Medicinal Plants in India: An Assessment of their Demand and Supply

National Medicinal Plants Board, Ministry of AYUSH
Government of India

Indian Council of Forestry Research and Education, Dehradun

About the Publication

Growth of the herbal-based healthcare and wellness sector is putting a high demand on the medicinal plant resources. The growing demand of medicinal plants has given rise to concerns about the sustainability of herbal raw drug supplies. Total commercial demand of herbal raw drugs in the country for the year 2014-15 has been estimated at 5,12,000 MT (dry weight) with corresponding trade value of about ₹ 7000 crore. The publication contains a checklist of 1178 medicinal plants species which form source of 1622 botanicals recorded in trade. Of these 1178 species, 242 species are in high commercial demand. The growth of the sector calls for active management of the medicinal plant resource so as to ensure sustained supply of authentic and quality herbal raw drugs to meet the growing needs of the domestic herbal industry, exports and of the households/ folk healers. Recommendations for strengthening the medicinal plant resources in the country have also been provided.

The text is laced with images, graphics and case studies to highlight the various issues. The study report has been organised in twelve theme-specific chapters and aims to provide reliable data in a consolidated manner that is expected to benefit all concerned with policy, research and action pertaining to medicinal plant resource base and indigenous health care systems in the country.

Medicinal Plants in India:

An Assessment of their Demand and Supply

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2017

Medicinal Plants in India: An Assessment of their Demand and Supply
[*An outcome of the assignment entrusted by the National Medicinal Plants Board, Ministry of AYUSH, Government of India to the Indian Council of Forestry Research & Education, Dehradun to assess demand and supply of medicinal plants in India*]

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GOVERNMENT OF INDIA**

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MESSAGE

India is home to some of the very old systems of medicine that continue to be the mainstay of healthcare delivery to a very large segment of its population even today. It is a matter of pride that these Indian Systems of Medicine are finding increasing acceptance in other countries too. These systems being largely dependent upon plants, assured supply of quality herbal raw drugs is crucial for growth of the sector. With nearly 1200 medicinal plant species in commercial use by the domestic herbal industry, traditional medical practitioners, and the export houses, supply chains of each of these species is required to be understood to develop assured supply lines. It is in this context that the National Medicinal Plants Board's initiative to get the consumption and supply status of medicinal plants in the country assessed towards formulation of strategies for strengthening medicinal plant resource base is a welcome step.

I appreciate the efforts by the team of professionals from the Indian Council of Forestry Research and Education for undertaking nation-wide study on behalf of the National Medicinal Plants Board on this very complex subject and bringing out a comprehensive report in the form of this publication. This publication assumes great relevance as it has come at the time when the government is mulling global promotion of Indian Systems of Medicine. I am sure that this publication will benefit all concerned with policy, research and action pertaining to medicinal plant resource base and indigenous health care systems in the country.

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एक कदम स्वच्छता की ओर

MAKE IN INDIA

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Message

The continuous growth of the herbal sector in the country is reflective of the robustness and contemporary relevance of the Indian Systems of Medicine and the increasing trust reposed by the communities on plant based wellness recipes. Further growth of the sector is, however, critically dependent upon the sustained supplies of medicinal plant species required by the sector. With cultivation limited to only a few medicinal plant species, wild collections remain the major supply source of herbal raw drugs, putting acute pressure on the wild medicinal plant resources. Many of the medicinal species have already been assessed as of conservation concern. The National Medicinal Plants Board has been making efforts to strengthen the medicinal plants resource base in the country through conservation and cultivation. However, periodic assessment of demand and supply of medicinal plants and flagging of related issues is required to effectively re-orient and guide the conservation and cultivation programs. The initiative by the National Medicinal Plants Board to constitute a nation-wide study on the subject is, thus, praiseworthy.

I compliment the team of experts from the Indian Council of Forestry Research and Education for accepting this challenging assignment and completing the same in a tight time schedule. The comprehensive report of the study brought out in the form of this publication attempts to unravel the various complexities related to the medicinal plants nomenclature, supply chains, trade and usage. I hope that the publication will provide the necessary platform for designing policies, strategies and action plans for strengthening the medicinal plants resource base in the country towards providing a fillip to the further growth of herbal sector in the country.

Sharan

(Ajit M. Sharan)

Dated the 09 March 2017, New Delhi

Gloriosa superba

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Message

The Indian Medical Systems, evolved over centuries in the lap of nature, draw heavily from the locally available medicinal plant resources. Whereas some of these plants have been successfully domesticated and brought under cultivation, the majority of this resource continues to be gathered from the wild. The shift to commercial production of herbal medicinal formulations has resulted in a thriving trade in herbal raw drugs collected from the wild from across the country. Most of these herbal raw drugs are traded under their local/ trade names that vary from area to area making consolidation of their trade data a challenge. Supply chains of most of these herbal raw drugs are poorly understood making the task of managing the resource very difficult and giving rise to concerns about the continuous supply of authentic herbal raw material.

The Indian Council of Forestry Research and Education (ICFRE) has been making significant contribution to the strengthening of medicinal plants resource base through development of domestication and cultivation protocols in respect of various medicinal plant species of conservation concern. I am glad that the National Medicinal Plants Board has collaborated with the Indian Council of Forestry Research and Education to address this complex issue through a nation-wide study and to make an updated assessment of the demand and supply of medicinal plants in India.

I am pleased that the ICFRE's team of experts has been able to undertake and complete this assignment in a time bound manner and bring out the report in the form of a comprehensive publication. I especially compliment Dr. G. S. Goraya, IFS, Deputy Director General, ICFRE for his dedication to the subject and leading the team from front. I am confident that this publication will be a source of valuable information for the policy makers, researchers, resource managers and the resource users including the practitioners of the Indian Systems of Medicine, the industry engaged in making herbal medicinal formulations, the herbal raw drug traders, the entrepreneurs engaged in foreign trade of medicinal plants, and will help in framing appropriate strategies for development of herbal sector in India.

(Shashi Kumar)

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Dactylorhiza hatageria

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Government of India
आयुष मंत्रालय
Ministry of AYUSH
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National Medicinal Plants Board

Message

Plants form the major resource base for India's varied codified and folk health care traditions. Continuous availability of authentic and quality medicinal plants is, thus, crucial to the sustenance and growth of these traditions. Demand on medicinal plants is also on the rise due to growth of herbal based wellness sector. The National Medicinal Plants Board has been supporting conservation and cultivation initiatives to strengthen the medicinal plants resource base in the country to meet their rising demand. However, with more than 6000 plant species already having been recorded in use for medicinal purposes in the country, majority of which are derived from the wild, there is a need to periodically re-prioritise the species for focused resource augmentation action in view of the usage trends. Assessment of demand and supply of medicinal plants on a regular periodicity to bring out their usage trends is, thus, very necessary for such re-prioritisation. The last such assessment, carried out for the year 2005-06 (Ved and Goraya, 2008), has been of great use in driving the conservation and cultivation program over the past ten years. It was to update the status of demand and supply of medicinal plants and to bring out trends in their usage that the National Medicinal Plants Board commissioned a nation-wide study on the subject through the Indian Council of Forestry Research and Education.

I am pleased to see the results of this study in the form of this comprehensive report that systematically addresses various issues related to the medicinal plants sector. The report presents a detailed account of medicinal plant cultivation and conservation initiatives, draws attention towards medicinal plant species of conservation concern and brings out a prioritized list of medicinal plants for focused action. I congratulate Dr. G.S. Goraya and Mr. D.K. Ved and the team of experts of Indian Council of Forestry Research and Education for bringing out this publication. I am sure that the results and recommendations of this study would go a long way in guiding programs for strengthening medicinal plants resource base in the country.

9 March 2017

(Shomita Biswas)

NATIONAL MEDICINAL PLANTS BOARD
Plants For Health & Prosperity

if the wisdom is herbal,
many ailments are curable

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Habenaria intermedia

Executive Summary

Growth of the herbal-based healthcare and wellness sector across the world, including India, is putting a high demand on the medicinal plant resources, both wild collected and cultivated. The growing demand of herbal material has given rise to concerns about the sustainability of herbal raw drug supplies, especially those obtained from species that are already facing threat to their very existence. Conservation of wild medicinal plant resources, thus, has come to assume a very high priority. The rising demand of herbal raw drugs has also given rise to concerns about the authenticity and quality of the material. And all these concerns get accentuated due to non-availability of consolidated and reliable information about the diversity of medicinal plant species in commercial trade and species-wise annual quantum of their use.

The basic step to address these concerns is to know about the diversity of medicinal plant species/ herbal raw drugs in commercial demand and estimate annual requirements of each of these entities so that appropriate resource management strategies could be put in practice. It is easier said than done though. The canvas portraying the commercial demand and supply of medicinal plants in India is very complex. There are about nine thousand manufacturing units that are licensed to prepare herbal medicines under different streams of Indian Systems of Medicine, thousands of traders engaged in domestic and foreign trade of herbal raw drugs, and millions of primary producers engaged in wild harvest or cultivation of more than one thousand medicinal plant species required for commercial use. Consumption of herbal raw drugs by more than a million folk healers dispensing self-prepared medicines and about 138 million rural households using medicinal herbs for their health care also has significant impact on the commercial demand of medicinal herbs. That most of the medicinal herbs are traded under local names, which vary from region to region for the same entity, only adds to the complexity.

The National Medicinal Plants Board (NMPB), Ministry of AYUSH, Government of India, soon after its inception, started making concerted efforts to know the diversity of medicinal plants in trade and estimate their annual consumption. It commissioned a study in respect of pre-selected 'very important' 162 medicinal plant species to CERPA, which assessed the demand of herbal raw drugs in the country for the year 1999-2000 at 2,34,675 MT including the material exported. Thereafter, to get a more holistic picture of the diversity of herbal raw drug entities in trade, the NMPB commissioned a nation-wide survey to assess demand and supply of medicinal plants in the country for the year 2005-06 through FRLHT. This study, the report of which was published as 'Demand and Supply of Medicinal Plants in India' under the authorship of Ved and Goraya (2008), resulted in an inventory of 960 medicinal plant species in commercial use based on survey of domestic herbal industry, raw drug mandis and rural households, and analysis of foreign trade data. The study estimated the total trade of herbal raw drugs for the year 2005-06 at 3,19,500 MT, including exports of 56,500 MT and 86,000 MT consumed by the rural households. This report has till recently remained the only source of information on the demand and supply status of the herbal raw drugs.

The medicinal plant sector has been reported to be growing all along, necessitating review of the demand and supply status of medicinal plants in the country and to bring out trends, if any. Appreciative of this need, the NMPB commissioned the present nation-wide study in February 2015 through the Indian Council of Forestry Research and Education (ICFRE) with the major objective to review and assess the status of demand and supply of medicinal plants in India for the year 2014-15. ICFRE, in strategic partnership with FRLHT, conducted this study under which

comprehensive review of literature was caried out and extensive field surveys were made to document the status of production and consumption of medicinal plants in the country. Highlights of this study are presented below:

1. Inventory of Medicinal Plant Species in Commercial Demand in India:

A comprehensive review and assessment of (a) consumption of botanical raw drugs by the domestic herbal industry and by rural households, (b) botanicals collected from the wild and those obtained from cultivation, (c) botanicals recorded from trade for commercial use in Indian Systems of Medicine, and (d) botanicals in foreign trade under the study has resulted in drawing up of a consolidated inventory of 1622 botanicals correlated to 1178 plant species. This inventory includes the known plant species used as equivalents, substitutes, and adulterants of major botanical raw drugs whether or not specifically recorded in trade. The trade of herbal raw drugs continues to use local/ trade names that vary from region to region - and not the globally accepted botanical names - making consolidation of data difficult. It is for this reason that some species reported to be in use in small quantities could not be included in the consolidated inventory as these could not be correlated to their botanical identities due to non-availability of samples.

The larger number of species recorded during the current survey over the one carried out for the year 2005-06 by Ved & Goraya (2008) is due to more robust sampling design, larger sample size, and good coverage of Unani and Homoeopathic units. To facilitate referencing, trade names, prominent common names and the API/ Sanskrit names have been given for each of the 1178 plant species. The botanical nomenclature of the enlisted species has been updated and popular synonyms have been incorporated for ease of reference. The 1178 enlisted species belong to 781 genera spread over 177 families with Fabaceae, Asteraceae and Lamiaceae being the top three families in respect of medicinal herbs in commercial demand in the country. 42% of the 1178 species are herbs, 27% trees and 31% shrubs and climbers. Nearly 53% of these species are subjected to destructive harvest to collect their underground parts, wood, bark or whole plants for use as herbal raw drugs.

2. Estimated Annual Demand of Herbal Raw Drugs in the Country:

The annual demand of herbal raw drugs in the country has been taken as equivalent to their annual estimated consumption by various categories of herbal raw drug users including the domestic herbal industry, rural households, folk practitioners and exporters. Estimated wastage of the raw drugs during post-harvest handing has also been factored in for estimating annual demand of herbal raw drugs.

Total commercial demand of herbal raw drugs in the country for the year 2014-15, converted to dry weight for all entities, has been estimated at 5,12,000 MT as detailed below:

Estimated Annual Demand of Herbal Raw Drugs (Dry Wt. in MT) for 2014-15				
Domestic Herbal Industry	**Exports**	**Rural Households**	**Wastage**	**Total**
1,95,000	1,34,500	1,67,500	14,910	5,11,910

or say 5,12,000 MT

The data in respect of export of herbal raw drugs has been extracted and compiled from the DGCIS reports for the year 2014-15. The demand estimates in respect of the domestic herbal industry have been prepared on the basis of 'consumption' of botanical raw drugs by 692 sampled domestic herbal units licensed to manufacture ASU and Homoeopathic formulations. The

demand estimates in respect of rural households of the country have been prepared based on analysis of stratified sample survey of 2450 rural households spread across 15 states. A significant portion of the harvested material gets lost during post-harvest handling putting pressure on the resource, and an average wastage of 3% (2% to 8% for different herbal raw drug entities) for all entities has been worked out. In addition, effort has been made to estimate the consumption of herbal raw drugs by folk healers and traditional practitioners who prefer to dispense medicines prepared by them. The average annual usage of herbal raw drugs by the sampled folk healers worked out to 109 kg but this data could not be extrapolated and added to the total demand of the herbal raw drugs in the country for want of reliable information on the total number of such folk practitioners in India.

The estimated annual demand of herbal raw drugs for the year 2014-15 has registered an increase of 62 percent in volume over the estimation of similar demand worked out by Ved and Goraya (2008) for the year 2005-06. The major increase has been in case of exports where the exported volume of botanical drugs increased from 56,500 MT in 2005-06 to 1,34,500 MT in 2014-15, i.e. more than doubled with an increase of 138 percent. Isabgol (*Plantago ovata*), Chakoda/ Powad Beej (*Senna tora*) and Sonpatta (*Senna alexandrina*) were recorded as the top three exported botanical drugs with export volumes of >32,000 MT, >28,000 MT and >13,000 MT respectively during the year 2014-15.

In respect of botanical drugs consumed by the domestic herbal industry, Ghritkumari (*Aloe vera*) with an estimated consumption of 15,700 MT (dry wt.) during 2014-15, was the highest consumed herbal raw drug. Amla (*Phyllanthus emblica*) with estimated consumption of 14,200 MT, Isabgol (*Plantago ovata*) with estimated consumption of 13,700 MT and Harad (*Terminalia chebula*) with estimated consumption of 6,000 MT during the same period, are the other important herbal raw drugs consumed in quantities >5,000 MT. A small reduction in the annual trade volumes in respect of Amla (*Phyllanthus emblica*), Harad (*Terminalia chebula*), and Bahera (*Terminalia bellirica*) as estimated in the current study vis-a-vis the earlier study by Ved and Goraya (2008) is perhaps on account of an increasing trend to use de-seeded material and extracts in respect of these entities.

3. Estimated Annual Trade Value of Herbal Raw Drugs in the Country:

The trade value of 5,12,000 MT of botanical raw drugs, estimated to be consumed in the country during the year 2014-15, works out to around ₹ 7,000 crores (> one billion USD).

Estimated Annual Value of Traded Herbal Raw Drugs for 2014-15 (in Crore Rupees)				
Domestic Herbal Industry	**Rural Households**	**Wastage**	**Exports**	**Total**
1,950	1,675	149	3,211	6,985

or say ₹ 7,000 crore

The trade values in respect of the consumption of botanicals by the domestic herbal industry, the rural households and the wastage have been arrived at by applying an average rate of ₹ 100.00 per kg. across herbal raw drug entities recorded in trade, including spices. The trade value of herbal raw drug entities, in exports, is based on the actual value recorded in the DGCIS data for the year 2014-15.

The estimated trade value of herbal raw drugs in commercial demand for the year 2014-15 is about seven times higher than the trade value of ₹ 1068 crore arrived at for the year 2005-06 by

Ved and Goraya (2008). The major increase has been in respect of the export which has increased from ₹ 354.80 crore in 2005-06 to ₹ 3211 crore in 2014-15, registering more than eight fold increase in ten years. The trade value of herbal raw drugs consumed by the domestic herbal industry has also registered more than two fold increase as per the latest estimates.

4. Estimated Annual Domestic Turnover of Herbal Industry in the Country:

The total estimated turnover of the domestic herbal industry in the country for the year 2014-15 stands at ₹ 20,000 crore! This estimation is based on the equation developed during this study that brings out that the expenditure incurred on procurement of herbal raw drugs by the domestic herbal industry during 2014-15, constitutes about 10% of their turnover for the year. Comparison of the estimated turnover of the domestic herbal industry for the year 2014-15 with the one worked out by Ved and Goraya (2008) for the year 2004-05 reveals that the sector has grown at a healthy 11% per year over the past decade.

5. Estimated Supply of Herbal Raw Drugs:

Non-availability of reliable country wide figures for production and supply of herbal raw drugs remained an area of concern. Most of the State Forest Departments (SFDs), which used to gather and consolidate on annual basis information regarding removals of NTFPs from the forest areas, are not maintaining this vital statistics any more. The major reason cited is the freeing of NTFPs from under governmental control and devolving their management rights to the Panchayats and local communities under the PESA and the FRA. Record of medicinal plants collected was available only in respect of a very few selected NTFPs, including medicinal plants, that have been 'nationalised' by some States. Some information on annual removal of medicinal plants could also be gathered from five SFDs. However, this information is based on the material exported from the area and not actually removed from the forest. Thus, even this information is far from complete. No record in respect of medicinal plants harvested from landscapes outside forests viz. fallow lands, farm lands, waste lands, road/ rail/ canal sides, water bodies, etc. could be obtained due to want of any agency maintaining such database.

During the survey, a large number of agencies including national level government bodies, research institutions, herbal industry and NGOs, were noticed to be engaged in promoting medicinal plant cultivation in the country. However, consolidated species-wise data related to extent of such cultivation was not available. Based on discussions with stakeholders and *a priori* information, visits were made to areas under sizeable cultivation of different medicinal plant species that revealed that 12 major medicinal plant species (Isabgol, Henna, Senna, Mentha, Tulasi, Ashwagandha, Ghritkumari, Pippali and Pippal Mool, Bach, Artemisia, Vetiver, and Kuth) were being cultivated on an estimated 2,02,000 hectares across the country forming major source of their supply. Information relating to the instances of cultivation of about 30 other species, over an estimated 5000 hectares area, has also been collected and compiled.

In addition to the collection of botanicals from the wild and cultivation of the selected entities, the third supply source of herbal raw drugs is imports. DGCIS data for the year 2014-15 records an import of about 65,000 MT of herbal raw drugs of which more than 31,000 MT is on account of imports of 'Gum Arabic' alone. Other major herbal raw drug entities in import include Pepper Long, Garcinia, and Asafoetida, with a collective import volume of just about 3600 MT. Most of the remaining botanicals in the imports get clubbed as 'Others' in the existing ITC (HS) Code of classification of commodities in foreign trade.

As is clear from the above, data in respect of production and supply of herbal raw drugs is either not available or is incomplete. In any case, the consumers seem to be getting their requirements of herbal raw drugs fulfilled. In this scenario, the supply of herbal raw drugs has been assumed to be equal to their current demand as estimated under para 2 above.

6. Medicinal Plant Species in High Commercial Demand (≥100 MT/ Year):

The species-wise annual consumption of herbal raw drugs obtained from the 1178 medicinal plant species enlisted under this study varies from less than 1 MT to more than 30,000 MT. The threshold of 100 MT towards high commercial demand as adopted by Ved and Goraya (2008) has been retained to maintain comparability of the statistics. Analysis of data gathered under the present study reveals that 242 species - wild gathered, cultivated or imported for main use as herbal raw drugs - are in high commercial demand i.e. the annual commercial demand of each of these is 100 MT or more. Further analysis of these 242 species reveals that supply source of 15 species (6%) is import; 54 species (22%) are obtained from cultivation; 59 species (25%) are wild collected from landscapes outside forests; and 114 species (47%) are collected from forests (36 species from the Himalayan temperate forests and 78 species from tropical forests). Ved & Goraya (2008) had enlisted 178 species to be in high commercial demand, of which 3% was procured through import; 20% from cultivation; 25% from landscapes outside forests; and 52% from forests. Comparison of the statistics of these two studies reveals a slight increase in the percentage of entities obtained from the cultivation and a two-fold increase in the percentage of imported entities.

Analysis of the data pertaining to the major supply sources of the 242 species in high commercial demand (>100 MT per year) reveals that herbal material pertaining to 72% of these species is sourced entirely or largely from the wild. In as far as the total annual consumption volume is concerned, the material from cultivation, due mainly to the bulk use of a few cultivated species like 'Aloe', 'Isabgol', '*Mentha*' and '*Senna*' in wellness products, forms about 40% of the total volumes consumed for all medicinal plants species. The classical Indian healthcare systems, however, continue to be largely dependent upon wild collected herbal raw material with nearly 85% of the species diversity and more than 70% of the volumes of herbal raw drugs consumed being sourced from the wild.

In addition to these 242 medicinal plant species that are wild collected, cultivated or imported for main use as herbal raw drugs, many other plant species that are collected/ cultivated mainly for other purposes are also used in large quantities as herbal raw drugs. For example, 7 species of cultivated aromatic genera like *Cymbopogon*, *Mentha* and *Rosa*, and 57 plant species cultivated mainly for use as spices, cereals, pulses, fruits, vegetables, and vegetable oils are also in high commercial demand for use as herbal raw drugs. However, their use as herbal raw drugs makes for a very small proportion of the total production/ consumption of these species. In addition, entities like Banslochan, Kapur, and Gaultheria oil generally correlated to the plant sources namely *Bambusa bambos*, *Cinnamomum camphora*, *Gaultheria fragrantissima* (and *Gaultheria procumbens*) respectively are reportedly consumed in very high quantities by the domestic herbal industry. However, there are serious doubts about the sourcing of these raw materials from the available plant resources as plant sources of these entities could not be verified during the study from the available data and due to the inability to access their authentic samples. Informal discussions with traders indicated that the source of these entities could be largely synthetic. The supply source of these entities, therefore, remains ambiguous, and needs further investigation.

Detailed supply source-wise lists of the 242 medicinal plant species recorded in high commercial demand for the year 2014-15 have been given in the main report. Appropriate footnotes on the 'alternate' or 'equivalent' species have also been added to these lists to enable the managers formulate their region-specific management actions. The list, would, however, need to be updated to include the species in high commercial demand that might have been inadvertently left out of the survey.

7. Domestic Trade of Herbal Raw Drugs:

Domestic trade of herbal raw drugs in the country occurs through Conventional Herbal Raw Drug Mandis; Krishi Upaj Mandis; Specialized Herbal Mandis; Cooperatives/ Federations/ Corporations; or Direct Trade under Buy-back Arrangements. Forty such herbal raw drug trade centres were visited as part of this study and data about the diversity and quantum of herbal raw drug entities traded in these centres gathered. The data revealed that more than 3 lakh MT of mostly wild collected herbal raw drugs pertaining to more than 700 medicinal plant species are traded through conventional herbal raw drug mandis alone. Major entities of such trade include Amla, Harad, Bahera, Giloe, Mahua, Sal beej, Shatavar, etc. Another 1.5 lakh MT of mostly cultivated herbal raw drug entities are traded through the Krishi Upaj Mandis with major entities of such trade being Isabgol, Henna, Senna, and Ashwagandha. The Specialised Herbal Raw Drug Mandis and the Cooperatives/ Corporations/ Federations collectively deal with trade of about 10,000 MT of herbal raw drugs. Direct trade under buy-back arrangements is an emerging trade route. However, the scale of such trade at present is too wide-scattered and too low to be effectively pooled. The trade across LoC makes a significant contribution to the annual trade of herbal raw drug entities. This trade has been captured for the first time as a part of this study and it has helped in resolving many riddles in the trade of Himalayan herbs.

A typical trade chain, based on study of trade chains in respect of various species, has been constructed and presented in the report. Value addition along this trade chain has also been studied and presented. Except in case of direct trade under buy-back arrangements, where the end user buys the material directly from the primary producer without engagement of middle men, the remaining herbal raw drug trade involves traders at one or more levels. The remuneration the primary producer – wild gatherer or cultivator – receives ranges between 40% and 60% of the price at which the end user procures the material. Much of this price gap is on account of value added at various levels, including wastages along the trade chain. The average cumulative working margin for the traders at all levels was estimated to be ranging between 12% and 20% for different herbal raw drug entities with most of the traders working at an individual margin of 6% to 7%.

Prices of herbal raw drugs collected from different mandis have revealed a large price fluctuation from mandi to mandi and from one season to the other and also in view of the felt demand of the commodity. A sudden spurt in the prices of some commodities, driven by higher demand or lower production, was also noticed. For example, during 2014-15, the prices of *Picrorhiza kurroa* (Karu) suddenly rose to ₹ 2,500 per kg, before settling at prices of ₹ 900-1100 per kg by the end of the year on the strength of imports from Nepal. It is, therefore, difficult to work out any 'common annual price' for the herbal raw drugs in trade.

Strengths and weaknesses of various systems of herbal raw drug trade in the country have been studied. Whereas the Specialised Herbal Raw Drug Mandis, the Corporations/ Cooperatives/ Federations, and the Krishi Upaj Mandis offer a transparent system of trade, their reach is limited

to a few high volume species and the cultivated species. The Conventional Herbal Raw Drug Mandis, on the other hand, offer trade in a very large diversity of wild collected entities for which they have established an intricate and efficient collection network in various states. The primary producers, under all these systems of trade, get just about half of the ruling market price for their produce.

8. Major Trends:

The study has revealed that the herbal raw drug sector in the country is on a path of growth riding on the growth of herbal based wellness industry, registering an annual growth of more than 10% between 2004-05 and 2014-15. Some other trends that have emerged from the study are highlighted below:

- That the total demand of herbal raw drugs, estimated to be 5,12,000 MT for the year 2014-15, is expected to grow to 6,50,000 MT by the year 2020.
- That in view of the increasing demand of wellness products, the export value of the herbal raw drugs has the potential to maintain the current rate of growth of about 20% per annum.
- That the estimated consumption of herbal raw drugs by the domestic herbal industry grew from 1,77,000 MT in 2004-05 to 1,95,000 MT in 2014-15; and -
  - Large and medium herbal industries (Category 'A' & Category 'B'), forming less than 3% of the total 8610 licensed units in the country, consumed more than 66% of the herbal raw drugs consumed annually by the entire herbal industry in the country with the large number of small and very small herbal units (Category 'C' & Category 'D') consuming only the remaining one third of herbal raw drugs.
  - 198 of the 907 medicinal plant species, recorded in active consumption by the domestic herbal industry, constituted 95% of the total consumption, with the remaining 709 species constituting only 5% of the consumption.
  - Ghritkumari (*Aloe vera*), with an annual estimated consumption of 15,700 MT (dry weight) emerged as the entity in highest consumption, replacing Amla (*Phyllanthus emblica*), that held this position for long.
  - A general shift from the use of whole 'myrobalans' to deseeded 'myrobalans' by the domestic herbal industry was noted, giving the impression that the consumption of these entities had dipped.
- That more than 85% of the medicinal plant species forming source of herbal raw drugs in active use in classical ASU formulations were still being sourced from the wild.
- That domestic herbal industry was increasingly engaged in the manufacture of wellness related patent and proprietary OTC formulations towards addressing wellness related issues like obesity, diabetes, joint pains, skin care, hair care, etc.
- That there was an increasing trend towards use of 'extracts' as evidenced from the use of extracts of about 500 species, with major use of extracts in wellness formulations.
- That cultivation of medicinal plants by number of species and area under cultivation has shown a definite increase over the past ten years; and -
  - The major species in cultivation were recorded to be Isabgol (*Plantago ovata*), Ghritkumari (*Aloe vera*), Vetiver (*Chrysoopogon zizanioides*), Senna (*Senna alexnadrina*), Ashwagandha (*Withania somnifera*), Bach (*Acorus calamus*), Tulasi (*Ocimum tenuiflorum*), Pippali/ Pippalmool (*Piper longum*), Kuth (*Saussurea costus*), Pushkarmool (*Inula racemosa*), Mentha (*Mentha* spp.).
  - The major driver of cultivation seemed to be the units engaged in making 'extracts', the herbal units engaged in making very specific formulations that requires large volume of

limited number of species with consistent quality, and the firms engaged in export of herbal raw drugs.
  - Almost all successful recent initiatives in the area of cultivation of medicinal plants were noted to involve some local CBO/ progressive farmer as coordinator for providing logistic and technical support and to act as a link between the producers and the buyers.
  - NMPB's program to promote medicinal plant cultivation was noted to have made a significant contribution in facilitating the cultivation of medicinal plants in the form of providing financial support, building confidence and in supporting CBOs towards hand holding of the farmers.
  - Cultivation of Red Listed species was noted to be still at an exploratory phase of cultivation, and would need more support to firmly entrench such cultivation in local agricultural practices.
- That the domestic herbal industry, responding to the consumer demand for quality and also due to enforcement of GMP guidelines, is also noticed to be in the process of makeover to modernization and better record keeping.

9. Action Points - Way Forward:

The herbal sector in the country is on the path of growth due to renewed interest in the Classical Indian Systems of Medicine and the fast growing wellness industry. This growth has brought the sector face to face with realities related to quality and authenticity of herbal raw drugs and their sustainable supplies. Fast growth of this sector needs close monitoring of the status of demand and supply of medicinal plants to ensure authenticity and quality of the material and management of resource base. The study has resulted in bringing out various issues that have been presented in the form of the following action points as a way forward for further development of this sector:

- Management of Wild Resources: The wild collected medicinal plants continue to be the major resource base for herbal raw drugs used in classical Indian Systems of Medicine. Conservation, strengthening and sustainable utilization of this resource has not received the level of inputs it deserves resulting in fast depletion of its wild populations, especially the invaluable medicinal trees and Himalayan herbs. Thus –

  - A long-term national program for in situ conservation, development and sustainable utilization of medicinal trees and Himalayan herbs of high conservation concern needs to be initiated immediately, lest many of these high value species reach a stage of no return.

- Promotion of Commercial Cultivation of Medicinal Plants: NMPB has played stellar role in promoting medicinal plant cultivation over the past about 15 years. However, with the projected growth in the sector, the demand of raw material is likely to grow further. The issues related to local anchoring of cultivation, availability of quality planting material, dispensation of subsidy, etc. however, still remain to be sorted out. Thus -

  - There is an immediate need of a national program supporting development, production and provisioning of quality planting material of priority medicinal plant species.
  - Support local CBOs/ Farmer Groups to anchor the medicinal plant cultivation through creation, servicing and hand holding of farmer clusters, providing link between the farmers and buyers, and between farmers and NMPB.
  - Revisit subsidy dispensation mechanisms to ensure their easier utilisation by the farmers.

- Good Post Harvest Practices & Infrastructure: A substantial portion of the herbal raw drugs is wasted due to bad handling of the produce from its production to use. Such wastage not only adversely impacts the economy, but also impacts the resource base. Thus –

  - NMPB needs to put in place mechanisms for development of facilities for post-harvest handling and testing of the produce at key medicinal plant cultivation and collection clusters.

- Fair Trade Practices: The herbal raw drug trade in the country continues to be far from transparent with little demonstrable mechanisms to reflect fair trade practices. As such the issues about source of the material, about its authenticity, and about fair returns to the primary producers continue to haunt the sector. Thus -

  - There is an urgent need to put in place an effective 'trade record management system' in place in respect of conventional herbal raw drug mandis, along with 'chain of custody' protocols for the traded material.
  - Support a national capacity building program for Panchayat functionaries and frontline staff of SFDs in identification and documentation of medicinal plants harvested from their area towards developing 'chain of custody' regime at the primary production level.

- Research & Development: Various organizations in the country are engaged in research on different aspects of medicinal plants without any coordination amongst them. Some aspects like resolving the issues of controversial raw drugs and long-term storage of germplasm of red-listed species have thus not received due attention. Repositories of Herbal Raw drugs for record and reference are yet to be established. Thus –

  - There is a need to network and coordinate efforts of the different organizations engaged in medicinal plant related research towards focused outputs.
  - An immediate national program to resolve the issues pertaining to controversial herbal raw drugs is required.
  - Support early establishment of a National and 4-5 Regional Raw Drug Repositories for referencing and authentication of material in trade.
  - Designate a national Nodal Agency and 4-5 specialized organizations to continuously gather subject specific data and bring out quinquennial report on demand and supply of medicinal plants in the country.

- Policy & Regulatory Regime: Medicinal plant sector in the country is governed by various legislative and operational provisions made by the Central and the State governments that need harmonization to facilitate development of the sector. Thus -

  - There is an urgent need to develop and adopt a National Medicinal Plants Policy-cum-Strategy to coordinate and guide development of the sector.
  - The Forest Produce Transit Rules of different States need to be harmonized to facilitate smooth movement of herbal raw drugs across the country.
  - The notifications under Section 38 and the Section 40 of the Biological Diversity Act, 2002 relating to the species on the verge of extinction, and entities normally traded as commodities respectively need to be reviewed and updated to promote the sector.
  - The existing system of coding of botanicals in foreign trade using ITC (HS) codes, needs to be

critically evaluated and improved to establish clear linkage of traded herbal raw drugs with their plant sources.

- Capacity Building: The growth of the sector has resulted in improved understanding about the issues related to medicinal plants resource, the primary producers, the traders, the regulatory agencies, etc. There is a need to disseminate this understanding and knowledge for better management of the sector. Thus –

  - It would be very useful for the various stakeholders if the NMPB supports publication of an Illustrated Compendium of 1178 traded medicinal plant species recorded under this study.
  - NMPB needs to get appropriate training modules developed for different stakeholder categories, and get these incorporated in the regular training curriculums for these stakeholder categories in use by different states.
  - Support for development and production of educational material on good harvesting practices and good post-harvest handling practices in the form of audio-visuals/ posters/ brochure/ etc. would go a long way in building capacity of primary producers and field level workers in better management of the produce.

- Institutional Mechanisms: The NMPB has been successful in drawing the focus towards various issues related to medicinal plants. These diverse issues need specialized inputs to strengthen the hands of NMPB for efficient handling of these issues. The State Medicinal Plants Boards are not structured to provide such support. Thus –

  - It is highly desirable to identify and designate 4-5 suitable organizations as Medicinal Plant Technical Support Groups (MP-TSG) to provide technical support to NMPB in dealing with diverse issues related to medicinal plants.
  - NMPB needs to develop and put in place a web-based National Medicinal Plants Portal for online submission of annual returns by the domestic herbal industry under Section 157A of the Drug and Cosmetic Rules, 1945.
  - There is a need to strengthen the NMPB to enable it to address the various issues pertaining to medicinal plants sector.

Preface

The herbal-based health care and wellness sector in India is continuing to grow reconfirming the robustness and contemporary relevance of Indian Systems of Medicine. This growth is, however, putting a high demand on the medicinal plant resources, both wild collected and cultivated, giving rise to concerns about the authenticity, quality and sustainability of herbal raw drug supplies, especially those obtained from wild species that are already facing threat to their very existence. Conservation and augmentation of medicinal plant resources, thus, has come to assume a very high priority. Any action to initiate measures to develop the medicinal plants resource base requires updated information about the diversity and quantum of medicinal plant species in commercial trade. 'Demand and Supply of Medicinal Plants in India' (Ved and Goraya, 2008), a report based on the nation-wide study commissioned by the National Medicinal Plants Board (NMPB), Ministry of AYUSH, Government of India, has been serving as the only comprehensive report on the subject even as it is almost ten year old. The dynamic nature of the herbal sector, however, calls for a periodic re-look on the entire gamut of demand and supply of medicinal plants in India so that medicinal plant development strategies could keep pace with the emerging trends.

It was to review the demand and supply status of medicinal plants in the country and to bring out trends that the NMPB commissioned the present nation-wide study in February 2015 through the Indian Council of Forestry Research and Education (ICFRE) with the major objective to review and assess the status of demand and supply of medicinal plants in India for the year 2014-15. The study presented many challenges including the lack of any standardized nomenclature in respect of herbal entities in trade making data collation a challenge; continuous opacity in herbal trade, especially related to the supply chains; difficulties in procuring samples of herbal entities in trade/ use, making their authentication a challenge; non-availability of any consolidated information on wild harvested or cultivated herbal material; non-availability of species-wise foreign trade data due to the ITC (HS) classification system in vogue; diversity and geographical range of resource users like licensed domestic herbal industry making herbal formulations under various Indian Systems of Medicine and registered exporters, and a vast range of other users like the folk healers, the households, petty traders, etc. making data collection and collation a challenge. The ICFRE took up this challenge and undertook this study employing a robust sampling design, and rigorous data collection and analysis regime. The results show a marked improvement in the data capture and understanding of the subject over the previous similar reports.

The highlights of the study include estimation of the total worth of the domestic herbal industry in the country for the year 2014-15 and estimation of total trade value of herbal raw drugs by all categories of users for the same year. The study also has also resulted in enlisting 1622 botanicals corresponding to 1178 species in commercial trade with a total trade volume of 512000 MT for the year 2014-15. The impact of household level use of herbal raw drugs upon the national demand has been worked out based on household survey in 15 states. The report also flags many issues for the first time. For example, the element of 'wastage' along supply chains have been estimated and included in the study for the first time. Issue related to direct consumption of herbal raw drugs by traditional practitioners of Indian Systems of Medicine and its impact on the total annual commercial requirement of the herbal raw drugs has been flagged for the first time. Text is laced with images, graphics and case studies to highlight the various issues. The study report has been brought out in the form of this publication that is organized in twelve theme-specific chapters.

A study of this complexity and magnitude wouldn't have been possible without the whole hearted support and encouragement from various quarters. First and foremost, we would like to express our

deep gratitude to Dr. Ashwani Kumar, the then Director General, and Dr. Shashi Kumar, the present Director General, ICFRE for their guidance and continuous support enabling us to take up and complete the study in a time bound manner. We are also grateful to Mr. Darshan Shankar, Director, FRLHT for agreeing to collaborate with ICFRE and allowing use of FRLHT's data base for this study.

We gratefully acknowledge the sincere efforts put in by the core team comprising of Dr. T. P. Singh, Dr. K. Ravikumar, Mr. B. S. Somashekhar Mr. Raman Nautiyal, Dr. Shilpa Gautam, Dr. R. S. Rawat, and Dr. Vaneet Jishtu in facilitating and gathering data from the field and for providing able editorial support. We also thank field team members including Dr. S. P. Subramani, Dr. Nawa Bahar, Mr. Ved Pal, Mr. S. R. Baloch, Mr. N. K. Limba, Dr. Sanjay Singh, Mr. M. Rajkumar, Mr. N. D. Khobragade, Mr. Ajay Kumar, Mr. H. R. Bora, Mr. Dhaneshwar Datta, of ICFRE and its Institutes, and Dr. Noorunnisa Begam, and Ms. Suma Tugadur of FRLHT for gathering data and case studies from various field sites in respect of cultivation and wild collections, communities, folk healers, domestic herbal industries, and herbal mandis. We also express our gratitude to Mr. STS Lepcha, Managing Director, Uttarakhand Forest Development Corporation; Dr. H. B. Naithani, Scientist (Retd.) and Ms. Rashmi Bajaj, Consultant for providing expert inputs in respect of wild harvest of medicinal plants, nomenclature issues and policy issues respectively. We would like to express our special gratitude to Dr. R. S. Rawat, Dr. Shilpa Gautam, and Mr. Umang Thapa for efficiently handling the data and facilitating its analysis.

Many other people, including wild gatherers, farmers, traders, owners of herbal industry, and forest managers, willingly came forward to share valuable information related to various aspects of medicinal plants. We express our deep gratitude to all of them. We are especially grateful to Dr. Lal Singh of HRG, Shimla; Mr. Nand Lal of Nanda Herbs, Manali; Mr. Dileep Rai of Asha Gramudyog Sansthan, Lucknow; Mr. Sita Ram Kushwaha of Dabur India Ltd., Mr. Pranab Ranjan Choudhury of Baitarani Initiatives, Bhubaneshwar; Mr. Shahandaaz Hussain of Agri Vista Tech, Guwahati; Mr. V. B. Ladole of CARD, Amravati; Mr. N. D. Prajapati of Jodhpur; and Mr. Mahadev Pawar of Gadag. We also express our gratitude to Mr. R. K. Agarwal and Dr. Amit Agarwal of Natural Remedies; Dr. Baba Brindavanam of Dabur India Ltd.; Padma Shree Vaidya Balendu Prakash; Mr. Janak Rawal of MedHerbs; Mr. Rakesh Aggarwal of National Herbs Company for providing insights into the various aspects of trade and use of medicinal plants.

We are grateful to the National Medicinal Plants Board for accepting ICFRE's proposal and providing it an opportunity to carry out this complex study of great national significance. We are especially grateful to the then Chief Executive Officers of NMPB, Mr. Jitendra Sharma and Dr. Meenakshi Negi, and the present Chief Executive Officer of NMPB, Ms. Shomita Biswas, for supporting the study team with introduction to stakeholders, helping the team finalise the structure of study outputs, and continuous guidance till its culmination. We also put on record our gratitude to Ms. Padmapriya Balakrishnan, Dy. CEO, NMPB and Dr. Lalit Tiwari, NMPB for their polite nudges to complete the study on time, and for facilitating its peer review. We would like to express our sincere gratitude to Mr. Ajit M. Sharan, Secretary, AYUSH for his keen interest in the study, sitting through long presentations of the draft and the draft final report and providing critical inputs towards developing action points.

We hope that the publication adds to the knowledge on the subject, results in improving understanding on various complex issues related to the subject and provides base to the policy makers, resource managers, resource users, and researchers for formulating strategies and initiating further action to strengthen medicinal plant resource base in the country towards sustainable supplies of authentic and quality herbal raw drugs.

27 February 2017

(G. S. Goraya and D. K. Ved)

Abbreviations

ACF	:	Assistant Conservator of Forests
ADMA	:	Ayurvedic Drug Manufactures Association
API	:	Ayurvedic Pharmacopoeia of India
ASU	:	Ayurveda, Sidha and Unani
ASU	:	Ayurvedic, Siddha, Unani
ASU&H	:	Ayurveda, Siddha, Unani 8: Homeopathy
AYUSH	:	Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha & Homoeopathy
BMC	:	Biodiversity Management Committee
BRDG	:	Bio-Research & Development Growth
CAMP	:	Conservation Assessment and Management Prioritization
CARD	:	Centre for Advanced Research & Development, Bhopal
CBOs	:	Community Based Organisations
CERPA	:	Centre for Research, Planning and Action, Delhi
CIMAP	:	Central Institute of Medicinal and Aromatic Plants, Lucknow
CITES	:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLP	:	Certificate of Legal Procurement
cm	:	Centimetre
CSIR	:	Council of Scientific & Industrial Research
CST	:	Central Sales Tax
DAP	:	Diammonium Phosphate
DFO	:	Divisional Forest Officer
DGCIS	:	Director General of Commercial Intelligence and Statistics
DGFT	:	Directorate General of Foreign Trade
DTRs	:	Daily Trade Returns
ENVIS	:	Environmental Information System
EXIM	:	Export-Import Bank of India
FRA	:	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
FRLHT	:	Foundation for Revitalisation of Local Health Traditions, Bangalore
GCC	:	Girijan Co-operative Corporation
GEF	:	Global Environment Facility
GI	:	Geographical Indication
GMP	:	Good Manufacturing Practice
ha	:	Hectare
HAPPRC	:	High Altitude Plant Physiology Research Centre, Srinagar (Garhwal)
HFRI	:	Himalayan Forest Research Institute, Shimla
HHRC	:	Herbal Health Research Consortium Pvt. Ltd.
HP	:	Himachal Pradesh
HRG	:	Himalayan Research Group, Shimla
HS Code	:	Harmonised System Code
ICAR	:	Indian Council of Agricultural Research
ICFRE	:	Indian Council of Forestry Research & Education, Dehradun
ICIMOD	:	International Centre for Integrated Mountain Development, Kathmandu
ICMR	:	Indian Council of Medical Research
ICRISAT	:	International Crops Research Institute for the Semi-Arid Tropics

IGC	:	Inter Governmental Committee
IHBT	:	Institute of Himalayan Bioresource Technology, Palampur
ISM	:	Indian Systems of Medicine
ITC (HS)	:	Indian Trade Classification (Harmonised System)
IUCN	:	International Union for Conservation of Nature
JFM	:	Joint Forest Management
JICA	:	Japan International Cooperation Agency
Kg	:	Kilogram
LAHDC	:	Ladakh Autonomous Hill Development Council, Leh
LoC	:	Line of Control
LSTM	:	Ladakh Society for Traditional Medicine
m asl	:	Meter above sea level
MFP	:	Minor Forest Produce
MNREGA	:	Mahatma Gandhi National Rural Employment Guarantee Act
MoEF	:	Ministry of Environment and Forests
MP	:	Madhya Pradesh
MPCA	:	Medicinal Plants Conservation Areas
MPCDAs	:	Medicinal Plants Conservation and Development Areas
MPTSGs	:	Medicinal Plant Technical Support Group
MSP	:	Minimum Support Price
MT	:	Metric Tonne
NBA	:	National Biodiversity Authority, Chennai
NGO	:	Non-Governmental Organisation
NHM	:	National Horticulture Mission.
NISCAIR	:	National Institute of Science Communication and Information Resources
NMPB	:	National Medicinal Plants Board
NTFP	:	Non-Timber Forest Produce
OTC	:	Over-the-Counter
PBR	:	People Biodiversity Register
PESA	:	Panchayats (Extension to Scheduled Areas) Act, 1996
₹	:	Indian Rupees
SFDs	:	State Forest Departments
SHG	:	Self-Help Group
SWOT	:	Strengths, Weakness, Opportunities, and Threats
TP	:	Transit Pass
UFDC	:	Uttarakhand Forest Development Corporation
UHF	:	Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni (Solan)
UNDP	:	United Nations Development Programme
UP	:	Uttar Pradesh
VAT	:	Value Added Tax
WCO	:	World Customs Organisation
WII	:	Wildlife Institute of India, Dehradun
WL	:	Wildlife

Terms Used

Adulterants: Raw drugs obtained from plant sources other than the officially accepted ones because of similarity in appearance, similarity in vernacular names, or otherwise.

Botanicals: Plant parts or exudates and galls obtained from plants that are used as raw drugs for preparing health care formulations.

Crore: A unit in the Indian Numbering System equal to 10 million.

Entities: Plant parts or exudates and galls obtained from plants that are used as raw drugs. This term has been used interchangeably with 'botanicals'.

Equivalents: Raw drugs that are obtained from more than one similar looking plant and are freely used as the same without discretion. For example, even as 'daruharidra' is officially correlated to Berberis aristata, the material obtained from many other species of Berberis is also collected as 'daruharidra' and freely used for the purposes for which 'daruharidra' is to be used.

Extract: Any substance obtained directly from plant material by physical or chemical means regardless of the manufacturing process. An extract may be solid (viz. crystals, resin, fine or coarse particles), semi-solid (viz. gums, waxes), or liquid (viz. solutions, tinctures, oil and essential oils)

Herbal Raw Drugs: Plant parts or exudates and galls obtained from plants that are used for medicinal purposes under one or the other system of medicine, including folk traditions.

Lakh: A unit in the Indian numbering system equal to one hundred thousand.

Mandi: Herbal Raw Drug Market

Medicinal Plants: The plant taxa that have medicinal use recorded in one or the other system of medicine, including folk traditions. For the purpose of this study, however, the medicinal plants of which the major quantity is primarily used as food, fruit and/ or spices, have not been taken up for assessment of their annual trade volume.

Quintal: A unit of weight equal to 100 kg.

Red-listed: Plant species that have been assessed as 'Critically Endangered', 'Endangered', and 'Vulnerable' following IUCN's Red List Categories and Criteria Versions - 2.3:IUCN (1994) & 3.1:IUCN (2001).

Substitutes: Raw drugs, the use of which in place of the raw drug mentioned in the Pharmacopeia, has been accepted/ documented in the classical texts or in the pharmacopeia.

Cheilocostus speciosus

Contents

Chapters

Annexure

Photo : Dr. H. B. Naithani

1

Herbal Sector in India: Current Scenario

1.1. INTRODUCTION

Medicinal plants have been the mainstay of traditional health care practices across all societies for centuries. A very significant population in the developing countries continues to thrive upon the herbal drugs, which could be gathered from nature almost free. India also has very strong traditional health care practices that are represented by the classical systems of medicine like Ayurveda, Siddha, Unani, and Swa-rigpa on one hand, and by a very diverse area-specific and community-specific folk healthcare practices on the other. The major commonality of the Indian classical and the folk health care traditions is their dependence upon the raw material derived from a large diversity of plant species, which is estimated to be about 6,500 species.

The practice of classical health care streams in India has undergone a major transformation as "the practice of the individual physician identifying drugs and preparing medicines himself for the use of his patients has been largely supplanted by the pharmaceutical industry... He (the practitioner) prefers to buy it straight from the market..." (Anon., 1978). This transformation in the practice of traditional medical systems has necessitated the collection of medicinal plants from the wild through millions of herb gatherers from different parts of the country in commercial quantities and transport these to 8600 odd licensed herbal units located in different parts of the country. This commercial collection of herbal raw drugs has given rise to a thriving medicinal plant based economy, both at the local level and the national level. It has, however, put the wild populations of many medicinal plants species under stress.

The global interest in herbal health care is concurrently undergoing a change. The plant based traditional health care practices that were believed to be on the decline till recently due to increasing reach of modern health care systems, are witnessing a strong global resurgence, despite "the traditional medicines attracting whole spectrum of reactions from 'uncritical enthusiasm to uninformed scepticism' on account of safety, efficacy, quality, etc." (WHO, 2002). This resurgence is witnessing increased use of complementary and alternative medicine in developed countries also. Health is now being increasingly seen as not only the absence of sickness, but also seen to encompass general well being of the person; and herbs are believed to provide this holistic health care.

This renewed global interest in herbal health care has started a race amongst the traditional societies with strong herbal based health care traditions to grab a pie in the increasing global trade of herbal raw drugs as well as the finished herbal products. The recent positioning of herbs as 'herbs for wellness' has surprised even the diehard sceptics when Global Wellness Institute sponsored study, in September 2014, has valued the 2013 global wellness economy at US$3.4

trillion (Bodekar, 2015). The medicinal plants, Bodekar (2015) opines, are no more mere niche filling sources of alternative medicines, but 'have now become the source of a whole new range of products and approaches designed to promote well being, reduce the effects of ageing, increase energy levels and general vitality, promote skin health, add power to nutrition, and combat stress'. Many of these wellness requirements are met through using medicinal plants in and as 'functional foods'.

The transformation of Indian classical health care practices increasingly depending upon ready to use commercially prepared herbal formulations on one hand, and the resurgence of global interest in herbal based wellness on the other is directly dependent on uninterrupted supplies of medicinal plants. Whereas some medicinal plants have been brought under commercial cultivation, major diversity of medicinal plants continues to be sourced from forests. The increasing harvesting pressure has already brought many medicinal plant species under red-listed categories. It has become necessary to know the annual consumption levels of the herbal raw drugs and the trends of their use to effectively manage the resource for ensuring sustainable supplies of authentic and quality botanical raw drugs to the herbal industry, folk users and growing global markets.

Harar (Chebulic Myrobalan)

Bahera (Belliric Myrobalan)

Amla (Emblic Myrobalan)

Tulasi (Holy Basil)

1.2. PREVIOUS ASSESSMENTS OF DEMAND AND SUPPLY OF MEDICINAL PLANTS IN INDIA

The commercialization of the production of classical ASU formulations requiring large quantities of wild harvested, cultivated or imported herbal raw drugs has witnessed the emergence of a thriving raw drug trade. Some of the herbal raw drug mandis (markets) in the country, like Khari Baoli in Delhi, are in operation for more than two centuries. The irony is that there has been no system at national level to maintain record of either the diversity of medicinal plant species or their quantities in trade. All along, the number of herbal raw drugs and the corresponding medicinal plant species in trade has been a matter of opinion with the estimates of such numbers varying from just 400 (Anon., 2000) to 1500 (Jain, 1996) to 'more than 2000 fruits, leaves, shrubs, minerals, metals as well as animals' in use only in Unani medicine (Bode & Maarten, 2004), to 2500 (Chauhan, 1999) to 7500 (Pushpangadan, 1995). However, none of these publications provides a list of traded herbal raw drugs at national levels.

The first serious attempt at national level to assess the demand and supply of medicinal plants in the country was

made by the National Medicinal Plant Board (NMPB) during 2001-02, when it commissioned a study through Centre for Research, Planning and Action (CERPA) to understand annual trade levels of selected 162 medicinal plant species. Thereafter, Export Import (EXIM) Bank commissioned a study to assess 'export potential of medicinal plants' through the Foundation for Revitalization of Local Health Traditions (FRLHT) in 2003. This study resulted in enlisting 1200 raw drug entities pertaining to 880 medicinal plant species in trade, including 42 species under foreign trade for the year 2001. The CERPA study assessed the demand of herbal raw drugs in the country for the year 1999-2000 at 2,34,675 MT including the material exported with a trade value of 1275.68 crore (CERPA, 2002). The EXIM Bank study, on the other hand, estimated the total consumption of herbal raw drugs in the country, including exports, for the year 2001 as 1,28,000 MT with a trade value of Rs. 847 crore (EXIM Bank, 2003). This study also projected a 10% annual growth of the herbal sector in the country.

Both these studies, even though brought the subject of medicinal plant trade in the country in focus, were largely indicative. The CERPA study based its findings mainly on the responses from selected manufacturing units in respect of pre-identified set of species. Similarly, the estimation of domestic consumption under the EXIM Bank study was based on the total turnover of the industry. In between there have been efforts by various organisations at undertaking market analysis related to levels of trade and prevailing prices of important medicinal plants. However, such studies have been of a scale and spread that has failed to make any significant addition to the knowledge on the subject at the national level.

The NMPB, thereafter in 2006-07, commissioned a national study to assess demand and supply of medicinal plants in India. That study, carried out by FRLHT, for the first time brought various intricacies in the herbal sector to the fore and added to the understanding of the subject related to the diversity of raw drug entities in trade, their botanical correlation, volume of annual trade and supply sources. A total of 1389 botanical entities corresponding to 960 plant species were enlisted under trade in that study. The focus provided by the report of this study resulted in initiation of research programs on many species of conservation concern. It also triggered large scale plantation programs in respect of 'Guggal', 'Asoka' and 'Dashamoola' group of species.

The medicinal plant sector is a very dynamic and intricate sector and the status of demand and supply of medicinal plants needs to be periodically assessed. The need for periodic review has become more important in view of the increased global interest in herbals for wellness. Moreover, there is always a scope to improve upon the findings brought out in the various works on the subject carried out earlier.

The complexity of the herbal sector, especially for India, still needs to be completely understood. Even now there is not much clarity about the chain of custody of a large number of species. The sources of many red-listed species are not known giving rise to doubts about authenticity of the material. Most of the herbal raw material still continues to be collected from the length and breadth of the country under different names, traded under different names and used under the classical sanskritized names, creating issues about their botanical identity. Many species are traded as imported from other countries viz. 'Banslochan Singapuri', 'Shatavari Nepali', etc. with no corresponding record of such imports. There is, therefore, a need to further refine the botanical correlations of the herbal raw drugs in trade. More data needs to be collected on medicinal plant species under cultivation and their share in the raw drug trade. There is also a need to assess demand of important medicinal herbs by parts traded to provide better inputs for management of species of conservation concern. Similarly, supply chain in respect of some

important raw drug entities could be worked out in detail for better appreciation of the intricacies of the trade web. There is also a need to develop better understanding of the botanicals under foreign trade.

Relative opacity of the operations at the level of gatherers, traders and industry makes the assessment of demand and supply very complicated. In most of the cases, there is a general reluctance to share samples of the material in trade or in use making species-wise assessment of demand and supply challenging. Any attempt to study the demand and supply of medicinal plants, therefore, requires a fair understanding of these intricacies to arrive at reliable conclusions.

Wild Collection of Medicinal Plants

Cultivation of Medicinal Plants

Herbal Raw Drug Mandi

1.3. THE PRESENT STUDY

As the herbal sector in the country is on a path of fast growth, there is a need to have a close watch on the annual demand and supply of medicinal plants, so as to plan measures for a sustainable resource supply. It is in this context that the NMPB assigned this study to the Indian Council of Forestry Research & Education (ICFRE) to re-assess the demand and supply of medicinal plants in the country. ICFRE has undertaken this study in strategic partnership with FRLHT, an organization that has developed comprehensive database pertaining to the medicinal plants and has a long experience of carrying out such other studies.

The major objective of this study was to review the status of knowledge in respect of demand and supply of medicinal plants in the country, find out the gaps and try to address these gaps on the basis of focused field surveys, interactions with various stakeholder groups and analysis of available information and field data.

The Expected Outcomes from the study are enlisted as under:

I. Assessment of the current supply of medicinal plant raw materials of various species in India from different sources including (a) wild sources and wastelands, (b) cultivation, and © import from other countries.
ii. Determination of the demand of medicinal plant raw materials of various species from various quarters including (a) household demand/ traditional healers demand, (b) demand of trade and industry, and (c) for exports.
iii. Review, study and bring out the following:
    a. Analysis of the current regulatory framework applicable to the Indian medicinal plant based industry in the context of domestic and international trade.
    b. Capturing of the major stakeholders in supply chain of medicinal plants, their strengths/ needs in the context of contemporary, business environment.
    c. Undertaking SWOT analysis of the Indian traditional medicine industry and the Indian medicinal plants sector.

d. Assessment of the current pricing structure including local taxes/ VAT/ custom duty at various stages of trade for certain selected species and trend analysis of top 50 species.
e. Suggesting measures and modalities to capture profile of the major traders/ wholesalers and the prevalent trading practices in major herbal mandis in India towards upgradation of practices to improve quality of raw material supply.
f. Suggestive approach towards rationalization/ fine tuning of HS coding system in respect of herbal raw drugs used in Ayurveda, Siddha & Unani (ASU) industry.

Herbal raw drug consumption data in respect of domestic herbal industry of India for the year 2014-15 has been worked out based on stratified sampling of 692 domestic herbal units. Foreign trade data for ten years i.e. from 2005-06 to 2014-15, has been procured from the Directorate General of Commercial Intelligence and Statistics (DGCIS) and analyzed. Estimate of consumption by rural households has been arrived at on the basis of a sample survey of 2450 households spread across 15 states. The report has also attempted a first in highlighting sizeable consumption of herbal raw drugs by folk healers and traditional practitioners, many of whom proudly showed very old medical manuscripts in the possession of their families. More than 40 herbal raw drug mandis of different types and categories were visited and data gathered on the diversity of herbal raw drugs in trade, trade chains of important herbal entities, and pricing. Various sites in the country have been visited to gather first hand data on the cultivation and wild collections. Legal and policy structure, including the ITC (HS) Code system, has been reviewed and analyzed from the perspective of growth of herbal sector.

The draft report was presented in the national consultation specially convened on 23 March 2016 at Dehradun to share highlights of the study with representatives of different stake holder groups and to seek their comments and inputs on different outputs of the study. The draft report was thereafter modified to incorporate views expressed by the stake holders. The highlights of the draft final report were presented to NMPB's specially convened committee with the Secretary AYUSH as chairperson and subject matter experts, representatives of herbal industry, traders and officers of the NMPB as members on 01 September 2016. The comments/ suggestions by the Secretary AYUSH and other members of the committee were duly incorporated to further refine the report and to bring it to its present form.

The output of the study has been organized in 12 subject-specific chapters with Chapters 11 and 12 containing the synthesis and recommendations. A consolidated inventory of the 1178 medicinal plant species recorded in trade, with trade and API names and popular synonyms, has been appended for easy referencing.

G. S. Goraya, D. K. Ved & T. P. Singh

2

Study Methodology and Strategy

Assessment of demand and supply of medicinal plants for India's complex herbal sector consisting of more than 8600 licensed domestic herbal units and thousands of cottage level unregulated herbal units; thousands of folk healers; millions of households using thousands of herbal raw drugs procured from various supply sources, is equally complex. Since the medicinal plant sector is on a path of continuous growth, it is assumed that all the different categories of users of medicinal plants are getting required supplies of the herbal raw drugs. Thus, demand and supply of herbal raw drugs in the country is equated to their annual consumption by different categories of resource users. Different statistical sampling techniques have been employed to estimate consumption by different user groups. The Director General of Commercial Intelligence and Statistics's (DGCIS) database has been used in respect of foreign trade (export & import) of herbal raw drugs. Data in respect of commercial trade and supplies of herbal raw drugs has been collected by making visits to herbal raw drug mandis. The major medicinal plant wild harvest and cultivation sites have also been visited and movement of this material along trade chain documented.

2.1. INTRODUCTION

India's herbal sector is represented by 8610 licensed herbal units, thousands of cottage-level unregulated herbal units and millions of folk healers and household level users of thousands of herbal raw drugs on one hand and a complex trade web on the other that channels the herbal raw drugs from various supply sources to the end users. The canvas portraying demand and supply of medicinal plants in the country is, thus, quite complex. Any effort to assess demand and supply of medicinal plants in these diverse arenas has to be a challenge. This challenge to assess demand and supply of medicinal plants in the country has been attempted to be addressed by employing a comprehensive sampling technique and technical rigour to understand and bring out the dynamics of demand and supply of medicinal plants in the prevailing legal and administrative environment in the country.

2.2. IDENTIFICATION OF KEY ISSUES

It is important for a country-wide study of this dimension to identify key issues that are needed to be understood and addressed for arriving at worthwhile inferences in the available time frame. In view of the complexity of the subject and the expected outcomes of the study, an Inception Workshop of the entire project team was organised at Dehradun on 08 May 2015 to familiarise the team members with the subject, to identify key issues and to develop strategy for comprehensive coverage of the entire ambit of study arenas in a uniform and efficient manner. The workshop resulted in bringing out the following key issues that need to be studied to arrive at holistic understanding of the subject:

- the diversity of herbal raw drugs that are routinely used by the local communities under folk health care practices; by the registered ISM practitioners; and by the domestic herbal industry for making ready-to-use ASU formulations, along with the estimated annual quantum of use of these raw drugs.

- the diversity and annual quantum of medicinal plant species in foreign trade, both export and import.

- the sources of supply of herbal raw drugs, viz. wild harvested, cultivated, and imported to develop strategies for sustainable supplies.

- the existing and potential trade/ marketing of these medicinal plant resources, especially from the wild and cultivation, for optimising benefits to the local communities; and

- the legal and administrative environment in so far as it relates to the medicinal plants harvest, trade and use in the country.

2.3. STUDY STRATEGY

Increasing reliance upon the herbal based pharmaceutical, nutraceutical and cosmeceutical products has caused considerable growth of herbal sector in the country. However, the herbal sector still remains largely unorganized with little documentation of the herbal resource available. It is especially true in respect of supply from the wild and the cultivated sources, these sources being very wide spread and involving millions of households across the country.

For the purpose of this study the complex herbal sector in the country was broadly categorized

into two operational arenas, i.e. the one linked to the consumption (demand) of raw material and the other linked to supply of raw material. The consumption of herbal raw material has been taken to include use by industry engaged in making herbal formulations, practitioners of Indian health care practices who prepare and dispense their own formulations, local communities that use plant

Inception Workshop (08 May 2015) to identify Key Issues and Finalise Strategy

material for their bona-fide household remedies, and for exports. Similarly, three known supply sources of medicinal plants i.e. wild, cultivations and imports have been considered for this study. The movement of herbal raw drugs from different supply sources to the end users has also been studied.

There is an acute deficiency in data availability in respect of consumption, supplies and trade of herbal raw drugs. On the consumption side, some data about annual consumption by the licensed domestic herbal industry has started becoming available pursuant to the introduction of section 157 (A) in the Drug and Cosmetics Act, 1945. Similarly, consolidated year-wise data in respect of exports is also available in the form of compilation by DGCIS. It is, however, difficult to decipher this data at the entity level due to the inadequacies of the present foreign trade classification system. In as far as the supplies from wild harvests are concerned most of the state forest departments have stopped maintaining data base on supplies from the wild after passing on the regulatory mechanisms to the local communities under different legislations.

In the absence of any reliable data sources on demand and supply of herbal raw drugs in the country, the annual demand of herbal raw drugs has been assumed to be equivalent to the annual consumption of herbal raw drugs by various resource users for the purpose of this study. Major reliance of this study has, therefore, been on estimating the annual consumption of herbal raw material, as comprehensively as possible, by the herbal industry, by the households and folk practitioners and on account of exports. The supplies of herbal raw drugs from all sources i.e. wild, cultivation and imports have been taken as equal to the demand as computed on the basis of consumption by all categories of users.

The annual estimated demand of herbal raw drugs has been functionally integrated with the supply sources in testing validity of the estimates and projections of demand and supply and to make a fair assessment of gaps (shortfalls) in supply and resultant pressure on the natural medicinal plant resource base.

2.4. REVIEW OF LITERATURE AND DATA SOURCES

The understanding of the status of knowledge on the subject and limitations of the previous studies as developed from the review of literature and available reports has been used in

developing study methodology. Some key data sources consulted to gather background information on various aspects pertaining to the study include the following:

- Previous reports on the subject, mainly the reports by Ved & Goraya (2008), EXIM Bank (2003), CERPA (2002), and Task Force of Planning Commission (Anon., 2000). These reports helped in developing perspective on the subject, helped in fine tuning the methodology, and acted as benchmark reference material for the study.

- The website of the Department of AYUSH giving ISM stream-wise and state-wise detail of the licensed herbal units in the country. The information, corroborated with the one obtained from some of the State Drug Controllers, formed the base on which domestic herbal industry has been stratified for this study.

- The annual 'Foreign Trade Statistics' published by the Director General of Commercial Intelligence and Statistics (DGCIS), Ministry of Commerce and Industry to get information about import and export of botanical raw drugs for the last 10 years, i.e. from 2005-06 onwards.

- Annual statements submitted by the domestic herbal industry in respect of species-wise plant material consumed by them to NMPB and State Drug Controllers in pursuance of amendment to the Section 157A of the Drug and Cosmetics Act, 1945.

- Records of the State Forest Departments to gather information about the diversity and quantum of wild harvest of medicinal plants and to understand the chain of custody in respect of important species. The information received from this data source was, however, very weak.

- Literature pertaining to ethno-medicinal studies carried out in the districts selected by using a multistage sampling strategy (with random selection of units at each stage) for household survey was referred to cross check the botanical correlations of the local names documented during the survey with their botanical nomenclature.

2.5. COMPUTATION OF ANNUAL DEMAND OF MEDICINAL PLANTS

As already brought out above, the total estimated annual demand of the herbal raw drugs has been assumed to be equal to the total estimated annual consumption of herbal raw drugs by various user categories as depicted in the equation below:

$$f_nD \simeq \sum_{j=1}^{m} Rui_j + \sum_{j=1}^{n} Rut_j + \sum_{j=1}^{o} Rue_k + (\sum RHw)$$

Where,

Rui	=	Estimated consumption by the domestic herbal industry
Rut	=	Estimated consumption by the household level users
Rue	=	Computed exports
RHw	=	Estimated resource wastage during handling
fnD	=	Estimated demand (quantity in MT/ year)

While working out the consumption estimates, quantities of various raw drug entities consumed

by various consumer groups have been converted to their equivalent 'dry weight'. Thus, in case of entities like 'amla' (*Phyllanthus emblica*), where a sizeable quantity of fresh fruits is also used, the quantities of fresh fruits consumed annually have been converted into equivalent dry weight by applying a factor of 5:1 (fresh fruit weight : dry weight). Similarly, in case of 'extracts' consumed by the domestic herbal industry, a common factor of 1:8 (extract: dry weight of raw drug) has been employed to work out the equivalent dry weight of concerned raw drugs. The weight of 'extracts' in foreign trade as computed from the DGCIS data has, however, not been converted into equivalent 'dry weight' to maintain compatibility with the DGCIS data.

In view of the diversity of the user categories, different strategies and different sampling designs as detailed below were employed to gather consumption data.

