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PITCAIRNIA ABUNDANS L.B.SM. (BROMELIACEAE): SUPPLEMENTARY DESCRIPTION, RANGE EXTENSION AND CONSERVATION STATUS OF AN ENDEMIC MEXICAN PLANT

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RESUMEN

Se presenta una descripción suplementaria de *Pitcairnia abundans* con base en nuevos especímenes recolectados en Nayarit, en o cerca de la localidad tipo y de una nueva localidad en Jalisco, la cual extiende su distribución conocida en aproximadamente 115 km. Presentamos información nueva de flores en antesis, de frutos y semillas, así como de fenología de floración y fructificación. La aplicación del método para la evaluación del riesgo de extinción en especies silvestres mexicanas (MER) resultó en un estatus de "en peligro de extinción" para esta especie.

Palabras clave: *Pitcairnia*, Bromeliaceae, conservación, extinción, MER, plantas mexicanas endémicas, bosque tropical caducifolio, occidente de México.

ABSTRACT

A supplementary description of *Pitcairnia abundans* is presented based on new specimens collected at or near the type locality in Nayarit and from a new location in Jalisco, which extends its known range about 115 km. We present previously unknown information from fresh flowers, fruits and seeds, as well as phenology of flowering and fruiting. The application of the method for the assessment of extinction risk in Mexican wild species (MER) resulted in endangered status for this species.

Key words: *Pitcairnia*, Bromeliaceae, conservation, extinction, MER, Mexican endemic plants, tropical deciduous forest, Western Mexico.

INTRODUCTION

Explorations in the Santiago River canyon (known in the Guadalajara city area as ''La Barranca'') which began in September of 1999 revealed an interesting rupicolous bromeliad of the genus *Pitcairnia*. A few plants were brought to the ''Jorge Victor Eller'' Botanic Garden of Universidad Autónoma de Guadalajara in June 2000 for cultivation, and flowered two years later. Upon flowering, the plants were identified as *Pitcairnia abundans* L.B.Sm., a species known only from the type locality, in southeastern Nayarit.

Espejo & López-Ferrari (1998) report about 61 genera and approximately 2700 species in the family Bromeliaceae, with 46 of the 266 known species of *Pitcairnia* occurring in Mexico. In Jalisco and Nayarit, there are reports of 12 and 8 species of *Pitcairnia* respectively. Of these, only *P. abundans* and *P. imbricata* have greenish-white flowers; both have been reported in both states.

This genus was traditionally divided in two subgenera: *Pepinia* with winged or naked seeds, and *Pitcairnia* with biappendiculate seeds (Smith and Downs, 1974). Besides the seed character, species of *Pitcairnia* are also distinguished by foliar traits (Espejo & López-Ferrari, 1998). *Pepinia* has recently received generic status (Varadarajan & Gilmartin, 1988) and will not be considered further.

Pitcairnia abundans was known only from scanty material from the type locality, and as the only flowers known at the time of the original description were senescent, many floral details were not known. Conservation of strict endemics is a priority but also a challenge considering the limited information that is commonly available. This is a rare plant that apparently was not collected outside the type locality since 1959. We hereby report one new locality of *P. abundans* that is close to Guadalajara, a city with dynamic botanic activity which increases the opportunities of learning more about this species.

The objective of this paper is to provide a supplementary description of *P. abundans*, document an extension of its range of distribution and to evaluate its conservation status.

METHODS

This study was based on 31 exploratory trips to the Santiago River Canyon and one to the Verde River Canyon between September 1999 and January 2005, in the municipalities of Tonalá, Guadalajara, Zapopan, and San Cristóbal de la Barranca in the former canyon, and Ixtlahuacán del Río in the latter; all in the state of Jalisco. Also, two visits to or near the type locality in Nayarit were made on September 25, 2002 and on March 1, 2003.

Some specimens from both Jalisco and Nayarit were cultivated at the «Jorge Victor Eller» Botanical Garden at the Universidad Autónoma de Guadalajara until they flowered. They were photographed and herbarium specimens prepared. All the herbarium specimens were deposited at the Herbarium of the Universidad Autónoma de Guadalajara (Acronym GUADA sensu Holmgren & Homgren, 1998). Upon study they were identified as *Pitcairnia abundans* L.B.Sm. The Botanical Type Specimen Register of the US National Herbarium, available at http://ravenel.si.edu/botany/

types/ was used to confirm the determination. A supplementary description of *Pitcairnia abundans* was prepared with the new fresh flowers and additional pressed material at hand.

