KNOWLEDGE OF TAXONOMY, ANATOMY AND PHYSIOLOGY OF PLANTS IN SOME SANSKRIT TEXTS OF ANCIENT INDIA

Sankar Bhattacharjee, Mrinal Kanti Bhattacharya

Department of Sanskrit, Assam University, Silchar, Assam

Department of Ecology and Environmental Science, N.C. College, Badarpur, Assam

Abstract

The Vedic Indians developed an intimate relationship with the plant kingdom. They used to prepare various beneficial drugs through processing the roots, barks, leaves, flowers and fruits of the plants. The usefulness of various plants has been enumerated in the Atharva Veda, Caraka SaõhitÅ, Sushruta SaõhitÅ etc. The environmental awareness of Indian seers, right from the Vedic period, was remarkable and commendable. They had enumerated water, air and plants as the basic foundations, which ecological balance stands upon and which sustain all living beings.

Materials for this treatise have been collected from a few Sanskrit works, selected at random. Published essays and books, authored by modern scholars and research workers have also been consulted. The data, thus collected from various sources, have been furnished under the following heads only- (1) Origin of Plants (2) Taxonomy (3) Morphology (4) Anatomy and (5) Plant Physiology.

On the basis of the data presented in the following pages, it may be said that Sanskrit texts of ancient India contain a rich treasure of botanical information. We believe, further endeavours will be made by scholars and researchers to bring to light new materials on this subject and other branches of science and this valuable treasure of wisdom will be utilized by future generations for the welfare of mankind.

Introduction

It is generally believed that although the Indian intelligentsia in ancient times made remarkable contributions in various branches of learning including art, music, literature, philosophy, political thoughts and allied subjects, in the field of science they made very little contribution or no contribution at all. This alleged apathy for the study of science is attributed to over emphasis on religion and philosophy, which is thought to have resulted in a culture of other worldliness. This erroneous impression gained such a wide acceptability amongst the learned people that even an astute scholar like Keith was prompted to remark-"In the great period of Sanskrit literature, at any rate, experimental science was at a low ebb, and little of importance was accomplished in those fields in which experiment is essential." Dutta (1978;348).

Energetic endeavours, undertaken by a number of schools and researchers in recent times, however, have brought to light convincing evidence that even in the field of science and technology the contribution of ancient Indian genius is by no means negligible. The scholars of ancient India researched into various branches of science and technology. Available literary evidence, found in Sanskrit texts bear testimony of the profundity of their knowledge, the depth of their insight and the accuracy of their observations.

In the field of plant-science too, ancient Indian scholars left the imprint of their perseverance and insight. The Vedic Indians developed an intimate relationship with the plant kingdom. They used to prepare various beneficial drugs through processing the roots, barks, leaves, flowers and fruits of the plants. The usefulness of various plants has been enumerated in the Atharva Veda, Caraka Samhité, Sushruta Samhité etc. The environmental awareness
of Indian seers, right from the Vedic period, was remarkable and commendable. They had enumerated water, air and plants as the basic foundations, which ecological balance stands upon and which sustain all living beings.

That is why plants were accorded a distinguished place of adoration in the Vedas, Smṛti, Purāṇas and also in literary treatises. A number of plant species and/or their parts were ascertained to be sacred and essential for the performance of particular sacrifices or other rituals. The Agnipurāṇa (ch.70) lays down rules of Vṛksārāma-pratiṣṭhā (installation ceremony of plant). In the appendix of Surapāla's Vṛksāyurveda we find a chapter, named Vṛksotsavavidhi (rules for observing plant-ceremony). Ceremonies related to preservation and promotion of plant-kingdom, which are still observed by different ethnic groups dwelling the hills and forests of India, speaks of the impact of the urge for the welfare of plant-kingdom, inculcated in the minds of the common people by the prudent and sagacious sages of this land. The authors of Smṛti literature provided for different degrees of punishment against the offenders, indulging in various cruel acts against the plants.

