

Check-list of Bromeliaceae from Mato Grosso do Sul, Brazil

Leonardo de Melo Versieux¹, João Vicente Coffani-Nunes²,
Gecele Matos Paggi³ & Andrea Ferreira da Costa⁴

¹Universidade Federal do Rio Grande do Norte, Departamento de Botânica e Zoologia Campus Universitário, Lagoa Nova, CEP 59078-900, Natal, Rio Grande do Norte, Brazil. lversieux@yahoo.com.br

²Universidade Estadual Paulista, Unidade Diferenciada de Registro, Av. Nelson Brihi Badur 430, CEP 11900-000, Registro, São Paulo, Brazil.

³Universidade Federal do Mato Grosso do Sul, Ciências Biológicas, Campus do Pantanal, CEP 79304-902, Corumbá, Mato Grosso do Sul, Brazil.

⁴Universidade Federal do Rio de Janeiro, Museu Nacional, Departamento de Botânica, Quinta da Boa Vista, São Cristóvão, CEP 20940-040, Rio de Janeiro, Rio de Janeiro, Brazil.

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ABSTRACT – A checklist of 11 genera and 41 species of *Bromeliaceae* occurring in the state of Mato Grosso do Sul (MS) is presented. Of the total number of species, five are endemic and belong to the genera *Dyckia* and *Tillandsia*. The subfamily *Pitcairnioideae* is the richest in number of genera and species, including taxa that are rare in Brazil (*Deuterocohnia* and *Fosterella*). *Tillandsioideae* is the richest subfamily in species number plus one infraspecific taxon; however, it is only represented by *Tillandsia*, and most species are widely distributed all over Brazil and/or nearby countries. *Bromelioideae*, a subfamily characteristic of the Atlantic rainforest is less represented. This checklist updates the number of species in Mato Grosso do Sul, when compared to the Official Brazilian Plant Checklist.

Keywords: bromeliads, catalogue, monocots, *Poales*, savanna

RESUMO – Apresenta-se o check-list de 11 gêneros e 41 espécies de *Bromeliaceae* ocorrentes em Mato Grosso do Sul (MS). Deste total de espécies, cinco são endêmicas do estado e pertencem aos gêneros *Dyckia* Schult. & Schult.f. e *Tillandsia* L. A subfamília *Pitcairnioideae* é a mais rica em número de gêneros e espécies, incluindo táxons raros no Brasil (*Deuterocohnia* Mez e *Fosterella* L.B.Sm.). *Tillandsioideae* é a subfamília com maior número de espécies, além de um táxon infraespecífico, todos pertencentes a *Tillandsia*, com ampla distribuição no Brasil e em países vizinhos. *Bromelioideae*, a subfamília característica da Floresta Atlântica, é a menos representada. Este *checklist* atualiza o número de espécies do MS, se comparado à Lista de Espécies da Flora do Brasil.

Palavras-chave: bromélias, catálogo, Cerrado, monocotiledôneas, *Poales*

INTRODUCTION

Bromeliaceae (58 genera, 3248 species) are almost exclusively Neotropical (Smith & Downs 1974, Luther 2010) and currently divided into eight subfamilies (*Brochinioideae*, *Lindmanioideae*, *Tillandsioideae*, *Hechtioideae*, *Navioideae*, *Pitcairnioideae*, *Puyoideae* and *Bromelioideae*) that are mainly characterized by the morphology of the flowers, fruit, seeds, and molecular data (Givnish *et al.* 2007, 2011).

The diversity of *Bromeliaceae* in Brazil is highest in humid areas of the Atlantic rainforest along eastern Brazil, with a decrease in species richness observed toward the drier inland territory (Reitz 1983, Versieux & Wendt 2006, 2007, Martinelli *et al.* 2008, Versieux *et al.* 2012). Nevertheless, drier areas may harbor endemic and xerophytic species, the systematics, taxonomy, and conservation of which have not yet received much attention (e.g., Miranda 2001, Braun & Pereira 2009, Leme *et al.* 2012, Paggi *et al.* 2015).

