Phcog Rev. Vol, 3, Issue 5, 1-7, 2009
Available Online : www.phcogrev.com

**PHCOG REV. : Survey Study**

# Controversial Nomenclature of Ayurvedic drugs: Challenges for Scientists

**Rajendra M Dobriyal* and DB Ananthanarayana**

*Hindustan Unilever Research Centre, 64, Main Road, Whitefield, Bangalore-560 066, India*
** Author for correspondence: rajendra.dobriyal@unilever.com*

**ABSTRACT**
Ayurveda, the traditional system of medicine in India is understood to have evolved many thousands years back. Ayurvedic medicines are made using materials of plant, mineral, metal and animal origin. However, plants constitute about 80 percent of the raw materials used in Ayurvedic recipes. Though the classical text books of Ayurveda cumulatively document about 1500 plants, about 600 plants are commonly used for manufacturing medicines currently in India. Many of plant drugs documented in Ayurvedic textbooks have a controversy on their accurate botanical linkages. Since plants and plant drugs in Ayurveda were designated Sanskrit names, often based on the "doctrine of signature", morphological appearance, properties and action, the interpretation of these names during the later period of time led to acceptance of more than one botanical species for one plant drug. An attempt has been made here to map the extent of this controversy as reflected in one of the most referred text books of Ayurveda, *Bhavprakash Nighantu*. We report here the controversies due to lack of precise nomenclature of plant drugs in Ayurveda and its impact on regulatory scenario. Aspects related to adulteration and substitutions are not covered.
**Key Words:** Ayurveda, nomenclature, substitution, adulteration, controversial drugs

## INTRODUCTION:

Ayurveda, the history of which can be traced back to 4000 BC is understood to be the oldest comprehensive health care system in the world (1). During its evolution Ayurveda has seen many ups and downs owing to various political and social developments in Indian subcontinent from time to time (2). The ancient Ayurvedic scholars are believed to have developed various recipes after validating the therapeutic benefits in humans through hit and trial, both the success and failure cases being discussed with other scholars during the regional congregations. The explanations of Sanskrit terms mentioned in *Charak Samhita (3)* namely, "*Praman*" (method of investigation), "*Aptopdesha*" (authoritative testimony of experienced ones), "*Pratyaksha*" (direct observation), "*Anuman*" (inference) and "*Yukti*" (conviction for experiment) reveal some of the strong indications of how recipes would have evolved in Ayurveda (4). While naming the drugs especially those of plant origin, the ancient saints are understood to have often referred them with the names, which were best suited to their physical appearance, habitat in the nature, therapeutic potency or even resemblance to animals and household articles. Thus terms like "*Kakanasa"* (like nose of a crow) for *Martynia diandra* seeds, "*Jal-pippali"* (Water Pepper) for *Lippia nodiflora* or "*Mandukparni*" (leaf like a frog) for *Centella asiatica* were used to refer plants and plants based drugs.

Due to lack of established botanical nomenclature at that time, these herbs were documented with their Sanskrit names. During later times different Ayurvedic scholars from different regions seem to have interpreted their botanical identity differently. Authors believe that multiple pharmacological actions ascribed to one plant drug in Ayurveda would have also added to complexities of establishing their exact botanical nomenclature.

The manufacture, sale and distribution of Ayurvedic products are regulated in India under the Drugs and Cosmetics Act 1940 and Rules 1945. As per these rules, each manufacturer is required to strictly adhere to the composition and process as given in either of 56 Ayurvedic books, recognized under this act as official texts, while manufacturing any Ayurvedic recipe. However, these recipes provide the composition with ingredient names written in Sanskrit. In most of the cases, the botanical identity of these drugs described in Sanskrit is established. However, in few cases the association of Sanskrit names of plant drugs is not linked to one botanical entity, which poses a problem for regulatory compliance.