We do not find any single Sanskrit work, devoted exclusively to Botany. But the knowledge of different branches and various aspects of plant-science is borne out by the Vedas, the Purāṇas, the Great Epic and works on Āyurveda, Kṛṣiśāstra, Dharmaśāstra, Arthaśāstra etc. An appraisal of some texts, selected at random, shows that while texts like Vṛksāyurveda of Parāśara and Surapāla, Kṛṣi-Parāśāra, Upavana-Vinoda etc. reflect on some specific areas of plant-science, texts belonging to other categories (like the Vedas, Purāṇas, epics etc.) are also rich in botanical data.

**Materials And Method**

Materials for this treatise have been collected from a few Sanskrit works, selected at random. Published essays and books, authored by modern scholars and research workers have also been consulted. The data, thus collected from various sources, have been furnished under the following heads only- (1) Origin of Plants (2) Taxonomy (3) Morphology (4) Anatomy and (5) Plant Physiology. Reference to the sources of information have always been made along with the data. The respective names of text, number of chapter(s) and sloka(s) have also been provided. An attempt has been made, wherever possible, to assess the status of knowledge in concerned areas of plant science by making comparison with accepted principles of modern plant science.

**Origin of Plants**

It has been observed by Parāśara in his celebrated work entitled Vṛksāyurveda (1.1.6) that the organic matters emerged from water, containing inorganic matters, under the influence of terrestrial energies. The idea of the origin of plants from the inorganic matters is also indicated in the Taittirīya Upaniṣad (II.1): तत्स्माद्विस्ताद्विमात्सर्वात्माः सम्बुधः। अक्षाद्विमाः। वायूयां। अध्यतं। अस्यद्विमाः। विषयाः। अवविमाः। अतः पुष्पः।

The text relates that from the very Ātman ākāsa (sky) emerged; from sky air, from air fire, from fire water, from water the earth, from the earth herbs, from herbs food and from food the man came to be. Similiar proposition is also found in the Chāndogya Upaniṣad (1.1.2) and the Brhadāranyaka Upaniṣad (VI.4.1).

The Manu Samhitā, (1.34-41) on the other hand, propounds the theory of Special Creation. According to this book, Brahma (the god of creation) created ten prajapatis (Lords of created beings). The prajapatis created seven Manus as also all the moving and stationary creatures including the birds and
beasts, insects and plants. The Vāyu Purāṇa (9.45;75.39-41;78.6-8), Kūrma Purāṇa (p. 7.32; p. 7.55), Vāmana Purāṇa (17.1-10) etc. also hold that different plants have originated from the limbs of some gods and goddesses.

Thus in Sanskrit works, we come across two different views about the origin of plants (i) the origin of living beings from a man under the influence of energy (ii) Theory of Special Creation, i.e., the plants, like other living creatures, were created by the Lord of creation or the gods.

It may be noticed that most of the present-day scientists accept theory of biogenesis, but till before the Theory of Chemical Evolution, propounded independently by Alexander Oparin and J.B.S. Haldane in 1920, the concept of Special Creation was an universally accepted proposition among the scientists of those days.

**Taxonomy**

The word 'taxonomy' means the classification of living and extinct organisms. A great variety of distinctions can be noticed in the forms, habits and other characteristics of plants. In spite of their having diverse forms, habits, food-value, taste and other properties, close similarities can be perceived between certain plants in respect of one or two items, mentioned above. These similarities are considered indicative of some relationship between a few plants and as such they are arranged into certain categories or classes or groups or divisions or in certain cases, into sub-divisions. Thus, from the days of yore, keen observers (of nature) in human society have been trying to classify the plants into various broad and small groups on the basis of similarities, observed amongst certain plants. In some Sanskrit texts also we perceive different modes of classification of plants. These classification are broadly based on - (a) habits (b) economic uses (c) habitats and (d) properties.

