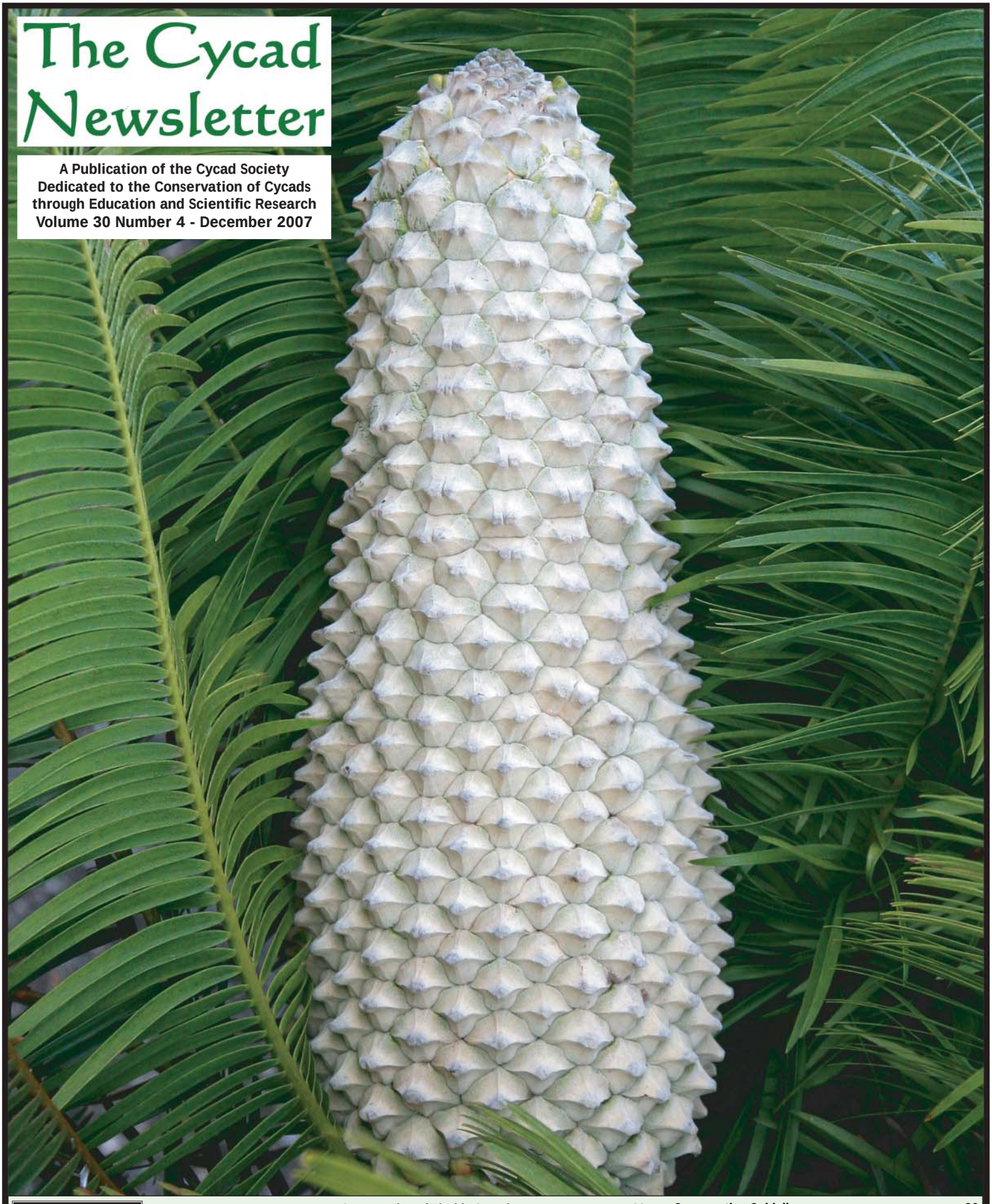
The Cycad Newsletter

A Publication of the Cycad Society
Dedicated to the Conservation of Cycads
through Education and Scientific Research
Volume 30 Number 4 - December 2007



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Microcycas calocoma

Some News of *Microcycas* in Cuba

Article and Photos by Ramiro Chaves & Yuriet Ferrer

In the past, information about *Microcycas calocoma* in its natural habitat has frequently come from outside sources, as is frequently the case with information about Cuba itself. The commercial embargo of Cuba by the United States, the largest cycad marketplace, has had a positive effect on *Microcycas* in one sense; its natural populations have been protected from illegal commercial exploitation during the same few decades in which there has been an explosive increase in demand for cycads. Conversely, the embargo has also meant a lack of possibilities to fund research on this species and fewer opportunities for researchers to travel out of Cuba. In addition, visits to the nearby island by American scientists and people interested in cycads are impeded by a U.S. governmental prohibition on travel to Cuba. All these things have contributed to make *Microcycas* an enigmatic genus among cycads.

Habitat description

Microcycas calocoma grows naturally only in Pinar del Río, Cuba's westernmost province. Its distribution range includes eight of the province's fourteen townships, encompassing more than 1,400 km^2. The species is able to grow on a variety of soils. However, it can only thrive in locations where taller trees are prevented from developing a closed canopy, such as those with rocky soils, steep slopes, or fluvial banks. This happens because of its slow growth and resultant poor ability to compete for the sunshine it needs. Its habitat is also restricted to places with enough humidity to allow seedlings to survive the dry season.

The species is present in four types of habitat with different relief structures, soils, vegetation types and degrees of usefulness for agriculture or cattle. The two best known habitats—and also the most modified because of their easy access — are those of stream banks in the higher plains of Consolación del Sur, and ravines of the neighboring slate hills. In the plains, *Microcycas* are part of relict river forests that have been heavily altered. In the slate ravines, they form part of semi-deciduous or river forests based on acidic soils and bordered by natural forests of pine and *Quercus* or planted pine plantations.