World Health Organization (WHO) and other organizations emphasize the need for quality and standardization of plants used in manufacturing of traditional medicines including Ayurveda where, the first basic requirement is establishing the correct botanical identity of plant drug attributing it to a specific genus and species (5-8). WHO guidelines on good agriculture and collection practices (8) for medicinal plants even goes to the extent of suggesting submission of a voucher specimen to a national herbarium and recommends that genetic patterns of each plant species being used in traditional medicine should be studied. Article 7 of good agricultural practice for traditional Chinese medicine materials (9) also lays emphasis on establishing the identification of medicinal plant species. In India Ayurvedic Pharmacopoeias (10), Indian Pharmacopoeia (11), Indian Herbal Pharmacopoeia (12) and ICMR Monographs (13) have standards for checking the authenticity of botanicals used in Ayurvedic or herbal products. However, authors of this paper have not come across any references, where serious efforts are made to resolve the issue of controversial nomenclature, though the existence of controversial nomenclature in Ayurveda has been acknowledged by few authors (14-17). For example

controversy on Ayurvedic plant drugs like *Brahmi* (14)*, Bharangi* (15) *Jeevani* (16)*,* and *Amlakibhumi* (17) has been reported.

*A*n attempt has been made by the authors to assess the extent of the controversies in nomenclature of plant based drugs in Ayurveda, taking one of the well known text book on *Dravya Guna* (Ayurvedic Pharmacology), *Bhavprakash Nighantu* (18), as the reference.

**Materials & Methods**

The widely referred text book commentary on *Dravya Guna*, *Bhavprakash Nighantu* (18), which covers most of the legally approved Ayurvedic plant drugs in India, was taken as a reference for this study. All the plant based drugs mentioned in the book were scrutinized for their Ayurvedic as well botanical nomenclature. In this study, the common name given as the title of the monograph in the book, in Sanskrit or Hindi, was considered as Ayurvedic name.

A list was then prepared having the Ayurvedic name of the plant drug and all the botanical entities attributed for the plant drug along with the family they belong to, as mentioned in the text book under reference. Instances, where more than one botanical entity was attributed to one single plant drug, were collated. A separate list was made basis no of species attributed to one drug, i.e. two species attributed to single drug, 3 species attributed to single drug and so on.

**Observation & Discussion:**

This review showed following two patterns.

**A:** A single Ayurvedic drug is known with many equivalent or alternate Ayurvedic names

**B:** More than one botanical entity are attributed to single Ayurvedic plant drug

The former case is found in other systems as well where one drug is known with many names. For example in allopathic system, Vitamin C is also known as Ascorbic Acid, Cevitamic Acid and Gulofuranolactone (19)**.** The situation where more than one botanical entity is attributed to single plant drug is not common in other systems. Authors have not studied whether or not this situation of more than one botanical entity being attributed to single plant drug occurs in other traditional systems.

Table 1 reveals 35 instances where more than 1 botanical entity is attributed to the same Ayurvedic plant drug. Though most of these cases show that 2 or 3 botanical species are linked to same drug, in some cases as many as 7 different species are ascribed to the same plant drug. Table 2 summarizes the no of instances, where frequency of more than one botanical entity is attributed to a singe Ayurvedic plant drug. Table 3 gives an example of *Pashanbhed*, the commonly used Ayurvedic herb for urinal calculi, found to be linked to 7 different botanical entities belonging to 6 different families.

The above analysis showed that, while in some cases all the different botanical entities belong to same genera, there are instances of plant drugs belonging to different genera and even different families. For example, table 4 shows all 3 species attributed to "*Chhoti Dudhi*, belong to same genera "*Euphorbia*". There are cases where the botanical species belonging to different genera of the same family as in the case of *Shweta Mushali* (Table 5) are attributed to same plant drug. Table 6 shows an example where all the species attributed to single Ayurvedic drug belong to altogether different families.

**Factors responsible for this controversy:**

With almost two decades of involvement in studying various aspects of Ayurveda including its historical aspects, authors offer following as probable factors responsible for the controversial nomenclature of plant drugs in Ayurveda.

**Doctrine of Signature:**

In ancient times, when man was desperate to find out remedies for ailments, intuitive use of natural ingredients was one of the important leads to test them for relieving ailments. Thus the specific habits, morphology, shape of different parts were linked to their possible pharmacological action. For example if a plant grows as lithophyte (growing intruding the stones or rocks) in nature, it was considered to have similar potential action on renal calculi, referred as kidney stone. On testing some of such thought plant ingredients worked. This is how the name of the drug "*pashanbhed*" (intruding the stones) would have come into existence and many physicians depending on the region, they belong to, must have attributed different lithophytic plants to the drug, "*Pashanbhed*". The similarity of plants or plant drugs with many household items, pet or wild animals, agricultural implements, habit of the plants, morphology of the part used was also given due importance while naming the plants.