The new geographic distribution of this species was determined on the basis of the available literature (Smith, 1964; Smith & Downs, 1974; McVaugh, 1989; Espejo & López-Ferrari, 1994), on the available and new specimens hereby reported, and a topographic map 1: 1,000 000 (INEGI, 1998). To determine the vulnerability to extinction of *Pitcairnia abundans*, we applied the method for the assessment of extinction risk in Mexican wild species (MER) (SEMARNAT, 2002). This method is required by Mexican law to evaluate the protection status that may be afforded to a species, and considers the following criteria: (1) extent of the distribution of the taxon in Mexico, (2) condition of the habitat for favoring or limiting the permanence of the taxon, (3) intrinsic biological vulnerability of the taxon, and (4) impact of human activities on the taxon. The evaluation of each criterion is then scored, and the sum of scores is compared with a scale. A taxon with a score of 12–14 is considered endangered, and one with a score of 10–11 is considered threatened. Additional details of this method are described in Table 1 by Lomelí-Sención & Sahagún-Godínez (2002).

RESULTS AND DISCUSSION

Supplementary description of *Pitcairnia abundans* L.B.Sm. Phytologia 10(6): 483, t. 2, f. 1-2. 1964. (Fig. 1).

Type: Mexico: Nayarit: Mountains 10 miles southeast of Ahuacatlán, on the road to Barranca del Oro and Amatlán; precipitous rocky south-facing slopes; elevation 1100-1300 m. Abundant on summits of rocks, in shade in the barranca. Flowers apparently white. *R. McVaugh and W.N. Koelz 751*, 17-18 November, 1959 (The holotype US, Photo!).

Plants short-caulescent, flowering after at least two years of growth, clumps connected by stout rhizomes ca. 25 cm long and ca. 2 cm diam. **Leaves** dimorphic, 10-20, subrosulate, light green; sheaths when fresh sparsely white-flocculose, concealed by one another, with minute recurved brown teeth on the edges, in senescence truncate and revolute at apex, when dry persisting at least into the next growing season; the 2-4 external ones produced at the outset of the shoot's first growing season nearly reduced to pectinate flat spines; the internal ones well developed, drought-deciduous, foliaceous, entire above the line of abscission, slightly undulate, long ensiform 60-78 cm long, 16-26 mm wide at the line of abscission and 33-43 mm wide at the widest point, shallowly canaliculate to conduplicate adaxially, long acuminate at apex, the tips at times filiform, in young leaves sparsely white-flocculose abaxially throughout, glabrescent in age.
Inflorescence an erect raceme, 27-50 flowered including unopened buds, 11.5-22 cm long, ca. 18 cm diam. the axis minutely glandular-puberulent, otherwise glabrous; **scape** stout glabrescent, cottony at the nodes near the base of bracts, (33) 60-70 cm long, 10-17 mm diam. at base, 4-8 mm diam. near apex; **scape bracts** green ca. 10-13 (20), the lowermost 4-5, leaf-like, with deciduous entire blades, longer than the internodes, linear ensiform, 3.5-40 cm long, 16-40 mm wide at base, acuminate at apex, their bases not concealed by contiguous bracts below, progressively becoming smaller toward the

Fig. 1. *Pitcairnia abundans* L.B.Sm. Part of the inflorescence showing a senescent white flower below, a greenish flower at anthesis, and flower buds above. Notice the cirrhous, undulate, recurved margins of the bud tips.

