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FLORISTIC COMPOSITION OF DIFFERENT SOIL TYPES IN A SEMI-ARID REGION OF BRAZIL[1]

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ABSTRACT - Studies have shown that the Caatinga has two vegetation types related to different soils originated from crystalline and sedimentary. However, it is unclear whether the flora as a whole varies in relation to this difference or if it only varies for certain plant habits. This article provides a comparative analysis of the different habits of flowering plant species that occur on different soil types in a semi-arid region of northeastern Brazil. Sixty plots (10 x 10m) were established to collect woody species and 300 plots (1 x 1m) were established to collect herbaceous species. The plots were in soils of crystalline and sedimentary origin, and drainage and relief were taken into consideration. One hundred and fifty species distributed in 40 families were recorded. Species richness was greatest in Leguminosae (37 spp.), Euphorbiaceae (16 spp.) and Convolvulaceae (13 spp.). There were 101 woody species and 49 herbaceous species, suggesting that the woody habit responds better to local morpho-pedological differences.

Keywords: Caatinga. Floristic. Soil. Drainage.

COMPOSIÇÃO FLORÍSTICA DE DIFERENTES TIPOS DE SOLO NA REGIÃO SEMI-ÁRIDA DO BRASIL

RESUMO - Estudos revelam que a caatinga apresenta dois ambientes vegetacionais relacionados a dois diferentes tipos de solo, sendo estes de origem cristalina e sedimentar. No entanto não se sabe se a flora como um todo responde a esta repartição ou se ela é somente válida para algum hábito de plantas. Foi feita uma análise comparativa da flora angiospérmica e seus distintos hábitos ocorrentes sobre diferentes quatro tipos de solo, em área da região semi-árida do nordeste do Brasil. Foram plotadas 60 parcelas (10 x 10m) para coleta de espécies lenhosas e 300 parcelas (1 x 1m) para herbáceas em solos de origem cristalina e sedimentar, combinados com a presença/ausência de rio próximo (drenagem) e mudanças na altitude. Um total de 150 espécies distribuídas em 40 famílias foram registradas. Leguminosae (37 spp.), Euphorbiaceae (16 spp.) e Convolvulaceae (13 spp.) apresentaram maior riqueza de espécies. O hábito lenhoso teve 101 espécies enquanto que o herbáceo 49 spp., sugerindo que o hábito lenhoso melhor respondeu as variações morfo-pedológicas locais.

Palavras-chave: Caatinga. Florística. Solo. Drenagem.

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INTRODUCTION

Northeastern Brazil is approximately 1.000.000 km^2 and consists mostly of steppe-savanna, locally known as Caatinga and is one of three domain semi-arid areas of South America (RADAMBRASIL, 1983). The climate in this region is characterized by a prolonged dry period, which may extend from one year to another, and by a short rainy season. The rainy season is erratic and poorly distributed, and has an average annual rainfall of 300 to 800 mm (RADAMBRASIL, 1983; MI, 2005). The vegetation is mainly a reflection of the local climate. However, in addition to the climate, different soil types that are associated with two geological units also help determine the heterogeneity of the vegetation in this environment (SANTOS et al., 1992).

As a consequence of this peculiarity associated with variation in climate and soils, the Caatinga vegetation varies from forests to shrub lands (ANDRADE-LIMA, 1981; PINHEIRO et al., 2009). In addition, the vegetation is deciduous, with thorny and xerophilous species, which is mainly due to adverse weather conditions, succulent plants also occur in the region, as well as ephemeral herbs that are only present during the rainy season (ANDRADE-LIMA, 1981).

The soil in the semi-arid region is comprised of a complex mosaic of soil types, which can be roughly placed in two different geological units: the crystalline matrices and those of sedimentary basins and plateaus (VELLOSO et al., 2002). According to Beltrão and Lamour (1985), these soils can be Litholic, shallow Ultisols or non-calcic Browns, mostly from the crystalline basement or very deep quartz-sand that is strongly drained and originated from sedimentary basins and plateaus.

It is known that the flora in the Caatinga ecosystem is distinct (ALCOFORADO-FILHO et al., 2003) and is associated with pedological changes in soils that originated from the crystalline basement or sedimentary basin (SANTOS et al., 1992; SILVA et al., 2009). However, is the flora as a whole influenced by this composition or are only some habits or groups of plants influenced? This remains unclear. Therefore, the aim of this study was to make a comparative analysis of the different habits of species of flowering plants that occur on the different soil types in a semi-arid region of northeastern Brazil.

