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Chapter 11

Usefulness of Plant Biodiversity in the Cities of Togo

Radji Raoufou and Kokou Kouami

Additional information is available at the end of the chapter

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Abstract

In an increasingly urbanized environment, the need for greenery and flowers is being more and more felt for esthetic reasons and ecological benefits. In Togo, more than six hundred species of horticultural plants are identified and composed of approximately 59% of dicotyledons (49 families, 145 genera, and 315 species) and 37.37% of monocotyledons. Pteridophytes and gymnosperms account for less than 6%. The spectrum of morphological types indicates that herbs are account for 55%, while trees and shrubs represent 15%. More than 50% of the species of this flora is exotic horticulture. A species distribution is made according to their decorative parts and their place of use. Across the country, 55 plantings are recorded and unevenly distributed in cities. Apart from their ornamental purpose, ornamental plants are used for feeding, traditional and industrial cosmetics in psychotherapy, horticultural therapy, and in traditional and conventional medicine. In this study, 79 species from 39 families are reported as medicinal plants. The *Apocynaceae* and *Fabaceae* (six species), the *Euphorbiaceae* and *Liliaceae* (five species), the *Arecaceae* and *Verbenaceae* (four species) are the best represented families. Production systems in ornamental horticulture in Togo are very diverse in terms of speculation, access to land (variable surfaces, direct or indirect forms of tenure, acquisition methods, land use, etc.) and socio-economic profiles of farmers (men, women, young, old, people with little or no qualifications, rural to urban, etc.). The family horticultural production system, which represents over 90% of 55 horticultural farms of this study, is the main production system. It is characterized by areas of less than 0.1 hectare and farms in relative land insecurity (97% of land used belongs to the state). Throughout the system, there is a salaried labor representing 5–8% of turnover. Temporary and permanent employees are paid on weekends or at the end of the month. Farmers use gardening equipment and processing plant more or less modern including clippers, shears, pruners, and sprayers. Production units provide direct employment (more than 3 employees per unit) and directly to several hundred people. Horticulture in urban and peri-urban areas improves the living conditions of farmers (income) and the population (embellishment of streets, maintenance or creation of green area buffer) despite some negative externalities associated particularly with the use of prohibited pesticides and uncontrolled use of spaces along the roads. Its survival is threatened by many constraints, including the extension of urban housing and road building. In Togo, beneficial effects of ornamental horticulture

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may be more noticeable if the political authorities, private stakeholders, and the researchers work together to organize the sector. It could thus participate effectively in the formal economy and the emergence of true development plans at the municipal level.

Keywords: biodiversity, ornamental horticulture flora, socio-economics, profitability, Togo, medicinal plants, parts used

1. Introduction

Urban growth is a fundamental ingredient for global population advancement in the time where towns aggregate an increasing part of this population.

Urban growth is a fundamental ingredient in the evolution of the world's population, insofar as cities have an increasing share of this population. Urbanization represents a culmination of the economic processes in progress, both those that are part of a developmental logic and those that are the result of a breakdown of rural societies. Moreover, urbanization often causes a conflict exacerbation between the population and its environment. Urban forests bring many benefits in terms of sustainability. They help to regulate the urban climate and are a benefit source of biodiversity, but they also constitute spaces for social practices and economic resources.

Created in the early 19th century [1], the word horticulture means, according to the French language dictionary (2008), the cultivation of ornamental plants, vegetables, and fruits. It is synonymous with gardening. In the Larousse dictionary (2008), horticulture is an art of cultivating gardens. It is a branch of agriculture including the cultivation of vegetables, flowers, trees, fruit, and ornamental shrubs. It is divided into two branches:

- food or edible horticulture that includes vegetable crops in the open field, vegetable or vegetable crops, and fruit trees;
- ornamental or inedible horticulture that includes potted plant production, bedding plants and cut flowers, ornamental arboriculture, and nurseries and bulbous plant production.

Acclimatization of plants is becoming more and more a commercial business and the collecting botanists sent on mission by large horticultural firms compete with the traveling botanists of scientific institutions. These explorations are current today and the transport of plants is not without dangers: phytosanitary problems, invasive plants and more recently the question of the ownership of the genetic resource [2].

In Togo, the colonial period (1884–1960) was active in the knowledge of Togo's flora and vegetation, thanks to civilian administrators, ethnologists, foresters, agronomists, doctors, etc. [3]. However, botanical prospections really started only with the creation of the first university (University of Lomé) in 1970. Since then, several authors, including Aké Assi [4], Ern [5, 6], Brunel [7], Brunel et al. [3], Brunel [8], and Scholz and Scholz [9] have contributed to improve this knowledge. The synthesis of all these works resulted in the publication of the Flora of

Togo [3], where 2500 species are described botanically. Since then, botanical investigations are continuing to complete this list [10]. Botanical harvests of Akpagana and Guelly [11] have increased this number of 235 new species. The works of Batawila [12], Kokou [13], Kokou et al. [14], and Akpagana and Gumedzoe [15] enabled a more exhaustive census of the plant species of Togo's spontaneous flora.

In Togo's flora, 40 species are reported in note as introduced plants used for ornamental purposes in parks and gardens [3]. From 1997 to date, the work of Radji has made it possible to formally establish Togo's horticultural flora.

These various studies have allowed, according to the major plant groups, to count about 3451 species gathering the spontaneous flora and that introduced. However, although rich enough, Togolese flora is still incompletely known [13, 16, 17].

2. Aims

The usefulness of this chapter is to constitute a part of the best knowledge of Togo's flora in particularly its horticultural flora made up to more than 90% of exotic plants, while the native local flora remains poorly known. It is also an interpellation of the botanist community from local universities and research institutions in botany and ethnobotany, to deepen the knowledge of the local flora, especially its valorization in many branches like the horticultural sector which is gaining considerable momentum in the country, by proposing a greater diversity of local ornamental plants.

3. Location of the study area

Lomé city and its surroundings in south, Kara city in the north and Atakpamé and Kpalimé in center was explored for floristic inventory (**Figure 1**). No flower planting has been identified in the other cities in Togo. However, the study takes into account the landscaped areas and the private gardens in public or private administrative institutions. Each planting or landscaped areas or garden was considered as a botanical survey of 68 plantings across the country, including 65 in Lomé and its surroundings and one in each of the three cities (Atakpamé, Kara, and Kpalime).

The identification of species was made with the flora of Berhaut [18], Byrd Graf [19], Houerou and Houerou [20], Grisvard et al. [21, 22], and Hessayon [23]. Further information was collected from those of Hutchinson and Dalziel [24, 25], Brunel et al. [3], and Lebrun and Stork [26–30]. The nomenclature used is that of the mentioned authors. Data from the International Code of Botanical Nomenclature [31] and those online as the Index Nominum Genericorum (ING) [32], the International Plant Names Index (IPNI) [33], and the Harvard University Herbaria (HUH) [34] were used for the names of authors and synonyms. The classification of ornamental plants followed that of Vidalie [35] and Aké-Assi et al. [36]. The works of Radji et al. [37, 38], Aké-Assi et al. [36], and Porter et al. [39] allowed clarifying the origin countries of the plants.

