



Hitherto Unexplored Aspects of Medicinal Plants from Ayurveda and Vrikshayurveda

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Abstract

Ayurveda is the traditional, ancient Indian system of health science. Vrikshayurveda is the ancient Indian science of plant life which deals with various trees and plant species and ensures the healthy growth and productivity. One of its chapters “Chitrikarana” depicts astounding techniques to make a plant bloom throughout the year irrespective of the season and other horticultural wonders to obtain different varieties of yield. The proper interpretation and availability of Vrikshayurveda can also play an important role in the field of intercropping and put forward for the use of organic fertilizers and can play a crucial role to build the ecofriendly environment. Kunapajala, a liquid biofertilizer explained in Vrikshayurveda is of great relevance in agriculture and horticulture. It can be prepared in a cost-effective way by using the raw materials like flesh and bone of animals, husk, oil cakes, dung, and urine of cattle which are easily available around us. The procedure of preparation is easy and economical too, which is an added advantage. A detailed study of Vrikshayurveda would also provide us with information on pest management based on the ecological principles. This paper intends to understand the traditional knowledge, particularly in the light of contemporary research, and demonstrate the value of traditional knowledge for cultivation and harvesting with special reference to medicinal plants. It is hoped that the ancient wisdom coupled with modern technology would benefit the mankind.

Keywords

Traditional conservation · Medicinal plants · Ayurveda · Vrikshayurveda · Kunapajala

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17.1 Introduction

Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and ailments (Sharma et al. 2008). Demand for herbal products is surging in India and abroad. India is the second largest exporter of AYUSH (Ayurveda, Yoga, Unani, Siddha, and Homeopathy) drugs as per Pharmaceutical Export Promotion Council of India (Pharmaexil). There is global resurgence in traditional and alternative health care systems resulting in world herbal trade which stands at US\$ 120 billion and is expected to reach US\$ 7 trillion by 2050 (Ganesan et al. 2016). Cultivation of medicinal plants has become the need of the hour to meet the growing demand of herbal drug requirement in the field of medicine. It is a well-established fact that the pesticide and fertilizers in the form of chemicals may have undesirable impact on the quality of the plants as well as human health (Bhat Savitha et al. 2012). Present scenario is very suitable for the development of the ancient sciences as there is a huge demand for the medicinal plant sciences. Traditional knowledge is vital for sustainability of natural resources including medicinal plants. Of late, there is a revival of interest with herbal-based medicine due to the increasing realization of the health hazards associated with the indiscriminate use of modern medicine. The herbal drug industries are now very fast growing sector in the international market. The focus is on preventive health and especially on medicinal plants. The demand for plant-based medicines, health products, pharmaceuticals, food supplement, cosmetics, etc. are increasing in both developing and developed countries (Sharma et al. 2008). Of late, there has been ruthless exploitation of natural resources and erratic collection practices. For medicinal plants with limited abundance and slow growth, destructive harvesting has led to species extinction. Hence, the collection of drugs with highest pharmacotherapeutic activity is to be planned so that the number of trees chopped off for medicinal purpose is reduced (Chen et al. 2016). Consequently, there has been a resurgence of interest in traditional health sciences.

Ancient India had achieved a level of agricultural technology which is equal to the knowledge in modern times. The seed selection, selection of soil, classification of diseases, management for various diseases, techniques like bonsai, production of seedless fruits, and alteration in fruits and flowers clearly indicate that level of knowledge was high and equivalent to modern agriculture (Shaik Nisar et al. 2017).

The concept of sustainable harvesting and conservation was deeply embedded in the Indian culture. For the people of India, environmental conservation is not a new concept. Historically, the protection of nature and wildlife was an ardent article of faith, reflected in the daily lives of people, enshrined in myths, folklore, religion, arts, and culture. The fundamental principles of ecology—the interrelationship and interdependence of all life—are conceptualized in the Indian ethos and reflected in the ancient scriptural text. Sustainability was ingrained in the thought processes of early Indians as evident from the teachings of Vedas. Sacred groves designated to particular God is an example of traditional practice for plant conservation (Chaithra and Thomas 2017; Kasagana and Karumuri 2011). Many useful plants have been mentioned to have special proximity to a particular God. For instance, Durva

[*Cynodon dactylon* (L.) Pers] is offered to Lord Ganesha and Parijata (*Nyctanthes arbor-tristis* L.) is offered to Lord Krishna. These plants are considered as pious, hence nurtured.

