

## **Rediscovery of *Pilosocereus oligolepsis* (Cactaceae) in the State of Roraima, Brazil**

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# Rediscovery of *Pilosocereus oligolepis* (Cactaceae) in the state of Roraima, Brazil

*Pilosocereus oligolepis* is a species of Cactaceae that is known only from three old type collections in Brazil (Roraima state) and Guyana. It is the only species of this genus to occur in northern Brazil. Due to the paucity of specimens and lack of precise locality data we undertook fieldwork in different vegetation types of Roraima aiming to find the species in the field. Populations of *P. oligolepis* were found in two previously unknown areas, occurring on granitic rock outcrops inside a vegetation mosaic of seasonal forests and savannas. Thus, it was possible to expand our knowledge of this species, increasing its occurrence and distributional data, as well as to provide pictures of the plants in their habitat and propose an updated conservation status.

**Keywords:** *Pilosocereus*, new record, Roraima, Cactaceae, Cactoideae.

## INTRODUCTION

Brazil has the world's richest Flora (Forzza et al., 2012; BFG, 2015) and one of the most representative genera of Cactaceae of the Brazilian Flora is *Pilosocereus* Byles & Rowley, encompassing 42 species (Hunt et al., 2006; Zappi et al., 2016) disjunctly distributed across the Americas in two areas: (1) Eastern Brazil and (2) Extreme Northern Brazil, Northern South America, Central and North Americas. The genus is widespread in forest formations (Atlantic and Amazonian forests) and in more arid environments (*Caatinga*, dry woodland, *Cerrado*, savannas and desert regions of North and Central America; Zappi, 1994).

A recent list of Brazilian rare plants includes 56 species of cacti endemic to the country that are rare (Machado, 2009). Although the occurrence of most *Pilosocereus* species is well-documented (Zappi, 1994; Taylor & Zappi, 2004; Hunt et al., 2006; Menezes et al., 2011; Zappi et al., 2016), *Pilosocereus oligolepis* (Vaup.) Byles & Rowley is known only from a few collections corresponding to type material referred to Brazil (Roraima state) and Guyana, and therefore could be listed as a rare species. The type specimen

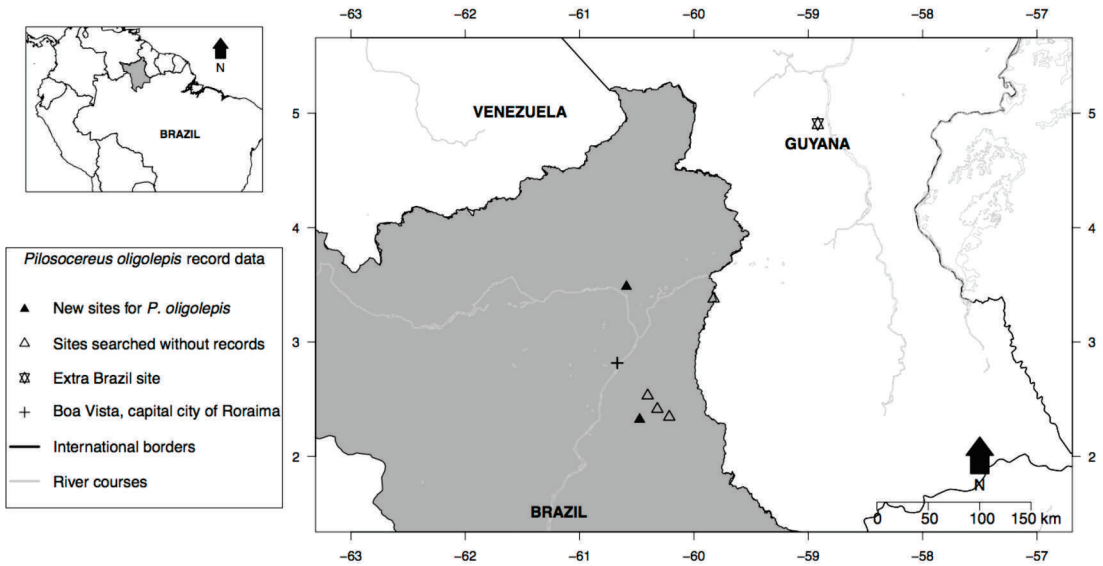
of *Cereus oligolepis* Vaupel (the basionym of *P. oligolepis*) was collected by the German botanist Ernest Heinrich Georg Ule in 1910 in "Serra do Mel" and is deposited in the herbarium of Berlin. Given the incomplete condition of the type, Zappi (1994) designated as neotype a collection of Luetzelburg from 1927 at the area of "São Marcos" in the Surumu river basin, also deposited in the herbarium of Berlin. A third recorded location for *P. oligolepis* is the type collection of *Pilosocereus kanukuensis* (Alexander) Leuenb. which is considered a synonym of *P. oligolepis* (Zappi, 1994); this specimen was collected by A. C. Smith in 1938, in the slopes of the Kanuku Mountains, drainage of the Moku Moku Creek (Zappi, 1994). The species was never recollected, being recorded solely by these three cited collections.

