

Introduction about the Botanic Garden & History of Transportation of Plants



Introduction about the Botanic Garden

A Botanic Garden is an open museum of living collection of myriad of plants, where trees, shrubs, herbs, climbers, lianas etc. are scientifically arranged, properly labelled based on an internationally accepted classification, and more closely allied groups/plants are specially grown together for better understanding of species. Unlike parks, in Botanic Gardens trees conserved in Arboretum, Gymnosperms and Pine trees are grown in Pinetum, Pandanus (screw pine) in Pandanetum, orchids in Orchidarium, bamboos in Bambusetum, palms in Palmetum, cactus in Cactarium etc.

Primarily, the earlier Botanic Gardens were set up with a role to introduce, grow and multiply important economic plants from around the globe and to carry out acclimatization study in different trial plots so as to release for cultivation in newer areas. Further emphasise was given to develop improved varieties of economically important plants of the region for commercial exploitation by conducting various horticultural researches such as hybridization, selection, cross pollination, trial etc. It also acts as a data base of plants and a living repository of native and exotic species. Comparative study of living and preserved herbarium specimen also being made through Botanic Garden for clear understanding of particular species and further taxonomic advancement.

At present there are about 2000 Botanic Gardens in the world and India having about 120 (including university, municipal and regional gardens) among that the Indian Botanic Garden (IBG), Howrah formerly known as 'Company Bagan', the Royal Botanic Garden, Kolkata, at present AJC Bose Indian Botanic Garden (AJCBIBG), Howrah, is one of the best landscaped gardens in the world. The original history of IBG is almost similar to the Kew Garden in England which is situated on the bank of the river Thames, a few miles away from London. The Kew garden is about 50 years younger to IBG, Howrah which owes its interests in the Botany of Royalty but the latter has been established with economic and scientific aims. The Kew garden started initially with a meagre area of 15 acres of land in 1841 and during the course of time it grew further under the hands of a well-known botanist Sir William Hooker, the first director of Royal Botanic Garden, Kew and now it possesses 288 acres. The Royal Botanic Garden, Kolkata, on the contrary, situated on the bank of river Hooghly a few kilometres away from Kolkata, established by **Col. Robert Kyd in 1787**, in a vast area of about 300 acres of land and it was regarded as the largest and one of the oldest botanic gardens in the world till the middle of 19th century and now occupies an area of 273 acres.



The Great Banyan Tree of AJCBIBG, Howrah



The Kyd's Monument at AJCBIBG, Howrah

Currently, the garden with an area of 273 acres and being a living repository of 1377 species of plants possesses 25 divisions and 24 interconnected lakes, and the lakes are connected to the Ganges through sluices for the regular inlet and outlet of water. The garden is a unique place of learning & rich array of curiosity and occupies matchless attractions like the 'Great Banyan Tree', a living wonder in the plant kingdom; the Large Palm House containing rich collection of palms including *Lodoicea maldivica* (the Double Coconut palm); Branching palm (*Hyphane thebaica*) introduced from Egypt; The century Palm (*Corypha macropoda*) ; The Giant Water Lily (*Victoria amazonica*) brought from Amazon river; The queen of flowering trees (*Amherstia nobilis*) a native of Burma; The mountain rose or Venezuelan rose (*Brownea sp.*); The Baobab tree or Kalpavriksh (*Adansonia digitata*) native of Africa; The Rosogolla tree (*Chrysohyllum cainito*); The Cannon ball tree (*Couroupita guianensis*); The African Sausage tree (*Kigelia pinnata*) and the mad tree (*Pterigota alata var. irregularis*); The 'Candle Stick Tree' (*Permentiera cereifera*) etc., are a few to mention.

