

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

4,800

Open access books available

122,000

International authors and editors

135M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Usefulness of Plant Biodiversity in the Cities of Togo

Radji Raoufou and Kokou Kouami

Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/intechopen.76776>

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 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

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.

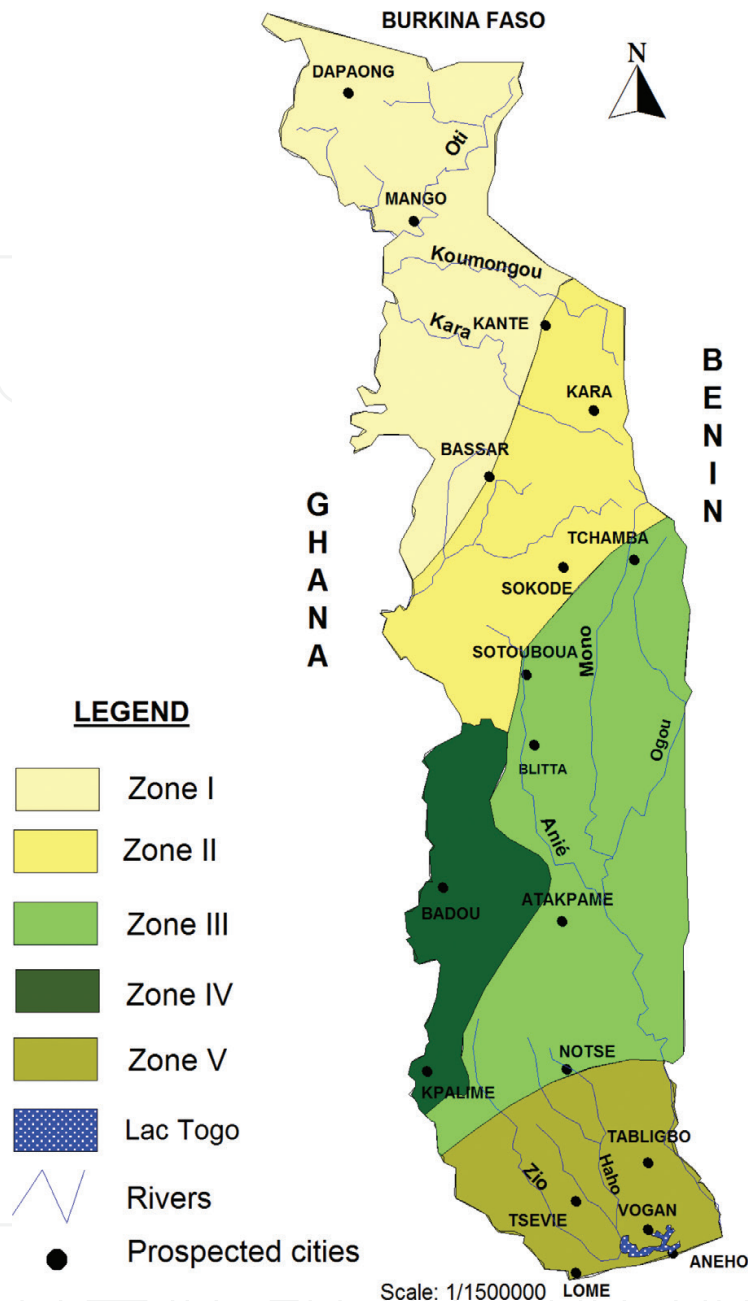


Figure 1. Togo eco-floristic subdivisions and major cities surveyed.

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 Practitioners in Lomé. They were subsequently brought into line with those that already existed in the reference literature [36, 40, 41]. The ethnobotanical 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.

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.