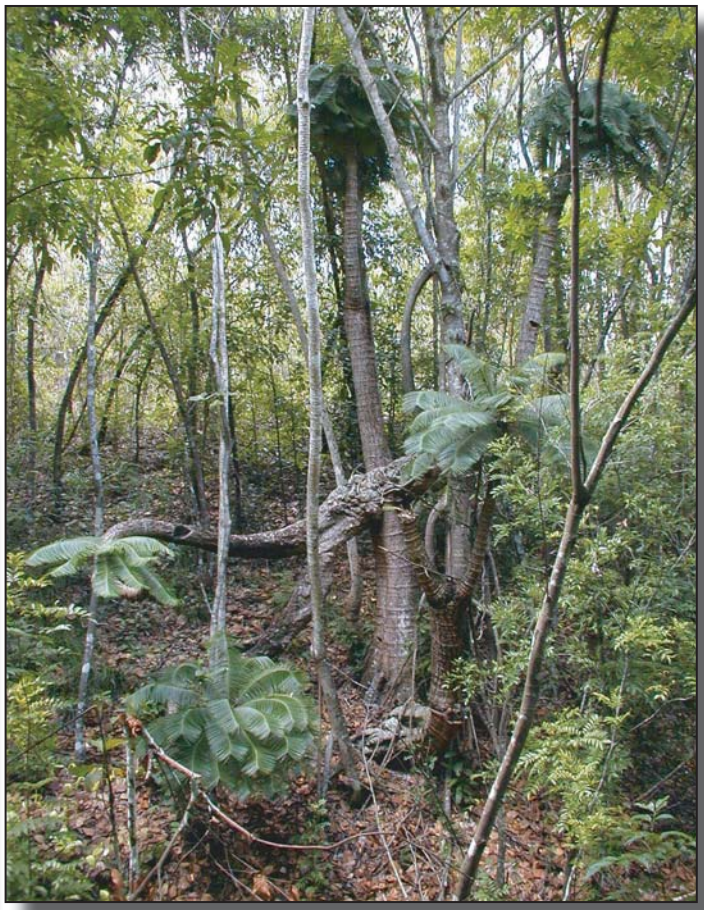
A third habitat is in the western part of Sierra del Rosario. These mountains are composed of a stratified mixture of rocks creating a steep but not abrupt relief. *Microcycas* populations there are less known but better conserved. They grow where rocks show on the surface, with most plants occurring near the top of the hills in semi-deciduous forest. The maximum altitude of 665 msl reported for the species occurs on one of these mountains (Risco *et al*. 1984).

The fourth type of habitat is that of the karstic (water-eroded calcareous) horst hills (called '*mogotes*') of the los Organos mountain chain. The soils are usually scarce and rocks emerge almost continuously, which allows for groups of *Microcycas* to occur at short intervals as part of some of the variant shapes of the so-called Mogote Vegetation Complex. Their conservation in the latter mountains has been assisted by the nature of this rough habitat, which is difficult to access and almost completely useless for agriculture or cattle.

Prevalence in habitat

The *Microcycas* colonies referred by

A karstic hill, one type of Microcycas *habitat*



Microcycas *locality at Granadinos*

botanic literature are few. Up to 1998, E. Peña and other researchers of the National Botanic Garden of Cuba reported only 23 colonies with an estimated 800 to 1,000 plants (Peña *et al.* 1998). Nevertheless, geographers and speleologists—who are the most frequent explorers of the Los Organos ranges—have documented the presence of more than 6,000 plants in at least 69 colonies (Carmenate, 2004). These data were collateral to their own expedition work, not the result of active searching. The region may therefore be home to more than double the number of specimens thus far reported. This and the rest of the mountainous regions in the species' distribution range have extensive unexplored areas with possibilities to find *Microcycas*.

Pollination

In 1998, Peña and her group also reported that natural pollination occurred only in 19 female plants, with reproducing females in only seven of the 23 known colonies (Peña *et al.*, 1998). This reproductive limitation in many of the colonies was attributed to a decline or extirpation of the yet unknown insect pollinator.

Old female Microcycas *plant at El Sebo*

Microcycas *in the Viñales National Park*

Chaves and Genaro (2005) described a probable insect pollinator named *Pharaxonotha esperanzae* (Coleoptera: Eriotilidae). It was found on a karstic hill within the Viñales National Park, which contains about 1,000 *Microcycas* plants distributed in numerous closely-spaced groups, where young plants are abundant and seed production occurs annually. The probable function for this insect is based on the fact that it is of the same genus and with the same behaviors as some of those that pollinate species of three other New World cycad genera (*Ceratozamia*, *Dioon* and *Zamia*) (Vovides, 1991; Tang, 2004). Besides, this is the only flying insect with repeated presence at the right moment to carry pollen from male to female cones—although it has not yet been observed on female cones to certify its role in pollination.

This little insect was scarcely observed by Chaves and Genaro (2005)—only an average of 13 adults per male cone—so no further work was conducted to search for them on female cones. We can now show new data to uphold the probable pollination function of this insect. First, it was absent in male cones that we examined from the colonies of Loma Granadinos, Cayo Ramones, and Barrabás. These are some of the colonies described by Foster and Rodriguez San Pedro (1942) as lacking natural seed production for many years and which still fail to set seed. Conversely, this year we found *Pharaxonotha esperanzae* in a male cone in the colony of Forneguera, which is located at the Mil Cumbres Protected Area of Managed Resources and contains about 87 *Microcycas* plants. This colony was reported in 1988 as having seed production (Peña *et al.*, 1988). This year we did not find seeds, but we did observe small plants up to five years old.

Only 50% of the fresh dehiscent male cones examined in Viñales National Park had adult *Pharaxonotha esperanzae* present. This and their low presence per cone are dissimilar to what has been described for pollinators of this beetle genus in other cycads. *Pharaxonotha* pollinators in *Ceratozamia* are described as abundant, with up to 5,300 adults per male cone (Vovides, 1991). Almost every receptive male cone of *Zamia floridana* in habitat in Florida is found to have a few to several dozen individuals of the pollinator *Pharaxonotha floridana* (Tang 1987). Based on the common presence of pollinators in male cones that are much smaller than those of *Microcycas*, one would expect to see exceedingly larger numbers of pollinators in the larger cones. Sadly, this is not the case.

