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RESEARCH ARTICLE

DIVERSITY AND ECOLOGICAL CHARACTERISTICS OF LIANESCENT AND HERBACEOUS SPECIES OF THE BINGERVILLE BOTANICAL GARDEN (SOUTH OF COTE D'IVOIRE)

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Abstract

A floristic study was carried out in the Bingerville botanical garden, an urban green space in the south of Côte d'Ivoire.The objective of this study is to determine the structure and ecological profile of the lianascent and herbaceous flora, for better management of the garden. The "round-the-field" inventory method was carried out in 29 plots on the site.The study identified 143 species, including 32 lianas and 111 herbaceous species. The flora is divided into 103 genera grouped into 45 families.The Poaceae and Fabaceae are the dominant families with a contribution of 16.78% and 10.49% respectively of the total species recorded.This flora is characterised by the predominance of phanerophytes with 46.15%, followed by therophytes with 20.98%.As regards chorological affinity, it is mainly composed of pantropical species (26.57%) and endemic species (33.57%), which account for more than half the species (61.14%).Zoochory (62.24%) was found to be the main adaptation to the spread of species diaspores.Heliophilous pioneer species (77.34%) make up the bulk of the plant community.The quantitative analysis of this flora reveals that six species constitute potential weeds that can be very common in the botanical garden.

Introduction:-

In Africa, the incorporation of trees into the urban environment is an integral part of the colonial policy which advocated social, economic and spatial isolation from the natives. This is how a european model of trees in the city was imported and includes, among other things, alignment and shade plantations, public parks, botanical gardens as well as experimental forest plots (Salah, 1999 cited by Tourey et al., 2020). These urban green spaces offer a multiplicity of services, in particular ecosystem services (Ali-Khodja, 2010; Tavin and Leseur, 2016).Unfortunately, the local populations, in search of urbanizable spaces and cultivable land as well as species with various virtues, exert strong pressure on these urban forests so that their surfaces are constantly being nibbled (Monssou et al., 2016).

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In Côte d'Ivoire, with a view to protecting urban biodiversity, the future of urban forest and tree resources is now at the heart of several environmental or development debates organized by the ministries in charge of the environment (Monssouet al., 2016). These reflections, organized to have more sustainable cities, have made it possible to revalorize the floristic diversity in urban areas. This is the case with public gardens whose vocation is to preserve plant species of different natures.

In the district of Abidjan, there are three public gardens, namely the botanical garden of the Institute of Education and Tropical Research (IDERT), in Adiopodoumé, the botanical garden of the University Félix HOUPHOUËT-BOIGNY or National Center for Floristique (CNF) and the botanical garden of Bingerville (Séguéna, 2015), site on which this study was carried out.

Left in a state of neglect for several years, the botanical garden of Bingervillewas rehabilitated in 1996. Its administration is currently ensured by the services of the Ministry of Water and Forests which aim to lead sustainable management there. This management requires knowledge of the flora of this space. Indeed, the indentations left in the canopy of the tree plantations and the ruderal zones in the botanical garden favour microcosms conducive to the installation and proliferation of herbaceous and creeping flora (Coudurier, 1992; Etien and Traoré, 2005). Knowledge of these lianas and herbaceous species makes it possible to judge the forest resilience of an area and also the degree of colonization of invasive plants.

The general objective is to characterize the floristic diversity of the botanical garden with a view to setting up an efficient management system for the available plant resources. Specifically, it is a question of (i) evaluating the specific liana and herbaceous richness, (ii) determining the composition of this flora and (iii) evaluating the ecological particularity of its species.

Material and Methods:-

Study area

The Bingerville botanical garden is located in the district of Abidjan, Côte d'Ivoire (Figure 1). It is a huge forest estate, with an area of 55 hectares, which is located north of the town of Bingerville, at geographical coordinates 5°21'44" and 5°21'46" north latitude and 3 °53'16" and 3°53'22" West longitude. The climate is characterized by a bimodal rainfall regime (april-july and october-november) with an average annual rainfall of 1650 mm.The average monthly temperatures vary between 25 and 29°C. The original vegetation, most of which was destroyed as part of the extension of the city of Abidjan, was characterized by dense evergreen forests with *Turraeanthusafricanus* and *Heisteria*parvifolia (Kouassi, 2010).

Material:-

The study material is composed of biological material and technical material. Biological material consists of spontaneous or planted plant species in the Bingerville botanical garden.The technical equipment is usually used by the botanist (GPS, 50 m tape measure, data collection sheets, pruning shears, newspaper, etc.).

Data collection

The data collection consisted in carrying out an exhaustive inventory of the species of lianas and herbaceous plants in the 29 plots of the botanical garden. The inventory was carried out using the “field trip” method.This itinerant prospecting method consists of making an inventory of all the species by traversing an observation area, defined according to the heterogeneity of the environments, in different directions (Chicouene, 2000; Noba, 2002). In the context of our study, the observation surfaces were those of the 29 plots of the botanical garden. The “field tour” method has the advantage of taking into account the agronomic importance of rapidly expanding species or indicator species of certain characteristics of the environment (Maillet, 1981).

The nomenclature used is that of Lebrun and Stork (1991-1997) and takes into consideration the classification of Angiosperms Phylogeny Group (APG IV, 2016).

