Vascular Flora of a Cerrado sensu stricto remnant in Pratânia, state of São Paulo, southeastern Brazil

Marina Begali Carvalho, Katia Losano Ishara and Rita C. S. Maimoni-Rodella *

Universidade Estadual Paulista, Instituto de Biociências, Departamento de Botânica. Caixa Postal 510. CEP 18618-000. Botucatu, SP, Brazil.
* Corresponding author. E-mail: rita@ibb.unesp.br

ABSTRACT: The Cerrado (Brazilian savanna) has suffered massive destruction in recent years, mainly due to the expansion of agricultural areas. Many remnants of this vegetation are still poorly studied. Therefore, the purpose of this study was to carry out a floristic survey in a remnant of Cerrado in the municipality of Pratânia, central-west region of state of São Paulo, southeastern Brazil. In total, 120 species (38 families, 88 genera) were registered. The families with greater richness were: Fabaceae (23 species), Asteraceae (15), Myrtaceae (10), Malpighiaceae and Rubiaceae (seven each) and Bignoniaceae (five). The shrub component was predominant in the study area representing 37.5 % of the recorded species. A comparison among eight Cerrado areas showed greater similarity between areas with similar altitude.

INTRODUCTION

The Brazilian savanna, so-called Cerrado, is the second largest biome of Brazil (Ribeiro and Walter 1998) and occupies the intermediate region between the two largest Neotropical moist forests: the Amazon forest and Atlantic forest (Méo et al. 2003).

The typical vegetation landscape of this biome consists of savanna of very variable structure, encompassing different vegetation physiognomies, and is termed Cerrado sensu lato. Depending on some environmental characteristics a series of physiognomies can be found, ranging from open grasslands (campo limpo) to dense woodlands (cerradão), with three intermediate physiognomies: campo sujo, grassland with a scattering of shrubs and small trees; campo Cerrado, where there are more shrubs and trees but still a larger proportion of grassland; and Cerrado sensu stricto, where trees and shrubs dominate but with a fair amount of herbaceous vegetation (Coutinho 2002). These differences are due to the wide area and distribution of Cerrado vegetation which provides a variety of environmental conditions related to seasonal precipitation, soil fertility and drainage, temperature and fire regime (Durigan et al. 2003). These variations condition the settlement of a Cerrado vegetation mosaic even in small areas (Coutinho 2002). According to Rizzini (1971), more than half of Brazil’s central savanna flora is originated from other vegetation types, which also contributes to its floristic heterogeneity. Besides the ecological importance of the Cerrado, many elements of the Cerrado flora have some economic potential, for example, as a source of active ingredients for the pharmaceutical industry among other uses (Cavassan 2002).

Despite its relevance, the Cerrado has been continuously destroyed to create pastures and field crops. In São Paulo state, southeastern Brazil, the Cerrado remnants are today very reduced and fragmented (Durigan et al. 2004) and only 0.5 % of the original area is protected in some kind of conservation unit (Durigan et al. 2006). Even so, these remnants are notably rich in species and therefore highly representative (Ratter et al. 2003) since 34 % of the total Cerrado species set can be found in São Paulo state (Cavassan 2002).

The Cerrado is included in the list of global hotspots or areas with high concentrations of endemic species, which suffered heavy habitat losses (Myers et al. 2000). The flora inventory is the first step to vegetation knowledge and its best use, serving as a basis for ecological studies and the planning of conservation projects (Felfili et al. 1993; Mendonça et al. 1998). Considering this, in the central-west region of São Paulo state, municipality of Pratânia, a Cerrado sensu stricto remnant was inventoried to provide a vascular flora check list. This study is part of a larger project which intends to perform a more detailed vegetation study concerning the structure and dynamics of the woody component of a Cerrado fragment in Pratânia Municipality, and was developed aiming to add information to the initial inventory performed by Machado et al. (2005), which included all three Cerrado physiognomies occurring in the area.

