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Ancient Indian rishi's (Sages) knowledge of botany and medicinal plants since Vedic period was much older than the period of Theophrastus, A case study- who was the actual father of botany?

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Abstract
In India, the study of Taxonomical rank classification and naming of plants in Sanskrit language is much older than that of Latin and Greek languages and the study dates back to Vedic period from 2500 BC to 600 BC. In Rigveda, three groups of plants have been recognised, *viz*. trees (Briksha), herbs (Osadhi) and creepers (Virudh). These are further classified into flowering, non-flowering, fruit bearing and fruitless plants. Atharva Veda also contains descriptions of many medicinal plants. In the ancient Indian texts, the nomenclature of the plants was generally based on the plant & # 39;s botanical characters and their therapeutic properties. In Rajanighantu, much importance has been given for nomenclature of plants for which seven factors have been described. In Europe botanical nomenclature has a long history from Theophrastus (c. 370-287 BC), Dioscorides (c. 40-90 AD) to Pliny the Elder (23-79 AD).
From Mediaeval times, Latin became the universal scientific language (lingua franca) in Europe. With the advancement of time more and more number of plants were explored which were somewhat similar morphologically but varying from each other in one or the other way.
Thus, a need of keen morphological description of plants aroused and modern science provided a number of tactics to identify and classify the available flora. So, the methods of nomenclature witnessed a sea change from the ancient times till today's 21st century. So, the present work aims to discuss about the classification of plants is older than the period of the Theophrastus.

Keywords: Sanskrit, plant classification, Veda, Theophrastus, Nighantu, samhita, Ayurveda

Introduction
The *Vedic* period (or *Vedic* age) (2500 BC to 600 BC) was the period in Indian history during which the *Vedas*, the oldest scriptures of India were composed. The study of classification and naming of plants in India is even older than those of Greeks and Romans and dates back to *Vedic* period. In *Rigveda*, three groups of plants have been recognized, *viz*. trees (*Vriksha*), herbs (*Osadhi*) and creepers (*Virudh*). In *Atharvaveda* type, shape and morphology of plants is also described. In Yajurveda four groups of medicinal plants is described [1-4].
Theophrastus (371-287 BC), a Greek native of Eresos in Lesbos, was the successor to Aristotle in the Peripatetic school. He came to Athens at a young age and initially studied in Plato's school. After Plato's death, he attached himself to Aristotle. Aristotle bequeathed to Theophrastus his writings and designated him as his successor at the Lyceum. Theophrastus presided over the Peripatetic school for thirty-six years, during which time the school flourished greatly. He is often considered the "father of botany" for his works on plants. After his death, the Athenians honoured him with a public funeral. His successor as head of the school was Strato of Lampsacus.
The interests of Theophrastus were wide ranging, extending from biology and physics to ethics and metaphysics. His two surviving botanical works, *Enquiry into Plants* and *On the Causes of Plants*, were an important influence on Renaissance science. There are also surviving works *On Moral Characters*, *On Sensation*, *On Stones* and fragments on *Physics* and *Metaphysics*. In philosophy, he studied grammar and language and continued Aristotle's work on logic. He also regarded space as the mere arrangement and position of bodies, time as an accident of motion and motion as a necessary consequence of all activity. In ethics, he regarded happiness as depending on external influences as well as on virtue and

Famously said that "life is ruled by fortune, not wisdom" [5-7].

