

**SUCCULENT ORNAMENTAL FLORA OF DAKAR / SENEGAL**

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**ABSTRACT**

The floriculture sector is expanding rapidly in Senegal and particularly in Dakar where it is noted an important plant diversity consisting of both native species and species introduced for a very long time or recently. However, ornamental succulents have been the subject of little scientific investigation. In addition, little is known about the distribution of these species in the major taxonomic groups. Objective: It is with this in mind that this study was undertaken to characterize the succulent ornamental flora identified in Dakar. It proposes to analyze the taxonomic, biological and chorological spectra. Methodology and results: To carry out this study, a traveling inventory was carried out in the various nurseries in the city of Dakar. Thus, the results showed that 35 succulent ornamental species, belonging to 20 genera and united in 12 families were identified. The most diverse genera are five (5) and include 60% of the species listed, or 21 species in total. These genera are in descending order: Kalanchoe (5 species), Euphorbia (5 species), Agave (3 species), Sansevieria (3 species) and Tradescantia (2 species). The distribution of these species in the major taxonomic groups indicates that the dicotyledons are largely predominant and represent 58.33% of families, 60% of genera, and 62.86% of species. In addition, this flora is dominated by 4 families which include 60% of the species listed, or 21 species in total. These families are: Euphorbiaceae (7 species), Asparagaceae (5 species), Crassulaceae (5 species) and Apocynaceae (4 species). This flora is mainly made up of perennial species which account for 97.14%. This flora is mainly made up of perennial species which account for 97.14%. In contrast, analysis of the chorological spectrum has shown that this flora is dominated by African and African-American species which each have 25.71 flora.

**Keywords :** Flora, Orenementale, succulent, Dakar, Senegal.

**1. INTRODUCTION**

Floriculture is a sector which is part of the axes of product diversification in Senegal where there are three areas particularly favorable to the said sector, namely Niayes, Mbour, and Casamance (NEAPB, 2016). Currently, ornamental horticultural sub-sector is expanding rapidly in Senegal and particularly in Dakar where it's noted a significant plant diversity consisting of both native species and species introduced for a very long time or recently. Indeed, it noted a significant proliferation of nurseries and ornamental gardens with the only concerns being the ornamental quality or the economic value of cultivated plants (Dieng, 2014). If at the level of floristic inventories, some studies have been made, the ornamental flora has been the subject of little

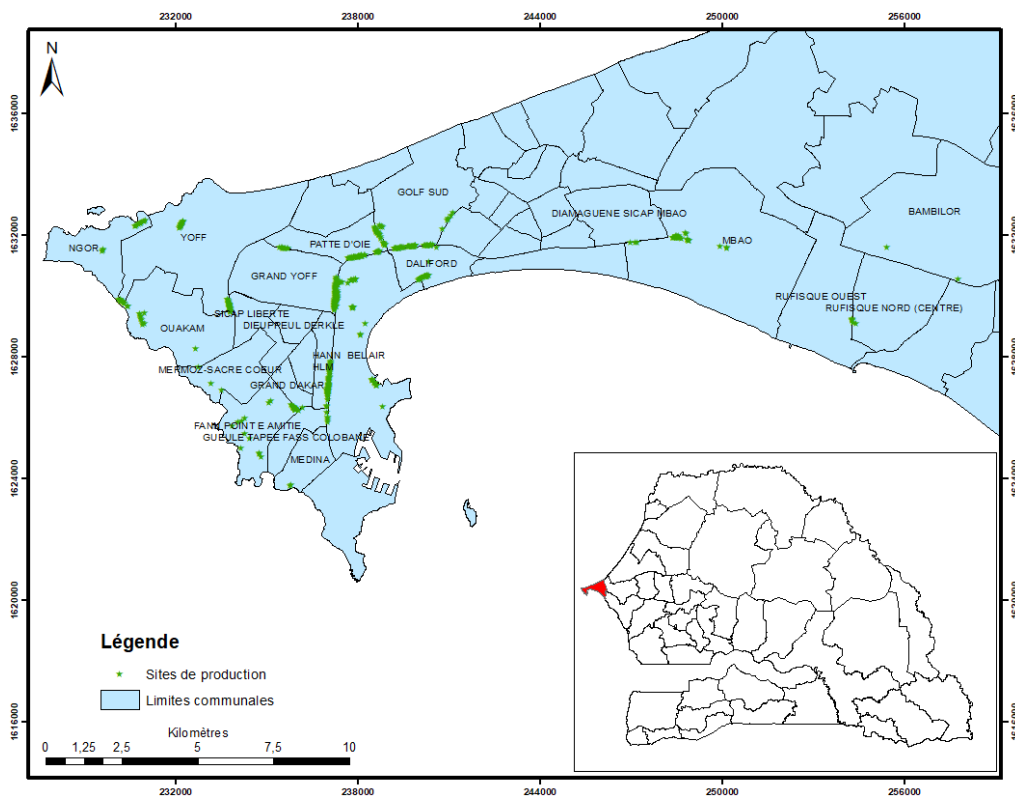
analysis. Thus, there is no summary document giving guidance on ornamental succulent plants. In addition, little is known about the distribution of succulents in major taxonomic groups.

