

Botanical Study in Ancient Indian Literature: A Review

Shri Praveen Kumar Chandel

Assistant Professor, Botany, Government College, Barmer, Rajasthan

ABSTRACT

Before the invention of microscope, and of course its super-cousin (SEM), the microscopic world was not visible to humans. Microscopes made it possible to study the vascular structures and their function in nutrient transport, as also cellular basis of growth. But minute and careful observation of plants in India dates back to a few thousand years. The ancient science of botany was quite developed in its understanding of the plant kingdom, as also in taxonomy. The beginning of relationship between humans and plants can be traced back to the prehistoric times. The Indus Valley people used to live in villages, cities and towns, wore clothes, cultivated crops including wheat, barley, millet, dates, vegetables, melon and other fruits and cotton; worshipped trees, glazed their pottery with the juice of plants and painted them with a large number of plant designs. They also knew the commercial value of plants and plant products. There are sufficient indications to show that Agriculture, Medicine, Horticulture, developed to a great extent during the Vedic Period. In the Vedic literature we find a large number of terms used in the description of plants and plant parts, both external features and internal structures; a definite attempt at classification of plants and evidence that use of manure and rotation of crops were practiced for the improvement of fertility of soil and nourishment of plants. Even Rigveda mentions that Vedic Indians had some knowledge about the food manufacture, the action of light on the process and storage of energy in the body of plants. In the post-Vedic Indian literature there is enough evidence to show that botany developed as an independent science on which was based the science of medicine (as embodied in the Charaka and Susruta Samhitas), Agriculture (as embodied in the Krsi-Parasara) and Arbori-Horticulture (as illustrated in the Upavana-vinoda as a branch of Botany). This science was known as the Vriksayurveda, also compiled by Parasara.

KEYWORDS: *botanical, Indian, ancient, literature, vedic, rigveda, taxonomy, plant, kingdom.*

Plants in Vedas

The most celebrated plant that finds frequent mention in the Rgveda 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). [1, 2]

The second most mentioned plant was peepal or the Asvattha (*Ficus religiosa*) 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) Silk cotton (*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 officinarum*) 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 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.[3,4]

<https://cejsr.academicjournal.io>

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 the Mahabharata. The lay literature 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 comprises medical works like the Charaka and Susruta Samhitas, lexicons like Medininihantu and Amarakosa, as well as the encyclopedic works like Arthashastra and Brhatsamhita. These works generally give excerpts of botany or what is known as vrksayurveda. In addition, there are a number of exclusive works under the title of Vrksayurveda. Parasara's Vrksayurveda is supposed to be the most ancient work in actual botany, to have been 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 well developed.[5,6]

Morphology

Casual references to different parts of the plant are found scattered throughout the Rgveda, 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: (1) Visakha (spreading branches); (2) Manjari (leaves with long clusters); (3) Sthambini (bushy plants); (4) Prastanavati (which expands); (5) Ekasrnga (those with monopodial growth); (6) Pratanavati (creeping plants); (7) Amsumati (with many stalks); and (8) Kandini (plants with knotty joints).

The Taittiriya Samhita and the Vajasenayi Samhita explain that plants comprise 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) [7,8] are: patra (leaf); puspa (flowers); phala (fruits); mula (root); tvak (bark); kanda (stem); sara (heart-wood); svarasa (sap); niryasa (exudation); kantaka (spines); bija (seed), and praroha (shoot).

Ancient literature has classified the roots on the basis of their growth behavior and structures, like, sakha sipa (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 (fasciculate root).[9,10]

Some ancient Sanskrit works also took notice of texture, colour, taste, surface etc. for morphological classification of plants.

- Texture: Lomasa-vasana for hairy stem; mrdu patra for soft leaf; komal patra for tender leaf; and snigdha patra for rough thick leaf.
- Shape: Dirgha patra for long leaf; mandala patra for rotund leaf; and visala patra for broad leaf.
- 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.
- Taste: Svadu patri for sweet leaf; amla patra for sour leaf; katu patra for leaves with spines; and tiksna patra (hot taste).
- Surface: Romasa patri for with hairy outgrowth; and randhra patri for leaf with holes; and valka patri for bark-like.

<https://cejsr.academicjournal.io>

- Leaflets: Ekapatrika for one leaflet; dvipatrika for two leaflets; tripatrika for three leaflets; catuspatrika for four leaflets; pancapatrika for five leaflets; saptaparni for seven leaflets; and bahupatrika for a number of leaflets.[11,12]

There are some other botanical terms, which can be identified with the modern terms, like pedicel (stalk of flowers) is called prasava bandhana (means the attachment to the mother plants); puspachhada, jalaka (calyx); puspadala (corolla); kesara (androecium); paraga (pollen); and varataka (pistil). Some examples about inflorescences are also present in ancient texts like, manjari (racemose inflorescences), stabaka, guccaka (cymose inflorescences), srihastini (helicoid cyme), chatra (umbellate), etc.