Right now, Acharya Jagadish Chandra Bose Indian Botanic Garden is taken as a centre of conservation of plant resources from their extinction. This garden serves as a living repository of plants of a country and also of selected exotic species, and a 'safe abode' for the rare and endemic plants. As a result, it houses the germ plasm collection of selected economic, ornamental and medicinal plants and their wild progenitors. The garden also acts to promote educational programmes in order to generate awareness about the value of trees and other curious, beautiful, interesting plants with delightful landscaping and display. This garden also organises flower, foliage and plant shows etc.; exchange of viable seeds, seedlings and other propagules as well. As a whole, this garden acts as a data bank of information and documentation on holdings in the botanic garden.

During the time of establishment of this Garden in 1787, Bengal was reeling through the aftermath of 'Great Bengal Famine' and subsequent failure of crops. So the garden played a greater role for introduction of many crops and economic plants like Tea, Coffee, Mahogany, Teak, Cardamom, Cinchona, Cinnamon, Cotton, Indigo, Nutmeg, Pepper, Clove, Sugarcane, Potato, Sago, Cocoa etc., and other species used as food, vegetable, fodder, oil, fruit, fibre, timber and ornamental plants were first introduced into this historic Garden. Multiplication of most of the introduced species carried out in the Garden itself and distributed to different parts of the country for commercial cultivation. Such a way this garden has helped for the economic development of the country.

History of Transportation of Plants

Many plants we find in cultivation today in our surroundings have not come of their own but they have been transported and introduced from far of places long ago, acclimatised and cultivated for our very own existence. They have been growing beyond national and geographical boundaries under different climatic conditions that was brought by the people of respective period and slowly got domesticated in our area for cultivation and thus the beginning of modern agricultural era. Some of our commonly cultivated cereal like Rice, vegetable like Potato, refreshing drink like Tea, timber yielding plant like Mahogany, spice plant like

Nutmeg and drug yielding plant like Cinchona etc. have a lot of story to say on their journey to our shores. Let us examine one by one.

Rice :

Rice is scientifically known as *Oryza sativa* and it belong to the grass family *Poaceae* or *Graminae*. Probably, rice is one of the oldest known crops to human race and the earliest form of it was brought under cultivation by Chinese some 5000 years ago. Archaeological evidence indicates that initially domestication of rice might have begun in the region of the Yangtze River valley in China and then spread to other parts. Currently, it is the staple food of world's one third population, mainly Asian region. Rice is the second largest produced cereal in the world. Asia is the biggest rice producer, accounting for 90% of the world's production and consumption of rice, especially China and India. Brazil is the most important non-Asian producer.

It is believed that the rice paddy was first invented by Chinese farmers, they cultivated it in man-made ponds for saving water and killing weeds as well. The spread of rice cultivation from China was rather



A close view of rice grain



A view of rice cultivation in Mussoorie hills in India

quick to the rest parts of the world like Asia, Africa and Europe etc. In India, it is thought that the rice cultivation was experimented by native people some 3000 years ago, however there is clear evidence that around 2500 BC, during Harappan period, people began to cultivate rice here.

As per the historian's assumption, initially there were two main varieties of rice namely indica and japonica found cultivation in India. The indica variety of rice was first domesticated in North-Eastern India covering the foothills of the Eastern Himalayas while the japonica variety was domesticated from wild rice in southern China. Perennial wild rice still grows in Assam and Nepal. There is a proverb in India that grains of rice should be like two brothers, close but not stuck together. It is often associated with prosperity and fertility, hence there is the custom of throwing rice at newly weds. Further, rice is always the first food offered to the babies when they start eating solids or to husband by his new bride, to ensure they will have children. Some say that the word rice is derived from the Tamil word 'arisi'.

Worldwide there are about 40,000 varieties of rice. There is also African variety of rice known as *Oryza glaberrima*. In India, there are about 82700 land races (folk rice) and the West Bengal at present having about 415 folk varieties and more than 5000 normal varieties of which about 150 are cultivated. Important growing varieties are Shatabdi, Rasi, Sasyasree, Khitish (for irrigated field); Rasi, PNR 381 (upland); Manasarovar, Swarnadhan, Shashi (shallow land); Sabita, Madhukar, Bhudeb (semi-deep water); Neeraja, Jalpriya, Jitendra (deep water); CSR 10, CSR 13, CSR 27 (saline soils).