**Verbal Communication:**

Ayurveda, like any other traditional system, descended down from generation to generation orally and the documentation started only during the later period of its development (20). In rural areas of India, the practice of communicating a remedy to their heirs by the healers only at the time of their death is still common, which is said to be in vogue much in ancient times. In the absence of any precise nomenclature the possibility of communication gap between the two might have led to use of different herbs by the followers.

**Different herbs used for one Indication:**

In ancient times people in different regions would have used different herbs to cure the same ailment. This was mainly because the communication was restricted to smaller areas and all the social interactions were restricted to limited areas. Endemism of various plant species as well as the prevalence of specific ailments in specific areas would have also forced mankind to use different plants for an ailment. Thus even though two or more plant species were being used for any specific ailment, all the species would have been known with the same name. Thus species like *Bacopa monnieri* and *Centella asiatica* were adopted at some part of history as "Brahmi" alone, instead of having two different Ayurvedic names for them.

In its wisdom, the Govt. of India while recognizing Ayurvedic textbooks have also recognized alternative herbs which have been allowed to be used to replace a specified herb in case of its non-availability. This concept can be found in official texts recognized under the act and are refereed as "*Pratinidhi Dravyas*" (official substitution). For example in absence of *Kuth* roots (*Saussurea lappa*)*,* Pushkarmool (*Inula racemosa*) can be

***Table 1: More than one plant entities attributed to single Ayurvedic plant drug***

| S. No. | Ayurvedic Name | No of cases | Botanical Species Linked to Drug | Family |
|---|---|---|---|---|
| 1. | Pashanbhed | i | *Saxifraga ligulata* | Saxifragaceae |
| | | ii | *Aerva lanata* | Amaranthaceae |
| | | iii | *Kalanchoe pinnata* | Crassulaceae |
| | | iv | *Coleus aromaticus* | Lamiaceae |
| | | v | *Homonoia riparia* | Euphorbiaceae |
| | | vi | *Rotula aquatica* | Boraginaceae |
| | | vii | *Ocimum basilicum* | Lamiaceae |
| 2. | Parpata | i | *Oldenlandia corymbosa* | Rubiaceae |
| | | ii | *Fumaria indica* | Fumariaceae |
| | | iii | *Polycarpea corymbosa* | Caryophyllaceae |
| | | iv | *Justicia procumbens* | Acanthaceae |
| | | v | *Glossocardia linearifolia* | Asteraceae |
| | | vi | *Mollugo stricta* | Ficoidaceae |
| 3. | Moorva | i | *Marsdenia tenacissima* | Asclepiadaceae |
| | | ii | *Sansevieria roxburghiana* | Haemodoraceae |
| | | iii | *Bauhinia vahlii* | Fabaceae |
| | | iv | *Clematis gouriana* | Ranunculaceae |
| | | v | *Maerua arenaria* | Capparidaceae |
| | | vi | *Helicteres isora* | Sterculiaceae |
| 4. | Rasna | i | *Pluchea lanceolata* | Asteraceae |
| | | ii | *Inula racemosa* | Asteraceae |
| | | iii | *Vanda roxburghii* | Orchidaceae |
| | | iv | *Saccolabium papillosum* | Orchidaceae |
| | | v | *Tylophora asthmatica* | Asclepiadaceae |
| 5. | Talispatra | i | *Taxus baccata* | Taxaceae |
| | | ii | *Abies webbiana* | Pinaceae |
| | | iii | *Rhododendron anthopogon* | Ericaceae |
| | | iv | *Rhododendron campanulatum* | Ericaceae |
| | | v | *Rhododendron lepidotum* | Ericaceae |
| 6. | Laxmana | i | *Ipomoea sepiaria* | Convolvulaceae |
| | | ii | *Atropa mandragora* | Atropaceae |
| | | iii | *Smithia geminiflora* | Lamiaceae |
| | | iv | *Biophytum sensitivum* | Geraniaceae |
| 7. | Varahikand | i | *Tacca aspera* | Taccaceae |
| | | ii | *Dioscorea bulbifera* | Dioscoreaceae |
| | | iii | *Ipomoea digitata* | Convolvulaceae |
| | | iv | *Pueraria tuberosa* | Fabaceae |
| 8. | Daruhaldi | i | *Berberis aristata* | Berberidaceae |
| | | ii | *Berberis asiatica* | Berberidaceae |
| | | iii | *Berberis lycium* | Berberidaceae |
| | | iv | *Coscinium fenestratum* | Liliaceae |
| 9. | Nagkeshar | i | *Mesua ferrea* | Clusiaceae |
| | | ii | *Ochrocarpus longifolius* | Clusiaceae |
| | | iii | *Calophyllum inophyllum* | Clusiaceae |