MATERIALS AND METHODS

The studied area is a Cerrado sensu stricto remnant located within a larger Cerrado fragment of nearly 180 ha that also presents other two Cerrado physiognomies: a cerradão and a campo Cerrado remnant. The fragment belongs to a private reserve of Cerrado (22°48’50” S, 48°44’36” W: 720 m average altitude), located in Pratânia Municipality, at the central-west region of São Paulo state, southeastern Brazil (Figure 1). The fragment is surrounded by pastures, sugar cane and eucalyptus plantations. The climate of the region is Cwa according to Köeppen classification, that is, humid subtropical climate with hot summers and no prolonged drought, annual average temperature of 21°C and annual average rainfall of 1,128
The floristic survey was carried from January to October 2008, on a weekly basis. Approximately 1 ha of the Cerrado sensu stricto area was inventoried and all species in reproductive phase were collected and identified. Voucher specimens were deposited in the Herbarium BOTU (Herbarió "Irina Delanova Gemtčůjńicov", Instituto de Biociências de Botucatu, UNESP). The floristic similarity was estimated using the Jaccard Index (Mueller-Dombois and Ellenberg 1974) and included the present study and other seven previously published studies on Cerrado sensu lato vegetation performed in São Paulo state. Species with incomplete identification (only genus, aff. or cf.) were excluded as well as those whose occurrence was reported in just one area, according to methodology adopted by Ratter et al. (2003). Only floristic surveys which included all plant habitats were compared. A cluster analysis among these eight areas was also performed using the Jaccard Index of Similarity and the UPGMA algorithm for the dendrogram elaboration (Sneath and Sokal 1973). These eight areas was also performed using the Jaccard Index of Similarity and the UPGMA algorithm for the dendrogram elaboration (Sneath and Sokal 1973).

In the center of the sampled area a 5 x 30 m transect was delimited and every woody plant with stem basal diameter equal or superior to 3 cm was recorded and drawn, in order to make a profile diagram, according to Albuquerque and Rodrigues (2000).

**Results and Discussion**

A total of 119 species of Angiosperms (37 families, 87 genera) and one pteridophyte were registered (Table 1). Although this number may seem small compared to core Cerrado (see Gottsberger and Silberbauer-Gottsberger 2006), many São Paulo state Cerrado areas have similar species number (see references in Table 2). Gottsberger and Silberbauer-Gottsberger (2006) also quoted these regional variations and provided an extensive discussion about this matter, pointing out that local edaphic condition and climate characteristics may interfere on the floristic composition, contributing to the extreme Cerrado flora heterogeneity.

The most species-rich families were Fabaceae with 23 species in total (10 species on Faboideae, seven on Mimosoideae and 6 on Caesalpinoideae), Asteraceae (15 species), Myrtaceae (10), Malpighiaceae and Rubiaceae (seven species each) and Bignoniaceae (five). These families account for 56 % of the surveyed species. The richest genera were *Eugenia* (five species), *Byrsonima*, *Miconia*, *Mimosa* and *Vernonia* (four species each). Among the angiosperms, 20 families and 69 genera had one single species.

Several weeds (17 species) were found in the area: *Baccharis dracunculifolia*, *Bidens gardineri*, *Chamaecrista desvauixii*, *C. flexuosa*, *Commelina diffusa*, *Cuphea cartaginensis*, *Emilia sonchifolia*, *Lantana camara*, *Mikania cordifolia*, *Pterocaulon lanatum*, *Pyrostegia venusta*, *Sida linearifolia*, *Solanum americanum*, *S. lycocarpum*, *Spermacoce capitata*, *Vernonia cognata* and *V. polyanthes*. This indicates some disturbance, probably caused by the proximity of agricultural areas. Four Cerrado species found in the study area - *Arrabidaea brachypoda*, *A. florida*, *Byrsonima intermedia* and *Dimorphandra mollis* – are frequently quoted as weeds (Lorenzi 2008) in areas where the original Cerrado vegetation was removed for the introduction of crops or pastures.

Shrubs make up 37.5 % of the inventoried flora, followed by herbs (27.5 %), trees (23 %), and vines (12 %). Among the shrub species, the richest families were Asteraceae and Myrtaceae (seven species each) and Fabaceae (five). Apocynaceae, Dilleniaceae, Erytroxylaceae, Euphorbiaceae, Lamiaceae and Proteaceae showed only one shrub species each. Among the herbs the richest families were: Fabaceae (nine species), Asteraceae (seven) and Rubiaceae (three). Acanthaceae, Amaranthaceae, Commelinaceae, Convolvulaceae, Euphorbiaceae, Lythraceae, Polygodiaceae and Sapotaceae had only one herbaceous species each. The arboreal component had Fabaceae (seven species), Malpighiaceae and Myrtaceae (three species each) as the richest families. Araliaceae, Chrysobalanaceae, Ebenaceae, Malvaceae, Ochnaceae, Salicaceae and Vochysiaceae had only one tree species each. The families with the highest number of vines were Apocynaceae and Bignoniaceae, both with three species each, and Fabaceae with two species. The other families where vines were represented had only one species each (see Table 1).