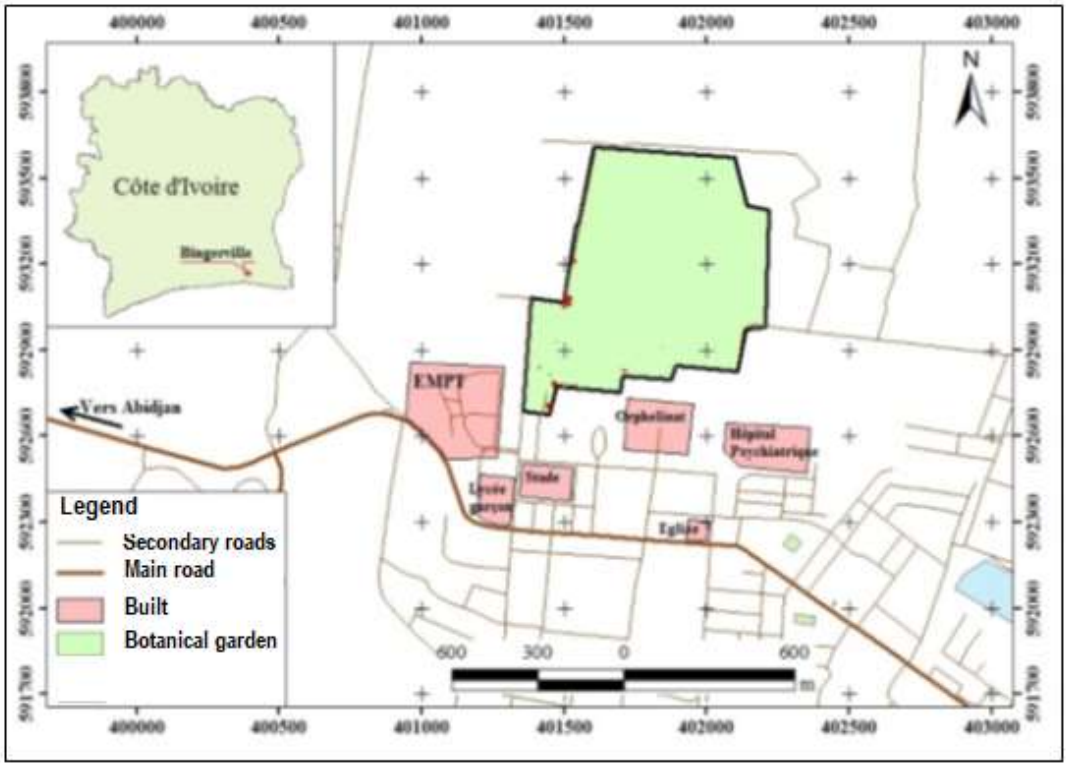

Figure 1:- Geographicallocation of the Bingerville botanical garden.

Data analysis

Floristic richness and composition

The floristic richness focused on the determination of the number of species of lianas and herbaceous plants within the limits of the botanical garden. Its measurement consists of making an inventory of all the species present on each plot without taking their abundance into account in order to group them together within a general list.

The floristic composition consisted of identifying the characteristics of the flora studied. It is a question of specifying: the families, the genera, the biological types and the chorological affinities. Species were grouped by genera and families to determine generic and botanical family diversity.

The assignment of biological types was made according to the classification model ofAké-Assi (1984; 2001 and 2002), itself adapted from Raunkiaer's model (1934). This classification makes it possible to recognize five biological types, namely hemicryptophytes (H), cryptophytes (C), therophytes (Th), chamephytes (Ch) and phanerophytes (P).

With regard to the characterization of species from the point of view of affinities chorological (phytogeographical), we based ourselves on the work of Aké-Assi (2001 and 2002). These are species that occur naturally in the Guinean-Congolese phytogeographical region (GC) or in the Sudano-Zambézianphytogeographical region (SZ), or both in these two phytogeographical regions (GC-SZ) or the species introduced (i).

Mode of dissemination of diaspores and ecological profile of species

With the aim of appreciating the mode of regeneration and conservation of the vegetation of the forest, we carried out a classification of the species according to the modes of dissemination of the diaspores (seeds, fruits or any other part of the plant being used for the dissemination of the 'species). This classification follows that of Lebrun (1947), which distinguishes anemochory, zoochory, hydrochory and barochory (autochory).

Anemochory is the spread of diaspores by the wind. Zoochory is the dissemination of diaspores by animals. This mode of dissemination can be external (epizoochory) or internal (endozoochory). Autochory is the dissemination of diaspores without apparent adaptation: at maturity, the diaspores detach and fall by gravity.

To evaluate the level of reconstitution of the exploited sectors, we evaluated the proportion of light species or pioneer species (pi), non-pioneer species (np) and shade-tolerant species or shade bearing (sb), according to the work of Hawthorne (1995).

Species-specific contribution

The specific contribution (SC) is defined according to the formula of Daget and Poissonet (1990) below:

$$CS(e) = \frac{FS(e)}{\sum_i^n FS(e)} \times 100$$

CS(e) being the specific contribution and FS(e) the specific frequency of species i.

The specific contributions of species have been grouped according to the work ofMangara (2010):

- species with CS(e) < 1% are said to be minor species or species with a more or less negligible representativeness;
- those with CS(e) between 1% and 4% are called potential species;
- those whose CS(e) is greater than 4% are called major or very representative species.

Results:-

Floristic richness

The inventory identified 32 species of lianas, which are divided into 13 botanical families and 21 genera (Table 1). The dominant families, with more than two species, are the Fabaceae, 10 species (i.e. 31.25%), the Convolvulaceae, 4 species (i.e. 12.5%), the Combretaceae and the Verbenaceae, 3 species each (i.e. 9.37 %). The most encountered genera are *Ipomea*, with 4 species (i.e. 12.5%) and *Combretum*, with 3 species (i.e. 9.37%).