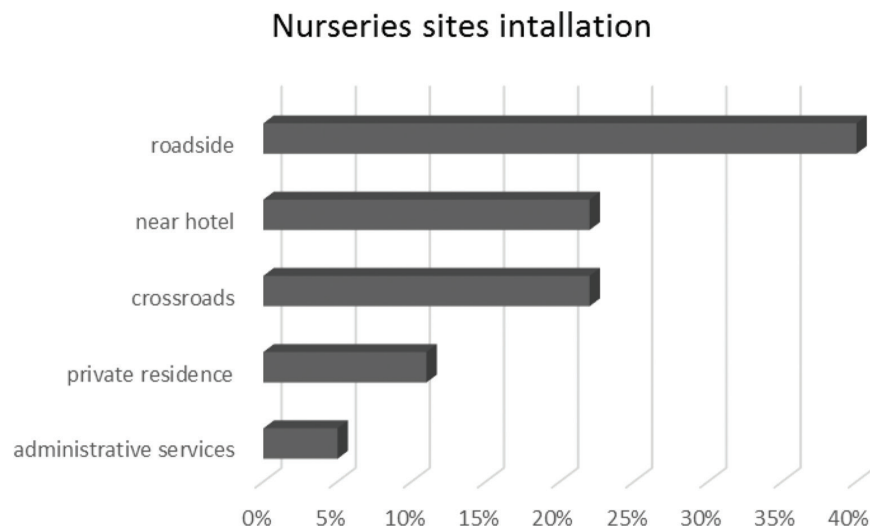


Figure 2. Distribution of nurseries according to places of installation.

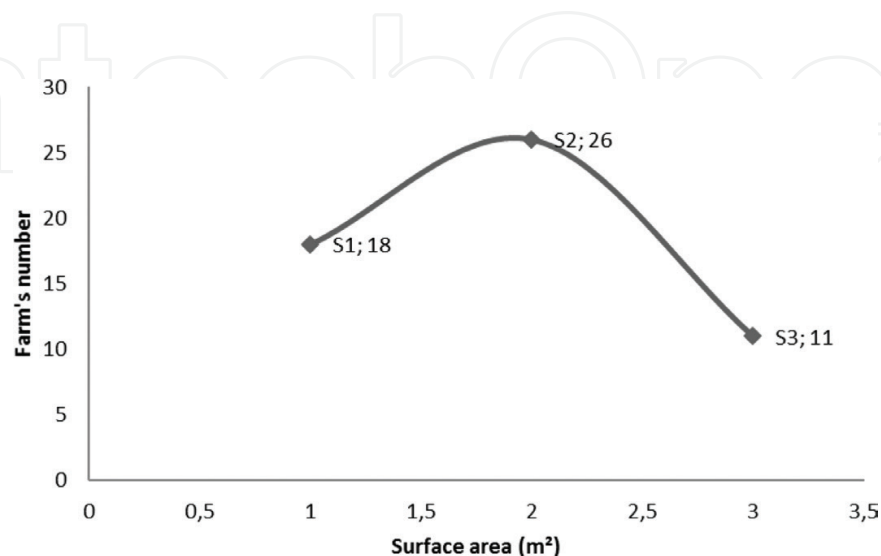


Figure 3. Distribution of farms according to dimensions (m²). The figures indicate the number of nurseries concerned, S1 = farms having less than 150 m²; 150 < S2 < 500 m²; S3 = farms having a surface area above 500 m².

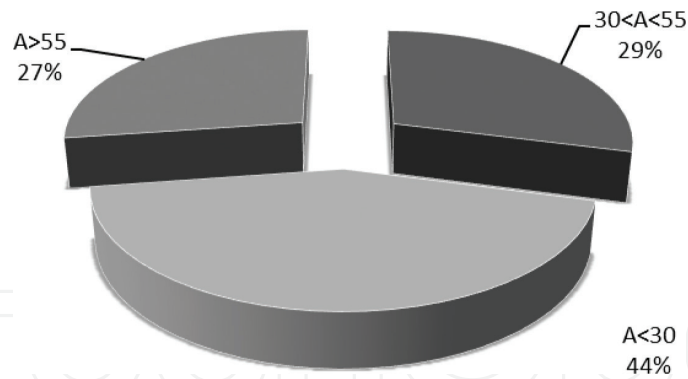


Figure 4. Age bracket of the farmers (A = age).

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	<i>Cananga odorata</i> (Lam.) Hook. f. & Thoms.	Flowers
Agavaceae	<i>Polianthes tuberosa</i> L.	Flowers
Caesalpiniaceae	<i>Cynometra megalophylla</i> Harms	Leaves
Moraceae	<i>Artocarpus communis</i> J.R. & G. Forst	Fruits
Oleaceae	<i>Jasminum nitidum</i> Skan	Flowers
	<i>Jasminum sambac</i> Ait.	Flowers
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	Leaves
Rutaceae	<i>Murraya paniculata</i> (L.) Jacq.	Flowers

Table 1. Fragrant plants.

