

Historiography of Plant Taxonomy in India

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Abstract

India's tradition in science is not only ancient, but also very extensive and varied. The awareness of plant taxonomy existed in Indian subcontinent from the very beginning in ancient forms when knowledge of science used to be disseminated through the traditional way of oral narration. The seminal works in plant taxonomy can actually be traced back to ancient India.

The study provides specific references to establish the fact that pursuit of plant taxonomy already existed in ancient India. Historic and literary evidences suggest that the science of classification and nomenclature of plant were already present in ancient India. It was the base of different branches of science like Herbal medicine, Anatomy, Physiology, Agriculture etc.

We have enough literary evidences which suggest that study of plant taxonomy originated in 250-200 BC. Theophrastus and Aristotle are the acknowledged names in this field. But historic evidences pinpoint that Parasara's Vriksayurveda is one of the oldest works on plant taxonomy. Rig-Veda, Manusmriti, Charak Samhita and Susuruta Samhitas substantiate wide culture and understanding of plant taxonomy in ancient India.

These classifications are based on comparative morphology of plants. With this origin, we find that this branch has changed its form. The journey begins from herbs, shrubs, and trees and ends at oil yielding fibres. It started from the natural system, but finally culminated to artificial system and today, its base is phylogenetic or microscopic study. A lot of literary materials on the subject were available in ancient India, but several foreign attacks on India mostly destroyed them, leaving back only a few for our study.

Introduction

The relationship between human and plant began in the prehistoric time. India had been inhabited by man almost from prehistoric times, and since then he hunted to acquire knowledge of his immediate surroundings, partly for his survival and partly for his inborn curiosity.

The Indus valley people lived in villages and towns. They used to cultivate crops like wheat, barley, millet, dates, melons, vegetables and other fruits and cottons, worship trees, glaze their pottery with the help of plant juices and finally paint them following many plant designs. The excavated seals of the Indus valley civilization in some parts of India indicate the presence of *Ficus religiosa*, *Ziziphus mauritiana* etc. which were used in one form or the other.

Taxonomical Studies during Ancient & Vedic Period in India

Early examples of plants taxonomy occur in Rig-Veda that divides plants into Vriksha (tree), Osadhi (herbs useful to humans) and Virudha (creepers), which are then further sub-divided. The Atharvaveda divides plants into eight classes – Visakha (spreading branches), Manjari (leaves with long clusters), Sthambini (bushy plants), Prastanavati (which expands), Ekasringa (those with monopodial growth), Pratanavati (creeping plants), Amsumati (with many stalks), and Kandini (plants with knotty joints). The Taittiriya Samhita classifies the plants kingdom into Vriksha, Vana and Druma (trees), Visakha (shrubs with spreading branches), Sasa (herbs), Amsumali (a spreading or deliquescent plant), Vratati (climber), Stambini (bushy plants), Pratanavati (creeper), and Alasala (those spreading on the ground). Manusmriti also proposed classification of plants into eight major categories. Charaka Samhita, Susruta Samhita and the Vaisesikas also present an elaborate Plant Taxonomy.

The most celebrated plant that has frequent mentions in the Rig-Veda and later Samhitas is Soma plant. The Indians of Vedic age hail Soma as the lord of forest (Vanaraja). The botanical identity of Soma plant, however, has not been decided till today. The probable genuses are Ephedra (a Gymnosperm), Sarcostemma (flowering plant) and mushroom (a fungus).

The plant that comes next is Peeple or the Asvattha (*Ficus religiosa*) of the Vedic period. The Rig-Veda refers to utensils and vessels fashioned out of the wood of the Asvattha tree. Some of the other trees that find

mention in the Vedas are Silk cotton (*Salvia malabaricum*), Khadira (*Acacia catechu*), Simsapa (*Dalbergia sissoo*), Vibhitaka (*Terminalia bellerica*), Sami (*Prosopis* sp.), Plaksa (*Ficus infectoria*). Iksu (sugarcane- *Saccharum officinarum*) is mentioned as a cultivated plants in the Atharvaveda, Maitrayani Samhita and other texts. The Vedic Indians knew many flower-bearing and fruit-bearing plants like Palasa (*Butea monosperma*), two varieties of lotus – white (*Pundarika*) and blue (*Puskara*), white lily (*kumuda*), cucumber (*Urvaruka*), Jujuba (*Zizypus jujuba*), udumbara (*Ficus glomerata*), kharjura (*Phoenix dactylifera*) and Bilva (*Aegle marmelos*) etc.