MATERIAL AND METHODS

Study area

The study was conducted in the Mirandiba municipality that, according to Velloso et al. (2002), is found in the ecoregion of the Depressão Sertaneja Meridional, and contains massifs and residual relief of low mountains. According to the MMA (2003), Mirandiba is cited as a priority area for scientific research because the region is insufficiently known. Mascarenhas et al. (2005) classified the climate of this area as Semi-arid Tropical, with summer rainfall, and an average annual rainfall totaling 431.8 mm. The region is characterized by predominantly soft-wavy relief, cut by narrow valleys and dissected slopes within the plains of the Pajeú River basin.

The study area formed a square with geographical limits between 08°02'–08°08'S and 38° 40'–38°48'W, which was defined based on the existing topography variations, soil types and drainage networks. The Army Department map (ME, 1985) was used for relief, while the pedological map prepared by EMBRAPA (2008), at the same scale, was used for soil. The soil typology is based on the Brazilian Soil Classification System (EMBRAPA SOLOS, 2006).

Four soils were identified in the study area (Figure 1). Within the crystalline matrix there are Argisols (Ultisols) (P 1, 2 and 3), Litolic Neosols (Inceptisols) (RL 1, 2 and 3) and Luvisols (Alfisols) (T 1, 2 and 3), the latter being dominant in approximately 50% of the area. Within the sedimentary basin, Quartzarenic Neosols (Entisols) were found (RQ 1, 2 and 3). The land use history throughout the study area was similar and the designated region was in good condition. The altitude in the study area varies from 436 m (RQ 1) to 572 m (RL 3) and the drainage network is composed of temporary rivers.

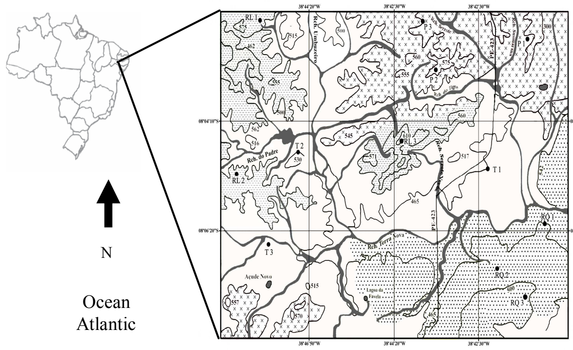

Figure 1. Map of study area with its respective strata. T–Luvisols, T1, 2 and 3-Luvisols with drainage, without drainage, and plateau; RQ–Quartzarenic Neosols, RQ 1, 2 and 3–Quartzarenic Neosols with drainage, without drainage and plateau; P–Argisols, P 1, 2 and 3-Argisols with drainage, and without drainage plateau; RL-Litolic Neosols, RL 1, 2 and 3–Litolic Neosols with drainage, without drainage and plateau.

Data collection

After delimitating the study area, a survey of the strata was performed. The strata are the combination of the four soils mentioned above, and are each associated with three different types of topography: with drainage systems (presence of a temporary river), without drainage (river absent) and plateau (here defined as an area ≥ 500 m elevation).

In each of the 12 strata, a 20 × 100 m plot was established, which created a total sampling area of 24.000 m^2. Each plot was subdivided into 20 plots of 10 × 10 m, of which five were randomly selected for the collection of angiosperm woody plants (trees, shrubs and woody climbers) (MUELLER-DOMBOIS; ELLENBERG, 1974).

Thereafter, 5 plots measuring 1 × 1 m, within each plot of woody plants, were designated for the collection of angiosperm herbaceous plants (upright and prostrate herbs, and herbaceous climbers). The plots were established systematically within the plots of 10 × 10 m; one in each of the four corners and one in the center (MUELLER-DOMBOIS; ELLENBERG, 1974).

To establish criteria for differentiating between woody plants and herbs. Herbs were considered plants with a level of lignification that was low or absent (ARAÚJO et al., 2005).

Data processing

The botanical material was collected in accordance to Mori et al. (1985). Plants were identified by comparing them to specimens deposited at UFP, IPA, PEUFR and HUEFS herbaria (THIERS, 2010). In addition, the authors used available literature, especially Alves et al. (2009), and consulted with experts when needed.