Machado et al. (2005), in an inventory of all Cerrado physiognomies in the same fragment quoted 168 species in total, but there was no indication of the class or classes of physiognomy where the plant species were found. This makes the comparisons difficult. However, it was possible to observe that 66 species were common to our inventory and that 54 species that we found were not collected by Machado et al. (2005), while they quote 102 other species that were not observed by us. These conflicting results are possibly due to the fact that our research was limited to the Cerrado sensu stricto area, while Machado et al. (2005) inventoried all the Cerrado physiognomies. On the other hand, the results highlight the fact that even in a restrict area more species can be found depending on the inventory effort.

The profile diagram of the vegetation (Figure 2) shows the occurrence of a dense woody layer, consisting of trees of small to medium size (three to six m tall), shrubs and sub-shrubs with multiple stems. A low, almost continuous canopy was observed, characterizing a dense Cerrado.

The overall number of species sampled in the eight localities chosen to be compared in relation to floristic similarity (Table 2) was 752. From this total, 431 species were discarded because they occurred in just one location.

**Figure 1.** Location of study area in Pratânia, state of São Paulo, southeastern Brazil.
The remaining set revealed that only 10 species were recorded in all eight Cerrado areas: *Anadenanthera falcata*, *Byrsonima cocclobifolia*, *B. verbascifolia*, *Machaerium acutifolium*, *Miconia albicans*, *Myrcia bella*, *Ouratea spectabilis*, *Schefflera vinosa*, *Styrax ferrugineus* and *Vochysia tucanorum*. Only 125 species occurred in more than four Cerrado areas. There were also nine species that occurred only in the Cerrado of Pratânia: *Aspilia reflexa*, *Chromolaena congesta*, *Commelina diffusa*, *Crotalaria longifolia*, *Dalechampia micromeria*, *Icthyothere elliptica*, *Mimosa xanthocentra*, *Pterocaulon lanatum* and *Serjania caracasana*.

The highest similarity index (54 %) was found between the Cerrado areas located in Botucatu Municipality, at altitudes around 500 m (Table 3). The similarity among the other sites was lower, but there was a trend leading to higher similarity between neighboring areas or between areas with similar altitude. In this category lies the Cerrado of Pratânia (720 m altitude) which was more similar to another Botucatu Cerrado (830 m altitude).

The cluster analysis (Figure 3) show the segregation of three major groups, one including areas of Assis, one including only the area of Pratânia and one area of Botucatu, both with higher altitudes (720 and 830 m, respectively) and other group joined areas with elevations ranging from 500 to 600 m. The higher similarity was observed between Cerrado areas within the same municipality or neighbor areas (Table 3). These results support the statement that the Cerrado vegetation is extremely variable even in very close locations, as noted before in other Cerrado biome areas (Bridgewater et al. 2004).

The species-richness and the peculiarities of the Cerrado of Pratânia indicate the importance of this fragment as a remnant of the original Cerrado vegetation in the area and may possibly serve as a floristic reference for future conservation measures.