Written records, in the form of manuscripts, are available in Sanskrit and several other Indian languages. Sanskrit literature includes the Vedas, the Upanisadas, and epics like the Ramayana and Mahabharata. The lay literature includes prose, poetry, and drama written by a number of Sanskrit authors like Kalidasa, Magha and Bhabhuti, where the information of plants is incidental and given by way of comparison. Technical literature comprises medical works like the Charaka and Susruta Samhitas, lexicons like Medinighantu and Amarakosa, as well as the encyclopedic works like Arthashastra and Brahatsamhita. In addition, there are a number of exclusive works under the title of Vriksayurveda. Parasara's Vriksayurveda, composed during the first century BC to first century AD, is supposed to be the most ancient work in actual botany. From the literary evidence, it is clear that even in the first millennium BC, Botany was fully systematized and taxonomy well developed.

Sophocles (505-495 BC) mentioned rice, sandalwood etc. specifically as Indian products which were known to the Greeks only by their Tamil names. There are several words of Indian origin as plant names in Greek; for examples Arise and Vetiver in Tamil became *Oryza* and *Vetiveria* respectively. Injiver and Elathari in Malayalam became *Zingiber* and *Elataria* respectively. Sandanam (Chandanam) and Sarkare became *Santalum* and *Saccharum* respectively. Among flowers, the sacred lotus (*Nelumbo nucifera*), used to wreath over the head of Sun-god, was the most popular. Plants were classified into two categories – (i) wholesome and good to eat and (ii) unwholesome or harmful.

The binomial system of nomenclature was also

followed : for examples, Bala is the modern genus *Sida* and the specific names are suffixed to the generic names. In Sanskrit on the other hand, the specific names is prefixed to the generic name. Atibala = *Sida rhomlifolia*, Naga bala = *Sida spinosa* etc.

Economic plant products of India like Cardamom, Black Pepper, Ginger, Cinnamon, Sugarcane, Sandalwood, Rosewood, Turmeric, Indigo etc. were known in various parts of the western world as oriental luxury several centuries before the birth of Christ.

Taxonomical Studies from pre-British to post-British period and modern India

I.H. Burkil (1965) in his book "Chapters on the History of Botany in India" has mentioned the history of modern development of Botany in India, which until the beginning of the 20th century was almost exclusively concerned with exploration and systematic Botany of higher plants over the four centuries beginning with 1500 AD. Natural Science, commonly known as Botany, was introduced in India as an exotic system of knowledge. In the beginning of the 16th century, Botany emerged out as the science or technique of healing in particular part of Europe.

The classical Greeks had been conspicuous in the healing art. Then came the Arabians, who from Baghdad reached out to the Indus during the reign of Khalif Al Mansur" (745-775 AD). They translated Charaka Samhita and the Susruta Samhita from Sanskrit to Arabic and Persia.

Later Vasco da Gama also rounded the Cape of Good Hope and anchored Calicut (Kozhikode) on 29th May 1498 by his 10 months and 12 days voyage from Lisbon. In addition to interest in spices and other luxury items from India, the shortage of wood on the shores of the Red Sea also was another important factor for the growth of Portuguese possessions in India and remained so till December 1961, when it was annexed to the Indian union.

A physician and pharmacist named Garcia de Orta (1490-1570 AD) came to Goa from Elva's to study native drugs and their uses. He published his work in a book called Coloquios in the year 1563 in which a detailed account of 57 more commonly used Indian

medicinal plants were described. The book became known to Europe mainly through the Latin summary of Clusius published in 1567.

