

A new *Malaxis* (Orchidaceae: Malaxidinae) from the Campos de Altitude of the Atlantic Rainforest in southern Brazil

Abstract

Malaxis ybytui is proposed as a new species from the wetlands of the Campos de Altitude of the Atlantic Rainforest of South Brazil. It is described, illustrated, and compared with other similar species. The new species is recognised by its flat to slightly conduplicate leaves, densely congested inflorescence with small flowers bearing free lateral sepals and four cavities in the lip. It is similar to *Malaxis cipoensis* and *Malaxis sertulifera*, being distinguished by its vegetative and floral morphology. The species is found in the mountain's hillside about 1500m elevation in the *Serra do Araçatuba**Papanduva* mountain chain. Due to the high degree of endemism in this environment, the few collection records and the anthropic pressure in the region, we infer that the species is Critically Endangered (CR).

Keywords: Endangered, Monocots, Orchids, Páramos

Introduction

Malaxis Solander ex Swartz (1788) is classified under the subtribe Malaxidinae Benth and Hooker (1883), and has traditionally been considered a cosmopolitan genus with over 300 species distributed throughout the Americas, Asia and Europe (Cribb 2005). Currently, ten species are registered in Brazil (Flora do Brasil 2020). However, an ongoing revision of the genus can change this number and the list of recognised taxa.

Recent molecular studies have challenged its taxonomy, revealing that the genus is polyphyletic in the conventional sense. Additionally, the current infrageneric classification does not group species based on their evolutionary lineages, and the genus, including *Microstylis* (Nuttall 1818) Eaton (1822), might be restricted to the Americas and temperate regions of Eurasia (Cameron 2005, Radins et al. 2014).

During our investigation of the Brazilian *Malaxis*, we discovered that a small size species collected in the Campos de Altitude of the Atlantic Rainforest of the Paraná state has not been previously described in scientific literature. Hence, we propose this taxon as new and provide its description, diagnosis, a plate showcasing the type collections, ecological insights, conservation status, illustration, and comparison with morphologically similar species.

Materials and Methods

Several field campaign attempts in the area where the species was first collected, aiming to find live material to aid with descriptions, were unsuccessful. Therefore, detailed morphological analysis was carried out using the collections of *O.S. Ribas 2132* (MBM218837) and *R. Kummrow 3381* (MBM167056). Type specimens were selected, indicating the voucher in overall better condition as the holotype. The morphological terminology employed in this study adheres to the guidelines provided by Rizzini (1977), Beentje (2010), and Stearn (2004). Descriptions, drawings, and plates were prepared based on the selected type specimens, while additional photographs were taken during the field excursions. To compare the species with similar taxa, specimens from the following herbaria were consulted: BHCN, SP, UB, and CEN. The conservation status assessment followed the guidelines provided by the IUCN (2022).

Results and Discussion

Malaxis ybytui T.F. Santos & E.C. Smidt. Type: BRAZIL. Paraná: Tijucas do Sul, Serra do Papanduva, 15.XII.1997, *O.S. Ribas 2132* (holotype MBM (barcode: 218837!)) (Figs. 1, 2).

Similis est Malaxis cipoensis Barros (1996) *et Malaxis sertulifera* (Barbosa Rodrigues 1877) Pabst (1967), *differentiata a primo per labio quattuor cavitatibus in loco duarum, et a secundo per sepala lateralibus libera in loco parte connata.*

64 Herb 31–73 mm, rhizome inconspicuous. Roots 8–22 mm, thin. Pseudobulbs 5–10 × 6–
 65 10 mm, oblong, covered by whitish to brownish deciduous foliaceous sheets. Leaves 27–
 66 43 × 11–21 mm, opposite, two per pseudobulbs; several layers of a sheetlike petiole 4–
 67 22 mm, imbricate in each other from the base to near the apex; lamina oblong or oblong-
 68 elliptic, flat or slight conduplicate, coriaceous, margin entire, apex obtuse to slightly
 69 acute. Inflorescence 40–89 mm; umbel-like densely congested raceme; floral bracts pale
 70 greenish; emerging in the apex of the peduncle, before the pedicels, triangular. Flowers
 71 non-resupinate, whitish yellow; twisted pedicels 2–5 mm; ovary 1 mm. Dorsal sepal 2.5–
 72 3.2 × 0.5–1 mm; 3-veined; oblong-lanceolate; margin entire; apex obtuse. Lateral sepals
 73 2.7–3.5 × 1.5–2 mm; free; 3-veined; oblong, usually wider than the dorsal; margin entire;
 74 apex obtuse. Petals 1–2 mm; 1-veined; linear, usually twisted, margin entire; apex obtuse.
 75 Lip 1.8–2.2 × 1.4–1.8 mm; trilobate; glabrous; callus absent; base truncate, attached to
 76 the column; lateral lobes acute to acuminate; mid lobe triangular, four oblong cavities,
 77 margin entire, apex acute. Column vertically compressed; yellowish; wings
 78 inconspicuous or absent. Pollinarium with two ovoid bipartite naked pollinia.