The state of Mato Grosso do Sul (MS) in central-western Brazil is covered by three different biomes: *Cerrado* (savanna), the Pantanal wetland (including part of the *Chaco*) and part of the Atlantic rainforest (IBGE 2004). The *Cerrado* savanna has a mosaic of physiognomies. It is severely threatened, and it is considered to be one of the areas of heaviest human impact in the state of MS (Cavalcanti & Joly 2002). In all these biomes, bromeliads occur and may be threatened due to habitat loss.

As a result of the collections that have become available recently, new *Bromeliaceae* taxa are being described or rediscovered from MS (e.g., Braun & Pereira 2008, 2009, Leme *et al.* 2012, Versieux *et al.* 2013, Paggi *et al.* 2015), but the knowledge of this family in MS is still fragmentary and is affected by the paucity of collections available in herbaria. The aim of this study is to provide a preliminary checklist for that state, which may help future studies focused on the taxonomy and conservation of this family in central-western Brazil.

MATERIAL AND METHODS

Data to establish the occurrence of *Bromeliaceae* taxa in the state of MS comes from three main sources: (1) herbarium collections which were examined by the authors (MBM, UEC, R, RB, COR acronyms according to Holmgren *et al.* 1990), (2) literature (checklists, floras, revisions of genera, descriptions of new taxa), and (3) on-line databases and virtual herbaria catalogues (HB, NY, K, US). The nomenclature used follows Govaerts *et al.* (2005). New species that have not been validly published or taxa that could not be identified, and thus demand revisions, are listed as numbered morphospecies. For each taxon one herbarium specimen is cited, the predominant growth style (or habit) annotated in the specimens labels (epiphyte, terrestrial, rupicolous), as well as an indication of the vegetation type where the species is commonly found (savanna = Brazilian *Cerrado*, including different physiognomies and riparian forests; seasonal dry forest; rainforest). The acronyms of herbaria highlighted by an asterisk indicate that the record of the taxon from MS was obtained from the literature or from databases and that the specimen was not examined by the authors.

RESULTS AND DISCUSSION

In the Brazilian official plant checklist, 11 genera, 30 species, and two varieties are included for the state of MS (Forzza *et al.* 2014). In the present work we list 11 genera, 40 species, and 41 taxa (including one variety) for the Flora of Mato Grosso do Sul (Table 1). From the total of species listed here, five are endemic to MS. The majority of the species occurring in MS can also be found in neighboring countries, such as Bolivia, Paraguay, and Argentina (Table 1). The subfamily Pitcairnioideae is the richest in species (5 genera / 18 spp.), followed by Tillandsioideae (1 genus / 12 spp.), and by Bromelioideae (5 genera / 10 spp.)

The more open vegetation of the savanna and seasonal dry forests, together with the high degree of outcropping (especially limestone and sandstone), are probably more conducive to the predominant terrestrial or lithophytic habit observed here for most of the Bromelioideae and Pitcairnioideae taxa. The genus *Tillandsia* (*Tillandsioideae* subfamily) is an exception to this pattern as most species are epiphytes. *Tillandsia* species are called “air plants” because they have several adaptations to endure water stress (e.g., CAM photosynthesis, dense indumentum, specialized trichomes) and thus can grow in most kind of habitats, including deserts (Benzing 2000a). In MS, *Tillandsia* is the richest genus and one new species was found there recently (Versieux *et al.* 2013). It is interesting, however, that both *T. usneoides* (L.) L. and *T. recurvata* (L.) L., the two best distributed bromeliad species across the entire Americas, were not found in this survey. Most of the species of *Tillandsia* found in MS are broadly distributed in Brazil and nearby countries (Table 1). Only *Tillandsia buchlohii* and *T. bonita* are more restricted, the first to the

area of Porto Murtinho and nearby inselbergs in Paraguay, and the latter is endemic to the Serra da Bodoquena (Till 1996, Versieux *et al.* 2013).

