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Etude de la dynamique spatiale et structure du Jardin Botanique Stanislas Lisowski de la Faculté des Sciences, UNIKIS, RD Congo

[Study of the spatial dynamics and structure of the botanical garden Stanislas Lisowski of the Faculty of Sciences, UNIKIS, RD Congo]

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ABSTRACT: The inventory, drawn up on the the whole garden, has permitted us to obtain 541 individuals distributed into 221 species, 60 families and 31 orders the studied florura contains a high content of spermaphytes. Angiosperms, almost alone, constitute the flora of this entity. Phanerophytes are largely dominant; the type of the species Diasporas is mostly sarcochores or fleshy Diasporas. Accordingly, 93species identified beforehand have disappeared from the garden due to lack of medium adaptation, and 16 other species are considered as newly settled since they are not mentioned in previous works.

KEYWORDS: dynamics, spatial, Structure, botanical garden, Lisowski.

RESUME: L'inventaire a porté sur toutes les espèces d'arbres présents dans le jardin et a permis d'obtenir 541 individus répartis en 221espèces, 60 familles et 31 ordres. La florule étudiée est riche en spermaphytes, les Angiospermes forment presque seules, la flore de cette entité. Les phanérophytes sont largement dominants. Le type de diaspore des espèces est surtout dominé par les sarcochores ou diaspores charnus. De ceci, il découle que 93 espèces préalablement recensés, sont disparues du jardin suite à la non adaptation aux conditions écologiques du milieu et 16 autres espèces sont considérés comme nouvellement installées car non signalées dans les travaux antérieurs.

MOTS-CLEFS: dynamique, Spatiale, Structure, Jardin botanique, Lisowski.

1 INTRODUCTION

Forests play a major role in preserving biodiversity, climate change and sustainable development [1]. This biodiversity plays a significant role in the forest dynamics. Tropical forests, particularly wet dense forests, are considered to house more than 50%, or even up to 80% of the specific terrestrial diversity. On hectare of dense humid forest, three hundred individuals are sometimes identified against a maximum of a few tens in temperate zones. Two-thirds of flowering plants are of tropical moist origin [2].

The protection of living species ultimately implies to be effective, the implementation of at least two types of measures:

In situ conservation: here, regardless of the salvage interest of endangered species through ex situ preservation measures, only the preservation of species habitat is likely to ensure the long-term conservation of biodiversity;

Ex situ conservation: This is the first step to be taken to safeguard a species in immediate danger of extinction [3].

The botanical and zoological gardens are created in this ex situ conservation framework. But then, these not only have the objective of protecting endangered species, but also and above all these are centers of environmental education, places of scientific research on biodiversity and places for tourists In search of peace and natural beauty [4].

At the Faculty of Science, one of the faculties of the University of Kisangani, a botanical garden was established for didactic reasons. Although conceived for these reasons, it contains the most common and most representative species of the local flora [5]. In the Department of Ecology and Management of plant resources of this faculty, a botanical garden is important not only for the sequestration of CO_2, recycling of the material in the cycle biogeochemical, morphological and physiological studies, But still in studies on the equatorial flora and the systematics of species. In an ecosystem, the competition between species both at the intra-specific level and at the interspecific level for the conquest of Water and energy sources (light) is a real battle for life [3].

The results lead to a fragile balance in which the whole community of living beings can be placed. This ecosystem is driven to evolve [1]. According to [6] the dynamics is the expression of the evolution in time and space, under the influence of the factors of the natural and anthropogenic parameters of the composition intra and inter specific of the population occupying a given space.

This work will report on the current state of the botanical garden Stanislas Lisowsky, its present floristic composition, to be compared with that which existed during its implantation and finally, to study certain variables of the dynamics of the garden.

2 Environment, Materials And Methods

2.1 Study Environment

2.1.1 Description of the environment

The Stanislas LISOWSKI Botanical Garden at the University of Kisangani is our study environment and is located within the Faculty of Science, in its southeastern part (city of Kisangani). It is located near the equator, at 25 ° 11 ' East longitude and 0 ° 31 ' north latitude [7].

Figure 1 gives the geographical location of the Faculty of Science of the University of Kisangani.

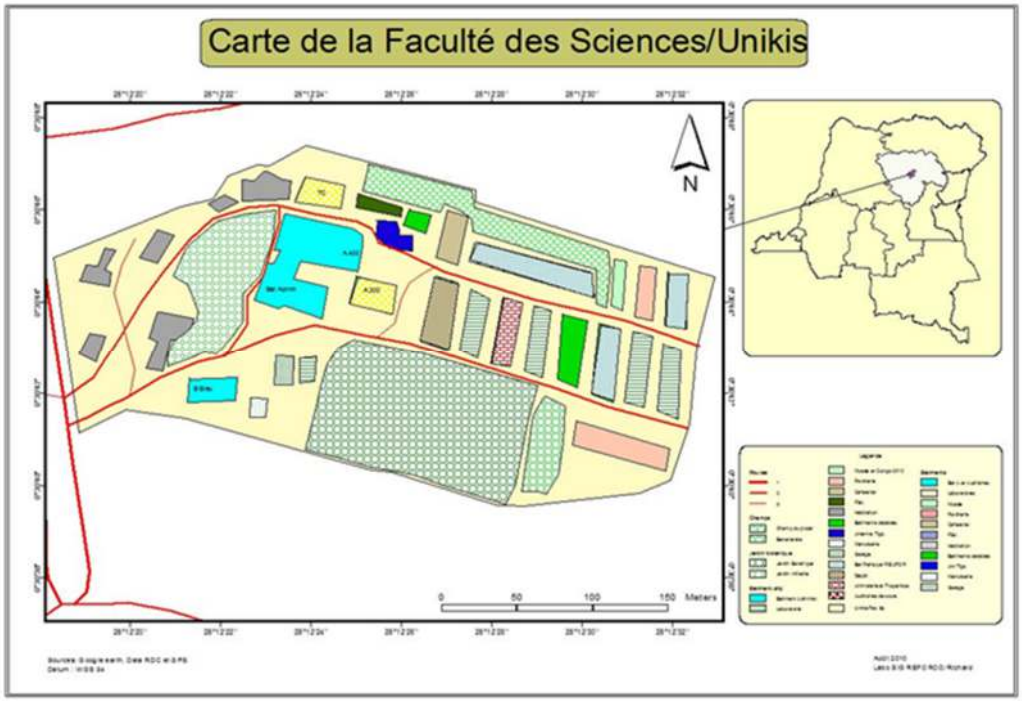

Fig. 1. Geographical location of the Faculty of Science of the University of Kisangani

The Botanical Garden of the Faculty of Science contains 13 lines (1-13) and 7 columns (A-G) divided into 91 plots separated by a distance of 100 cm. The floristic inventory was made from one parcel to another in the square below (Figure 2). Its surface area of 7,076 m which extends over a length of 116 m and a width of 61 m.