| | | | | |
|---|---|---|---|---|
| 10. | Priyangu | i | *Callicarpa macrophylla* | Verbenaceae |
| | | ii | *Prunus mahaleb* | Rosaceae |
| | | iii | *Aglaia roxburghiana* | Meliaceae |
| 11. | Satala | i | *Euphorbia tirucalli* | Euphorbiaceae |
| | | ii | *Acacia concinna* | Fabaceae |
| | | iii | *Euphorbia dracunculoides* | Euphorbiaceae |
| 12. | Nagbala | i | *Sida veronicaefolia* | Malvaceae |
| | | ii | *Sida spinosa* | Malvaceae |
| | | iii | *Grewia hirsuta* | Tiliaceae |
| 13. | Trayman | i | *Delphinium zalil* | Ranunculaceae |
| | | ii | *Thalictrum foliolosum* | Ranunculaceae |
| | | iii | *Ficus heterophylla* | Moraceae |
| 14. | Kakjangha | i | *Peristrophe bicalculata* | Acanthaceae |
| | Kakjangha | ii | *Vitex peduncularis* | Verbenaceae |
| | Kakjangha | iii | *Leea hirta* | Vitaceae |
| 15. | Kakanasa | i | *Asclepias curassavica* | Asclepiadaceae |
| | Kakanasa | ii | *Martynia diandra* | Pedaliaceae |
| | Kakanasa | iii | *Thunbergia alata* | Acanthaceae |
| 16. | Shankhpushpi | i | *Evolvulus alsinoides* | Convolvulaceae |
| | | ii | *Convolvulus pluricaulis* | Convolvulaceae |
| | | iii | *Canscora decussata* | Gentianaceae |
| 17. | Chhoti Dudhi | i | *Euphorbia thymifolia* | Euphorbiaceae |
| | | ii | *Euphorbia microphylla* | Euphorbiaceae |
| | | iii | *Euphorbia hypericifolia* | Euphorbiaceae |
| 18. | Ajwain Jangali | i | *Seseli indicum* | Apiaceae |
| | | ii | *Thymus serpyllum* | Lamiaceae |
| 19. | Jangali Pyaj | i | *Urginea indica* | Liliaceae |
| | | ii | *Scilla indica* | Liliaceae |
| 20. | Renuka | i | *Piper aurantiacum* | Piperaceae |
| | | ii | *Vitex agnus-castus* | Verbenaceae |
| 21. | Elwaluk | i | *Prunus cerasus* | Rosaceae |
| | | ii | *Gisekia pharnaceoides* | Ficoidaceae |
| 22. | Prishniparni | i | *Uraria lagopoides* | Fabaceae |
| | | ii | *Uraria picta* | Fabaceae |
| 23. | Jeevanti | i | *Leptadenia reticulata* | Asclepiadaceae |
| | | ii | *Dendrobium macraei* | Orchidaceae |
| 24. | Mahanimb | i | *Melia azedarach* | Meliaceae |
| | | ii | *Ailanthus excelsa* | Simarubaceae |
| 25. | Vetas | i | *Salix caprea* | Salicaceae |
| | | ii | *Calamus tenuis* | Palmae |
| 26. | Safed Mushali | i | *Asparagus adscendens* | Liliaceae |
| | | ii | *Chlorophytum arundinaceum* | Liliaceae |