2.5.1. Estimation of Consumption by the Domestic Herbal Industry

The herbal raw drugs in India are used by domestic herbal industry in making health care formulations, as well as in the manufacture of cosmeceuticals and nutraceuticals. Some of the botanicals, used in herbal pharmaceutical formulations, have major use as cereals (rice, barley, etc.); spices (viz. black pepper, nutmeg, cinnamon, bay leaves, cumin, fenugreek, etc); fruits (mango, papaya, etc.); and vegetables (bitter gourd, bhindi, etc.). Many of these items do not route through the traditional raw drug mandis. Any effort at assessing demand of the botanicals based on raw drug market survey, therefore, has to factor in the competitive uses various botanicals are put to, which is a very complex exercise. The following assumptions were, therefore, made to develop a sampling design for comprehensive gathering of data on consumption of herbal raw drugs by the domestic herbal industry:

- that the annual consumption of raw drugs by volume, including those that are usually categorized as spices, by a herbal unit is a fair indicator of its annual turnover.

- that the quantum of resource use is largely independent of the different ISM streams.

- that even though the number of traded herbal raw drugs is fairly large, only a limited number of entities are traded in large quantities i.e. >100 MT/ year.

- that irrespective of their current operational status, all licensed small and very small manufacturing units were taken to be operational. It was done to offset the impact on the total demand of herbal raw drugs consumed by a large number of cottage scale unlicensed units using herbal raw material for health care products.

The Ministry of AYUSH, Government of India recognizes the existence of 8610 licensed manufacturing units registered under Indian System of Medicine (ISM) in the year 2011 (AYUSH, 2011). The Department of AYUSH has also categorized the herbal industry into four size-wise classes on the basis of annual turnover i.e. Large (annual turnover > ₹ 50 crore), Medium (annual turnover between ₹ 5-50 crore), Small (annual turnover between ₹ 1-5 crore), and Very Small (annual turnover < ₹ 1 crore) and has used this categorization to classify 7000 herbal units (Anon. 2002). The same broad categorization has been followed in stratifying the 8610 licensed herbal units into four size-wise strata (table 2.1). Since the annual turnover for all licensed herbal units was not available, an equation to correlate the size-wise categories of herbal units with their annual consumption of herbal raw drugs including spices was developed and used to work out the categories (table 2.1).

Table 2.1. Categories of Domestic Herbal Units based on Annual Turnover and Annual Consumption of Herbal Raw Drugs including Spices

Unit Size	Based on Annual Turnover		Based on Annual Consumption of Herbal Raw Drugs	
	Annual turnover (₹ in Crore)	Apprx. number of units	Annual Consumption of Herbal Raw Drugs (MT)	Apprx. number of units
Large	> 50	20	>500	50
Medium	5-50	50	50-500	200
Small	1-5	2000	10-50	2000
Very Small	< 1	6540	<10	6360
Total		**8610**		**8610**

The equation to correlate the size-wise categories of herbal units with their annual consumption of herbal raw drugs including spices has been based on the percentage of the cost of herbal raw drugs including spices vis-a-vis the annual turnover of the unit. A sample analysis of such data in respect of herbal units reveals that the cost of herbal raw drugs including spices makes about 10% of the total turnover of the herbal units. Similarly, the cost of the herbal raw drugs including spices has been worked out to be a shade above ₹ 100 per kg. However, the rate has been rounded off to ₹ 100 per kg for the ease of calculations. Based on these calculations, a herbal unit with annual turnover of ₹ 1 crore consumes herbal raw drugs including spices for a value of ₹ 10 lakh, which at a rate of ₹ 100 per kg works out to 10000 kg or 10 MT. For the purpose of working out sampling design under this study, the category-wise classification based on annual consumption of herbal raw drugs by the industry was used.

A Stratified Random Sample with proportional allocation of sampling units (domestic herbal units) based on stratification variables including, a) their annual turnover so as to proportionally cover industries of large, medium and small sizes; b) geographical occurrence of units so as to cover variations in resource use across the country; and c) Indian Systems of Medicine used as base for manufacturing herbal formulations to cover the sector in its entirety has been employed to gather consumption data through direct survey of the herbal industry. The herbal industry's categorization based on annual consumption of herbal raw drugs, has been adopted for stratification of herbal industry for the purpose of data gathering. Details of the sample size planned are given in the table 2.2.

Table 2.2. Category-wise Detail of the Domestic Herbal Units Planned to be Sampled

Unit Size	Apprx. number of units based on annual consumption of herbal raw drugs	Planned sample size	No. of units planned to be sampled
Large	50	50%	25
Medium	200	40%	80
Small	2000	5%	100
V. Small	6360	3%	191
Total	**8610**	**-**	**396**

Data on consumption of botanicals by domestic herbal units has been obtained (a) from the formats submitted by these units under Section 157 (A) of the Drug and Cosmetics Rules, 1945 to the State Drug Controllers and to the NMPB, and (b) by direct visits to the selected herbal units

with a special focus to understand and validate the botanical correlations of the herbal entities in use by them.

2.5.2. Estimation of Consumption by Households and Folk Practitioners

A detailed multistage sampling with region, state, district and villages in successive stages and household as sampling unit has been followed to gather information on consumption of medicinal plants by rural households from across the country. As per this design, survey was to be carried out in randomly selected 13 states across 6 eco-geogrphical regions, 39 districts (@ 3 districts per selected state) and 195 villages (@ 5 villages per district). At village level, information was to be collected from 15 households from every selected village, irrespective of the size of the village. Thus, in all data from 2925 households was planned to be collected under this survey. Some deviation from this sampling design was necessitated due to Panchayat election in one state, and insurgency problems in other. Data was thus collected from 2450 households spread over 15 states. Information on both quantitative and qualitative parameters in respect of use of botanicals was gathered at the household level.

As far as folk healers and registered practitioners of different streams of codified health care systems are concerned, the folk healers from the selected villages were identified by using *a priori* information.

The information from the households and the folk healers was recorded as per pre-tested semi-structured questionnaires on specially designed formats. The plants used by the communities and the folk healers were identified with the help of local floras, by consulting experts, and by comparing the local names with the ones recorded in the ethno-medicinal survey literature.

2.5.3. Computation of Exports

DGCIS data on exports for the years 2005-06 to 2014-15 was obtained and analysed to compute export of medicinal plants, and to work out export trends of top traded species. Efforts were made to decipher ITC (HS) codes to arrive at the level of species under export. The species-wise export data has been validated through consultations with the various agencies involved in export of botanicals including 'Exporters', 'Export Regulating Agencies' and 'Export related Data Management Agencies'.

2.6. ASSESSMENT OF SUPPLY OF MEDICINAL PLANTS

Data sources on supplies of medicinal plants are very weak. Therefore, it was assumed that all different categories of users of herbal raw drugs were able to meet their annual requirement and the supplies were, therefore, assumed to be equivalent to demand. Efforts were made to collate as much information as possible from different supply sources.

2.6.1. Estimation of Supplies from Wild Resources

The wild resources include forests and habitats outside forests (viz. farm lands, road/ rail sides, canal banks, ponds and lakes, waste lands, etc.) with the major supply of raw drugs of wild origin coming from forests. The State Forest Departments, custodians of the forest lands, and the MFP Federations, Corporations and Cooperatives were approached to provide information on the annual quantum of removals of medicinal plants from the forests. However, data received from these organisations was generally weak. Field visits were made to sites in different States to document wild harvest and the trade chain. Information was also sought from local gatherers/

agents on the subject and it was of immense help in understanding the lines of harvest and trade (both quantitative and qualitative).

2.6.2. Estimation of Supplies from Cultivation

Cultivation of medicinal plants has become an important source of supplies over the years. However, there is no data source where species-wise information on cultivation at national level is maintained. In the absence of data sources, information on cultivation is usually based on inferences drawn from the resource use side. In cases where the species is sourced only from cultivation, e.g. 'isabgol', 'mentha', or 'senna', the use figures (domestic and export) provide a fairly good idea of total production. However, such estimation in respect of species that are partly sourced from the wild and are also cultivated or imported is complex and needs critical studies. The following strategy was employed to gather information on the subject:

- Information about the source of material (wild/ cultivated) was recorded during market survey.
- Information about any cultivation under buy-back arrangements was recorded during industry visits.
- Information about cultivation of medicinal plants already available in literature and with ICFRE/ FRLHT was reviewed.

Field visits were made to known medicinal plant cultivation sites to document the size of cultivation and activities along trade chain. Various issues related to cultivation were also directly discussed with randomly selected farmers.

Consultation with farmers and wild gatherers of medicinal plants

2.6.3. Computation of Imports

DGCIS data on imports for the years 2005-06 to 2014-15 was obtained and analysed to compute import of medicinal plants, and to work out import trends of top traded species. Efforts were made to decipher ITC (HS) codes to arrive at the level of species under import. The species-wise import data has been validated through consultations with the various agencies involved in import of botanicals including 'Importers', Import Regulating Agencies' and 'Import related Data Management Agencies'.

2.7. STUDY OF RAW DRUG MARKETS

Most of the botanical raw material, except the one cultivated under buy back arrangements between farmers and the industry, passes through raw drug markets of various sizes across the

country. Study of these markets is very important to understand the dynamics of movement of botanical raw material from production centres to the consumption centres. The trading of medicinal plants currently happens through the Conventional Herbal Raw Drug Mandis of various sizes; the Krishi Upaj Mandis; the MFP Federations/ Corporations/ Cooperatives; Specialised Herbal Mandis; and under Buy-back Arrangements.

Visits were made to more than 40 herbal raw drug mandis of different types and information generated in respect of -

- the diversity of botanical entities under trade for medicinal purposes along with their trade names and prices.
- species in significant trade, say >100 MT/ year, along with supply chain/ trade web of important species.
- species that are Red-Listed and are of high Conservation Concern, irrespective of their annual trade volumes.

Basic information on the points given above was compiled from the FRLHT's database and other recent publications, and market and price bulletins published by different states and agencies.

Data was also collected from randomly selected retail shops selling botanical raw drugs and the information so gathered has been used in compiling the Comprehensive Inventory of Medicinal Plants in Commercial Trade.

2.8. ESTABLISHING BOTANICAL CORRELATION OF HERBAL RAW DRUGS

Establishing critical identity of the herbal raw drugs in trade is the biggest challenge in assessing their demand and supply. It is understood from the previous works on the subject that many raw drug entities pass on as equivalents, substitutes or adulterants of the officially accepted raw drugs. List of many such known controversial raw drug groups viz. 'shankhapushapi', 'daruharidra', 'jivanti', 'rasna', 'gokshura', 'vidari', 'vidanga', etc. were prepared before visiting the herbal raw drug mandis for the survey. This list kept the field teams vigilant about the entity actually in trade. Even as most of the traders were reluctant to share samples of the herbal raw drugs in trade, the teams were successful in procuring some samples of raw drugs from across various raw drug mandis for confirmation and future reference. These samples helped in confirming the botanical identity of some controversial raw drugs like 'jivanti', 'gurhal', 'ativisa', etc. Controversial herbal raw drugs recorded during the study have been enlisted for detailed investigation.

2.9. ASSESSMENT OF RAW DRUG WASTAGE

Some portion of the medicinal herbs collected from the wild or cultivated sources gets wasted from the time of collection to their eventual use. Major reasons for such wastage include insect or fungal attacks due to non-following of good post harvest handling methods, or during transit due to poor packaging. Such wastage has definite implications in as far as demand or supply of medicinal herbs is concerned. The percentage of such wastage is, however, not known and has, therefore, failed to get factored in the previous studies on demand or supply of medicinal herbs. Under this present study effort was made to estimate the wastage along the supply chain of selected medicinal herbs and an average wastage percentage worked out for the herbal raw drugs in trade.

2.10. ANALYSIS OF POLICIES AND REGULATORY REGIMES

The wild harvest, trade, pricing, consumption and foreign trade of medicinal plants involve various policy issues and regulatory regimes. These issues have been examined and appropriate interventions for improvements suggested. The main policy and regulatory issues analysed under the study are -

- ITC (HS) Code for Trade Classification for foreign trade.
- Transit Rules concerning trade of wild harvested and cultivated material.
- MFP Federations, Corporations and Cooperatives and trade of medicinal plants.
- Devolving rights over MFPs to local communities.
- Implications of Biological Diversity Act, 2002 on medicinal plant sector.

Available literature on the subject was reviewed and consultations with experts held to examine the issues and to arrive at appropriate recommendations.

2.11. HIGHLIGHTING RED-LISTED MEDICINAL PLANTS

Concerns about the depleting wild populations of a number of medicinal plants are being raised for quite some time. Some attempts at assessing the threat status of medicinal plants have also been made. The available reports related to assessment of threat status of medicinal plants using IUCN's Red-List Categories and Criteria were examined and the lists of red listed medicinal plant species compared with the medicinal plant species in high trade. The species facing threat have been flagged to guide conservation action in the field and to ensure sustainable supplies of these threatened species.

2.12. SYNTHESIS OF DATA AND COMPILATION OF STUDY REPORT

The study-cum-survey has generated enormous data that has been collated, cleaned, computed and analyzed separately for each study arena following appropriate analytical tools in accordance with the proposed sampling design. The qualitative information gathered for different study arenas has been appropriately grouped, correlated with the quantitative data and inferences drawn from these.

Since large number of medicinal plant species have been documented in commercial trade for the year 2014-15, data collation has been prioritized based on (a) the volume of annual trade i.e. detailed analysis has been carried out for species in high volume trade i.e. >100 MT/ year; (b) the

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Presentation of Draft Final Report on Demand and Supply of Medicinal Plants

species having high monetary value, and (c) species of conservation concern, irrespective of the volume of annual trade.

The draft report was presented in the national consultation specially convened on 23 March 2016 at Dehradun to share highlights of the study with representatives of different stake holder groups and to seek their comments and inputs on different outputs of the study. The draft report was thereafter modified to incorporate views expressed by the stake holders. The highlights of the draft final report were presented to NMPB's specially convened committee with the Secretary AYUSH as chairperson and subject matter experts, representatives of herbal industry, traders and officers of the NMPB as members on 01 September 2016. The comments/ suggestions by the Secretary AYUSH and other members of the committee were duly incorporated to further refine the report and to bring it to its present form.

Based on the inferences drawn from the collated data, suggestions for further fillip to the herbal sector in the country have been made in the form of recommendations.


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Consumption by Domestic Herbal Industry

India's domestic herbal industry consists of 8610 licensed herbal units engaged in making herbal health care formulations under different streams of Indian Systems of Medicine. The herbal units are categorised into large, medium, small and very small categories depending upon the stated annual turnover of the units. Under this study, this annual turnover-based categorisation has been correlated to herbal raw drug consumption based categorisation to arrive at the category of the industry in the absence of its annual turnover data. In accordance with a stratified sampling design, 692 domestic herbal units have been sampled under the current study to work out the domestic herbal industry's annual consumption of herbal raw drugs. The data reveals that the India's domestic herbal industry is consuming herbal raw drugs correlating to a total of 907 plant species. Based on the sampling of 692 units, the total annual consumption of herbal raw drugs by the domestic herbal industry in the country has been estimated at 1,95,000 MT, of which more than two thirds is consumed by the large and the medium units. The data also reveals that nearly 85% of the medicinal plant species used in making classical formulations under Indian codified medical streams continue to be sourced from the wild. Total annual turnover of the domestic herbal industry for the year 2014-15 has been estimated at ₹ 20,000 crore.

3.1. INTRODUCTION

India' domestic herbal industry is represented by 8610 licensed herbal units spread across different States in the country (Table 3.1). Uttar Pradesh, with 2247 licensed herbal units, has the highest concentration of such units in any State. Kerala with 905 licensed herbal units comes second. The north-eastern states of Manipur, Mizoram, Nagaland, Tripura and Arunachal Pradesh do not have any licensed herbal units. 87% of the licensed herbal units in the country have been registered under Ayurveda stream of ISM, whereas 4.9% herbal units are registered for making Unani formulations, 3.8% for making Sidha formulations, and 4.3% for making Homoeopathy formulations. At present no licensed herbal unit under Swa-rigpa (Tibetan) stream of ISM is there in the country.

Domestic Herbal Industry : Formulations under Preparation

It is interesting to note that out of the 328 herbal units registered under Siddha stream of ISM, 324 units are located in Tamil Nadu, the state with very strong Siddha traditions. Similarly, of the 421 herbal units registered under the Unani stream of ISM, 237 units are located in Uttar Pradesh and 106 units are located in Andhra Pradesh, the states where there is a lot of reliance upon Unani Tibb. Uttar Pradesh also accounts for more than one fourth of the total herbal units registered under Ayurveda stream of ISM. Kerala, with 12% of the country's Ayurvedic herbal units, is another state with strong Ayurvedic herbal industry.

Table 3.1: State-wise Data of Licensed Herbal Units

State	Number of Licenced Herbal Units					
	Ayurveda	Unani	Siddha	Tibetan	Homeopathic	Total
Andaman & Nicobar	-	-	-	-	-	-
Andhra Pradesh	473	106	-	-	31	610
Arunachal Pradesh	-	-	-	-	-	-
Assam	52	-	-	-	1	53
Bihar	214	27	-	-	40	281
Chandigarh	1	-	-	-	-	1
Chhattisgarh	31	-	-	-	-	31
Dadra & Nagar Haveli	5	-	-	-	-	5
Daman & Diu	10	-	-	-	-	10
Delhi	43	12	-	-	8	63
Goa	7	-	-	-	-	7
Gujarat	480	-	-	-	15	495
Haryana	274	3	-	-	23	300
Himachal Pradesh	135	-	-	-	3	138
Jammu & Kashmir	11	2	-	-	2	15
Jharkhand	-	-	-	-	-	-
Karnataka	166	1	-	-	10	177
Kerala	880	1	4	-	20	905
Lakshdeep	-	-	-	-	-	-
Madhya Pradesh	625	-	-	-	8	633
Maharashtra	660	6	-	-	39	705
Manipur	-	-	-	-	-	-
Meghalaya	1	-	-	-	-	1
Mizoram	-	-	-	-	-	-
Nagaland	-	-	-	-	34	34
Odisha	148	-	-	-	12	160
Puducherry	25	10	-	-	6	41
Punjab	284	-	-	-	-	284
Rajasthan	265	3	-	-	-	268
Sikkim	1	-	-	-	-	1
Tamil Nadu	323	10	324	-	5	662
Tripura	-	-	-	-	-	-
Uttarakhand	237	3	-	-	-	240
Uttar Pradesh	1974	237	-	-	36	2247
West Bengal	169	3	-	-	105	277
Total	**7494**	**421**	**328**	**-**	**367**	**8610**

Source: AYUSH (2011). Website 'indianmedicine.nic.in' giving State-wise Statistics of licensed herbal units

The Department of AYUSH, in the year 2002, used four category classes on the basis of annual turnover i.e. Large (annual turnover > ₹ 50 crore), Medium (annual turnover between ₹ 5-50 crore), Small (annual turnover between ₹ 1-5 crore), and Very Small (annual turnover < ₹ 1 crore) while categorizing the 7000 herbal units (Anon., 2002). The same broad categorization has been followed in stratifying the 8610 licensed herbal units into four size-wise classes (Table 3.2). Since the annual turnover for all licensed herbal units could not be obtained under this study, another realistic equation to correlate the annual turnover of the herbal units with their annual consumption of herbal raw drugs including spices was developed and used to classify herbal units in four size-wise categories. This equation to correlate the size-wise categories of herbal units with their annual consumption of herbal raw drugs including spices has been based on the percentage of the cost of herbal raw drugs including spices incurred by the sampled herbal units vis-a-vis the annual turnover of these units. The sample analysis of such data in respect of herbal units reveals that the cost of herbal raw drugs including spices makes approximately one tenth of the total turnover of the herbal units. The average cost of the herbal raw drugs including spices consumed by the herbal industry in India for the year 2014-15 has been worked out to be a shade above ₹ 100 per kg. However, the rate has been rounded off to ₹ 100 per kg for the ease of calculations. Based on these calculations, a herbal unit with annual turnover of ₹ 1 crore consumes herbal raw drugs including spices worth ₹ 10 lakh, which at a rate of ₹ 100 per kg works out to 10000 kg or 10 MT. Similarly, the herbal industry with a annual turnover of ₹ 50 crore spends ₹ 5 crore on procurement of herbal raw dugs including spices, correlating to a quantity of 500 MT at ₹ 100 per kg. Size-wise classification of 8,610 licensed herbal units in the country based on both the annual turnover and the annual raw drug consumption is given in Table 3.2.

Table 3.2. Categories of Domestic Herbal Units based on Annual Turnover and Annual Consumption of Herbal Raw Drugs including Spices

Unit Size	Based on Annual Turnover		Based on Annual Consumption of Herbal Raw Drugs	
	Annual turnover (₹ in Crore)	Apprx. number of units	Annual Consumption of Herbal Raw Drugs (MT)	Apprx. number of units
Large	> 50	20	>500	50
Medium	5-50	50	50-500	200
Small	1-5	2000	10-50	2000
Very Small	< 1	6540	<10	6360
	Total	**8610**		**8610**

The categorisation of domestic herbal industry based on there annual consumption of herbal raw drugs by volume has been used to work out the sampling design, carrying out survey of the domestic herbal industry and analysis.

Data on consumption of herbal raw drugs by the domestic herbal industry was obtained (a) from the data formats submitted by the licensed herbal units under Section 157 (A) of the Drug and Cosmetics Act, 1945 to the State Drug Controllers and the NMPB, and (b) by directly visiting the herbal units and interacting with unit managers and other staff. During the study it was noticed that many domestic herbal units had started maintaining annual raw drug consumption record in accordance with the formats prescribed vide amendment dated 09.07.2008 to the Drug and Cosmetics Rules, 1945, where under the new section (157A) mandates each licensed manufacturing unit of Ayurveda or Siddha or Unani drugs to keep record of raw material used by them in the proforma given in Schedule to the Act in respect of all raw materials utilized in the

manufacture of Ayurveda or Siddha or Unani drugs in the preceding financial year. It is also pertinent to mention that many of the domestic herbal units willingly shared this data.

As against the proposed sample size of 396 units, consumption data in respect of more than 700 domestic herbal units was collected. This data was thereafter subjected to detailed scrutiny to identify any inconsistency. Consequent to this scrutiny, data in respect of 692 domestic herbal units was found fit for further collation and analysis. Details of the sample size planned and that achieved are given in the table 3.3.

Table 3.3. Category-wise detail of the Domestic Herbal Units Sampled

Unit Size	Apprx. number of units	Planned sample size	No. of units planned to be sampled	No. of units sampled	Sample size covered
Large	50	50%	25	36	72%
Medium	200	40%	80	118	59%
Small	2000	5%	100	147	7%
V. Small	6360	3%	191	391	6%
Total	**8610**	**-**	**396**	**692**	**-**

Data from 692 domestic herbal units, in addition to adding to the quality of data through a larger sample size, also helped in comprehensive coverage of the herbal industry in respect of geographical coverage, and type and size of the industry. Visits to the herbal units helped in understanding the raw drug procurement procedures, storage and use processes. These visits also helped in discussing the issues pertaining to the status of availability of herbal raw drug and to their nomenclature correlation with the experienced personnel in the pharmacies. These interactions were of immense use in fine-tuning the consolidated inventory of herbal raw drugs in commercial demand in the country.

Visits to Herbal Raw Drug Storage Facilities at Herbal Units and Interactions with their Staff


Cleaning and processing of herbal raw drugs

3.2. ESTIMATED CONSUMPTION OF HERBAL RAW DRUGS BY DOMESTIC HERBAL INDUSTRY IN INDIA FOR THE YEAR 2014-15

Computation of the herbal raw drug consumption data of 692 domestic herbal units in the country for the year 2014-15 has resulted in documentation of herbal material pertaining to 907 medicinal plant species to be in active use by the Indian herbal industry. The herbal entities commonly used as cereals, vegetables, and fruits have not been included. Extrapolation of consumption data of 692 sampled domestic herbal units category-wise over the 8610 registered domestic herbal units brings out that India's herbal industry consumed a total of 1,95,000 MT of herbal raw drugs during the year 2014-15.

Analysis of the data reveals that herbal raw drugs pertaining to 198 plant species are used in annual quantities of more than 100 MT and these 198 species accounted for about 95% of the total herbal raw drugs consumed by India's herbal industry during 2014-15. Documentation of 198 species in high annual consumption by the domestic herbal industry is an improvement over the documentation of 117 species in high consumption documented by Ved and Goraya (2008) in a previous study. Species-wise detail of the medicinal plant species consumed by India's herbal industry in large quantities is given in table 3.4. Analysis of the data in table 3.4 from the perspective of use by different categories of the licensed herbal industry reveals that the large and the medium herbal industries (Category 'A' & 'B'), forming less than 3% of the total licensed herbal units in the country, consume more than two thirds of the total herbal raw drugs consumed annually by the entire licensed herbal industry in the country with the 97% of small and very small (Category 'C' & 'D') herbal units consuming only the remaining 1/3rd of the herbal raw drugs. Ved and Goraya (2008) had estimated that the annual consumption by the large and the medium herbal units was about 35% of the total annual consumption by the entire herbal industry in the year 2005-06.

Total consumption of Herbal Raw Drugs by India's Herbal Industry for 2014-15 has been estimated at 1,95,000 MT

Table 3.4: Estimated Annual Consumption of Herbal Raw Drugs by Domestic Herbal Industry (with species-wise detail of entities in high trade i.e. >100 MT/year)

S. No.	Botanical Name	Estimated Consumption (Dry Weight) (MT)	Category-wise Estimated Consumption (%)		Source (Wild/ Cultivation/ Import)
			A & B Category %	C & D Category %	
1	*Aloe vera*	15677.08	84.56	15.44	C
2	*Phyllanthus emblica*	14178.23	83.20	16.80	W/C
3	*Plantago ovata*	13712.50	99.06	0.94	C
4	*Mentha arvensis*	6289.33	84.20	15.80	C
5	*Terminalia chebula*	6068.16	68.36	31.64	W
6	*Withania somnifera*	4198.26	59.60	40.40	C
7	*Mentha piperita*	3859.18	91.57	8.43	C
8	*Tinospora cordifolia*	3782.67	63.05	36.95	W
9	*Gaultheria procumbens*	3130.85	99.33	0.67	I
10	*Cinnamomum camphora*	2953.11	65.05	34.95	C
11	*Glycyrrhiza glabra*	2832.10	51.71	48.29	I
12	*Asparagus racemosus*	2723.00	57.62	42.38	W/C
13	*Terminalia bellirica*	2696.47	60.54	39.46	W/C
14	*Gaultheria fragrantissima*	2606.34	92.32	7.68	I
15	*Piper longum*	2553.05	77.20	22.80	C/W
16	*Lawsonia inermis*	2488.13	58.62	41.38	C
17	*Azadirachta indica*	2310.85	58.46	41.54	C/W
18	*Aegle marmelos*	2298.67	77.56	22.44	C/W
19	*Eucalyptus globulus*	2156.44	77.84	22.16	C
20	*Zingiber officinale*	2028.57	43.04	56.96	C
21	*Justicia adhatoda*	2017.85	49.37	50.63	W/C
22	*Terminalia arjuna*	1988.20	66.75	33.25	W/C
23	*Tribulus terrestris*	1973.58	58.40	41.60	W
24	*Eclipta prostrata*	1932.20	52.87	47.13	W
25	*Andrographis paniculata*	1828.35	82.23	17.77	W/C
26	*Saraca asoca*	1770.85	71.84	28.15	W
27	*Boerhavia diffusa*	1722.53	66.18	33.82	W
28	*Bambusa arundinacea*	1564.11	87.73	12.27	W/I
29	*Ocimum tenuiflorum*	1362.81	57.88	42.12	C
30	*Sida rhombifolia*	1345.42	90.38	9.62	W
31	*Commiphora wightii*	1343.96	63.23	36.77	I/W
32	*Acacia nilotica subsp. indica*	1334.13	81.70	18.30	W/C
33	*Curcuma longa*	1316.51	65.65	34.35	C
34	*Pinus roxburghii*	1310.31	77.97	22.03	W
35	*Solanum nigrum*	1290.75	87.71	12.29	W/C
36	*Senna alexandrina*	1284.35	31.47	68.53	C
37	*Woodfordia fruticosa*	1268.48	84.39	15.61	W
38	*Tamarindus indica*	1253.78	84.49	15.51	C/W
39	*Ricinus communis*	1188.81	54.99	45.01	C/W
40	*Trachyspermum ammi*	1178.10	44.60	55.40	C
41	*Phyllanthus amarus*	1166.95	70.50	29.50	C/W
42	*Piper nigrum*	1141.86	58.17	41.83	C
43	*Bacopa monnieri*	1134.86	57.50	42.50	W/C

S. No.	Botanical Name	Estimated Consumption (Dry Weight) (MT)	Category-wise Estimated Consumption (%)		Source (Wild/ Cultivation/ Import)
			A & B Category %	C & D Category %	
44	*Berberis aristata*	1046.66	65.86	34.14	W
45	*Cedrus deodara*	1035.14	66.23	33.76	W
46	*Rubia cordifolia*	974.92	76.41	23.59	W
47	*Holarrhena pubescens*	934.41	66.52	33.48	W
48	*Mentha spicata*	920.91	97.38	2.62	C
49	*Acacia catechu*	903.45	78.83	21.17	W
50	*Mucuna pruriens*	887.69	29.58	70.42	W/C
51	*Cyperus rotundus*	886.69	62.07	37.93	W
52	*Sida cordifolia*	862.90	68.09	31.91	W
53	*Cichorium intybus*	840.50	71.77	28.23	C/W
54	*Oroxylum indicum*	794.98	92.11	7.88	W
55	*Centella asiatica*	781.02	49.90	50.10	C/W
56	*Embelia ribes*	772.98	64.31	35.69	W
57	*Solanum virginianum*	763.43	63.71	36.29	W
58	*Pueraria tuberosa*	705.34	71.22	28.78	W
59	*Syzygium cumini*	702.64	64.73	35.27	W/C
60	*Morinda citrifolia*	693.6	65.33	34.67	W
61	*Vitex negundo*	690.61	43.26	56.74	W
62	*Symplocos racemosa*	666.95	56.88	43.12	W
63	*Operculina turpethum*	666.01	61.61	38.39	W
64	*Boswellia serrata*	655.47	25.10	74.90	W
65	*Plumbago zeylanica*	636.70	61.20	38.80	W
66	*Foeniculum vulgare*	622.07	51.23	48.77	C
67	*Pongamia pinnata*	610.82	30.20	69.80	C/W
68	*Hibiscus rosa-sinensis*	609.06	87.03	12.97	C
69	*Solanum anguivi*	599.24	84.29	15.71	W
70	*Gmelina arborea*	591.54	80.60	19.40	W/C
71	*Acorus calamus*	590.10	66.31	33.68	C/W
72	*Bergenia ciliata*	584.31	87.29	12.71	W
73	*Gymnema sylvestre*	582.01	55.62	44.38	W
74	*Hemidesmus indicus*	580.33	48.96	51.04	W
75	*Desmodium gangeticum*	571.66	87.90	12.10	W
76	*Picrorhiza kurroa*	568.61	51.72	48.27	W
77	*Punica granatum*	564.66	70.50	29.50	C/W
78	*Nardostachys jatamansi*	528.11	52.39	47.61	W
79	*Convolvulus prostratus*	522.32	67.54	32.46	W
80	*Capparis spinosa*	518.41	95.43	4.57	W
81	*Cinnamomum verum*	492.10	59.09	40.91	C
82	*Atropa belladonna*	472.31	1.55	98.46	I
83	*Stereospermum chelonoides*	469.92	60.11	39.89	W
84	*Amorphophallus paeoniifolius*	463.40	9.30	90.70	C/W
85	*Tephrosia purpurea*	443.29	52.92	47.08	W
86	*Wrightia tinctoria*	440.30	96.61	3.39	C/W
87	*Datura metel*	438.09	92.13	7.87	W
88	*Leptadenia reticulata*	422.19	88.63	11.37	W
89	*Chrysopogon zizanioides*	418.93	45.25	54.75	W/C

S. No.	Botanical Name	Estimated Consumption (Dry Weight) (MT)	Category-wise Estimated Consumption (%)		Source (Wild/ Cultivation/ Import)
			A & B Category %	C & D Category %	
90	*Swertia chirayita*	404.70	56.04	43.96	W/C
91	*Santalum album*	398.66	58.01	41.98	W
92	*Mesua ferrea*	392.36	75.46	24.54	W
93	*Strobilanthes ciliata*	388.12	92.23	7.76	W
94	*Alpinia galanga*	383.39	64.21	35.79	C/W
95	*Clerodendrum phlomidis*	369.23	86.92	13.08	W
96	*Cassia fistula*	367.31	58.77	41.24	W
97	*Elettaria cardamomum*	357.83	49.53	50.47	C
98	*Curcuma zerumbet*	354.38	77.34	22.66	C/W
99	*Senna occidentalis*	345.34	91.84	8.16	W/C
100	*Moringa oleifera*	344.19	54.81	45.19	W
101	*Phyllanthus maderaspatensis*	342.66	99.91	0.09	W
102	*Achyranthes aspera*	325.30	73.17	26.83	W
103	*Hygrophila schulli*	322.72	64.36	35.64	W
104	*Inula racemosa*	316.44	85.48	14.52	C
105	*Pterocarpus marsupium*	308.75	73.27	26.73	W
106	*Piper chaba*	308.20	82.30	17.70	I
107	*Garcinia gummi-gutta*	301.04	64.63	35.37	C/W
108	*Cinnamomum tamala*	297.80	65.36	34.64	W/C
109	*Pterocarpus santalinus*	297.48	59.86	40.14	W
110	*Crateva religiosa*	296.80	60.97	39.03	W/C
111	*Salix caprea*	290.01	99.32	0.68	I
112	*Celastrus paniculatus*	290.00	77.95	22.05	W
113	*Madhuca indica*	286.40	92.08	7.92	W
114	*Pluchea lanceolata*	284.05	57.24	42.76	W
115	*Myristica fragrans*	278.22	42.61	57.38	C
116	*Asparagus adscendens*	277.63	63.64	36.36	W
117	*Rauvolfia serpentina*	275.34	72.50	27.50	W
118	*Anethum graveolens*	269.11	67.04	32.96	C
119	*Anacyclus pyrethrum*	261.14	67.66	32.34	I
120	*Sphaeranthus indicus*	259.12	30.39	69.61	W
121	*Cullen corylifolium*	258.71	50.90	49.10	W
122	*Stereospermum tetargonum*	257.42	89.17	10.83	W
123	*Cissus quadrangularis*	256.13	71.78	28.22	W
124	*Dioscorea bulbifera*	254.47	58.78	41.22	C/W
125	*Pistacia integerrima*	254.23	68.01	31.99	W
126	*Cyperus scariosus*	248.81	63.12	36.88	W
127	*Pseudarthria viscida*	246.34	89.35	10.65	W
128	*Ziziphus mauritiana*	242.27	77.67	22.32	C/W
129	*Zanthoxylum armatum*	237.78	85.99	14.01	W
130	*Strychnos nux-vomica*	236.33	41.40	58.60	W
131	*Ipomoea mauritiana*	231.42	84.39	15.61	W
132	*Chlorophytum tuberosum*	230.73	4.86	95.14	W/C
133	*Butea monosperma*	227.60	78.59	21.41	W
134	*Apium graveolens*	225.52	47.97	52.03	C/W
135	*Onosma bracteata*	225.19	95.34	4.66	I/W

S. No.	Botanical Name	Estimated Consumption (Dry Weight) (MT)	Category-wise Estimated Consumption (%)		Source (Wild/ Cultivation/ Import)
			A & B Category %	C & D Category %	
136	*Madhuca longifolia*	221.03	99.23	0.76	C/W
137	*Tragia involucrata*	218.28	86.21	13.79	W
138	*Hedychium spicatum*	217.67	40.12	59.88	W
139	*Uraria picta*	209.93	82.53	17.47	W
140	*Valeriana jatamansi*	207.53	71.82	28.19	W
141	*Mimusops elengi*	196.23	74.11	25.89	W/C
142	*Indigofera tinctoria*	195.62	52.14	47.86	C
143	*Citrullus colocynthis*	194.20	87.63	12.37	W
144	*Nigella sativa*	189.44	30.67	69.33	C
145	*Acacia sinuata*	188.21	40.04	59.97	W
146	*Vigna trilobata*	187.79	93.64	6.36	C
147	*Clerodendrum serratum*	186.32	37.50	62.50	W
148	*Plumbago indica*	184.19	72.75	27.25	C/W
149	*Fumaria indica*	184.18	74.24	25.76	W
150	*Justicia beddomei*	183.46	88.50	11.50	W
151	*Cymbopogon flexuosus*	178.08	0.00	100.00	W
152	*Premna serratifolia*	167.38	81.92	18.07	W
153	*Saussurea costus*	164.65	68.12	31.88	C/W
154	*Paederia foetida*	164.33	73.08	26.93	W
155	*Cynodon dactylon*	160.51	65.60	34.40	C/W
156	*Rheum australe*	158.27	76.68	23.33	W
157	*Cardiospermum halicacabum*	157.28	84.53	15.47	W
158	*Maranta arundinacea*	156.35	90.06	9.95	C
159	*Barleria prionitis*	154.30	87.58	12.42	C/W
160	*Nelumbo nucifera*	153.53	61.51	38.49	W/C
161	*Curculigo orchioides*	153.05	70.26	29.75	W
162	*Aerva lanata*	147.79	96.48	3.53	W
163	*Pedalium murex*	142.93	33.53	66.47	W
164	*Ficus religiosa*	141.53	21.89	78.12	C/W
165	*Melia azedarach*	139.85	42.10	57.90	W/C
166	*Martynia annua*	138.57	98.97	1.03	W
167	*Teramnus labialis*	138.31	84.78	15.22	W
168	*Tamarix gallica*	135.72	89.78	10.22	I
169	*Holoptelea integrifolia*	133.55	77.24	22.76	W
170	*Tecomella undulata*	131.15	10.61	89.39	W
171	*Didymocarpus pedicellatus*	127.84	100.00	0.00	W
172	*Aconitum heterophyllum*	127.65	58.87	41.13	W
173	*Quercus infectoria*	127.25	70.97	29.03	I
174	*Premna corymbosa*	125.82	95.08	4.92	W
175	*Spermacoce hispida*	124.88	65.25	34.75	W
176	*Salacia reticulata*	123.04	78.64	21.36	W
177	*Kaempferia galanga*	122.80	68.72	31.28	C
178	*Ficus benghalensis*	121.91	50.87	49.13	W/C
179	*Tamarix indica*	121.31	99.22	0.79	C/W
180	*Argyreia elliptica*	120.46	100.00	0.00	W
181	*Smilax china*	120.34	45.92	54.08	I

S. No.	Botanical Name	Estimated Consumption (Dry Weight) (MT)	Category-wise Estimated Consumption (%)		Source (Wild/ Cultivation/ Import)
			A & B Category %	C & D Category %	
182	*Shorea robusta*	118.56	49.52	50.47	W
183	*Trichosanthes dioica*	117.68	54.55	45.46	W
184	*Baliospermum montanum*	117.12	86.07	13.93	W
185	*Melaleuca leucadendra*	116.80	44.33	55.68	I
186	*Semecarpus anacardium*	115.83	28.64	71.36	W
187	*Prunus cerasoides*	114.59	67.03	32.98	C/W
188	*Trachyspermum roxburghianum*	111.64	94.18	5.82	W
189	*Rhododendron arboreum*	109.14	0.00	100.00	W
190	*Bauhinia variegata*	108.51	70.44	29.55	C/W
191	*Alhagi pseudalhagi*	105.98	97.85	2.16	W
192	*Amomum subulatum*	104.66	75.87	24.12	C/W
193	*Erythrina variegata*	103.87	60.17	39.83	C/W
194	*Bombax ceiba*	103.82	61.16	38.84	W
195	*Cymbopogon citratus*	102.82	53.74	46.26	C/W
196	*Albizia amara*	102.07	100.00	0.00	W
197	*Baccharoides anthelmintica*	101.02	78.22	21.77	W
198	*Scindapsus officinalis*	100.06	92.25	7.75	W
199	Others (709 Species)	9132.70	52.57	47.43	-
	Total	**194749.57**	**67.55%**	**32.45%**	**-**
	or say 195000.00				

The shift in the consumption pattern of herbal raw drugs by the large and medium industries estimated under this study and the one estimated by the Ved and Goraya (2008) is mainly due to the entry of new large herbal units viz. Patanjai Ayurved Ltd. in the sector, up gradation of processing capacity by the existing large and medium herbal units, and moving up of many herbal units into the upper two categories as is evident from the estimated number of herbal units in categories 'A' & 'B' increasing from just 50 in 2005-06 to 250 in 2014-15.

Consumption pattern of herbal raw drugs by different categories of herbal units reveals apparent preference of some herbal raw drugs by large and medium herbal industry and of some others by the small and very small herbal units. For example, more than 80% quantity of the entities like Aloe, Amla, Mint oil, and Gaultheria oil in trade were being consumed by the large and the medium industries. All these commodities have major use in wellness products and the large and medium herbal units were in a better position to effectively market such products. On the other hand, small and very small herbal units seem to have preference for using those entities that have been traditionally used locally for health care, to ensure their easy marketing. The use of raw drugs obtained from species like *Tecomella undulata, Pedalium murex, Chlorophytum tuberosum, Mucuna pruriens, Amorphophallus paeoniifolius*, etc. in very large quantities by the small and very small herbal units is indicative of this preference. This consumption pattern also matches with the trend observed during the study about the increasing inclination of the large and medium herbal units in making proprietary wellness products.

The data pertaining to annual consumption by sampled domestic herbal units was subjected to statistical analysis and category-wise Standard Error of Mean and Mean Values at 90% Confidence

Table 3.5. Estimated Mean of Consumption by Domestic Herbal Industry

Category	Apprx. No. of licensed domestic herbal units (Population)	Sampled Units	Mean Value of Annual Consumption (MT/Unit/Yr)	S.E. of Mean (MT)	Coefficient of Variation	90% Confidence Interval of Estimated Mean	
A (Large)	50	36	2203.45	265.83	12.06	1766.16	2640.74
B (Medium)	200	118	127.37	6.61	5.19	116.49	138.24
C (Small)	2000	147	18.49	0.86	4.65	17.07	19.90
D (V. Small)	6360	391	2.03	0.10	4.93	1.86	2.19

Intervals worked out (Table 3.5). The analysis in table 3.5 brings out the average herbal raw drug consumption per unit for the year 2014-15 by the four different categories of herbal units. The threshold annual consumption of herbal raw drugs consumed by the herbal units categorised as 'very small' is <10MT. The study reveals that the very small herbal units consume a mean quantity of only 2.03 MT of herbal raw drugs per year. Assuming that all the very small herbal units are in operation, the data reflects a very low level of operation of these units. As against very low annual consumption of herbal raw drugs by more than six thousand 'very small' herbal units, the annual consumption of herbal raw drugs at 2203.45 MT by the herbal units categories as 'large' is much above the threshold consumption level of 500 MT for this category of herbal industries. This clearly reflects the large level of operations for these units.

Analysis of the coefficient of variation as worked out in the table 3.5 reveals a fair uniformity in the diversity of herbal raw drugs consumed by the 'small; and 'very small' herbal units, whereas the consumption pattern of herbal raw drugs by 'large' herbal units shows a fairly large variation. It seems to be due to the product specificity of many large herbal units, especially those engaged in preparing large quantities of patent and proprietary wellness formulations with each such formulation based on smaller number of constituent herbal raw drugs.

At an industry-gate average price of ₹ 100 per kg of all herbal raw drugs, including spices, the total estimated price for 1,95,000 MT of the herbal raw drugs for the year 2014-15 works out to ₹ 1950 crore, and the total turnover of the India's herbal industry works out to ₹ 19,500 or say ₹ 20,000 crore.

3.3. SIGNIFICANT TRENDS RELATED TO THE CONSUMPTION OF HERBAL RAW DRUGS BY THE DOMESTIC HERBAL INDUSTRY

The growth of the herbal industry in the country has triggered various shifts in the traditional herbal trade dynamics. Analysis of the data gathered under the study coupled with visits to herbal units in various parts of the country and interactions with experts reveals that many of such shifts in trade dynamics are now reflected in the form of trends, of which some prominent ones are highlighted below:

3.3.1: Growth of the Domestic Herbal Industry

The estimated herbal raw drug consumption by India's herbal industry for the year 2014-15 reflects an increase of about 10% over the estimated consumption worked out for the year 2005-06 by Ved and Goraya (2008). Even as this increase in consumption of herbal raw drugs is apparently not very significant, there has been a very significant growth in the estimated turnover

of the domestic herbal industry over the same period. The total turnover of India's herbal industry, estimated at ₹ 8,800 crore for the year 2005-06 by Ved and Goraya (2008) has grown to ₹ 20,000 crore in 2014-15, registering an annual growth of about 10%.

The data presented in table 3.4 brings out that the 250 large and medium herbal industries (Category 'A' & 'B'), forming less than 3% of the total licensed herbal units in the country, consume more than two thirds of the total herbal raw drugs consumed annually by the entire herbal industry in the country. This segment of domestic herbal industry was reported to be consuming only about 35% of the total annual consumption by the entire herbal industry in the year 2005-06 (Ved and Goraya, 2008). It is apparent that the major growth in the herbal sector has been largely driven by the 'large' and the 'medium' industries, with a very large contingent of the small and the medium herbal industries seemingly left far behind in the growth graph. This trend is also apparent from the mean values of consumption worked out in table 3.5. As the trend reveals, the 'large' herbal industries will continue to consolidate their position and be the major consumers of the herbal raw drugs. Some of the 'medium' herbal industries with annual consumption of herbal raw drugs around the upper consumption threshold of 500 MT per annum are likely to consolidate their position and move up to the category of 'large' herbal industries.

Whereas Dabur India Ltd. remains a major force amongst the domestic herbal industry in the country, Patanjali Ayurved group, a new entrant in the sector during the last 10 years, has emerged as the single major group in as far as consumption of herbal raw drugs for its diversified fast moving consumer and wellness products is concerned.

Total turnover of India's Herbal Industry for 2014-15 has been estimated at ₹ 20,000 crore

The study also reveals a growing trend towards manufacture of a variety of patent and proprietary wellness formulations alongside preparation of classical formulations by many of the domestic herbal units. Most of these patent and proprietary recipes, aimed to help cure lifestyle conditions like diabetes, joint pains, gastric disorders and obesity; to help cure kidney stones, and sexual disorders; and promising skin and hair care, etc., carry suggestive brand names and are widely publicised. These patent and proprietary items are usually sold over the counter and have significantly contributed to the growth of the sector.

3.3.2: Medicinal Plants Species in High Trade

Herbal raw drugs pertaining to 198 plant species have been recorded in high annual consumption (>100 MT) by the domestic herbal industry. Collective consumption of these 198 species accounts for about 95% of the total herbal raw drugs consumed by the entire domestic herbal industry during 2014-15. Ved and Goraya (2008) had documented 117 species in high consumption by the domestic herbal industry and the collective consumption of these 117 medicinal plants species formed 80% of the total consumption by the entire domestic herbal industry in the country.

'Amla' (*Phyllanthus emblica*), recorded as the top traded herbal raw drug entity during 2005-06 by Ved and Goraya (2008), has been replaced by 'ghritkumari' (*Aloe vera*) as the top traded herbal raw drug entity in the present study. Total estimated trade of 'ghritkumari' during 2005-06 was just 1,621 MT, and the same has grown to 15,677 MT in 2014-15. The major reason for this almost ten time increase in consumption of 'ghritkumari' is its successful positioning as a health, food and other wellness products.

The small decline in the estimated annual consumption of 'amla' and 'harar' (*Terminalia chebula*) in 2014-15 from the one reported by Ved and Goraya (2008), is perhaps due to a shift by the herbal industry towards procurement and use of deseeded material and extracts.

3.3.3: Increasing Use of 'Extracts'

During the compilation of data, an emerging trend towards the use of 'extracts' in place of 'herbal raw drugs' has been noticed. More prevalent with the herbal units engaged in making cosmeceuticals and nutraceuticals, the practice of using 'extracts' has also been adopted by the traditional herbal industry. Data from the current study brings out that 'extracts' obtained from more than 500 medicinal plant species are in extensive use by India' herbal industry. 'Mentha' extract (*Mentha arvensis / Mentha piperita*) is used in very large quantities with more than 6000 MT of this extract (oil) finding use in cosmeceutical and nutraceutical preparations alone. About 650 MT of 'amla' extract is now being annually used by the herbal industry in India. Enquiries revealed that there was a general perception that the use of 'extracts' provided more assurance about the authenticity of the material. Moreover, the herbal units, by using 'extracts', were making significant savings on account of transport and storage of the otherwise bulky material. With herbal sector in the country projected to grow further, a corresponding increase in the consumption of 'extracts' is also expected.

It is interesting to note that 'rice' (*Oryza sativa*) extract, with estimated consumption of more than 27,000 MT during 2014-15, mainly by the Indian herbal industry engaged in making cosmeceutical products has emerged as the highest consumed herbal entity by the Indian herbal industry. Similarly, the domestic herbal industry also uses 'extracts' of many other cereals, pulses, vegetables and fruits in fairly large quantities. Since the scope of this study was limited to estimation of demand and supply of only the medicinal plants, the cereals, pulses, vegetable, and fruits used by the herbal industry have not been included in the list of herbal entities consumed by the herbal industry. The herbal commodities usually traded as 'spices', forming integral part of the classical formulations, have however been included in the list.

3.3.4: Makeover of the Domestic Herbal Industry

The domestic herbal industry, usually seen as opaque and old style, seems to be in the process of transformation. Whereas there is a general endeavour to modernise the manufacturing facilities, many of the large and the medium herbal units have undergone complete makeover. Even the very traditional herbal units have switched over to electric or gas based appliances. Use of wood and cahcoal in most of the herbal units is now limited to some specific purposes like preparation of 'bhasmas', or to run boilers to generate steam. Resultantly, the unit operations are now much cleaner. Many of the units have set up separate quality control laboratories and quarantined manufacturing and packaging facilities.

The domestic herbal industry also seems to have started following good manufacturing practices. The herbal units now present a fairly clean image, with the workers usually seen wearing aprons and head scarves. The raw drug storage is fairly good with herbal raw drug bags duly labelled and systematically stacked in the stores. Many of the units have well defined protocols of closely inspecting the raw drugs and subjecting these to final round of cleaning before use. Many of the herbal units seem to have already started following the data maintenance protocols required under section 157A of the Drug and Cosmetic Rules, 1945. With likely increase in the number of herbal units complying with the rules and maintaining data about annual consumption of herbal raw drugs, the assessment of demand of the medicinal plants, in future, will become easier.

Preparation of Health Care Formulations by Herbal Units

3.4. INFERENCES ABOUT CORRELATION OF HERBAL RAW DRUGS TO THEIR BOTANICAL IDENTITIES

The trade of herbal raw drugs continues to be under the local/trade names that vary from region to region. Similarly, the herbal units prefer referring to the material procured under their trade names by their API/ Sanskrit names. This practice of using varied names for the same entity by traders and by the herbal industry gives rise to problems of correlating herbal raw drugs to their exact botanical identities. The following examples will clarify the issue further:

Herbal raw drug popularly traded under the name 'Jatamansi' has been recorded in high consumption. The herbal industry usually correlates this entity to *Nardostachys jatamansi*, a Himalayan medicinal herb. This species, with highly fragmented wild populations, has been assessed as 'threatened'. With its cultivation on large scale not known, it is very unlikely that its wild populations can act as supply source of 500 MT of its roots per year. It seems that the material used by the herbal industry as 'jatamansi' could be pertaining to *Valeriana jatamansi*, another Himalayan herb that is also sometimes known by the same name. A high consumption of 127.84 MT of another Himalayan herb *Didymocarpus pedicellatus*, locally known as 'pathar-phori', 'shila-pushpi', 'kalpasi', 'pathar-laung', and sometime 'pashan bhedi' has been reported by some domestic herbal units. This species is very site specific and has highly fragmented patches of small populations. Thus, it is highly unlikely that the sparse wild populations of this species are able to support this high level of annual demand. The leaves of *Didymocarpus pedicellatus* have some resemblance with the leaves of *Bergenia ciliata*, other medicinal plant with extensive wild populations found alongside *Didymocarpus pedicellatus*, which is traded and used as 'pashan bhed'. The material reportedly being used as 'pashan bhed' and botanically correlated by the industry to *Didymocarpus pedicellatus* is very likely pertains to *Bergenia ciliata*. As samples of the material could not be accessed, its botanical identity remains to be confirmed.

Similarly, the issues pertaining to correlation of herbal raw drugs of 'shankhapushpi', 'bala', 'vidari', 'jivanti', 'daruharidra', etc. group of plants in use by the herbal industry remains to be addressed. The traders at Tanakpur herbal mandi were correlating 'jivanti' in trade to *Holostemma ada-kodien*, a climber found in peninsular India. However, closer examination of the specimen revealed that the material actually belonged to *Flickingeria macraei*, an epiphytic orchid! In addition, a very high consumption of material used as 'gandhapatra taila' (*Gaultheria procumbens* & *Gaultheria fragrantissima*), 'kapur' (*Cinnamomum camphora*), and 'banslochan (*Bambusa arundinacea*) has been recorded in the data collected from the domestic herbal industry under this study. However, the supply of the large volumes of the material in respective of the above mentioned three entities could not be traced back to the known plants sources of these entities. It is believed that the material traded and consumed as 'gandhapatra taila', 'kapur', and 'banslochan' might not be plant product at all. The issue needs further investigation.

3.5. COTTAGE SCALE MANUFACTURERS OF HERBAL FORMULATIONS

The herbal sector in the country includes, in addition to the licensed 8610 herbal units, a very large body of petty cottage scale entrepreneurs engaged in manufacture of herbal formulations for health care and wellness. This cottage scale sector includes thousands of local vaidyas, many of whom have set up small facilities for making herbal formulations for dispensing to their patients. There also are small entrepreneurs who prepare herbal formulations, mainly 'churnas', to alleviate wellness related conditions like obesity, rheumatic pains, gastric ailments, skin problems, diabetes, etc. and sell these along road sides, weekly haats, or at places frequented by visitors like

parks, religious places, and melas. Some of the smarter entrepreneurs have put up grinders powered by diesel engines on their pick-up vans and prepare and pack the powdered formulations from the whole raw drugs in front of the buyers. Whereas the local vaidyas get patients at their places, the small entrepreneurs move from place to place and sell their products by attracting potential buyers and convincing them about the useful properties of natural products used by them and promising sure relief from various conditions.

Petty entrepreneurs selling herbal formulations in melas, and outside religious places

Then there is a large community of nomadic vaidyas selling herbal remedies from their tented 'pharmacies' put up along the roads for short periods in almost all towns in the country. These dispensers of herbal medicines claim to be specialising in curing chronic illness, sexual disorders, and in enhancing sexual vigour with 'Himalayan herbs', 'animal parts, and 'metals and minerals'. None of these categories of manufacturers and dispensers of herbal medicines is registered for making herbal medicines.

Tented 'pharmacies' of nomadic vaidyas - a common sight in many towns

Self Help Groups (SHGs), promoted by different government agencies to enhance rural livelihoods, is yet another category of consumers of herbal raw drugs for making finished/ semi-finished products for sale through counters of the concerned departments or through tie ups with other agencies. Most of such SHGs have been promoted by the State Forest Departments and the State Tribal Development Departments. Some of such initiative have also been promoted by the National Medicinal Plants Board. Irrespective of the type of cottage scale initiative, these petty entrepreneurs consume large quantities of herbal raw drugs. Thriving on secrecy of their herbal

Medicinal Plants Processing by Forest Self Help Groups

recipes, most of these petty manufacturers bluntly refuse to share their herbal recipes and the diversity and quantity of herbal raw drugs used by them. The consumption of herbal raw drugs by this sector is believed to be fairly significant. However, in the absence of any data about their numbers and the size of their operation, estimation of their total collective consumption per year was not found feasible. This issue needs further investigation to bring consumption of botanicals by this large body of consumers into national estimations of demand of herbal raw drugs.

3.6. LIMITATIONS

India has a very large number of domestic herbal units spread over the various regions of the country making formulations under different streams of the Indian System of Medicine. Whereas all possible effort has been made to stratify these herbal units to adequately represent all segments, the ultimate analysis is based on the sampling of 692 herbal units. The data and analysis therefore is constrained with the following limitations:

- All efforts have been made to gather data in respect of the different segments and strata of the domestic herbal industry. However, this stratification was based on interactions with experts and *a priori* knowledge on the subject. It is possible that some niche herbal units using specific herbal raw drugs could have been missed during the survey. For example, *Artemisia annua*, used exclusively by Ipca Laboratories, a licensed pharmaceutical company, for extraction of 'artemisinin' used in making anti-malarial medicines, could not be documented under the survey of domestic herbal industry. It was only during field visits that cultivation of this species came to notice and efforts at forward trade linkages of the cultivated produce revealed its use by Ipca Laboratories.
- The annual quantum of consumption of herbal raw drugs as given by the responding herbal units has been taken as true and used for extrapolation over the entire sector and for drawing various inferences from the consolidated data.
- The listing of species is based upon the botanical correlations established and shared by the sampled domestic herbal units, and not upon 100% verification of such nomenclature correlation with the samples of herbal raw drugs used by these units. Whereas many of the herbal units allowed the field teams to their raw drug godowns, there was a general reluctance to provide samples of the herbal raw drugs used by them.
- Field visits to survey wild harvests and the herbal mandis reveal the trade of a number of species as 'equivalents' to many officially recognised herbal raw drug entities. However, the data made available by the herbal units reflects the consumption of only the officially recognised herbal raw drugs. Whereas we have enlisted only those medicinal plant species that have been recorded by the herbal industry, we have, however, included the commonly used 'substitutes', 'equivalents', and 'adulterants' in the 'Consolidated Inventory of the Medicinal Plants in Commercial Demand' given as Annexure-I to this report.

4

Raw Drugs Consumption by Rural Household and Folk Healers

Nearly 138 million rural households in India and thousands of folk healers are believed to consume significant quantities of a diversity of medicinal plants for wellness and health care. Many of these plants are also known to be in commercial trade. It is important to know the annual demand of such commercially traded medicinal plants by different user groups for planning and implementing resource management initiatives. A survey for gathering information on consumption of herbal raw drugs by rural household and folk healers/ traditional practitioners was conducted in 15 randomly selected states under different agro-climatic zones of the country. The data collected reveals that virtually all rural households consume a good diversity of herbal raw drugs for health care. A sizeable total of 479 medicinal plants species has been recorded in use by the sampled rural households. The total consumption of herbal raw drugs in the country by this segment of users in 2014-15 has been estimated at 1,71,500 MT. Out of the total number of medicinal plant species consumed, 296 species forming 94% of the total annual consumption by weight are also in active trade. Survey of the traditional folk healers, identified by using *a priori* information in the sampled villages, revealed the use of 340 medicinal plant species of which 202 species are in active trade, at an average consumption of 5.89 MT of herbal raw drugs per folk healer.

4.1. INTRODUCTION

India has one of the oldest as well as one of the most varied traditional systems of medicine, both oral and codified, which are completely integrated with its culture. The various ethnic communities in the country have been using the botanicals from the nearby forests since times immemorial for their primary health care needs. To help address more serious health care issues, almost every village in the country also has folk healers/ traditional practitioners, often specialising in treating one or more ailments. The major mainstay of these practices is healing herbs collected either from the nearby areas or purchased from the retail shops. These communities and folk healers hold a phenomenal knowledge about the use of locally available plants for health care. Till date use of about 6,500 plant species by these communities across various States in the country has been documented (FRLHT database). The quantity of material used by this very important segment of the users of medicinal plants is believed to be very significant. Many of the plant species used by this segment of users is also in active trade. This brings in an issue of resource management. Till recently, consumption of medicinal plants by this important user group was not factored-in while estimating demand and supply of medicinal plants in the country. It was only after Ved and Goraya (2008), working on a very limited rural household sample, flagged the issue and estimated the total annual consumption of herbal raw drugs by this user segment at 86,000 MT that competitive consumption of medicinal plant species in actice trade has started gaining importance.

The present study was taken up with a view to revisit the previous estimates of consumption of herbal raw drugs by rural households and the folk healers.

4.2. ESTIMATION OF ANNUAL CONSUMPTION OF MEDICINAL PLANTS BY RURAL HOUSEHOLDS

National Census data for the year 2011 (Census, 2011), whereunder about 138 million households forming 71.16% of the total houseolds in the country have been recorded as rural households, has been taken as the base for planning the rural household sample survey for consumption of medicinal plants. The sample survey of rural households was carried out in accordance with planned multistage sampling with zone, state, district and villages in successive stages and household as sampling unit. The information on consumption of raw drugs by households was recorded as per pre-tested semi-structured questionnaires. A total of 2450 rural households spread across 15 states were surveyed as per detail given in table 4.1.

Table 4.1. Details of the Rural Household Surveyed

S. No.	Zone	States under the zone	Total Number of Rural Households in the zone*	States Selected as per Random Selection	Household Surveyed (Nos.)
1	North Western Zone	Chandigarh, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Uttarakhand	8793486	Himachal Pradesh, Punjab, Uttarakhand	409
2	North Eastern Zone	Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram,	17238501	Assam, Arunachal Pradesh,	675

S. No.	Zone	States under the zone	Total Number of Rural Households in the zone*	States Selected as per Random Selection	Household Surveyed (Nos.)
		Nagaland, Sikkim, Tripura, West Bengal		Mizoram	
3	Northern Zone	Bihar, Delhi, Jharkhand, Uttar Pradesh	36696541	Bihar	228
4	Central Zone	Chhattishgarh, Madhya, Pradesh, Maharashtra, Odisha	29062006	Chhattishgarh, Odisha	528
5	Western Zone	Daman & Diu, Goa, Gujarat, Rajasthan	13198663	Daman & Diu, Goa, Gujarat	428
6	Southern Zone	Andhra Pradesh, Andaman & Nicobar, Kerala, Karnataka, Lakshdeep, Puducherry, Telangana, Tamil Nadu	32758187	Andhra Pradesh, Karnataka, Puducherry	182
		Total	**137747384**		**2450**

*Number of rural households as per Census 2011

The major challenge during this survey was to establish identity of the medicinal plants reported to be in use by the rural communities and to correlate these with their accepted botanical nomenclature. The local names given were matched with the local and botanical names recorded in the available ethno-medicinal literature from the area [Das (1995), Mohant and Rout (2001), Das and Tag (2006), Patel and Patel (2006), Baruah and Kalita (2007), Verma and Chauhan (2007), Tag *et al.* (2007), Bhattacharjya and Borah (2008), Sen *et al.* (2008), Sharma and Mishra (2009), Udayakumar *et al.* (2009), Kalita and Phukan (2010), Meena and Yadav (2010), Dixit and Sudurshan (2011), Kaur *et al.* (2011), Nimachow *et al.* (2011), Sharma *et al.* (2011), Tangjanga *et al.* (2011), Chakravarty and Kalita (2012), Raut *et al.* (2012), Sinha *et al.* (2012), Sharma and Sood (2013), Sonowal (2013), Vashist and Sharma (2013), Kumar (2014); Sahu *et al.* (2014); Bhattacharjee (2015), Mahant (2015), Maitreya (2015) and Kumar *et al.* (2016)] and local floras and by consulting experts. As far as possible, samples of the plants reported to be used for health care were accessed and their identity confirmed with local floras and matching with herbarium specimens. Popular traditional/ vernacular names were thereafter correlated with the updated botanical nomenclature. Some plant species, of which the households were not able to show the specimens and which could not be correlated to botanical identities by the local names, have not been included in the documentation. Information on quantitative and qualitative parameters (local name of raw drugs, parts used, quantity used in a year, source of collection, price if purchased) in respect raw drugs consumed by rural households was gathered, collated and analysed. The average consumption per household worked out on the basis of data collected from the samples households in the zone, was extrapolated over all households of the zone. The data for all zones was thereafter added to arrive at the national consumption estimates.

Collation of the data gathered from the 2450 sampled rural households has resulted in documenting of 677 herbal raw drug entities pertaining to 479 medicinal plants species (excluding vegetables, fruits, spices, cereals and pulses) under use by the sampled rural communities for their health care. (table 4.2).