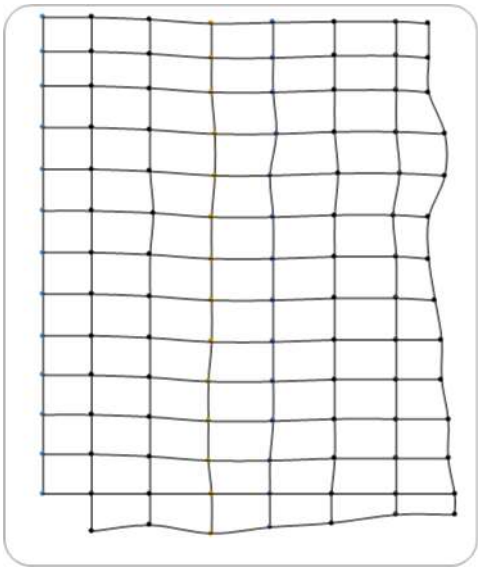

Fig. 2. The Botanical Garden

2.2 MATERIALS

To carry out this field work, the following instruments have used:

- A pruner for the collection of samples;
- Papers, Sheets and presses to form herbariums;
- Notebooks, pencils, ball pens and markers for taking notes.

2.3 METHODS

2.3.1 FLORISTIC INVENTORY

The investigation covered the whole garden. The inventory was carried out randomly parcel by parcel following the order of rows and rows.

2.3.2 ANALYSIS OF BIOLOGICAL TYPES AND ECOLOGICAL SPECTRUM

2.3.2.1 BIOLOGICAL TYPES

For a given species, the biological type refers to the set of anatomical and morphological devices that characterise its vegetative apparatus and conspicuous its port and physiognomy [8]. The different biological types obtained in this work are defined according to the classification of [9], adopted in tropical regions by many authors [10]; [11]. The different biological types obtained in this work are defined according to the classification of [9], adopted in tropical regions by many authors [10]; [11].Depending on the nature and degree of protection of buds and seedlings during the period Rigorous, the following types are distinguished:

- **The phanerophytes**

All plants whose persistent buds or shoots are located at a significant distance on the aerial axes endowed with a more or less long persistence.

A. Woody or erect phanerophytes:

All plants that are generally erected and necessarily have a fully woody architecture regardless of their size.

- MgPh: Mégaphanérophytes, trees whose tender organs are situated above 30 cm from the ground;
- Hcts: Mésophanérophytes, organ trees located between 10 and 30 cm above the ground;
- McPh: Microphanérophytes, shrubs with buds between 4 – 10 cm from the soil;
- NPh: Nanophanérophytes; Subshrubs with young shoots at a height of between 0.4 – 4 cm.

B. Creepy or climbing phanerophytes (Phgr)

These are lianas that can reach a considerable thickness and easily climb up to the top of the trees using various fastening modes. There are some types:

- Voluble and propped Up (Phgrv): Lianas winding around their support thanks to their little Woody end, voluble;
- A spins and hooks (Phgrc): These are lianas whose stem progression on their support is facilitated by numerous tendrils located either at the end of the branches or at the nodes or leaf insertion;
- Herbaceous (Phgrh): small creeping vines, subwood or belatedly lignified.

- **Geophytes**

They are plants possessing a shoot apparatus whose buds are in the soil; It includes:

- Grh: Geophytes rhizomatous; Plants having perennial organs, or rhizomes;
- Gtu: Geophytes tuberous; Plants having perennial organs of tubers.

2.3.2.2 TYPES OF DIASPORES

1. The dissemination of diaspores plays an essential role in forest Dynamics [12] in [13]. Thus, the diaspores of the species identified in the set of phytosociological surveys carried out were determined from the literature [14], [15] and [13]. They meet the categories defined by [16] and [17].

2. Autochores

Diaspores not showing any obvious adaptation to any external dispersion agent. We can distinguish in this category:

- Ballochores (Ballo): Diaspores ejected by the plant itself;
- Barachores (Baro): Diaspores characterized by their weights and the absence of another characteristic with dispersion.

3. Hétérochores

The diaspores are fitted with appendages and extremely light or wrapped in fleshy layers. In this group we have:

- Pléochores (Pléo): Diaspores having a flotation device;
- Pogonochores (Pogo): Diaspores with feathery appendages, hairs and egrets;
- Ptérochores (Ptéro): Diaspores with winged appendages;
- Sarcochores (Sarco): Diaspores provided with fleshy outer layers and marrow;
- Sclérochores (Scléro): diaspores hanging or adhesive.

2.3.3 DYNAMICS OF THE GARDEN

It is based on a few fundamental processes: reproduction (flowering, pollination, fruiting, spreading and germination), growth and death of individuals or species.

In the ecological sense and according to [18], the dynamic is a characteristic of the phytocenoses which is manifested by the natural evolution of plants taking over the same area to get closer to the climax.

Figure 3 presents the S. Lisowski Botanical Garden with some lighthouse species.

Fig. 3. Some lighthouse species and the undergrowth of the Botanical garden S. Lisowski (Faculty of Science, University of Kisangani)

3 RESULTS

3.1 FLORISTIC AND TAXONOMIC ANALYSIS

The floristic inventory of families and species collected in the garden is given below. The following elements accompany these species: biological type (TB), diaspores type (TD) and phytogeographic distribution (DP).

3.1.1 BIOLOGICAL TYPES

Overall, the study of the current composition of the flora of the Botanical Garden of the Faculty of Sciences gave 541 individuals belonging to 221 species, 183 genera grouped in 60 families, 31 orders and 4 branches. The majority of these species are Spermaphytes; the pteridophytes are almost not represented.

We present in the Fig. 4 the different biological types.

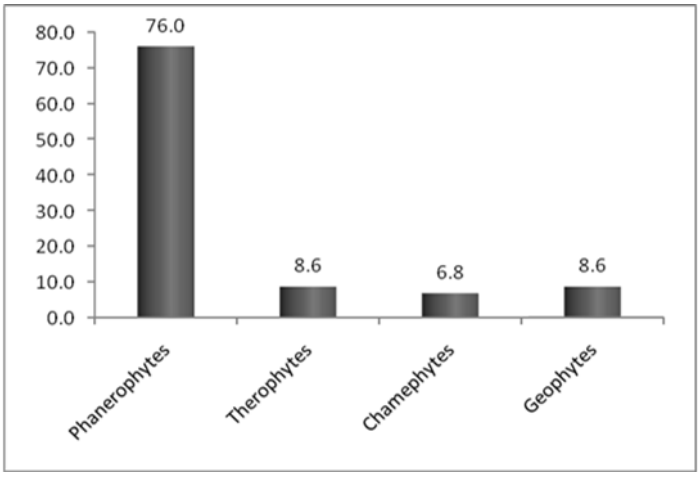

Fig. 4. Biological Types

From this graph, it appears that the phanerophytes are dominant (mésophanérophytes: 200 individuals, or 36.97%, followed by microphanérophytes: 169 individuals, or 31.24%, then, mégaphanérophytes and phanerophytes climbers). In total, phanerophytes represent 76%, while other biological types are less dominant.

