

Short Communication

Evaluation of the conservation status of *Morangaya pensilis* (Cactaceae), a little known endemic monotypic genus of southern Baja California, Mexico

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Abstract *Morangaya pensilis* is an endemic monotypic cactus genus from the southern part of the Baja California Peninsula, Mexico. Previously known only as scattered individuals occurring at a very low density in the highest areas of Sierra de La Laguna, the occurrence of a relatively more dense population (4–7 plants per 250 m²) is reported on Sierra Cacachilas, c. 40 km to the north. Disturbance to the species' habitat includes fragmentation, illegal collection and trade, and land use changes, especially to farming and cattle ranching. Seeds collected from Sierra Cacachilas had a relatively high viability (92%) but recruitment (of 2-month old seedlings) in the

area was relatively low, despite above average rainfall in the year of measurement. *M. pensilis* is eligible for inclusion in Mexico's list of threatened species and fulfils the requirements for categorization as Vulnerable on the IUCN Red List. Management activities that are already taking place in this area include restrictions on cattle and goat grazing and consideration of areas suitable for translocation of the species.

Keywords Baja California, Cactaceae, Mexico, *Morangaya pensilis*, Red List, Vulnerable.

The plant family Cactaceae is distributed in the arid and semi-arid regions of the American continent. Many species are threatened (Eggle & Taylor, 1991; Hunt, 1992; Anderson & Taylor, 1994; Anderson, 2001) because, given their low numbers and population growth and recruitment rates, all of which limit their ability to recover after perturbations, they are particularly vulnerable to disturbance. In recent years many species of cacti have been subject to intense disturbance along the entire Baja California Peninsula (Garcillán *et al.*, 2003), even though this region has the lowest human population density in Mexico. Disturbance includes habitat fragmentation, illegal collection and trade, and land use changes, especially to farming and cattle ranching (Arias, 1993). Because populations are declining, many species of cacti are in need of urgent attention from conservation agencies. Currently, however, inclusion of cacti in national and international lists of threatened species seems to be based on incidental observations rather than on detailed field data (Contreras & Valverde, 2002).

In this study we examined *Morangaya pensilis* (K. Brandegee) G. Rowley, a pendant and/or creeping cactus

endemic to the southern Baja California Peninsula, Mexico. Some authors recognize this taxon within the genus *Echinocereus* (Taylor, 1985; Anderson, 2001). This species is not yet included in the *Norma Oficial Mexicana* (Mexican Official Regulation 059) list of threatened species, in spite of its limited distribution and habitat specificity. Until now the demographic traits and status of this species were unknown, probably because it does not occur as dense or broadly distributed populations, but as isolated groups of plants.

This monospecific genus was previously only known from the highest areas of Sierra de La Laguna (Fig. 1; Moran, 1977), which are characterized by oak-pine and oak woodlands over altitudes of 1,200–2,100 m. Scattered individuals of *M. pensilis* hang from cliffs and granite boulders as several-branched plants (Moran, 1977). Some branches grow up to 180 cm (pers. obs.). At this site the species appears to be more frequent at higher elevations, where there is a greater abundance of suitable rocky substrates on ridge tops and where the less arid climate and higher solar radiation could favour plant establishment and growth (pers. obs.).

In 2002 I found a dense population of this species growing in a botanically unexplored area on Sierra Cacachilas (Fig. 1), c. 40 km north of the species' formerly known range. Several cattle breeding farms or 'ranchos' are located in the lowlands, but the summit area of the main mountain (Cerro del Puerto de los Soldados,