Thus, this study was undertaken to characterize the succulent ornamental flora identified in Dakar. It proposes to analyze the taxonomic, biological and chorological spectra.

## 2. MATERIAL AND METHODS

### 2.1. The study area

The studies were carried out in Dakar (14 ° 41'37 " North latitude and 17 ° 26'38 " West longitude) from 2016 to 2018. In total, 84 nurseries were visited, distributed in different municipalities (Fig . 1)



**Figure 1.** Location of nurseries according to municipality

### 2.2. Inventory and identification of taxa

The inventory was carried out on 84 farms spread across the various municipalities of the Dakar region. And in each site, an itinerant inventory was carried out allowing an exhaustive census of the succulent species which are cultivated there.

In addition, the species determination was carried out using :

Flora (Berhaut, 1967, 1971, 1974, 1975, 1976, 1979; Hay, & Beckett, 1978; Hutchinson & Dalziel, 1954, 1963, 1972; Hutchinson & al, 1958; Friedmann, 2011; LEjoly & a.l, 2010 ).

The nomenclature used follows the database managed at the Conservatoire et Jardin Botanique (CJB) in Geneva; this database is based on the important work of Lebrun and Stork (1991-1997) and is accessible on the following regularly updated site :

<http://www.ville-ge.ch/musinfo/bd/cjb/africa/index.php?langue=fr>

The classification used is that of APG III (2009).

#### **2.4. Analysis of the structure of the flora**

To analyze the ornamental flora, the spectrum, taxonomic, biological and chorological has been developed.

##### ➤ **The taxonomic spectrum**

For each species listed and identified, its scientific name (genus name + specific epithet) and its family have been attributed to it. Thus, the total number of species, genera and families of ornamental flora could be studied.

##### ➤ **The biological spectrum**

To achieve the biological spectrum, species were classified according to their biological type. And to do this, we used the classification of Raunkier (1934) adapted to the tropical zone where the unfavorable season corresponds to the dry season (Lebrun, 1966). This classification distinguishes 8 biological forms which are : phanerophytes (P), nanophanerophytes (Np), chaméphytes (C), hemicryptophytes (H), geophytes (G), therophytes (T).

For the evaluation and interpretation of the results, the percentage proportion of each biological type is calculated by the following formula.

$$\text{Proportion (\%)} = \frac{\text{Species number of each biological type}}{\text{Total number of species}} * 100$$

##### ➤ **The chorological spectrum**

For the development of the chorological spectrum, the species were classified according to their geographical origin. To do this, the information mainly comes from the flora of Hutchinson & Dalziel (1972), the illustrated flora of Berhaut (1971-1991). There are African Species (Af), Afro-American Species (Am), Afro-Asian Species (As), Afro-Malagasy Species (Ma), Cosmopolitan Species (Cos), and Pantropical Species (Pt ).

For the evaluation and interpretation of the results, the percentage proportion of each biogeographic affinity is calculated by the following formula :

$$\text{Proportion (\%)} = \frac{\text{Number of species of each biogeographic affinity}}{\text{Total number of species}} * 100$$

### 3. RESULTS AND DISCUSSION

#### ➤ Overall structure of the ornamental succulent flora

Table 1 lists the succulent ornamental species inventoried in 84 nurseries. For each species, its biological type and geographical distribution have been mentioned.

This work made it possible to identify 35 ornamental species in Dakar, belonging to 20 genera united in 12 families (Tab. 1). The infra-specific diversity is low with one taxon in each species with the exception of *Sansevieria trifasciata* represented by two varieties (Tab. 1).

