

The Epiphytic Bromeliad Flora of the RTP Cerros Negro-Yucaño, Oaxaca, Mexico

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Introduction

Oaxaca is one of the Mexican states with highest plant species richness (García-Mendoza & Meave 2011, Villaseñor 2016), hosting about 10,000 taxa of vascular plants. The Bromeliaceae family is represented in Oaxaca by 184 species, which corresponds to 44% of the Mexican bromeliad flora (Espejo-Serna et al. 2007, Espejo-Serna & López-Ferrari 2018). About 29% (53 spp.) and 67% (124 spp.) of these species are endemic to the state and to the country, respectively.

The Regiones Terrestres Prioritarias (Terrestrial Priority Regions) Project (RTP's) was proposed in the year 2000 by the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) to determine the most biodiverse areas of Mexico, considering their species and ecosystem richness, with the purpose of establishing policies for the future conservation of biodiversity. The RTP's were spatially defined according to natural features of the landscape, including topography, watersheds, soil and vegetation types, together with the range of distribution of certain key species. The presence of protected natural areas, as well as first-hand knowledge provided by experts were also considered when defining the final boundaries of the RTP's (Arriaga et al. 2000). In the state of Oaxaca eight RTP's were considered: Cerros Negro-Yucaño, Sierras Triqui-Mixteca, El Tlacuache, Bajo río Verde-Chacahua, Sierras sur y costa de Oaxaca, Sierras del norte de Oaxaca, Mixe, and Selva Zoque-La Sepultura. The RTP **Cerros Negro-Yucaño** is located in the NW portion of the state [16°57'49"-17°40'36" N, 97°15'21"-97°33'48" W], and comprises a surface area of 1,274 km² (Arriaga et al., 2000), that represents 1.35 % of the state's territory that covers partially or totally 31 municipalities of the 570 registered for Oaxaca (Fig. 1). The vegetation types present in this region are oak forest, pine forest, juniper forest, tropical deciduous and semi-evergreen seasonal forests, as well as desert scrub and palm grove. The elevation ranges from 1,300 to 3,200 m a.s.l.

As part of a Master's thesis about The Epiphytic Angiosperms of the RTP Cerros Negro-Yucaño (Gomez-Escamilla, 2016) botanical sampling (Fig. 2) was carried out between January 2014 and February 2015 in different locations of the region, especially

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Figure 2. Nayeli Gomez-Escamilla during fieldwork at the RTP Cerros Negro-Yucaño, Oaxaca, Mexico. In addition to the collection of voucher specimens, photos were taken of all epiphytic species encountered during the study. These photos provide further documentation of the species currently present in the study area. Photo by E. González-Rocha.