3.1.2 TYPE OF DIASPORES

In the following figure, we present the different types of diaspores:

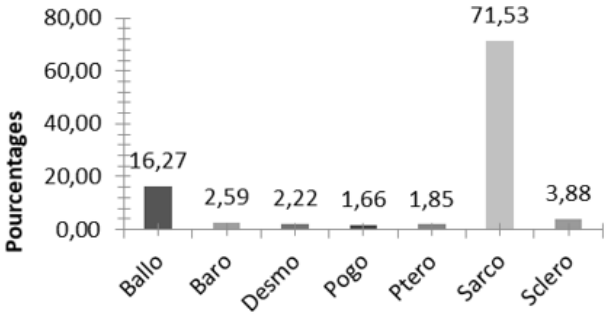

Fig. 5. Type of Diaspores

This graph reveals that the majority of species identified are disseminated by Sarcochorie with 71.53% followed by Ballochorie 16.27%; However, Pogonochores and Ptérochores are less represented with 1.66% and 1.84% respectively.

3.1.3 PHYTOGEOGRAPHIC DISTRIBUTION

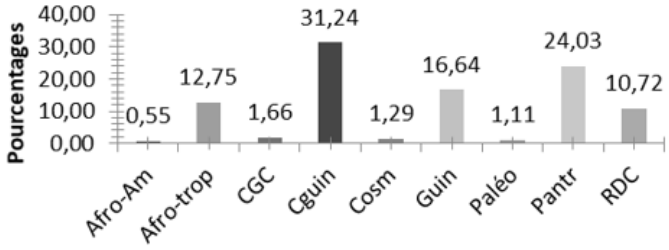

Fig. 6. Phytogeographic Distribution

This figure shows a clear predominance of guineo-Congolese species with 31.24%, followed by pantropical species with 24.03%; After come the Guinean species with 16.64%. The other species are less represented.

3.1.4 DENSITY

3.1.4.1 SPECIES DENSITIES

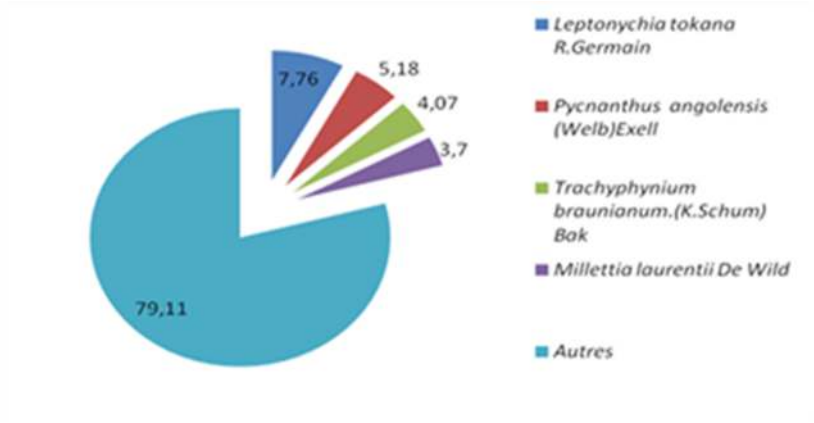

Fig. 7. Species densities

From this graph, it is apparent that the greatest relative density is that of the species Leptonychia Tokana R. Germain with 7.76%; This is followed by species Pycnanthus angolensis (Welb.) Exell, Trachyphrynium Braunianum. (K. Schum.) Bak and Millettia laurentii from Wild.

3.1.4.2 FAMILY DENSITIES

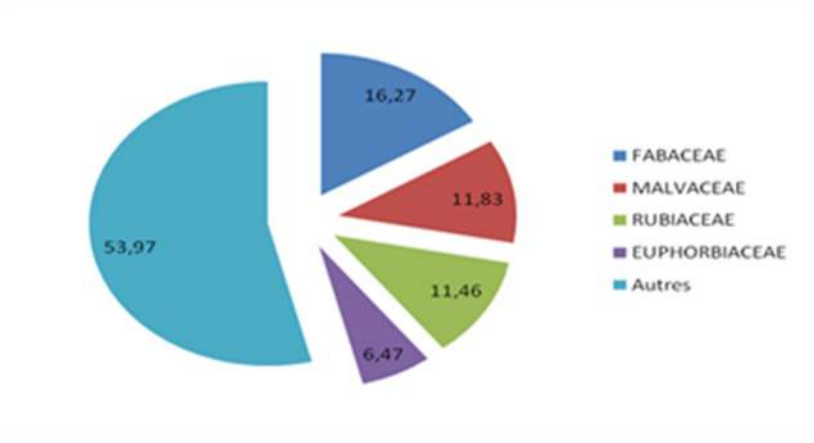

Fig. 8. Density of families

The relative densities of the highest families are observed in the following families: *Fabaceae* with 16.27%, *Malvaceae* with 11.83%, *Rubiaceae* with 11.46%, *Euphorbiaceae* with 6.47%. The other families are poorly represented.

3.1.5 GARDEN DYNAMICS

3.1.5.1 BASAL AREA

Fig. 9. Basal area

It follows from this graph that the species Milicia excelsa occupies the largest basal area with 2.49%, followed by Pycnanthus angolensis with 2.47% and Cola gigantea with 2.14%.

3.1.5.2 PHYSIOGNOMY OF THE GARDEN

[19] in [20] defines the physiognomy of a forest as a morphological organization of elements and strata dominated by biological forms and well-defined taxa. The garden is already a forest. In fact, a forest is a closed tree formation. In its structure, we distinguish the following elements:

- **The trees**: they form the upper or the tree stratum. Depending on the size of their casks and the height reached, they can be divided into three categories:

- Trees with dbh greater than 50 cm: are mostly trees that emerge from the garden.
- Trees with dbh between 30 and 50 cm. Form the middle category.
- Trees with dbh less than 30 cm. They are made up in most cases, individuals who are growing. B. **Shrubs**: Usually have a dbh less than 10 cm. They form with the large grasses of the monocotyledons, the shrub layer having an estimated height of 1 – 5 m. Among the shrubs, there are those that merge with the young trees and usually have a dbh of at least 5 cm.

- **Herbs:** Apart from the large herbs that are associated with shrubs (Marantaceae), we find in this garden a good number of species that form the low herbaceous stratum.
- **Lianas:** Some lianas species have developed well in the garden, such as Cnetis ferruginea.
- **Stranglers**: Plants of the genus Ficus strangle stipes of Elaeis guineensis and trunks of other trees.
- **The epiphytic**: Beside the Stranglers, there are many plant species that live as epiphytic

3.1.5.3 DOMINANCE OF FAMILIES

Family dominance is given in Figure 10 below:

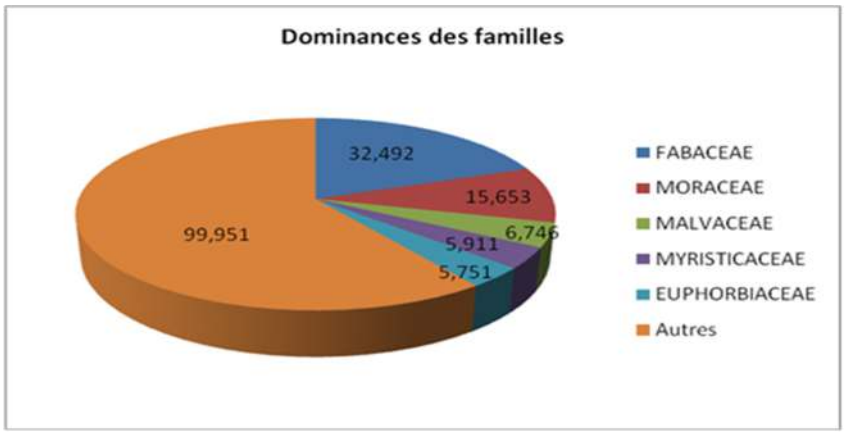

Fig. 10. Dominance of families

This figure shows that the following families are dominant: *Fabaceae, Moraceae, Euphorbiaceae, Malvaceae, Myristicaceae.*

3.1.5.4 DOMINANCE OF SPECIES

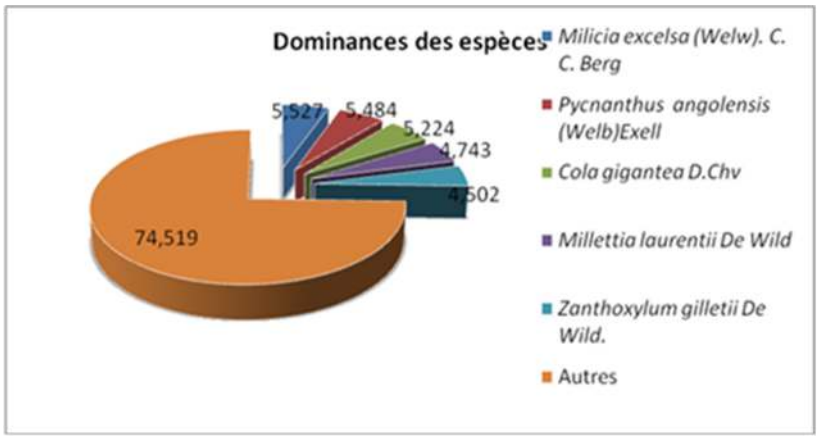

Fig. 11. Species dominance this figure reveals that the following species are dominant Milicia excelsa, Pycnanthus angolensis, Cola gigantea.

3.1.5.5 EXTINCT SPECIES

In total, 98 species that existed at least once in the garden are no longer present.

The analysis of this list shows that most of these extinct species are ornamental plants such as *Plumeria acuminata, Thevettia neriifolia, Bixa Orellana, Allamanda cathartica, Agave americana,* spontaneous species such as *Talinum triangulare, Bridelia ndellensis, Thunbergia erecta,* plants that are maintained only in the cultivated state as Pineapple *Ananas comosus, Dioscorea bulbifera* and also exotic plants from temperate areas such as *Cycas Circinalis, Cyperus Distans.*

3.1.5.6 NEWLY EMERGED SPECIES

The new species identified during this work and which are not included in the previous work are 17 (table presenting the different species newly appeared in the Garden Lisoswki new species: *Alchornea floribunda, Amaranthus viridis, Antiaris Toxicana, Bidens pilosa, Akbar Kirkii, Cassia occidentalis, Catharanthus roseus, Cleome Spinoza, Cynodon typistn, Desplatsia dewevrei, Euphorbia hirta, Musa sp, Oxyanthus speciosus, Paspalum virgatum, Physalis micrantha, Portulaca oleracea, Scaphopetalum thonneri.*

Among them, we find the forest species such as *Scaphopetalum thonneri, Akbar Kirkii, Desplatsia Dewevrei* and also plants grown as *Solanum Melongena*, Musa sp. Other species are ruderal and ségetales species.

3.1.5.7 THE DYNAMIC SPECIES OF THE GARDEN

At this point we hold some species like *Millettia laurentti, Craterispermum Cerinanthum, Averrhoa Pilea, Leptonychia Tokana, Tricalisia bequaertii, Pseudospondias microcarpa.*

3.1.5.8 THE SENESCENT SPECIES OF THE GARDEN

These species are characterized by the ageing of the organs. Among these, we have the species *Musanga cecropioides, Myrianthus arboreus, Anonidium mannii, Pericopsis elata.* Others are cultivated plants such as *Psidium Guajava, Aristolochia rangens*.

4 DISCUSSION

This work focuses on the spatial and temporal dynamics of the garden. Overall we obtained 541 individuals divided into 221 species, 60 families.

In this chapter we will try to compare our results with those of the other authors to assert or refute the following hypotheses:

- the garden would be in a state of evolution towards a natural forest;
- some species of origin would have disappeared in the garden due to environmental conditions;
- the garden would contain a number of the Recrus.

4.1 BIOLOGICAL TYPES AND THOSE OF OTHER BIOTOPES

The comparison of biological types shows a massive dominance of phanerophytes in our florule. This reflects the forest nature of our environment and it's belonging to the equatorial climate region where the flora is composed essentially of 88% of Phanerophytes [21].

This also confirms the low proportion of chaméphytes and geophytes by the fact that the large proportions of phanerophytes would be the consequence of development-friendly climatic factors which reduces the proliferation of herbs, which form the groups of Geophytes, Chaméphytes and Thérophytes.

4.2 FLORISTIC COMPARISON

We compared the flora of the botanical garden Stanislas with that of the forest at *Gilbertiodendron dewevrei* de MASAKO [22]; De *Brachystegia laurentii* de YOKO [23] and that of the same medium at 1996 [20] in this table.

Table 1. Comparaison

Forest Type	MASAKO	YOKO	J.B 1996	J.B 2011
Number of species	270	304	332	221
Ptéridophytes	10	13	10	5
Spermaphytes	260	291	321	208
Gymnosperms	1	1	2	1
Angiosperms	259	290	261	194
Monocots	37	32	59	32
Dicots	223	258	261	162

This table shows that our medium is essentially composed of the Spermaphytes among which the flowering plants are very abundant while the gymnosperms are less represented.

4.3 INTERPRETATIONS OF SPECIES DYNAMICS

Dispersal of species depends on the combination of ecological and migratory factors of species [24] cited by [20]. The physical environment and especially the climate play a major role in the dynamics of species.

- **Extinct species**

The extinct species are in most of the cultivated plants. From our observations we say that these species have not found good ecological conditions for their development. This would be the main cause but then the exotic plants were unable to withstand without favorable conservation conditions especially since they were removed in their ecological environment.

The *Ananas Comosus* species would be extirpated by the non-renewal of its cycle and other ruderal species would be extirpated by the influence of large trees and the lack of maintenance of the garden. There would also be species extinct by human action such as *Zingiber officinalis*, *Discorea bulbifera*, Citrus lemon by cutting organs (leaves, stems, flowers, roots).

- **Newly installed species**

Some other species were newly emerged as *Akbar Kirki, Antiaris Toxicana, Desplatsia Dewevrei, Scaphorpetalum tonneri* others were mostly spontaneous, allegedly brought by Zoochorie.