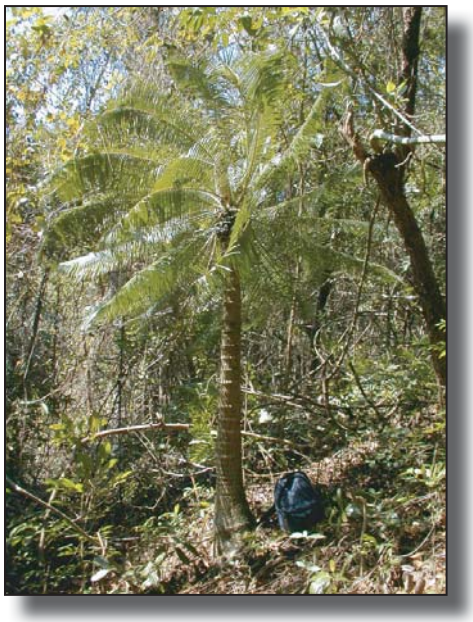
All of these things make us suspect that pollinators are declining in the region of endemicity. Furthermore, although there is evidence of annual pollination, only about half of the female cones set seed, and then only in small quantities.

Conservation status

Microcycas was classified as critically endangered in 1998 by Peña and her collaborators, based on the estimated 10 km^2 area occupied by known colonies, the severely fragmented habitat, and the continuing reduction in geographic area, habitat quality, and number of reproductive females. The total number of reproductive females was also estimated by Peña (1998) to be fewer than 250; these were also reported to be actively declining in number and with no more than 50 reproductive females in any individual colony. Data from newly discovered colonies remain to be analyzed, but overall they do not seem to justify changing its classification.

Ethnobotanic issues

We think the arguments given by other authors regarding the etymology of the common name 'palma corcho' or 'corcho' (cork) are illogical and lack merit. Seeds



Large coning microsporangiate Microcycas calocoma *plant at Maceo*

Large Microcycas calocoma *plant at Managuaca growing along a stream bank*

Old trunk of Microcycas calocoma *with its persistent armor of leaf bases*

have neither the form nor the appearance of a bottle cork, as stated by Caldwell (1907). The idea of the name being due to "the trunk's consistency of a cork when cut with a machete," as first stated by Cendrero (1940), or to the stem's brittleness and soft texture as compared to those of a cork, as later stated by Foster and Rodríguez San Pedro (1942), also does not sound credible because (1) the first is an improbable comparison, and (2) neither seem to us to accurately portray the consistency of the trunk.

Grouping of Microcycas calocoma *plants at Viñales National Park*

In addition to referring to *Microcycas*, countrymen in Cuba use the noun 'corcho' for a hollow cylinder of trunk (of any kind) used as a beehive. As an adjective, they use 'corcho' to qualify any trunk interiorly hollow. These things make us believe that the name 'palma corcho' most likely arose from old plants sometimes being hollow and containing beehives. In fact, we have found eight *Microcycas* plants containing wild beehives in their centers. If a countryman finds a beehive, he keeps it a secret to preserve the honey for his own enjoyment. The survival of a host plant can be compromised by the cuts made to reach the honeycombs. Some plants show scars of wounds from the process of removing honeycombs over several seasons. We know a story of a *Microcycas* plant dying after extracting honey from a beehive. Thus, avoiding the penalties by forest rangers of damaging a protected plant is also a motive to keep the secret.

Caldwell reported in 1907 that *Microcycas* roots were once used as rat poison in some of the zones of Sierra del Rosario. In other areas we have found no knowledge of this usage. Instead, countrymen along the los Organos ranges informed us that their parents several decades in the past occasionally used the fibers extracted from the trunk to make long-lasting brushes and ropes. Another informant in the Consolación Plains said that the cortex of *Microcycas* is useful to make an alcoholic maceration to heal joint pain. That recipe was given to him by an old healer of the area to whom he went for treatment for persistent pain of his inflamed knees. Since then he never suffered from them again. The indigenous people ignore the dangers of the possible neurotoxic and carcinogenic effects of cycads.

Above: Microcycas calocoma *receptive female cone; left: coning microsporangiate plant at Viñales National Park with enlarged cone inset*

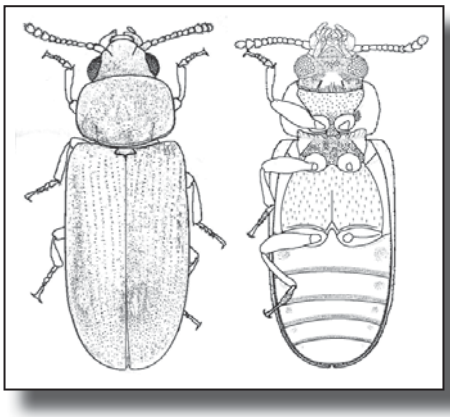
References

Cadwell, O. W. 1907. *Microcycas calocoma*. Contributions from the Hull Botanical Laboratory XCVII. *Botanical Gazette* 44:118-141.

Carmenate, H. 2004. Exploración al Hoyo del Volcán (El Explorador. Periódico Digital Espeleológico. Grupo de Espeleología y Deportes de Aventuras [GEDA] ed.) [http://www.italia-cuba.speleo.it/explo_01.pdf] (Downloaded in 2007).

Cendrero, O. 1940. El *Microcycas calocoma*, palma corcho, palma de corcho o corcho. *Memorias de la Sociedad*

Pharaxonotha esperanzae *on collected microsporophylls of* Microcycas calocoma



Dorsal(left) and ventral(right) views of Pharaxonotha esperanzae, *the suspected pollinator of* Microcycas calocoma

Cubana de Historia Natural 'Felipe Poey' 8:175-182.

Chaves, R., & J. A. Genaro 2005. A new species of *Pharaxonotha* (Coleoptera : Erotylidae), probable pollinator of the endangered Cuban cycad, *Microcycas calocoma* (Zamiaceae)". *Insecta Mundi* 19(3):143-150.

del Risco, E., J. Morell & V. Samek. 1984. Algunos apuntes sobre *Microcycas calocoma* (Miq.) A. DC. *Revista del Jardín Botánico Nacional, Universidad de La Habana* 5:111-129.

Foster, A.S. & M. Rodríguez San Pedro. 1942. Field studies on *Microcycas calocoma*. *Memorias de la Sociedad Cubana de Historia Natural 'Felipe Poey'* 16:105-121.

Peña, E., R. Chaves, & O. Pimentel 1988. *Microcycas calocoma*: Hallazgos interesantes con vistas a sus posibilidades de conservación. *Revista del Jardín Botánico Nacional, Universidad de La Habana* 9: 84-99.