17.2 Method

Ayurveda is perceived as one of the most ancient and well-documented systems of medicine equally relevant in modern times. *Charaka Samhita*, *Sushruta Samhita*, *Bhavaprakasha Nighantu*, *Raja nighantu*, and *Vrikshayurveda* were some of the texts referred for this work. *Acharya Charaka* in *Charaka Samhitha* describes an excellent design of drug research and has given much importance for season of collection along with the place and method of collection (Swagata and Nishteswar 2014).

17.2.1 Drug Research (Ayurvedic Viewpoints)

Bhumipariksha (Selection of land).
Sangrahaniya dravyas (Selection of drug).
Sangrahaniya Vidhi (Method of cultivating).
Sangrahaniya Kala (Time for collection).

Under the heading of *Desha Vichara* (Details pertaining to place) *Kalavichara* (Season and time factor), Ayurveda has emphasized about the collection of raw materials at specific time of plant's life cycle or collection from specific places (Narahari, RajaNighantu) as given in the Table 17.1.

Collection of herbs at right maturity determines the efficacy of medicinal plants. Traditional medical knowledge is bioactivity oriented and informs about best time of collection for certain medicinal species, as observed in case of *Vidari* (*Ipomoea mauritiana* Jacq.). It is interesting to note that the traditionally recommended mature tubers

Table 17.1 Showing the parts of plants and collecting seasons

Sl. No.	Part of the plant specified for therapeutic use	Harvesting season
1.	Flowers	Spring (Vasantha) /Yatharutu (whenever it blooms)
2.	Fruits	Summer/yatharutu
3.	Roots	Summer or in the late winter greeshma, shishira
4.	Leaves and spring (early summer)	Rainy season and spring (early summer)
5.	Branches	Rainy season (varsha)
6.	Bark	Sharad (early winter)
7.	Stem & tuber	Sharad (early winter)
8.	Latex	Sharad (early winter)

of the plant *Ipomoea mauritiana* Jacq. are richer in terms of both their biodiversity and in phytoconstituents than their immature counterparts (Sajjad Khan et al. 2009). Similar case involves the difference between the bioactivity of fresh and dry Brahmi [*Bacopa monnieri* (L.) Wettst.]. Another example of collection as mentioned in the classical texts of Ayurveda is about turmeric (*Curcuma longa* L.) whose rhizomes for therapeutic purposes are collected at night time. Preliminary studies indicate that the turmeric collected at night was significantly more bioactive than that collected during the day (Venkatasubramaniam et al. 2007). In contrast to the above, unripe Bilwa [*Aegle marmelos* (L.) Correa] is to be collected as unripe fruit as it has higher tannin content and acts as *stambhaka* (binding agent), whereas ripened *Bilwa* fruit has higher amount of mucilage and sugar and acts as a mild laxative (Dwivedi 2012).

There are numerous examples to substantiate this view point. In the immature plant of *Datura stramonium* L., the ratio of hyoscyne and hyoscyamine is 80:20 and in mature plants it is 20:80 (Miraldi et al. 2001). Similarly, morphine is highest in opium plant 2–3 weeks after flowering. The total alkaloidal contents of Guduchi [*Tinospora cordifolia* (Willd.) Miers.] satva are slightly higher in rainy season and spring while the minimum yield was obtained in Grishmarutu (Summer) (Sharma et al. 2013). The leaves of Parijata (*Nyctanthes arbor-trisis* L.) should be collected in VarshaRutu (rainy season). The leaves show that loss on drying was minimum when they are fully grown. Daily fluctuations were also seen in the essential oil of wild basil herb, or *Ocimum gratissimum* L. (Lamiaceae), where levels of eugenol in the essential oil were observed to drop from 98% at 12 a.m. to 11% at 5 p.m. (Shah and Goyal 2017).