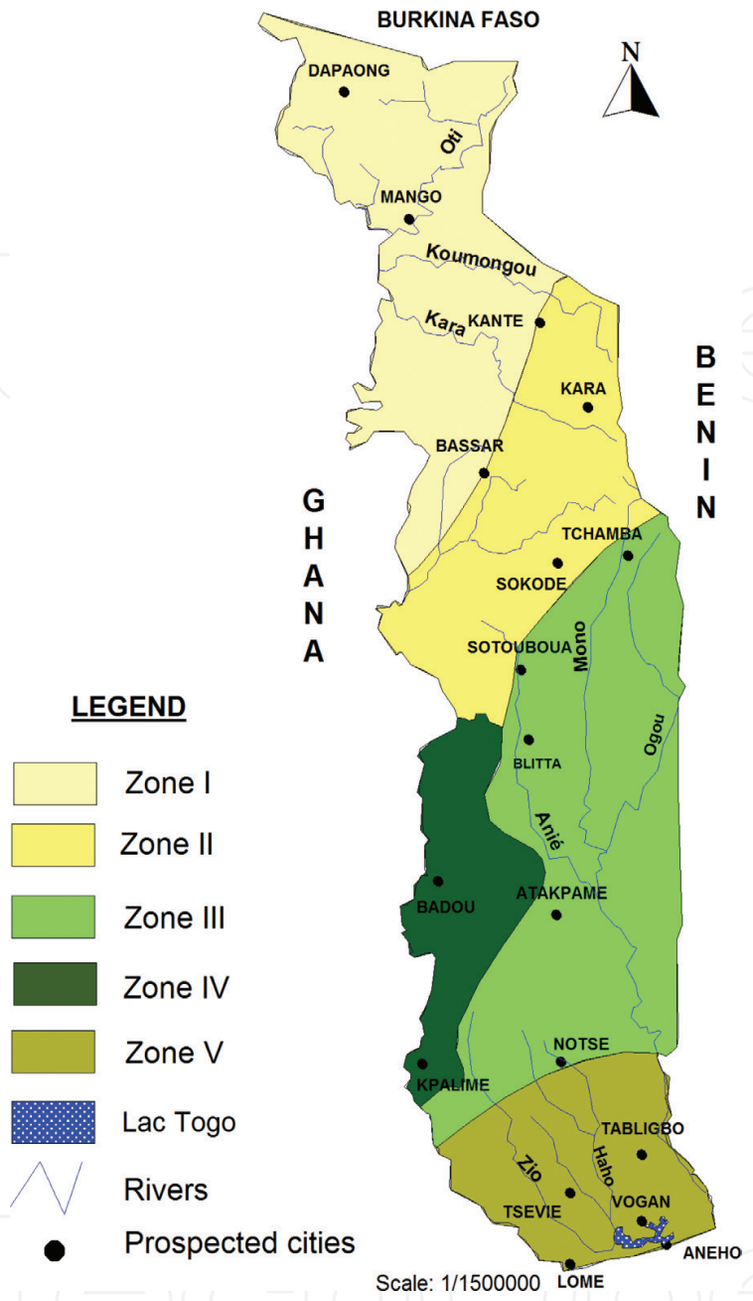


Figure 1. Togo eco-floristic subdivisions and major cities surveyed.

In each planting, an ethnobotanical survey has covered therapeutic uses of the identified species. This work was conducted with 279 respondents. The data collected were supplemented with two Traditional Practioners in Lomé. They were subsequently brought into line with those that already existed in the reference literature [36, 40, 41]. The ethno botanical information collected were recorded on sheets of raw data and then transferred to a database. They were processed and analyzed under RGui 2.7.0 statistical software [42] to obtain standardized data concerning the key constituents, therapeutic properties and uses assigned to each reported species, the parts used, and the most commonly mentioned methods of preparation. The status of rare species is indicated by an index of scarcity RI obtained from the equation of Géhu and Géhu [43], where *ni* indicates the number of readings in which the species *i* is present and *N* is the total number of readings.

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4. Organization of Togo's ornamental firms

In 2016, the number of horticultural exploitations listed in Togo was 68 geographically distributed as; one farm in Kara, one in Atakpamé, another one in Kpalimé, and 65 in Lomé. From 1997 to 2010, the number of horticultural farms (22 in Lomé in 1997) has increased by 66.66%. Ninety-four percent (52 farms) are located in the "administrative reserves" belonging to the government area and six percent are setting on individual private property (**Figure 2**).

More than 90% of the nurseries are private family farms. Their average size is 291.47 m². (**Figure 3**). The gap (202.76) is very high, showing a great variability of the surface area of horticultural farms.

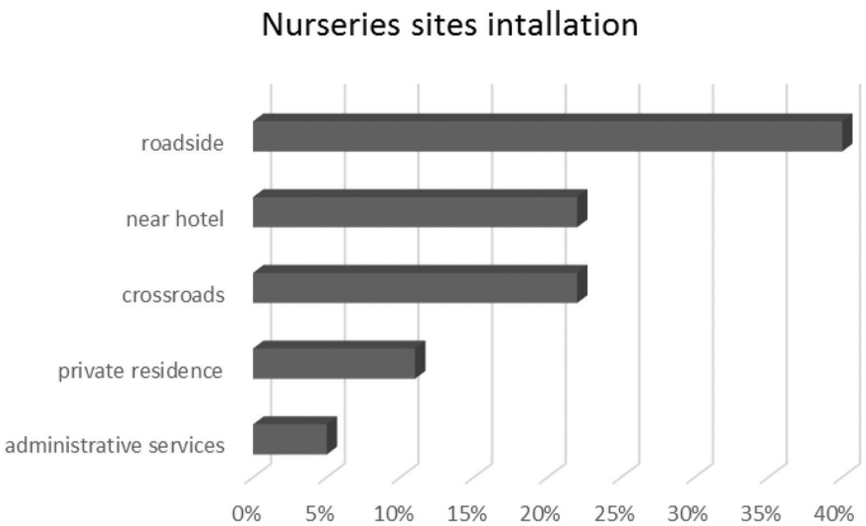


Figure 2. Distribution of nurseries according to places of installation.