**Table 1.** Species recorded in the Cerrado sensu stricto area in Pratânia, SP.

| SPECIES | POPULAR NAME | HABIT |
|---------|--------------|-------|
| Pteridophyta | | |
| Polyplodiaceae | | |
| Polypodium latipes | Polipódio-de-pé-largo | Herb |
| Acanthaceae | | |
| Ruellia geminiflora | Ipecaconha | Herb |
| Amaranthaceae | | |
| Gomphrena macrocephala | Para-tudo-do-Cerrado | Herb |
| Apocynaceae | | |
| Blepharodon bicupidatum | – | Vine |
| Blepharodon nitidum (Veill.) J.F. Macbr. | – | Vine |
| Mandevilla velutina | Jalapa | Shrub |
| Temnadenia violacea (Veil) Miers | – | Vine |
| SPECIES | POPULAR NAME | HABIT |
|---------|--------------|-------|
| **Araliaceae** | | |
| *Schefflera vinosa* (Cham. & Schltdl.) Frodin & Fiaschi | mandioqueira | Tree |
| **Asteraceae** | | |
| *Aspilia reflexa* Baker | bem-me-quer | Herb |
| *Baccharis dracunculifolia* DC. | alecrim-do-campo | Shrub |
| *Bidens gardneri* Baker | piçao | Herb |
| *Chromolaena compestris* (DC.) R.M. King & H. Rob. | – | Shrub |
| *Chromolaena congesta* (Hook. & Arn.) R.M. King & H. Rob. | – | herb |
| *Emilia sonchifolia* (L.) DC. | bela-emilia | Herb |
| *Gochnatia barrosii* Cabrera | cambará-veludo | Shrub |
| *Ichthyothere elliptica* H. Rob. | lixa | Herb |
| *Mikania cordifolia* (L. f.) Willd. | cipó-cabeludo | Vine |
| *Piptocarpus rotundifolia* (Less.) Baker | solidão | Shrub |
| *Pterocaulon lanatum* Kuntze | branqueja | Shrub |
| *Vernonia cognata* Less. | assa-peixe-roxo | Herb |
| *Vernonia geminata* Kunth. | – | Shrub |
| *Vernonia grandiflora* Less. | saudades-do-campo | Herb |
| *Vernonia polyanthes* Less. | assa-peixe | Shrub |
| **Bignoniaceae** | | |
| *Arrabidaea brachypoda* (DC. Bureau) | cipó-uma | Vine |
| *Arrabidaea florida* DC. | cipó-neve | Vine |
| *Jacaranda oxyphylla* Cham. | caroba-de-são-paulo | Shrub |
| *Pyrostegia venusta* (Ker Gawl.) Miers | cipó-de-são-joão | Vine |
| *Zeyheria montana* Mart. | bolsa-de-pastor | Shrub |
| **Bromeliaceae** | | |
| *Ananas ananassoides* (Baker) L.B. Sm. | abacaxi-do-Cerrado | Herb |
| *Dyckia leptostachya* Baker | gravatazinho | Herb |
| **Chrysochonaceae** | | |
| *Couepia grandiflora* (Mart. & Zucc.) Bent. ex Hook.f. | oiti-do-sertão | Tree |
| **Clusiaceae** | | |
| *Kielmeyera coriacea* Mart. & Zucc. | para-tudo | Tree |
| *Kielmeyera rubriflora* Cambess. | para-tudo | Tree |
| **Commelinaceae** | | |
| *Commelina diffusa* Burm. f. | trapoeraba | Herb |
| **Convolvulaceae** | | |
| *Evolvulus canescens* Meisn. | – | Herb |
| **Cucurbitaceae** | | |
| *Cayaponia espena* (Silva Manso) Cogn. | espelina-verdadeira | Vine |
| **Dilleniaceae** | | |
| *Davilla elliptica* A. St.-Hil. | cipó-vermelho | Shrub |
| **Ebenaceae** | | |
| *Diospyros hispida* A. DC. | caqui-do-Cerrado | Tree |
| **Erythroxylaceae** | | |
| *Erythroxylum tortuosum* Mart. | galinha-choca | Shrub |
| **Euphorbiaceae** | | |
| *Dalechampia micromeria* Ball. | goela-de-pato | Vine |
| *Manihot caerulescens* Pohl | mandioca-brava | Shrub |
| *Sebastiania serrulata* (Mart.) Mullenders | – | Herb |
| **Fabaceae-Caesalpinioideae** | | |
| *Bauhinia rufa* (Bong.) Steud. | pata-de-vaca | Shrub |
| *Chamaecrista cathartica* (Mart.) H.S.Irwin & Barneby | sene-do-campo | Herb |
| *Chamaecrista desvauxii* (Collad.) Killip | sene | Shrub |
| *Chamaecrista flexuosa* (L.) Greene | mimosa | Herb |
| *Dimorphandra mollis* Benth. | falsa-barbatimão | Tree |
| *Senna rugosa* (G. Don.) H.S. Irwin & Barneby | boi-gordo | Shrub |
| SPECIES | POPULAR NAME | HABIT |
|---------|--------------|-------|
| **Fabaceae-Faboideae** |  |  |
| *Acosmium subelegans* (Mohlenbr.) Yakovlev | amendoim-falso | Tree |
| *Bowedichia virgilioides* Kunth | sucupira-preta | Tree |
| *Clitoria simplicifolia* (Kunth) Benth. | – | Herb |
| *Crotalaria longifolia* Lam. | crotalária | Herb |
| *Crotalaria maypurensis* Kunth | crotalária | Herb |
| *Galactia erosematoides* Harms | – | Shrub |
| *Glycine* sp. | Vine |  |
| *Machaerium acutifolium* Vogel | jacarandá-do-campo | Tree |
| *Stylosanthes acuminata* M. B. Ferreira & S. Costa | meladinho | Herb |
| *Vigna* sp. | Vine |  |
| **Fabaceae-Mimosoideae** |  |  |
