



Tatiana Nkwah Bantec

**The Relevance of Lapa dos Esteios (Quinta das Canas) - A
Historical Garden in Coimbra, Portugal.**

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Supervised by Professor António Xavier de Barros e Cunha Pereira Coutinho

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The Relevance of Lapa dos Esteios (Quinta das Canas) - A Historical Garden in Coimbra, Portugal.

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Tatiana Nkwah Bantec

Department of Life Science

University of Coimbra

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Dedication

I dedicate this work to my family; my father and mother: Mr and Mrs Tana Ivo Nkwah, my sister: Yvette Nkwah Koabigh and brothers: Njong Ettienne Nkwah and Che Conrad Toah, and my entire family in Cameroon, thank you for your unconditional love and support especially during this master's program. To all my family members in the Netherlands: my aunts, uncles and cousins especially aunt Wil Babei, thank you for your unconditional love and support throughout my studies in Portugal; I could not have completed my studies without your unremitting assistance.

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Abstract

Lapa dos Esteios is a historical garden in Coimbra, it was constructed in the seventeenth century by the Sá Pessoa family. Dom José Maria de Vasconcelos Azevedo Silva e Carvajal purchased this garden in 1860. He was given the title of Viscount and Count of Lapa dos Esteios by King Louis I of Portugal on 27th April 1865 and 20th of June 1870 respectively. His wife, Dona Maria Isabel de Melo Freire de Bulhões transformed this garden place to a site for intellectual gathering during the period of Romanticism. It is presently owned and inhabited by the National Republican Guard (GNR) since 1979. The Government of Portugal classified Lapa dos Esteios on 2nd March 2011, as a place of Public Interest. It is located on the left bank of the Mondego, south of Coimbra on the Lajes road. This project, ‘The Relevance of Lapa dos Esteios (Quinta das Canas) - A Historical Garden in Coimbra, Portugal’ aims to identify, classify and study the ethnobotanical properties of the flora of this garden. This work was started by Doctor Jorge A. R. Paiva, a Lecturer, and researcher at the University of Coimbra. Between November 2016 and June 2018, several field trips from were made to this garden to identify its flora. Photographs of the plants and lichens were taken during these visits. Statistical analyses were done to compare the flora of Lapa dos Esteios to other places in Portugal and the rest of the world. Also, an ethnobotanical study was done to classify these plants according to previous uses. A total of 135 species were identified and classified into 73 families and two kingdoms: Plantae and Fungi (lichens in this case). This garden has a handful of poisonous, medicinal and edible plants. Lapa dos Esteios is a garden of significant importance and has been visited by the Emperor of Brazil, Dom Pedro II in 1872.

Keywords: Classification, Ethnobotanical Identification, Floristic Diversity, and Lapa dos Esteios.

Resumo

A Lapa dos Esteios é um jardim histórico em Coimbra, foi construído no século XVII pela família Sá Pessoa. Dom José Maria de Vasconcelos Azevedo Silva e Carvajal adquiriu este jardim em 1860. Recebeu o título de Visconde e Conde da Lapa dos Esteios pelo Rei Luís I de Portugal em 27 de abril de 1865 e 20 de junho de 1870, respetivamente. Sua esposa, dona Maria Isabel de Melo Freire de Bulhões transformou este lugar de jardim em um local de encontro intelectual durante o período do romantismo. Atualmente é propriedade e habitada pela Guarda Nacional Republicana (GNR) desde 1979. O Governo de Portugal classificou a Lapa dos Esteios em 2 de março de 2011, como local de Interesse Público. Localiza-se na margem esquerda do Mondego, a sul de Coimbra, na estrada das Lajes. Este projeto, "A Relevância da Lapa dos Esteios (Quinta das Canas) - Um Jardim Histórico em Coimbra, Portugal" visa identificar, classificar e estudar as propriedades etnobotânicas da flora deste jardim. Este trabalho foi iniciado pelo Doutor Jorge A. R. Paiva, professor e pesquisador da Universidade de Coimbra. Entre novembro de 2016 e junho de 2018, foram feitas várias viagens de campo a este jardim para identificar sua flora. Fotografias das plantas e líquens foram tiradas durante essas visitas. Análises estatísticas foram feitas para comparar a flora da Lapa dos Esteios com outros locais em Portugal e no resto do mundo. Além disso, um estudo etnobotânico foi feito para classificar essas plantas de acordo com usos anteriores. Um total de 135 espécies foram identificadas e classificadas em 73 famílias e dois reinos: Plantae e Fungi (líquens, neste caso). Este jardim tem um punhado de plantas venenosas, medicinais e comestíveis. A Lapa dos Esteios é um jardim de grande importância e já foi visitada pelo Imperador do Brasil, Dom Pedro II em 1872.

Palavras-chave: Classificação, Diversidade Florística, Etnobotânica Identificação, e Lapa dos Esteios.

1. INTRODUCTION

1.1 History of Lapa dos Esteios

Lapa dos Esteios is a mythical estate where one can enjoy the unique landscape of the river and the city of Coimbra (Turismo de Coimbra, 2018). It is surrounded by poems and has been a privilege site for intellectual and artistic gatherings for a century. It has a set of statues from the 17th century facing the city which shows magnificent work of arts and represent Strength (Fortaleza), Diogenes and Asia. It has sculptures located inside the garden, representing Faith, Hope, Charity and Death (Turismo de Coimbra, 2018). It was formally called Quinta das Canas. In Portuguese, “Quinta” means farm or estate and Canas is a plant with the scientific name *Arundo donax*. This plant is called ‘giant reed’ or ‘giant cane’ in English and had inhabited this garden before it’s construction in the seventeenth century by the Sa’ Pessoa family who were its first owners. This plant is native to the South and East of Asia and the Mediterranean basin, but it is classified as an invasive species in Portugal.

The estate was purchased by Dom José Maria de Vasconcelos Azevedo Silva e Carvajal in 1860. He was born in Elvas, Portugal on 16th October 1813 and died in Coimbra. He had a Bachelor’s Degree from the University of Coimbra, was a gentleman of the Royal House and a deputy of the nation in 1857. He was the son of Dom André José de Vasconcelos Azevedo e Silva and D. Maria Constança de Carvajal Vasconcelos e Lancastre. In addition, he was married to D. Maria Isabel de Melo Freire de Bulhões, daughter of Feliciano de Melo Godinho de Bulhões and of D. Teresa Rita Freire de Vasconcelos Castelo Branco. King Louis I of Portugal gave him the title of Viscount on 27th April 1865 and later the title of nobility of Count of Quinta das Canas on 20th June 1870 (Zúquete, 1961). His wife, the countess of Lapa dos Esteios, transformed this estate to a site that receives poets and musicians.

These visits were related to the national and international Romanticism at that time. Romanticism was a movement in arts and literature that originated in the late eighteenth century and emphasized inspiration, subjectivity and the primacy of the individual. This estate has a fountain of spring which was built in the seventeen Century by its first owners and it was dedicated to António Feliciano-de Castilho, a blind Portuguese Romanticist who lived between 1800 and 1875. It also has a set of poetry stones that was construction in the 19th century, including the oldest carved stone in Coimbra (1844). One of these poetry stones were carved in 1872 after the visit of the Emperor of Brazil, Dom Pedro II to Lapa dos Esteios (Real *et al.*, 1872). He took some ivy leaves with him as a souvenir. From 1840 to the twentieth century, many intellectual gatherings of poets and writers were held in Lapa dos Esteios. The very first of such gathering was held in 1822 and was called Festival of Spring. It is speculated that this estate was constructed between the sixteen and Seventeen century since the main house is a U-shape and it's typical of buildings at that time. The estate has a chapel, which was constructed in the nineteenth century by the countess of Quinta das Canas.

The ownership of Lapa dos Esteios was passed to other people whose names are not documented. However, in 1979 this estate was bought and accommodated by the Fiscal Guard of Coimbra and

on 2nd March 2011, Lapa dos Esteios was classified by the state as a place of Public interest. This classification includes both the home and the garden of the estate.

1.2 Location

Lapa dos Esteios is found on coordinates 40°11'25 North and 8°25'37 West. It is in Santa Clara; on the left bank of the Mondego River; on the outskirts of Coimbra, Portugal (Rota da Bairrada, 2018).

Picture 1- the map of Lapa dos Esteios with the Mondego River to its right.



1.3 Plant biodiversity

1.3.1 Diversity

In the world, the most abundant plant family is Asteraceae with over 32,500 species (State of the World's Plants, 2018). Asteraceae is sometimes called Compositae and is highly known as daisy family (State of the World's Plants, 2017). The table below shows the five most abundant flowering plant family in the world (State of the World's Plants, 2017):

Family	Number of species
Asteraceae (daisies)	32,581
Orchidaceae (orchids)	28,234
Fabaceae (legumes)	20,856
Rubiaceae (coffees and bedstraws)	13,686
Poaceae (grasses)	11,434

The latest revision of Angiosperm Phylogeny Group IV published in 2016, recognised 416 families of flowering plants (State of the world's plant, 2017). The three biggest plant families in the world are Compositae (daisy family) 9%, Orchidaceae (orchid family) 8% and Leguminosae (Pea and

Bean family) 6%. These three families also have the highest number of plant names (The Plant List, 2018)

The Flora Checklist of Portugal (Continental, Azores and Madeira) reviews the entire vascular flora of Portugal based on taxonomic and nomenclature criteria published in reference works, with priority for Flora Ibérica (Castroviejo *et al.*, 1986-2007). This list also contains information regarding, geographical distribution in the mentioned territories, listing a total of 3995 taxa of which occur:

-3314 in mainland Portugal,

-1006 in the archipelago of the Azores,

-1233 in the archipelago of Madeira (ICNF: Checklist da Flora Portugal, 2018)

1.3.2 Dispersal

A diaspore can be defined simply as a unit of dispersion. It can be a fruit, seed, spore, bulb or any other structure that function in the dispersal of plants (Bell, 2008). There are several types of plant dispersal depending on the vector (wind, water, or animals). It is crucial for plants to be able to disperse their seeds these days in order that they can survive given the changing environment (Vittoz & Engler, 2007).

1.4 Ethnobotany

The word 'ethnobotany' was first coined in 1876 by the American botanist John Harshberger as the study of plants used by primitive and aboriginal people (Abbasi *et al.*, 2012). According to Hamilton, 'Ethnobotany is the study of how people of a particular culture and region make use of indigenous plants', it is the science that studies the relationship between a given society and its environment and particularly the plant world (Hamilton, 2002).

1.4.1 Poisonous Plants

A poison is a substance that can kill in minute amount while a toxin is a substance that exerts negative effect on an organism and its metabolism. This implies that toxins are less poisonous (Wink & Van Wyk, 2008). Hazardous plants are commonly used as garden ornamentals, potted plants, or florist flowers, yet many people are unaware of the dangers posed by the toxins derived from them (Wink & Van Wyk, 2012). However, even substances that are considered good to the human body can be harmful if given in high doses. The father of toxicology, Paracelsus (Theophrastus von Hohenheim) wrote about this in his famous quote "sola dosis facit venenum" "(it is the dose that makes the poison)" or "All things are poisons, and nothing is without poison, only the dose permits something not to be poisonous". The toxicity of a substance depends on the following;

-Route of administration

-Solubility of the substance in body fluids

-Frequency of intoxication

-Health and age of the individual

Some plants were identified in Lapa dos Esteios as poisonous and their main toxins are classified below. The knowledge of these plants will raise awareness to poisonous plants in Portugal and around the world where children and livestock are most susceptible to poisoning (Shirley, 1998).

1.4.2 Medicinal Plants

Medicinal plants are plants used in herbalism and some of these plants have medical activities (Hassan, 2012). The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body. The most important of these bioactive constituents of plants are alkaloids, tannins, flavonoids and phenolic compounds (Hill, 1952). According to records from fossil, humans used plants for medicine at least as far back as 60,000 years ago at the middle of the Palaeolithic Age (Fabricant & Farnsworth, 2001). Historically, plants have often been selected for drug development programmes because they contain specific classes of compounds, such as alkaloids and terpenoids, that are known to be biologically active, or because of their traditional medicinal uses (The State of the World's Plants, 2017). In the world, there are 416 families of flowering plants (Angiosperm Phylogeny Group IV); of the 20 largest, 12 demonstrate a higher than normal percentage of species with a medicinal use (State of the World's Plant, 2017).