Today, rice is grown and harvested on every continent except Antarctica,

where conditions make its growth impossible. The majority of all rice produced comes from India, China, Japan, Indonesia, Thailand, Burma, and Bangladesh etc.

Potato :

The word potato derived from Spanish word 'Patata' the Carib term for sweet potato (*Ipomoea batatas*), which preceded the potato by eighty years in its introduction to Europe from Peru. The scientific name of potato is *Solanum tuberosum*. Domestication of potato was first made in Peru and Northern Bolivia between 8000 and 5000 BC. The earliest archaeologically verified potato tuber remains have been found at the coastal site of Ancon (central Peru), dating to 2500 BC. It is the world's fourth-largest food crop, following maize, wheat and rice. Wild potato species can be found throughout America from U.S.A to Southern Chile.



Potato - *Solanum tuberosum*

Potatoes yield abundantly with little effort, and adapt readily to diverse climates as long as the climate is cool and moist enough for the plants to gather sufficient water from the soil to form the starchy tubers. Potatoes do not keep very well in storage and are vulnerable to moulds that feed on the stored tubers. After flowering, potato plants produce small green fruits that resemble green cherry tomatoes each containing about 300 seeds. Like all parts of the plant except the tubers, the fruit contain the toxic alkaloid solanine are therefore unsuitable for consumption. The green leaves and green skins of tubers exposed to the sun light are also toxic.

The potato is best known for its carbohydrates content (approximately 26 grams in a medium potato). The predominant form of this carbohydrate is starch. It also contains vitamins and minerals, as well as an assortment of phytochemicals, such as carotenoids and natural phenols.

The FAO (food and agricultural organization) reports that the world production of potatoes in 2013 was about 368 million tonnes. At present There are about 5,000 potato varieties worldwide. Three thousands of them are found in the Andes alone, mainly in Peru, Bolivia, Ecuador, Chile, and Colombia. They belong to eight or nine species, depending on the taxonomic school. Apart from the 5,000 cultivated varieties, there are about 200 wild species and subspecies, many of which can be cross-bred with cultivated varieties. Cross-breeding has been done repeatedly to transfer resistance to certain pests and diseases from the gene pool of wild species to the gene pool of cultivated potato species. Plants propagated from



Potato tubers - various shades

tubers are clones of the parent, whereas those propagated from seed produce a range of different varieties.

Potato arrived in Europe probably through sailors returning from the Andes to Spain for their own food on the trip in Spain around 1570. Historians speculate that leftover tubers were carried ashore and planted. It was around 1562 potato was introduced in the Canary Islands from South America. Fishermen from Spain used potatoes as ships' stores for their voyages across the Atlantic in the 16th century, and introduced the tuber to western Ireland, where they landed to dry their cod. English sailor Sir Francis Drake or Sir Walter Raleigh's employee Thomas Harriot are commonly credited with introducing potatoes into England.

It is generally believed that potatoes entered Africa with colonists, who consumed them as a vegetable rather than as a staple starch. Colonialists also promoted them as a low cost food and so it was a symbol of domination. In former European colonies of Africa, potatoes were initially consumed only occasionally, but increased production made them a staple in certain areas.

The potato spread widely after 1600, becoming a major food resource in Europe and East Asia. Following its introduction into China toward the end of 1600, it immediately became a delicacy of the imperial family. The population increases in China and subsequent need to increase grain yields coupled with greater peasant geographic mobility led to the rapid spread of potato cultivation throughout China, and it was acclimated to local natural conditions. In United States Potato cultivation arrived only in 1838 (Idaho).

The early historical record of the potato in India is unclear. In India, the history of potato is only about 400 yrs. old. The Portuguese introduced potatoes, which they called 'Batata', to India in the early seventeenth century when they cultivated it along the western coast. The earliest known reference to "potato" in India is from an account by Edward Terry, who was vicar to Sir Thomas Roe, British ambassador to the court of the Mughal Emperor Jahangir from 1615 to 1619, narrates presence of potato in the northern area of contemporary India.