Table 4.2. Herbal Raw Drugs Consumed by Rural Households including those that are in Commercial Trade

S. No.	Name of Plant Species	Local Name (s)	Part Used	N	NE	NW	C	W	S	Estimated Total Annual Consump--tion (MT)	Status in Comme--rcial Trade
1	*Abelmoschus manihot*	Mushkdana, Kasturidana	Root	-	√	-	-	-	-	0.61	-
2	*Abroma augusta*	Ulatkambal	Leaf, Bark, Root	-	√	-	-	-	-	4.66	√
3	*Abrus precatorius*	Kunnimuthu, Gundumani	Seed, Leaf	-	-	-	√	√	√	109.85	√
4	*Abutilon indicum*	Thuthi	Leaf, Seed, Inflorescence	-	-	-	-	√	√	11.29	√
5	*Acacia catechu*	Kasikatti	Bark, Extract	-	-	-	√	-	-	5.50	√
6	*Acacia farnesiana [= A. indica]*	Irmed	Stem, Bark	-	√	-	-	-	-	60.63	√
7	*Acacia nilotica subsp. indica [= A. arabica var. indica*	Karuvelum, Babul, Kikar	Gum, Fruit, Leaf, Bark, Stem, Flower	√	-	√	-	√	√	520.89	√
8	*Acacia pennata*	Agla bel, Biswal	Leaf	-	√	-	-	-	-	1.74	-
9	*Acacia senegal*	Kumtha, Char gond, Kordofan, Kitir	Gum	-	-	-	-	√	-	57.09	√
10	*Acacia sinuata* [=*A. concinna*]	Shikakai	Fruit	-	-	-	-	-	√	86.40	√
11	*Acacia leucophloea*	Vaela maram	Root	-	-	-	-	-	√	21.60	√
12	*Acalypha indica*	Kuppai Maeni	Whole Plant	-	-	-	√	-	√	363.59	√
13	*Achyranthes aspera*	Nayuruvi, Putt Kanda	Whole Plant	√	√	√	√	-	√	2750.27	√
14	*Acmella oleracea [= Spilanthes acmella var. oleracea]*	Karkara	Flower, Leaf	-	√	√	√	-	-	12.98	√
15	*Acmella paniculata*	Jati malkathi	Whole Plant	-	√	-	-	-	-	7.51	√
16	*Aconitum heterophyllum*	Atees, Athividayan	Tubers	-	-	√	-	-	-	25.80	√
17	*Aconitum violaceum*	Dudhiya mohra	Root	-	-	√	-	-	-	3.01	√
18	*Acorus calamus*	Gurbach, Vasambu	Root, Leaf, Rhizome	-	√	-	√	-	√	163.91	√
19	*Adiantum capillus -veneris*	Maidenhair fern	Whole Plant	-	-	-	-	-	√	0.43	√
20	*Aeginetia indica*	Aankuri bankuri	Leaf	-	√	-	-	-	-	4.49	-

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21	*Aegle marmelos*	Vilvam	Fruit Pulp, Bark, Leaf	√	√	√	√	√	√	10592.02	√
22	*Aerva lanata*	Chiru poolai	Whole Plant	-	-	-	√	-	-	202.00	√
23	*Aeschynomene aspera*	Thakka poondu	Leaf	-	-	-	-	-	√	2.16	-
24	*Ageratum conyzoides*	Ukhal butti	Whole Plant	-	√	√	-	-	√	586.68	√
25	*Ailanthus excelsa*	Mahanim	Bark	-	-	-	√	-	-	22.02	√
26	*Ajuga parviflora*	Nilkanthi	Leaf	-	-	√	-	-	-	13.54	√
27	*Albizia amara*	Usilai	Leaf	-	-	-	-	-	√	7.20	√
28	*Albizia lebbeck*	Siris	Wood	-	-	√	-	-	-	1.07	√
29	*Albizia procera*	Siris	Leaf	-	√	-	-	-	-	1.02	√
30	*Alocasia macrorrh izos [= A. indica]*	Mankanda	Leaf, Stem	-	√	-	-	-	-	20.43	-
31	*Aloe vera [= A.barbadensis]*	Elva, Kumari, Soththu katrazhai	Leaf, Pulp, Stem	√	√	√	√	√	√	3262.07	√
32	*Alpinia nigra*	Tora	Rhizome	-	√	-	-	-	-	3.58	√
33	*Alpinia calcarata*	Sitharathai	Root, Rhizome	-	-	-	√	-	√	11.35	√
34	*Alpinia galanga*	Perarathai, Kulanjan	Rhizome	-	√	-	-	-	-	11.80	√
35	*Alstonia scholaris*	Saitan	Leaf, Bark, Stem	-	√	-	√	-	-	363.54	√
36	*Alternanthera sessilis*	Ponnanganni keerai, Mati kaduri	Whole Plant	-	√	-	-	-	√	1929.45	-
37	*Amorphophallus paeoniifolius [= A. campanulatus]*	Arsghna, Surankand, Zaminkand	Root, Flower, Rhizome	-	√	-	√	-	-	86.56	√
38	*Anacyclus pyrethrum*	Akraharam	Whole Plant	-	-	√	-	-	-	5.16	√
39	*Andrographis paniculata*	Nila vembu, Kalmegh	Whole Plant	√	√	-	√	-	√	2082.33	√
40	*Angelica glauca*	Chanra	Root	-	-	√	-	-	-	8.17	√
41	*Anisomeles indica*	Kala Bhangra	Aerial Parts	-	√	-	-	-	-	74.06	√
42	*Anogeissus acuminata*	Dhau	Stem	-	√	-	-	-	-	4.49	-
43	*Aponogeton natans*	Kottikizh anghu	Leaf	-	-	-	-	-	√	1.08	-
44	*Aporosa octandra*	Tamsir	Bark	-	√	-	-	-	-	63.85	-
45	*Ardisia paniculata*	Panicled Coralberry	Root	-	√	-	-	-	-	22.98	-
46	*Argemone mexicana*	Brahma dandu	Latex, Seed	-	-	-	√	-	√	2.54	√

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47	*Argyreia nervosa [= A. speciosa]*	Samudraphal, Samundra Sokh	Leaf, Latex	-	√	-	-	-	-	21.91	√
48	*Arisaema tortuosum*	Baag Mingari	Tuber	-	-	√	-	-	-	21.93	√
49	*Aristolochia bracteolata*	Aaduthinna paalai	Whole Plant	-	-	-	-	-	√	15.12	√
50	*Arnebia benthamii*	Massrchini	Root	-	-	√	-	-	-	7.31	√
51	*Artemisia capillaris*	Wormwood		-	-	√	-	-	-	0.21	-
52	*Artocarpus chama*	Chaplash	Fruit	-	√	-	-	-	-	2.91	-
53	*Asparagus filicinus*	Chiriya-kanda	Bark	-	-	√	-	-	-	7.44	-
54	*Asparagus racemosus*	Shatawar	Root, Rhizome, Leaf	√	√	√	√	√	√	675.56	√
55	*Azadirachta indica*	Neem, Vembu Vaeppan, Vembu	Whole Plant	√	√	√	√	√	√	9087.68	√
56	*Azima tetracantha*	Sanga ilai	Leaf	-	-	-	-	-	√	33.84	√
57	*Baccaurea ramiflora*	Burmese Grape	Stem, Bark	-	√	-	-	-	-	4.55	-
58	*Baccharoides anthelmintica [= Centratherum anthelminticum]*	Kali zeeri	Seed	-	-	-	√	-	-	1.65	√
59	*Bacopa monnieri*	Neer brahmi	Whole Plant	-	√	√	√	√	-	140.62	√
60	*Bambusa bambos*	Mungilarisi, Bambo	Seed, Leaf	√	-	√	-	-	√	633.62	√
61	*Barleria prionitis*	Vajradanti	Leaf, Root	-	-	√	-	-	-	2.24	√
62	*Bauhinia tomentosa*	Thiruvaatchi	Leaf	-	-	-	-	-	√	62.64	√
63	*Bauhinia variegata*	Kachnar	Flower buds	-	-	√	-	-	-	19.35	√
64	*Begonia roxburghii*	Dieng jajew	Root, Rhizome, Leaf, Stem, Petiole	-	√	-	-	-	-	83.87	-
65	*Berberis aristata*	Daruhaldi	Stem, Bark, Root	-	√	√	-	-	-	49.95	√
66	*Berberis lycium*	Kasmala	Whole Plant	-	-	√	-	-	-	283.80	√
67	*Berginia ciliata*	Pashan Bhed	Whole Plant	-	√	√	-	-	-	124.89	√
68	*Bidens pilosa*	Phutium	Whole Plant	-	-	√	-	-	-	0.09	-
69	*Bischofia javanica*	Asri, Bolasri	Bark	-	√	-	-	-	-	2.55	-
70	*Bistorta affinis*	Ninai	Root	-	-	√	-	-	-	9.03	-
71	*Bixa orellana*	Jaffra vedai	Seed	-	√	-	-	-	-	2.04	√
72	*Blepharis maderaspatensis*	Elumbotti thazhai	Leaf	-	-	-	-	-	√	12.24	√

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73	*Blumea balsamifera*	Basoor	Leaf	-	-	-	-	√	-	11.69	√
74	*Blumea lanceolaria*	Tera paibi	Leaf	-	√	-	-	-	-	5.11	√
75	*Boerhavia diffusa*	Punarnava, Mukarattai	Whole Plant	-	-	-	√	-	√	1047.02	√
76	*Bombax ceiba [= B. malabaricum*	Maratti mokku, Elevam, Seemal Flower	Fruits, Flower, Bark	√	√	√	√	-	-	443.31	√
77	*Bonnaya reptans*	Kausidarya	Whole Plant	-	√	-	-	-	-	167.48	-
78	*Boswellia serrata*	Mani kundrikam	Gum	-	-	-	-	√	-	13.43	√
79	*Breynia retusa [= B. patens]*	Kangli, Dalfodi	Leaf	-	-	-	-	√	-	5.78	-
80	*Bryophyllum campanulatum*	Patharchur	Leaf	-	√	-	-	-	-	13.28	√
81	*Bryophyllum peltatum*	Patharchur	Leaf	√	-	-	-	-	-	32.19	-
82	*Bryophyllum pinnatum [= Kalanchoe pinnata]*	Patharchur	Leaf, Whole Plant	-	√	√	-	-	-	108.69	√
83	*Butea monosperma [= B. frondosa]*	Murukkam, Tesu Phool, Palas Phool	Bark (Stem), Flower	-	-	√	√	√	-	603.52	√
84	*Byttneria pilosa*	Sazukngha wnghlap	Leaf	-	√	-	-	-	-	2.20	-
85	*Byttneria aspera [= B. grandifolia.]*	Tikani barua	Stem, Leaf	-	√	-	-	-	-	3.37	√
86	*Cadaba fruticosa [= C. indica]*	Vizhudhi	Leaf	-	-	-	√	-	√	42.01	√
87	*Caesalpinia bonduc*	Kalaachi kaai	Seed, Leaf	√	√	-	√	-	√	713.67	√
88	*Caeselpinia sappan*	Pathimugam	Wood	-	√	-	-	-	-	7.66	√
89	*Calamus guruba*	Rattan	Tender Plant		√					50.72	√
90	*Calendula officinalis*	Genda	Leaf	-	√	-	-	-	-	0.97	√
91	*Callicarpa arborea*	Khimbar, Moskhanchi	Bark, Leaf	-	√	-	-	-	-	153.33	-
92	*Callicarpa macrophylla*	Gandhphali	Root	-	√	-	-	-	-	0.31	√
93	*Calotropis gigantea*	Erukkam, Aak	Flower, Leaf, Seed, Latex	√	√	√	-	√	√	369.17	√

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94	*Calotropis procera*	Aak, Akon	Flower, Leaf, Seed, Latex, Root	√	√	√	√	√	-	529.98	√
95	*Cannabis sativa*	Bhang	Leaf, Root	-	√	√	-	-	-	149.46	√
96	*Cardiospermum halicacabum*	Mudakaththaan	Whole Plant	-	-	-	-	-	√	4499.75	√
97	*Carissa carandas*	Karundal	Root	-	-	√	-	-	√	39.91	√
98	*Carum carvi*	Seemail sombu	Seed	-	-	-	√	-	-	4.40	√
99	*Cassia fistula*	Amaltas, Ghur lakkar	Leaf, Bark, Fruit (Pods), Seed, Root, Stem	-	√	√	√	-	-	841.99	√
100	*Cassine glauca*	Jamrasi	Root	-	-	-	√	-	-	1.10	-
101	*Castanopsis tribuloides*	Katus	Bark, Stem	-	√	-	-	-	-	16.70	-
102	*Catharanthus roseus [= Vinca rosea]*	Nithya kalyani	Whole Plant	√	√	√	√	-	√	249.26	√
103	*Celastrus paniculatus*	Vaaluluvai, Malkangni	Seed	-	-	-	-	-	√	0.86	√
104	*Centella asiatica*	Vallaarai, Brahmi, Thankhuni, Vaaluluvai, Malkangni	Whole Plant	-	√	√	-	-	√	1870.48	√
105	*Cheilocostus speciosus [= Costus speciosus]*	Kustha, Koshtum, Kuth	Aerial Parts, Rhizome, Tubers	-	√	-	√	-	√	189.07	√
106	*Chloranthus elatior*	Lope	Leaf	-	√	-	-	-	-	2.55	-
107	*Chlorophytum borivilianum*	Safed Musli	Seed	-	-	√	-	-	-	25.80	√
108	*Chlorophytum nepalense*	Safed Musli	Stem	-	√	-	-	-	-	1.07	-
109	*Chlorophytum tuberosum*	Safed Musli	Root	-	-	-	√	-	-	1.10	√
110	*Chromolaena odorata [= Eupatorium odoratum]*	Yamdak	Leaf	-	√	-	-	-	-	1.69	-
111	*Chrysanthemum indicum*	Guladaudi	Leaf	-	√	-	-	-	-	42.65	√
112	*Chrysopogon zizanioides*	Vilaamicham	Root	-	-	-	-	-	√	1355.32	√
113	*Cichorium intybus*	Kaasini	Seed, Leaf	-	-	-	-	-	√	18.00	√
114	*Cinnamomum glanduliferum*	Rolu	Stem	-	√	-	-	-	-	3.27	-

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115	*Cinnamomum tamala*	Tejpatta	Leaf	-	√	√	-	-	-	156.74	√
116	*Cinnamomum verum [= C. zeylanicum]*	Dalchini	Bark	-	√	√	-	-	√	6.76	√
117	*Citrullus colocynthis*	Tumma	Fruit, Root	-	-	√	√	-	-	520.00	√
118	*Cissus quadrangularis*	Pirandai, Hutjodi	Whole Plant	√	√	-	√	-	√	5267.03	√
119	*Cleistanthus collinus*	Kutaja, Garhar	Bark	-	-	-	√	-	-	1.10	√
120	*Cleome gynandra [= Gynandropsis pentaphylla]*	Vaelai keerai, Nalla vaelai	Whole Plant	-	-	-	-	-	√	1124.58	√
121	*Cleome viscosa*	Naaivaelai	Leaf	-	-	-	-	-	√	134.99	√
122	*Clerodendrum colebrookianum*	Papua Toh	Leaf, Shoot	-	√	-	-	-	-	205.33	√
123	*Clerodendrum phlomidis*	Thazhuth aazhai	Leaf	-	-	-	√	-	√	3.73	√
124	*Clerodendrum glandulosum*	Tapen	Leaf	-	√	-	-	-	-	187.20	-
125	*Clerodendrum infortunatum [= C. viscosum]*	Bhant, Batigosh	Flower, Leaf	√	√	-	-	-	-	642.86	√
126	*Clitoria ternatea*	Sankhpushpa mKakkattaan, Sangupoo	Seed, Flower	-	-	-	-	-	√	2.34	√
127	*Cocculus hirsutus*	Vasanvel	Root	-	-	-	√	-	-	11.01	√
128	*Coleus forskohlii [= Plectranthus barbatu]*	Gandira	Leaf	-	-	-	-	√	-	2.08	√
129	*Commelina benghalensis*	Kozhi keerai, Kaanaankuzhal	Whole Plant	-	√	-	-	-	√	77.07	-
130	*Commiphora wightii*	Guggulu	Gum Resin	-	-	-	-	√	-	3.36	√
131	*Conyza leucantha*	Fleabane	Whole Plant	-	√	-	-	-	-	0.56	-
132	*Coptis teeta*	Peetha rohini	Root	-	√	-	-	-	-	71.61	√
133	*Cordia dichotoma*	Lasora, Sapistan	Leaf	-	-	-	-	-	√	1.12	√
134	*Cordia sinensis [= C. rothii]*	Gond	Leaf	√	-	-	-	√	-	33.76	-
135	*Crataeva religiosa [= C. nurvula]*	Maavilangam	Bark, Leaf	-	√	-	-	-	-	22.63	-
136	*Crotalaria pallida [= C. mucronata]*	Hemp	Root	-	-	-	√	-	-	0.55	-

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137	*Croton caudatus*	Damdawi	Leaf	-	√	-	-	-	-	7.56	-
138	*Croton tiglium*	Nervalum	Seed	-	√	-	-	-	√	4.62	√
139	*Cullen corylifolium [= Psoralea corylifolia]*	Babachi, Babchi	Leaf	-	-	-	-	√	-	1.01	√
140	*Curculigo orchioides*	Nilapanai	Root, Tuber	-	-	-	√	-	-	133.20	√
141	*Curcuma angustifolia*	Tikhur	Root	√	-	-	√	-	-	58.53	√
142	*Curcuma caesia*	Nar-kachura, Kala-haldi	Rhizome, Leaf	-	√	-	-	-	-	106.96	√
143	*Cuscuta reflexa*	Amar Bel, Amar lata	Aerial Parts, Stem	√	√	√	-	-	-	142.38	√
144	*Cymbopogon citratus*	Sonakapul	Aerial Parts, Stem, Leaf	√	-	-	-	√	-	133.72	√
145	*Cynodon dactylon*	Arugampul, Doob	Whole Plant	√	√	-	√	-	√	2954.05	√
146	*Cyperus rotundus*	Motha, Korai kizhangu, Sirukorai kizhanghu	Root, Tuber	√	-	-	√	-	√	1352.17	√
147	*Dactylorhiza hatagiera*	Hathajodi	Root	-	-	√	-	-	-	9.03	√
148	*Dalbergia sissoo*	Shisham	Heart Wood Bark (Stem)	√	-	√	-	-	-	287.66	√
149	*Dalbergia lanceol aria [= D. paniculata]*	Bithua, Bitwa, Takoli	Heart Wood Bark (Stem)	-	√	-	√	-	-	6.76	√
150	*Datura metel*	Oomaththai, Umatham	Fruit, Leaf, Seed	-	√	-	√	-	√	24.55	√
151	*Datura stramonium*	Dhatura	Leaf, Root	-	√	-	-	√	-	3.29	√
152	*Delonix elata*	Vaadha naraayanan	Leaf	-	-	-	-	-	√	517.29	√
153	*Dendrobium heterocarpum*	Tai Taming	Stem	-	√	-	-	-	-	6.13	-
154	*Dendrocalamus strictus*	Baans	Leaf	-	-	-	√	-	-	1.10	-
155	*Dicliptera chinensis [= D. roxburghiana]*	Ghas	Leaf	-	-	√	-	-	-	77.40	-
156	*Digera muricata*	Thoyyaa keerai	Leaf	-	-	-	-	-	√	170.99	
157	*Dillenia indica*	Chalita	Fruit, Sepals	-	√	-	-	-	-	145.11	-
158	*Dillenia pentagyna*	Nagkesaram	Bark	-	√	-	-	-	-	43.98	?
159	*Dioscorea bulbifera*	Varahi kand	Tuber	-	-	√	-	-	-	0.21	-

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160	*Dioscorea hispida*	Kath Alu	Tuber	-	-	-	√	-	-	220.17	-
161	*Dioscorea pentaphylla*	Kanta alu	Tuber	-	√	-	-	-	-	2.91	-
162	*Diospyros montana*	Bistendu, Kala dhao, Kendu	Root, Fruit	-	-	-	√	-	-	13.32	-
163	*Diplazium esculentum*	Diplazium esculentum	Rhizome, Root, Leaf, Tender Plant	-	√	-	-	-	-	112.37	-
164	*Dodonaea viscosa*	Mehandu	Leaf	-	-	√	-	-	-	32.25	√
165	*Drymaria cordata*	Sara Kiklo	Leaf	-	√	-	-	-	-	525.94	-
166	*Dysoxylum excelsum*	Bili devdari	Leaf	-	√	-	-	-	-	6.03	-
167	*Dysoxylum gotadhora*	Bili devdari	Root	-	√	-	-	-	-	0.61	-
168	*Eclipta prostrata [= E. alba]*	Bhringraj, Karisaalai	Whole Plant	√	√	-	√	-	√	2482.72	√
169	*Elaeagnus caudata*	Sarzuk	Bark, Leaf, Root	-	√	-	-	-	-	9.30	-
170	*Elaeagnus latifolia*	Goeli, Muslendi	Leaf, Root	-	√	-	-	-	-	66.91	√
171	*Elaeagnus pyriformis*	Sarzukui	Leaf	-	√	-	-	-	-	5.11	-
172	*Elaeocarpus floribundus*	Olive	Fruit	-	√	-	-	-	-	0.31	-
173	*Elephantopus scaber*	Gjihiva	Leaf, Root	-	√	-	√	-	-	220.80	√
174	*Elsholtzia blanda*	Ban tulsi, Lomba, Mauhri	Leaf	-	√	-	-	-	-	12.26	-
175	*Elsholtzia ciliata*	Crested Late -Summer Mint	Leaf	-	√	-	-	-	-	5.11	-
176	*Elsholtzia communis*	Kewa	Leaf	-	√	-	-	-	-	2.96	-
177	*Embelia ribes*	Vaividang	Stem	-	-	-	√	-	-	2.20	√
178	*Enicostemma axillare [= E. littorale]*	Vellarugu	Aerial Parts	-	-	-	-	-	√	2.52	√
179	*Entada phaseoloides*	Kakavalli	Seed	-	√	-	-	-	-	3.58	-
180	*Eryngium foetidum*	Ban dhania	Whole Plant	-	√	-	-	-	-	8.94	-
181	*Erythrina variegata [= E. indica]*	Kalyanamur ungai	Stem, Leaf	-	√	-	-	-	√	79.71	√
182	*Erythrina stricta*	Pangara, Korao	Flower	-	√	-	-	-	-	4.70	-

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183	*Ethulia conyzoides*	Golphuli	Leaf	-	√	-	-	-	-	2.66	-
184	*Eucalyptus globulus*	Safeda	Leaf, Root	√	-	√	-	√	√	359.25	√
185	*Eucalyptus tereticornis*	Speda, Thaila maram	Leaf	-	-	√	-	-	√	86.04	-
186	*Eupatorium odoratum*	Tivra gandha, Bagh dhoka	Leaf	-	√	-	-	-	-	33.94	-
187	*Euphorbia antiquorum*	Thiru kalli	Latex, Stem	-	-	-	-	-	√	7.20	-
188	*Euphorbia caducifolia*	Danda-thor	Leaf	-	-	-	-	√	-	13.57	-
189	*Euphorbia hirta*	Ammaan pacharisi	Whole Plant	-	-	-	√	-	√	8.62	√
190	*Euphorbia neriifolia*	Garbhans, Siju, Sign	Leaf, Stem	√	√	-	-	-	-	265.80	√
191	*Euphorbia prostrata*	Dudhli Booti	Leaf	-	-	√	-	-	-	12.90	-
192	*Euphorbia pulcherrima*	Lalpatta	Leaf	-	-	-	-	√	-	6.72	-
193	*Euphorbia royleana*	Giloe, Choro	Stem,	-	-	√	-	-	-	4.51	-
194	*Euphorbia tirucalli*	Llaikkalli, Paithangali	Latex, Stem	-	-	-	-	-	√	34.02	√
195	*Ficus benghalensis*	Aal, Bohr, Barota Ki Dari, Aalam	Seed, Bark, Leaf, Exuade, Root	√	-	√	-	-	√	340.48	√
196	*Ficus hispida*	Phalgu	Fruit	-	√	-	-	-	-	5.01	√
197	*Ficus maclellandii*	Alii Fig	Latex	-	√	-	-	-	-	1.28	-
198	*Ficus racemosa [= F. glomerata]*	Aththi, Gooler	Fruit, Leaf, Latex	√	-	-	-	-	√	37.02	√
199	*Ficus religiosa*	Arasu, Pipal, Arasan	Bark, Fruit, Leaf, Root, Latex	√	√	√	√	-	√	1391.44	√
200	*Ficus virens*	Pilkhan	Leaf	-	√	-	-	-	-	0.15	-
201	*Flacourtia indica*	Kattar	Bark	-	-	-	√	-	-	13.21	√
202	*Flemingia strobilifera*	Kanphuta	Root	-	-	-	√	-	-	1.10	-
203	*Flueggea virosa*	Dalme, patala	Leaf	-	√	-	-	-	-	10.98	√
204	*Fragaria vesca*	Tayin	Fruit	-	√	-	-	-	-	51.59	-
205	*Galium aparine*	Kharasha	Root	-	-	√	-	-	-	6.02	-
206	*Garcinia cowa*	Bonthekra	Fruit	-	√	-	-	-	-	8.17	-
207	*Garcinia indica*	Kokam, Cambogie	Fruit	-	-	-	-	√	-	261.96	√
208	*Garcinia lanceifolia*	Rupahi-thekera, Pelh, Rupohi tekera	Fruit	-	√	-	-	-	-	0.72	-

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209	*Garcinia pedunculata*	Amlavetasa	Fruit	-	√	-	-	-	-	229.90	√
210	*Garcinia sopsopia*	Vawm-va, Thensaker	Fruit	-	√	-	-	-	-	0.87	-
211	*Glinus oppositifolius*	Ushnasundara	Whole Plant	-	√	-	-	-	-	1.79	√
212	*Glycyrrhiza glabra*	Mulethi, Adhimadhuarm	Root, Stem	-	-	-	√	-	-	5.50	√
213	*Gmelina arborea*	Gamhar	Leaf, Bark, Root	√	√	-	-	-	-	13.27	√
214	*Gomphogyne cissiformis*	Jhur Thliem	Fruit	-	√	-	-	-	-	1.33	-
215	*Grewia hirsuta*	Kukurbicha, Phrongli, Nagvala	Root	-	-	-	√	-	-	2.20	-
216	*Gymnema sylvestre*	Sarkarai kolli, Siru kurinjaan	Leaf	-	-	-	√	√	√	2748.20	√
217	*Hedyotis scandens*	Kelhnamatur	Leaf	-	√	-	-	-	-	25.23	-
218	*Helicia robusta*	Pasaltakaza	Stem, Root, Leaf	-	√	-	-	-	-	63.28	-
219	*Helicteres isora*	Valampuri-Idampuri	Fruits	-	-	-	√	-	√	4.70	√
220	*Heliotropium indicum*	Thekkada	Whole Plant	-	√	-	-	-	-	0.05	-
221	*Hemidesmus indicus*	Nannari, Maahaali, Anantmool, Murod Phah	Root	-	-	-	√	-	√	40.54	√
222	*Hibiscus cannabinus*	Pulicha keerai	Flower, Leaf	-	-	-	√	-	√	101.91	-
223	*Hibiscus rosa-sinensis*	Semparuthi, Jobabhool	Flower, Leaf	√	√	-	-	-	√	1947.78	√
224	*Hibiscus sabdariffa*	Pulichchakeerai, Kasarakeerai	Aerial Parts	-	-	-	-	-	√	125.27	√
225	*Hiptage benghalensis*	Kerek-Iota	Root	-	-	-	√	-	-	0.55	-
226	*Holarrhena pubescens [= H. antidysenterica]*	Indirayan Beej, Kasappu vetpaalai	Root, Leaf, Bark, Stem	-	√	-	√	√	√	55.77	√
227	*Holostemma ada-kodien. [= H. annulare]*	Jeevanti	Whole Plant	-	-	-	√	-	-	1.10	√
228	*Homalomena aromatica*	Sugan mantri	Rhizome	-	√	-	-	-	-	44.64	√

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229	*Houttuynia cordata*	Fakmoi	Whole Plant	-	√	-	-	-	-	21.66	-
230	*Hybanthus enneaspermus*	Ratan Purush	Whole Plant	-	-	-	-	-	√	0.72	√
231	*Hydrocotyle rotundifolia*	Saru Manimuni	Whole Plant	-	√	-	-	-	-	182.45	-
232	*Hygrophila auricul ata [=H. schulli]*	Nirmulli	Whole Plant	-	-	-	-	-	√	169.19	-
233	*Hyptis suaveolens*	Naatu pachchilai	Leaf, Seed	√	-	√	√	-	-	115.17	-
234	*Illicium griffithii*	Domlishi	Fruits	-	√	-	-	-	-	5.47	√
235	*Impatiens balsamina*	Gul-mehndi	Root	-	√	-	-	-	-	0.18	-
236	*Inula cappa*	Buarthau	Leaf	-	√	-	-	-	-	14.51	-
237	*Ipomoea aquatica*	Vellaikeerai, Kalmisek	Whole Plant	-	√	-	-	-	√	235.62	√
238	*Ipomoea marginata [= I. sepiaria]*	Thallikeerai	Whole Plant	-	-	-	-	-	√	104.39	√
239	*Ipomoea paniculata*	Vellai kilangu	Tubers	-	-	-	-	√	-	13.43	-
240	*Ipomoea carnea*	Neyveli kaataman akku	Latex, Fruit, Leaf	-	-	-	-	-	√	12.96	-
241	*Ipomoea nil [= I. hederacea]*	Kaladanah	Seed	-	-	-	√	-	-	0.55	√√
242	*Ixora parviflora*	White Ixora, Naveri, Kuraat	Fruit, Root	-	-	-	-	-	√	0.72	-
243	*Jasminum multiflorum*	Khorika jai, Ban malati	Root	-	√	-	-	-	√	5.07	-
244	*Jatropha curcas*	Jamalghota, Ratanjot	Seed, Stem, Leaf	-	√	-	-	√	√	322.87	√
245	*Juglans regia*	Akhrot	Bark, Root, Stem	-	-	√	-	-	-	2.62	√
246	*Jurinea macrocephala [= J. dolomiaea]*	Dhoop	Root	-	-	√	-	-	-	10.96	√
247	*Justicia adhatoda [= Adhatoda zeylanica, A. vasica]*	Adathodai	Leaf	√	√	√	-	√	√	1973.82	√
248	*Justicia gendarussa [= Gendarussa vulgaris]*	Karunochchi	Leaf	-	√	-	-	-	√	52.23	√

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249	*Kalanchoe abrupta*	Bish Kobra	Leaf	-	√	-	-	-	-	15.07	-
250	*Kigelia africana*	Phari Khira	Fruit	-	-	√	-	-	-	258.00	-
251	*Kirganelia reticulata*	Amloki	Leaf	-	-	-	-	√	-	6.72	√
252	*Knema cinerea*	Kelat	Latex	-	√	-	-	-	-	0.15	-
253	*Knema linifolia*		Stem	-	√	-	-	-	-	0.56	-
254	*Lannea coromandelica*	Othiya maram	Bark	-	-	-	-	-	√	41.04	√
255	*Lantana camara*	Unnichedi	Leaf	-	-	-	-	-	√	2.88	√
256	*Laportea crenulata*	Bap Kangsam	Leaf, Shoots, Root	-	√	-	-	-	-	13.43	-
257	*Lasia spinosa*	Kanakachu	Leaf, Root, Stem, Tender Twig	-	√	-	-	-	-	85.35	-
258	*Lawsonia inermis*	Maruthondri	Leaf	√	-	√	-	√	√	990.05	√
259	*Lepidagathis cristata*	Kaadhu kaduppan poonu	Whole Plant	-	-	-	-	-	√	9.00	-
260	*Lepionurus sylvestris*	Vangvattur	Leaf	-	√	-	-	-	-	2.81	-
261	*Leptadenia reticulata*	Jivanti, Paalai kodi	Whole Plant	-	-	-	-	-	√	221.03	√
262	*Leucas aspera [= L. plukenetii]*	Dharm puspa	Whole Plant	-	√	-	√	-	√	402.22	√
263	*Leucas biflora [= L. procumbens]*	Jodi burumbi	Leaf	-	√	-	-	-	-	8.84	-
264	*Leucas indica*	Thumbai	Whole Plant	-	-	-	-	-	√	15.48	-
265	*Lindernia ruellioides*	Kausidarya	Whole Plant	-	√	-	-	-	-	8.99	-
266	*Litsea glutinosa [= L. chinensis]*	Menda Lakadi, Naramamidi, Maidachal, Medasakah	Bark	-	-	√	√	-	-	7.65	√
267	*Litsea salicifolia*	digloti, dighal-lat	Root	-	√	-	-	-	-	0.23	-
268	*Litsea polyantha*	Tumitla	Stem	-	√	-	-	-	-	0.77	-
269	*Lobelia angulata*	Choakthi	Leaf, Fruit	-	√	-	-	-	-	1.94	-
270	*Ludwigia perennis*	Dhan ghass	Leaf	√	-	-	-	-	-	7.73	-
271	*Madhuca longifolia var. latifolia*	Mahua	Root	-	-	-	√	-	-	1.10	√
272	*Mallotus nudiflorus*	Pindar, Wangphop	Root	-	√	-	-	-	-	1.28	√
273	*Mallotus roxburghianus*	Khabi-lakoi	Aerial Parts	-	√	-	-	-	-	25.08	-

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274	*Manilkra hexandra*	Rayan	Leaf	-	-	-	-	√	-	16.73	-
275	*Marsilea quadrifolia*	Aaraa keerai	Whole Plant	-	-	-	-	-	√	10.80	√
276	*Medicago polymorpha*	Bindo arxa, Nettho sag	Leaf	-	-	-	-	√	-	1.07	-
277	*Melastoma malabathricum*	Phutki	Root, Leaf	-	√	-	-	-	-	7.25	-
278	*Melia azedarach*	Neem, Malaivembu	Leaf, Seed	√	√	-	-	-	√	388.64	√
279	*Melia dubia*	Kadukhajur, Malabar Neem	Leaf	-	√	-	-	-	-	1.12	-
280	*Melocanna baccifera*	Muli Bans	Stem	-	√	-	-	-	-	0.10	-
281	*Mentha arvensis*	Pudina, Puthina	Whole Plant	√	√	√	√	-	√	300.23	√
282	*Mentha longifolia*	Pudina	Leaf	-	-	√	-	-	-	58.69	√
283	*Mentha piperita*	Puthina	Whole Plant,	-	√	-	√	-	√	307.39	√
284	*Merremia umbellata*	Voktesentil	Stem	-	√	-	-	-	-	0.15	√
285	*Merremia emarginata*	Elithazhai	Whole Plant	-	-	-	-	-	√	1.26	√
286	*Mikania micrantha*	Congress lota	Whole Plant	-	√	-	-	-	-	33.08	-
287	*Mimosa pudica*	Gajjalu, lajwanti, Lajpatti	Whole Plant	-	√	-	√	-	-	61.59	√
288	*Mimusops elengi*	Magudam poo	Flower, Bark, Fruit	-	√	-	-	-	-	20.43	√
289	*Mirabilis jalapa*	Amthimani tharai	Leaf	-	-	-	-	-	√	6.84	√
290	*Molineria capitulata*	Palm Grass	Tubers	-	√	-	-	-	-	0.56	-
291	*Mollugo cerviana*	Parpadagam	Whole Plant	-	-	-	-	-	√	0.72	
292	*Morinda coreia [= M. pubescens; M. tinctoria var. tomentosa]*	Nonaa, Nunna	Leaf, Fruits	-	√	-	-	-	√	295.08	√
293	*Moringa oleifera*	Murungai	Stem Bark, Seed, Leaf	√	√	-	√	-	√	8654.09	√
294	*Mucuna pruriens*	Konch	Seed	-	-	-	√	-	-	28.62	√
295	*Mukia maderaspatana [= Melothria maderaspatana]*	Musumu sukkai	Aerial Parts, Leaf	-	-	-	-	-	√	108.53	√
296	*Murraya koenigii*	Mitha Neem, Kari Patta, Karuvepilai	Leaf	-	√	√	-	√	√	538.21	√

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297	*Murraya paniculata*	Kamini	Leaf	-	√	-	-	-	-	7.41	-
298	*Myristica fragrans*	Jaathikaai, Jaiphal	Seed, Fruits	-	-	√	√	-	√	3.26	√
299	*Nardostachys jatamansi [= N. grandiflora]*	Jatamansi	Whole Plant	√	√	-	-	-	-	11.14	√
300	*Nelumbo nucifera*	Kamal phul, Kamala	Flower, Root (Rhizome)	-	-	-	-	-	√	1.44	√
301	*Nepenthes khasiana*	Ghatparni	Leaf	-	√	-	-	-	-	20.43	-
302	*Nerium oleander [= N. indicum]*	Kaner	Leaf	-	-	√	-	-	-	0.52	√
303	*Nervilia aragoana*	Sthalapadma	Root	-	√	-	-	-	-	1.53	√
304	*Nigella sativa*	Karunjeera gam, Kalonji	Seed	-	-	-	√	-	√	3.08	√
305	*Nyctanthes arbortristis*	Singar kali, Harsingar, Sewati dheu	Leaf, Bark, Flower	√	√	√	√	-	-	3262.52	√
306	*Nymphaea alba*	Kumud	Tuber	√	-	-	-	-	-	4.51	√
307	*Nymphaea pubescens*	Alli	Tuber	-	-	-	-	-	√	1.44	-
308	*Ocimum americanum*	Ganjam thulasi	Whole Plant	√	√	-	-	-	√	96.12	√
309	*Ocimum basilicum*	Kali Tulsi	Leaf	-	√	-	-	-	-	73.30	√
310	*Ocimum tenuiflorum [= O. sanctum]*	Thulasi	Whole Plant	√	√	√	√	√	√	30083.39	√
311	*Oldenlandia corymbosa [= Hedyotis corymbosa]*	Horpojiva	Whole Plant	-	√	-	-	-	-	9.35	√
312	*Oldenlandia herbacea [= Hedyotis diffusa]*	Mangaluk	Whole Plant	-	√	-	-	-	-	23.34	-
313	*Operculina turpethum [= Merremia turpethum]*	Shivadi	Root, Stem	√	-	-	-	-	-	117.49	√
314	*Opuntia dillenii*	Nag Phan	Leaf	-	√	-	-	-	-	0.20	√
315	*Oroxylum indicum*		Root, Bark, Stem, Fruit	-	√	-	-	-	-	312.08	√
316	*Oxalis corniculata*	Araa keerai, Tengeri	Whole Plant	-	√	√	-	-	√	329.71	√
317	*Paederia foetida*	Lokolast, Bhadai lota	Root, Leaf, Stem	√	√	-	-	-	-	510.67	√
318	*Paederia scandens*	Prasaarani	Leaf	-	√	-	√	-	-	36.30	√
319	*Panax bipinnatifidus var.*	Tetuchaal, Arlu,	Rhizome	-	√	-	-	-	-	10.57	-

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	angustifolius [= P. sikkimensis]	Syonaka									
320	*Pandanus amaryllifolius*	Rampe, Ambemohor Pat	Root	-	√	-	-	-	-	2.04	-
321	*Pandanus odorifer [= P. odorus]*	Kewada, Ketaki	Stem	-	√	-	-	-	-	2.20	√
322	*Paris polyphylla*	Satuwaa	Root, Rhizome	-	√	-	-	-	-	5.57	√
323	*Parmelia perforata*	Chhadila	Fruiting Body	-	-	-	-	-	√	1.73	√
324	*Pavetta indica*	Paavatta	Leaf	-	-	-	-	-	√	23.40	-
325	*Pavonia odorata*	Sugandh abala	Root	-	-	-	-	-	√	18.07	√
326	*Pedalium murex*	Annai nerunji, Peru nerinjal	Fruit, Leaf, Aerial Parts	-	-	-	-	-	√	161.99	√
327	*Peperomia pellucida*	Ponounua	Leaf	-	√	-	-	-	-	14.05	-
328	*Pergularia daemia*	Uthaamani	Leaf	-	-	-	-	-	√	37.80	√
329	*Phlogacanthus curviflorus*	Lamgi nongmangkha	Leaf	-	√	-	-	-	-	3.27	-
330	*Phlogacanthus pubinervius*	Titaaphul	Leaf	-	√	-	-	-	-	3.32	-
331	*Phlogacanthus thyrsiflorus*	Titaaphul	Leaf	-	√	-	-	-	-	81.62	-
332	*Phyla nodiflora*	Poduthalai	Whole Plant	-	-	-	-	-	√	183.95	√
333	*Phyllanthus amarus [= P. fraternus]*	Keezhaa nelli, Bhui aonala, Dudli	Whole Plant	√	√	√	√	-	√	266.78	√
334	*Phyllanthus emblica [= Emblica officinalis]*	Aonla, Nelli	Fruit, Leaf	√	√	√	√	√	√	11982.00	√
335	*Phyllanthus maderaspatensis*	Mevaa nelli	Whole Plant	-	-	-	√	-	-	11.01	√
336	*Phyllanthus niruri*	Bhuiamla, Bahupatra	Whole Plant	-	√	√	√	-	-	21.58	-
337	*Phyllanthus urinaria*	Hajarmani, chakpaheikru	Whole Plant	-	√	-	-	-	-	17.67	√
338	*Phyllanthus acidus*	Harfarauri, Gihori	Fruit	-	√	-	-	-	-	0.87	-
339	*Physalis minima*	Tulatipati, Tankari	Whole Plant	-	-	-	-	-	√	7.63	√
340	*Picrasma javanica*	Bonpashala	Leaf	-	√	-	-	-	-	8.17	-
341	*Picria fel-terrae*	Longritong	Leaf	-	√	-	-	-	-	4.75	-
342	*Picrorhiza kurroa*	Kutki	Root	-	-	√	-	-	-	15.05	√
343	*Pinus roxburghii*	Gandabiroja, Sarala	Resin	-	-	√	-	-	-	1.68	√

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344	*Pinus wallichiana*	Blue Pine	Bark	-	√	-	-	-	-	0.10	-
345	*Piper album*	Vellamilagu	Fruits	-	√	-	-	-	-	0.51	-
346	*Piper longum*	Pipal chhoti, Pipli	Seed, Fruit, Root, Leaf	-	√	-	√	-	√	227.00	√
347	*Piper thomsonii*	Pipla	Fruits	-	√	-	-	-	-	0.26	-
348	*Pisonia grandis*	Nachchu kottai	Leaf	-	-	-	-	-	√	10.08	-
349	*Pistacia integerrima [= P. chinensis subsp. integerrima]*	Kakarsingi	Galls, Fruit	-	-	√	-	-	-	18.70	√
350	*Plantago major*	Lahuriya	Whole Plant	-	√	-	-	-	-	26.97	√
351	*Plantago ovata*	Isappukol	Seed	-	-	-	-	√	-	322.41	√
352	*Plectranthus amboinicus*	Karpooravali	Leaf	-	-	-	-	-	√	137.48	√
353	*Plumbago zeylanica*	Kodiveli, Chitramulam	Root, Bark, Leaf, Stem	-	√	-	√	-	-	1344.00	√
354	*Podophyllum hexandrum [= P. emodi]*	Bankakri, Papra	Leaf	-	√	-	-	-	-	0.10	√
355	*Pogostemon benghalensis*	Jui-lata	Leaf	-	√	-	-	-	-	129.13	-
356	*Polyalthia longifolia*	Debodarn	Leaf, Bark	-	√	-	-	-	-	1.38	√
357	*Polygonum hydropiper*	Panimorisk	Leaf	-	√	-	-	-	-	4.19	-
358	*Polygonum microcephalum*	Tarakmana	Leaf	-	√	-	-	-	-	1.63	-
359	*Polygonum strigosum*	Tarakmana	Whole Plant	-	√	-	-	-	-	5.98	-
360	*Pongamia pinnata [= Derris indica]*	Karanj	Root	-	-	-	√	√	√	30.38	√
361	*Portulaca oleracea*	Kulfa	Seed	-	-	-	-	-	√	399.58	√
362	*Portulaca quadrifida*	Pasala keerai, Pasalai	Whole Plant	-	-	-	-	-	√	629.97	√
363	*Prosopis juliflora*	Velikaathaan	Leaf	-	-	-	-	-	√	16.38	-
364	*Prunus cornuta*	Jangli jamun	Bark (Root)	-	-	√	-	-	-	3.01	-
365	*Pseudodrynaria coronans [= Aglaomorpha coronans]*	Awmvel	Rhizome	-	√	-	-	-	-	0.31	-
366	*Pterocarpus marsupium*	Bijasal	Wood, Fruit, Bark	-	-	-	√	√	-	1412.79	√
367	*Pterospermum acerifolium*	Kanak Champa	Leaf	-	-	-	-	-	√	0.86	√
368	*Pueraria tuberosa*	Vidharikhand	Tubers	-	-	-	√	-	-	1.10	√

[N: Northern, NE: North Eastern, NW: North Western, CW: Central Western, S: Southern]

S. No.	Name of Plant Species	Local Name (s)	Part Used	N	NE	NW	C	W	S	Estimated Total Annual Consump--tion (MT)	Status in Comme--rcial Trade
369	*Punica granatum*	Maadulam	Seed, Fruit rind, Leaf	-	√	√	-	-	√	301.29	√
370	*Pyrus pashia*	Kainth	Fruit	-	-	√	-	-	-	6.45	-
371	*Quercus leucotrichophora*	Banj	Gum	-	-	√	-	-	-	0.82	-
372	*Rauvolfia serpentina*	Sarpagandha, Sivanmelpodi	Root, Leaf	-	-	-	√	√	-	26.47	√
373	*Rheum australe [= R. emodi]*	Revanchini, Dolu	Root	-	-	√	-	-	-	33.39	√
374	*Rhodiola wallichiana*	Mathi	Leaf	-	-	√	-	-	-	657.90	-
375	*Rhododendron arboreum*	Burans	Flower	-	-	√	-	-	-	17.50	√
376	*Rhododendron formosum*	Tiewsaw	Stem	-	√	-	-	-	-	0.92	-
377	*Rhododendron fulgens*	Tiewsaw	Flower	-	√	-	-	-	-	4.80	-
378	*Rhododendron campanulatum*	Cherailu	Leaf, wood	-	-	√	-	-	-	3.22	√
379	*Rhus chinensis*	Tamo	Seed, Leaf	-	√	-	-	-	-	6.59	-
380	*Rhynchostylis retusa*	Chintaran amu	Root	-	√	-	-	-	-	48.27	-
381	*Roylea cinerea*	Kadavi	Leaf	-	-	√	-	-	-	3.22	-
382	*Rubia cordifolia*	Manjeeth, Manjishti	Stem, Root	-	√	-	-	-	-	1.53	√
383	*Rubus alceifolius*	Sial-inuchhu	Fruit	-	√	-	-	-	-	0.26	-
384	*Rubus ellipticus*	Hmu-tau, Hisalu	Root, Fruit	-	√	√	-	-	-	46.74	-
385	*Rubus glaucifolius*		Fruit	-	√	-	-	-	-	15.32	-
386	*Rubus moluccanus*	Jetulipoka	Fruit, Root	-	√	-	-	-	-	2.36	-
387	*Ruellia prostrata*	Pattaasu ilai	Leaf	-	-	-	-	-	√	2.16	-
388	*Ruta chalepensis*	Pismaram	Aerial Parts	-	-	-	-	-	√	1.30	-
389	*Salvadora oleiodes*	Bada Pelu	Leaf	-	-	-	-	√	-	18.47	√
390	*Salvadora persica*	Bann	Fruit, Root	-	-	√	-	√	-	30.45	√
391	*Sansevieria roxburghiana*	Marul	Whole Plant	-	√	-	-	-	√	128.52	√
392	*Sapindus mukorossi*	Reetha	Fruit, Seed	-	√	√	-	-	-	116.19	√
393	*Saurauia napaulensis*	Goganda, Singkrang	Shoot	-	√	-	-	-	-	0.77	-
394	*Schima wallichii*	Chilauni, Makria	Bark, Fruit	-	√	-	-	-	-	5.77	-
395	*Scoparia dulcis*	Chinipatta	Whole Plant	-	√	-	-	-	-	139.34	-
396	*Scurrula parasitica*	Pavetta	Leaf	-	√	-	-	-	-	1.23	-
397	*Semecarpus anacardium*	Senkottai	Fruit	-	-	-	√	-	-	1.76	√

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S. No.	Name of Plant Species	Local Name (s)	Part Used	N	NE	NW	C	W	S	Estimated Total Annual Consump--tion (MT)	Status in Comme--rcial Trade
398	*Senna alata [= Cassia alata]*	Khorpat	Leaf	-	√	-	-	-	-	36.62	√
399	*Senna alexandrina [= Cassia angustifolia, C. senna]*	Sona patta, Sonamukhi, Senna, Svarnapatri	Leaf, Flower	-	-	-	√	√	-	36.55	√
400	*Senna auriculata [= Cassia auriculata]*	Avarai	Root, Leaf, Fruit	-	-	-	√	√	√	628.65	√
401	*Senna occidentalis [= Cassia occidentalis]*	Shyam Chakor	Seed	√	-	-	-	-	-	939.95	√
402	*Senna sophera [= Cassia sophera]*	Kasodi, Ponthakaram	Root	-	√	-	-	-	-	0.10	√
403	*Senna tora [= Cassia tora]*	Oosi thagarai	Leaf, Seed	-	√	-	-	√	-	1.92	√
404	*Sesbania grandiflora*	Agathi	Leaf	-	-	-	-	-	√	411.82	√
405	*Shorea robusta*	Raal, Sala	Fruit	-	-	-	√	-	-	12.11	√
406	*Sida acuta*	Vatta thirupi	Whole Plant	-	-	-	√	-	-	1.10	√
407	*Sida cordata*	Bala	Whole Plant, Bark, Seed						√	2.70	√
408	*Sida cordifolia*	Velipaassai	Leaf	-	√	-	-	-		13.18	√
409	*Silybum marianum*	Milk thistle	Leaf	-	-	-	-	√	-	2.55	√
410	*Smilax glabra*	Chobchini, Lokhandi	Whole Plant	-	√	-	-	-	-	188.88	√
411	*Smilax zeylanica*	Jangali Ushbaa	Whole Plant	-	√	-	-	-	-	0.51	-
412	*Smilax purhampuy [= S. macrophylla]*	Sarsaparilla	Root	-	-	-	√	-	-	1.10	-
413	*Solanum anguivi. [= S. indicum., S.violaceum]*	Karimulli	Whole Plant	-	√	-	-	-	-	130.35	√
414	*Solanum khasianum*	Nightshade	Fruit	-	√	-	-	-	-	5.77	-
415	*Solanum nigrum*	Makoh, Mirchi, Man athakkaali	Whole Plant	√	√	√	-	-	√	1683.06	√
416	*Solanum torvum*	Sundakaai	Leaf, Fruit, Root	-	√	-	-	-	√	21.21	√
417	*Solanum trilobatum*	Thoodhuvalai	Whole Plant	-	-	-	-	-	√	104.39	√
418	*Solanum viarum*	Athalo	Fruit	-	√	-	-	-	-	1.28	-
419	*Solanum virginianum [= S. surattense,*	Kantakari, Kandan kattari,	Whole Plant	-	-	√	√	-	-	293.00	√

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S. No.	Name of Plant Species	Local Name (s)	Part Used	N	NE	NW	C	W	S	Estimated Total Annual Consump--tion (MT)	Status in Comme--rcial Trade
	S. xanthocarpum]	Shankar, namoli									
420	*Sonerila maculata*		Leaf	-	√	-	-	-	-	0.92	-
421	*Soymida febrifuga*	Raktarohan	Bark	-	-	-	√	-	-	11.01	√
422	*Sphaeranthus indicus*	Kotta karanthai	Flower	-	-	-	√	-	-	11.01	√
423	*Sphagneticola calendulacea [= Wedelia chinensis, W. calendulacea]*	Manja karisalaangkanni	Whole Plant	-	-	-	-	-	√	992.74	-
424	*Spilanthes paniculata*	Pkakphet	Whole Plant,	-	√	-	-	-	-	20.33	√
425	*Spondias pinnata*	Mathimaangaa, Amora	Stem, Fruit, Leaf	-	√	-	-	-	√	122.14	√
426	*Stemona tuberosa*	Sural, Bilaikand, Bharda	Leaf	-	√	-	-	-	-	1.79	-
427	*Stephania rotunda*	Purha	Root	-	√	-	-	-	-	20.12	-
428	*Sterculia villosa*	Udal, Katira	Leaf	-	√	-	-	-	-	0.36	-
429	*Stereospermum chelonoides [= S. suaveolens]*	Padal fali	Seed, Fruit	-	√	-	√	-	-	20.83	√
430	*Streblus asper*	Sohra	Latex	√	-	-	-	-	-	3.22	√
431	*Strobilanthes callosus*	Maruadona	Leaf	-	-	-	-	√	-	1.68	-
432	*Strychnos nux-vomica*	Etti, Kuchada	Seed	-	-	-	-	-	√	0.29	√
433	*Strychnos potatorum*	Thaethaan	Seed, Stem	-	-	-	√	-	-	22.68	√
434	*Swertia chirayita*	Chiretta	Whole Plant	√	√	-	-	-	-	145.29	√
435	*Syzygium cumini*	Naaval	Seed, Fruits, Leaf, Stem, Bark	√	√	√	√	-	√	862.60	√
436	*Tabernaemontana divaricata [= T. coronaria]*	Nanthiya vattam	Stem, Leaf	-	√	-	-	-	√	6.86	√
437	*Tagetes erecta*	Genda	Leaf	√	√	√	-	-	√	623.46	√
438	*Tephrosia purpurea*	Kozhinji	Whole Plant	-	-	-	-	-	√	0.72	√
439	*Terminalia alata*	Asan, Sain	Fruits	-	-	-	√	-	-	33.03	-
440	*Terminalia arjuna*	Marudham, Arjun	Bark (Stem), Fruits	√	√	√	√	-	-	2747.17	√
441	*Terminalia bellirica*	Thandrikaai, Beheda	Fruits, Seed	√	√	√	√	√	√	5780.47	√
442	*Terminalia catappa*	Jangli badam	Bark	-	-	√	-	-	-	1.93	√
443	*Terminalia chebula*	Kadukkaai, Harda	Fruit, Flower, Bark	√	√	√	√	√	-	5740.33	√

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S. No.	Name of Plant Species	Local Name (s)	Part Used	N	NE	NW	C	W	S	Estimated Total Annual Consump--tion (MT)	Status in Comme--rcial Trade
444	*Terminalia citrina*	Citrine myrobalan, Hillika	Fruit	-	√	-	-	-	-	15.27	-
445	*Tetrameles nudiflora*	Thitpok	Stem	-	√	-	-	-	-	11.44	-
446	*Tetrastigma serrulatum*	Monjam Hei	Leaf	-	√	-	-	-	-	38.26	-
447	*Tetrastigma thomsonianum*	Nal tenga	Leaf	-	√	-	-	-	-	3.37	-
448	*Thalictrum foliolosum*	Mamira	Root	-	-	√	-	-	-	1.63	√
449	*Thespesia populnea*	Poovarasa maram	Leaf, Stem	-	-	-	-	-	√	72.36	√
450	*Thottea tomentosa*	Thottea	Root, Rhizome	-	√	-	-	-	-	3.98	-
451	*Thunbergia alata*	Black-Eyed Susan Vine	Stem	-	√	-	-	-	-	3.22	-
452	*Thunbergia coccinea*	Chonga lota	Stem	-	√	-	-	-	-	2.86	-
453	*Thunbergia grandiflora*	Kukua loti, Neel Lata	Stem	-	√	-	-	-	-	1.74	-
454	*Thymus serpyllum*	Banajwain	Leaf	-	-	√	-	-	-	16.12	√
455	*Tinospora cordifolia*	Giloe, Amruthvalli, Seendhil	Whole Plant	√	√	√	√	√	√	2331.92	√
456	*Toddalia asiatica*	Milgaranai	Whole Plant	-	-	-	-	-	√	1.30	√
457	*Trianthema portulacastrum*	Mamadha poondu	Aerial Parts	-	-	-	-	-	√	97.19	√
458	*Tribulus terrestris [= T. lanuginosus]*	Gokuru, Seru nerunjil	Whole Plant	-	-	-	√	-	√	81.14	√
459	*Trichosanthes cucumerina [= T. anguina]*		Fruit	-	√	-	-	-	-	4.19	√
460	*Tridax procumbens*	Thaatha thalavetti poo	Leaf	-	-	-	√	-	√	537.54	√
461	*Tylophora indica [= T. asthmatica]*	Nanju murichaan	Whole Plant	-	-	-	-	-	√	1.80	√
462	*Uncaria macrophylla*	Cat's claw	Bark	-	√	-	-	-	-	2.55	√
463	*Urena lobata*	Sampakpi	Root, Stem	-	√	-	-	-	-	1.23	-
464	*Urginea indica*	jangli-piyaz	Root	-	-	-	√	-	-	22.13	√
465	*Urtica dioica*	Bichchhu buti, Kandali	Leaf, Root	-	√	√	-	-	-	133.33	√
466	*Valeriana jatamansii*	Tagar ganth, Sugandhbala, Asaroon	Root	-	√	-	-	-	-	1.28	√

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S. No.	Name of Plant Species	Local Name (s)	Part Used	N	NE	NW	C	W	S	Estimated Total Annual Consump--tion (MT)	Status in Comme--rcial Trade
467	*Vallaris solanacea*	Agarmoni	Leaf, Stem	-	-	-	-	-	√	1.73	-
468	*Ventilago maderaspatana*	Pitti	Root, Seed	-	-	-	√	-	-	4.40	√
469	*Verbena officinalis*	Tharo-phijub	Root	-	√	-	-	-	-	35.75	-
470	*Viola pilosa*	Banksha	Flower	-	-	√	-	-	-	13.54	√
471	*Vitex negundo*	Nochi	Leaf, Seed	√	√	√	-	√	√	759.13	√
472	*Vitex peduncularis*	Kaktikta	Stem, Bark	-	√	-	-	-	-	16.75	-
473	*Withania somnifera*	Amukkuraa, Ashwagandha	Shoots, Root	-	-	-	√	√	√	19.32	√
474	*Wrightia tinctoria*	Veppalai	Bark, Seed, Leaf	-	-	-	√	-	√	11.08	√
475	*Zaleya decandra [= Trianthema decandra]*	Muthu saataranai	Aerial Parts	-	-	-	-	-	√	54.00	√
476	*Zanthoxylum armatum*	Timru	Whole Plant	-	√	√	-	-	-	219.19	√
477	*Zanthoxylum nitidum [= Z. hamiltonianum]*	Ricom, Tezmui	Root, Stem	-	√	-	-	-	-	12.69	√
478	*Ziziphus mauritiana [= Z. jujuba]*	Elandhai, Ber	Fruit, Leave	-	√	√	-	-	√	40.34	√
479	*Ziziphus rugosa*	Bogori	Root	-	√	-	-	-	-	2.04	√

Zone-wise analysis of the consumption pattern of diversity of medicinal plant specis used by rural households as given in table 4.2 reveals that the highest diversity of plants was used in North Eastern Zone followed by households of Southern Zone, Central Zone, North Western Zone, Northern Zone and Western Zone respectively (fig. 4.1).

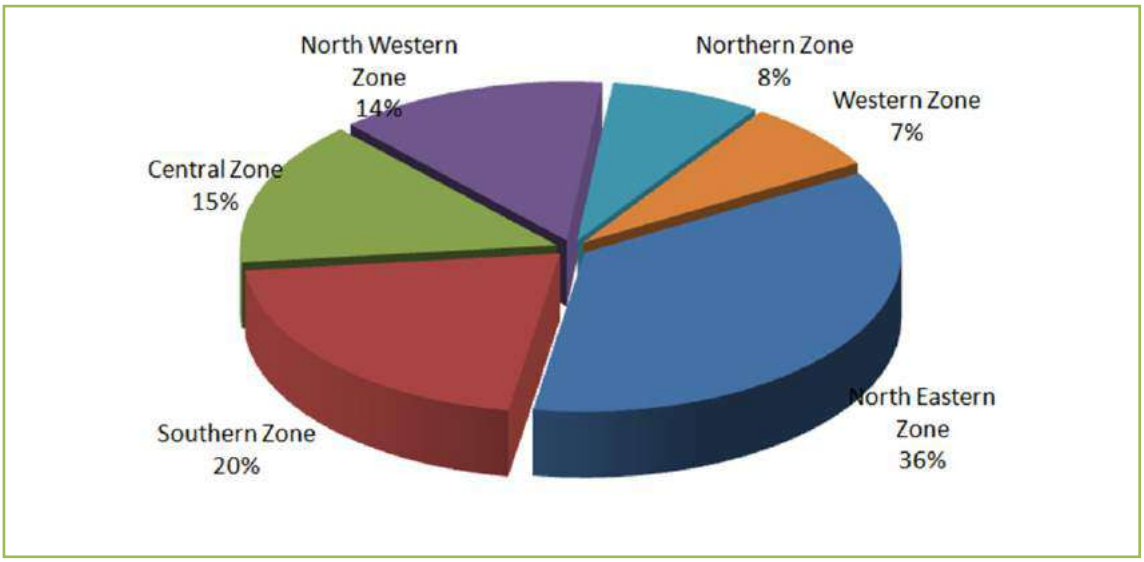

Fig. 4.1. Zone-wise usage of 479 medicinal plant species by rural household

Analysis of data in table 4.2 also reveals that 8 species i.e. 'tulasi' (*Ocimum tenuiflorum*), 'amla' (*Phyllanthus emblica*), 'bael' (*Aegle marmelos*), 'neem' (*Azadirachta indica*), 'sahjan' (*Moringa oleifera*), 'bahera' (*Terminalia bellirica*), 'shatavari' (*Asparagus racemosus*), and 'ghritkumari (*Aloe vera*) are used by rural households across all the 6 zones. 10 species including 'arka' (*Calotropis procera*), 'sadabahar' (*Catharanthus roseus*), 'harar' (*Terminalia chebula*), 'asvatha' (*Ficus religiosa*), 'vasaka' (*Justicia adhatoda*), 'mint' (*Mentha arvensis*), 'bhumiamla' (*Phyllanthus amarus*), 'jamum' (*Syzygium cumini*), and 'nirgundi' (*Vitex negundo*) are used across 5 zones. Another 14 species are used across 4 zones. The remaining species were used in three or less zones.

Documentation of 479 medicinal plant species under this study is an improvement over the 354 medicinal plant species documented by Ved and Goraya (2008) for the rural households. Average annual consumption of herbal raw drugs (dry weight) per household has been computed at 1.24 kg. Computation of the estimated annual consumption, on dry weight basis, of the 479 recorded medicinal plant species by rural households at national level on the basis of sampled rural households places the annual estimated consumption of herbal raw drugs by rural households for the year 2014-15 at 1,71,500 MT. Out of the total recorded medicinal plant species from rural household surveys, 296 species, constituting about 94% of the total consumption by weight of herbal raw drugs by rural household, are in active trade (Table 4.2).

Further analysis of data in table 4.2 reveals that 109 medicinal plants out of the 296 listed as traded have annual consumption of >100 MT. These 109 species account for 92% of the total annual consumption at the rural household level. Of these 109 medicinal plant species, 'tulasi' (*Ocimum tenuiflorum*), 'amla' (*Phyllanthus emblica*), 'bael' (*Aegle marmelos*), 'neem' (*Azadirachta indica*), 'sahjan' (*Moringa oleifera*), 'bahera' (*Terminalia bellirica*), 'harar' (*Terminalia chebula*), 'asthisamhrta' (*Cissus quadrangularis*), 'karnasphota' (*Cardiospermum halicacabum*), 'harshingar' (*Nyctnathes arbor-tristis*), and 'ghritkumari (*Aloe vera*) are used in very large quantities i.e. exceeding 3000 MT per year, at the rural household level.

Habit-wise analysis (fig. 4.2) of the 296 species in active trade as given in table 4.2 reveals that 41% of these species are herbs, 27% are trees, 23% are shrubs, and 9% are climbers, with one entity falling in the category of 'thallus' (*Parmelia perlata*).

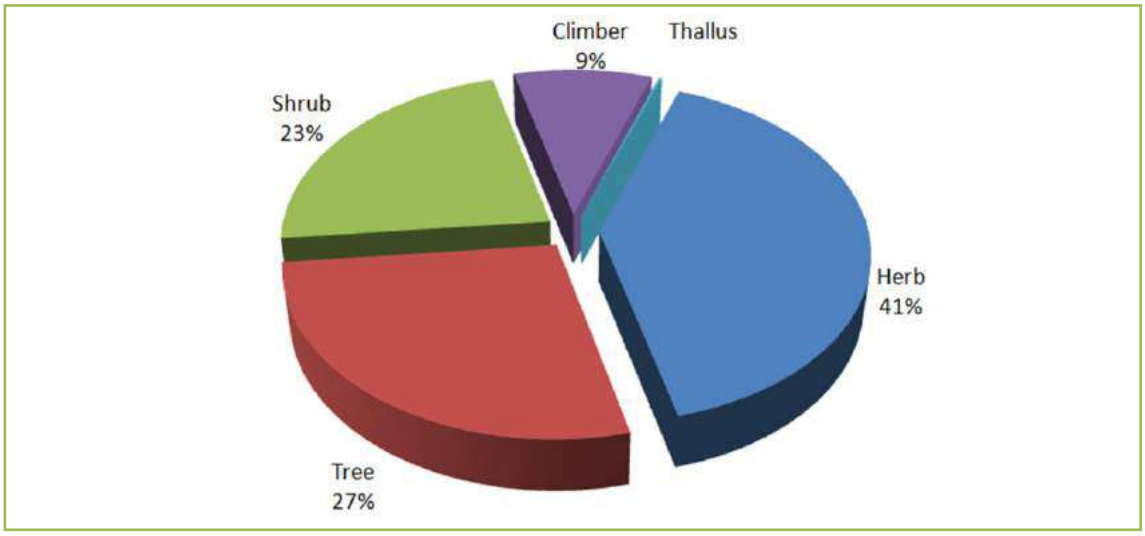

Fig. 4.2. Habit wise distribution of 296 traded Medicinal Plant species consumed by Rural Households

The 479 medicinal plant species documented under this rural households survey belong to 128 families of plants, of which the dominant families are Asteraceae, Lamiaceae, Fabaceae, Malvaceae, Euphorbiaceae, Rubiaceae, Acanthaceae, Apocynaceae, Solanaceae, Caesalpiniaceae, Convolvulaceae, Mimosaceae, and Phyllanthaceae with each of these families represented by at least 11 plant species (fig. 4.3). More than one third medicinal plant entities used by the rural households belong to three plant families i.e. Asteraceae, Fabaceae and Lamiaceae. This highlights the pressures on these limited numbers of families and suggests use of an added focus for further studies.

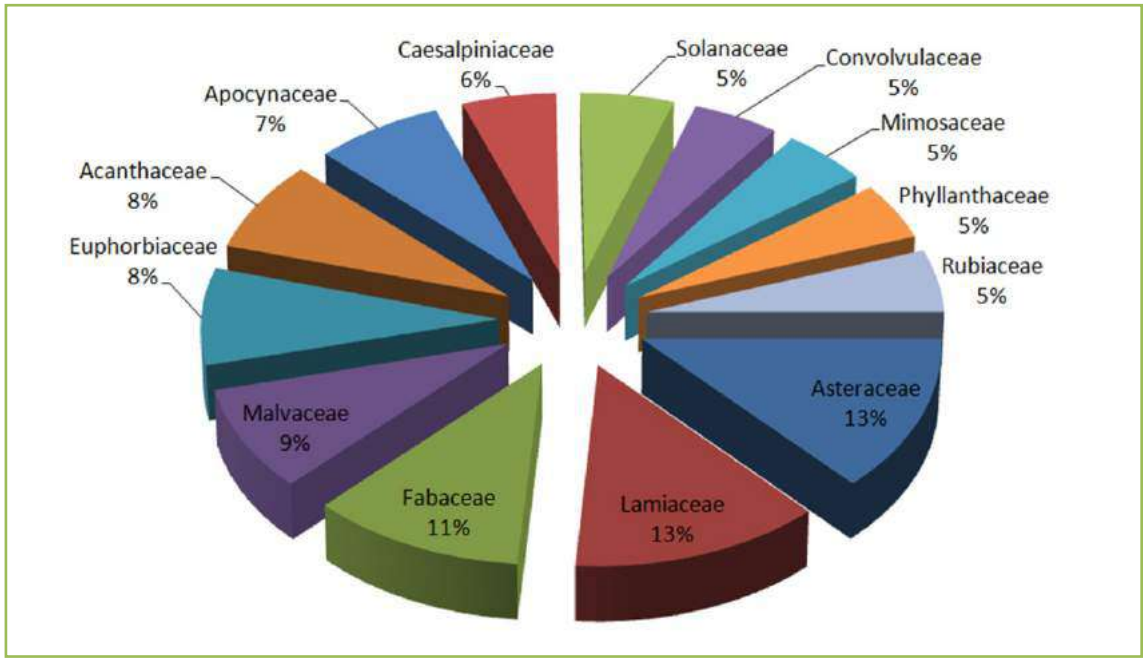

Fig. 4.3. Dominant Families of 479 Medicinal Plant Species Consumed by Rural Households

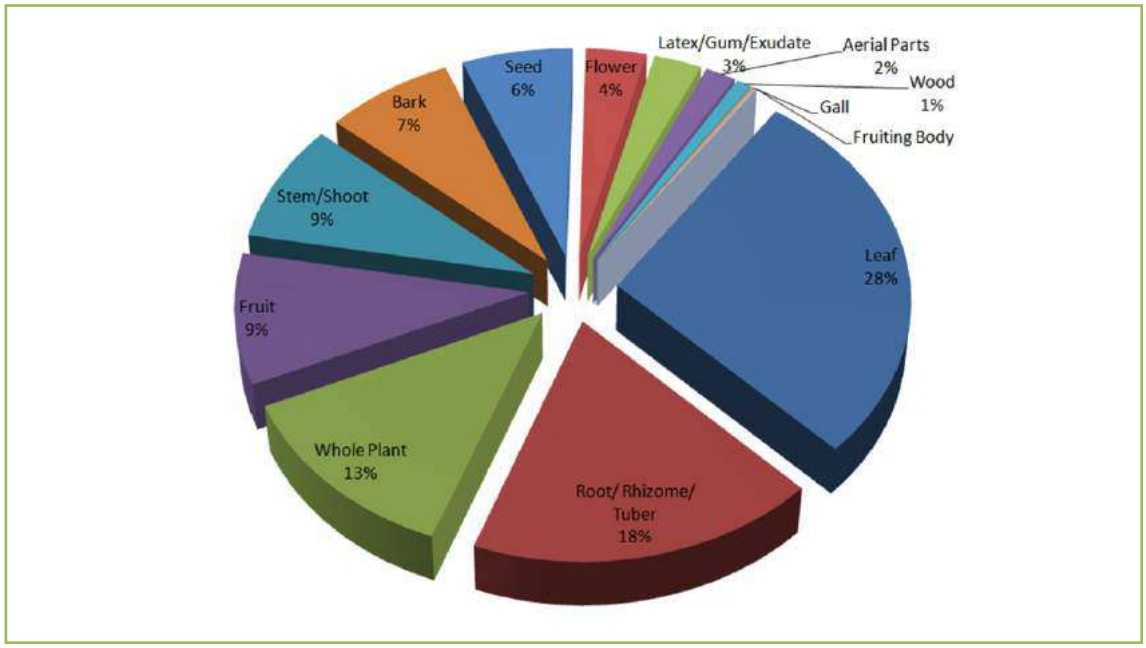

Fig. 4.4. Part-wise Consumption of 677 Herbal Raw drug entities by Rural Households

Analysis of the 677 herbal raw drug entities pertaining to 479 medicinal plant species consumed by the rural households brings out that leaf (28%), and root/ rhizome/ tuber (18%) form the major herbal raw drugs used by these communities. The remaining raw drug entities pertain to whole plant (13%), fruits and stem (9%), bark (7%), seeds (6%), flowers (4%) with less than 1% being latex/ gum/ exudates, aerial parts, wood, gall and fruiting body/ thallus, etc. (fig. 4.4). Use of whole plants, roots, stem and bark, amounting to destructive harvesting, forms about 47% of the total medicinal plant species in usage.

During survey people at many places shared that availability of some of the species had become scarce. It was also noted that some plant species, in less frequent use, remained very important as these were needed for very specific therapeutic purposes. The people expressed a general fear that the increasing scarcity of many plants might lead to the loss of traditional knowledge about the medicinal uses of such species. For example, drastic decrease in the availability of medicinal plant species like *Aconitum heterophyllum*, *Paris polyphylla*, *Dactylorhiza hatageria*, *Podophyllum hexandrum*, *Rhododendron campanulatum*, *Swertia chirayita* and *Zanthoxylum armatum*, was reported by the local people during survey in the North-West zone.

The most frequently mentioned diseases recorded during the survey were related to digestive/ abdominal disorders, post-delivery care, snake bite, body injuries, common cold, flu, cough and wounds. The survey also highlighted that most of the medicinal plant species common to all regions were being used to treat more than one common ailment. It also came out that different parts of the same plant were being used for different purposes by different population groups. Sometimes, a specific plant part was being used for children and another part of the same plant for adults to treat the same disease. It was generally observed that the women folk were especially knowledgeable regarding common home remedies, and it was them who were managing the collection of plants, and also the preparation of formulations and their administration.

Chewing Sticks for Oral Healthcare

Chewing sticks are one of the most widely used herbal raw drugs for dental and oral healthcare across the country, both in rural and urban areas. Taken from various plant parts viz. stem, bark, root or leaf of various plant species, chewing sticks are used as tooth brushes and are chewed several times daily to clean and freshen teeth, strengthen gums and also to mitigate digestive problems. The use of chewing sticks is thus both preventative and curative. A number of plant species used for dental care and care of oral cavity were documented during the survey of households. Some of the commonly used species for this purpose include 'neem' (*Azadirachta indica*), 'babool' (*Acacia nilotica*), 'meswak' (*Salvadora oleoides*), 'dandasa' (*Juglans regia*), 'paja' (*Prunus cerasoides*), 'bashal' (*Salix tetrasperma*), 'basuti' (*Adhatoda zeylanica*), 'gandhla' (*Murraya koenigii*), 'puthkanda' (*Achyranthes aspera*), and 'timber' (*Zanthoxylum armatum*). These plant entities have characteristic taste and flavour (bitter, sweet, sour, astringent and antiseptic) and qualities (hard and soft) and the local people use different chewing sticks for taking care of teeth, oral hygiene and digestion problems.

