

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/262413780>

Good Agricultural and Field Collection Practices for Medicinal plants: Retrospect and Prospect

Chapter · March 2014

CITATIONS

2

READS

1,706

6 authors, including:



Narayanam Srikanth

Central Council for Research in Ayurvedic Sciences

1,035 PUBLICATIONS 2,018 CITATIONS

SEE PROFILE



N. Haripriya

University of Delhikrishna veni junior college, vijawada, andhra pradesh

11 PUBLICATIONS 33 CITATIONS

SEE PROFILE



Anupam K Mangal

Central Council for Research in Ayurveda & Siddha

136 PUBLICATIONS 1,025 CITATIONS

SEE PROFILE



Madan Mohan Padhi

Central Council for Research in Ayurvedic Sciences

193 PUBLICATIONS 1,342 CITATIONS

SEE PROFILE

Good Agricultural And Field Collection Practices For Medicinal Plants: Retrospect And Prospect

N.Srikanth, N.Haripriya, A.K.Mangal, Bishnupriya Dhar M.M.Padhi and Abhimanyu Kumar

The science of cultivation and harvesting is not the legacy of modern science at least in India. Ancient educational system or ashrama traditions carving out of wild and natural forests with preservation of trees and herbs of diverse values indicates the tending of plant sciences. Survival of living beings depends on the harmonious functioning of bio-ecological factors where in the role of 'producers' is pivotal being the sustainable source of supply of nutrients (ahara) and medicines(oushadhi). Plants form the major source of medicines meeting most of health needs of humanity since ages. Ancient India recognized the importance of conservation, developed cultivation, collection methods of plant bio-resources and their rational use for health promotion and of therapeutic purpose. Furthermore the primeval classics of India laid emphasis on comprehension of plant taxonomy, classification of soil , relevant practices of cultivation viz. selection of soil, plant propagation techniques (through seeds, roots, cuttings, apical portions etc.), plant nourishment, plant diseases and their management .

International communities have shown over the time to delve into the works of ancient Indian scholars. Sir Monier Williams writes in the Introduction to his Sanskrit-English dictionary (1899), “The Hindus have made considerable advances in astronomy, arithmetic, botany, and medicine, not to mention superiority in grammar, long before some of these sciences were cultivated by the most ancient nations of Europe. Hence, it has happened that I have been painfully reminded during the progress of this dictionary that a Sanskrit lexicographer ought to aim at a kind of quasi-omniscience.” Such remarks are not just a consequence of superficial studies but methodological analysis that has resulted in unearthing of the length, breadth and depth of knowledge that existed in ancient India.

Owing to generation of greater interest and increased demand towards the 'natural and traditional holistic systems of healing' in recent times, it is the juncture to develop appropriate methodology of cultivation and harvesting of medicinal plants by integrating the knowledge of traditional and contemporary sciences which consecutively aid in sustainable supply of quality assured plant drugs, besides their conservation.

Introduction

A resurgence of interest in Ayurveda and other traditional systems of medicine has resulted from the preference of health seekers towards holistic approach and products of natural origin. About 80 % of population in India utilizes AYUSH and LHTs (Local Health Traditions) to help meet their primary health requirements. (Anonymous, 2008; Anonymous, 2009; Ritu Priya *et.al*, 2010). India is having the world's richest flora, comprising of about 120 families of plants, comprising 1,30,000 species. Ayurvedic texts cover about 2000 species of plants with their medicinal uses as described by ancient Indian medical scholars. About 10,000 herbs are used worldwide for medicinal purposes (table-1)

With a this renaissance of utility of Indian Systems of medicine, there is an increasing need to refer to not just the profile of the ingredients but to satisfy the consumer that safety and efficacy of the drugs has indeed been established. Though animal and mineral sources comprise a part of drug source, plants represent the major resource traditional systems. Quality assurance is the pivotal aspect for the development of these systems and major challenge being the availability of raw plant material satisfying specific protocols cited traditional classical literatures and also fulfilling present-day scientific benchmarks. Adding to this, certain medicinal plants reported as endangered or extinct.