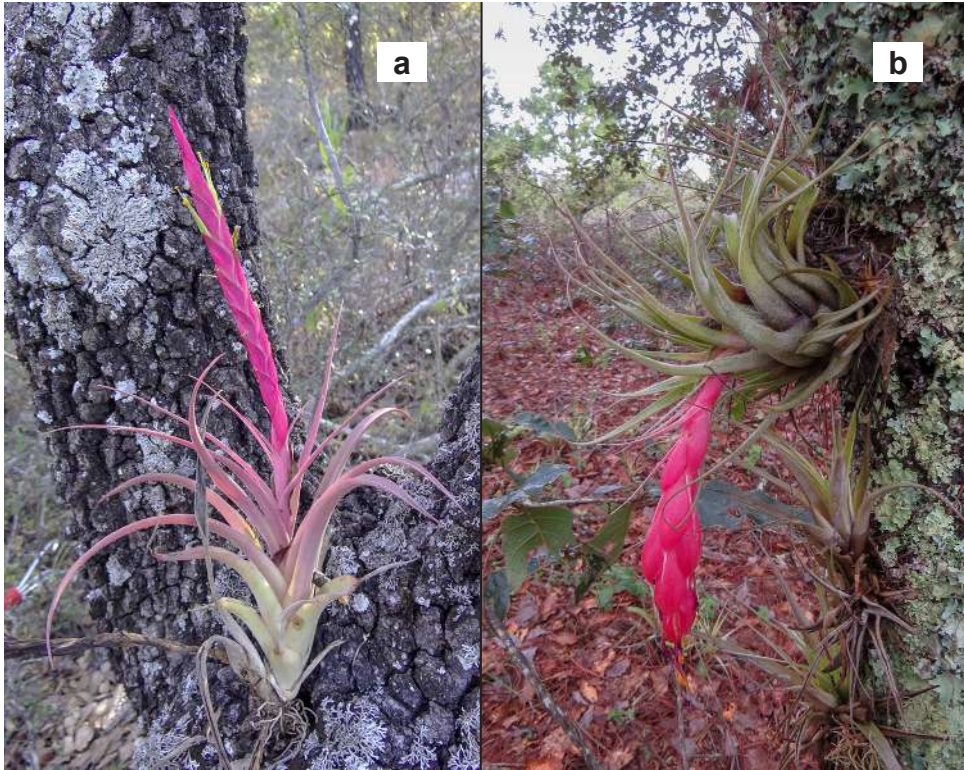


Figure 3. **a)** *Tillandsia achyrostachys* **b)** *Tillandsia atrococcinea*. Photos by N. Gomez-Escamilla.



Figure 4. **a)** *Tillandsia calothyrsus* **b)** *Tillandsia circinnatioides*. Photos by B. Téllez-Baños and N. Gomez-Escamilla.

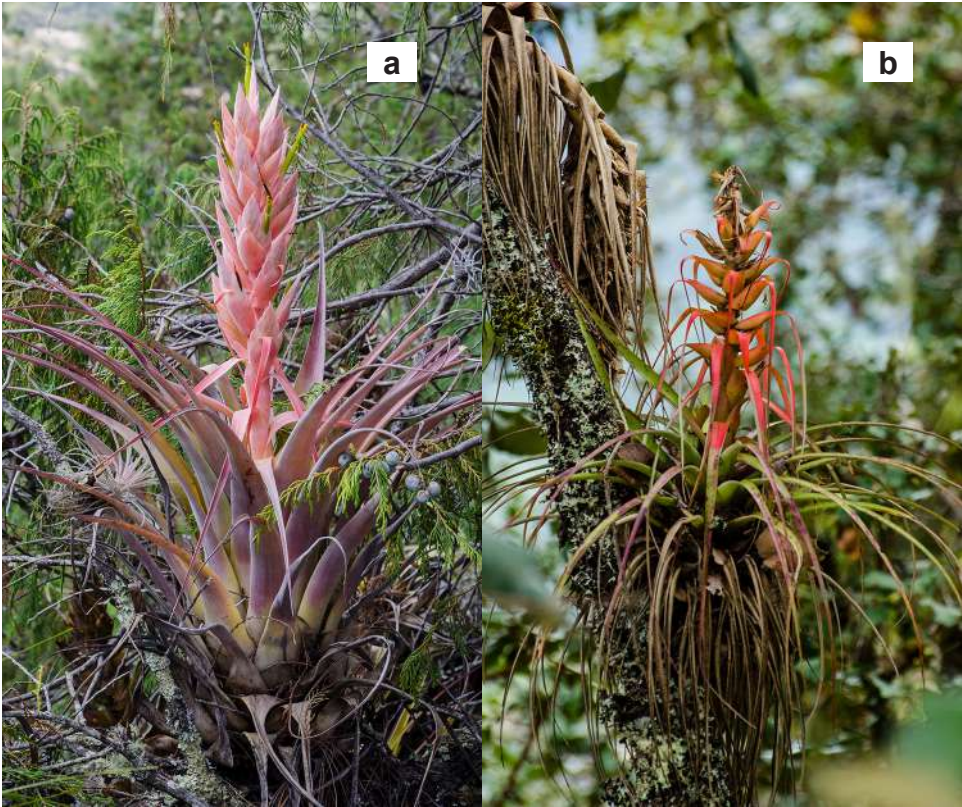


Figure 5. **a)** *Tillandsia bourgaei* **b)** *Tillandsia carlos-hankii*. Photos by B. Téllez-Baños.