(a) **Classification based on habits:**

In the Āgveda, the earliest work of Indians, terms like Vṛksa (tree), Gulma (shrub), Bheṣaja (medicinal plants) and Lata (creeper) occur frequently in the mantras. In the same Veda, plants have again been divided into four classes on the basis of their varied habits:

\[\text{या: फलिनीयों अफला अपुष्पा यास्क पुष्पिणीः।} \]
\[\text{मुख्यत्वसहसवास्त्वा नो मुख्यत्वकर्षः।} \]

(Rgveda, 10.97.15)

(i) **Phalini-bearing fruits.**

(ii) **Aphala-not bearing fruits.**

(iii) **Apuspa-devoid of flowers.**

(iv) **Puspini-having flowers.**

Almost similar classification is found in the Atharva Veda also (8.17.27) e.g., पुष्पवतिः प्रसुस्सति: फलिनीरस्मृतिः उत्ता।

In the Manu Samhita (1.46-48), the plants have been classified into eight groups, probably on their mode of growth and morphological characteristics. Manu defines the plants (Udbhijja) and broadly classified the same thus:

\[\text{उद्भिज्ज्य: स्रावरोः सात्व बीजकाण्डप्रेषिण्यः।} \]

i.e. all the immovable creatures, which grow by piercing seeds and soil are called Udbhijja; these belong to two main groups-some shoot from seeds, while others develop from cuttings of bough, planted on the soil.

This general category of Udbhijja again has been divided into eight groups:

(i) **Osdhī-Plants** of this class bear many flowers and fruits, but die after ripening of fruits (1.46);

(ii) **Vanaspati-plants** which bring forth only fruits but not flowers (1.47);

(iii) **Vrksa-plants** in which fruits develop from flowers (1.47);

(iv) **Guccha-A bunch of many creepers**, originating from the same root (1.48);

(v) **Gulma-plants** in which many branches of stem develop just from the top of the root (1.48).
(vi) Tṛṇa-grass plants (1.48).
(vii) Pratana-plants with tendrils (1.48);
(viii) valli-creepers twining round a tree or
any other support.

According to Caraka again, plants are of four
classes-

Caraka enumerates the different classes thus:

वन्यपत्तिविविधाः वानपायतःतीलोपनःः।

Caraka Āmṛta-Sūstrāthāna 1.70,
Caraka enumerates the different classes thus:

(i) Vanaspati-same as in Manu Āmṛtā
(ii) Vānaspatya-same as Vṛksa in Manu.
(iii) Oṣadhi-same as in Manu.
(iv) Virudha-plants with tendrils; same as gulma,
pratana and valli in Manu.

The verse, composed by Caraka, runs thus:

वन्यपत्तिविविधाः वानपायतःतीलोपनःः।

Caraka Āmṛta-Sūstrāthāna 1.70,

Susruta's classification is like that of Caraka,
with the only difference that Susruta uses the term
Vṛksa in place of Vānaspatya of Caraka'; cp. तासां
स्थायवर्धवलिः:--वनपायतो, वृक्ष: चौरस:; ओषधय: इति।

Susruta Sarhita-Sūstrāthāna 1.29.

The Bhāgavata Purāṇa (iii.10.11-23) enumerates
six different classes of plants:

(i) Vanaspati-Same as in Manu.
(ii) Oṣadhi-same as in Manu.
(iii) Latā-corresponding to Valli of Manu.
(iv) Tvaksāra-shrubs which do not entwine other
plants and look like clumps.
(v) Virudha-trees bearing flowers followed by
fruits.
(vi) Droma-trees bearing flowers followed by
fruits.

The Vāyu Purāṇa again mentions six types of
plants; they are: Vṛksa, Gulma, Lata, Valli, Virudha and
Tṛṇa.

Cp. सूक्ष्म गुल्मलतावलीविस्त्रयतः।

The author of the same Purāṇa has given the
names of seventeen types of grains, born of osadhī
dand again fourteen types of grains of the osadhī class.
(वायु पुराण 8.150-155).

The Vṛksāyurveda (I.1-11) of Parasara
classifies plants into four principal groups; viz. (a)
Vānaspati (plants whose flowers remain hidden) (b)
Vānaspatya (plants which begets visible flowers and
fruits (c) Virudha-Valli (creepers having tendrils) (d)
Gulma or Kṣupa (plants with short branches and roots,
but with no tendril). All these categories have been
described in details in the text and have been further
subdivided.