**Table 1. List of species recorded with indications on their biological type (T.B) and their geographical distribution (R.G)**

Family	N. G	N. E	Species	T. B	R.G
Agavaceae (M)	1	3	<i>Agave americana</i> L.	G	Cos m
			<i>Agave americana</i> L. var.variegata	G	Cos m
			<i>Agave sisalana</i> L.	P	Pt
Aloeaceae (M)	1	1	<i>Aloe vera</i> (L.) Burm.f	H	Cos m
Apocynaceae (D)	2	4	<i>Adenium obesum</i> (Forsk.) Roem. Et Schult.	C	Pt
			<i>Pachypodium geayii</i> Costantin & Bois.	P	Ma
			<i>Pachypodium lamerii</i> Drake.	P	Ma
			<i>Pachypodium rutenbergianum</i> Vatke.	P	Ma
Araceae (M)	1	1	<i>Zamioculcas zamiifolia</i> (Lodd.) Engl.	G	Af
Asparagaceae (M)	3	5	<i>Beaucarnea recurvata</i> Lem.	P	Am
			<i>Furcraea selloa</i> . Koch.Var. <i>marginata</i>	P	Pt
			<i>Sansevieria cylindrica</i> W.B	G	Af
			<i>Sansevieria trifasciata</i> Prain.	G	Af
			<i>Sansevieria trifasciata</i> (De Wild.) NEBr. var <i>laurentii</i>	G	Af
Begoniaceae (D)	1	1	<i>Begonia semperflorenshort.</i>	T	Am
Cacataceae (D)	3	3	<i>Cereus peruvianus</i> (L.) Miller	Np	Am
			<i>Echinocactus grusonii</i> Hildm.	C	Am
			<i>Nopalea cochenillifera</i> (L.) Salm-Dyck	Np	Am

<b>Commelinaceae (M)</b>	2	3	<i>Rhoeo spathacea</i> (Sw.) Stearn vittata	C	Am
			<i>Tradescantia pallida.</i> Var. <i>purpurea</i>	C	Am
			<i>Tradescantia zebrina</i> Bos.	C	Cosm
<b>Costaceae (D)</b>	1	1	<i>Costus Spicatus</i> (Jacq.) Sw	C	Am
<b>Crassulaceae (D)</b>	1	5	<i>Kalanchoe blossfeldiana</i> Poelln.	C	Ma
			<i>Kalanchoe delagoensis</i> Eckl. Zeyh	C	Ma
			<i>Kalanchoe gastonis-bonnierei</i> Raym.-Hamet	C	Ma
			<i>Kalanchoe laetivirens</i> Des.	C	Ma
			<i>Kalanchoe thyrsiflora</i> Harv.	C	Af
<b>Didiereaceae (D)</b>	1	1	<i>Alluaudia procera</i> Drake	P	Ma
<b>Euphorbiaceae (D)</b>	3	7	<i>Elaeophorbia drupifera</i> (Thonn.) Stapf	P	Af
			<i>Euphorbia grandicornis</i> Goebel ex N.E.Br.	Np	Af
			<i>Euphorbia Kamerunica</i> Pax.	Np	Af
			<i>Euphorbia lactea</i> Haw.	Np	As
			<i>Euphorbia milii</i> Des Moul.	C	Pt
			<i>Euphorbia trigona</i> Mill.	Np	Af
			<i>Pedilanthus tithymaloides</i> (Linn.) Poit.	C	Am
<b>12 Familles</b>	<b>20</b>	<b>35</b>			

**D** = Dicotyledons ; **M** = Monocotyledons ; **TB** = Type biologique ; Therophytes (T) ; Geophytes (G) ; Chamephytes (C); Phanerophytes (P) ; Nanophanérophytes (Np) ; Hemicryptophytes (H) ; **R.G** = repartition géographique ; African species (Af) ; Afro-american (Am) ; Pantropicales (Pt) ; Afro-Malagasy (Ma); Afro-Asiatic (As) ; Cosmopolitan (Cosm) ;

### ➤ Taxonomic spectrum

Table 2 represents the taxonomic spectrum of ornamental succulent species recorded in Dakar. Our analysis shows that dicotyledons are largely predominant and represent 58.33% of families, 60% of genera, and 62.86% of species (Tab. 2). As for monocots, they group together 41.67% of families, 40% of genera, and 37.14% of species.

**Table 2: Taxonomic spectrum of ornamental succulent flora**

Taxonomic groups	Family		Genus		Species	
	Number	Proportion (%)	Number	Proportion (%)	Number	Proportion (%)
<b>Dicotyledons</b>	7	58,33	12	60,00	22	62,86
<b>Monocotyledons</b>	5	41,67	8	40,00	13	37,14
<b>TOTAL</b>	<b>12</b>	<b>100,00</b>	<b>20</b>	<b>100,00</b>	<b>35</b>	<b>100,00</b>

➤ **Breakdown by family of species**

Table 3 shows the distribution by family of succulent ornamental species recorded in Dakar. This flora is dominated by 4 families which group together 60% of the species recorded, ie 21 species in total (Tab. 3). These families are: Euphorbiaceae (7 species), Asparagaceae (5 species), Crassulaceae (5 species) and Apocynaceae (4 species).

