



RESEARCH ARTICLE

ANGIOSPERMS OF SENEGAL: DIVERSITY OF FAMILIES IN THE CLASS MONOCOTYLEDONS AND DICOTYLEDONS

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ABSTRACT

In Senegal, the Angiosperms represent the best known and most diverse group. The main objective of this work is to contribute to a better knowledge of the biodiversity of Senegal. More specifically, this work seeks to analyse the diversity of Angiosperms in Senegal. The application of several sources of information (herbaria, floras and botanical gardens) has made it possible to show that the flora of Senegal is composed of 2512 species and 1006 genera distributed in 167 families. Dicotyledons are largely dominant with 1788 species distributed in 776 genera and 130 families. On the other hand, only 724 species of Monocotyledons distributed in 230 genera and 37 families have been recorded. The most representative families of Dicotyledons are the Fabaceae, Asteraceae, Apocynaceae, Rubiaceae, Malvaceae and Euphorbiaceae. These 6 families include 317 genera, i.e. 40.84% and 839 species, i.e. 46.93% of the Dicotyledonous flora of Senegal. For the Monocotyledons, they are mostly represented by the family Poaceae, Cyperaceae, Arecaceae, Araceae, Orchidaceae, Liliaceae, Commelinaceae. These 5 families account for 65.65% of the genera and 75.41% of the species of the Monocotyledonous flora of Senegal.

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INTRODUCTION

Drylands cover about 40% of the world's land area (5.1 billion ha) (UNEP, 1992, Diouf, 2011). As a result, the Sahel appears to be one of the regions where harsh climatic conditions have the greatest impact on natural resources. The degradation of ecosystems is now a threat to biodiversity, through the destruction of natural environments, leading inevitably to the scarcity or even disappearance of species (Swaminathan, 1990; Diatta et al, 2009). In sub-Saharan Africa, plant biodiversity provides many resources: food, medicinal, energy, etc. for local populations (Sokpon and Lejoly, 1996; Ros-Tonen, 1999; Goussanou et al., 2011; Djego et al., 2011). However, for more than 40 years, a process of unprecedented degradation, following the drought of the 1970s, in parallel with multiple anthropic actions, has accentuated the threats to biodiversity. This phenomenon has resulted in a reduction in plant cover and the fragmentation of ecosystems (Ndiaye et al., 2013).

In the flora of Senegal, Angiosperms constitute the most diverse group and are distributed in the classes Dicotyledons and Monocotyledons, with a predominance of Dicotyledons (Ba & Noba, 2001, Noba et al., 2004). However, in Senegal, the species of this group are not very well known. Knowledge of the species is essential for good conservation of plant resources. However, good knowledge of plant resources requires species identification. However, in the tropics, the identification of plant species presents particular difficulties since floras are often lacking (Spichiger et al., 2000). Indeed, the main task of the botanist in the field is to identify the material down to the family level, as specialists usually work at this level and it is to them that the material should be sent for definitive determination (Spichiger et al., 2000). The main objective of this work is to contribute to a better knowledge of the biodiversity of Senegal. More specifically, this work seeks to analyse the diversity of Angiosperms in Senegal.

MATERIALS AND METHODS

The identification of the samples was carried out at the Laboratoire de Botanique et Biodiversité (LBB) of the Université Cheikh Anta Diop de Dakar (UCAD). The sources of information are: the University Library (BU), the Dakar herbarium and the Botanical Garden.

This work was carried out using

- flora (Aubreville, 1950; Hutchinson & Dalziel, 1954 and 1972; Hutchinson et al., 1958; Berhaut, 1967, and 1979; Merlier & Montegut, 1982; Jonhson, 1997; Le Bourgeois & Merlier, 1995)
- the results of the work of the Laboratoire de Botanique et Biodiversité (Noba & Ba, 1992; Noba et al., 1994; Sambou, 2000; Ba & Noba, 2001, Mbaye et al., 2001; Sarr et al., 2001) and those of Poilecot (1995 and 1999)
- observations made in the herbarium and the Botanical Garden.

RESULTS

The results concern the analysis of the diversity of Monocotyledons and Dicotyledons.