Regarding herbaceous species, the inventory identified 111 species divided into 82 genera and 37 families (Table 1). In descending order, the most represented families are Poaceae, with 24 species (i.e. 21.62%), Cyperaceae, with 10 species (i.e. 9.01%), Asteraceae, Euphorbiaceae and Solanaceae, with 7 species each (i.e. 6.31%), the Araceae, with 6 species (i.e. 5.40%) and the Fabaceae, with 5 species (i.e. 4.50%). The most encountered genera, with at least 3 species, are*Cyperus*, with 5 species (i.e. 4.50%), *Euphorbia*, *Solanum*, with 4 species each (i.e. 3.60%), *Bambusa*, *Emilia*, *Kylinga*, *Panicum* and *Sida*, with 3 species each (i.e. 2.70%).

The flora resulting from the floristic synthesis is evaluated at143 species of lianas and herbs from the botanical garden. These species are divided into 103 genera that include 45 families (Table 1). For the families (Figure 2) we have the Poaceae which dominate with 24 species (i.e. 16.78%), followed by the Fabaceae, 15 species (10.49%), Cyperaceae, with 10 species (6.99%), Asteraceae , with 8 species (5.59%), Euphorbiaceae, with 8 species (i.e. 5.59%), Solanaceae, with 7 species (i.e. 4.89%) and Araceae, with 6 species (i.e. 4.69¨ %). The other families are represented by less than five species. For genera, the genera *Cyperus*, *Solanum*, *Euphorbia* and *Ipomea* are the most diverse, with at least four species each.For classes, Dicotyledons predominate with 85 species (i.e. 59.44%), followed by Monocotyledons, with 56 species (i.e. 39.16%) and Pteridophytes, with 2 species (i.e. 1.40%).

Biological types of species

The analysis of biological types (Figure 3) highlights a predominance of phanerophytes, with 66 species (ie 46.15%). They are divided into nanophanerophytes, with 45 species (i.e. 31.46%) and microphanerophytes, with 21 species (i.e. 14.68%). Therophytes follow, with 30 species (i.e. 20.98%), geophytes, with 19 species (i.e. 13.29%) and hemicryptophytes, with 18 species (i.e. 12.59%). The chamaephytes, with 9 species (i.e. 6.29%) and the epiphytes, 1 species (0.69%) are the least represented. The same biologicaltypes are the majority in terms of herbaceous flora, but with some differences in proportions. They are estimated at31.53%, 25.22% and 16.22%respectivelyfornanophanerophytes,therophytes and hemicryptophytes.The analysis of the biological types of this creeper flora highlights the microphanerophytes as the most present species with 17 species (i.e. 53.12%), followed by the nanophanerophytes with 10 species (i.e. 31.25%). Therophytes with 2 species (i.e. 6.25%) are the least represented.

Table 1:- Distribution of inventoried species according to the major taxonomic levels of the Bingerville botanical garden.

Taxonomiclevels	Vine species		Herbaceousspecies		Global Flora
	Number	%	Number	%	
Species	32	22.38	111	62.62	143
Genera	21	20.39	82	79.61	103
Families	13	28.89	37	82.22	45
Dicotyledons	32	37.65	53	62.35	85
Monocotyledons	0	0	56	100	56
Pteridophytes	0	0	2	100	2

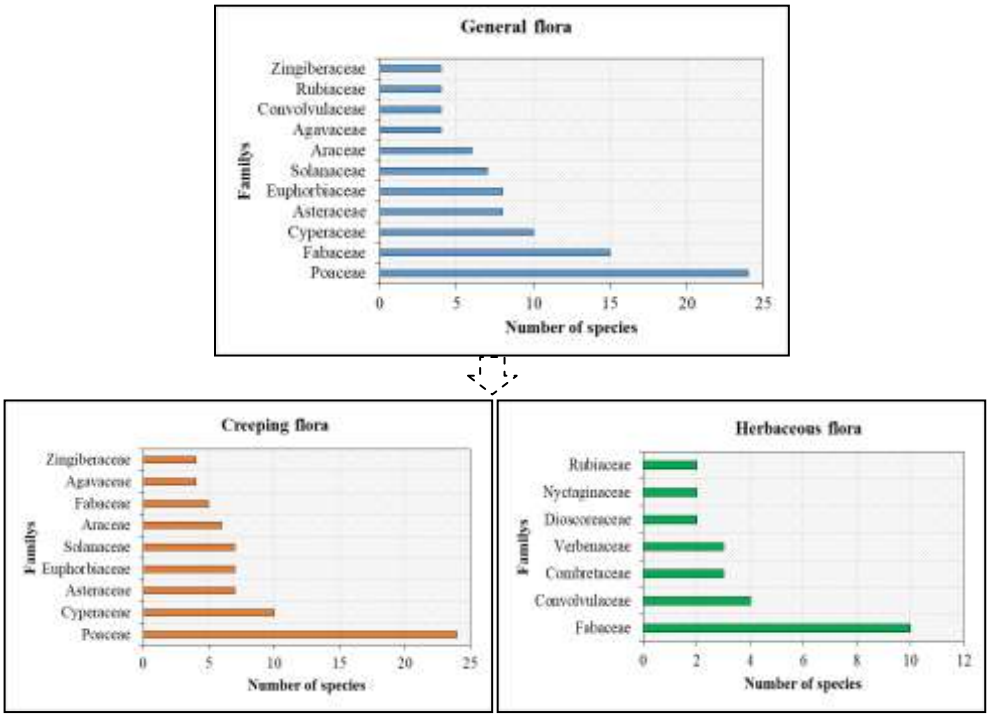

Figure 2:- Spectrum of the dominant families of creeper and herbaceous flora of the Bingerville botanical garden.