Specimens from this study are deposited in the UFP Herbarium and duplicates will be distributed to RB, HUEFS, JPB and MO herbaria (THIERS, 2010). The floristic list follows the APG II (STEVENS, 2001) classification system.

Presence or absence data were used to estimate species richness as well as to perform a similarity analysis, with the use of the Jaccard index and the Paired group linking measure, using the program PAST version 1.77 (HAMMER et al., 2001).

RESULTS AND DISCUSSION

Approximately 2.000 flowering plant samples were collected, belonging to 40 families and 150 species (Table 1). Of the taxa collected, 11 species were new to the flora of Mirandiba, which will be added to the 440 species of angiosperms already cataloged by Alves et al. (2009) for this region.

Families	Species	Soil types				Hab	Cat	Voucher
		T	RQ	P	RL			
Acanthaceae	*Elytraria imbricata* (Vahl) Pers			x	x	Her		KP 757
	Justicia aequilabris (Nees) Lindau		x	x		Arb		KP 1088
	Ruellia asperula (Mart. & Nees) Lindau	x				Arb		KP 1220
	Ruellia paniculata L.	x	x	x	x	Arb		KP 849
Amaranthaceae	*Alternanthera ficoidea* (L.) R.Br.	x		x	x	Arb		KP 872
	Alternanthera brasiliana (L.) Kuntze	x	x		x	Her	Rud	KP 1113
	Gomphrena vaga Mart.	x			x	Arb		KP 1239
Anacardiaceae	*Myracrodruon urundeuva* Allemão			x		Arv	Ame	KP 1289
	Schinopsis brasiliensis Engl.	x		x		Arv	Ame, Ins	KP 1291
Annonaceae	*Rollinia leptopetala* R.E.Fr.		x			Arv	End	KP 1349
Apocynaceae	*Aspidosperma pyrifolium* Mart.	x	x	x	x	Arv	End	KP 1244
	Marsdenia altissima (Jacq.) Dugand				x	Tel		KP 1334
Arecaceae	*Syagrus coronata* (Mart.) Becc.		x			Arv		KP 1354
Asteraceae	*Blainvilllea acmella* (L.) Philipson			x	x	Her		KP 976
	Centratherum punctatum Cass.	x		x	x	Her		KP 756
	Conocliniopsis prasiifolia (DC.) R.M. King & H. Rob.		x			Arb		KP 790
	Delilia biflora (L.) Kuntze	x				Her		KP 896
	Vernonia chalybaea Mart. ex DC.		x			Arb		KP 809
	Lagascea mollis Cav.	x			x	Arb		KP 1133
Bignoniaceae	*Anemopaegma laeve* DC.		x			Teh	End	KP 1226
	Arrabidaea corallina (Jacq.) Sandwith	x	x	x	x	Tel		KP 1045
	Mansoa angustidens Bureu & K. Schum.		x			Tel		KP 1055
	Handroanthus impetiginosus (Mart. ex DC.) Mattos		x	x	x	Arv		KP 1086
Boraginaceae	*Cordia leucocephala* Moric.	x	x		x	Arb	End	KP 1330

Table 1 continued.