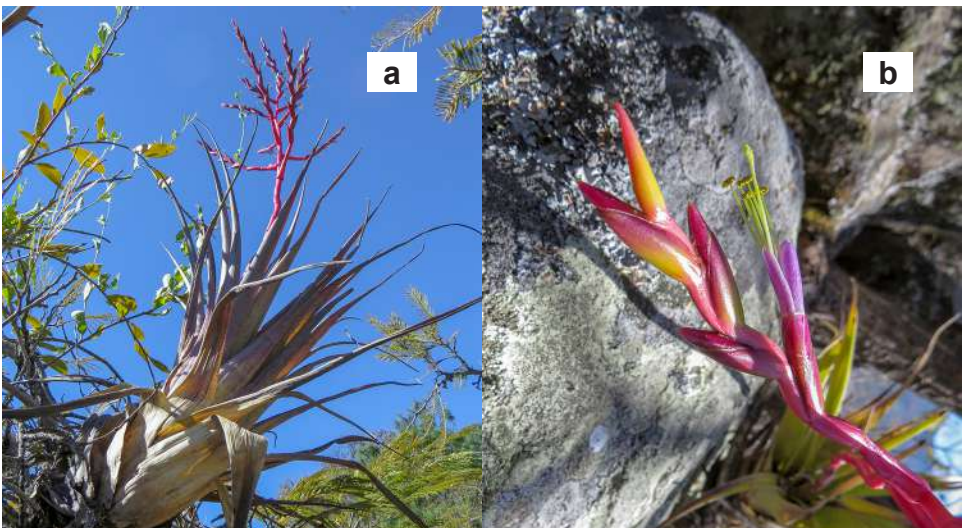


Figure 6. **a)** *Tillandsia tehuacana* **b)** *T. makoyana* inflorescence branch with open flower. Photos by N. Gomez-Escamilla.

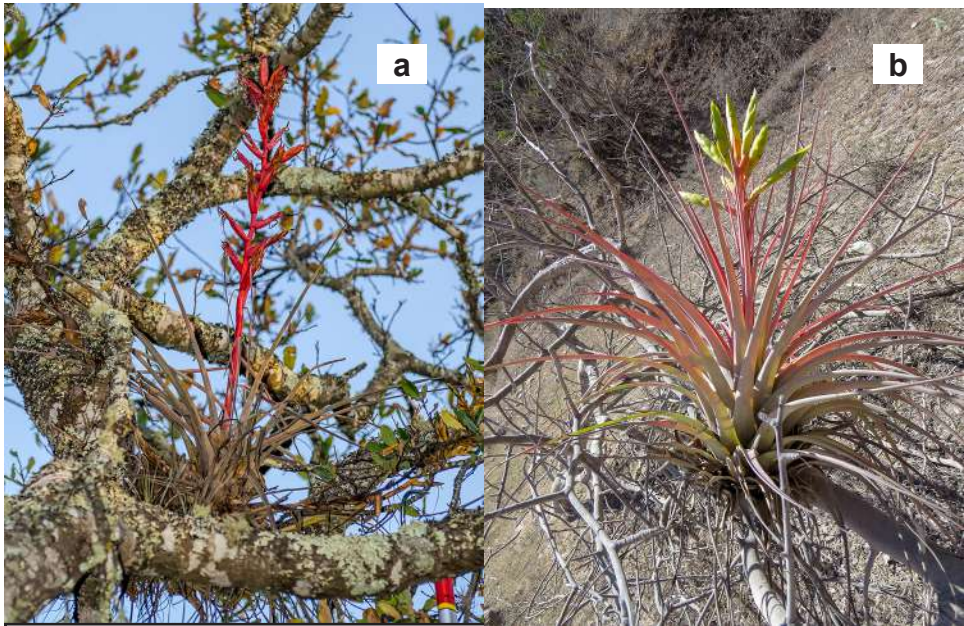


Figure 7. **a)** *Tillandsia dugesii* **b)** *Tillandsia fasciculata*. Photos by B. Téllez-Baños and N. Gomez-Escamilla.

