

## FLORISTICS OF THE HERBACEOUS AND SUBSHRUB LAYER OF A MOIST GRASSLAND IN THE CERRADO BIOSPHERE RESERVE (ALTO PARAÍSO DE GOIÁS), BRAZIL

C. B. R. MUNHOZ<sup>1</sup> & J. M. FELFILI<sup>2</sup>

The floristic composition of *campo limpo úmido*, a moist savanna grassland vegetation of the cerrado biome, is still little described, even though its herbs and subshrubs form a major component of the cerrado vegetation. The objective of this study was to characterize the floristic richness of the herbaceous and subshrub layer of a moist grassland at the Água Fria Farm, Alto Paraíso, Goiás State (14°04'8.83"S, 47°30'33.1"W). The principal use of such grasslands is to graze cattle; in addition, local people collect vast numbers of selected species of wild plants to sell for the decorative dried plant trade, or for their medicinal qualities. Little is known, however, about the sustainability of this extractivism. A survey of a 21 ha area, with intensive quarterly collections of herbarium specimens, was made from April 2000 to March 2001. Despite the small size of the study site it proved to be very rich floristically. A total of 207 species in 90 genera and 33 families was registered in the area. Thirty-one species not yet recorded in the checklist of the flora of the cerrado biome were found in this study, plus three that seem to be new to science. The richest families were *Cyperaceae* (30 species), *Poaceae* (28), *Xyridaceae* (23), *Eriocaulaceae* (20), *Asteraceae* (18), and *Orchidaceae* and *Melastomataceae* with 10 species each. These results suggest the need for more research on the moist grassland to provide overall estimates for the plant species richness of this widespread vegetation type and as a basis to help guide conservation and management policies.

*Keywords.* Cerrado, floristics, herbaceous and subshrub layer, moist grassland, Veadeiros Plateaux.

### INTRODUCTION

The cerrado vegetation of the Brazilian Central Plateaux consists of a structural gradient from grasslands with less than 10% of tree cover (called *campo limpo*) to dense woodlands (known as *cerradão*) where tree cover reaches more than 70% (Eiten, 1992; Ratter *et al.*, 1997). Our study area is situated at Alto Paraíso on the Veadeiros Plateaux, a highland complex with altitudes ranging from 800 m to 1650 m located in the State of Goiás, Central Brazil (centred at c.14°S, 47°W). The complex has a very diverse landscape including areas of grasslands and low scrubby cerrado on rocky outcrops at high altitude, and cerrado woodlands on shallow soils derived

<sup>1</sup> Universidade Católica de Brasília, Curso de Biologia, QS7 Lote 01 EPCT, Águas Claras, 72030-170 Taguatinga-DF, Brazil. E-mail: cassia@ucb.br

<sup>2</sup> Universidade de Brasília, Departamento de Engenharia Florestal, CP 04357, 71-919-970 Brasília-DF, Brazil.

from quartzitic and arenitic rocks (Ribeiro & Walter, 1998). The flora is rich and contains several endemics, especially in the *Leguminosae*, *Eriocaulaceae*, *Lythraceae*, *Asteraceae*, *Poaceae*, *Melastomataceae* and *Velloziaceae* (Giulietti *et al.*, 1987; Harley, 1995; Munhoz & Proença, 1998; Simon & Proença, 2000), and new species are frequently described (Kirkbride, 1997; Cantino, 1999; Filgueiras & Zuloaga, 1999; Koschnitzke & Martins, 1999; Filgueiras *et al.*, 2001; Morrone & Zuloaga, 2003). Munhoz & Proença (1998) listed 1300 phanerogamic species in 122 families for the municipality of Alto Paraíso, representing c.21% of the 6062 phanerogamic taxa compiled by Mendonça *et al.* (1998) for the total cerrado biome. The species-rich high grasslands reaching 1600 m (Felfili *et al.*, 1997) agree with Alves & Kolbek's (1994) description of high richness and endemism at high-altitude sites in the tropics. Because of its enormous biological and landscape interest Alto Paraíso de Goiás was included in the Cerrado Biosphere Reserve within the UNESCO Man and the Biosphere Program as a priority area for conservation of the world's biodiversity.