tip, long sheaths floccose when young, glabrous in age, with minute recurved brown teeth on the margin, revolute at apex when dry, the uppermost bracts linear-lanceolate, entire throughout, 2.0-5.3 cm long, 7-25 mm wide at base, somewhat involute when dry with persistent blades; **floral bracts** 27-50, similar to the uppermost scape bracts, becoming smaller toward the apex of the inflorescence, margins involute when dry; **flower buds** light green, the apex cirrhous, undulate, recurved and resembling three stigma branches, strongly reflexed at anthesis. **Flowers** polystichous, zygomorphic, spreading, light green, whitish throughout at senescence; **pedicel** obconic, 4-7 mm long, 5.5 mm diam. at the widest point, strongly bisulcate adaxially; **sepals** narrowly lanceolate, green, 2-3 cm long, 5-7 mm wide, minutely tuberculate, sulcate when dry, not keeled, margin entire, apiculate, the apiculum 1-2 mm long; **petals** membranaceous, imbricate, light green to yellowish green, whitish toward the base, elliptic, oblong-elliptic to lanceolate, 6.0-8.1 cm long, 14-20 mm wide, the margin entire, bearing at base an adaxial basal elliptic-ovate to suborbicular scale, the apical half free, truncate to rounded and erose at apex, 0.8-1.3 cm long, 6-9 mm wide, connivent at anthesis; **stamens** included, those of the inner verticil basally adherent to longitudinal furrows on the ovary, **filaments** flattened, nearly straight, or sigmoid toward the base, wider toward apex, (3.5) 4.3-5.6 cm long, **anthers** basifixed, linear, becoming filiform after dehiscence, 1.1-1.3 cm long; **ovary** nearly two thirds inferior, green, trilobate and trisulcate, the furrows alternate with the sepals, narrowly ovoid, ca. 11 mm long (including the inferior portion), 4-6.5 mm diam., ovules numerous, placentation axile, **style** linear, 5.5-6.3 cm long, trilobate, each lobe continued into a stigmatic branch, **stigma** 4-5 mm long, 0.8-1.5 mm diam. at the widest point, with three flattened sinistrorse branches, and glandular hairs on the adaxial margin ca. 0.2 mm long. **Capsule** ovoid, septicidal, trilobate, tricarpellar, with a filiform persistent wiry style, (7) 10-12 mm long, (6) 7-8 mm diam., lustrous smooth, greenish brown becoming dull straw in age, the calyx persistent, connate 5 mm at base, there also adnate to the fruit, the valves widely open at apex, remaining closed at base, petals persistent, whitish, coiled. **Seeds** numerous, orange-yellow, becoming straw-colored in age, linear, nearly terete, 3 mm long, the surface minutely vesiculate in longitudinal rows, with a fleshy white appendage ca. 1 mm long on each end, connected with each other through a narrow longitudinal white ridge ca. one third to one fourth the width of the seed.

This description builds on the original one provided by L.B. Smith (1964) and the revised version of McVaugh (1989). Our report includes descriptions of petals, fruits and seed which were previously unknown. McVaugh (1989), indicates in his description that sepals have «...long subulate tips becoming twisted together or coiled in drying, ...» but we were unable to observe this. Rather, in dry material, we have seen that the apices of petals in unopened buds have such features.

Distribution. Endemic to western Mexico. Known only from the type locality in Nayarit and the Santiago River basin in Jalisco. The new collections reported herein from Nayarit are presumably from the type locality, which apparently hadn't been revisited since the initial collection in 1959 by McVaugh. Fourteen species of *Pitcairnia* have been reported in Jalisco and Nayarit (Espejo and López-Ferrari, 1994) of which, 12 have red

flowers and only two have greenish-white flowers, namely *P. abundans* and *P. imbricata*.

Phenology. Flowering: September-November. Fruiting: October-December. Flowering at night, but extending until noon in cloudy weather. The Nayarit plants have flowers with a faint herbal scent, whereas those from near Guadalajara have a skunk-like odor. This would suggest perhaps bat-pollination, but we were unable to observe any pollinator activity.

Habitat. Rupicolous on large rocks near creeks in barrancas, in tropical deciduous forest near the ecotone with oak forest in cool, protected but well lit spots under the canopy. Growing together with *Alvaradoa amorphoides* Liebm., *Bursera bipinnata* (Sessé & Moc. ex DC.) Engl., *B. fagaroides* (Kunth) Engl., *Cochlospermum vitifolium* Spreng., *Euphorbia calcarata* (Millsp.) V.W. Steinm., *Leucaena esculenta* (Moc. & Sessé ex DC.) Benth., *Lysiloma microphyllum* Benth., *Opuntia* sp., *Pereskiopsis aquosa* (F.A.C. Weber) Britton & Rose, *Plumeria rubra* L., *Pouzolzia* sp., *Trema micrantha* (L.) Blume, and bambusoid plants. Elevation. 1100-1350 m.