Peña, E., P. I. López, J. Lazcano, D. Pérez, & Z. Torriente. 1998. CAMP. Hoja de datos de taxón para Zamiaceae: *Microcycas calocoma* (Miq.) A. DC. Pp.89-95 *in*: Peña, E., P. I. López, J. Lazcano, A. T. Leiva, and U. S. Seal (eds.), *Memorias del Primer Taller para la Conservación, Análisis y Manejo Planificado de Plantas Silvestres Cubanas CAMP I*. Vol.II,. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, MN, USA.

Tang, W. 1987. Insect pollination in the cycad *Zamia pumila* (Zamiaceae). *American Journal of Botany* 74:90-99.

Tang, W. 2004. Cycad insects and pollination. Pp. 383-394 *in*: Srivastava, P. C. (ed.), *Vistas in Palaeobotany and Plant Morphology: Evolutionary and Environmental Perspectives. Prof. D.D. Pant Memorial Volume*. U.P. Offset, Lucknow, India.

Vovides, A. P. 1991. Insect symbionts of some Mexican cycads in their natural habitat. *Biotropica* 23(1):102-104.

Larvae of Pharaxonotha esperanzae

Microcycas *trunk with beehive at Barrabás*

Microcycas *trunk with beehive at Granadinos*

Microcycas *mature seeds and seedlings*

Microcycas *female cone with immature seeds*

Notes on *Microcycas calocoma*

Article and photos by Julio Lazcano

Distribution and habitat

Microcycas calocoma is the single species of an endemic genus restricted to the north-central zone of the western Cuban province of Pinar del Río. Because of its scientific relevance and its aesthetic value, *Microcycas* was declared a "National Natural Monument" in Cuba In 1989—this species is to the plant world what "Old Havana" is to historical places. In 1998, a group of Cuban botanists assessed its conservation status as "critically endangered" (CR).

Throughout my years at the National Botanic Garden of Cuba, I have visited almost all published localities of *Microcycas* as well as some localities that remain undocumented to science. I have seen *Microcycas calocoma* living in two general types of habitat. The first type consists of lowlands and hills with deep, stony-sandy, yellowish quartz-allitic soils, which in some places are enriched with humus. In these sites, the vegetation changes from a pine/oak forest and semi-deciduous secondary forest to artificial grassland. The second type consist of massive hills with shallow, carbonated rendzina soils and "dog's tooth" rocks exposed on most of the surface (limestone cliffs known as 'mogotes'), sometimes with a thick litter layer; in these sites the vegetation changes from an open *Agave* scrub to a closed semi-deciduous forest. *Microcycas calocoma* is a great survivor, as are many cycads, and within those general habitat types the plants occupy a variety of niches ranging from "ideal" to extreme conditions. There are localities where many individuals are living near or just in the riverbed, or in open-sunny surfaces on top of the hills or in closed-shady forest on well-protected hills and gorges where they become exceptional emergent trees, but most of the specimens live on moderate slopes within a partially open forest throughout the dry season (from November to April).

The largest and healthiest colonies that I have seen are found in the massive limestone hills, known as the Sierras, located at Viñales National Park, although the oldest specimens are located in hills formed by quartz-allitic soils near the town of Consolación del Sur. In some localities, hundreds of individuals can be found in groups of variable density and patchy distribution; however, the presence of single, scattered individuals suggests the past existence of huge, continuous populations.

Reproduction in the wild

Coning is not an uncommon event in *Microcycas*, though effective pollination and subsequent seed production are rare. I have recorded male and female individuals that produce cones regularly on an or biannual basis, although even when they are growing in relatively close proximity no seed has been produced. From 2001 to 2005, I studied a large (941 individuals), well-structured (J inverted shape), healthy, previously undescribed colony at Viñales National Park. There I inventoried 412 adults, and 125 of them (66 male, 59 female) were producing cones. Seed production was directly or indirectly confirmed in only 27 female plants.

In *Microcycas* there is a long and winding road between the seed and the adult stage. Most of the reproductively active female plants are living on the massive limestone hills, where suitable places for seedling establishment are not common. In the absence of a dispersal agent, seeds fall from the cone and remain at the base of the mother plant, where the viable ones germinate to develop seedlings that die after one or two years, despite their capacity to grow in small amounts of soil.

Semi-deciduous secondary forest on hills with quartz-allitic soils near Consolación del Sur where Microcycas calocoma *grows*

Detail of the stony-sandy, yellowish quartz-allitic soil, enriched with humus (near Consolación del Sur)

Limestone cliff ("mogote") and massive limestone hills ("sierras") at Viñales National Park

Detail of dog's tooth rock abundant in limestone cliffs and hills (Viñales National Park)

Microcycas calocoma *living in the riverbed in deep, sandy quartz-allitic soil (Manahuacas near Consolación del Sur)*

Microcycas calocoma *living near the riverbed in limestone (Sagua River near San Juan de Sagua)*

Conservation

The conservation status of *Microcycas calocoma* is relatively secure in the limestone hills at Viñales National Park and Mil Cumbres Protected Area. In those places, due to the hostility of the habitat, human activity is minimal (only selective timber and palm leaf harvest). Nevertheless, the quartz-allitic hills near Consolación del Sur show a different scenario. Due to agriculture, most of the lowland colonies located in this region have disappeared and even with the recovery of the forest in places that were previously transformed into grasslands, critical processes like pollination and seed production have not returned.

A good management practice to protect natural populations from overcollection may be to selectively harvest seeds that have no possibility of surviving in the wild and to cultivate them in *ex situ* conditions for future reintroduction, exchange, or controlled sales.

References

Del Risco, E., Morell, J. & Samek, V. 1984. Algunos apuntes sobre *Microcycas calocoma* (Miq.) A. DC. *Revista Jard. Bot. Nac. Univ. Habana* 5: 111-131.

Foster, A.S. & Rodríguez San Pedro, M. 1942. Field Studies on *Microcycas calocoma*. *Mem. Soc. Cub. Hist. Nat.* 16: 105-121.

