

# The Botanical Garden of Naples

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**Riassunto.** Vengono fornite informazioni sulla storia, organizzazione e finalità dell'Orto Botanico di Napoli dell'Università degli Studi di Napoli Federico II. Sono descritte le aree tematiche, le collezioni di piante e le specie di particolare interesse.

**Abstract.** Information on history, organization and aims of the Botanical Garden of Naples at the University of Naples Federico II, Italy, is given. Thematic areas, plant collections and species of particular interest of the Botanical Garden are described.

**Key words:** Botanical Garden of Naples, Scientific museology

## HISTORICAL NARRATIVE

There have been accounts of private botanical gardens in the city of Naples since the second half of the 16th century (DE LUCA 1992; MENALE & BARONE LUMAGA 2000a). They had, as was the custom of the time, characteristics of a 'Giardino dei semplici' (Italian expression referring to a garden in which plants used in folk or official medicine were cultivated), and were typically tended by monks. The necessity for a university botanical garden in Naples had already been recognised under the Reign of Borbone, but during the French occupation only such a garden was realised (CATALANO 1958).

In 1807, the 'Giardino dei Semplici' of Monteoliveto, Naples, used for university teaching, was abolished and the area was destined from the French to realize the food market of the city. To avoid the destruction of the existing plant collections, Borbone created a new botanical garden by transferring the most interesting plants cultivated in the old garden (ZECCHINO 2005). The site chosen for the new garden was expropriated by a decree that stated: "The land that is between the 'Albergo dei

Poveri' and the church 'Santa Maria degli Angeli alle Croci', belonging in part to the hospital 'Ospedale della Cava' and in part to the religious institution 'Pii Religiosi della Pace', will be established as the Royal Garden of Plants for the instruction of the public and for multiplication of species useful to health, agriculture, and industry" (CATALANO 1958; DE LUCA & MENALE 1997). The site extended over about 40 acres (approximately 13 hectares). The place and design of the new Garden was quite modern and markedly different from the pre-existing 'Giardino dei Semplici'. Development of the project was entrusted to the architects De Fazio and Paoletti. De Fazio developed the monumental facade, in a style uniform with the adjacent Hospice of the Poor. The main street was perpendicular to the facade, the street orthogonal to the latter was the seat of the Institute and ended against the 'cold oven' with a Doric colonnade and the doors with a rounded opening rotating around a central pivot (PISANO 1992; RUSSO 1992; BARONE LUMAGA & MENALE 2000). Paoletti was entrusted with the planning and developed of the lower part of the Garden.

In 1818 the Garden was endowed with a 'hot oven' that was added to the 'cold oven'. To establish the Botanical Institute, laboratories and offices, a building in form of castle (Fig. 1) dating from the 16th century, probably built by Venetian merchants and until that time occupied by farmers as a country cottage, was restored and used (BRUNO 1992).

A decree dated March 25, 1810 nominated Michele Tenore director of the Botanical Garden (NAZZARO & MENALE 2000; DE LUCA & MENALE 2011). Tenore completed his studies in medicine under Petagna, director of the 'Giardino dei Semplici' of Monteoliveto, and inherited from his teacher a passion for botany as a science in its own right, rather than a discipline supporting medicine. Such a concept of botany led Tenore to organize the Garden in a scientific manner, an innovative way as compared to the earlier organization of 'Giardino dei Semplici' (DE LUCA 1992).

Michele Tenore directed the Garden until 1860 and during his 50 years of direction increased the collections, bringing the number of cultivated species to about 9,000. He also worked to establish connections with the most important European Gardens, with the knowledge and appreciation by the international botanical world (DE LUCA 1992; MENALE & BARONE LUMAGA 2000b).

Tenore was succeeded in the direction of the Garden by Guglielmo Gasparrini. Under Gasparrini's direction, from 1861 to 1866, there were systematic revisions of the arboretum, citrus orchards, and the fruit collections, which had fallen into a state of abandonment in the last years of Tenore's direction (DE LUCA 1992). Furthermore, a 'little valley' was created for growing alpine plants, and a new heated greenhouse was built to replace an earlier defective greenhouse. Gasparrini was involved with establishment of the Museum of Botany, the library of Gussone (BALSAMO & GEREMICCA 1913), and the arrangement of the herbarium that was enriched with the exsiccata collections by Tenore (CATALANO 1958).