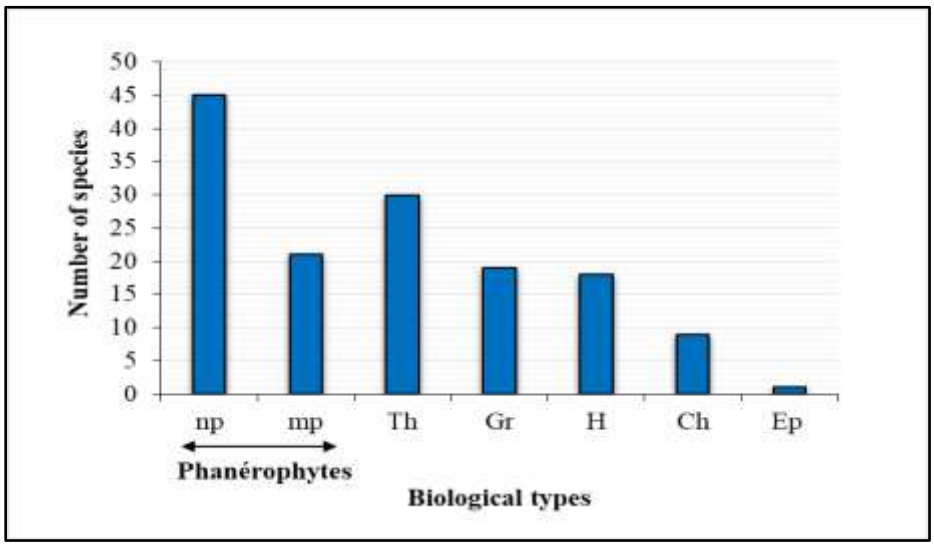

Figure 3:- Biological spectrum of the species of the Bingerville botanical garden

Chorological affinities of species

With regard to the spectrum of chorological affinities (Figure 4), the groups of species with wide distribution are the majority, with 95 species (i.e. 66.43%) where the pantropical species (PanT) are the most important, with 38 species (i.e. 26.57%).Considering phytogeographical endemism, it is the group of species from the savannah-forest transition zone (GC-SZ) which predominates, with 25 species (i.e. 17.48%). Next, come the groups of species from the Guinean-Congolese zone (GC) with 20 species (i.e., 13.99%). The group of species from the Sudano-Zambian zone (SZ), with 1 species (i.e., 0.40%), is the least represented. The exotic species of the ivorian flora in the botanical garden are 39 in number (i.e., 27.27%) and are mainly composed of species from tropical america (neoT), with 11 species (i.e., 7.69%). Among these introduced species, there are 12 creeper species (i.e., 40.62%) and 27 herbaceous species (i.e., 24.32%).

At the level of the herbaceous flora, the chorological affinities indicate that wide distribution species groups predominate with 74 species (i.e., 66.67%) where pantropical species (PanT) are the most dominant, with 29 species (i.e., 26.13%). Considering the species of phytogeographical endemism, it is the species of the transition zone (GC-SZ) which are the most abundant with 50 species (i.e., 45.04%), followed by the Guinean-Congolese species (GC) 30 species (27.03%) and introduced species (i) 27 species (i.e., 24.32%).

Concerning the lianescent flora, the chorological affinities reveal that the groups of species with wide distribution predominate with 21 species (i.e., 65.62%) where the pantropical species (PanT) are the most dominant with 9 species (i.e., 28.12%). Considering the species of phytogeographical endemism, it is the species of the Guinean-Congolese zone (GC) which are the most abundant with 13 species (i.e., 40.62%), followed by introduced species (i) 12 species (37.05%).

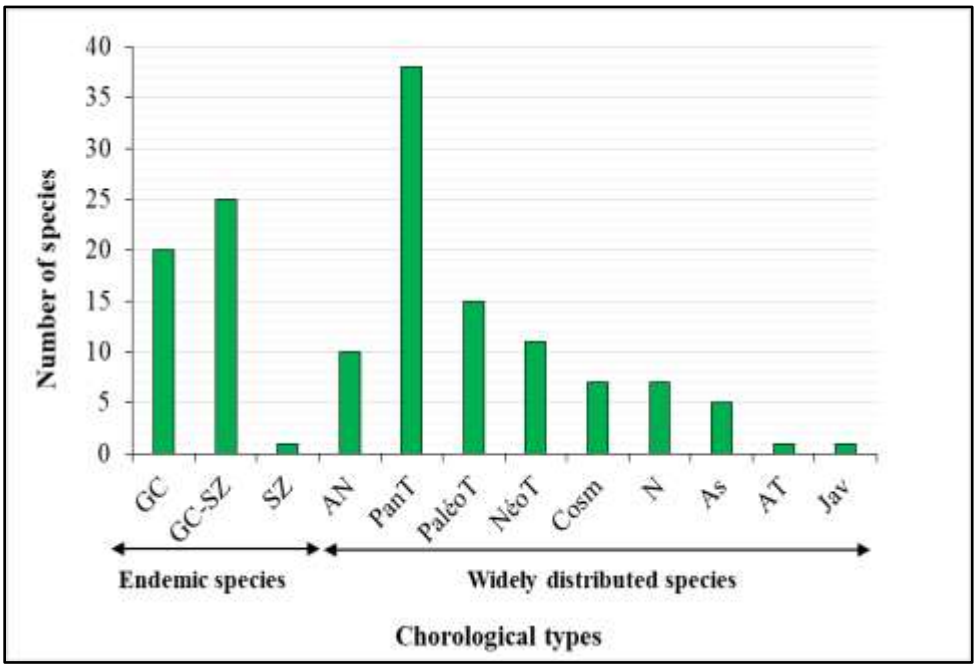

Figure 4:- Chorological spectrum of the species of the Bingerville botanical garden.