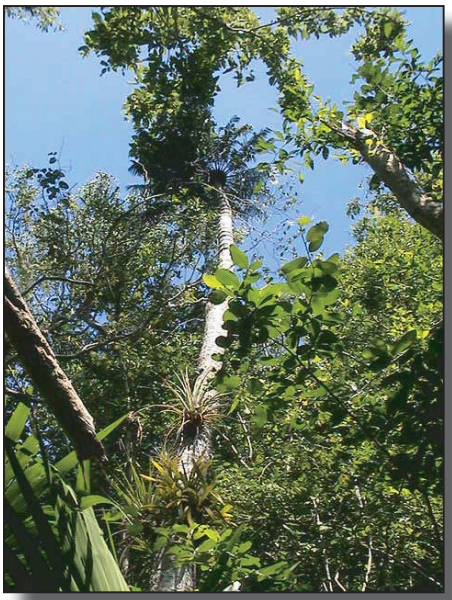
Lazcano-Lara, J.C. 2004. Biología poblacional y aspectos ecológicos de *Microcycas calocoma* (Miq.) A. DC. en la Sierra de La Caoba, Viñales. Tesis de Maestría. Jardín Botánico Nacional, Universidad de La Habana, 92pp.

Peña, E., García, P.I., Lazcano, J., Pérez, D. & Torriente, Z. 1996-97a. La reproducción sexual en *Microcycas*. I. Estudios de monitoreo *in situ*. *Revista Jard. Bot. Nac. Univ. Habana* 17-18: 147-158.

Microcycas calocoma *with Agave in open vegetation on hilltop (Viñales National Park)*

Juvenile plant of Microcycas calocoma *growing on a moderate slope (Viñales National Park)*

Green emergent male cone of Microcycas calocoma *at Viñales National Park*



11 m male tall Microcycas calocoma *plant growing as an emergent tree in dense, semi-deciduous forest (Viñales National Park)*

"El Abuelo," the oldest registered male plant, at Granadinos near Consolación del Sur, with height ca. 8 m, trunk circumference 2 m, 12 branches

Yellow-brown dehiscent male cone of Microcycas calocoma *at Viñales National Park*

Above: Female cones of Microcycas calocoma *(Viñales National Park).*

Female cone releasing seeds (Viñales National Park)

Microcycas calocoma seeds that fell and remained at the base of the mother plant, marked with a red arrow (Viñales National Park)

Rats eat the sarcotesta of the seeds without damaging the embryo, but they leave the seeds in almost the same place they found them (Viñales National Park)

Microcycas calocoma seeds that fall onto the bare rock cannot survive in the wild (Viñales National Park)

This *Microcycas calocoma* seedling is growing in a small cavity with very little soil (Viñales National Park).

Extreme example of the capability of *Microcycas calocoma* seedling to grow in small amounts of soil (specimen from Viñales National Park, photographed at National Botanic Garden of Cuba).

Three- to five-year-old single survivor of hundreds of seeds produced by the mother plant living in a small step of a vertical wall (Viñales National Park)

These seedlings had good luck; one or two will likely survive to reach the juvenile stage (Viñales National Park)

A Taxonomic and Bibliographic History of *Microcycas calocoma* (Miq.) A. DC.

Jody Haynes

The earliest known description of this monotypic Cuban endemic is that of the well-known Dutch botanist F.A.W. Miquel (1852) in Van Houtte's *Flore des Serres et des Jardins de l'Europe*. Miquel gave it the name *Zamia calocoma* and compared it to *Z. tenuis* (which is a synonym of *Z. integrifolia*; see Hill *et al*., 2007), saying that the former differs from the latter in form and number of leaves (*Microcycas* bears many more per plant). Miquel also proposed a new section for this species within the genus *Zamia*, to be called *Microcycas*. With only juvenile plants in cultivation and without any reproductive material to examine, some believe that Miquel's original intent in suggesting the name *Microcycas* was in reference to a 'small cycad' rather than a small form of well-known *Cycas revoluta* (Hill & Stevenson, 2007); others maintain, however, that the genus was named for the resemblance of the leaves to a small version of *Cycas* (Chamberlain, 1919). The origin of Miquel's specific epithet is more straightforward, as it derives from the Greek *calos*, meaning 'beautiful', and *coma*, meaning 'hair', and literally translates to "beautiful crown of leaves" (Hill & Stevenson, 2007).

Five years later, Regel mentioned *Zamia calocoma* in one of his articles (in *Gartenflora* 6:16, 1857), but provided no description. Later that same year, Regel gave a brief description of the species (in *Bull. Soc. Nat. Mosc.* 1:191) based on a specimen which he said was brought from Cuba by a man named Chappy. At the end of the latter article, Regel concluded that *Z. calocoma* was so different from the other species of *Zamia* that it may constitute a new genus. In 1861, Miquel (in *Prodromus Systematis Cycadearum* p.26) also suggested that it might represent a new genus based on vegetative traits, but he reserved judgment because no cones had yet been observed. Grisebach (in *Cat. Pl. Cub.* 217, 1866) referred to a collection of material by Wright and provided a very brief summary of those materials. And in 1868, De Candolle described the genus *Microcycas* (in *Prodromus* 16:522-548) based largely on Miquel's suggestion and previously published sectional name, in addition to his own personal examination of Wright's materials. More than a decade later, Bentham & Hooker reportedly gave an incomplete characterization of the genus (in *Gen. Plant.* 3:447, 1880) and mistakenly cited the specific epithet as *cubensis* (*sensu* Caldwell & Baker, 1907).

In 1905, researchers affiliated with the State Normal School in Charleston, IL, and the Estación Agronomica in Santiago de las Vegas, Cuba, received numerous male and female cones and vegetative material of a small cycad collected in Cuba and purported to be *Microcycas calocoma* (Caldwell & Baker, 1907). They quickly determined that the material was not *Microcycas*, but was, instead, most likely *Zamia pumila*. These workers also stated that specimens of *Z. pumila* had been mistakenly issued several times from the New York Botanical Garden as *Microcycas*. Because of the confusion that existed in reference to the genus and the incomplete published accounts of the species, Caldwell & Baker (1907) then set out to provide a full and accurate account of its bibliography and characteristics. This included a collecting trip to the higher regions of the 'Sierras' of western Cuba, which resulted in indisputable specimens of *Microcycas calocoma* (see photo of one of their herbarium specimens), detailed descriptions of vegetative and reproductive structures, and quite possibly the first published photos of the species.

Also in 1907, Caldwell described the reproductive structures of *Microcycas*, including the superficial characters of the embryo and seedling. Caldwell (*l.c.*) also made reference to some vernacular names and ethnobotanical uses of *Microcycas* by the indigenous peoples of Cuba. One of the more interesting references was that the common name 'palma corcho' or 'corcho' derived from the seeds presumably resembling a bottle cork (see also Chavez & Ferrer, this issue). Two years later, Dorety (1909) expanded on Caldwell's (*l.c.*) work and described, in detail, the vascular anatomy of *Microcycas* seedlings.