Grasslands in the cerrado biome generally occur in the transition zone between gallery forests and woodlands (Eiten, 1992), playing an important role linking these physiognomies. Woody species do not establish in this zone either due to the excess humidity in the soil (with the water table near the surface), or because of the shallowness of the soils, or for both reasons (Ribeiro & Walter, 1998). According to Reatto *et al.* (1998), 2.3% of the moist grasslands within the cerrado biome occur on hydromorphic soils and 0.2% on humic gleys.

The principal use of the grasslands is cattle grazing, with fire used as a management tool to induce new growth. In addition, extractivism plays an important part in the economy of the area. Local people collect vast numbers of selected species of wild plants to sell for the decorative dried plant trade, or for their medicinal qualities (Giulietti *et al.*, 1987; WWF, 1998). Little is known, however, about the sustainability of this practice since there is a lack of information on the floristics, structure and dynamics of this ecosystem to help guide conservation and management policies.

The objective of this work was to study the floristic composition of a moist grassland (*campo limpo úmido*) to provide baseline information on its biodiversity, a necessary starting point for studies of conservation and sustainable use of the ecosystem.

## MATERIALS AND METHODS

### *Study site*

The study site is an area of 21 ha, lying close to a stream at an altitude of 1482 m. It is situated at 14°04'8.83"S, 47°30'33.1"W on the Água Fria Farm (FAF), Municipality of Alto Paraíso, Goiás State. No traces of burning, livestock grazing or extractivism were noticeable in the area before the study. It contained large numbers of the species harvested for the dried-flower trade by local people (WWF, 1998).

The climate is Aw by the Köppen classification, with two distinct seasons: hotter and rainy (October to April) and colder and drier (May to September). According to Assad (1994), the average annual precipitation for the region is between 1200 and 1600 mm, with an average annual temperature of 20°C, and an average of 18°C for the coldest month. However, during the period of this study (from April 2000 to March 2001) a considerably lower figure for precipitation was recorded. This came from the National Water Agency meteorological station and gave a figure of 992 mm for Alto Paraíso city.

The area is predominantly covered in moist, non-inundated grassland but there is a seasonally flooded portion near to some veredas (swampy areas with lines of the palm tree *Mauritia flexuosa* L.f.) and a permanently flooded portion bordering a gallery forest alongside the stream, while nearby there is savanna woodland on rocky soils.

The relief is plain with dystrophic plinthite-rich soils of medium sandy texture and moderate drainage, apart from an area near the gallery forest where a humic gley soil with a high content of organic matter is found.

#### *Data collection*

Plant voucher specimens were collected quarterly from April 2000 to March 2001 along transects in the moist grassland and deposited in the herbaria of the University of Brasília (UB) and the IBGE Ecological Reserve (IBGE). They were identified at these herbaria, or in the case of the more critical taxonomic groups, were sent to specialists. The family classification used was that of the Angiosperm Phylogeny Group (2003). Species and author names were checked in *The Plant Names Project* (2000) and on the site *W<sup>3</sup>Tropicos* (<http://www.mobot.org>, July 2005). A checklist of species giving families and collection numbers was compiled and analyzed (Table 1).

### RESULTS AND DISCUSSION

A total of 781 flowering and fruiting specimens belonging to 207 species or infraspecific taxa in 90 genera (including two determined only to family level) and 33 families was collected (Table 1). Of these 183 were identified to species or infraspecific taxon and 20 only to genus, including three species apparently new to science and which will soon be described. These are a *Paepalanthus* and a *Syngonanthus* (both *Eriocaulaceae*), and a *Trichogonia* (*Asteraceae*). Two specimens were identified only to family, including an apparent new genus of *Acanthaceae* according to a specialist in the group. Two specimens still remain undetermined to family.

Only two of the species recorded are not natives of the flora of the cerrado biome. These are the weedy species *Fimbristylis autumnalis* (L.) Roem. & Schult. (*Cyperaceae*) and *Andropogon leucostachyus* Kunth (*Poaceae*).