Plant Physiology

Udayana, in his Prthviniraparyam, says that in plants there is life, death, sleep, waking, disease, drugging, transmission of specific characters by means of ova, movement towards what is favourable and away from what is unfavourable. The Buddhist logician Dharmottara in his Nyayavindutika records the phenomenon of sleep in certain plants, in the form of contraction of their leaves during night. Gunaratna, in his Saddarsana-samuccaya, enumerates different characteristics of life: (1) the plant passes through three stages of infancy, youth and age; (2) they have regular growth; (3) their various kinds of movement are conditioned by sleep, walking, response to touch or need for support; (4) plants deal with wounds and laceration sustained by their organs and make use of drugs to overcome wounds as well as diseases; (5) assimilation of food from the soil is determined by requirements of plants for growth; (6) recovery from wounds and diseases by the application of drugs; (7) dryness or the opposite due to sap; and (8) special food favourable for impregnation.[13,14]

Sankaramisra in his Upaskara mentions that after a wound or laceration, there is natural recuperation due to the growth of organs (bhagnaksatasamrohana). The Santiparva of Mahabharata enumerates several physiological principles including the sense of touch, hearing (response to sound), vision, smell, irritability, etc, in respect of plants.

Nourishment

As to the physiology of nourishment, scattered references amply indicate the knowledge that plants receive their nutrients from the soil in the form of solution through the agency of the root. The use of padapa for the root, as already pointed out, is significant. Santiparva explains the phenomenon of ascent of sap in the following lines, "the tree sucks water from its base (root) with the force, and along with air, water is drawn up the tree". Dixon and Joly explained this theory only in 1894.

The nutritive value of absorbed water and its role in plant metabolism is clearly illustrated in the following lines of the Santiparva "the water absorbed by the plant is converted into food under the influence of agni (energy) and maruta (air), and due to this, plant can grow".[15,16]

Vrksayurveda of Parasara, explained the food preparation in the leaf. According to Parasara, "the watery sap obtained from earth (parthivarasa) is transported from root up to the leaf through syandana (xylem). There it gets digested with the help of chlorophyll (ranjakena pacyamanat) into nutritive substance and a by-product (malam)".

Several Sanskrit texts also describe the movements of the plants. According to literature, plants show movements towards a direction, which is favourable to them, and move away from a direction unfavourable to them.

The sensitiveness property of the touch-me-not plant (*Mimosa pudica*) is also clearly described in some ancient texts. [17, 18]

The concept of flowering at different times during a day – morning or evening – has also been observed by the ancient botanists.

<https://cejsr.academicjournal.io>

Plant Pathology

Many references to plant diseases and their treatment are also available in the Vedic literature. According to S. Sundara Rajan, the Atharvaveda explains the destruction of corn due to insect pests. Vinaya, the famous Buddhist text, describes the blight and mildew diseases. A much later text, Sukraniti, gives a detailed account of danger to grains from various agents such as fire, snow, worm, insect, etc. Gunaratna, in his Saddarsanasamuccaya, observes that plants are afflicted by diseases, displacement or dislocation of flowers, fruits, leaves and barks in the same way as the human body suffers from jaundice, dropsy, emaciation, stunted growth of finger, nose, etc., and respond to treatment like human bodies.[19,20]

According to Varahamihira, plant diseases are caused by cold climate (low temperature), wind (dryness) and sun (heat) and indicated by the yellowness of the leaves, non-or under-development of buds, dryness of the branches and the exudation of the sap. He also described the treatment: the paste of ghee, vidanga (*Embelia ribes*) and mud kneaded in the infected parts and then diluted milk should be sprinkled over the area. Agnipurana prescribes a mixture of vidanga with rice, fish and flesh. Agnipurana and Brhatsamhita suggested following treatment when a tree is not producing flowers and fruits: the hot decoction prepared of kulattha (horsegram, *Dolichos biflorus*), masa (blackgram, *Phaseolus mungo*), mudga (greengram *Phaseolus radiatus*), tila (*Sesamum indicum*) and yava (barley) in milk. Cool the mixture and sprinkle it on trees.[22,23]

Consciousness in Plants

Ancient Indians believed that plants as living organisms possess consciousness, but it remained dormant and was not comparable to Indian animals. Manu writes that the plant has a latent consciousness, which is capable of perceiving both pleasure and pain.

In Mahabharata, Santiparva explains that the plant has life, touch, feel, smell, vision, and hearing senses.

Germination

The technical term used for seed is vija. The seed is enclosed in a vessel called vijakosa. The endosperm is called sasya and the cotyledon vijapatra. Parasara used the term vijamatrka to denote cotyledon and recognizes monocotyledonous (ekamatrkavija) and dicotyledonous (dvimatrkavija) seeds.

Germination of a seed is called ankurodbheda, which means sprouting of the seed to life; ankura means seedling. According to Susruta, proper season, good soil, requisite supply of water and good seeds are required for germination of the seed.[24,25]

Gunaratna observes in his commentary that the seeds of vata (*Ficus indicum*), pippala (*Ficus religiosa*), nimbu (*Melia azadirachta*), etc. are germinated during the rainy season under the influence of dew and air.

Parasara also gives the descriptive commentary on the process of germination in Vrksayurveda. According to Parasara, "during the sprouting up of the seedling (praroha), its body receives nourishment from the cotyledons. This nourishment enables the seedling to grow until its root develops and comes of its own. The cotyledons dry up as soon as the seedling is able independently to receive nourishment directly from the soil of the earth".