| | | | | |
|---|---|---|---|---|
| 27. | Krishna Saariva | i | *Ichnocarpus fruitiscens* | Apocyanaceae |
| | | ii | *Cryptolepis buchanani* | Asclepiadaceae |
| 28. | Som | i | *Ephedra gerardiana* | Gnetaceae |
| | | ii | *Sarcostemma brevistigma* | Asclepiadaceae |
| 29. | Amarbel | i | *Cuscua reflexa* | Convolvulaceae |
| | | ii | *Cassytha filiformis* | Lauraceae |
| 30. | Banda | i | *Loranthus longiflorus* | Loranthaceae |
| | | ii | *Viscum album* | Loranthaceae |
| 31. | Sarpakshi | i | *Ophiorrhiza mungos* | Rubiaceae |
| | | ii | *Polygonum plebejum* | Polygonaceae |
| 32. | Gaujivha | i | *Elephantopus scaber* | Asteraceae |
| | | ii | *Onosma bracteatum* | Boraginaceae |
| 33. | Sthala Padma | i | *Ionidium suffruticosum* | Violaceae |
| | | ii | *Hibiscus mutabilis* | Malvaceae |
| 34. | Jalakumbhi | i | *Eichornia crassipes* | Pontederiaceae |
| | | ii | *Pistia stratiotes* | Araceae |
| 35. | Ashok | i | *Saraca indica* | Fabaceae |
| | | ii | *Polyalthia longifolia* | Annonaceae |

***Table 2: Frequency of instances, where single Ayurvedic plant drug is attributed to more than one plant entities.***

| No of plant species attributed to one drug in Ayurveda | No of such cases reported |
|---|---|
| **SEVEN** | 1 |
| **SIX** | 2 |
| **FIVE** | 2 |
| **FOUR** | 3 |
| **THREE** | 8 |
| **TWO** | 19 |
| **TOTAL** no of controversial cases | 35 |

**Table 3: Seven different plant species referred as "*PASHANBHED*"**

| Name of the Plant | Family |
|---|---|
| *Saxifraga ligulata* Wall | Saxifragaceae |
| *Aerva lanata* Juss | Amaranthaceae |
| *Kalanchoe pinnata* Pers | Crassulaceae |
| *Homonoia riparia* Lour | Euphorbiaceae |
| *Rotula aquatica* Lour | Boraginaceae |
| *Ocimum basilicum* Linn | Lamiaceae |
| *Coleus aromaticus* Benth | Lamiaceae |

***Table 4: Example where attributed species belong to same genera***

| Ayurvedic Drug | Attributed Plant Species | Family |
|---|---|---|
| *Chhoti Dudhi* | *Euphorbia thymifolia* Linn | Euphorbiaceae |
| | *Euphorbia microphylla* Heyne | Euphorbiaceae |
| | *Euphorbia hypercifolia* Linn. | Euphorbiaceae |

**Table5: Example where attributed species belong to different genera of same family**

| Ayurvedic Drug | Attributed Plant Species | Family |
|---|---|---|
| *Shweta Mushli* | *Asparagus adscendens* Roxb | Liliaceae |
| | *Chlorophytum arundinaceum* Baker | Liliaceae |

**Table 6: Example where attributed species belong to different families**

| Ayurvedic Drug | Attributed Plant Species | Family |
|---|---|---|
| *Priyangu* | *Callicarpa macrophylla* Vahl. | Verbenaceae |
| | *Prunus mahaleb* Linn. | Rosaceae |
| | *Aglaia roxburghiana* Miq. | Meliaceae |

used. From sustainability perspective if the pharmacological activity of the substitute herb is similar to the original herb, the approach should be welcome as it would promote sustainability in a legally approved way.

During the history of development of Ayurveda it might have happened in some cases, that instead of being recognized as substitute or alternate herbs, two or more botanical entities would have been linked to the same botanical entity.

**Ayurvedic Nomenclature V/s Botanical Nomenclature:**

While Ayurveda is said to be originated well before Christian era, the system of plant nomenclature started only during the 15th or 16th century. Carrolus Linnaeus for the first time proposed binomial nomenclature only in 1753, in his book, "Species Plantarum". Prior to this, due to lack of any systematic scheme of nomenclature, the plant species and the drugs obtained from them were named by various *Vaidyas*, often naming many species with the same name.