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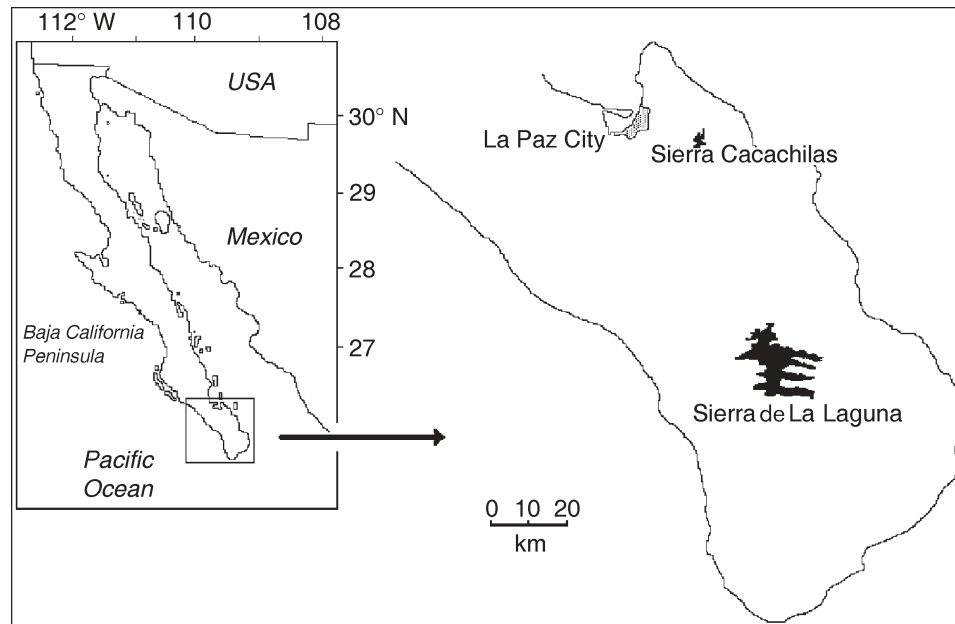


Fig. 1 Location of the study area in Baja California, Mexico (inset), and of the previously known population of *Morangaya pensilis* in Sierra de La Laguna and of the population reported here, in Sierra Cacachilas.

Table 1 Demography of *Morangaya pensilis* in eight 5 * 50 m transects on Sierra Cacachilas (see Fig. 1 for location).

Transect	No. plants	Mean no. live branches	Mean no. dead branches	Largest live branch (cm)
1	4	4.75	2.50	56
2	5	4.00	4.41	48
3	4	4.00	2.73	42
4	6	4.67	2.00	57
5	5	5.40	2.84	50
6	7	4.86	3.50	63
7	5	4.80	1.81	46
8	5	4.80	2.64	48
Mean ± SD	5.12 ± 0.99	4.66 ± 0.45	2.79 ± 0.89	51.25 ± 6.86

950–1,200 m) is mostly free of such activities. This area has steep gradients of 50–60° and is underlain by granite. Granite boulders cover 40–50% of the surface. *M. pensilis* is a common plant in this area, growing beside rocks but, contrary to its habit in the type location (Sierra de La Laguna, Fig. 1), it is rarely found hanging from rock outcrops.

In spring and early summer 2003 I made four visits to Sierra Cacachilas to determine plant density, make observations during blooming and notes on floral visitors and fruiting set, and to collect fruit to study seed contents and evaluate seed germination. On 28 March 2003 I labelled 60 plants for monitoring reproductive phenology. On 25 January 2004 a fifth and final visit was made to count plantlet recruitment after a heavy rainy season (August–October 2003). During the first trip I

counted the number of individual plants and branches of *M. pensilis* within a 2,000 m² plot, using eight 5 * 50 m transects. Only live branches longer than 5 cm were recorded. The number of dead branches per plant were also recorded, as well as the length of the longest living branch on each plant.

The high density of individuals on the slopes of this mountain (4–7 plants per 250 m²; Table 1) suggests this area contains the main population of the species and therefore requires special conservation attention. At Sierra de La Laguna individual *M. pensilis* occur at a much lower density (Moran, 1977). The main difference between individuals in the newly discovered population and that of Sierra de La Laguna is the tendency of the population in Sierra Cacachilas to develop short branches (up to 63 cm in length, and 51 cm on average), and the caespitose appearance of plants because new branches appear from the soil instead of on the exposed surface of old branches. Because of the low canopy coverage, solar radiation is high and plants appear to experience high water stress during the hot and dry months (April to July). Most of the plants had a very dehydrated appearance from May until the start of the rainy season in July/August. Branch mortality appears to be a common occurrence because c. 37% of all branches were dead (Table 1). Age of the plants is difficult to estimate because new branches are continuously appearing as the older and largest die.