	Heliotropium procumbens Mill.				x	Her		KP 1331
	Tournefortia salzmannii DC.	x				Arb		KP 1242
Bromeliaceae	*Bromelia laciniosa* Mart. ex Schult. f.		x			Her		KP 829
	Neoglaziovia variegata (Arruda) Mez		x		x	Her	End	KP 1228
Burseraceae	*Commiphora leptophloeos* (Mart.) J.B. Gillett				x	Arv	End	KP 1336
Cactaceae	*Arrojadoa rhodantha* (Gürke) Britton & Rose				x	Arb	End	KP 744
	Melocactus zehntneri (Britton & Rose) Luetzelb.	x				Her		KP 1355
Capparaceae	*Cleome guianensis* Aubl.	x				Her		KP 1345
	Cleome rotundifolia (Mart. & Zucc.) H.H. Iltis		x			Her		KP 1348
	Colicodendron yco Mart.	x		x	x	Arb	End	KP 1245
	Cynophalla flexuosa (L.) J.Presl	x		x	x	Arv	End	KP 1216
	Neocalyptrocalyx longifolium (Mart.) X. Cornejo & H.H.Iltis				x	Arb	End	KP 1170 A
Combretaceae	*Combretum hilarianum* D. Dietr.	x	x			Tel		KP 904
	Thiloa glaucocarpa (Mart.) Eichler				x	Arb		KP 1200
Commelinaceae	*Commelina obliqua* Vahl		x	x		Her		KP 1302
Convolvulaceae	*Evolvulus barbatus* Meisn.		x			Teh		KP 807
	Evolvulus filipes Mart.		x			Teh		KP 1068
	Ipomoea brasiliana Meisn.	x	x			Teh	End	KP 1059
	Ipomoea marcellia Meisn.				x	Tel		KP 960
	Ipomoea cf. *nil* (L.) Roth	x	x	x	x	Teh	Rud	KP 881
	Ipomoea rosea Choisy	x				Teh		KP 914
	Ipomoea subincana Meisn.		x			Teh		KP 1072
	Ipomoea triloba L.				x	Teh		KP 940
	Ipomoea sp1	x				Teh		KP 919
	Ipomoea sp2				x	Teh		KP 767
	Jacquemontia confusa Meisn.	x	x		x	Teh		KP 1017
	Jacquemontia glaucescens Choisy		x			Teh		KP 1052
	Merremia aegyptia (L.) Urb.	x		x	x	Teh	Rud	KP 880
Cyperaceae	*Cyperus uncinulatus* Schrad. ex Nees	x				Her		KP 1346
	Cyperus sp.		x			Her		KP 806
Dioscoriaceae	*Dioscorea ovata* Vell.		x			Teh		KP 1073
Erythroxylaceae	*Erythroxylum caatingae* Plowman		x		x	Arb		KP 1082
	Erythroxylum pungens O.E. Schulz		x			Arb		KP 1071
	Erythroxylum sp.		x			Arb		KP 1237
Euphorbiaceae	*Cnidoscolus vitifolius* (Mill.) Pohl		x			Arb		KP 1018
	Cnidoscolus sp.		x			Arb		KP 782
	Croton adamantinus Müll Arg.	x	x			Arb		KP 1300
	Croton blanchetianus Baill.	x	x	x	x	Arb		KP 1313
	Croton rhamnifolioides Pax & K. Hoftm.	x			x	Arb		KP 1197
	Croton heliotropiifolius Kunth				x	Arb		KP 762
	Croton sp.		x			Arb		KP 1062 A
	Dalechampia scandens L.				x	Tel		KP 1304
	Ditaxis malpighiaceae (Ule) Pax & K. Hoffm.	x				Arb	End	KP 1134
	Euphorbia insulana Vell.			x	x	Her		KP 749
	Gymnantes sp.		x			Arb		KP 1084
	Jatropha mollissima (Pohl) Baill.	x	x	x	x	Arb	End	KP 1276
	Jatropha mutabilis Benth.		x			Arb	End	KP 1308
	Manihot dichotoma Ule			x		Arv	End	KP 1301
	Manihot glaziovii Müll. Arg.		x	x	x	Arb	End	KP 1329

Table 1 continued.