TABLE 1. Species of the herbaceous and subshrub flora in a 21 ha area of moist grassland on the Veadeiros Plateaux at Água Fria Farm, Alto Paraíso de Goiás, Goiás State. N = C. Munhoz collection number; \* = weedy exotic species; \*\* = a probably new species according to a specialist; underlined = names not previously recorded for the cerrado biome vascular flora by Mendonça *et al.* (1998); **bold** = names not recorded by Felfili *et al.* (1997) for the flora of the Veadeiros Plateaux

	Life form	N
<b>ACANTHACEAE</b>		
<b><u>Ruellia adenocalyx</u> Lindau</b>	Subshrub	1248
<u>Ruellia</u> cf. <u>pohlii</u> (Nees) Lindau	Subshrub	2110
<u>Stenandrium</u> sp.	Subshrub	2152
<u>Acanthaceae</u> sp. nov.**	Subshrub	1144
<b>AMARANTHACEAE</b>		
<u>Froelichiella</u> <u>grisea</u> R.E.Fr.	Subshrub	1825
<u>Gomphrena</u> sp.	Subshrub	1780
<b>APIACEAE</b>		
<u>Eryngium</u> <u>juncifolium</u> (Urb.) Mathias & Constance	Herb	1917
<b>APOCYNACEAE</b>		
<u>Ditassa</u> <u>cordata</u> (Turcz.) Fontella	Herb	2607
<u>Mandevilla</u> <u>myriophyllum</u> (Taub.) Woodson	Herb	1174
<b>ASTERACEAE</b>		
<u>Ageratum</u> <u>fastigiatum</u> (Gardner) R.M.King & H.Rob.	Subshrub	1795
<u>Aspilia</u> sp.	Subshrub	2112
<u>Ayapana</u> <u>amygdalina</u> (Lam.) R.M.King & H.Rob.	Subshrub	1784
<u>Calea</u> <u>elongata</u> Baker	Subshrub	1243
<u>Calea</u> <u>gardneriana</u> Baker	Herb	1150
<u>Lepidaploa</u> <u>aurea</u> (Mart. ex DC.) H.Rob.	Shrub	1419
<b><u>Lessingianthus</u> <u>crystalinae</u> (H.Rob.) H.Rob.</b>	Herb	1077
<b><u>Lessingianthus</u> <u>eitenii</u> (H.Rob.) H.Rob.</b>	Subshrub	2651
<b><u>Lessingianthus</u> <u>psilophyllus</u> (DC.) H.Rob.</b>	Subshrub	1250
<u>Porophyllum</u> <u>angustissimum</u> Gardner	Shrub	1151
<b><u>Raulinoreitzia</u> <u>leptophlebia</u> (B.L.Rob.) R.M.King &amp; H.Rob.</b>	Shrub	1176
<u>Senecio</u> <u>adamantinus</u> Bong.	Herb	2269
<u>Stevia</u> <u>heptachaeta</u> DC.	Herb	1132
<u>Trichogonia</u> <u>prancei</u> G.M.Barroso	Herb	2558
<u>Trichogonia</u> sp. nov.**	Shrub	1158
<b><u>Vernonia</u> <u>foliosa</u> Gardner</b>	Subshrub	2342
<b>BURMANNIACEAE</b>		
<u>Burmannia</u> <u>bicolor</u> Mart.	Herb	2634
<u>Burmannia</u> <u>flava</u> Mart.	Herb	1081
<b>CONVOLVULACEAE</b>		
<u>Evolvulus</u> <u>lagopodioides</u> Meisn.	Subshrub	2662
<u>Ipomoea</u> <u>pinifolia</u> Meisn.	Subshrub	1142
<b>CYPERACEAE</b>		
<u>Bulbostylis</u> <u>jacobinae</u> (Steud.) Lindm.	Herb	2589

TABLE 1. (Cont'd).