1.4.3 Economic Botany

This is the branch of Botany that is concerned about the commercial aspects of plants. Eighty per cent of the food derived from plants comes from 17 plant families (FAO, 2009). The most important of these are Poaceae, Fabaceae and Brassicaceae. The Food and Agricultural Organization of the United Nations (FAO) estimates that there are roughly a quarter of a million plant varieties available for agriculture, but less than 3 percent of these are in use today. With disuse comes neglect and possibly extinction. (IDRC, 2018). The world's food supply depends on about 150 plant species. Of these 150, just 12 provide three-quarters of the world's food. More than half of the world's food energy comes from a limited number of varieties of three "mega-crops": rice, wheat, and maize (IDRC, 2018).

1.4.4 Language of Flowers

Flowers have been used for centuries to convey messages especially to those we love. It is a way to express our emotions which may be happy or sad, joy or grief, love or hate, gain or loss. This method of communication differs with cultures and seasons. For instance, the Hanami festival in Japan has been celebrated for more than a thousand years. During the peak of the cherry blossom (Sakura Zensen), families and friends gather in parks. The lily of the valley celebrations in France (Porte-Bonheur) on the first of May is another seasonal tradition (Kirkby, 2011). Flowers have also been associated with religion and supreme beings (deities). Christians portray the picture of the virgin Mary with white lily because of the report of the Apostles who found white lilies and roses when her casket was opened. In Hindu religion, the eyes of deities are represented by the blossom of flowers which communicate their abilities to show compassion and wisdom for their subjects. The Victorian era was the time when flowers were most popularly used (Kirkby, 2011). However, the western language of flowers began in the eighteenth century after the death of Lady Mary Wortley Montague. She was the wife of the British Ambassador to Turkey and her letters were published after her death in 1763 and described Sélem as a way of communicating to our

love ones without writing a word. These letters explained how goods such as flowers, foodstuff, dragon blood, etc, were sent to love ones and the receivers associated words to these stuffs based on words that sounded like the objects they received. These letters became popular in Europe around the same time of the Victorian era where Europeans were already obsessed with flowers. Thus, they simply copied the Sélem but only included the communication with flowers and excluded the other stuffs. The first language of flower dictionary was produced in 1818 by Charlotte de la Tour and is called “Le Langage des fleurs”. The Victorian era was a time when it was believed that people allowed their emotions to control their decisions. In this present time, the Information Age, despite the changes in science and technology, we still use flowers to express our emotions such as love, passion, anger or death. ‘We plant, we nurture, we grow, and we give different flowers for different moments in time, but for the same purpose, to say that which cannot be said and to say it with beauty and with grace’ (Kirkby, 2011).

1.4.5 Mythology

Mythology is the study of myths of a religion or cultural tradition. Doctrine of signatures was a system involved by discovering certain marks or appearances of a plant’s structure and predicting medicinal virtue attached to it. These structures could be their leaves, flowers or fruits (Folkard, 1884). Many nations of Antiquity considered certain trees and plants a special respect, for example a superstitious worship (Folkard, 1884).

1.5 Lichens

A lichen is an organism which consist of two or three organisms: a fungus (mycobiont) and a photosynthetic partner (photobiont) which could be an alga, cyanobacteria or both. The fungus is the dominant and it occupies eighty percent of the lichen body. Some lichens have both algae and cyanobacteria in one body while others have just one. Algae provide sugars to their fungi partners through photosynthesis while cyanobacteria provide both sugars and nitrogen to their dominant partner (the fungi) in the same process. Lichens reproduce both sexually and asexually however, only the fungus partner undergoes sexual reproduction (Whelan, 2011).

Uses of lichens

- Production of medicines, poisons and dyes; dyes can be used to colour wood.
- Manufacture of perfumes; they aid in the gradual release of scent.
- Source of nitrogen for most plants
- Biomonitor; lichens and mosses are often used to monitor heavy metal pollution in the atmosphere since they have a high ability to accumulate metals compared to higher plants (Aksoy & Ozturk, 1997).

1.6 Objectives

The main objective of this project is to identify all the vegetal flora of this garden, a work that was started by Doctor Jorge A. R. Paiva, a lecturer and researcher at the University of Coimbra. The specific objectives of this project are:

- Identification of the flora of Lapa dos Esteios.
- Classification of the identified species.

- Ethnobotanical study of the identified species.

2. MATERIAL AND METHODS

2.1 Material

2.1.1 Identification of species

a) I used textbooks listed in the reference section and PlantNet Plant identification app to identify the plants and lichens in the garden.

b) I used a phone to take photographs of plants, lichens and some art work in the garden. The properties of the phone are:

Samsung galaxy A3 2016 with properties: Display 4.70-inch, Processor 1.5GHz quad-core, Front Camera 5-megapixel, Resolution 720x1280 pixels, RAM 1.5GB, OS Android 5.1, Storage 16GB, Rear Camera 13-megapixel, Battery Capacity 2300mAh.

2.2 Methods

2.2.1 Identification of existing species

I undertook one field trip per month to Lapa dos Esteios from November 2016 to March 2018 with intentions to observe and identify new species. Plants in this garden grow and blossom at different periods of the year because some are perennial, annual or biennial. This made it impossible in many cases to do a correct identification after the first few visits. Identification of these plants was done using references to several Floras and field guides under the supervision of Doctor Antonio Pereira Coutinho, a lecturer and researcher at the University of Coimbra. I collected leaves, flowers and fruits of plants to do further identification when on site identification was unsuccessful. I also took photographs of plants, lichens and some art works in the garden.

2.2.2 Classification of identified species

Textbooks (see References) and some websites were employed to classify the identified species into their respective kingdoms, family name, genus, scientific name, common name in English and Portuguese. These websites are: The Plant List, 2018; Royal Horticultural Society, 2018; Utad jardim botânico, 2018; Encyclopedia of Life, 2018; Scielo, 2018.

2.2.3 Study of Ethnobotany

Textbooks and published scientific articles were utilized to study the ethnobotany of the species identified in Lapa dos Esteios. The branches of ethnobotany considered in this work are poisonous effects of plants, medicinal uses of the plants and flower language.

3. RESULTS



3.1 Identification of the flora




A total of 135 species were identified into seventy-three families. Majority of the species identified are plants (129) while lichens were a minority (6).





3.2 Classification of the identified species





These species were classified into their respective kingdoms, family, scientific names (binomial nomenclature), common names in English and Portuguese. The table below shows the classification of these identified species with photographs.





Table 1 – Classification of identified plants in Lapa dos Esteios





Family	Taxa	English Common name	Portuguese Common name	Photographs	Native origin
Acanthaceae	<i>Acanthus mollis</i> L.	Dear's breeches, Sea dock.	Acanto, Erva-gigante.		Southern Europe and North-western Africa
Adoxaceae	<i>Viburnum tinus</i> L.	Laurestine.	Folhado, Laurestim, Folhado-comum.		The Mediterranean area of Europe and North Africa
Agapanthaceae	<i>Agapanthus praecox</i> Willd.	Common Agapanthus, blue lily.	Agapanto, Coroas-de-Henrique.		South Africa (Cape Province and Natal)





Alstroemeriac eae	<i>Alstroemeria aurea</i> Graham.	alstroemeria, Chilean lily, golden lily- of-the-Incas, golden Peruvian lily			Southern South America (that is Argentina and Chile).
Amaranthacea e	<i>Chenopodium album</i> L.	Lamb's Quarter, bacon weed, Dirtweed	Erva- couvinha, Ansarina- branca, Catassol.		Europe, Eastern Asia
Amaryllidacea e	<i>Narcissus</i> sp.	Daffodil, daffadowndil ly, narcissus, and jonquil	Narciso.		Southern Europe and North Africa


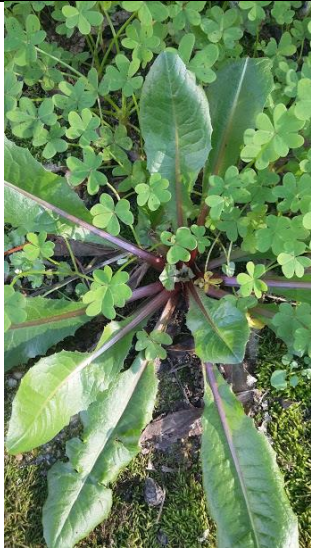


Anacardiaceae	<i>Pistacia lentiscus</i> L.	Chios mastic, lentisco.	Árvore-do-mástique, Lentisco-verdadeiro, Aroeira, Daro.		Throughout the Mediterranean region and the Canary Islands
	<i>Schinus molle</i> L.	Peruvian Pepper tree, California pepper tree.	Pimenteira-bastarda, Pimenteira-americana, Pimenta-bastarda.		The Peruvian Andes
Apiaceae	<i>Foeniculum vulgare</i> Mill.	Fennel, common fennel.	Fiôlho, Funcho-doce.		The shores of the Mediterranean
	<i>Torilis arvensis</i> (Huds.) Link.	Spreading hedge parsley.	Salsinha.		Parts of Europe







Apocynaceae	<i>Nerium oleander</i> L.	Nerium, Oleander.	Loendro, Cevadilha.		No precise region of origin, however, it is speculated to originate from Southwest Asia
	<i>Vinca difformis</i> Pour.	Intermediate Periwinkle.	Pervinca, Erva-da-Inveja, Congossa.		Western Europe, including the Iberian Peninsula, France, the Italian Peninsula and Sardinia.
Araceae	<i>Monstera deliciosa</i> Liebm.	Swiss cheese plant.	Costela-de-adão.		The tropical forests of Southern Mexico, South to Panama.
	<i>Arum italicum</i> Mill.	Italian arum, Italian Lords and Ladies.	Jarros-comum, Alho-dos-campos.		The Mediterranean region, Great Britain, Netherlands, Crimea, Caucasus, Canary Islands, Madeira, and the Azores







	<i>Zantedeschia aethiopica</i> (L) Spreng.	Arum lilly, Calla lily.	Jarro-de-jardim, Jarro, Bigalhó.		Southern Africa in Lesotho, South Africa, and Swaziland
Araliaceae	<i>Hedera helix</i> L.	Common Ivy, English Ivy, Yedra.	Hera-das- muros, Hera- comum.		Most of Europe and Western Asia
	<i>Hedera maderensis</i> K.Koch ex A.Rutherf.	Madeiran Ivy.	N/A		The Atlantic coast in Madeira Island
Areaceae	<i>Phoenix canariensis</i> Chabaud.	Canary Island date palm, Pineapple palm.	Palmeira- das-canarias.		The Canary Islands






	<i>Trachycarpus fortunei</i> (Hook.) H. Wendl.	Chinese windmill, Windmill palm.	Palmeira-da-china, Palmeira-excelsa, Palmeira-do-cânhamo.		Central China, Southern Japan, South to Northern Myanmar and Northern India.
Asparagaceae	<i>Asparagus aphyllus</i> L.	Wild asparagus, Portuguese espargos.	Espargobravo-maior, Corruda-maior.		The Mediterranean region
	<i>Aspidistra elatior</i> Blume.	Cast-iron plant, Bar-Room plant.	Aspidistra-de-folhas-grandes.		Japan and China
	<i>Ruscus aculeatus</i> L.	Butcher's broom, box holly.	Gilbardeira, Erva-dos-Vasculhos.		Black Sea, Belgium, England and Mediterranean region






