**Pleurostachys** (Cyperaceae): nomenclatural notes, geographical distribution and conservation status

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**Abstract**

*Pleurostachys* Brongn. is a Neotropical genus of Cyperaceae closely related to *Rhynchospora* Vahl. It is found in the Atlantic and Amazon Forests from northern South America to southern Brazil and most of the species grow in the humid and shady understory. Fourteen species are confirmed, 11 of them are endemic to the Brazilian Atlantic Forest and six are considered under the conservation status of Vulnerable. New synonyms and lectotypes are also indicated.

**Key words:** Atlantic Forest, Neotropics, Rhynchospora, Conservation, Poales.

**Introduction**

*Pleurostachys* Brongn. is a Neotropical genus of Cyperaceae with a restricted distribution, being mainly found in the Atlantic Forest, humid forests which run along the Brazilian coast (Thomas & Alves, 2008). Almost 35 valid names are cited for the genus by Govaerts *et al.* (2007), and 14–20 of them have been accepted by Guaglianone *et al.* (2008) and Alves *et al.* (2009, 2014) for Brazil. This shows that Brazil is a center of diversity of the genus.

Its close morphological alliance to *Rhynchospora* Vahl has been pointed out by several authors including Pfeiffer (1925), Smith (1934) and Kükenenthal (1952). In more recent studies both genera emerge mixed up (Goetghheber, 1998; Thomas *et al.* 2009) and the phylogenies show no support for them being separate genera (Thomas & Alves 2008; Thomas *et al.* 2013).


Since then, only a few studies related to *Pleurostachys* have been made available. These are mainly restricted to a world checklist of Cyperaceae (Govaerts *et al.* 2007), a checklist of the Brazilian species and their geographical distribution (Alves *et al.* 2009, 2014), a new species recently described from Brazil (Thomas *et al.* 2013) and nomenclatural notes (Longhi-Wagner *et al.* 2010).

The approach employed here provides general data available about species of *Pleurostachys* and their related names, including synonyms, and types. Besides that, information on geographical scales, distally plumose vs. non-plumose to scabrid perianth bristles, and decurrent vs. short-decurrent to truncate style bases (Goetghheber 1998; Thomas & Alves 2008; Thomas *et al.* 2013).

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distribution, conservation status based on categories by the IUCN (2012) and some diagnostic characters are also presented.

Methods

This study made use of extensive collections which have been made by the authors over the last 10 years. They include samples from field expeditions all over Brazil, but especially along the coastal Atlantic Forest, from the state of Paraíba to Santa Catarina.

Samples collected have been primarily deposited at the UFP herbarium, with duplicates at CEPEC, NY, RB, SP, and SPF, among others.

In addition, morphological and geographical data were collected from samples examined at the following herbaria: ALCB, ASE, B, BHCMB, BM, BOLO, CVRD, FLOR, FR, FURB, G, GOET, GUA, HB, HBG, HBR, HPZ, HRR, HST, HUEFS, HUESB, IAN, ICN, INPA, IPA, JPB, K, M, MBM, MBML, NY, P, PAD, PEUF, R, RB, S, SP, SPF, UFP, UB, UPCB, US, W, and WU.

The conservation status follows the criteria adopted by the IUCN (2012). Under the “representative material examined”, up to five samples are cited to represent the range of distribution, habitats and morphological variation of each species.

Results and Discussion

Pleurostachys is here also confirmed as a genus endemic to the tropical and subtropical areas of South America (Goetghebeur 1998; Govaerts et al. 2007; Thomas et al. 2009). It is often found in the understory of humid and shady forests and close to streams. A few species can also be found in open vegetation, such as rocky outcrops and sandy soil, as is the case of P. stricta Kunth.

Govaerts et al. (2007) cited 33 species and Alves et al. (2014) 18, but only 14 of them are recognized here. Two names are new synonym and two others remain to be confirmed as valid species - P. peruviana C.B. Clarke and P. pearcei both described from Peru. Types of these names have not been located yet and descriptions are not complete enough for a taxonomic decision.