Reproduction, Sex and Heredity

Ancient Indian literature also deals with sex, genetics, and reproduction of plants by fruits, seeds, roots, cuttings, graftings, plant apices and leaves. Buddha Ghosa, in his Sumangala-vilasini, a commentary on the Digha Nikaya, describes some of these methods under such terms as mula-vija

<https://cejsr.academicjournal.io>

(root seed), khandabija (cuttings), phaluvija (joints), agravija (budding) and bija-bija (seed). Atharvaveda and Arthasastra describe the propagation by seed (bija-bija or vijaruha) and bulbous roots (kandavija), respectively. The method of cutting (skandhavija) is described in the Arthasastra, Brhatsamhita and Sumangala-vilasini in the case of sugar cane, jackfruit, blackberry, pomegranate, vine, lemon tree, asvattha (*Ficus religiosa*), nyagrodha (*Ficus bengalensis*), udumbara (*Ficus glomerata*) and several others. Some ideas related to sexuality in plants are noticeable in the Harita and Charak Samhitas. Charak recognized male and female individuals in the plant called Kutaja (*Hollerhina antidysenterica*), and the male categories of plants bearing white flowers, large fruit and tender leaves and the female categories characterized by yellow flowers, small fruits, short stalk, etc. The Rajanighantu mentions the existence of male and female plants in the plant Ketaki (*Pandanus odoratissimus*). The male plant is called sitaketaki, and the female is called svarna ketaki. Regarding heredity, Charaka and Susruta mention that the fertilized ovum contains in miniature all the organs of the plants, for example the bamboo seed containing in miniature the entire structure of the bamboo tree, and further that the male sperm cell have minute elements derived from each of its organs and tissues. Such ideas closely resemble Darwin's 'gemmules'. [26,27]

Plant Taxonomy & Nomenclature

In ancient times, plants were named to mark:

1. Special associations, like bodhidruma (*Ficus religiosa*), asoka (*Saraca indica*) and Sivasekhara (*Datura*).
2. Special properties such as medicinal, domestically useful, etc., like dadrugghna (*Cassia fistula*), arsoghna (*Amorphophallus campanulatus*), kusthanasini (somaraji), dantadhavana (*Acacia catechu*), karpasa (cotton) and lekhana (reed).
3. Morphological characteristics, e.g. shape of leaf, number of leaflets in a compound leaf, shape and colour of flowers, etc., like kisaparni (*Achyranthes* sp.), asvaparnaka (*Shorea robusta*), pancangula (*Ricinus* sp.), tripatra, saptaparna, vakrapuspa (*Sesbania grandiflora*) and satamuli (*Asparagus* sp.).
4. Local association and environmental association, like saubira (*Zizyphus jujuba*), magadhi (Jasmine), vaidehi (Pepper), jalaja, pankeruha (lotus) and maruvaka (*Ocimum* sp.).
5. Other peculiarities, like vakrapuspa (plant having curved flowers), vranari (enemy of boils) for the plant *Sesbania grandiflora*; kantaphala (having spiny fruits), ghantapuspa (possessing bell-shaped flowers) and mahamohi (great intoxicator) for the plant *Datura alba*. [28,29]

According to S. Sundara Rajan, in the ancient Indian texts, the nomenclature of the plants was generally based on the plant's botanical characters (paricaya prjnapikasamjna) and their therapeutic properties (guna prajnapikasamjna).

Classification of Plants

Plants were classified in accordance with three distinct principles, botanical (udbhida), medicinal (virecanadi) and dietetic (annapanadi).

The Rgveda divides plants roughly into three broad classes, namely, Vrska (tree), Osadhi (herbs useful to humans) and Virudh (creepers). Plants are further subdivided into Visakha (shrubs), Sasa (herbs), Vratati (climbers), Pratanavati (creepers) and Alasala (spreading on the ground). All grasses are separately classified as Trna, flowering plants are Puspavati, and the fruit bearing ones are Phalavati. Leafless plants are placed under the group, Karira. The Atharvaveda has classified plants into various categories based on their morphological characters and other properties, such as Prasthanavati (spreading), Sthambini (bushy), Ekasugna (with single whorl of calyx), amsumati (having many shoots), Kandini (jointed), Visakha (having extending branches), Jiivala (lively),

<https://cejsr.academicjournal.io>

Nagharisa (harmless) and Madhumati (very sweet).[30]

Some ancient scientists, like Manu, Charaka and Udayana, etc. also classified the plants in various classes.

Manu divided plants under eight classes as follows:

1. Osadhi – plants bearing abundant flowers and fruits, but withering away after fructification, e.g. rice, wheat.
2. Vanaspati – plants bearing fruits without evident flowers.
3. Vrksa – trees bearing both flowers and fruits.
4. Guccha – bushy herbs
5. Gulma – succulent shrubs
6. Trna – grasses
7. Pratana – creepers which spread their stems on the ground
8. Valli – climbers and entwiners.

According to Charaka and Susruta Samhita the plants are categorized into four classes: (1) Vanaspati – which bear fruits but not flowers, (2) Vrksa or vanaspatya – which bear both fruits and flowers, (3) Virudh – which creep on the ground or entwine, (4) Osadhi – annual herbs which wither away after fructification).