In the overview of his ongoing phylogenetic study of cycads, Chamberlain (1915) stated that the "nine genera of living cycads are so sharply defined that there is no difficulty in recognizing them." Shortly thereafter, in his well-known book entitled *The Living Cycads*, Chamberlain (1919) included a brief section on *Microcycas* that was more of a travelogue than a taxonomic treatment, although he did indicate that the species was quite rare in habitat, that it was quite possibly the most geographically restricted cycad genus, and that it could easily become extinct.

In 1928, Downie provided the first description of the male gametophyte of *Microcycas*. Four years later, Schuster's (1932) taxonomic treatment provided a lengthy description of *Microcycas*, but it was essentially a compilation of previously published characters and provided little new information. The most detailed field observations to date were published ten years later by Foster & Rodriguez San Pedro (1942); part of their work is summarized in the accompanying contribution by Chaves & Ferrer (this issue).

In an unpublished manuscript entitled *A Taxonomic Monograph of the Cycads*—written shortly before his death in 1943—Chamberlain (n.d.) provided a comprehensive summary of the genus and species based on previous reports and his own field work in Cuba (see the herbarium specimen collected by him in 1938). He again indicated that the genus name referred to a small version of *Cycas*,

Herbarium specimen of Microcycas calocoma *collected by Caldwell & Baker in 1907*

which he stated is "a most unfortunate choice, since [*Microcycas*] is one of the tallest of the cycads." He further stated that, although plants of *Zamia pumila* had been distributed as *Microcycas*, "its appearance in the field is so characteristic that no one could mistake it for any other cycad." Chamberlain also reiterated his early statement regarding *Microcycas* possibly being one of the rarest and most restricted genera in the Cycadales.

Very little additional information was published on *Microcycas* until Kiem's (1963) report of his visit to 'Castro Cuba' in 1959 in search of plants to bring back to Fairchild Tropical Garden in an effort to increase the genetic diversity of their collection (see Calonje's accompanying article, this issue). Of particular note was Kiem's description of one of the habitats in which he found plants growing:

> The *Microcycas* plants were found, after a bit of hunting, widely scattered in the ravines, usually on the lower part within a few feet of the water. Apparently when the water rises due to rain it frequently washes about the roots and lower part of the trunks of many of the plants of this cycad. The conditions were shady, with few being exposed to any direct sun. The soil was heavy brown clay, becoming very sticky when wet and proved to be acid, with a pH of between 5 and 6.

This particular habitat description is in stark contrast to the very dry conditions and exceptionally well-drained soils that so many horticulturists recommend for growing this species in cultivation (see Broome's accompanying article, this issue).

In 1980, Eckenwalder cited the holotype of *Microcycas calocoma* as being in the Leiden University branch of the National Herbarium of the Netherlands, reportedly without ever having seen such a specimen (*sensu* Stevenson & Sabato, 1986). In their ongoing effort to clarify outstanding issues regarding the typification of New World cycads, Stevenson & Sabato (1986) provided a well-researched summary of previous references to type specimens. They concluded that De Candolle had clearly stated in his description of the genus that he was basing his description upon specimens collected by Wright. Thus, Stevenson & Sabato (*l.c.*) determined that the Wright specimen housed in the De Candolle Herbarium in Geneva, Switzerland, should serve as the neotype (= 'new type').

The articles by Landry (1991) & Osborne & Santana (1995) did an excellent job of summarizing various aspects of the species. The latter article, in particular, represents the most comprehensive work on the species to date, with a page on its discovery, three pages on its distribution and ecology, details of the vegetative and reproductive structures and its affinities to *Zamia*, and notes on its conservation and cultivation.

Peña *et al.* (1998) reported poor reproductive success in natural populations of *Microcycas calocoma* and suggested that this may be due to a decline or complete extirpation of the insect pollinator—which at that time was still unknown. They also classified the species as critically endangered based on its restricted area of occupancy, severe habitat fragmentation in the area of endemicity, and a continuing decline in the number of reproductive females—which they estimated to be less than 250 at that time (see also Chavez & Ferrer, this volume).

In the most comprehensive attempt at assessing the conservation status of the New World cycads, Stevenson *et al.* (2003) estimated the total wild population of *Microcycas calocoma* at 300-500 mature plants and listed the species as critically endangered. For those familiar with the IUCN Categories and Criteria for determining conservation status (IUCN, 2001), the complete 'Red List' assessment is CR B1ab(iii,iv,v)+ 2ab(iii,iv,v) (IUCN, 2006). This critically endangered status is also reflected in the Lazcano & Chavez/Ferrer articles in this Cycad Focus column (this issue).

References

Caldwell, O.W. 1907. *Microcycas calocoma*. Contributions from the Hull Botanical Laboratory XCVII. *Botanical Gazette* 44:118-141.

Caldwell, O.W., & C.F. Baker. 1907. The identity of *Microcycas calocoma. Botanical Gazette* 43:330-335.

Chamberlain, C.J. 1915. A phylogenetic study of cycads. *Proceedings of the National Academy of Sciences U.S.A.* 1(2):86–90.

Chamberlain, C.J. 1919. *The Living Cycads*. University of Chicago Press, Chicago, IL.

Chamberlain, C.J. (n.d.). *A Taxonomic Monograph of the Cycads*. Unpublished manuscript. (Note: This manuscript has been made available in the Publications section of the Cycad Society website: www.cycad.org.)

Dorety, H.A. 1909. Vascular anatomy of the seedling of *Microcycas calocoma. Botanical Gazette* 47:139-147.

Downie, D. 1928. Male gametophyte of *Microcycas calocoma. Bot. Gaz.* 85:437.

Eckenwalder, J.E. 1980. Taxonomy of West Indian cycads. *Journal of the Arnold Arboretum* 61:701-722.

Foster, A.S., & M. Rodríguez San Pedro. 1942. Field studies on *Microcycas calocoma*. *Memorias de la Sociedad Cubana de Historia Natural 'Felipe Poey'* 16:105-121.

Hill, K.D., & D. W. Stevenson. 2007. *Microcycas calocoma*. *The Cycad Pages*. Royal Botanic Gardens Sydney, Australia. Website: http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/cycadpg?taxname=Microcycas+calocoma.