Mode of dissemination of diaspores and ecological profile of species

The taxa of lianas and herbs of the Bingerville botanical garden can be divided into three modes of dissemination of diaspores (Figure 5). They are zoochory, anemochory and autochory. Anemochory is the mode of dissemination of diaspores which predominates in creeper species, with 15 species (i.e., 46.87%). Zoochory follows, with 14 species (i.e., 43.75%) where endozoochory is the most representative type of dissemination (37.50%).

Among herbaceous species, zoochory is the most important mode of dissemination, with 75 species (i.e., 67.57%). In this category of dissemination of diaspores, epizoochory is the most representative type with an estimated

proportion of 34.23%. Zoochory is followed by anemochory, with 25 species (i.e., 22.52%). Autochory remains the least representative mode of dissemination of diaspores, with 9 species (i.e., 8.11%).

For all of the creeper and herbaceous flora, zoochory is the most observed mode of dissemination, with 89 species (i.e., 62.24%) where endozoochory is the most representative type of dissemination (34.27%). It is followed by anemochory, with 40 species (i.e., 27.97%). Autochory is the least represented mode of dissemination of diaspores, with 12 species (i.e., 8.39%).

From the point of view of ecological temperament, pioneer species dominate the flora of the botanical garden(Table 3), with 99 species (i.e., 77.34%); shade-tolerant species follow, with 7 species (i.e., 5.47%) and non-pioneer heliophilous species, with 17 species (i.e., 13.28%). Specific analysis of morphological types confirms this predominance of pioneer species which have the largest proportions. These are followed by non-pioneer heliophilous species, then shade-tolerant species whose respective rates are12.5% and 6.25%, at the level of lianescent species, and 2.70% and 6.31%, at the level of herbaceous species.

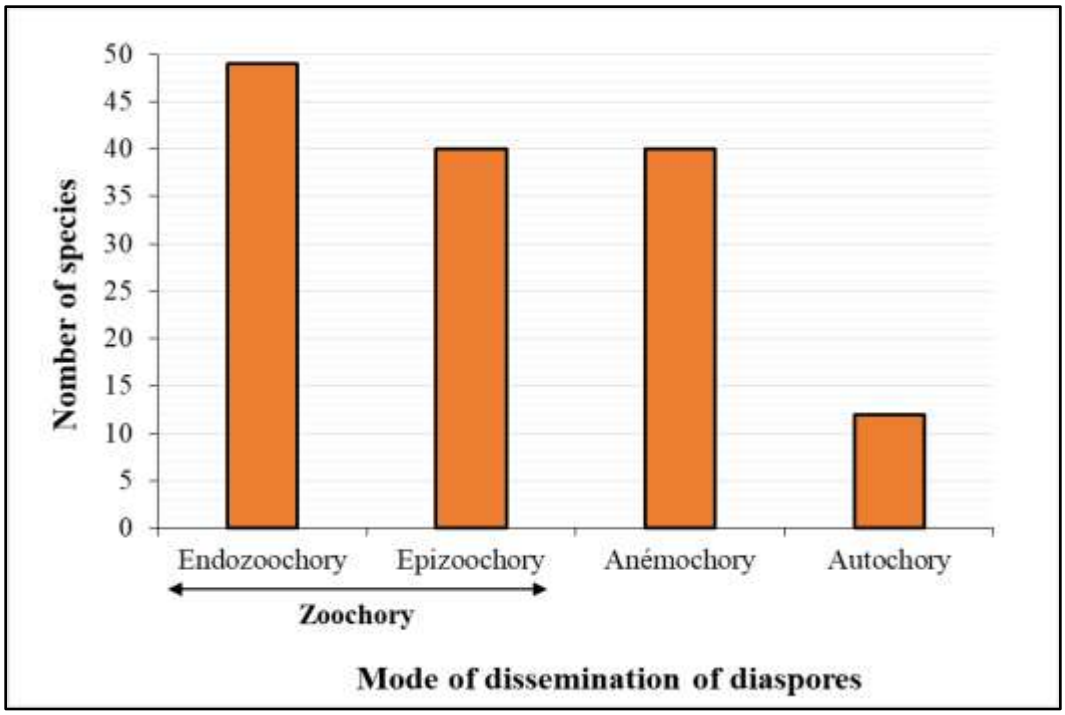

Figure 5:- Spectrummodes of dissemination of species of the Bingerville botanical garden.

Table 2:- Proportion of the ecological profile of liana and grass species in theBingerville botanical garden.

Ecological profile	Vine species	Herbaceousspecies	Flora set
np	12.5%	2.70%	13.28%
pi	81.25%	77.48%	77.34%
sb	6.25%	6.31%	5.47%

np: non-pioneer heliophilous species; pi: pioneer species; sb: shade-tolerant species.