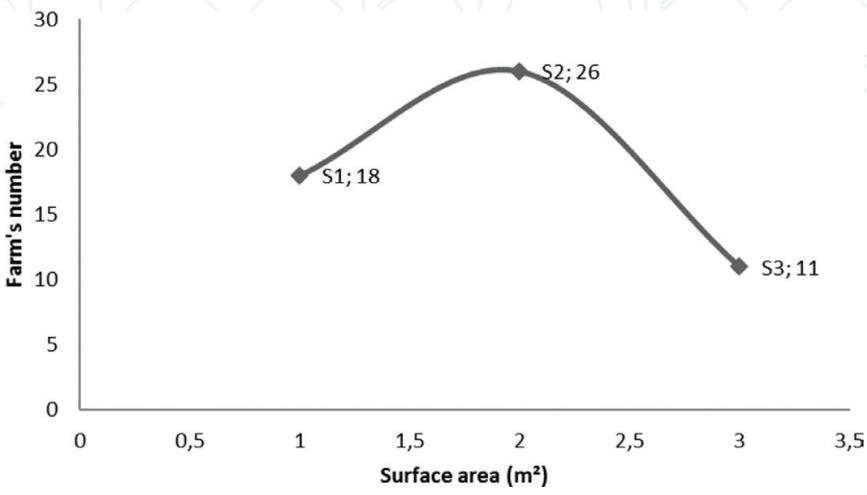


Figure 3. Distribution of farms according to dimensions (m²). The figures indicate the number of nurseries concerned, S1 = farms having less than 150 m²; 150 < S2 < 500 m²; S3 = farms having a surface area above 500 m²).

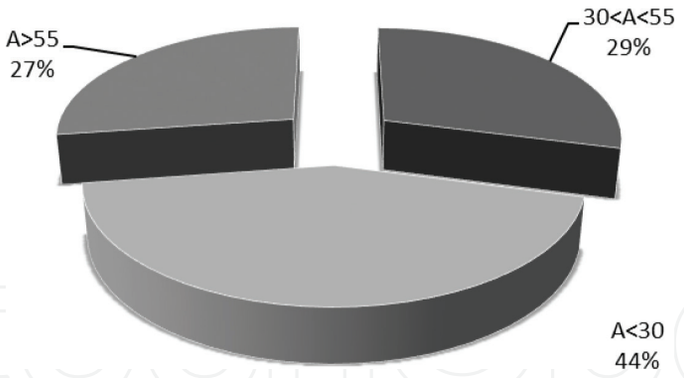


Figure 4. Age bracket of the farmers (A = age).

Otherwise, 179 people work in the ornamental horticulture sector in Togo and 58% are male. The farm lords are predominantly the youth: 44% are less than 30 year old (**Figure 4**), 29% aged between 30 and 55 years, whereas 27% are more than 55 years.

5. Togo ornamental biodiversity

5.1. Floristic richness

In Kara (north Togo) like Atakpamé (Togo center), the inventory allowed to identify 123 species distributed in 42 families and 93 genera. In Kpalimé (west), 138 species were identified and divided into 54 families and 103 genera. In Lomé (south and capital), the number of species identified is 612 which divided into 246 genera and 80 families. All the species identified outside Lomé (estimated at 380 species) are at 100% found in the list of the species identified in Lomé and its surroundings. However, nearly 500 species accounted in Lomé are not yet grown in the other cities.

In term of genus, dicotyledonous represent 59% of Togo's ornamental plants; then Monocots are 38% and Pteridophyta and Gymnospermae are less than 6%. Otherwise, all dicotyledonous belong to 49 family, 145 genera, and 315 species **Table 1**.

The average of the floristic richness is 142.91 ± 57.92 species per planting and the equation $y = 0.069x + 0.449$ with $R^2 = 0.236$ justifies the relationship between the floristic richness and the age of the nursery (**Figure 5**). This significant relationship shows that the experience acquired by the planting operator over time, especially by taking into account the demands and requirements of customers and the need to meet customer demand, is a major factor that can improve the species richness of horticultural planting.

5.2. Preferential species

This study shows that 274 species representing 44.77% of the species surveyed are the "preferential species" (RI < 80%). As listed, there are 15 most preferential species: *Aloe vera* L. var. *chinensis, Bougainvillea glabra, Catharanthus roseus* (L.) G. Don, *Cordyline terminalis* (L.) *Kunth., Dieffenbachia amoena, Dracaena arborea* (Willd.) Link., *Erythrina indica* Lamk., var. *picta* L. *Euphorbia millii* Des Moul. var. *breonii, Ficus bengamina* L., *Ficus retusa* L., *Ixora macrothyrsa,*

Fragrant plants		
Family	Taxa	Part exhaling gasoline
Annonaceae	*Cananga odorata* (Lam.) Hook. f. & Thoms.	Flowers
Agavaceae	*Polianthes tuberosa* L.	Flowers
Caesalpiniaceae	*Cynometra megalophylla* Harms	Leaves
Moraceae	*Artocarpus communis* J.R. & G. Forst	Fruits
Oleaceae	*Jasminum nitidum Skan*	Flowers
	Jasminum sambac Ait.	Flowers
Poaceae	*Cymbopogon citratus* (DC.) Stapf	Leaves
Rutaceae	*Murraya paniculata* (L.) Jacq.	Flowers

Table 1. Fragrant plants.

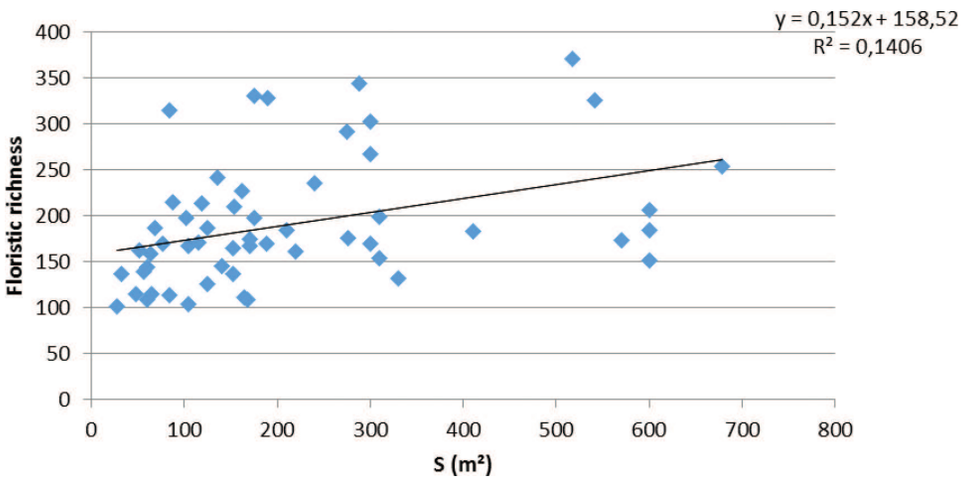


Figure 5. Relationship between floristic richness and age of nursery.

Murraya paniculata, Nerium oleander, Pithecellobium dulce (Roxb.) Thunb., and *Polyalthia longifolia.*

With RI ≥ 80%, 338 species (55.23%) are "rare" and were listed in less than 10% of the readings. Among them, 67 have only one occurrence (RI ≥ 98.18%). This is the case of *Calathea makoyana E.* Morr. & Boom, *Cryptostegia grandiflora* Br. R. ex Lindl., *Davallia bullata* Wall. Ex Hook., *Echinocereus pectinatus* Engelm., *Ficus elastica* Roxb. var. *decora*, *Monstera deliciosa* Liebm., *Oxalis ovate* Ruiz ex Knuth, A. *Tithonia diversifolia* A. Gray, *Vanda coerulea* Griff. ex Lindl., and *Zamia furfuracea* L.f.