Table-1 Evolution of Indian pharmacopeia

Period	Approximate number of Plants	Remarks on changes	Literature
3000 BC - 1000 BC	289	Building of the Pharmacopoeia (Atharvaveda)	Vedic texts
1500 BC - 500 AD	650	Incorporation / discarding drugs	Ayurvedic Texts <ul style="list-style-type: none"> • Charaka Samhita • Sushrut Samhita • Astanga Samgraha
500 AD- 1900 AD	2000	Incorporation / discarding drugs Varieties identified Substitutes identified Expansion in applications	16 major Nighantus (like Dhanvantari Bhavprakash, Raja Nighantu upto Shaligram Nighantu)

Biodiversity

Global and country scenario: Medicinal plant biodiversity is the natural biological capital of the earth. Its conservation and sustainable management is of pivotal importance. Medicinal plants are important components of natural resources and are currently recognized throughout the world. An estimated 30,000 species fall into this group. Around 90% of the species are used by the people in the ecosystem and 10% of the medicinal plants are in the national and global trade. Around 70% of the world's known plants are found in tropical forests. The remaining 30% are found in temperate, alpine, and high-altitude vegetation. India – with varied bioclimatic. Altitudinal, edaphic zones and other accompanying micro-climatic conditions-nurtures rich and diverse flora. It has a unique combination of habitats and ecosystems, which together makes it a diversity-rich country in the world and is fortunate enough to be ranked sixth among the seventeen mega biodiversity countries. The total number of plant species in India is estimated to be about 45,000. 17,500 flowering plants, 64 gymnosperms. 2843 bryophytes, 1012 pteridophytes, 1940 lichens, and 21,600 fungi.

According to some studies out of about 9500 species in the country, 7500 are used for medicinal purpose by traditional systems, local health traditions and folk healers, while 3900 for edible use, 700 for other material & cultural requirements, 525 as fiber and cordage, 400 as food material, 300 as pesticides, etc., 300 plants yield gum, resin & dye and about 100 species forms base for perfumes. In terms of the use of plant material and traditional medicine, it is estimated that local communities used over 7,500 species of plants. (Gangadharan G.G 2000)

Conservation and cultivation practices in ancient India

Natural Recourses are part of the sum total of conditions under which humanity exists, a major component of its environment used in the process of production to satisfy society's material and cultural needs, that includes vegetable and animals recourses along with other sources of earth like water, minerals and etc. It is generally recognized that the conservation of nature is society's efforts to secure the rational exploitation, conservation and renewal of Natural resources.

Conservation of nature calls for the optimization of the relationship between society and the environment. Measures to conserve and improve the environment, rationally use and renew natural recourses are worked out and implemented with the purpose of such optimization. Recognizing the significance of plant bio-resources of varied values in ancient India, emphasis has been laid on conservation of flora. *Rigveda*, (5000 BC.) the oldest source of Indian knowledge says 'be gracious to forests enriched with medicinal plants

Sham Na Oushadhirvanino Bhavantuh -Rig-Veda , VII.35.5

While *Vriksha Ayurveda* (a component of *Agnipurana*, one of the oldest epics of India), -a dedicated text on Agricultural Science signifies the conservation of plants and utmost importance has been attributed to plantation- equating ten human lives with a single plant (Table-2). The original Sanskrit verse runs as follows

*Dasa Kupa samo Vapi-Dasa Vapi samo Hridah/
Dasa Hrida samo Putrah-Dasa Putra samo Drumah//*

- *Vriksha Ayurveda*

Table-2. Importance of Plant Bio Resources and Conservation

10- Wells	=	1 - Tank
10- Tanks	=	1 - Lake
10- Lakes	=	1 - Child
10-Children	=	1 - Plant

Later in 20th century several efforts have been made in regarding conservation of resources and plants at the first All-Russia Congress for Conservation of Nature, held in 1929 and in the First Intergovernmental Conference of Experts on Scientific Basis for the Rational Use and Conversation of the Recourses of the Biosphere (Paris) in the year 1968 and so on (L.P. Astanin and K.N. Blagosklonov, 1978).