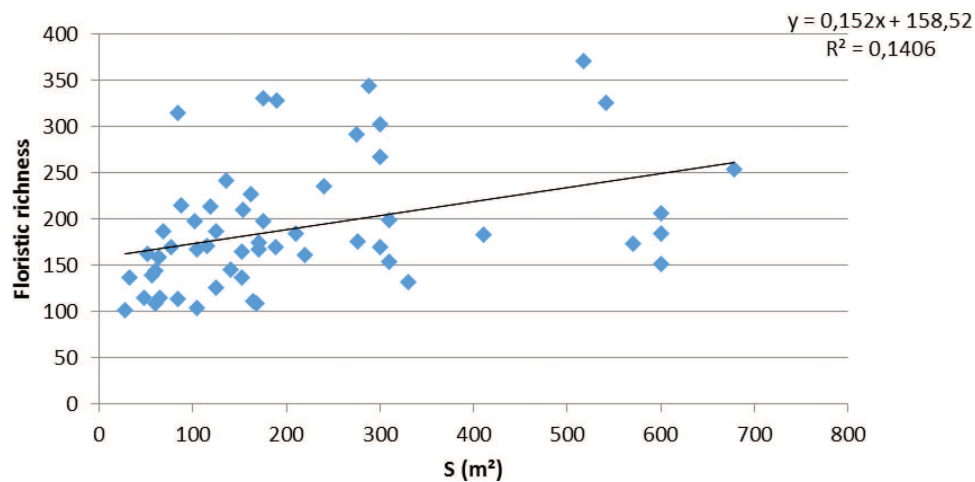


Figure 5. Relationship between floristic richness and age of nursery.

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

With $RI \geq 80\%$, 338 species (55.23%) are “rare” and were listed in less than 10% of the readings. Among them, 67 have only one occurrence ($RI \geq 98.18\%$). 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

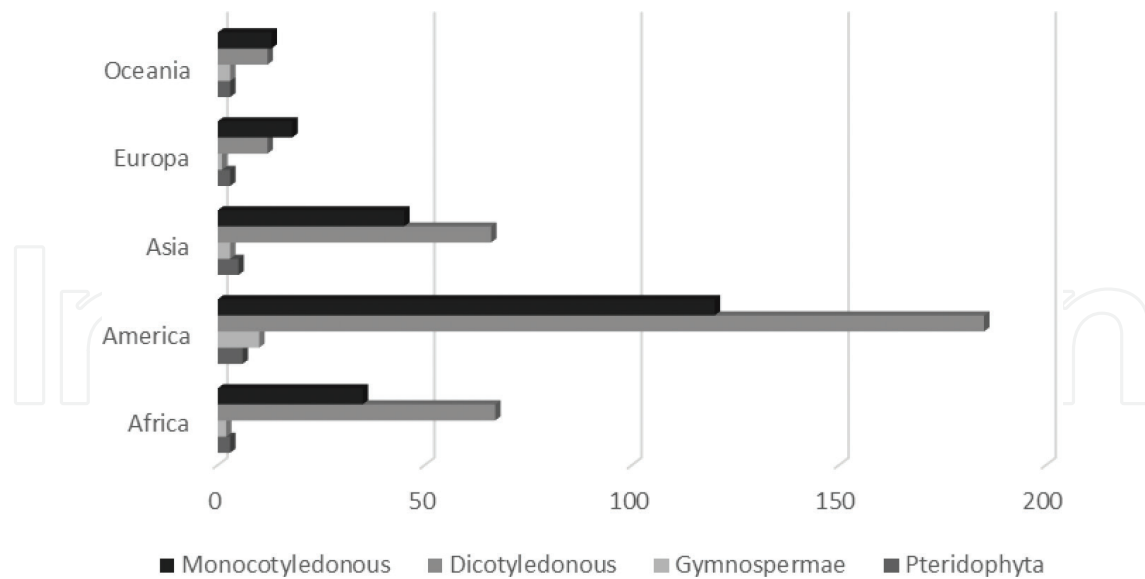


Figure 6. Species distribution according to taxonomic groups and continents.

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, *Areaceae* 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* (*Areaceae*) 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 *Areaceae* 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.