Van Rhee de Drakenste, the Governor of Dutch Possession in India, started publication of his monumental *Hortus Malabaricus*, an illustrated account of the floristic resources of the area, for the exploitation and benefit of all. Live plants from Cochin and its neighborhood were brought, illustrated and described; the accounts were finally translated into Latin. The manuscript was prepared at Cochin and sent to the Netherlands.

The first volume of this great collaborative work was published in 1678 under the title *Hortus Indicus Malabaricus*. The next 11 volumes were also published from Amsterdam. In these volume, there are 794 excellent illustrations covering about 780 species. When Van Rhee de was organizing the work on *Hortus Malabaricus*, the English had very good relation with the Dutch and inspired by latter, the English also began collecting plants in the Madras coast with the help of the captains of ships and others connected with East India Company. Among these English collectors, special mention may be made about James Petiver, Charles Du Bois, an official of East India Company.

In 1697, Leonard Plukenet (1641-1707 AD) began to publish copper-plate illustration of plants under the *Phytographia*. Petiver also began publishing reports of the plants. The plants possessed by Plukenet and Petiver ultimately reached the British Museum. The Pre Lumean inquiry into the Flora of India ended with Petiver.

In the 17th and first half of 18th century, there were no generally accepted rules for naming the plants. Linnaeus *Species Plantarum* (1753) and *Genera Plantarum* (1754, 5th ed.) marked a new epoch in botanical history. In *Species Plantarum*, he consistently used the binomial nomenclature. The description of *Genera Plantarum* is accepted to validate names.

The beginning of Post-Linnaean Botany in India may be said to date from the arrival of J. G. Koenig, a pupil of Linne, in 1768. Koenig joined the Tranquebar Mission as a surgeon and naturalist, and in union with some of United Brethren such as Klein, Rottler, etc,

made splendid collection in the neighbourhood of Madras; the Brethren sent their specimen to various botanists in Europe. There was also a botanical Garden Tranquebar in around 1768. Moravian brothers were awarded the contract to sell dried plants to Joseph banks and carried out their promise from 1775 to 1778. It was from this transaction that an idea of starting a learned society of Botanists at Madras came up and "United Brothers" by name, was formed in 1775.

In Bengal, the earlier works on Botany were associated with Johan Fleming, Sir William Jones, Roxburgh, Wallich, Buchanan-Hamilton, etc. In 1787, Robert Kyd founded the Botanical Garden of Calcutta, and from the very beginning, it has occupied a pre-eminent position in the development of botanical studies in India.

The initial progress of Botany in Bombay was associated with the names of Alexander Gibson, John S. Law, J. E. Stocks and Johan Graham. Bombay can boast of being the first province in India to have a Conservator of Forest, Mr. A. Gibson (1847), whose main duty was to put a stop to the wasteful destruction of forests within the province.

In North and North-West parts of country, the name of J. F. Royle stands out prominently. He did some exploration works in the neighbourhood of Saharanpur Botanical Garden and in the Himalayas. Other early explorers in the North-West are W. S. Webb, William Moorcroft, Alexander and James S. Gerard, Henry Strachey, Richard Strachey etc. Many of their collections were gathered at the Saharanpur Botanical Garden (later transferred to Dehra Dun), and Royle based his splendid illustrations on these collections as well as his own.

In Madras, commendable works in Botany were done by the Tranquebar Brethren, Roxburgh (at the beginning of his service in India) and by Robert Wight. Wight has been rightly called the greatest collector of plants during his time. He was indefatigable in his field tours in the northern parts of Madras, Tanjore and later in other parts of South India, and also in the publication of most magnificent books, which are indispensable to any serious worker in Botany even today. During his 35 years of stay in India, Wight described 38 new genera and more than 3000 species. His contributions include

28 publications, amongst which "Illustrations of Indian Botany" (1831-1832, 1840 and 1850) is worth mentioning.