The subfamilies *Bromelioideae* and *Pitcairnioideae* call attention due to their richness of genera (five in total). *Pitcairnioideae* is believed to have undergone a strong lineage diversification in Central Andes, along the region that now corresponds to Bolivia (Givnish *et al.* 2011). The proximity between MS and Bolivia may explain the occurrence of particular genera such as *Deuterocohnia* and *Fosterella*, which have restricted distribution in Brazil. *Deuterocohnia* is represented in Brazil only by *D. meiziana*, which is confined to MS, Mato Grosso, southeastern Bolivia and Paraguay (Smith & Downs 1974, Forzza *et al.* 2014). Currently, 18 species are recognized within this genus (Luther 2010), all of them are perennial lithophytes or terrestrials that can tolerate large temperature shifts, including frosts (Benzing 2000a) and also extended dry periods. The distribution of most species is restricted to the dry areas of southern South America, mainly from southern Bolivia to northern Argentina, but it also reaches arid coastal habitats in Peru (Rundel & Dillon 1998) or isolated coastal desert in Chile (Zizka *et al.* 2009). Some species of *Deuterocohnia* present perennial inflorescences, flowering repeatedly for 6-8 years through the producing of new spikes from lateral buds (Benzing 2000b), and several of them show a conspicuous clonal growth, thus being called cushion-plants (Givnish *et al.* 2011). *Fosterella* genus is another interesting Pitcairnioideae, which is distributed across central South America, with a center of diversity in arid and semi-humid habitats of the northeastern Andean slopes of Bolivia (Rex *et al.* 2009). In Brazil, *Fosterella* is represented by three species (Forzza *et al.* 2014) and *F. hastschbachii* is a rupicolous taxon that grows on shaded sandstones in MS as well as in neighboring Mato Grosso state. It has lax inflorescences and delicate flowers. Regarding the Bromelioideae genera, all with baccate fruits, are broadly distributed in Brazilian territory. *Ananas*, *Bromelia* and *Pseudoananas* taxa occurring in MS are all terrestrial xerophytic species.

Due to its geographic location the bromeliads that occur in MS may also grow in Argentina, Paraguay, and Bolivia. Old specimens from the “Comissão Rondon” and “Expedição Científica Roosevelt-Rondon” are deposited in Museu Nacional (Herbarium R) for *Dyckia leptostachya*, a taxon that has a long synonymy including other species described from neighboring countries. *Dyckia* is a large genus, with at least 120 species in Brazil (Forzza *et al.* 2014) that are adapted to xeric habitats. It is extremely difficult to study *Dyckia* based only on herbarium material. Collections usually are incomplete, lacking the rosette or containing only branches of the inflorescence, and indumentum and size of the rosettes may present large variation (Versieux 2012). *Dyckia*, like many other low-dispersed Pitcairnioideae has a high degree of endemic species (Versieux & Wendt 2006, 2007). During our inventory we saw many names in the herbaria that are

Table 1. Bromeliaceae taxa occurring in Mato Grosso do Sul, followed by a herbarium specimen, growth style (habit), habitat and overall geographic distribution. Abbreviations used: Epi = Epiphyte, Rup. = Rupicolous, Ter. = Terricolous. Habitat: RF = Rainforest, Sav = Savanna (Cerrado *sensu lato*), SDF = Seasonal Dry Forest.