Diversity analysis of the families of the class Monocotyledons: The Monocotyledons (Table 1) comprise 37 families, 230 genera and 724 species (i.e. 28.82%), giving an average of 6.21 genera and 12.56 species per family. The Poaceae family has the highest number of genera (40.43%) and species (39.36%). This family is followed by Cyperaceae with 8.26% of genera and 25.97% of species, Arecaceae (6.52% of genera and 2.62% of species), Araceae (5.22% of genera against 2.49% of species), Orchidaceae (5.22% of genera and 4.97% of species). These 5 families alone account for 65.65% of genera and 75.41% of species of the Monocotyledonous flora of Senegal. The 32 other families gather 34.22% of genera and 24.6% of species, largely below the previous ones.

Diversity analysis of the families of the class Dicotyledons: The class Dicotyledons consists of 130 families, 776 genera and 1788 species (71.18% of the angiosperms). These values correspond to an average of 5.66 genera and 13.05 species per family (Table 2). The family Fabaceae has the highest number of genera (12.62%) and species (21.19%). Next come the Asteraceae (7.22% of genera and 5.37% of species), the Apocynaceae (6.96% of genera and 4.48% of species), the Rubiaceae (5.80% of genera and 5.82% of species), the Malvaceae (4.25% of genera and 5.2% of species) and the Euphorbiaceae (3.99% of genera and 4.87% of species). These 6 families include 317 genera or 40.84% and 839 species or 46.93% of the Dicotyledonous flora of Senegal. If we add to these families the Acanthaceae (2.96% of genera and 2.85% of species), the Scrophylariaceae (2.45% of genera and 2.91% of species), the Labiatae (2.19% of genera and 1.62% of species), the number of genera increases to 376, i.e. 48.44%, and the number of species also increases to 971, i.e. 54.31%. Thus, these 9 plant families, out of a total of 130 families, account for 48.44% of genera and 54.31% of species. The remaining species are distributed among 121 families, of which 54 are represented by only one genus (0.13%) and a maximum of 5 species (0.28%).

Table 1. Family structure of the class Monocotyledons in Senegal

N°	Family	Genus		Species	
		N	%	N	%
1	<i>Gramineae (Poaceae)</i>	93	40,43	285	39,36
2	<i>Cyperaceae</i>	19	8,26	188	25,97
3	<i>Palmaceae (Arecaceae)</i>	15	6,52	19	2,62
4	<i>Araceae</i>	12	5,22	18	2,49
5	<i>Orchidaceae</i>	12	5,22	36	4,97
6	<i>Liliaceae</i>	11	4,78	28	3,87
7	<i>Commelinaceae</i>	8	3,48	28	3,87
8	<i>Amaryllidaceae</i>	7	3,04	13	1,80
9	<i>Agavaceae</i>	5	2,17	16	2,21
10	<i>Alismataceae</i>	5	2,17	6	0,83
11	<i>Maranthaceae</i>	4	1,74	4	0,55
12	<i>Hydrocharitaceae</i>	3	1,30	3	0,41
13	<i>Lemnaceae</i>	3	1,30	4	0,55
14	<i>Musaceae</i>	3	1,30	3	0,41
15	<i>Pontederiaceae</i>	3	1,30	3	0,41
16	<i>Potamogetonaceae</i>	3	1,30	5	0,69
17	<i>Zingiberaceae</i>	3	1,30	7	0,97
18	<i>Eriocaulaceae</i>	2	0,87	12	1,66
19	<i>Alliaceae</i>	1	0,43	2	0,28
20	<i>Aponogetonaceae</i>	1	0,43	2	0,28
21	<i>Asparagaceae</i>	1	0,43	3	0,41
22	<i>Bromeliaceae</i>	1	0,43	1	0,14
23	<i>Burmanniaceae</i>	1	0,43	1	0,14
24	<i>Butomaceae</i>	1	0,43	1	0,14
25	<i>Cannaceae</i>	1	0,43	1	0,14
26	<i>Dioscoreaceae</i>	1	0,43	10	1,38
27	<i>Hyppoxidaceae</i>	1	0,43	1	0,14
28	<i>Iridaceae</i>	1	0,43	3	0,41
29	<i>Juncaceae</i>	1	0,43	1	0,14
30	<i>Limnocaritaceae</i>	1	0,43	1	0,14
31	<i>Najadaceae</i>	1	0,43	4	0,55
32	<i>Pandanaceae</i>	1	0,43	3	0,41
33	<i>Smilacaceae</i>	1	0,43	1	0,14
34	<i>Taccaceae</i>	1	0,43	1	0,14
35	<i>Typhaceae</i>	1	0,43	2	0,28
36	<i>Xyridaceae</i>	1	0,43	6	0,83
37	<i>Zannichellaceae</i>	1	0,43	2	0,28
	Total	230	100,00	724	100,00