Asphodelaceae	<i>Aloe arborescens</i> Mill.	Candelabra aloe, Octopus plant, Torch plant.	Aloé-Candelabro, Foguetes-de-Natal, Babosa, Aloé.		Southern Africa
Asteraceae	<i>Andryala integrifolia</i> L.	Common andryala.	Alface-do-monte, Tripa-de-ovelha, Camareira.		Europe, North Africa, and the Middle East
	<i>Arctotis steochadifolia</i> P. J. Bergius.	African daisy, silver arctotis.	Margarida-africana.		South African
	<i>Calendula arvensis</i> L.	Field marigold.	Erva-vaqueira, Belas-noites, Calêndula-hortense, Malmequerdos-campos.		Central and Southern Europe




	<i>Carduus tenuiflorus</i> Curtis.	Slender thistle.	Curtis, Cardo-azul.		Europe and North Africa
	<i>Cichorium intybus</i> L.	Chicory, blue sailors.	Almeirão, Chicória- amarga, Chicória-do- café.		Europe
	<i>Coleostephus myconis</i> (L.) Rchb. F.	Corn marigold.	Pampilho-de- micão, Olhos-de- boi.		Mediterranean region of Southern Europe
	<i>Crepis capillaris</i> (L.) Wallr.	Smooth hawksbeard.	Almeirão- branco, Barba-de- falção, Almeiroa.		Europe


	<i>Erigeron canadensis</i> L.	Horseweed, Butterweed.	Arabeta, Erva-estrelada.		Most of North America and Central America
	<i>Erigeron karvinskianus</i> DC.	Mexican fleabane, Latin American fleabane.	Intrometidas, Floricos, Vitadinias-floristas.		Mexico, Central America, Colombia and Venezuela
	<i>Galactites tomentosa</i> Moench.	Purple milk thistle.	Cardo, Cardo-dospicos.		The Mediterranean region
	<i>Helminthotheca echioides</i> (L.) Holub.	Bristly oxtoque.	Erva-tábua, Raspapernas.		North Africa and Europe
	<i>Jacobaea vulgaris</i> Gaertn	Ragwort, common ragwort, stinking willie, benweed	Erva-de-São-Tiago, Mija-cão, Tasna, Tasneira		Northern Eurasia
	<i>Lactuca serriola</i> L.	Prickly lettuce, Compass plant.	Alface-brava, Alface-brava-menor.		Europe, Asia, and North Africa




	<i>Senecio mikanooides</i> Otto ex Walp.	Cape Ivy, German Ivy.	Erva-de-São-Tiago.		South Africa
	<i>Senecio vulgaris</i> L.	Groundsel, Old man-in-the-Spring.	Tasneirinha, Cardo-morto.		Europe
	<i>Sonchus oleraceus</i> (L.) L.	Common Sow thistle, hare's Colwort.	Serralha, Serralha-branca.		Europe and western Asia
Brassicaceae	<i>Arabidopsis thaliana</i> (L.) Heynh.	Codded mouse-ear, Thale cress.	Arabeta, Erva-estrelada.		Eurasia and Africa
	<i>Cardamine hirsuta</i> L.	hairy bittercress, lamb's cress.	Agião-de-canário, Cardamina-pilosa.		Europe as far east as the Caucasus, and North Africa
	<i>Raphanus raphanistrum</i> L.	Wild Radish.	Saramago, Rábano-Silvestre.		Western Asia, Europe and parts of Northern Africa





Buxaceae	<i>Buxus sempervirens</i> L.	Common Box, European box.	Buxo, Buxeira.		Western and Southern Europe, Northwest Africa, and Southwest Asia.
Cactaceae	<i>Opuntia ficus-indica</i> (L.) Mill.	Indian fig, Opuntia, edible prickly pear.	Tabaibeira, figueira da Índia, piteira.		Mexico
	<i>Opuntia maxima</i> Mill.	Prickly pear, barbary fig.	Figueira-da-Índia or piteira.		N/A
Campanulaceae	<i>Campanula erinus</i> L.	Campanula	Campaínhas, Campânula.		N/A
Cannaceae	<i>Canna</i> sp.	Canna	Conteira.		Tropical and subtropical regions of the New World, from the Southern United States and South to Northern Argentina






Caprifoliaceae	<i>Centranthus calcitrapae</i> (L.) Dufr.	Annual valerian.	Calcitrapa.		N/A
Caryophyllaceae	<i>Cerastium glomeratum</i> Thuill.	Sticky mouse-ear, clammy chickweed.	Cerástio-enovelado, Orelha-de-rato.		N/A
Celastraceae	<i>Euonymus japonicus</i> Thunb.	Evergreen spindle, Japanese spindle.	Barrete-de-padre, Evónimo-dos-jardins.		N/A
Convolvulaceae	<i>Convolvulus arvensis</i> L.	Field bindweed, bearbind.	Corriola, Corriola-campestre.		N/A
Crassulaceae	<i>Sedum album</i> L.	White stone crop, Jelly bean Sedum.	Arroz-dos-telhaados, Pinhões-de-rato.		N/A





	<p><i>Crassula ovata</i> (Mill.) Druce</p>	<p>jade plant, friendship tree, lucky plant, money plant, money tree</p>	<p>N/A</p>		<p>South Africa and Mozambique</p>
	<p><i>Aeonium arboreum</i> Webb & Berthel.</p>	<p>the tree aeonium, tree houseleek, Irish rose</p>			<p>The hillsides of the Canary Islands</p>
	<p><i>Umbilicus rupestris</i> (Salisb.) Dandy.</p>	<p>Wall pennywort, navelwort.</p>	<p>Conchelos, Umbigos-de-Vénus, Coucelos, Sobreirinhos-dos-telhados.</p>		<p>The Iberian Peninsula, France, the British Isles, the Apennine Peninsula, the Balkan Peninsula, Turkey, Cyprus, Syria, Madeira, Northwest Africa and Libya.</p>





Cucurbitaceae	<i>Bryonia dioica</i> Jacq.	White bryony, Devil's cherry.	Briónia, Briónia-branca.		Central and Southern Europe
Cupressaceae	<i>Chamaecyparis lawsoniana</i> (A. Murray bis) Parl.	Port Orford Cedar, Lawson cypress.	Camaecipáriis-do-Oregon, Falso-Cipreste, Cedro-branco, Cedro-do-Oregon.		Oregon and North Western California
	<i>Cupressus lusitanica</i> Mill.	White cedar, Cedar-of-Goa.	Cedro-do-Buçaco, Cedro-de-Goa, Cipreste-do-Buçaco.		Mexico and Central America (Guatemala, El Salvador and Honduras)
Dioscoreaceae	<i>Dioscorea communis</i> (L.) Caddick & Wilkin.	Black Bryony, Lady's Seal.	Narça-preta, Uva-de-cão.		Southern and Central Europe, Northwest Africa and Western Asia, from Ireland to the Canary Islands, East to Iran and Crimea
Euphorbiaceae	<i>Euphorbia peplus</i> L.	Petty spurge, Radium weed.	Ésula-redonda.		Europe, Northern Africa and Western Asia





	<i>Mercurialis annua</i> L.	Annual mercury, baron's mercury.	Mercurial-anual, Urtiga-morta, Urtiga-bastarda.		Europe, North Africa, and the Middle East
Fabaceae	<i>Acacia melanoxylon</i> R. Br.	Australia blackwood, Sally Wattle.	Acácia-da-Austrália, Acácia-negra-da-Austrália.		South- Eastern Australia
	<i>Cercis siliquastrum</i> L.	Judas tree	Olaia, Arvore-de-Judas.		Southern Europe and Western Asia





	<i>Robinia pseudoacacia</i> L.	Black locust, false acacia.	Acácia-bastarda Acácia-párasol Falsa-acácia Robínia		South-eastern United States
	<i>Vicia sativa</i> L.	Common Vetch, garden vetch, tare.	Ervilhaca-comum, Ervilhacamansa.		N/A
	<i>Wisteria sinensis</i> (Sims) DC.	Chinese wisteria, Chinese kidney bean.	Glicínia-da-China, Lilás.		China
Fumariaceae	<i>Fumaria capreolata</i> L.	White ramping fumitory, white-flower fumitory.	Fumária-maior, Fumária-dos-campos.		Europe, Western Asia and Northern Africa
	<i>Fumaria muralis</i> sond. ex W. D. J. Koch	Common ramping fumitory, Wall fumitory.	Fumária-das-paredes, Salta-sebes.		Western Europe and North-western Africa





Garyaceae	<i>Aucuba japonica</i> Thunb.	Spotted laurel, Japanese laurel.	Loureiro-do-Japão, Aucuba-do-Japão.		China, Korea, and Japan.
Geraniaceae	<i>Erodium botrys</i> (Cav) Bertol.	Mediterranean stork's bill.	Agulheta.		Eurasia, the Mediterranean region, and North Africa.
	<i>Geranium dissectum</i> L.	Cut-leaved cranesbill.	Coentrinho, Bico-de-pomba.		Europe
	<i>Geranium molle</i> L.	Dove's foot cranesbill, culver root.	Bico-de-pomba-menor.		Mediterranean and sub-Mediterranean areas
	<i>Geranium purpureum</i> Vill.	The little robin.	Erva-de-São-Roberto, Pássara.		N/A





	<i>Pelargonium</i> sp.	Geraniums.			temperate and tropical regions of the world
Hydrangeaceae	<i>Hydrangea macrophylla</i> (Thunb.) Ser.	Big leaf hydrangea, Hortensia.	Hortênsia, Novelão.		Japan and Korea
Iridaceae	<i>Crocasmia</i> sp	Montbretia, Copper tips, falling stars	N/A		The grasslands of Southern and Eastern Africa, ranging from South Africa to Sudan
Juglandaceae	<i>Juglans regia</i> L.	English walnut, Madeira nut.	Nogueira-europeia, Nogueira-comum.		From the Balkans eastward to the Himalayas and Southwest China


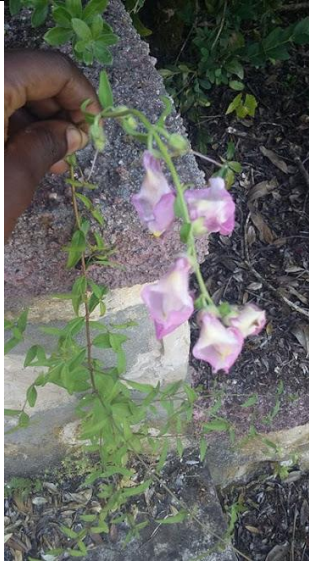

Lamiaceae	<i>Micromeria juliana</i> (L.) Benth. ex Rchb.	Savory.	N/A		N/A
	<i>Rosmarinus officinalis</i> L.	Rosemary.	Alecrim, Alecrim-da-terra.		Mediterranean region
Lauraceae	<i>Laurus nobilis</i> L.	Bay tree, bay laurel.	Loureiro, Loureiro-comum, Sempre-verde.		Mediterranean region
Linaceae	<i>Linum bienne</i> Mill.	Pale flax.	Linho-de-Inverno, Linho-bravo, Linho-galego.		Mediterranean region and Western Europe, North to England and Ireland.






Malvaceae	<i>Lavatera cretica</i> L.	Cornish mallow, Cretan hollyhock.	Malva-bastarda, Lavatera.		Western Europe, North Africa, and the Mediterranean Basin
	<i>Tilia x europaea</i> L.	Common lime.	Tília-europeia, Tília-comum.		Europe
Meliaceae	<i>Melia azedarach</i> L.	Chinaberry, Persian Lilac, African Lilac, False Sycamore.	Amargoseira, Conteira, Mélia, Árvore-dos-rosários, Falso-sicómoro.		Indomalaya and Australasia.
Moraceae	<i>Ficus carica</i> L.	Fig, Common fig,	Figueira-comum, Bebereira		The Middle East and western Asia





	<i>Ficus benjamina</i> L.	Weeping fig, Benjamin fig.	Beringan, Figueira-Benjamina.		Asia and Australia
Myrtaceae	<i>Eucalyptus globulus</i> Labill.	Common eucalyptus, Tasmanian eucalyptus.	Eucaliptocomum, Gomeiro-azul.		Australia
	<i>Myrtus communis</i> L.	Myrthe, Common Myrthe.	Mirto, Murta.		Southern Europe, North Africa, Western Asia, Macaronesia, and the Indian Subcontinent
Nephrolepidaceae	<i>Nephrolepis exaltata</i> (L.) Schott.	Sword fern, Tuber ladder fern.	Feto-espada.		Tropical regions throughout the world.