In 1855, Sir J. D. Hooker and Thompson published the first volume of "Flora of India". But this work was soon given up in favour of more comprehensive publication "Flora of British India", which started in 1872 – the seventh and last volume came out in 1897. Although, the work was a pioneering one, yet Hooker himself acknowledged that in a work of this scope, neither fullness nor completeness is attainable in the present state of science. In spite of such incompleteness, "Flora of British India" is considered a monumental work reflecting the ingenuity and diligence of Hooker and his assistants, and has formed the basis of all later provincial publications.

From the inception of the Indian Botanical Garden, a new era of Botanical research began. This garden has been a centre of intense activity in the taxonomic study of plants. The Herbarium contains the most valuable collection of plants from India and adjacent countries – many types of Indian plants were carefully preserved there. On account of a large number and varieties of specimens (calculated as several millions), the Herbarium forms the most valuable nucleus of Botanical specimens in India, and deserve due attention from Indian Botanists.

Effort was made to fulfil the plan of having publications on floras of various peninsular provinces that did not have them. Intensive exploration went on all over the country under the initiative of Botanical Survey of India with little help from the universities. The latter seemed to be more attracted towards other branches of Biological Sciences, such as Embryology, Physiology etc. As a matter of fact, after the closure of Botanical Survey of India, plant taxonomical work in the country got a set back and practically came to a standstill. A few centres of activity, although, kept on continuing their work in spite of difficulties.

Calcutta has continued to be at the head of Systematic Botany in the Peninsular India in this century, as it was also during the previous one. At the beginning of the century, D. Prain published his book on Bengal plants and made several important contributions. The records of Botanical Survey of India were brought out in 16 volumes. The annals of Royal Botanic Garden,

Calcutta, were published in 6 volumes between 1900 and 1950, the latest being on Dioscorea by I. H. Burkil and D. Prain. The successive superintendents of Botanical Garden and their assistants have kept up the traditions of the Garden in spite of acute shortage of fund and manpower.

In 1915, J. S. Gamble published the first part of his "Flora of Madras" and at the outset, the book was received in the botanical world as one of the best works on the floras of India. Gamble supervised the publication of the first seven parts. After his death in 1925, C. E. C Fischer, who had done intensive study on the flora of the province, completed the work in 1936. P. F. Fyson studied the flora of Nilgiris and other high hills of South India. In 1929, P. V. Mayuranathan brought out a publication on flowering plants of Madras city and its immediate neighbourhood. This was one of the best books on local or restricted floras of this century. In 1938, E. Barnes published a supplement to Mayuranathan's book. During the last few years, great commitment has been shown by a school of young and energetic botanists of Bangalore and Mysore. It is hoped that their enthusiasm will not fade until the flora of Mysore is fully known.

With the establishment of the southern circle of Botanical Survey of India at Coimbatore in 1955, floristic studies under their jurisdiction were intensified. Over 325 research papers dealing with about 75 new taxa and 360 additional records for the area have been developed.

Subramanyam Sebastine and their colleagues explored intensively in several parts of the country. Scientists from other units of BSI, particularly from Calcutta also collected specimens in Tamil Nadu during the period. K. S. Srinivasan and T. A. Rao collected plants of the coastal regions of Tamil Nadu. Workers other than those of BSI were also engaged in floristic work. Rapinat Herbarium, Tiruchirapally is a centre of intensive floristic activity. Here, Fr. K. M. Matthew and his colleagues have worked and added much to our knowledge of plants of Tamil Nadu. Matthew brought out materials for publication of "The Flora of Tamilnadu Carnatic" (1983) in 3 volumes, Flora of Palni Hills (1996) etc. Dr. T. Senthil Kumar and K. V. Krishnamurthy of the Bharathidasan University carried out extensive research work on Ethnobotanical study on Shervaroy Hills of Eastern Ghats. A number of

staff of the Calicut University studied the plants of Manilal in Northern Kerala and published the "Flora of Silent Valley" (1988). The Kerala Forest Research Institute (KFRI), Peechi is another ideal centre for floristic activities with its publication "Flowering Plants of Kerala" (2004). Tropical Botanical Garden & Research Institute (TBGRI), Palode, Trivandrum is also playing a very vital role for plant taxonomy in Kerala. The institute concentrates, especially on the plants growing on Agasthyamala hills and some small islands of Kerala. "Flora of Kerala" is a good database of about 4000 flowering plants of Kerala for the last five years, being published by TBGRI.

