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Original article

Characterization of three new localities for Microcycas calocoma in the northern area of the municipality of Los Palacios

Caracterización de tres nuevas localidades para Microcycas calocoma en la zona norte del municipio de Los Palacios

Caracterização de três novas localidades para calocoma de Microcycas na zona norte do município de Los Palacios

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ABSTRACT

Microcycas Calocoma is considered the "Jewel of Cuban Flora" and is categorized as a "Critically Endangered" species by the Red List of Cuban Flora, which is why its conservation is essential. The objective of the study is to characterize three new localities north of San Diego de los Baños, Los Palacios, where the species has been reported. At each locality, the total number of individuals, plant height, trunk girth, presence of mechanical damage, phytosanitary status, and level of epiphytism were recorded. A total of 17 individuals were recorded, grouped toward the second phases of their life cycle. Six individuals presented mechanical damage with good phytosanitary status and low epiphytism. The described localities could represent remnants of a previous population, so it is necessary to incorporate these records as part of the *ex situ* and *in situ conservation plan* for the species.

Keyword: Cork palm, *Microcycas calocoma*, conservation

RESUMEN

Microcycas calocoma es considerada “Joya de la Flora de Cuba” y se categoriza como especie en “Peligro Crítico” por la Lista Roja Flora de Cuba, razón por la que es necesaria su conservación. El objetivo del estudio es caracterizar tres nuevas localidades al norte de San Diego de los Baños, Los Palacios donde se reporta la presencia de la especie. En cada localidad se registró el total de individuos, la altura de la planta, perímetro del tronco, presencia de daños mecánicos, estado fitosanitario y el nivel de epifitismo. Se registraron un total de 17 individuos, que se agrupan hacia las segundas fases de su ciclo de vida. Seis individuos presentaron daños mecánicos con estado fitosanitario bueno y bajo epifitismo. Las localidades descritas pudieran representar remanentes de una población anterior, por lo que es necesario incorporar estos registros como parte del plan de conservación *ex situ* e *in situ* de la especie.

Palabra clave: Palma corcho, *Microcycas calocoma*, conservación.

RESUMO

Microcycas calocoma é considerada "Jóia da Flora de Cuba" e está categorizada como espécie "Criticamente Ameaçada" pela Lista Vermelha da Flora de Cuba, razão pela qual sua conservação é necessária. O objetivo do estudo é caracterizar três novas localidades ao norte de San Diego de los Baños, Los Palacios, onde é relatada a presença da espécie. Em cada local foram registrados o número total de indivíduos, a altura das plantas, o perímetro do tronco, a presença de danos mecânicos, o estado fitossanitário e o nível de epifitismo. Foram registrados 17 indivíduos, agrupados nas segundas fases do seu ciclo de vida. Seis indivíduos apresentaram danos mecânicos com bom estado fitossanitário e baixo epifitismo. As localidades descritas podem representar remanescentes de uma população anterior, por isso é necessário incorporar esses registros como parte do plano de conservação ex situ e in situ da espécie.

Palavras-chave: Sobreiro, *Microcycas calocoma*, conservação.

INTRODUCTION

The northern area of Los Palacios comprises two mountain ranges within the Guaniguanico Mountain Range: The Sierra de los Órganos and the Sierra del Rosario, spatially separated by the depression of San Diego River valley (Cobiella-Reguerra *et al.*, 2000). The Los Palacios Mountain system comprises a wide variety of plant formations which, although affected and impacted by deforestation, are home to a high level of plant diversity and endemic species, including *Microcycas calocoma* (Miq.) A. DC., Zamiaceae family.

M. calocoma is one of the most emblematic species of Cuban flora, belonging to a monotypic genus endemic to Cuba. It is found exclusively in the province of Pinar del Río and the westernmost part of Artemisa (Barrios, 2022).

The species has an IUCN Red List category and is protected by Appendices I and II of CITES, and is considered Critically Endangered (González-Torres *et al.*, 2016). Due to its ecological importance and taxonomic and geographic rarity, it was declared a National

Natural Monument in 1989 and recognized as a "Jewel of Cuban Flora" (Lazcano-Lara, 2007).

M. calocoma is included in the Cuban flora conservation projects and on the list of Species of Special Significance for Biological Diversity (Res 160/2011) by the Ministry of Science, Technology and Environment (CITMA). For its conservation, the species has been the subject of countless population, embryological, germination, pollination and dispersal studies (Peña *et al.*, 1996; Del Risco & Morell, 1984; Vovides *et al.*, 1997; Chaves *et al.*, 2005; Lazcano-Lara, 2007; Barrios, 2022).

This study aims to characterize three new localities of *M. calocoma* in the north-central region of San Diego de Los Baños, Los Palacios, in the Sierra del Rosario, to provide important aspects of species hábitats and the main threats for conservation action plans.