Oleaceae	<i>Fraxinus angustifolia</i> Vahl.	Narrow- leave Ash, Desert Ash.	Freixo- comum, Freixo-de- folhas- estreitas.		Central and southern regions of Europe, Northwest Africa, and Southwest Asia.
	<i>Olea europaea</i> L.	Olive tree, Common olive.	Oliveira.		The Mediterranean Basin
	<i>Phillyrea latifolia</i> L.	Green olive tree, Mock privet.	Aderno, Aderno-de- folhas-largas.		The Mediterranean region
Orchidaceae	<i>Anacamptis pyramidalis</i> (L) Rich.	The Pyramidal orchid, Pyramid orchid.	Satirião- menor, Orquídea- piramidal, Satírio- menor.		South western Eurasia,






Orobanchaceae	<i>Orobanche</i> sp.	Broomrape or Broomrape.	N/A		The temperate Northern Hemisphere
Oxalidaceae	<i>Oxalis pes-caprae</i> L.	Canary grass, Clover Sour.	Erva-pata, Erva-canária, Trevo-vermelho.		South Africa
Phytolaccaceae	<i>Phytolacca americana</i> L.	Pokeweeds, Pokebush.	Erva-dos-cachos-da-Índia, Fitolaca, Tintureira, Uva-dos-passarinhos.		The Eastern United States.
Pinaceae	<i>Cedrus atlantica</i> (Endl.) Carrière.	The Atlas cedar, Atlantic Cedar.	Cedro-do-Atlas.		From the Atlas Mountains of Morocco, to the Rif, and to the Tell Atlas in Algeria






Pittosporaceae	<i>Pittosporum undulatum</i> Vent.	Sweet Pittosporum, native Daphne.	Árvore-do- Incenso, Pitósporo, Incenseiro.		South-east Queensland to Eastern Victoria
	<i>Antirrhinum majus</i> L.	Snapdragon.	boca-de-leão, bocas-de-lobos.		The Mediterranean region, from Morocco and Portugal North to Southern France, and East to Turkey and Syria
Plantaginaceae	<i>Plantago coronopus</i> L.	Buck's horn plantain, cut-leaved plantain.	Erva-das-pulgas, Zaragatoa, Diabelha.		





	<i>Plantago major</i> L.	Roadleaf plantain, White man's foot.	Tanchagem-maior, Chantage.		Most of Europe and Northern and Central Asia
	<i>Platanus x hispanica</i> L.	London plane, maple.	Plátano, Plátano-híbrido.		The Northern Hemisphere
Poaceae	<i>Avena sterilis</i> L.	animated oat, sterile oat, wild oat	Aveão, Aveião, Balanco-bravo, Balanco-maior		N/A
	<i>Briza media</i> L.	Quaking-grass, Dodder-grass	Bole-bole, Bole-bole-intermédio, Bule-bule		N/A
	<i>Bromus</i> sp.	Bromes, Bromes grasses.	Bromo.		N/A

<p><i>Hordeum murinum</i> L. Subsp. <i>Murinum</i></p>	<p>Wall barley, Mouse barley.</p>	<p>Falsa- Cevada, Cevada-dos- ratos.</p>		<p>Europe, Northern Africa and temperate Asia</p>
<p><i>Panicum repens</i> L.</p>	<p>torpedograss, creeping panic, panic rampant</p>	<p>Escalracho</p>		<p>Africa, Australia, Eurasia, the Mediterranean, Israel, and Argentina</p>
<p><i>Piptatherum miliaceum</i> (L.) Coss.</p>	<p>Smilograss, Rice millet.</p>	<p>Talha-dente, Milho- miúdo.</p>		<p>Eurasia</p>
<p><i>Poa annua</i> L.</p>	<p>Annual meadow grass, annual grass.</p>	<p>Poa-comum, Cabelo-de- Cão, Erva- das-galinhas, Pé-de- galinha.</p>		<p>N/A</p>

	<i>Phyllostachys bambusoides</i> Siebold & Zucc	Madake, giant timber bamboo.			China
Polypodiaceae	<i>Polypodium cambricum</i> L.	Southern Polypody, Welsh Polypody.	Polipódio, Fentelho.		Southern and Western Europe
Primulaceae	<i>Anagallis arvensis</i> L.	Blue scarlet pimpernel.	Morrião, Morrião-dos-campos, Morrão-vermelho.		Europe and Western Asia and North Africa
Pteridaceae	<i>Adiantum capillus-veneris</i> L.	Venus hair fern, maidenhair fern.	Avenca-das-fontes, Cabelo-de-Vénus, Capilária.		United States, Mexico, Central America, to South America, Eurasia, Australasia
Ranunculaceae	<i>Ranunculus repens</i>	Ranunculus	Botão-de-ouro, manteiguinha		Europe, Asia and North-western Africa
Rhamnaceae	<i>Rhamnus alaternus</i> L.	Buck-thorn, Mediterranean buckthorn.	Sanguinho-das-Sebes, Aderno-bastardo.		N/A

Rosaceae	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Loquat.	Nespereira-do Japão, Magnólio.		The cooler hill regions of China to South-central China.
	<i>Prunus persica</i> (L.) Batsch.	Peach, ornamental Peach.	Pessegueiro, Alpercheiro.		Northwest China
	<i>Rubus ulmifolius</i> Schott.	Elmleaf blackberry, Thornless blackberry.	Amoras-Silvestres, Silvas.		Europe and North Africa
Rubiaceae	<i>Galium aparine</i> L.	Cleavers, goose grass.	Amor-de-hortelão, Erva-peganhosa.		Europe, North Africa and Asia from Britain and the Canary Islands to Japan
	<i>Rubia peregrina</i> L.	Common wild madder.	Ruiva-brava, Raspa-língua, Pegamasso.		N/A

Rutaceae	<i>Citrus sinensis</i> (L.) Osbeck.	Sweet orange.	Laranjeira-doce, Laranjeira-da-China.		N/A
Sapindaceae	<i>Acer pseudoplatanus</i> L.	Sycamore, Sycamore maple.	Padreiro, Plátano-bastardo.		Central Europe and Western Asia
Saxifragaceae	<i>Bergenia crassifolia</i> (L.) Fritsch.	Siberian tea, Mongolian tea.	Cha' - da-Siberia, Bergenia.		Central Asia, Afghanistan, China and the Himalayan region.
Scrophulariaceae	<i>Veronica persica</i> Poir.	Bird's eye Speedwell, Common field speedwell.	Verónica-da-persia.		Eurasia
	<i>Scrophularia grandiflora</i> DC.	Figworts.	N/A		N/A

Simaroubaceae	<i>Ailanthus altissima</i> (Mill.) Swingle.	Tree of heaven, false varnish tree.	Ailanto, Ailanto-de-China, Árvore-do-céu.		Northeast and Central China, Taiwan
Smilacaceae	<i>Smilax aspera</i> L.	Rough bindweed, Common Smilax.	Salsaparrilha -bastarda, Alegação, Alegra-campo.		Portugal to Yugoslavia.
Solanaceae	<i>Solanum nigrum</i> L.	Black nightshade, garden huckleberry.	Erva-moira, Erva-moira-da-baga-preta.		<u>Eurasia.</u>
Ulmaceae	<i>Ulmus minor</i> Mill.	The Field elm, smooth leaved elm.	Ulmeiro, Negrilho, Olmo, Lamegueiro, Mosqueiro.		South European, extending to Asia Minor and Iran.










Urticaceae	<i>Parietaria judaica</i> L.	Spreading pellitory	Alfavaca-de-cobra		Europe, Central and Cestern Asia and Northern Africa
	<i>Urtica dioica</i> L.	common nettle, stinging nettle, nettle leaf			Europe, Asia, Northern Africa, and North America

Table 2: Classification of lichens at Lapa

Family	Taxa	English Common name	Photographs
Chrysothrichaceae	<i>Chrysothrix candelaris</i> (L.) J. R. Laundon	Coastal gold dust lichen.	
Parmeliaceae	<i>Evernia prunastri</i> (L.) Ach	Oakmoss.	

	<i>Flavoparmelia caperata</i> (L.) Hale.	Common Greenshield Lichen.	
	<i>Parmotrema perlatum</i> (Huds.) M. Choisy.	Black stone flower or Kalpasi.	
	<i>Usnea</i> sp.	Beard lichen.	
Ramalinaceae	<i>Ramalina farinacea</i> (L.) Ach.	Farinose cartilage lichen	
Teloschistales	<i>Xanthoria parietina</i> (L.) Th. Fr.	Common Orange Lichen.	

4.0 DISCUSSION

4.1 Identification of Lapa dos Esteios flora

4.1.1 Floristic diversity

Lapa dos Esteios has a rich floristic diversity with over one hundred and thirty-five species identified in seventy-three families. The chart below shows the floristic diversity of this garden with special attention to the Asteraceae family covering a total of fourteen percent of the total species identified.

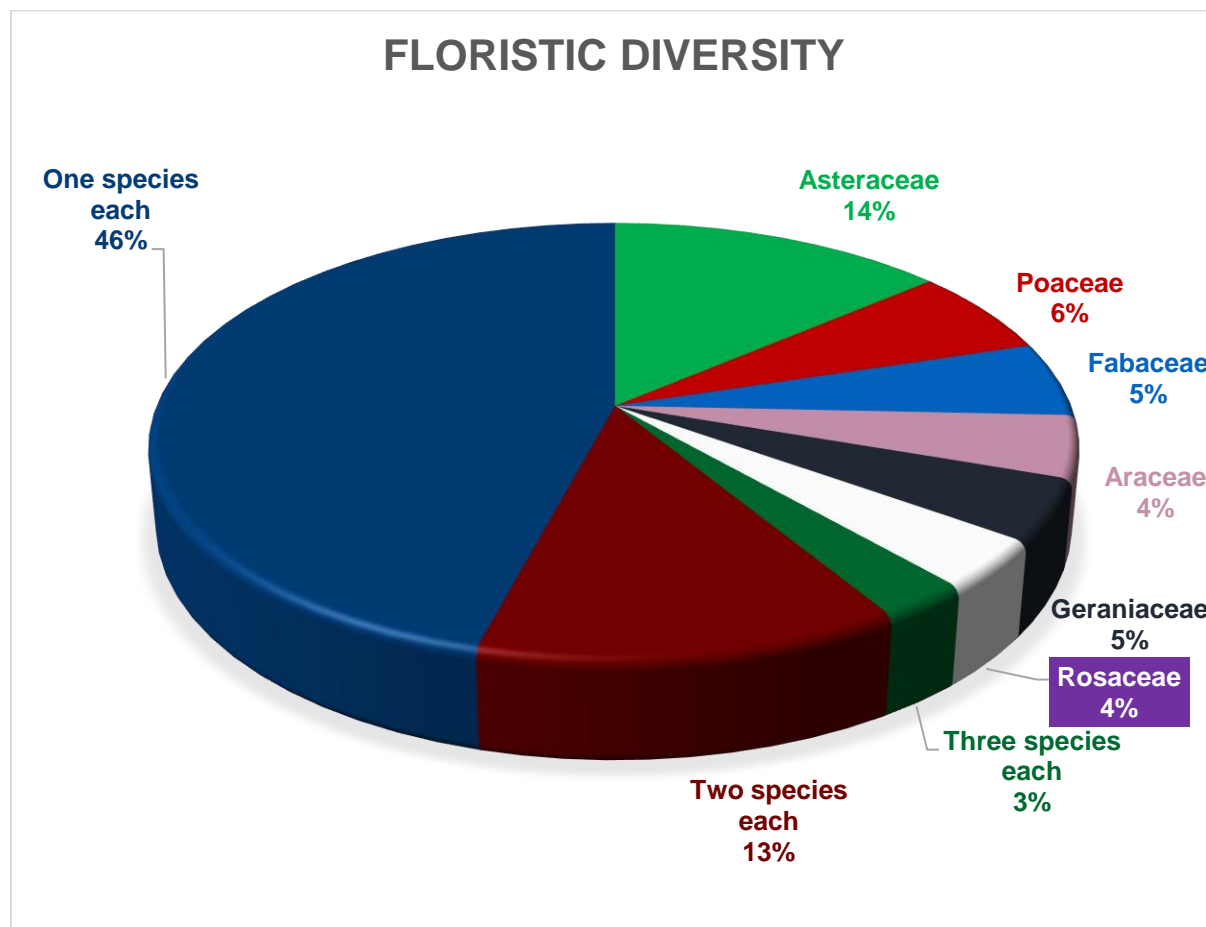


Figure 1 – Percentage of each family to the total number of species identified

4.1.2 Abundance

The chart below shows the families with at least three distinct species each identified in this work. From the chart, Asteraceae is the only family with fifteen distinct plant species. The rest of the sixty-eight families not represented on this chart have one or two species in each family.