Uses cases of ornamental as medicinal plants

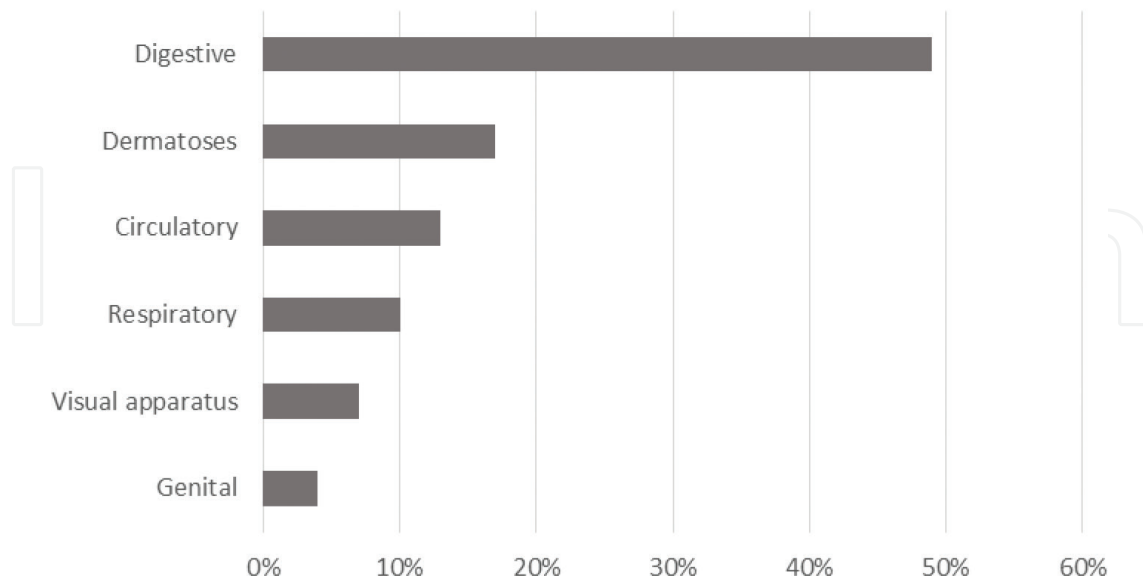


Figure 7. Uses cases of ornamental medicinal plants.

Plants different parts used

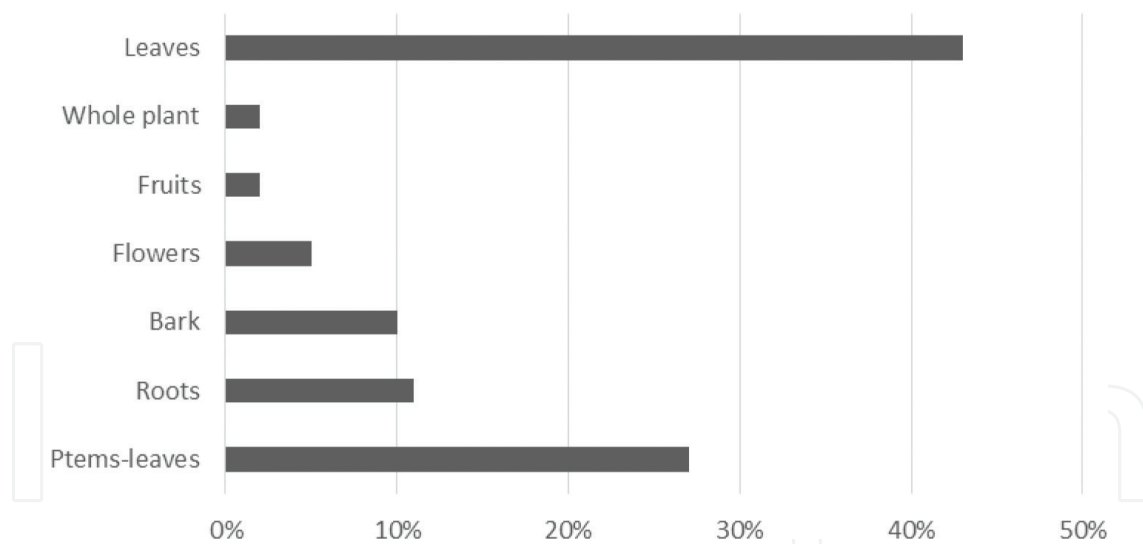


Figure 8. Distribution of plants different parts used.

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%).