	Life form	N
<b><i>Bulbostylis laeta</i> C.B.Clarke</b>	Herb	1102
<b><i>Bulbostylis sellowiana</i> (Kunth) Palla</b>	Herb	1986
<i>Cyperus haspan</i> L.	Herb	2637
<b><i>Cyperus schomburgkianus</i> Nees</b>	Herb	1115
<i>Cyperus</i> sp. 1	Herb	2371
<i>Cyperus</i> sp. 2	Herb	2345
<i>Exochogyne amazonica</i> C.B.Clarke	Herb	2487
<i>Fimbristylis autumnalis</i> (L.) Roem. & Schult.*	Herb	1089
<i>Lagenocarpus rigidus</i> (Kunth) Nees	Herb	1162
<i>Lagenocarpus rigidus</i> subsp. <i>tenuifolius</i> (Boeck.) T.Koyama & Maguire	Herb	2405
<b><i>Rhynchospora brevirostris</i> Griseb.</b>	Herb	1256
<i>Rhynchospora confinis</i> (Nees) C.B.Clarke	Herb	2626
<i>Rhynchospora emaciata</i> (Nees) Boeck.	Herb	1828
<i>Rhynchospora globosa</i> (Kunth) Roem. & Schult.	Herb	2351
<i>Rhynchospora graminea</i> Uittien	Herb	1127
<i>Rhynchospora hirta</i> (Nees) Boeck.	Herb	1985
<i>Rhynchospora marisculus</i> Lindl. ex Nees	Herb	2252
<i>Rhynchospora pilosa</i> (Kunth) Boeck.	Herb	2580
<i>Rhynchospora robusta</i> (Kunth) Boeck.	Herb	1163
<i>Rhynchospora rugosa</i> (Vahl) Gale	Herb	1514
<i>Rhynchospora setacea</i> Vahl	Herb	2201
<i>Rhynchospora tenerrima</i> Nees ex Spreng.	Herb	1122
<i>Rhynchospora velutina</i> (Kunth) Boeck.	Herb	1274
<i>Rhynchospora</i> sp. 1	Herb	2341
<i>Rhynchospora</i> sp. 2	Herb	1152
<i>Rhynchospora</i> sp. 3	Herb	1639
<i>Scleria hirtella</i> Sw.	Herb	1090
<i>Scleria leptostachya</i> Kunth	Herb	1167
<i>Scleria setacea</i> Poir.	Herb	1802
<b>DROSERACEAE</b>		
<i>Drosera montana</i> A.St.-Hil.	Herb	1171
<b>ERICACEAE</b>		
<i>Gaylussacia brasiliensis</i> (Spreng.) Meisn.	Subshrub	2203
<b>ERIOCAULACEAE</b>		
<i>Eriocaulon sellowianum</i> Kunth	Herb	1245
<i>Paepalanthus acanthophyllus</i> Ruhland	Herb	1138
<i>Paepalanthus bifidus</i> (Schrader) Kunth	Herb	1427
<i>Paepalanthus canescens</i> (Bong.) Körn.	Herb	1108
<i>Paepalanthus elongatus</i> Körn.	Herb	1110
<i>Paepalanthus elongatus</i> Körn. var. <i>niger</i> Moldenke	Herb	1430
<b><i>Paepalanthus eriocauloides</i> Ruhland</b>	Herb	1271
<b><i>Paepalanthus exiguus</i> (Bong.) Körn.</b>	Herb	1148
<i>Paepalanthus flaccidus</i> (Bong.) Kunth	Herb	1772
<b><i>Paepalanthus gracilis</i> (Bong.) Körn.</b>	Herb	1436
<i>Paepalanthus phaeocephalus</i> Ruhland	Herb	2413

TABLE 1. (Cont'd).