Data gathering on Herbal Raw Drug Consumption by Rural Households

4.3. SOURCE OF MEDICINAL PLANTS / RAW DRUGS

The rural communities have been traditionally collecting most of the medicinal plant species from nearby forests and from field bunds and fallow lands/ wastelands. Some of the species are also cultivated in the homesteads and some are purchased from market too. Survey data from rural households reveals that the communities were collecting more than 80% of the medicinal plants (excluding fruits, vegetables, cereals and spices) from the local forests and non-forest habitats, and about 10% of the medicinal plants were being sourced from cultivation in the homesteads. Only the remaining less than 10% of the medicinal plants, not available locally, are purchased from the market.

Constituents of Triphala - a popular herbal formulation

4.4. ESTIMATION OF HERBAL RAW DRUG CONSUMPTION BY FOLK HEALERS

Based on *a priori* information gathered during household survey, 89 folk healers were interviewed and data about their usage of herbal raw drugs for treating various ailments recorded.

Collation of data has resulted in enlisting of 340 medicinal plant species (excluding vegetables, fruits, spices, cereals and pulses) used by the surveyed 89 folk healers for their day-to-day dispensation (table 4.4). Total annual consumption of medicinal plants by 89 responding folk healers has been estimated to be 9.82 MT with an average estimated per folk healer annual consumption of about 109 kg.

Table 4.4. Herbal Raw Drugs Reported in Consumption by 89 Sampled Folk Healers

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commer-cial Trade
1	*Abelmoschus manihot*	Mushkdana, Kasturidana	Root	0.00002	-
2	*Abroma augusta*	Gorokhia kosai	Root	0.00050	√
3	*Abutilon indicum*	Thuthi	Leaf	0.02450	√
4	*Acacia catechu*	Kasikatti, Khair, Katha	Stem, Bark	0.01610	√
5	*Acacia pennata*	Agla bel, Biswal	Leaf/Bark	0.00001	-
6	*Achyranthes aspera*	Nayuruvi, Chid chida, Sajhi	Whole Plant, Stem, Leaf, Root	0.00675	√
7	*Acmella oleracea*	Akarkara	Root	0.00003	√
8	*Acmella paniculata*	Jatimal kath, Jati malkathi	Whole Plant, Leaf, Root	0.00284	-
9	*Aconitum heterophyllum*	Bonga kanpo, Atees	Root, Bulb	0.00025	√
10	*Aconitum chasmanthum*	Bikh	Root	0.00002	√
11	*Aconitum ferox*	Metha zehar, Chandog	Root, Bulb	0.00013	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
12	*Acontum lethale*	Bonga marpo	Root	0.00005	√
13	*Acorus calamus*	Gurbach, Vasambu, Bach	Root, Rhizome, Leaf	0.01447	√
14	*Adenia trilobata*	Pu-hing	Leaf	0.00007	-
15	*Aeginetia indica*	Aankuri bankuri	Leaf	0.00007	-
16	*Aegle marmelos*	Bel	Bark, Fruit, Leaf	0.23329	√
17	*Aerva lanata*	Chiru poolai	Root	0.00060	√
18	*Ageratum conyzoides*	Ukhal butti	Whole Plant	0.00001	√
19	*Ajuga bracteosa*	Neel Kanthi	Leaf	0.00130	√
20	*Alangium salvifolium*	Azhinjal	Root	0.00100	√
21	*Albizia lebbeck*	Siris	Wood, Leaf, Bark	0.00242	√
22	*Albizia lucidior*	Moj	Root	0.00014	-
23	*Aloe vera*	Gritkumari	Leaf	1.07720	√
24	*Alpinia galanga*	Perarathai, Kulanjan, Rasna	Rhizome, Root	0.22214	√
25	*Alpinia nigra*	Ya-muneheu	Tender Shoot	0.00280	-
26	*Alstonia scholaris*	Saitan	Stem, Bark, Leaf, Latex	0.00337	√
27	*Alternanthera sessilis*	Khutora sal	Whole Plant	0.00009	√
28	*Amorphophallus paeoniifolius*	Olkochu, Suran	Tuber, Leaf	0.00024	√
29	*Andrographis paniculata*	Nila vembu, Kalmegh	Whole Plant, Leaf	0.01655	√
30	*Angelica glauca*	Chanra	Root	0.00017	√
31	*Anisomeles indica*	Hakup hing	Ariel Part	0.00163	-
32	*Anogeissus latifolia*	Dhaura	Leaf	0.00020	√
33	*Anogeissus acuminata*	Dhau, Dhoy, Dhaura	Bark (Stem)	0.00006	-
34	*Aporosa octandra*	Tamsir	Bark	0.00090	-
35	*Argemone mexicana*	Brahma dandu	Root	0.00300	√
36	*Argyreia nervosa*	Guduk Twak	Bark (Stem), Leaf	0.02542	√
37	*Arisaema speciosum*	Chamosh	Bulbs	0.00017	-
38	*Aristolochia bracteolata*	Kidmaar	Leaf	0.00030	√
39	*Aristolochia indica*	Eeswaramooli	Leaf/Root	0.00036	√
40	*Aristolochia tagala*	Puliphum	Leaf	0.00005	√
41	*Artocarpus chama*	Robot	Seed	0.00006	-
42	*Asparagus racemosus*	Shatawar	Root/Rhizome, Leaf, Stem	0.16628	√
43	*Asparagus adscendens*	Satrouri	Leaf	0.00014	√
44	*Asparagus officinalis*	Hathmol	Rhizome	0.00006	-
45	*Averrhoa carambola*	Nanni nai	Fruit	0.00071	-
46	*Azadirachta indica*	Neem, Vaeppan, Maha Neem	Leaf, Whole Plant, Bark, Stem	0.06341	√
47	*Baccaurea ramiflora*	Burmese Grape	Bark	0.00005	-
48	*Bacopa monnieri*	Neer brahmi	Leaf, Whole Plant	0.00206	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
49	*Bambusa bombas*	Mungilarisi, Banh	Stem, Tender Shoot	0.00126	√
50	*Barleria prionitis*	Daskaranta	Whole Plant	0.06000	√
51	*Bauhinia variegata*	Kachnar	Flower	0.00180	√
52	*Begonia roxburghii*	Dieng jajew	Stem, Root/ Rhizome, Leaf	0.00096	-
53	*Berberis aristata*	Daruhaldi, Kilmora	Root	0.00120	√
54	*Berginia ciliata*	Pashan Bhed, Silfora, Pathhar chatta, Bramentok	Root / Bulb, Leaf	0.00081	√
55	*Blumea lanceolaria*	Tera paibi	Leaf	0.00008	-
56	*Boerhavia diffusa*	Punarnava, Mukarattai	Whole Plant, Leaf, Bark, Root, Seed	0.00196	√
57	*Bombax ceiba*	Simalu, Savari	Root/ Tuber	0.00176	√
58	*Bonnaya reptans*	Kausidarya	Whole Plant	0.00067	-
59	*Boswellia serrata*	Mani kundrikam	Bark	0.00080	√
60	*Bryophyllum pinnatum*	Dupoor tanga, Pathar Chatt	Leaf	0.00075	√
61	*Bulbophyllum odoratissimum*	Washom, Rapak hing	Rhizome/ Bulb	0.00038	-
62	*Butea monosperma*	Tesu Phool, Palas Phool	Root, Flower	0.00026	√
63	*Buxus sempervirens*	Kangu	Whole Plant	0.00030	-
64	*Byttneria aspera*	Tikani barua	Stem/Bark	0.00007	-
65	*Byttneria pilosa*	Sazuknghawnghlap	Leaf	0.00002	-
66	*Caesalpinia bonduc*	Sagargoti	Soot	0.00050	√
67	*Calamus guruba*	Rattan	Tender Shoot	0.00008	-
68	*Callicarpa arborea*	Tabuk-hing	Bark (Stem & Root), Root	0.00578	-
69	*Callicarpa macrophylla*	Tonglofi	Tender Shoot, Fruit	0.00712	√
70	*Calotropis gigantea*	Erukkam	Leaf, Latex	0.00037	√
71	*Calotropis procera*	Aken	Root, Leaf	0.00410	√
72	*Cannabis sativa*	Fung, Bhang	Leaf	0.00029	√
73	*Carum carvi*	Seemail sombu, Goh nyud	Seed	0.00030	√
74	*Castanopsis tribuloides*	Katus	Stem/Bark	0.00008	-
75	*Catharanthus roseus*	Nithyakalyani	Leaf, Flower, Tender Shoot	0.00305	√
76	*Catunaregam spinosa*	Bihmora	Seed	0.00009	√
77	*Cedrus deodara*	Devdaru	Bark, Wood, Leaf	0.01200	√
78	*Celastrus aculeatus*	Bhumloti	Tender twig	0.00009	-
79	*Centella asiatica*	Vallaarai	Whole Plant	0.00402	√
80	*Cheilocostus speciosus*	Dev dhonki, Jamlakhuti	Root/Rhizome	0.00139	√
81	*Chlorophytum borivilianum*	Safed musli	Root, Seed	0.00260	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
82	*Chlorophytum arundinaceum*	Safed musli	Root	0.00280	-
83	*Chlorophytum nepalense*	Safed musli	Stem / Bark Juice	0.00002	-
84	*Chloroxylon swietenia*	Bhirra, Bhivia, Dhoura	Bark	0.00100	-
85	*Chromolaena odorata*	Hingan	Leaf, Root	0.00071	-
86	*Chrysopogon zizanioides*	Birina	Root	0.00172	√
87	*Cichorium intybus*	Kaasini	Leaf	0.00030	√
88	*Cinnamomum verum*	Dalchini	Bark	0.00040	√
89	*Cinnamomum glanduliferum*	Rolu	Stem, Bark	0.00011	-
90	*Cissampelos pareira* var. *hirsuta*	Randsang satu	Leaf, Root/Bulb	0.00288	√
91	*Cissus quadrangularis*	Pirandai, Hutjodi	Stem	0.00200	√
92	*Cleome gynandra*	Vaelai keerai, Nalla vaelai	Leaf	0.00020	√
93	*Clerodendrum glandulosum*	Tapen	Leaf	0.00032	-
94	*Clerodendrum infortunatum*	Bhant, Batigosh	Leaf, Tender Shoot	0.00142	√
95	*Clitoria ternatea*	Aprajita Black Flower	Fruit	0.00320	√
96	*Codariocalyx motorius*	Thozhukanni	Leaf	0.00050	-
97	*Coleus forskohlii*	Gandira	Root	0.00002	√
98	*Colona floribunda*	Devanagari	Leaf	0.00001	-
99	*Commiphora wightii*	Guggulu	Stem, Gum Resin	0.02420	√
100	*Conyza leucantha*	Fleabane	Whole Plant / Stem	0.00001	-
101	*Crateva religiosa*	Bomn	Bark	0.00024	√
102	*Croton caudatus*	Lata mahudi	Twig, Leaf	0.00019	-
103	*Croton tiglium*	Nervalum, Kanibih	Root/Bark	0.00021	√
104	*Curculigo orchioides*	Nilapanai, Kali musli	Root/Tuber	0.00900	√
105	*Curcuma angustifolia*	Ya-pansut	Rhizome	0.00280	√
106	*Curcuma caesia*	Nar-kachura, Kala-haldi	Rhizome	0.00124	√
107	*Cuscuta europaea*	Aakash Laguli, Aakash bel	Leaf/Root	0.00200	-
108	*Cuscuta reflexa*	Amar bel, Akashi lata	Stem	0.00052	√
109	*Cynodon dactylon*	Arugampul, Dub ghas	Whole Plant	0.00316	√
110	*Cyperus scariosus*	Nagarmotha	Rhizome	0.00006	√
111	*Dactylicapnos scandens*	Thoo	Root/Tuber	0.00006	-
112	*Dactylorhiza hatagirea*	Wanpolagpa, Hathajodi, Salam panja	Root, Rhizome	0.00400	√
113	*Dalbergia sissoo*	Shisham	Leaf, Twigs	0.00125	√
114	*Datura metel*	Oomaththai, Umatham, Maah-hing, Dudura/Datura	Fruit	0.00053	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
115	*Datura stramonium*	Dhatura	Flower, Fruit, Seed, Leaf	0.03360	√
116	*Dendrobium heterocarpum*	Tai Taming	Stem/Leaf	0.00001	-
117	*Dendrocalamus strictus*	Baans	Root	0.00006	-
118	*Dendrocnide sinuata*		Root, Shoota	0.00018	-
119	*Desmodium sequax*	Bioni sabala	Tender Leaf	0.00065	-
120	*Dichrostachys cinerea*		Leaf	0.00050	√
121	*Dillenia indica*	Chalita	Flower	0.00069	-
122	*Dillenia pentagyna*	Nagkesaram	Leaf	0.00042	√
123	*Dioscorea bulbifera*	Varahi kand,	Root	0.00080	√
124	*Dioscorea hispida*	Kath Alu, Baichandi	Tuber	0.00003	-
125	*Dioscorea pentaphylla*	Kanta alu	Rhizome/Tuber	0.00001	√
126	*Diplocyclos palmatus*	Shivlingi	Seed	0.00040	√
127	*Drymaria cordata*	Ya-kithoy	Whole Plant	0.00028	-
128	*Dysoxylum excelsum*	Bili devdari	Leaf	0.00005	-
129	*Dysoxylum gotadhora*	Bili devdari	Root/Bulb	0.00001	-
130	*Eclipta prostrata*	Bhrangraj	Leaf	0.00600	√
131	*Elaeagnus caudata*	Mirika tory, Sarzuk	Leaf, Bark (Stem), Root	0.00064	-
132	*Elaeagnus latifolia*	Goeli, Muslendi	Leaf, stem, Root	0.00030	-
133	*Elaeagnus pyriformis*	Sarzukui	Leaf	0.00004	-
134	*Elephantopus scaber*	Gjihiva	Leaf	0.00160	√
135	*Elsholtzia communis*	Kewa	Leaf	0.00001	-
136	*Entada phaseoloides*	Kakavalli	Seed	0.00003	-
137	*Eryngium foetidum*	Ban dhania	Leaf	0.00010	-
138	*Erythrina variegata [= E. indica]*	Kalyanamurungai	Bark, Stem	0.00008	√
139	*Euphorbia antiquorum*	Bisalyakarani	Leaf	0.00060	-
140	*Euphorbia hirta*	Ammaan pacharisi	Whole Plant, Stem, Leaf, Root	0.00227	√
141	*Euphorbia neriifolia*	Sigu	Stem	0.00009	√
142	*Ficus benghalensis*	Aal	Stem, Bark, Leaf	0.00095	√
143	*Ficus hispida*	Dimaru, Awa dimaru	Root	0.00040	√
144	*Ficus racemosa*	Gular, Phangrok	Leaf, Fruit	0.00055	√
145	*Ficus maclellandii*	Alii Fig	Latex	0.00001	-
146	*Ficus palmata*	Dudla safed mirch	Leaf	0.00130	-
147	*Ficus religiosa*	Arasu	Root	0.00160	√
148	*Ficus virens*	Nai	Leaf Powder	0.00006	-
149	*Flueggea virosa*	Dalme, patala	Leaf	0.00004	√
150	*Fragaria vesca*	Niwikhea	Arial Parts	0.00140	-
151	*Garcinia sopsopia*	Vawm-va, Thensaker	Fruit	0.00009	-
152	*Gardenia resinifera*	Jaysendha	Bark (Stem, Root)	0.01065	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
153	*Glinus oppositifolius*	Ushnasundara	Whole Plant	0.00001	√
154	*Gloriosa superba*	Chithiraikizhangu	Root/Tuber	0.00004	√
155	*Glycyrrhiza glabra*	Mulethi	Stem, Root	0.03840	√
156	*Gmelina arborea*	Gamhar	Bark	0.00120	√
157	*Gomphogyne cissiformis*	Jhur Thliem	Fruit	0.00005	-
158	*Gymnema sylvestre*	Sarkarai kolli, Siru kurinjaan	Leaf, Whole Plant	0.01394	√
159	*Hedyotis scandens*	Kelhnamatur	Leaf	0.00018	-
160	*Helicia robusta*	Pasaltakaza	Stem, Root, Leaf, Bark (Stem & Root)	0.00057	-
161	*Helicteres isora*	Valampuri-Idampuri	Fruit	0.00005	√
162	*Hemidesmus indicus*	Anantmul	Leaf, Root	0.01520	√
163	*Heteropanax fragrans*	Keserm	Bark	0.00024	-
164	*Hibiscus rosa-sinensis*	Joba phool	Root Powder	0.00030	√
165	*Holarrhena pubescens*	Kurai/Kutaz	Bark, Fruit, Root	0.04100	√
166	*Homalomena aromatica*	Sugan mantri	Rhizome	0.00051	√
167	*Houttuynia cordata*	Soru maimimi		0.00009	-
168	*Impatiens balsamina*	Kanjuli, Gul-mehndi	Stem	0.00005	-
169	*Imperata cylindrica*	Boroter		0.00008	√
170	*Inula racemosa*	Manav	Root	0.00500	√
171	*Inula cappa*	Chinen lap	Leaf	0.00017	-
172	*Ipomoea fistulosa*	Amar	Root	0.00018	-
173	*Jatropha curcas*	Bhotax	Latex, Stem, Seed	0.00059	√
174	*Justicia adhatoda*	Adathodai, Pait boha	Leaf, Whole Plant	0.00162	√
175	*Justicia gendarussa*	Rapak hing	Leaf	0.00030	√
176	*Kalanchoe laciniata*	Pathar Chatt	Leaf	0.00017	√
177	*Knema cinerea*	Kelat	Latex	0.000002	-
178	*Knema linifolia*		Stem Bark	0.00004	-
179	*Kyllinga brevifolia*	Kahan Ban	Arial Parts	0.00030	-
180	*Lannea coromandelica*	Movai	Stem	0.00024	√
181	*Lasia spinosa*	Sengmora	Rhizome	0.00012	-
182	*Lawsonia inermis*	Maruthondri, Mehndi Paat	Leaf	0.00420	√
183	*Leea compactiflora*	Kum-tin-tuai	Leaf, Flower	0.00015	-
184	*Lepidium sativum*	Chitamul	Whole Plant	0.02000	√
185	*Lepionurus sylvestris*	An-pang-thuam, Vangvattur	Leaf	0.00004	-
186	*Leucas aspera*	Drunban	Tender Leaf	0.00039	√
187	*Ligularia amplexicaulis*	Richo dola	Root	0.00090	-
188	*Lindernia crustacea*	Kachidnia	Root	0.00012	-
189	*Lindernia ruellioides*	Kausidarya	Whole Plant	0.00020	-
190	*Litsea cubeba*	Mejanka	Bark	0.00012	-
191	*Litsea salicifolia*	Dighloti	Root	0.00012	-

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
192	*Lobelia angulata*	Choakthi	Leaf, Fruit	0.00006	-
193	*Madhuca longifolia*	Mahua	Fruit, Fruit, Bark, Leaf	0.00341	√
194	*Mallotus nudiflorus*	Pindar, Wangphop	Root	0.00001	-
195	*Mallotus philippensis*	Loban	Root	0.00008	√
196	*Mallotus roxburghianus*	Lapakidn phum	Ariel Part, Leaf	0.00046	-
197	*Mappia foetida*	Ponong gaus	Leaf	0.00060	√
198	*Melastoma malabathricum*	Phutki	Root	0.00015	-
199	*Melocanna baccifera*	Muli Bans	Stem	0.00000	-
200	*Mentha arvensis*	Pudina	Leaf	0.00310	√
201	*Mikania micrantha*	Congress lota	Leaf	0.00001	-
202	*Mimosa pudica*	Gajjalu, Lajwanti	Leaf, Whole Plant, Root	0.00156	√
203	*Mimusops elengi*	Bokul	Bark	0.00009	√
204	*Molineria capitulata*	Palm Grass	Root/Tuber	0.00008	-
205	*Moringa oleifera*	Murungai, Sainja	Leaf	0.00150	√
206	*Morus alba*	Shatoot	Bark	0.00040	√
207	*Mucuna pruriens*	Krouch, Bidung, Konch	Leaf, Seed	0.09050	√
208	*Myrica esculenta*	Kaphud	Bark	0.00080	√
209	*Myristica fragrans*	Jaathikaai, Jaiphal	Seed, Fruit	0.00160	√
210	*Nardostachys jatamansi*	Jatamansi	Root/Rhizome, Whole Plant	0.04417	√
211	*Nelumbo nucifera*	Kamalkand	Rhizome	0.00240	√
212	*Neolamarckia cadamba*	Roghu, Kadamb	Bark	0.00012	√
213	*Nervilia aragoana*	Sthalapadma	Root	0.00004	√
214	*Nyctanthes arbor-tristis*	Ganga Siuli, Singar kali, Harsingar, Sewati dheu	Root/Rhizome, Leaf	0.00700	√
215	*Ocimum tenuiflorum*	Thulasi	Leaf, Leafy Twigs, Root	0.00622	√
216	*Oldenlandia corymbosa*	Jarpajihba	Leaf	0.00006	√
217	*Oldenlandia diffusa*	Bonmlu	Whole Plant	0.00009	-
218	*Oldenlandia umbellata*	Inbooral	Whole Plant	0.00010	√
219	*Oldenlandia verticillata*	Mihkat hing	Leaf, Stem, Root	0.00027	-
220	*Operculina turpethum*	Teodi, Shivadi	Root/Bark	0.00450	√
221	*Opuntia dillenii*	Nag Phan	Leaf	0.00002	√
222	*Oroxylum indicum*	Panokai, Kutannat	Root (Powder), Root, Stem, Bark, Fruit	0.00366	√
223	*Oxalis corniculata*	Tengari	Stem	0.00009	√
224	*Paederia foetida*	Lokolast, Bhadai lota	Leaf, Stem, Root	0.00152	√
225	*Panax pseudoginseng*	Ginseng	Root Powder	0.00100	√
226	*Pandanus amaryllifolius*	Kea kothal	Tender twig	0.00012	-
227	*Pandanus odorifer*	Kewada, Ketaki	Stem/Root	0.00003	√
228	*Paris polyphylla*	Satuaa	Root Powder	0.00100	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
229	*Pedalium murex*	Yaanai nerunji	Whole Plant	0.00050	√
230	*Pergularia daemia*	Utierudi	Aerial Parts	0.00040	√
231	*Phyllanthus acidus*	Makham	Bark	0.00280	-
232	*Phyllanthus amarus*	Keezhaa nelli, Bhui aonala	Whole Plant	0.10340	√
233	*Phyllanthus emblica*	Aonla, Nelli	Fruit	0.40741	√
234	*Phyllanthus niruri*	Ban Aam Lekhi, Bhui aonla	Whole Plant	0.00418	-
235	*Phyllanthus urinaria*	Hajarmani, chakpa-heikru	Whole Plant	0.00029	√
236	*Picria fel-terrae*	Longritong	Leaf	0.00013	-
237	*Picrorhiza kurroa*	Kutki, Hongbu	Root, Leaf	0.05170	√
238	*Piper longum*	Pipli	Flower, Fruit, Seed	0.45552	√
239	*Pistacia integerrima*	Kakar singhi	Flower	0.00160	√
240	*Plantago major*	Bon lopha	Leaf, Whole Plant	0.00044	√
241	*Plantago ovata*	Isobgol	Husk, Seed	0.13600	√
242	*Plumbago zeylanica*	Kodiveli, Chitramulam, Agachita	Root, Leaf	0.00972	√
243	*Pogostemon benghalensis*	Sukloti	Root	0.00519	-
244	*Pongamia pinnata*	Karanji	Root, Fruit	0.00606	√
245	*Prunus cerasoides*	Padam	Bark, Stem	0.00102	√
246	*Prunus dulcis*	Mahum long	Leaf	0.00002	√
247	*Pseudodrynaria coronans*	Awmvel	Root	0.00001	-
248	*Pterocarpus marsupium*	Bijasal	Bark	0.00180	√
249	*Pterocarpus santalinus*	Rakta chandan	Wood	0.02500	√
250	*Pueraria tuberosa*	Vidharikhand	Tuber	0.01000	√
251	*Quercus leucotrichophora*	Banjh	Gum	0.00007	-
252	*Ranunculus sceleratus*	Dhaniya ghas	Root	0.00002	-
253	*Rauvolfia serpentina*	Sarpagandha, Sivanmelpodi	Root/Tuber	0.01414	√
254	*Rheum australe*	Revanchini, Dolu	Stem	0.00001	√
255	*Rhododendron arboreum*	Burans	Flower	0.00055	√
256	*Rhododendron formosum*	Tiewsaw	Stem	0.00001	-
257	*Rhus chinensis*	Boi-Song	Seed/Powder	0.00011	-
258	*Rhynchostylis retusa*	Kuphal	Root	0.00009	-
259	*Ricinus communis*	Aamanakku, Arand	Root, Seed, Bark	0.00243	√
260	*Rubus buergeri*	Jalulipok	Root	0.00012	-
261	*Rubus ellipticus*	Hisalu	Root, Fruit	0.00015	-
262	*Rubus hawaiensis*	Akala Bindu	Root	0.00060	-
263	*Rubus niveus*	Kala hisalu	Leaf/Fruit	0.00200	-
264	*Ruellia prostrata*	Padachchi chedi	Leaf	0.00024	-
265	*Rumex nepalensis*	Jangli palak	Rhizome	0.00070	-
266	*Sagittaria sagittifolia*	Coldanikochu mahudi	Tender Stem	0.00009	-

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
267	*Sansevieria roxburghiana*	Mokya	Leaf	0.00770	√
268	*Santalum album*	Sweta chandan	Wood	0.01900	√
269	*Sapindus mukorossi*	Reetha	Fruit	0.00194	√
270	*Saraca asoca*	Ashok	Bark, Leaf	0.06030	√
271	*Saurauia napaulensis*	Goganda, Singkrang	Shoot	0.00001	-
272	*Saussurea costus*	Rauta	Root	0.03500	√
273	*Schima wallichii*	Chilauni, Makria	Fruit, Bark (Stem)	0.00014	-
274	*Scoparia dulcis*	Ya-hang-an	Root/ Whole Plant	0.00336	-
275	*Scurrula parasitica*	Pavetta	Leaf	0.00001	-
276	*Senna alata*	Khorpat	Leaf	0.00011	√
277	*Senna alexandrina*	Sona patta, Sonamukhi, Senna, Svarnapatri	Whole Plant, Leaf	0.02350	√
278	*Senna auriculata*	Avarai	Whole Plant	0.00300	√
279	*Senna tora*	Oosi thagarai, Nimgang	Root, Leaf	0.00684	√
280	*Sida cordata*	Bisakhapuri	Aerial Parts	0.00040	√
281	*Sida cordifolia*	San borial	Root	0.00490	√
282	*Smilax glabra*	Chobchini, Lokhandi	Whole Plant, Tender Shoot, Root/Bulb	0.00172	√
283	*Solanum aculeatissimum*	Hathi bhikuri	Fruit	0.00100	-
284	*Solanum anguivi*	Karimulli	Fruit, Root	0.00075	√
285	*Solanum ferox*	Bnjamin	Fruit/Root	0.00012	-
286	*Solanum nigrum*	Makoh, Sokhssi	Leaf, Whole Plant, Root, Flower	0.00148	√
287	*Solanum spirale*	Thukalap	Leaf	0.00084	-
288	*Solanum torvum*	Bhuitita	Stem, Leaf, Root	0.00021	√
289	*Solanum viarum*	Tilabhakuri	Leaf/Fruit	0.00003	-
290	*Solanum virginianum*	Akranti	Root, Seed	0.01050	√
291	*Sonerila maculata*		Leaf	0.00001	-
292	*Spermacoce neohispida*		Root/Leaf	0.00006	-
293	*Sphaeranthus indicus*	Kotta karanthai	Root	0.00100	√
294	*Sphaerostephanos unitus*	Pakutphet	Leaf	0.00014	-
295	*Sphagneticola calendulacea*	Bhim raj	Tuber	0.00010	-
296	*Spondias pinnata*	Amora	Bark, Fruit, Leaf, Stem, Bark	0.00032	√
297	*Stemona tuberosa*	Sural, Bilaikand, Bharda	Leaf/Bulb	0.00001	-
298	*Stephania rotunda*	Purha	Root/Bulb	0.00059	-
299	*Sterculia urens*	Kulu	Resin	0.00320	√
300	*Sterculia villosa*	Udol hing	Bark	0.00120	-
301	*Stereospermum chelonoides*	Padal fali	Stem Bark	0.00059	√

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Commercial Trade
302	*Strychnos nux-vomica*	Etti, Kuchada	Seed	0.00500	√
303	*Swertia chirayita*	Chiretta	Whole Plant, Aerial Parts	0.09677	√
304	*Symplocos racemosa*	Lodhra	Leaf	0.00030	√
305	*Syzygium cumini*	Naaval, Borjamin, Jamun	Bark, Leaf, Seed	0.00295	√
306	*Tabernaemontana divaricata*	Kathane	Root, Stem, Bark	0.00401	√
307	*Taxus wallichiana*	Chalira patra	Leaf	0.00410	√
308	*Tephrosia purpurea*	Kozhinji	Root/Leaf	0.00050	√
309	*Terminalia arjuna*	Marudham, Arjun	Bark (Stem)	0.02616	√
310	*Terminalia bellirica*	Thandrikaai, Beheda	Fruit	0.54660	√
311	*Terminalia chebula*	Kadukkaai, Harda	Seed, Fruit	0.54162	√
312	*Terminalia citrina*	Citrine myrobalan, Hillika	Fruit	0.00002	-
313	*Terminalia elliptica*	Saja, Sain	Bark	0.00200	√
314	*Tetrameles nudiflora*	Thitpok	Stem Latex, Bark (Stem)	0.00012	-
315	*Tetrastigma serrulatum*	Wanmak hing	Rhizome	0.00136	-
316	*Thladiantha cordifolia*	Bili poka	Root, Leaf	0.00007	-
317	*Thottea tomentosa*	Thottea	Root/Rhizome	0.00007	-
318	*Thunbergia alata*	Black-Eyed Susan Vine	Stem	0.00007	-
319	*Thunbergia coccinea*	Chonga lota	Stem	0.00004	-
320	*Thunbergia grandiflora*	Kukua loti, Neel Lata	Stem	0.00001	-
321	*Tinospora cordifolia*	Giloe, Amruthvalli, Seendhil, Iraking phum	Stem, Root, Leaf	0.29808	√
322	*Tribulus terrestris*	Gokuru, Seru nerunjil	Whole Plant	0.00040	√
323	*Trichosanthes cucumerina*	Peipudal	Root	0.00005	√
324	*Tridax procumbens*	Thaatha thalavetti poo	Leaf, Root	0.00290	√
325	*Trillium govanianum*	Nagchatri	Rhizome	0.00300	√
326	*Tylophora indica*	Nanju murichaan	Whole Plant	0.00005	√
327	*Urena lobata*	Konkinsin	Root/Shoot	0.00029	-
328	*Urtica parviflora*	Bichu ghas	Leaf	0.00005	-
329	*Valeriana jatamansi*	Tagar ganth, Sugandhbala, Asaroon, Laungpanpos	Root	0.00050	√
330	*Verbena officinalis*	Seng-sai-banru	Root	0.00280	-
331	*Vitex negundo*	Nochi, Poshothia	Leaf, Seed	0.00157	√
332	*Vitex peduncularis*	Kaktikta	Bark	0.00024	-
333	*Withania somnifera*	Amukkuraa, Ashwagandha	Root	4.37300	√
334	*Woodfordia fruticosa*	Thaathiri	Root	0.00060	√
335	*Xanthium strumarium*	Agora	Root	0.00012	-
336	*Zanthoxylum armatum*	Timru, Aerma yer	Seed	0.00250	√
337	*Zanthoxylum nitidum*	Tegmui	Root	0.00421	√
338	*Zehneria hookeriana*	Bdipoka	Leaf/Rhizome	0.00009	-

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)	Status in Comme--rcial Trade
339	*Ziziphus jujuba*	Ber	Leaf	0.00140	√
340	*Ziziphus oenopolia*	Kanta Marisa	Whole Plant	0.00040	-
			Total Consumption	**9.822846**	

Out of the 340 medicinal plant species documented in use by folk healers, 202 species are in active trade. Medicinal plants species used by folk healers in large quantities (≥ 0.050 MT per annum) are given in Table 5.

Table 4.5. Raw Drugs/ Medicinal Plant Species in High Collective Usage (≥0.050 MT) by 89 Sampled Folk Healers

S. No.	Botanical Name	Vernacular / Common Name	Part Used	Annual Consumption (MT)
1	*Withania somnifera*	Amukkuraa, Ashwagandha	Root	4.37300
2	*Aloe vera*	Gritkumari	Leaf	1.07720
3	*Terminalia bellirica*	Thandrikaai, Beheda	Fruit	0.54660
4	*Terminalia chebula*	Kadukkaai, Harda	Seed, Fruit	0.54162
5	*Piper longum*	Pipli	Flower, Fruit, Seed	0.45552
6	*Phyllanthus emblica*	Aonla, Nelli	Fruit	0.40741
7	*Tinospora cordifolia*	Giloe, Amruthvalli, Seendhil, Iraking phum	Stem, Root, Leaf	0.29808
8	*Aegle marmelos*	Bel	Bark, Fruit, Leaf	0.23329
9	*Alpinia galanga*	Perarathai, Kulanjan, Rasna	Rhizome, Root	0.22214
10	*Asparagus racemosus*	Shatawar	Root/Rhizome, Leaf, Stem	0.16628
11	*Plantago ovata*	Isobgol	Husk, Seed	0.13600
12	*Phyllanthus amarus*	Keezhaa nelli, Bhui aonala	Whole Plant	0.10340
13	*Swertia chirayita*	Chiretta	Whole Plant, Aerial Parts	0.09677
14	*Mucuna pruriens*	Krouch, Bidung, Konch	Leaf, Seed	0.09050
15	*Azadirachta indica*	Neem, Vaeppan, Maha Neem	Leaf, Whole Plant, Bark, Stem	0.06341
16	*Saraca asoca*	Ashok	Bark, Leaf	0.06030
17	*Barleria prionitis*	Daskaranta	Whole Plant	0.06000
18	*Picrorhiza kurroa*	Kutki, Hongbu	Root, Leaf	0.05170

Habit-wise analysis of medicinal plants consumed by folk healers (Fig. 4.5) reveals that about 39% of these are herbs, 31% are trees, 21% are shrubs and 9% are climbers. This habit-wise distribution of medicinal plants used by the folk healers is very similar to the habit-wise distribution of medicinal plants used by the rural households. This similarity aptly demonstrates that the major

proportion of the medicinal plants in use by both the local households and the folk healers is sourced from the nearby forests and habitats outside forests.

340 medicinal plants recorded in use by folk healers under this study for their daily dispensation belong to 114 plant families, with Asteraceae, Fabaceae, Lamiaceae, Euphorbiaceae, Malvaceae, Apocynaceae and Solanaceae each represented by more than 10 plant species, being the dominant families (Fig. 4.6).

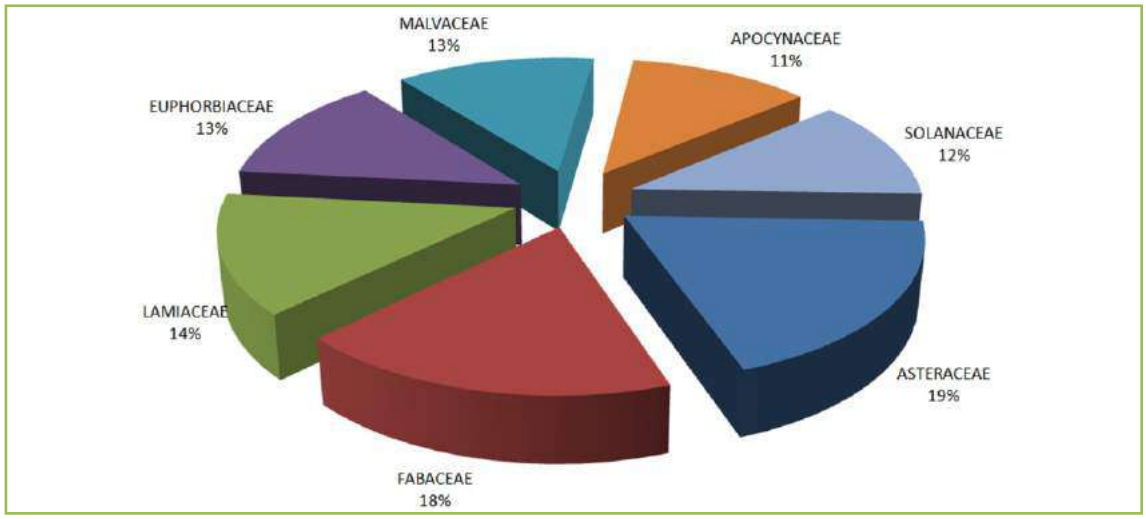

Fig. 4.6. Dominant Families of Medicinal Plants used by Folk Healers

More than one part of most of the 340 plant species recorded under the study is used for treating different ailments. In all, a total of 517 herbal raw drug entities corresponding to 340 medicinal plant species have been documented in use by the 90 respondent folk healers. Part-wise distribution of these herbal raw drug entities reveals that leaf (24%) and root (17%) are the major raw drug parts, followed by whole plant (11%), stem and bark (9%), fruit (8%), seeds (6%), with remaining entities being flower, latex / gum / exudates, wood, gall and root bark (Fig. 4.7). This part-wise distribution also makes it evident that 46% of the herbal raw drug entities in use by folk healers pertain to whole plants, roots, stem and bark, and as such their wild collection involves destructive harvesting.

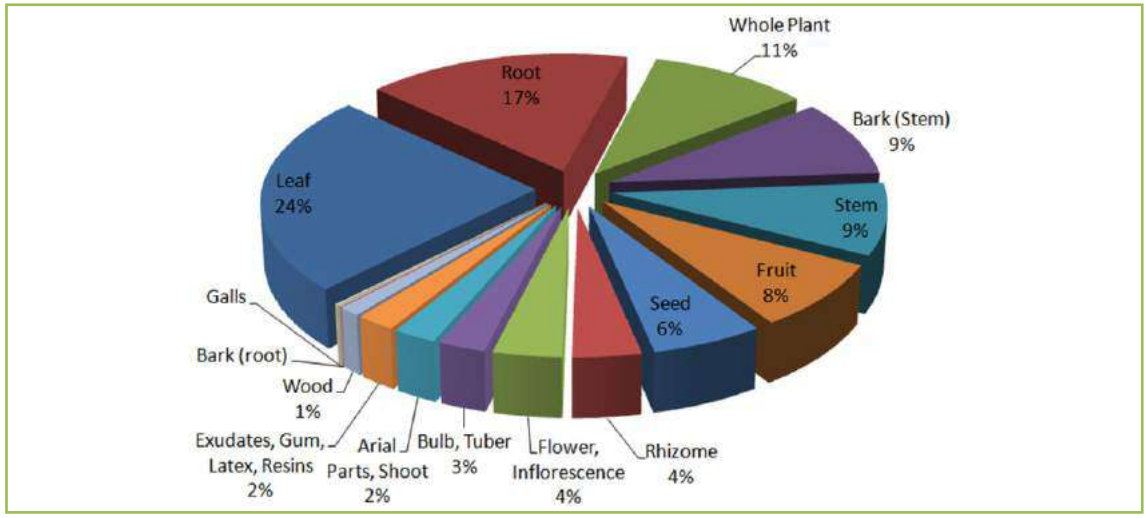

Fig. 4.7. Part-wise distribution of Herbal Raw Drugs used by Folk Healers

Survey of folk healers brought out that some folk healers were using different parts of the same plant under different names for treating different ailments. For example, different parts of 'neem' (*Azadirachta indica*) viz. 'neem chaal', 'neem beej', 'neem patti' were used to treat different ailments. Similarly, 'amaltas' (*Cassia fistula*) is used by them in number of medicinal recipes. Decoctions of its stem, leaves, bark, fruit (pods), seeds and roots are used as a diuretic, laxative, tonic and abortifacient, as well as in treatments for other abdominal ailments. 'Sohanjan' (*Moringa oleifolia*) was also recorded in use for treating various ailments like joint pains, asthma, stomach related ailments, kidney stones, aphrodisiac, skin problems, to reduce swellings, thyroid, constipation, etc. Some other similar plants widely used include *Aegle marmelos*, *Hibiscus rosa-sinensis* (flower and leaf), *Cinnamomum obtusifolia* (bark and leaves) and *Acacia catechu* (leaves, roots, wood paste). Cases of usage of a variety of plant entities in conjunction with each other also came to notice. In most of the cases, the folk healers were relying upon fresh material for their herbal preparations and thus preferred nearby local plants.

Teams gathering data from folk healers

Medicinal Plants in the Practice of Sowa Rigpa

An estimated 500 plant species are reported to be used in the practice of Sowa rigpa, an Indian System of Medicine prevalent in the trans-Himalayas. Many of these species are collected from the region. An interaction with Dr. Tsering Phunstog, Chief Amchi, LAHDC, Leh (09419887650/ 08493846494) revealed that the availability of most of the medicinal plants traditionally collected from the cold desert areas has declined over the years. Citing the example of one workshop conducted for Amchis in 2000, he informed that during a 2 hour field visit to slopes around South Pullu enroute Khardung La, the participating Amchis were able to collect about 70 medicinal plants species. The repeat of that exercise in 2016 has resulted in collection of merely 25-30 medicinal plant species from the same area over the same time. He opined that the major reason for this decline was fast changing climatic conditions - the area was receiving much less winter snow and negligible summer rains - and not over-harvesting by the Amchis. He said that Amchis were still following the principles of 'Ska sar Skei-wa' (right location), and 'Tus Su Turva' (right time) for making the wild collections. He further informed that the Swa Rigpa requires Amchis to follow 'Soma Ning Pa' i.e. the prescribed shelf life of the herbal raw drugs. This system assures against overharvesting during any year as the Amchis have to necessarily discard the herbal raw drugs that have completed their prescribed shelf life.

Dr. Phunstog also informed that the LSTM (Ladakh Society for Traditional Medicine), an NGO, was helping the local communities in conservation of medicinal plants through awareness campaigns and community organisation. One Medicinal Plant Conservation Area (MPCA) was also established due to these efforts at Sinmo Ralpa, near Mahe in Changthang for *in situ* conservation of *Dactylorhiza hatageria*, *Aconitum heterophyllum*, *Dracocephalum* spp., and *Arnebia euchroma*. Two community reserves-cum-sustainable harvesting areas were also demarcated at Rangdom Village in Zanskar and at Sapi Village in Kargil. The local village committees to manage these reserves were regulating the collections from these areas. The two community reserves, he informed, have gained prominence as medicinal plant rich areas and Amchis from far off areas come to these areas for making collections of medicinal plants after paying fee to the village committees.

Dr. Tenzin Thaye, visiting physician of H.H. the Dalai Lama, also corroborates the declining availability of species like *Meconopsis aculeata*, *Dactylorhiza hatageria*, and *Aconitum heterophyllum*. He informed that getting authentic material in respect of other 200 odd medicinal plant species regularly used by them was becoming a challenge. About 90% of their estimated annual requirement of 15-20 MT of the herbal raw drugs was being met through market purchases from Majith Mandi, Amritsar and Khari Baoli, Delhi. It was only a few high-Himalayan herbs that were required in non-

commercial quantities that were being got collected directly from the wild.

There are about 250 reported Amchis in Ladakh and another 70 in Himachal Pradesh. Each of these Amchis uses an average of (40) 50 (100) medicinal plant species, with annual consumption of all herbs by each Amchi varying from 40-50 kg. Each Amchi has an average flow of 3-5 patients per day. A few Amchis were also reported to be preparing medicines on larger scale for which they were using an average of 4-5 MT of raw herbs per year. The Ladakh Amchi Sabha has also initiated a Manjor Khang (Preparation Centre) where medicines are prepared for other practitioners. This unit uses an average of 10 MT of herbal raw drugs annually for making medicines. A part of this requirement is met from purchases from Delhi / Amritsar.

Some Interesting Highlights about Medicinal Plants from the Field Survey

The field survey in Himachal Pradesh, in addition to recording usage of herbal raw drugs, resulted in documentation of interesting information about the belief and myths around medicinal plants. At many places gathering and use of medicinal plants is linked to some rituals. For example, some plants are to be collected only at certain times of the day, in a certain month or from a specific location.

- In Surd village of Rampur Forest Division, the 'chora' (*Angelica glauca*) roots are collected only on one day during May in the entire year. Permission is sought from the local deity and a day is fixed when the villagers move together into the forest to collect their yearly supply of 'chora'.
- In the remote Janglik village of Rohru, the collection of 'karu' (*Picrorhiza kurroa*) is regulated by the local deity and a time is fixed when the village folk move to camp in the higher altitudes for collection/ harvest of 'karu'. The area for collection and time is also specified for conservation of the species.
- In the Baspa Valley of Kinnaur, the 'Brahmkamal' (*Saussurea obvallata*) is collected after the third week of July and that too by the unmarried youth of the village. It is a ceremonial affair and first the village deity is consulted, a day is fixed and then the youth move into the higher alpine slopes for collection. On return the flowers are first offered to the local deity.
- In Lahaul, it is believed that no male member of a household can uproot the plant of 'bajar bhang' (*Datisca cannabina*) unless he is the only male member in the household.

Moreover, in the NW Himalayas, as a general rule, most of the medicinal plants are collected after 'bees bhadon' (end August). The folk healers and locals believe that the medicinal properties are less active if they are gathered earlier. The timing and manner in which plant medicines are collected determine their medicinal power. Also, there is a general belief that the medicinal plants that are collected from deep inside the forest are more powerful and effective.

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5

Supply of Herbal Raw Drugs from Wild Collections

Wild/ self grown plants from forests and from habitats outside forests (agricultural farms, fallow lands, road/ rail sides, canal banks, ponds and lakes, waste lands) form the major source of supply of a large number of herbal raw drugs. Thousands of rural and forest-side people act as wild gatherers from these habitats with the primary objective of generating for them cash income. The material so collected from the wild enters the trade to meet the demands of end users. With commercial demand for many of the wild collected species on the rise, the natural populations of many species have undergone drastic reduction. 344 native medicinal plant species of India have already been assessed as Red-Listed at regional, national or global level through rapid threat assessment exercises across the country. Wild collections from non-forest habitats have always been free with no agency maintaining record of such harvests. With most of the states having devolved the rights over minor forest produce, including medicinal plants, to the local Panchayats, the concerned forest departments have now done away with the system of maintaining records of wild harvests even from the forests. The situation calls for immediate amends. It needs to be appreciated that annual wild harvest data is of paramount importance for species-specific management interventions. Initiatives towards long-term conservation of threatened medicinal plants are also needed to be upscaled and systems put in place for periodic monitoring and evaluation of the impacts of conservation efforts.

5.1. INTRODUCTION

Wild/ self grown medicinal plants remain the major source of botanical raw drugs supplies to meet the commercial demands of the material on one hand and to form a source of cash income to thousands of wild gatherers in the country on the other. More than 60% of the 310 medicinal plant species recorded in high trade (>100 MT per year) under this study are sourced from the wild i.e. from forests and from habitats outside forests (agricultural farms, fallow lands, road/ rail sides, canal banks, ponds and lakes, waste lands). Most of the herbal raw drugs sourced from the high-Himalayan medicinal herbs, and trees and other long gestation medicinal plants are collected from the wild.

Generally, it is the local communities that undertake wild harvest, with more than 50% of the wild gatherers being women. The wild collection is usually dependent upon the market trigger by large traders that informally announces the demand of a particular material for the year. The word about the requirement of traders spreads by word of mouth, mainly by aggregators/ traders/ commission agents working in different layers of trade web. At the community level, wild harvest is seen as an opportunity to earn cash income and has, therefore become highly individualistic activity with 'before my neighbour and more than my neighbour' as the major collection motto (Ved and Goraya, 2008a). This competitive wild collection invariably leads to destructive harvesting, and has put wild populations of many medicinal plant species under severe stress. Species like *Fritillaria roylei*, *Trillidium govanianum*, *Ophiocordyceps sinensis*, etc. are already on the brink of extinction due to destructive wild collections. This practice is at variance with the 'time tested community based traditional sustainable wild collection practices of going in for wild collections during designated periods only'. Such time tested sustainable wild collection practice was manifested in the observance of bees bhadon (20th of 'Bhadon'- a month as per Indian calendar corresponding to about mid-September) as the day to initiate wild harvests in Himachal Pradesh. Local people on this day would first pay obeisance to the local deity and only then proceed to the alpine meadows for wild collection. 'This practice not only ensured maturity of the officinal parts and shedding of seeds, it also ensured a collective check on over-harvests' (Goraya, 2014).

Interactions with wild gatherers, traders and end users bring out that the supplies of herbal raw drugs from this very important natural resource are on the decline. In fact, availability of some herbal raw drugs had become so scarce that the traders and users were constrained to increasingly rely upon the 'equivalents' and 'substitutes' for the original raw drug. The scenario calls for immediate management interventions to conserve and build the wild populations of priority species, i.e. the species in high demand and the species that have become 'threatened'. Such management intervention would require data in respect of annual harvests of different species from the forests and habitats outside forests. However, the practice of maintaining record of wild harvests from forests has been discontinued by many state forest departments after devolving control over minor forest produce, including medicinal plants, to local communities. It is only in respect of a few high volume medicinal plant species that have been 'nationalised' by some states that harvest records are maintained now.

5.2. STATUS OF MAINTENANCE OF WILD HARVEST RECORDS BY STATES

An estimated 80% of the medicinal plant species diversity in annual commercial demand is sourced wholly or partially from the wild from both the forest and non-forest landscapes. It includes a large number of species in high annual demand.

5.2.1. From Forests: The State Forest Departments being custodians of forest lands should be maintaining record of wild harvests from the forests. However, it is not so and the practice of maintaining record of species-wise annual harvest of herbal material from forests being followed by the state forest departments till about 2003 seems to have been discontinued by many states. The states of Madhya Pradesh and Chhattisgarh maintain record of annual removals in respect of only a few 'nationalised' species. The communities in these states have been given the rights to freely collect and trade all medicinal plant species other than the 'nationalised' ones without the need for procuring 'transit passes' from the forest department. The states of Uttarakhand and Gujarat have made the State Forest Corporations as the nodal agencies for trading wild collected medicinal herbs. Whereas Uttarakhand Forest Corporation trades all the herbal material that is brought to its three designated depots by the agencies authorized to undertake wild harvest, the Gujarat Forest Corporation trades in the listed species through its depots.

Many other states have devolved the rights over minor forest produce, including medicinal plants, to the local communities and have delegated to the concerned Panchayats the powers to issue export permits for the wild collected herbal produce. However, the necessary mechanisms to collate Panchayat data about the collection and trade of medicinal herbs at the states level is yet to be put in place.

During the current study, data with respect to wild harvest of medicinal plants could be gathered from only 7 states and 2 Union Territories. The States of Delhi and Goa and the Union Territories of Chandigarh and Dadra & Nagar Haveli have reported 'Nil' removals of medicinal herbs over the last three years. Data received from the other 5 states is tabulated below:

Table 5.1. State-wise data of Annual Harvests of Medicinal Plants from Forests for the year 2014-15

S. No.	Species	Local Name	Parts Harvested	Quantity Harvested in 2014-15 (in qtls)				
				Maha-rashtra	Uttara-khand*	Mizo-ram	Mani-pur	Gujarat
1	*Abrus precatorius*	Gunja	Leaves	3	0	0	0	0
2	*Acacia concinna*	Shikekai	Fruits	290	0	0	0	0
3	*Achyranthes aspera*	Apmarga	Whole Plant	0	10	0	0	0
4	*Aconitum heterophyllum*	Atis	Rhizome	0	0.04	0	0	0
5	*Justicia adhatoda*	Vasa	Whole Plant	0	30	0	0	0
6	*Aquilaria malaccensis*	Agar	Stem	0	0	0	0.07	0
7	*Asparagus racemosus*	Shatavari	Roots	0	0	0	0	3
8	*Azadirachta indica*	Neem	Leaves	0	8	8	0	8
9	*Azadirachta indica*	Neem	Seeds	0	0	0	0	454
10	*Boswellia serrata*	Salai Gum	Gum	0	0	0	0	76
11	*Buchanania cochinchinensis*	Charoli	Fruits (Seeds)	2332	0	0	0	0
12	*Butea monosperma*	Palas	Gum	3533	0	0	0	0
13	*Butea monosperma*	Palas	Seed	400	0	0	0	0
14	*Butea monosperma*	Palas	Flower	9	0	0	0	0

S. No.	Species	Local Name	Parts Harvested	Quantity Harvested in 2014-15 (in qtls)				
				Maha-rashtra	Uttara-khand*	Mizo-ram	Mani-pur	Gujarat
15	*Cinnamomum tamala*	Leaves Tamlpatra	131	34	0	0	0	
16	*Dactylorhiza hatagirea*	Salam Panja	Rhizome	0	0.08	0	0	0
17	*Datura metel*	Dhatura	Whole Plant	0	8	0	0	0
18	*Desmodium gangeticum*	Salvan	Whole Plant	108	0	0	0	0
19	*Embelia ribes*	Vavding	Fruits	33	0	0	0	0
20	*Phyllanthus emblica*	Awala	Fruits	56	7	0	0	0
21	*Entada phaseoloides*	Garbi	Pods, Seeds	110	0	0	0	0
22	*Ficus benghalensis*	Vata	Leaves	0	5	0	0	0
23	*Ficus benghalensis*	Vata	Aerial Roots	0	3	0	0	0
24	*Garcinia gummi-gutta*	Kokum	Fruits	10	0	0	0	0
25	*Holarrhena antidysentrica*	Inderjao	Seeds	0	0	0	0	1
26	*Homalomena aromatica*	Anchiri	Rhizomes	0	0	167	0	0
27	*Madhuca longifolia*	Mahua	Flowers	9593	0	0	0	3737
28	*Madhuca longifolia*	Mahuda	Seeds	0	0	0	0	1108
29	*Mesua ferrea*	Nagkesor	Flower	0	0	0	66	0
30	*Mucuna pruriens*	Kaunch	Seeds	0	0	0	0	29
31	*Operculina turpethum*	Black nasotar	Roots	0	0	0	0	100.4
32	*Ophiocordyceps sinensis*	Yarsa gumba	Caterpillar-fungus	0	3	0	0	0
33	*Panax pseudoginseng*	Ginseng	Rhizome	0	0	0	8.6	0
34	*Paris polyphylla*	Satua	Roots	0	2	0	0	0
35	*Parmelia* spp.	Jhula	Thallus	0	12257	0	0	0
36	*Phyllanthus emblica*	Amla	Fruit Pulp	0	0	0	0	30
37	*Pongamia pinnata*	Karanj	Seeds, Fruits	174	0	0	0	0
38	*Prosopis cineraria*	Prosopis Gum	Gum	0	0	0	0	830
39	*Rumex hastatus*	Bhilmora	Whole Plant	0	30	0	0	0
40	*Saccharum munja*	Sarkanda	Roots	0	8	0	0	0
41	*Semecarpus anacardium*	Biba	Fruits	168	0	0	0	0
42	*Sida cordifolia*	Khreti Bala	Whole Plant	0	10	0	0	0
43	*Smilax aspera*	Smilax	Root	0	0	0	42.5	0
44	*Solanum virginianum*	Bhoiringni, Kantakari	Whole Plant	0	2	0	0	5

S. No.	Species	Local Name	Parts Harvested	Quantity Harvested in 2014-15 (in qtls)				
				Maha-rashtra	Uttara-khand*	Mizo-ram	Mani-pur	Gujarat
45	*Sterculia urens*	Kadaya Gum	Gum	0	0	0	0	16
46	*Strobilanthes ciliata*	Karvi	Roots, Leaves	2760	0	0	0	0
47	*Syzygium cumini*	Jambu	Seeds	0	0	0	0	2.5
48	*Tacca aspera*	Dukarkand	Tubers	15	0	0	0	0
49	*Tamarindus indica*	Chinch	Fruits	1	0	0	0	0
50	*Terminalia bellirica*	Behada	Fruits	2424	1	0	0	4.7
51	*Terminalia bellirica*	Behada	Fruit Rind	0	0	0	0	30
52	*Terminalia chebula*	Hirda	Fruits	10301	0	0	0	5
53	*Tinospora cordifolia*	Gulwel	Stem	274	6	0	0	0

*Uttarakhand Forest Development Corporation

In addition to the data presented in the above table, some information about the wild collection and trade of 'kullu gum' (*Sterculia urens*) and 'van tulasi' (*Ocimum gratissimum*) has been obtained. As per data maintained by the Madhya Pradesh MFP Federation, the extraction and trade of 'kullu gum' is showing a declining trend and the total production had reduced from 567 qtls. of 'kullu gum' collected and traded by the Federation during 2006-07 to collection of only 7 qtls. of 'kullu gum' during 2014-15. The Chhattisgarh MFP Federation has reported trade of 119 quintals of 'van tulasi' through the Federation during 2014-15.

The non-maintenance of any record by the state forest departments in respect of medicinal plant species that are routinely collected destructively from the wild is an issue of major concern. For example, no record of wild harvest of the tree species forming key constituent of 'dashamoola' group could be gathered from any of the state forest departments. Knowing that the domestic herbal industry consumes the wood and roots of each of the five tree species of this group in large quantities every year and that forests are the only source of supply of these species, the continuous damage to the resource that is happening without apparent knowledge of the forest managers is sure a cause of concern.

Similarly, some species that have come under large scale commercial exploitation in the recent past also seem to be missing from the data base of the State Forest Departments. The wild collection of Nag Chhatri (*Trillidium govanianum*) and Ban Lahsun (*Fritillaria roylei*) from north-western Himalayan states can be cited as examples. Wild collection of species like 'basanti' (*Hypericum perforatum*), *Euphrasia*, 'bankakri' roots (*Podophyllum hexandrum*), 'thyme' (*Thymus serpyllum*), 'kaknach' (*Solanum pseudo-capsicum*), 'Himalayan blue poppy' (*Meconopsis aculeata*), 'kala zira' (*Bunium persicum*) from forests came to notice during interactions with local wild gatherers and traders in Himachal Pradesh. Similarly, wild harvest of 'badiyan' (*Illicium griffithii*), 'majith' (*Rubia cordifolia*), 'satva' (*Paris polyphylla*), and 'syonka' bark (*Oroxylum indicum*) was reported from the forests of the north-eastern states. No official record of such wild harvests from forest areas, however, was available.

5.2.2. From Outside Forests: As far as wild harvest from the habitats outside forests is concerned, herbal raw drugs pertaining to 59 medicinal plant species in high trade are regularly collected from these habitats. However, no record of the quantum of annual harvests or the localities from where such material is harvested is available.

5.3. SOME CASE STUDIES OF WILD HARVEST

5.3.1: Harvest of Anardana (Seeds of *Punica granatum*)

Anardana or pomegranate (*Punica granatum*) seeds form an important raw material under the Indian Systems of Medicine. Trade of pomegranate seeds extracted from the fruits of pomegranate trees growing wild in the lower hills of Himachal Pradesh forms an important source of cash income to the local people. Whereas the wild pomegranate trees occurring on forest land are forest property, the local communities have been granted the right to collect its fruits and sell its seeds. Collection of fruits from the forest areas usually takes place during August-September on a day fixed by the local forest authorities in consultation with local people. On the scheduled day, local people go to the forest to harvest pomegranate fruits from the trees that the community has divided amongst themselves under non-formal arrangement. The collection starts early in the morning and continues up to midday (because the fruit is difficult to sight in bright sunshine) and then again from evening till dusk. The average harvest per person is about 20-25 kg. It means that more hands a family has on the day, more harvest the family can make. Harvest from pomegranate trees growing on private lands is done during October when the fruits are fully ripe and when the seed quality is also considered better.

Local people engaged in wild harvest and extraction of Pomegranate seeds

All members of the family participate in the seed separation process. The opened fruits are spread on jute bags or tarpaulin for sun drying to make extraction of seeds easier. Seeds are usually removed with hands, but sometimes wooden sticks are also used to separate from the rind. The extracted seeds are spread on roofs and sun dried to make anardana. One kilogram of fully ripened fresh fruit yields on an average 100 gms of anardana. Most of the families in the study area in Shimla district are able to extract 70-80 kgs of anardana from the trees on forest lands and from private trees per year, of which they retain 4-5 kilogrms for their own consumption

and sell the remaining quantity. At an average sale price is ₹400 per kilogram at the farm gate for good quality anardana (the retail price in Shimla market at ₹600 per kg), the annual cash income of each of the families from sale of anardana comes to more than ₹25,000.

The fruit rind, presently of no commercial value in this region, is either used for composting or is dried to be used as fuel during winters.

In view of the contribution 'anardana' makes to the livelihoods of local communities, the local forest department has been augmenting the wild populations of pomegranate in the area through plantations. The fruits are, however, susceptible to insect attack that sometimes adversely affects the yield [with inputs from Ms. Drishti Sharma, HFRI].

5.3.2: Collection and Trade of Yartsa Gumba (*Ophiocordyceps sinensis*)

Collection of Keera Jari or Yartsa Gumba, a caterpillar fungus (*Ophiocordyceps sinensis* = *Cordyceps sinensis*) found at altitudes between 3,000 to 4,500 m asl in the Tibetan Plateau, has become one of the major and very lucrative sources of cash income for the local communities of the region. In India, its major occurrence has been reported from alpine meadows of Pithoragarh in Kumaon hills, Uttarakhand. Occurrence of this caterpillar fungus is also reported from Chamoli and Uttarakashi districts of Garhwal Himalaya in the state.

Survey for Yartsa Gumba on steep slopes in Chhipla Kedar (Pithoragarh, Uttarakhand)

A field study to assess the current harvesting practices and recent trends in the availability of Yartsa Gumba was undertaken during early June 2015 in the alpine meadows (3600-4400 m asl) around Chhipla Kedar and Najurikot in Pithoragarh district of Uttarakhand. The areas above 4000

m asl were still under snow and the gatherers, already camping in the prime areas, were awaiting snow melt and emergence of the Yartsa Gumba. The past Keera Jari collectors were taken as guides and facilitators for interviewing other gatherers to know about the status and extraction pattern. The experienced collectors informed that about 2200-4000 dried pieces of Keera Jari made one kg weight. The rate of a single piece could be upto ₹ 500 depending upon the size, colour, taste and annual collection levels, with the material from the higher altitudes and pieces of large sizes, golden colour and neutral taste fetching higher prices. An idea about the high stakes in Yartsa Gumba trade can be had from the fact that an estimated 1 MT of this produce at a market value to the tune of ₹ 100 crore is collected in Uttarakhand every year!

The collectors were consistent in stating that the availability of Yartsa Gumba has been on the decline over the last 4-5 years with the current year being particularly poor in Yartsa Gumba production, possibly due to dry spell during May- June. They also expressed their concern about the increasing number of people reaching the alpine slopes in search of Keera Jari and the increasing associated conflicts.

The state of Uttarakhand has, since 2004, made it mandatory for all forest produce to be auctioned only through Uttarakhand Forest Development Corporation's Herbal Depots. Scrutiny of the auction data of the Corporation Herbal Depots, however, reveals that out of the huge annual collections, it was only during 2014-15 that 2.8 kg of Yartsa Gumba was received at these mandis! Despite concerns about unregulated and destructive harvest of Keera Jari expressed by different agencies (UFDC, 2009), the situation has not changed. Even as collection of Yartsa Gumba has been equated with 'gold rush' helping transform the livelihood of mountain dwellers, concerns are being expressed about the adverse impact the human activities related to collection of Yartsa Gumba are having on the alpine ecology (Yadav, 2016). The call of nature to regulate the collections, if only to save the species from extinction, needs to be given immediate attention. [With inputs from Dr. G S Rawat, Ishwari Dutt Rai and Gautam Talukdar, WII]

5.3.3: 'Nag Chhatri' and 'Ban Lahsun' - A Case of Highly Destructive Wild Extraction

Extraction of two high Himalayans herbs i.e. 'Nag Chhatri', also known as 'Satva' in trade, (*Trillidium govanianum*) for its rhizomes and 'Ban Lahsun' (*Fritillaria roylei*) for its bulbs witnessed a sudden spurt between 2009-10 and 2014-15 in Himachal Pradesh, Jammu & Kashmir and Uttarakhand. Over these five years the price payable to wild gatherers for one kilogram of dried rhizomes of 'Nag Chhatri' shot up from ₹ 800 to ₹ 2600. Similarly, the price paid to wild gatherers for one kilogram of dried bulbs of 'Ban Lahsun' rose from ₹ 1200 to ₹ 6000 during the same period. An idea about the level of destructive harvest could be had from the fact that it requires uprooting of an average of 2000 plants to make one kilogram of dried material in respect of each of these species. The lucrative price of these species resulted in collection of these species even from the areas closed for collection during a particular year, causing seizure of large quantities of such illicitly collected material. The lure of high returns, however, made the people take such seizures in their

Trillidium govanianum

Fritillaria roylei

stride and continue with ruthless wild harvest of these two entities causing near decimation of wild populations of both these species.

Another impact of engagement of local wild gatherers in harvest of these two species made the wild harvest of other usually collected medicinal plant species from the high hills non-remunerative, creating their shortage in the market. It is only during the current year that the prices of both these species have come down to ₹ 1800 and ₹ 3000 per kg respectively providing a respite to their wild harvest.

5.3.4: Harvest of Bahera, Harar and Amla (Fruis of *Terminalia bellirica*, *Terminalia chebula* and *Phyllanthus emblica*)

The fruits of 'bahera', 'harar' and 'amla' form the three key ingredients of Triphala for which these are collected in very large quantities. The herbal industry usually accepts de-seeded dried fruits. Bahera, harar and amla trees occur naturally in tropical dry deciduous and semi-evergreen forests across the country. Since deseeding and drying of 'bahera', 'harar' and 'amla' is a labour intensive work, this activity is confined mainly to the remote forest-fringe villages with few opportunities of income generation. A visit was made to one such village in Odisha during January 2016 to understand the process involved in collection and post-harvest handling of these three fruits. The village Sitaparhi, in Balliguda block, Kandhamal district of Odisha is a remote tribal village with little avenues of cash income.

Most of the collection of 'bahera', 'harar' and 'amla' is done by the women, who have organized themselves in to Self Help Group (SHG) for collection and processing of herbal raw drugs. These

Deseeding and drying of 'Bahera'

women go to the nearby forests in small groups with at least one male member to climb the trees and shake the branches to make the fruits fall. The women then collect the fruits from the ground, and carry back the sacks on their heads to the village.

The SHG members informed that 'bahera' trees from around villages were ruthlessly felled for brick kiln fuel some years back and that now they had to go deep inside the forests to make collections, incurring additional expenditure on transport of the harvested produce. The 'harar' trees were rather scatted and involved more labour in its collection.

Deseeding of 'Harar'

The fresh 'bahera', 'harar' and 'amla' fruits are spread for a day or two for the moisture from the skin to evaporate and to make the rind easily open. It is the old women in the household who usually do the deseeding work by manually breaking the fruits with locally available stones. Deseeding of 'bahera' and 'harar' fruits is a very intense work as any distraction can cause injury to the fingers.

Deseeded 'Amla'

The deseeded rind is then spread on floor or on tarpaulins for 5-6 days and turned every few hours to let it dry. The dried material is then packed into jute bags and stacked till picked up for sale by the local agent.

Dried and deseeded 'bahera' fruits fetch a low price of ₹ 8-10 per kg, and the rates for dried deseeded fruits of 'harar' and 'amla' were informed to be ₹ 12-14 per kg and ₹ 45-50 per kg respectively. During discussions with the SHG members, it came out that they collect 40-50 kg of 'bahera' fruits per person per day. After deseeding, only about 10 kg of dried 'bahera' is left.

SHG members in Kandhamal district of Odisha with deseeded and dried 'harar' & 'bahera'

The SHG members expressed that the returns from collection and processing of raw drugs was much less than the wages under MNREGA (₹ 226 per day) and local agricultural activities (₹ 150 per day). In addition, the collection involved risk of injury and life.

The SHG members informed that many a times, the persistent overcast sky caused delay in drying of material spoiling its colour and appearance. They requested for some quick drying mechanisms to be installed at their village. The SHG members also informed that it was the collective initiative of the Odisha Forest Department, the Baitarani Initiatives, an NGO and the Dabur India Ltd. that was promoting collection, processing and trade of wild medicinal produce from the area. They were also praise for Mr. Jatinanda, a Community Resource Person (CRP) appointed under this initiative and working in a cluster of 10 villages. Mr. Jatinanda was acting as a link between the Self Help Groups (SHGs) of these 10 villages and the consortium and was facilitating sustainable harvest and processing of Harar, Bahera and Amla.