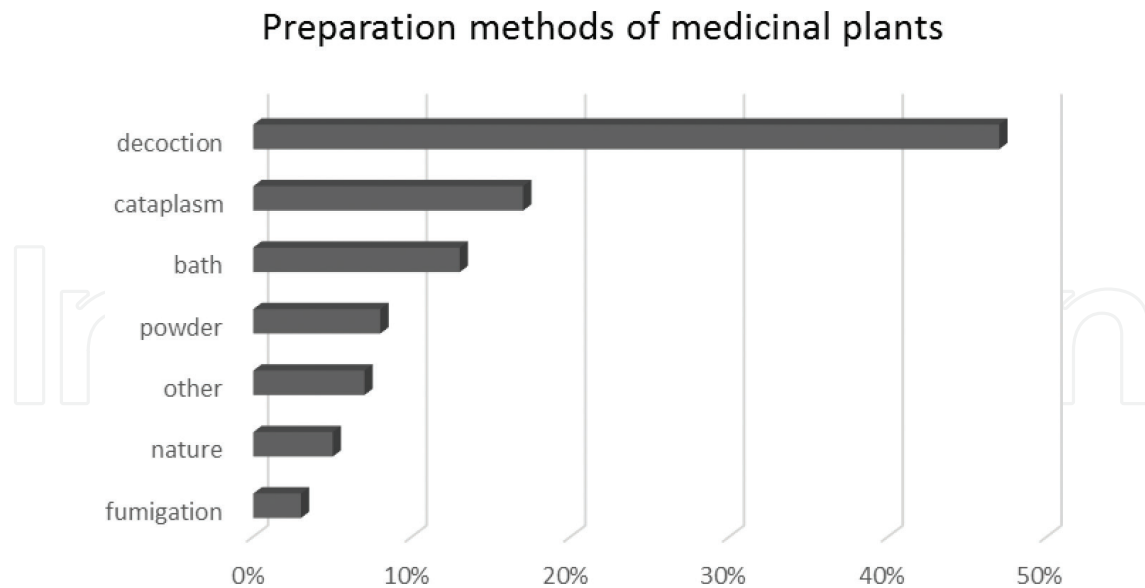


Figure 9. Spectrum of different methods of preparation of medicinal plants.

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

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

Table 2. Other uses identified for ornamental plants.

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

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

Author details

Radji Raoufou* and Kokou Kouami

*Address all correspondence to: pradji@hotmail.com

Laboratory of Forest Research, Faculty of Science, University of Lomé, Lomé, Togo

References

- [1] Durnerin A. Les grandes expéditions botaniques du XVIIe au XIXe siècle et le transport des plantes. In: *Le voyage des plantes: Les jardins, acteurs culturels de la biodiversité. Deuxième Cahier du Conseil national des parcs et jardins*; 2008. pp. 10-17
- [2] Bellec F, Girault de Coursac P. *La généreuse et tragique expédition Lapérouse*. Ouest-France; 1985
- [3] Brunel JF, Hiepko P, Scholz H. *Flore analytique du Togo*. Eschborn: GTZ éd; 1984. 750p
- [4] Aké Assi L. Présence d'un Piper d'Amérique du Sud sur les pentes de la montagne Klouto (Togo). *Mitteilungen der Botanischen Staatssammlung München*. 1971;**10**:169
- [5] Ern H. Die Vegetation Togos. Gliederrung, Gefährdung, Erhaltung. *Willdenowia*. 1979;**9**: 295-312