It is important to note that in modern
classification of plants on the basis of habits, the
following classes are recognised: (a) herbs (b) shrubs
(c) climbers and (e) creepers. This modern
classification is in conformity with the classification
given by Paṛśāra. This author of Vṛksāyurveda also
makes a commendable and successful endeavour to
provided an elaborate system of classification, based
on the morphological characteristics of flowers and
fruits. Actually, the author has enumerated nearly
thirty flowering families (ganīyam) in the text (1.5.64-
92). Sensarma (2003 : 8 ) opines that this effort is
unique and deserves to be critically analysed by the
modern scholars. Sensarma also says that in the
history of classification Carolus Linnaeus (18th
Century A.D.) was the first scientist who developed
a system of classification of plants, primarily on the
basis of their floral characters. [Banerjee Sastri,
2003].

Linnaeus, who made the pompous statement
"God created plants and Linnaeus classified them",
enumerated nearly 7,300 species of plants and
arranged them in accordance with their sexual system of classification. But a few centuries earlier, Parāśara accomplished the marvellous job in the form of enumeration of plant families and their classification on the basis of floral characters and this was no mean achievement.

(b) Classification based on economic uses

Human beings depend on the plants for food, shelter, garments, medicine, fuel and a number of other useful products. With the advancement of human civilization man's dependance on plants increased and efforts were made to identify the plants, having economic uses.

Kauṭilya's Arthaśastra (Kupyādhyaśa Prakāraṇa-2.17.38-4-12) affords a list of various forest produce and categorizes those on the basis of their respective economic uses under the following nine groups:

(i) Sāradāvarga (timber yielding plants)
(ii) Veṇu-varga (group of reeds or bamboos)
(iii) Valli-varga (group of creepers)
(iv) Vakka-varga (group of fibre-yielding plants)
(v) Rajjubhāṇḍa-varga (group of plants constituting raw materials for ropes)
(vi) Patra-varga (plants used for writing upon or as utensils)
(vii) Puspa-varga (plants which yield dye from flowers).
(viii) Auṣadha-varga (group of medicinal plants)
(ix) Viśā-varga (group of poison-yielding plants)

Sensarma (2003 : 9) remarks that 'Kauṭilya's classification of plants is more in line with modern economic botany.'

Caraka classifies the plant products on the basis of their respective food value (Sūrasthāna, 27.4-304):

(i) Śukadhāṇya-varga-Those corns which have husk. These have been subdivided into eleven varieties: e.g., sali, vrhi, yava, godhuma etc.
(ii) Śamidhāṇya-varga-Twelve kinds of corns viz., mudga, māsa etc.
(iii) Śaka-varga-18 varieties of vegetables belong to this class.
(iv) Phala-varga-various type of fruits, having medicinal qualities.
(v) Harita-varga-adrakci (Zingiber officinale), mulaka (Raphanus sativus), Palanduand Lasuna (Allium cepa and Allium sativum) etc. belong to this group.
(vi) Ikṣu-varga-Ikṣu, Varšaka, Guda etc.
(vii) Āhārayogī-varga-Oils of sesamum, mustard etc. belong to this class.

Susruta in his Sūrasthāna has divided plant products into six broad classes, on the basis of their food-value. These are - (i) Śāli-varga i (ii) Kudhānyavarga (iii) Phala-varga (iv) Śaka-varga (v) Puspa-varga and (vi) Kanda-varga [Susruta Samhita, Sūrasthāna, 46.1-52,139-312]

Susruta has classified these plant-products into various sub-divisions and has given an extensive list of such produce.

Classification based on habitat

Parāśara in his Vṛkṣāyurveda (1.2.3-17) has classified the plants into three broad classes on the basis of their normal habitats, viz., (i) jāṅgala (ii) anūpa and (iii) miśra. The classification on the basis of habitats as found in Caraka Samhita (Kalpashāna, 6-9) and Susruta Samhita (Sūrasthāna, 35.42) is exactly the same; but, in these two works the word sādhārana has been used in place of miśra of the Vṛkṣāyurveda.