Taxon	Voucher (Herb.)	Growth	Habitat	Geographical distribution
<i>Aechmea bromeliifolia</i> var. <i>albobracteata</i> Philcox	Wendt et al. 261 (COR)	Epi, Ter	Sav, SDF	Argentina, Paraguay, central, south and south-eastern Brazil (Faria et al. 2010)
<i>A. distichantha</i> Lem.	Pott et al. 4412 (MBM)	Ter	Sav	Argentina, Paraguay, Uruguay, south and south-eastern Brazil and MS (Smith & Downs 1979)
<i>Ananas ananassoides</i> (Baker) L.B.Sm.	Guimarães 1176 (RB)	Ter	Sav	Argentina, Brazil, Paraguay (Smith & Downs 1979)
<i>Billbergia kuhlmannii</i> L.B.Sm.	Damasceno-Júnior et al. 3845 (COR)	Epi	SDF	Brazil (MS, MT) (Forzza et al. 2014)
<i>B. nutans</i> H.Wendl. ex Regel	Garcia 14103 (UEC)	Epi	Sav, SDF	Argentina, Brazil, Paraguay, Uruguay (Smith & Downs 1979)
<i>Bromelia balansae</i> Mez	Damasceno-Júnior et al. 3089 (COR)	Ter	Sav, SDF	Argentina, Bolivia, Brazil, Colombia, Paraguay (Smith & Downs 1979)
<i>B. hieronymii</i> Mez	Ishii et al. 781 (COR)	Ter	SDF	Argentina, Bolivia, Paraguay (Smith & Downs 1979), Brazil (MS) (Forzza et al. 2014)
<i>B. interior</i> L.B.Sm.	Oliveira 10 (MBM)	Ter	Sav	Brazil (DF, GO, MA, MG, MS, MT, RO, SP) (Smith & Downs 1979)
<i>B. serra</i> Griseb.	Wendt et al. 266 (MBM)	Ter	Sav	Argentina, Brazil, Bolivia, Paraguay, (Smith & Downs 1979)
<i>Deuterocohnia meiziana</i> Kuntze ex Mez	Vieira et al. 1419 (RB)	Ter, Rup	Sav	Bolivia, Brazil (MS, MT), Paraguay (Forzza et al. 2014)
<i>Dyckia coximensis</i> L.B.Sm. & Reitz	Reitz 7365 (HBR*)	Ter	?	Brazil (MT, MS) (Smith & Downs 1979, Forzza et al. 2014)
<i>D. duckei</i> L.B.Sm.	Leme 3458 (HB*)	Ter, Rup	Sav	Brazil (MA, MS, PA) (Forzza et al. 2014)
<i>D. excelsa</i> Leme	Ishii et al. 785 (COR)	Ter, Rup	SDF	Brazil (MS, MT) (Forzza et al. 2014; Paggi et al. 2015)
<i>D. exserta</i> L.B.Sm.	Hatschbach & Zelma 49117 (MBM, HB)	Ter, Rup	?	Brazil (MS), Paraguay (Smith & Downs 1979)
<i>D. ferruginea</i> Mez	Pereira 383 (RB)	Ter	SDF	Brazil (MS, MT) (Smith & Downs 1979, Forzza et al. 2014)
<i>D. gracilis</i> Mez	Ishii et al. 794 (COR)	Ter	Sav	Argentina, Bolivia, Brazil (MS) (Smith & Downs 1979, Paggi et al. in press)
<i>D. grandidentata</i> P.J. Braun & Esteves	Esteves & Braun 659 (UFG*)	Rup	SDF	Brazil, Endemic to MS (Braun & Pereira 2008)
<i>D. leptostachya</i> Baker	Hoehne 3548 (R)	Ter	Sav	Argentina, Bolivia, Brazil (MS, PR, RS, SC) (Smith & Downs 1979)
<i>D. paucispina</i> Leme & E.Esteves	Esteves & Braun 378 (UFG*)	Rup	Sav	Brazil, Endemic to MS (Leme & Pereira 2003)
<i>D. pottiorum</i> Leme	Leme et al. 8579 (HB, RB)	Rup	Sav	Brazil, Endemic to MS (Leme et al. 2012)
<i>D. stolonifera</i> P.J.Braun & Esteves	Esteves & Braun 627 (UFG*)	Rup	SDF	Brazil, Endemic to MS (Braun & Pereira 2009)
<i>D. sp. 1</i>	Kranz 139 (RB)	?	Sav	?
<i>D. sp. 2</i>	Hatschbach 60802 (MBM)	Ter, Rup	?	?
<i>Encholirium lymanianum</i> E.Pereira & Martinelli	Martinelli 400 (RB)	Rup	Sav	Brazil (MS, MT) (Forzza 2005)
<i>Fosterella hatschbachii</i> L.B.Sm. & Read	Hatschbach 30497 (MBM, NY*)	Rup	SDF	Brazil (MS, MT) (Forzza et al. 2014)
<i>Pitcairnia burchellii</i> Mez	Hatschbach 24278 (MBM)	Rup	SDF	Brazil (DF, GO, MG, MS, MT, RO, TO) (Forzza et al. 2014)
<i>P. matogrossensis</i> E.Pereira & Leme	Kautsky 896 (HB*)	?	?	Brazil, Endemic to MS (Pereira & Leme 1986)
<i>Pseudananas sagenarius</i> (Arruda) Camargo	Ferreira 499 (RB)	Ter	SDF	South America (Smith & Downs 1977)
<i>Tillandsia bonita</i> Versieux & Martinelli	Martinelli 16923 (RB)	Epi	SDF	Brazil, Endemic to MS (Versieux et al. 2013)
<i>T. bulchlohii</i> Rauh	Rojas s.n. (LIL*)	Epi, Ter	SDF	Brazil (MS) and Paraguay (Till 1996)
<i>T. didisticha</i> (E.Morren) Baker	Hatschbach & Ribas 72890 (MBM, RB)	Epi	Sav, SDF	Argentina, Brazil, Bolivia, Paraguay (Govaerts et al. 2005)
<i>T. duratii</i> Vis.	Lima 5562 (RB)	Epi	SDF	Southern South America (Govaerts et al. 2005)