Plants of *Vedic* period

The most celebrated plant that finds frequent mention in the *Rigveda* and later *Samhitas* is the *Soma* plant. The Vedic Indians hail *Soma* as the Lord of the forest (*Vanaraja*). The botanical identity of *Soma* plant, however, has not been decided till today. The probable candidates are *Ephedra* (a Gymnosperm); *Sarcostemma* (flowering plant) and mushroom (a fungus commonly known as *Agaricus*). The second most mentioned plant was *Peepal* or the *Asvattha* (*Ficus religiosa* L.) during the *Vedic* period. The *Rigveda* 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: (i) *Shalmali* (*Salmalia malabaricum*); (ii) *Khadira* (*Acacia catechu*) (iii) *Simsupa* (*Dalbergia sissoo*); (iv) *Vibhitaka* (*Terminalia bellerica*); (v) *Sami* (*Prosopis* sp.); and (vi) *Plaksa* (*Ficus infectoria*); *lksu* (sugar cane – *Saccharum offcinarum*) finds a mention as a cultivated plant in the *Atharvaveda, Maitaryani Samhita,* and other texts. The *Vedic* Indians knew about many flower-bearing and fruit-bearing plants, like *Palas* (*Butea monosperma*), two varieties of *Kamala* (lotus) – white (*Pundarika*) and blue (*Puskara*), *Kumuda* (white lily), *Urvaruka* (cucumber), *Badara* (*Zizypus jujuba*), *Udumbara* (*Ficus glomerata*), *Kharjura* (*Phoenix dactylifera*) and *Bilva* (*Aegle marmelos*), etc. Various ancient written records, in the form of manuscripts, are available in *Sanskrit* and several other Indian languages. *Sanskrit* literature includes the *Vedas*, the *Upanisada* and epics like the *Ramayana* and the *Mahabharata*. The common literature available includes prose, poetry and drama of a number of *Sanskrit* authors like *Kalidasa, Magha* and *Bhavabhuti*, in whose works the information on plants is incidental and given by way of comparison. Technical literature on medicinal plants with complete detail of morphology and pharmacology is described in the works like the *Caraka-Samhita* and *Susruta Samhita,* lexicons like *Medinikosa* and *Amarakosa,* as well as the encyclopedic works like *Arthasastra* and *Brhatsamhita* are also there. In addition, there is an exclusive Sanskrit and plants related work under the title of *Vrksayurveda*. *Parasara's Vrksayurveda* is supposed to be the most ancient work in actual botany; it was composed during first century BC and first century AD. From the literary evidence it is clear that even in the First Millennium BC, botany was fully systematized and taxonomy was well developed in India [8-10].

Theophrastus work on Plants

The most important work of Theophrastus (370 - c. 285 BC) was his two large botanical treatises, *Enquiry into Plants* and *On the Causes of Plants* which constitute the most important contribution to botanical science during antiquity and the Middle Ages, the first systemization of the botanical world; on the strength of these works some, following Linnaeus, call him the 'father of botany.'

His *Enquiry into Plants* was originally ten books, of which nine survived. This work was arranged into a system whereby plants are classified according to their modes of generation, their localities, their sizes and according to their practical uses such as foods, juices, herbs, etc. The first book deals with the parts of plants; the second book with the reproduction of plants and the times and manner of sowing; the third, fourth and fifth books are devoted to trees, their types, their locations and their practical applications; the sixth book deals with shrubs and spiny plants; the seventh book deals with herbs; the eighth book deals with plants that produce edible seeds; and the ninth book deals with plants that produce useful juices, gums, resins, etc. *On the Causes of Plants* was originally eight books, of which six survived. It concerns the growth of plants; the influences on their fecundity; the proper times they should be sown and reaped; the methods of preparing the soil, manuring it and the use of tools; and of the smells, tastes, and properties of many types of plants. The work deals mainly with the economical uses of plants rather than their medicinal uses, although the latter is sometimes mentioned. Although these works contain many absurd and fabulous statements, they include valuable observations concerning the functions and properties of plants. Theophrastus detected the process of germination and realized the importance of climate and soil to plants. Much of the information on the Greek plants may have come from his own observations, as he is known to have travelled throughout Greece, and to have had a botanical garden of his own; but the works also profit from the reports on plants of India brought back from those who followed Alexander the Great: to the reports of Alexander's followers he owed his accounts of such plants as the cotton-plant, banyan, pepper, cinnamon, myrrh, and frankincense.

Theophrastus's *Enquiry into Plants* was first published in a Latin translation by Theodore Gaza, at Treviso, 1483; in its original Greek it first appeared from the press of Aldus Manutius at Venice, 1495-1498, from a third-rate manuscript, which, like the majority of the manuscripts that were sent to printers' workshops in the fifteenth and sixteenth century, has disappeared. Wimmer identified two manuscripts of first quality, the *Codex Urbinas* in the Vatican Library, which was not made known to J. G. Schneider, who made the first modern critical edition, 1818-1821, and the excerpts in the *Codex Parisiensis* in the Bibliothèque nationale de France [11-14].

Detailed study of plants in Vedic period (2500 BC to 600 BC) in India.