(i) Jāṅgala (literally means dry place)-this type of habitat is described as a tract almost like a desert with very little vegetation and limited water resources. Caraka says that it is a region of open spaces where a steady and dry wind blows and has few rivers and rivulets. The soil is composed of mainly dry and rough sands.

The Vṛkṣāyurveda and Caraka Samhita has named the plants that grow in this region, viz., khacliira, asana, dhava, tinisa, sallaki, sāla, vadari etc.
(ii) Anūpa (literally means marshy or watery region)-Parāśara states that this type of habitat abounds in rivers, streams and lakes. The soil is clayey. Caraka says that this class of region is very difficult to traverse because of its network of rivers. The land is swept by cold air and there is no mountain in this region. Normally, the following plants abounds in this region: hintāla, tamāla, kadali, vetasa and bamboos.

(iii) Miṣra or Sādhārana (literally means mixed or ordinary or normal)-According to Parāśara, this region is composed of mixed features of jāṅgala and anūpa regions. The soil is grey, red or black; the atmosphere is neither too dry nor too moist. The land is fertile and abounds in various types of trees, herbs creepers and shrubs.

In this connection, it may be mentioned that some purāṇas like Vāmana Purāṇa (85.16-17), Brahma Purāṇa (chaps.36,42,68) etc. enumerate the following plants as jalaja (aquatic): Kahlāra, Kamala, Kumuda etc.

It deserves to be mentioned that in modern plant-science too, plants are classified on the basis of their habitat, as follows:-

(a) Aquatic and wet land dwellers-those which are found in water or in marshy areas.

(b) Terrestrial-those which are found on land.

(c) Xerophytes-those which are found in deserts.

(d) Lithophytes-those which are found on rocks.

(e) Epiphytes-those which are found on treetops.

Classification according to properties

Caraka, in Sūtrasthāna (ch.4) broadly divides the plants into two categories viz., (i) Virecana (purgative) and Kaśāya (Astringent).

According to him, 600 species belong to the first class (Virecana) and 500 to the second (Kaśāya). On the basis of medicinal qualities of plants, Suśruta has divided the entire plant kingdom into 37 classes (gana).

The author furnished a detailed list of the ganas (groups) in the same chapter.

On the basis of taste, the Matsya Purāṇa (217.43-59,62-81) classifies the plants into five following groups (gana):

(i) Madhurāgana (sweet)-jivaka, ṛśabhaka, kakoli, āmalaki, kharjura etc.

(ii) Amalagāṇa (sour)-dĀśima, Āmr Ātaka, amlavetasā, vādari, bhavya etc.

(iii) Kañgagana (pungent)-pippali, cavya, citraka, kuveraka, sarsapa etc.

(iv) Tiktagana (bitter)-musta, candan, haridrā, dūrvā, pātali etc.

(v) Kaśāyagana (caustic)-haritaki, āmalaki, vibhiṣitaka, priyāṇi, arijuna etc.

The Vāyu Purāṇa (78.9-11) divides the plants according to taste into two groups only, viz., kaśāya and madhura (sweet). Sūmāka, hastināma, patola, agastyaśikha etc. are put in the kaśāya group while nāgara, dirghamālaka, sarjika, bhūstrpa etc. are included in madhura group.

It may be pointed out here that in the 18th and 19th century, taxonomists based their classification mostly on morphological characters. In the 20th century, while morphology remained the prime criterion for classification, chemical constituents of plants, palynology, cytology etc. were also regarded as important consideration for classification of plants. It is important to note that in ancient works like Matsya Purāṇa and Vāyu Purana chemical characters like madhura, kaśāya, amla etc. were considered as taxonomical characters.

Morphology

The term 'morphology' means the science dealing with the form and external structure of plants and animals. A few Sanskrit texts mention various external parts of a plant body. Majumdar (1986: 116-117) informs that different parts of a plant body finds mention in the Rgveda at many places. He also states that Atharva-Veda enumerates the following parts of
a plant-root, stem, flower and fruit. The Mahâbhârata enumerates different parts of a plant body in two metaphorical verses (1.1.71-72). The text mentions five different parts of a tree, viz. mûla (root), skandha (trunk or stem), sâkhâ (branch), puspâ (flower) and phala (fruit). The Vishnu Purâna (II.8.37-38) enumerates the following parts of a tree, which originate from the seed of a paddy; all these parts lay in potential state before the sprout comes forth. These parts are-(i) mûla (root), nala (reed or stalk), patra (leaf), ânkura (sprout), kânda (stem), kośa (bud), puspâ (flower), ksira (milky juice or sap), tândula (rice), tuṣa (husk) and kana (grain).