In yet another study on the antidiabetic and hypolipidemic effects of *Momordica charantia* L. fruit extract, it is observed that the highest activity was with spring sample, followed by the summer sample (Kolawole and Ayankunle 2012).

17.2.2 Relevance of Traditional Advice

Pippali (*Piper longum* L.) is a widely used Ayurvedic medicinal plant. For therapeutic purposes Pippali has been used as Ksheerapaka (Milk decoction). It has been observed that the brine shrimp bioactivity studies indicate that the milk decoction is 27 times more effective than the aqueous extract (Venkatasubramaniam et al. 2007) which justifies the practice of traditional methods of preparation. Similarly, the drug Kupilu (*Strychnos nux-vomica* L.) which is a poisonous drug is purified by pretreatment with milk. There has been a reduction in the toxicity by tenfolds upon detoxification of seeds and this is well correlated with the fact that the alkaloid content reduces with detoxification, which further influences the toxicity (Kolawole and Ayankunle 2012).

Yet another interesting fact is about the recommendation of the use of Musta (*Cyperus rotundus* L.) instead of Ativisha (*Aconitum heterophyllum* Wall. ex Royle) in Ayurvedic classical texts. Ancient texts have mentioned them as substitutes in spite of having no botanical similarities. However, it is interesting to know that high performance liquid chromatography (HPLC) has revealed that they have similar chemical profiles (Venkatasubramaniam et al. 2007).

17.2.3 Desha Vichara

Acharya Sushruta has emphasized on “*Bhumi Pāriksha*” (Examination of the cultivated land) in the context of collection of medicinal plants. The effect of ecological conditions on properties of plants has been subtly conveyed by *Acharya Charaka* who states that plants from Himalayas are qualitatively better than those of Vindhya Mountains. The concept of *Vanya* (wild) and *Gramya* (cultivated) varieties of some medicinal plants like *Masha* (*Vignamungo* (L.) Hepper) mentioned in *Nighantus* (lexicons) possess different medicinal properties and it reveals the effect of eco-sphere on the plants) (Agnivesha 2014). There are innumerable practical examples to support this view. For instance, the Neem plant (*Azadirachta indica* A. Juss) collected from dry, hot, and arid habitat is considered to be more potent. Tinnevely Senna from Southern parts of Tamil Nadu (India) has higher concentration of alkaloids than others. *Yashtimadhu* (*Glycyrrhiza glabra* L.) cultivated in Afghanistan is better than North Indian sample (Kokate 2008).

17.3 Relevance of Vrikshayurveda

Ancient texts contain many descriptions of the uses and management of forests and highlight sustainability as an implicit theme. Treatise called *Vrikshayurveda* mentions in depth about the plants, its importance, diseases suffered by them, treatment, protection from external factors, increasing the yield, conservation techniques like protection of plants from mist, pests, etc.

Vrikshayurveda is an ancient science of plant life consisting of the details of about 170 different plant species including herbs, shrubs, and trees. The different chapters of *Vrikshayurveda* deal with agri horticulture, home gardening, intercropping, and storage and conservation (Srikanth et al. 2015).

The chapter “*Chitrikarana*” depicts astounding techniques such as to make a plant boom throughout the year irrespective of the season brings forth premature maturity to plants and fruits and change the shape and form of fruits. For instance, the seeds of pumpkin (*Cucurbita maxima* Duchesne) when processed with fat of animals and planted yield big-sized fruits without seeds (Surapala 2010).