British colonial governor Warren Hastings promoted potato cultivation during his term, from 1772 to 1785, and by the late eighteenth to early nineteenth century, potatoes were sufficiently established in the hills and plains of India that varieties had acquired local names, such as : *Phulwa* ('flowering in the plains'), *Gola* ('round potatoes'), and *Satha* ('maturing in sixty days'). However, the potato remained a garden vegetable of minor scale, often grown at higher altitudes by British colonizers as a summer crop. British traders also introduced potatoes to Bengal as a root crop, 'Alu'. By the end of the 18th century, it was cultivated across northern hill areas of India. Potatoes were introduced to Tibet by the 19th century through trade route from India. In India, Uttar Pradesh is the leading potato producer followed by West Bengal.

The Central Potato Research Institute (CPRI) at Shimla was founded in 1949, approximately two years after national independence, to develop potato varieties and technologies appropriate to Indian conditions. By 1950, 32 cultivated varieties had been identified, 16 each of relatively recent European import and more locally adapted so-called *Desi* varieties. By 2002, CPRI had released an additional 35 varieties, contributing to an enormous expansion of potato cultivation and productivity. Over the past few decades, potato has become the fastest growing

staple crop in India.

Important varieties under cultivation in India are Kufri Jyoti, Kufri Badshah, Super Jyoti, Kufri Ashoka, Kufri Sindhuri, Kufri Jawahar, Kufri Sujlet, Kufri Pushkar, Atlantic (ATL), Diamant, Diamond, Lady Rosseta (LR), Santana etc.

Tea :

It is very difficult for us to imagine a single day to pass without having a cup of tea. The cultivation and brewing of tea in India has a long history of applications in traditional system of medicine and for consumption. The exact date of introduction of tea in India from China is not clearly known. It is known that the tea was first introduced in India in Indian Botanic Garden, Howrah from Guangzhou (Canton) during Roxburgh's period (1895-1914).



A tea estate



Tea plant in flowering (Camellia theifera)

East India Company constituted a tea committee consisting of Dr. N. Wallich, G. J. Gordon, and W. Grant to promote tea cultivation in India. However, Chinese tea could not develop much interest on people.

It was in 1823 when Robert Bruce (An army officer) while travelling in Assam over the Brahmaputra encountered a few tribes known as 'Singpho' and 'Khamti', near river Dihang, saw they prepare and consume tea from local tea bushes. His younger brother Alexander followed up his brothers findings brought some seedlings of this plant from the locality at later stages and introduced in Indian Botanic Garden, Howrah. Afterwards, in 1834 Francis Jenkins made large scale trial of tea cultivation in Indian Botanic Garden, Howrah and forwarded some specimen to Dr. Wallich who identified it as *Camellia theifera*, the source of tea. Thus, the Garden laid the foundation of tea cultivation in India. Later on tea cultivation started in different parts of India like Assam, Darjeeling, Ooty, Kodaikanal, Munnar etc.



A West Indies mahogany tree



Close view of fruit and leaf

Today, India is one of the largest tea producers in the world, though over 70% of the tea is consumed within India itself. A number of renowned teas, such as Assam, Darjeeling and Munnar, also grow exclusively in India. The Indian tea

industry has grown to own many global tea brands, and has evolved to one of the most technologically equipped tea industries in the world. Tea production, certification, export, and all other facets of the tea trade in India are controlled by the Tea Board of India.

Mahogany :

The famous mahogany avenue of Indian Botanic Garden is familiar to visitors. It is the testimony for the successful introduction of high quality timber yielding mahogany from West Indies in Indian Botanic Garden, Howrah in 1795, just after a few years of inception of this Garden. Sir. J. D. Hooker, then the Director of Kew Botanic Garden in England, supplied several species of mahogany to establish in Indian Botanic Garden, Howrah. Large scale multiplication of mahogany carried out here and distributed to different parts of India. Today it is one of the unparalleled timbers of high quality found in the forest areas of India.