Roraima is located in Northern Brazil, on the border of the Amazonian Forest, close to Guyana and Venezuela, and features a mosaic of different forest and non-forest types (Flores & Rodrigues, 2010). Among non-forest formations in the state of Roraima, one can distinguish the '*Lavrado*', local term to designate the savannas in the region (Barbosa et al., 2007). This vegetation, also referred to as the ecoregion of the Guyana's savannas, has been little-studied floristically (Flores & Rodrigues, 2010), and covers an area of over 60,000 km<sup>2</sup> between Brazil, Guyana and Venezuela, of which 70% occurs in Brazilian territory (Barbosa et al., 2007). Roraima has 3,075 species of angiosperms cataloged (BFG, 2015), placing it in only 18th position regarding angiosperm species richness from Brazil. In our view, this number is severely

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1. Distribution map and collection effort of *Pilosocereus oligolepis* in the state of Roraima, Brazil.

underestimated due to incomplete sampling.

As means to obtain samples of *P. oligolepis* to include in a phylogenetic investigation of *Pilosocereus*, the authors recently searched for specimens of the species in the wild in different vegetation types of Roraima. This paper aims to relate new and present-day occurrence data for *P. oligolepis*, update its geographic distribution data, conservation status and depict living specimens of this rare cactus in its natural habitat.

Despite the motivation to gather updated information about a rare and poorly known cactus, we had a particular interest to investigate this species. *Pilosocereus oligolepis* is of great significance in order to understand the biogeography of the genus because it is the only species to occur in northern Brazil, since the great majority of taxa are distributed in eastern Brazil, and the remaining are in northern South America (only *P. lanuginosus* (L.) Byles & G.D.Rowley) and Central and North America. Thus, one could hypothesize that this species represents a taxon intermediate between Brazilian and non-Brazilian species of the genus.

## MATERIAL AND METHODS

Field work in areas of possible occurrence of *P. oligolepis* was done in November 2014 along the municipalities of Amajari, Boa Vista, Bonfim and Cantá in the state of Roraima, northern Brazil. The following areas were visited while searching for populations of the species: “Serra do Tabaco” (municipally of Amajari); “Serra da Moça” (municipally of Boa Vista); “Serra Grande” and “Serra da Lua” (municipally of Cantá);

and an unnamed site in municipally of Bonfim (Fig. 1).

The specimens collected were dried and included into the collections of UFRN (Universidade Federal do Rio Grande do Norte) and UFRR (Universidade Federal de Roraima) herbaria. Morphological description of the species was based exclusively on specimens collected in this work. The identification of the species was based on Zappi (1994) and Hunt et al. (2006).

Geographic distributions presented for this species were based on coordinates of recent collection data obtained in this work, and in literature sources (Hunt et al., 2006). We used the software package *R* (R Core Team, 2015), the cartographic base of the *maps* package (Becker et al., 2015) and color palette *RColorBrewer* package (Neuwirth, 2014) to make the map presented.

## RESULTS

In this study we describe new occurrence data for the poorly known *P. oligolepis*. During recent visits to different vegetation types of Roraima, populations of *P. oligolepis* were found in two newly discovered areas. These results increase the area of distribution known for the species. Populations of *P. oligolepis* were found in Serra Grande (municipally of Cantá) and in Serra do Tabaco (municipally of Amajari) (Fig. 1). It can be considered a rare species in both sites, with few individuals contributing to each population.

*Pilosocereus oligolepis* inhabits an area formed by a mosaic of savannas and seasonal forests, interspersed with granitic rock outcrops. The arboreal species *Anacardium occidentale* L. (Anacardiaceae), *Byrsonima*



## 2. Habitat of *Pilosocereus oligolepis* in Serra Grande, municipally of Cantá, Brazil.

*crassifolia* (L.) Kunth (Malpighiaceae) and *Curatella americana* L. (Dilleniaceae), dominate the landscape in the savanna, while the seasonal forest formations are dominated by species of Leguminosae, Sapotaceae and Salicaceae (Jaramillo and Barbosa, unpublished data; Jaramillo, 2015). In Serra Grande, the individuals showed only flower buds, growing exposed on the rock outcrops encircled by seasonal forest. The population of Serra do Tabaco was found on a rock outcrop surrounded by savanna fields and all individuals observed were sterile (Fig. 2).