Species-specific contribution

The notion of specific contribution, which expresses the amplitude of the representativeness of a species in a phytocenosis, in direct relation to its absolute frequency, was determined for each species in the Garden (Table 3). It made it possible to identify species which have a specific contribution greater than 1 and which are the most representative species. These species, six in number, contribute 6.70% to the flora of the Garden. Among these species, there are 5 species of grasses (i.e., 4.50%) and one species of lianas (i.e., 3.12%). *Cassiamimosoides* is the species with the highest specific contribution to this flora.

Table 3:- Plant species with a specific contribution greater than 1 in the Bingerville botanical garden

No.	Plant species	Absolutefrequencies	Specific contribution
1	*Cassia mimosoides*	27	1.23
2	*Dioscorea alata*	26	1.19
3	*Aframomummelegueta*	25	1.14
4	*Aspilia bussei*	24	1.09
5	*Panicumrepens*	23	1.05
6	*Sidarhombifolia*	22	1.00
Total			**6.70**

Discussion:-

The results of this study provide information on the current state of the liana and herbaceous flora of the Bingerville botanical garden. The floristic inventory by the method of the "tour of the field" made it possible to identify 143 species.

Concerning the morphological composition of this flora, we note the presence of 112 species of herbs against 32 species of lianas. The dominance of herbaceous plants over liana species shows the non-forest character of thebotanical garden. Indeed, the dominance of liana species in a biotope has been cited as an indicator of its forest character by many authors (Manbangula, 1988; Etien et al., 2018).The absence of maintenance activities and cultivation practices in some Bingerville botanical garden plots are responsible for the invasion of herbaceous species (Monssou et al., 2018).

The families most dominant of the floristic synthesis of the flora are the Poaceae and the Fabaceae. The predominance of these two families of the flora of the Bingervillebotanical gardenis relatively identical to that of the flora of the district of Oumako in Benin and the agro-pastoral systems of Lower Casamance, in Senegal (Dahan et al., 2018; Bassené et al., 2014). The representativeness of these two families is a characteristic of anthropized environments (Monssou et al., 2018).

The analysis of the biological types of the herbaceous and lianescente florula of thebotanical gardenhighlights thephanerophytes like the majority of plants, with46.15% of total flora, followed by therophytes20.98%. According to Arouna (2012), this high abundance of phanerophytes shows the strong representativeness of woody plants in the species studied. The high representativeness of phanerophytes would also express a great specific richness of the flora studied (Kouadja et al., 2022).On the other hand, the presence of therophytes characterizes the anthropization of the Bingerville botanical garden space, because these are species with high seed productivity and whose phenology is perfectly adapted to disturbed environments (Dahan et al., 2018; Hannachi, 2010).

For the phytogeographical types that reflect the fidelity of species to their confinement region and make it possible to judge the specificity of the flora (Toko, 2008; Arouna, 2012), species with a wide distribution are abundant and dominant in the whole of the Bingerville botanical garden flora. We also note,the low representativeness of African phytogeographical endemism species. This result reflects the loss of identity of the botanical garden space due to the human activities that take place there. According to Djègo (2007), the dominance of widely distributed species reflects an index of degradation and signals a gradual loss of the floristic identity of the study area. The introduction of exotic species, whose proportion is 27.28%, within the framework of the development of the botanical garden contributes to the loss of this floral identity. The dominance of species in the transition zone (GC-SZ), when considering regional phytogeographic endemism, shows that the environment is losing its specificity (Guineo-Congolese zone).

The spectrum of diaspore dissemination modes reveals the dominance of zoochorous species (62.24%) for both morphological types of the general flora. Animals would therefore play an important role in the dissemination of diaspores of herbaceous and creeper species in the botanical garden. The zoochory of the Bingervillebotanical garden, as in many other biotopes (Bertault, 1986; N'Guessan, 2013), involves birds and frugivorous vertebrates present in the environment. The flora of the botanical garden, although isolated in urban areas, is so far similar to that of dense secondary forests where the most frequent mode of dissemination is zoochory (Bangirinama et al., 2009). The presence of non-negligible anemochorous species (28.83%) is due to the dominance of Fabaceae, whose diaspores of liana species are disseminated by the wind.

The ecological profile of the species clearly shows the dominance of heliophilous species (77.34%) over the other forms. The installation of these pioneer species with strong colonizing power is favoured by the anthropogenic activities that take place in the Bingerville botanical garden. The isolation of the Bingerville botanical garden, which has lost its original vegetation due to its development, leads to an increase in diversity through the establishment of pioneer or even ruderal species. Indeed, pioneer and heliophilous species illustrate the secondary status of a given site following natural or anthropogenic disturbances (Beina, 2011).

In the perimeter of the Bingerville botanical garden, certain species such as *Cassiamimosoides*, Dioscorea alata, *Aframomummelegueta*, *Aspiliabussei*, *Panicumrepens* and *Sidarhombifolia* are characterized by a specific contribution of≥ 1% and constitute potential weeds which can prove to be very covering. Indeed, Marmotte (1989) and Traoré (1991), quoted by Traoré et al. (2005), showed in their work carried out in Burkina Faso that the most frequent species were also the most cover.