According to Banerji (1980) and Majumdar (1986), systematic accounts of the arts of a plant can be seen in the Taittirîya Samhitâ and Vajasaneyi Samhita. According to these Vedic texts, plants comprise mûla (root), Tûla (shoot), Kânda (stem), valsa (twig), puspâ and phala. Besides these parts, the trees have skandha, sâkhâ and pana (leaf).

The Vṛksāyurveda (1.1.14) of Parâśara mentions the following distinct parts of a plant body-mûla, kânda, patra puspâ, phala, tvak (skin), sara (heart wood), svarasa (sap), niryasa (exudation), sneha (fats and oils), kaṅṭaka (pickle), vija (seed) and prâroha (sprout).

From the above discussion, it becomes clear that various Sanskrit works exhibit different approaches in determining the basic constituent organs of a plant. All the authors of those works, however, think that a plant has the following parts-mûla, kânda, parṇa, puspâ and phala. In modern Botany, a plant is generally thought to consist of a total of five parts-three vegetative parts, viz., root, stem and leaf and two parts connected with reproduction i.e., flower and fruit. Thus, we may conclude that the basic concept about the constituent parts of a plant body, as occurring in Sanskrit texts of ancient India, is still functional.

Anatomy

The word 'anatomy' means the internal structure of animal or plant body. Sensarma (2003: 12) opines that the study of this science advanced to a considerable extent during the Vedic period. The Bṛhadāraṇyaka Upaniṣad (III. 9.28/1-28/3) compares a tree with the human body. The leaves of a tree have been said to be like the skin, the sap like blood, the innermost layer of the bark like the nerves, wood like the bone and the pith like the marrow (of man). Majumdar (1986: 118) observes-"This is indeed far more detailed description than what we get in Theophrastus, who is regarded as the father of plant anatomy". It is heartening to note that our ancient people had such an elaborate knowledge about anatomy of plants much before 17th century A.D. when microscope, the basic tool for anatomical investigation, was invented.

Parâśara, in his Vṛksāyurveda (1.4.27) also gives an elaborate description of the internal structure of a leaf. According to him, the body of a leaf consists of many cells (rasakośa). The cell-wall is fine, transparent (sûkmacchapatraka) and derived from a jelly-like substance (kalalam) through metabolic processes under the influence of heat.

This description is very much in line with the concept of modern plant anatomy. The cell, the cell-wall and the protoplasm (the jelly-like substance) are the structural components of the plantbody.

According to Parâśara, the cell functions as the storehouse of the sap (rasasyâsraya ādhrâśca). The cell sap contains the properties of all the five basic constituents (pancabhautika gunasammanvitaḥ) and colouring matter (ranjakayuktami). Further, the reference to tvak (epidermis), sara (heart wood), svarasa (sap), niryasa (exudation) and sneha (fats and oils), as found in the work of Parasara, indicates the depth of anatomical knowledge.

Plant Physiology

Physiology consists in the science of functioning of living organisms. Banerji (1972: 11) informs that Guṇaratna, in his commentary on 'Saḍdarśanasamuccaya' opined that as human body is nourished by milk and
other articles of food, so also fertile land and water contribute to the nourishment of trees. Want of proper nutrition obstructs the growth and impairs the health of both human body and plant body. Ancient Indian scholars observed that it is with their roots, corresponding to human mouth, that trees take the water and that is why they are called pādapa (that which drinks with foot). The intake of food by the plants, the distribution of food over their different parts; assimilation of food and the vital role played in the matter by wind; these have been beautifully described in the Mahābhārata.