Table 1. Cont.

Taxon	Voucher (Herb.)	Growth	Habitat	Geographical distribution
<i>Tillandsia duratii</i> var. <i>saxatilis</i> (Hassl.) L.B.Sm.	Pott <i>et al.</i> 829 (MBM)	Epi	Sav, SDF	Argentina, Brazil, Bolivia, Paraguay (Govaerts <i>et al.</i> 2005)
<i>T. geminiflora</i> Brongn.	Damasceno-Júnior <i>et al.</i> 1717 (COR)	Epi	SDF	Argentina, Brazil, Paraguay, Uruguay, Suriname (Smith & Downs 1977)
<i>T. loliacea</i> Mart. ex Schult. & Schult.f.	Hatschbach 60901 (HB, MBM)	Epi	Sav, SDF	Argentina, Brazil, Bolivia, Paraguay (Govaerts <i>et al.</i> 2005)
<i>T. polystachya</i> (L.) L.	Kozera 1772 (MBM)	Epi	SDF	Americas, Brazil (MS) (Smith & Downs 1977)
<i>T. pohliana</i> Mez	Sucre 10475 (RB)	Epi	Sav, SDF	Argentina, Bolivia, Brazil, Paraguay, Peru, (Smith & Downs 1977)
<i>T. recurvifolia</i> Hook.	Barbosa & Silva 1537 (RB)	Epi	Sav	Argentina, Brazil (MS, PR, SC, SP), Paraguay, Uruguay (Govaerts <i>et al.</i> 2005)
<i>T. streptocarpa</i> Baker	Braga <i>s. n.</i> (COR)	Epi, Rup	Sav, SDF	Brazil, Bolivia, Paraguay, Peru (Smith & Downs 1977)
<i>T. tenuifolia</i> L.	Damasceno-Júnior <i>et al.</i> 1838 (COR)	Epi	RF, Sav	West Indies and South America (Smith & Downs 1977)
<i>T. tricholepis</i> Baker	Pott <i>et al.</i> 7094 (MBM)	Epi	RF, Sav	Argentina, Brazil, Bolivia, Paraguay (Smith & Downs 1977)

plants from other Brazilian states. We could not thoroughly evaluate species delimitations/identifications within this genus, but we suggest that a revisionary study of dyckias from MS should be done, since new records of populations in the field may greatly contribute to our knowledge about each species. The total number of species from MS may be underestimated, as indicated by three recently described species (Braun & Pereira 2008, 2009, Leme *et al.* 2012), all of them suffering with habitat loss. Recently, for the first time, natural populations of *D. excelsa* were found in ironstone outcrops (Corumbá and Ladário cities, Pantanal region, MS) (Paggi *et al.* 2015). This species was described based on a single individual from a private collection (Leme 1993), without describing the precise provenance. Such kind of field work may greatly contribute to a better understanding of these problematic taxa.