Taxonomical perception on cultivation and collection practices

Ancient Indian literatures on medicine, agriculture, philosophy, religion, law etc provide vast knowledge and information on classification of plants based on morphology, physiology, therapeutic use, fruiting and flowering patterns etc. and several times the cultivation and collection practices are specific for different variety of plants under such classification.(Table -3 to Table-6)

Table -3 Plant Taxonomy-Charaka's and Sushruta's Classification

Type	Description
1. Vanaspathi	Trees bear fruits with out flowers eg. <i>Udumbara</i> (ficus species)
2. Vanaspathyas or vriksha	Trees bear flowers and fruits eg. <i>Udumbara</i> (ficus species)
3. Oushadhis	Wither away after fructification
4. Virudhs	Creepers and shrubs

Table -4 Plant Taxonomy- Panani's Classification

Type	Description
1. Vanaspathi	Trees in natural forests and cultivated grove of trees
2. Oushadhis	Trina and Dhanya (Grasses and crops)

Table -5 Plant Taxonomy- Upavana Vinoda 's Classification

Type	Description
	Fruits without flowers
Drumas	Produce fruits and flowers
Latas	Creepers
Gulmas	Spreads several branches a little above ground

Table -6 Plant Taxonomy- Manu 's Classification

Type	Description
Vanaspathi	Fruits without evident flowers
Oushadhis	Wither away after fructification
Vriksha	Produce flowers alone and fruits alone
Gulmas	Shrubs-Spreads several branches a little above ground- Nerium
Guchas	Bushy shrubs –Jasmine
Trina	Grasses
Pratanas	Creepers spreading on the ground
Vallis	Twin and climb around other tree for support

Good agricultural and field collection practices in ancient India

Systematic and detailed scientific documentation on 'Good Agricultural and Field collection Practices, encompassing major issues like- selection of the soil, plant propagation methods, irrigation and watering methods ,plant nourishment, plant diseases and management etc. can be traced back from aboriginal classics of India viz *Rigveda Atharaveda, Vriksha Ayurveda, Agnipurana, Satapatha Brahmana, Brhat Samhita, Vishnupurana ,Panaini Vyakarana, Amarakosa ,Upavana vinoda, Krishi prasara,, Ramayana* and so on.

Alongside, the protocols and methodology on crucial issues determining quality and efficacy viz. soil suitable for cultivation and collection of drugs,

proper identification, period of collection, seasons for collection, parts used, preservation methods etc. have been detailed in Ayurveda Siddha & Unani (ASU) literatures viz. *Charaka Samhita*, *Susruta Samhita Bhavaprakasha*, *Sarangadhara Samhita* etc. For instance, plants should be collected from a clean place with good soil; herbs grown in dirty places, marshy land and in places near burial ground should not be taken and those infected with worms and affected by fire/snow should also be avoided. In general, the science of Ayurveda advocates *Sharad Ritu* (i.e. October and November) as the best season for the harvesting of herbs for therapeutic purpose.

Further particular part of the plant in a particular season will possess more active principles such as roots in summer or in the late winter, leaves and branches in rainy and spring (early summer) seasons as the leaves and branches are at their fresh & healthy state and contain an optimum of the products of the plant metabolism and one can obtain most desirable therapeutic action. Flowers and fruits were said to be auspicious in spring season or they may be collected accordingly. The bark, stem and latex were said to be the best in early winter (*Sharad Ritu*) (*Charakasamhita*, *Kalpasthana* -1/10, 1976, 1977, 1988) (Table -7 to Table -9)

Physiological & phyto-chemical basis of harvesting (season, time and place)

The usual time of collection of leaves is when the flowers are beginning to expand, or flowering just arriving just at its height. At this time it is rational to assume that the leaves are in the healthiest state and contain an optimum of the products of the plant metabolism and one can obtain the most desirable therapeutic action. As moisture decreases the constituents, they are collected in dry weather.

Collection of flowers must always be made in fine, dry Weather. Collection of flowers must always be made in fine, dry Weather, because the petals which are damp when gathered become badly discolored during drying. Roots & Rhizomes are usually collected when their tissues are fully stored with reserve foods, it being assumed that medicinal constituents will be almost abundant during this season. In temperate regions autumn is therefore the season for collection. The time of collection of Bark is usually spring or early summer, when the sap is rising in the stem and the Cambium is active and therefore, more easily torn than at other seasons.