Hill, K.D., D.W. Stevenson, & R. Osborne. 2007. The World List of Cycads. In press *in*: Proceedings of the Seventh International Conference on Cycad Biology, Xalapa, Veracruz, Mexico. *Memoirs of the New York Botanical Garden* 98.

IUCN. 2001. *2001 IUCN Categories & Criteria (version 3.1)*. IUCN, Gland, Switzerland, and Cambridge, U.K. Website: http://www.redlist.org/info/categories_criteria2001.html

IUCN. 2006. *2006 IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland, and Cambridge, U.K. Website: http://www.redlist.org

Kiem, S.C. 1963. FTG superintendent recalls trip to Castro Cuba to find rare cycad. *Fairchild Tropical Garden Bulletin* 18(4):92-96.

Landry, L. 1991. Portrait of a species: *Microcycas calocoma*. *Cycad Newsletter* 14(2):14-19.

Miquel, F.A.W. 1852. Sur une espèce nouvelle de Zamia des Indies Occidentales, introduite dans l'établissement L. Van Houtte, à Gand. *Flore des Serres et des Jardins de l'Europe* 7:141-2.

Osborne, R., & R. M. Santana. 1995. Focus on ... *Microcycas calocoma. Encephalartos* 42:4-11.

Peña, E., R. Chaves, & O. Pimentel. 1988. *Microcycas calocoma*: Hallazgos interesantes con vistas a sus posibilidades de conservación. *Revista del Jardín Botánico Nacional, Universidad de La Habana* 9:84-99.

Schuster J. 1932. Cycadaceae. Pp. 1-168, *in*: Engler, A. (ed.), *Das Pflanzenreich* 99(IV. 1).

Stevenson, D.W., & S. Sabato. 1986. Typification of names in *Ceratozamia* Brongn., *Dion* Lindl., and *Microcycas* A. DC. (Zamiaceae). *Taxon* 35:578-584.

Stevenson, D.W., A. Vovides & J. Chemnick. 2003. Regional overview: New World. Pp. 31-38 *in*: Donaldson, J. (ed.), *Cycads: Status Survey and Conservation Action Plan*. IUCN/SSC Cycad Specialist Group. IUCN, Gland, Switzerland, and Cambridge, U.K.

History, Growth Rate and Phenology of *Microcycas calocoma* in South Florida.

Michael Calonje*

History of *Microcycas* calocoma in South Florida

In 1932 Robert H. Montgomery began construction of his home in the estate he called the Coconut Grove Palmetum, which eventually become Montgomery Botanical Center (MBC). With the assistance of Tom Fennell, assistant director of the USDA Plant Introduction Station at nearby Chapman Field, Montgomery quickly acquired close to 1,000 large palm and cycad specimens from nurseries and private individuals throughout Florida, converting his estate into an instant world-class palmetum (Zuckerman 1997). Among these plants, he acquired two *Microcycas calocoma* plants from wealthy neighbor Charles Deering for $90, or the equivalent of $1,150 today. How Deering obtained these is unclear, but they were obviously wild-collected plants from Cuba. At the time of their purchase in October 1932, they were already five and eight feet tall and planted in large tubs. The smaller one was planted at Montgomery's estate (see picture) where it still survives today, and the larger one was donated to Fairchild Tropical Botanic Garden (FTBG), which Robert Montgomery founded in 1938. Montgomery received two additional accessions of *Microcycas calocoma* from Brother Leon in Cuba in the 1930's, but none of these survived.

FTBG received multiple requests for *Microcycas* seed from all over the world, but unfortunately the two original plants from Deering turned out to be male.
In 1959, then Fairchild superintendent Stanley Kiem set out to Cuba to collect *Microcycas* and other Cuban palms and cycads (Kiem, 1963). The timing of Kiem's trip was critical, as Batista's government had just been overthrown by Castro, and the island was soon to be closed to those Castro considered "Yankee imperialists." Kiem visited a population in the Sierra de Los Organos, and recalled that even then reproduction was virtually non-existent, as he checked several female cones and no seeds were being produced. A study published in 1997 (Vovides *et al.*, 1997) confirms that pollination and seedling recruitment in native *Microcycas* populations is very rare, perhaps due to the scarcity of its native pollinator. Kiem was unable to find seeds or seedlings to bring back, so he cut some tops off a few large multi-headed plants with female cone remnants. In total, he collected two large trunks, one small plant, and three suckers from this population, and received four wild-collected seedlings as a gift from Cuban horticulturist Marcial Truffin.

One of the large female trunks from Sierra de Los Organos was rooted and planted at Montgomery's estate along with two of the seedlings donated by Marcial Truffin. One of the Truffin plants coned male for the first time in 1974, 15 years after it had been collected. The Sierra de Los Organos plant coned female for the first time two years later and was pollinated with pollen from the Truffin plant. This first cone yielded 714 seeds in March 1977. These F1 generation seeds were germinated by FTBG staff and resulted in most of the *Microcycas* plants at FTBG and MBC today, 19 of which still survive to this date.

In 1991, lightning struck all three of Kiem's *Microcycas* plants at MBC, including the only female plant. Sadly, all plants lost their main trunks, and only the male plant donated by Marcial Truffin was able to bounce back, eventually producing two suckers, the tallest of which is now about three feet tall. It was not until 1994 that the first of these second-generation plants coned female (17 years after the seed was germinated) and MBC was able to begin pollinating and distributing *Microcycas* seeds.

Beginning in 1995, MBC has distributed 6,486 *Microcycas* seeds, an average of about 500 seeds per year. Most of the *Microcycas* plants in cultivation in the US today are descendants of the two plants brought back by Stanley Kiem, although pollen from the one remaining plant purchased from Charles Deering has also been used in some of the pollinations. This means that cultivated plants in the US have low genetic diversity and will continue to lose this as future generations continue to be crossed. It would thus be very beneficial if more *Microcycas* germplasm from Cuba could be brought into botanical collections in the US.

Growth rate

Microcycas plants at MBC take approximately six years from seed to begin forming a trunk. The tallest plant from the F1 generation from Stanley Kiem's collection is a female about eight feet tall, grown from seed sprouted in 1977. If we assume this plant began vertical growth six years after sowing, this means the plant has grown eight feet in 24 years, or about four inches per year. However, the growth rate seems to vary widely from year to year, as leaf bases from flushes occurring in sequential years are found up to ten inches apart on some plants.