Specimens seen

Jalisco: Barranca of the Santiago River, 0.5 km before La Soledad, on the road Ixcatán-Huaxtla, Municipality of Zapopan. Elevation 1200 m. 20°53'N 103°21'W. In tropical deciduous forest. *M.A. Macías-Rodríguez, E. Sahagún-Godínez and R. León-Maldonado 895,* 26 June, 2000 (GUADA); Barranca of the Santiago river, on the road from La Soledad to Huaxtla (by way of Ixcatán), Municipality of Zapopan. Elevation 1300 m. 20°55'N 103°22'W. Growing in tropical deciduous forest, near the ecotone with oak forest, on a large flat rock near a stream. *E. Sahagún-Godínez, M.A. Macías-Rodríguez and R. León-Maldonado 2450* (GUADA) [collected in sterile condition on 26 June, 2000; pressed on 24 September, 2002 when the plant flowered at the "Jorge Victor Eller" Botanical Garden of Universidad Autónoma de Guadalajara]; Barranca of the Santiago river, on the road from La Soledad to Huaxtla (by way of Ixcatán), Municipality of Zapopan. Elevation 1300 m. 20°55'N 103°22'W. Growing in tropical deciduous forest, near the ecotone with oak forest, on the edge of the cliff with abundant bambusoid grasses; sterile plant. *E. Sahagún-Godínez and J.A. Lomelí-Sención 2451,* 24 September, 2002 (GUADA). **Nayarit:** 18 km on the road from Ahuacatlán to Estancia Los López, Municipality of Amatlán de Cañas. (Sierra del Guamúchil). Elevation 1275-1350 m. 20°57'N 104°28'W. Shady and rocky ravine. *P. Carrillo-Reyes and J.A. Lomelí-Sención 3481,* 25 September, 2002 (GUADA); Ibid. *J.A. Lomelí-Sención 3628,* 1 March, 2003 (GUADA).

Extension of the known geographic distribution of *Pitcairnia abundans* L.B.Sm.

The new location in Jalisco hereby reported extends the known distribution range of *P. abundans* about 115 km from the type locality in Nayarit; however no additional populations were found between the two known disjunct populations. Both sites are in a region known as the Mexican Transversal Volcanic Belt; the Nayarit location is part of the Ameca river basin and the one in Jalisco is located in the Santiago River Canyon. Interestingly, both locations are very similar in vegetation composition, elevation and latitude. We observed that,

as far as known, this is a strictly endemic species with very limited distribution. In the Jalisco population, very few individuals were seen in only one site, despite much exploration in the area. Although the Nayarit region was not as thoroughly explored, a similar pattern of localized distribution was also noticed. The observed scarcity of this species prompted an evaluation of its conservation status which may help protect it in the future. Since the known populations of *Pitcairnia abundans* are very restricted and grow in areas that are difficult to access, future exploration in western Mexico may reveal additional stands.

Conservation status

a) Geographic distribution: Scores range from 1-4. After analyzing the known distribution range of this species, we assign it a score of 4 due to the reduced area it occupies. *Pitcairnia abundans* is found in a short ravine in Nayarit and in two small adjacent clumps in Jalisco. This extension amounts to much less than 5% of the territory of Mexico.
b) Habitat condition: Scores range from 1-3. We gave *P. abundans* a score of 3 due to the combination of similar environmental factors of the two regions where it grows such as a humid and partly shady environment, rupicolous habit by creeks on the ecotone of oak forest and tropical deciduous forest, similar elevation and latitude. This would suggest a narrow tolerance to environmental change.
c) Intrinsic biologic vulnerability: Scores range from 1-3. We assigned this criterion a value of 3 because of its monocarpic shoots which require at least two years to flower, its nocturnal or crepuscular habit with little observable recruitment and the fact that many of the plants are clones, which suggests little genetic variability. Also, there is no information on the dispersal and germination of the seeds but the evidence at hand points to low success rates. It seems that the species has been able to survive due to its ability for vegetative reproduction.
d) Impact of human activity: Scores range from 2-4. We gave this criterion a low value of 2 since the species grows in ravines that are difficult to access and therefore have little use for agriculture. Also, the plants have no known local uses.

The assigned values for the evaluated criteria total 12, which on the MER scale correspond to a status of endangered species. *Pitcairnia abundans* would be the first species in this genus to be afforded legal protection by NOM-059-SEMARNAT-2001. Although several other species in this genus may result endangered or threatened using MER methodology this does not necessarily mean that the method is excessively permissive in affording protected status to a plant species. In fact, the method uses a wide range of characteristics to evaluate a species' status in an effort to offset the effect of using just a single factor, such as a very limited geographic distribution. This ensures that species afforded legal protection would do so as a result of a realistic and objective analysis. So far the method has proven effective, as the list of species under protection has not grown out of control (the plant list is available at http://www.conabio.gob.mx/conocimiento/ise/fichas/doctos/plantas.html).

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