The naming of plants and study of classification in India is even older than those of Greeks and Romans, and dates back to *Vedic* period (2500 BC to 600 BC). The *Rigveda*, recognised three groups of plants, *viz*. trees (*Vrksha*), herbs (*Osadhi*) and creepers (*Virudh*). These are further classified into flowering, non-flowering, fruit bearing and fruitless plants. *Atharvaveda* also contains descriptions of many medicinal plants. Casual references to different parts of the plant are found scattered throughout the *Rigveda* and almost complete details of plants are found in the *Atharvaveda*. Here we can say that the *Atharvaveda* is perhaps the earliest recorded authority on plant morphology. It presents an account of eight types of growth habits of trees. These are *Visakha* (spreading branches), *Manjari* (leaves with long clusters), *Sthambini* (bushy plants), *Prastanavati* (which expands), *Ekasrnga* (those with monopodial growth), *Pratanavati* (creeping plants), *Amsumati* (with many stalks) and *Kandini* (plants with knotty joints). The *Taittiriya Samhita* and the *Vajasenayi Samhita* explain that plants are comprised of *Mula* (root), the *Tula* (shoot), the *Kanda* (stem), the *Valsa* (twigs), *Puspa* (flowers) and *Phala* (fruits). While trees have in addition *Skandha* (the crown), *Sakha* (branches) and *Parna* (leaf). Different kinds of plants

are distinguished, namely, *Vrksa*, *Vana* and *Druma* (trees), *Visakha* (shrubs with spreading branches), *Sasa* (a herb), *Amsumali* (a spreading or deliquescent plant), *Vratati* (a climber), *Stambini* (a bushy plant), *Pratanavati* (a creeper), and *Alasala* (those spreading on the ground). The *Vrksayurveda* of *Parasara* deals extensively with the morphology of plants. According to *Parasara*, the *Vrksangas* (parts of plant) are *Patra* (leaf), *Puspa* (flowers), *Phala* (fruits), *Mula* (root), *Tvak* (bark), *Kanda* (stem), *Sara* (heartwood), *Svarasa* (sap), *Niryasa* (exudation), *Kantaka* (s pines), *Bija* (seed) and *Praroha* (shoot). Ancient literature also classified the roots on the basis of their growth behavior and structures like *Sakha*, *Sipha* (root originating from the branches), *Krsnamuli* (black coloured root), *Sveta muli* (coloured root), *Bahumuli* (many roots), *Tripadi* (plant with three main roots), *Asta padi* (plant with eight roots), *Sthulamula* (thick root), *Suksmamula* (thin root) and *Jatamula* (fasciculated root).

Detailed study of plants in *Samhita* period (900 – 600 BC) in India

1. The *Caraka Samhita*

The *Caraka-Smhita* or (Compendium of *Maharishi Caraka*) is an early text on *Ayurveda* (Indian traditional medicine). Along with the *Sushruta samhita*, it is one of the two fundamental texts of this field that have survived from ancient India. Early literature is dated to the period of 900 BC-600 BC. While the later editions of *Caraka-Smhita*are dated to later centuries.

2. The *Sushruta Samhita*

The *Sushruta Samhita* is an important Classical *Sanskrit* text on medicine. Written by *Maharishi Sushruta*, it is commonly dated to the period of 600 BC. It is one of the foundational texts of *Ayurveda* (Indian traditional medicine), alongside the *Caaraka Samhita*, *Bhela Samhita* and the medical portions of the 'Bower Manuscript'. The *Sushruta samhita*, in its extant form, in 184 chapters contains descriptions of 1,120 illnesses, 700 medicinal plants, 64 preparations from mineral sources and 57 preparations based on animal sources. The text discusses surgical techniques of making incisions, probing, extraction of foreign bodies, alkali and thermal cauterization, tooth extraction, excisions, and trocars for draining abscess, draining hydrocele and ascitic fluid, the removal of the prostate gland, urethral stricture dilatation, vesiculolithotomy, hernia surgery, caesarian section, management of haemorrhoids, fistulae, laparotomy and management of intestinal obstruction, perforated intestines, and accidental perforation of the abdomen with protrusion of omentum and the principles of fracture management, *viz*., traction, manipulation, appositions and stabilization including some measures of rehabilitation and fitting of prosthetics. It enumerates six types of dislocations, twelve varieties of fractures, and classification of the bones and their reaction to the injuries, and gives a classification of eye diseases including cataract surgery.