6. Plants provenance of Togo's horticultural flora

Fifty-two percent of the horticultural flora species in Togo are coming from Americas against less than 20% from Africa (**Figure 6**). Outside the Americas (30%) and Asia (25%), each of

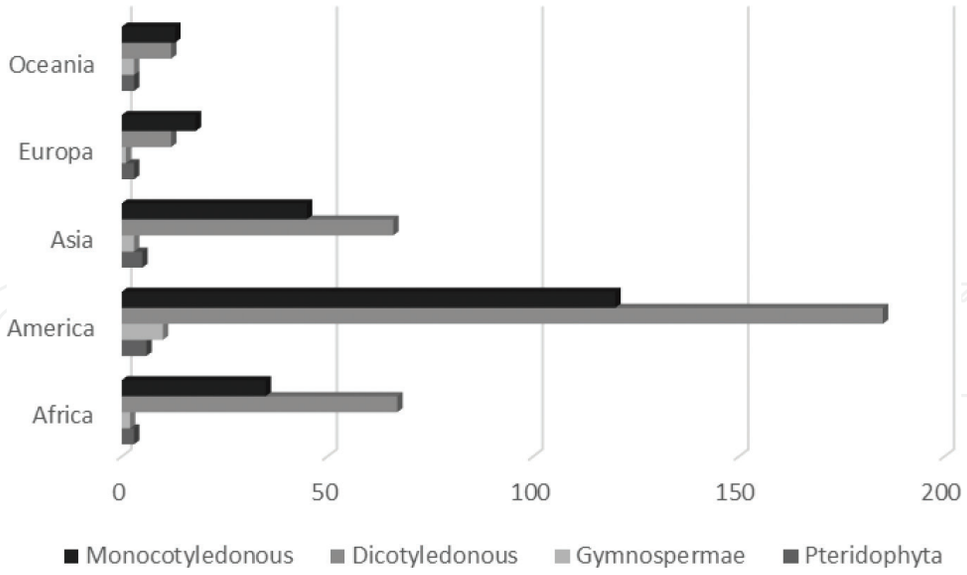


Figure 6. Species distribution according to taxonomic groups and continents.

the three other continents include 15% of Pteridophyta identified. The Gymnosperms are 53% from the Americas and only 10% are from Africa. Concerning the monocotyledons, the species originated from Africa account for only 15% of the total. This percentage is 20% for dicotyledons. Among dicotyledons, the plants originating from the Americas include only 54% of the total.

7. Species distribution according to decorative parts

In this study, 311 species grouped into 106 genera and 30 families are grown and used in Togo as ornamental decorative foliage plants. The most representative families are, respectively, *Arecaceae* with 18 genera and 22 species, *Araceae* with 14 genera and 53 species, *Acanthaceae* with 12 genera and 16 species, and the *Euphorbiaceae* with 5 genera and 31 species.

Twelve families including 34 genera and 69 species have ornamental architecture. The following species are listed as an illustration: *Polyalthia longifolia* (Sonn.) Hook. f. & Thomson (*Annonaceae*) *Ravenala madagascariensis* Gmel. J.F. (*Strelitziaceae*) and *Terminalia mantaly* H. Perrier (*Combretaceae*).

It is about 166 species from 37 families of monocotyledons and dicotyledons. This is the case of *Allamanda cathartica* L. (*Apocynaceae*), *Gardenia jasminoides* Ellis (*Rubiaceae*), *Guaiacum officinale* L. (*Zygophyllaceae*), *Hibiscus rosa-sinensis* L. (*Malvaceae*), *Mussaenda philippica* A. Rich. (*Rubiaceae*), and *Plumbago capensis* Thunb. (*Plumbaginaceae*).

Nine species are grown for the scent of their flowers, leaves, and fruits. They are from eight families (**Table 1**).

In the list of horticultural plants in Togo, three families with only one genus are ornamentals by their fruits. Families are *Arecaceae, Bignoniaceae*, and *Moraceae*. Species concerned are *Cocos nucifera* L., *Crescentia cujete* L., and *Artocarpus altilis* (Parkinson) Fosberg.

Depending on the season, the characteristics previously described (foliage, habit/look, flowering, and fruit) can be combined to give the plant its ornamental or decorative appearance. It may be the foliage and flowers (as for *Adenium obesum* (Forssk.) Roem & Schult. and *Plumeria rubra* L. from the *Apocynaceae* family; or flowers-habit/look association (as for *Guaiacum officinale* L. (*Zygophyllaceae*); or foliage and inflorescences (case of *Bougainvillea glabra* Choisy *variegata, Ligustrum ovalifolium* Hassk., and the aquatic plant *Victoria regia* Lindl.).

8. Distribution of ornamental species according to their use

The inventory gives 35 species grouped into 17 families and 26 genera used as curbs, walkways or paths plants. There are generally decorative trees and shrubs by their leaves and look and seasonally by their inflorescences such as *Khaya senegalensis* and *Delonix regia*.

Others used as outdoor garden plants are trees, shrubs, and herbs potted, installed outdoors or putted in the ground on lawns. Isolated plants, lawns plants, bedding, ornamental or protective hedges, ground cover or coating plants, and water decorative plants can also be distinguished.

Isolated plants are 49 species grouped into 34 genera belonging to 21 families. For a species to be planted alone in a garden, it must offer a spectacle of beauty either by its foliage (*Nerium oleander variegatum*) or by its look (*Araucaria excelsa* R. Br and *Cycas revoluta* Thunb.) or by its flowers (*Mussaenda philippica, Hibiscus rosa-sinensis, and Polianthes tuberosa* L.) or its fruits (*Crescentia cujete* L.).

The *Poaceae* are mostly used in Togo as lawn plants. In alphabetical order, this study was collected: *Chrysopogon aciculatus* (Retz.) Trin, *Cynodon dactylon* Pers, *Paspalum distichum* L. *Stenotaphrum secundatum* (Walt.) Kuntze. *variegatum,* and *Zoysia tenuifolia* Trin.

A part from lawns, other plants are used to cover non-grassed bare surfaces. These include creepers such as *Episcia cupreata* (Hook.) Hanst. (*Gesneriaceae*) or twining plants such as *Ipomoea quamoclit* (*Convolvulaceae*). Depending on the structure of the plant, some species are used as carpets; this is the case *Wedelia trilobata* (L.) Hitch. (*Asteraceae*) or in wall carpet as the case of *Ficus pumila* L. (*Moraceae*).