- [6] Ern H. Proposals for the installation and organisation of a botanical garden in Togo (Tropical West Africa). Proc. Gen. Meet. & Conf. IABG, Canberra. 1982;8:38
- [7] Brunel JF. Contribution à l'étude de quelques Phyllanthoideae africains et à la taxonomie du genre Phyllanthus L. (Euphorbiaceae). Thèse 3e cycle, ULP, Strasbourg; 1975. 206 p
- [8] Brunel JF. Sur le genre Phyllanthus L. et quelques genres voisins de la Tribu des Phyllanthoidae Dumort. (Euphorbiaceae) en Afrique intertropicale et Madagascar. Thèse ès-Sci, Univ. Strasbourg; 1987. 768 p
- [9] Scholz H, Scholz U. Flore descriptive des Cypéracées et Graminées du Togo. Phanerog. Monogr. 1983;15:360
- [10] Akpagana K, Bouchet Ph. Nouvelles espèces d'Angiospermes pour la flore du Togo. Acta botanica Gallica. 1994;141(3):367-372
- [11] Akpagana K, Guelly AK. Nouvelles espèces d'Angiospermes pour la flore du Togo. Acta botanica Gallica. 1994;141(6/7):781-787
- [12] Batawila. Recherches sur les formations dégradées et jachères de la plaine côtière du sud Togo. Mém. DEA. Biol Dév. Univ. Lomé; 1997. 65 p
- [13] Kokou K. Les mosaïques forestières au sud du Togo: biodiversité, dynamique et activités humaines. Th. Doct. Univ. Montpellier II; 1998. 140 p
- [14] Kokou K, Caballé G, Akpagana K, Batawila K. Les îlots forestiers au sud du Togo: dynamique et relations avec les végétations périphériques. Rev. Ecol. (Terre vie). 1999;54:301-313
- [15] Akpagana K, Gumedzoe MYD. La flore. In: Rapport national sur la diversité biologique. PNAE Togo; 2001. 102 p
- [16] Akpagana K. Espèces nouvelles pour la flore du Togo. Ann. Univ. Bénin, sect. sci. 1992;10:25-32
- [17] Radji AR. Contribution à l'étude de la diversité floristique du Togo : la flore horticole de la ville de Lomé et ses aspects économiques. Mém. DEA Biol. Vég. App., Univ. Bénin, Togo; 1997. 52 p
- [18] Berhaut J. Flore illustrée du Sénégal, Dicotylédones, Tomes I, II, IV, V, VI & IX. Sainte-Rufine, France: Presses de l'Imprimerie Maisonneuve; 1971-1988
- [19] Byrd Graf A. Tropica: Color Cyclopedia of Exotic Plants and Trees, 2e éd. N.J., USA: Roehrs Company East Rutherford; 1981. 1136p
- [20] Houerou V, Houerou J-Y. L'arbre du voyageur. Abidjan: Les Nouvelles Editions Africaines; 1987. 186p
- [21] Grisvard P, Chaudun V, Chouard P, Guillaumin A, Schneiter P. Le Bon jardinier Encyclopédie horticole. Paris: La Maison Rustique; 1990. 152e éd. Tome I. 883p

- [22] Grisvard P, Chaudun V, Chouard P, Guillaumin A, Schneiter P. *Le Bon jardinier Encyclopédie horticole*. Paris: La Maison Rustique; 1990. 152e éd. Tome II. 783p
- [23] Hessayon DG. *The New House Plant Expert*. Herts: PBI Publications; 1992. 256p
- [24] Hutchinson J, Dalziel JM. In: Keay RWJ, Hepper FN, editors. *Flora of West Tropical Africa*. 2nd ed. Vol. I-III. London; 1954-1972
- [25] Hutchinson J, Dalziel JM. In: Keay RWJ, editor. *Flora of West Tropical Africa*. 2nd ed. Vol. 1. London: Crown Agents for Overseas; 1954
- [26] Lebrun J-P, Stork A. *Tropical African Flowering Plants. Ecology and Distribution*. vol. 1 Annonaceae-Balanitaceae. Conservatoire et Jardin botaniques de la Ville de Genève. hors-série 9; 2003. 793p
- [27] Lebrun J-P, Stork A. *Tropical African Flowering plants. Ecology and distribution*. vol. 2 Euphorbiaceae-Dichapetalaceae. Conservatoire et Jardin botaniques de la Ville de Genève. hors-série 9a; 2006. 306p
- [28] Lebrun J-P, Stork A. *Tropical African Flowering Plants. Ecology and Distribution*. vol. 3 Mimosaceae-Fabaceae. Conservatoire et Jardin botaniques de la Ville de Genève. hors-série; 2008. 325p
- [29] Lebrun J-P, Stork A. *Tropical African Flowering Plants. Ecology and Distribution*. vol. 4 Fabaceae (Desmodium-Zornia). Conservatoire et Jardin botaniques de la Ville de Genève. hors-série; 2008. 291p
- [30] Lebrun J-P, Stork A. *African flowering plants database (online)*. Available from: <http://www.ville-ge.ch/musinfo/bd/cjb/africa/recherche.php> [Consulted on: July 10, 2011]
- [31] *International Code of Botanical Nomenclature (online)*. Available from: <http://www.bgbm.fu-berlin.de/iapt/nomenclature/code/SaintLouis/0000St.Luistitle.htm> [Consulted on: July 9, 2012]
- [32] *ING: Index Nominum Genericorum (online)*. Available from: <http://botany.si.edu/ing/> [Consulted on: July 10, 2011]
- [33] *IPNI: The International Plant Name Index (online)*. Available from: <http://www.ipni.org/> [Consulted on: July 10, 2012]
- [34] *HUH: Harvard University Herbarium databases (online)*. Available from: http://kiki.huh.harvard.edu/databases/botanist_index.html [Consulted on: July 2012]
- [35] Vidalie H. *Les productions florales*. Paris: Lavoisier TEC & DOC; 1998
- [36] Aké-Assi E, Adou Yao CY, Ipou Ipou J, Neuba DF, Aké Assi L, Traoré D. Représentations des plantes ornementales pour les populations d'Abidjan et San Pedro, en Côte d'Ivoire. In: van der Burgt X, van der Maesen J, Onana J-M, editors. *Systématique et Conservation des Plantes Africaines*. Royal Botanic Gardens: Kew; 2010. pp. 289-296