Description of plant morphology in *Samhita*

Charak (1st Century AD) divided the plants into

a. *Vanaspati:* Trees with fruits.
b. *Vanaspatya:* Trees with flower and fruits.
c. *Osadhi:* Herbs that wither after fruiting.
d. *Virudha:* Other herbs with spreading stems.

Susruta (600 BC) had almost an identical classification as of *Charak*. Manu classified the plants into eight groups:

a. *Osadhi:* Plants bearin abundant flowers and fruits, but withering away after fruiting e.g. rice, wheat, etc.
b. *Vansapati:* Those plants which bear fruits without evident flowers, e.g. *Ficus.*
c. *Vriksha:* Plants which bear both flowers and fruits, e.g. mango.
d. *Guchcha:* Bushy herbs e.g. jasmine.
e. *Trina:* All types of grasses
f. *Gulma:* Succulent plants
g. *Pratan:* Creepers
h. *Valli:* Twiner or such plants which need a support.

Parasar (1st Century BC or AD) compiled a book entitled *Vrikshayurveda* (Science of medicinal plants). In this book, apart from describing morphology, anatomy of plants and 14 types of forests, a system of classification was provided. According to Majumdar (1946), the system which is based on comparative morphology of plants, was more advanced than any other developed in western countries before 18th century. In this system plants are classified into Gana,- Bibhag or families. Some of the common families are *Samiganiya*, *Puplikganiya*, *Swastikaganiya*, *Tripushpaganiya*, *Kurchpushpaganiya*, *Mallikaganiya* which are now known as Leguminosae, Rutaceae, Cruciferae, Cucurbitaceae, Compositae, and Apocynaceae, respectively. Some ancient *Sanskrit* works also took notice of texture, colour, taste, surface etc. for morphological classification of plants.

1. Texture: *Lomasa-vasana* for hairy stem; *Mrdupatra* for soft leaf; *Komal patra* for tender leaf; and *snigdha patra* for rough thick leaf.
2. Shape: *Dirgha patra* for long leaf; *Mandala patra* for rotund leaf; and *Visala patra* for broad leaf.
3. Colour: *Sveta patra* for white coloured; *Rakta patra* for red coloured; *Nila parna* for blue coloured; *Suvarna parna* for gold coloured and *Dhumra parna* for smoke coloured leaf.
4. Taste: *Svadu patri* for sweet leaf; *Amla patra* for sour leaf; *Katu patra* for leaves with spines; and *Tiksna patra* (hot taste).
5. Surface: *Romasa patri* for with hairy outgrowth, *Randhra patri* for leaf with holes and *Valka patri* for bark-like.
6. Leaflets: *Ekapatrika* for one leaflet, *Dvipatrika* for two leaflets, *Tripatrika* for three leaflets, *Chatuspatrika* for four leaflets, *Panchapatrika* for five leaflets, *Saptaparni* for seven leaflets and *Bahupatrika* for a number of leaflets.

Study of plants in *Nighantu* Period in India

1. In *Rajanighantu* names and synonyms of medicinal plants are assigned on the basis of traditional usage, effect, habitat, morphological character, simile, potency and names prevalent in other regions or due to other factors.
2. In *Dhanvantarinighantu* one or many names are assigned to the plants according to habitat, form, colour, potency, taste, effects, etc.
3. In *Nighantushesha*, *Khanda* (Chapter) is described on the basis of *Vrksha* (Tree), *Gulma* (Shrub), *Lata* (Creeper), *Saka* (Herb), *Trina* (Grass) and *Dhanya*.
4. In *Bhavprakashnighantu* specific characters of

medicinal plants is described on the basis of *guna* and morphological characters [15-43].

Conclusion

On the basis of above historical periods of documentation in India from the ancient books and literature, it may be concluded that study of plants (plant taxonomy and study of medicinal plants) had been developed during *Vedic* period (2500 BC to 600 BC). Our renowned botanist (sages) had vast knowledge of plants with their botanical characteristics and medicinal value. Various botanical names (mostly derived from Greek and Latin words by Linnaeus) are taken from *Sanskrit* word like *Amala* (*Phyllanthus emblica*), the word *emblica* derived from *Sanskrit* word *Amlaki* and Vasaka (*Adhatoda vasica*) derived from *Sanskrit* word *Vasa*. Based on these historical evidence and ethno botanical studies, we can conclude that the Indian ancient renowned sages of *Vedic* period who studied plants in detail much earlier than Theophrastus were the actual father of botany.

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