Oldest Microcycas calocoma *at Montgomery Botanical Center (Acc. RM384*B); in 1932, in 1965 and 2006 with Dr. P. Barry Tomlinson, Nat'l. Tropical Bot. Garden (1932 photo from MBC's archive; 1965 photo by Len Bass; 2006 photo by Dr. M. Patrick Griffith)*

*Cycad Biologist, Montgomery Botanical Center

The original *Microcycas* at MBC purchased from Charles Deering was about five feet tall when planted in 1932. It is now the tallest *Microcycas* plant in cultivation in the US, measuring about 16 feet tall today. It has grown 11 feet in 75 years, or an average of 1¾"/yr-3/4. However, it must be noted that as cycads grow taller, their stems can compress vertically from their own weight. Also, the growth rates of trees are known to decline as they increase in size, and a similar phenomenon may also occur in cycads, leading to a very low average growth rate for tall, old plants. In addition, this plant now has two main stems, the taller of which has three separate heads, so it may be diverting resources from height growth to offset production. Based on the growth rate of 1-3/4¾" ¾ inches per/ year,, and assuming it had formed a trunk after 6six years, the plant may have been close to 40 years old when first planted at the Montgomery Estate. However, because much of this growth occurred under non-ideal conditions in habitat, this plant may have actually been much older.

In the hot year-round temperatures in Thailand under the expert horticultural care of Nong Nooch Tropical Botanical Garden, the average distance between leaf flushes of *Microcycas* is reported to be 8 -and 2/3" inches (Anders Lindstrom, pers. comm.).

In conclusion, after developing a trunk, *Microcycas* plants can grow anywhere from 2 to -10" inches per /year depending on the growing conditions.

Phenology

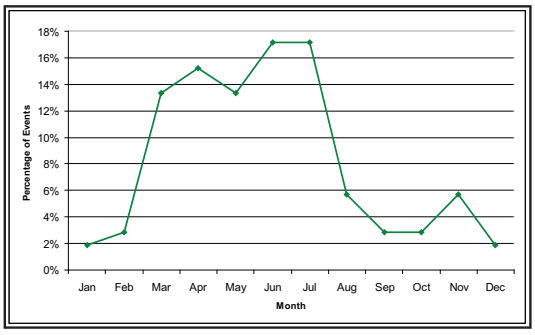
In South Florida, *Microcycas* begins producing male cones about 16 years after germination and female cones after 18 years. Cones of both sexes emerge in the summer months, peaking in June and July. Pollen release and female cone receptivity occur approximately two months after emergence, peaking in August, and seeds are produced 9-11 months after pollination, peaking in May. Vegetative flushes occur in the spring and summer months, with no distinct peak.

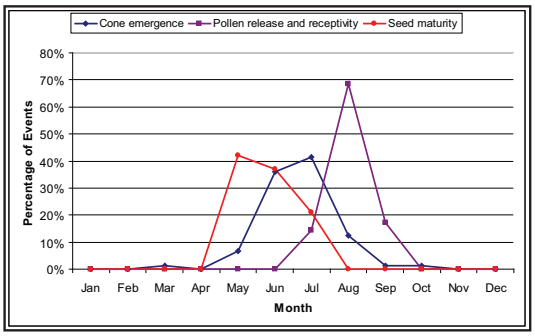
References

Kiem, S. 1963. FTG superintendent recalls trip to Castro Cuba to find rare cycad. *Fairchild Tropical Garden Bulletin* 18(4):92-97.

Vovides, A.P., Ogata, N., & Sosa, V. 1997. Pollination of endangered Cuban cycad *Microcycas calocoma* (Miq.) A.DC. *Botanical Journal of the Linnean Society* 125:201-210.

Zuckerman, B. 1997. *The Montgomery Story*. The Montgomery Foundation, New Port Richey, FL. 88 pp.





Phenology of Microcycas calocoma *at Montgomery Botanical Center; left: vegetative phenology; right: reproductive phenology.*

Growing Microcycas in Central Florida

Tom Broome

Growing *Microcycas calocoma* in central Florida has certainly been a challenge for me. This plant is not cold hardy enough to grow outside, so my plants are in containers and greenhouse grown. Others who live in coastal central Florida such as St. Petersburg or Cocoa Beach can put them in the ground and grow them easily.

Microcycas plants are very susceptible to rot during the first two years from seed. Once the plants reach a certain size, they seem to become much easier to keep alive and grow. I have seen some older plants that were all but forgotten in a nursery; they were staying alive without any special care. Many of our members who have received *Microcycas* seeds from our seedbank over the years have had to grow them in containers, and many have had some problems. I have experimented with these seedlings and have found a way that works for me to keep them alive. I grow the seedlings out in coarse sand and keep the apex at least a half -inch higher than the sand level. Microcycas have a tendency to pull the apex below ground so keeping them above ground has helped to keep them from rotting. There are probably other materials, such as pumice, perlite, or rock products that may work as well, but I have always liked sand for germinating and growing out cycads. Instead of watering them deeply, I lightly sprinkle the leaves and just barely let the water hit the sand, but give it enough water so that the sand's capillary action can pull down just enough moisture to keep the sand slightly moist. After about three years I have been able to pot them up into an extremely well-draining cycad mix. My regular soil mix holds too much moisture, so I add extra coarse sand and small rocks to insure good drainage.

I know of at least one member in a coastal area who planted his new seedlings directly in the ground. The ground there is naturally very sandy, and whether or not this is significant, has some salt influence. The seedlings grew very fast and none had any problems with rot. I think there is something very important here that I may not totally be able to explain, but I think people in California who have drier weather should have a much easier time growing these. I know some of the coastal locations of central Florida, such as parts of St. Petersburg, get a lot less rain per year than we do inland, and may account for the ease in growing this species. I have seen a few gardens in central Florida that have this same kind of microclimate, and in these gardens, are growing some of the most beautiful blue encephalartos species. There is no reason why *Microcycas* won't do just as well.

I don't think everyone should try to grow *Microcycas calocoma*. It needs special care in certain areas. However, if you live in the right area for this plant, I wholeheartedly encourage you to grow the species. Plants are very beautiful but not well-suited for most of central Florida.

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