Nutmeg fruits

Nutmeg :

The nutmeg is scientifically known as *Myristica fragrans* under the family *Myristicaceae*. It is one of the important spices we use for flavouring dishes. It is native to Banda Islands in the Moluccas, Indonesia. The Banda Islands became the scene of the earliest European ventures in Asia, in order to get a grip on the spice trade. Nutmeg is known to have been a prized and costly spice in European medieval cuisine as a flavouring, medicinal, and preservative agent.

Nutmeg is the seed of the tree, roughly egg-shaped and about 20 to 30 mm long and 15 to 18 mm wide, and weighing between 5 and 10 g dried, while mace is the dried 'lacy' reddish covering or aril of the seed. This is the only tropical fruit that is the source of two different spices, obtained from different parts of the plant. The first harvest of nutmeg trees takes place 7-9 years after planting, and the trees reach full production after twenty years. Nutmeg is usually used in powdered form. Several other commercial products are also produced from the trees, including essential oils, and nutmeg butter.

Nutmeg trees are dioecious plants which are propagated sexually and asexually, the latter being the standard. Sexual propagation by seedling yields 50%



A Cinchona plant growing in Cinchona Garden



Close view of seeds Mungpu, Darjeeling

male seedlings, which are unproductive. As there is no reliable method of determining plant sex before flowering in the sixth to eighth year, and sexual propagation bears inconsistent yields, grafting is the preferred method of propagation.

In India, the Nutmeg was first introduced in Indian Botanic Garden, Howrah through the expeditions of Christopher Smith (Roxburgh's nursery men) to Moluccas in 1798. Ample number of seedlings have been developed in the garden and sent to different parts of India for commercial cultivation. Now it is one of the important spices cultivated in Kerala, Tamilnadu, Karnataka and Andaman Islands.

Cinchona :

The medicinal properties of the cinchona tree were originally discovered by the 'Quechua' peoples of Peru and Bolivia, and long cultivated by them as a muscle relaxant to halt shivering due to low temperatures. The Jesuit Brother Agostino Salumbrino (1561-1642), an apothecary by training and who lived in Lima, observed the Quechua using the quinine-containing bark of the cinchona tree for that purpose. While its effect in treating malaria (and hence malaria-induced shivering) was entirely unrelated to its effect in controlling shivering from cold, it was nevertheless the correct medicine for malaria.

It was a dreadful scene of epidemic Malaria prevailing in Indian sub-continent at the time of Thomas Anderson when he became the superintendent of India Botanic Garden, Howrah in 1861, and then thousands of people die annually due this disease. Anderson played a key role in the introduction of Cinchona plants in India. He brought several species of Cinchona from Kew (the plant is originally from South America) in 1861 raised its seedling in Indian Botanic Garden, Howrah for field trial. Later Anderson introduced Cinchona Cultivation in Mungpo and Darjeeling Hills. Due to his ailing health Anderson could not complete the job, and the task was subsequently taken over by other superintendents like C. B. Clarke and George King. They also acted as superintendents of Cinchona plantation at Mungpo.

During the time of Dr. George King, a cheap malarial drug 'Quinine' obtained from the alkaloids of *Cinchona succirubra* grown at Mungpo was tested effectively and approved by Physicians and was released in the market for effective malarial cure. In such a way, Indian Botanic Garden saved lives of millions of people by giving effective cure for malaria.

Conclusion

Likewise, we may not have any idea about many plants we cultivate today in our fields and the ornamentals we grow. There will be interesting stories behind each crop whether that may be a cereal, pulse, vegetable, medicinal plant, timber, or flowering plant of any kind. The food we eat every day and the refreshing drinks we enjoy must be having a lot of history to tell us. Understanding the history and transportation of plants will help us to realize better the past history of mankind and path he travelled, and it would further help to plan our agriculture for posterity.

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