All 14 accepted taxa are found in Brazil and three of them also grow in Bolivia, Colombia, French Guyana, Guyana, Ecuador, Peru, Suriname, Trinidad & Tobago, and Venezuela - P. orbignyana Brongn., P. scaposa C.B. Clarke and P. sparsiflora Kunth. The three species are associated with the Amazon Forest. In the Brazilian Amazon Forest, Pleurostachys is found in the states of Acre, Amazonas, Pará and Rondônia.

The Atlantic Forest is clearly the center of diversity of the genus with 12 species, some of which are narrow endemics such as P. bradei R. Gross, P. pilulifera (Bertol.) Longhi-Wagner, Baldini & A.C. Araújo, and P. rabenii Boeck. Pleurostachys can be found from the state of Pernambuco (P. orbignyana Brongn.) to Rio Grande do Sul (P. gaudichaudii Brongn. and P. stricta Kunth). All species recorded from the Atlantic Forest are also found in the state of Rio de Janeiro which makes this the most species-rich state for the genus. It is followed by the states of São Paulo (10 species and 2 to be confirmed) and Minas Gerais, Paraná and Santa Catarina (8 species each).

Pleurostachys orbignyana is the only example of disjunction between the Atlantic and Amazon Forests and is the most widely distributed species of the genus. It is also the species with the longest north-south occurrence range in the Atlantic Forest, being found from the states of Pernambuco to Santa Catarina. This pattern is common in Cyperaceae and has previously been related to Hypolytrum (Alves et al. 2003), a genus found mainly in humid and shady forests, as is true with Pleurostachys.

Even growing in well established populations and with most species found in preserved natural areas, six species are here considered under the conservation status of Vulnerable (VU) because of their narrow-restricted to restricted distributions.

Some taxa are highly morphologically variable, making their correct identification difficult. It is possible that more studies using population analyses and molecular tools will provide a better understanding of their limits as maybe different taxa. This reality can be seen in P. orbignyana and also in a group of closely related species: P. bradei, P. rabenii and P. stricta.

Some nomenclatural types were not found and were possibly destroyed during the II World War at Herbaria as B, HBG and BREM. A couple of them were also not located at the herbarium were the authors of the names had spent most of their professional time and where the samples could be is a mystery. Kukenthal was a very active cyperologist, including reviewing Pleurostachys, in Germany during 1936-1945 and we assume that some specimens were being studied by him.
during this time and got lost. *Nemochloa beyrichii* Nees, *P. angustifolia* Boeck., *P. paniculata* Boeck., and *P. schottmulleri* Boeck. are among the names (all of them are considered synonyms) which the nomenclatural types were not found and are probably destroyed. For these names, because of the lack of other specimens with any indication that were studied by the authors of the names, we decided not to designate lectotypes for now.

In summary, this work updates current knowledge of the diversity of the genus, with 14 species, 11 of them confirmed as endemic to the Brazilian Atlantic Forest, around 20 names lectotypified, 14 new synonyms indicated and more than 50 type-specimens located.


Endemic to Brazil and widespread in the central-southern part of the Atlantic Forest from the states of Bahia to Santa Catarina, including Minas Gerais (Thomas et al. 2013; Alves et al. 2014). It is found in well-established populations and in several protected forest fragments and classified by Thomas et al. (2013) as VU (Vulnerable). This species can be easily recognized by the leafy culm and the arrangement of the spikelets in the synflorescence. Representative material examined: BRAZIL. BAHIA: Jussari, Reserva Serra do Téimoso, 15.IX.2001. *J. Jardim et al*. 3922 (CEPEC, NY). 21 Nov 1996. *W. W. Thomas et al*. 11367 (holotype CEPEC!, isotypes G!, K!, NY!).


Endemic to Brazil and found in very restricted submontane and montane areas of Atlantic Forest in the south of the state of Rio de Janeiro bordering the states of São Paulo and Minas Gerais (Alves et al. 2014). A few samples are available in local herbaria and the narrow-endemic distribution of the species in a National Park suggests it as VU. This species can be recognized by the spikelets clustered in short-branched inflorescence supported by a long and thin axis. Material examined: BRAZIL. RIO DE JANEIRO: Itatiaia, Maromba, VIII.1933. *A. Brade 12643* (RB), 26.VII.1996. *G. Eiten & L. Eiten 7459* (MO, UB); Tinguá, Represa do Rio Piaba, 28.VIII.1960. *G. Pabst 5396* (HB).