Following the death of Gasparrini, Giuseppe Antonio Pasquale was nominated *interim* director, and in 1868 the directorship was trusted to Vincenzo Cesati. Cesati

remained at the Garden until 1882. The main event characterizing this period is the construction of an artificially heated greenhouse (DE LUCA 1992). Construction of a new city street reduced the area of the Garden by a little less than two hectares.

The directorship then passed again to Giuseppe Antonio Pasquale, who remained until 1893. In this period, Pasquale succeeded in preventing the establishment of new seats for university institutes that were planned within the Botanical Garden.

Federico Delpino succeeded Pasquale, and remained in charge until 1905. The major problem that he had to face was an extreme lack of sympathy and support toward the Garden from the university administration. This lack of support brought many economic and administrative problems that paved the way for a slow decline of the Garden.

Many changes came about in the Garden under the direction of Fridiano Cavara (1906-1929). In addition to a growth of the collections, an area for xerophytes and succulents, and a pond and two raised pools for aquatic plants were created. The cold greenhouse was restored and the construction of a new building to host the Institute of Botany began (CATALANO 1958; DE LUCA 1992). Cavara's most important contribution was the establishment in 1928 of the Experimental Station for Medicinal Plants for the cultivation and study of these plants. This structure, endowed with autonomous funds, functioned under the direct supervision of the Garden, but was institutionally independent from the Garden administration. Administrative funds were granted for the most part by the Ministry of National Economy and in a small part by the Province, City, and Commerce Chamber (DE LUCA 1992; CASORIA *et al.*, 1997).

In 1930 the directorship passed to Biagio Longo, who continued the work initiated by his predecessor. In 1936 the Institute of Botany was completed (the process took 18 years). In this period, the peak of the activities of the Garden was attained in 1940 when an extraordinary meeting of the Italian Botanical Society was held in the Garden on occasion of the inauguration of the 'Mostra d'Oltremare' (CATA-





Fig. 1 - The Castle.



Fig. 2 - A view of the entrance of the Garden, today.



LANO 1958; OTTIERI 1992).

In the following years, wartime events negatively impacted the activities of the Garden: iron structures were diverted to military uses, large scale cultivation of beans, potatoes and grains was introduced, and at various times the population invaded the Garden to find refuge and to have access to water. Bombings were equally devastating on the city and on the Garden, but even greater destructions were due to the Allied troops that occupied the Garden (DE LUCA & MENALE 2011). The new Institute was used as barracks, the grounds were covered with cement or cleaned and transformed in parking lots for military vehicles, and part of the grounds were used as sport fields. In 1947, a little after the end of his directorship, Longo

published a paper describing the Garden's state of total disfigurement (DE LUCA 1992).

Such was the state of the Garden inherited by Giuseppe Catalano, director of the Garden from 1949 to 1959. During this time, reconstruction was carried out, partially for the old Institute and totally for the new, by using public funds and grants put at the disposal of the Garden. The iron gates were rebuilt and the greenhouse restored; in particular, an extended area for a large elevated pool was added to the heated greenhouse. The grounds were liberated from cement paving and planted with essential oil trees. The 'little valley' in which alpine plants were formerly grown was transformed into a fern garden (DE LUCA & MENALE 2011).

During his directorship (1959-1963)



Fig. 3 - View of the gymnosperm area.





Fig. 4 - Cycads in the gymnosperm area.



Fig. 5 - *Ginkgo biloba* L.





Fig. 6 - The palm area.

Valerio Giacomini maintained, with little change, the situation left to him by Catalano.

In 1963, the directorship was assumed by Aldo Merola. Under Merola's direction the Botanical Garden of Naples saw its rebirth and renewal. The basis of this rebirth was the achievement in 1967 of the objective of transforming the Garden into an University Institute, administratively and economically independent. Such autonomy permitted to obtain funds by scientific national institutions that allowed the construction of a 5,000 m<sup>2</sup> greenhouse complex at the end of the '60s. Heating equipment was installed in the cold greenhouse (the monumental greenhouse, today dedicated to Merola) and an additional small working greenhouse were built. The creation of a network of pipelines for water distribution replaced the previous system of pumping water from a well and distributing it manually from large mobile tubs (DE LUCA 1992). Merola also showed a keen interest in legislation, succeeding, to the extent possible, at raising the awareness of the political powers to the problems of the Garden. The main result from these efforts was the creation of a regular staff of gardeners that brought an increase in specialized personnel. A greater availability of

funds also allowed the acquisition of machinery for gardening, which improved the ability of the workers to perform their duties. The only three rooms in working order of the old Institute (referred to as the 'Castle') were converted to the Garden offices, while the new building became the seat of the Institute of Botany.