5.4. HERBAL RAW DRUGS COLLECTED FROM HABITATS OUTSIDE FORESTS

Habitats outside forests including agricultural farms, fallow lands, road/ rail sides, canal banks, ponds and lakes, and waste lands have traditionally been a very crucial source of herbal raw drugs used locally and at commercial scale. These habitats form the only or the major source of some very important herbal raw drug entities like 'gokshura', 'bala', 'punarnava', 'apmarga', 'bhumi amla', 'parpata', 'durva', 'musta', 'nagar motha', 'shankhapushapi', 'rasna', etc. In fact, 59 medicinal plant species recorded in high trade in the country are sourced from the habitats outside forests. The species growing in these habitats are known to be aggressive colonisers, and in normal circumstances would continue to grow in abundance.

However, the herbal raw drug supplies from this in case of seemingly infinite source have now become a cause of concern. In some cases, viz. *Fumaria indica*, *Alhagi pseudalhagi*, *Convolvulus prostratus*, *Citrullus colocynthis*, *Tribulus* spp., etc., the very habitat has got shrunk over the years due to intensification of agriculture whereby large chunks of hitherto fallow lands forming habitat for these species have been brought under plough. The availability of some species like *Cissus quadrangularis* and *Cardiospermum halicacabum* is also reported to be getting reduced due to over collection to meet the rising commercial and household demand.

Another issue of serious concern related to these habitats is the increasing contamination and pollution of these landscapes. While the agricultural lands have become much exposed to overdoses of fertilisers, insecticides, fungisides and weedisides, many of the waste lands and road/ rail/ canal sides have come under discharge of industrial affluents and sewer water, making the medicinal plants growing in these habitats non-suitable as herbal raw drugs.

Pilot cultivation of some of these species like *Bacopa monnieri*, *Centella asiatica*, *Cyperus scariousus*, *Phyllanthus amarus*, *Solanum nigrun*, etc. to get authentic and unadulterated material has already been initiated. It would need to be strengthened and more species from this group would need to be brought under domestication.

5.5. COMMUNITY BASED INITIATIVES FOR COLLECTION & MARKETING OF MEDICINAL PLANTS

Destructive wild collection practices and poor post harvest handling of wild collected herbal raw drugs are very largely responsible for depleting natural populations of many medicinal plant species on one hand and low quality of the produce on the other. Collection of immature parts requires harvesting of larger number of plants per unit of weight. In addition, such harvest is lower

in quality as the active ingredients have not yet fully developed in immature plants. Harvesting of immature plants also impacts the regeneration as most of such harvesting is done before the plants had chance to shed mature seeds.

Post harvest handling of wild collected produce is another area of concern. Usually the wild gatherers have to go to areas away from their villages to collect the plant material. The freshly collected material has to, therefore, be kept in sacks for long periods till the wild gatherers reach back their homes. This material is then spread directly on the surface for drying at all types of available places - courtyards, fallow fields, roof tops, etc., and exposed to dirt and foreign matter. Only at a very few places, the material was seen spread over tarpaulins or jute sheets. Proper drying platforms were nowhere to be seen. Many a times the material has to be kept stacked due to overcast conditions resulting in fungal attacks and damage to the material. Also the drying, processing and grading is a purely individualistic activity. Non-availability of the drying platforms and storage facilities at the village level is a major drawback in maintaining quality of the produce.

It is to address these issues that NMPB is supporting creation of Community Raw Drug Storage Facilities (>800 ft^2 each) at village level. One such recently completed facility was visited at Targabali village in Phiringia Range of Phulbani Forest Division in Odisha. A drying platform was also under construction as part of this facility. Even as the facility was under construction, question emerged about operationalization of the facility. It was realised that mere creation of facility will not serve the objective unless the communities are organized and encouraged to make use of the facility. Appropriate record keeping mechanisms of the material stored and disposed off were also required to be worked out. With these questions in mind, the Odisha Forest Department is now making efforts to link this facility with the SHGs that were created under the recently concluded JICA funded Orissa State Forest Development Project (OSFDP).

To kick start this linkage, Community Resource Persons (CRP) have been engaged to facilitate the functioning of the SHGs. The State Forest Department has also entered into understanding with Dabur India Ltd. that has come forward to procure the material collected by the SHGs. Baitarani Initiative, a local NGO, has joined hands with Dabur India Ltd. to facilitate organized collections and processing. The Community Resource Person and the staff of Baitarni Initiative are approaching the communities and creating clusters of about 10 SHGs with one SHG designated as Aggregating SHG per cluster. For the Targaballi Cluster, SHG of Gurupada village has been designated as the aggregating SHG. The SHGs were, at the time of our visit, were engaged in collecting 'harar', 'bahera' and 'amla' with 'shatavari' and 'dhobi nut' also being collected in small quantities.

As a result of these efforts, members of the cluster SHGs had already started bringing their produce - individually or collectively; in raw or processed form; loose or packed - to the Aggregating SHG. The Aggregating SHG was processing and stocking the material, keeping record, and was dispatching the material. We noticed 10 bags (30 kg each) of processed (deseeded) 'bahera' already stored in the facility. Dabur India Ltd. had announced its requirement and pricing in the beginning. The SHG members informed that they were getting their payments fairly fast.

This type of facilities and implementation mechanism is required to be set up at the village level to regulate wild collections and effective post harvest handling of the wild collected herbal material.

5.6. WILD MEDICINAL PLANTS OF CONSERVATION CONCERN CURRENTLY BEING TRADED IN HIGH VOLUMES

The current study on assessment of trade of botanical drugs in our country has revealed that herbal raw drugs pertaining to 242 plant species are in significant trade i.e. the annual demand for each of these botanicals exceeds 100 MT per year. 173 of these species are sourced almost entirely from the wild of which 114 species are found mainly or entirely, in India's forests. It is important to examine each of these 114 species to assess the impact of this trade and resulting lessons for the management and conservation of these valuable forest resources. This requires a reliable and rapid assessment of conservation status of each of these forest species recorded in high volume trade.

Using a Conservation Assessment and Management Prioritisation (CAMP) technique, an initiative to assess conservation status of wild medicinal plants species is in operation since 1995. Led by the Foundation for Revitalisation of Local Health Traditions (FRLHT), a total of 18 States have been covered under this initiative so far. A compilation of the results of these exercises has resulted in enlistment of 344 wild medicinal plant species that have been assigned Red List status ranging from Near Threatened (NT) to Critically Endangered (CR) for one or more states.

Conservation Assessment and Management Prioritization (CAMP) is a technique that allows rapid assessment of the conservation status of wild medicinal plants. Essentially involving 30-40 experts consisting of well-known field taxonomists, forest managers, traders as well as knowledgeable local practitioners of Indian Systems of Medicine (ISM), this exercise is carried out in the form of a workshop. These workshops, usually organized regionally with States as a unit, assess conservation status of prioritized medicinal plant species of the State using IUCN Red List Criteria & Categories and drawing upon the collective knowledge of the participants in the workshop.

In order to draw lessons for developing informed management responses for these wild resources a tabulation has been prepared enlisting 49 threatened medicinal plants which have been recorded in high volume trade also (table 5.2). These 49 medicinal plant species have been assessed as "Threatened" in one or more states of India while these are also recorded in high volume trade. An analysis of the listed species reveals that more than one third of these (17 species) belong to the temperate forests of the Himalayan states. Out of these 17 Himalayan species 9 are alpine herbs like *Aconitum heterophyllum*, *Picrorhiza kurroa*, *Rheum moorcroftianum*, *Valeriana hardwickii*, *Valeriana jatamansi*, *Nardostachys grandiflora* etc.

A few of these threatened species, in high volume trade, are endemic to the Western Ghats region of Western and South Western India e.g. *Garcinia indica*, *Coscinium fenestratum*, *Cinnamomum sulphuratum*, *Nilgirianthus ciliatus* and *Vateria indica*.

Adequate attention of the forest managers and policy makers is needed to take note of this and ensure that these valuable wild medicinal resources are sustainably used and conserved in their natural habitats.

Table 5.2. Red-listed Medicinal Plant Species recorded in High Trade

S. No.	Botanical Names	Habit	Assessed Conservation Status
1	*Aconitum ferox*	H	Assessed as Endangered in Arunachal Pradesh, Sikkim and West Bengal.
2	*Aconitum heterophyllum*	H	Assessed as Critically Endangered in Jammu & Kashmir, Himachal Pradesh and Uttarakhand.
3	*Aquilaria malaccensis*	T	Assessed as Critically Endangered in Arunachal Pradesh and Endangered in Assam and Meghalaya.
4	*Berberis aristata*	S	Assessed as Vulnerable in West Bengal
5	*Bergenia ciliata*	H	Assessed as Vulnerable in Arunachal Pradesh, Meghalaya and Sikkim.
6	*Boswellia serrata*	T	Assessed as Endangered in Rajasthan; Vulnerable in Chhattisgarh and Madhya Pradesh
7	*Buchanania lanzan*	T	Assessed as Vulnerable in Rajasthan ; Near Threatened in Chhattisgarh and Madhya Pradesh
8	*Celastrus paniculatus*	C	Assessed as Endangered in West Bengal; Vulnerable in Kerala, Chhattisgarh, Madhya Pradesh, Rajasthan and Orissa; Near Threatened in Karnataka, Tamil Nadu and Andhra Pradesh.
9	*Chlorophytum tuberosum*	H	Assessed as Vulnerable in Chhattisgarh, Madhya Pradesh
10	*Cinnamomum sulphuratum*	T	Assessed as Vulnerable in Karnataka, Kerala, and Tamil Nadu. Endemic to West Bengal
11	*Cinnamomum tamala*	T	Assessed as Endangered in Jammu & Kashmir and Vulnerable in Arunachal Pradesh, Meghalaya, Himachal Pradesh and Uttarakhand
12	*Commiphora wightii*	S	Critically Endangered in Rajastan, Madhya Pradesh and Gujarat
13	*Coscinium fenestratum*	C	Assessed as Critically Endangered in Karnataka, Kerala and Tamil Nadu
14	*Decalepis hamiltonii*	C	Assessed as Endangered in Karnataka, Kerala, Tamil Nadu and Andhra Pradesh
15	*Embelia ribes Burm*	C	Assessed as Critically Endangered in AP; Vulnerable in Karnataka, Tamil Nadu and Orissa; Near Threatened in Kerala
16	*Embelia tsjeriam-cottam*	S	Assessed as Vulnerable in Karnataka, Kerala, Tamil Nadu, Maharashtra, Madhya Pradesh, Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Orissa; Near Threatened in Chhattisgarh
17	*Ephedra gerardiana*	S	Assessed as Endangered in Jammu & Kashmir, Himachal Pradesh and Uttarakhand
18	*Garcinia indica*	T	Assessed as Vulnerable in Karnataka and Kerala; Near Threatened in Maharashtra Endemic to Western Ghats.

S. No.	Botanical Names	Habit	Assessed Conservation Status
19	*Gloriosa superba*	C	Assessed as Endangered in Orissa; Vulnerable in Karnataka, Kerala, Andhra Pradesh, Maharashtra, Chhittisgarh, Madhya Pradesh, Jammu & Kashmir, Himachal Pradesh, Uttarakhand, West Bengal and Rajasthan.
20	*Gymnema sylvestre*	C	Assessed as Endangered in Rajasthan; Vulnerable in Andhra Pradesh, Chhattisgarh, Madhya Pradesh and West Bengal; Near Threatened in Maharashtra
21	*Holostemma ada-kodien*	C	Assessed as Critically Endangered in Maharashtra; Endangered in Kerala; Vulnerable in Karnataka and Rajasthan; Near Threatened in Andhra Pradesh and Tamil Nadu
22	*Jurinea dolomiaea*	H	Assessed as Endangered in Jammu & Kashmir, Himachal Pradesh and Uttarakhand
23	*Litsea glutinosa*	T	Assessed as Critically endangered in Andhra Pradesh; Endangered in Jammu Kashmir; Vunerable in Chattishgarh, Madhyapradesh, Himachal Pradesh and Orissa; Near Threatened in Uttarakand
24	*Mesua ferrea*	T	Assessed as Endangered in West Bengal and Orissa
25	*Nardostachys grandiflora*	H	Assessed as Critically endangered in Uttarakhand; Endangered in Arunachal Pradesh, Sikkim and Himachal Pradesh
26	*Nilgirianthus ciliatus*	S	Assessed as Endangered in Karnataka, Kerala and Tamil Nadu; Endemic to Western Ghats.
27	*Operculina turpethum*	C	Assessed as Endangered in Kerala, Maharashtra; Vulnerable in Karnataka, Orissa; Near Threatened in Tamil Nadu, Chhattisgarh and Madhya Pradesh;
28	*Oroxylum indicum*	T	Assessed as Endangered in Kerala, Maharashtra, Rajasthan, Orissa; Vulnerable in Karnataka, Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Arunachal Pradesh, Assam, Meghalaya and Sikkim;
29	*Picrorhiza kurrooa*	H	Assessed as Critically Endangered in Uttarakhand and West Bengal: Endangered in Arunachal Pradesh, Jammu & Kashmir, Himachal Pradesh; Vulnerable in Sikkim; Not evaluated in Assam and Meghalaya
30	*Pseudarthria viscida*	H	Assessed as Vulnerable in Karnataka, Kerala; Near Threatened in Tamil Nadu.
31	*Pterocarpus marsupium*	T	Assessed as Critically Endangered in Rajasthan; Endangered in West Bengal, Orissa; Vulnerable in Maharashtra, Chhattisgarh and Madhya Pradesh
32	*Pterocarpus santalinus*	T	Assessed as Critically Endangered in Andhra Pradesh. Endemic
33	*Rauvolfia serpentina*	H	Assessed as Critically Endangered in Andhra Pradesh, Maharashtra, Chhattisgarh, Arunachal Pradesh,

S. No.	Botanical Names	Habit	Assessed Conservation Status
			Himachal Pradesh; Endangered in Karnaataka, Kerala, Tamil Nadu, West Bengal; Vulnerable in Madhya Pradesh, Assam, Meghalaya, Jammu & Kashmir and Uttarakhand
34	*Rheum emodi*	H	Assessed as Endangered in Jammu & Kashmir, Himachal Pradesh and Uttarakhand
35	*Rheum moorcroftianum*	H	Assessed as Endangered in Himachal Pradesh; Vulnerable in Jammu & Kashmir; Near Threatened in Uttarakhand
36	*Rhododendron anthopogon*	S	Assessed as Endangered in Sikkim, Vulnerable in Arunachal Pradesh, Jammu & Kashmir and Himachal Pradesh; Near Threatened in Uttarakhand
37	*Rubia cordifolia*	H	Assessed as Vulnerable in Andhra Pradesh, Maharashtra, Chhattisgarh and Arunachal Pradesh
38	*Santalum album*	T	Assessed as Endangered in Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra; Vulnerable in Karnataka
39	*Saraca asoca*	T	Assessed as Critically Endangered in Orissa; Endangered in Karnataka, Andhra Pradesh, Maharashtra, Data Deficient in Kerala and Tamil Nadu
40	*Saussurea costus*	H	Assessed as Critically Endangered in Jammu & Kashmir. Endemic to Western Ghats.
41	*Schrebera swietenioides*	T	Assessed as Vulnerable in Karnataka Rajasthan and Orissa
42	*Smilax glabra*	C	Assessed as Critically Endangered in Arunachal Pradesh, Assam and Meghalaya
43	*Sterculia urens*	T	Assessed as Endangered in Rajasthan; Vulnerable in Andhra Pradesh, Chhattisgarh and Madhya Pradesh.
44	*Swertia chirayita*	H	Assessed as Critically Endangered in Jammu & Kashmir, Himachal Pradesh and West Bengal; Endangered in Uttarakhand; Vulnerable in Arunachal Pradesh, Meghalaya and Sikkim.
45	*Symplocos racemosa*	T	Assessed as Critically Endangered in Orissa; Vulnerable in Karnataka and Maharashtra; Near Threatened in Tamil Nadu.
46	*Taxus wallichiana*	T	Assessed as Critically Endangered in Meghalaya, and West Bengal; Endangered in Arunachal Pradesh, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand.
47	*Valeriana hardwickii*	H	Assessed as Vulnerable in Arunachal Pradesh, Meghalaya and Sikkim.
48	*Valeriana jatamansi*	H	Assessed as Vulnerable in Arunachal Pradesh, Meghalaya, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand.
49	*Vateria indica*	T	Assessed as Vulnerable in Karnataka, Kerala and Tamil Nadu; Endemic to Western Ghats.

5.7. COLLECTION OF WILD MEDICINAL PLANTS: COMMUNITY BASED PRACTICES TOWARDS SUSTAINABLE HARVEST

Wild collection of medicinal plants forms a key source of cash income to millions of households across the country. Herb gatherers are known to eagerly wait for the next season of collection and schedule their activities around wild collection of medicinal herbs. For long, most of such wild collection has been sustainable with local communities knowing when and how much to collect. Although many of such sustainable harvest practices are on the vane due to increasing commercial demand and growing individualism in the society, some communities, one of which is cited below, are still religiously following the age old practices of wild collection, contributing to the conservation of wild medicinal plant resources.

Deodi, Tangnu and Janglik villages in Khashdhar Range of Rohru Forest Division form one of the most interior village clusters in Shimla district of Himachal Pradesh. The area remains under severe cold and snow for almost six months every year. The key activities of the villagers revolve around stocking provisions for themselves and for their livestock for these six months. Wild harvest of medicinal herbs forms one of the important sources of cash income for these communities.

Their area, however, opens for wild harvest only once in four years under the prescribed management regulations. The communities, instead of rushing to the alpine meadows immediately on opening of the area for wild collection to maximize collection of medicinal herbs, lay their faith in the local devta (deity), the 'Jakh Sa'ab' that decides the date of start of wild collection and the number of days such collection will be undertaken.

Temple of 'Jakh Sa'ab'

With the area declared opened for wild harvest in 2015, tentative period for starting wild collection of alpine herbs for the year was fixed from 1st week of October and the harvest was to continue for about 20 days. The local people were to pay obeisance to the local deity on the fixed date and were to proceed for wild collection to the alpine meadows. Wild collection in this area is done only by the local people and no hired labour is allowed for the purpose.

The system in vogue in this area ensures equitable chance of wild collection to all households. It also ensures that the collection is made when the plants are fully mature and that the seed has fully ripened. It also ensures that collections are being carried out sustainably under the watchful eyes of elders. The local communities actually did not engage in any harvesting during 2015 due to low projected demand and low procurement rates announced for the year and continuous bad weather. Local communities of two villages in Ladakh have initiated a different type of medicinal plant conservation and sustainable harvest practice. This initiative has been spearheaded by LSTM (Ladakh Society for Traditional Medicine), an NGO, that is helping the local communities in conservation of medicinal plants through awareness campaigns and community organisation. The LSTM plus community initiative has resulted in demarcation of Community Reserves-cum-Sustainable Harvesting areas at Rangdom Village in Zanskar and at Sapi Village in Kargil. The local village committees manage these reserves and regulate the collections from these areas. These

two community reserves have gained local prominence as medicinal plant rich areas and Amchis from far off areas come to these areas for making regulated collections of medicinal plants after paying fee to the village committees.

Such community based medicinal plant conservation initiatives need to be strengthened.

5.8. *IN SITU* CONSERVATION OF WILD MEDICINAL PLANTS - INITIATIVES

As the demand of herbal raw drugs is increasing, the list of wild medicinal plant species under threat is also increasing. The community based traditional practices of sustainable harvest, not able to cope up with the race for maximizing profits from wild collections, are gradually collapsing. The situation calls for urgent focused interventions to arrest the further decline of wild populations of medicinal plant species assessed as 'Red Listed'.

The issue has been sought to be addressed by following a multi-pronged strategy, which includes the following:

5.8.1: Establishment of Medicinal Plant Conservation Areas (MPCAs)

Conservation of Red Listed species in their natural habitat, i.e. *in situ* conservation, is considered to afford the best possible and the cheapest means to conserve on long-term basis the available gene pool of that species. A concept of establishing Medicinal Plant Conservation Areas (MPCAs) in forest areas traditionally known to be rich repositories of medicinal plants was developed at the Foundation for Revitalisation of Local Health Traditions (FRLHT) under the MoEF-DANIDA-FRLHT project. The concept was further refined to develop such MPCAs around viable populations of those medicinal plant species that needed priority conservation action. Starting with a network of 30 MPCAs established in Tamil Nadu, Kerala and Karnataka following the first approach, four more MPCAs were subsequently added following the second approach for focused conservation of *Saraca asoca*, *Coscinium fenestratum*, *Utleria salicifolia* and *Janakia arayalpatra*.

Thematic entrance to MPCA's

The MPCA concept was continued to be followed and MPCAs were established in Andhra Pradesh and Maharashtra under the UNDP supported CCF-I project and in Madhya Pradesh, Rajasthan, Odisha, and West Bengal under the UNDP supported CCF-II project. The MPCA network was further expanded under the recently concluded MoEF-UNDP-GEF project when more MPCAs were established in the states of Arunachal Pradesh, Chhattisgarh, and Uttarakhand. The common thread in the establishment of all these MPCAs is the stellar role of the FRLHT. List of the MPCAs established under all these initiatives is given in table 5.3. below:

Table 5.3. List of Medicinal Plant Conservation Areas (MPCAs) Established under various Projects

S. No.	Name of MPCA	District	Area (ha)	Year of Establishment	No. of recorded Medicinal Plant Species	Program under which Established
Tamil Nadu						
1	Petchparai	Nagercoil	210	1993 - 2003	244	
2	Mundanthurai	Tirunelveli	200	1993 - 2003	267	
3	Kutrallum	Tirunelveli	200	1993 - 2003	288	MoEF-
4	Thaniparai	Tirunelveli	100	1993 - 2003	259	DANIDA-
5	Alagarkovil	Ramanathapuram	250	1993 - 2003	227	FRLHT
6	Kodaikanal	Madurai	115	1993 - 2003	85	Project
7	Kodikarai	Nagapattinum	252	1993 - 2003	288	
8	Topslip	Coimbatore	229	1993 - 2003	189	
9	Kollihills	Salem	200	1993 - 2003	231	
10	Kurumbaram	Kanchipuram	108	1993 - 2003	317	
11	Thenmalai	Tiruvannamalai	150	1993 - 2003	320	
12	Nambikoil	KMTR	400	1993 - 2003	146	
Kerala						
13	Agasthiarmalai	Thiruvanantha-puram	174	1993 - 2003	217	
14	Triveni	Pathanamthitta	308	1993 - 2003	208	
15	Eravikulam	Idukki	200	1993 - 2003	83	MoEF-
16	Peechi	Thrissur	156	1993 - 2003	275	DANIDA-
17	Athirapally	Thrissur	112	1993 - 2003	234	FRLHT
18	Silent Valley	Pallakad	206	1993 - 2003	205	Project
19	Waynad	Wyanaadu	148	1993 - 2003	163	
20	Kulamavu	Idukki	*	1993 - 2003	182	
21	Anappady	Pallakad	*	1993 - 2003	271	
Karnataka						
22	BRT Hills	Mysore	150	1993 - 2003	259	
23	Talacauvery	Madikeri	80	1993 - 2003	255	
24	Savandurga	Bangalore	280	1993 - 2003	314	
25	Subramanya	Mangalore	200	1993 - 2003	220	
26	Charmadi	Mangalore	283	1993 - 2003	310	MoEF-
27	Devrayandurga	Tumkur	178	1993 - 2003	140	DANIDA-
28	Kudermukh	Chikmagalur	110	1993 - 2003	238	FRLHT
29	Kemmangundi	Chikmagalur	310	1993 - 2003	184	Project
30	Agumbe	Shimoga	210	1993 - 2003	270	
31	Devimane	Karwar	210	1993 - 2003	259	
32	Sandur	Bellary	350	1993 - 2003	238	
33	Karpakapalli	Bidar	150	1993 - 2003	150	
34	Kollur	Udupi	*	1998 - 2001	231	
Andhra Pradesh						
35	Mallur	Warangal	197	2001 - 2004	225	
36	Sukkumamidi	Kahmmam	200	2001 - 2004	288	UNDP-CCF-I
37	Maredumilli	East Goravari	260	2001 - 2004	214	
38	Lankapakalu	Visakhapatnam	275	2001 - 2004	104	

S. No.	Name of MPCA	District	Area (ha)	Year of Establishment	No. of recorded Medicinal Plant Species	Program under which Established
39	Coringa	East Godawari	350	2001 - 2004	25	
40	Peddacheruvu	Kurnool	220	2001 - 2004	177	
41	K. Kuntlapalli	Anantpur	313	2001 - 2004	266	
42	Talakona	Chittoor	200	2001 - 2004	202	
Maharashtra						
43	Gadmauli	Gadchiroli	200	2001 - 2004	92	
44	Nagzira	Gondia	200	2001 - 2004	81	
45	Bhaskaracharya	Jalgoan	500	2001 - 2004	124	
46	Yedshi Ramling	Osmanabad	100	2001 - 2004	124	
47	Toranmal	Nandurbar	584.59	2001 - 2004	228	
48	Chichkund deo	Nandurbar	180	2001 - 2004	*	UNDP-CCF-I
49	Kayare	Nashik	304	2001 - 2004	*	
50	Amboli	Sindhudurg	267.68	2001 - 2004	146	
51	Navaja	Satara	250	2001 - 2004	152	
52	SGNP Borivali	Thane	244.96	2001 - 2004	180	
53	Gullarghat	Amravati	635.66	2001 - 2004	168	
54	Honya Koli	Pune	592	2001 - 2004	183	
55	Amba	Raigad	150	2001 - 2004	118	
Madhya Pradesh						
56	Bhundakona	Anuppur	200	2008-09	152	
57	Latari Bithali	Balaghat	200	2008-09	129	
58	Chappari	Mandla	248	2008-09	129	
59	Panarpani	Hoshangabad	200	2008-09	143	
60	Shyamgiri	Panna	216	2008-09	169	
61	Kapoornala	Chhindwara	200	2008-09	*	
62	Hinota	Panna	200	2008-09	*	
63	Bhagpura	Khandwa	234	2008-09	*	UNDP-CCF- II
64	Pakka Paaracha	Sehore	200	2008-09	*	
65	BhinsaMukunda	Narsimpur	200	2008-09	*	
66	Narayanapur	Sagar	200	2008-09	*	
67	Nawali & Sawad	Mandsaur	250	2008-09	*	
68	Kupi-Jatashankri	Chhatarpur	200	2008-09	*	
Odisha						
69	Kapilash	Dhenkanal	200	2008-09	333	
70	Tamana	Khurda	200	2008-09	374	
71	Pradhanpat	Deogarh	200	2008-09	162	UNDP-CCF-II
72	Gurudongar	Nuapada	200	2008-09	352	
73	Satkosia	Mayurbhanj	200	2008-09	195	
West Bengal						
74	Tonglu	Tonglu	230	2008-09	254	
75	Dhortrey	Dhotrey	180	2008-09	154	
76	North Rajabhatkhawar	Buxaduar	400	2008-09	249	

S. No.	Name of MPCA	District	Area (ha)	Year of Establishment	No. of recorded Medicinal Plant Species	Program under which Established
77	North Sevoke	10th Mile	100	2008-09	209	UNDP-CCF-II
78	Sursuti	Lataguri	100	2008-09	216	
79	Garhpanchkot	Raghunathpur	250	2008-09	206	
80	Bonnie Camp	Raidighi	300	2008-09	30	
Rajasthan						
81	Ramkunda	Udaipur	300	2008-09	83	
82	Barkochra	Ajmer	71.6	2007-08	49	
83	Gajroop Sagar	Jaisalmer	100	2008-09		
84	Bhanwarkot	Banswara	200	2008-09	93	UNDP-CCF-II
85	Bada Bhakar	Jodhpur	250	2008-09		
86	Kumbhalgarh WLS	Rajsamand	124	2008-09	N	
87	Sitamata WLS	Chittorgarh	N.A.	2008-09	106	
Chhattisgarh						
88	Tiriya	Bastar	*	2009	*	
89	Bhatwa	Bastar	*	2009	*	
90	Jabara	Dhamtari	*	2009	*	MoEF-
91	Bandhatola	Rajnandgaon	*	2009	*	UNDP-GEF
92	Amadob	Bilaspur	*	2009	*	Project
93	Ghatpendari	Surguja	*	2009	*	
94	Patiya	Jashpur	*	2009	*	
Arunachal Pradesh						
95	Tezu -	Lohit	*	2009	*	
	Parsuramkund					
96	Roing- Mayodia	Lower Dibang Valley	*	2009	*	MoEF-
97	Kanubari -	Tirap	*	2009	*	UNDP-GEF
	Wannu					Project
98	Bomdila	West Kameng	*	2009	*	
99	Hake-Tari	Lower Subansiri	*	2009	*	
100	Lumla	Tawang	*	2009	*	
101	Dakpe	Daporijo	*	2009	*	
Uttarakhand						
102	Kandara	Utarkashi	*	2009	*	
103	Gangi	Tehri Garhwal	*	2009	*	
104	Jhuni	Bageshwar	*	2009	*	MoEF-
105	Mandal	Chamoli	*	2009	*	UNDP-GEF
106	Khaliya	Pithoragarh	*	2009	*	Project
107	Mohan	Almora	*	2009	*	
108	Bastiya	Champawat	*	2009	*	

As per the original concept, MPCAs were to be 'sanctum sanctorum' or 'hands off' areas, from where no removals of medicinal plants was allowed. Management of invasive alien species, fire protection and soil and moisture conservation were the only activities permissible in the MPCAs. To compensate the local communities for the rights forgone over these areas, other activities like developing medicinal plant nurseries, paying to the community group for management of the

MPCAs, etc. were included in the program as incentive. At some places, Medicinal Plant Development Areas (MPDAs) were also delineated around the MPCAs as buffer areas to provide facility to the local communities for harvest of medicinal plants. However, such buffer areas were not available around all the MPCAs.

5.8.2: NMPB Supported Medicinal Plant Conservation and Development Areas (MPCDAs)

The National Medicinal Plants Board has developed a modified concept of medicinal plant conservation through establishment of MPCDAs where the elements of augmentation of natural populations of Red Listed medicinal plant species and their sustainable utilization has been added to the original concept of MPCAs. Under this program, the Board is providing funding to the State Forest Departments for conservation and development of medicinal plants in the states, with a special focus on the Red Listed medicinal plant species. It is under this initiative that MPCDAs are at various stages of establishment in different states. List of such MPCDAs is given in table 5.4:

Table. 5.4. List of NMPB supported Medicinal Plant Conservation and Development Areas

S. No.	Name of MPCDA
Nagaland	
1	Jalukie Village Peren Dist.
2	Changtonya Mokokchung Dist.
3	Chipvu Lurho Park
4	Intanki National Park Peren
Mizoram	
5	Bilkhawthlir Kolasib Div.
6	Vairengte Kolasib Div.
7	Humunpui ram Thenzawl Div.
8	Sialsik range Thenzawl Div.
Gujarat	
9	Mangvana Kutchh Circle
10	Gugliayna Kutchh Circle
11	Thravda Kutchh Circle
12	Ler Kutchh Circle
13	Mathal Kutchh Circle
14	Tharvada
Sikkim	
15	Lashar Valley Lachen
16	Latui RF East Sikkim
17	Mangrhing RF South Sikkim
18	Bhudang, Jhum W. Sikkim
Maharashtra	
19	Ambewadi Nashik range
20	Comptt 146 Mandavi range
21	Mendhavan Somata range
22	East Melghat Ghatang range
23	Chilkhadra Ghatang range
24	Wardha
25	Pilapur
26	Ajneneri
27	Chandanapuri
28	Comptt 191 Mendhavan
29	Comptt 192 Mendhavan
30	Vehelpaha Comptt 375
31	Vihali Comptt 284
32	Chandanapuri
Himachal Pradesh	
33	Dhel Thatch, GHNP, Kullu
34	Dodra, Shimla
35	Chhitkul, Kinnaur
36	Kukumseri, Lahaul Valley
37	Modda Ka Tibba, Sirmour
Tamil Nadu	
38	Edmankarai Mannavannur
39	Thalavukanal Poombarai
40	Jamendar Berijam
41	Deramandu Perumpallam
42	Kumbakarai Devadanapatty
43	Kollimalai
44	Kurumbavam
45	Azhagarkoil
46	Thanipparai
47	Mundanthurai
48	Nambikoil
49	Point Calimere
50	Topslip
51	Pechiparai
Madhya Pradesh	
52	Bhind
Karnataka	
53	Shrigunj
54	Kodambale
55	Achwe
56	Mahime
57	Jankadkal
Manipur	
58	Khangkhuikulle Ukhrul
59	Kailam Churachandpur
60	Langol Imphal
West Bengal	
61	Panchanai
62	Phalut
63	Rechela
64	Bichabhanga
65	North Rajabhatkhawa
66	Kankrajhore
67	Susunia
Haryana	
68	Rasulpur RF
Karnataka	
69	Channarayanadurga Koratage range 1
70	Channarayanadurga Koratage range 2
71	Thimalapura 1 Madhugiri range
72	Thimalapura 2 Madhugiri range
73	Thimalapura 3 Madhugiri range
74	Thimalapura 4 Madhugiri range
75	Kunda SF Honnethala
76	Nantur Shimoga

Details pertaining to area of the above mentioned MPCDAs and the floristic inventorisation of these areas were reported to be under finalization. Field enquiries from the concerned state authorities in Himachal Pradesh revealed that their effort had been to establish the MPCDAs around viable populations of priority Red Listed medicinal plant species. The exercise entailed extensive field surveys to locate viable populations of priority Red Listed medicinal plant species, and these surveys resulted in locating good wild populations of *Gentiana kurroo*, *Colchicum luteum*, *Betula utilis*, *Aconitum* spp., *Fritillaria roylei* and establishment of MPCDAs respectively at Modda ka Tibba, Kukumseri, Chhitkul, Dodra, and Dhel Thatch for these species. These MPCDAs also bear good wild populations of many other threatened species including *Trillidium govanianum*, *Polygonatum cirrhifolium*, *Rhododendron anthopogon*, *Podophyllum hexandum*, *Habenaria edgeworthii*, and *Habenaria intermedia*, etc.

5.8.3: Protected Area Network and Conservation of Red Listed Medicinal Plants

India has established a strong network of 108 National Parks, 528 Wild Life Sanctuaries, and 65 Conservation Reserves under the provisions of the Wildlife (Protection) Act, 1972 for conservation of wildlife. Even as the major conservation focus of these protected areas is on keystone animal species, the conservation efforts also include protection and management of habitats. Most of these areas are free from the burden of community rights or have limited community rights of extraction of bio-materials. Since these habitats also include medicinal plants, it is assumed that many medicinal plant species might be getting protected here. However, evaluation of such incidental protection of medicinal plant species is required.

5.8.4: *In Situ* Conservation: Way Forward

The initiatives listed at 5.8.1 and 5.8.2 need to be further strengthened by establishing MPCAs for the remaining Red Listed species. Protocols to periodically monitor and evaluate the efficacy of these sites in conserving the threatened wild populations of medicinal plant species are also needed to be put in place.

Since medicinal plants would continue to be harvested from the wild, it is desirable that appropriate inputs be made for strengthening the wild populations of the threatened medicinal plant species in their natural habitats. The local communities traditionally engaged in harvesting of these medicinal plants for self use or sale would need to be involved in such initiatives. There exists an instrument of Joint Forest Management (JFM) under which the local communities can be made responsible for management of the given patch of forest, where the communities can, with the local forest department, grow native trees, shrubs and herbs and share the benefits of the produce on harvest. It would be very useful to make use of this JFM instrument and create 'Community Medicinal Plant Reserves' (CMPRs), to be managed by the local community.

6

Supply of Herbal Raw Drugs from Cultivation

Cultivation of medicinal plant species like Isabgol (*Plantago ovata*), Senna (*Senna alexandrina*), Ashwagandha (*Withania somnifera*), and Kuth (*Saussurea costus*) has since long established in the country with the entire commercial demand of these entities being met from cultivation. The dwindling wild populations of many wild collected medicinal plant species due to harvesting pressure has prompted the government agencies like NMPB and the domestic herbal industry to promote cultivation of these species. These promotional efforts have resulted in bringing many medicinal plant species under successful cultivation. Some of these species are *Piper longum* for fruiting spikes and roots; *Chrysopogon zizanioides* for vetiver roots; *Uraria picta* for roots called 'prshniparni'; *Acorus calamus* for 'bach'; *Phyllanthus amarus* for aerial parts called 'bhumiamla'; *Centella asiatica* for leaves called 'mandukparni'; etc. Whereas NMPB's subsidy scheme has played a definite role in promotion of cultivation of medicinal plants, it is the active part played by local CBOs/ NGOs in organizing farmer clusters and in providing technical and marketing support that has made cultivation of many medicinal plants a profitable venture. The role of the CBOs/ NGOs needs to be acknowledged for further promotion of the medicinal plants cultivation. It is also necessary to engage research organizations on long-term basis for development of high quality planting material of the prioritized medicinal plant species for cultivation. The complex and state-specific rule position related to cultivation of medicinal plants needs to be simplified. Appropriate modifications in the notifications issued under section 38 of the Biological Diversity Act, 2002 need to be brought in to promote cultivation of listed species.

6.1. INTRODUCTION

India has a long history of domestication and cultivation of medicinal plant species. Some of the important medicinal plant species under domestication and cultivation since long are Neem (*Azadirachta indica*), Gritkumari (*Aloe vera*), Tulasi (*Ocimum tenuiflorum*), Marua (*Ocimum basilicum*), Sehanjan (*Moringa oleifera*), Kari Patta (*Murraya koenigii*), Mehndi (*Lawsonia inermis*), etc. Such cultivation was, however, limited to a few species only and a large diversity of herbal raw drugs needed by the domestic herbal industry was being collected from the wild resources from different parts of the country. Ved and Goraya (2008) reported that out of the 178 herbal raw drugs being traded in large quantities, only 36 species were wholly or partially sourced from the cultivated sources and of these Isabgol (*Plantago ovata*) and Senna (*Senna alexandrina*) formed the major entities sourced entirely from cultivation.

It was in the early 1950s that concerns started to be expressed about the quality and decreasing availability of the wild collected medicinal herbs to the growing domestic herbal industry. Concerns were also being raised about some herbal raw drugs that were being regularly imported at an avoidable cost to the nation. It was to examine these issues that the Ministry of Commerce and Industry, Government of India in 1954 set up a Pharmaceutical Enquiry Committee. One of the key recommendations of this Committee was to initiate immediate steps to organize cultivation of medicinal plants in a scientific manner. The Committee further recommended designating and supporting nodal agencies for collection, storage and marketing of medicinal plants. The recommendations of the Pharmaceutical Enquiry Committee led to a joint meeting of the Medicinal Plants Committee of the ICAR, the Pharmaceutical and Drugs Committee of the CSIR and the Pharmacology Committee of the ICMR during February 1956 wherein need for bringing medicinal plants species under scientific cultivation was reiterated (Chopra *et al*., 1957). A Central Indian Medicinal Plants Organisation (presently CIMAP, Lucknow) was thereafter established in 1959 under the auspices of CSIR to coordinate medicinal plants cultivation program in the country. Four regions i.e. Kashmir (Presently Jammu & Kashmir), Assam, Madras (presently Tamil Nadu) and Bengal (presently West Bengal) were identified to launch pilot programs for medicinal plants cultivation. These regional centres did undertake cultivation trials on a number of medicinal plant species that were either under import or were perceived to be under threat of extinction. Selection and development of germplasm with higher alkaloid content was also taken as one of the key research subjects during these cultivation trials.

Alongside these research efforts on cultivation of medicinal plants, consolidation of cultivation of some medicinal plant species was going on simultaneously which resulted in bringing under significant cultivation species like Isabgol (*Plantago ovata*), Ashwagandha (*Withania somnifera*), 'bach' (*Acorus calamus*), 'vasaka' (*Adhatoda zeylanica*), 'kuth' (*Saussurea costus*), 'vetiver' (*Chrysopogon zizanioides*), etc. However, despite these successful cultivation efforts, long drawn trials at standardizing agro-techniques of many medicinal plant species, the reliance upon wild resources did not reduce much. Ved and Goraya (2008), on the basis of comprehensive data analysis in respect of herbal raw drug entities consumed by domestic herbal industry in large quantities, reported that in the year 2005-06 more than 80% of the herbal raw drugs, both by species diversity and by volume, continued to be sourced from the wild.

6.2. RENEWED INTEREST IN CULTIVATION OF MEDICINAL PLANTS

The growing concerns and worries about the fast dwindling wild resources, increasing consciousness about the product quality, the ever increasing outflow of precious foreign exchange

to procure herbal raw drug entities from other countries, and non-acceptance of value added products in other countries unless certified as to the source and sustainable harvest regimes, have prompted a renewed interest in the cultivation of medicinal plants.

The continued medicinal plants related research and extension programs at CIMAP and other national organizations had resulted in developing high yielding cultivars in respect of species like 'amla', 'mentha', 'tulasi', etc. that helped in firmly establishing cultivation of these species in many parts of the country. Some of the medicinal plant species for which high yielding/ better quality varieties have been developed by selection, hybridization or mutations and released are as under:

S. No.	Name of Species	Variety	Released in	Developed by
1	*Plantago ovata*	Gujarat Isabgol-1	1976	Gujarat Agricultural University, Anand
		Gujarat Isabgol-2	1983	Gujarat Agricultural University, Anand
		Haryana Isabgol-5	-	Haryana Agricultural University, Hisar
		Jawahar Isabgol-4	1996	College of Agriculture, Mandsaur
		Neeharika	1998	CIMAP, Lucknow
2	*Withania somnifera*	Jawahar Asgandh-20	1989	College of Agriculture, Mandsaur
		Jawahar Asgandh-134	1998	College of Agriculture, Mandsaur
		Poshita	2001	CIMAP, Lucknow
		CIM-Pratap	2011	CIMAP, Lucknow
3	*Senna alexandrina*	Anand Late Selection	1989	Gujarat Agricultural University, Anand
		Sona	1997	CIMAP, Lucknow
4	*Chrysopogon zizanioides*	Hyb-8	-	NBPGR, Pusa Campus, New Delhi
		Dharini	1998	CIMAP, Lucknow
		Gulabi	1998	CIMAP, Lucknow
		Kesari	1998	CIMAP, Lucknow
5	*Bacopa monnieiri*	Subodhak	1999	CIMAP, Lucknow
		Pragyashakti	1999	CIMAP, Lucknow
		CIM-Jagriti	2007	CIMAP, Lucknow
6	*Centella asiatica*	Kayakrit	1999	CIMAP, Lucknow
		Majjaposhak	1999	CIMAP, Lucknow
7	*Glycyrrhiza glabra*	Haryana Mulhatti-1	1989	Haryana Agricultural University, Hisar
		Mishree	1997	CIMAP, Lucknow
8	*Catharanthus roseus*	Nirmal	-	Haryana Agricultural University, Hisar
		Prabal	2001	CIMAP, Lucknow
9	*Valeriana jatamansi*	Dalhousie clone	1994	UHF, Nauni, HP
		Himbala	2006	IHBT, Palampur, HP
10	*Commiphora wightii*	Marusudha	1997	CIMAP, Lucknow
11	*Ocimum basilicum*	Vikarshudha	1999	CIMAP, Lucknow
		Kusumohak	1999	CIMAP, Lucknow
		CIM-Saumya	2003	CIMAP, Lucknow
		CIMAP-Sharada	2015	CIMAP, Lucknow
12	*Hedychium spicatum*	Himkachri	2006	IHBT, Palampur, HP

S. No.	Name of Species	Variety	Released in	Developed by
13	*Acorus calamus*	CIM-Balya	2006	CIMAP, Lucknow
14	*Mentha arvensis*	Kosi	1999	CIMAP, Lucknow
		CIM-Kushal	2002	CIMAP, Lucknow
		CIM-Saryu	2010	CIMAP, Lucknow
		CIM-Kranti	2013	CIMAP, Lucknow
15	*Mentha piperata*	CIM-Madhuras	2004	CIMAP, Lucknow
		CIM-Indus	2005	CIMAP, Lucknow
		CIM-Patra	2010	CIMAP, Lucknow

Source: Maiti (2006) & intranet.cimap.res.in/cimvariety (accessed in July 2016)

However, these efforts somehow missed the wild collected species, availability of which was declining. The all important focus on the real time threat to wild collected native medicinal plant species was developed by the Foundation for Revitalisation of Local Health Traditions (FRLHT), a Bangalore based non-government organization working on medicinal plants since 1993. Lists of medicinal plant species under threat of extinction on account of unsustainable harvesting were developed using globally accepted threat assessment criteria. Many State Forest Departments, taking clue from the threat lists, initiated limited but sure programs to augment wild resources of medicinal plant species assessed threatened for their states. For example, the Andhra Pradesh Forest Department took up resource augmentation of 'magali' (*Decalepis hamiltonii*) in a big way, the Karnataka Forest Department initiated large scale plantations of 'ashoka' (*Saraca asoca*), and the Rajasthan Forest Department initiated nursery trials on 'guggul' (*Commiphora wightii*).

Cultivation of medicinal plant species got a national fillip with the setting up of a dedicated national body, the 'National Medicinal Plants Board' (NMPB) in November 2000, to address issues related to conservation and development of medicinal plants in the country. The NMPB has been promoting cultivation of medicinal plants under a subsidy scheme since its inception. Starting with a list of 32 medicinal plant species, notified under this scheme during 2006-07, the Board now supports cultivation of 116 species with three sets of subsidy regimes for three different sets of species (NMPB, 2012), which is 20% for 59 listed species, 50% for 38 listed species and 75% for 19 listed species. Most of these listed species are native to India and are either in high demand or are assessed as threatened. The Board is promoting cultivation of medicinal plants under a Centrally Sponsored Scheme, titled the 'National Mission on Medicinal Plants', which is being implemented through the National Horticulture Mission (NHM), Ministry of Agriculture. The Board is also promoting research on developing viable agro-forestry models for integrating medicinal plants with conventional agri-crops and horti-crops. Various research organizations have been involved in developing such models through establishing trials on farmers' fields for quick dissemination.

Domestic herbal industry also seems to have come to realize the importance and urgency of shifting their herbal raw drug procurement from wild to cultivated sources. Dabur India Ltd., Natural Remedies, Himalaya Drug Company, Sami Labs, Patanjali, Sri Baidyanath, Emami, and Ipca Laboratories are some of the companies that have already made a good beginning in this area and have created farmer clusters in different parts of the country for cultivation of medicinal plants according to their priority. The initiative by the domestic herbal industry has resulted in bringing an estimated 5000 ha of farm land under medicinal plant cultivation. The 'Gram Mooligai

Company Ltd.', a special community owned initiative, has also been promoting cultivation of selected medicinal plants and helping communities in their remunerative disposal over the past more than 15 years.

Some extraneous circumstances have also prompted a large number of farmers to opt for medicinal plant cultivation. Susceptibility of traditional agricultural crops to vagaries of nature and increasing vulnerability of these crops to damage by wild animals are some of these reasons.

6.3. CASE STUDIES OF MEDICINAL PLANTS UNDER CULTIVATION

Various sites under stabilized cultivation of medicinal plants were visited and first hand information about the experiences of farmers and the local level hand holding agencies gathered.

6.3.1. Cultivation of Kuth (*Saussurea costus*)

'Kuth' is dried roots of *Saussurea costus*, a plant assessed as Critically Endangered in its natural habitat and included in Schedule-VI of the Wildlife (Protection) Act, 1972. Reported to occur wild in India in small pockets only in Kashmir, the plant was taken up for cultivation in 1940s in Lahaul valley of Himachal Pradesh. The plant has ever since adapted well in the cold dry conditions of the Lahaul valley and has become a part of the local agricultural practices.

'Kuth' is a 3-year crop that is raised from seed. Seed is sown in the month of either November (more common) or May (less common) in rows in well ploughed fields having deep sandy loam soil. The farmers engaged in 'kuth' cultivation, maintain crops of one year, two year and three years on their fields to maintain the extraction cycle. The crop, depending upon the rainfall, requires 4-6 irrigations (1 each in June and September and 2 each in July and August).

Harvesting of 'kuth' is done during September-October. Leaves of the plants are cut 10-15 days before digging of roots is taken up. The cut leaves are collected and stored to be used as fodder during winters. Roots are dug up manually with the help of pickaxes. Average production per bigha is about 500 kg fresh weight and the farmers get about ₹ 10,000 per 'mand' (40 kg) of dried produce at the current prices. The dug up roots are usually put to drying immediately after harvest without any washing. However, now a trend of washing the roots before drying is also picking up. The washed roots are spread on roof tops, on sheets, or in the fields for drying and it takes between 20-30 days for complete drying of the produce. The larger roots are also cut into pieces to facilitate drying.

'Kuth' fields and 'Kuth' harvest

Cleaning, sizing and drying of 'Kuth' in Miar Valley, Lahaul, HP

The dried roots are transported to Kullu valley in November before the Rohtang Pass closes due to snowfall for 5-6 months. The material is cleaned, graded and packaged in jute bags @ 50 kg per bag (total bag weight = 51.100 kg to account for the weight of jute bag) in Kullu valley by the 'Kuth' dealers for domestic supplies. Total current annual production of 'Kuth' from the Lahaul valley is estimated to be about 60 MT of which about 3 MT of the graded material is said to be exported. Lahaul Kuth is considered to be better than the one cultivated in Kullu valley of Himachal Pradesh, Uttarakhand, or in China.

At present only about 150 ha area is under 'kuth' cultivation in Lahaul valley. The crop seems to have good potential demand for domestic consumption as well as for export. The farmers also expressed their interest in 'kuth' cultivation as it helps them in deep digging of soil and its periodic upturning to maintain productivity. Two issues, however, keep many farmers away from adopting 'kuth' for cultivation. The first is related to the procedural complexities involved in 'kuth' cultivation and trade due to its inclusion under the Wildlife (Protection) Act, 1972 and its inclusion in Appendix-I of the IUCN. The second issue is related to the transport of the dried material out of the valley before snowfall blocks Rohtang Pass. If the farmers fail to transport the material before snowfall, they have to keep the material with them over entire winter months, blocking payment to them. It was suggested during interaction with farmers and traders that some drying facility created in Kullu valley might help them in transporting fresh material out of Lahaul valley before snowfall.

Cleaning, grading and packaging of 'Kuth' in trader's godown

Cultivation of 'kuth' has also been promoted in Uttarakhand, where it is cultivated in about 100 ha with estimated annual production of about 40 MT per year. Pilot cultivation of 'kuth' has also been reported from Gonkhang area of Tawang in Arunachal Pradesh.

6.3.2. Cultivation of Pippal Mool (*Piper longum*) in Andhra Pradesh

Pippal Mool, the dried roots of *Piper longum*, form one of the important raw drugs used in Indian Systems of Medicine. Market survey and interaction with traders revealed that major supplies of 'pippal mool' are obtained from cultivation in Andhra Pradesh and Odisha. A field visit was undertaken to Vaddathi Madugula Mandal, known for cultivation of 'pippal mool', in Visakhapatanam district of Andhra Pradesh to understand the cultivation practices. The taluk is known to produce 75% of the 1000 MT of 'pippal mool' produced in the entire Vishakhapatnam district.

'Pipallu modi', as 'pippal mool' is popularly known in the local dialect, is cultivated largely by the tribal people inhabiting the hilly villages and tribal hamlets of Paderu, Hukumpetta, Pedha bayalu, Arakku, Gangaraju Madugula, Munchangi puttu, GK Veedi, Nakkalaput, Dumbri guda, Chintapalli and Sileru in Vishakhapatnam district. The area under 'pippal mool' cultivation in each of these villages varies from 10 to 200 acres (4 to 80 ha). Per farmer cultivation in the area varies from less than a bigha to 2 acres.

Cultivation of Pippal Mool around Madugula in Andhra Pradesh

The entire 'pippal mool' cultivation is organic, as only cow and buffalo dung is used as manure and no chemical fertilizer or pesticide is used. Cultivation practice involves cutting and storing the aerial portion of the plant as seedling for the next planting season. It is a 2-year crop. The farmers cut all the aerial portions comprising the stems and male spikes after one year to promote larger spread of roots and for better yield. The roots are dug up between November to January with agricultural implements for sale in the nearby Santha (local market). It is observed in the field that all the plants cultivated for 'pippal mool' are the male plants. It came as a surprise that none of the cultivators had seen the female plant or was aware of the female Pippali spikes. 1 acre of cultivation yields about 1500 kg of roots and the average sale rate of dried roots is ₹ 100 per kg in the local Santha. The whole sale local traders buy the material from the Santhas and process it further for sale to end users.

The procured 'pippal mool' is properly dried and broadly graded in to 3 quality classes by the local traders. The grade type-3 material, known as Nalaka and comprising of small thin adventitious roots, is priced at about ₹ 30 per kg. The grade type-2 material, known as Putras and comprising of small thick roots cut little away from the main roots, is sold for an average of ₹ 100 per kg. The grade type-1 material, known as Enchu and comprising of thick roots possessing strong taste and containing higher piperin content, is sold at ₹ 250 to ₹ 300 per kg. Shri Karnam Venkata Krishna Rao, popularly known as Madras Krishna Rao (mobile no.: 09491572699), Proprietor, Devi Prasad Industries, Vaddathi Madugula, Vishakhapatnam and in the business for 2 generations, trades

Pippal Mool in 17 different grades and exports about 100 MT of 'pippal mool' roots annually. In addition to Shri Rao, the village has many more 'pippal mool' traders with about 10 traders exporting between 50 to 100 MT of roots annually; about 10 traders selling about 10 MT of roots annually and 30 to 40 small traders selling about 500 kg of roots per year to meet mainly local supplies.

Sizing, grading and packaging of Pippal Mool

It came out from the traders that the produce from Andhra Pradesh accounted for only 30% supply of 'pippal mool' with the remaining 70% coming from Kanta, Vanakadilli, Kincharala, Taruva, Kiluva, Vuppapada, Koraput, Jaipur and Rayagada districts of Odisha. In all, 'pippal mool' was being cultivated over about 2000 ha in these two states.

6.3.3. Cultivation of Vetiver (*Chrysopogon zizanioides*) in Tamil Nadu

Some progressive farmers in Nochikadu, a coastal village located along the Coromandel Coast of India, 13 Km from Cuddalore, in Tamil Nadu have taken to 'vetiver' cultivation to offset their decreasing returns from the conventional agricultural crops like groundnut, cashew, onion, and paddy. Mr. R. Bhaskar, s/o Mr. Rathakrishna Padayachi of this village is one such farmer (mobile: 9751113931) who switched over 'vetiver' cultivation about 20 years back. 'Vetiver' is known locally as 'vilamichchi ver', and as 'ramachcham' in Kerala and 'lavachcham' in Karnataka. His success prompted other farmers in the village to adopt 'vetiver' as one of the crops in their regular agri-practices. Presently almost all farmers in the village cultivate 'vetiver' over a collective area of about 100 ha. Another about 100 ha of 'vetiver' cultivation is now taking place in the adjoining villages of Naduthittu (40 ha), Thiyagavalli (20 ha), Periyapattu (20 ha) and Aandikuzhi (20 ha). Major areas of 'vetiver' cultivation in southern India, however, is in Kerala where it is extensively cultivated in the coastal areas like Malappuram, Ponnani, Palapatti, Savakkadu, Guruvayur and Kozhikodu.

The original planting material for 'vetiver' cultivation in Nochikadu village was brought from Kerala. Now almost all farmers maintain their own seeding stock selected from the best rattans of each clump. For planting in 1 acre, 15 sacks of seedlings are required and 1 sack contains about 4500 seedlings. The separated seedlings can be stored up to 15 days. After planting, till harvesting period, daily irrigation is essential. As the fields are located chiefly along the coastal area, even 7 metre deep borewells are enough for such irrigation.

In a day, 3 acres of crop can be irrigated through sprinkler. No major insect/ pest attack has been reported except occasional mealy bug and white fly attacks and such attacks are addressed by spraying neem oil mixed with monocrotophos on leaves. The right season for new planting is between June to July. However, based on demand the planting can be done at any time of the year. The roots are usually harvested after one year of planting when good oil content gets accumulated in the roots. However, based on demand, harvest is sometimes done even after 8 months of planting.

Cultivation, Harvesting & Post-Harvest Handling of Vetiver

Harvesting of the roots is now done with Hitachi Buckling, a hydraulic excavator, as it takes much less time for harvesting, and saves the farmers from the labour problems. It is also believed that damage to the roots is less if harvesting is done with machine. Roots of different maturity, cleanliness and colour fetch different prices. The roots harvested between 6 to 8 months of planting are usually white in colour and sell for about ₹ 90 per kg, whereas the ashy-white to reddish tinged roots harvested after 10-12 months of planting sell for ₹ 100-110 per kg. The washed and cleaned roots sell for still higher prices of about ₹ 125 per kg. Well dried material can be safely stored for one year without any loss in quality. The dried roots are bundled in pressing machines, each bundle weighing 45-50 kg. The bundles are usually sold through herbal mandis located in Tamil Nadu, Pondicherry, Kerala and Karnataka. An average annual quantity of about 500 MT is traded from this village cluster only.

As an average yield of 2-2.5 MT of roots is obtained per hectare of 'vetiver' cultivation. 10% wastage on account of incomplete digging and loss during cleaning and bundling is considered acceptable. The crop is considered profitable if produce sells at prices above ₹ 90 per kg.

Pilot cultivation of 'vetiver' has also been reported from Assam. Dabur Herbal Farm, Sandila, Uttar Pradesh has successfully culminated trials on 'vetiver' cultivation under alkaline (pH 9-10) and water logged conditions. The pilot experiment carried out on 10 ha land has resulted in a yield of 2-2.5 MT of dried roots. Asha Gramodyog Sansthan, Lucknow has also promoted Vetiver cultivation in Uttar Pradesh over about 50 ha. The farmers here add value to the produce before selling. The dug up roots are washed and taken to distillation units set up primarily for Mentha, subjected to distillation and oil extracted. An average of 16 kg (12-20 kg) of Vetiver oil is recovered per ha. The current sale price of Vetiver oil is about ₹ 14,000 per kg.

6.3.4. Cultivation of Vettiver Coleus (*Plectranthus vettiveroides*) in Tamil Nadu

Vettiver Coleus (*Plectranthus vettiveroides*), locally known as 'vettiver' or 'black iribeli' and called 'harivera' in Sanskrit, has been under cultivation in the sandy-loam soils along river Cauvery in some villages of Sirkali Taluka in Nagapattinam district of Tamil Nadu for long for its dried aromatic roots, that have been traditionally used to make garland to decorate deities in temples in the state. The roots also form key ingredient of many Ayurveda and Siddha formulations. The long, fibrous roots are straw coloured with light fragrance when fresh, but turn blackish with strong aroma on drying. Extensively cultivated in the erstwhile North Arcot, Coimbatore, Madurai, Thanjavur, Tirunelveli and Chengalpet districts of Tamil Nadu, and Palakkad district of Kerala at the turn of the 20th century, cultivation of this species is now limited to a few villages in Nagapattinum and Thanjavur districts over a total area of just about 10 hectare (Murugan *et al.*, 2015).

Mr. S. Sekar, S/o Mr. M. Chellakannu Padayachi, Thillaimangalam Village, Aanaikaaran Chathiram PO., Kollidam Via, Sirkali Taluka, Nagapattinam District (Moblie: 95850 15310) is one of the few farmers who is continuing with the cultivation of Vettiver (Coleus). His family has cultivated 'vettiver' for three generations. Most of other farmers have stopped cultivating this species over

Cultivation, Harvesting & Post-Harvest Handling of Vetiver

the last ten years due to poor returns. As a standard practice, 6 twigs of 10'' length and having 3-4 pairs of leaves are planted together on ridges in well ploughed sandy land. The plants need daily watering in the morning hours. Groundnut oil cake powder is sprayed on the roots after 20 days of planting for which soil is loosened on both sides of the planting ridge. 'Vettiver' is a 3 months crop, but can also be harvested after 80 days of planting. Harvesting requires special attention. Roots have to be washed free of sand through continuous pouring water at the base of the plants. Despite such care, some delicate roots still remain in the soil.

The freshly harvested roots are sold to temples (Nataraja temple at Chidambaram; Murugan temple at Palani; Balaji temple at Tirupathi; Karaikkal Ammaiyar temple at Karaikkal, etc.) in bundles of 12 individual stems (one muttu), where these are used for decorating the idols, added in making of garlands and thatches. About a third of the produce is dried and sold to herbal shops locally and at Chennai for use as herbal medicine at ₹ 150 per kg. The stem portions of the plant are chopped, dried and sold to the small scale cottage industry making Agarbathi (incense sticks). With investment of ₹ 25,000 per acre, a good crop can yield ₹ 75,000 worth of roots after 3 months. Even though cultivation seems to be good economics, the crop needs a lot of labour inputs and therefore its cultivation is being continued by only the passionate farmers. This species, with no known wild populations, has been assessed as 'Extinct in the Wild', is presently known from only its cultivated source. The species is under real time threat of extinction even from cultivation, if the pace at which its cultivation is reducing continues.

The species shares its Tamil name 'vettiver' with the roots of *Chrysopogon zizanioides* (= *Vettiveria zizanioides*) belonging to the grass family and sometimes confused with the same. Thus, with reference to Tamil Nadu, the name 'vettiver' should be attributed only to *Plectranthus vettiveroides*. *Chrysopogon zizanioides*, in Tamil Nadu is known as 'vilamichchiver'.

3.5. Cultivation of Agar *(Aquilaria malaccensis)* in Tamil Nadu

Agar *(Aquilaria malaccensis =A. agallocha),* locally known as Sanchi or Sasi in Assam, is a tree native to north-eastern States in India and is known for yielding very high value oil from its fungal infested wood. In nature, the wood of mature trees is infested by fungus through the tunnels made by the larvae of a stem borer insect (*Zeuzera conferta*). With its natural populations having come under severe threat of extinction due to over exploitation, the species has been listed under the IUCN Red-List, being assessed as 'Vulnerable' globally and 'Critically Endangered' in India. It is now enlisted in Appendix II of the CITES and also in the Negative List of Exports issued by the Ministry of Commerce in India.

The wild populations of the species having been severely depleted, the species has come under extensive cultivation in Assam and other north-eastern states. As per one survey carried out by the Assam Forest Department in 2003, there exist about 9-10 million trees of Agar on private lands. These private plantations have kept the Agar trade live with Hojai (District Nagaon, Assam) being the major hub of Agar trade in India. An estimated more than nine thousand agar distillation units of various sizes are in operation in Assam alone, a very large proportion of these being operated without license.

The lucrative price of agar oil has prompted farmers from other states also to take up Agar plantation. Mr. K. Jothimani, s/o Mr. D. Krishnaswamy Padayachi, Keezhakuppam Village, Nadukuppam PO., Kadampuliyur Via, Panruti Taluka, Cuddalore District of Tamil Nadu has taken initiative to take the plant out of its natural habitat and try it in Tamil Nadu. Based on a newspaper

advertisement, this agriculturist along with his 2 partners, invested ₹ 3 lakhs for procuring 1000 Agar seedlings from Northeast India and planting these over 4 acres of land. He also experimented with intercropping with banana and ground nut (1 time harvest only). He also introduced Pathimugam (*Caesalpinia sappan*), Jack fruit (*Artocarpus heterophyllus*), Teak (*Tectona grandis*), Coconut (*Cocos nucifera*), Mango (*Mangifera indica*), Drumstick (*Moringa oleifera*), Portia (*Thespesia populnea*) and Guava (*Psidium guajava*) trees on his remaining land.

Agar wood cultivation in Tamil Nadu

After 4 years of planting, about 900 trees of Agar plant have survived and established. All the trees were found to have attained an average height of 6 m and each tree has 3-7 individual poles/ trunks. The average girth of each tree is about 50 cm. They shed the leaves during the months of June-July. The soil type of the field is red sandy and the plants are irrigated once in a week. Once in a year Panchakavya (five products from cow i.e. milk, curd, ghee, urine and dung) solution is applied on the roots of the plants. Over the past four years, the fertilization regime followed includes one-time application of 30 sacks (@50 kg. per sack, and ₹ 500 per sack) of natural fertilizer from Idea company, burnt ash of groundnut plants, and 48 tonnes of cow dung. Application of goat dung and urea was noticed to be not suitable, as post this application about 70 trees died.

The farmer informed that he was getting ready to inject the specific fungus to each tree in order to

develop the brown-black coloured wood at the rate of ₹ 4 per pole/ trunk. M/s Kanagaraj, Agarwood Development, Cheyyar, Tiruvannamalai District, Tamil Nadu has been advising the farmer in respect of this plantation. The farmer has been assured that the wood can be harvested after 6 months of injecting the fungus. However, the farmer has spent close to ₹ 8 lakh on this venture and is now calling upon experts to guide him for harvesting and marketing of the produce.

6.3.6. Cultivation of Prshniparni (*Uraria picta*)

Prshniparni, an important constituent of Dashamoola, has been assessed as a threatened medicinal plant species due to massive decline in its wild populations. The FRLHT and the Forest Departments of Gujarat, Uttarakhand, and Maharashtra have been making good efforts for the last more than ten years at locating wild populations of this species, gathering its germplasm and at raising it in their nurseries. Gujarat Forest Department has also initiated a project to augment wild populations of Dashamoola species, including Prshniparni. Organisations like the Forest Research Institute, Dehradun have worked on developing its agro-techniques and plantation models. It was, however, the concerted efforts by the Bio Resources Development Group (BRDG) of Dabur Research & Development Centre that made the journey of this species from forest to farm possible.

The BRDG, with financial support from the NMPB, initiated research on sodium tolerance, phytochemical profile and genetic stability of the 'prshniparni' germplasm collected from different populations in Uttarakhand and Gujarat. The plants were subjected to graded dosing of sodium in the nutrient medium and the tolerant plants were taken up for mass multiplication. Technique for *in vitro* multiplication of the plants with multiplication ratio of 1:5 and survivability of 80% was also standardized. Method for growing plants from seeds giving 85% germination was also standardized. This was followed by developing commercially viable agronomic package that was duly demonstrated to the farmers. The cultivation trials recorded substantial high yields of aerial parts for UP-3 accession over other accessions.

The average first year yield of the aerial parts is recorded as about 1.2 MT per ha. However, the yield of the ratoon crop is five times higher than the first crop. BRDG has, in collaboration with Asha Garmudyog Sansthan, Lucknow, has promoted its cultivation and presently some 60 farmers in Kushinagar district in Uttar Pradesh are growing 'prshniparni' over about 20 hectares of their land. Trials to introduce its cultivation in Lucknow district have also been initiated by the Asha Garmudyog Sansthan.

Prishiniparni cultivation in U.P.

6.3.7. Cultivation of Bach/ Sweet flag (*Acorus calamus*)

"The roots (harvested produce) from the 'sweet flag' fields irrigated with underground water are more aromatic than the ones irrigated with sewage water...", says Mr. Rajanna, a farmer from Kuntammana Thota near Bheemasandra village in Tumkur district of Karnataka, showing the long flagellate roots of Sweet flag freshly harvested from his field. He further explained that the 'sweet flag' required year round irrigation and copious green manure to ensure good quality produce having thick white pith and good returns. Sweet flag is cultivated over 125 ha in Tumkur and Koratgere taluks in Tumkur district of Karnataka. The 'sweet flag' cultivated in this region is traditionally known to be of high quality and much sought after by the Ayurveda physicians and domestic herbal industry. The produce from this region is believed to meet significant part of the domestic herbal industry's annual requirement of this commodity.

'Sweet flag'/ 'bach' cultivation

Sweet flag is grown in wet fields with puddles, which are prepared much similar to the traditional paddy fields. Regular irrigation is derived from either irrigation tanks/ underground water lifted from open wells/ bore wells, or urban sewage water directed into the fields. Every farmer of Sweet flag maintains his own planting material in the form of apical shoot pieces with growing meristem extracted from the harvested plants of the previous crop. These apical pieces are planted in the sunken nursery beds where they grow to about 12'' in about 30 days. These are then transplanted onto the prepared main field (land is thoroughly ploughed, clods crushed, weeds removed, land flooded, puddles prepared, planting furrows opened to make the field ready for planting) at a spacing of 4'' between the plants and 18'' between the rows. The field is irrigated with tank water or well water. Fertilizer is applied as required. The crop comes to yield in about 10-12 months, when the leaves start turning yellowish. At this time the irrigation is stopped and the fields are

allowed to dry. The land is then dug and the plants along with subterraneous roots are pulled out. The greenish tops with the growing tips are severed and kept aside as the planting material for subsequent crop. The pinkish, stout, flagellate rhizomatous roots with multiple internodes are the raw form of 'sweet flag' produce.

The 'sweet flag' roots are then thoroughly washed to remove dirt, soil and coarse leaf scales from the nodes. The cleaned roots are then heaped in open threshing yards, chopped into finger long pieces, spread and allowed to dry for about 3-5 days. The rhizome pieces are frequently turned over to facilitate uniform drying and to prevent mold growth. The dried pieces are then thrashed thoroughly with wooden mallet followed by vigorous rubbing against an abrasive surface (usually gunny sacks) so as to separate the dried fibrous roots from the nodes. The thrashed pieces are then dusted and spread in shade before they are finally filled into sacks. The sacks are temporarily stacked in a local warehouse and later transported to Sweet flag traders in Tumkur market from where it is eventually transported largely to Mumbai and to mandis in Tamil Nadu.