	Tragia volubilis L.				x	Tel		KP 743
Lamiaceae	*Hyptis suaveolens* (L.) Poit.		x	x	x	Her	Rud	KP 986
Leg.Caesalpinioideae	*Amburana caerensis* (Allemão) A.C. Sm.				x	Arv	Ame	KP 750
	Bauhinia acuruana Moric.		x			Arb		KP 1064
	Bauhinia cheilantha (Bong.) Steud.				x	Arb		KP 1174
	Chamaecrista calycioides (DC. ex Collad.) Greene		x			Her		KP 773
	Chamaecrista rotundifolia (Pers.) Greene		x			Her		KP 773
	Hymenaea courbaril L.		x			Arv		KP 1353
	Libidibia ferrea (Mart. ex Tul.) L.P.Queiroz	x				Arb		KP 1121
	Poincianella bracteosa (Tul.) L.P.Queiroz	x	x	x	x	Arb		KP 1021
	Senna macranthera (DC. ex Collad.) H.S. Irwin & Barneby	x		x	x	Arv		KP 1004
	Senna rizzinii H.S. Irwin & Barneby		x	x	x	Arv	End	KP 819
	Senna spectabilis (DC.) H.S. Irwin & Barneby			x		Arv		KP 878
	Senna splendida (Vogel) H.S. Irwin & Barneby		x			Arv		KP 1024
	Senna trachypus H.S. Irwin & Barneby		x			Arv		KP 1050
	Senna uniflora (Mill.) H.S. Irwin & Barneby			x		Arb		KP 873
Leg.Mimosoideae	*Anadenanthera colubrina* (Vell.) Brenan	x		x	x	Arv		KP 847
	Calliandra depauperata Benth.	x				Arb	End	KP 1344
	Chloroleucon dumosum (Benth.) G.P. Lewis				x	Arv	End	KP 1204
	Chloroleucon foliolosum (Benth.) G.P. Lewis		x	x		Arv		KP 1281
	Enterolobium contortisiliquum (Vell.) Morong		x			Arv		KP 784
	Mimosa arenosa (Willd.) Poir.	x	x	x	x	Arb		KP 954
	Mimosa invisa Mart. ex Colla		x			Arb	Rud	KP 1011
	Mimosa sensitiva L.		x			Tel		KP 794
	Mimosa tenuiflora Benth.	x		x		Arv		KP 875
	Parapiptadenia zehntneri (Harms) M.P.M. de Lima & H.C. de Lima				x	Arb	End	KP 1181
	Piptadenia stipulacea (Benth.) Ducke	x	x		x	Arv		KP 1108
	Pityrocarpa moniliformis (Benth.) Luckow & R.W. Jobson		x			Arv		KP 1031
	Senegalia piauhiensis (Benth.) Seigler & Ebinger	x				Arv		KP 908
	Senegalia polyphylla (DC.) Britton & Rose		x			Arv		KP 793
Leg.Papilionioideae	*Canavalia brasiliensis* Mart. ex Benth.			x		Tel		KP 992
	Galactia striata (Jacq.) Urb.			x		Teh		KP 967
	Luetzelburgia auriculata (Allemão) Ducke			x		Arv		KP 991
	Macroptilium gracile (Poepp. ex Benth.) Urb.			x		Teh		KP 995
	Macroptilium martii (Benth.) Marechal & Bowdet		x			Teh		KP 811
	Trischidium molle (Benth.) H.E. Ireland		x			Arb		KP 1321
	Vigna peduncularis (Kunth) Fawc. & Rendle		x		x	Tel		KP 828
	Zornia sericea Moric.		x			Her		KP 799
Loasaceae	*Mentzelia aspera* L.			x		Her		KP 997
Loganiaceae	*Strychnos rubiginosa* DC.		x			Arb		KP 1350

Table 1 continued.