79 Additional examined specimens: Brazil. Paraná: Guaratuba, Serra do Araçatuba,
 80 21.I.1994, *R. Kummrow 3381* (paratype MBM (167056!)) (Fig. 2).—*Malaxis cipoensis*;
 81 GOIÁS: Alto Paraíso de Goiás. Chapada dos Veadeiros, 4.II.1979, *G.F. Gates 132* (UB).
 82 MINAS GERAIS: Belo Horizonte. Serra da Moeda, 7.XII.2007, *J.A.N. Batista 2328*
 83 (BHCB).—*Malaxis sertulifera*; DISTRITO FEDERAL: Brasília. Reserva Ecológica do
 84 IBGE, 21.II.2003, *J.A.N. Batista 1398* (BHCB, CEN). MINAS GERAIS: Aiuruoca,
 85 Parque Estadual da Serra do Papagaio, 18.I.2008, *J.A.N. Batista 2441* (BHCB).

Distribution, ecology, and conservation:—This species has been recorded only in Paraná State. The first discovery in the field was accomplished by *R. Kummrow* 3381 in 1994 and later rediscovered in 1997 by *O.S. Ribas* 2132, both in the *Serra do Araçatuba/Papanduva* (25°54'S, 49°00'W) (Fig. 3), a mountain chain located between the municipalities of Tijucas do Sul and Guaratuba. The region is part of the Atlantic Rainforest Biome, with vegetation formations of Mixed Ombrophilous Forest in the lower areas; patches of montane Dense Ombrophilous Forest in higher elevations; and near the summits the dominant vegetative conformation is the Campos de Altitude, recognised as the ‘‘Brazilian Páramos’’ (Campos et al. 2018) due to the similarities in floristic, physiognomics and edaphic characteristics to the mountains summits of the Andes, a type of vegetation marked by several grass species that grows associated with humidity and the shallow soil of the rock formations (Safford 2007, Campos et al. 2018).

Malaxis ybytui was collected blooming in December and January during the summer in the Campos de Altitude wetland fields at about 1500m elevation, growing in the mountain's hillside, in a sympatric environment to *Xyris lucida* Malme (1913: 98) (Lozano et al. 2008), another endemic species of this environment and considered as ‘‘Endangered’’ by CNCFlora (2012).

Although there are few registers and collection information to infer precisely its conservation status, which in some cases can be characterised as (DD) category according to the IUCN (2022), *M. ybytui* was last found 26 years ago, and several field campaigns in the type-collection locality were unsuccessful in rediscovering it. This, together with the high degree of endemism of the Campos de Altitude (Ribeiro et al. 2007, Vasconcelos 2011) and the anthropic pressure on the Araçatuba mountain range, that suffers from recurrent fires and the presence of introduced *Pinus* sp (Fig. 3), we infer that this species should be treated as ‘‘Critically Endangered (CR) [CR B2a,b(i,ii,iii)]’’.

Etymology:—Ybytu is the word wind in the Tupi-Guarani language. It also references the constant strong winds on the mountain summits of the region where the species was found.

Taxonomic Discussion:—It differs from most Brazilian *Malaxis* mainly by the reduced vegetative size. However, it is morphologically similar to *M. cipoensis* and *M. sertulifera*, two small species from the Brazilian midwest that occur in the states of Goiás, Minas Gerais, and Distrito Federal. Several listed characteristics can differentiate and recognise them (Table 1).

References

- Barros F (1996) Uma nova espécie de *Malaxis* Sol. ex Sw. (Orchidaceae) da Serra do Cipó (Minas Gerais, Brasil) e considerações sobre as seções brasileiras do gênero. Boletim de Botânica da Universidade de São Paulo 15:31–34.
- Beentje HJ (2010) The Kew plant glossary: an illustrated dictionary of plant terms. Royal Botanic Gardens, London.
- Bentham G, Hooker JD (1883) Genera Plantarum. Reeve L, London.
- Cameron KM, Chase MW, Whitten WM, Kores PJ, Jarrell DC, Albert VA, Yukawa T, Hills HG, Goldman DS (1999) A phylogenetic analysis of the Orchidaceae: evidence from rbcL nucleotide sequences. American Journal of Botany 86:208–224.
- Campos PV, Villa PM, Nunes JA, Schaefer CE, Porembski S, Neri AV (2018) Plant diversity and community structure of Brazilian Páramos. Journal of Mountain Science 15(6):1186–1198.

- 136 CNCFlora (2012) *Xyris lucida* in Lista Vermelha da flora brasileira versão 2012.2
 137 Centro Nacional de Conservação da Flora. Disponível em
 138 <[http://cncflora.jbrj.gov.br/portal/pt-br/profile/Xyris lucida](http://cncflora.jbrj.gov.br/portal/pt-br/profile/Xyris_lucida)>. Accessed on: 22
 139 June 2023.
- 140 Cribb PJ (2005) *Malaxis*. In: Pridgeon AM , Cribb PJ, Chase MW, Rasmussen FN (ed)
 141 Genera Orchidacearum, vol 4. Epidendroideae (Part One). Oxford, pp 471–475.
- 142 Eaton A (1822) Manual of Botany for the Northern and Middle States of America.
 143 Websters & Skinners, Albany.
- 144 IUCN (2001) IUCN Red List Categories and Criteria: Version 3.1. IUCN Species
 145 Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- 146 Lozano ED, Smidt EC, Wanderley MGL (2018) Estudos taxonômicos das Xyridaceae
 147 no estado do Paraná, Brasil. Rodriguésia 69:1737–1769.
- 148 *Malaxis* in Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Available at:
 149 <<https://floradobrasil.jbrj.gov.br/FB11814>>. Accessed on: 12 Apr. 2023
- 150 Malme GO (1913) *Xyris* L. Untergattung Nematopus (Seubert). Entwurf einer
 151 Gliederung. Arkiv För Botanik 13:1–103.
- 152 Nuttall T (1818) The genera of North American plants and a catalogue to the species to
 153 the year 1817, vol. 2. D., Heartt, Philadelphia.
- 154 Pabst GFJ (1967) Additamenta ad orquideologia brasiliensem VIII. Orquídea (Rio de
 155 Janeiro) 29:112–113.
- 156 Radins JA, Salazar GA, Cabrera LI, Jiménez-Machorro R, Batista JAN (2014) A new
 157 paludicolous species of *Malaxis* (Orchidaceae) from Argentina and Uruguay.
 158 Phytotaxa 175(3):121–132.

- Ribeiro KT, Medina BMO, Scarano FR (2007) Species composition and biogeographic relations of the rock outcrop flora on the high plateau of Itatiaia, SE-Brazil. Brazilian Journal of Botany 30:623–639.
- Rizzini CT (1977) Sistematização terminológica da folha. Rodriguésia 42:103–125.
- Safford HD (2007) Brazilian paramos IV. Phytogeography of the highland fields. Journal of Biogeography 34:1701–1722.
- Stearn WT (2004) Botanical Latin. Timber Press, Portland.
- Swartz O (1788) Orchidaceae. In: Holmia, Upsala & Abo (ed) Nova Genera et Species Plantarum seu Prodromus. Stockholm, pp 118–126.
- Vasconcelos MFD (2011) O que são campos rupestres e campos de altitude nos topos de montanha do Leste do Brasil?. Brazilian Journal of Botany 34:241–246.

Table 1 Comparison between *Malaxis ybytui* and other similar Brazilian *Malaxis*

Character	<i>M. ybytui</i>	<i>M. cipoensis</i>	<i>M. sertulifera</i>
Biome	Atlantic Rainforest	Cerrado	Atlantic Rainforest and Cerrado
Vegetation domain	Campos de Altitude	Rupestrian fields	Forest
Herb size (mm)	31–73	20–62	54–115
Leaf type	flat to slightly conduplicate	flat to slightly conduplicate	flat

Leaf shape	oblong; oblong-elliptic	elliptic	lanceolate; oblong-lanceolate
Petiole	fully imbricate	fully imbricate	partially imbricate
imbrication			
Inflorescence	densely congested	densely congested	congested
Dorsal sepal	2.5–3.2 × 0.5–1	1–2 × 1.5–2	2.5–3.5 × 1.5–2
(mm)			
Lateral sepals	2.7–3.5 × 1.5–2	1–2 × 1.3–1.5	1.7–1.8 × 1–1.5
(mm)			
Junction of the lateral sepals	free	free	partially connate
Petals (mm)	1.8–2	1	1.5–2
Lip (mm)	1.8–2.2 × 1.4–1.8	0.8–1 × 1	1.5–2 × 1–2
Lateral lobe shape	acuminate	rounded	acuminate
Lip cavities	4	2	4

173

174

175 **Fig. 1** Illustration of *Malaxis ybytui* by L.K.R. Hinoshita; based on the type specimen. **a.**

176 Habit. **b.** Leaf blade. **c.** Inflorescence. **d.** Frontal view of the flower attached to the

177 pedicel. **e.** Dorsal sepal. **f.** Petal. **g.** Connated lateral sepal. **h.** Lip. **i.** Column.

178

179 **Fig. 2** Type specimens of *Malaxis ybytui*. **a.** Holotype (MBM 218837). **b.** Paratype
180 (MBM 167056).

181

182 **Fig. 3** Habitat of *Malaxis ybytui*. **a.** Campos de Altitude near the summit of the Araçatuba
183 peak. **b.** Campos de Altitude exposed in the summits of the Araçatuba mountain chains.
184 **c.** Mountain's hillside in the Araçatuba peak, presence of invasive *Pinus* sp. **d.** Araçatuba
185 chains; view from the Araçatuba peak. **e.** Wetlands vegetation growing in the Mountain's
186 hillside. **f.** Vegetation exposed to the strong wind in the Araçatuba peak.

187

188