**A Retrospection of Botanical Nomenclature:**

Historically, given the difficulties in transport, movement of people across regions, use of plants for either food or medicines would have got localized. Such localized usages also would have led to referring to plants with different names, which was obvious keeping in view the secluded habitat of various ethnic groups and their dialects. This practice might probably have continued by various ethnic and tribal communities who used to refer the plants with names of their own regional languages and dialects. As a result, one plant species carried different names in different languages at different places while, at the same time one name was given to more than one plant species. For these common names, no uniform accord could be attained. This confusion led to the need of assigning only one name to one species, which is valid and is followed throughout the world. As a result, some unique scientific name in Latin language was given to each species, which were to be accepted by every one irrespective of regional and national boundaries.

The earliest scientific names were too lengthy, being polynomials, which formed more or less the full description of the plant. For example today's, *Sida acuta*, was named by Pulkonat as "*Chrysopyllum follis ovalis superne glabris, parallele striatis, subtus tomentosonitidis*" (21). Carrolus Linnaeus for the first time in 1753 proposed binomial system of nomenclature in his book called "*Species Plantarum* (22)**"**. Binomial nomenclature consists of two Latin words, the first being the generic epithet, while the second one, the species epithet. Later, International Code of Botanical Nomenclature (ICBN) was established and first International Botanical Congress was held in Paris in 1867, which made some rules mandatory for naming a plant species. Today we accept only one valid "Botanical Name" for one plant species, which is internationally recognized.

It is worth mentioning here that in botanical nomenclature also, more than one name for one plant species, which are referred as "synonyms", do exist. This is because development in the Plant taxonomy is an ongoing subject and many species are named and renamed based on the new discoveries. Today many other branches of Botany like, molecular botany, cytology, genetics etc. are also considered while deciding the nomenclature of a plant species unlike earlier days when it was based on the floral and vegetative characteristics alone. Thus today's system of natural classification is based on the analysis and harmonization of evidence from all organs, tissues and parts (23). Further "International Code of Botanical Nomenclature" also proposes, *Nomina Conservenda*, which validates the names, which are in long use, even though they might have been changed (21). For example, *Hydrocotyle asiatica* was the name given to *Mandookparni* by Linnaeous initially, but Urban transferred it to genus *Centella* as *Centella asiatica* (Linn.) Urban. While in all the species of *Hydrocotyle* the inflorescence was umbellose raceme it was cyme in *H. asiatica*, which was the case in rest of the members of *Centella*. Also in *H. asiatica*, the ovular traces are derived from the carpel, a character resembling with *Centella*, unlike in other member of *Hydrocotyle* where they arise from placental strands[24]. These were the valid reasons why *Hydrocotyle asiatica* was renamed as *Centella asiatica*. Today both the names *Hydrocotyle asiatica* Linn. & *Centella asiatica* (Linn.) Urban are not only frequently used but are legitimate too. Thus adoption of this system ensured that each plant entity carried a specific genus and species epithets and was kept under one of the family of the plant kingdom. The system also ensures that two different plant entities can never have the same botanical name.

It needs to be recognized that at physician's level as well as at Industrial scale, whenever a recipe, as given in one of the official books (*granthas*) of Ayurveda is prepared, the plant species available in that region with a specific botanical identify is being used to make that recipe. It is also a fact that same recipe when made in different region may have the similar named drug but coming from different botanical entity available in that region. It is to be recognized that, though a very well established documentation system does not exist on

the efficacy and safety as post marketing observation for traditional medicines including Ayurveda; one does not find any reports of lack of efficacy or any side effects being reported due to use of recipes with alternate botanical species.

6. **Conclusion:**

There is huge surge in Ayurvedic plants and world over it has become a subject of intensive research for various aspects. There have also been substantial efforts to standardize the Ayurvedic crude drugs as well as finished Ayurvedic medicines. However, these initiatives would imperatively need establishing correct identity of the plant drug. The long history of safe usage of Ayurvedic medicines can be extrapolated only when the botanical identity of the plant going into those medicines is established and standardized. Hence proper nomenclature of all crude drugs and establishing their exact botanical origin is a must.