## Taxonomic Treatment

*Pilosocereus oligolepis* (Vaupel) Byles & Rowley 1957 in *Cact. Succ. J. Gr. Brit.* 19(3): 67.

*Cereus oligolepis* Vaupel in *Notizbl. Bot. Gart. Berl.* 5: 285–286 (1913). Type: Brazil, [N Roraima], Serra do Mel, Rio Surumu, 4°N, Feb. 1910, *Ule* 8580 (B†). Neotype (Zappi, 1994 in *Succulent Plant Research*): Brazil, [N Roraima], São Marcos [nr Rio Surumu], Nov. 1927, *Lutzelburg* 20406 (M; R, isoneotype).

= *Pilosocereus kanukuensis* (Alexander) Leuenb., *Willdenowia* 16: 506. 1987; P. J. Braun in *Succulenta* 66: 106–107 (1987). *Cephalocereus kanukuensis* Alexander in *Lloydia* 2: 200 (1939). Type: Guyana, NW slopes of the Kanuku Mountains, drainage of the Moku Moku

Creek (Takutu tributary), 150–400m, March–April 1938, *A. C. Smith* 3380 (NY, holo., US, K, iso.).

Shrub, 1–2 m tall, unbranched or branched at base; branches erect to semi-scandent (Fig. 3); epidermis grayish-green to dark green, smooth; ribs 4–6, with straight sinuses and conspicuous transverse folds above the young areoles (Fig. 4). Areoles < 1.0 cm, with long hairs < 1.5 cm. Spines dark brown in the base and pale yellow at apex; centrals 1–6, < 3.0 cm; radials 8–16, < 1.4 cm (Figs. 2d–h). Fertile part of stem not or only slightly differentiated, with white or brownish hairs. Flower bud 7.0 cm (Fig. 2g). Fruit 2–2.5 cm, green when immature, depressed-globose, with floral remnant pendent (Figs. 2h–i).

## Material Examined

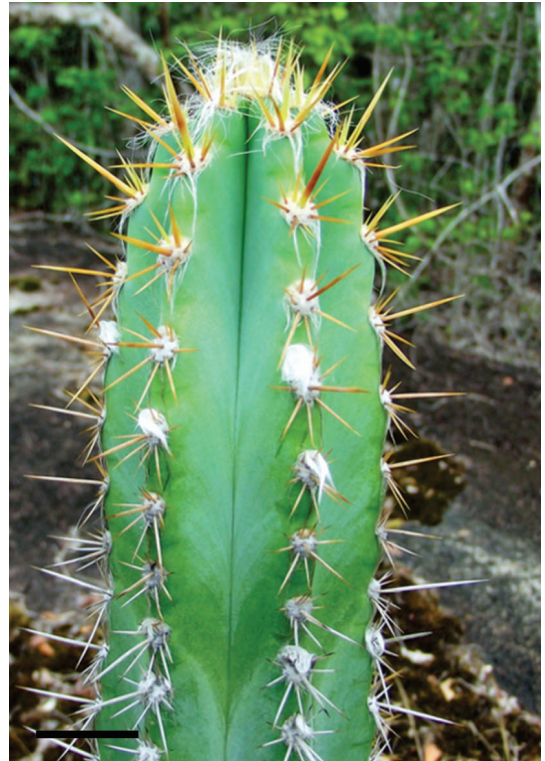
BRAZIL. Roraima: Cantá, Serra Grande, 22 November 2014, *P. Lavour et al.* 60 (UFRN, UFRR), *ibidem*, *P. Lavour et al.* 64 (UFRN), *ibidem*, *P. Lavour et al.* 66 (UFRN, UFRR), *ibidem*, *P. Lavour et al.* 67 (UFRN, UFRR). Amajari, Serra do Tabaco, 24 November 2014, *P. Lavour & J. Lavour* 68 (UFRN, UFRR); *ibidem*, 24 November 2014, *P. Lavour & J. Lavour* 69 (UFRN).

## DISCUSSION





3. *Pilosocereus oligolepis* adult individual, state of Roraima, Brazil. Bar = 50 cm.



4. *Pilosocereus oligolepis*, part of cladode. Bar = 2 cm.