	Life form	N
<i>Paepalanthus</i> sp. nov.**	Herb	1618
<i>Syngonanthus caulescens</i> (Poir.) Ruhland	Herb	2559
<i>Syngonanthus decorus</i> Moldenke	Herb	1609
<b><i>Syngonanthus densiflorus</i> (Körn.) Ruhland</b>	Herb	1651
<b>var. <i>majus</i> Moldenke</b>		
<b><i>Syngonanthus gracilis</i> (Bong.) Ruhland</b>	Herb	1428
<i>Syngonanthus nitens</i> (Bong.) Ruhland	Herb	1139
<i>Syngonanthus xeranthemoides</i> (Bong.) Ruhland	Herb	1155
<i>Syngonanthus</i> sp. 1 sp. nov.**	Herb	1797
<i>Syngonanthus</i> sp. 2	Herb	1994
<b>ERYTHROXYLACEAE</b>		
<i>Erythroxylum suberosum</i> A.St.-Hil.	Subshrub	2117
<b>EUPHORBIACEAE</b>		
<b><i>Microstachys bidentata</i> (Mart. &amp; Zucc.) Esser</b>	Subshrub	1273
<i>Phyllanthus dawsonii</i> Steyerf.	Herb	1832
<b>FABACEAE</b>		
<i>Chamaecrista conferta</i> (Benth.) H.S.Irwin & Barneby	Subshrub	1247
<i>Mimosa oedoclada</i> Barneby	Shrub	2428
<i>Mimosa setosa</i> Benth. subsp. <i>granitica</i> Barneby	Shrub	1733
<i>Senna</i> sp.	Shrub	1408
<b>GENTIANACEAE</b>		
<i>Curtia tenuifolia</i> (Aubl.) Knobl.	Herb	2643
<i>Deianira chiquitana</i> Herzog	Herb	1652
<i>Irlbachia caerulescens</i> (Aubl.) Griseb.	Herb	2329
<b>IRIDACEAE</b>		
<i>Cipura</i> cf. <i>paludosa</i> Aubl.	Herb	2492
<i>Cipura xanthomellas</i> Mart. ex Klatt	Herb	1121
<i>Sisyrinchium vaginatum</i> Spreng.	Herb	1169
<b><i>Trimezia cathartica</i> (Klatt) Niederl.</b>	Herb	2362
<i>Trimezia juncifolia</i> (Klatt) Benth. & Hook.f.	Herb	1418
<i>Trimezia</i> sp.	Herb	2192
<b>LAMIACEAE</b>		
<i>Hyptis conferta</i> Pohl ex Benth.	Subshrub	1900
<i>Hyptis cruciformis</i> Epling	Shrub	1149
<i>Hyptis lanuginosa</i> Glaz. ex Epling	Shrub	2593
<i>Hyptis pachyphylla</i> Epling	Shrub	2630
<i>Hyptis pycnocephala</i> Benth.	Herb	1730
<i>Hyptis selaginifolia</i> Mart. ex Benth.	Shrub	1732
<i>Hyptis tagetifolia</i> Harley	Shrub	1615
<b>LENTIBULARIACEAE</b>		
<b><i>Utricularia adpressa</i> Salzm. ex A.St.-Hil. &amp; Girard</b>	Herb	1097
<i>Utricularia amethystina</i> Salzm. ex A.St.-Hil. & Girard	Herb	1168
<b><i>Utricularia hispida</i> Lam.</b>	Herb	2365
<i>Utricularia neottioides</i> A.St.-Hil. & Girard	Herb	1251

TABLE 1. (Cont'd).