The Vṛṣṇiśvarṇa (1.7.3) of Parāśara also illustrates that the roots absorb the saps of six different tastes from the soil and transport the same to other parts of the plant. The text (1.7.13) further holds that the plant has a circulatory system consisting of syandani (pulsators) and śīra (tubular vessels of the body). They are spread out all over the plant body like a net. Through this system the nutrient fluid goes to all the organs of a plant and is circulated both in the inward and outward direction.

According to present-day plant-science xylem and phloem constitute the vascular system of the plant. Water and mineral salts are absorbed by the roots, which are transported to the leaves through xylem. In the leaves plants prepare carbohydrates with the help of carbon-di-oxide taken from air and water, absorbed by the roots in presence of chlorophyl molecules, which capture energy from sunlight. In the Mahābhārata (Sāntiparva, 178.18) we find:

तत्र तत्रालमाद्वत्त्व जयस्यार्द्धात्।
आःत्तपरिशिला स्तेष्व वृद्धिः जायते॥

The process of photosynthesis has been very nicely illustrated in the present verse. The prepared food materials are transported to different parts of the plant body through phloem. Thus xylem tubes and phloem vessels form a continuous network in the plant body for effective performance of ascent of sap and translocation of food materials respectively. This idea of present-day plant-physiology is exactly in line with the concept found in the Sanskrit text, which is conceived to have been compose several thousands of years ago.

Here we may quote another verse (Mahābhārata, Sāntiparva, 178.16) which even indicates something nearer to Dixon's Theory of transpiration pull of the ascent of sap.

वक्ष्योत्तपलालनोर्त्त्व यष्टोत्त्व जलालमदेव।
तथा पवनसंयुक्तार्त्त् पाद: पितवति पादप॥

[As one draws water up through a lotus-stalk with the mouth, the plant, endowed with air, take water with its feet (roots).]

Consciousness of plants

Right from the Vedic period, our ancient people believed that the plants are living organisms. The Atharvaveda (6.44.1) holds that the trees enjoy sleep while standing: 'अशुरूहा बृहस्पत्यप्रमितादि' The Brhadāraṇyaka Upaniṣad says "Though cut off by somebody, plants shoots forth from the roots as a newly born creature." Even if the plant, being cut off, dies, it again pierces through the seed and is born again." [3.9.284-5]

Parāśara's Vṛṣṇiśvarṇa says-

चक्ष: संझो पवेदत: सुखद:-खसमन्वितार॥

The Manusamhitā also makes similar observation, almost in identical language-

अत:-संझा भवन्ते सुखद:-खसमन्वितार॥

The Bhāgavata Purāṇa also holds that the plants have unmanifested consciousness and they feel pleasure or pain inside. [iii.10.19]

The Māṣya Purāṇa refers to weeping (rodana) and smiling (hasana) of plants as bad omens. 'weeping' is an expression of sorrow and 'smiling' is an expression of joy. Thus the Purana seems to suggest that the plants not only feel pleasure and pain but, they can also express their feelings.

In this connection Majumdar (1986) observes: "Plants have been regarded as living beings since Vedic times. A concise but clear discussion of the
existence of life in plants is given in the Mahabharata. Further evidence is to be found in Guatratna’s commentary on the Sukraniti, Udayana’s Kiranavali, Sanaka Misra’s Upaskara and the Bhagavata Purana.

Conclusion

On the basis of the data presented in the preceding pages, it may be said that Sanskrit texts of ancient India contain a rich treasure of botanical information. We believe, further endeavours will be made by scholars and researchers to bring to light new materials on this subject and other branches of science and this valuable treasure of wisdom will be utilized by future generations for the welfare of mankind.

References:

Sanskrit Works:
15. (1379 B.S.) Vayu Puranam, Kolkata, Navabharat.
16. (1395 B.S.), Kurma Puranam, Kolkata, Navabharat.
17. (1396 B.S.), Vamana Puranam, Kolkata, Navabharat.
18. (1398 B.S.)- Brahman Puranam, Kolkata, Navabharat.
19. (1390 B.S.)-Visnu Puranam, Kolkata, Navabharat.
20. (1395 B.S.)-Matsya Puranam, Kolkata, Navabharat.

English Books: