

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

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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).

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10 leaves, densely congested inflorescence with small flowers bearing free lateral sepals and
11 four cavities in the lip. It is similar to *Malaxis cipoensis* and *Malaxis sertulifera*, being
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19 **Keywords:** Endangered, Monocots, Orchids, Páramos

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21 **Introduction**

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23 *Malaxis* Solander ex Swartz (1788) is classified under the subtribe Malaxidinae Benth
24 and Hooker (1883), and has traditionally been considered a cosmopolitan genus with over
25 300 species distributed throughout the Americas, Asia and Europe (Cribb 2005).
26 Currently, ten species are registered in Brazil (Flora do Brasil 2020). However, an
27 ongoing revision of the genus can change this number and the list of recognised taxa.

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

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

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41 **Materials and Methods**

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

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56 **Results and Discussion**

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58 *Malaxis ybytui* T.F. Santos & E.C. Smidt. Type: BRAZIL. Paraná: Tijucas do Sul, Serra
59 do Papanduva, 15.XII.1997, *O.S. Ribas 2132* (holotype MBM (barcode: 218837!)) (Figs.
60 1, 2).

61 *Similis est Malaxis cipoensis* Barros (1996) *et Malaxis sertulifera* (Barbosa Rodrigues
62 1877) Pabst (1967), *differentiata a primo per labio quattuor cavitatibus in loco duarum,*
63 *et a secundo per sepala lateralia 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
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86 Distribution, ecology, and conservation:—This species has been recorded only in
87 Paraná State. The first discovery in the field was accomplished by *R. Kummrow 3381* in
88 1994 and later rediscovered in 1997 by *O.S. Ribas 2132*, both in the *Serra do*
89 *Araçatuba/Papanduva* (25°54'S, 49°00'W) (Fig. 3), a mountain chain located between the
90 municipalities of Tijucas do Sul and Guaratuba. The region is part of the Atlantic
91 Rainforest Biome, with vegetation formations of Mixed Ombrophilous Forest in the lower
92 areas; patches of montane Dense Ombrophilous Forest in higher elevations; and near the
93 summits the dominant vegetative conformation is the Campos de Altitude, recognised as
94 the ‘‘Brazilian Páramos’’ (Campos et al. 2018) due to the similarities in floristic,
95 physiognomics and edaphic characteristics to the mountains summits of the Andes, a type
96 of vegetation marked by several grass species that grows associated with humidity and
97 the shallow soil of the rock formations (Safford 2007, Campos et al. 2018).

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

103 Although there are few registers and collection information to infer precisely its
104 conservation status, which in some cases can be characterised as (DD) category according
105 to the IUCN (2022), *M. ybytui* was last found 26 years ago, and several field campaigns
106 in the type-collection locality were unsuccessful in rediscovering it. This, together with
107 the high degree of endemism of the Campos de Altitude (Ribeiro et al. 2007, Vasconcelos
108 2011) and the anthropic pressure on the Araçatuba mountain range, that suffers from
109 recurrent fires and the presence of introduced *Pinus* sp (Fig. 3), we infer that this species
110 should be treated as ‘‘Critically Endangered (CR) [CR B2a,b(i,ii,iii)]’’.

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

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

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171

172 **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 imbrication	fully imbricate	fully imbricate	partially imbricate
Inflorescence	densely congested	densely congested	congested
Dorsal sepal (mm)	2.5–3.2 × 0.5–1	1–2 × 1.5–2	2.5–3.5 × 1.5–2
Lateral sepals (mm)	2.7–3.5 × 1.5–2	1–2 × 1.3–1.5	1.7–1.8 × 1–1.5
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

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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 the177 pedicel. **e.** Dorsal sepal. **f.** Petal. **g.** Connated lateral sepal. **h.** Lip. **i.** Column.