| *Anadenanthera falcata* (Benth.) Speg. | angico-do-Cerrado | Tree |
| *Mimosa capillipes* Benth. | mimosa | Herb |
| *Mimosa dolens* Vell. | juquiri | Shrub |
| *Mimosa rixosa* Mart. | mimosa | Herb |
| *Mimosa xanthocentra* Mart. | juquiri | Herb |
| *Stryphnodendron adstringens* (Mart.) Coville | barbatimão | Tree |
| *Stryphnodendron polyphyllum* Mart. | barbatimão | Tree |
| **Lamiaceae** |  |  |
| *Aegiphila lhotszkyana* Cham. | tamanqueira | shrub |
| *Hypenia macrantha* (A. St.-Hil. ex Benth.) Harley | – | herb |
| *Hyptis crinita* Benth. | – | herb |
| **Lythraceae** |  |  |
| *Cuphea cartaginensis* (Jacq.) Machbr. | sete-sangrias | herb |
| **Malpighiaceae** |  |  |
| *Banisteriopsis variabilis* B. Gates | – | shrub |
| *Byronima basiloba* A. Juss. | murici-amargoso | tree |
| *Byronima cocolobifolia* Kunth | murici-pequeno | tree |
| *Byronima intermedia* A. Juss. | canjica | shrub |
| *Byronima verbascifolia* (L.) DC. | murici | tree |
| *Heteropterys umbellata* A. Juss. | – | shrub |
| *Tetrapterys ramiflora* A. Juss. | cipó-preto | shrub |
| **Malvaceae** |  |  |
| *Eriotheca gracilipes* (K. Schum.) A. Robyns | paina-do-campo | tree |
| *Peltophorum pterocarpum* (A. St.-Hil.) Krapov. & Cristóbal | mahá-do-campo | shrub |
| *Sida lineanotifolia* A. St.-Hil. | – | shrub |
| *Waltheria communis* A. St.-Hil. | – | shrub |
| **Melastomataceae** |  |  |
| *Miconia albicans* (Sw.) Triana | quaresmeira-branca | tree |
| *Miconia fallax* DC. | – | shrub |
| *Miconia ligustroides* (DC.) Naudin | vassoura-preta | tree |
| *Miconia stenostachya* DC. | papaterra | shrub |
| **Myrsinaceae** |  |  |
| *Myrsine guianensis* Aubl. | caporão-ca-comum | tree |
| *Myrsine umbellata* (Mart.) Mez | caporão-ca-verdeira | tree |
| **Myrtaceae** |  |  |
| *Eugenia aurata* O. Berg | murtinha | shrub |
| *Eugenia bimarginata* DC. | aperta-goela | shrub |
| *Eugenia livida* Elmer | – | shrub |
| *Eugenia obversa* O. Berg | fruta-de-perdiz | shrub |
| *Eugenia paniculata* (Kunth) DC. | cereja-do-Cerrado | shrub |
| *Myrcia bella* Cambess. | cambuí | tree |
| *Myrcia guianensis* (Aubl.) DC. | guamirim-vermelho | tree |
| *Myrcia lingua* (O. Berg) Mattos & D. Legrand | brasa-viva | tree |
| SPECIES | POPULAR NAME | HABIT  |
|---------|--------------|--------|
| *Psidium cinereum* Mart. ex DC. | araçá | shrub |
| *Psidium inaequilaterum* Mart. ex DC. | araçá | shrub |
| **Ochnaceae** | | |
| *Ochna spectabilis* (Mart. ex Engl.) Engl. | batiputá | tree |
| **Poaceae** | | |
| *Loudetia chrysophylla* (Nees) Conert | – | herb |
| *Panicum olyroides* Kunth | – | herb |
| **Proteaceae** | | |
| *Roupala montana* Willd. | carne-de-vaca | shrub |
| **Rubiaceae** | | |
| *Alibertia concolor* (Cham.) K. Schum. | marmelinho-do-campo | shrub |
| *Alibertia sessilis* (Veill.) K. Schum. | marmelada | shrub |
| *Coccolobus lanceolatus* (Ruiz & Pav.) Pers. | piririca | herb |
| *Declaena fruticosa* (Willd. ex Roem. & Schult.) Kuntze | – | herb |
| *Palicourea rigida* Kunth | douradinha | shrub |
| *Spermacoce capitata* Ruiz & Pav. | poaia-da-praia | herb |
| *Tocoyena formosa* (Cham. & Schltdl.) K. Schum. | jenipapo-bravo | shrub |
| **Salicaceae** | | |
| *Casearia sylvestris* Sw. | guaçatonga | tree |
| **Sapindaceae** | | |
| *Serjania caracasana* (Jacq.) Willd. | – | vine |
| **Sapotaceae** | | |
| *Pouteria subcaerulea* Pierre ex Dubard | curriola-rasteira | herb |
| **Smilacaceae** | | |
| *Smilax montana* Griseb. | – | vine |
| **Solanaceae** | | |
| *Solanum americanum* Mill. | maria-preta | shrub |
| *Solanum lycocarpum* A. St.-Hil. | lobeira | shrub |
| **Styracaceae** | | |
| *Styrax camporum* Pohl | laranjeira-do-mato | tree |
| *Styrax ferrugineus* Nees & Mart. | laranjeira-do-campo | tree |
| **Verbenaceae** | | |
| *Lantana camara* L. | cambarazinho | shrub |
| *Lippia lapulina* Cham. | rosa-do-campo | shrub |
| *Lippia velutina* Schauer | – | shrub |
| **Vitaceae** | | |
| *Cissus ineris* (Baker) Planch. | – | vine |
| **Vochysiaceae** | | |
| *Vochysia tucanorum* Mart. | pau-de-tucano | tree |
**Table 2.** Areas of Cerrado sensu lato in São Paulo state compared with this study.