Sl. No	Yield	Recipes
1.	Beejarahitaphala (seedless variety)	Application of paste of <i>Yastimadhu</i> (<i>Glycyrrhiza glabra</i> L.) and <i>Kusta</i> [<i>Cheilocostus speciosus</i> (J. Koenig) C. D. S pecht], <i>Madhu pushpa</i> (<i>Madhuca indica</i> J. F. Gmel.) and Sita (sugar) to the roots of the plant)
2.	AkaleKusuma (to obtain unseasonal flowering)	Application of ripened sugarcane juice to the root of <i>Vidarikhanda</i> [<i>Pueraria tuberosa</i> (Willd.) DC.]
3.	To obtain fragrant flowers	Application of sandalwood (<i>Santalum album</i> L.) and fumigation with ghee to the roots
4.	To obtain flowers and fruits early	Fish, fat and meat of pig is triturated with kshara (alkali) of <i>Chanaka</i> (<i>Cicer arietinum</i> L.)

Sl. No	Yield	Recipes
5.	To have perennial fruits	Mango (<i>Mangifera indica</i> L.) seed is triturated with rabbits blood and washed with milk
6.	To obtain big-sized radish	Bones of cow and pig along with the cow dung are burnt and filled into a pit and radish is grown there
7.	To obtain sweet neem fruits	Application of the paste of <i>Vidanga</i> (<i>Embelia ribes</i> Burm. f.) <i>Yastimadhu</i> (<i>Glycyrrhiza glabra</i> L.) honey, milk and jaggery to neem tree (<i>Azadirachta indica</i> A. Juss) and wash with milk and water

Drumaraksa is the chapter which deals with several advices to save plants and trees from the weather and other conditions like winds and storms. It also tells about the medicinal plants used on the broken branch to protect the whole tree from dying. Use of powders of *Solanum indicum* L., *Sesamum indicum* L., *Embelia ribes* Burm. f., and *Brassica juncea* (L.) Czern., milk, ghee, and cow dung has been mentioned in almost all the texts for protection during storage (Surapala 2010; Geetha Suresh 2013). In addition to pretreatments applicable to all seeds in general, treatments specific to particular plants also have been described. Various seed priming processes have been carefully designed in Vrikshayurveda to allow early germination, to obtain good quality of seedlings by following the classical techniques. A study conducted to compare the effects of Vrikshayurveda and Modern cultivation techniques on germination of *Bakuchi* [*Cullen corylifolia* (L.) Medik.] has revalidated the germination behavior of dormant seeds when treated with milk overnight and shade dried, kept in paste of *Brihati* (*Solanum indicum* L.), *Tila* (*Sesamum indicum* L.), *Kamala nala* (*Nelumbo nucifera* Gaertn.), and ghee as compared to control (treated with water) and standard groups (treated with sulfuric acid) (Gangadhar et al. 2016).

For nourishment of plants, use of a biofertilizer called “*Kunapajala*” has been mentioned. *Kunapajala* is a natural organic product derived from animal and plant products containing a significant quantity of one or more of the primary nutrients like nitrogen, phosphorus, and potassium which are necessary for plant growth. The literary meaning of the Sanskrit word *Kunapa* is “smelling like dead or stinking” and the name is apt for the liquid manure which is prepared using excreta, bones, body, flesh and marrow of animals, fish, decayed plant products, etc. *Kunapajala* has some plant growth regulatory actions through which it enhances the overall growth of plants. Being a liquid biofertilizer it is more suitable form of manure and can be beneficial in growth of medicinal plants with probably minimal toxic effects on human body when compared to chemical fertilizer (Mridula Chaturvedi and Chaturvedi 2017).

The other important micronutrients are magnesium, calcium, zinc, manganese, copper, iron, and selenium which are also supplemented by the organic compost *Kunapajala* (Bhat Savitha et al. 2012). Researchers suggest that application of the principles of Vrikshayurveda like *Kunapajala* does produce phenomenal and interesting results. Since few research works have been carried out, this discipline of science needs to be developed through concerted research efforts to ascertain its utility.