Endemic to the Atlantic Forest in Brazil from the state of Rio de Janeiro to Santa Catarina (Alves et al. 2014) in submontane and montane forests. It is found in well-established populations in some protected forest fragments, and also in small populations. It is considered of LC (Least Concern) based on its wide area of occurrence and numerous natural populations. This species can be recognized by the leafy culm with linear leaves on the final third of the culm which resembles the arrangement of the leaves found in some understory species of Bambusoideae - Poaceae (Renvoize 1984). Representative material examined: BRAZIL. RIO DE JANEIRO: Petrópolis, Pato do Alferes, 22.IV.1980, *T. Plowman & G. Martinelli 10116* (K, NY, RB). SÃO PAULO: Jundiaí, Serra do Japi, 8.X.1976, *H. Leitão Filho et al.* 3198 (NY, UEC). SANTA CATARINA: Blumenau, Parque Natural Municipal São Francisco de Assis, 18.II.2011, *M. Verdi 5889* (FLOR, FURB).


Endemic to Brazil and found in very restricted submontane and montane areas of Atlantic Forest in the south of the state of Rio de Janeiro bordering the states of São Paulo and Minas Gerais (Alves et al. 2014). A few samples are available in local herbaria and the narrow-endemic distribution of the species in a National Park suggests it as VU. This species can be recognized by the spikelets clustered in short-branched inflorescence supported by a long and thin axis. Material examined: BRAZIL. RIO DE JANEIRO: Itatiaia, Maromba, VIII.1933. *A. Brade 12643* (RB), 26.VII.1996. *G. Eiten & L. Eiten 7459* (MO, UB); Tinguá, Represa do Rio Piaba, 28.VIII.1960. *G. Pabst 5396* (HB).
This species can be recognized by the leafy culm and the natural populations. It is found in well-established populations and in several protected forest fragments. It is considered LC based on the area of occurrence and the natural populations. This species can be identified with clustered spikelets.


Endemic to Brazil and widespread in the central-southern part of the Atlantic Coastal Forest from the states of Bahia to Rio Grande do Sul (Alves et al. 2014). It is found in well-established populations and in several protected forest fragments. It is considered LC based on the area of occurrence and the natural populations. This species can be misidentified as *Hypolytrum bullatum* C.B. Clarke because of the similarities of the general aspect of the plant and the undulate (bollate) leaves (Alves 2003) which is an easy character to distinguish it from other species of *Pleurostachys*.

Representative material examined: BRAZIL. BAHIA: Santa Luzia, Serra da Onça, 21 XI 1996. W. Thomas et

It is endemic to Brazil and occurs occasionally in the central part of the Atlantic Forest from the states of Bahia to São Paulo (Alves et al. 2014). It is found in small populations and in protected forest fragments and is considered VU. This species can be easily recognized among the other species by having the largest spikelets and achenes up to 7mm long.


It is the most widespread species of the genus and occurs in the Atlantic Forest (Brazil from the
states of Pernambuco to Santa Catarina including Minas Gerais) and in the Amazon Forest in Bolivia, Colombia, French Guiana, Guyana, Ecuador, Peru, Suriname, Trinidad & Tobago, Venezuela, and Brazil in the states of Acre and Rondônia (Govaerts et al. 2007: Alves et al. 2014). It is found in small and large populations and in protected forest fragments. It is considered LC based on the area of occurrence and the natural populations. This species can be easily recognized by the leafy habit and branched inflorescence associated with small spikelets up to 3.5 mm long. Two names have been largely used to identify samples of this species: P. beyrichii and P. pubera, both proposed here as new synonyms. After a large set of samples analyzed from different localities especially from Brazil, it is clear that the variation in leaf length, number of branches in the synflorescence and achene size is widespread in the taxon, making it impossible to use regular macromorphological characters to recognize different species as had previous been done by Govaerts et al. (2007) and Alves et al. (2009, 2014).

Population studies under a molecular approach can provide a better understanding and maybe result in the recognition of more than one taxon.


Endemic to Brazil and known from montane Atlantic Forest in the states of Río de Janeiro and São Paulo (Alves et al. 2014). It should be classified as VU because of the small number of known populations and most of the collections dating back more than 30 years ago. It can be recognized by the small size of the plants (up to 50 cm tall), the leafy culm and the spikelets very-clustered in the synflorescence which is short-pedicelate. Longhi-Wagner et al. (2010) recently proposed a new name and synonym under this taxon which is here followed.