| CODE FOR THE AREAS | STUDY SITE | PHYSIOGAMY | GEOGRAPHIC COORDINATES | CLIMATE TYPE* | ALTITUDE (M) | N OF TAXONS | REFERENCE |
|---------------------|------------|------------|------------------------|---------------|--------------|-------------|-----------|
| A                   | Pratânia   | Cerrado sensu stricto | 22°48'50" S, 48°44'36" W | Cwa           | 720          | 120         | Present study |
| B                   | Agudos     | Cerrado sensu stricto | 22° to 23° S, 49°30' to 48°56' W | Cwa           | 550          | 212         | Bentocini (unpublished data) |
| C                   | Assis      | Cerrado sensu stricto | 22°33'6.5" to 22°36'68" S, 50°23'0" to 50°22'29" W | Cwa           | 520 a 590    | 298         | Durigan et al. (1999) |
| D                   | Assis      | Cerrado sensu stricto | 22°33'6.5" to 22°36'68" S, 50°23'0" to 50°22'29" W | Cwa           | 520 a 590    | 242         | Durigan et al. (1999) |
| E                   | Botucatu   | Cerrado       | 22°48' S, 48°17' W | Cfa           | 500          | 260         | Bicudo (unpublished data) |
| F                   | Botucatu   | Cerrado sensu stricto | 22°45' S, 48°25' W | Cfa           | 550          | 301         | Gottsberger and Silberbauer-Gottsberger (2006) |
| G                   | Botucatu   | Cerrado sensu stricto | 22°57'34" S, 48°31'20" W | Cfa           | 830          | 184         | Ishara et al. (2008) |
| H                   | Santa Rita do Passa Quatro | Cerrado sensu stricto | 21°43' S, 47°35' W | Cwa           | 600          | 141         | Weiser and Godoy (2001) |

* According to the Koeppen Classification

**Table 3.** Jaccard’s Index among eight Cerrado sensu lato areas in São Paulo state. In bold the highest rates obtained. The areas are identified by letters (A to H) which are described in table 2.