Though, chemical fertilizers increase the yield, they pose certain serious health threats to human beings, especially infants and pregnant and nursing mothers. Another concern for health is contamination of medicinal plants with toxic heavy metals like mercury, lead, and cadmium, through fertilizers, harmful industrial wastes contaminating the water sources, etc. In contrast, organic manures are considered to be safe and yielding good product by improving water penetration, water holding capacity, improvement in soil structure, microbial biomass, nutrient availability, drought, and heat stress resistance. It also helps in improving the soil pH which has an impact on plant growth and soil microbial activity (Vermeer et al. 1998). Studies using Kunapajala for growing Senna have shown that the total Sennoside content per plant was more. Similarly, for *Langali* (*Gloriosa superba* L.) the active principle (methanol extract) Colchicine was found in higher amount. When Kunapajala was used for *Vrntaki* (*Solanum melongena* L.), it produced large number of branches, higher yield, fruits with lesser seeds, and lower susceptibility to diseases, when compared with plants grown with artificial fertilizer. Similarly for mango, coconut, chilly, paddy, vegetables, etc. similar results have been found (Bhat Savitha et al. 2012). Thus, Kunapajala by virtue of its behavior as growth regulator has been effective in increasing the leaf area, yield of flowers and fruits as well as phytoconstituents.

Some major centers carrying out Vrikshayurveda-related work are Centre for Indian Knowledge Systems (CIKS, Chennai) (Balasubramanian et al. 2003), Asian Agri-History Foundation (AAHF, Secunderabad), and National Institute of Vrikshayurveda; Jhansi. Prof. Nene and his group at the AAHF are promoting Vrikshayurveda in a big way. CIKS, Chennai, is involved in promoting organic farming and works along with farmers belonging to various villages in Tamil Nadu. They are also involved in testing and validation of indigenous knowledge of agriculture by rapid assessment of traditional agricultural practices (Suresh et al. 2017). As a result of their experiments, as well as that of Indian Council of Agricultural Research, using the modern research procedures, it has been proved that the traditional knowledge is valid beyond doubt (Balasubramanian et al. 2009).

17.4 Road Map for Future

There are numerous recipes in Vrikshayurveda which awaits authenticity and validity. Some of them are listed below

- Combination of Sesame, Turmeric, and Yava (*Hordeum vulgare* L.) are to be added to the roots of Cotton plant, and decoction prepared from these drugs is added to obtain red colored cotton.
- Similarly, the drugs like *Shalmali* (*Bombax ceiba* L.), *Nisha* (*Curcuma longa* L.), *Neeli* (*Indigofera tinctoria* L.), *Triphala* (Combination of three drugs—*Terminalia chebula* Retz., *Terminalia bellirica* Wall., *Phyllanthus emblica* L.), and *Kushta* [*Saussurea costus* (Falc.) Lipsch.] when added along with medicated wine to the cotton plant root, it yields green cotton.

- By addition of sugarcane juice to the roots of any tree and smearing sugarcane juice to the cut shoots, it flowers and bears fruits in off season too.
- If the bones of the pig ones are nailed into the shoot of any tree, the tree does not die.
- If the seeds of pumpkin (*Cucurbita pepo* L.), brinjal (*Solanum melongena* L.), etc. are processed with fat of animals and planted, one can expect big-sized fruits without seeds. (Similarly many such recipes are mentioned for increasing the yield or improving the size of fruit which can be explored with the help of allied sciences like biotechnology and genetic engineering (Surapala 2010).

17.5 Conclusion

The use of *Pañcagavyam* (combination of cow dung, cows urine, milk, ghee, and curds), *Kuṇapajala*, and other procedures mentioned in the various texts can be studied further for efficacy, and if found to be suitable, they can be adopted for the various steps involved in development of organic nursery protocol for medicinal plants. Chemical fertilizers show dramatic short-term benefits, but, in the longer run they adversely impact the soil, water, and perhaps the nutritional quality of the plants. Hence, there is great scope to integrate traditional practices for better productivity of quality planting materials. Ayurvedic literature recognized the role of multidisciplinary approach and emphasized on integration of diverse fields as potential tool for development of medical science. It is hoped that ancient wisdom coupled with modern technology would benefit the mankind.

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