Twenty-eight species grouped into 18 genera and 15 families are bedding grown ornamental plants. Species commonly inventoried are *Acanthus mollis* L. *Barleria lupulina* Lindl. (*Acanthaceae*), *Canna generalis* L. H. Bailey (*Cannaceae*), *Lantana camara* L. (*Verbenaceae*), *Thunbergia erecta* (Benth.) T. Anders., *Turnera ulmifolia* L. (*Turneraceae*), and *Yucca aloifolia* L. (*Agavaceae*).

Ornamental hedges include 33 species of 18 genera and 14 families. Species commonly appreciated are *Clerodendrum inerme* (*Verbenaceae*) for its dense foliage, *Bougainvillea glabra* (*Nyctaginaceae*) for its purple flowers and its thorns, *Pithecellobium dulce* (*Fabaceae*) mainly for its thorns and its dense foliage when the plant is young, and *Pereskia grandiflora* (*Acanthaceae*) for its thorns and ease of its cuttings pushing.

As water ornamental plants, two families are identified: *Pontederiaceae* represented by *Eichhornia crassipes* (Mart.) Solms. and *Nymphaeaceae* with 4 genera *Euryale*, *Nelumbo*, *Nymphaea*, and *Victoria*.

9. Indoor garden plants

House plants are species that fit inside houses and apartments: balconies, verandas, hallways or inside the offices. 193 species grouped into 44 genera and 17 families are identified as house plants. The genera *Pteris* (*Adiantaceae*), *Asplenium* (*Aspleniaceae*), *Aglaonema*, *Alocasia*, *Caladium*, *Dieffenbachia*, *Monstera* and *Philodendron* (*Araceae*), *Schefflera* (*Araliaceae*), *Oxalis* (*Oxalidaceae*) and *Licuala*, *Kentia,* and *Livistona* (*Arecaceae*) can be mentioned.

Several species are grown in order to provide useful elements to the preparation of floral bouquets. These bouquets are placed in clay pots or glass jars for home decor. Among the species recorded and identified, we have the genera *Caesalpinia and Melia* for inflorescences *Alpinia*, *Anthurium*, *Aster*, and *Chrysanthemum*, *Polyanthes* and *Heliconia* for flowers, *Alpinia*, *Cordyline*, *Cycas*, *Dracaena*, *Maranta*, and *Sansevieria* for the leaves, and *Cyperus* for the stem and the leaves.

10. Ornamental plants for therapeutic purposes

Seventy-seven ornamental species belonging to 39 families are listed as medicinal plants. The most represented families in number of species are the *Apocynaceae* and *Fabaceae* represented by six species, *Euphorbiaceae* and *Liliaceae* five species, and *Arecaceae* and *Verbenaceae* with four species are the most represented families.

The ethnobotanical survey revealed that 49% of the identified species are used against diseases of digestive system and 17% for dermatoses. Visual, bone, urinary, and auditory parts of the nervous system is represented by less than 7% (**Figure 7**).

Some species are used to treat many diseases and the use of others requires a combination with non-ornamental plants.

For about 43% of the species, the leaves are the most solicited parts (**Figure 8**). They are followed by, in descending order, the association stem leaves (27%), the underground parts, the bark, the flowers, the fruits, and the entire plant.

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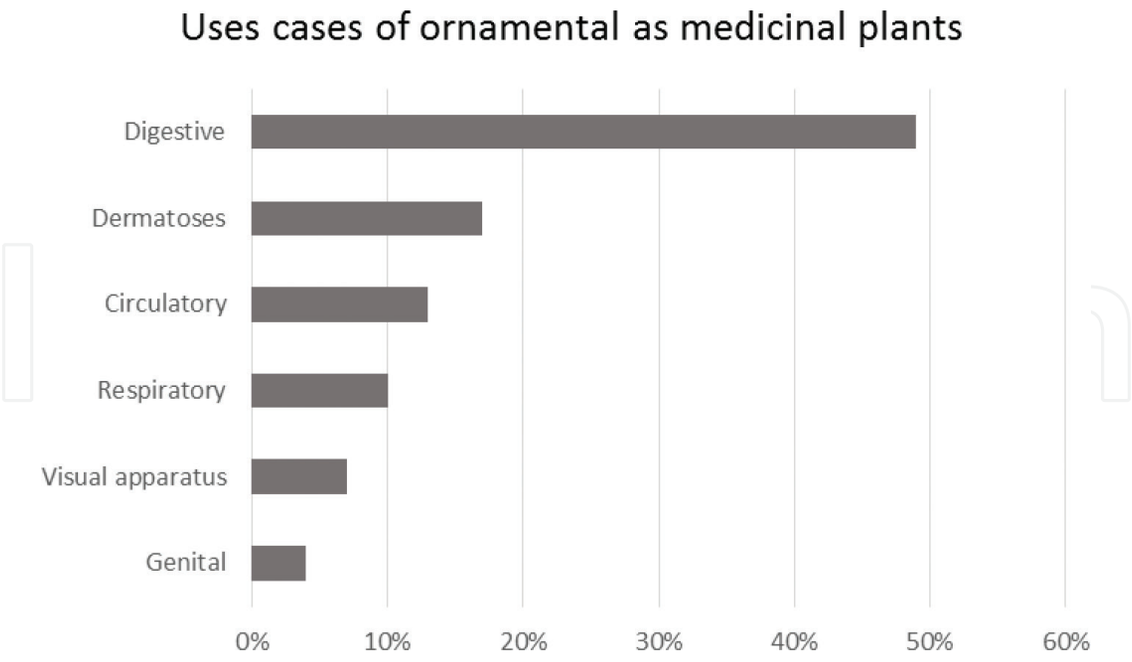


Figure 7. Uses cases of ornamental medicinal plants.