DISCUSSION

The very low representation of genera and species in certain families, as well as the abundance of certain groups, reflect the particularity of this flora. The high number of species in many genera reflects a significant specific diversification within certain groups. These groups had retained their evolutionary potential, which was expressed in particular, as is generally accepted, after the establishment of the peridotites (IRD, 2001). Families made up of a small number of genera do not seem to have evolved much compared to those made up of several genera. These results show that the vascular flora of Senegal is very well diversified, with 2512 species and 1006 genera distributed in 167 families. This diversity in terms of number of species, genera and families is in line with the work of some authors such as Hutchinson & Dalziel (1954 and 1972); Hutchinson et al (1958); Berhaut (1967, and 1979). These are also comparable to those of Bâ and Noba (2001). However, the importance of dicotyledons compared to monocotyledons has been observed in all the studies carried out on the flora in Senegal. These results corroborate with those obtained by Sambou (2004), Diatta et al. (2009), Ka et al, 2017. Studies on the weed flora have also shown the dominance of dicotyledons over monocotyledons Noba (2002), Mbaye (2013), Bassène (2014), Mballo et al (2018). These results also confirm the work of other authors in other parts of

Table 2. Family structure of the class Dicotyledons in Senegal

N°	Family		Genus		Species	
			N	%	N	%
1	<i>Fabaceae</i>	<i>Faboideae</i>	58	7,47	284	15,88
		<i>Caesalpinoideae</i>	23	2,96	46	2,57
		<i>Mimosoideae</i>	17	2,19	49	2,74
2	<i>Asteraceae (Composeae)</i>		56	7,22	96	5,37
3	<i>Rubiaceae</i>		45	5,80	104	5,82
4	<i>Euphorbiaceae</i>		31	3,99	87	4,87
5	<i>Apocynaceae</i>	<i>Asclepiodeae</i>	30	3,87	47	2,63
		<i>Apocynoideae</i>	24	3,09	33	1,85
6	<i>Acanthaceae</i>		23	2,96	51	2,85
7	<i>Scrophulariaceae</i>		19	2,45	52	2,91
8	<i>Labiatae</i>		17	2,19	29	1,62
9	<i>Convolvulaceae</i>		15	1,93	62	3,47
10	<i>Verbenaceae</i>		14	1,80	30	1,68
11	<i>Cucurbitaceae</i>		13	1,68	25	1,40
12	<i>Amaranthaceae</i>		12	1,55	26	1,45