Buds were first evident on the 60 labelled plants on 5 May. Blooms appeared over 15–20 May, and no fresh flowers were present by the time of the next visit on 1 June. We counted 102 dry flowers on 52 individuals, but

48 were aborted or unfertilized, i.e. 54 developed into fruit. On 20 July we recorded the setting of fruits and collected some, but only 34 were found, i.e. 20 were either consumed or aborted before the visit. The average number of seeds in 10 fruits was $223 \pm \text{SD } 43$, of which a total of 75 were abnormal.

According to Taylor (1985) *Morangaya* flowers are adapted for diurnal pollination by wasps, bees and hummingbirds. I observed that they open for a few hours in the early morning (05.00–11.00), and that a generalist flower visitor, a small species of the insect family Nitidulidae (Order Coleoptera), appeared to be the main pollinator.

I evaluated seed viability by inducing germination of 100 seeds in a Petri dish containing wet paper. After 10 days, 67 seedlings appeared. Using the technique of adding red tetrazolium (2,3,5-triphenyltetrazolium chloride, 0.5 M) solution to seeds for 10 minutes in darkness, which colours live embryos red, we found that 25 of the ungerminated seeds were still alive, i.e. only eight seeds were dead. During the fifth survey after a total rainfall of 620 mm from August to October (recorded at the nearest meteorological station, at La Paz City), compared to the mean total annual rainfall of 220 mm, only a total of 17 seedlings were found in the 2,000 m² plot.

One of the characteristics of rare species is their inability to colonize new areas (Gaston & Kunin, 1997). Low dispersal ability is due to factors other than seed yield and viability, the most important being the opportunities for dispersal from the mother plant. In *M. pensilis* adventitious roots are common on old branches and thus asexual propagation is an alternative to dispersal, but only over short ranges. As in other cacti, *M. pensilis* fruits are berries. Germination is facilitated when such berries are consumed by vertebrates, the pulp stripped by passage through the digestive tract, and deposited on suitable sites (León de la Luz & Domínguez, 1991). Animals that favour this process are passerine birds and some lizards, and these animals are common at Sierra Cacachilas.

The density of mature plants in a given population depends not just on high seed viability, but on the factors that facilitate germination, establishment of seedlings, and further development (Lovett-Doust & Lovett-Doust, 1988). The relatively high seed viability in this population of *M. pensilis* (92%) contrasted with relatively low recruitment (of 2-month old seedlings), especially considering this was after unusually heavy rainfall. In years with average rainfall percentage germination is probably lower.

Using the information gathered in this study we used the risk evaluation method (Método de Evaluacion de Riesgo; SEMARNAT, 2002), a semi-quantitative method that standardizes data on species to rank them using four

criteria, each assigned a numerical value (range 1–4). These are: (1) geographical range of the taxon (in the case of *M. pensilis*, restricted or <5% of Mexican territory = 4); (2) habitat characteristics (in this case, hostile and limiting = 3); (3) vulnerability of the taxon (considering demography and the reproductive capacity of the population = 4); (4) human impact on the taxon (evidence of disturbance in the area is low = 2). The sum of these values is 13, which means that, by the established criteria of 12–14 points, this species should be considered as threatened with extinction, and is therefore eligible for inclusion in Mexico's list of threatened species (SEMARNAT, 2002). With respect to demography and reproductive capacity, this species shows a similar pattern to many other species of cacti, i.e. high seed viability (Rojas-Aréchiga & Vázquez-Yanes, 2000) and low recruitment. Using the IUCN Red List criteria (IUCN, 2001) *M. pensilis* fulfils the requirements for categorization as Vulnerable, based on criteria B1ab(iv), i.e. extent of occurrence <20,000 km² (B1), known from no more than 10 locations (a), and continuing decline (b(iv)) in a number of locations.

Further studies of this species should examine seedling survivorship over a longer time span of several years, and floral biology. In addition, given the low percentage germination, the physiological constraints during early development require examination. Management activities that are already taking place in this area include restrictions on cattle and goat grazing and consideration of suitable areas for translocation. Potential areas for translocation includes the summit area of Sierra del Mechudo, which rises to 1,100 m, 50 km north-west of the La Paz bay.

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Biographical sketch

José Luis León de la Luz has dedicated the last 25 years of his life to the study of the flora and vegetation of the Baja California peninsula and adjacent islands. His main research interests currently include the biotic relationships between plants and their pollinators and seed disseminators.