Conclusion:-

The analysis of the vine and herbaceous flora of the Bingervillebotanical garden made it possible to obtain 143 species, including 32 species of lianas and 111 species of grasses. This flora is divided into103 genera and 45 families. The most represented families are the Poaceae (16.78%) and the Fabaceae (10.49%). Dicotyledons (59.44%)contain the majority of flora species.Phanerophytes and therophytes are the dominant types, with respectively 46.15% and 20.98% of the rate of species identified

Animals play an important role in the dissemination of diaspores of species of this flora. It presents a phytogeographical diversity dominated, for the most part, by species with a wide distribution (66.43%), for which the pantropical species are the most important (26.57%).

The study showed that six taxa (7.70%) constitute potential weeds in the botanical garden. Moreover, the remarkable presence in the herbaceous and lianescent flora of pioneer and heliophilous species can generate a microclimate which could be favourable to the germination of seeds of secondary species if other disturbances do not interrupt the process of reconstitution.

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References:-

1. Aké-Assi. L. (1984). La flore de la Côte d'Ivoire : étude descriptive et biogéographique, avec quelques notes ethnobotaniques. Tome I, II, III. Thèse Docteur d'Etat ès Science Naturel. FA.S.T., Université Nationale de Côte d'ivoire, Abidjan, 1205 p.
2. Aké-Assi L. (2002). Flore de la Côte d'Ivoire 2, catalogue, systématique, biogéographie et écologie. Genève, Suisse : Conservatoire et Jardin Botanique, Boisseria58, Genève (Suisse), 441 p.
3. Aké-Assi L. (2001). Flore de la Côte d'Ivoire 1, catalogue, systématique, biogéographie et écologie. Genève, Suisse : Conservatoire et jardin Botanique de Genève. Boissiera 57 : 396 p.
4. Ali-Khodja, A. (2010). Aménagement urbain : la problématique de l'espace vert public dans la ville de Constantine. Science et technologie, 32: 9-18.
5. APG IV (2016). An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants. Botanical Journal of the Linnean Society, 181: 1-20. https://doi.org/10.1111/boj.12385
6. Arouna O. (2012). Cartographie et modélisation prédictive des changements spatio- temporels de la végétation dans la Commune de Djidja au Bénin : implications pour l'aménagement du territoire. Thèse de Doctorat Unique. FLASH/UAC, 246 p.
7. Bangirinama F., Masharabu T., Bigendako M.J., Lejoly J., De Cannière C. &Bogaert J. (2009). Évolution des paramètres floristiques au cours de la dynamique post culturale dans les jachères du site Bibara dans le Parc national de la Ruvubu (Burundi). BulletinScientifiquede L'INECN, 7: 3-13.