MATERIALS AND METHODS

The study was conducted in the mountainous region of the Sierra del Rosario (Figure 1), located north of San Diego de los Baños, part of the municipality of Los Palacios, Pinar del Río. Three expeditions were carried out, allowing the presence of the species to be reported in three new localities. The term "locality" was used to designate each location where there is a grouping of individuals of the species, spatially and ecologically distantly (Peña *et al.*, 1988). Each locality was georeferenced and assigned the name of the area (Table 1).

Table 1 – Localities under study and their geographical location

Localities	**Geographical coordinates**	
	Latitude	**Longitude**
El Papayal	N 22°40'36.0''	O 83°21'01.8''
Paredón del Gato	N 22°40'60.0''	O 83°21'03.1''
Hoyo del Majagual	N 22°41'14.4''	Or 83°20'22.8''
Total		

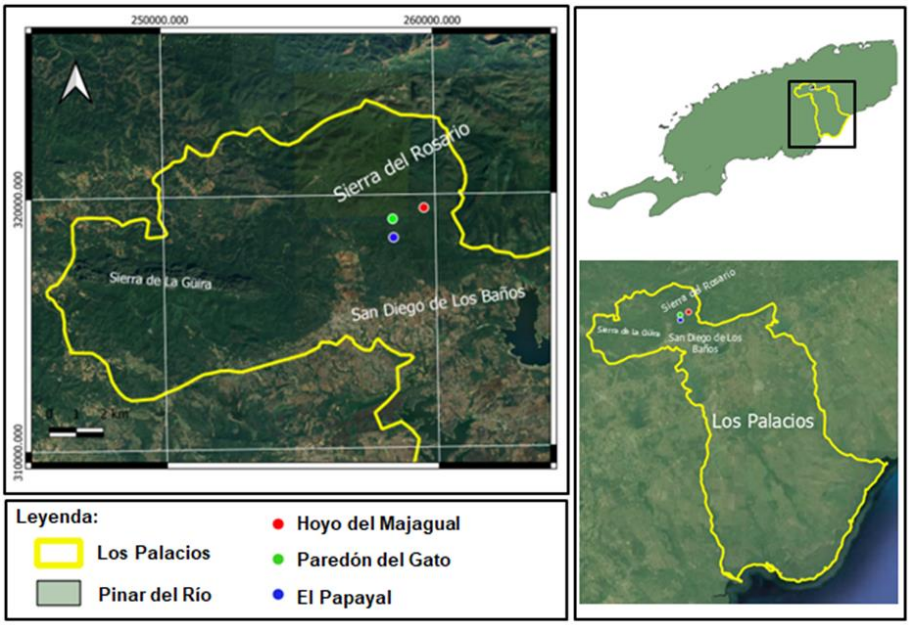

Figure 1. *- Location of the three localities of M. calocoma North of San Diego de Los Baños, Los Palacios*

For the study, each location where the species is found was characterized, and general data were collected on the conservation status of the vegetation and elevation characteristics.

M. calocoma individuals was counted at each location and classified as seedlings, juveniles, and adults. To analyze the species' population structure in the area according to Lascano-Lara (2007), the following were measured:

- Plant height, measured with a tape measure up to 2 m, individuals larger than 2 m had were estimated the height.
- The trunk perimeter was measured with a tape measure. Measurements were made according to height: at 1 m for individuals taller than 1 m; at 0.50 m for plants between 0.60 and 1 m; at 0.25 m for plants between 0.40 and 0.59 m; and half the height for plants shorter than 0.39 m.
- Development stage: seedlings (height ≤ 0.25 m and circumference ≤ 0.15 m); juveniles (between 0.26 m and 1.50 m in height and between 0.16 and 0.30 m in perimeter); and adults (more than 1.50 m in height and perimeter greater than 0.30 m)

- Sex and number of strobili: Presence of the strobila.
- Presence of mechanical damage: loss of the apex or wounds on the trunk.
- Phytosanitary status: good (B) for healthy plants, fair (R) for those affected by sooty mold, coccids or termites, and bad (M) for those with more than 40 % of the specimen affected.
- Presence of epiphytes: absence of epiphytes (A), low (B) when the trunk is covered up to 0.25 % by them, medium (M) between 0.25-0.50 % of coverage and high (A) above 0.50 % of the trunk surface covered.

RESULTS AND DISCUSSION

A total of 17 individuals were registered in the three locations (Table 2), these were found mainly on the peaks and rocky slopes near areas of karst in the form of "dog's tooth".

Locality 1. El Papayal: Elevation reaching 270 m a.s.l. On the northeast slope, it forms a small, mogote-like ravine. Five individuals of *M. calocoma* were found at 220 m a.s.l. The distance between plants ranges from five to ten m. The individuals grow under the canopy of the semi-deciduous mesophilic forest on limestone rock (Figure 2).