	Life form	N
<b>LYCOPODIACEAE</b>		
<i>Lycopodiella alopecuroides</i> (L.) Cranfill	Herb	1284
<i>Lycopodiella cernua</i> (L.) Pic.Serm.	Herb	s.n.
<b>LYTHRACEAE</b>		
<i>Diplusodon rotundifolius</i> DC.	Subshrub	1146
<b>MELASTOMATACEAE</b>		
<i>Lavoisiera bergii</i> Cogn.	Shrub	1751
<i>Microlicia albida</i> Pilg.	Subshrub	2160
<b><i>Microlicia castrata</i> Naudin</b>	Subshrub	1411
<i>Microlicia euphorbioides</i> Mart. var. <i>setosa</i> Cogn.	Subshrub	2513
<i>Microlicia psammophila</i> Wurdack	Subshrub	1094
<i>Microlicia ramosa</i> Pilg.	Subshrub	1995
<i>Microlicia vestita</i> DC.	Subshrub	2570
<i>Microlicia viminalis</i> (DC.) Triana	Subshrub	2118
<i>Rhynchanthera grandiflora</i> (Aubl.) DC.	Subshrub	2255
<i>Siphanthera cordata</i> Pohl	Subshrub	1641
<b>MYRTACEAE</b>		
<i>Eugenia cristaensis</i> O.Berg	Subshrub	1137
<b>ONAGRACEAE</b>		
<i>Ludwigia nervosa</i> (Poir.) H.Hara	Shrub	1799
<b>ORCHIDACEAE</b>		
<i>Cleistes castanoides</i> Hoehne	Herb	2355
<b><i>Cleistes</i> aff. <i>paranaensis</i> (Barb.Rodr.) Schltr.</b>	Herb	2404
<i>Cleistes</i> sp.	Herb	2364
<i>Epidendrum secundum</i> Jacq.	Herb	2518
<b><i>Galeandra paraguayensis</i> Cogn.</b>	Herb	2195
<b><i>Habenaria edwallii</i> Cogn.</b>	Herb	2421
<i>Habenaria magniscutata</i> Catling	Herb	2501
<i>Habenaria schwackei</i> Barb.Rodr.	Herb	2326
<i>Oncidium hydrophilum</i> Barb.Rodr.	Herb	1242
<i>Stenorrhynchus</i> sp.	Herb	1509
<b>OROBANCHACEAE</b>		
<i>Buchnera lavandulacea</i> Cham. & Schldl.	Herb	2623
<b><i>Esterhazyia macrodonta</i> Cham. &amp; Schldl.</b>	Subshrub	1111
<i>Esterhazyia splendida</i> J.C.Mikan	Subshrub	2594
<b>POACEAE</b>		
<i>Agenium leptocladum</i> (Hack.) Clayton	Herb	1631
<i>Andropogon leucostachyus</i> Kunth*	Herb	2206
<i>Andropogon selloanus</i> (Hack.) Hack.	Herb	1178
<i>Andropogon virgatus</i> Desv. ex Ham.	Herb	2114
<i>Aristida capillacea</i> Lam.	Herb	1252
<i>Axonopus aureus</i> P.Beauv.	Herb	1088
<i>Axonopus brasiliensis</i> (Spreng.) Kuhlm.	Herb	1426
<i>Axonopus fastigiatus</i> (Nees ex Trin.) Kuhlm.	Herb	1996

TABLE 1. (Cont'd).

	Life form	N
<i>Axonopus siccus</i> (Nees) Kuhlms.	Herb	1533
<i>Echinolaena inflexa</i> (Poir.) Chase	Herb	1093
<i>Eragrostis maypurensis</i> (Kunth) Steud.	Herb	1423
<i>Gymnopogon foliosus</i> (Willd.) Nees	Herb	1531
<i>Ichnanthus procurrans</i> (Nees ex Trin.) Swallen	Herb	1930
<i>Loudetiopsis chrysothrix</i> (Nees) Conert	Herb	2629
<i>Mesosetum elytrochaetum</i> (Hack.) Swallen	Herb	2408
<i>Mesosetum loliiforme</i> (Hochst. ex Steud.) Chase	Herb	2616
<i>Panicum cyanescens</i> Nees ex Trin.	Herb	1290
<i>Panicum parvifolium</i> Lam.	Herb	1652
<i>Paspalum carinatum</i> Humb. & Bonpl. ex Flügge	Herb	2332
<i>Paspalum lineare</i> Trin. [Voucher: <i>E.P. Heringer 2379</i> ]	Herb	–
<i>Paspalum maculosum</i> Trin.	Herb	2627
<i>Paspalum minarum</i> Hack.	Herb	1082
<i>Paspalum pilosum</i> Lam.	Herb	2583
<i>Paspalum scalare</i> Trin.	Herb	1130
<i>Sacciolepis myuros</i> (Lam.) Chase	Herb	1166
<b><i>Setaria</i> cf. <i>tenacissima</i> Schrad. ex Schult.</b>	Herb	1189
<i>Trachypogon macroglossus</i> Trin.	Herb	2659
<i>Trachypogon spicatus</i> (L.f.) Kuntze	Herb	1173
<b>POLYGALACEAE</b>		
<i>Polygala carphoides</i> Chodat	Herb	1268
<i>Polygala celosioides</i> Mart. ex A.W.Benn.	Herb	2639
<i>Polygala</i> cf. <i>exigua</i> Hassk.	Herb	1272
<i>Polygala glochidiata</i> Kunth	Herb	2646
<i>Polygala herbiola</i> A.St.-Hil.	Herb	2573
<i>Polygala hygrophila</i> Kunth	Herb	1178A
<i>Polygala sedoides</i> A.W.Benn.	Herb	1091
<i>Polygala tenuis</i> DC.	Herb	1521
<b>PORTULACACEAE</b>		
<i>Portulaca</i> sp.	Herb	2572
<b>RUBIACEAE</b>		
<i>Borreria irwiniana</i> E.L.Cabral	Herb	1087
<i>Mitracarpus</i> sp.	Herb	1826
<b><i>Spermacoce marticrovettiana</i> (E.L.Cabral) R.Govaerts</b>	Subshrub	1422
<b>TURNERACEAE</b>		
<b><i>Turnera guianensis</i> Aubl.</b>	Subshrub	1898
<i>Turnera</i> cf. <i>tenuicaulis</i> Urb.	Subshrub	2516
<i>Turnera trigona</i> Urb.	Subshrub	1114
<b>VELLOZIACEAE</b>		
<i>Vellozia pumila</i> Goethart & Henrard	Herb	2148
<i>Vellozia tubiflora</i> (A.Rich.) Kunth	Subshrub	2409
<b>VERBENACEAE</b>		
<i>Verbenaceae</i> sp.	Subshrub	1288