- [37] Radji R, Bouchet P, Akpagana K. La flore horticole du Togo. *Journal de Botanique de la Société Botanique de France*. 1998;8:87-94
- [38] Radji AR, Kokou K, Akpagana K. Étude diagnostique de la flore ornementale du Togo. *International Journal of Biological and Chemical Sciences*. 2010;4(2):491-508
- [39] Porter L, Bongers F, Kouamé FN, Hawthorne WD. Biodiversity of west African Forest. In: *An Ecological Atlas of Woody Plant Species*. CABI Publishing; 2004
- [40] Aké Assi AE. Contribution à l'étude des plantes ornementales cultivées dans les régions d'Abidjan et de San-Pedro, en Côte d'Ivoire. Volume 1—Textes et iconographies. Volume 2—Catalogue illustré de 241 espèces et variétés horticoles. Th. Doct. 3^e cycle, Univ. Cocody (RCI); 2002. 242p
- [41] Florence J, Chevillotte H, Ollier C, Meyer J-Y. Base de données botaniques Nadeaud de l'Herbier de la Polynésie française (PAP). 2007. Available from: <http://www.herbier-tahiti.pf>
- [42] Ihaka R, Gentleman RR. A language for data analysis and graphics. *Journal of Computational and Graphical Statistics*. 1996;5(3):299-314
- [43] Géhu JM, Géhu J. Essai d'objection de l'évaluation biologique des milieux naturels. Exemples littoraux. In: Géhu JM, editor, *Séminaire de Phytosociologie Appliquée*. Amicale Francophone de Phytosociologie. Metz; 1980. pp. 75-94
- [44] Nevena D, Oderab MM, Reardon T, Wang H. Kenyan supermarkets, emerging middle-class horticultural farmers, and employment impacts on the rural poor. *World Development*. 2009;37(11):1802-1811
- [45] Niang I, Stinghlamber G. Étude pour un programme de développement du secteur horticole au Sénégal. Rapport final. Dakar: Cabinet JEXCO; 2001. 71p + annexes
- [46] IQRHH. Diagnostic sur la main d'œuvre en horticulture ornementale au Québec. Secteur commercialisation et services. Rapport final; 2003. 91p
- [47] Watson G. Overview of the Canadian horticulture industry. In: *Introduction to the Floriculture Crop Profile Series*. Centre pour la lutte antiparasitaire d'AAC (non publié); 2006
- [48] Waylen K. Botanic Gardens: Using Biodiversity to Improve Human Well-Being. Botanic Gardens Conservation International. 2006. Available from: <http://www.bgci.org/wellbeing/report/> [Consulted on: December 30, 2011]
- [49] Brethour C, Watson G, Sparling B, Bucknell D, Moore T. Revue de la littérature sur les bienfaits des produits de l'horticulture ornementale sur la santé et l'environnement. In: *Rapport Final*. George Morris Centre; 2007. 76p
- [50] Biley FC. Utilizing the Mythical and Folkloric Power of Trees in the Modern Hospital Environment. *Complementary Therapies in Nursing & Midwifery*. 2001;7:207-210