| A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|
| **A** | 34.02 | 25.56 | 15.84 | 33.97 | 26.01 | 36.09 | 25.75 |
| **B** | 34.44 | 24.11 | 39.06 | 45.74 | 34.98 | 35.83 |
| **C** | 45.37 | 37.05 | 36.90 | 30.09 | 31.73 |
| **D** | 20.65 | 20.08 | 22.77 | 21.92 |
| **E** | 54.02 | 28.95 | 29.24 |
| **F** | 27.70 | 33.49 |
| **G** | 29.48 |
| **H** | 29.48 |

**Acknowledgments:** We are grateful to the owners of the Private Reserve of Cerrado “Fazenda Palmeira da Serra” for research license, to FAPESP for a grant conceded to the first author and to CAPES for a grant conceded to the second author. We also thank Dr. Silvia Rodrigues Machado for suggestions and logistic support which contributed to the development of the present research.

**Literature Cited**

Albuquerque, G.B. and R.R. Rodrigues. 2000. A vegetação do Morro de Ançaoalba, Floresta Nacional de Ipanema, Iperó (SP). *Scientia Florestalis* 58: 145-159.

Bridgewater, S., J.A. Ratter and J.F. Ribeiro. 2004. Biogeographic patterns, β-diversity and dominance in the Cerrado biome of Brazil. *Biodiversity and Conservation* 13: 2295-2318.

Cavassan, O. 2002. O Cerrado do Estado de São Paulo; p. 93-106 *In: A.L. Klein* (ed.). *Eugen Warming e o Cerrado brasileiro: um século depois*. São Paulo: Editora UNESP; Imprensa Oficial do Estado.

Coutinho, L.M. 2002. O bioma do Cerrado; p. 77-91 *In: A.L. Klein* (ed.). *Eugen Warming e o Cerrado brasileiro: um século depois*. São Paulo: Editora UNESP; Imprensa Oficial do Estado.

Déstro, G.F.G. and S. Campos. 2006. SIG-SPRING na caracterização do uso dos solos a partir de imagens do satélite CBERS. *Energia na Agricultura* 21: 26-35.

Durigan, G., M.C. Bacic, G.A.D.C. Franco and M.F. Siqueira. 1999. Inventário florístico do Cerrado na Estação Ecológica de Assis, SP. *Hoehnea* 26: 149-172.

Durigan, G., J.A. Ratter, S. Bridgewater, M.F. Siqueira and G.A.D.C. Franco. 2003. Padrões fitogeográficos do Cerrado paulista sob uma nova perspectiva regional. *Hoehnea* 30: 39-51.

Durigan, G., G.A.D.C. Franco and M.F. Siqueira. 2004. A vegetação dos remanescentes de cerradão no estado de São Paulo; p. 29-56 *In: M.D. Bitencourt and R.R. Mendonça* (eds.). *Viabilidade do desenvolvimento dos remanescentes de cerradão no Estado de São Paulo*. São Paulo: Annablume.
Ratter, J.A., S. Bridgewater, and J.F. Ribeiro. 2003. Analysis of the floristic composition of the Brazilian Cerrado vegetation III: comparison of the woody vegetation of 376 areas. *Edinburgh Journal of Botany* 60: 57-109.

Ribeiro, J.F. and B.M.T. Walter. 1998. Fitofisionomias do bioma Cerrado; p. 89-166 In: S.M. Sano and S.P. Almeida (eds.). *Cerrado: ambiente e flora*. Brasilia: EMBRAPA.

Rizzini, C.T. 1971. A flora do Cerrado: análise florística das savanas centrais; p. 107-153 In M.G. Ferri (ed). *Simpósio sobre o Cerrado*. São Paulo: EDUSP.

Sneath, P.H. and R.R. Sokal. 1973. *Numerical taxonomy*. San Francisco: W.H. Freeman & Co. 573 p.

Weiser, V.L. and S.A.P. Godoy. 2001. Florística de um hectare de Cerrado stricto sensu na ARIE - Cerrado Pé-de-Gigante, Santa Rita do Passa Quatro, SP. *Acta Botanica Brasilica* 15: 201-212.

**RECEIVED:** April 2010  
**REVISED:** April 2010  
**ACCEPTED:** April 2010  
**PUBLISHED ONLINE:** August 2010  
**EDITORIAL RESPONSIBILITY:** Angelo Gilberto Manzatto