Soil selection

The soil provides three essentials to all plants; a firm foothold and water. Hence knowledge of the soil-its surface configuration, general natural fertility and supply

**Table-7 Field Collection Practices –
Harvesting Season for different parts of the plant**

Part of the plant specified for therapeutic use	Harvesting Season
Flowers	Spring
Fruits	Spring
Roots	Summer or in the late winter
Leaves	Rainy season and spring (early summer)
Branches	Rainy season and spring (early summer)
Bark	Early winter
Stem	Early winter
Latex	Early winter
Harvesting in general	Early winter

Table-8. Field Collection Practices –Potency of Drug

Potency of Drugs	Season of collection	Prescribed province for collection
<i>Sita Virya</i>	Winter	Himalayan province
<i>Ushna Virya</i>	Summer	Vindhya province (Central part of India)

Table-9. Field Collection Practices –Therapeutic use

Intended Therapeutic Use of Drug	Season of collection	Type of Soil
Therapeutic induction of Purgation (<i>Virechana</i>)	Spring	Dry, white /Gray ,Hilly areas.(<i>Agni and Akasha Desha</i>)
Therapeutic induction of Emesis (<i>Vamana</i>)	Spring	Black soil,enriched with Big trees and,herbs and grasses (<i>Parthiva Desha</i>) & Marshy,Watery soil, enriched with small trees.(<i>Jaleeya desha</i>)
Nasal (<i>Nasya</i>) administration of drugs		
Rectal (<i>Vasti</i>) administration of drugs		
Other palliative therapies	Winter	Black soil ,Hilly areas. (Akasha Desha)

of water had been closely observed by our ancients. Hence they prayed, in general, for regions that are fertile and yielding abundance. (Rigveda .1.125.5,1986; and Yajurveda, Verse 18-1970) Extensive information on scientific classification of soils based on geography, morphology, availability of water sources, rainfall, color and morphology, nature of general resources, type of native flora etc. The role of each variety of soil in collection ,cultivation of raw materials for therapeutic purpose can be traced from ancient medical and non-medical literatures of India (Table-9 to Table-12).

Table-10 . Classification of the Soil -Soil variety Vs Fertility

Soil Color	Taste	Properties
Black (Asita)	Sweet	Most Fertile
Off White (Vipandu)	Sour	Less Fertile
Blue (Syamala)	Salty	Relatively Lesser Fertile
Red (Lohita)	Bitter	In-Fertile
Yellow (pita)	Astringent	Relatively Infertile
White (Sita)	Pungent	Relatively Lesser infertile

Table-11. Classification of the Soil –Bio-Geographical perspective

Elemental Composition of Soil (Pancha Maha Bhuthas)	Soil Nature	Color	Vegetation
Prthivi	Pebbly	Dark blue Or black	Rich vegetation
Jala	Unctous, Cool	white	Grass
Agni	Stony	Multicolur	Small sized trees
Vayu	Rough	Grey	Small trees
Akasa	Soft	No colour	Trees of no value

Table-12 . Soil selection for specific crops in Ancient India

Crops	Lands (Soil)
Vrihi (Corn)	Vraiheya
Sali (Rice)	Saleyam
Yava (Barley)	Yavyam, Yavakyam
Tila (Seasamum)	Tilam, Tailinam
Mudga (Grains)	Maudginam
Kudra (Pulases)	Kaudravinam

The above classification of soil brings out the fact that in ancient India soils were classified based on vegetation of plants of medicinal and economic value, The fertility of soils were also taken in to account to avoid infertile land and choose soil correctly for growing plants and crops.(Upavana Vinoda; Verse-46). Fertility is the main criterion for classifying the soil. The Vedic people divided the soil mainly into three varieties (Table-13).

Table-13. Vedic Classification of soil based on fertility factor

Type of Lands (Soil)	Reference
Urvara (fertile)	Rigveda I.127. 6; IV.41.6; V.33.4;VI.25.4; X.30.3; Atherva veda V. X.6.33; XIV.2.14;
Anurvara or usara (sterile)	(Satapatha Brahmana II.1.1.6.).
Dhanva -The sandy desert is referred to an dhanva.	(Rigveda .1.116.4.)