Susruta subdivides Virudhs into two groups, pratanavatya (creepers with spreading stem on the grounds) and gulminya (succulent herbs), and Charaka subdivides Virudhs into lata (creeper), gulma and osadhis into annuals or perennials bearing fruits and grasses which go without fruits. He further divided the plants into 50 groups based on their physiological actions and diseases they cure, and flowering plants into the following seven heads based on dietetic principles: 1) Sukadhanya (cereals), 2) Samidhanya (pulses), 3) Saka varga (pot herbs), 4) Phala varga (fruits), 5) Harita varga (vegetable), 6) Ahayogi varga (oils), and 7) Iksu varga (sugarcane).[28,29]

The Vaisesikas classify plants under seven heads, e.g. Vrksa, Trna, Osadhi, Gulma, Lata, Avatana and Vanaspati. Defining the characteristics of the various groups Udayana's Kiranavali, remarks that Vrksas are plants with trunk, branches, flowers and fruits; Trnas are exemplified by ulupa like plant; Osadhis are plants like kaluma which die after fruition; Gulmas are plant like bhata, latas are represented by kusmanda, a species of Cucurbita; Avatanas are plants like ketaki; and Vanaspatis are trees which produce fruits without flowers.

According S. Sundara Rajan, the Vanausadhivarga of Amarakosa identifies plants under three categories, mushrooms (citra, aticatra and phalghna), parasites (Vanda and Vrksadani) and epiphytes (Vrksaruha and jivantika).

In his Vrksayurveda, Parasara developed a more elaborate classification. Parasara mentions two types of plants: Dvimatrka (Dicotyledons) and Ekamatrka (Monocotyledons). He further classified plants into families (gana vibhaga), [27,28] like:

1. Samiganiya (Leguminosea) – This family covers samivrksa, a plant bearing simbiphala, (legume or pod, compound leaves held on a common stalk and leaflets arranged like a feather). Flowers are hypogynous (puspkrantabijadhara) and five-petalled, with gamosepalous calyx and an androecium of 10 stamens. This family has three subtypes: vakra-puspa, vikarnika-puspa and suka-puspa.

<https://cejsr.academicjournal.io>

2. Puplikagalniya (Rutaceae) – In this family the plants bear spines, odoriferous leaves and winged petioles, flowers are hypogynous (tundamandala) with free petals and stamens. Fruits formed of superior ovary (puspa-krantaphala) contain hairy succulent flesh and multiple seeds. Family has two subtypes: kesaraka and maluraphala.
3. Svastikaganiya (Cruciferae) – According to the name, the shape of the calyx looks like a svastika. The flower has four sepals, four petals and six stamens, and a superior ovary (tundamandala). In the inflorescence flowers are arranged in rows.[26,27]
4. Tripuspaganiya (Cucurbitaceae) – The plant is epigynous (kumbhamandala), which are sometimes unisexual. The flower has five united sepals and petals and three stamens and a style with three-pointed stigma (trisirsavarata). The ovary is trivartaka (tri-locular).
5. Mallikaganiya (Apocynaceae) – Plants having mixed inflorescence and which are hermaphrodite (samanga), calyx and corolla are united having five stamens, epipetalous (avyoktakesara). The seeds having long fine hairs (tulapucchasamanvita).
6. Kurcapuspaganiya (Compositae) – The flowers are sessile and borne on a common axis, surrounded by a common calyx and look like a brushy head (kurcakara). The ovary is inferior (puspasirsakabijadhara).[25,26]

Plant Anatomy

Detailed study of internal structure of plants becomes possible only after the invention of the compound microscope. But in the Rgveda, daru or the wood is distinguished from the softer outer part of a tree. Taittiriya Samhita separates the outer part into valka (outer) and vakala (inner) bark. The Brhadaranyaka Upanisad shows more detailed picture in this field. According to Brhadaranyaka Upanisad the five regions present in a plant are: tvak (skin or bark), mamsa (soft tissues); asthi (wood or xylem), majja (pith), and snayu (fibres both xylem and sclerenchyma).

But the Vrksayurveda of Parasara gives more detailed and clearer description of the plant anatomy. According to Parasara, there are tissue systems meant for the transportation of nutrients and sap. The whole of the vascular system has been given the name sarvasrotamsi (that which helps in the flow). This is divided into two categories, first is syandana and second in sirajala, which is obviously xylem and phloem, respectively. He explains that the syandana is involved in the transportation of rasa, which is absorbed from the Earth (Prthvi) to all parts of the plant body and sirajala (pl. sirajalani) helps in the re-distribution of nutrition from the leaf to other parts of a plant.[24,25]

But the most remarkable anatomical observation made by Parasara relates to a detailed description of the plant-cell. He gives a more detailed study than Robert Hooke who discovered the cell in 17th century. Parasara notes that the internal structure of the leaf consists of innumerable compartments, which are filled with the sap. They are the storehouse of sap (rasasrayah) and covered by a boundary-cell wall or cell-membrane (kalavestana). The structure has five elemental principles (pancabhautika gunasamanvita) as well as a colouring principle (ranjakayukta), and cant be visible to the naked eye. The thin boundary originates from a fluid (kalaladupajayate), which is called protoplasm by the modern botanists.