At the beginning of the '70's, the Experimental Station for Medicinal Plants was abolished and its garden plots, personnel and building became an integral part of the Garden (CASORIA *et al.*, 1997).

The plant collections, which had become extremely impoverished, were notably improved. This was brought about by acquisition of plants from various parts of the world, principally by the field collection of plant specimens during frequent expeditions that included participation of Italian botanists and of an illustrious amateur botanist, Prof. Luigi Califano (MEROLA 1976-1977). The largest growth in the collection was in the cycads, *Tillandsia*, succulents, and ferns (DE LUCA 1992).

Merola re-established contacts with other European botanical gardens, thus favouring exchange of plant material and scientific



Fig. 7 - The fern area.

expertise. These contacts gave his directorship a scientific reality and a more extensive breadth. The Garden, thus, began to grow beyond the provincialism that had characterized it from the beginning of the century. Merola was very attentive to the Garden's great potential in the teaching area, by providing labels that listed the taxonomical and distributional information available for each plant and creating new display areas; in some of these areas the plants were organized by systematic criteria while other areas followed ecological criteria. The areas designated for plant families and for gymnosperms are examples of displays that follow taxonomic criteria. The 'desert', the 'bog', the 'beach' and the rock garden are the display areas that attempt to reconstruct natural environments (DE LUCA 1992).

On the death of Merola in November 1980, the directorship was assumed on an *interim* basis by Giuseppe Caputo. During this time the city was struck by a disastrous earthquake that caused a great deal of damage to the Castle (Fig. 1), as well as to the Garden. The Garden was occupied for several days by the townspeople in search of refuge. Freed from the occupation with the help of the police, funds were provided to protect the Garden using the services of armed guards, in order to prevent looting made possible by damages to the facilities.

In 1981, Paolo De Luca was nominated director of the Garden. Repair of damage caused by the earthquake was carried out in part with funds by the government finalized to the reconstruction of the area affected by the seismic activity. The Castle, partially damaged by the earthquake, was completely renovated, restoring it to full use. On the ground floor of this building, various storage rooms, a repair shop for garden equipment, and lecture hall supplied with audiovisual equipment were set. The first floor housed offices, the library, the education section, a visitor's apartment, and an office with computerized equipment for cutting plastic display labels which report taxonomic and geographic data of each species grown in the Garden. The second floor was occupied by the Museum of Botany and by laboratories.

The monumental facade, more than 200 m long, was restored using funds secured from Superintendent of Monuments, as were the monumental greenhouses, now dedicated to Aldo Merola. The complex of the new greenhouses, already dedicated to Luigi Califano during the directorship of Merola, was fitted with heat and humidification systems, while the smaller working greenhouse was restructured. Locker rooms for the gardeners, in a state of total disintegration, were fully restored and provided with heat. The irrigation system was completed so that all areas of the garden





Fig. 8 - The citrus grove.



Fig. 9 - *Citrus x paradisi* Macfad. grown in the citrus grove.





Fig. 10 - *Ophrys tenthredinifera* Willd. in the bulb area.

received water from the artesian well. Mechanization of gardening operations, begun under Merola's direction, continued with acquisition

of additional equipment and the increasing of the staff. The collections were enriched with specimens that were purchased or collected during various botanical expeditions. Some areas, still not restored by Merola, were freed from brambles and weeds. The grounds of the Garden were in terrible condition and were replanted, and an area formerly used by the former Experimental Station was returned to use. The citrus grove, reduced to a few specimens from the old collection planted around the middle of the 19th century, was enlarged with the acquisition of new species of the genus *Citrus* and other genera of Rutaceae related to *Citrus*. A new ecological habitat display area, the Mediterranean maquis, was added to those already put in place by Merola. The maquis area is a collection of plants representative of that particular environmental setting. For teaching purposes, areas were developed to show plants of ethnobotanical interest (dye plants, fibers, essential oils, food grasses, medicinal plants, drink plants); in addition, a nursery was built.