TABLE 1. (Cont'd).

	Life form	N
<b>XYRIDACEAE</b>		
<i>Abolboda poarchon</i> Seub.	Herb	1535
<i>Abolboda pulchella</i> Bonpl.	Herb	2636
<i>Xyris blanchetiana</i> Malme	Herb	2578
<i>Xyris blepharophylla</i> Mart.	Herb	1833
<i>Xyris ciliata</i> Thunb.	Herb	1126
<i>Xyris dawsonii</i> L.B.Sm. & Downs	Herb	2586
<i>Xyris diaphanobracteata</i> Kral & Wand.	Herb	1179
<b><i>Xyris fallax</i> Malme</b>	Herb	2412
<i>Xyris filifolia</i> A.Nilsson	Herb	1647
<i>Xyris</i> cf. <i>guaranitica</i> Malme	Herb	1434
<i>Xyris hymenachne</i> Mart.	Herb	1989
<i>Xyris lacerata</i> Pohl ex Seub.	Herb	1758
<i>Xyris lanuginosa</i> Seub.	Herb	1129
<i>Xyris laxifolia</i> Mart.	Herb	2354
<i>Xyris machrisiana</i> L.B.Sm. & Downs	Herb	1637
<i>Xyris paradisiaca</i> Wand.	Herb	1147
<i>Xyris savanensis</i> Miq.	Herb	1912
<i>Xyris schizachne</i> Mart.	Herb	1404
<i>Xyris tenella</i> Kunth	Herb	1604
<i>Xyris tortula</i> Mart.	Herb	1925
<i>Xyris veruina</i> Malme	Herb	1113
<i>Xyris</i> sp. 1	Herb	1083
<i>Xyris</i> sp. 2	Herb	1134
<b>FAMILY INDET.</b>		
INDET. 1	Subshrub	1104
INDET. 2	Herb	1624

Eight families (24.2%) contained 71% of the 207 taxa collected in the moist grassland: *Cyperaceae* (30 species); *Poaceae* (28); *Xyridaceae* (23); *Eriocaulaceae* (20); *Asteraceae* (18); *Melastomataceae* and *Orchidaceae* with 10 species each, and *Polygalaceae* (eight) (Fig. 1). On the other hand, eight (24.2%) of the families contained only one species, six (18.2%) had two species, while another four (12.1%) had three species. The family composition is typical of the vegetation of moist places, with abundant *Cyperaceae*, *Gramineae*, *Xyridaceae* and *Eriocaulaceae* and low representation of *Myrtaceae*, *Leguminosae* (with not a single species of papilionoid legume), *Euphorbiaceae*, *Rubiaceae* and *Malvaceae*. Seven genera (7.8%) contained 37.7% of the total 207 species: *Xyris* (21 species); *Rhynchospora* (16); *Paepalanthus* (11); *Polygala* and *Syngonanthus* (eight each), and *Microlicia* and *Hyptis* (seven each). Fifty-seven of the 90 genera (63.3%) contained just one species while 15 (16.7%) had two, eight (8.9%) had three, and 11 (12.2%) had more than three species.