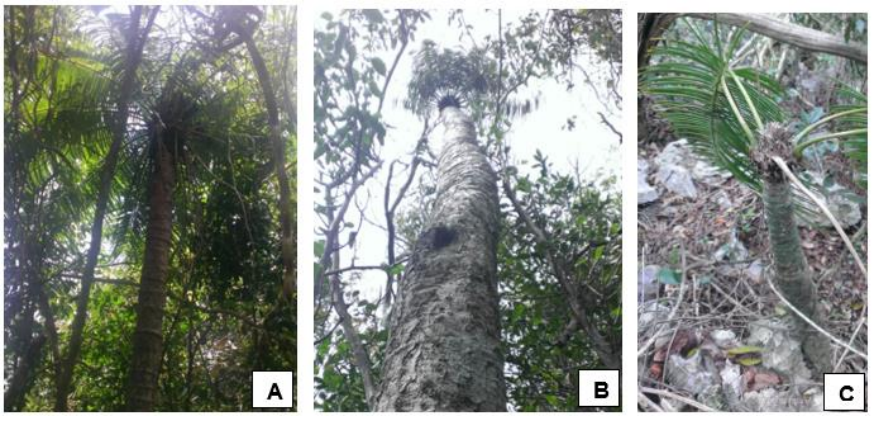

Figure 2. -*Three specimens of M. calocoma at the El Papayal locality.* ***A.*** *Adult specimen in good condition growing under the canopy.* ***B.*** *Taller and larger specimen found at all three localities.* ***C.*** *Juvenile growing next to limestone formations known as "dog's tooth".*

Locality 2. Paredón del Gato: This was the highest locality. It is located at an elevation of 440 m a.s.l and is approximately 2 km north of Locality 1. Only three individuals were found on the southern face of the elevation at approximately 430 m a.s.l. The individuals were in good condition and were growing under the mesophilous semi-deciduous forest on limestone soil (Figure 3).

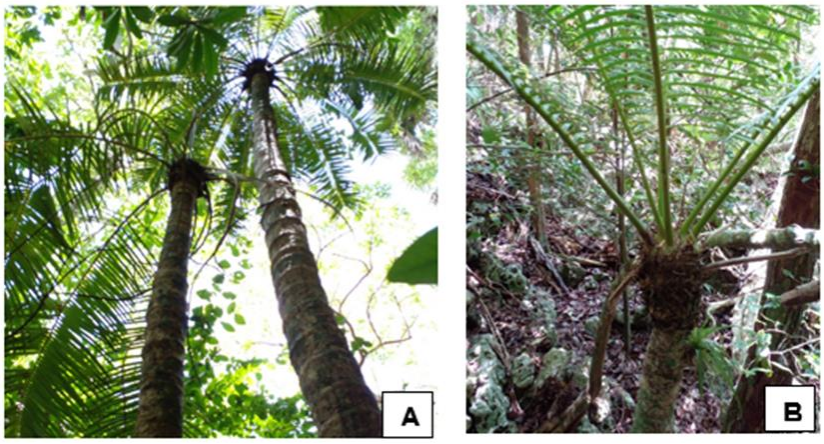

Figure 3. - *Microcycas specimens calocoma in the locality of El Paredón del Gato.* ***A.*** *Adult specimens in good condition growing under the canopy.* ***B.*** *Juvenile specimen*

Locality 3. Hoyo del Majagual: Located approximately 5 km from localities 1 and 2, on the southern slope of an elevation that reaches 500 m a.s.l. To reach the locality, it must enter into a very humid depression called Hoyo del Majagual. Nine individuals were found at approximately 300 m a.s.l., in a steeply sloping ravine where it grow in dense mesophilic semi-deciduous vegetation with a greater presence of limestone rocks. The greatest mechanical damage to the specie was observed at this locality (Figure 4).

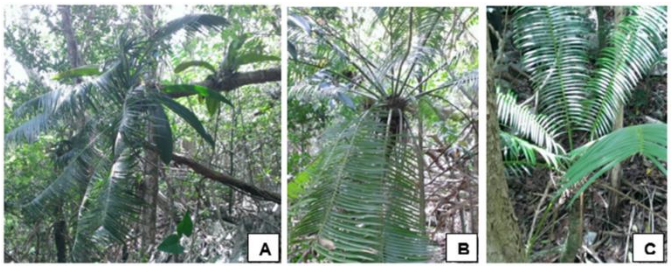

Figure 4. -*Specimens of M. calocoma in the Hoyo del Majagual area.* ***A.*** *Adult individual fallen, due to severe meteorological events.* ***B.*** *Adult specimen in good condition.* ***C.*** *Juvenile specimen.*

Lascano-Lara (2004) states that there is no a reliable method to estimate the age of individuals and suggests that the height and perimeter ratio can be used as an indicator of their state of development.