cf. Lythraceae			x			Arb		KP 831
Malpighiaceae	*Mascagnia psilophylla* (A. Juss.) Griseb.			x		Tel		KP 998
	Ptilochaeta bahiensis Turcz.	x		x	x	Arb		KP 1203
Malvaceae	*Herissantia crispa* (L.) Brizicky	x	x		x	Arb	End	KP 951
	Herissantia tiubae (K. Schum.) Brizicky	x			x	Arb	End	KP 955
	Malvastrum scabrum (Cav.) A. Gray	x				Arb		KP 1117
	Pseudobombax marginatum (A.St.-Hil., Juss. & Cambess.) A.Robyns				x	Arv	End	KP 1339
	Sida cordifolia L.	x		x	x	Arb	Rud	KP 1333
	Sida galheirensis Ulbr.	x	x	x		Arb	End	KP 797
	Sida regnellii R.E.Fr.		x	x	x	Arb		KP 778
	Sida spinosa L.	x		x	x	Arb	Rud	KP 938
	Waltheria rotundifolia Schrank	x			x	Arb		KP 952
	Waltheria albicans Turcz.		x			Arb		KP 810
	Wissadula contracta (Link) R.E.Fr.	x		x	x	Arb	End	KP 956
Myrtaceae	*Campomanesia viatoris* Landrum		x			Arb		KP 1319
Nyctaginaceae	*Guapira laxa* (Netto) Furlan				x	Arv		KP 962
Oxalidaceae	*Oxalis glaucescens* Norlind				x	Her		KP 1275
Passifloraceae	*Passiflora foetida* L.		x	x	x	Teh		KP 1224
	Passiflora cincinnata Mast			x		Teh		KP 1148
Plumbaginaceae	*Plumbago scandens* L.	x		x		Tel		KP 1286
Poaceae	*Eragrostis ciliaris* (L.) R. Br.		x			Her	Rud	KP 787
Portulacaceae	*Portulaca mucronata* Link.		x			Her		KP 1040
	Talinum triangulare (Jacq.) Willd.	x				Her		KP 1327
Rhamnaceae	*Ziziphus cotinifolia* Reissek	x		x		Arv	End	KP 867
Rubiaceae	*Diodella apiculata* (Willd. ex Roem. & Schult.) Delprete		x			Her		KP 801
	Mitracarpus sp.	x	x			Her		
	Richardia grandiflora (Cham. & Schltdl.) Ateud.		x			Her		KP 771
	Staelia virgata (Link ex Roem. & S-chult.) K. Schum.		x			Her		KP 770
Sapindaceae	*Cardiospermum corindum* L.	x	x			Teh		KP 905
	Serjania glabrata Benth.	x			x	Teh		KP 841
Solanaceae	*Solanum agrarium* Sendtn.	x				Arb		KP 1328
	Solanum rhytidoandrum Sendtn.		x			Arb		KP 826
Turneraceae	*Piriqueta* sp.		x			Arb		KP 1314
Verbenaceae	*Durantea repens* L.		x			Arb	Rud	KP 1307
	Lantana camara L.	x				Arb		KP 1270
	Lippia sp.		x			Arb		KP 1047
Vitaceae	*Cissus decidua* Lombardi	x	x			Tel		KP 1241
Total		57	80	47	61			

The richest families were Leguminosae (37 species, 25% of total), Euphorbiaceae (16 spp., 17%), Convolvulaceae (13 spp., 9%), Malvaceae (11 spp., 8%) and Asteraceae (6 spp., 4%), and together these accounted for about 63% of the species. At the generic level, the richest taxa were *Ipomoea* (8 spp.), *Senna* (6 spp.), *Croton* (5 spp.), *Sida* (4 spp.) and *Mimosa* (4 spp.).

For the woody plants, 101 species were collected, representing 67% of the total number of species, while 49 species of herbs were collected. There were 34 climbing taxa (23% of spp.), of which 13 taxa were classified as woody (woody climbers) and 21 species as herbaceous (herbaceous climbers).

Of the taxa collected, 70 species (49 woody and 21 herbaceous) were restricted to the nine areas inventoried with soils originating from the crystalline matrix, and 49 species (31 woody and 18 herbaceous) were restricted to the three areas with sedimentary soils. The two major geological units shared 31 species (21 woody and 10 herbaceous) and the Jaccard similarity index of 11% (r = 0.9121) was considered low (Figure 2).

The Quartzarenic Neosols (Entisols) of sedimentary origin was the soil type with the highest number of taxa (32 families, 80 species). Among these, six families and over half the species were restricted to this soil (48 spp.), of which 30 were woody and 18 were herbaceous (Table 2). Noteworthy was the occurrence of *Campomanesia viatoris* Lamdrum (Myrtaceae), a new record for the state of Pernambuco, which was previously known only from the states of Alagoas, Ceará and Bahia, in sedimentary areas, according to herbaria based.

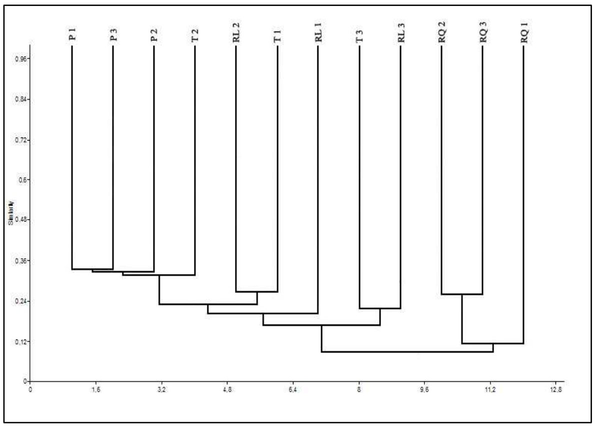

Figure 2. Dendrogram of floristic similarity among the groups studied in Mirandiba, Pernambuco. Presence of rectangle-crystalline matrix area; Absence of rectangle-sedimentary basin area. T–Luvisols, T1, 2 and 3-Luvisols with drainage, without drainage, and plateau; RQ–Quartzarenic Neosols, RQ 1, 2 and 3–Quartzarenic Neosols with drainage, without drainage and plateau; P–Argisols, P 1, 2 and 3-Argisols with drainage, and without drainage plateau; RL-Litolic Neosols, RL 1, 2 and 3–Litolic Neosols with drainage, without drainage and plateau.