Fig. 11 - View of the desert area.





Fig. 12 - The shore area.



Fig. 13 - The bog area.





Fig. 14 - The Mediterranean maquis area.



Fig. 15 - *Arbutus unedo* L. grown in the Mediterranean maquis area.



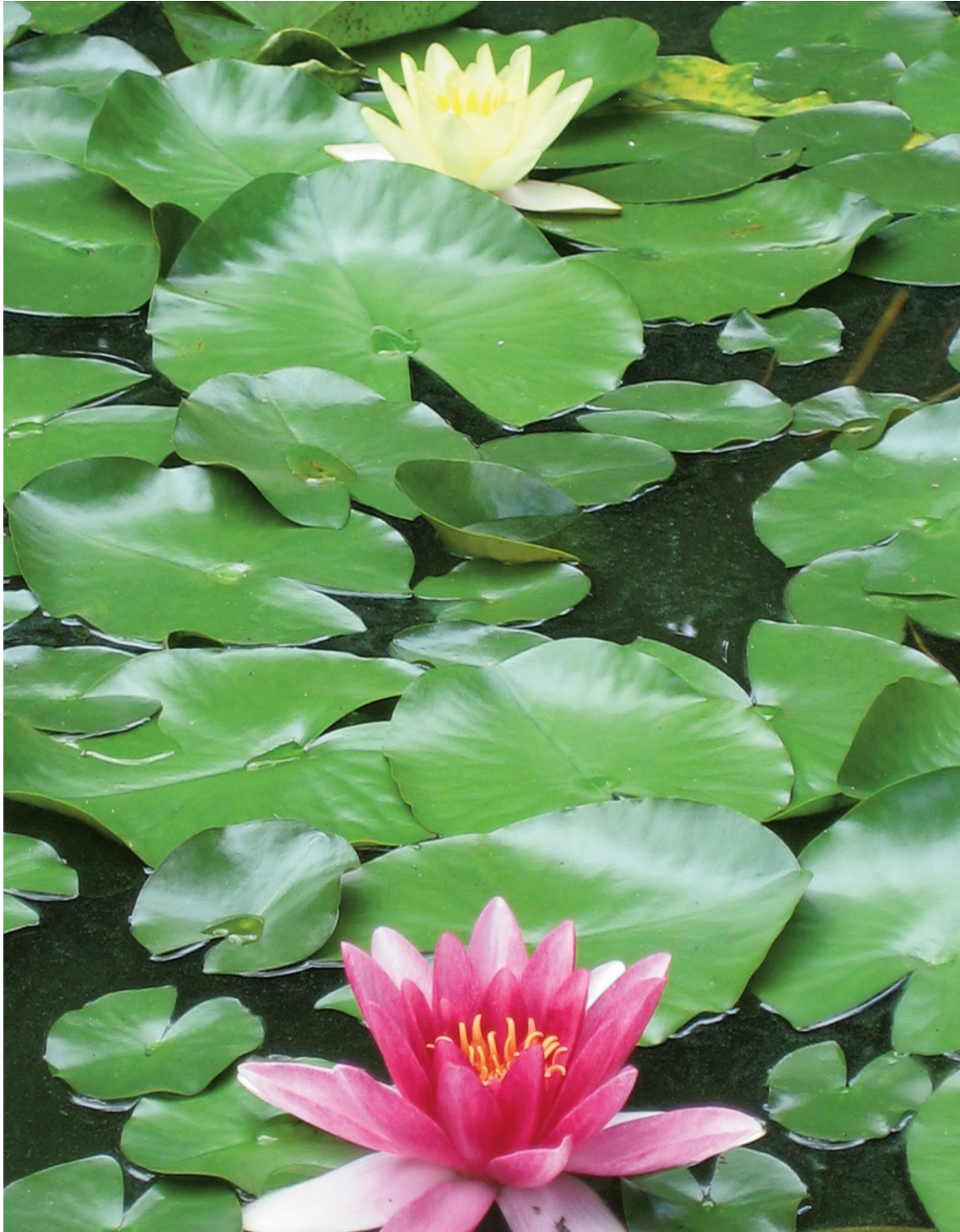


Fig. 16 - *Nymphaea* spp. grown in a vessel of the Garden.