Propagation protocols

In ancient India Plants have been propagated scientifically by experts in numerous ways. Several Propagation techniques have been developed and adopted by scholars as endorsed by authentic liter tures viz. *Rigveda*, *Sathapatha Brahmana*, *Brihat Samhita*, *Kautilya's Artha Sastra*. A variety of methods including seed collection, seed treatment, sowing of seeds etc. have been described in detail. This reveals the vast knowledge and in-depth understanding of plant propagation methods by Indian scholars. The following are major techniques developed and practiced in ancient India. (Table -14)

Table-14 . Major Plant Propagation methods in Ancient India

Plant Propagation Methods	Interpretation	References
Bijaruha	By Seeds -seed collection methods - seed treatment - sowing of seeds	<i>Sathapatha Brahmana VI.6.3.1</i> <i>TaithariyaSamhitaVII.2.10.2.</i> <i>ManasollasaV7.8</i> <i>Upavana vinoda V.V51-53</i> <i>Bhrit samhita 5.24-26</i>
Mulaja	By Roots	<i>Kautilya 's Artha SastraII.24</i>
Kandyaropya and Skandhaja	Cutting and grafting	<i>Kautilya 's Artha SastraII.24</i> <i>Upavana vinoda 45-46</i> <i>Bhrit samhita -55-4-5</i>
Agrabija and parna yoni	Apical portions and leaves	<i>Upavana vinoda 57-70</i>

Plant nutrition

It is suggested that for increasing the yield of flowers and fruits of trees, creepers and shrubs, they should be sprinkled always with a mixture of two adakas (128 palas) of the powder of droppings of goat and sheep. One adhaka of sesameum, a prastha (16 palas) of wheat, a tula (100 palas) of beaf and a drone (256 palas) of water kept for seven nights. Kasyapa also gives identical proportion of the ingredients but recommends that water added the should be $2^{1/2}$ times the volume of dry ingredients. This fermentation process achieves two objects breadding down of proteins into available from usable directly by the plants, the destruction of pathogenic bacteria.

Phyto-pathology and management protocols

References to the Science of phyto-pathology (The sciences of treatment of diseases caused by micro organisms and infects and animals (pathogens) on plants) can be traced back to *Vedic* period.(Rigveda -V.54.6,1986). It mentions a worm called kapana that destroys the leaves of trees *kapana*h means creeping, ie. Worm.Destruction of corns by various kinds of reptiles and vermins such as upakvasa, (Abnoxious insect), jobhya (Snapper), Tarda (borer), Vyadvarah (Rodents, Samarika (hook), the mole and some other, is referred to in Atharva veda (Atharva veda -verse VI.50, 971)

Scientific Evidence Base

Ancient Indian knowledge

Several scientific studies have been conducted to find out influence of several factors viz. time, season, place of collection, harvesting etc in relation to Phyto chemistry and clinical efficacy. These studies endorse the soundness of concepts of ancient scholars.

- Enriched fraction of valepotriates in underground pats ranged from 2.0 to 5.6%. Enriched fraction of valepotriates was significantly higher during January, October and November (5.4, 4.7, and 4.9% respectively). Essential oil in the underground parts ranged from 0.1 to 0.5% and was significantly higher during March to June (0.3-0.4%) attaining its peak in June (0.4%) Estimate of yield of enriched fraction of valepotriates indicated that November or January is the ideal time to harvest V. Jatamansi for enriched fraction of valepotriates production, while May is appropriate harvesting time for production of essential oil in western Himalayan region in India. (R.D. Singh, *et al.* 2010).
- Analytical determination by HPLC of five taxanes -paclitaxel, cephalomannine, 10-deacetylpaclitaxel, 10-deacetylcephalomannine

and taxcultine-in extracts from the bark of *Taxus Baccata* indicates that taxane concentration vary seasonally. The highest concentration was found in October and the lowest in January for all taxanes examined. (Daniela Vesela, *et al.* 1999).