For soils of crystalline origin, the Litolic Neosols (Inceptisols) was the richest with 21 families and 61 species. Three families and 19 species (15 woody and 4 herbaceous) were limited to this soil type. The Luvisols (Alfisols), with 24 families and 57 species, had 16 species (9 woody and 7 herbaceous) limited to this type of soil. In turn, the Argisols (Ultisols) supported 19 families (one exclusive to this soil type) and 47 species, of which 11 species (7 woody and 4 herbaceous) were restricted to this type (Table 2).

For the areas located near the drainage networks the diversity was greatest on the Argisols, which had 33 species (21 woody and 12 herbaceous) and the Quartzarenic Neosols, which had 45 species (27 woody and 18 herbaceous), followed by the higher elevation area with 23 species (Argisols) and 35 species (Quartzarenic Neosols) (Table 2).

For the Luvisol, the greatest diversity was also found near the drainage system, which had 26 species (23 woody and 3 herbaceous). This number was not considerably different when compared to the species numbers found on this soil type in the other study areas (Table 2).

For Litolic Neosols (Inceptisols), unlike the other soils studied, the area at a higher elevation had the richest flora (31 spp.), and only 26 species (16 woody and 10 herbaceous) were recorded in the area near the drainage system (Table 2).

Among the plant species inventoried, according to Giulietti et al. (2002), 26 are endemic to the Caatinga, of which 23 species are woody and 3 species are herbaceous (Table 1); noteworthy are the Euphorbiaceae and Malvaceae with five species each (GIULIETTI et al., 2002). According to the MMA (2008), three species are considered threatened with extinction: *Amburana caerensis* (Allemão) AC Sm. (Amburana de cambão), *Myracrodruon urundeuva* Allemão (Aroeira) and *Schinopsis brasiliensis* Engl. (Baraúna), the latter is also classified as a Brazilian species with insufficient data (MMA, 2008).

The flora of the Caatinga is primarily related to the semi-arid climate, the topography and historical events, and secondarily to the soil. However, because these factors are very diverse in the Caatinga the regions in this area contain different types of vegetation. The two major geological units are the crystalline shield and sedimentary portions that are discordantly placed in this basement (ANDRADE-LIMA, 1981).

Different studies undertaken in the Caatinga, which mostly dealt with woody plants, have clearly shown that there are two distinct floras associated with the two geological units (RODAL et al., 1999; QUEIROZ, 2009).

In our study, there were a higher number of woody species in each of the soils studied. This pattern was also observed in another area of Caatinga, Parnamirim (PE), where different communities from seven soil types, some similar to the soil types in our work, differed primarily by the density and number of woody species (SANTOS et al., 1992). However, the low diversity of herbaceous plants compared to woody plants has not been found in other areas of the Caatinga (COSTA et al., 2009).

Further, because the Caatinga is often inhospitable to herbaceous plants, which are generally only present during the annual rainy season, the flora of this ecosystem tends to be characterized by a predominance of woody taxa. Therefore, herbaceous plants are not considered dominant in the Caatinga (QUEIROZ, 2009),

The herbaceous component of the Caatinga is associated with the presence of water so it is most likely that the greatest number of herbs will be found near drainage systems (QUEIROZ, 2009). This fact seems to be a reflection of the conditions of humidity that are more favorable to this habit (SILVA et al., 2009).

However, the area with Luvisols and a drainage system, unlike the others, did not have a large number of herbs. Santos et al. (1992) emphasized that this soil type is best characterized, in both number and density, by the predominance of woody taxa.

In addition to the herbaceous component, many of the species were climbers which deserves attention since this is a poorly studied habit. According to Araújo et al. (2005), as with the herbaceous species, climbing species also have an important role in the dynamics of the vegetation component, and can sometimes influence the height of the vegetation throughout the landscape.