Medical Botany

The bulk of the Ayurvedic medicines belong to the plant kingdom. And all the Ayurvedic texts deal with botanical aspects, mainly the identification and categorization of plants as source of drugs. The Charaka Samhita has a chapter titled Vibhagavidya, dealing with the classification of plants and animals. The Susruta samhita, the second Ayurvedic classic, also deals with several aspects of botany such as morphology and taxonomy. Susruta also provides classification of plants on the basis of medicinal properties.[23,24]

<https://cejsr.academicjournal.io>

Discussion

India was one of the foremost-developed countries in ancient times. Learned persons of Vedic culture were quite aware regarding unimaginable Obligation of plants for the very substance of animal life. At the ancient time People also realized that there is no conduct of life, where the plant kingdom does not make its contribution like food, fuel shelter fiber, fodder and Medicine. Vedas are the oldest books in world's library and only source of perfect Knowledge and this is the admitted fact. The period of Vedas goes back to the Origin of universe and it is shown as 1, 97, 29, and 39,079 in 1980 according to Dayananda and on the basis of vedic literature. This is also supported by geological findings. So, if we get the reference of plants and classification of Plants then, the credit should be given to them being older and ancient. In the Vedas there are so many names of plants, classification and use. Atharveda is full of the knowledge of plants and their use especially on human diseases. In 'Yajurveda' also the names of plants originated from Veda only and deals with The plants their contents, their use in the human diseases their collection, Preservation and classification. Their basis of classification was the Morphology but much more trace was given to the contents, which they call it Drava. Use of herbal medicines can be traced to the remade past one of the Oldest treaties in the oldest treaties in the world is RIG-VED' (4500 BC – 1000 BC) Where healing properties of herbs mentioned. The Drava, which is Present in plants used as a medicine (Aushadhi). [22, 23]

Inter-relationship with Panchamahabhuta

In an ancient Indian Science the attempt was also made to show the interrelationship of the so called the contents of plants to the Panchamahabhoota, which are present in universe around the plants and Showed the relationship with properties. Panchamahabhuta are Ap, Tej, vayu, Akash and pruthavi.

Classification of the Dravya and Plants

The dravya are having their own properties and characters hence, they May differ from each other. In modern science we consider the chemical contents and know the physical and chemical properties but in ancient IndianScience the study was more deep than today's. According to them Dravya are having five properties i.e. 1] Ras 2] Gun 3] Virya 4] Vipak 5] Prabhav

1] Ras : Ras are six 1] Madhur 2] Khatta 3] Namkin 4] Tikta 5] Kadwa6] Kasaila

All the Dosa have all five Mahabhuta in their composition but are by one or more of them. Their location is fixed Aggravation of Dosa results in certain symptoms. Dosa are three in number, namely Vat, Pitta, and Kapha. Location of Dosa and their functions are fixed.Rasa having common gun, with Dosa increase that Dosa, Rasa having Opposite Guna to Dosa decrease Dosa. Thus Madhura, Amla and Lavana Decrease Vata but increase Kapha. Tickta, Katu and Kasaya decrease Kapha and increase vat, Dr. Joshi has given details about properties of different Guna and interrelationship of Rasa, Guna, Virya and Vipak with three Dosa.[21,22]

From this it is clear that they knew that raises can increase or decrease The Tridosh i.e. Vat, Pitta and Kaf. To understand and appreciate the meaning of technical terms used in Ayurveda, it will be appropriate to explain in some details these terms and their Inter relationship. Dosa are three namely vat, Pitta, Kaff. Their properties are as follows.

Vat: Structure of vat is Akasa and Vayu. Inspiration, expiration, voluntary action, circulation of Ras, Rakta etc. throughout the body and discharge of excretory products out of body are functions of Vata.

Pitta: Structure of Pitta is Teja. Digestion, heat production, hunger, thirst, Softness and luster, cheerfulness and intelligence are main function of Pitta.

Kapha : Structure of Kapha is Apa and Prathvi smooth working of joints, general stability, strength

<https://cejsr.academicjournal.io>

tolerance, courage and greedlessness are properties of Kapha.

Guans: They are having the relation with Panchamahabhootas of the nature and accordingly the plant will be showing the properties. The Panchamahabhootas are having Laghu, Guru, Snigadh; Rukkch, Tikchan gunns of the Akash, Pruthvi, Jal, Vayu and Agni respectively. That is why the plants or the contents (Drava) are having these guans. Of the Akash, Pruthvi, Jal, Vayu & Agni respectively. That is why the plants or the contents (Drava) are having these guans[20,21]

Bhavamishra also contributed to this knowledge and gave Bhavprakash In this Aushadhi are classified into Various Vargas. Later on Raj mandanpal has written Madnvinot nighuntu (Koshgranth) and classified into 14 Vargas. These Classifications clearly show that, they were taking into account the locality, Habit, morphology, habitat, and the contents of it the guans and the medicinal Use of the same. They gave less importance to the morphology and gave much Importance to the guans and the properties. They also knew that the guans are Because of the god and nobody should try to test these.