- Phytochemical estimations has been carried out for the different plant parts viz. apical bud (AB), mature leaves (ML), stem (ST), whole plant (WP) and flower (FL) of *Calotropis procera* (Ait) R. Br. Whole plant includes only aerial plant parts. The effect of season is not uniform for all the phytochemicals or for all the organs investigated. This is perhaps due to the fact that the different organs would obviously have different physiology and different functions. Protein was at its highest in summer in all the organs but in flowers more pronounced. Next to protein were the carbohydrates. Once again most plants parts exhibited highest carbohydrate concentration in summer. Tannin, in general, is present in low amount as compared to other phytochemicals except phenol, however the apical bud showed highest concentration of tannin, in monsoon samples and stem was highest in tannin during summer. Phenol, just like tannin, was also reported to be low in this taxon. This apical bud showed higher concentration of phenol in winter. Fixed oil was also in higher concentration in apical bud and was not susceptible to seasons. (Falguni SHETT)
- Treatment with methanol extracts of *Momordica Charantia* caused a significant ($p < 0.01$) and dose-dependent changes with respect to blood glucose level and lipid profile in all the four samples, when compared with the untreated animals. The highest activity was observed with spring sample, followed by the summer sample. Autumn and winter samples have more or less similar but lesser effects than summer sample. The results of this study showed that anti-diabetic and hypolipidemic effects of *Momordica charantia* fruit extract vary during different seasons of the year. The spring sample produced the highest activity. This suggests that the active principles in *Momordica charantia* fruit that are responsible for its anti-diabetic and hypolipidemic activity vary in quantity and/or during different seasons of the year and reach the peak during spring (O.T. Kolawole, *et al.* 2012)

Development of guidelines on GAP and GFCP

Global and country scenario

There is a growing recognition, nationally and internationally, of the need for

incorporating the contributions of these systems of health knowledge into the dominant one to meet the limitations of modern medicine. The relevance of traditional medicine is seen in the context of promoting ecologically sensitive life patterns and technologies conducive to local natural conditions, and because people's preferences and use of Traditional Medicine show the impact, its various forms have on their well-being. The current guidelines such as WHO Guidelines on Quality control methods for Medicinal plant materials; Guidelines for methodologies on Research & Evaluation of Research of Traditional medicine, Good Agricultural and Collection Practices etc., have provided immense support and guidance in this field. Besides this, commendable efforts have been made by National Medicinal Plants Board, Department of AYUSH, Ministry of Health and Family Welfare, Government of India and issued Guidelines on Good Agricultural Practices and Good Field Collection practices for Indian Medicinal Plants in particular. (WHO Guidelines 2000, 2003, 2007, 2009; Anonymous, 1998)

Conclusion and way forward

In view of current day demand, it is the juncture to develop and validate the integrated protocols & methods of cultivation & field collection, amalgamating the basic concepts of ancient Indian knowledge with contemporary sciences, tools and technological advancements such as agricultural sciences, soil sciences, phyto-chemistry etc.

- **Promotion of mass cultivation: need of the day:** Despite, the availability of quality raw drugs with desired Pharmacognosy, chemical and biological markers and parameters has become a challenge. This may probably be the resultant of collecting raw drugs from diverse wild sources and natural habitats and no control over several aspects. At this time, the necessity of controlled mass cultivation becomes significant in medicinal plant sector.
- **Interdisciplinary approach:** Ayurvedic literatures recognized the role of multidisciplinary approach and emphasized on 'integration of diverse fields' as potential tool for development of medical science. (*Sushruta Samhita, Sutrasthana 4/7*). The integration of traditional systems with modern sciences and technology should be a symbiosis without losing their own core fundamentals and such translational approach could possibly provide a solution for sustainable deliverance of quality assured plant based drugs.