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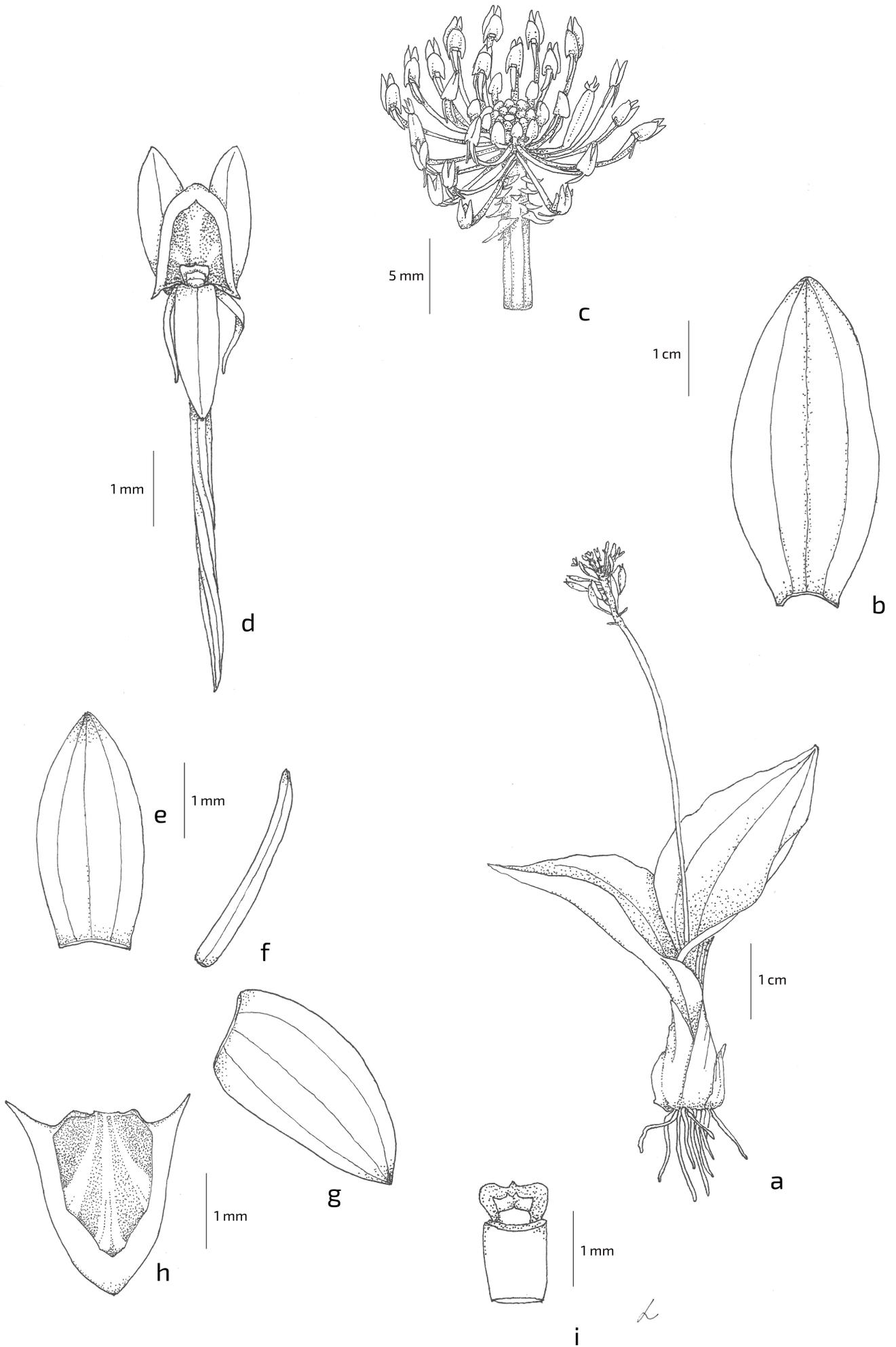
179 **Fig. 2** Type specimens of *Malaxis ybytui*. **a.** Holotype (MBM 218837). **b.** Paratype
180 (MBM 167056).

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.

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PREFEITURA MUNICIPAL DE CURITIBA
 MUSEU BOTÂNICO MUNICIPAL

HERBÁRIO Nº
218837

Orchidaceae
Malaxis warmingii (Rehb.f.) Kuntze
 Det. J.F. Slonick V/2007
 Serra de Papanduva (Mun. Tijucas do Sul) Paraná
 O.S. Ribas, J. Cordeiro & L.B.S. Pereira 2132, 15.XII.1997
 Terrícola, flor creme amarelada. Campo gramíneo e úmido da
 encosta do morro. Alt. aprox.: 1500m.

PMC - DPP 004



a


PREFEITURA MUNICIPAL DE CURITIBA
 MUSEU BOTÂNICO MUNICIPAL

HERBÁRIO Nº
167056

FAM. Orchidaceae N.V.
 N. Malaxis warmingii (Rehb.f.) Kuntze
 LOC. Serra do Araçatuba (mun. Guaratuba) Paraná
 LEG. R. Kummrow 3381, J.M. Silva & J. Cordeiro 21-I-1994
 DET. J.F. Slonick V/2007
 Flor creme. Campo gramíneo, junto a rochas.
 Alt.: 1400m. Unicata.

PMC - DPP 004



b