The History of Ancient Indian science including vedas and books in Ayurveda the knowledge of plants and their medicinal use is present. Today's Broad classification is also seen in vedas. Here the plants are classified into Apushpa and Pushpa, Aphala and Saphala, This is equivalent to the cryptogames and phanerogames and further in to Gymnosperm and Angiosperms. The Athraveda and the books on Ayurveda Are full of history of plants their contents and their use in the eradication and Control of diseases. They also considered the habit and the age or the life period for the classification. They also considered the habit and the age plant for Classification. The plants contain the Drava, which is also called medicine. [19,20] Drava Are having properties Ras, Gun, Virya, Vipak and Prabhav. Each plant is having its own properties. It is also showed that the Dravyas are having Inter Relationship with panchamahabhootas and carryout the functions related to the panchamahabhootas. The Dravyas of plants can remove or increase the tridosh i.e. vat, pitta and kaff. Not only is this but dravyas also having other gunas. Such as dipana, Pachana, Virechan, Vaman etc. The Ancient Indian people also knew about the prabhav, which is not the subject of today's chemistry. They also declared that nobody should try to test these Gunas or Properties in the laboratory; because these are natural all cannot be tested in laboratory. With this knowledge keeping in the view the medicinal properties are classified into various groups or Gunas or Vargas. Plants are also described as Laghu, Guru, Snighdh, Ruchak and Tikta on the basis of Panchamahabhootas. From this it is quite clear that the knowledge of the ancient Indian people about the plants, their contents, their use as medicine and the classification was much ahead of today's botany and its system of classification. Their classification is more correct, minute useful and perfect. Hence this knowledge should be preserved propagated and used to serve mankind[18,19]

Results

Vedas are the root of Indian culture and the seed of almost all the branches of Science. Botany is one of those branches of science which is closely connected with nature. Botany means the scientific study of physiology, genetics, ecology, distribution, classification and economic importance of plants. Generally the study of this branch has two parts, i.e. Pure Botany and Applied Botany. Pure Botany is the study of all plants existed in the world, where as Applied Botany is the study of those plants which are useful to people. The history of Botany in India can be traced from the Vedic period. A huge number of information about both divisions of this branch are scattered in the whole Vedic literature and in various Vedic rituals (karmakāṇ d a). Here some of these concepts are discussed very briefly. A lot of indications of morphology of plants are traced in the Vedic literature. In the Taittirīyasamhitā, the parts of plants are eulogized viz. root (mūla), shoot (tūla), stem (kāṇ d a), twig (valśa), branch (śākhā), leaf (parṇ a), flower (pus pa) and fruit (phala). The Vājasaneyīsam hitā and the Atharvaveda also mention about the physiology of plants. According to the Vājasaneyīsam hitā, yajña is performed for improving the roots, branches of forest trees, flowers, fruits and herbs [17,18]-mulebhyaḥ svāhā śākhābhyaḥ svāhā vanaspatibhyaḥ svāhā pus pebhyaḥ

<https://cejsr.academicjournal.io>

svāhā phalebhyaḥ svāhaus adhībhyaḥ svāhā. The Atharvaveda says that the branches of a tree roundabout the trunk -vṛks asya skandhaḥ parita iva śākhā . Besides these, the parts of plants are compared to the parts of human body. The term skandha is used in the R gveda for the corona of a tree. The Bṛhadāraṇyakopaniṣad also has very clearly mentioned the fact that various parts of plants are like different parts of the human body. Here some similarities are traced as follows: Parts of human body Parts of tree Hair (loma) leaf (parṇa) Skin (tvak) external bark (bāhya tvak) Blood (rudhir) juice (rasa) Flesh (māmsa) soft tissue (śakarā) Nerve (snāva) inner fiber (kināt a) Bone (asthi) wood (dāru) Marrow (majjā) pith (majjā). It is claimed that plants possess internal consciousness and they feel both pleasure and pain— antah sam jñā bhavantyete sukhaduh khasamanvitāh . From the above information, it is confirmed that our ancestors are very much aware about the internal morphology of plants. In this context, the words of A.K. Ghose and S.N. Sen may be cited : “It is futile to expect any detailed knowledge of the internal structure of plants, but some gross anatomy of the plant body is indicated in the Rgveda which clearly distinguishes wood (dāru) from the softer part of tree. [16,17]A few data of classification of plants are found in the Vedas. The R gveda classifies the plants in the following heads viz. fruitful (phalinah), blossoming (puṣpavatī), having flowers (prasuvarih), grass (tṛṇa) etc. The Atharvaveda also mentions various classifications of plants. In one mantra of this Veda, the following classification is found – those rich in flowers (pus pavatī), those rich in shoots (prasūmatī), those rich in fruits (phalinī) and those lacking fruits (aphalā). Another classification of tree is also seen in this Veda. These are the forest tree (vanaspati), fruit tree with conspicuous flowers (vānaspati or vṛks a), the herb (os adhi) and plant (vīrudha). The same Veda again classifies trees as those that are expand (prastr natih), those that are bushy (stambinīh), those having only one sheath (ekasun gah), those that creep (pratānavatih), those having many stalks (an gsumatih), are knotty or joined (kān d inih) or those that have spreading branches (viśākhāḥ). In another place of the Atharvaveda, a special classification of trees are made on the basis of colour of trees like brown (babru), white (śukra), red (rohin ī), spotted (pṛṣṇi), black (kṛṣṇa), swarthy (asiknī). Besides these, some other special classifications of plants are also made in the Vedas. While discussing the second part of Botany i.e. applied Botany, mainly reference may be made to food and medicinal use of plant. In the Vedic age, the word dhānya is used for food in general. [15,16]There are twelve types of dhānya mentioned in the Vājasaneyīsam hitā. These are—rice, barley, pulses and beans, sesamum and grams, kidney beans and their cooking, grams and their cooking, millet and its cooking, excellent rice and inferior corn, rice of wild growth and their cooking, wheat and its cooking, lentils and other food grains : vṛhayaśca me yavāśca me mās āśca me tilāśca me mudgāśca me khalvāśca me priyaṅgavaśca me'n avaśca me śyāmākāśca me nīvārāśca me godhūmāśca me masūrāśca me yajñena kalpatām. Yava and brīhi are main food at the time of Vedas. Many references are found about these two. Generally paddy is cultivated twice in a year : dvisamvatsaram sasyam pacyate. Yava is cultivated in the season called grīs ma and brīhi in the śarada : yavam grīs māya brīhi na śarade. The Rgveda repeatedly mentioned about yava : gobhiryavam na carkṛs at In the Atharvaveda, there is a complete hymn named by annasūkta where yava is equated to god. Besides this, brīhi¹⁸ , dhānya, etc. are also mentioned here. Some trees are used in Vedic sacrifice like aśvattha, śamī etc. The juice of soma tree is the main oblation of soma sacrifice. In the Rigveda, the name of soma tree is very much common. This is the basic thing to perform the soma sacrifice. The whole 9th man d ala of the same is devoted to this plant and hence it is called as somapavamānaman d ala. Another important usefulness of plant is the medicinal herbs i.e., the ośadhīs. A numerous mantras are found for the eulogy of ośadhīs. In the 97th sūkta of tenth man d ala of the same Veda, soma is praised as the best of all ośadhīs. In the Vājasaneyīsam hitā, various mantras are seen for this type of plant. According to these mantras, different types of diseases like vilāsa, arśa, śoṭha, ślīpada, hṛdaroga, kuṣṭha etc. are cured by use of these ośadhīs. Different types of ośadhīs are also mentioned in the Vājasaneyīsam hitā. In another mantra of the same, the way of taking the ośadhī is highlighted. The Taittirīyasamhitā also mentions some ośadhīs relating to cure of some diseases like dr s t iprāpti, yaks mā, unmāda etc. Besides these, a huge