13	<i>Bignoniaceae</i>		12	1,55	13	0,73
14	<i>Sapindaceae</i>		12	1,55	13	0,73
15	<i>Malvaceae</i>	<i>Malvoideae</i>	11	1,42	49	2,74
		<i>Tilioideae</i>	9	1,16	21	1,17
		<i>Bombacoideae</i>	5	0,64	5	0,28
		<i>Sterculoideae</i>	8	1,03	18	1,01
16	<i>Anacardiaceae</i>		10	1,29	17	0,95
17	<i>Annonaceae</i>		9	1,16	17	0,95
18	<i>Capparidaceae</i>		9	1,16	21	1,17
19	<i>Meliaceae</i>		9	1,16	10	0,56
20	<i>Combretaceae</i>		8	1,03	34	1,90
21	<i>Gentianaceae</i>		8	1,03	9	0,50
22	<i>Loganiaceae</i>		8	1,03	12	0,67
23	<i>Moraceae</i>		8	1,03	38	2,13
24	<i>Connaraceae</i>		7	0,90	9	0,50
25	<i>Malpighiaceae</i>		7	0,90	9	0,50
26	<i>Sapotaceae</i>		7	0,90	10	0,56
27	<i>Celastraceae</i>		6	0,77	9	0,50
28	<i>Chenopodiaceae</i>		6	0,77	9	0,50
29	<i>Loranthaceae</i>		6	0,77	8	0,45
30	<i>Melastomaceae</i>		6	0,77	15	0,84
31	<i>Zygophyllaceae</i>		9	1,16	12	0,67
32	<i>Borraginaceae</i>		5	0,64	13	0,73
33	<i>Flacourtiaceae</i>		5	0,64	5	0,28
34	<i>Guttiferae (Hypericaceae)</i>		5	0,64	8	0,45
35	<i>Lythraceae</i>		5	0,64	21	1,17
36	<i>Menispermaceae</i>		5	0,64	5	0,28
37	<i>Myrtaceae</i>		5	0,64	16	0,89
38	<i>Polygonaceae</i>		5	0,64	11	0,62
39	<i>Solanaceae</i>		5	0,64	16	0,89
40	<i>Urticaceae</i>		5	0,64	5	0,28
41	<i>Ampelidaceae</i>		4	0,52	23	1,29
42	<i>Araliaceae</i>		4	0,52	5	0,28
43	<i>Cactaceae</i>		4	0,52	6	0,34
44	<i>Molluginaceae</i>		4	0,52	10	0,56
45	<i>Nyctaginaceae</i>		4	0,52	13	0,73
46	<i>Ochnaceae</i>		4	0,52	9	0,50
47	<i>Oleaceae</i>		4	0,52	6	0,34
48	<i>Burceraceae</i>		3	0,39	4	0,22
49	<i>Campanulaceae</i>		3	0,39	4	0,22
50	<i>Caryophyllaceae</i>		3	0,39	9	0,50
51	<i>Cruciferae</i>		3	0,39	3	0,17
52	<i>Ficoideae</i>		3	0,39	6	0,34
53	<i>Icacinaceae</i>		3	0,39	3	0,17
54	<i>Olacaceae</i>		3	0,39	3	0,17
55	<i>Oxalidaceae</i>		3	0,39	4	0,22
56	<i>Passifloraceae</i>		3	0,39	7	0,39
57	<i>Pedaliaceae</i>		3	0,39	6	0,34
58	<i>Phytolacaceae</i>		3	0,39	3	0,17
59	<i>Polygalaceae</i>		3	0,39	13	0,73
60	<i>Rutaceae</i>		3	0,39	4	0,22
61	<i>Umbelliferae</i>		3	0,39	3	0,17
62	<i>Crassulaceae</i>		2	0,26	5	0,28
63	<i>Elatinaceae</i>		2	0,26	5	0,28
64	<i>Gesneriaceae</i>		2	0,26	2	0,11
65	<i>Lentibulariaceae</i>		2	0,26	14	0,78