8. Bassène C., Mbaye M. S., Camara A. A., Kane A., Gueye M., Sylla S. N. &Noba K. (2014). Flore des systèmes agropastoraux de la Basse Casamance (Sénégal) : cas de la communauté rurale de Mlomp. International Journal of Biological and Chimical Sciences, 8(5) : 2258-2273. http://dx.doi.org/10.4314/ijbcs.v8i5.28.
9. Beina, D. (2011). Diversité floristique de la Forêt dense semi-décidue de Mbaïki, République Centrafricaine : Étude expérimentale de l'impact de deux types d'intervention sylvicole. Thèse de Doctorat en Biologie Santé, Université De Picardie Jules Verne. 226 p.
10. Bertault J.G. (1986). Étude de l'effet d'interventions sylvicoles sur la régénération naturelle au sein d'un périmètre expérimental d'aménagement en forêt dense humide de Côte d'Ivoire. Thèse de Doctorat de l'Université de Nancy, 254 p.
11. Chicouene D. (2000). Évaluation du peuplement de mauvaises herbes en végétation dans une parcelle : II-Protocoles rapides pour un usage courant. P.-D. des cultures 524 : 18-23.
12. Coudurier T. (1992). Sur la place des lianes dans la forêt Guyanaise. Une approche qui utilise l'architecture végétale. Thèse, Université de Montpellier II, France, 263 pp.
13. Daget P. &Poissonet J. (1990). Notion de valeur pastorale. Repères, 2 : 4-8.
14. Dahan K.S., TokoImoro I. &Toyi S.M. (2018). État et caractéristiques de la végétation et de la flore de l'arrondissement d'Oumako (commune de Comé au Bénin). Revue de l'Environnement et de la Biodiversité-PASRES, 3(2) : 1-14.
15. Djègo J.G.M. (2007). Phytosociologie de la végétation de sous-bois et impact écologique des plantations forestières sur la diversité floristique au sud et au centre du Bénin. Thèse de Doctorat, FLASH, Universitéd'Abomey-Calavi, Bénin 388 p.
16. Etien D.T. & Traoré D. (2005). Climbing plants of the Haut-Sassandra forest: species and biomorphology, In Forest Climbing Plants of West Africa: Diversity, Ecology and Management. F., Bongers ; M. P. E., Parren ; D., Traoré, Cabi Publishing, London, pp. 137-146.
17. Etien D.T., Vroh B.T.A., Adou Yao C.Y. &N'Guessan K.E. (2018). Diversité Des Espèces Herbacées Et Lianescentes De La Forêt Classée Du Haut-Sassandra (Centre-Ouest, 247 Côte d'Ivoire) Après Plusieurs Années D'exploitation Forestière. EuropeanScientificJournal, 14(18) : 247-263.
18. Hannachi A. (2010). Etude des mauvaises herbes des cultures de la région de Batna : systématique, biologie et écologie. Mémoire pour l'obtention du diplôme de magister en sciences agronomiques. Univ. Ferhat Abbas-Setif (UFAS) (algerie). Faculté des Sciences département d'agronomie. 124 p.
19. Hawthorne W.D. (1995). Ecological profiles of Ghanaian forest trees. Oxford Forestry Institute - Department of plant sciences – University of Oxford. 345 p.
20. Kouadja G.S., Kouassi A F. & Kouadio K.E. (2022). Biodiversité, typologie et qualité du fourrage des parcours naturels périurbains de Bouaké au Centre de la Côte d'Ivoire. Journalof Animal & Plant Sciences, **52**(1) : 9362-9376.
21. Kouassi M.O. (2010). Inventaire floristique et régénération des espèces arbustives, lianescentes et herbacées de la parcelle Henry Konan Bédié du JBB (Côte d'Ivoire). Mémoire de Maîtrise UFR des Sciences de la Nature, Université d'Abobo-Adjamé, Côte d'Ivoire.
22. Lebrun J.P., Stork A.L. (1991-1997). Enumération des Plantes à Fleurs d'Afrique Tropicale. Conservatoire et Jardin Botanique de la Ville de Genève, Genève. Vol. 1 : 249 p., vol. 2 : 257 p., vol. 3 : 341 p., vol. 4 : 711 p..
23. Lebrun J. (1947). La végétation de la plaine alluviale au sud Lac Édouard. Institut des Parcs Naturels du Congo-Belge, Mission Lebrun (1937-1938), 800 p.
24. Maillet J. (1981). Evolution de la flore adventice dans le montpelliérais sous la pression des techniques culturales. DDI, USTL, Montpellier, 20 pages + annexes
25. Manbangula L.N. (1988). Etude floristique et biologique des lianes et herbes grimpantes de forêts secondaires de Masako à Kisangani (Haut-Zaïre). Mémoire de Licence en Sciences, Faculté des Sciences, Université de Kisangani Zaïre, 86 p.
26. Mangara A. (2010). Les adventices en culture d'ananas : Ananas comosus (L.) Merr. (Bromeliaceae), dans les localités d'Anguédédou, de Bonoua et de N'douci, en basse Côte d'Ivoire : inventaire et essai de lutte. Thèse de doctoract, . UFR Biosciences, Université de Cocody, Abidjan, 207 p.
27. Marnotte P. (1989). Plantes nuisibles, désherbage, herbicides au complexe sucrier de la SOSUCO. Rapport de mission en Malherbologie à Banfora (Burkina Faso). Montpellier, CIRAD-CA, 23 p.
28. Monssou E.O., Vroh B.T.A., Goné Bi Z.B., Adou Yao. C.Y. & N'Guessan K. E. (2016). Evaluation de la diversité et estimation de la biomasse aérienne des arbres du Jardin Botanique de Bingerville (District d'Abidjan, Côte d'Ivoire). EuropeanScientificJournal, 12 (6): 168-184
29. N'Guessan K.E. (2013). Évaluation Biophysique et des Services écosystémiques du Parc National du Banco. Rapport d'Études d'Impact Environnemental et Social, Abidjan (Côte d'Ivoire), 65 p.

30. Noba K. (2002).La flore adventice dans le sud du bassin arachidier (Sénégal) : structure, dynamique et impact sur la production du mil et de l'arachide. Thèse de doctorat, 137 p.
31. Raunkiaer C. (1934). The life forms of plants and statistical plant geography; being the collected papers of C. Raunkiaer. Clarendron Press, London (UK), 632 p.
32. Salah, R. (1999). La foresterie urbaine et périurbaine en Afrique. Une étude de cas sur le sahel (Dakar, Niamey, Nouakchott et Ouagadougou). Archives et documents de la FAO, 26 p., consulté le 26/06/2022, [En ligne] URL: http://www.fao.org/DOCREP/005/X3994F/X3994F01.htm
33. Séguéna, F. (2015). Le Jardin Botanique de Bingerville : diversité floristique et quelques notes ethnobotaniques. Thèse de Doctorat unique. UFR Biosciences, Université FélixHOUPHOUËT- BOIGNY, Abidjan, Côte d'Ivoire. 222 p.
34. Tavin, A. &Leseur A. (2016). Végétaliser la ville Pour quels bénéfices, avec quels financements, suivis et gouvernances des projets ? L'apport d'exemples européens et nord-américains. I4CE, Institute for ClimateEconomics, 33 p.
35. Toko I. (2008). Étude de la variabilité spatialede la biomasse herbacée, de la phénologieet de la structure de la végétation le longdestoposéquences du bassin supérieur dufleuveOuémé au Bénin. Thèse de Doctorat, Universitéd'Abomey-Calavi, Bénin, 241 p.
36. Tourey, S., Boukpessi, T., DjagnikpoKpedenou, K. &Tchamie, T.K.T. (2020). Diversité et importance de la flore ligneuse de la ville de Sokodé (Centre Togo). VertigO, 20(3). https://doi.org/10.4000/vertigo.28991
37. Traoré H. (1991). Influence des facteurs agroécologiques sur la constitution des communautés adventices des cultures céréalières (sorgho, mil, maïs) du Burkina Faso. Thèse de Doctorat, Biologie et Ecologie Végétales, USTL, Montpellier II, France. Montpellier, USTL, 180 p. + annexes.
38. Traore K., Péné C.B., Aman Kadio G. & Aké S. (2005). Phytosociologie et diversité floristique du périmètre elaeicole de la Mé en basse Côte d'Ivoire forestière. AgronomieAfricaine 17(3) : 163-178.