<https://cejsr.academicjournal.io>

number of oṣadhīs are described in the Atharvaveda. Here different types of oṣadhīs, how to use them, usefulness etc. are thoroughly discussed. There are at least forty types of oṣadhīs which can be traced in this Veda. Some of these are muñja (*Saccharum munj* Roxb) rajanī (haridra) (*Curcuma longa* Linn) rāmā (bhr ngarāja) (*Eclipta alba* Hassk) śyāma (nīla, asiknī) (*Indigofera tinctoria* Linn), kr s n ā (indrāvarun ī) (*Citrullus colocynthis* Schrad) parn adhi (lodhra) (*Symplocor racemosa* Roxb) pr śniparn ī (*Uraria Picta* Jesv) vacā (baca, ghod abaca) (*Acorus Calamus* Linn), śepahars an ī (kapitha) (*Feronia Elophantinum*), soma (*Ephedra Gerardiana*), kulmala (padma) (*Nelumbo nucifera* Gaertn) varan a (varan ā) (*Crataeva nurvala* Buch Ham), śan a (*Crotalaria juncea* Linn), prakrī (prakīrya) (*Pongamia Pinnata* Pierre), lāks ā (*Laccifer Lacca* Karr.), apāmārga (*Achyranthes Aspera* Linn) gulgulu (guggulu) (*Commiphora Mukul*) kus t ha (kūt ha) (*Saussurea Lappa* C.B Clark) śamī (*Prospis cineraria* Druce) arka (*Colotropis procera* (Alt) R.Br.) pippalī (Piper Longum Linn) jīvantī (*Leptadenia reticulata* W. & A.) yava (*Hardlum Bulgare*), brīhi, baja (*Brassica campestris* Linn. Var.), darbha (*Demostachya bipinrota* staps), kanera (*Merium indicum* Mill), taudī (kanyā, ghr tāsī) (*Aloe Vera* Tourn. Ex Linn., agni (citrika) (*Plumbage Zeylanica* Linn.), udumbara (*Ficus glomerata* Roxb.), bilva (*Aegle marmelos* Corr.), rohan ī (*Soymida Febrifuga* A. Juss.) mandūkī (*Centrella Asiatica* Linn. Urban) etc. For example, the first born overpowering the spotted leaf called pr śniparn ī destroys the durn āma (cause of leprosy) and kan va (embryo eating germ). The muñja grass is considered as the best of all os adhis. It is the remedy for flux and all diseases – tvamuttamamanāsrāvamarogan am. The juice of varan ā tree is useful for destroyer of poison because an on-pouring of ambrosia (amṛta) is there - vāridaṁ vārayātai varan āvatyāmadhi/ tatrāmṛtasyāsiktaṁ tenā te vāraya vis am etc. Many of these plants have not only medicinal values but also used as food and other ways. At the time of Atharvaveda, purchasing and selling of oṣadhīs are very much common in the society- dhanairabhi śrutvā yanti/. The oṣadhī called varan āvatī is purchased by pavasā tree or skin of deer. Besides these, numerous information of plants are found in the Vedas.[20] Plant word is inseparable part of human life. People cannot survive without these. Without the aid of these all-round welfare of human beings cannot take place. Plants are used as food, for preparing shelter, clothes and other household utensils. Besides these, medicinal herbs are very much essential for curing diseases. Plants are used not only for maintenance of livelihood but also for religious purposes. For the safety purpose of the earth, plant world appear to play a significant role. From the very remote age, this concept of botany is highlighted. Not only today but ancient seers also recognized the direct influence of plant world i.e. Botany. And hence they described some concept of Botany in the Vedas.[28,29]

Conclusions

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. [30]

References

1. Indian scriptures. The Science of Life in the Vedic age. Retrieved from <http://www.indianscriptures.com/vedicknowledge/contribution-to-the-world/biology/thescience-of-life-in-the-vedic-age>, 2017.
2. Wikipedia. Middle Ages. Retrieved from https://en.wikipedia.org/wiki/Middle_Ages, 2017.