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66	<i>Onagraceae</i>	2	0,26	13	0,73
67	<i>Piperaceae</i>	2	0,26	2	0,11
68	<i>Portulacaceae</i>	2	0,26	8	0,45
69	<i>Proteaceae</i>	2	0,26	2	0,11
70	<i>Rhamnaceae</i>	2	0,26	6	0,34
71	<i>Rhizophoraceae</i>	2	0,26	5	0,28
72	<i>Rosaceae</i>	2	0,26	7	0,39
73	<i>Rubiaceae</i>	2	0,26	5	0,28
74	<i>Samydeaceae</i>	2	0,26	2	0,11
75	<i>Ulmaceae</i>	2	0,26	3	0,17
76	<i>Violaceae</i>	2	0,26	5	0,28
77	<i>Ancistrocladaceae</i>	1	0,13	1	0,06
78	<i>Aquifoliaceae</i>	1	0,13	1	0,06
79	<i>Aristolochiaceae</i>	1	0,13	3	0,17
80	<i>Avicenniaceae</i>	1	0,13	1	0,06
81	<i>Balanophoraceae</i>	1	0,13	1	0,06
82	<i>Balsaminaceae</i>	1	0,13	1	0,06
83	<i>Basselaceae</i>	1	0,13	1	0,06
84	<i>Begoniaceae</i>	1	0,13	1	0,06
85	<i>Cannabinnaceae</i>	1	0,13	1	0,06
86	<i>Caricaceae</i>	1	0,13	1	0,06
87	<i>Casuarinaceae</i>	1	0,13	1	0,06
88	<i>Ceratophyllaceae</i>	1	0,13	1	0,06
89	<i>Cochlospermaceae</i>	1	0,13	2	0,11
90	<i>Dilleniaceae</i>	1	0,13	2	0,11
91	<i>Dipterocarpaceae</i>	1	0,13	1	0,06
92	<i>Droceraceae</i>	1	0,13	1	0,06
93	<i>Ebenaceae</i>	1	0,13	5	0,28
94	<i>Frankeniaceae</i>	1	0,13	1	0,06
95	<i>Geraniaceae</i>	1	0,13	1	0,06
96	<i>Godeniaceae</i>	1	0,13	1	0,06
97	<i>Hallorhaceae</i>	1	0,13	1	0,06
98	<i>Hernandiaceae</i>	1	0,13	1	0,06
99	<i>Humiriaceae</i>	1	0,13	1	0,06
100	<i>Hydrophyllaceae</i>	1	0,13	3	0,17
101	<i>Illeceae</i>	1	0,13	1	0,06
102	<i>Irvingiaceae</i>	1	0,13	2	0,11
103	<i>Lauraceae</i>	1	0,13	2	0,11
104	<i>Lecythidaceae</i>	1	0,13	1	0,06
105	<i>Linaceae</i>	1	0,13	1	0,06
106	<i>Lobelliaceae</i>	1	0,13	3	0,17
107	<i>Medusandraceae</i>	1	0,13	1	0,06
108	<i>Menhyantaceae</i>	1	0,13	2	0,11
109	<i>Moringaceae</i>	1	0,13	1	0,06
110	<i>Myristicaceae</i>	1	0,13	2	0,11
111	<i>Myrsinaceae</i>	1	0,13	2	0,11
112	<i>Nympheaceae</i>	1	0,13	4	0,22
113	<i>Opiliaceae</i>	1	0,13	1	0,06
114	<i>Orobanchaceae</i>	1	0,13	1	0,06
115	<i>Papaveraceae</i>	1	0,13	1	0,06
116	<i>Plombaginaceae</i>	1	0,13	2	0,11
117	<i>Podostemonaceae</i>	1	0,13	1	0,06
118	<i>Primulaceae</i>	1	0,13	1	0,06
119	<i>Punicaceae</i>	1	0,13	1	0,06
120	<i>Ranunculaceae</i>	1	0,13	1	0,06
121	<i>Salicaceae</i>	1	0,13	3	0,17
122	<i>Salvadoraceae</i>	1	0,13	1	0,06
123	<i>Saxifragaceae</i>	1	0,13	2	0,11
124	<i>Sphenocleaceae</i>	1	0,13	2	0,11
125	<i>Surianaceae</i>	1	0,13	1	0,06
126	<i>Tamaricaceae</i>	1	0,13	1	0,06
127	<i>Thymeleaceae</i>	1	0,13	2	0,11
128	<i>Trapaceae</i>	1	0,13	1	0,06
129	<i>Turneraceae</i>	1	0,13	1	0,06
130	<i>Vahliaceae</i>	1	0,13	2	0,11
	Total	776	100,00	1788	100,00

West and Central Africa (; Le Bourgeois, 1993; Boraud, 2000; Mangara ,2010), who observed a proportion of 2/3 Dicotyledons and 1/3 Monocotyledons. In this study, the Fabaceae, Cyparaceae and Poaceae largely dominate this flora. The dominance of these families is linked to the fact that they are mostly therophytes and adapt well to the constraints of the Sahelian environment and to the agropedoclimatic conditions.

These results are also comparable to those of Bâ and Noba (2001) and Hutchinson Dalziel (1954 and 1972).

CONCLUSION

This study, whose aim was to contribute to a better knowledge of the plant biodiversity of Senegal, showed that the vascular

flora of Senegal is composed of 2512 species and 1006 genera distributed in 167 families. The dicotyledons are largely representative with 1788 species and 776 genera distributed in 130 families. Monocots have only 724 species, 230 genera and 37 families. The most important families are represented by the Fabaceae, Cyperaceae and Poaceae. This study gave us an overview of the number and diversity of botanical families in Senegal.

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