Rhizomes from the field irrigated with tank/ borewell water are brighter in color than those from the field irrigated with sewage water, which are darker in color. The produce is further segregated into two grades based on the size i.e. well grown healthy stout pieces constitute the first grade, while the lanky and shriveled pieces the second grade. On an average, a sack of rhizome pieces weighs between 36-40 kg, while the yield varies from 4 to 4.5 MT (dry weight) per ha. An average of 500 MT of dried 'sweet flag' roots are traded from the area every year.

Fresh and dried rhizomes of ‘Sweet flag’/ ‘bach’

Mr. Padmarajaiah, a leading 'sweet flag' trader in Tumkur informed that the Tumkur Traders' Guild announces in advance the approximate demand for the next year and the prices to enable farmers to decide upon the extent of cultivation to be taken up. The prices of the commodity have been very variable over the past decade or so and varied from ₹ 2700 per quintal during 2000 to a high of ₹ 23,000 per quintal in the year 2013, before settling to ₹ 8000 per quintal during 2014-15.

The difficulty in getting labour for harvesting and post harvest handling, promotion of newer and more remunerative cash crops, failure of monsoon, and drying of aquifers have contributed to drastic reduction of area under Sweet flag in Koratagere. In case of Tumkur, however, the area under Sweet flag has shown a significant increase. Special gains in Sweet flag cultivation have been noticed in Bheemasandra, Dibbur and Gubbi Gate Palya villages beyond the urban fringes of Tumkur, where the total area under sweet flag cultivation has risen from about 35-40 hectare till some years back to more than 100 hectare. Much of this increase in area under Sweet flag in these

villages has happened in the catchment area of the river Shimsha, a tributary of river Cauvery, where traditionally paddy was grown. One of the reasons cited by the farmers for this shift to 'sweet flag' is availability of perennial source of irrigation water on account of extension of Hemavathi river irrigation canal network to the area. They also cited non-susceptibility of 'sweet flag' to insect pests and diseases, and assured minimum returns as other reasons for this shift.

Trial cultivation of 'sweet flag' has also been initiated at Dabur Herbal Farm, Sandila, Uttar Pradesh under alkaline (pH 9-10) and water logged conditions. The pilot experiment carried out on 4 ha of alkaline land has resulted in a yield of 2.5-3 MT of dried roots per ha and opened possibility of its cultivation on a larger scale in such lands. As against the going market rate of ₹ 60-80 per kg of dried roots, Dabur has offered a rate of ₹ 115-120 per kg of cultivated dried roots to promote its cultivation. Cultivation of 'sweet flag' over 30 acres in Uttarakhand (Sitarganj, Shaktifarm, and Kiccha near Rudarpur in Uddham Singh Nagar and Tharali in Chamoli) is also being promotd by Dabur India Ltd.

6.3.8. Cultivation of Ashwagandha (*Withania somnifera*)

Ashwagandha, used in large quantities in Indian Systems of Medicine, is a species of choice for cultivation in dried parts of the country with the largest cultivation clusters located in Neemuch district of Madhya Pradesh. Presently, an area of about 1000 ha is reported to be under 'ashwagandha' cultivation in the village cluster of Piplia Raoji, Uched, and Jamniya Raoji in this district. The 'ashwagandha' roots of Ratitala are, however, considered to be the most prized.

Mr. Ram Singh and Mr. Surendra Singh Shekhavat of village Piplia Rao have been cultivating 'ashwagandha' for many years. They shared that 'ashwagandha' cultivation has been a good source of cash income for them. Sown in the month of July, this crop they said does not need much care and becomes ready for harvest by December-January. On full maturity, the plants are uprooted, shoot portion severed while the root stumps are retained. The stumps are spread in open and allowed to dry for 7 days. Roots are then thrashed and cleaned of all foreign particles and the remnants of clumps, and then chopped into pieces. A fully mature crop yields an average of 4.4 MT of fresh roots, that on drying come to about 1.5 MT per ha. The dried roots are graded and index finger thickness roots are segregated being of the best quality and these fetch the highest prices. The remaining 40-50% of the material of lesser thickness is called 'taar' and is sold at lower prices. Prices also varied depending upon the quantity of starch in the roots. The fibrous roots are priced low as compared to the roots with higher starch content.

'Ashwagandha' cultivation

The farmers informed that the crop during the year 2015-16 was not good as the area received deficit rains and that there was little provision of irrigation. It also came out that over the years, the leaf and seeds of the species have also found good market.

In addition to cultivation of 'ashwagandha' in Neemuch and surrounding areas of Madhya Pradesh and Rajasthan, extensive areas have been brought under 'ashwagandha' cultivation in Guntakul and Kurnool area of Andhra Pradesh. Similarly, its cultivation has also been initiated over about 100 ha in Gadag, Hospet, Bellary region of north Karnataka.

6.3.9. Cultivation of Bhumiamla (*Phyllanthus amarus*)

The market samples of herbal raw drug 'bhumi amla', correlated to *Phyllanthus amarus* in India, consist of material from many commonly found and similar looking species of this genus posing a question about the uniformity and authenticity of the material used. It is to address this issue that efforts at cultivation of authentic 'bhumi amla' have been initiated.

Dried 'Bhumiamla'

Mr. Sunder Lal of village Parora in Tehsil Hasanganj of district Unnao in Uttar Pradesh and cultivating 'bhumi amla' for the last five years, while showing the team the field where he had grown 'bhumi amla', reverently removed his foot wear before entering the field. He informed that Asha Gramudyog Sansthan, Lucknow provided him the initial seed stock and was also providing technical support for raising and marketing of this crop. The crop, he informed, was usually sown during February, needed 8-10 irrigations and the plants grow to about 1.5 m tall in 60-70 days, when these were ready for harvest. Most of the farmers take two harvests, the second on the onset of rainy season. With an average annual yield of 6 MT per ha, and much less cost of inputs than conventional crops, cultivation of 'bhumi amla' is seen as profitable by the farmers. They, however, informed that the second harvest plants usually get fungal infested affecting the quality and the rates. The harvested produce is dried and chopped by the farmers before selling. The current farm gate price for the dried and chopped produce was reported to be ₹ 35 per kg.

'Bhumiamla' cultivation

Mr. Dileep Rai, Director, Asha Gramudyog Sansthan informed that 15 families were cultivating 'bhumi amla' in this village over about 10 ha of land. His organization, he informed, was supporting about 120 farmers in 40 villages to grow 'bhumi amla'. It was the result of these efforts that bhumi amla has presently come to be cultivated over 80 ha farm land in the area with current annual

consolidated output of 150 MT. M/s Natural Remedies, with annual purchase order of 100 MT, was reported to be the major buyer of the produce. M/s Dabur India Ltd. and M/s AIMIL Pharmaceuticals were the other major buyers of the produce.

6.3.10. Cultivation of Mandukparni (*Centella asiatica*)

Mandukparni, known more popularly as Brahmi, is used extensively in the Indian Systems of Medicine both for making commercial formulations by the industry and at household levels for primary health care needs. The plant commonly grows in moist niches along the banks of canals, ponds, lakes, etc., farm bunds, and in regularly watered lawns. Wild collected material is however susceptible to admixture of other similar looking species of genus *Hydrocotyle*. Cultivation of this species is therefore catching up to get regular supplies of authentic material from known sources. It is a one step towards getting the material certified.

'Mandukparni' cultivation

Asha Gramudyog Sansthan, Lucknow is spearheading cultivation of 'mandukparni' through its farmer clusters in district Barabanki and Sitapur. Interactions with farmers in Hakkabad Khinjana village in this cluster revealed that the seed source for its cultivation was of Sri Lankan origin, having bigger plants, larger leaves, higher yield and alkaloid content equal to that of Indian varieties. The farmers informed that they had already taken five cuttings in two years of planting. The plants are known to continuously provide 3-5 cuttings per year for 3-4 years. The fresh harvest is completely dried before selling. Annual yield is estimated to be 7-8 MT per ha and the current farm gate price of the dried produce was informed to be about ₹ 80 per kg. With a total of about 8 ha area currently under 'mandukparni' cultivation, Asha Gramudyog Sansthan is able to collect and sell an average of 2.5-3.0 MT of dried 'mandukparni' leaves every month.

6.3.11. Cultivation of Mentha (*Mentha arvensis*)

'Mentha' is under cultivation in Hakkabad Khinjana and surrounding villages in Barabanki district of Uttar Pradesh for the past about 20 years, where it is cultivated over 50 ha of land by about 150 farmers. Planted in the month of February, this crop, after 7-8 irrigations and 2-3 light pest sprays, becomes ready for harvesting of the first cut in about 60 days and after another 5-6 irrigations for the second cut in another 50-60 days. The harvested shoots are air dried for 10-12 hours and subjected to distillation to extract 'mentha' oil. Many large farmers have also installed their own distillation units and these units were also being made available to smaller farmers for distillation of their produce. At present 10 distillation units were reported to be functional in the village cluster. Once the crop comes to harvesting, the distillation units are run round the clock. One distillation cycle takes 60 qtl of fresh cut 'mentha' (air dried for 10-12 hours) and it takes about 6


'Mentha' cultivation

hours to complete the cycle. With fresh cut from one bigha being about 18-20 qtl, produce from at least three bigha is needed to run one cycle of distillation unit. The dried herbage after distillation forms the bulk of fuel to run the distillation units. The total average annual yield of oil from both the cuts is about 200 litres per ha. Mr. Raj Kumar, a local farmer cultivating 'mentha'over 4 ha since 1995-96, expressed that banks might sometimes delay the payments, but no such delay in payment has ever been experienced in case of 'mentha' oil as this oil finds ready sale and gets immediate cash payment.


'Mentha' harvest and distillation unit

Every farmer in the area maintains his own nursery for planting during the next year. For this purpose, the rootstock is planted at close spacing in a shaded area after the second cut at the onset of monsoons. This plot is maintained through regular irrigation for the next 5-6 months. The tillers from this rootstock are used for 'mentha' plantation during the next year.

In the State of Uttar Pradesh alone, 'mentha' is cultivated over more than 30,000 ha in various parts of the state, with the prominent clusters being in Rohilkhand and in Barabanki-Lakhimpur-Faizabad. Interaction with farmers of Budaun area of Uttar Pradesh revealed that the area under 'mentha' cultivation had drastically decreased over the past 2-3 years, with some respondents reporting such reduction to be more than 80%. The major reasons cited for such decline in 'mentha' cultivation were increasing input costs, especially labour wages and irrigation cost, and decreasing prices of 'mentha' oil that have decreased from ₹ 2200 per kg to just about ₹ 900 per kg over the past 2-3 years.

'Mentha' cultivation over about 400 hectares has also come to notice from Hoshiarpur and Nawanshahar districts of Punjab, and its cultivation is picking up as an alternative cash crop.

6.3.12. Cultivation of Tulasi (*Ocimum tenuiflorum* & *Ocimum gratissimum*)

'Tulasi' is perhaps the most important plant of the country from religio-cultural and therapeutic point of view. It is extensively used as offering to the deities, as a household remedy for various ailments, and as an important ingredient of many commercial formulations. Large traditional cultivation of this plant is known from around Mathura to cater to the need of Vrindavan temple where the stems of this plant are used to make garlands. Similar cultivation clusters to meet the need for offerings to the deities are also known from around temples in southern India.

Cultivation and harvest of 'Tulasi'

Of late, 'tulasi' cultivation for therapeutic purposes has also caught the attention of farmers. Visit to the Mahmudabad village cluster spanning Sitapur and Barabanki districts revealed that 'tulasi' is being cultivated by about 60 farmers in 15 villages over about 20 ha of land. This village cluster produces about 20-25 MT of dried 'tulasi' leaves and about 35-40 MT of dried 'tulasi' stems from two cuttings every year. Whereas the dried 'tulasi' leaves fetch a price of ₹ 80-100 per kg to the farmers, the 'tulasi' stems sell for about ₹ 40 per kg. The domestic herbal industry is the major buyer of dried 'tulasi' leaves and the dried 'tulasi' stems are generally used in making veterinary medicines.

Organic India Ltd. is also reported to support organic cultivation of 'tulasi' over an area of about 1000 ha in Rath tehsil of Hamirpur district in Bundelkhand, Uttar Pradesh for use in their herbal tea. Two varieties of *Ocimum tenuiflorum* i.e. Rama Tulasi and Shama Tulasi are grown under this program for which the company is paying a rate of about ₹ 90 per kg of graded 'tulasi' leaves. There is another attempt at 'tulasi' cultivation under federated farming in Gadag tehsil in Karnataka. Farmers of six villages in this area, under leadership of Mr. Mahadeva Pawar, an enterprising farmer from Kalasapur village of Gadag tehsil, have come together and have taken up cultivation of various species of medicinal and aromatic plants with 'tulasi' cultivation over 4 ha of land. The farmers here are obtaining an average yield of 3 MT per ha of dried 'tulasi' leaves. The minimum assured farm gate price committed by the pharma companies is ₹ 120 per kg.

The company is also promoting the cultivation of Vana Tulasi (*Ocimum gratissimum*) that fetches a little lower price. Vana Tulasi is also being cultivated over about 8 ha in Barabanki district of Uttar Pradesh. Mr. Alok Kumar, a farmer of village Tigayian in this district shared that if planted in July, this species gets ready for first harvest in September and for second harvest in December. The crop needs irrigation for 2-3 times in between. The species, if planted in March, needs 4-5 rounds of irrigation. The annual production of leaf is about 2500 kg per ha and that of stems about 4000 kg per ha.

Vana Tulasi (*Ocimum gratissimum*), known locally as Tulsa, has also come to be a choice medicinal plant for cultivation in areas around Neemuch in Madhya Pradesh and Udaipur in Rajasthan, where it is grown for its seed. Visit to the fields of Mr. Ashok Kumar Sharma and Mr. Shyam Sunder Sharma of village Dholakhari in Udaipur district brought to notice the various difficulties associated with cultivation of Tulsa. The crop is usually sown during late June to take benefit of the first monsoon showers. However, if the monsoon fails to arrive in time, all the seeds are eaten up by ants, requiring re-sowing and adversely affecting the yield. The crop sown during June becomes ready for harvest by the first week of December. The plants are thrashed and winnowed to get seeds that are sold in the Neemuch mandi. The annual production of Tulasi seed from this area is estimated to be more than 1000 MT, major part of which is sold at Neemuch mandi. The crop was reported to be susceptible to damage by Neelgai, herds of which run through the standing crop badly trampling the plants. No report of Neelgai eating this crop, however, came to notice.

6.3.13. Cultivation of Makoi (*Solanum nigrum*)

Makoi is a natural grown medicinal plant species commonly found on waste lands and as a farm side weed, from where an estimated 2000 MT of its aerial parts are harvested every year. Of this,

'Makoi' cultivation in Uttar Pradesh

about one third i.e. about 600 MT is collected from Hasanganj tehsil of Uttar Pradesh only. In addition, about 10-15 MT of its fruits are also collected from the wild. The major buyer of this species is the herbal industry making extracts (viz. Natural Remedies and Indian Herbs) and veterinary medicines (viz. Ayurvet Ltd.).

The quality considerations have brought this otherwise fairly common species under cultivation. As at present, an area of about 80 ha is under its cultivation in Uttar Pradesh. An estimated annual production of aerial parts from this cultivation is about 100 MT and that of fruits is of about 25 MT. Whereas the dried aerial parts fetch a price of ₹ 12-15 per kg at the farm gate, the dried fruits sell at ₹ 100-110 per kg.

6.3.14. Cultivation of Isabgol (*Plantago ovata*)

Isabgol or Psyllium, with annual trade of more than 60,000 MT, is entirely sourced from cultivation done in the States of Rajasthan, Gujarat and Madhya Pradesh. In western Rajasthan, it is cultivated over about 2400 ha land around Jaisalmer. Sowing of seeds @ 4 kg/ ha is done during November-December. A spacing of 30 x 45 cm is considered ideal for higher seed yield. The crop requires 4-6 irrigations over the period it becomes ready for harvesting in 110-130 days i.e. during March-April. The harvested plants are spread for about two days for air drying, after which they are threshed with tractor/ bullocks. A good crop yields 800-900 kg of seeds per hectare.

Isabgol cultivation has also been started in the areas of Rajasthan adjoining Neemuch in Madhya Pradesh over the last about 6-7 years. Interaction with Mr. Goverdhan Lal Sharma of village Kedariya, tehsil Vallabhnagar, district Udaipur, Rajasthan provided good insights in to the issues

'Isbagol' cultivation in Rajasthan

related to Isabgol cultivation in the area. It was informed that Isabgol cultivation was presently being done on about 10 ha land in the village. The major reason for this shift from wheat was lesser irrigation required for Isabgol vis-à-vis wheat and high susceptibility of wheat to damage by Neelgai, locally called 'Rozda'. It was, however, informed that Rozda has started nibbling the flowers and browsing whole plants also. The crop has also become susceptible to aphid (Mola) attacks. The crop needs 3-4 irrigations and two sprays, one for killing weeds like 'bathua' (*Chenopodium* spp.) and the other to kill 'mola' (aphids). Sh. Goverdhan Lal informed that he has to perform night vigil at his farm located about one kilometer away from the village proper to shoo away the raiding herds of Rozda. The crop is also highly vulnerable to untimely rains, especially after seed setting, when even a little rain can cause the seeds to shed and the entire soil becomes mucilaginous and hard. The crop in this area yields about 1200 kg seeds per ha. The produce from this village is usually sold at Fatehpur, Nimbaheda or Neemuch mandis that are respectively 30 km, 100 km and 130 km from the village. Mr. Goverdhan informed that he got ₹ 12000 per qtl during 2015-16 at farm gate for his entire produce of Isabgol seeds.

The area under isabgol cultivation is registering a decline in some areas due to climatic adversaries and farmers are shifting to other crops like jeera and fennel seeds or saunf. Isabgol is a risky crop as a little unseasonal rain can ruin the whole crops.

6.3.15. Cultivation of Rosemary (*Rosemarinus officinalis*)

Rosemary, a European aromatic herb, known for its essential oil used in pharmaceutical, cosmetic and food flavouring industry, has been brought under viable cultivation in Gadag and Shirahatti

'Rosemary' cultivation in Karnataka

taluks of Gadag district, Bellary taluk of Bellary district and Gundlupet and Chamarajanagar taluks of Chamarajanagar district in Karnataka under a federated farming initiative being spearheaded by Mr. Mahadeva Pawar, an enterprising farmer from Kalasapur village of Gadag tehsil. At present, it is cultivated over about 10 ha of land.

Rosemary is propagated through softwood stem cuttings. About 6-inch long cuttings are prepared from the previous crop and are planted at close distance in the nursery beds and allowed to root. During early rains, the land is ploughed, leveled, weeds removed, and furrows opened. Rooted cuttings are planted in the main field at a spacing of 60 cm between the plants and rows. Fields are irrigated once in 8-10 days. Standard dose of fertilizer (DAP) is given during the fourth month. Occasional weeding and soil raking is done, while the crop is maintained for one year. Crop is generally free from any major pests, however, occasional root wilt and root grub infestation is noticed.

Harvesting is done during October and March. Plants are uprooted and spread in open for 7 days, with frequent turning over to ensure uniform drying. Dried plants are subsequently thrashed with

wooden clubs, to separate the leaves. The small needle like leaves, constitute the raw drug material. This dried leaf mass is cleaned to remove shoot pieces and other extraneous material. An average yield of 3 MT per ha is expected from a well maintained field. The produce is then filled into sacks, with each bag containing an average weight of 35 kg. The current assured farm-gate price was reported to be ₹ 100 per kg of dried leaves. It came out that the dried leaf mass first enters the raw drug mandis in Mumbai and Delhi, from where it is distributed to different essential oil extraction units.

6.3.16. Cultivation of Chiretta (*Swertia cordata*)

Chiretta is an important herbal raw drug used in Indian Systems of Medicine. Excessive exploitation of its wild resources has brought this group of species (*Swertia chirayita*, as well as its equivalents like *Swertia cordata*, *Swertia angustifolia*, etc.) under threat of extinction. These days, Chiretta of trade is mainly sourced from Nepal with a part of the material that is traded as Chiretta actually being Kalmegh (*Andrographis paniculata*), which is known in trade as 'Tikt chirata'. Many

'Chiretta' cultivation and harvest

previous efforts at cultivation of Chiretta at commercial scale did not yield desired results. Dr. Lal Singh, Director, Himalayan Research Group (HRG), Shimla, identified *Swertia cordata* as a potential Chiretta species for commercial cultivation in Chachiot tehsil in Mandi district of Himachal Pradesh and started agro-techniques standardisation work in 2002 with support from Department of Science and Technology, Government of India. With initial financial help from the NMPB, he enrolled 507 farmers for cultivation of Chiretta, out of which a group of 55 master growers was trained to maintain the first crop on their fields for producing seed. A total of 11.415 kg seed was recovered from these fields during October 2009. He enrolled another set of 487 farmers to initiate Chiretta cultivation in February-March 2010. Most of these farmers are women and the fields used are the ones that were once under Hemp. By the end of 2010, total number of farmers enrolled for Chiretta cultivation in this cluster was about 1000 and total area under Chiretta cultivation was about 70 ha making it the largest cluster of farmers growing medicinal plant of wild origin in the Indian Himalayan region.

Marketing of the produce, the first commercial lot of 5 MT became available in 2011, became an issue with traders and herbal companies coming up with offers of very low prices. The HRG held its nerve, got itself registered for VAT and CST to be able to transport the material on behalf of the farmers and helped farmers in selling the first commercial consignment of 2.5 MT to M/s Dabur India Limited. The farmers had to pay export permit fee of ₹ 7 per kg to the State Forest Department for the entire produce sold to M/s Dabur India Ltd. This came as dampener, as such levy was originally meant for wild collected produce only.

With the hand holding provided by the HRG, the farmers are showing more interest in cultivation of other high value Himalayan medicinal plants also. Marketing remains an issue and HRG has taken up this matter with the government to simplify the procedures for marketing and develop effective strategy and framework for marketing of farmers produce. [*Text and Photos by Dr. Lal Singh, HRG*]

6.3.17. Cultivation of Karu/ Kutki (*Picrorhiza kurroa*)

Karu/ Kutki is a very important Himalayan herb that is extensively used in Indian Systems of Medicine. Ruthless harvest from wild has brought this species under threat of extinction and the species is now listed in the CITES. The efforts by High Altitude Plant Physiology Research Centre (HAPPRC) in Uttarakhand to develop agro-techniques of this plant have culminated in the form successful commercial cultivation of this species in Gheshe, a remote village located at 2500 m altitude in Chamoli district of Garhwal. The cultivation started with a tripartite agreement between HAPPRC, Dhawan international, a herbal unit, and the Gheshe villagers on August 9, 2002. This document laid the basis of the cultivation of the aforementioned species and the buy-back guarantee for harvested produce.

'Kutki' cultivation and harvest

Pursuant to the signing of this agreement, 32 farmers registered for Kutki cultivation and assigned 5 ha of total area for the purpose. With the limited germplasm of the high yielding broad leaf (BL) variant of the species, cultivation could, however, be started with only five farmers. The first harvest was reaped during October 2005. Dhawan International procured all the 200 kg of dried material. The farmers of the village have now organised themselves into a society and have got it registered under the name 'Gheshe Kishan Samiti' with the State Bhaisaj Sangh, mainly to acquire permit for commercial cultivation of Kutki. Presently, after 13 years of its initiation, Kutki is now

cultivated by 35 farmers over 4.5 ha land in this village in small scattered fields.

The present annual production from this area is about 1 MT of dried roots of very high quality and M/s Dhawan International is procuring part of the produce at the farm gate price of ₹ 800 per kg. Since 2011, M/s Dabur India Ltd. has also been making purchases of a major part of the produce from this area

Large scale cultivation of *Picrorhiza kurroa* will be helpful to provide the pure drug to the pharmaceutical industries and can also reduce the exploitation pressure on the natural population, thus helping to conserve the species in its natural habitat. *[Text and Photos by Prof. M. C. Nautiyal, HAPPRC]*

6.3.18. Cultivation of Senna (*Senna alexandrina*)

Senna has long been under cultivation in Tirunelveli, Madurai, and Tiruchirapalli districts of Tamil Nadu. In areas with dry, gravelly, and red-loamy soils, it has naturalized and comes up as self grown crop also. Popularly known as Tirunelveli Senna in trade, the annual production of its leaves in 1955 was nearly 500 MT and that of its pods was about 80 MT. 'Senna' is still being extensively cultivated in these areas and forms a good source of cash income to the local farmers.

'Senna' cultivation in Rajasthan

During the 1950s, the plant was introduced to Mysore and Jammu, where its cultivation trials were laid. Even as the cultivation of the species was found to be viable, it has not picked up in these areas. Its introduction in Rajasthan for cultivation about 20 years back has been very successful. The species, known as 'Sonamukhi' in Rajasthan, has become a crop of choice in the state. It is cultivated under typical rainfed situations and grows best in newly cultivated areas, where it requires neither any fertilizers nor any pesticide etc., thus, making all 'senna' cultivation as 'organic'. A total of about 10,000 MT of 'senna' was processed in 2014-15 in the 50 odd processing units located in Rajasthan. The processed 'senna' is largely exported to Japan, Germany, USA and China. An estimated area of about 5,000 hectares is under 'senna' cultivation in the districts of Jalore, Jodhpur, Pali and Barmer. A hectare of well cultivated 'senna' yields about 1.5 MT of 'farmer grade' dried matter (leaflets, pods and leaf rachis/ branchlets). The current procurement price of farmer grade 'senna' leaves is ₹ 10-12/- per kg. The farmer grade 'senna' contains about 30% leaf rachis/ branchlets.

6.3.19. Cultivation of Tejpatta (*Cinnamomum tamala*)

Tejpatta or Indian Bay Leaf has hitherto been largely collected from the wild, with some collection being made from the self grown trees on farm bunds. The demand and trade of this produce has,

however, been picking up over the years. This prompted the farmers, especially in Uttarakhand, to maintain the self grown trees on their farms and also plant more trees towards getting ready cash income from the sale of leaves. An ICIMOD sponsored intervention some ten years back trained the farmers and wild collectors in sustainable harvest and value addition techniques. This intervention resulted not only in many-fold increase in the price of graded leaves, but also in taking up of 'tejpatta' cultivation by many farmers. Presently, an estimated 10000 farmers in both Garhwal and Kumaon regions of Uttarakhand are involved in planting of 'tejpatta' on their fields.

'Tejpatta' plant

The cultivation and trade of 'tejpatta' in Uttarakhand has got a boost in the form of its getting GI (geographical Indicator) tag with a name 'Uttarakhand Tejpat'. The Uttarakhand 'tejpatta' has been GI registered (No. 520 dated 31 May 2016) for having 'cinnamaldehyde' that accords sweetness to the leaves. The 'tejpatta' for Uttarakhand is, therefore, also called 'meetha tejpat'.

The harvesting of leaves is done from October-November to February-March depending upon the elevation and precipitation. For harvesting the leaves, the branches are usually lopped to encourage new branches during the next year. An average yield of 15-20 kg of dried 'tejpatta' is obtained per mature tree per year. Presently, graded leaves are fetching a sale price of ₹ 50-60 per kg. The total trade volume of 'tejpatta' from Uttarakhand is estimated to be 1000 MT per annum.

Farmer engaged in 'Tejpatta' harvesting, and a harvested tree

Trade of about 25 MT of bark of this tree per year from Kumaon region of Uttarakhand has also come to notice.

6.3.20. Cultivation of Other Species

In addition, cultivation of the following species was also come across, but could not be studied in detail due to the growing and harvesting cycle of these not commensurate with the visits of field teams to the cultivation area:

Artemisia (*Artemisia annua*): This species is under organized cultivation over about 400 ha in the districts of Lucknow, Sitapur, Hardoi and Lakhimpur in Uttar Pradesh. The yield of aerial parts is about 50-60 MT per ha. The species is reported to be used for making anti-malaria vaccine. The plant material for this purpose needs to have artemisin content of 0.5-0.7%. Ipca Laboratories, with annual procurement of more than 1000 MT, is the single largest buyer of the produce. M/s Samut Products and M/s Ayurvet are other major buyers of this species.

'Pippali' cultivation in Maharashtra

Pippali (*Piper longum*): Pippali, the dried fruiting spike, is extensively used both as a spice and as a herbal drug and forms an important constituent of Ayurvedic formulation 'Trikatu'. A part of the annual demand is met from the wild populations of this plant that grows naturally in the rain forests. Major supply of the Pippali is, however, met from cultivation in different parts of the country. One such Pippali cultivation cluster, under active technical and marketing support from Mr. V. B. Ladole, Chief Functionary, CARD, a local NGO, is located in Anjangaon Surji of Amravati district in Maharashtra where about 1000 farmers cultivate Pippali over about 600 ha and produce an average of 400 MT of Pippli every year. Many of these cultivators are landless farmers who take land on lease for this cultivation. The crop saw a drastic drop in prices in 2014-15, with farm gate prices crashing to just about ₹ 350 per kg, making it difficult for the farmers to even recover their cost of cultivation. The prices have, however, recovered to about ₹ 700 per kg over the last year. The area has a long history of intercropping Pippali with betel vines. However, cultivation of Pippali as single crop started only during the 1960s. Sh. Ladole, associated with Pippali cultivation for about 45 years, has made it into a commercial venture. The usual trade chain involves selling the produce to the local trader who then sends it to Delhi or Mumbai herbal raw drug mandis. Some farmers have also started dealing directly with the terminal mandis.

Pippali is also reported to be under cultivation over about 800 ha as an intercrop in oil palm orchards at Jangareddyguddam in West Godavari district of Andhra Pradesh, under an initiative by M/s Dabur India Ltd.

'Castor' cultivation in Rajasthan

Castor (*Ricinus communis*): Castor is an important medicinal plant of which seed oil, roots and leaves are used as herbal raw drugs. The duration of traditional castor crop is 7-8 months. The farmers in Rajasthan

have now taken to cultivating high yielding castor varieties like NPH-1 (Aruna), GAUCH-4, and TMVCH that mature in about 150 to 180 days. Harvesting is generally done when one or two capsules in a bunch show signs of drying. However, it is advisable to harvest only the fully ripe capsules to get oil of better quality. Castor is cultivated both as rain-fed and as irrigated crop and as pure or mixed crop. During the year 2014-15, a total of 1.49 lakh hectare area was recorded to be cultivated with castor in Rajasthan with the total production of castor seeds recorded at 1.56 lakh MT. The average yield for the year 2014-15 was, therefore, 1,050 kg/ ha. The area under castor cultivation in Gujarat was recorded as nearly 7.33 lakh hectare. Castor is also cultivated in Karnataka and Tamil Nadu.

Chiretta (*Swertia chirayita*): As per API, 'Chiretta' is correlated to *Swertia chirayita*, a species the availability of which from the wild has drastically reduced. Efforts at its cultivation, going on for quite some time, are reported to have borne fruit in the form of bringing about 2 hectares in Uttarakhand and about 10 hectares in Nepal under its cultivation through promotion by Dabur India Ltd.

Ghritkumari (*Aloe vera*): Cultivation of 'ghritkumari' has increased many fold over the past 4-5 years. The major reason for this increase in area under cultivation is successful positioning of the *Aloe* products as over the counter health food items. Ghritkumari is a perennial plant that yields first flush of leaves after one year of planting, with subsequent flush of leaves getting ready for harvest every three months. This is one of the few herbal raw drugs that sells in fresh form. The crop yields an average of 700 quintal of fresh leaves per hectare per year. The sale price of the fresh leaves varies from ₹ 5 to ₹ 7 per kg. An area of about 115 ha was recorded to be under *Aloe* cultivation in Jodhpur division alone during 2014-15.

Mehndi/ Henna (*Lawsonia inermis*): Mehndi is grown over more than 40,000 hectare in Sojat tehsil of Pali district in Rajasthan, where the limestone parent rock is believed to enrich the

Henna (*Lawsonia inermis*) cultivation in Rajasthan

produce with deep colour. Mehndi is a perennial crop with the plants known to continue producing leaves for 70-80 years, with annual harvest of about 600 kg per hectare. For harvesting the leaves, the branches are cut about 3'' above the ground to promote bushy growth for better yield. The cut branches are dried for 2-3 days and then leaves are separated by light thrashing. The produce is taken to special Mehndi Yard of the Sojat Krishi Upaj Mandi where the produce is put to open auction. During the year 2014-15, the sale rate of dried 'mehandi' leaves varied from ₹ 30-40 per kg.

Kavach Beej/ Velvet Bean (*Mucuna pruriens*): It is popular as 'Nasugunni' in Kannada and is

'Kavach' cultivation in Karnataka

another herbal plant in demand, amenable for cultivation with least inputs. It is seen in about 5 acres in Gadag region. Planting is done, similar to the planting of French beans. After proper tilling, the field is made ready by opening alternate ridges and furrows. Seeds are individually sown in the ridges at a distance of 2 feet. Spot irrigation is given immediately after planting. Despite being a vine, Velvet bean plants here, are however encouraged to come up as solitary bushes. Wooden stakes, props or pandals as support for the growing vines are not encouraged as it would incur additional cost, which the traders are not willing to pay, the farmers assert. Plants are maintained for 9 months while there will be profuse flowering and fruit set.

Mature pods are harvested and dried in open. They are then thrashed; chaff and pod crusts are removed to separate the seeds. Seeds, which look like French bean seeds constitute the traded material. Seeds of all size are seen, but are not graded. Ungraded and assorted seeds are then filled into sacs for shipment.

Other Cultivation Initiatives: Cultivation of medicinal and aromatic plant species like Kulanjan (*Alpinia galanga*), Lemon grass (*Cymbopogon flexuosus*), Kachur (*Curcuma zerumbet*), Gunja (*Abrus precatorius*), Kalihari (*Gloriosa superba*), Pushkarmool (*Inula racemosa*), etc. has already stabilized in different parts of the country.

Kalihari (*Gloriosa superba*) cultivation in Tamilnadu

Akarkara (*Anacyclus pyrethrum*), previously imported from Morocco, has been brought under cultivation in Bareilly, Rampur and Lucknow in Uttar Pradesh. This area has also come to be known for fairly large-scale cultivation of Tukhm-e-Kahoo (*Lactuca sativa*) and Pili Shatavar (*Asparagus*

Pushkarmool (*Inula racemosa*) cultivation in Lahaul, Himachal Pradesh

Atis (*Aconitum heterophyllum*) cultivation in Himachal Pradesh

racemosus). Similarly, cultivation of Kasni (*Cicorium intybus*) has also come to notice from Gurgaon and Rewari districts of Haryana.

Cultivation of some other species like *Acorus calamus*, *Berberis aristata*, *Hedychium spicatum*, *Phyllanthus emblica*, *Sapindus mukorossi*, *Taxus wallichiana*, etc. has come to notice from Uttarakhand. These cultivation initiatives in the State are being spearheaded by the Herbal Research and Development Institute (HRDI) NMPB sponsorship. Additionally, cultivation of species like Chhipri (*Pleurospermum angelicoides*) and Archa (*Rheum australe*) in Uttarakhand has also come to notice. However, these cultivations are too small and too scattered and, thus, data on the total area under their cultivation could not be compiled.

Cultivation of 'shankhapushapi' (*Convolvulus prostratus*) under a collective initiative of ICRISAT and Dabur India Ltd. in Barmer district of Rajasthan has also come to notice. This initiative is reported to have resulted in production of about 40 MT of dried produce during 2014-15.

Contractual cultivation of *Coleus forskohlii* over more than 1000 hectares and involving about 1500 farmers under Sami Labs initiative has also come to notice. This cultivation is under buy-back agreement. The Sami Labs, in addition to providing technical support to the farmers, also provides them with interest free credit in the form of quality seeds, fertilizers and pesticides.

Small scale cultivation of species like 'Bankakri' (*Podophyllum hexandrum*) in Himachal Pradesh;

Table 6.1. Major Medicinal Plant Species under Cultivation with Area

S. No.	Trade Entity	Plant Species	Estimated area under Cultivation & Production		Region/ States
			Area (in ha)	Annual Production (Dry. Wt. in MT)	
1	Isabgol	*Plantago ovata*	80000	45000	Gujarat, Rajasthan & MP
2	Mentha oil	*Mentha arvensis*	40000	8 lakh ltr	UP, Uttarakhand, Bihar, Punjab
3	Henna	*Lawsonia inermis*	40000	25000	Rajasthan
4	Senna	*Senna alexandrina*	22000	20000	Rajasthan, Tamil Nadu
5	Aswagandha Roots	*Withania somnifera*	6000	5000	MP, Rajasthan, Andhra Pradesh
6	Tulsi	*Ocimum tenuiflorum*	5000	5000	UP, Karnataka,Tamil Nadu
7	Pippal Mool	*Piper longum*	4000	2000	Andhra Pradesh, Odisha
8	Pippali	*Piper longum*	1500	2000	Maharashtra, Andhra Pradesh
9	Kuth	*Saussurea costus*	250	120	Himachal Pradesh, Uttarakhand
10	Bach	*Acorus calamus*	400	3500	Karnataka, Uttar Pradesh
11	Vetiver	*Cymbopogon vetiveroides*	1500	500	Tamil Nadu, Kerala, Chhatisgarh
12	Artemisia	*Atremisia annua*	400	2000	Uttar Pradesh,
13	Ghritkumari	*Aloe vera*	1000	15000	Rajasthan, Gujarat, Madhya Pradesh,Karnataka, Haryana
14	Other Species	-	5000	-	Chhatisgarh, Uttar Pradesh, Kerala, North East States, Uttarakhand, Karnataka, Tamilnadu,
		Total	**207050**		

'Ginseng' (*Panax sikkimensis*), 'Jatamansi' (*Nardostachys jatamansi*), and 'Chokpa' (*Angelica glauca*) in North-eastern States, and 'Ratnapurush' (*Hybanthus enneaspermus*) in Tamilnadu has also come to notice.

6.4. SPECIES PHASED OUT FROM UNDER CULTIVATION

During the late 1990s, a lot of effort was made to promote cultivation of Jojoba (*Simmondsia chinensis*), an exotic species, the seeds of which were supposed to have a great export market. A special farm for its cultivation was established at Dhand (Rajasthan) over 37 ha and plantations were raised over about 200 ha in other parts of Rajasthan and Gujarat. Jojoba Seeds were also recorded as a noticeable commodity in foreign trade with export of 867 MT of its seeds during 2004-05 (Ved and Goraya, 2008). However, export of Jojoba seeds continuously declined thereafter and came to just 3 MT during 2009-10 and has been almost nil from 2010-11 to 2014-15. During the field visit to Rajasthan, our teams noted that the Jojoba farms were now under conversion to some other crops.

A similar case of phasing out from cultivation has happened with another exotic species Milk Thistle (*Silybum marianum*), believed to have a great potential of export. Cultivation of Milk

Thistle was promoted over 400 ha in the drier parts of Rajasthan and an estimated annual production of 500 MT was reported for the year 2004-05 (Ved and Goraya, 2008). The species seems to have got almost phased out from cultivation over the years with only negligible trade of this species having been recorded during the year 2014-15.
Stevia (*Stevia rebaudiana*) is another exotic species that was tried to be promoted for large scale cultivation during 1990s. Cultivation of the species has failed to stabilize and no significant cultivation of this species has come to notice during 2014-15.

The above examples go on to show that the process from introduction of a medicinal plant species under cultivation to its final incorporation in the established agri-practices of the area is long-drawn and beset with challenges including chances of failure. It is, therefore, very necessary that adequate research at choice of species, introduction trials and marketing tie up is carried out before promoting any medicinal plant species for cultivation.

6.5. EMERGING TRENDS IN CULTIVATION OF MEDICINAL PLANTS

Cultivation of medicinal plants seems to have come to be accepted by farmers as a viable option for crop diversification and cash income, and by the herbal industry as a source of assured certified material in required quantities.

6.5.1. Developing Models for Intercropping

The Forest Research Institute, Dehradun has developed various models of successful integration of various medicinal plants with agri-crops. Some of these commercially viable agri-models successfully demonstrated include for *Rauvolfia serpentina*, *Uraria picta*, *Asparagus racemosus*, and *Piper longum*. Similarly, the Himalayan Forest Research Institute, Shimla has long been working on developing commercially viable models of integration of medicinal plants with horticulture and have standardized models for integration of *Valeriana jatamansi* and *Picrorhiza kurroa* with apple.

Development of intercropping models is now no more limited to the Research Institutes alone. The farmers, seeing good prospects of the medicinal plant cultivation, have started experimenting with their own intercropping models. Farmers in the Gadag area of Karnataka, who have taken to federated farming of medicinal plants, have started employing innovative methods like introduction of an important medicinal plant *Salacia chinensis* as an intercrop in Rosemary plots, usually taken up on dry, parched fields. Likewise, they have also started growing Shatavar (*Asparagus racemosus*) climbers along the bunds. Farmers in Gujarat have perfected the technique of integrating climbers of *Leptadenia reticulata* in their agricultural fields.

Whereas the intercropping models are likely to stay, the research institutes need to work out modalities for application of insecticide/ fungicides and fertilizers required for the primary agriculture or horticulture crop, to ensure that application of chemicals does not impact the quality of medicinal plants.

6.5.2. Hand holding Role of Local NGOs/ Progressive Farmers in Medicinal Plant Cultivation

Almost all case studies of successful cultivation of medicinal plants have at least one thing in common. And that is all such cultivations are steered by some local NGO or a Progressive Farmer. Some examples are given below to highlight the point:

Dr. Lal Singh, Director, Himalayan Research Group, Shimla took upon himself the challenge of

cultivating Chiretta in Himachal Pradesh and organized a cluster of about 500 farmers in more than 20 villages of Jeoni Valley in Mandi district of the state, for this cultivation. Today, after initial hiccups running over more than 10 years, his cluster produces more than 50 MT of Chiretta every year. Dr. Lal Singh continues to provide technical guidance and marketing support to the farmers.
Senna/ Sonamukhi cultivation in Rajasthan has now come to stay as a very profitable venture, especially in newly cultivated lands under rainfed conditions. It is successful even today as its propounder, Mr. N D Prajapati, a progressive farmer and entrepreneur from Jodhpur, continues to do hand holding of farmers for the past more than 20 years.

Mr. Dileep Rai, Director, Asha Gramudyog Sansthan, a Lucknow based NGO, has been organizing farmers in Lucknow, Sitapur, Barabamki and Unnao districts of Uttar Pradesh for cultivation of various medicinal plant species like Tulasi, Bhumi amla, Makoi, Mandukparni, Prshniparni, Vetiver, Mentha, etc., and providing them technical and marketing support. As on date, more than 1000 farmers from about 100 villages are successfully cultivating medicinal plants in his organized group.

Kuth cultivation in trans-Hiamlayan valley of Lahaul in Hiamcahal Pradesh was on the decline, when Mr. Nand Lal Sharma of Nanda Medicinal Plants Exports, Mansari village in Kullu district took up the challenge of reviving this cultivation. He explored global markets for sale of the produce and is providing technical inputs to Kuth farmers to add value and to prepare Kuth for export. He has been successful in his efforts and Kuth cultivation is looking up again. Mr. Nand Lal has also organized the farmers for cultivation of Karu and Atees, two other very important high value Himalayan medicinal plants.

Mr. Pranab Ranjan Choudhury of Baitarani Initiatives, Bhubaneshwar has joined hands with Dabur India Ltd. and local farmers in collecting and processing herbal raw drugs collected from forests in Phulbani and Bolangir districts of Odisha. He has also now organized farmers to undertake cultivation of medicinal plants and for this purpose has already set up a nursery-cum-demonstration plot for cultivation of Briht Panchmool species for training of local farmers.

Mr. Shahandaaz Hussain, Managing Director of Agri Vista Tech, a Guwahati based company is promoting medicinal plant cultivation by organizing farmer groups in the north-eastern states of the country. He has been successful with *Alpinia galanga* cultivation in Arunachal Pradesh, Nagaland, Mizoram and Meghalaya and his cultivation clusters produce more than 300 MT of galangal roots every year. He is also using these cultivation clusters to promote cultivation of species like *Acorus calamus*, *Saussurea costus*, *Inula racemosa*, *Panax sikkimensis*, *Dactylorhiza hatageria*, *Angelica glauca*, *Aconitum heterophyllum*, *Nardostachys jatamansi*, and *Valeriana* spp., the field trials of which have been already completed.

Mr. V. B. Ladole, Chief Functionary, CARD, a local NGO located in Anjangaon Surji of Amravati district in Maharashtra, has, as a part of his mission of rural development through community action, organized more than 1000 farmers to cultivate medicinal herbs, the prominent of these being Pippali. The cluster has also initiated cultivation of Musli (*Chlorophytum borivilianum*) and presently about 200 farmers of this cluster are growing it over about 150 hectares.

In case of adoption of medicinal plant cultivation in Gadag tehsil of Karnataka, efforts by Mr. Mahadeva Pawar, an enterprising farmer from Kalasapur village of the same tehsil need to be appreciated. He organized the farmers and interacted with herbal industries and local traders for

remunerative marketing of the produce before choosing species for cultivation. His efforts have not only made medicinal plant cultivation a profitable venture for the farmers, but also helped in bringing many parched fields under vegetation.

It is clear from the above examples that any new initiative at promoting cultivation of medicinal plants requires hand holding by some local agency over long periods. The farmers need technical inputs in the form of advice about choice of species, initial germplasm, tending of crops, post

Interaction with medicinal plant farmers (01. Tulsi farmers in U.P.; 02. Mandukparni farmers in U.P.; 03. Bhumiamla farmers in U.P.; 04. Farmers in Odisha; 05. Isbagol farmers in Rajasthan; 06. Tulsa farmers in M.P.))

harvest handling and marketing. The efforts of the various NGOs and progressive farmers to lead consistent production of large volumes of good quality produce over years has brought these clusters in lime light with many herbal industries now ready to strike deals with these clusters for long term supplies of the material.

6.6. ISSUES IN PROMOTING CULTIVATION OF MEDICINAL PLANTS

The medicinal plants cultivation, with all the efforts at its promotion, has not yet attained the size and scale it has the potential to achieve. Some key reasons for this slow progress in the sector are as follows:

(i) There is no good mechanism to announce demand of the produce for the next 2-3 years in respect of different species. This lack of knowledge usually results in either over production causing crash in prices or under production causing rise in prices. Many of the high value medicinal plants, especially the shrubs and climbers and the Himalayan herbs, need 2-3 years to become harvestable and such knowledge about the demand at the time of harvesting of produce would save them from losses.

(ii) There still is inadequate acceptability of cultivated produce of some species. For example, the cultivated Atees is not finding favour with the buyers and fetches lower price than the wild harvested one.

(iii) There are issues with dispensation of subsidy. The farmers, many of them not educated enough, are required to prepare cases for seeking subsidy. On approval of the cases, they get first installment of subsidy also. However, the process of getting the second installment released is rather complex. It involves getting the farm inspected and verified by the designated officers, which many a times gets much delayed. Many of the farmers tend to lose their interest in the medicinal plant cultivation during this period.

(iv) Most of the farmers take to medicinal plant cultivation for cash income. However, with payments increasingly being made through Rural Cooperative Banks, there is usually a long delay between deposition of cheques and their clearing for payments.

(v) Adequate availability of good quality planting material remains an issue.

(vi) At many places the farmers get lower than agreed prices as their produce gets reported by the terminal buyer as containing lower percentage of alkaloids or being of lower quality. This is due to non availability of laboratories in the vicinity of the cultivation centres.

(vii) Many states like Himachal Pradesh and Uttarakhand require farmers, desirous of cultivating medicinal plants, to register with the authorized offices under Transit of Forest Produce (Land Route) Rules. The process does not end with registration alone. The farms are required to be inspected by different levels of officials till the crop is harvested and made ready for transportation. It causes inordinate delays, many a times causing damage to the product quality.

(viii) Many medicinal plant species have been notified under Section 38 of the National Biological Diversity Act, 2002 with strict regulations on their trade. The regulations while notifying the species under this section need to be reviewed and made supportive of cultivation of the notified species.

(ix) Much of the cultivated medicinal plant produce gets damaged during post harvest handling due to want of necessary infrastructure to dry, clean, chop, grade and package it. Many farmers during interactions desired creation of such facilities at community level to help them undertake post harvest handling of the produce in a more efficient way. Setting up of drying platforms and drying kilns is of utmost importance at or near Manali to enable taking out and handling fresh and semi dry consignments of Kuth before snowfall blocks the only road link to the Lahaul valley.

(x) Cultivation can get the farmers better dividends if the farms are certified as organic.

6.7. DISCUSSION

Unregulated harvest of many of the naturally growing medicinal plants has resulted in serious decline of their wild populations and thus pushed these wild species towards extinction. Cultivation of such species seems to have become a necessity for meeting the consistent demand for their use and not just a choice. From the above, it is clear that there is a new genre of entrepreneurs in the form of NGOs on one hand and farmers in search of crop diversification on the other hand to give medicinal plant cultivation a serious try. Industry also seems to have realized the inevitability of encouraging cultivation. The need now is to create a facilitating environment for this purpose. For one, the policy and legal framework, especially for the Himalayan states, would need to be revisited and made conducive for cultivation of Red-Listed Himalayan herbs. The system of Transit Pass/ Export Permit under Transit Rules of different states also need to be reviewed and made easier to facilitate trade of cultivated medicinal plant produce. There is a need to develop infrastructure for post harvest handling with associated capacity building training programs for the farmers and the supporting NGOs. The research Institutes would need to be supported for developing large scale planting material for production of high quality material.


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7

Domestic Trade of Herbal Raw Drugs

Trade of herbal raw drugs in the country has been traditionally happening through a network of conventional herbal mandis strategically located close to the wild sources of the produce. The procurement and sale of the produce gathered from the wild in these mandis is based on negotiated rates that vary from trader to trader and place to place. The smaller herbal mandis located in the remote areas act as conduits for the larger national level herbal mandis for eventual sale to the end users. A large number of herbal raw drug entities, nearly 700, are present in substantial trade in these mandis with about 140 entities in annual trade of more than 100 MT each. Even though a lot more clarity is now there about the chain of custody in respect of herbal entities traded in large quantities, the trade through conventional herbal mandis still remains secretive with many issues still to be resolved.

Of late many medicinal plants have come up under cultivation and their trade is happening through the Krishi Upaj mandis set up by the state governments. Neemuch, Unjha and Sojat Krishi Upaj mandis have developed an internationally recognized niche for trade of cultivated material respectively of 'ashwagandha' (*Withania somnifera*), 'isabgol' (*Plantago ovata*), and for 'mehndi' (*Lawsonia inermis*). Some states like Uttarakhand have also established specialized 'herbal mandis' and some states have entrusted the trade of medicinal herbs to specific Cooperatives, Federations or Corporations. The operations of these specialized trade instruments are, however, limited to a few entities traded in large quantities. A lot more still needs to be done to improve disposal mechanisms by these specialized agencies and ensure better returns to the wild gatherers.

7.1. INTRODUCTION

India has a thriving herbal trade to meet the demands of the 8600 odd domestic herbal industrial units, thousands of practitioners of Indian Systems of Medicine who use medicinal herbs for preparing herbal formulations, and millions of households that use herbal raw drugs on day-to-day basis for their healthcare. An idea about the magnitude of this trade can be gauged from the fact that it meets the annual demand of nearly 5 lakh MT of herbal raw drugs obtained from about 1200 medicinal plant species. The medicinal plant species in trade are sourced from many different agro-climatic zones in the country, routed and re-routed under different local names through various raw drug markets before the material finally reaches the herbal industry and the retail shops across different states in the country. This makes this trade in medicinal plants fairly complex.

The herbal raw drug trade in the country involves thousands of traders and commission agents, who act as interface between the primary producers/ wild gatherers of medicinal herbs and the end users. This trade also involves lakhs of local agents who work on behalf of the traders and facilitate collection and aggregation of medicinal herbs from millions of the wild gatherers/ cultivators. The herbal raw drug trade is carried out through various types of herbal markets that have been characterized by Ved and Goraya (2008) based on (a) the 'size of annual transactions' (viz. Large Mandis, Regional Mandis, Intermediate Mandis, and Roadside Mandis) and (b) the 'type of transactions' (viz. Traditional Jari-Buti Mandis, and Organized Agricultural Mandis). Whereas this categorization of the herbal raw drug mandis continues to be largely valid, some new trade practices have been tried over time. To account for these changes in the trade practices, we have attempted to study the herbal raw drug trade in the country under the following headings:

Trade through Conventional Herbal Raw Drug Mandis
Trade through Krishi Upaj Mandis
Trade through Specialized Herbal Mandis
Trade through Cooperatives/ Federations/ Corporations
Trade under Buy-back Agreements

Our teams visited more than 40 herbal raw drug mandis of different types across the country, interacted with traders and commission agents and gathered first hand information about the diversity and annual quantum of herbal entities traded through these mandis. At many places where there was doubt about the identity of the material, samples were procured wherever possible and identity of many such material confirmed with the help from experts. These mandis are known to trade a large number of herbal raw drugs to meet the demand of domestic herbal industry, exports and households. Many of these mandis also trade in spices (dalchini, cloves, nutmeg, star anise, cardamom, etc.), food items (cucumber, watermelon & muskmelon seeds) and oil seeds (coconut, castor, linseed, etc.) that are sourced entirely from cultivation.

The present study resulted in documentation of a considerable diversity of herbal raw drugs usually traded in these mandis. Whereas it was possible to document the diversity of medicinal plant species being traded in Krishi Upaj mandis and the specialized herbal raw drug trading organizations set up by states, documentation of complete diversity of the herbal raw drugs traded in conventional mandis was, however, found to be still shrouded in ambiguity due to (a) reluctance of most of the traders to share their statistics of trade, (b) use of local/ vernacular names for traded entities making their correlation to their botanical entities difficult, (c) opportunistic trade of some herbal raw drug entities not known to be normally traded in a

particular mandi, (d) non-sharing of information on the species that are red-listed, (e) non-sharing of samples of herbal raw drugs by most of the traders, and (f) direct sale of some entities from the original source without routing through the mandi. Absence of any official system of record maintenance in the conventional herbal mandis only compounds the issue.

Study teams interacting with traders in different region of the country

An overview of the different trade practices prevalent in the country is given below:

7.2. TRADE THROUGH CONVENTIONAL HERBAL RAW DRUG MANDIS

The major proportion of the herbal raw drug trade in the country occurs through conventional herbal raw drug mandis of different sizes and shapes depending upon their annual trade volumes. Usually operating from narrow lanes of cities' old markets, these mandis make clear statement of their claim to long history. It is not very uncommon to come across trading companies and commission agents in these mandis engaged in herbal trade for over more than three generations!

Bustling with intense activity and trading huge volumes of a large variety of herbal raw drugs every year, these mandis seem to follow their own unwritten code of practice. It is intriguing to understand the smooth transactions, often large scale, happening in the absence of ideal modern day mandi management parameters like (a) formally defined mandi precinct, (b) centralized regulatory and record keeping mechanisms, (c) practice of open auctions of the produce brought to these mandis, and (d) the need for the transacted herbal material to necessarily pass through these mandis. Much of the herbal material is traded through deals made over telephone or internet. This mandi mechanism does not have any provision for facilitating an active interaction between the primary producers and the end users. The chain of custody and knowledge about the origin and authenticity of the material usually gets buried under the layers of agents operating in the system. This system of operation, therefore, brings in a general feeling of secrecy and opaqueness about the trade.

Notwithstanding the lack of ideal mandi management mechanisms as brought out above, the conventional herbal raw drug mandis continue to grow with trade volumes increasing year by year. The diversity of herbal entities traded through these mandis and the trade volumes being very large, different traders have created their own niche areas of trade, specializing in collecting and aggregating large volumes of specific material from different areas through a network of local level agents. This way the traders have been able to create a sort of confidence and trust of both sellers and the buyers.

Since there is no centralized regulatory or record keeping mechanism in these mandis, the estimation of herbal trade in this study has been based on the information that could be gathered from individual traders, and is, thus, far from complete.

Given below are highlights of some of the conventional mandis visited during the study:

7.2.1. Conventional Herbal Raw Drug Mandis in Tamil Nadu

The three herbal mandis of Tamil Nadu i.e. Virudhnagar, Dindigul and Chennai, account for more than 80% of the domestic herbal trade in the state with a collective annual trade volume of more than 20000 MT. Whereas the Chennai raw drug market deals with larger number of raw drug entities sourced from across different parts of the country, the ones at Virudhnagar and Dindigul specialize in trade of a limited number of locally collected herbal raw drugs.

Virudhnagar Herbal Mandi trades about 75 herbal raw drug entities with an estimated annual trade volume of about 10,000 MT. Trade of about 45 herbal raw drug entities with an estimated annual trade volume of 3500 MT was recorded from Dindigul. Both these mandis have an estimated collective annual trade turnover of more than ₹ 100 crore. The major herbal raw drugs collected from the wild that are traded in high volume at these mandis include leaf and seed of

Thuthi (*Abutilon indicum*), Neem leaf (*Azadirachta indica*), stems of Priandai (*Cissus quadrangularis*), roots of Nilapanai (*Curculigo orchioides*), roots of Motha (*Cyperus rotundus*), whole plants of Bhringraj (*Eclipta prostrata*), dried fruits of Nunaa (*Morinda coreia*), whole plants of Maela nelli (*Phyllanthus maderaspatensis*), whole plants of Vatta thirupi (*Sida acuta*), whole plants of Kozhinji (*Tephrosia purpurea*), and fruits of Siru nerunjil (*Tribulus lanuginosus*). Some medicinal plants of conservation concern viz. Aaduthinna paalai (*Aristolochia bracteolata*) and Karudakodi (*Aristolochia indica*) are also traded in smaller quantities at these mandis. Whereas the 20 odd traders in these mandis deal with an average of 40 herbal raw drugs each, at least one trader in Dindigul has specialized in trade of Etti seeds (*Strychnos nux-vomica*) with an annual trade volume of about 1000 MT. He sources his material from nearby areas and also from Andhra Pradesh, Odisha, Karnataka and Kerala. The traders informed that fast depleting inflows of the roots of Kali musli (*Cuculigo orchioides*) and leaf of Gudmar (*Gymnema sylvestre*) have become a cause of worry.

More than 5,000 local people, of whom about 90% are women, are engaged in collection of herbal raw drugs from the wild in nearby areas. As these collections are mostly done during dry season, these form a very significant income generating vocation for the local people during lean period. These mandis also deal in herbal raw drugs that are locally cultivated viz. Nithyakalyani (*Catharanthus roseus*), Thulasi (*Ocimum tenuiflorum*), Senna (*Senna alexandrina*), and Aavaarai (*Senna auriculata*).

Trade of about 180 herbal raw drug entities with an estimated annual trade volume of about 8,000 MT has been recorded from Chennai herbal raw market. The entities in annual trade of 100 MT or above include Peepal Mool (*Piper longum*) of three grades with respective rates being ₹ 50-60 per kg, ₹ 200-210 and ₹ 300-350 per kg. Another entity in high trade is roots of *Decalepis hamiltonii*, which are sold as substitute of *Hemidesmis indicus*. Supplies in respect of both these commodities are sourced from Andhra Pradesh – cultivated source in case of Peepal Mool and wild collections in case of *Decalepis hamiltonii*. The traders lamented the decreasing availability of the desirable thick root stock of both *Hemidesmis indicus* and *Decalepis hamiltonii*, indicating fast decline in their wild populations. Most of the other entities are traded between 10 to 100 MT each with a few imported entities like Rumi mastaki (*Pistacia lentiscus*), Ustukhudus (*Prunella vulgaris*), Gaozaban (*Onosma bracteata*), etc. being traded in quantities of less than 1MT per annum.

7.2.2. Conventional Herbal Raw Drug Mandis in Uttarakhand

Tanakpur and Ramnagar are very prominent conventional herbal mandis of Uttarakhand with estimated annual trade volumes of 8,000 MT and 5,000 MT respectively. These mandis receive most of their material from the high hills of the state, with supplies of some important species also coming from Nepal under free trade agreement with that country. Tejpatta (*Cinnamomum tamala*), collected from wild as well as from cultivated sources is one of the major herbal commodities in trade in these mandis. Chiretta (*Swertia chirayita*), all imported from Nepal, has been another commodity of high trade at these mandis. A large proportion of the material from these mandis gets routed through Khari Baoli, Delhi. However, a part of the material is also traded directly with other herbal mandis in the country and also with herbal manufacturing units.

7.2.3. Conventional Herbal Raw Drug Mandis in Chhattisgarh

Chhattisgarh with its vast forest expanses forms a home for a large number of medicinal plants. The major wild collected herbal raw drugs that are in trade in Chhattisgarh include Harar (*Terminalia chebula*), Baheda (*Teminalia bellirica*) and Aonla (*Phyllanthus emblica*) with each of

these entities having an annual trade volume of about 3000 MT. Other important herbal raw drugs in substantial trade include Kalmegh (*Andrographis paniculata*), Baibidang (*Embelia tjerium-cottam*), Bel (*Aegle marmelos*), and Bhilawa (*Semecarpus anacardium*), Dhai (*Woodfordia fruticosa*), Chakoda seeds (*Cassia tora*) with an average annual trade of each of these entities being about 1000 MT (MPVS, 2015). All these herbal raw drugs are collected from the wild, and are traded at weekly markets as well as at larger herbal mandis at Kankar, Katni, Bilaspur, Dhamtari, Jagdalpur, and Raipur.

Dhamtari herbal mandi, with an annual trade volume of 12,500 MT, receives wild collected material mainly from forests areas of Bastar, Rajnandgaon and Durg falling south of Raipur. Some material is also received from the adjoining areas of Madhya Pradesh. The 18 odd herbal traders also procure some material from the weekly 'Haats'. Whereas MPVS (2015) mentions closing of herbal business by 5 trading firms on account of reducing annual arrivals in the mandi, our field teams didn't notice such a shift. The traders have taken to value addition to the business in the form of grading of material and keeping it in better storage facilities. The material from this market is supplied to the major markets like Khari Baoli, Delhi and also directly to leading herbal industries. The Gol Bazar herbal mandi of Raipur has an annual trade volume turnover of about 21,000 MT. This mandi mainly receives wild collected material from the forest areas north of Raipur. Some of the traders at this mandi also have their own processing units close by. This mandi is an intermediate mandi for further supplies to herbal mandis at Delhi, Aakola, Mumbai, Kanpur, etc.

These mandis have established network of local level agents who procure material directly from wild gatherers or from weekly haats, aggregate the same and forward the material to these larger mandis. Wild gatherers, more than 70% of whom are women and children, are paid in cash as per quality of the material. Even as some traders came forward to share information, the details of exact source of supplies and the quantum of annual trade were withheld by them as 'trade secrets'. It also emerged that many of the local traders have graduated into dealing directly with larger mandis and with herbal industries.

7.2.4. Conventional Herbal Raw Drug Mandis in Madhya Pradesh

Madhya Pradesh, with its varied physiographic zones and diverse forest types, has been traditionally known to be a very rich repository of medicinal herbs. The areas bordering Chhattisgarh are rich in Harar (*Terminalia chebula*), Baheda (*Teminalia bellirica*), Amla (*Phyllanthus emblica*), Mahua (*Madhuca indica*), Safed Musli (*Chlorophytum tuberosum*), Baibidang (*Embelia tjerium-cottam*), and Kalmegh (*Andrographis paniculata*), the ones bordering Rajasthan and Uttar Pradesh are good sources of Shatavar (*Asparagus racemosa*), Salai Guggal (*Boswellia serrata*), Konch Beej (*Mucuna pruriens*), Bael (*Aegle marmelos*), and Giloe (*Tinospora cordifolia*). Madhya Pradesh also has large scale cultivation of medicinal plants and the produce from cultivation finds way to the Neemuch Agri-Produce mandi. In as far as the wild collected produce is concerned, the major mandis include Shivpuri, Jabalpur, Indore, Betul, Bhopal, Chhindwara, Balaghat, and Shahdol etc. Like in Chhattisgarh, the increasing connectivity and communication has prompted many petty local traders in Madhya Pradesh also to start dealing directly with the end users. The established traders at the intermediate mandis, though, continue to expand their business by engaging other local agents. An increasing trend of value addition in the form making extracts by some of the enterprising traders has also come to notice.

7.2.5. Conventional Herbal Raw Drug Mandis in Odisha

Odisha is another state having excellent medicinal plant resources in the wild. The tribal populations in many districts of the state are largely dependent upon the collection of medicinal herbs from the forests and sell these for their livelihood. Most of the material collected in this way is sold through the weekly haats. The local agents then procure such material, aggregate the same and dispatch it to larger mandis like Koraput, and Cuttak in the state. Some 40 odd herbal entities including Harar (*Terminalia chebula*), Baheda (*Teminalia bellirica*) and Aonla (*Phyllanthus emblica*) being traded in large quantities, are traded in these mandis with a cumulative annual trade volume of about 4,000 MT. The material from these mandis goes to Khari Baoli, Delhi, and also to the herbal manufacturing units directly.

7.2.6. Conventional Herbal Raw Drug Mandi, Khari Baoli, Delhi

Khari Baoli, Delhi is considered to be the largest spice market in Asia and the largest conventional herbal raw drug mandi in the country. Operating since 17th century from the narrow alleys of Khari Baoli area, near Chandni Chowk, this mandi is still living its old heritage. Most of the traders in this mandi are continuing their inherited family business and it is not uncommon to come across traders here who are in herbal trade for more than 5 generations! The mandi also still retains its ancient flavor in its material carriage tradition i.e. either on porter backs or by hand carts.

Enquiries with traders revealed that more than 300 herbal raw drug entities, received from various parts of the country and abroad, are regularly traded in this mandi, of which about 30 entities are traded in volumes exceeding 1000 MT per year, and about 50 entities are traded in volume between 100 MT and 1000 MT annually. It is estimated that the 250 odd traders having a shop in this mandi collectively handle a trade of about 150,000 MT of herbal raw drugs every year. No official record of such annual trade volumes is, however, available, as no record keeping mechanism exists at this mandi. We also tried to corroborate the annual quantum of trade at this mandi with the daily number of trucks of the herbal raw drugs getting unloaded at this mandi. Interactions with loaders, porters and traders brought out that an average of 70 truckloads of herbal raw drugs was getting unloaded at this mandi every day. At an average of 7 MT per truck load, the daily arrivals of herbal raw drugs at this mandi translate to 490 MT, and taking 300 working days per year, the annual volume of herbal raw drugs received at this mandi works out to 147,000 MT. Some of the material is also known to be traded without its getting physically routed through the mandi. The daily trade of herbal raw drugs alone results in generating wages worth about ₹ 700,000 every day with each of the 700 odd porters/ hand cart owners earning an average of ₹ 1000 per day.

Visit to this mandi is an experience in itself. All day long it is abuzz with activity, whether it is the porters and hand carts ferrying sacs of herbal raw drugs from the unloading points on the outer main roads to the godowns of traders in the narrow alleys, or ferrying of sold material from these godowns to the loading points. The mandi also witnesses a great daily rush of buyers/ traders from across the country who move from shop to shop in search of material of their choice – from both qualitative and rate perspective. Most of the transactions are facilitated by scores of free lance agents who have developed uncanny ability to detect a potential buyer as soon as he enters the area. These agents take upon themselves the responsibility of directing the potential buyers to specific shops, and get a commission from the trader if the deal is closed. The mandi also witnesses lateral trade amongst resident traders of the mandi. It is intriguing to watch most of the transactions happening by way of only slips issued by the traders. There is, however, a definite design in this apparent disorder.

The top ten traded herbal raw drugs at this mandi were recorded to be Mehndi leaf (*Lawsonia inermis*), Mulathi (*Glycyrrhiza glabra*), Tulasi (*Ocimum tenuiflorum*), Karu (*Picrorhiza kurroa*), Daruhaldi *(Berberis* sp.), Amla (*Phyllanthus emblica*), Harar (*Terminalia chebula*), Ritha (*Sapindus mukorossi*), Isabgol (*Plantago ovata*), and Majith (*Rubia cordifolia*).

Interactions with the traders at Khari Baoli mandi brought out that the grading and packaging of the material at the source end had improved over the years and that the traders here were now usually receiving dried, graded and well packed material. Whereas the fast moving items and the items traded in smaller quantities are stored in godowns close to the shops, the bulk items and items susceptible to damage are stored in rented space in cold stores. Even as some of the bigger trading houses have been using the cold store facilities for the past 30 odd years, there was a growing trend to keep large stocks of slow moving herbal raw drugs in cold stores to save the material from insect pests and fungal attacks and to maintain quality of the material. Such storage did result in escalation of cost (extra loading, unloading & transport; storage charges, and loss of an average of 8% weight during storage). However, such cost escalation on account of storage, they said, was very worthwhile to retain quality of the material, to save the material from damage, and to ultimately add to conservation of the resource in the wild.