- **Dynamic species**

These are species that are resistant to the current ecological conditions of the garden, we believe that these are species that have found conditions similar to those in their home environment or simply they are indifferent species that Adapt to several biotopes. These species such as *Bridelia Atroviridis Mull. Arg, Funtumia africana (Benth). Staf, Carterispermum cerinanthum Heirn, Pseudospondias microcarpa (A. Rich) Eng, Musanga Cecropioides R.Br., Myrianthys Arboreus. P. Beauv; Scaphopetalum Thonnerii from Wild.* ; are considered as secondary forest species according to [21].

Other species are found to be characteristic of climax forests *Piptadeniastrum africana (Hook. F), Albizia Lebbeck (L) Beth, Milicia excelsa (WELW). C. C. Berg, Isolona Hexaloba Engl & Diels, Gilbertiodendron dewevrei J. Léornard;* According to [10] and [25]; this shows us that our study environment already has a start to a natural forest. Most shrubs that are dynamic are those that support shading conditions like; *Leptonychia Tokana R. Germain, Cathium vulgaris (K. Schum) Bull., Theobroma cacao L, Averrhoa pilea l, Hura crepitans L, Tricalysia bequaertii, Carterispermum cerinanthum Hiern,*

5 CONCLUSION AND SUGGESTIONS

The present work focused on the dynamics of the garden, 541 individuals were inventoried and distributed in 221 species, 183 genera 60 most important families are: *Fabaceae, Moraceae, Euphorbiaceae, Malvaceae, Myristicaceae.*

The florule studied is rich in Spermaphytes. The flowering plants form, almost only the flora of this territory; The Gymnosperms show only 0.22%. This is a characteristic of tropical forests marked by poverty in gymnosperms.

The comparison of our results with previous work reveals the disappearance of 98 species that are lost over time by the non-adaptation to environmental conditions of the environment, the lack of maintenance of the garden, the absence of conditions favorable to Development. The same comparison found 16 newly installed species, not reported in previous work.

REFERENCES

[1] KUKUPULA, M., 2009 : Etude de la dynamique spatio-temporelle de *Megaphrynium macrostahyum* (Bentu) Milne-renead (Marantaceae) dans la Réserve de la YOKO (Kisangani RDC) DEA inédit FS 70 p.

[2] RICHARD, F., 2008 : Des forêts des bois 121 pp.

[3] PONCEBLANC, M., 2000 : Science de la vie et de la terre, 223 p. Edition: Cécile colonna-zunguin

[4] DEBAL, A., LANATA, F., MADUNGU, A., 2010 : Les jardins botaniques en RDC 34p

[5] TOIRAMBE, B., 1986 : Inventaire des plantes cultivées au jardin botanique de la Faculté des Sciences de Kisangani, Monographie inédit FS, 36pp.

[6] Reynaud-Farrera, I., Maley, J. & Wirrmann, D. 1996. Végétation et climat dans les forêts du Sud-Ouest Cameroun depuis 4770 ans B.P. analyse pollinique des sédiments du lac Ossa. C. R. Acad. Sci. Paris, Série 2a, 322, 749–755.

[7] M. NYAKABWA. Phytocenose de l'écosystème urbain de Kisangani (RDC). Thèse de doctorat, Faculté des Sciences, Université de Kisangani, République démocratique du Congo, 1982.

[8] LEBRUN, J. et Gilbert, G., 1954 : une classification écologique des forêts du Congo. Pub INEAC sér. Scient. N° 63 Pages

[9] RAUNKIAER, C. 1934. – The life forms of plants and statistical plant geography. Oxford Univ. Press, Oxford.

[10] LEBRUN, J, et GILBERT, G., 1954 : Une classification écologique des forêts du Congo. Publ. INEAC, série SC ; 800p.

[11] SCHNELL 1971, R. 1971. – Introduction à la phytogéographie des pays tropicaux. Vol. II : les milieux, les Groupements végétaux. Gauthier-Villars, Paris : 951p.

[12] FORGET, C. & Penelon, A. 1999. – Ecocertification de bois tropicaux. L'écologie par l'économie. Revue Canopée n° 15, pp11-16.

[13] LOMBA, B., 2007 : Contribution à l'étude de la phytodiversité de la réserve forestière de la YOKO (Ubundu, R.D.Congo) DES, Faculté des Science, UNIKIS 72p + annexe

[14] NSHIMBA, S, 2005 : Etude floristique écologique et phytosociologique de forêt inondée de l'ile Mbiye à Kisangani (RDC) DEA Faculté des Sciences, UNIKIS 101p + annexe.

[15] 15. BOYEMBA 2008 : Régénération naturelle post-exploitation dans le sous-bois des forêts denses humides d'Ubundu à Kisangani, RDC *Ann. Fac. Sci. Unikis 13 :49-59*

[16] DANSEREAU, P. & Lems, K. 1957. – The grading of dispersal types in plant communities and their Ecological significance. Contrib. Inst. Bot. Univ. Montréal, 71: 52 p.

[17] LANDE, R., DEVRIES, P. J. and Walla, T. R. 2000. When species accumulation curves intersect: implications for ranking diversity using small samples. Oikos 89: 601- 605.

[18] MOKBONDO, L., 1999 : Contribution à étude de la dynamique du sous-bois de l'arboretum de Kisangani Mémoire inédit, FS, 38 p.

[19] GOUNOT, M. 1969 – Méthode d'étude quantitative de la végétation. Ed. Masson & Cie, Paris, 314 p.

[20] GOUNOT, M., 1969. - Méthodes d'étude quantitative de la végétation. Masson et Cie, Paris, 314p.

[21] KASERAKA, S., 1999 : Flore et aspect dynamique du jardin botanique de la Faculté de Sciences, Mémoire inédit FS, UNIKIS 59p.

[22] NYAKABWA, M., 1976 : Flore urbaine de Kisangani, Mémoire inédit FS, UNIKIS, 228 p.

[23] MAKANA, M., 1984 : Contribution à l'étude de l'humide du sol de différents biotopes de la FS de l'UNIKIS. Monographie inédit, 38p

[24] UMUNAY, M., 2004 : Contribution à l'étude floristique de la forêt à *Brachystegia laurentii* (De Wild.) Louis de la réserve forestière de la YOKO. Mémoire inédit FS , 52p

[25] GODRON, M., POISSONET, J. et POISSONET, P., 1967. - Méthodes d'étude des formations herbacées denses. Essais d'application à l'étude du dynamisme de la végétation. Document n° 35J C.N.R.S.C.E.P.E., Montpellier, 28p.

[26] GILBERT, G. & Troupin, G. 1951. - Flore du Congo Belge et du Rwanda-Urundi. Spermatophytes. Myristicaceae, vol.II, Publ. I.N.E.A.C, Bxl, pp 390-399.