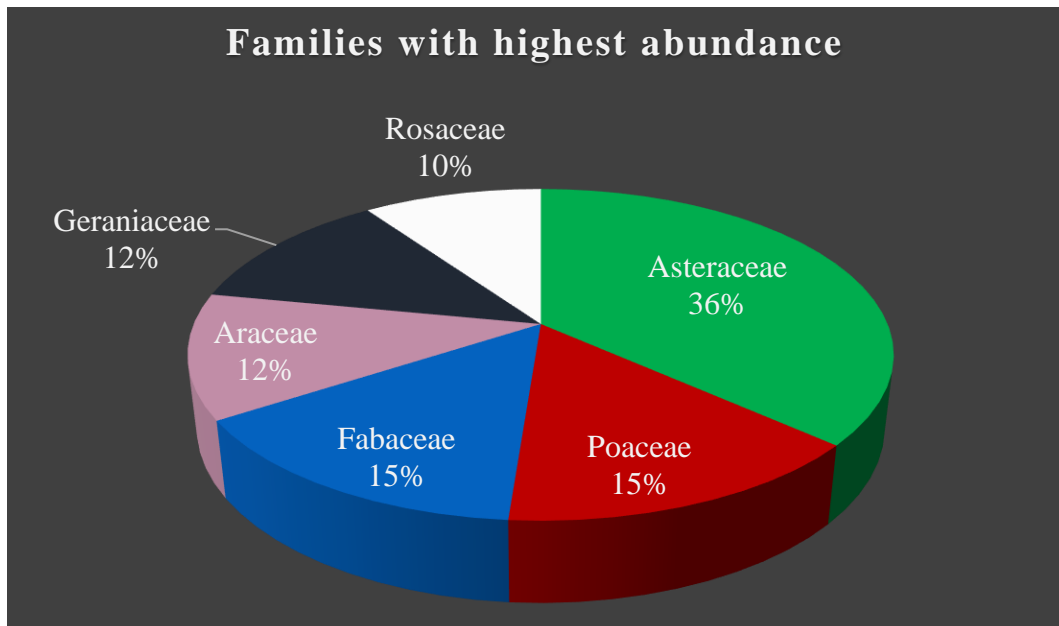


Figure 2 – Percentage of species/family for plant families with largest species

4.1.3 Floristic Comparison

The total number of plant families identified in Lapa dos Esteios is sixty-nine. The figure below shows the comparison of these families to that of Portugal continental and the world.

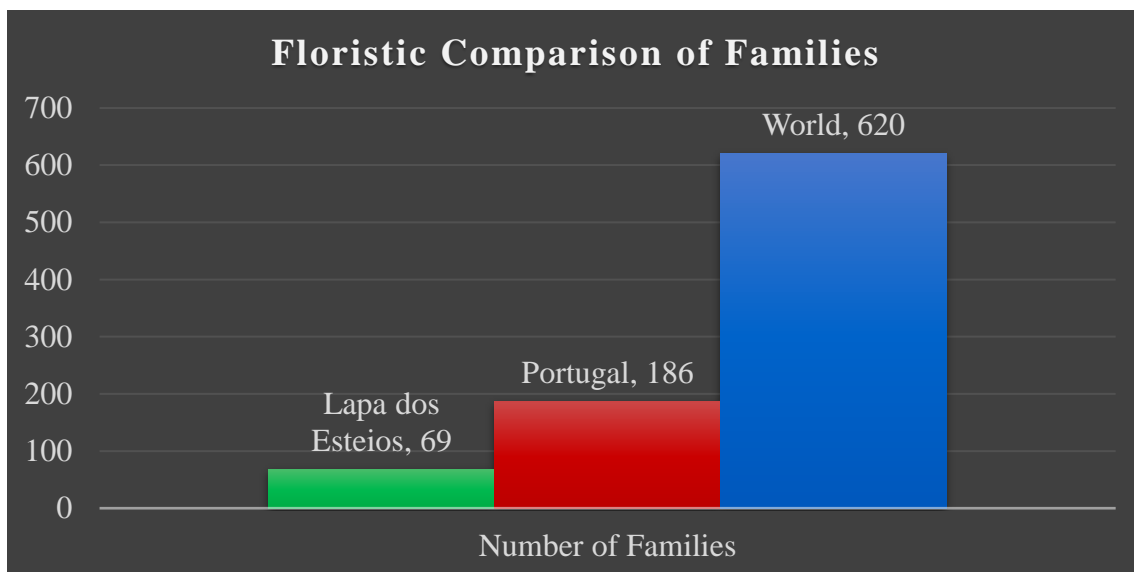


Figure 3 - Relationship between the total number of plant families identified in Lapa dos Esteios compared to the total number of families in Portugal and the world.

4.1.4 Division of the flora of Lapa dos Esteios

The flora studied in this research consist mainly of vascular plants; flowering plants, conifers and ferns, and lichens. The figure below shows the distribution of each.

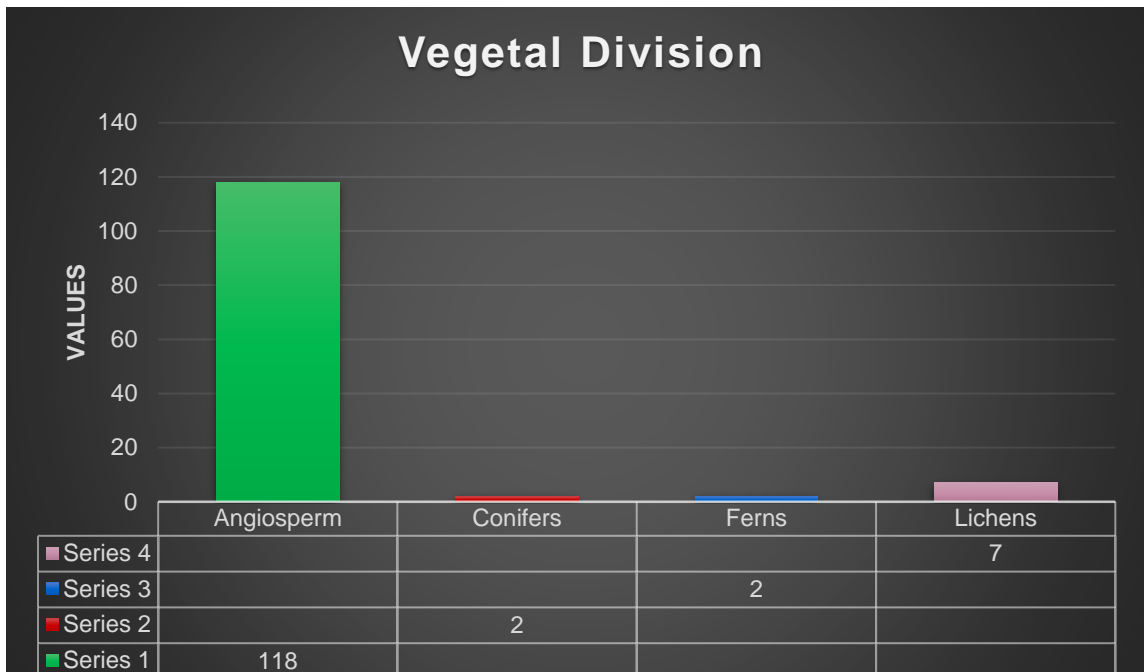


Figure 4 – Comparison of the number of vascular plants, ferns (nonflowering, vascular plants) and lichens identified from this estate.

4.1.5 Exotic plant species

Exotic plants are plants that are introduced from another country or continent. They do not belong to the native flora of a particular area. The figure below shows a comparison of exotic plants in Lapa dos Esteios compared to that in Portugal

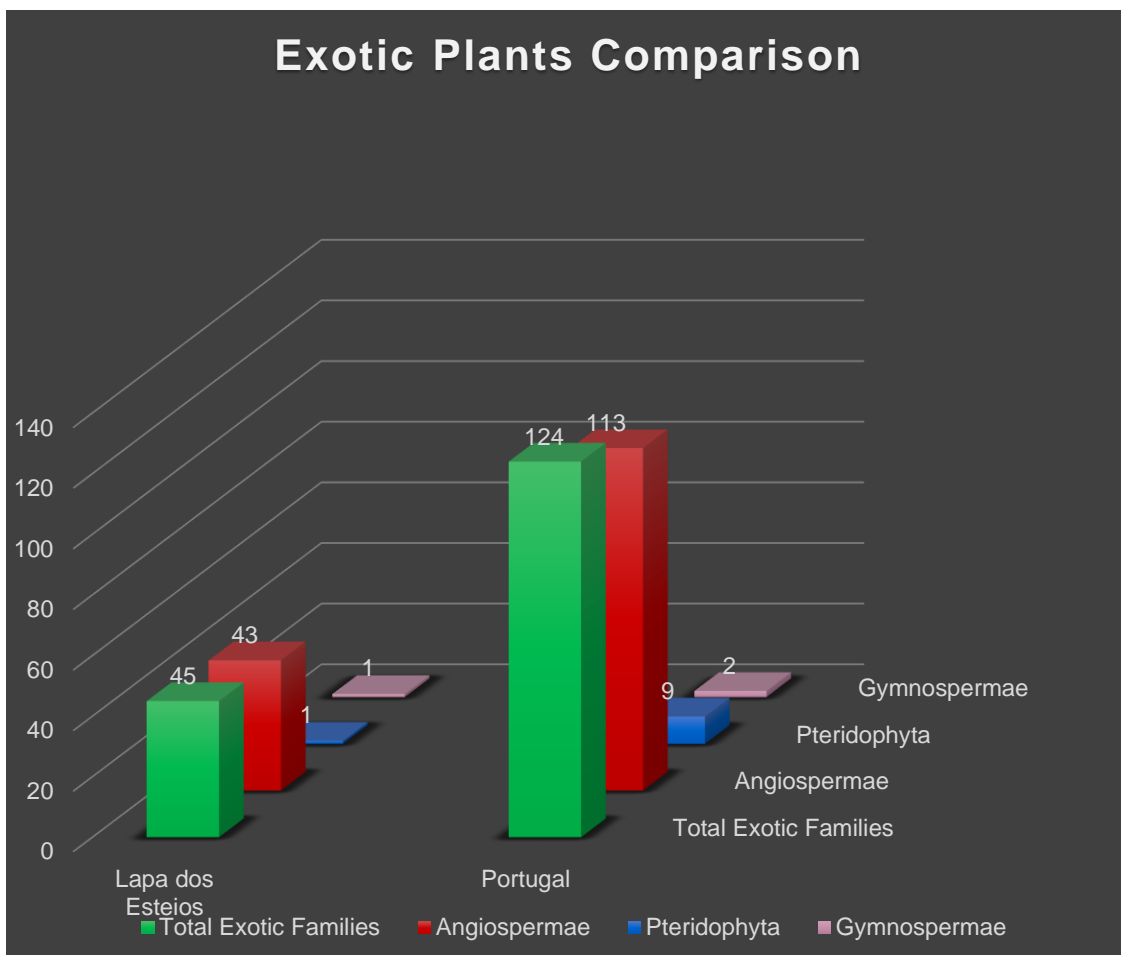


Figure 5- Comparison of the phyla divisions of exotic plants in Lapa dos Esteios compared to that of Portugal (Almeida & Freitas, 2012.)