- [51] Barloy JJ. Le monde végétal: Les plantes dans l'évolution de la vie et des civilisations. Ed. Hachette Jeunesse, Paris; 1984. 73 p
- [52] Anonymous. Dictionnaire universel de poche. Hachette Livre et Librairie Générale Française; 1993. 759 p
- [53] Fouchet JG, Marquet A, Hambuckers A. Les plantes médicinales: de la plante au médicament. Observatoire du Monde des Plantes, Liège; 2000. 18 p
- [54] Jiofack T, Ayissi I, Fokunang C, Guedje N, Kemeuze V. Ethnobotany and phytomedicine of the upper Nyong Valley forest in Cameroon. *African Journal of Pharmacy and Pharmacology*. 2009;3(4):144-150
- [55] Betti JL, Mebere Yemefa SR. Contribution à la connaissance des produits forestiers non ligneux du parc de Kalamaloué, Extrême nord Cameroun : les plantes alimentaires. *International Journal of Biological and Chemical Sciences*. 2011;5(1):291-303
- [56] CIB-UNESCO (Comité international de bioéthique—Organisation des Nations-Unies pour l'Éducation, la science et la culture). Avant-projet de rapport sur la médecine traditionnelle et ses implications éthiques. SHS/EST/CIB-17/10/CONF.501/3. Paris; 2010. 19p
- [57] Dibong SD, Mpondo Mpondo E, Ngoye A, Betti JL. Ethnobotanique et phytomédecine des plantes médicinales vendues sur les marchés de Douala, Cameroun. *Journal of Applied Biosciences*. 2011;37:2496-2507
- [58] Ngono Ngane RA, Koanga Mogtomo ML, Tchinda Tabou A, Magnifouet Nana H, Motso Chieffo PR, Mballa Bounou Z, Ebelle Etame RM, Ndifor F, Biyiti L, Amvam Zollo PH. Ethnobotanical survey of some camerounian plants used for treatment of viral diseases. *African Journal of Plant Science*. 2011;5(1):15-21
- [59] Okafor J, Ham R. Identification, utilisation et conservation des plantes médicinales dans le sud-est du Nigéria. *Thèmes de la biodiversité africaine*. 1999;3:1-8
- [60] Mehdioui R, Kahouadji A. Etude ethnobotanique auprès de la population riveraine de la forêt d'Amsittène: cas de la Commune d'Imi n'Tlit (Province d'Essaouira). *Bulletin de l'Institut Scientifique, Rabat, Section Sciences de la Vie*. 2007;29:11-20
- [61] Chevallier A. Encyclopédie des plantes médicinales. Montréal: Sélection du Reader's Digest (Canada); 1996
- [62] Dobelis IN. Magic and Medicine of Plants. NewYork: The Reader's Digest Association Inc. Pleasantville; 1986. pp. 53-67
- [63] Ouattara D. Contribution à l'inventaire des plantes médicinales significatives utilisées dans la région de Divo (sud forestier de la Côte-d'Ivoire) et à la diagnose du poivrier de Guinée: *Xylopiya aethiopica* (Dunal) A. Rich. (Annonaceae). Doctorate Dissertation of Thèse de Doctorat de l'Université de Cocody-Abidjan (Côte-d'Ivoire), UFR Biosciences, Laboratoire de Botanique; 2006. 184p

- [64] Adjanohoun JE, Aké Assi L. Contribution au recensement des plantes médicinales de Côte-d'Ivoire. Université d'Abidjan, Centre National de Floristique (C.N.F.). 1979; 358 p
- [65] Zirihi GN. Contribution au recensement, à l'identification et à la connaissance de quelques espèces végétales utilisées dans la médecine traditionnelle et la pharmacopée chez les Bété du Département d'Issia, Côte d'Ivoire. Thèse de Doctorat de 3ème Cycle, Université d'Abidjan, F.A.S.T.; 1991. 150 pp
- [66] N'Guessan K, Kadja B, Zirihi G, Traoré D, Aké-Assi L. Screening phytochimique de quelques plantes médicinales ivoiriennes utilisées en pays Krobou (Agboville, Côte-d'Ivoire). *SciNat*. 2009;6(1):1-15
- [67] WHO, IUCN, and WWF. Principes directeurs pour la conservation des plantes médicinales. Suisse: Gland; 1993. 35p