It is another narrow-endemic species of the genus, restricted to southeastern Brazil (Alves et al. 2014) and known only from very restricted areas at high altitudes of the Serra da Mantiqueira (border of the states of Minas Gerais, São Paulo and Rio de Janeiro) which is part of the Atlantic Forest domain. Few samples are available in local herbaria and its narrow-restricted distribution suggest it as VU. It is morphologically very close to P. stricta and P. bradei which sometimes makes it difficult to distinguish specimens among all three taxa. However it can be recognized by the slender and longer culms and pedicels with a leafy bract. Further studies can show that all three names represent one species. However, for now it is not possible to confirm.


In Brazil, it is known only from a few samples from the type locality, which were collected a century ago. The samples available were collected in a juvenile stage which makes the reproductive characters unclear in some points. It grows in Peru and Brazil in the states of Acre and Pará (probably in the state of Amazonas too) in the Amazon Forest (Govaerts et al. 2007; Alves et al. 2014). The data available are insufficient for any indication of its conservation status.


= *P. calypotrocyroides* R. Gross, Feddes Repert 42: 175. 1937. Type: Brazil. Rio de Janeiro, Angra dos Reis, Jussaral, *A. Brade* 14946 (holotype B!, isotype RB!).


It is widespread in the central and southern part of the Atlantic Forest from southern Bahia to Rio Grande do Sul (Alves et al. 2014). It grows in well-established populations on the border of several protected lowland forest fragments and also in rocky outcrops and sandy soil. It is considered LC.
based on its wide area of occurrence and numerous natural populations. As stated previously, *P. stricta* is morphologically close to *P. bradei* and *P. rabenii* which are narrow-endemics in the mountains on the border of the states of Minas Gerais, Rio de Janeiro and São Paulo. Specimens of *P. stricta* are often recognized by the medium-length rhizome with fibrous brownish to reddish sheath, coriaceous and somewhat rigid and erect leaves when dried and the single spikelets with short and erect pedicels. *Pleurostachys stricta* var. *dissoluta* has been cited as a synonym of *P. stricta* by Govaerts et al. (2007) and is accepted as such here. However, the type specimens (*A. Brade 8646*) have been cited by Govaerts *et al.* (2007) which was also noticed by Kükenthal (1952). For a better understanding of this variation more collections from the area are mandatory.


It is widespread in the southern part of the Atlantic Forest from the states of Espírito Santo to Santa Catarina including Minas Gerais (Alves *et al.* 2014). Although it was not cited by Guaglianone *et al.* (2008), it is possible that it could be found in similar vegetation types in northern Argentina and eastern Paraguay. It grows in well-established populations and in several protected forest fragments and considered LC based on the wide area of occurrence and numerous natural populations. The spikelets are elliptical and isolated at the end of each axis of the highly-branched synflorescence. This species can be confused with *P. urvillei*, but it is easily distinguished by the lanceolate, larger and less clustered culm leaves. We fully agree with the nomenclatural reasons to use the name *Pleurostachys tenuiflora* (*Scirpus latifolius* Bertol. was published earlier) as suggested by Longhi-Wagner *et al.* (2010). 

**Representative material examined:** BRAZIL. ESPIRITO SANTO: Flexeiras, Atílio Vivacua,
**Pleurostachys (Cyperaceae)**


= *P. ulei* Boeck., Beitr. Cyp. 2: 19. 1890. Type: Brazil. Santa Catarina, Itajai, s.d., *E. Ule 553* (holotype B!, isotypes HBG!, K!, P!, RB!).


It is widespread in the southern part of the Atlantic Forest from the states of Rio de Janeiro to Santa Catarina (Alves et al. 2014), and is sympatric with *P. tenuiflora*. It probably grows in the Atlantic forest areas in Argentina and Paraguay too but was not cited by Guaglianone et al. (2008). It is found in well-established populations and in several protected forest fragments and is considered LC based on the wide area of occurrence and numerous natural populations. This species is easily recognized by the elliptical leaves and their acute and somewhat curved apex.


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**References**


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