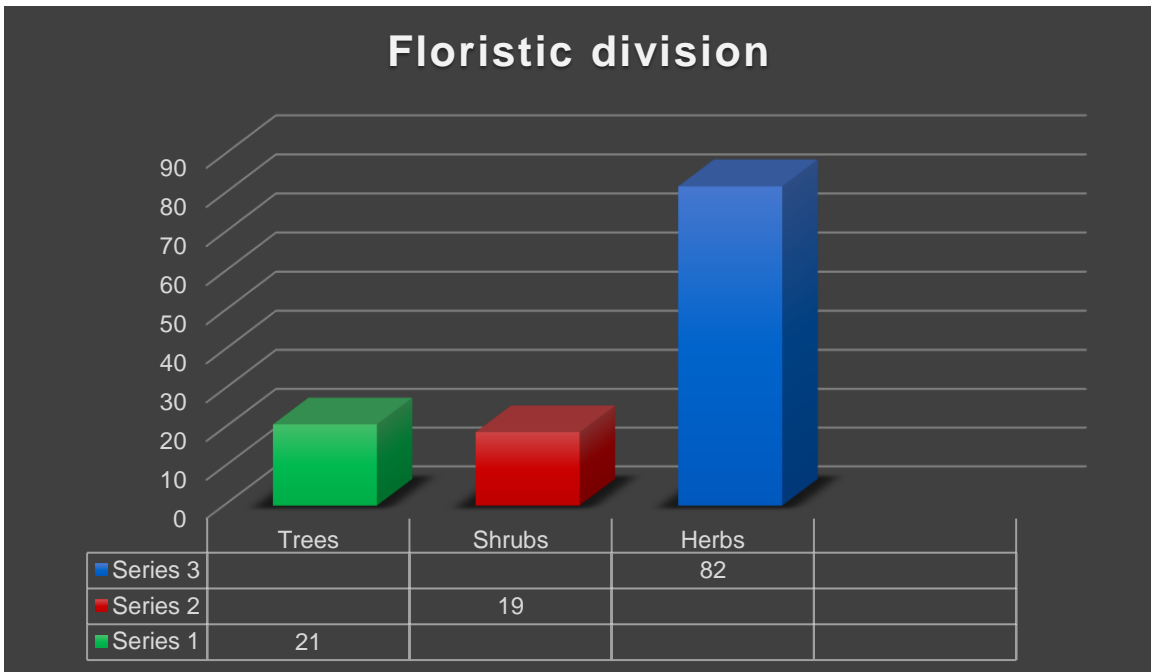


Figure 6 - Habits of the plants of Lapa dos Esteios

4.2 Ethnobotany

4.2.1 Allergenic Plants

The families with allergenic pollen grains found in this garden are Asteraceae, Cupressaceae, Oleaceae, Poaceae and Urticaceae (D'Amato *et al.*, 2007).

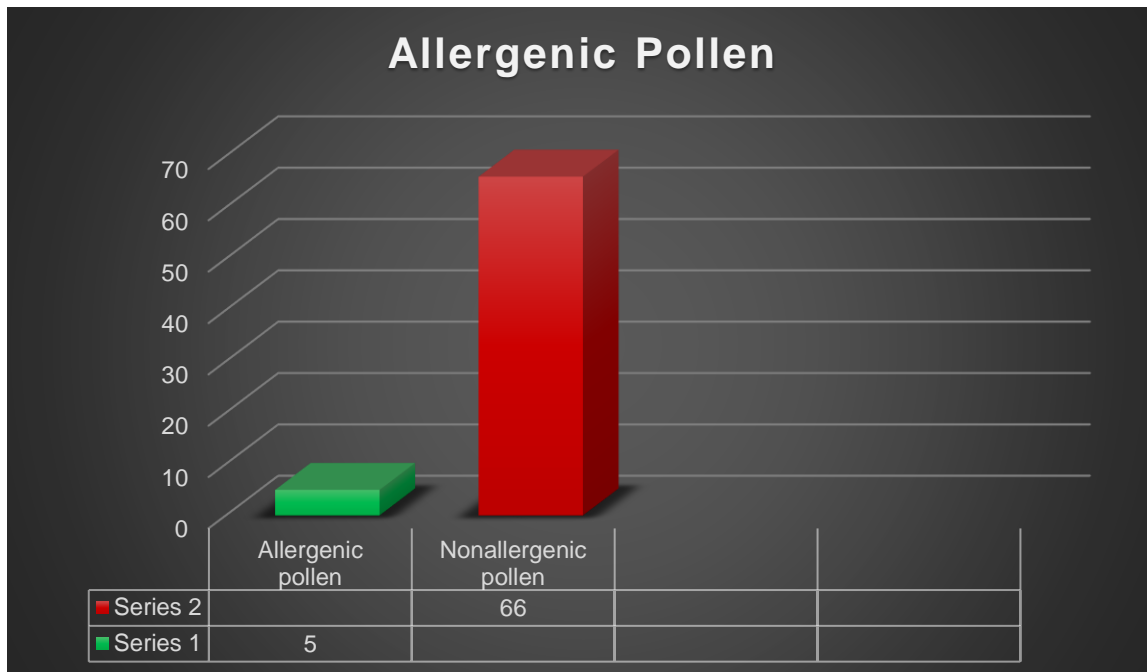


Figure 7- Families with allergenic pollen versus total families

4.2.2 Poisonous Plants

Table 3: Some Poisonous plants and their active chemical from Lapa dos Esteios (Wink & Van Wyk, 2008)

Scientific name	Hazardous plant parts	Active Principle	Symptoms and therapy
<i>Aloe arborescens</i>	Aerial parts, leaf, Exudate	Aloin	Strong laxative causing gastroenteritis, at high doses causes intestinal bleeding, enhances menstrual and uterine bleeding (abortifacient), kidney disturbance, hypertrophy of intestine tissues Therapy: Anthraquinones
<i>Arum italicum</i>	Aerial parts, Fruits	Aroin, cyanogenic glycosides, saponins, Ca ²⁺ - oxalate	Skin irritants, blister formation, burning sensation in the mouth and throats, cardiac arrhythmia, CNS disturbances of GI tract, Therapy: Arum and oxalic acid.
<i>Aucuba japonica</i>	Aerial parts, Fruits	Aucubin and other iridoids glycosides	Disturbance of the GI tract; diarrhea; colic; large doses introduce cerebral bleeding. Therapy: Terpenes and phenylpropanoids with aldehyde groups.
<i>Bryonia dioica</i>	all parts especially fruits (red or black berries), roots	Bryonin, bryonidine, bryonicin, cucurbitacins	Skin irritation, nausea, vomiting, diarrhea with blood, strong colic and spasm, kidney inflammation, tachychadia, respiratory arrest. Therapy: Cucurbitacins, and Bryonia
<i>Buxus sempervirens</i>	aerial parts	Buxine, Cyclobuxine, and several related alkaloids	Contact dermatitis, initially exciting, later paralyzing and hypotensive; nausea; vomiting, dizziness, diarrhoea, spasms, death by respiratory arrest; livestock poisoning Therapy: Buxus
<i>Citrus sinensis</i>	bitter peel	Essential oil, limonene	Essential oil can cause violent colic and convulsions, large doses have led to death in children Therapy: Monoterpenes
<i>Convolvulus arvensis</i>	Seeds	Convolvamine (a tropane alkaloid); possibly ergot alkaloids	Tropane and ergot alkaloids have psychotropic properties that could explain a potential hypnotic and hallucinogenic effect reported from these plants. Therapy: Hyoscyamine and ergot alkaloids.
<i>Dioscorea communis</i>	All parts especially roots and berries	Ca ²⁺ oxalate raphides; steroid saponins	Burning in mouth and throat, vomiting, diarrhoea, gastroenteritis, skin irritant; ingestion of high amounts can be fatal. Therapy: Oxalic acid
<i>Eriobotrya japonica</i>	Seeds	Amygdalin (cyanogenic glycoside)	Amygdalin releases HCN which inhibits cellular respiration; symptoms of HCN poisoning. Therapy: Amygdalin
<i>Eucalyptus globulus</i>	Aerial parts	Essential oil with several monoterpenes, such as 1,8 cineol	High doses cause CNS and GI disturbance; HCN poisoning through prunasin, especially in animals (sheep).

			Therapy: Monoterpenes and amygdalin
<i>Euonymus japonicus</i>	All parts especially fruits	Evonine and several alkaloids	Irritation of GI tract; hallucinations, nausea, extensive vomiting, shock, hyperthermia, bloody diarrhoea, liver and kidney disturbance; arrhythmia, strong spasms, coma after 12h, cardiac arrest. Therapy: Cardiac glycosides
<i>Euphorbia peplus</i>	All parts, especially latex and seeds	phorbol esters in latex; triterpenoids	Strong skin irritant (blister formation); vomiting, stomach pain, purgative; bloody diarrhea; arrhythmia, tinnitus, liver and kidney disturbances, coma; co-carcinogen. Therapy: Phorbol esters
<i>Ficus benjamina, Ficus carica</i>	Latex	furanocoumarins, flavonoids, triterpenes, sesquiterpene glycosides, proteins	Latex can cause photodermatitis; ingestion results in disturbance of GI tract; rarely hazardous. Therapy: Coumarins
<i>Fumaria capreolata, Fumaria muralis</i>	All parts	Protopine, scoulerine, cryptopine, stylopine, and other isoquinoline alkaloids	Mildly psychoactive; sedative, narcotic, substantial ingestion causes burning sensation in mouth and throat, nausea, vomiting, diarrhea and hypotension. Therapy: Protoanemonin
<i>Hedera helix, Hedera maderensis</i>	All parts, especially leaves, fruits	alpha- Hederin and other, triterpene saponins, sesquiterpenes; falcarinol (a polyacetylene)	Irritation of GI tract; nausea, vomiting, palpitations, eczema, dizziness, nervous depression, hyperthermia, death by respiratory arrest; mydriasis. Skin reactions include rashes, red, swollen skin, blisters, oedema and pain. Therapy: Saponins and polyacetylenes
<i>Hydrangea macrophylla</i>	Rhizomes, leaves, flower buds	Hydrangin (cyanogenic glucoside), saponins, quinazoline alkaloids (fabrifugine)	High doses cause vertigo, gastroenteritis, dyspnoea, cerebral disturbances; common contact allergen; supposed to have mind-altering activities (active compound not known) Therapy: Amygdalin
<i>Jacobaea vulgaris, Senecio vulgaris</i>	All parts, Especially flowers	Senecionine and other pyrrolizidine alkaloids.	PAs are hepatotoxic (veno-occlusive disease), alkylate DNA and are therefore mutagenic and carcinogenic; inhibits peripheral nerves; important animal poison. Therapy: Senecionine and Senecio.
<i>Melia azedarach</i>	All parts especially fruits and bark	Several triterpenes (melinon and melianol), also kulinone, kulacton, meliantriol, melia toxins A ₁ , A ₂ , B ₁ and B ₂ ; alkaloids (azaridine)	In high doses fruits can cause nausea, vomiting, diarrhoea, thirst, cold perspiration, spasms, even death; also used as natural insecticide with pronounced livestock toxicity. Therapy: Saponins
<i>Mercurialis annua</i>	All parts	Saponins, aliphatic amines (methylamine, trimethylamine)	Saponins are cytotoxic; in animals: gastroenteritis with kidney and liver damage. Therapy: Saponins
<i>Monstera deliciosa</i>	Roots, aerial parts	Ca ²⁺ - oxalate raphides; toxic peptides	High doses: skin irritant; blister formation; severe swelling of the throat and mouth, burning sensation in