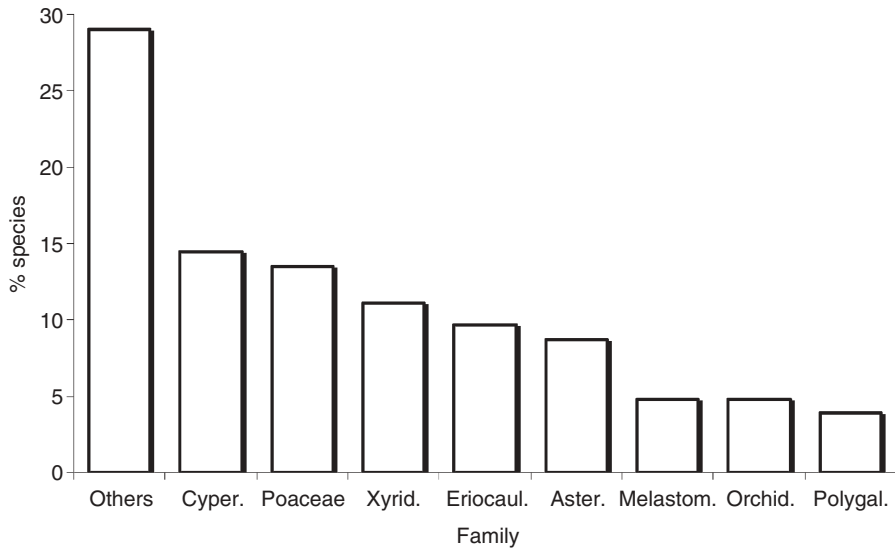


FIG. 1. Percentage of species by families for the herbaceous-shrub flora of a moist grassland at Água Fria Farm, Alto Paraíso de Goiás, Goiás State, on the Veadeiros Plateaux (Aster. = *Asteraceae*; Cyper. = *Cyperaceae*; Eriocaul. = *Eriocaulaceae*; Melastom. = *Melastomataceae*; Orchid. = *Orchidaceae*; Polygal. = *Polygalaceae*; Xyrid. = *Xyridaceae*).

Herbs dominate the moist grassland flora with 153 species (73.9%), followed by subshrubs with 40 species (19.3%), while only 14 species (6.8%) of shrub were registered.

Thirty-one (15%) of the 207 taxa registered in this study were not recorded in the checklist of the cerrado biome vascular flora published by Mendonça *et al.* (1998), while 25 species (12.1%) were not registered by Felfili *et al.* (1997) for the Veadeiros Plateaux.

On the basis of the data from this study, plus Felfili *et al.* (1997), the moist grassland represents 10.2% of the total Veadeiros region flora. This study added an extra 2.6% in the number of species recorded for the region.

The flora of the Veadeiros Plateaux is extremely rich and needs much more research to be fully known, as demonstrated by the addition of a considerable number of new records, including new species, by the present study of a relatively small area. Much more collecting is required for the region and for the cerrado biome in general. There is much to be found as shown here and by the work of others; for example, Batalha & Martins (2002) registered six previously undescribed species in the herbaceous and subshrub layer of the Emas National Park cerrado.

The occurrence of families recorded in our moist grassland study site is typical of that found in damper areas of cerrado vegetation, for example veredas and grasslands bordering gallery forest. However, the vegetation, with 207 recorded species and infraspecific taxa, seems to be floristically rich in comparison with other

well-studied sites (e.g. Silva & Nogueira, 1999; Araújo *et al.*, 2002; Batalha & Martins, 2002). For instance, work by Batalha & Martins (2002) in the Emas National Park, Goiás State, based on a one-year monthly collection programme, found only 131 species in the herbaceous and subshrub layer of several cerrado physiognomies. There was also a remarkably low floristic similarity between our Veadeiros site and those in the Emas National Park, with only 2.3% of species in common. This indicates that a very high degree of floristic heterogeneity occurs in this type of vegetation. The sampling of several sites covered by this vegetation under standardized methodology is desirable for evaluating the floristic heterogeneity within the biome. At present, the available data from published surveys make comparisons difficult due to the adoption of different methodologies with very different sampling efforts.

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