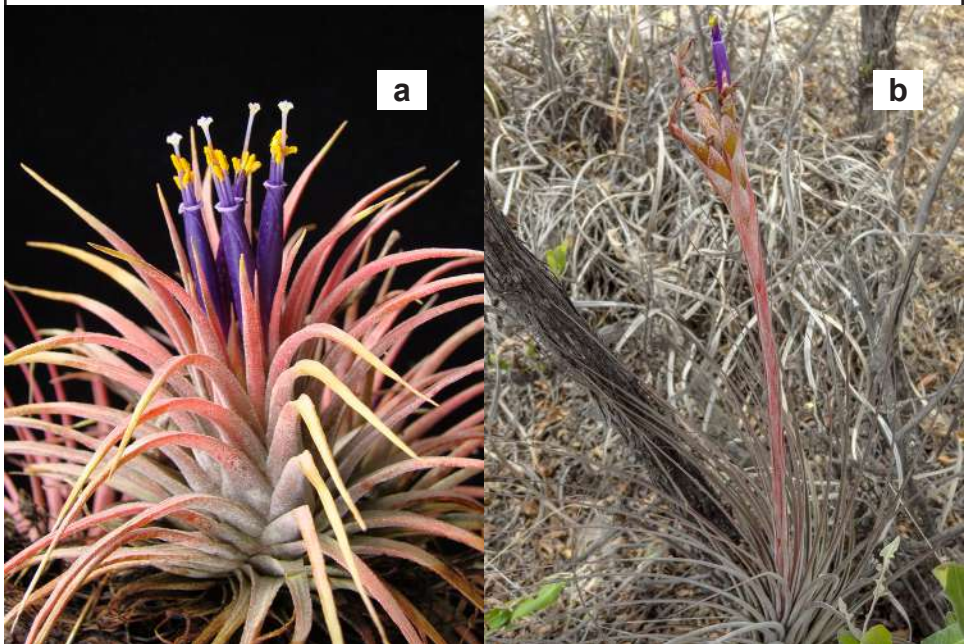


Figure 8. **a)** *Tillandsia ionantha* **b)** *T. juncea*. Photos by A. Espejo-Serna and N. Gomez-Escamilla.



Figure 9. **a)** *Tillandsia macdougallii* **b)** *Tillandsia prodigiosa*. Photos by B. Téllez-Baños.

in areas covered by oak forests (Fig. 1). Plant material of all epiphytic angiosperms was collected, photographed *in situ*, and herbarium specimens were deposited at the herbarium UAMIZ (Herbario Metropolitano, Universidad Autónoma Metropolitana Iztapalapa), located in Mexico City. Here we present the data obtained for the Bromeliaceae.

Results

A total of 20 epiphytic bromeliad species of the genera *Tillandsia* and *Viridantha* were present in the RTP Cerros Negro-Yucaño (Table 1, Figs. 3-12). Most species occur in oak forests, with the exception of *Tillandsia circinnatioides*, *T. fasciculata* and *T. tehuacana*, which were found only in juniper forests, while *T. ionantha* was registered only in desert scrubs. Most bromeliads in the region showed a wide elevational range (1,900 – 2,500 m), although *T. achyrostachys*, *T. dugesii*, *T. fasciculata*, *T. schiedeana*, *Viridantha atroviridipetala* and *V. plumosa* were also growing below 1,900 m a.s.l. In contrast, *Tillandsia carlos-bankii* and *T. violacea* were always found in oak forests above 2,500 m a.s.l. Fourteen species are endemic to Mexico while *Tillandsia atrococcinea*, *T. calothyrsus* and *T. carlos-bankii* are restricted to the state of Oaxaca (Table 1). The municipalities of San Pedro y San Pablo Teposcolula and San Pedro Yucunama had the highest number of collections with 31 and 33 respectively, and those with the highest number of species were San Pedro Yucunama and Magdalena Yodocono, each one with 15 taxa each.



Figure 10. **a)** *Tillandsia recurvata* **b)** *Tillandsia schiedeana*. Photos by A. Espejo-Serna.



Figure 11. **a)** *Tillandsia usneoides* **b)** *Tillandsia violacea*. Photos by B. Téllez-Baños and A. Espejo-Serna.



Figure 12. **a)** *Viridantha atroviridipetala* **b)** *Viridantha plumosa*. Photos by N. Gomez-Escamilla and B. Téllez-Baños. [Editor’s note: BSI currently does not recognize *Viridantha* as a genus, so you will usually see these species listed as *Tillandsia atroviridipetala* and *T. plumosa*.]



Figure 13. **a)** *Tillandsia usneoides* growing on the arch at the entrance to San Pedro Yucunama **b)** *Tillandsia prodigiosa* cultivated as ornamental plant. Photos by N. Gomez-Escamilla.

Discussion

Of the eight RTP’s proposed by CONABIO for Oaxaca, Cerros Negro-Yucaño lacks a published floristic catalogue, despite having one of the largest and most diverse patches of conserved oak vegetation that still exist in the Mixteca Alta region (Arriaga et al. 2000). In this region the temperate forests (oak and pine woods) and the tropical deciduous forests are the ecosystems transformed most by humans (GEF Mixteca

Table 1. Bromeliad species occurring in the RTP Cerros Negro-Yucaño, Oaxaca, Mexico with notes on: elevational range (m a.s.l.), vegetation type and geographical distribution within the study site. Species names preceded by an * indicate the species is endemic to Mexico. Vegetation types sampled during the study were: OF= oak forest, PF= pine forest, JP= juniper forest, DS= desert scrub and PG= palm grove. The municipalities each species was found in are listed alphabetically using the acronyms found in Figure 1.