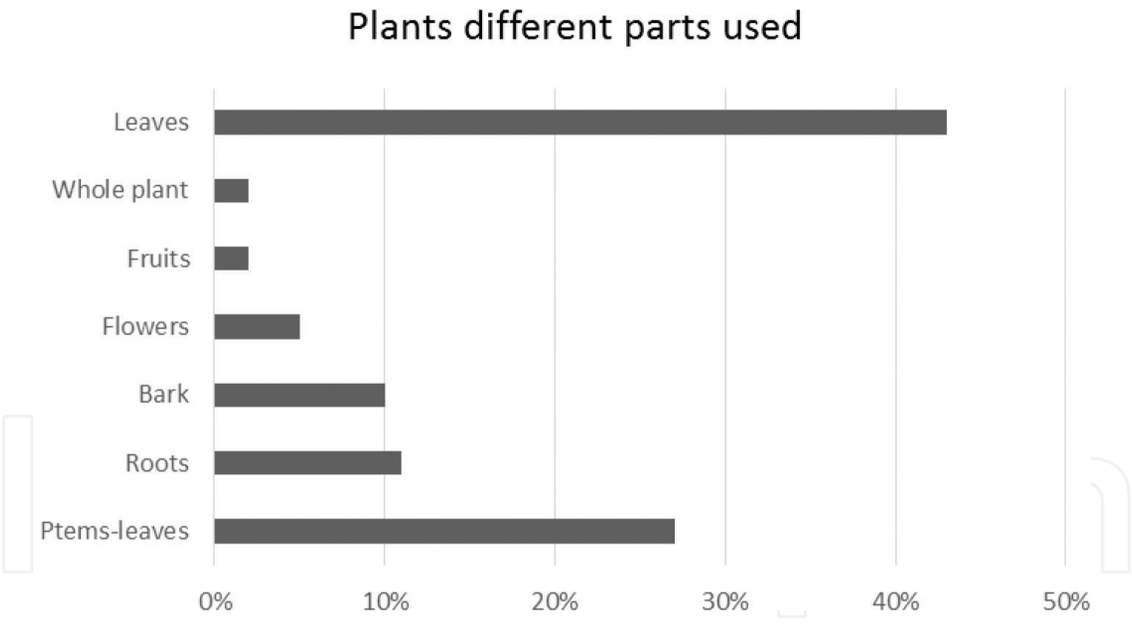


Figure 8. Distribution of plants different parts used.

Decoction is the most common method of preparation (47%). It is followed by the poultice (17%) and the bath (13%). The other methods (maceration, nature, fumigation, infusion, and powder) represent 23% (**Figure 9**). Among the modes of administration, the most used is the oral absorption (82%).

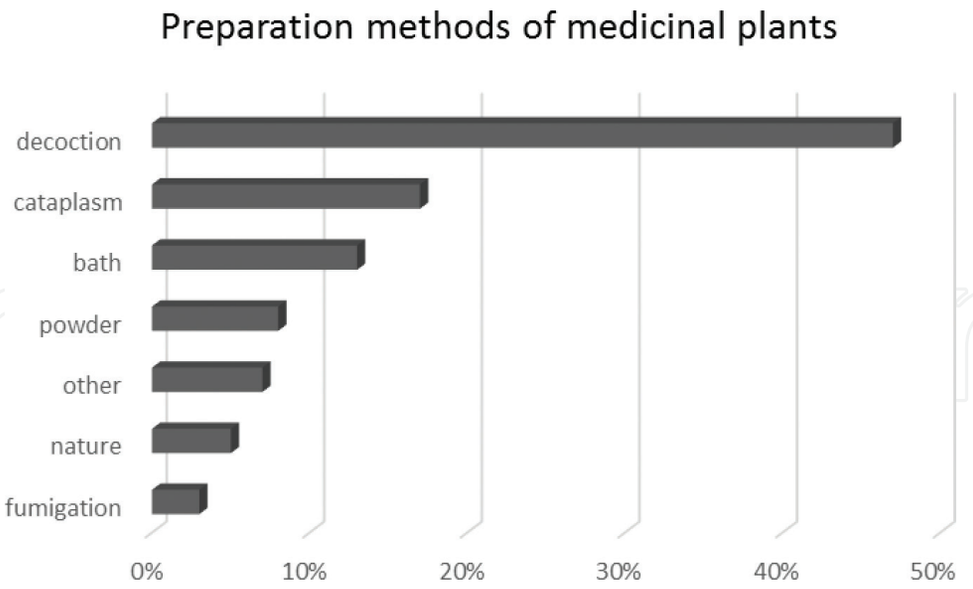


Figure 9. Spectrum of different methods of preparation of medicinal plants.

11. Other uses identified for ornamental plants in Togo

Although the first reason for their cultivation is ornamentation and beauty, many ornamental plants are used for other purposes. In Togo, the present study identified: plants for psychomagic, feeding, traditional or industrial cosmetics (**Table 2**), and toxic plants (**Table 3**).

For food plants, fruits and leaves (*Eugenia malaccensis* L. *Gomphrena globosa* L.) are the most used while wood is very useful as timber (*Gmelina arborea* Roxb.) in buildings (*Acacia auriculiformis* L.) and as firewood (*Cassia siamea* Lam.).

For human consumption, 15 plant species was identified, 3 others are reported for traditional cosmetics and 11 in the agro-food system, industrial cosmetics, and wood industry.

12. Discussions

The farms surveyed are less than 0.1 hectare in size. This constraint prevents the development of the sector, its modernization and competition, and making its participation in the formal economy invisible [44, 45]. The equipment is basic and the use of inputs, especially fertilizers, is minimal. Squatting (illegal occupation) of land is the dominant tenor.

Although entrepreneurial horticultural production systems constitute only 5.45% of horticultural holdings, they hold almost the entire public market as they have completed the administrative formalities toward the municipal administration and paid the taxes. They are private farms characterized by the use of permanent wage labor, the use of modern tools (lawn mower, hedge shears, and motorized sprayer). However, employees have no specialty in horticulture. The main destination of production is local consumption. The ornamental horticultural sector in Togo is therefore not registered for export.

Scientific name	Organs consumed	Products obtained
Food		
Artocarpus communis J.R. & G. Forst.	Fruit	
Caladium bicolor (Ait.) Vent.	Leaves and bulb	
Chrysophyllum albidum G. Don	Fruit	
Citrus maxima; *C. sinensis*	Fruit (pulp and juice) and flowers	Beverages, jams, flavoring, and beekeeping
Cocos nucifera L.	Fruit	
Cycas revoluta Thunb.	Marrow	
Elaeis guineensis Jacq.	Seed, sap	Fermented beverages, alcohol, and vegetable oils
Eugenia malaccensis L.	Fruit	
Gmelina arborea Roxb.	Leaves	Food package
Gomphrena globosa L.	Leaves	
Mangifera indica L.	Fruit (nature, dried or cooked)	Jams, marmalades, jellies, compotes, and alcohol
Pithecellobium dulce (Roxb.) Benth.	Fruit (aril)	
Punica granatum L.	Fruit (pulp)	Jams
Samanea saman (Willd.) Merril.	Clove	
Terminalia cattapa L.	Almond	
Cosmetic		
Bixa orellana L.	Seed	Dyestuff
Elaeis guineensis Jacq.	Fruit	Palm kernel oil
Lawsonia inermis L.	Leaves and flowers	Dyestuff, tincture, perfume, and toothpicks
Industrial		
Acacia auriculiformis L.	Wood	Cabinetmaking
Azadirachta indica A. Juss.	Wood, seeds, and gum	Softwood lumber, firewood and charcoal, oil, tincture, lubricants, disinfectants, cosmetics, and insecticides
Cananga odorata (Lam.) Hook. f. & Thoms.	Flowers	Perfume
Cassia siamea Lam.	Wood	Cabinetmaking, firewood, and charcoal
Catharanthus roseus L.	Leaves, flowers, and fruits	Drugs
Citrus maxima; C. sinensis	Wood and branches	Woodwork, turning, and marquetry

Scientific name	Organs consumed	Products obtained
Cocos nucifera L.	Fruit	Vegetable oil consumption
Ealeis guineensis Jacq.	Seed, fruit, and stipe	Palm kernel cake, construction, bridges, straw, fencing, and brush
Gmelina arborea Roxb.	Wood	Frames, poles, woodmaking, sculpture, crates, plywood, Firewood, and for matches
Lantana camara L.	Leaves	Sandpaper to polish wood
Mangifera indica L.	Green or dried fruit, wood	Fuel, construction, tincture, and black ink
Psycho-magic		
Aloe vera	Leaves	Negative influences and household accidents protection
Bambusa vulgaris	Trunk, leaves, and stems powder	Protection against negative energies, bad luck, brings luck, and fortune
Croton zambesicus Müll Arg.	Whole plant	Protection and hunting evil spirits
Thevetia neriifolia Juss.	Fruit	Ordeals and divinations

Table 2. Other uses identified for ornamental plants.