The traders also shared some of the issues that they felt were impacting the rates of herbal raw drugs. The first major factors they felt was sudden spurt in the demand of some high value material that shifts the focus of local wild gatherers towards that commodity. Citing the specific examples of 'Satva' (*Trillidium govanianum*) that saw very high demand at a very high rate (₹ 1800-₹ 2400 per kg) over the last 4-5 years, they said that it diverted the focus of wild gatherers to this species only, adversely impacting the wild collections of other Himalayan herbs and causing their prices to rise. It was perhaps this effect that prices of 'Karu' (*Picrorhiza kurroa*) shot from ₹ 800 per kg to about ₹ 2500 per kg during 2014-15. The prices stabilized at ₹ 900 to ₹ 1200 per kg only after this price rise resulted in large scale import of 'Karu' from Nepal. They also cited MNREGA effect on the prices of some wild collected medicinal herbs as in case of low value herbs, working for MNREGA was more remunerative to the local gatherers. The traders were in such cases obliged to either pay higher wages or engage outside labour to effect wild collections to meet their supply commitments.

Some of the traders also shared their experiences about the usual trade practices pertaining to wild collected medicinal herbs. The process, they shared, usually starts with spreading a word amongst the local wild gatherers about the demand of given commodities through local agents. The wild gatherers are usually paid some money in advance for the purpose. The local agent procures the material from the primary gatherers and settles their payments at pre-agreed prices. He aggregates the material from different sources and keeps it stored in godown till further transport to the larger trader. The local agent is usually paid his money immediately on receipt of material. Further supplies of the material to the herbal industry/ exporters usually happen on credit. This entire process involves risks of loss at various stages. The first stage of risk, they shared, is at the level of primary producer/ wild gatherer. If the wild gatherer fails to make the agreed supplies due to some reason, the money advanced to him is usually taken as money lost. The second stage of risk is the damages on account of mis-handling of the produce during post harvest handling and during storage. Delays in transport and final disposal of the collected material add to such damage and loss. The third stage of risk is the downward fluctuation in prices. The fourth stage of risk, they shared, is on account of non-receipt of payments against supplies from many end users. Each of the traders interacted with was having small or large bad debts on this count. Since a large amount of money gets locked up at various ends, there is also a loss of bank interest on such investments.

Trade and value addition activities in different herbal raw drugs markets in the country

7.2.7. Mandi-wise Estimation of Annual Trade Volumes in Respect of Conventional Herbal Raw Drug Mandis

Quantification of annual trade volumes for each of the 34 conventional herbal mandis visited during this study proved to be very difficult. The estimations have been arrived at on the basis of subjective assessment by the few traders in each mandi who volunteered to come forward and shared information. The information gathering process gets frequently interrupted due to trade enquiries by hundred of potential buyers coming to the respondent trader from across the country. Moreover, the information gathering process is probity driven i.e. asking the trader about

the annual volumes of particular commodities traded by him and his assessment of the total annual trade of that commodity in the whole mandi. With a limited number of respondents coming forward to share information, the results are far from comprehensive. Thus, the figures given in the table 7.1 are based on extrapolation of the subjective information provided by different traders. Attempts to cross check the figures through non-structured interactions with different stakeholder groups viz. traders, commission agents, buyers, coolies, transporters have been made and the mandi-wise data moderated.

Table 7.1. Estimation of Annual Trade Volumes in respect of Conventional Herbal Raw Drug Mandies

S. No.	Name of Mandi	Number of Traders in the Mandi (Approx.)	Number of Major Entities Traded	Annual Trade Volume (MT)
1.	Khari Baoli, Delhi	250	300	≈1,50,000
2.	Majith Mandi, Amritsar (Punjab)	35	70	≈≈20,000
3.	Tanakpur (Uttarakhand)	14	35	≈9,000
4.	Ramnagar (Uttarakhand)	12	28	≈5,000
5.	Sharanpur (Uttar Pradesh)	08	38	≈3,000
6.	Kanpur (Uttar Pradesh)	21	35	≈4,000
7.	Lucknow (Uttar Pradesh)	23	72	≈2,500
8.	Kannauj (Uttar Pradesh)	09	31	≈2,000
9.	Banaras (Uttar Pradesh)	06	29	≈2,500
10.	Jagdalpur (Chhattisgarh)	06	23	≈8,500
11.	Dhamtri (Chhattisgarh)	18	20	≈12,500
12.	Kankar (Chhattisgarh)	04	09	≈2,200
13.	Katni (Chhattisgarh)	05	10	≈1,000
14.	Raipur (Chhattisgarh)	21	06	≈21,000
15.	Jabalpur (Madhya Pradesh)	03	08	≈3,000
16.	Indore (Madhya Pradesh)	10	12	≈4,000
17.	Betul (Madhya Pradesh)	02	07	≈1,600
18.	Bhopal (Madhya Pradesh)	11	13	≈500
19.	Chhindwara (Madhya Pradesh)	01	12	≈600
20.	Mumbai (Maharashtra)	250	78	≈17,000
21.	Chandrapur (Maharashtra)	01	02	≈100
22.	Nagpur (Maharashtra)	07	35	≈500
23.	Amravati (Maharashtra)	02	07	≈500
24.	Koraput (Odisha)	09	20	≈3,000
25.	Cuttak (Odisha)	03	49	≈1,000
26.	Patna (Bihar)	04	29	≈500
27.	Ranchi (Jharkhand)	02	11	≈300
28.	Kolkata (West Bengal)	54	31	≈1,000
29.	Chennai (Tamil Nadu)	40	175	≈8,000
30.	Virudhnagar (Tamil Nadu)	15	93	≈10,000
31.	Dindukkal (Tamil Nadu)	06	39	≈3,500
32	Jammu (Jammu & Kashmir)	37	48	≈500
33	Srinagar (Jammu & Kashmir)	14	12	≈100
34	Jaipur (Rajasthan)	39	11	≈2,500

There were limitations in respect of gathering of trade data on at least two other counts. At some places the traders provided only local names in their local dialect, which could not be correlated to their botanical identities due to want of samples. Secondly, there is an issue of many herbal raw drugs flowing from one mandi to another and getting double counted. Thus, the above estimations are at best indicative about the diversity of herbal raw drugs usually traded at these mandis and the approximate volumes traded annually.

The visits to herbal mandis did, however, provide good information about the areas of major production and chain of custody of entities traded in large quantities.

7.3. TRADE THROUGH KRISHI UPAJ MANDIS

Different states in the country have set up state-specific Mandi Boards to facilitate trade of the agricultural produce through a network of well laid out Krishi Upaj Mandis (Agriculture Produce Markets). These mandis provide a platform for the farmers and the buyers to come in direct contact with each other. The produce brought to these mandis by the farmers is put to auction by specialized paid auctioners, ensuring that the farmer gets the best returns for the same. Each such mandi is provided with necessary infrastructure for stacking and auctioning of the produce. The auctioned produce is weighed in the presence of the concerned farmer, and he is issued a cash memo recording the quantity of produce sold and the rate of sale. This cash memo enables the farmer to receive his payment from the buyer usually by the day end. In many of the mandis, a layer of commission agents is also present. The commission agents facilitate the auctions on behalf of buyers, arrange for the bags (bardana), get these filled up, weighed and make payment to the farmers. The commission in such cases is charged from the buyer. The mandi charges some fixed fee towards infrastructure and mandi management.

These regulated mandis, set up with the prime objective of catering to the need of conventional agricultural crops like wheat, rice, corn, pearl millet, cotton, ground nut, etc. provide an excellent opportunity to route the trade of medicinal herbs, of both cultivation and wild collected origin, through these. Some of these mandis have already added various commodities of local importance to their auction lists and have, over the years, specialized in the trade of a diversity of commodities, including herbal raw drugs. To formalise this process, various state governments have notified the list of commodities, whether cultivated or wild collected, that have to be necessarily traded through these mandis. Presented below are the examples of some of the mandis that have very successfully made a name in trading of herbal produce:

7.3.1. Neemuch Mandi (Madhya Pradesh)

Neemuch Krishi Upaj Mandi is the oldest such market in the country that was set up in 1922. Spread over an area of 15 acres, this mandi has separate sections for auctioning different commodities. This mandi is nationally acclaimed for the trade of 'Garlic' and 'Ashwagandha'. It routinely handles more than 50 items - mostly agricultural produce – of which more than 20 items are botanical raw drugs, both cultivated and collected from the wild. There is one dedicated covered yard for auctioning Isabgol seeds and two covered yards for auction of other herbal raw drugs.

An average 17,000 MT of the 20 odd botanical raw drug entities are traded through this mandi annually, of which the major ones are listed in table-7.2:

Table 7.2. Herbal Raw Drug Entities Traded at Neemuch Mandi

S. No.	Entities in Trade	Botanical Name	Apprx. Trade Volume during 2015-16 (MT)	Average Rates during 2015-16 (₹/Qtl)
1	Isabgol Seeds	*Plantago ovata*	7500	7500
2	Ashwagandha Roots	*Withania somnifera*	2000	9500
3	Ashwagandha Leaf		800	600
4	Ashwagandha Seed		150	1100
5	Kalonji	*Nigella sativa*	3000	14500
6	Kalmegh	*Andrographis paniculata*	1300	1250
7	Tulsi Seed	*Ocimum gratissimum*	1000	8000
8	Mehndi	*Lawsonia inermis*	300	3300
9	Amla	*Phyllanthus emblica*	300	5000
10	Neem Giloye	*Tinospora cordifolia*	100	800
11	Neem Leaf	*Azadirachta indica*	100	1100
12	Asaliya/ Halon	*Lepidium sativum*	100	6400

In addition, some other herbal entities brought to this mandi for trade in smaller quantities are 'Satavar' (*Asparagus racemosus*), 'Hingot fruits' (*Balanites aegyptica*), 'Kaith fruits' (*Limonia acidessimma*), Bahera (*Terminalia belerica*), 'Amaltas pods' (*Cassia fistula*), Powad seeds (*Cassia tora*), Posta seed (*Papaver somniferum*), Neem Seeds (*Azadirachta indica*), Tulsi Leaf (*Ocimum tenuiflorum*), Safed Musli (*Chlorophytum tuberosum*), Tesu Phool (*Butea monosperma*), Ark roots (*Calotrois procera*) and Vilayiti babool pods (*Prosopis juliflora*).

This mandi is one of the few examples where farmers and gatherers of medicinal plants come face to face with traders/ buyers of the produce. The open auction of the produce ensures the best prices to the farmers/ gatherers. Interactions with the farmers and Mandi officials revealed that the auctioned produce is put in jute bags, weighed in the presence of the concerned farmer and sent to the godown of the buyer immediately after auction. The farmer is issued an auction slip and he receives his payment in cash by 3 PM the same day from the buyer. An indicative trade procedure in respect of Ashwagandha and Isabgol Seeds is given in Boxes 7.1 and 7.2 respectively.

In addition to fetching good prices to the farmers, the mandi is also a source of good income to a variety of stakeholders. Jute bag-fillers is one such category working in the mandi precincts itself. The bag-fillers are paid ₹ 4/- per bag of upto 50 kg. Above this weight charges are ₹ 4.50 per bag. Then there are loaders and carriage owners that transport the sold material to godowns of traders.

The inflow of herbal raw drugs to the mandi has been on the increase. Interactions with traders brought out that the space was becoming a big constraint. Even the vast open courtyard outside the two covered platforms earmarked for auction of botanical raw drugs was now inadequate to handle the inflow. It was resulting in damage to the material. The mandi officials informed that a new site of 70 acres has already been procured to provide better space and would become operational soon.

The magnitude of trade in this mandi can be appreciated from the fact that it generates an average monthly collection of ₹ 2 crores @ 2% of the sale value of the produce that is charged from the

buyer. One fourth of this fee is retained in the mandi to meet the routine administrative and operational costs, whereas the remaining three fourth part of the fee is deposited with the Mandi Board general development of mandis in the state.

Box 7.1. Ashwagandha Trade at Neemuch Mandi

Neemuch mandi is the hub in the country engaged in trading the highest volume of Ashwagandha (*Withania somnifera*) every year. This mandi alone trades about 2000 MT of Ashwagandha roots, about 150 MT of Ashwagandha seeds (asgandh beej) and more than 800 MT of Ashwagandha leaf (asgandh patti) every year. A major portion of the produce is derived from the villages of Piplia Raoji, Uched and Jamniya Raoji in Neemuch district, which with cultivation of Ashwagandha over more than 1000 hectares of land, forms the single largest cluster cultivating Ashwanadha in the country. Ashwagandha is also cultivated sporadically over large areas in the states of Madhya Pradesh, Rajasthan and Andhra Pradesh, and the produce from these areas is also brought to Neemuch mandi for sale.

Ashwagandha stocks ready for auction

The Ashwagandha roots brought to the mandi are carefully graded into different categories depending upon the thickness of the material. The pieces of index finger thickness fetch the highest prices, whereas the lower thin portions (taar) fetch low prices. Prices also vary depending upon the density of the roots. The less the fibre in the roots, the higher the prices it fetches. Thus, material from Kurnool (Andhra Pradesh), being lighter and more fibrous, is usually rated inferior to the one produced in Madhya Pradesh. The produce from Ratitala area in the state is the most prized.

Sizing and grading of Ashwagandha roots

The average rate of Ashwagandha roots in Neemuch mandi varies from year to year. Whereas the average rate was ₹ 158 per kilogram during 2014-15, it was commanding a lower average price of ₹ 95 per kilogram during 2015-16. The reason for this fall in prices is said to be the generally lower quality of the produce during the current year due to rainfall failure.

Box. 7.2. Trade of Isabgol Seeds at Neemuch Mandi

Isabgol seeds (*Plantago ovata*) form an important herbal entity in trade at Neemuch mandi with a trade volume of about 7500 MT recorded during 2015-16. The inflow of produce faces quite wide annual fluctuations as the crop is much dependent upon the climatic conditions. Depending upon the quality, the rate varies from as low as ₹ 35/ kg to a high of ₹ 86/ kg with an average price of ₹ 75/ kg. There is a separate covered yard for auction of Isabgol. The auction process usually starts at about 0930 hrs. and is over by about 1030 hrs. Mandi officials put each heap to auction in the presence of the concerned farmer.

The filling into bags starts immediately after a stack is auctioned. Isabgol is filled in large jute bags, with each filled bag weighing 60.700 kg (Isabgol seed = 60 kg + jute bag = 700 gms). Weighing takes place in the presence of the concerned farmer. Immediately after his entire auctioned produce is filled in bags and weighed, the famer is issued a cash memo by the buyer. The filled bags are then loaded on vehicles and transported to the godown of the buyers. The entire auction and after-auction handling process is very efficient and the entire platform is cleared of Isabgol seeds by noon.

Isabgol - auction, packaging and weighing

In addition to Neemuch, there are other krishi upaj mandis in the nearby towns to facilitate trade of produce from those areas. Of these, the Krishi Upaj Mandi, Mandsaur trades more than 1000 MT each of Isabgol, Kalonji, Alsi and Asalia per annum. Small quantities of all the 20 odd botanical raw drugs that are traded at Neemuch mandi are also traded through Jeeran Krishi Upaj Mandi in Neemuch district of Madhya Pradesh.

(1) Neem leaves; (2) Asaliya seeds; (3) Tulsi seeds; (4) Kalmegh in trade process at Neemuch

7.3.2. Unjha Mandi (Gujarat)

This Krishi Upaj Mandi is an excellent example of regulated market for trade of agriculture produce. It is known as the largest 'Jeera' (*Cuminum cyminum*) mandi in Asia with an average annual sale volume of 1,25,000MT of this commodity alone. It is also the largest 'Isabgol' (*Plantago ovata*) mandi in the country and trades an average of 50,000 MT of Isabgol every year. The third important item in significant annual trade at this mandi is 'Variali' (Saunf, Fennel) with an average annual trade of 35000 MT. In addition to these three top traded commodities, more than 20 other commodities are brought to this mandi for trade by farmers, prominent of these being mustard seeds, castor seeds, till (sesamum), fenugreek, coriander seeds, suwa (dill seed), etc.

This mandi is in operation since 1954 and handles an average annual trade volume of about 2,75,000 MT of all commodities. This mandi has very successfully introduced good trading practices in the form of (a) standardized weighing equipment and associated protocols, (b) provision of cash payment to farmers on the very day his produce is sold, (c) provision of amenities like drinking water, washrooms, covered auction yards, etc., (d) subsidized quality testing laboratory, established in collaboration with the Spices Board, Ministry of Commerce and Industry, Government of India, and (e) on campus godown facility for storage of unsold and sold material. With modernization of all mandi functions, the auction continues to be in 20 kilogram traditional local units, called 'mann'.

The excellent trade practices and facilities available at the Unjha mandi is encouraging farmers from even far off places to bring their produce to this mandi for sale. With the arrivals to the mandi

on the rise, the management had to procure another piece of land on the city outskirts to handle the inflow, where facilities are under development.

During 2014-15, about 62,000 MT of Isabgol seeds (*Plantago ovata*) were traded at Unjha mandi at an average rate of ₹ 100 per kg. The rates varied from a low of ₹ 1600 per mann to ₹ 2500 per mann depending upon the quality of the seed. About 12 traders regularly participate in Isabgol auctions every day.

The mandi charges a market fee of 0.5% from the purchasers. The mandi is acclaimed for its quality standards and for making on-the-spot cash payment to the farmers at the time of sale for their produce.

7.3.3. Rajasthan Krishi Upaj Mandis

Rajasthan has come to be widely recognized for large scale cultivation of Mehndi, Senna, Castor, and Isabgol. To facilitate trade of these botanical raw drugs, the Rajasthan State Agricultural Marketing Board (RSAMB) has included these commodities for trade through its Krishi Upaj Mandis. However, over the years some of these mandis have specialized for trade of one or more of such botanical raw drugs. Krishi Upaj Mandi at Sojat (Rajasthan) is one such mandi that has made its name in trade of Mehndi (Henna). The mandi has a separate section dedicated to Mehndi and has put in very meticulous quality control mechanisms to ensure quality of the material auctioned through its yards. The mandi usually receives Mehndi from around Sojat where it is cultivated over 40000 hectares. During 2014-15, about 30,700 MT of Mehndi leaf were traded through this mandi. Small quantities of Mehndi are also traded at the Sojat Road mandi, a satellite of the old Sojat mandi.

Data received from the Jt. Director, Agriculture Marketing Committee, Jodhpur reveals that the cultivated botanical raw drugs are traded through a network of about 15 krishi upaj mandis in the circle. In addition to sale of Mehndi from Sojat, during 2014-15, 13680 MT of Isabgol, 15800 MT of Castor seed, and 18310 MT Senna leaf and pods was sold through various Krishi Upaj Mandis in the State.

7.3.4. Other Krishi Upaj Mandis

Various other Krishi Upaj Mandis in different states provide platform for trade of medicinal herbs. For example, the state of Himachal Pradesh has also notified some 35 medicinal plant species, cultivated as well as wild collected, for trade through the Krishi Upaj Mandis of the State. However, cultivation of medicinal plants has not yet picked up in the state and as such medicinal plant trade of wild collected medicinal plants continues to be controlled by the local traders.

The Krishi Van Upaj mandis are organized and regulated markets that follow good trade practices and protocols. Meticulous records of all transactions, by volumes traded per day along with daily rates, are maintained and put on mandis' web site. In addition to providing transparency in trade and getting best prices to the farmer, this mandi system also comprehensively addresses the issue related to the chain of custody. As such these mandis provide a good opportunity for trade of cultivated medicinal plants through these. These could be effectively put to use for trade of wild collected medicinal plants for which necessary government orders need to be put in place.

It needs to be noted that conducive regulatory regime about cultivation and transport of medicinal plants is required for efficient working of these mandis. Even as government

notifications in respect of trade of listed wild collected medicinal plant species through these mandis is in place in various states, such trade has not picked up due to very complex and time consuming material transport procedures. To make such mandis effective in all states, the regulatory regimes for cultivation and transport of cultivated and wild collected produce to these mandis and from these mandis to outside the state need to be reviewed and made more facilitative.

7.4. TRADE THROUGH SPECIALIZED HERBAL MANDIS

Trade of wild collected botanical raw drugs has been long considered to be highly exploitative of the wild gatherers. The various state governments have been trying to find workable mechanisms to ensure remunerative returns to the wild gatherers. The initiative by the Uttrakhand government in this direction is presented below:

The Uttarakhand Government, in 2003, notified a scheme for Conservation, Development and Harvesting of Medicinal and Aromatic Plants from the forest areas and appointed the Uttarakhand Forest Development Corporation (UFDC) as the marketing agency for the wild collected produce. Through another notification in June 2004, procedure for operationalisation of wild harvest and marketing of medicinal herbs was laid. As a result three herbal mandis were set up in the state. These three mandis are Bibiwala (Rishikesh), Aamdanda (Ramnagar), and Tanakpur Depot (Tanakpur). All these three mandis are located in the precincts of the existing timber depots of the UFDC, where some area has been set aside and developed for trade of medicinal herbs. Facilities like godowns and auction yards have been created at these mandis. One of the key factors to locate the herbal mandis at these places was the existence of conventional herbal mandis at these places.

The wild collection of medicinal herbs is carried out by the registered local gatherers under the aegis of either of UFDC, Bheshaj Sangh, Kumaon Mandal Vikas Nigam, Garhwal Mandal Vikas Nigam and Van Panchayats from the forest areas allocated to them by the concerned Divisional Forest Officer. The produce so collected is transported to the nearest herbal mandi under export permit (ravanna) issued by the concerned Divisional Forest Officer. A royalty @ 8% on the notified sale price is collected from the designated harvesting agency at the time of issue of export permit. Auctions at these herbal mandis are conducted on fixed dates i.e. Bibiwala, Rishikesh (01 & 16 of every month), Aamdanda, Ramnagar (06 & 21 of every month), and Tanakpur (10 & 26 of every month). The material received at these mandis is auctioned on 'as is where is' basis and no value addition is carried out in the mandi precincts. The sale proceeds are subject to deductions on account of mandi fee (1%), income tax (2.6%), sales tax (4.5%), and UFDC overheads (10%). In case of sale proceeds from cultivated material, no royalty is charged.

Perusal of the trade volumes at these mandis reveals that the annual trade volume grew from about 2200 MT in 2005-06 to a high of about 3130 MT in 2012-13. The trade volumes, however, decreased to 1980 MT in 2013-14, 1700 MT in 2014-15 and just 1440 MT in 2015-16. The trade value over the past three years was ₹ 18.08 crore (2013-14), ₹ 16.44 crore (2014-15) and ₹ 19.77 crore (2015-16).

Critical analysis of the trade data reveals that Jhula (*Parmelia* spp.) and Moss (*Chondrus* spp.) has been consistently forming nearly 95% of the total annual trade volumes recorded at these mandis. Tejpatta (*Cinnamomum tamala*), with average annual trade of about 30 MT, is another commodity of some significance that is traded in these mandis. Other species that are occasionally brought to

these mandis in much smaller quantities include Chitrak (*Plumbago zeylanica*), Dandasa (*Juglans regia*), Padam kashth (*Prunus cerasoides*), Van haldi (*Hedychium spicatum*), Ritha (*Sapindus mukorossi*), Pashanbhed (*Bergenia ciliata*), Satua (*Paris polyphylla*), Giloe (*Tinospora cordifolia*), Atees (*Aconitum heterophyllum*), Salampanja (*Dactylorhiza hatageria*), Yartsa gumba (*Ophiocordyceps sinensis*), etc. It is a common knowledge that removals of these commodities from the forests are much higher than the mandi data reveals. Presumably, a large proportion of the harvest is getting removed through unauthorized channels.

Interactions with local people and staff of authorized extraction agencies brings out that the procedure to move the harvested material from field depots to the herbal mandis was quite complex and time consuming. That this delay adversely affected the quality of the produce has also been highlighted (UFDC, 2009). The time lag in getting payments was also fairly long, discouraging people from taking the material to the herbal mandis. Moreover, the major buyers at these herbal mandis continued to be the local traders who sell the material procured from these mandis to end users at much higher prices, albeit after adding value in the form of cleaning, grading and packing. These herbal mandis have, therefore, not been able to fulfill the objective of eliminating the intermediary layers from the trade chain.

The government of Himachal Pradesh also tried to emulate the 'successful' (?) medicinal plant trade model of Uttarakhand and established a Medicinal Plant sale depot at Shamshi, Kullu. Basic facilities for collection, storage, drying and auction of the produce received at this mandi were also created. With no commodity available for auction in high quantities, the auctions did not get desired participation, and this experiment, initiated during 2008-09, still remains a non-starter.

The government of Rajasthan has also set up a specialized MFP (Medicinal Plants) Mandi at Udaipur under the Rajasthan Tribal Area Development Cooperative Federation Ltd. and the mandi has become functional from October 2015. To facilitate movement of wild collected material from the forest areas to the mandi within the Scheduled Areas or from the Scheduled Areas, the government of Rajasthan has, by a notification dated September 14, 2015 exempted 26 listed MFP entities from under the provisions of Rajasthan Forest (Produce Transit) Rules, 1957. The mandi is reported to have received a good response during first year of its operations, with better returns having gone to the tribal communities engaged in wild harvest of medicinal herbs.

7.5. TRADE THROUGH COOPERATIVES/ FEDERATIONS/ CORPORATIONS

Some states have set up Minor Forest Produce (MFP) Federations, Cooperative or Corporations for collection, aggregation and marketing of minor forest produce, including medicinal plants, in areas where local communities have high dependence upon forest resources, and where wild collected forest produce makes a significant part of their cash income. The central objective of these Cooperatives/ Corporations/ Federations is to ensure remunerative prices to the tribal communities through procurement of produce at the doorsteps and elimination of middlemen.

Girijan Cooperative Corporation Ltd. (GCC), established in 1956 by the State of Andhra Pradesh, is perhaps the first such organization in the country. Originally named the Andhra Scheduled Tribe Cooperative Finance and Development Corporation, it was rechristened as the Girijan Cooperative Corporation Ltd. in 1970. Bifurcation of the State has resulted in bifurcation of this corporation also into the Andhra Pradesh Girijan Cooperative Corporation Ltd. and the Telangana Girijan Cooperative Corporation Ltd.

Data about the annual sales of MFPs was collected from the Telangana Girijan Cooperative

Corporation Ltd. This corporation is engaged in procuring listed MFPs through its various field depots at rates that are pro-decided. Sale data presented in table 7.3 below reveals that the GCC's average annual trade volume of MFPs from 2011-12 to 2014-15 was 1475 MT at an average annual trade value of ₹ 4.35 crore only. Of this, Gum Karaya alone with an annual trade value of ₹ 2.25 crore formed more than 50% of the total trade value of all MFPs. In volume terms, Mahua flowers, Mahua seeds and Nux-vomica seeds remained the major commodities of trade by the GCC with average annual trade volumes of 570 MT, 190 MT and 275 MT respectively over a four year period from 2011-12 to 2014-15.

Table 7.3. Time Series Data of Annual Trade of MFPs by Telangana GCC

	2011-12		2012-13		2013-14		2014-15	
	Qty*	Value*	Qty*	Value*	Qty*	Value*	Qty*	Value*
Gum Karaya	3805.9	278.98	1172.8	180.07	960.5	141.59	1721.21	308.39
Myrobalans	27.98	0.22	17.15	0.04	28.65	0.18	24.53	0.14
Nux-vomica (*Strychnos nux-vomica*)	3145.6	69.69	357.73	7.73	4682.1	138.8	2877.01	67.94
Tamarind seeded	5	0.11	5.3	0.16	450.93	7.24	1528.48	26.64
Tamarind de-seeded	222.1	7.46	2955.3	101.02	322.28	14.48	574.63	19.95
Pungam seed	151.29	1.45	424.58	4.04	58.54	0.58	274.25	2.37
Cleaning nut (*Strychnos potatorum*)	96.4	1.13	27.91	0.34	51.44	0.97	248.76	4.49
Marking nut (*Semecarpus anacardium*)	0.12	0	3	0.02	25.34	0.28	4.11	0.05
Mohwa seed	2549.1	30.13	138.31	1.78	2065.4	28.7	2795.45	45.06
Mohwa flower	8641.4	60.54	2217.1	15.52	7695.5	76.93	4230.79	42.3
Soapnut (*Sapindus emarginatus*)	642.21	11.75	986.61	9.47	4.26	0.02	193.67	2.08
Naramamidi Bark (*Litsea glutinosa*)	91.71	2.57	51.97	1.45	131.64	3.69	147.48	5.46
Maredugeddalu (*Decalepis hamiltonii*)	40.46	3.44	69.17	6.92	59.97	6.46	46.1	4.81
Medicinal Herbs	0	0.29	0	0.45	0	0.12	0	0
Total	**19419.27**	**467.76**	**8426.93**	**329.01**	**16536.55**	**420.04**	**14666.47**	**529.68**

Source : GCC Ltd. (Pers. Comm.) and Ravi (2015) *Qty (in Quintals); Value (₹ in Lakh)

Analysis of the price data reveals that the prices of Nux-vomica seeds has, over the past ten year period, risen from about ₹ 17 per kg in 2005-06 (Ved and Goraya, 2008) to just about ₹ 23 per kg in 2014-15. These prices, reported to be less than 50% of the ruling market prices of this commodity in 2005-06, continue to be so even during 2014-15. Price analysis in respect of Soapnut (*Sapindus emarginatus*), Cleaning Nut (*Strychnos potatorum*), and Myrobalans (*Terminalia belirica* and *T. chebula*) reveals a similar trend. The only commodity that has shown significant increase in prices over the years is Gum karaya (*Stercuia urens*), the average annual price of which has almost doubled from about ₹ 85 per kg during 2005-06 to about ₹ 179 per kg in 2014-15. The price is,

however, much lower than the MSP of ₹ 220 per kg being offered by the Chhatisgarh MFP Federation.

GCC's MFP trade data also reveals that the trade of medicinal plants is limited to only about 12 commodities with large annual trade volumes. There are likely to be a large number of other medicinal plant entities that are collected in lesser volumes from the command area of the GCC. It is assumed that these are sold directly to the local traders through weekly haats or other means. Further, even as the traders have been legally prohibited from purchasing minor forest produce directly from the tribals, the Corporation itself sells the produce in the open market to these very private traders and whole sale dealers without adding any value to it.

The states of Madhya Pradesh and Chhatisgarh have their own MFP Federations, namely the MP State Minor Forest Produce (Trading & Development) Cooperative Federation Ltd. and the Chhatisgarh State Minor Forest Produce (Trading & Development) Cooperative Federation Ltd. to procure and trade MFPs in their respective states. Both these Federations have been dealing with a large number of MFPs till 2003 when the rights to harvest and trade MFPs were devolved to the Panchayats. The MP MFP Federation now retains monopoly rights over 3 specified commodities i.e. Tendu leaf, Sal seed and Kullu gum. The Chhatisgarh MFP Federation retains monopoly rights over 5 specified commodities i.e. Tendu leaf, Kullu gum, Dhawada gum, Khair gum and Babool gum. Both these Federations have also joined hands with the Ministry of Tribal Affairs and are implementing its 'Mechanism for Marketing of MFPs through Minimum Support Price (MSP) and Development of Value Chain'. For the year 2015-16, the the state of Madhya Pradesh has fixed MSP for Harar, Mahua Seeds, Mahua Flowers, Neem Seed, and Karanj Seeds (table-7.4).

Table 7.4. MSP of Botanicals fixed by Madhya Pradesh and Chhattisgarh

S. No.	Commodity	MSP Fixed by MP (Rs. / Kg)	MSP Fixed by Chhattisgarh (Rs. / Kg)
1	Sal Seed	-	10.00
2	Kullu Gum	-	220.00
3	Dhawada Gum	-	29.00
4	Khair Gum	-	17.40
5	Babool Gum	-	17.40
6	Harar	10.00 (Common), 20.00 (Kachariya) 35.00 (Bal harar)	11.00
7	Mahua Seed	9.00	22.00
8	Mahua Flower	(ground collected) 14.00 (net collected) 20.00	-
9	Tamarind		22.00
10	Chironjee Seed		100.00
11	Neem Seed	7.00	-
12	Karanj Seed	35.00	-

As the things stand today, Tendu leaf (*Diospyros melanoxylon*) remains the major commodity of trade accounting for nearly 99% of the Federation's annual procurement and sales. The other MFPs, including medicinal herbs, which the Federations receive in much smaller volumes, are

disposed off through open auction to the traders without adding any value at the Federation depots. With wild gatherers now free to sell their produce to anyone, the inflow of non-specified commodities at Federation depots has become much less than when these commodities were listed as specified. It goes on to show that major procurement of medicinal herbs in these states is now once again in the hands of the local traders.

The state of Gujarat has made the Gujarat State Forest Development Corporation Ltd. as the lead agency in respect of collection, processing and marketing of MFPs. The Corporation has got monopoly rights over the collection and trade of nationalized entities that include Timru (tendu) leaf (*Diospyros melanoxylon*), Mahuda flowers, Mahuda doli, and all types of gums. In addition, the Corporation has also notified other 90 odd MFPs, including medicinal herbs, for trade through its depots. The mechanism of collection of MFPs is through appointed agents who get 10% commission *ad valorem*. The collected produce is stored in the Corporation warehouses and on getting adequate quantities, it is disposed off through auction on 'as is where is' basis. The proceeds are transmitted to the wild gatherers after retaining Corporation expenses.

The above discussion makes it amply clear that the Federations/ Cooperatives/ Corporations, assigned the responsibility of collection and trade of MFPs with the objective to get optimum returns to the wild gatherers, have fallen short on that count. Neither these organizations have been able to deal with the diversity of medicinal herbs usually collected from their areas, nor have these been able to get the gatherers prevailing market rates of the commodities traded through these. These organizations have been sustaining on the strength of sale proceeds of a few major commodities or through their other functions that absorb the losses due to trade of miscellaneous herbal raw drugs. MoPR (2011) also records that 'these corporations/ federations take up the trade of only the more viable MFPs, leaving the rest for free trade'. This widely glorified model of procurement and trade of medicinal herbs needs a hard review and refinement to be able to meet the noble objectives set by these organizations.

7.6. TRADE ACROSS LINE OF CONTROL

Field enquiries in Jammu and Kashmir revealed that a large number of botanical raw drug entities are in trade from across Line of Control (LoC). Data of botanical raw drug entities received from across LoC during 2014-15, as maintained at two forest check posts, one in Srinagar and the other in Jammu, has been procured, collated and is presented below (table 7.5):

Table.7.5. Herbal Raw Drugs Recorded in Trade across LoC during 2014-15

S. No.	Species	Common Name	Part Traded	Receipt at Jammu (kg)	Receipt at Srinagar (kg)	Total Inflows across LoC (MT)
1	*Acacia senegal*	Gound choura	Gum extract	5688	3276	8.96
2	*Aconitum heterophyllum*	Atees/ Patis	Root/ Tuber	19785	0	19.79
3	*Acorus calamus*	Buch	Root/ Rh.	9838	2564	12.40
4	*Aesculus indica*	Ghoon	Fruit	750	0	0.75
5	*Allium sativam*	Lasun	Bulb/ Seed	115	430	0.55
6	*Aquillaria agallocha*	Ood saleb	Root	32015	4268	36.28
7	*Argyreia speciosa*	Salib dana	Fruit	7871	4305	12.18
8	*Arnebia benthamii*	Ratanjot	Root	35922	45065	80.99
9	*Artemisia absentium*	Tethwan	Root	0	10852	10.85
10	*Asperagus racemosus*	Shatavar	Roots	12330	9800	22.13
11	*Berberis lycium*	Rasount	Gum extract	79300	0	79.30
12	*Betula utilis*	Bhoj patter	Bark	104276	24568	128.84
13	*Bombax ceiba*	Mochras	Gum extract	7510	0	7.51
14	*Borago officinalis*	Gouzaban	Whole plant	15506	5440	20.95
15	*Bunium persicum*	Sha Zeera	Seed	0	2360	2.36
16	*Butea monosperma*	Kamarkas	Gum extract	520	0	0.52
17	*Centaurea behan*	Bavan	Root	22082	0	22.08
18	*Cetraria islandica* (?) *Parmelia* spp.	Charela	Lichen	22660	20964	43.62
19	*Chlorophytum* spp.	Musli	Root	52052	2454	54.51
20	*Cochlospermum religiosum*	Gund katira	Gum extract	5472	0	5.47
21	*Colchicum luteum*	Suranjan	Corm/ Root	54818	5688	60.51
22	*Commiphora wighiti*	Gugal	Gum extract	204534	32100	236.63
23	*Crocus sativus*	Zainbed	Seed	70	0	0.07
24	*Curcuma longa*	Haldi	Rh./ Root	880	1245	2.13
25	*Cuscuta reflexa*	Aftimoon	Stems	2559	0	2.56
26	*Dactylorhiza hatagirea*	Salam panja	Root	4072	2054	6.13
27	*Eclipta postrata*	Bringraj	Seed	2030	0	2.03
28	*Embelia tjerium-cottam*	Wowring	Seed	232862	5300	238.16
29	*Ephedra gerardiana*	Somlata	Twig	57344	0	57.34
30	*Erysimum cheiri*	Safed tadri	Seed	1780	965	2.75

S. No.	Species	Common Name	Part Traded	Receipt at Jammu (kg)	Receipt at Srinagar (kg)	Total Inflows across LoC (MT)
31	*Ferula asafoetida*	Hing	Resin extract	60	0	0.06
32	*Ficus bengalensis*	Bar pipal	N.A	1840	0	1.84
33	*Ficus carica*	Anjeer	Fruit	635	1588	2.22
34	*Glycyrriza glabra*	Mulathi	Root	166630	45742	212.37
35	*Hyssopus officinalis*	Zoofa	Flower	13916	8758	22.67
36	*Juniperus macropoda*	How ber	Fruit	0	40865	40.87
37	*Jurinea dolomiaea*	Dhoop	Root	763	0	0.76
38	*Morchella esculenta*	Guchies	Fungus	1658	870	2.53
39	*Nelumbo sp.*	Col Doda	Seed	16730	0	16.73
40	*Origanum vulgare*	Sattar patti	Flower tops	6772	1260	8.03
41	*Peganum hermala*	Lal dana	Seed	70935	52340	123.27
42	*Phoenix dactylifera*	Dates	Fruit	785	64390	65.18
43	*Picrorrhiza kurroa*	Koda kutki	Root	16815	0	16.82
44	*Pinus gerardiana*	Chilgoza	Seed	2870	0	2.87
45	*Pistacia integerrima*	Kakar sanghi	Galls	37316	9865	47.18
46	*Podophyllum hexandrum*	Bankakri	Root	9021	6754	15.78
47	*Polyganatum verticillatum*	Salam misri	Corm/ Root	2391	1800	4.19
48	*Punica granatum*	Anardana	Dried fruit	43501	0	43.50
49	*Quercus infectoria*	Maju	Gall	50567	0	50.57
50	*Rosa* spp.	Gulab	Petals	9390	5400	14.79
51	*Rubia cordifolia*	Majeeth	Root	14120	2652	16.77
52	*Santalum album*	Sandalwood	Wood Pwdr	69520	28760	98.28
53	*Saussrea costus*	Kuth	Root	1250	1320	2.57
54	*Terminalia chebula*	Harad	Fruit	442100	0	442.10
55	*Trachyspermum ammi*	Ajwain	Seed	974	0	0.97
56	*Tribulus terrestris*	Gokhroo	Gall	3357	5430	8.79
57	*Trillium govanianum*	Nagchatri	Root	199741	97655	297.40
58	*Valeriana hardwickii*	Tagar	Root	0	20900	20.90
59	*Valeriana jatamansii*	Mushakbala	Roots	193479	32974	226.45
60	*Viola odorata*	Banafsha	Flower	22398	10200	32.60
61	*Vitis venifera*	Monaka	Fruit	1900	2396	4.30
62	*Withania coagulans*	Paneer Dodi	Fruit (Berry)	13600	3200	16.80
63	*Withania somnifera*	Ashwagandha	Fruit (Berry)	500	1865	2.37
64	*Zizyphus jujuba*	Anab	Fruit (Berry)	1250	0	1.25
65	*Myristica fragrans*	Jalwatry	Aril	0	2320	2.32

These inflows from across LoC are very significant, especially for resolving the supply related issues in respect of red-listed species like 'atees', 'bankakri', 'salam mishri', 'salampanja', etc.

7.7. TRADE UNDER BUY BACK AGREEMENTS

The herbal industry in the country has initiated limited programs to get some key medicinal plants cultivated under buy-back agreements with the farmers. Some of these species are Bhui Amla (*Phyllanthus amarus*), Tulasi (*Ocimum tenuiflorum*), Prishnparni (*Uraria picta*), Chiretta (*Swertia chirayita*), Atees/ Patis (*Aconitum heterophyllum*), and Karu (*Picrorhiza kurroa*). The industry has assigned the task of operationalisation of this mechanism to some local community based NGOs. These NGOs first identify village clusters suitable for cultivating specific medicinal plant species. They then enroll farmers under the program, build their capacity and provide time to time technical inputs. The harvested produce is collected and the farmers handed over bank cheques towards their produce procured at pre-agreed prices. The farmers, under this mechanism, are provided liberty to sell their produce in open market. Currently, Dabur India Ltd. is the major player in this field with good interventions by Natural Remedies, Himalayan Drug Company, Sami Labs, etc. The rates pre-fixed under the buyback agreement are usually better than the going rates in the open market.

The traders at Neemuch, however, had a different version about the buying back arrangements with farmers and preferred to continue with the open auction system in the mandi precincts. The system of open auction, they shared, ensured that the farmers brought cleaned material to the mandi, which was not the case under buyback arrangements.

7.8. BOTANICALS IN HIGH TRADE IN DIFFERENT MANDIS

Commodity-wise trade data in respect of all the 40 odd herbal mandis surveyed during the study has been collated. A total of 700 herbal entities have been recorded in this trade from the mandis visited. The list of herbal 165 raw drug entities corresponding to 138 plant species plus 1 rock exudate (Shilajit) that are traded in high quantities of 100 MT or more per year is given in table 7.6.

Table 7.6. Botanicals Recorded in High Trade in Herbal Mandis for the year 2014-15

S. No.	Botanical Name	Trade Name	Parts Traded	Trade Volume (MT/ Year)
1	*Abrus precatorius*	Kundumani, Ratti	Seed	100-200
		Kunnimuthu	Leaf	10-50
2	*Abutilon indicum*	Thuthi	Leaf	50-100
		Thuthi	Seed	100-200
3	*Acacia concina*	Shikakai	Fruit (Pod)	1000-1500
4	*Achyranthes aspera*	Nayuruvi, Apamarga	Whole Plant	200-500
5	*Acorus calamus*	Bach	Root	200-500
6	*Aegle marmelos*	Bael, Bel, Vivam	Fruit Pulp	200-500
		Bael Guda	Fruit (Dry)	500-1000
		Bael Pattri	Leaf	10-50
7	*Aloe barbadensis*	Elva, Kumari, Ghritkuwari	Leaf	100
8	*Alpinia galanga*	Perarathai, Kulanjan	Rhizome	100-200
9	*Althaea officinalis*	Khatmi	Seed	200-500
		Gul-e-Khatmi	Flower	10-50
10	*Apium graveolens*	Ajmoda	Seed	1000-1500
11	*Andrographis paniculata*	Nila vembu, Kalmegh	Whole Plant	2000-3000
12	*Asparagus racemosus*	Shatawar	Roots	500-2000
13	*Asphaltum punjabianum**	Shilajit	*Rock exudate	100-200

S. No.	Botanical Name	Trade Name	Parts Traded	Trade Volume (MT/ Year)
14	*Azadirachta indica*	Neem, Vaeppan	Leaf	500-1000
		Neem seeds	Seeds	10-50
		Neem	Bark	10-50
15	*Bacopa monnieri*	Neer brahmi	Whole Plant	200-500
16	*Berberis* spp.	Daruhaldi	Stem/Root	1000-1500
17	*Berginia ciliata*	Pashan Bhed	Root	1000-1500
		Pashan Bhed	Leaf	50-100
18	*Betula utilis*	Bhojpatra	Bark	100-200
19	*Boerhavia diffusa*	Punarnava, Mukarattai	Whole Plant	200-500
		Punarnava, Mukarattai	Root	200-500
20	*Bombax ceiba*	Semal musli	Root	100-200
21	*Boswellia serrata*	Mani kundrikam, Kunduru, Salai Guggal	Gum	500-1000
22	*Buchanania cochinchinensis*	Kashlu	Seed	100-200
23	*Butea monosperma*	Murukkam	Bark (Stem)	10-50
		Tesu Phool, Palas Phool	Flower	100-200
24	*Calendula officinalis*	Marigold/ Gulasharfi	Flower	100-200
25	*Carthamus tinctorius*	Kusum Phool	Flower	100-200
26	*Catharanthus roseus*	Nithyakalyani	Leaf	200-500
27	*Celastrus paniculatus*	Malkangni	Seed	100-200
28	*Centratherum anthelminticum*	Vaaluluvai, Malkangni	Aerial Parts	10-50
		Kali Zeeri	Seed	200-500
29	*Centella asiatica*	Brahmi, Mandukparni	Whole Plant	100-200
30	*Chamaecrista absus*	Chaksu	Seed	100-200
31	*Chlorophytum borivilianum*	Safedmusli	Root	100-200
32	*Cichorium intybus*	Kaasini	Seed	100-200
33	*Cinnamomum cassia*	Dalchini	Bark	200-500
34	*Cinnamomum tamala*	Tejpatta	Leaf	4000-5000
35	*Cinnamomum verum*	Dalchini	Bark	500-1000
36	*Cissus quadrangularis*	Pirandai, Hutjodi	Stem	200-500
37	*Citrullus colocynthis*	Indrayan	Fruit	200-500
38	*Chondrus* spp.	Moss	Whole Plant	200-500
39	*Commiphora wightii*	Guggulu, Gugal	Gum Resin	1000-1500
40	*Convolvulus prostratus*	Shankpuspi	Whole Plant	200-500
41	*Curculigo orchioides*	Nilapanai	Tuber	200-500
42	*Curcuma zedoaria*	Poolan kizhangu	Root	200-500
43	*Cyperus rotundus*	Motha, Korai kizhangu	Root	500-1000
44	*Cyperus scariosus*	Nagarmotha	Root	200-500
45	*Datura metel*	Oomaththai, Umatham	Leaf	10-50
		Oomaththai, Umatham	Seeds	100-200
46	*Eclipta prostrata*	Bhringraj	Whole Plant	1000-1500
47	*Embelia ribes*	Vai-Vidang	Fruit	200-500
48	*Phyllanthus emblica*	Amla	Fruit (Fresh)	1000-2000
		Nelli	Fruit (Dry)	2000-3000

S. No.	Botanical Name	Trade Name	Parts Traded	Trade Volume (MT/ Year)
49	*Ferula asafetida*	Hing	Exudate	500-1000
50	*Ficus benghalensis*	Aal, Bargad	Bark, Jata	200-500
51	*Ficus religiosa*	Arasu	Bark, Fruit	200-500
52	*Glycyrrhiza glabra*	Mulethi, Adhi Madhuarm	Root	1000-1500
53	*Gymnema sylvestre*	Sarkarai kolli, Gudmar Siru kurinjaan	Leaf	200-500
54	*Hedychium spicatum*	Kapur Kachri	Root	200-500
55	*Helicteres isora*	Valampuri-Idampuri	Root	100-200
56	*Hibiscus rosa-sinensis*	Gudhal	Flower	100-200
57	*Holarrhena pubescens*	Inderjau, Kutaja	Seed	100-200
58	*Holostemma ada-kodien*	Jeevanti	Whole Plant	500-1000
59	*Homalomena aromatica*	Sugandh-mantri	Root	200-500
60	*Hyoscyamus niger*	Khurasaniu Ajvayan	Seed	100-200
		Kurarani Omam		
61	*Inula racemosa*	Pushkarmool	Root	100-200
62	*Ipomoea hederacea*	Kaladana	Seed	100-200
63	*Jasminum sambac*	Bela Mogra	Flower	100-200
64	*Juniperus macropoda*	Dhoop, Dhoopi Lakkad	Seed	100-200
65	*Justicia adhatoda*	Adusa, Basuti, Vasa	Leaf	500-1000
66	*Lactuca sativa*	Kahoo	Seed	100-200
67	*Lawsonia inermis*	Mehandi	Leaf	>30000
68	*Lepidium sativum*	Aali vidhai, Asaliya	Seed	1000-1500
69	*Linum usitatissimum*	Alsi	Seed	500-1000
70	*Litsea glutinosa*	Maida Lakri,	Bark	500-1000
71	*Madhuca longifolia* var. *latifolia*	Mahaua Phool	Flower	200-500
		Mahaua Beej	Seed	100-200
72	*Mollugo cerviana*	Parpadagam	Whole Plant	500-1000
73	*Momordica charantia*	Pavakkaai, Karela	Fruit	100-200
74	*Morinda coreia*	Nunaa	Fruit	200-500
75	*Moringa oleifera*	Murungai	Leaf	500-1000
		Murungai	Seed	10-50
		Murungai	Bark (Stem)	10-50
76	*Mucuna pruriens*	Kaunch beej	Seed	100-200
77	*Murraya koenigii*	Kadipatta	Leaf	200-500
78	*Nardostachys grandiflora*	Jatamansi	Root	100-200
79	*Nigella sativa*	Karunjeeragam, Kalonji	Seed	2000-3000
80	*Ocimum basilicum*	Tukmaria	Seed	100-200
81	*Ocimum tenuiflorum*	Tulsi	Whole Plant	2000-3000
		Tulsi	Leaf	200-500
82	*Onosma bracteata*	Gaozeban, Gule-e-Gaozeban	Flower	100-200
83	*Onosoma hispidum*	Ratanjot	Root	100-200
84	*Operculina turpethum*	Shivadi	Root	200-500
85	*Papaver somniferum*	Afeem, Khas-Khas, Posta	Fruit	1500-2000

S. No.	Botanical Name	Trade Name	Parts Traded	Trade Volume (MT/ Year)
86	*Parmelia* spp.	Jhula, Chhadila, Dagarphool, Kalpaasi, Mehndi, Pathar ka Phool, Shilapushpa, Stone Flower	Thallus	500-1000
87	*Peganum harmala*	Harmal	Seed	100-200
88	*Phyllanthus amarus*	Keezhaa nelli, Bhui aonala Bhumi amla	Whole Plant	200-500
89	*Phyllanthus maderaspatensis*	Mevaa nelli	Whole Plant	1000-1500
90	*Picrorhiza kurroa*	Kutki	Root	1000-1500
91	*Piper longum*	Pipli	Fruit	1000-1500
		Piplamool	Root	200-500
92	*Pistacia integerrima*	Kakarsingi	Galls	100-200
93	*Plantago ovata*	Isabgol	Seed/ Husk	>20000
94	*Plumbago zeylanica*	Chitrak, Chitramulam	Root	200-500
95	*Pterocarpus santalinus*	Lalchandan	Wood	100-200
96	*Rauvolfia serpentina*	Sarpgandha	Root	100-200
97	*Rheum australe*	Padmachal, Revand Chini	Root	1000-1500
98	*Ricinus communis*	Arandi Mool	Root	50-100
		Arandi Beej	Seed	>10000
99	*Rosa damascena*	Gulab	Flower	1000-1500
100	*Rosa cymosa*	Gulab	Flower	200-500
101	*Rubia cordifolia*	Majith	Root	500-1000
102	*Santalum album*	Chandan	Wood	500-1000
103	*Sapindus mukorossi*	Reetha	Fruit	1500-2000
104	*Saussurea costus*	Kuth	Root	100-150
105	*Semecarpus anacardium*	Senkottai	Fruit	200-500
		Bhilva	Seed	100-200
106	*Senna alexandrina*	Senna	Leaf	>20000
107	*Senna auriculata*	Aavaarai	Leaf	500-1000
		Aavaarai	Flower	100-200
108	*Senna tora*	Oosi Thagarai	Seed	2000-3000
109	*Sida acuta*	Vatta thirupi	Whole Plant	100-200
110	*Sida cordifolia*	Bala	Whole Plant	1000-1500
111	*Solanum americanum*	Makoi, Manathakkali	Seed/ Fruit	100-200
		Makoi	Whole Plant	200-500
112	*Solanum virginianum*	Kateli, Kantakari	Whole Plant	200-500
113	*Sterculia urens*	Gum Karaya/ Kullu Gum	Gum Exudate	100-200
114	*Strychnos nux-vomica*	Etti, Kuchada, Kuchla	Seed	500-1000
115	*Swertia chirayita*	Chiretta	Whole Plant	2000-3000
116	*Symplocos racemosa*	Lodh, Lodhra	Bark (Stem)	100-200
117	*Syzygium jambos*	Jamun	Seed	100-200
118	*Tamarindus indica*	Imli	Fruit	>20000
119	*Tephrosia purpurea*	Kozhinji	Whole Plant	200-500

S. No.	Botanical Name	Trade Name	Parts Traded	Trade Volume (MT/ Year)
120	*Terminalia arjuna*	Arjun	Fruit	100-200
		Marudham	Bark	100-200
121	*Terminalia bellirica*	Baheda	Fruit	3000-4000
122	*Terminalia chebula*	Harda, Kadukkaai	Fruit	3000-4000
123	*Tinospora cordifolia*	Giloe, Seendhil, Amruthvalli	Stem	1000-1500
124	*Trapa natans*	Singhara	Fruit (Dry)	100-200
125	*Tribulus lanuginosus*	Gokhru	Fruit	200-500
126	*Tribulus terrestris*	Gokhru	Fruit	1000-1500
127	*Trigonella foenum-graecum*	Methi	Seed	1000-1500
128	*Trillium govanianum*	Nagchatri	Root	200-500
129	*Valeriana jatamansi*	Muskbala, Tagarganth, Sugandhbala, Asaroon	Root	1000-1500
130	*Chrysopogon zizanioides*	Khas	Leaf	100-200
		Khas, Vetiver	Root	200-500
131	*Viola odorata*	Bansfsha	Whole Plant	100-200
132	*Vitis vinifera*	Kishmish	Fruit	1000-1500
133	*Withania somnifera*	Amukkuraa, Ashwagandha	Root	3000-4000
			Leaf	1000-1500
			Seed	100-200
134	*Woodfordia fruticosa*	Thaathiri	Flower	3000-4000
135	*Wrightia tinctoria*	Indrajau (Meetha)	Seed	100-200
136	*Zaleya decandra*	Vellai saaranai	Root	100-200
137	*Zanthoxylum armatum*	Timru	Seeds	100-200
138	*Zingiber officinale*	Sukku, Saunth, Adrak	Rhizome	1000-1500
139	*Ziziphus jujuba*	Baer	Fruit	100-200

7.9. RETAIL SALE OF HERBAL RAW DRUGS

Millions of households in the country continue to rely upon herbal medicines, self prepared in the house or dispensed to them by local practitioners, for taking care of their day-to-day health care needs. These health care recipes are usually specific to the region and involve a very large diversity of herbal entities many of which need to be procured from the local retail shops in small quantities. These retail shops, located in almost all towns and cities in the country, procure major part of their material from the established herbal mandis. However, some of the material of purely local importance is also got directly collected by them from the wild. Sample survey of the retailers at Dehradun, Bangalore, Shimla, and Hyderabad confirms the findings by Ved and Goraya (2008) that each of these retailers deals in 300-500 entities in annual quantities ranging from 1 kg to 100 kg. The retailers usually keep the material in containers that are arranged in an order specific to the retailers to make the retrieval easier.

7.10. THE TRADE WEB

As discussed above, the trade of herbal raw drugs is much more than the primary producers mandi open auction system as is prevalent for the agricultural produce. In the case of herbal raw drugs, there is a complex chain comprising of local agents, more than one layer of intermediate traders and large traders in terminal mandis. Many a times, different constituents of this chain

have no interface with each other. Moreover, the flow of material from the primary source to the end user is far from unidirectional, often cross-traded from one mandi to other before reaching end users. In case of some entities, the local level dealers are sometimes able to strike direct deals with end users and the entire process of the material passing through the mandis is skipped. Similarly, sometimes some industries are also able to get herbal raw drugs directly from the primary gatherers/ cultivators, bye-passing the mandi route. Ved and Goraya (2008) have provided a very comprehensive graphic representation of the complex herbal raw drug trade web.

The very complex trade web makes it very difficult to document the diversity of herbal raw drug entities in trade. It, therefore, also makes it very difficult to make projections of the demand of herbal raw drugs over time.

7.11. A TYPICAL HERBAL RAW DRUGS TRADE CHAIN

The herbal trade in the country is usually considered exploitative of the primary producers i.e. the wild gatherers and the farmers. Much of this inference is drawn from the difference between the low prices the primary producer gets and the high prices at which the end user procures the material. This price difference for many commodities was reported to be more than hundred percent of the prices the primary producer was receiving. It is believed that most of the profits on this count are pocketed by middlemen and the traders, putting both the primary producer and the end user at loss. The issue was sought to be thoroughly investigated as a part of the recently concluded GEF-UNDP project 'Mainstreaming Conservation and Sustainable Use of Medicinal Plant Diversity in Three Indian States' implemented in the States of Uttarakhand, Chhattisgarh, and Arunachal Pradesh. One of the reports prepared under the projects records the following:

“Apart from this, the trade in medicinal plants was found to be shrouded in mystery and uncertainty (arising from variation in quantity in good and bad crop years, sudden shortage of raw material and its upward demand, extremely variable market rates, etc.). Most of it appeared to be dictated by unknown actors – pharmaceutical companies, export agencies, overseas demand, stockiest, commission agents and others but seldom by the poor gatherer. The gatherer was always a loser for being branded as supplier of substandard material which deserved much lower price than expected, suffering from helplessness due to being unorganized, the material brought by them being in small quantity which (s)he was desperate to sell to purchase daily need commodities. Their bargaining power is very low as they have to do marketing on their own with economics of scale not being in their favour” (MPVS, 2015).

The trade web being very complex, interactions were held with traders and the various activities along this chain studied in order to understand the various activities along the trade chain. A typical value chain pertaining to wild harvest involves the following levels:

a) Primary Gatherer: On coming to know of the demand for the year, the wild gatherers go to the forest, sometimes camp there for days together, make collections of raw drugs, clean, wash and dry the material and bring it to the road head for supplying to the local aggregator or sale through weekly haats. The wild gatherers run the risk of non-lifting of the material by local aggregators if there is sudden drop in the demand of the material, making their labour on wild collection of such material infructuous.

b) Local Aggregator: The village level shopkeeper usually acts as the local aggregator and collects the material from the wild gatherers at pre-agreed rates or from weekly 'Haats' on cash payment;

transports the material to his godown; dries, cleans and repacks the material in bags of given specification and makes it transport ready; procures necessary export permits from the designated authorities; transports the material to clients in different herbal mandis. The process involves incurring of expenses on account of (i) procurement of material on cash from the wild gatherers, (ii) collection and transport of material from roadside depots to the godown, (iii) cleaning, drying, grading and re-packing of material, (iv) procurement of packaging material, (v) godown rent, (vi) running around to procure transit passes (export permit) for transport of material, (vii) loss of bank interest on the investments on holding the collected material for 2-4 months before transport, (viii) transport of material from godown to different herbal mandis, and (ix) loss of bank interest on the investment from date of transportation to the actual receipt of payment from clients. The local aggregator also bears the risk of (a) damage to the material during post harvest handling including wastage, (b) sudden drop in rates of procured material due to extraneous reasons, and (c) bad debts on account of wild gatherers not being able to fulfill commitment due to some reasons.

c) Large Traders: The large trader usually receives dried, graded and well packed material and gets it stored in ware houses/ cold stores till final disposal. The process involves costs on account of (i) unloading and stacking of material in warehouses, (ii) rent of warehouse/ cold stores, (iii) loss of bank interest on account of holding the material for 2-6 months and money remaining locked till the material is disposed off. The traders run the risk of bad debts on account of non-realisation of money towards supplies of material to the end users, i.e. herbal industry, on short credit. The traders also run the risk of sudden fall in prices of the procured material due to extraneous reasons.

There could be one or more layers at the level (b) and level (c) mentioned above, with each layer playing its part. The primary gatherers have neither the commercial quantities of the material nor wherewithal to engage in trade of the material with mandis located far off. The local aggregators usually have to make small investments as they handle relatively small quantities of material from their area. As the material reaches the larger traders from many local aggregators, the quantity with each trader swells and so his investments. The direct costs involved in handling of the material from primary producers to its landing at the large mandis need to be taken into account while making inferences about the price difference between the one paid to primary producer and the one at which the end user procures the material. As per market information, after paying the primary producer and accounting for the direct costs, each level works at 6-8 percent profit margin. If there are three layers of local aggregators and traders involved in the trade chain, the price escalation on account of profit margins alone over the prices paid to the primary gatherers is likely to be between 18-24 percent. The marketing forces are, however, continuously making corrections in the herbal raw drug trade in the country. With the primary producers (wild gatherers, and cultivators) now increasingly getting into direct interaction with the large traders or herbal units, the layers of commission agents are gradually getting reduced.

7.12. VALUE ADDITION AND PRICING OF HERBAL RAW DRUGS ALONG TRADE CHAIN

The herbal raw drug material undergoes a complex journey from the primary producers to the end users. Along this trade chain expenses are incurred and value is added at almost every step. Aggregation of material by the village level agent from primary producers from various villages involves labour, transportation and storage cost. The aggregator, many a times has to dry, grade and re-pack the material to make it transport worthy. Storage of material by large traders in cold stores to enhance its shelf life is also a value addition that adds to the cost.

7.12.1. Trade Chain of Karu (*Picrorhiza kurroa*) – A Case Study from Himachal Pradesh

The trade chain of Karu along with costs at each level was studied in Kullu, Himachal Pradesh. Karu occurs naturally at altitudes above 3000 m asl in the Western Himalayas. Harvest and trade of the species usually follows the stages given below:

Stage-I: A word about the demand for the year is usually spread by the traders to their village level agents, usually local shopkeepers, who in turn inform the local wild gatherers accordingly. A rate of procurement is also usually agreed before initiating collections.

Stage-II: At right time, which is not being religiously followed in most of the cases, the wild herb gatherers proceed to the high altitudes for collection of Karu and camp there, usually in rock shelters, for a period of one month or so normally between June end to August end. The harvested rhizomes are washed in the alpine streams near camp site and spread for drying in the rock shelters.

Stage-III: The material is usually almost dry when it is carried to the village level agent, who procures the material against cash payment after adjusting advances if any given to the gatherers. The village level agent gathers the material from various wild gatherers, checks the drying and spreads the material for drying if needed, and stores in his godown. Usually, the normal retention time at this stage is about a month for which the local agent has to keep the material in godowns.

Stage-IV: The village level agent takes the material to the traders at Kullu, who weigh the material and take it to their godowns, usually against cash payment after adjusting advances if any given to the village level agent.

Stage-V: Since the material received is in different types of crude packing material, the Kullu traders usually re-package the material into good quality jute packing material (bardana). During the process, wastage occurs on account of loss of material and removal of foreign particles, like attached soil, etc. In addition, the material also tends to lose weight due to further drying on exposure to air. An estimated wastage/ drying of 3-5 percent occurs.

Stage-VI: The traders at Kullu apply for and procure necessary transit documents from the designated offices for export of the material to different destinations in the country. Till the material is exported, it remains in the godowns of the traders. The period of retention of the material sometimes goes to more than six months.

It is evident from the above that cash value is added at each stage. The prices of Karu along the value chain during 2015 were recorded as ₹ 500-550 per kg at the level of wild gatherers and ₹ 800-900 per kg at Delhi market.

7.12.2. Trade Chain of Amla (*Phyllanthus emblica*) – A Case Study from Madhya Pradesh

Amla is collected from wild in very large quantities from forests in Madhya Pradesh. The fresh fruit so collected is sold in the weekly haats at ₹ 7-8 per kg in Katni area. However, the wild gatherers, of late, with the help of some local NGOs, have started adding value to the wild collected amla. The fruit is now deseeded, dried, and cleaned before selling it to larger buyers. The amla during such processing dries to about one fourth of its fresh weight. The value added produce, however, now fetches prices ranging from ₹ 40-45 per kg to the local people. The dried deseeded amla is then transported to different markets in the country where it is temporarily stored. The value added commodity is commanding a sale rate of ₹ 55-65 per kg in Delhi mandi.

7.12.3. Value Addition through Cleaning of Material – a Case Study

Sample study of the impurities in raw drugs carried out at the Herbal Health Research Consortium Pvt. Ltd. (HHRC), Amritsar reveals that the impurities vary from as low as 0.5% to as high as 35% for different species. It was noticed that the impurities in the form of attached soil were the highest in case of herbs like Mandookparni (*Centella asiatica*) and Nagarmotha (*Cyperus scariousus*) those are collected from moist localities. Similarly, the seeds like that of Talmakhana (*Hygrophylla schulli*) and Gokhru (*Tribulus terrestris*) that require drying of the plants by spreading on soil and thrashing contain large impurities in the form of pebbles and soil that get collected while collecting the separated seed. Indicative examples of cleaning of Talmakhana and Atibala raw drug samples received from the field are given below as example:

(1a) Talmakhana (*Hygrophylla schulli*) plant; (1b) Talmakhana raw drug received; (2 & 3) Pebbles and chaff segregated from raw drug; (4) Clean Talmakhana seeds

(1a) Atibala (*Abutilon indicum*) plant; (1b) Atibala raw drug received (2 & 3) Foreign matter and dust segregated from raw drug (4) Clean raw drug

7.13. WASTAGE ALONG THE TRADE CHAIN

Interactions with traders at different levels brings out that there always is an element of wastage of material along the trade chain. Wastage is different from weight loss that happens due to loss of moisture along the trade chain, cleaning of the material of foreign matter, and the like. Detailed discussions with the primary producers brought out that the traders usually build the potential weight loss on account of cleaning of material and drying along the trade chain while weighing the material to be procured from primary producers. The primary producer bears costs on account of weight loss at an average rate of 5% on this count.

Wastage is the loss of material due to improper post harvest handing of the material including rot, insect and rodent attacks, and during transportation. The major cause of wastage was reported to be non-proper drying of the material that resulted in fungal infestation and rotting of the material causing lowering of quality or rendering the material unfit for use. Insect borers and rodents were reported to be the second major cause of wastage, especially during storage. Transportation losses were mainly due to poor packaging of the material.

At most of the places, the traders were not able to separate the two issues of wastage and weight loss and insisted upon treating these as one, as both these resulted in financial loss to them. However, careful observations at different stages along trade chain reveal that some herbal raw drugs, were more prone to damage during storage than others. The wastage was estimated to vary from as little as 2% for some entities (wood, bark, roots) to as high as 8% for some other entities (fruits, fleshy flowers, etc.) under proper storage conditions. The inference from these consultations is that wastage of material along trade chain makes a significant impact on the availability of the resource. Taking in view the part-wise distribution of the herbal raw drug entities in trade, an average wastage of 3% for all herbal raw drug entities has been worked out for the purpose of estimating total demand of the medicinal plants in the country.

7.14. QUALITY IMPROVEMENT INTERVENTIONS

The availability of authentic and quality herbal raw material, especially which is collected from the wild, is increasingly becoming a challenge for the industry engaged in making ASU and wellness formulations. Some attempts to organize and train wild gatherers in good harvest and post harvest handling techniques have been initiated in different parts of the country with a view to ensure authenticity and quality of the herbal material at the wild collection level itself. Whereas some of these initiatives are being driven under the various government incentive schemes and under various externally funded projects by the state forest departments and the local CBOs; herbal industry is also partnering in some of these initiatives. These efforts have made a definite improvement in the quality of the herbal raw drugs like Tejpatta (*Cinnamomum tamala*), Karu (*Picrorhiza kurroa*), and Triphala (*Terminalia chebula*, *Terminalia bellirica*, and *Phyllanthus emblica*) coming from the wild gatherer groups organized and trained under these initiatives. Such efforts, however, are still limited to a few groups and a few species only, with bulk of the species and material entering the herbal raw drug markets requiring authentication and quality check.

Of the wild collected herbal raw drugs that enter the trade chain, a part is selectively subjected to some cleaning, grading and re-packing at the end of traders and stockists to fulfill quality requirements of export or some specific manufacturing units. The basis of quality check even in such cases remains largely physical inspection of the material. Quality certification in accordance with API parameters is done for very specific supplies only. At the consumer end, some herbal industries do get some consignments of herbal raw drugs tested at laboratories to ensure

conformation to the API standards. Such quality check is, however, again too limited to have any significant impact on the total scale of operations in this sector.

The NMPB and the Ministry of AYUSH, striving to improve quality of the herbal medicines and wellness formulations in the country, have launched schemes to set up herbal raw drug testing and certification facilities in different regions of the country. These facilities, being set up on a cluster approach in a project mode, are under various stages of completion. One such facility was visited during the course of the present study (Box.7.3).

Box.7.3. Herbal Health Research Consortium Pvt. Ltd.' (HHRC) – An Initiative towards Ensuring Quality of Herbal Raw Drugs

Recognizing the need for quality herbal raw drugs, a group of 29 Ayurvedic manufacturers has come together to form 'Herbal Health Research Consortium Pvt. Ltd.' (HHRC), a private limited company based at Amritsar (Punjab) with a vision to support and strengthen AYUSH industry to produce quality medicine. This consortium has been supported by the Department of AYUSH (now Ministry of AYUSH), Government of India to set up raw drug testing and certification facilities at village Khyala Khurd near Amritsar with a mission to make available 'authentic', 'cleaned', 'dried', 'graded', and 'tested' herbal raw material to the Ayurvedic industry. Part of the investment in creating the infrastructure has been borne by the consortium.