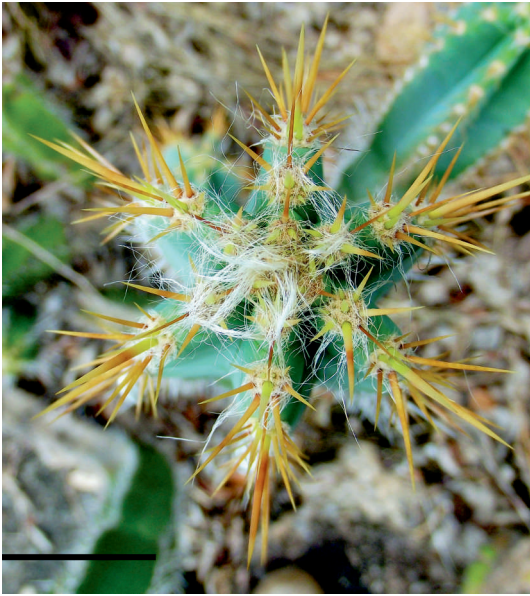


5. *Pilosocereus oligolepis* cladode with flower bud. Bar = 2 cm.



6. *Pilosocereus oligolepis* cladode with fruit. Bar = 2 cm.





7. View of *Pilosocereus oligolepis* cladode, showing number of ribs. Bar = 2 cm.



8. *Pilosocereus oligolepis* flower bud. Bar = 2 cm.

*Pilosocereus oligolepis* can be recognized in the field as a columnar cactus, with shrubby habit, unbranched or branched at the base; epidermis gray-green to dark green, smooth; with 4 to 6 ribs. It is the only species of the genus to occur in the Brazilian Amazon. Another species, *P. lanuginosus*, is known to occur in Northern South America, except in Brazil. This species can be differentiated from *P. oligolepis* for the shrubby to tree-like habit; blue-green or green epidermis, often glaucous, and ribs varying from 8 to 10 (Hunt et al., 2006).



9. Cladode tip of *Pilosocereus oligolepis* showing indumentum of areoles. Bar = 1 cm.



10. Immature fruit of *Pilosocereus oligolepis*. Bar = 1 cm.

The populations of *P. oligolepis* have been registered in natural habitat in five locations to date. Two of them are newly described in this work (Figs. 2j & k). Although three sites have been historically cited for its occurrence (Serra do Mel and São Marcos in Brazil; and Kanuku Mountain in Guyana), we could not confirm the present day existence of populations of the species in these Brazilian localities due to the restriction of access to indigenous areas (Serra do Mel and Surumu River integrate the indigenous land of

São Marcos). We did not pursue to investigate the present-day occurrence of the species in Guyana, however the location cited as Kanuku Mountains corresponds to an extremely wide area where the specific search for the species would be laborious.

The currently known geographic distribution of *P. oligolepis* suggests that it is highly restricted to the 'Lavrado' formation (including areas in Brazil and Guyana) and despite this being highlighted as one of the priority areas for biodiversity conservation in the Amazon (MMA, 2007), the region does not have any official conservation and is strongly threatened by the expansion of farmlands (especially by soy bean cultivation), large infrastructures projects (e.g. hydroelectric power plant construction), property speculation, illegal appropriation of land and extensive livestock production (Barbosa et al., 2007). Further threats include the pressure from the mining industry.

To complete this grim scenario, the proposal of the National Park of Lavrado which would have protect most populations of this taxon, was cancelled (Brasil, 2015). The initiative to create this conservation unit was an effort of local activists and a few regional entities for the preservation of biodiversity and water resources of these savannas, and would require the state government of Roraima to formally act toward biodiversity conservation in this area. However, without the protection of an implemented official conservation unit in the area, the agribusiness model is expected to develop massively resulting in the suppression of the majority of native 'Lavrado' vegetation in the state.

The current Red List of Threatened Species assessment for *P. oligolepis* is "Data Deficient" (DD) due to the absence of accurate information on type locality, the lack of recent records, population size, distribution and the unknown current threats (Zappi & Taylor, 2013). However, using data provided by this work we propose the classification of this species under "Vulnerable" (VU under criterion B1a, b(iii); D2), because *P. oligolepis* is found only in two localities that are not in protect areas (three old locations described only in literature, totaling five areas of occurrence), are prone to the effects of human activities or stochastic events, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period (IUCN, 2012).

## CONCLUSION

In this work we were able to expand the knowledge about *P. oligolepis*, increasing its distributional data (discovering two new locations of occurrence), as

well as provide new data (images of living plants, herbarium specimens, data collected in populations in the field), and propose an updated conservation status for the species.

However, more studies are still necessary to better characterize *P. oligolepis* including data about its reproductive biology, genetics and ecology (since the species can occur both in forest as non-forest areas, dispersing over long distances). Also, this work suggests that is important to increase cactus collection efforts in the Amazon region, since the area is traditionally considered as being of lower diversity for the family compared to other Brazilian phytogeonomies (Zappi et al., 2011). This general assumption may be biased due to under-collection.

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12. Adult *Pilosocereus oligolepis* in Serra do Tabaco, municipally of Amajari. Bar = 50 cm.