[27]

ANNEXES

FLORISTIC LIST

FAMILY	SPECIES	TB	TD	DP
ACANTHACEAE	*Acanthus montanus (Nees) T. Anders*	NPh	Ballo	Guin
	Asystasia gangetica (L) T.Ander	Chd	Ballo	Pantr
	Graptophyllum pictum (L) Griffith	Phgr	Ballo	Cguin
	Pseuderanthemum ludovicianum	Chr	Sarco	Guin
	Sanchezia nobilis Hook.F.	NPh	Ballo	Pantr
AMARANTHACEAE	*Amaranthus viridis L.*	Thd	Sclero	Cosm
	Cyathula prostata (L.) Blume.	Thd	Desmo	Pantr
ANACARDIACEAE	*Antrocaryon nanannii (Oliv) Engl*	MsPh	Sarco	Cguin
	Lannea welwitschii (Hiern) Engl	MsPh	Sarco	Guin
	Mangifera indica L.	MsPh	Sarco	Pantr
	Pseudospondias microcarpa A.Rich	MsPh	Sarco	Afr-trp
	Spondias cytherea Sonner.	MsPh	sarco	Paléo
	Spondias mombin L.	MsPH	Sarco	Afr-trp
ANNONACEAE	*Anonidium mannii (Oliv)Engl Diel*	MsPh	Sarco	Cguin
	Cananga odorata (Lam.) Hook.F.	MsPh	Sarco	Pantr
	Isolona congolana Engl & Diels.	MsPh	Sarco	Guin
	Isolona hexaloba Engl & Diels.	MsPh	Sarco	Cguin
	Monodora angolensis Welw.	MsPh	Sarco	Cguin
	Monodora myristica (Gaerth.) Dunal.	McPh	Sarco	Guin
	Xylopia aethiopica (Dunal). A. Rich.	MsPh	Sarco	CGC
APOCYNACEAE	*Cantharanthus roseus (L.) G. Dom.*	Ch	Sarco	Pantr
	Funtumia africana (Benth).Staf.	MsPh	Pogo	Cguin
	Gongronema latifolium Benth.	PhGr	Sarco	Afr-trp
	Landolfia owariensis P.Beau.	PhGr	Sarco	Afr-trp
	Rauvolfia vomitoria Afzel.	NPh	Sarco	Guin
ARACEAE	*Anthurium andraeanum Lind.*	Gr	Sarco	Pantr
	Colocasia esculenta(L) Schott.	Grh	Sarco	Pantr
	Scindapus aeraeus Eng.	Grh	Sarco	Pantr
	Xanthosoma sagitifolia Schott.	Gb	Sarco	Pantr
ARALIACEA	*Polyscias balfouriana Bailey.*	PhGr	Sarco	Pantr
ARECACEAE	*Areca cathecu L.*	MsPH	Sarco	Pantr
	Arenga pinnata (Wurmb) Mirril.	McPh	Sarco	Pantr
	Borassus aethiopum Mart.	MsPh	Sarco	Afr-trp
	Elaeis guineensis Jacq.	McPh	Sarco	Guin
	Raphia gilleti (De Wild.) Becc	MsPh	Sarco	Afr-trp
	Rostonea regia O.F.Cook	PhGr	Sarco	Pantr
ARISTOLOCHIACEAE	*Aristolochia ringens Vahl.*	McPh	Ballo	Guin
ASPARAGACEAE	*Cordiline terminalis Kunth*	McPh	Sarco	Pantr
	Dracaena arborea (Wild) Link	NPh	Sarco	Guin
	Dracaena nitens Welw	McPh	Sarco	Afr-trp
	Sansevieria trifasciata Prain	Gr	Sarco	Pantr
ASPLENIACEAE	*Asplenium africanum Desv*	Grh	Sclero	Pantr
ASTERACEAE	*Ageratum conyzoides L.*	Thd	Desmo	Pantr
	Bidens pilosa L.	Thd	Desmo	Pantr
	Eleutheranthera ruderalis SW.	Thd	Ptero	Pantr
	Synedrella nodifolia Gaerth	Thd	Ptero	Pantr
	Vernonia amygdalina Del.	McPh	Pogo	Afr-trp
BIGNONIACEAE	*Fernandoa adolfi- frederici Heine*	MgPh	Ptero	RDC
	Kigelia africana (lam) Benth	MsPh	Baro	Afr-trp
	Newbouldia laevis Seem.	McPh	Sarco	Afr-trp

CARICACEAE	*Carica papaya L.*	McPh	Ballo	Pantr
CLEOMACEAE	*Cleome spinosa Jacq.*	Thr	Sclero	Cosm
CLUSIACEAE	*Garcinia cola Heckel*	MgPh	Sarco	Guin
	Mammea africana Sabine	MgPH	Sarco	Cguin
COMBRETACEAE	*Combretum lokele Liben*	MgPh	Ptero	RDC
	Terminalia superba Engl& Diels	MsPH	Sarco	Guin
COMMELINACEAE	*Palisota hirsuta (Thumb) K. schum*	Chd	Sarco	Cguin
	Zebrina pendula Schnitzl	Chpr	Sarco	Pantr
CONNARACEAE	*Cnestis ferruginnea DC*	PhGr	Sarco	Cguin
CONVOLVULACEAE	*Ipomoea involucrata Beauv*	Gt	Sarco	Afr-trp
	Ipomoea mauritiana Jacq	Gt	Sarco	Pantr
COSTACEAE	*Costus lucanusianus J.Braun*	Gr	Sarco	Pantr
	Costus phyllocephalus K. Schum	Gr	Sarco	Pantr
CUCURBITACEAE	*Coccinea barteri(Hook.F) Keay*	PhGr	Sarco	Afr-trp
	Lagenaria breviflora Benth	Thgr	Sarco	Afr-trp
	Momordica charantia L.	Thgr	Sarco	Pantr
EUPHORBIACEAE	*Acalypha neptunica Mull.Arg*	NPh	Sarco	Cguin
	Alchornea cordifolia	McPh	Sarco	Afr-trp
	Alchornea yambuyaensis De Wild.	NPH	Sarco	Guin
	Bridelia atroviridis Mull. Arg.	McPh	Sarco	Afr-trp
	Croton haumanianus J.Léonard	MsPh	Sarco	Cguin
	Dichostema glaucescens Pierre	McPh	Sarco	Cguin
	Euphorbia hirta L.	Thr	Sclero	Pantr
	Hevea brasiliensis (Willd.).Mull.Arg	MgPh	Ballo	Pantr
	Hura crepitans L	MsPh	Sarco	Pantr
	Jatropha curcas L.	McPh	Sarco	Cguin
	Macaranga spinosa Mull.Arg.	MsPh	Sarco	Cguin
	Manihot esculenta Crant	Gt	Ballo	Pantr
	Maniophyton fulvum Mull.	MsPh	Ballo	Cguin
	Ricinodendron heudelotii Pierre	MsPh	Sarco	Pantr
	Tetrorchidium didymostemon Pax	MsPh	Sarco	Pantr
FABACEAE	*Acassia sp.*	MsPh	Ballo	Guin
	Acassia kirkii Oliv	MsPH	Ballo	Afrotrp
	Afzelia bella Harms	McPh	Sarco	Cguin
	Albisia gummifera	MsPh	Ballo	Guin
	Albizia chinensis (Osbeck) Merril	MsPh	Ballo	Guin
	Albizia ferruginea (Guill. &Pierre)	McPh	Ballo	Guin
	Albizia lebbeck (L) Beth	MsPh	Ballo	Guin
	Anthonotha macrophylla. P. Beauv	MgPh	Ballo	Guin
	Aphanocalyx cynometroides Oliv	MsPH	Ballo	Paléo
	Baikiaea insignis Benth subsp.	MsPh	Ballo	CGC
	Cassia fructicosa Mill	MsPH	Ballo	AfrAm
	Cassia hirsuta L.	NPH	Ballo	Pantr
	Cassia occidentalis L.	NPH	Baro	Pantr
	Cassia siamea Lam	NPH	Ballo	AfrAm
	Cassia Spectabilis DC	McPh	Baro	Pantr
	Centrosema pubenscens Benth	McPh	Desmo	Cguin
	Dalbergia laxiflora Micheli	Phgr	Desmo	Afr-trp
	Dalhousia africa S. Moore	PhGr	Desmo	RDC
	Delonus regia Raf.	MsPh	Baro	Cguin
	Dioclea reflexa Hook.F	PhGr	Desmo	Cguin
	Gilbertiodendron dewevrei J.L.	MsPh	Baro	Cguin
	Leeucaena leucocephala Lam.	McPh	Sarco	Pantr
	Millettia drastica Welw	MsPh	Ballo	Cguin
	Millettia elskensii De Wild	Phgr	Ballo	Cguin
	Millettia harmsiana De Wild	Phgr	Ballo	Pantr