Scientific names	Part used	Main chemical composition	Effects
Acalypha hispida Burm.f.	Whole plant	Steroids, saponoides, polyphenols, tannins, and cyanogenic derived	
Adenium obesum (Forssk.) Roem. & Schult.	Latex and root	Cardiotoxic heterosides	Dangerous for eyes and cause of violent diarrhea
Allamanda cathartica L.	Whole plant	Cardiotoxic heterosides	
Alocasia macrorhiza Schott.	Whole plant	Alkaloid, oxalate de calcium	
Aralia balfouriana Bailey	Whole plant	Saponin, alkaloid	
Asclepias curassavica L.	Whole plant	Cardiotoxic heterosides	
Caesalpinia pulcherrima (L.)Sw.	Racines and seeds	Cyanhydric acide	
Caladium bicolor (Ait.) Vent	Whole plant	Calcium oxalate	
Calotropis procera (Aiton) W.T. Aiton	Whole plant and latex	Cardiotoxic	
Crescentia cujete L.	Pulpe, fruit, seed	Cyanhydric acid and acids oleic acid	
Cycas circinalis L.	Whole plant	Methylazoxyméthanol, and alkylating agents	

Scientific names	Part used	Main chemical composition	Effects
Cycas revoluta Thunb.	Whole plant	Carcinogenic alkaloid and neurotropic agent	
Duranta repens L.	Fruit	Saponin (sterols)	
Erythrina indica Lam.	Whole plant	Saponin (sterols), alkaloids, and acid cyanhydrique	
Euphorbia millii Des Moul.	Latex	Euphorbone, résine, caoutchouc, substance non identifiée crystallized into needless	
Euphorbia turicalli L.	Latex	Euphol, tirucallol, tinyatoxine, triterpénoïdes (euphorbinol, cycloeuphorbinol, euphoron, 31-nortriterpen cycloeuphordénol), and macrocyclic diterpen (tirucalicin)	Very caustic and toxic, makes blind, and irritating to the stomach
Jatropha multifida L.	Leaves and seeds	Saponosides, tannins, sterols, and alkaloids	
Lantana camara L.	Leaves and flowers	Toxic terpenoid	
Pedilanthus tithymaloides (L.) Poit.	Seeds	Caustic latex	
Rhoeo spathacea (Sw.) Stern	Whole plant	Anthocyan βD-glucan	
Setcreasea purpuracea Boan	Sap		
Thevetia neriifolia Juss. ex Steud	Whole plant	Cardiotoxic heterosides	
Thevetia peruviana (Pers.) Merr.	Whole plant	Cardiotoxic heterosides	

Table 3. Ornamental plants with toxic constituents.

The cultivation of cut flowers is fairly technical and requires technical training. Large companies operating in Africa belong to European groups that market in the European community and participate in major international exhibitions. Currently, the best way for the African horticulturist to integrate this commercial network is to outsource, as recommended by IQRHH [46] to Quebec horticulturists. Indeed, it is a question of settling near big companies to benefit from advice, technical aids and outlets without having to risk a depreciation of the goods during the transport, and the search of a final clientele. Organizing in a formal grouping (ADF, 2007) is also a solution. Such a grouping is a success in various countries exporting other products (coffee, cocoa, etc.). Government assistance through chambers of commerce and industry to the organization of the sector is a necessity and a non-negligible source of foreign exchange for producers but also for the state. Everything argues in favor of this sector in Togo which has land, labor, and the climate allowing the development (reproduction and harvesting) of crops throughout the year. Technicity remains to be formed.

Like foliage and flowers, the colorful fruits are used to beautify the gardens. Fruit size, shape, and appearance contribute to the recognition of taxa. Of a generally bright color (yellow, orange, red, green-yellow, etc.), the fruits are easily enhanced in the greenish foliage.

Age, size, shape, and ecological requirements can provide information on the use of plants. Among these criteria, the ecological requirements are decisive for the place of a harmonious development of the plant. According to these requirements, three main categories are identified for the place of use of ornamental plants:

- plants of shade or alignment along avenues and roads;
- outdoor garden plants: planted in isolated, massive, ornamental or safe hedges, ground cover, and water plants;
- indoor garden plants that can be installed on the balcony or in apartments.

Moreover, the use of ornamental plants is related to the type of housing and the standard of living of the populations. We can thus distinguish three types of populations [40]:

- the wealthy population is found in the "common courtyards", rental dwellings of which the inhabitants do not own. In these dwellings, the inhabitants are placed in front of their room, the ornamental plants in the cement pots. These are usually shrubs or herbs. The few trees found there are planted in the middle of the common courtyard and serve as species of shade and rest.
- The population with an average level of living resides in more spacious dwellings with an interior space where they can install pots with indoor plants or a cemented terrace, where they also have pots with green plants, variegated foliage or able to bloom. In these types of concessions, the external space is cemented and does not allow the installation of an outdoor garden requiring resources for its maintenance.
- The high-income population is found in residential neighborhoods or in private and individual dwellings. Outside the pots of indoor plants or terraces/balconies, an outside garden is implanted. It is often composed of lawns, flower beds, hedges, and odoriferous plants and requires a labor often permanent for its maintenance.

The use of ornamental plants, in relation to the living environment, informs about the standard of living and cultures. Whatever the standard of living of the population, the current trend is to have a plant in its place of residence [38] and many people are convinced that contact with trees and other [47, 48]. For the population still in rental house or not very well, this is expressed by the presence at the portal of a pot containing a plant symbol, usually an herbaceous. This is the case of *Setcreasea purpurea*, Aloe vera, *Rhoeo spathacea*, *Euphorbia millii* or a shrub (*Schefflera arboricola*, *Codiaeum variegatum*, etc.). For the average or well-to-do population, it is a garden of varying size with a flowerbed and a flower-lined terrace. The type of pot and its contents are also indicators of the standard of living of the owner of the concession.

The work of Waliczek et al., (2005) supports the idea that gardening is a hobby that can enhance the level of satisfaction with life and improve general health [49].