Bromeliad species	Elevation range (m)	Vegetation type	Municipality
* <i>Tillandsia achyrostachys</i> E. Morren ex Baker	1550-2380	OF, DS, PG	SAT, SCS, SJA, SMP, SMT, ST
* <i>Tillandsia atrococcinea</i> Matuda	2200-2600	OF, PF	SDY, SPSPT, SPY
* <i>Tillandsia bourgaei</i> Baker	2220-2640	OF, DS	SAL, SCS, SJT, SPSPT, SPY, SVN
* <i>Tillandsia calothyrsus</i> Mez	2070-2500	JF, OF	MYPD, SCS, SDY, SJD, SMN, SPY, ST, SVN
* <i>Tillandsia carlos-hankii</i> Matuda	2650	OF	MYPD
* <i>Tillandsia circinnatioides</i> Matuda	2290	PF	SPSPT
* <i>Tillandsia dugesii</i> Baker	1340-2500	JF, OF, DS	MYPD, SAT, SBY, SCT, SDY, SJT, SMN, SMP, SPSPT, SPY, ST
<i>Tillandsia fasciculata</i> Sw.	1550-1920	JF, PG	SBY, SMT
<i>Tillandsia ionantha</i> Planch.	2400	DS	VTU
<i>Tillandsia juncea</i> (Ruiz & Pav.) Poir.	1890-2480	JF, OF	MYPD, SAT, SBY, SCS, SCT, SJA
* <i>Tillandsia macdougallii</i> L. B. Sm.	2650-2770	OF	MYPD
* <i>Tillandsia makoyana</i> Baker	1940-2140	OF	SJA, SMP, ST
* <i>Tillandsia prodigiosa</i> (Lem.) Baker	2360-2730	OF	MYPD, SJD, SJT, SMN, SPY, ST, SVN
<i>Tillandsia recurvata</i> (L.) L.	1920-2490	JF, OF, DS	MYPD, SBY, SCS, SCT, SMN, SPY, ST, VTU
<i>Tillandsia schiedeana</i> Steud.	1550-2325	JF, OF, DS, PG	SAT, SBY, SCT, SMN, SMP, SMT, ST
* <i>Tillandsia tehucana</i> I. Ramírez & Carnevali	1920	JF	SBY
<i>Tillandsia usneoides</i> (L.) L.	2060-2535	OF	MYPD, SCS, SCT, SJD, SMN, SOSPT, SPY
* <i>Tillandsia violacea</i> Baker	2800-2920	OF	MYPD, SVN

Table 1, continued.

Bromeliad species	Elevation range (m)	Vegetation type	Municipality
* <i>Viridantha atroviridipetala</i> (Matuda) Espejo	1560-2070	JF, OF	SAT, SBY, SPPT, ST
* <i>Viridantha plumosa</i> (Baker) Espejo	1560-2650	OF	MYPD, SAL, SCS, SJD, SJT, SPPT, SPY, ST, SVN

Project 2015). This study was carried out to determine whether Cerros Negro-Yucaño would be suitable for incorporation into the Sistema Nacional de Áreas Naturales Protegidas (SINANP) in order to protect groups of vulnerable plants like epiphytic bromeliads and promote their sustainable use by the human communities involved.

Of the bromeliads present in the area *Tillandsia carlos-bankii* is the only species registered in the Mexican legislation (NOM-059-SEMARNAT-2010) under the category of Threatened (A). The widespread *T. usneoides* (Spanish moss) and *T. violacea* (Fig. 13), are extensively used by the locals, but their populations are probably not endangered by illegal harvesting from the wild. However, several epiphytic orchid and fern species are used as non-timber forest products for ceremonial purposes during the celebration of Holy Week, which requires a management plan to protect them from over-exploitation (Méndez-García y Mondragón, 2012; Méndez-García et al., 2011; Sandoval et al., 2004).

Furthermore, San Pedro y San Pablo Teposcolula joined the Pueblos Mágicos program in 2015, a status that attracts a high number of visitors (<http://www.gob.mx/sectur/acciones-y-programas/programa-pueblos-magicos>). Besides, San Pedro Yucunama has incorporated ecotourism trails in its forests, so it is necessary to carry out a proper management of the biological resources that are currently in demand. The municipalities with greatest extensions of conserved forests are Magdalena Yodocono, San Miguel Achiutla, San Pedro Tidaá, and San Bartolomé Yucuañe, probably due to the lack of accessible roads and the implementation of some conservation policies by the local people.

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