	Millettia laurentii De Wild	MsPh	Ballo	Cguin
	Millettia versicolor. Welw. Ex. Bak	MsPh	Ballo	Cguin
	Monopetalantus microphyllus.Harms	MgPh	Baro	Cguin
	Panchyelasma tessmanii (Harms) Harms	MsPh	Sarco	Afr-trp
	Paramacrolobium coerulum J. Leonard	McPh	Sarco	Pantr
	Pentaclethra macrophylla Benth	MsPh	Ballo	Guin
	Pericopsis elata (Harms) van Meeuven	MgPh	Ballo	RDC
	Piptadeniastrum africana (Hook.F) Brenan	MgPh	Ballo	Guin
	Pterocarpus soyauxi Taub	MgPh	Sarco	Cguin
	Scorodophloeus zenkeri Harms	MgPH	Ballo	Afr-trp
	Tamarindus indica L	McPh	Ballo	Cguin
	Tetrapleura tetraptera Thonn	McPh	Ballo	RDC
	Vigna racemosa Hutur & Dalz	Chgr	Sarco	Pantr
	Vigna vexillata (L) Benth	Chgr	Desmo	Pantr
IRVINGIACEAE	*Irvingia gabonensis Ex. O'Rooke*	MgPh	Sarco	Cguin
	Irvingia grandifolia (Eng).Eng	MgPh	Sarco	CGC
LAMIACEAE	*Clerodendrum Schweinfurthii Gur*	PhGr	Sarco	Cguin
	Congea velutina vight	PhGr	Sarco	Afr-trp
	Solenostemon monostachyus P. Beauv.	Thd	Sarco	Afr-trp
	Tectonia grandis. L	MsPh	Sarco	Pantr
	Vitex welwitshii Gurke	MsPh	Sarco	Cguin
LAURACEAE	*Persea americana Mull.*	MsPh	Sarco	Pantr
LECYTHIDACEAE	*Petersianthus macrocarpus Liben*	MgPh	Ptero	Guin
LILIACEAE	*Curculogo recurvata Ait.*	MsPh	Sarco	Cguin
LINACEAE	*Hygonia plastysepala welw. Ex oli*	Phgr	Sarco	Guin
MALVACEAE	*Laportea aestturans (L) Chew*	Thd	Desmo	Pantr
	Cola gigantea D.Chv	McPh	Sarco	Cguin
	Desplasia dewevrei De Wild. &Th.	McPh	Sarco	Guin
	Gluphaea brevis (Spreng.) Monach	McPh	Sclero	Afr-trp
	Hibiscus schizopetalus(Mast) Hoddof	NPh	Sarco	Afr-trp
	Leptonychia tokana R.Germain	McPh	Sarco	RDC
	Malvaviscus arboreus CAV	NPh	Sarco	Pantr
	Pachira acquatica Aublet	McPh	Pogo	Pantr
	Pterygota bequaertii De Wild	McPh	Sarco	Cguin
	Scaphopetalum thonnerii Dewild. & Th.Dur.	McPh	Sarco	Cguin
	Sida acuta Burn	Chd	Desmo	Pantr
	Theobroma cacao L	McPh	Sarco	Pantr
	Urena lobata L.	Chd	Desmo	Pantr
MARANTACEAE	*Ataenidia conferta (Bentz) K.*	Grh	Sarco	Guin
	Trachyphynium braunianum.(K.Schum) Bak	PhGr	Sarco	Guin
MELASTOMATACEAE	*Bellucia aubletii Seem*	McPh	Sarco	Afr-trp
MELIACEAE	*Antandrophragma candolei Harms*	McPh	Ptero	CGC
	Carapa procera DC.var procera	MsPh	Sarco	RDC
	Entandrophragma utile Sprague.	MsPh	Ptero	Guin
	Trichilia welwitshii C.DC	MsPh	Sarco	CGC
MENISPERMACEAE	*Cisampelos owariensis P. Beauv.*	Phgr	Sarco	Guin
MORACEAE	*Antiaris toxicana Well.*	MsPh	Sarco	Afr-trp
	Artocarpus insisa L. F	MsPh	Sarco	Pantr
	Ficus asperifolia Miq.	MsPH	Sarco	Afr-trp
	Ficus bubu Warb	MsPh	Sarco	Cguin
	Ficus seretti lebrun & Boutique	MsPH	Sarco	Cguin
	Ficus sp	MsPh	Sarco	Afrotrp
	Ficus valis -choudae Del	MsPh	Sarco	Afrotrp
	Milicia excelsa (Welw). C. C. Berg	MgPh	Sarco	Cguin
	Musanga Cecropioides R.Br.	MsPh	Sarco	Cguin