Three (3) other families are relatively well represented: they are Agavaceae (8.57%), Cactaceae (8.57%), and Commelinaceae (8.57%), i.e. a total of 25.71% of species encountered (Tab. 3). The other species (14.29%) are divided into 5 families (Tab. 3)

**Table 3. Distribution of species by family**

Family	Number of species	Proportion (%)
Euphorbiaceae (D)	7	20,00
Asparagaceae (M)	5	14,29
Crassulaceae (D)	5	14,29
Apocynaceae (D)	4	11,43
Agavaceae (M)	3	8,57
Commelinaceae (M)	3	8,57
Cacataceae (D)	3	8,57
Araceae (M)	1	2,86
Aloeaceae (M)	1	2,86
Begoniaceae (D)	1	2,86
Costaceae (D)	1	2,86
Didiereaceae (D)	1	2,86
<b>Total</b>	<b>35</b>	<b>100,00</b>

➤ **Distribution of species by genus**

The distribution of species by genus is shown in Table 4.

The most diverse genera are five (5) and include 60% of the species listed, or 21 species in total (Tab. 4). These genus are in descending order: Kalanchoe (5 species), Euphorbia (5 species), Agave (3 species), Sansevieria (3 species) and Tradescantia (2 species).

In addition, there are 14 genus with less than 2 species, ie around 40% of the succulent ornamental species recorded (Tab. 4).

**Table 4. Distribution of species by genus**

N°	Genus	Number of species	Proportion (%)
1	<i>Kalanchoe</i>	5	14,29
2	<i>Euphorbia</i>	5	14,29
3	<i>Agave</i>	3	8,57
4	<i>Pachypodium</i>	3	8,57
5	<i>Sansevieria</i>	3	8,57
6	<i>Tradescantia</i>	2	5,71
<b>Other genera</b>		<b>14</b>	<b>40,00</b>
<b>Total species</b>		<b>35</b>	<b>100,00</b>

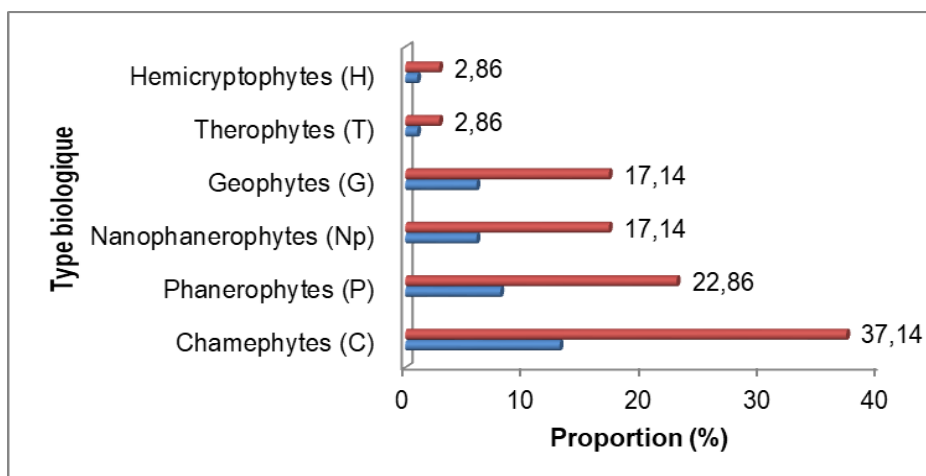
➤ **Biological spectrum**

The indications of the biological types of the species listed are given in figure 2.

The analysis of Figure 2 indicates that this flora is mainly made up of perennial species which account for 97.14%. They are distributed among :

- Camephytes (37.14%), Phanerophytes (22.86%), Nanophanerophytes (17.14%), Geophytes (17.14%) and Hemicryptophytes (2.86%).

In addition, annual species contain only 2.86% of the ornamental flora (Fig.2).