Based on the known flora of Mirandiba (ALVES et al., 2009), the following 11 new records were found for this region: *Thiloa glaucocarpa* (Mart.) Eichler (Combretaceae), *Ipomoea triloba* L., and *Jacquemontia glaucescens* Choisy (Convolvulaceae), *Dioscorea ovata* Vell. (Dioscoriaceae), *Senna rizzinii* H.S. Irwin & Barneby and *Senegalia piauhiensis* (Benth.) Seigler & Ebinger (Leguminosae), *Mentzelia aspera* L. (Loasaceae), *Campomanesia viatoris* Landrum (Myrtaceae), *Mitracarpus* sp. (Rubiaceae), *Solanum agrarium* Sendtn. (Solanaceae) and *Piriqueta* sp. (Turneraceae) (Table 1).

The high richness of Leguminosae and Euphorbiaceae in the study area corroborates findings in other qualitative and quantitative surveys within semi-arid environments in Caatinga, of both crystalline and sedimentary origin, and in Carrasco (RODAL et al., 1999; ARAÚJO et al., 1998; ALCOFORADO-FILHO et al., 2003). Besides the high diversity of these families it has also been found that these groups are represented by numerous individuals in the Caatinga, as seen in the Cariris Paraibanos (OLIVEIRA et al., 2009). Thus, it is suggested that these families are important component groups of the caatinga vegetation, as emphasized by Gentry (1995) for neotropical dry forests. In addition to the Leguminosae and Euphorbiaceae, the Convolvulaceae is one of the most common families in the Caatinga (BURIL-VITAL et al., 2009), a group that is mostly represented by herbaceous climbers.

In turn, the results for the Malvaceae and Asteraceae are corroborated by other surveys and confirm the observations of other authors that these are common families in the Caatinga, and others environments, but can vary in number (RODAL et al., 1999; ALCOFORADO-FILHO et al., 2003; SILVA et al., 2009).

Table 2. List of number of families and species in four soil types and 12 areas of the semi-arid region, Pernambuco, Brazil.

Soil types	Total Families	Exclusive Families	Total Species	Exclusive species
Luvisols				
Without drainage	14	0	24	4
with drainage	13	0	26	5
Plateau	13	0	25	7
Shared and exclusive taxa of Luvisols	0	-	-	0
Total Luvisols	24	0	57	16
Argisols				
Without drainage	8	0	21	2
with drainage	16	1	33	5
Plateau	13	0	23	1
Shared and exclusive taxa of Argisols	0	-	-	3
Total Argisols	19	1	47	11
Litolic Neosols				
Without drainage	10	0	26	4
with drainage	12	1	26	6
Plateau	17	2	31	8
Shared and exclusive taxa of Litolic Neosols	1	-	-	1
Total Litolic Neosols	21	3	61	19
Quartzarenic Neosols				
Without drainage	11	1	24	5
with drainage	21	2	45	23
Plateau	18	3	35	9
Shared and exclusive taxa of Quartzarenic Neosols	2	-	-	11
Total Quartzarenic Neosols	32	6	80	48

The low similarity found between crystalline and sedimentary units shows that a division in the floristic composition exists. Thus, these two major geological units do not share the same flora. This is corroborated by other studies, in which this variation in the flora was found based on the soils (RODAL et al., 1999; ALCOFORADO-FILHO et al., 2003; QUEIROZ, 2009).

Because soils of sedimentary origin are deeper and have a higher capacity to retain water, the amount of water available in these soils is greater (SAMPAIO, 2003; EMBRAPA SOLOS, 2006). Therefore, the plant diversity on this soil type is a reflection of the better conditions. In this work, the higher diversity found on these soils corroborates with what was found at several other Caatinga sites on sedimentary basins (RODAL et al. 1998; RODAL et al., 1999; SILVA et al., 2009).

In contrast, it is possible that soils with crystalline basement are less diverse because they have a smaller capacity to accumulate water, which is mainly because they are shallower, stony and compacted (SAMPAIO, 2003; EMBRAPA SOLOS, 2006).

CONCLUSION

The inventoried study areas had differences in floristic composition and species richness according to local morpho-pedological differences. The greatest richness was found in the areas near drainage systems.

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