	Myrianthys arboreus .P.Beauv	McPh	Sarco	Guin
	Trilepisium madagascariensis DC	MsPh	Sarco	Cguin
MUSACEAE	*Musa sp*	Grh	Sarco	Pantr
MYRISTICACEAE	*Pycnanthus angolensis Welb*	MsPh	Sarco	Cguin
	Staudia gabonensis Warb	MsPh	Sarco	Cguin
MYRTACEAE	*Psidium guajava L*	McPh	Sarco	Cguin
	Syzygium congolensis Vermoeser.ex.Amsh	MsPh	Sarco	Cguin
	Syzygium jambos (L) Aloton	MsPh	Sarco	Afr-trp
NEPHROLEPIDACEAE	*Nephrolepis acutifolia (DSV) Chuist*	G epi	Sclero	Pantr
	Nephrolepis biserata (S.W) Alston	Grh	Sclero	Cguin
OCHNACEAE	*Rhabdophyllum arnoldinum De Wil*	McPh	Sarco	Cguin
OXALIDACEAE	*Averrhoa carambola L*	McPh	Sarco	Pantr
	Oxalis barrelieri L.	Thd	Sarco	AfrAm
PANDANACEAE	*Pandanus Sanderi Mast*	McPh	Sarco	Pantr
	Pandanus pacificus.Weitch	McPh	Sarco	Pantr
PHYLLANTHACEAE	*Breynia nivosa (W.G.Sm) Small*	McPh	Sarco	Pantr
	Phyllantus niururi L.	Thd	Ballo	Paléo
	Uapaca guineensis Mull.Arg	MsPh	Sarco	Cguin
PIPERACEAE	*Peperomia pellucida (L) H.B. et K*	Thd	Sarco	Pantr
POACEAE	*Bambusa vulagaris Schrad.*	MsPh	Sclero	Afr-trp
	Cynodon dactylon (L.) Pers.	Ch	Sclero	Cosm
	Panicum brevifolium L	Thr	Sclero	Paléo
	Panicum maximum L.	Ch	Sclero	Pantr
	Panicum repens L	Grh	Sclero	Pantr
	Paspalum conjugatum Berg	Chr	Sarco	Pantr
	Paspalum virigatum Steud.	CH	Sclero	Cosm
POLIPADIACEAE	*Microsorium punctatum (L) copel*	G épi	Sclero	Cosm
	Phymatosorus scolopendria Pic.	G épi	Sclero	Cosm
PORTULACACEAE	*Portulaca oleracea Link.*	TH	Ballo	Pantr
RUBIACEAE	*Cathium vulgaris (K.Schum) Bull*	PhGr	Sarco	Afo-trp
	Coffea canephora Pierre	NPh	Sarco	Pantr
	Coffea robusta Pierre.	McPh	Sarco	RDC
	Craterispermum cerinanthum Heirn	McPh	Sarco	Cguin
	Heinsia crinita (Afzel) G. Tayl	McPh	Sarco	Guin
	Ixora coccinea (BL) DC	NPh	Sarco	Pantr
	Ixora javanica L	NPh	Sarco	Pantr
	Morinda lucida Benth	MsPh	Sarco	Guin
	Oxyanthus speciosuis DC	MsPH	Sclero	Cosm
	Oxyanthus unilocularis Hierm	MgPh	Sarco	Guin
	Pauridianta callicarpoide (Heirn Bremek)	MsPh	Sarco	Cguin
	Tricalisia bequaertii De Wild	McPh	Sarco	Cguin
	Trilepisium madagascariensis DC	MsPh	Sarco	Cguin
RUTACEAE	*Zanthoxylum gilletii De Wild.*	MgPh	Sarco	Afr-trp
	Zanthoxylum lemaeri De Wild	McPh	Sarco	Guin
SALICACEAE	*Barteria nigritiana Hook. F.*	McPh	Sarco	Afr-trp
	Caloncoba crepiniana (De Wild & Th). Gilg	McPh	Sarco	RDC
SAPINDACEAE	*Allophylus africana P.Beauv.*	McPh	Sarco	Afr-trp
	Blighia weluritschii (Hiern) Radlk	McPh	Sarco	Afr-trp
SAPOTACEAE	*Autranella concolensis De Wild*	MgPh	Sarco	Cguin
	Synsepalum Stipulatum Schum	McPh	Sarco	Guin
SOLANACEAE	*Capsicum frutescens Roxb*	NPh	Sarco	Pantr
	Physalis angulata L	Thd	Sarco	Pantr
	Physalis micrantha Link.	Thd	Sclero	Pantr
	Solanum melongena L.	Chg	Sclero	Pantr
STERLITZIACEAE	*Ravenala madagascariensis Sonne*	MsPh	Sarco	Pantr
THOMANDERSIACEAE	*Thomandersia heinsii De Wild& Th*	NPH	Ballo	Cguin

VITACEAE	*Cyphostemma adenocoulestend A.*	Chg	Sarco	Cguin
ZAMIACEAE	*Encephalarthos laurentianus De Wild.*	MsPh	Sarco	Afr-trp
ZINGIBERACEAE	*Afromomum sanguineum (K. Schum) K.*	Gr	Sarco	Afr-trp

Branch s/ Branch Class s/ Class	Order	Families	No. of species	No. of individuals
Branch : Magnoliophyta	Lilliales	Liliaceae	1	1
s/ Branch : Magnoliophytina	Asparagales	Asparagaceae	4	5
Class : Lilliopsida	Alismatales	Araceae	4	4
S/ Class : Lilliidae	Pandanales	Pandanaceae	1	3
S/Class : Commelinidae	Arecales	Arecaceae	6	20
	Commelinales	Commelinaceae	2	2
	Zingiberales	Maranthaceae	2	23
		Sterliziaceae	1	2
		Musaceae	1	1
		Costaceae	2	2
		Zingiberaceae	1	1
	Poales	Poaceae	7	8
Class Magnoliopsida	Magnoliales	Annonaceae	7	7
		Myristicaceae	2	28
	Laurales	Lauraceae	1	2
	Piperales	Aristolochiaceae	1	1
		Piperaceae	1	1
	Cariophyllales	Amaranthaceae	1	2
		Portulacaceae	1	1
Branch : Rosophytina	Rosales	Moraceae	11	23
Class : *Rosopsida*	Oxalidales	Oxalidaceae	2	19
s/Class : Eurosidae I		Connaraceae	1	5
	Ranunculales	Menispermaceae	1	1
	Vitales	Vitaceae	1	1
	Myrtales	Combretaceae	2	4
		Myrtaceae	3	7
Eurosidae II		Melastomataceae	1	1
	Fabales	Fabaceae	39	89
	Malpighiales	Irvingiaceae	2	2
		Clusiaceae	2	3
		Pandaceae	1	1
		Ochnaceae	1	1
		Phyllanthaceae	3	3
		Salicaceae	2	4
		Euphorbiaceae	9	35
		Linaceae	1	1
	Cucurbitales	Cucurbitaceae	3	3
	Malvales	Malvaceae	13	65
	Sapindales	Sapindaceae Meliaceae	2	2
		Anacardiaceae	4	8
		Rutaceae	6	22
		Caricaceae	2	5
	Brassicales	Cleomaceae	1	1
			1	1

Class : *Asteropsida*	Ericales	Sapotaceae	2	2
S/Class : Préastéridae		Lecythidaceae	1	1
	Gentianales	Rubiaceae	14	62
S/Class : Euasteridae I		Apocynaceae	5	14
	Lamiales	Acanthaceae	5	8
		Lamiaceae	5	6
		Bignoniaceae	3	7
		Thomandersiaceae	1	1
	Solanales	Solanaceae	4	4
		Convolvulaceae	2	2
	Asterales	Asteraceae	5	5
S/Class : *Euasteridae* II	Dipsacales	Araliaceae	1	1
Branch : Spermaphyta	Zamiales	Zamiaceae	1	2
S/ Branch : Pinophytina				
Class : Cycadopsida				
Branch : Pteridophyta	Filicales	Aspleniaceae	1	1
S/Branch : Pteridophytina		Nephrolepidiaceae	2	2
Class : Leptofilicidae		Polipodiaceae	2	2
Total	**31**	**60**	**221**	**541**