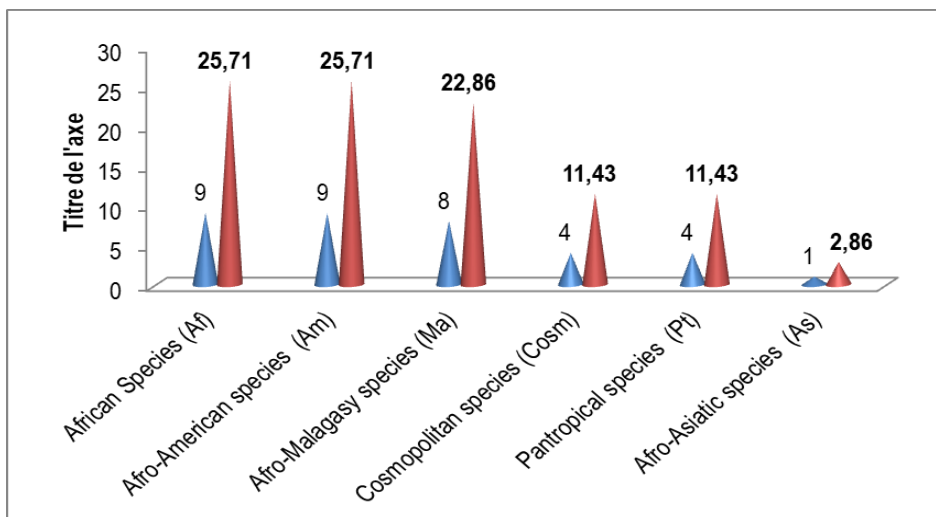


**Figure 2.** Distribution of biological types

➤ **Chorological spectrum**

Figure 3 provides information on the distribution of species according to their biogeographical affinities.

Our analysis shows that this flora is dominated by African and Afro-American species which each comprise 25.71% of the flora, or 51.43% of all the species encountered (Fig. 3). As for Afro-Malagasy species, they include 22.86% of the ornamental succulent flora. In addition, cosmopolitan and pantropical species are relatively well represented and each group together 11.43% of the flora. The poorly represented Afro-Asiatic species only represent 2.86% of the flora (Fig. 3).



**Figure 3.** Chorological spectrum

#### 4. DISCUSSION

From the point of view of taxonomic diversity, the succulent ornamental flora is rich in 35 species belonging to 20 genera united in 12 families. Despite the economic importance for international succulent plant horticulture, most of them have not been taxonomically revised since their description except for the genus *Operculicarya* spp (Bako *and al.*, 2011). According to Michayewicz (2018), *Aloe vera*, which is one of the succulent ornamental plants identified in Dakar, is an effective medicinal plant in the treatment of acute constipation and mucilage in that of wounds and burns. In addition, the juice of *A. vera*, by the presence of some of its anthracene compounds, shows laxative, antibacterial and antiproliferative activities. As for the freezing of *A. vera*, rich in polysaccharides, vitamins, enzymes, sterols and minerals, it has anti-inflammatory, anti-ulcer, immunostimulant, antioxidant, healing, anti-tumor and hypoglycemic activities (Michayewicz, 2018). In addition, the dicotyledons are largely predominant and represent 58.33% of families, 60% of genera, and 62.86% of species. This dominance of dicotyledons is an overall characteristic of the flora of Senegal (Bâ and Noba, 2001). On the other hand, this flora is dominated by the Euphorbiaceae family which includes 20% of the listed species. This dominance of Euphorbiaceae is also noted in the succulent flora of Madagascar (Cross, 2006). In addition, this flora is mainly made up of perennial species which account for 97.14%. These results corroborate with those of Dieng (2019) who showed that the parent species are in the majority with 94.5%. Analysis of the chorological spectrum has shown that this flora is dominated by African and African-American species which each have 25.71 flora. These



results are different from those of Dieng (2019) and Radji *and al.*, (2010), who had shown that African species were in the minority with 5.5%.

## 5. CONCLUSION

This work made it possible to identify 35 succulent ornamental species in Dakar, belonging to 20 genera and united in 12 families. The most diverse genera are five (5) and include 60% of the species listed, or 21 species in total. These genera are in descending order: Kalanchoe (5 species), Euphorbia (5 species), Agave (3 species), Sansevieria (3 species) and Tradescantia (2 species). The distribution of these species in the major taxonomic groups indicates that the dicotyledons are largely predominant and represent 58.33% of families, 60% of genera, and 62.86% of species. In addition, this flora is dominated by 4 families which include 60% of the species listed, or 21 species in total. These families are: Euphorbiaceae (7 species), Asparagaceae (5 species), Crassulaceae (5 species) and Apocynaceae (4 species). This flora is mainly made up of perennial species which account for 97.14%. This flora is mainly made up of perennial species which account for 97.14%. On the other hand, the chorological spectrum is dominated by African and Afro-American species which each include 25,71 of the succulent flora

## RECOMMENDATION

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