#### THE GARDEN TODAY

The Botanical Garden of Naples occupies a total area of about 12 hectares (Fig. 2). The collections include about 10,000 species, with about 25,000 specimens arranged in various

areas by taxonomical, ecological, and ethnobotanical criteria. The arboretum does not follow these criteria and is composed of various species of trees and shrubs, among which *Zelkova carpinifolia* Dippel, with a base circumference around 5 m, large specimens of





Fig. 17 - View of the Tactile Olfactive area.

*Melaleuca styphelioides* Sm., *Ginkgo biloba* L., *Parrotia persica* C.A. Mey., *Araucaria bidwilli* Hook., *Cordia martinicensis* Roem. & Schult., *Celtis australis* L., *Cinnamomum glanduliferum* (Wall.) Meisn., various majestic specimens of genus *Quercus*, and *Rhus toxicodendron* L.

Plants are arranged in systematic order in the areas designated for gymnosperms, palms, ferns, citrus, angiosperm orders; small areas are dedicated to single angiosperm taxa and bulb collections.

The gymnosperm area (Fig. 3) combines examples of the four living classes of these plants. The class Cycadopsida (cycads) is represented by the genera *Cycas*, *Encephalartos*, *Dioon*, *Zamia*, *Macrozamia*, *Ceratozamia* (Fig. 4). The only living species of Ginkgoopsida, *Ginkgo biloba* (Fig. 5), is in the collections, and there are several species of *Ephedra* representing the Gnetopsida. The majority of the plants in this area belongs to the class Pinopsida. These include *Cupressus duprezia-*

*na* A. Camus and *Pinus leucodermis* Antoine (two species threatened with extinction), noteworthy examples of *Pinus nigra* C. F. Arnold, *Pinus canariensis* C. Sm., *Agathis robusta* (C. Moore ex F. Muell.) F. M. Bailey, a vast collection of *Araucaria* and specimens of *Cryptomeria japonica* D. Don, *Sciadopitys verticillata* Siebold & Zucc., *Cunninghamia lanceolata* Lamb. and *Wollemia nobilis* W. G. Jones, K. D. Hill & J. M. Allen.

The palm area (Fig. 6) contains several species of notable interest including *Jubaea chilensis* Baill., *Howea fosteriana* (F. Muell.) Becc., *Trithrinax campestris* Drude & Griseb., *Brahea roezlii* Linden, *Syagrus romanzoffiana* (Cham.) Glassman and some species of the genus *Phoenix*. Furthermore, there are excellent collections of *Sabal*, *Rhaphis* and *Chamaedorea* (of particular interest are *C. desmoncoides* H. Wendl. and *C. tenella* H. Wendl.).

The fern garden serves two aspects: taxonomical and ecological. This area, situated at a





Fig. 18 - The Bible Garden.



Fig. 19 - *Nymphaea caerulea* Savigny, grown in the Bible Garden.





Fig. 20 - The Califano greenhouses.



Fig. 21 - The collection of cycads in the Califano greenhouses.





Fig. 22 - The Merola greenhouse.

level a few meters lower than the rest of the Garden and protected from excessive sunlight by a belt of surrounding trees, is quite humid due to two artificial pools connected by canals that run through the entire area. These conditions created the ideal environment for the hydrophytes, which are also displayed in this area. Several tree fern species of the genera *Cyathea* and *Dicksonia* are grown in the fern garden (Fig. 7). Only one specimen of each species was collected in nature; the others were derived from these original specimens by reproduction carried out in garden's greenhouses. The sporophytes obtained in this way were bred in a small nursery close to the area. The fern garden also boasts examples of almost all the native Italian ferns, among which is the tertiary relic species *Woodwardia radicans* (L.) Sm., and many species from Europe and the rest of the world.

The citrus grove contains the remains of the collection from Tenore with the additions made by Pasquale, comprising many of the most common citrus cultivars. Recently, the

collection grew with the introduction of nearly all of the species of the genus *Citrus* (Figs. 8 and 9) and several representatives of closely related genera, with particular attention to species less contaminated by cultivation. Species of special interest include *Severinia buxifolia* Ten., *Microcitrus australis* (Planch.) Swingle, *M. australasica* (F. Muell.) Swingle, *Citrus hystrix* DC. and *Citrus indica* Tanaka. A notable cultivar of *Citrus limon* (L.) Burm. f. is the 'Volkamerian lemon', elevated by Pasquale to the level of species (*Citrus volkameriana* Pasquale) based on studies carried out on plants grown at the Garden of Naples.