<https://cejsr.academicjournal.io>

3. BSM-ANCIENTBHARAT. POST-VEDIC CLASSICAL PERIOD - Botany: Part3. Retrieved from <http://www.bsm-ancientbharat.in/index.php/item/290-post-vedic-classical-period-botany-part3>, 2016.
4. Wikipedia. Flora of the Indian epic period. Retrieved from, 2017. https://en.wikipedia.org/wiki/Flora_of_the_Indian_epic_period
5. Wikipedia. Theophrastus. Retrieved from <https://en.wikipedia.org/wiki/Theophrastus>, 2017.
6. Kidzsearch. Retrieved, 2013. from <http://wiki.kidzsearch.com/wiki/Theophrastus>
7. Conche M. (n.d.). Philosophizing ad Infinitum. Infinite Nature, Infinite Philosophy. 160.
8. Ibiblio. (n.d.). Chapter 4 – Food and Art in the Vedic age. Retrieved from <https://www.ibiblio.org/britishraj/Jackson1/chapter04.html>
9. Indianetzone. Traditional Indian Medicine in Vedas. Retrieved, 2008. From http://www.indianetzone.com/64/traditional_indian_medicine_during_vedic_period.htm
10. Importantindia. Vedic Agriculture in Ancient India. Retrieved, 2016. from <http://www.importantindia.com/15407/vedicagriculture-in-ancient-india/>
11. Wikipedia. Historia Plantarum (Theophrastus). Retrieved, 2017. from [https://en.wikipedia.org/wiki/Historia_Plantarum_\(Theophrastus\)](https://en.wikipedia.org/wiki/Historia_Plantarum_(Theophrastus))
12. Trinity College Dublin. Theophrastus (371 - 287 BC). Retrieved, 2011. from <https://www.tcd.ie/Botany/tercentenary/origins/theophrastus.php>
13. Chicago Botanic Garden. Theophrastus and the beginnings of modern botany in the Renaissance. Retrieved, 2017. from <https://www.chicagobotanic.org/library/stories/theophrastus>
14. Botany at the Edward worth Library. Theophrastus of Eresus. Retrieved, 2017. from <http://botany.edwardworthlibrary.ie/ancientbotany/theophrastus/>
15. Chunekar KC, Pandey GS. Bhavprakash-Nighantu. Varanasi (India): Chaukhambha Bharati Academy Publishers & Distributors, 2010.
16. Dutt C. Caraka-Samhita Vols. I-II. Varanasi (India): Chaukhambha Surbharati Prakashan, 2000.
17. Ghanekar BG. Susruta-Samhita. Fifth Edition. Delhi (India): Motilal Banarasidas, 1975.
18. Ghanekar BG. Susruta-Samhita. New Delhi (India): Meharchand Lachhmandas Publications, 2008.
19. Murthy KRS. Susruta-Samhita. Third Edition. Varanasi (India): Chaukhambha Prakashan, 2010.
20. Ohja J, Mishra U. Dhanvantari-Nighantu. Second Edition. Varanasi (India): Chaukhambha Surbharati Prakashan Publishers & Distributors, 2004.
21. Pandey Kashinatha, Chaturvedi GN. Caraka Samhita. Second Edition. Varanasi (India): Chaukhambha Bharati Academy, 2009.
22. Rao GP. Susruta-Samhita. Third Edition. Varanasi (India): Chaukhambha Prakashan, 2011.
23. Sastri G. Bhavaprakasa-Nighantu. Second Edition. Mumbai (India): Khemraj Shrikrishnadass Prakashan, 1837.
24. Sharma AR. Susruta-Samhita Vols.I-III. First Edition. Varanasi (India): Chaukhambha Surbharati Prakashan, 2001.
25. Sharma PV. Susruta-Samhita. Ninth Edition. Varanasi (India): Chaukhambha Orientalia, 2007.

<https://cejsr.academicjournal.io>

26. Sharma PV. Carak-Samhita. Vol. I. Second Edition. Varanasi (India): Chaukhambha Orientalia, 2011.
27. Sharma PV, Sharma GP. Dhanvantari-Nighantu. Varanasi (India): Chaukhambha Orientalia, 1998.
28. Sharma PV, Sharma GP. Dhanvantari-Nighantu. Varanasi (India): Chaukhambha Orientalia, 2008.
29. Sharma PV. Susruta-Samhita. Vol. II. Varanasi (India): Chaukhambha Vishvabharati Oriental Publishers & Distributors, 2010.
30. Sharma S. Caraka-Samhita. Mumbai (India): Khemraj Shrikrishnadass Prakashan, 2007.