			mouth; disturbance of GI tract and internal bleeding: possibly cardiac arrhythmia; CNS disturbance; spasms; low body temperature. Therapy: Oxalic acid
<i>Narcissus</i> sp.	All parts especially bulbs	Lycorine, haemanthamine, narcisclatine, tazettine and other isoquinoline alkaloids; Ca ²⁺ -oxalate crystals	Ca ²⁺ -oxalate and alkaloids cause skin irritation and inflammation (contact dermatitis); alkaloids cause nausea, vomiting, diarrhoea, abdominal spasms, heavy perspiration, and even death. Therapy: Lycorine and oxalic acid
<i>Nerium oleander</i>	All parts; nectar, even honey	Oleandrine and several other cardenolides	Typical symptoms of cardiac glycoside poisoning; tongue and throat become numb, nausea, vomiting, bloody diarrhoea, spasms, arrhythmia, bradycardia, dilated pupils, dyspnea, blue lips and hands; respiratory arrest, death can occur after 2-3 hours. Therapy: Cardiac glycosides
<i>Phytolacca americana</i>	Roots, leaves	Lectins, phytolaccatoxin (triterpene saponins)	Vomiting, diarrhoea, stomach cramps, weakened pulse, in severe cases: breathing difficulty, convulsions, death; used as molluscicide. Therapy: Saponins
<i>Prunus persica</i>	All parts, especially seeds	amygdalin, prunasin (cyanogenic glucosides); especially high concentration in seeds (5-8%)	When seeds are crushed they release HCN which is a strong respiratory poison; high doses with HCN poisoning symptoms: burning sensation in throat, sweating, abdominal pains, vomiting, red face, salivation, convulsions, respiratory and cardiac arrest. Therapy: Amygdalin
<i>Robinia pseudoacacia</i>	All parts, especially roots, bark, fruits	Robin (a lectin); tannins	The lectin has agglutinating properties and is cytotoxic, causes nausea, vomiting, diarrhea, sleepiness, mydriasis, seizures, abdominal pains; parenteral application can cause life-threatening multisystem organ failure, toxic for cattle and horses Therapy: Abrin
<i>Ruscus aculeatus</i>	All parts, Fruits	Steroidial saponins	Cytotoxic, gastrointestinal disturbance; no serious intoxication in humans. Therapy: Saponins
<i>Schinus molle</i>	Fruits, essential oil	(15:1)-cardanol; α- & β-phellandrene, limonene, myrcene, α-pinene and other terpenoids	(15:1)-cardanol is a strong mucosal and skin irritant, headache, swollen lids; GI tract disturbances; should not be used as a spice in larger quantities Therapy: Saponins
<i>Solanum nigrum</i>	Green parts (red berries are usually not hazardous)	Green fruits and leaves contain steroidal glycol-alkaloids, such as soladulcidine, solanine, solasodine etc, saponins	Disturbance of GI tract, vomiting, spasms, internal bleeding, salivation, trembling, restlessness, headache, delirium, fever and coma; in severe cases death may occur through respiratory arrest. Livestock poisoning. Therapy: Solanine and Solanum

<i>Vicia sativa</i>	Leaves, seeds	Glycosides of pyrimidines; NPAAAs	Mostly animal poisoning; the glycosides appear to cause light sensitivity disease “hairy vetch poisoning” with hair loss, itching, conjunctivitis, diarrhoea, nephritis. Therapy: Non-protein amino acids
<i>Wisteria sinensis</i>	All parts, Especially bark, fruits and seeds	Wistarine; haemagglutinating lectins	Nausea, vomiting, gastroenteritis, diarrhoea, abdominal pains, mydriasis, circulatory disturbance; dangerous for children when more than 2-4 seeds are ingested. Therapy: Non-protein amino acid
<i>Zantedeschia aethiopica</i>	All parts	Probably Ca ²⁺ -oxalates raphides	Burning sensation in the mouth and throat; nausea, vomiting. Therapy: Oxalic acid

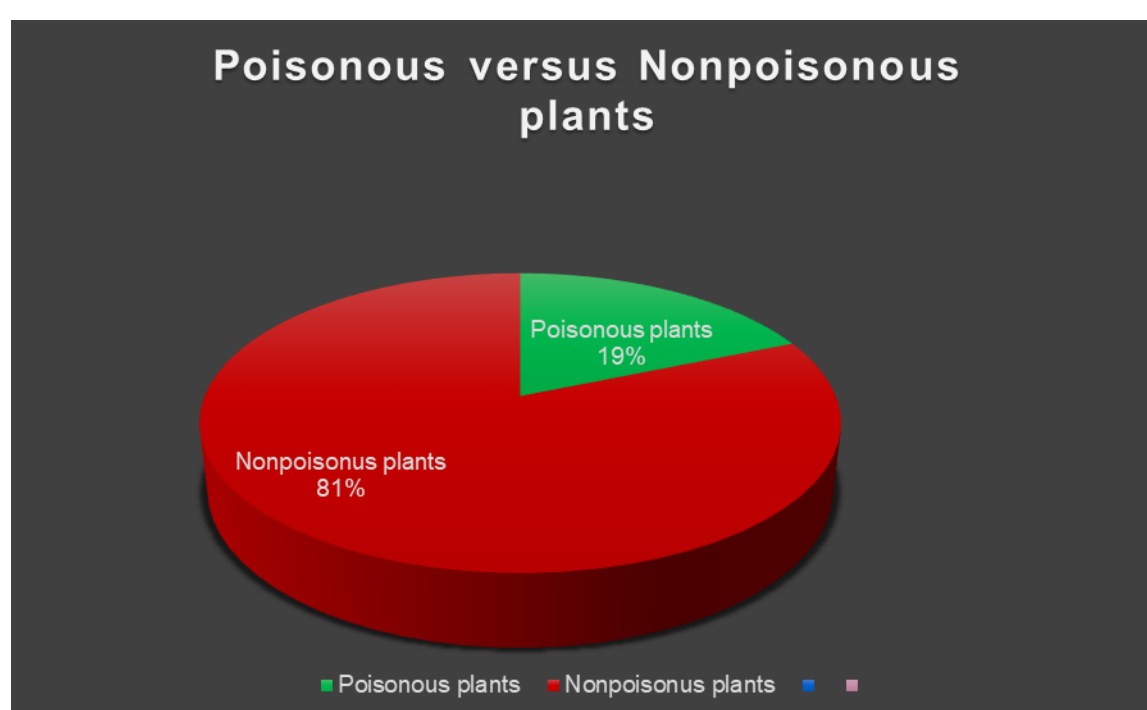


Figure 8 – Percentage of poisonous plants compared to the total number of species identified

4.2.3 Medicinal Plants

The table below shows the medicinal value of some plants in Lapa dos Esteios.

Table 4- Medicinal plants (Flück, 1976; Duke, 2002; Duke, 2003)

Plant	Chemical constituent	Uses	Parts used
<i>Ailanthus altissima</i>	Ailanthone, Ailanthinone, Chaparrine, and Ailanthinol B	Amebicide, antimalaria, antipyretic, laxative	Leaves, bark, and roots
<i>Buxus sempervirens</i>	Triterpenoidal alkaloids, Diacetylboxadine, Demethylcyclomikuranine	Antibacterial, antipyretic, antitumor, diuretic, tonic, and sedative	Leaves, roots
<i>Dioscorea communis</i>	Calcium oxalate and alkaloids	diuretic, emetic, laxative, and propepic	Roots and seeds

<i>Eucalyptus globulus</i>	Eucalyptol,	Antidiabetic, anti-inflammatory, antitumor, antipyretic, antiviral	Leaves, oil
<i>Euphorbia peplus</i>	Ingenol mebutate	skin lesions, including cancer	
<i>Ficus carica</i>	Terpenes, Sterols and Fatty acids	Alexiteric, anticancer, antiseptic, antitumor, deodorant, restorative, tonic, stomachic	Fruits and leaves
<i>Foeniculum vulgare</i>	Essential oil	Analgesic, anti-inflammatory, antiviral, appetizer, carminative, laxative, and stimulant	Fruits, and seeds
<i>Juglans regia</i>	Tannins, volatile oil, juglone, hydrojuglone	Anti-inflammatory, antiseptic, antibacterial, antioxidant, anticancer, tonic, and laxative	Dried leaflets and fresh fruit walls
<i>Laurus nobilis</i>	1,8-Cineole, Sabinene and alpha-Terpinyl acetate	Aperitif, carminative, diuretic, emetic, emmenagogue, narcotic, nervine, stimulant, stomachic, and sudorific.	Fruits and leaves
<i>Myrtus communis</i>	1,8-Cineol, Limonene, Linalool, Myrtenyl acetate, α -pinene, linalyl acetate geranyl acetate, and α -terpineol	Analgesic, antiseptic, carminative, parasiticide, stimulant, stomachic and tonic.	Leaves, berries, seeds,
<i>Olea europaea</i>	Oleuropein, Hydroxytyrosol	Antiarrhythmic, antibacterial, vasodilator, tonic	Leaves, seeds and fruits
<i>Plantago major</i>	Mucilage and glycoside aucubin	Resolutive for coughs, fresh leaves help to heal wounds.	dried leaves, seldom fresh
<i>Rosmarinus officinalis</i>	essential oil (p-cymene, linalool, gamma-terpinene, thymol, beta-pinene, alpha-pinene, and eucalyptol) and tannin and sesquiterpene hydrocarbons)	Analgesic, antiaging, antiseptic, diaphoretic, diuretic, fungicide, parasiticide, stomachic, tonic,	leaves, twigs, and flowering apices
<i>Solanum nigrum</i>	Polyphenols, Gentisic acid, luteolin, apigenin, kaempferol, and m-coumaric acid	Analgesic, anesthetic, antipyretic, antispasmodic, antiulcer, aperitif, fungicide, stimulant, stomachic, tonic	Leaves, stems and fruits

4.2.3 Economic Botany

Lapa dos Esteios has some plants with economy significance. *Citrus sinensis* produces edible oranges and the estate sometimes gives these oranges to the poor and less privileged yearly. The fruits (berries) of *Ficus carica* and *Eriobotrya japonica* are edible, while *Olea europaea* have edible olives and olive oil can be extracted from it which can be used for cooking. The leaves of *Laurus nobilis* are savoury and used in culinary. Lichens have been used for centuries for the manufacture of different products. For instance, *Evernia prunastri* is used in manufacture of some perfumes. Most of the plants (both native and exotic) in this garden were planted for ornamental reasons.

4.2.4 Language of flowers

The flower language of some plants in this garden are listed below;

Table 5- Language of flowers in Lapa dos Esteios (Folkard, 1884; Kirkby, 2011)

Plants taxa	Definition
<i>Acacia</i>	Secret love
<i>Acanthus</i>	Artifice
<i>Adiantum capillus-veneris</i>	Secrecy
<i>Agapanthus</i>	Love letter
<i>Anagalis arvensis</i>	Change
<i>Antirrhinum majus</i>	Presumption
<i>Buxus</i>	Stoicism
<i>Cichorium intybus</i>	Frugality
<i>Cupressus</i>	Mourning
<i>Eucalyptus</i>	Protection
<i>Euphorbia</i>	Persistence
<i>Ficus carica</i>	Longevity
<i>Foeniculum vulgare</i>	Strength
<i>Fraxinus</i>	Grandeur
<i>Hedera helix</i>	Fidelity
<i>Hydrangea</i>	You are cold
<i>Laurus nobilis</i>	Glory
Myrtle	Love
<i>Narcissus</i>	New beginning
<i>Nerium oleander</i>	Beware
<i>Olea</i>	Peace
<i>Opuntia</i>	Ardent love
<i>Rosmarinus officinalis</i>	Remembrance
<i>Zantedeschia aethiopica</i>	Modesty

4.2.5 Doctrine of Plant Signatures

Following are examples of some plants and the part of the body that it was believed to cure;

Table 6- Plants meaning according to the Doctrine of Signatures (Folkard, 1884)

Body part	Plants
Ears	Mountain Bindweed
Eyes	The flowers of Acacia, Geranium, Narcissus, Ranunculus
Hair	Asparagus, Fennel, Flax
Hands, Fingers and Nerves	Fig, Geranium, Soapwort
Head	Antirrhinum, Geranium
Intestine	Navel-wort
Lungs	Fennel, Aloe

4.2.6 Plants and Ancient Deities

The table below shows some of the plants in this estate and the supreme deities they represented in ancient times.