The angiosperms orders area includes the most representative species of each order of flowering plants; here, small evergreen perennial plants producing flowers, large enough to show reproductive structures are mainly cultivated. Moreover, most of the selected species come from the Mediterranean region or from world temperate regions. Among the small areas dedicated to single taxa of angiosperms outside the area designated for the flowering





Fig. 23 - The tropical greenhouse.

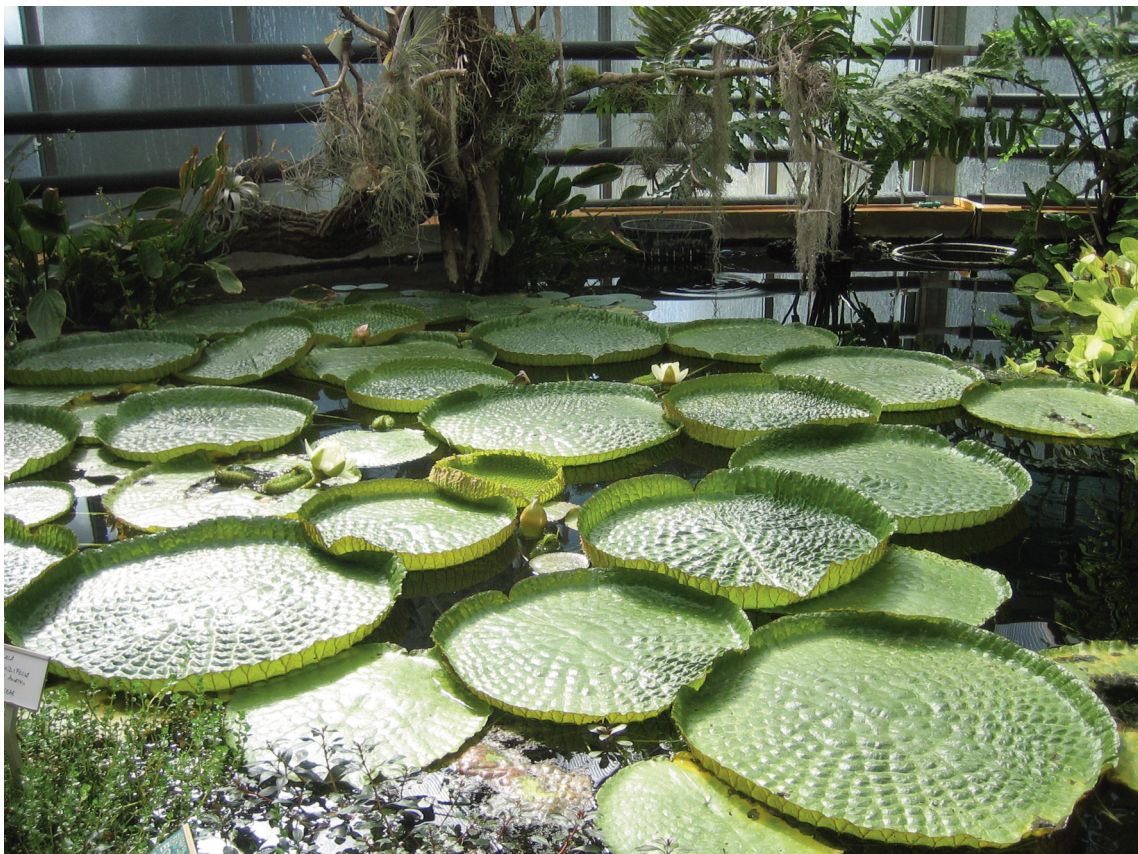


Fig. 24 - *Victoria cruziana* A.D. Orb. grown in the tropical greenhouse.





Fig. 25 - The Museum of Botany. View of a room devoted to Ethnobotany.

plants orders, a *Camellia* area is worth mentioning, which includes an excellent sample of *Camellia japonica* L., with simple flowers, started from seed about 200 years ago.

The bulb collection includes diverse Orchidaceae (Fig. 10) and Liliaceae, and many species of *Allium* and *Crocus* native to the Italian flora.