In this case, according to height, no seedlings were found at any location, only juveniles and adults, which represent 47 % and 52.3 % respectively. But, regarding the perimeter, five individuals can be classified as seedlings, which represent 35 %, and juveniles and adults represent 41 % and 24 % respectively (Table 2).

This could be related to the proposal made by Lazcano-Lara (2007) that, beyond a certain height, the rate of plant growth increases in thickness, and, therefore, it is possible for individuals of different ages to have the same perimeters. In this sense, height could be the variable that best describes the state of development. No individuals were found in any locality that had heights less than or equal to 0.25 m. Therefore, the species is represented only by juvenile and adult plants.

Table 2. - *Number of M. calocoma individuals in each locality and number of individuals by development stage*

Locality	Number of individuals	Height			Perimeter		
		Seedling	Juvenil	Adult	Seedling	Juvenil	Adult
El Papayal	5	0	2	3	1	3	1
Paredón del Gato	3	0	5	4	3	4	0
Hoyo del Majagual	9	0	1	2	1	2	2
Total	17	0	8	9	5	9	3

No individuals with cones were detected at any location, so it was not possible to identify the sex of each individual. The absence of cones and seedlings may indicate that the reproductive potential at the locations is very low. Peña *et al.* (1988) in a study in locations belonging to the Mil Cumbres Protected Area, reported a similar condition in

which the reproductive potential estimated from the number of plants that produce cones with respect to the total number of individuals is extremely low, even in locations with a relatively high number of specimens.

The analysis of epiphytism showed that 80 % of the individuals do not have associated epiphytes and only species such as *Tillandia sp.* and an orchids like *Trichocentrum ensatum* and *Vanilla sp. were found.*

Thirty-five percent of the individuals showed mechanical damage, primarily loss of the apex, split trunks, and bent and semi-drooping individuals (Figure 5), that means a high rate of mechanical damage in the localities. Lascano-Lara (2007) reported similar damages to several specimens in the Sierra de la Caoba locality, which remain in the population without affecting the survival.

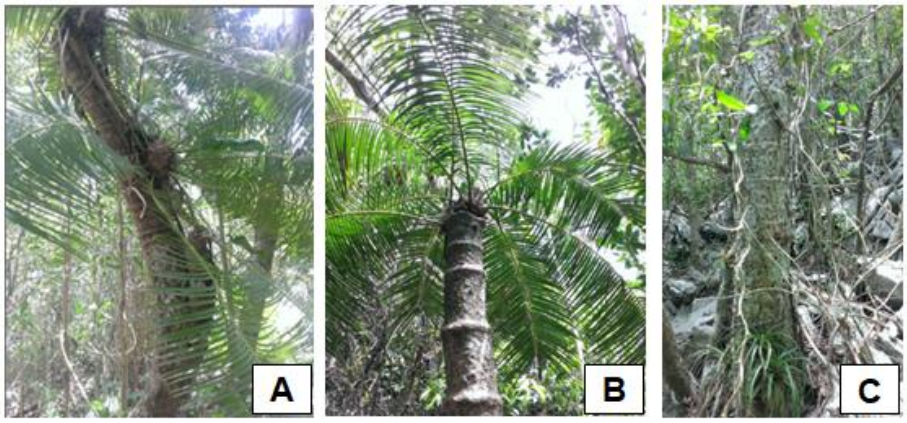

Figure 5. -*Individual of M. calocoma.* ***A.*** *Individual from the El Papayal locality with consequences of mechanical damage and presence of leaf sprouts and cataphylls.* ***B.*** *Individual from the Hoyo del Majagual locality with mechanical damage and a new apex growing.* ***C.*** *Dead individual.*

Regarding the phytosanitary status, all individuals were evaluated as healthy, even those with mechanical damage, and only one dead individual was found (Figure 5 C) in the Hoyo del Majagual.

Other important problems worth highlighting in the studied locations are the evidence of human intervention in the illegal logging of timber species and the presence of *Sus scrofa* (pigs) in the areas, which represent direct threats to the species. In this regard, Del

Risco & Morell (1984), Peña *et al.* (1988), Peña *et al.* (1996) and Lascano-Lara (2007) have documented the destruction of seeds and seedlings of the species by wild pigs.

The population structure of these localities suggests that they could represent remnants of a single, much larger, earlier population that was fragmented, so it is necessary to incorporate these records as part of the *ex situ* and *in situ* conservation plan for the species.

CONCLUSIONS

The three new locations for *Microcycas calocoma* in the north of San Diego de Los Baños, are characterized by the small number of adult individuals, the absence of regeneration.

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Conflicts of interest:

The authors declare not to have any interest conflicts.

***Contribution of the authors*:**

The authors have participated in the writing of the work and analysis of the documents.