Table 7- Plants and Deities (Folkard, 1884)

Plant	Deity
Ash	Mars
Bay	Apollo
Buckthorns	Janus
Cypress	Pluto
Daffodil	Ceres, Pluto, and Proserpine
Ivy	Bacchus
Laurel	Apollo
Maidenhair	Pluto and Proserpine
Myrtle	Venus and Mars
Olive	Minerva
Palm	Mercury

4.2.7 Lichens

Table 8 - Lichens and atmospheric pollution (Friedel, 1987)

Type of Pollution	S0 ₂ (mg/m ³ of air)	Lichens
Small	less than 70	<i>Xanthoria</i> , in concrete and walls
	less than 60	<i>Parmelia saxatilis</i> , in acid stone.
	Less than 40	<i>Parmelia</i> and other foliose grey lichens on trees
	Less than 30	All fruticose lichens on trees
Pure air		<i>Usnea</i> on trunks

Table 9 – Atmospheric conditions favourable for the growth of lichens (Van & Asta,2009)

Lichen	Atmospheric conditions	Toxicity
<i>Chrysothrix candelaris</i>	prefers humid temperature,	very acidophilic, sciaphile to moderately heliophilous, and little or no nitrophilous
<i>Evernia prunastri</i>	prefers humid to very humid atmospheres	acidophilic to sub-neutrophilic, photophilic or heliophilic, moderately toxigenic, little or no nitrophilous
<i>Flavoparmelia caperata</i>	N/A	photophilic to heliophilic, non-toxigenic, non-nitrophilous
<i>Parmotrema perlatum</i>	moderately humid atmosphere,	acidophilic, photophilic, non-nitrophilous, toxiphobic
<i>Ramalina farinacea</i>	N/A	less tolerant, most common lichen, less sensitive to pollution.
<i>Usnea sp.</i>	Prefers humid atmospheres	acidophilic, toxiphore, nitrophore
<i>Xanthoria parietina</i>	humid atmospheres	basophilic with photophilic or heliophilic subneutrophiles, and nitrophiles.

4.2.8 Dispersal of diaspores

The table below shows the dispersion types and vectors of plants in the diaspora collection from Lapa dos Esteios.

Table 10 – Types of seed dispersal (Aronne & Russo, 1997; Vittoz & Engler, 2007)

	Plants	Dispersal vector	Dispersal type
1	<i>Acer pseudoplatanus</i>	wind, water, animals, and gravity	Pterometeorochory and Barochory, Nautochory and Zoochory
2	<i>Cercis siliquastrum</i>	wind, gravity and internal pressure	Barochory, Ballochory

3	<i>Cupressus lusitanica</i>	internal tension and gravity	Ballochory and Barochory
4	<i>Eucalyptus globulus</i>	wind, gravity	Anemochory and Barochory
5	<i>Hordeum murinum</i>	wind and animal	Anemochory and Epizoochory
6	<i>Laurus nobilis</i>	birds and gravity	Endozoochory and Barochory
7	<i>Melia azedarach</i>	gravity,	Barochory
8	<i>Myrtus communis</i>	ants, birds, and gravity	Myrmecochory, Endozoochory and Barochory
9	<i>Panicum repens</i>	wind and gravity	Anemochory and Barochory
10	<i>Phillyrea latifolia</i>	bird, gravity	Endozoochory and Barochory
11	<i>Phytolacca americana</i>	birds and gravity	Endozoochory and Barochory
12	<i>Piptatherum miliaceum</i>	mammals, wind, water	Endozoochory, Trichometeorochory and Hydrochory
13	<i>Platanus x hispanica</i>	wind and gravity	Trichometeorochory and Barochory
14	<i>Ruscus aculeatus</i>	birds and gravity	Endozoochory and Barochory
15	<i>Schinus molle</i>	birds, Mammals and water	Endozoochory, Hydrochory and Barochory
16	<i>Smilax aspera</i>	animals and gravity	Endozoochory and Barochory
17	<i>Tilia x europaea</i>	wind and gravity	Pterometeorochory and Barochory
18	<i>Viburnum tinus</i>	animal and gravity	Endozoochory and Barochory

The picture below is a diaspora collection I made from fruits, seeds, and other dispersal parts of the plants in Lapa dos Esteios.



Picture 2: The diaspora collection of some seeds and fruits in Lapa dos Esteios

5.0 CONCLUSIONS

The floristic diversity of this garden is made up of one hundred and thirty-five species in seventy-three families. These plants are used in various parts of botany such as ornamentals, food, flavoury, medicine, poisons, and wood. Exotic plants were introduced into this garden from all over the world for many reasons, one being that this garden existed during the Victorian Age, when Europeans were obsessed with flowers. However, some exotic plants in this garden are invasive in Portugal; some of which include, *Oxalis pes-caprae*, *Robina pseudoacacia*, and *Eucalyptus globulus*. This estate has a valuable heritage, which began from the nineteenth century with the visits of poets and artists during the period of Romanticism, the statues which represent great works of arts, the poetry stones which are carved and surrounds the garden and the visit of Emperor Pedro II of Brazil. This study shows the historical heritage of this garden, provides this estate with the first and only detailed information of its flora diversity which can be used as field guides to its visitors. It also provides a list of poisonous plants: the principal chemicals responsible for toxicity, and signs and symptoms. This work aims to raise awareness on the effects of poisonous plants found in gardens and roadsides. Such poisonous plants are susceptible mostly to children and animals. To conclude, I strongly recommend anyone who is interested to know anything about history, arts, plants or just curious about touristic sites in Coimbra to make a visit to Lapa dos Esteios.

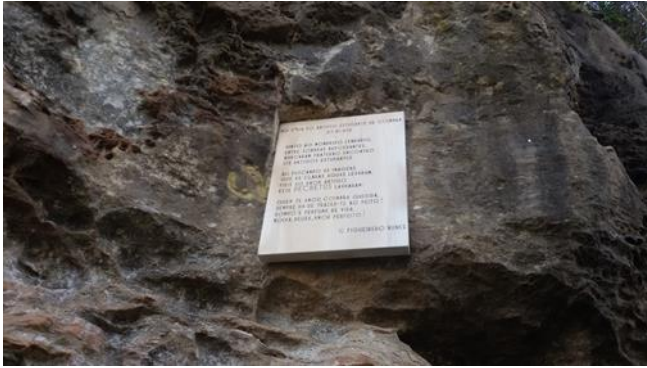
Recommendation

I recommend that the following could be done to make Lapa dos Esteios a more interesting place for the community:

- Plant labels should be made to ease identification of its flora.
- The windmill in the garden be repaired to pump water from the ground up to water the plants in the garden.
- Lapa dos esteios should have a gardener to care for the plants and manage the weed

APPENDIX

Photographs of some poetry stones in Lapa dos Esteios



Dichotomous Keys

A dichotomous key is a tool used for the identification of organisms by the means of mutual exclusive characters.

a) Dichotomous key for the identification of lichen in Lapa dos Esteios.

The hypothesis of this key states that, the lichen should fulfil all the features described in each step to be qualified as the name of the lichen.

- 1. A brilliant yellow, powder lichen----- *Chrysothrix granulosa*
Lichen not as above-----2
- 2. Large foliose, pale yellow green when dry----- *Flavoparmelia caperata*
Lichen not as above-----3
- 3. Large foliose, smooth thallus, pearl-grey when dry----- *Parmotrema perlatum*
Lichen not as above-----4
- 4. An epiphytic bushy shaped lichen-----*Ramalina farinacea*
Lichen not as above-----5
- 6. Pale greyish-green fruticose----- *Usnea* sp.
Lichen not as above-----7
- 7. Leafy orange lichen----- *Xanthoria parietina*
Lichen not as above----- *Evernia prunastri*

b) Dichotomous key for the identification of trees in Lapa dos Esteios. (Bailey LH, 1924; Heywood. 1993)

The hypothesis of this key states that, the leaves of the tree should fulfil all the features described in each step to be qualified as the name of the plant

- 1. Leaves bipinnate, phyllodia acute, curved, 6-11 x 1.9 cm, with 3-6 longitudinal veins -----
-----*Acacia melanoxylon*
- Leaves not as above-----2

2. Leaves opposite, palmate, 10 x 25 cm, five unequalled pointed lobes, base cordate, margin denticulate -----*Acer pseudoplatanus*
 Leaves not as above-----3
3. Leaves pinnate, alternate, 11-18 leaflets, entire except near the base-----*Ailanthus altissima*
 Leaves not as above-----4
4. Leaves needle-like, pale or bluish-green, less than 2.5 cm long, -----*Cedrus atlantica*
 Leaves not as above-----5
5. Leaves alternate, 8-10 x 10-12cm, broadly cordate to reniform, yellowish or dark green above, pale and glaucous beneath entire, veins fanwise -----*Cercis siliquastrum*
 Leaves not as above-----6
6. Leaves unifoliate, leathery, evergreen, elliptical to oblong to oval, 6.5-15 cm long, 2.5-9.5 cm wide, petioles narrowed winged -----*Citrus sinensis*
 Leaves not as above-----7
7. Leaves scale-like, appressed, freely spread, slightly free and acute at the tips with faint resinous aroma when crushed-----*Cupressus lusitanica*
 Leaves not as above-----8
8. Leaves stiff, obovate to elliptic-lanceolate 13- 25 cm long, acute or acuminate, glossy above, tomentose beneath-----*Eriobotrya japonica*
 Leaves not as above-----9
9. Leaves narrow, sickle-shaped, 15-35cm long, with a conspicuous marginal vein-----
 -----*Eucalyptus globulus*
 Leaves not as above-----10
10. Leaves opposite or in whorls of three, pinnate, 15–25 cm long, 3-13 leaflets; slender, 3–8 cm long, 1-1.5 cm broad -----*Fraxinus angustifolia*
 Leaves not as above-----11
11. Leaves pinnate, 20-45cm long, leaflets between 3-7 but mostly 7, shoe polish scented when crushed-----*Juglans regia*
 Leaves not as above-----12
12. Leaves glossy, dark green, with wavy margins-----*Laurus nobilis*
 Leaves not as above-----13
13. Leaves bipinnate, 1-3 ft long, with numerous leaflets that are 2.5-5 cm, acute, sharply serrate or lobed-----*Melia azedarach*
 Leaves not as above-----14

14. Leaves elliptic, oblong-elliptic, entire, smooth, lanceolate, mucronate, 4-10 x 1-3 cm, dark green above, whitish to almost silvery beneath-----	<i>Olea europaea</i>
Leaves not as above-----	15
15. Leaves pinnate, induplicate, 4-6 long, 80-100 leaflets, bole covered with old petiole, leaflets inserted in several planes but small angle differences, spines formed at basal leaflets-----	
-----	<i>Phoenix canariensis</i>
Leaves not as above-----	16
16. Leaves opposite, lanceolate, dentate -----	<i>Phillyrea latifolia</i>
Leaves not as above-----	17
17. Leaves lanceolate, 7-16 x 2-3 cm, pinnately veined -----	<i>Prunus persica</i>
Leaves not as above-----	18
18. Leaves pinnate, alternate, dark or yellowish green above, greyish green and glabrous beneath, 9-19 leaflets; oval, 3.5 x 2.5cm-----	<i>Robinia pseudoacacia.</i>
Leaves not as above-----	19
19. Leaves bright green, 5-10 cm long, broad-ovate, abruptly acuminate, obliquely cordate at the base, aristate teeth, glabrous beneath-----	<i>Tilia europea</i>
Leaves not as above-----	20
20. Leaves 3ft long, nearly orbicular, black hair-like fibre covers the bole-----	
-----	<i>Trachycarpus fortunei</i>
Leaves not as above-----	21
21. Leaves glossy, flat, smooth, leathery to the touch, double toothed, 6-15cm long -----	
-----	<i>Ulmus minor</i>

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