There are plants inspiring all sorts of beliefs [50, 51]; some are known as beneficial or lucky (*Croton zambesicus*), and others evil or mischievous (case of Cactaceae). The presence or absence of a type of plant in the life environment can have a positive or negative influence on the activities of the inhabitants of this framework. This fact is called superstition. Indeed, superstition is the belief in the manifestation of mysterious forces linked to acts, objects or phenomena [52]. Biley [50] describes different types of trees that can be planted in the perimeter of a hospital where patients, visitors, and employees will not only benefit from the esthetic appeal of trees but also mythical powers. Vendors and users of ornamental plants report that plants with abundant flowering or pleasantly perfumed flowers are lucky plants. This is the case of *Mussaenda philippica*, *Cananga odorata*, and *Murraya paniculata*. *Setcreasea purpurea* is also listed in this category. They attribute to Draceana fragrans massangeana the role of removing the quarrels from the homes, thus ensuring by their presence in the concession a certain tranquility and security to the couples [40]; to *Euphorbia tirucalli* the role of moving creeping animals away and to *Croton zambesicus*, that of keeping evil spirits away. The color of the flowers also has an interpretation. White symbolizes peace, reconciliation, reunion, the red expresses a sincere love, and the pink is in relation with the friendship. On the other hand, plants whose organs exhale an unpleasant odor are termed dishwashing plants and sellers avoid cultivating them on their site [38].

Despite the extensions of the Togolese cities, the social stratification is not pronounced. All types of housing can be found in all neighborhoods. Apart from residential cities, spatial segregation [40] is not characteristic of cities in Togo.

Plants are still the first reservoir of new drugs. Approximately 75% of drugs are of plant origin and each year new drugs are developed [53]. African countries have a long tradition of medicine and traditional medicinal plant-based know-how. Approximately 80% of the populations in developing countries use traditional medicine for primary health care [54–58], either through cultural tradition, or due to the lack of other alternatives, such as the difficulty of accessing conventional care or the higher cost of conventional medicines [59]. The majority of the medicinal species in this study are used 49% to treat diseases of the digestive system and 17% against skin diseases. This is in line with the work of Mehdioui and Kahouadji [60] who find 50% and 15%, respectively, for the same conditions.

The diversity of parts of the plants from which natural medicines are extracted is surprising. In addition to leaves and flowers, sap (Aloe vera), bark (*Khaya senegalensis*), seeds, fruits, wood (Gaiacum officinale), walnut (Cocos nucifera), stem, resin, straw, tuber, bulb, and roots ([61, 62]). These organs are used raw, dried or extracted in "sodabi" and local alcoholic beverage [38]. In this study, leaves (43%) are mostly solicited and this confirms the work of Mehdioui and Kahouadji [60], Poffenberger et al., (1992) in Ouattara [63], Zihiri (1991), and Adjanohoun and Aké Assi [64]. If the value of 30% found by Mehdioui and Kahouadji [60] seems lower than that of 43% of the present work, the other authors found percentages ranging from 50.90% for Vangah (1986) to 64.49% for Zirihi [65]. Poffenberger et al. (1992) quoted

by Ouattara [63] estimates that harvesting 50% of the leaves of a tree would not significantly affect its survival.

In addition, the most used method of preparation in this study is the decoction (47%). This result is very close to the 42.30% established by N'Guessan et al. [66] and equals the 47% found by Mehdioui and Kahouadji [60]. On the other hand, it is very much higher compared to the 32.94% reported by Adjanohoun and Aké Assi [64]. As for the mode of administration of the drugs, the buccal absorption is solicited to 82%. If this mode is similarly reported in other studies, its value is far superior to that of N'Guessan et al. [66] which indicate 48.97%, to that of 32.35% established by Ouattara [63] or of 27.06% indicated by Adjanohoun and Aké Assi [64].

Ornamental horticulture that incorporates the cultivation of medicinal plants could reduce the pressure on the medicinal plant species most used in traditional pharmacopeia. In the case of rare, threatened or overexploited plants for commercialization, cultivation is the only way to obtain the necessary plant quantities without further compromising the survival of these species [67].

13. Conclusion

More than 600 species divided into 20 Pteridophyta, 17 Gymnosperms, and 575 Angiosperms are the constituent elements of Togo ornamental flora taxonomically predominated by dicotyledonous with *Rubiaceae* and *Annonaceae* as preferential families. Among the monocotyledonous, the strongly represented families are *Araceae* and *Liliaceae*. These species are diverse across continents and over 82% are exotic to Africa. They are classified on the one hand, according to the ornamental organs, in particular the leaves, the flowers, the pace or the port, and the fruits and, on the other hand, depending on the place of use as an interior garden (apartment and balconies), outdoor garden (lawns, massifs, siding, and hedges), and alignment plants along streets and avenues. Depending on the presence or not of these plants and their diversity in a dwelling, a social stratification can be envisaged. Of the species listed, 77 clustered in 39 botanical families are used as medicinal plants. The most representative families in terms of specific richness are *Apocynaceae*, *Fabaceae*, *Euphorbiaceae*, *Liliaceae*, *Arecaceae,* and *Verbenaceae*. This study revealed that 49% of the listed species are used against diseases of the digestive system and 17% for dermatoses.

1. Apart from decorative and medicinal use, horticultural species are used for other purposes especially in traditional therapeutics. Despite advances in therapeutics, there is room for new medications for poorly tolerated or accustomed active substances, for new or emerging microbial strains or for disarming against a number of mainly tropical diseases. The exploration of the resources of the vegetable and horticultural world remains current. The wild destruction of forests deprives humankind of a source of material essential for the discovery of new molecules necessary for the development of future medicines. Is crop production in ornamental horticulture not a panacea to this destruction and to the *in situ* or *ex situ* conservation of overexploited species and put in a situation of threats or even disappearance?

Ornamental horticulture in Togo is characterized by the weakness of the areas exploited and the inorganization of the sector. It makes it possible to satisfy in part the ornamental plants needs of the capital, to participate in the generation of direct and indirect income, to partially reduce unemployment and to improve the environmental landscape of cities. The mode of acquisition and exploitation of the spaces is precarious as soon as the cities of the country and especially Lomé (the capital) are under construction especially in the construction of road infrastructures. This work, as is currently the case for operators located on the Boulevard du Mono (Lomé—Benin Border) axis, force operators installed on public roads to forcible removal, plunging the sector into precarious situations. The maintenance of a balance between urbanization and ornamental horticulture may exist provided that the authorities concerned are aware of its importance in improving the quality of urban life, in supplying cities with ornamental species and diversity, the elimination of unemployment and participation in the national economy. It is therefore important that all the actors on the ground have an integrated and concerted approach not only to improve the performance of production systems but also to take horticultural holdings into account in urban planning schemes.

As part of the policy of embellishing cities, flowers can play a very important role. It is therefore necessary to take action to enable the nascent horticultural sector to play its full part in this policy and in the economy of the country. The training of a skilled workforce would be an asset for its development.

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