The areas in which plants are grouped ecologically are the 'desert', the 'shore', the 'bog', the 'rock garden', the Mediterranean maquis, and pools for aquatic plants. The 'desert' (Fig. 11) shows collections of succulents that do not have great difficulty in a growing in the open at latitude of Naples; the area is arranged similarly to an 'amphitheater' with cement bed prepared to look like rocks and positioned to receive midday sun. This area is equipped with an excellent drainage system that utilizes channels that drain the loam-filled cement beds in which the plants are grown. Species that are particularly sensitive to the spring rains are protected by removable iron and plastic covers. Among the plants of notable interest in this area are three splendid samples of *Euphorbia resinifera* Berg, various specimens of *Machae-*

*rocereus eruca* (Brandege) Britton & Rose, *Borzicactus ventimigliae* Riccobono, and some species from the collections of *Aloe*, *Agave*, and *Opuntia* present in the greenhouse.

The 'shore' (Fig. 12), the 'bog' (Fig. 13), and the 'rock garden' are small reproductions of these environments in which species characteristic of these habitats can be seen.

In the area of the Mediterranean maquis there is a collection of species characteristic of that environment (Figs. 14 and 15). To allow more comfortable observation of the plants, the thick vegetation associated with the maquis environment is not reproduced.

The vessels for aquatic plants (Fig. 16), located at various points in the Garden, house floating plant species and other aquatic plants living along river banks or in shallow waters.

Ethnobotany is represented in the experimental beds (the former Experimental Section for Medicinal Plants) in which plants used in medicine, for essence, as dyes, as beverages, for fiber, and as food are grown. Noteworthy, among them is a collection of *Triticum* species with different chromosome numbers. Two greenhouses, a hot humid one and a hot dry

one, host useful plants coming from different parts of the world.

In the NE part of the Experimental Section for Medicinal Plants, an orchard collection is present which includes ancient cultivar of plants that come from South Italy in order to preserve the biodiversity. Recently, in the Experimental Section, a new exhibit area has been organized and devoted to the cultivation of plants selected for their strong smell or for their coloured flowers. The principle on which it is founded is that of aromatherapy and chromotherapy disciplines supposed to be beneficial in some disorders.

Next to the Experimental Station two special areas have been planned: a Tactile Olfactive Museum (Fig. 17) and a Bible Garden (Figs. 18 and 19).

In the Botanical garden, the main greenhouses currently in use are the Califano complex of greenhouses (Fig. 20), the Merola greenhouse, and the tropical greenhouse.

The Califano greenhouses contain several important collections as well as additional specimens of plants growing in the open. The most prestigious collection is that of Cycadales (Fig. 21), which includes representatives of most genera in this order, for a total of more than 100 species and about 1,000 specimens. Of a particular interest are *Encephalartos woodii* Hort., a plant extinct in the wild and conserved in only a very few collections worldwide, *Microcycas calocoma* A. DC. and various species of *Dioon*, mainly described by Neapolitan botanists from plants collected in the wild during expeditions to Mexico. Another collection of note is that of the genus *Tillandsia*, including 40 species and about 300 specimens. Almost all of these plants were collected in nature during botanical expeditions to Central and North America, and some represent the types on which the species were

described. Of special interest is the collection of *Sansevieria*, which includes the type on which the genus is based. In addition, this greenhouses complex contains specimens of the genera *Rhizophora* and *Avicennia* and a large specimen of *Equisetum giganteum* L.

The Merola greenhouse (Fig. 22) hosts, during periods of adverse weather, plants from warm climates.

The tropical greenhouse (Figs. 23 and 24) has been recently built; it hosts plants coming from hot humid Mexican forests.

Seedlings of some of the Garden species are grown in the nursery. These act as a reserve for replacement, as necessary, of display plants in poor condition or that have died. This area is also used for acclimatization of introduced plants.

Current activities of the Garden deal with the cultivation and museological aims of the collections, with research and teaching, as well as with protection of rare and endangered species. Main fields of research investigation are reproduction via micropropagation, selection of useful tropical plant cultivars that can live at latitude of Naples, organic compounds and cytotoxic investigations on food plants.

Teaching activities revolve around university students and middle and high school students. These activities are carried out by guided tours for students, annual courses for middle and elementary school teachers and training for instructors in using the Garden and its collections for teaching.

Facilities include the Botanical museum, with a section of Paleobotany, rich in fossils, and a section of Ethnobotany (Fig. 25).

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