References

- Atharvaveda, (1971). Ed. Pt. S.D. Satvalekar, Svadhyaya Mandal, pardi, 1941, English Transl. by W. B. Whiteney, in two vols. Harvard Oriental Series, vols.7-8,Motilal Banasidass, Delhi.
- Amarakosa with the comm. of Lingayasurin and Mallinatha (1971, 1978, 1983). 3 vols.,Adyar Library and Research Centre, Madras.
- Anonymous (2009). Mainstreaming AYUSH & Revitalizing Local Health Traditions under the National Rural Health Mission- A Health Systems Perspective, National Health Systems resource center, National Rural Health Mission Ministry of Health & Family Welfare, government of India New Delhi.
- Anonymous (2008). A Manual for Doctors on Mainstreaming of AYUSH under NRHM),Department of AYUSH, Ministry of Health and Family Welfare, Government of India New Delhi.
- Anonymous(1998) Quality control methods for Medicinal plant materials), World Health Organization (WHO), Geneva.
- Brhadaranyaka Upanisad With Eng. Transl.(1946),Sri Ramakrishna Math, Madras.
- Caraka Samhita (1976, 1977, 1988). With the comm. of Cakrapanidatta ed. Jadavji TrivikramjiAcarya,Bombay, 1914.Reprint, Delhi, 1981 with Eng. Transl. By R.K. Sharma and Bhagwan Dash, vols. I,III, Varansi.
- Daniela Vesela, et.al (1999). Seasonal variations in the content of taxanes in the bark of *Taxus Baccata* L., *Phytochemical Analysis*, Volume 10, issues 6. pages 319.321, November/December, Daniela Vesela, et. Al., Seasonal variations in the content of taxanes in the bark of *Taxus Baccata* L., *Phytochemical Analysis*, November/December, 1999,Volume 10, issues 6. pages 319.321.
- Falguni SHETT, Range of seasonal phytochemical variations in *Calotropis procera* (Ait.) R. Br., *Int.J. Med. Arom. Plants*, ISSN 2249-4340.
- Gangadharan G.G., (2000). Need for Friendly interaction, *The Hindu folio*, October, 2000, pp 34-37.
- Guide lines for Methodologies on Research and Evaluation of Research of Traditional Medicine, (2000). World Health Organization (WHO), Geneva.

- Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants, (2003). World Health Organization (WHO), Geneva.
- Guidelines on Good Field Collection Practices for Indian Medicinal Plants, (2009). National Medicinal Plants Board, Department of AYUSH, Ministry of Health and Family Welfare, Government of India.
- Guidelines on Good Agricultural Practices for Indian Medicinal Plants, (2009). National Medicinal Plants Board, Department of AYUSH, Ministry of Health and Family Welfare, Government of India.
- Guidelines for Assessing Quality of Herbal Medicines with Reference to Contaminants and Residues, (2007). World Health Organization (WHO), Geneva.
- H.N. Apte, editor. (1904). Agnipurdna, Anandasrama Sanskrit series, 41, Bombay, 1900, Eng. Transl. by M.N. Dutt, Culcutta, 2 vols., Calcutta.
- Kautilya, (1960, 1963). Arthashastra critical Edn., and English transl. by R.P. Kangle in 2 vols., ed. R. Sharma Sastri, Mysore, 1919. University of Bombay.
- L.P. Astanin and K.N. Blagosklonov, (1978). Conservation of Nature, Progress Publishers, Moscow.
- Manusmriti, (1925). Nirnaya Sagar Press edn. Bombay.
- O.T. Kolawole, and A.A. Ayankunle, Seasonal variation in the anti-Diabetic and Hypolipidemic Effects of Momordica Charantia Fruit extract in Rats, European Journal of Medicinal plants, 2(2): 177-195 2012.
- R.D. Singh, *et al.*, (2010). Seasonal variation of bioactive components in Valeriana Jatamansi from Himachal Pradesh, India, Industrial crops and products, volume 32, Issues 3, November 2010, pages 292-296.
- Rgveda (1986). ed. S.D. Satvalekar, svadhyay Mandal. Pardi, 1957, Eng. Transl. by R.T.H. Griffith, Motilal Banarsidass, Delhi.
- Ritupriya *et al.* (2010). Status and role of AYUSH and Local health Traditions under the National Rural Health Mission-Report of a Study: National Health Systems Resource Centre, National Rural Health Mission Ministry of Health & Family Welfare, Government of India New Delhi.
- Satapatha Bramana (Vol. I-1967; Vol. II-1969). with Hindi Trans, by Pt. Ganga Prasad Upadhyaya, (in two volumes), The Research Institute of Ancient Scientific Studies, Delhi.

Susruta Samhita, (1963). with the comm. of Dalhana, ed. Jadavji Trivikramji Acarya, Bombay, 1965.Eng. Transl. Kavairaha Kunjalal Bhisagratna, in 3 vols. Varanasi.

Sripada Satvalekar, Svadhyaya Mandal(Ed.), (1957). Taittriya Samhita. Pardi, Bombay.

Upavana Vinoda(1935) ,with Eng. Transl. by G.P. Majumdar, The Indian Research Centre, Calcutta,

Yajurveda (1970). ed. S.D. Satvalekar, Svadhyaya Mandal, Pardi, Motilal Banarsidass, Delhi.