In Andhra Pradesh, publications worth mentioning are "Flora Andhrica" (1859) by W. Elliot, "Forest Flora of Hyderabad State" (1953) by S. M. Khan, "Flora of Andhra Pradesh" (1997) by Pullaiah & Moulali and "Flora of Visakhapatnam District, Andhra Pradesh" in 2 volumes by G. V. Subba Rao and G. R. Kumari.

The Forest Research Institute, Dehra Dun has been one of the most active centres in India. Botanists have extended and spread their work all over the country through similar institutes. Notable contributions have been made to the flora of the Upper Gangetic Plain and other parts of Northern India by J. F. Duthie, R. N. Parker, C. E. Parkinson, M. B. Raizada, N. L. Bor and others.

At the beginning of the century, Pune was the centre for Botanical explorations in the western parts of the country. Outstanding works were done by T. Cooke, G. A. Gammie, R. K. Bhide, G. M. Woodrow etc. W. A. Talbot concentrated his works on the forest flora, particularly that in Bombay Presidency. Plants of Northern Gujarat were explored by W. T. Saxton and L. J. Sedgwick. Sedgwick also made extensive collection in Dharwar. G. L. Sha of Sardar Patel University, Vallabh Vidhyanagar and his students explored several parts of Gujarat and published many records. He also published the Flora of Gujarat in two parts (1978), which also has elaborate bibliography. In Bombay itself, E. Blatter formed a school of systematic Botany, and together with his pupils, made extensive exploration in various parts of the province. Bombay can boast of Jayakrishana Indrajith Thaker, who after long apprenticeship in Bombay went to Saurashtra and explored the Barda hills. His results are embodied in a monumental book, the first scientific book on

systematic Botany written in a regional language (Gujarati) in India.

Theodore Cooke (1836-1910) came to India in 1860 as Railway Engineer and later became the Principal of Civil Engineering College, Pune. He was also attached to the Agricultural College from where he studied the plants of Bombay Presidency. Cooke published the first volume of the "Flora of Presidency of Bombay" in 1901 and the second volume in 1908. These volumes were reprinted with some corrections in 1958 by the Botanical Survey of India. Cooke's flora also covered Sind, Gujarat and North Karnataka.

The next botanical period in Maharashtra was led by Rev. Ethelbert Blatter (1877-1934), a Swiss Botanist, who did a great deal of field work. He was the chairman of Biology Department, St. Xavier's College, Bombay.

H. H. Haines did much work in Chota Nagpur plateau in Bihar and Orissa. His work was continued by H. F. Mooney, who recently brought out a comprehensive supplement to Haines Botany. At present, there is a great interest in the study of the vegetation of Madhya Pradesh, and the preparation of regional flora is well advanced. Botanical Survey of India published "Flora of Madhya Pradesh" in 1997.

The last of the great provincial floras came out in Assam. It took a big team of botanists, under the energetic direction of U. N. Kanjilal, several years to bring out the series of volumes on *Flora of Assam*. Independently, C. E. C. Fischer has published a number of papers on Assam novelties; N. L. Bor has done very good work on the grasses of the province. Assam, however, still has many districts of which the botany is very little known.

The latest developments in the study of systematic Botany are very encouraging. The world, at large, and our own national laboratories, in particular, have come to realize the great dependence of many branches of science on raw materials from the plant kingdom. One of the visible signs of interest in systematic Botany is the growing attention paid by our universities. Of late, papers have been received from the universities of Benaras, Annamalai and Allahabad in India and also from Rangoon in Burma and Karachi and other universities in Pakistan. Intensive work also goes on in some of the best universities of the various countries

under the survey. Thus, we see that the ancient scientists did realize the need to classify plants according to their various properties. In some cases, they come close to modern classification.

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