Current practice of Ayurvedic physician and Industry is to use one of the several alternate herbs that are considered equivalent Ayurvedic plant drug. Some amount of legal sanction exists for use of plants as one can use only plant drugs mentioned in one of the 56 authorized books by Drugs and Cosmetics Act of India 1940. Hence even though, one would use the alternate herbs, one would restrict to only those which are mentioned in the Ayurvedic authorized text books. However for global acceptance as well as providing safe and effective Ayurvedic products it would be required to identify which of the particular botanical entities is to be used to have regulatory compliance. Ayurvedic scholars, plant taxonomists and regulators need to work together on this.

**REFERENCES:**


1. Mishra LC, Scientific Basis of Ayurvedic Therapies. CRC Press (2004)
2. Mukherjee PK, Wahile A., Integrated approaches towards drug development from Ayurveda and other Indian systems of medicines, *J Ethnopharmacol*, **103**: 25-35 (2006)
3. Sharma PV (Ed.), Charaka Samhita, Text and English Translation, Vol. I-IV, Chaukhambha Orientalia, Varanasi, (2001)
4. Ananthnarayana DB, Dobriyal RM. Complimentary medicines and 21st century therapeutics: Challenges for Pharmacologists. In: Gupta SK editor. Pharmacology and Therapeutics in the New Millennium, Narosa Publishing House, Delhi, p. 326 (2001)
5. World Health Organization, Quality Control Methods for Medicinal Plants, World Health Organizations, Geneva, (1998)
6. World Health Organization, Traditional Medicine Strategy 2002-2005, WHO/EDM/TRM/2002.1, (2002)
7. European Medicine Evaluation Agency, Guidelines on quality of herbal medicinal products/ traditional herbal medicinal products, EMEA/CVMP/814/00, London, (2006)
8. World Health Organization, Guidelines on good agriculture ad collection (GACP) practices for medicinal plants, WHO, Geneva, (2003)
9. Good Agricultural Practice for Traditional Chinese Medicinal Materials, Decree by State Administration of Pharmaceutical Supervision, No. 32, Peoples Republic of China, (2002)
10. The Ayurvedic Pharmacopoeia of India: Part 1, Vol. 1-5, Ministry of Health & Family Welfare, Govt. of India (1989-2005)
11. Indian Pharmacopoeia: Addendum 2005, Indian Pharmacopoeia Commission, India, 2005
12. Indian Herbal Pharmacopeia, Revised Edition, 2002, Indian Drugs Manufacturers Association, Mumbai, (2002)
13. Quality Standards of Indian Medicinal Plants, Indian Council of Medical Research, New Delhi, (2003)
14. Warrier PK, Nambiar VPK, Ramamurthy C Editors: Indian Medicinal Plants, Vol. I-V, Orient Longman, (1994)
15. Sivarajan VV, Balchandran I, Ayurvedic Drugs and Their Plant Sources, Oxford & IBH, New Delhi, (1994)
16. Bapalal Vaidya, Some Controversial Drugs in Indian Medicine, Chaukhambha Orientalia, Varanasi, (1982)
17. Ganeshaiah KM, Ganeshan R, Shankar RU, Meera C. A taxonomic hurdle or hurdled by Taxonomists, AMRUTH, 2 (4), FRLHT, Bangalore, (1998)
18. Chunekar KC, Pandey GS. Bhavprakash Nighantu (Indian Materia Medica) of Sri Bhavamisra, Chaukhambha Bharati Academy, Varanasi, (2002)
19. Wade A, Weller PJ, Editors: Handbook of Pharmaceutical Excipients, American Pharmaceutical Association, Washington, (1994)
20. Northridge ME, Mack R. Integrating ethnobotany into public health, *American Journal of Public Health*, **92 (10)**, (2002)
21. Singh V, Jain DK. Taxonomy of Angiosperm. Rastogi Publications, Meerut, (1985)
22. Caroli Linnaei, Species plantarum, Holmiae Impensis Laurentii Salvii, (1753)
23. Bailey LH. Manual of Cultivated Plants, The Macmillan Company, New York, (1949)
24. Mittal SP, A contribution to the morphology of *Centella asiatica* (Linn). Urban and some related species, *J. Ind. Bot. Society*, **34**, (1955)