The ecological importance of Bromeliaceae is broadly cited in the literature (*cf.* Benzing 2000a). In MS, bromeliads are important sources of nectar for birds, as is the case of *Ananas ananassoides* and *Bromelia balansae* (Araújo & Sazima 2003, Faria & Araújo 2010). Some specimens examined here had annotations that indicated characteristics of plant populations. *Deuterocohnia meiziana* occurs on limestone rocks and one specimen mentioned that there were mining activities close to the plant population. *Pseudananas sagenarius* is usually mentioned as an abundant species. On the other hand, *Dyckia* species and *Fosterella* are not common. Species of *Bromelia*, particularly *B. balansae* are traditionally used by native “pantaneiros” as medicine. This species is extremely common in some areas of the Pantanal wetland, where it grows forming dense and insurmountable clumps, and is one of the characteristic elements of this landscape, recorded in different studies (Araújo & Sazima 2003, Bueno *et al.* 2007).

Main Research Groups, Collections, and future research

The main groups researching Bromeliaceae in Brazil

are centered in the Southeast region. However, nowadays there are researchers working with different aspects of bromeliads, such as systematics, physiology, morphology, reproductive biology, population genetics, phylogeography, evolution and cultivation in most of the Brazilian states. Considering the number of taxonomists available, Bromeliaceae ranks among the preferred plant families to be studied in Brazil, with at least 20 specialists (data from the Index Herbariorum).

Considering only the herbaria that have their collections data available through SpeciesLink, the largest bromeliad collections belong to the Mato Grosso do Sul Federal University Herbarium (CGMS), followed by Rio de Janeiro Botanic Garden (RB) and by the Embrapa Pantanal from Corumbá (CPAP). Also belonging to the Federal University of Mato Grosso do Sul, the herbarium of Corumbá (COR), although not available on-line yet, has 140 specimens of bromeliads. Most collections have less than 50 specimens (Fig. 1) and the total of specimens in the 20 collections available in the SpeciesLink is 471 (SpeciesLink 2014).

The collection effort should be increased in the entire state, allowing further biogeographical analysis. The number of specimens in the examined collection is still low and many of them were collected along roads. Given the profound landscape modifications that occurred in the last three decades in MS (*cf.* Braun & Pereira 2009) conservation measurements are necessary in order to clearly document the diversity of Bromeliaceae and their habitats in MS.

A complete taxonomic inventory of the Bromeliaceae from Mato Grosso do Sul should be done, increasing collection numbers and sampling all the different physiognomies. It is also a desirable goal to have a revision of *Dyckia* and *Tillandsia* species occurring there, since taxon delimitation in this group is problematic. Ecological niche modeling may be a good tool to be tested and to indicate potential areas of occurrence of species poorly known

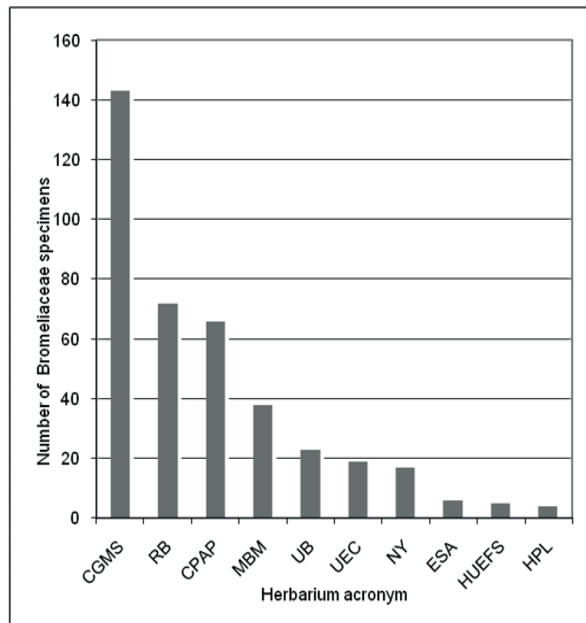


Fig. 1. Number of *Bromeliaceae* specimens in the 10 largest collections available in the SpeciesLink database. Herbaria acronyms follow Index Herbariorum.

or that have lost most of their habitats by fragmentation. Integrating the knowledge of the plants in the field, with their potential distribution and conservation status will be of the utmost importance to set a clear plan to conserve as many species as possible. Creation of new reserves to protect the endemic and rare species should be encouraged and will be much appreciated.

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