This collaborative approach envisages leveraging the geographical proximity of the competing herbal enterprises in collaborating towards cost effectiveness and production of quality medicine by getting certified quality raw material from their common central facility. Living up to the promise, HHRC has established a state of the art laboratory facility equipped with necessary high-end instruments. The unit directly procures herbal raw material from various sources. The procured material is stacked in the godown and authenticated, cleaned, graded, tested for physio-chemical properties, microbial load, primary alkaloid percent, and packed lot-wise and labeled accordingly. Presently the company is dealing with nearly 200 herbal raw drug entities and has capacity to clean, grade and pack 4 MT of the raw material per day.

The entire cleaning, grading and certification process adds to the cost of the material. A large portion of the certified material is procured by the constituent herbal units of the consortium. HHRC strives to keep the sale prices of certified material competitive through measures such as direct procurement from the primary producers. It, however, sometimes finds it difficult to get buyers of the certified raw material at even slightly higher prices.

Cleaning, grading, packaging & stacking operations at HHRC

The HHRC is also using its facilities for organising awareness and training programs for the personnel from regulatory and quality control authorities, and students from various disciplines.

7.15. DISCUSSION

The data and case studies presented above make it clear that a lot of value and costs are added from the time the herbal raw material is procured from the primary producers (wild gatherers/ cultivators) till its final disposal to the end users. The average returns per unit volume of non-value added material of most of the species thus received by the primary producers hover around 50% of the market price of the material. The returns to the primary producers also depend upon the quality of the material, with the material having impurities fetching lower price.

The various systems of trade of herbal raw drugs prevalent in the country have their strengths and weaknesses. The specialized herbal trade instruments set up by various state governments ensure transparency of deals. However, the primary producers continue to get less than half of the ruling market prices for their produce. These agencies, therefore, need to do much more to ensure better returns to the primary producers. Another flip side of this effort is the lack of specialization in dealing with a diversity of herbal raw drugs, as the staff at these organizations is subjected to frequent transfers. Moreover, the protocols for accounting for wastage, damages, drying percent, low prices than the procurement prices, etc. are yet to be developed.

The Krishi Upaj Mandi system is better in that it provides good decision making opportunity to the primary producers to sell their material at the auction prices or not. All arrivals at the mandi and disposals are recorded, providing authentic clues to chain of custody. However, once the material comes to larger mandis the backward linkage gets difficult to establish. These mandis need to put in place mechanisms for attaching passport data with each consignment leaving the town.

The major strength of individual herbal traders lies in their experience, often running over generations, to identify the material from look, smell and taste. These traders have been patronizing primary producers of their niche areas over decades and have over time developed trust of wild gatherers and local aggregators on one hand and the end users on the other. Whereas it is neither easy nor desirable to replace the experience of herbal raw drug traders, it is necessary to create awareness amongst them and do their hand holding in developing mechanisms for better maintenance of records, especially in respect of passport data. Such an effort will go a long way in creating wider clientele of the product under Indian Systems of Medicine and will also help in better managing and strengthening the herbal raw drug resource.

8

Foreign Trade (Export and Import) of Herbal Raw Drugs

Buoyed at the increasing global reliance upon herbal products, India's exports of medicinal plants grew at an average annual rate of 22% over the past ten years and stood at ₹3211 crore in 2014-15. Export of extracts during the period registered the highest growth and formed about 50% of the total export value in the year 2014-15. This points towards an emerging trend of exporting value added products from the country. Amongst the crude herbal raw drugs, Isabgol husk, Senna leaves and pods and *Senna tora* seeds remained the top three entities in export. On the import side, Gum Arabic remained the top entity imported by the country. Limitations of the ITC (HS) coding system in providing species-wise detail of entities in foreign trade was acutely felt during the current study. An effort has, nevertheless, been made to bring out complexities in respect of species in high foreign trade. The various policies and legislative provisions impacting foreign trade of medicinal plants have been discussed. A conceptual proposal for improving the ITC (HS) coding system has also been given in the chapter.

8.1. INTRODUCTION

The indigenous medical traditions in different countries are believed to have developed around the bio-resources available in that eco-region. There have, however, always been efforts to find more efficacious medicinal herbs from the same or the other eco-regions to make these medical traditions more potent. It is no wonder that, with opening of the land and sea trade routes, the medicinal herbs, including spices, always formed a substantial part of the merchandise traded between the countries. It is because of this trade that many a botanical raw drugs that do not occur in India have come to form an integral part of many key herbal formulations of this country. For example, Mulethi (*Glycyrhiza glabra*) is extensively used in India in both classical and folk herbal traditions even as it does not occur naturally in India and its use is totally dependent upon its import. Unab (*Ziziphus sativa*), majuphal (*Quercus infectoria*), Hing (*Asafoetida*) are some of the other raw drugs used in India that are exclusively import based. On the other hand, Isabgol (*Plantago ovata*) and Senna (*Cassia angustifoia*), cultivated in India on large scale, are exported in large quantities from India to meet its demand in other countries. As the things stand today, a large number of medicinal plant species have come to be in active foreign trade (export and import) from and to India, and the volume of such foreign trade is on the rise.

A large number of Import and Export houses and agencies in the country are engaged in foreign trade of botanical raw drugs through more than 100 ports. Since foreign trade of botanicals has direct impact on (a) the availability of such botanicals to the domestic herbal industry, (b) the conservation status of the wild resource, and (c) the cultivation levels of important species, it is very necessary to know the exact details of the entities in foreign trade. With a large number of firms engaged in foreign trade of botanical raw drugs through large number of ports, and most of the foreign trade happening under local vernacular/ trade names, the task to collate entity-wise information on the foreign trade of botanical raw drugs becomes very complex.

In the Indian context, the data relating to India's exports and imports by commodities is officially compiled and published by the Directorate General of Commercial Intelligence and Statistics (DGCIS) of Government of India. The data is compiled in accordance with the Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS) of tariff nomenclature, developed and maintained by the World Customs Organization (WCO) and adopted by the Government of India as Indian Trade Classification, commonly called ITC (HS) codes. As per this system entities in foreign trade are grouped under chapters and assigned unique codes to enable tracking of their trade volumes and trends. The DGCIS compiles foreign trade data in respect of imports and exports of various entities through all ports in the country, arranging the same ITC (HS) code wise, with traded quantities reflected in kilograms and trade value in rupees.

In as far as botanical raw drugs are concerned, these are broadly covered with the bioresources under foreign trade that have been classified under different chapters, with Chapter 12 entitled “Oil Seeds and Oleaginous Fruits; Miscellaneous Grains, Seeds and Fruit; Industrial or Medicinal Plants; Straw and Fodder” covering a major diversity of plants and plant material in foreign trade. More specifically, it is heading 1211 under this chapter i.e. “Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fungicidal or similar purposes, fresh or dried, whether or not cut, crushed or powdered” under which most of the medicinal herbs are traded. Analysis of DGCIS data from 2005-06 to 2014-15 reveals that a total of 39 botanical raw drug entities under foreign trade can be segregated under the heading 1211. Some medicinal herbs are also categorized under chapter 13 and chapter 14 wherein foreign trade data in respect of 10 and 6 botanical raw drug entities respectively is recorded. Some

commodities like cinnamon bark, pepper long, juniper berries and *Cassia tora* seeds, that are used as botanical raw drugs in large quantities are clubbed under chapter 9 with spices. From the above it is evident that the DGCIS data is able to provide entity-wise information on the foreign trade of medicinal plants for about 60 species only. The data is, however, good enough to provide information on gross foreign trade of medicinal herbs.

8.2. FOREIGN TRADE OF BOTANICAL RAW DRUGS FROM 2005-06 TO 2014-15

DGCIS data (DGCIS, 2015) for a period of ten years i.e. from 2005-06 to 2014-15 has been analyzed in respect of the botanical raw drug entities recorded under chapters 9, 12, 13 and 14 of ITC (HS) and is presented in table 8.1. In addition to the botanical raw drugs, entities defined as 'extracts' of botanical raw drugs and 'gums' under foreign trade, have been included in this analysis. The botanical entities usually traded as 'spices', 'cereals', 'pulses', fruits/ vegetables or for purposes other than medicinal use have, however, not been included in this analysis.

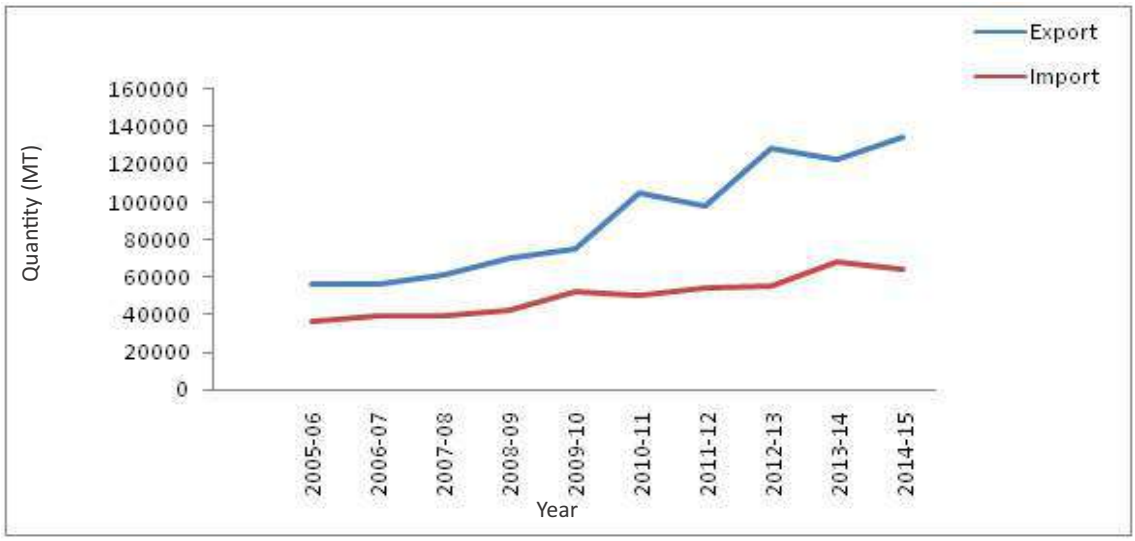
Table 8.1: Gross Export and Import of Botanical Raw Drugs from 2005-06 to 2014-15

Year	Export		Import	
	Quantity (MT)	Value (₹ in Lakh)	Quantity (MT)	Value (₹ in Lakh)
2005-06	56014.17	57920.50	36143.68	19165.71
2006-07	55854.62	71999.13	39311.68	26156.85
2007-08	60379.24	74143.90	38675.35	28649.92
2008-09	69822.45	103107.54	42310.85	35457.67
2009-10	74611.74	97186.31	51987.63	37808.51
2010-11	104115.13	117000.62	58076.93	49107.56
2011-12	97244.43	163642.63	53753.29	59438.05
2012-13	128247.37	243748.62	54798.97	67577.39
2013-14	122374.91	277300.43	68209.25	96872.56
2014-15	134436.52	321133.44	64545.34	107572.10
Av. / year (rounded)	90310.00	152718.00	50781.00	52781.00

It can be amply inferred from the above table that at gross level, the export as well as the import of the botanical raw drugs has steadily increased over the past ten years in terms of volumes as well as value. In as far as export of botanical raw drugs is concerned the trade volume has increased from about 56,015 MT in 2005-06 to 134,437 MT in 2014-15 registering an average annual increase of about 11%. In value terms, the export of botanical raw drugs registered an average annual increase of about 22% with the total export value rising from ₹ 579 crore in 2005-06 to ₹ 3211 crore in 2014-15. The import of botanical raw drugs, on the other hand, registered an average annual increase of 7% in volume terms with the total import volume rising from 36,143 MT in 2005-06 to 64545 MT in 2014-15. The import value registered a corresponding average annual increase of 22% with the import value rising from ₹ 192 crore in 2005-06 to ₹ 1076 crore in 2014-15.

Further analysis of the figures in the table above reveals a healthy trade balance between the export and import of medicinal plants over the ten year period. Whereas the volume of medicinal plants exported during 2005-06 was 1.5 times of the volume of medicinal plants imported, the export volume grew to more than two times that of volume imported over the ten year period. Similar trend is also revealed in respect of the export and import value over the years. The gross

value of the medicinal plants exported over the ten year period from 2005-06 to 2014-15 remained about three times that of the import value.



Gross Volume of Foreign Trade of Botanical Raw Drugs

The increase or decrease of annual trade volumes of export and import is considered a robust measure to understand trends of export and import of commodities over the years. An average annual increase of 11% in export volumes of botanical raw drugs, recorded over the ten year period from 2005-06 to 2014-15, amounts to a significant increase. The average annual increase of 22% in the value of export of botanical raw drugs over a ten year period, also forms a significant increase, even with a ten year average annual inflation index of 8.5%.

Since 'extracts' and 'gums' form a significant part of the 'botanical raw drugs' in foreign trade, it is important to study the trends in foreign trade of 'extracts' and 'gums' separately also.

8.2.1. Extracts

Foreign trade of extracts of botanical raw drugs, recorded under ITC (HS) 1311.19.11 to ITC (HS) 1311.19.19, is compiled and presented in the table 8.2.

Table 8.2. Year-wise Foreign Trade of 'Extracts' of Botanical Raw Drugs

Year	Export		Import	
	Quantity (MT)	Value (₹ in Lakh)	Quantity (MT)	Value (₹ in Lakh)
2005-06	1575.22	19458.9	130.32	1093.64
2006-07	2322.29	29337.9	154.51	977.71
2007-08	1972.32	23108.6	199.40	1519.35
2008-09	2716.94	35097.0	397.80	3425.18
2009-10	2066.49	35950.6	242.18	2995.43
2010-11	2199.10	38326.9	379.02	3801.80
2011-12	3215.63	66561.9	357.01	6498.21
2012-13	4638.29	113270.6	285.54	8636.03
2013-14	7419.62	142610.8	1328.65	10074.50
2014-15	11639.36	151734.2	1692.85	10785.42

The foreign trade of 'extracts' of botanical raw drugs, especially their export, has come to occupy a very important position over the years and has gone up from 1,575 MT during 2005-06 to 11,640 MT during 2014-15 with a corresponding export value of ₹ 195 crore in 2005-06 and ₹ 1517 crore in 2014-15. The major species accounting for the extract export are Camboge, Gymnema, Neem, Belladona, Agar, Nux-vomica with major gains seen in the export of Camboge extract, Neem extract and extract of miscellaneous botanical raw drugs that has gone up by almost 10 times.

The import of extracts has also grown about ten-fold over the ten year period from 2005-06 to 2014-15, rising in volumes imported from 130 MT in 2005-06 to more than 1690 MT in 2014-15, and in value from about ₹ 11 crore to ₹ 108 crore. The major entity under import of 'extracts', for which segregated data of imports is available, is 'Ginseng Extract' with average annual import of 21 MT at an average annual import value of ₹ 11 crore over the ten year period from 2005-06 to 2014-15.

It is, however, a matter of concern that the present ITC (HS) coding system does not allow entity-wise segregation of extracts clubbed under 'other extracts' even as these form the bulk of extracts in foreign trade. Analysis of the export data for the year 2014-15 reveals that about 6,100 MT of herbal extracts forming more than 50% of the total extracts exported during the year by volume were clubbed under the category 'other extracts'. In value terms, the export value of the extracts clubbed under the category 'other extracts' during 2014-15 was ₹ 1,244 crore forming more than 80% of the total export value of all extracts! This analysis also makes it very apparent that the extracts getting clubbed under 'other extracts' include some entities of very high value. Similarly, import of extracts worth ₹ 87 crore out of total extracts worth ₹ 108 crore imported during 2014-15 and forming about 80% of the total imports for the year, is recorded under the category 'other extracts'.

Lack of reflection of such entities in the national database does not augur well for management and development of the resource plant species used in making such extracts. The ITC (HS) Code, therefore, needs to be refined to suitably accommodate the entity-wise information on foreign trade of extracts made of botanical raw drugs.

8.2.2. Gums

Gums form a sizeable item of foreign trade, with Gum Arabic, Gum Karaya, Asian Gum, and Guggal forming the major items of such trade. During the year 2014-15 a total of 4,074 MT of gums were exported at an export value of ₹ 84.98 crore. Similarly, a total of 32,274 MT of gums were imported during the same year at a total import value of ₹ 141.29 crore (table-8.3).

Table 8.3. Year-wise Foreign Trade of Medicinal 'Gums'

Year	Export		Import	
	Quantity (MT)	Value (₹ in Lakh)	Quantity (MT)	Value (₹ in Lakh)
2005-06	2282.00	2481.90	15381.13	4575.27
2006-07	1726.35	2204.06	19401.81	5732.87
2007-08	2075.74	2381.23	15706.11	4614.26
2008-09	4498.03	6356.96	16316.27	5442.43
2009-10	3869.76	5562.61	21231.62	6957.83
2010-11	4102.13	8423.81	19523.40	6600.89
2011-12	4504.34	11757.63	26374.34	8171.28

Year	Export		Import	
	Quantity (MT)	Value (₹ in Lakh)	Quantity (MT)	Value (₹ in Lakh)
2012-13	2424.34	8414.11	23320.87	8844.67
2013-14	3243.70	10909.79	33940.36	14478.56
2014-15	4073.87	8497.75	32274.29	14128.93

Close scrutiny of the data reveals that the major entities forming foreign trade of 'gums' is the 'Gum Arabic'. One prominent entity traded as 'gum' and forming a large bulk of plant based gums in foreign trade i.e. 'Guar Gum' has not been included in this data as it is not traded primarily as medicinal raw drug.

8.3. FOREIGN TRADE OF ASU & H MEDICAMENTS FROM 2005-06 TO 2014-15

A significant part of the botanical raw drugs, including extracts and gums, is imported and exported in the form of ASU & H value added products. The foreign trade of these value added products is recorded in the DGCIS data as 'Medicants' (ITC (HS) 30039011) and 'Medicaments' (ITC (HS) 30049011). As can be noticed from the table 8.4 below, the gross quantity of ASU & H medicaments under exports steadily grew from 6330 MT in 2005-06 to about 15750 MT in 2014-15. In value terms, the export value of ASU&H medicaments during 2005-06 was ₹ 235 crore, which rose to ₹ 708 crore in 2014-15. Ayurvedic formulations form the major share of medicaments (about 99%) in export, with those under Sidhha, Unani and Homoeopathy systems account for only just about one percent of total exports.

Table 8.4. Export of ASU&H Medicaments (Qty. in MT, Value in ₹ crore)

Year	Ayurvedic		Unani		Siddha		Homeopathic		Total	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
2005-06	6275.3	23306.7	42.1	112.8	4.9	29.8	7.9	44.2	6330.2	23493.5
2006-07	8681.6	25953.9	8.0	70.1	0.2	2.1	16.7	135.6	8706.5	26161.7
2007-08	11020.7	32143.8	41.0	113.3	9.6	41.5	26.0	129.6	11097.3	32428.2
2008-09	13787.3	55150.4	105.4	543.4	2.9	11.8	73.7	260.3	13969.3	55965.9
2009-10	13936.6	67202.5	13.3	43.0	2.2	43.3	131.3	558.2	14083.4	67847.0
2010-11	14785.0	70045.3	34.4	121.5	12.1	131.2	27.8	92.8	14859.3	70390.8
2011-12	15963.4	80817.5	101.0	5091.4	9.0	75.8	55.3	316.0	16128.7	86300.7
2012-13	12895.2	84977.5	44.8	908.6	40.1	1157.4	11.7	184.5	12991.8	87228.0
2013-14	12461.1	88084.3	62.9	7391.6	17.6	206.1	39.6	322.4	12581.2	96004.4
2014-15	15671.5	70314.9	17.9	67.6	11.0	99.4	48.7	358.2	15749.1	70840.1

The imports of ASU&H medicaments have risen from about 1390 MT in 2005-06 to about 1530 MT in 2014-15 with peak import of about 2000 MT recorded during 2007-08 and 2009-10 and a low of about 600 MT recorded during 2012-13 (table 8.5). The corresponding import value, however, registered a rather steady upward trend as it rose from ₹ 60 crores in 2005-06 to ₹ 159 crore in 2014-15. The major component of import is Homoeopathy medicaments (59%) followed by Ayurveda medicaments (41%).

Whereas the increasing foreign trade of ASU&H medicaments amply reflects the trend towards 'herbals', higher export of value added products also generate greater foreign exchange for the country. The export value generated by export of ASU&H medicaments is almost five times of the

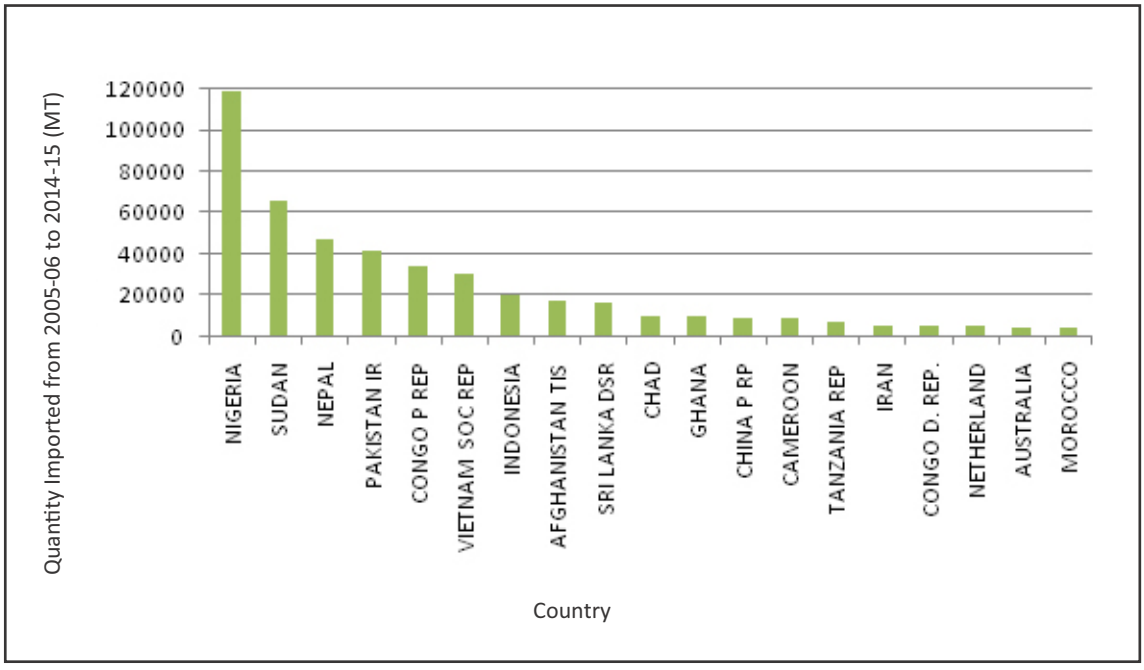
Table 8.5. Import of ASY&H Medicaments (Qty. in MT, Value in ₹ crore)

Year	Ayurvedic		Unani		Siddha		Homeopathic		Total	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value
2005-06	1299.3	3531.9	9.9	46.6	6.2	37.5	75.9	2386.9	1391.2	6002.9
2006-07	1119.2	3251.6	70.4	103.0	0	0	67.8	3092.8	1257.4	6447.4
2007-08	2014.6	3460.5	49.6	37.0	0	0	35.2	3152.1	2099.4	6649.6
2008-09	1723.6	6445.2	1.7	4.9	0	0	22.1	4012.3	1747.4	10462.5
2009-10	1711.5	3133.2	15.3	32.5	0	0	369.5	2810.6	2096.4	5976.3
2010-11	1183.9	3282.8	0	0	0	0	164.9	4665.5	1348.8	7948.3
2011-12	902.1	4081.1	0	0	2.7	334.1	93.2	5779.6	997.9	10194.8
2012-13	562.8	3774.3	1.5	4.1	0.0	3.7	33.5	7870.1	597.8	11652.2
2013-14	1349.6	4745.9	0	0	0.3	3.6	17.2	9328.4	1367.1	14077.9
2014-15	1383.6	6560.4	0	0	0.1	0.9	144.9	9330.3	1528.6	15891.7

value on account of imports of herbal based medicaments. However, the total export value of ASU&H medicaments is still about one fifth of the total export value generated by the 'botanical raw drugs'.

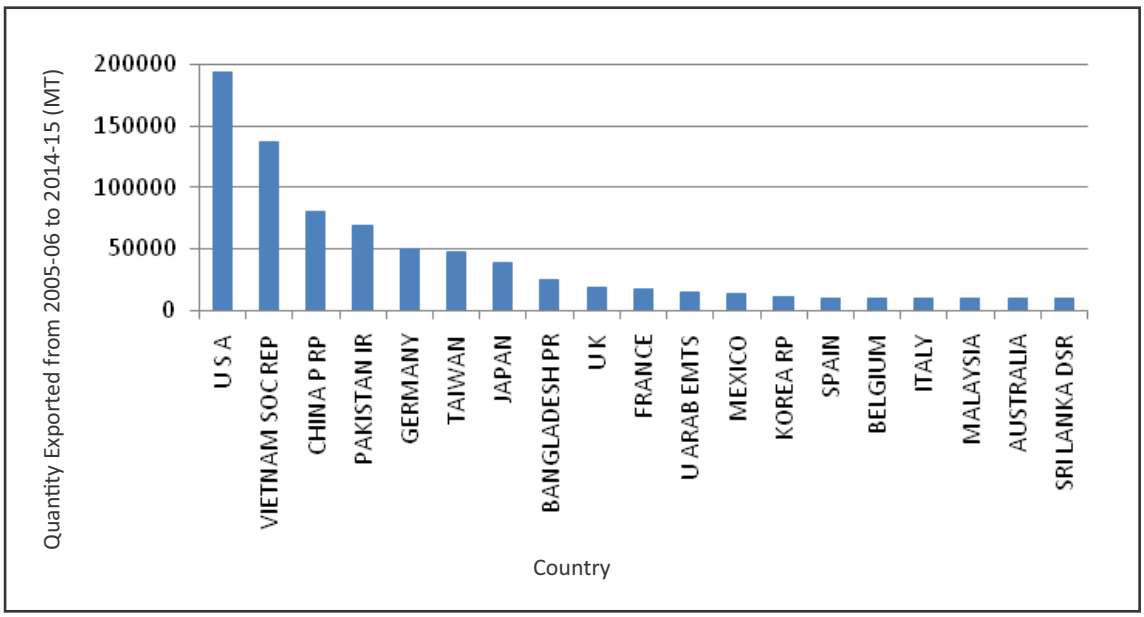
8.4. MAJOR COUNTRIES INVOLVED IN FOREIGN TRADE OF BOTANICAL RAW DRUGS WITH INDIA

India exports a large number of botanical raw drugs to and imports various botanical raw drugs from many countries across the globe. The major countries that had high cumulative foreign trade of medicinal plants with India over a ten year period from 2005-06 to 2014-15 are given the figures below:



Import of Botanical Raw Drugs

The very high import figures from African countries is on account of import of 'Gum Arabic'. United States of America has been the largest importer of botanical raw drugs from India over the ten year period from 2005-06 to 2014-15, with the major entity of export to USA being 'Isabgol'.



Export of Botanical Raw Drugs

8.5. PROFILE OF BOTANICAL RAW DRUGS ENTITIES IN FOREIGN TRADE

ITC (HS) code-wise export and import data in respect of botanical raw drugs over the past decade i.e. from 2005-06 to 2014-15, based on the DGCIS reports, is presented in tables 8.6a & 8.6b (Exports) and 8.7a & 8.7b (Imports) appended at the end of this chapter. As can be noticed, even after exhaustive listing of the entities traded under different codes, it is possible to list only about 60 botanical raw drug entities under foreign trade. Hundreds of other botanical raw drugs in foreign trade are clubbed under a few ITC (HS) codes titled 'others'.

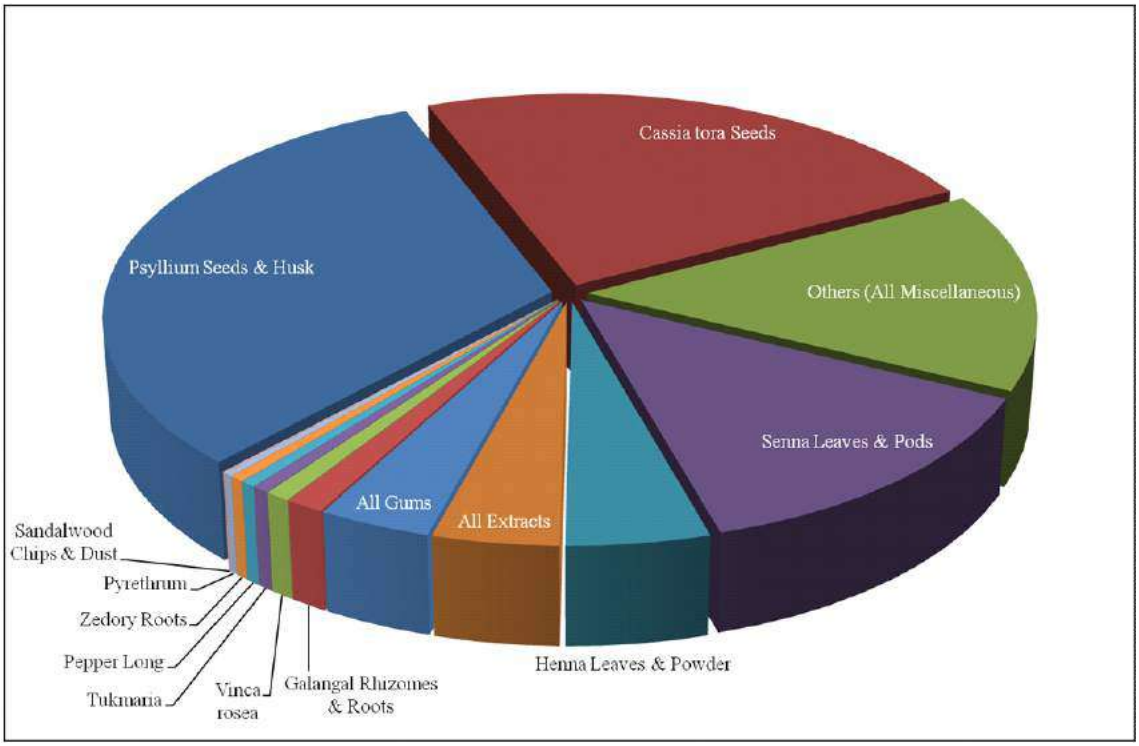
8.5.1. Exports

Analysis of the export data reveals that Isabgol (*Plantago ovata*) registered the highest export trade volumes during all the ten years and accounted for about one third of the export value of all botanical raw drugs. This trend is consistent with the similar trend recorded by Ved and Goraya (2008) in an earlier study. Similarly, the export of 'extracts' has followed an increasing trend over the ten years with export volumes increasing from 1,575 MT during 2005-06 to nearly 11,640 MT during 2014-15. Botanical raw drug entities that remained in high foreign trade over the ten year period from 2005-06 to 2014-15 are as under:

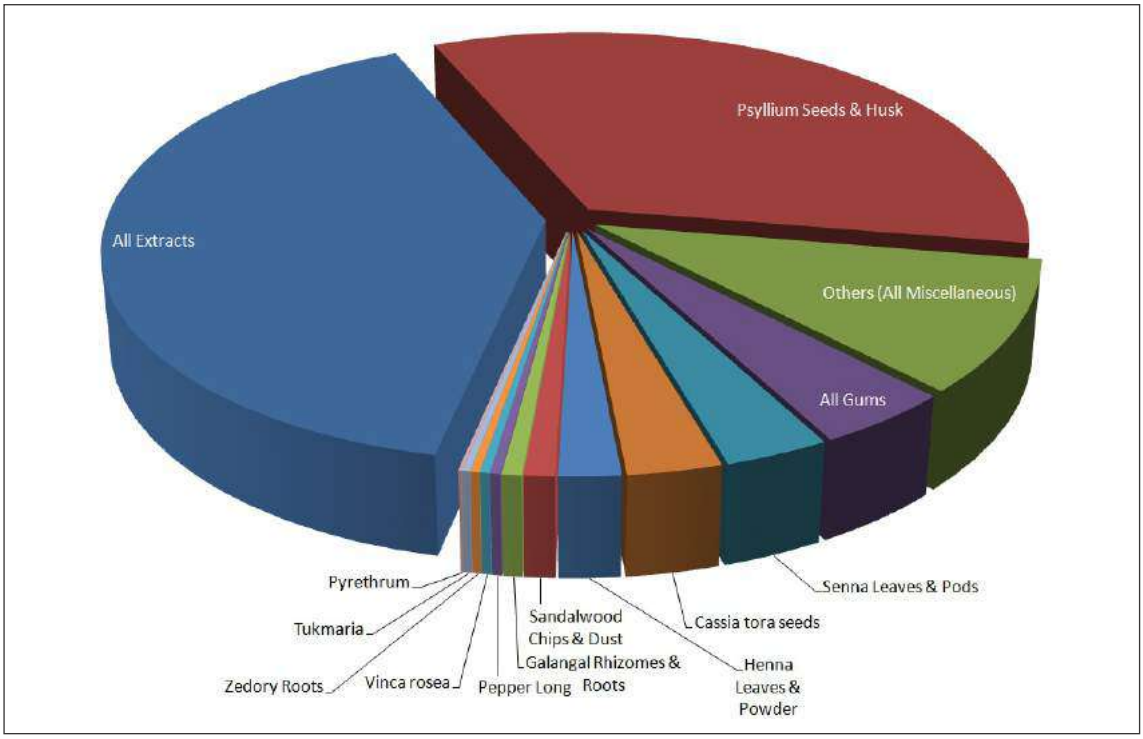
S. No.	ITC (HS) Code	Name of the Entity	Average Export Volume (MT)	Average Export Value (₹ in Crore)
1	12119013 12119032	Psyllium Seeds & Husk	29000	520
2	12119022	Senna Leaves & Pods	12100	51
3	09041110	Pepper Long	450	5
4	09109915	*Cassia tora* seeds	21000	46
5	12119026	Pyrethrum	270	1.5
6	12119042	Galangal Rhizomes & Roots	1130	9.5
7	12119050	Sandalwood Chips & Dust	78	15
8	12119060	*Vinca rosea*	735	4.6

S. No.	ITC (HS) Code	Name of the Entity	Average Export Volume (MT)	Average Export Value (Rs. in Crore)
9	12119092	Tukmaria	500	4
10	12119045	Zedovary Roots	427	4.3
11	14041011 14014019	Henna Leaves & Powder	4200	30
12	13012000, 13019016 to 13019019	All Gums	3300	67
13	13021400 to 13021919	All Extracts	3700	614
14		Others (All Miscellaneous)	13420	155
		Total	**90310**	**1527**

Comparison of the current export data with the one presented in Ved and Goraya (2008) brings out that export of some of the high trading entities has fallen over the years. For example, the export volume of 'Jojoba Seeds', recorded as a high export entity in 2004-05, has fallen to less than 1 MT from 2010-11 onwards. Similarly, the export of 'Pyrethrum' has come down from more than 950 MT in 2005-06 to less than 50 MT in 2014-15, and that of '*Vinca rosea*' from 1300 MT in 2005-06 to about 550 MT in 2014-15.



Average Export Volume (MT) of different Botanical Raw Drugs from 2005-06 to 2014-15



Average Export Value (₹ in Crore) of different Botanical Raw Drugs from 2005-06 to 2014-15

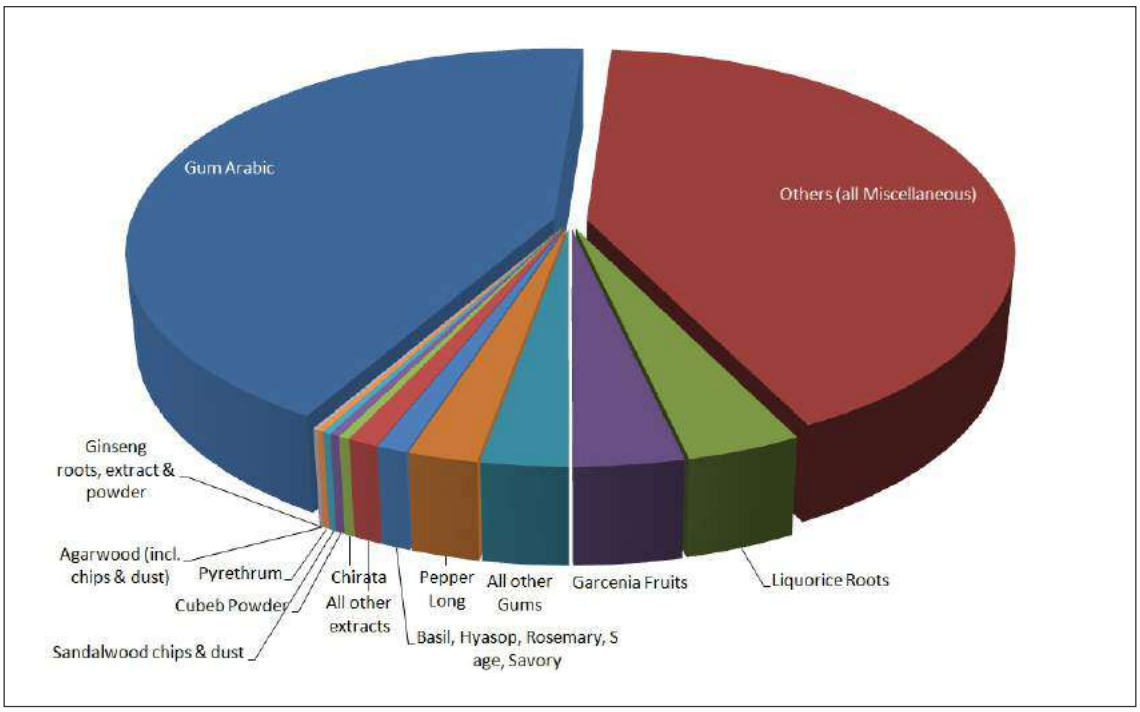
On the other hand, the data reveals a nearly fifteen time increase in exports of '*Cassia tora* seeds' over the ten year period, growing from just about 2100 MT in 2005-06 to nearly 30000 MT in 2014-15. Another entity that has registered a steady increase in exports is 'Tukmaria', the seeds of *Ocimum basilicum*, the export of which steadily grew from 230 MT in 2005-06 to 711 MT in 2013-14 before a decline to 433 MT in 2014-15. Export of 'Zedovary Roots' has also grown from about 92 MT to 1120 MT over a ten year period from 2005-06 to 2014-15.

Herbal Raw Drug entities in high export volumes

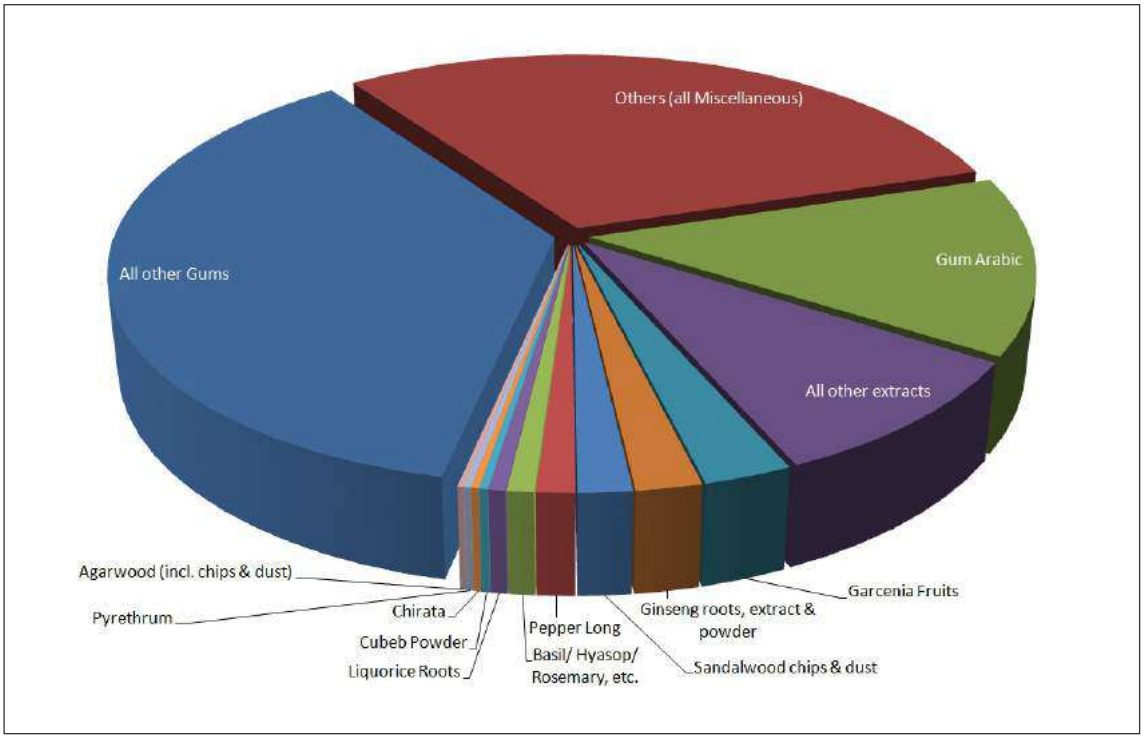
8.5.2. Imports

On the import side, Gum Arabic registered the highest import volumes over the ten year period with an increase in import volumes from 14,826 MT in 2005-06 to 31,008 MT in 2014-15. The decade saw a steady decline in the import of Pepper Long (*Piper longum*), a commodity that was recorded as the top imported botanical raw drug entity during 2004-05.

S. No.	ITC (HS) Code	Name of the Entity	Average Import Volume (MT)	Average Import Value (₹ in Crore)
1	13012000	Gum Arabic	21758	72.17
2	12119096	Garcenia Fruits	1815	14.52
3	09041110	Pepper Long	1152	6.34
4	12111000	Liquorice Roots	1900	2.75
5	12112000 13021914	Ginseng roots & extract incl. powder	29	10.83
6	12119050	Sandalwood chips and dust	130	8.86
7	12119094	Basil, hyasop, rosemary sage, savory	509	4.41
8	12119025	Cubeb Powder	164	1.44
9	12119099	Chirata	176	1.22
10	12119026	Pyrethrum	115	1.16
11	12119080	Agarwood (including chips & dust)	42	0.97
12	-	All other gums	1427	194.35
13	-	All other extracts	495	49.81
14	-	Others (all Miscellaneous)	21069	158.97
		Total	**50781**	**528**



Average Import Volume (MT) of different Botanical Raw Drugs from 2005-06 to 2014-15



Average Import Value (₹ in Crore) of different Botanical Raw Drugs from 2005-06 to 2014-15

8.6. MAJOR ENTITIES IN FOREIGN TRADE

Presented below are the highlights of foreign trade in respect of top traded entities under export/ import:

8.6.1. Psyllium or Isabgol

Psyllium or Isabgol, the seeds or seed husk of *Plantago ovata*, traded for its husk [ITC (HS) 12119013] and for its seeds [ITC (HS) 12119032], registered the highest export trade volumes from 2005-06 to 2014-15 with an average annual trade volume of 27,750 MT of Psyllium husk and an average annual trade volume of 712 MT of Psyllium seeds over this ten year period. Psyllium has also been the single largest foreign exchange earning botanical raw drug with its export value increasing from ₹ 209 crore in 2005-06 to ₹ 767 crore in 2014-15. The combined export of Psyllium husk and Psyllium seed constitutes about 20% of total export of botanical raw drugs by volume and about 24% of total exports of botanical raw drugs by value. Minor quantities of Psyllium husk was also imported during this period. However, the import price per kilogram has shown a fall from a high of ₹ 281 per kilogram in 2006-07 to ₹ 52 in 2014-15. The average export price of Psyllium husk, on the other hand, witnessed an increase from ₹ 83 per kilogram to ₹ 201 per kilogram over this period.

India is the major Psyllium producing and exporting country, contributing about 80% of the Psyllium traded in the world market. United States of America is the single major buyer of Psyllium husk, accounting for about 75% of the total exports of the material from India. Other main buyers

of Psyllium husk from India include the United Kingdom, France, Germany, Sweden, Denmark, Norway, Spain, Italy, Japan, Indonesia, Taiwan, Australia and Korea. In as far as Psyllium seeds are concerned, the major importer of this material from India is Germany. Most of the Psyllium exports occur through the Mundra Port and Sabarmati Inland Container Depot, Ahmedabad in Gujarat and Jawaharlal Nehru Port Trust, Nhava Sheva, Mumbai.

The entire supply of Psyllium seeds is met from cultivation in the states of Rajasthan, Madhya Pradesh and Gujarat, where it is cultivated over about 60,000 hectares. Unjha in Gujarat is the biggest mandi for trade of Isabgol. No wonder that 16 of the 18 major Isabgol processing units are located in the Unjha-Sidhpur belt.

8.6.2. Gum Arabic

Gum Arabic [ITC (HS) 13012000], the gum obtained mainly from *Acacia senegal* trees, and known locally as 'Kumtha' or 'Char Gond', has been the major botanical raw drug entity of import over the ten year period from 2005-06 to 2014-15 with an annual average import volume of 21800 MT over the period. This import volume reflects an increase of more than 200% with imports rising from 14826 MT in 2005-06 to 31008 MT in 2014-15. India is second only to the US in consumption of Gum Arabic (NGARA, 2004). The import value also registered an increase of more than 300% over the same period with the import value rising from ₹ 42 crore in 2005-06 to ₹ 300 crore in 2014-15. The average import price per kilogram over the period has been ₹ 31.80, varying from ₹ 28.46/ kg during 2005-06 to ₹ 41.44/ kg during 2014-15.

Gum Arabic has also been an item of sizeable export/ re-export over this ten year period with exports rising from just 58 MT in 2005-06 to nearly 1900 MT in 2014-15. The Gum Arabic that was exported from the country fetched a much higher price as compared to the Gum Arabic imported during the period. The average export price during this period was ₹ 150 per kilogram against the import price of ₹ 31.80 per kilogram. The export price, in fact, recorded a high of ₹ 257.14 per kilogram during 2013-14 before plummeting to ₹ 92.56 per kilogram in 2014-15 due to unexplained reasons. Re-export of processed and value added Gum Arabic (solubilized, atomized, kibbled) is a very common trade practice with France and United Kingdom leading the countries engaged in such re-export.

Acacia senegal tree and a flowering twig

This large variation in the prices per unit of Gum Arabic material being imported by India and the material being exported from India brings up the issue of critical identity of the Gum Arabic material under import and export. The official source of Gum Arabic is *Acacia senegal*, a tree that occurs naturally in Sahel region of Africa with small populations of this species also occurring in drier parts of India. Sudan, Chad and Nigeria account for about 96% of the total annual global trade of about 70,000 MT (ITC, 2008). In commercial trade, the *Acacia senegal* gum is known as 'Kordofan' or 'Hashab' gum, if it originates from Sudan, and 'Kitir' gum, if it originates from Chad. About 800 MT of Gum Arabic is tapped from *Acacia senegal* trees every year in India also (IINRG, 2008).

Gum obtained from another Acacia tree i.e. *Acacia seyal* is also traded in the international market as Gum Arabic under the trade name 'Talha' gum or 'Nigerian Gum Arabic' depending upon whether it comes from Chad or Nigeria respectively. Produced mainly in Chad and Nigeria, this gum fetches lower prices than the true Gum Arabic obtained from *Acacia senegal*. Current regulations dealing with Gum Arabic, however, do not distinguish between gum obtained from *Acacia senegal* and *Acacia seyal*. Therefore, although gum from *Acacia seyal* is considered to be of inferior quality to the gum obtained from *Acacia senegal*, it continues to be commonly traded as Gum Arabic. India is one of the major buyers of this gum and it imports an estimated 50% of the 9000 MT of this gum produced in Nigeria because of its superior colour (NGARA, 2004).

Gum obtained from *Acacia polyacantha* and *Acacia laeta* is also traded as Gum Arabic. It is considered to be of lower quality than that obtained from *Acacia senegal* and fetches much lower price than the true Gum Arabic. Gum of *Combretum nigricans* is another gum that is traded as Gum Arabic, and is considered as an adulterant to the true Gum Arabic (Anderson et al.1991).

It is fairly apparent from the above discussion that trade recording system in respect of the trade of Gum Arabic tapped from so many different tree sources and commanding different prices under one ITC (HS) code is highly inadequate to track the species-wise data of this important botanical raw drug.

8.6.3. Pepper Long

Pepper Long [ITC (HS) 09041110] has been recorded in sizeable foreign trade as an item of both import and export during the period of this study. Whereas the import of this item has witnessed a steady decline from about 3300 MT in 2005-06 to just about 850 MT in 2014-15, the export of this item has been rather erratic with the exports declining from 718 MT in 2005-06 to only 86 MT in 2010-11 before picking up again and registering a high export volume of 1205 MT in 2014-15. Analysis of the per unit prices in respect of import and export reveals that during this period Pepper Long has been imported at an average price of ₹ 56 per kg (₹ 35.38 – ₹ 78.38), whereas its average export price during this period has been ₹ 171 per kg (₹ 90.78 – ₹ 347.04).

The vast difference in import and export prices of Pepper Long throws up a question about the botanical identity of the Pepper Long under import and export. Pepper Long, commonly known in

India as 'Pippali', is the fruiting spikes of *Piper longum*, a climbing shrub found wild in the country and also cultivated on large scale. The Pepper Long sourced from *Piper longum* fetches high prices in the foreign trade. India's major source of import of Pepper Long is Indonesia, a country that cultivates and also has wide-spread wild populations of another species of Piper i.e. *Piper retrofractum* (=*P. chaba*) that also yields fruiting spikes known in trade as Pepper Long, that are cheaper. Both these species are traded interchangeably under the same ITC (HS) code making it difficult to track the trade of Pepper Long obtained from *Piper longum* and *Piper retrofractum* separately. It seems, however, safe to assume that the Pepper Long entity that is exported is the fruiting spike of *Piper longum* and the one imported is the fruiting spikes of *Piper retrofractum*.

8.6.4. Garcinia and Camboge

Garcinia [ITC (HS) 12119096] and Camboge [ITC (HS) 13021918] usually refer to the produce obtained from the fruits of *Garcinia gummi-gutta* (= *G. cambogia*), a tree occurring in the Southern Western Ghats in India and also in Sri Lanka and Indonesia. Local people in its range of occurrence also cultivate the species in homesteads and private fields for its fruit that is used for culinary purposes. The fruit has come to be an important commodity under foreign trade due to its debatable anti-obesity properties.

India is a big producer of Garcinia fruits and exports a part of the same in dried form. Over the ten year period from 2005-06 to 2014-15, India exported an average of 37 MT of dried fruits of Garcinia under ITC (HS) 12119096 per year, with high exports of 103 MT and 93 MT recorded during the years 2013-14 and 2014-15. India, however, imported much larger quantities of Garcinia fruits over the same period with an average annual import of 1804 MT, with very high imports of 3548 MT recorded during 2013-14. The major countries of import of Garcinia fruits have been Sri Lanka making for more than 69% of total imports and Indonesia making for about 20% of the total imports. The Garcinia fruit being imported from Sri Lanka is usually traded under the name 'Goraka', common name of Garcinia fruit in Sinhala. More than 70% of all import consignments of Garcinia fruit land at Chennai ports – both by sea and air.

It is interesting to note that India also exports Garcinia fruit extracts under the name Camboge extract that is exported under ITC (HS) 13021918. It is a value added product that fetches much higher export price than the dried Garcinia fruits. Over the ten year period 2005-06 to 2014-15, the dried Garcinia fruits have received an average price of ₹ 77 per kg, whereas the average export price commanded by the Garcinia fruit extract over the same period has been ₹ 551 per kg. India exported an average of 1166 MT of Camboge extract per year from 2005-06 to 2014-15 and earned an export value of ₹ 130 crore in 2014-15. Juxtaposing the annual import figures of Garcinia fruits and annual export figures of Camboge extract for the same period, as depicted in the table below, point to the fact that India imports Garcinia fruit at very low prices from Sri Lanka and re-exports the same after making it into Camboge extract at much higher export prices.

Table 8.6. Garcinia and Camboge Import and Export figures Juxtaposed

Year	Export of Garcinia Fruit [ITC (HS) 12119096]		Import of Garcinia Fruit [ITC (HS) 12119096]		Export of Camboge Extract [ITC (HS) 13021918]	
	Quantity (MT)	Value (₹ in Lakh)	Quantity (MT)	Value (₹ in Lakh)	Quantity (MT)	Value (₹ in Lakh)
2005-06	64.00	467.09	878.20	348.66	672.65	3257.34
2006-07	31.07	134.25	2585.68	1559.49	93.59	558.44
2007-08	8.82	57.90	911.42	294.18	581.68	2856.26
2008-09	10.41	64.71	2992.10	998.99	1314.64	7529.37
2009-10	21.20	84.15	1408.27	492.18	475.80	2848.35
2010-11	10.89	51.70	1320.55	757.38	585.63	3371.65
2011-12	3.77	20.48	891.58	904.18	592.06	4805.47
2012-13	25.30	59.75	1726.00	1434.84	561.50	4401.45
2013-14	103.10	577.27	3548.45	4855.35	1725.41	15680.12
2014-15	93.28	799.22	1780.36	3449.04	5053.92	12960.32

Major buyer of Camboge extract from India is United States of America that accounts for more than 50% of the exported volume, with South Korea, Japan, Germany and Australia as other major importers of this commodity. Even though India is the largest exporter of Camboge extract, it imports small quantities of the same, usually in very pure form.

The issue of tracking the import and export of Garcinia fruits and Camboge extract is far from simple, as foreign trade of these entities takes place under a large number of ITC (HS) Codes. In addition to the two ITC (HS) codes referred to above, under which dried Garcinia fruits and Camboge extract is usually traded, these commodities have been noticed to be also traded under the following 13 ITC (HS) codes: ITC (HS) 12079940; ITC (HS) 13021918; ITC (HS) 13021919; ITC (HS) 13021930; ITC (HS) 13021990; ITC (HS) 21061000; ITC (HS) 21069099; ITC (HS) 29389090; ITC (HS) 30049011; ITC (HS) 30049099; ITC (HS) 33012949; ITC (HS) 39269099; and ITC (HS) 84301020.

The issue related to complexity of foreign trade of *Garcinia* fruits does not end here. *Garcinia* also refers to the fruits of many other tree species of genus *Garcinia* viz. *G. indica* (the Kokum tree), *G. morella* (Kadukaai pulli), *G. xanthochymus* (Mysore Gamboge), etc. Fruit extract of *Garcinia indica* has been noted to be exported under the ITC (HS) code 13021918, the same code as for Camboge extract. The fruits of this species are also traded under the ITC (HS) codes 12079940, 15159010, 15159099 and 30049011, as food supplement. In the above scenario, it is imperative that the ITC (HS) coding system of Garcinia and Camboge is refined to be able to effectively track trends in its foreign trade.

8.6.5. Senna Leaves and Pods

Senna leaves and pods, exported and imported under ITC (HS) code 12119022, is the produce obtained from *Senna alexandrina* Gars. ex Mill. [= *Cassia angustifolia* M. Vahl]. In addition to the use of this commodity by the domestic herbal industry in large quantities, Senna leaves and pods form an important commodity exported from the country. The quantities exported and the export value realised over the ten year period from 2005-06 to 2014-15 is given in the table below:

Analysis of the table above reveals that Senna has been a fairly stable

Year	Qty. Exported (MT)	Value (₹ in Lakh)
2005-06	11430.18	2392.97
2006-07	9398.89	2670.43
2007-08	10006.28	3070.69
2008-09	12286.83	4907.41
2009-10	12653.46	4653.98
2010-11	15048.58	4496.19
2011-12	13576.09	5100.24
2012-13	11975.64	6736.40
2013-14	11214.63	7769.58
2014-15	13243.56	8817.39

commodity in as far as its export is concerned with its average annual quantity exported over the ten year period from 2005-06 to 2014-15 being around 12000 MT. The entity has, however, seen more than 3.5 times growth in the value terms.

Senna - dried leaves and pods

Senna is under extensive cultivation in Tamil Nadu, Rajasthan and Gujarat and the cultivated material is able to fully meet the demand of the species.

8.6.6. Henna Leaves and Henna Powder

Henna (Mehndi) Leaves and Henna Powder, obtained from *Lawsonia inermis*, a shrub that is widely cultivated around Sojat in Rajasthan, is known to command a good export market. Till about 2007-08, the foreign trade of Henna Leaves and Henna Powder was recorded under ITC (HS) codes 14041011 and 14041019 respectively. An average annual export volume of more than 200 MT of Henna Leaves and more than 4000 MT of Henna Powder at a collective average annual export value of more than ₹ 30 crore was being recorded under these ITC (HS) codes till 2007-08. However, there is no record of the foreign trade of these entities under these ITC (HS) codes. Limited scrutiny of the DTR data shows that the export of these entities is now being recorded under many different ITC (HS) codes viz. 12119029, with the result that segregated data of export of these entities is now not readily available.

8.6.7. Myrobalans

Myrobalans ('Amla' and 'Others') were reported to form an important export commodity during 2004-05 by Ved and Goraya (2008) with a total export volume of more than 4000 MT at a export value of about ₹ 20 crore. Recorded under ITC (HS) Codes 14041061 and 14041069 till 2007-08, an

annual average trade of 'Myrobalans' has been about 800 MT at an average annual export value of ₹ 4 crore. No record of the export of this commodity is now available under the above mentioned ITC (HS) codes. A limited analysis of the DTR data shows that the export of these entities is now being recorded under various different ITC (HS) codes viz. 12119049, making it difficult to pool segregated data of export of this commodity. Moreover, entity-wise information in respect of different entities in foreign trade as 'myrobalans' is not available.

8.6.8. Nux-Vomica Seeds

Nux-Vomica seeds (*Strychnos nux-vomica*) are traded under the ITC (HS) 12119012 and form one of the important botanical raw drugs under export from India. The export of this commodity has, however, registered a sharp decline from a high of 24 MT during 2007-08 to a mere 0.2 MT in 2014-15 with nil export recorded during 2012-13. The major consumer of exported Nux-Vomica seeds is the Homoeopathic industry, with limited annual requirement of the material. One of the reasons for decline in export of Nux-Vomica seeds from 2005-06 to 2014-15 seems to be the simultaneous rise in export of Nux-Vomica extracts [ITC (HS) 13021913] during the same period. The export of Nux-Vomica extract started moderately in 2006-07 with export of only 20 kg of material, rose up to 4.5MT in 2010-11 and then leveling off at about 1.5 MT per annum, registering an unexplained dip to just 20 kg in 2014-15. It is interesting to note that the total export volume of Nux Vomica seeds over the ten year period from 2005-06 to 2014-15 was 83.6 MT and that of Nux-Vomica extract was only 8.87 MT. However, the export value of Nux-Vomica extract was ₹ 392 Lakh against the total export value of only ₹ 52 Lakh in respect of Nux-Vomica seeds. It is apparent that the per unit rate in respect of export of Nux-Vomica extract was much higher than that for the Nux-Vomica seeds.

8.6.9. Liquorice Roots

Liquorice (also Licorice) roots (Mulethi) is the produce obtained from the roots of *Glycyrrhiza glabra* and forms an important item of import. Till 2007-08 data on its foreign trade was being maintained under ITC (HS) code 1211.10.00, and an average annual import volume of about 1900 MT at average annual import value of ₹ 2.75 crore was being recorded under this code. However, from 2008-09 onwards, data of import of this commodity is NOT being maintained under the code 1211.10.00 making it difficult to pool comprehensive data of its import. Liquorice roots continue to be a commodity of significant import and sample scrutiny of the DTRs reveals that during the year 2015-16, import of this commodity has been effected under ITC (HS) Codes 1211.90.11 (assigned to 'Ambrette seeds'), 1211.90.49 (assigned to 'other' roots), and 1211.90.99 (assigned to 'other' plant parts).

8.6.10. *Cassia tora* Seeds

Cassia tora seeds, traded under ITC (HS) Code 09109915, have remained another commodity in

Cassia tora - seeds and plant

high exports over the ten year period from 2005-06 to 2014-15 with its export volume increasing over ten times from 2083 MT during 2005-06 to 28190 MT during 2014-15, with a corresponding increase in export value from ₹ 3.57 crore in 20105-06 to ₹ 123.99 crore in 2014-15. The export price per kg has also increased from just about ₹ 17 per kg in 2005-06 to ₹ 44 per kg in 2014-15.

8.6.11. Galangal and Zedovary Roots

Galangal Roots (*Alpinia galanga*) and Zedovary Roots (*Curcuma zerambet*) have remained important commodities of export over the past decade. The Galangal Roots, traded under ITC (HS) Code 12119042, registered an increase in export volumes from about 361 MT in 2005-06 to a high of 3095 MT in 2012-13, before coming down to 705 MT in 2014-15. The export value also reflected a corresponding increase from ₹ 2.57 crore in 2005-06 to a high of 26 crore in 2012-13 before coming down to ₹ 7.94 crore in 2014-15. Similarly, Zedovary Roots, traded under ITC (HS) Code 12119045 also registered an increase in export volume from about 92 MT in 2005-06 to 1124 MT in 2014-15 with corresponding increase in export value from about ₹ 36 lakh in 20015-06 to ₹ 13.79 crore in 2014-15. Major source of both Galangal Roots and Zedovary Roots in the country is cultivation and both the species seem to have good potential of creating cash income for the farmers.

8.6.12. Import of Miscellaneous Herbal Raw Drugs

The Indian herbal industry is known to use a large number of herbal raw drugs, many of which are imported from other countries. Most of these species are clubbed under 'others' categories under the present system of ITC (HS) classification, making it difficult to get entity-wise information. A sample check of the DTR records of 2014-15 in respect of entities clubbed as 'others' has revealed import of herbal raw drugs like Kakar singi (*Pistacia integerrima*) from China; dried leaves of Mandukparni (*Centella asiatica*) from Madagascar; dried leaves of Taxus baccata from Netherlands; Gule-gauzaban (*Alcanna tinctoria/ Caccinea macrantha*) from Mediterranian countries.

8.7. RULES AND REGULATIONS RELATED TO FOREIGN TRADE OF BOTANICAL RAW DRUGS

The wild populations of a large number of medicinal plants have drastically declined due to increasing exploitation pressure, bringing many of these species to the brink of extinction. The global concern about the conservation and sustainable utilization of such red-listed species has led countries to join the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). At the heart of the CITES agreement is an extensive list of animal and plant species that have been identified as threatened due to overexploitation through international trade. Depending upon the gravity of threat status, different species have been assigned under Appendix I, Appendix II or Appendix III, with the Critically Endangered species being listed under Appendix I and the other two appendices containing lists of species under lesser threat. As at present, 14 species native to India, including *Saussurea costus*, an imported medicinal plant species, are listed in Appendix-I. An additional 58 species native to India, including important medicinal plant species like *Nardostachys jatamansii*, *Picrorhiza kurroa* and *Rauvolfia serpentina*, are listed in Appendix-II. The Appendix-II also enlists two plant families i.e. Cactaceae and Orchidaceae. 4 species native to India are listed under Appendix-III.

India is also a signatory to the CITES and has put in place various provisions related to export of plants, plant portions and their derivatives and extracts, obtained from the wild. CITES is implemented in India through a combination of the Wildlife (Protection) Act, 1972, the Export and Import Policy (EXIM) of the Foreign Trade (Development and Regulation) Act, 1992 and the

Customs Act, 1962. The lists of plant species included in the CITES Appendix I and the CITES Appendix II form the basis for regulating the foreign trade of medicinal plants under various policy and legal provisions in the country.

The Wildlife (Protection) Act, 1972

This Act prohibits export of the following six species/ specie groups, included in Schedule VI (Section 2) of the Act (Inserted by Act 44 of 1991, w.e.f. 2-10-1991).

1. Beddomes' cycad (*Cycas beddomei*)
2. Blue Vanda (*Vanda soerulec*)
3. Kuth (*Saussurea lappa = S. costus*)
4. Ladies slipper orchids (*Paphiopedilum* spp.)
5. Pitcher plant (*Nepenthes khasiana*)
6. Red Vanda (*Rananthera inschootiana*)

All the above six species/ specie groups are included in the CITES Appendix-I. Of these, Kuth (*Saussurea lappa =Saussurea costus*), is an important medicinal plant.

The Biological Diversity Act, 2002

The Act does not specifically mention export of biological resources. However various sections of the Act deal with regulations related to obtaining and trade of the biological resources and ipso facto apply to the export of these resources also. Section 38 of the Act empowers the Central government, in consultation with the concerned State government, to notify red-listed species and 'prohibit or regulate collection thereof for any purpose'. At present 118 species (after adjusting an overlap of 14 species) have been notified through notifications in respect of 17 states. Further, as per Section 3 of the Act, the foreign nationals and the NRIs are required to obtain prior approval of the National Biodiversity Authority to access biological resources for research or for commercial utilization or for bio-survey and bio-utilization. Forms for making application for such approval are provided under Rule 14 of the Biological Diversity Rules, 2004. Section 7 of the Act enjoins Indian citizens to give prior intimation to the concerned State Biodiversity Board for obtaining biological resources for commercial utilization or for bio-survey and bio-utilization. The Central Government, vide MoEF & CC Notification dated 07 April 2016 has, under section 40 of the Act, however, has exempted 385 plant species pertaining to biological resources, including 108 species of medicinal plants, from the purview of this Act, being “normally traded commodities”.

The EXIM Policy

The major policy on foreign trade in wildlife and wildlife products, including medicinal plants, is the Export and Import Policy, commonly called the EXIM Policy. This policy, subjected to periodic revisions, is decided in consultation with the Directorate of Wildlife Preservation of the Government of India, and the CITES Management Authority for CITES implementation in the country. The EXIM policy is put into effect via the provisions of the Foreign Trade (Development and Regulation) Act, 1992 and enforced via the Customs Act.

The export of plant species, many of which are of medicinal importance, is regulated under the Schedule 2 (Appendix 2) of the EXIM policy. This schedule includes 6 plant species listed in Appendix-I, 12 plant species listed in Appendix-II, and 1 species of plants listed in Appendix-III of CITES and acts as a 'Negative List of Exports'. As at present, 29 plant species have been notified in this schedule and their exports prohibited (vide DGFT's notification dated 14.10.1998, reproduced

in the box below). All the six plant species listed under Schedule VI of the Wildlife (Protection) Act, 1972 also form part of this negative list of exports. The negative list of exports, first notified in 1998, under the EXIM Policy 1997-2002, still continues.

8 enlisted 'plants' actually refer to groups of plants, 3 at 'Family' level and 5 at 'Genus' level, with a very large number of species in these groups, especially the family 'Orchidaceae'. The actual number of plant species in the list is, therefore, much higher than meets the eye. Further analysis of this list brings out that there are certain overlaps in the list that need to be removed. For example, there is no need to list a few species of orchids when the entire Orchidaceae family has been included. In the present list, along with the family Orchidaceae, 5 species of orchids have also been listed. Similarly, when the entire Cycadaceae family is included in the list, there is no need to make specific listing of *Cycas beddomie*, a member of family Cycadaceae. There is a need to re-assess the inclusion of the entire *Euphorbia* genus in the list, as many of the Euphorbias are common weeds. Over the years threat status of many medicinal plant species has been assessed in the country. Some of the species assessed as red-listed may need to be included in the 'Negative List of Exports'. Further, the nomenclature of the listed species needs to be updated.

Export of CITES Listed Medicinal Plants

The rules and guidelines regarding export of medicinal plants are given in the ITC (HS) Export Schedule-I. The export of all plants and plant portions of wild origin, which are listed in Appendix I of the CITES, Schedule VI of the Wildlife (Protection) Act, 1972 or Schedule 2 (Appendix 2) of the EXIM policy is prohibited.

The export of all plants and plant portions (except Red Sanders - *Pterocarpus santalinus*), listed in Appendix I of the CITES, Schedule VI of the Wildlife (Protection) Act, 1972 or Schedule 2 (Appendix 2) of the EXIM policy is, however, allowed if such material is obtained from cultivation. Such export is, however, subject to fulfillment of the following conditions (Heron, 2012).

Certificate of Cultivation: This certificate is issued by the concerned authority to the farmer as proof that a specified quantity of medicinal plant material has been obtained from cultivation done in the farmer's land. This certificate can be used by the farmer or the buyer to apply for the Certificate of Legal Procurement.

The farmers/ traders/ exporters wishing to cultivate/ trade/ export medicinal plant species enlisted in CITES Appendix-I and Schedule-VI of the Wildlife (Protection) Act, 1972 are required to procure a License for such cultivation/ trade/ export from the Chief Wildlife Warden of the concerned State. Under the CITES regulations, the farmer must register his nursery/ land where he wishes to cultivate medicinal plant species enlisted in CITES Appendix-I with the CITES Secretariat, that will issue a Registration Certificate to the farmer.

Certificate of Legal Procurement (CLP): This certificate is issued to the farmer/ trader/ exporter by the designated authority – usually the concerned Divisional Forest Officer – after the produce obtained from cultivation is packed, sealed and stamped in the presence of the designated authority. This certificate is the same as the one previously known as the Legal Procurement Certificate (LPC). The nomenclature has been changed under new DGFT Rules. The CLP is the key document needed by the CITES Management Authority for issuing CITES Export Permit.

In most of the cases, the farmers are not in a position to export the medicinal plant material directly, and sell it to some local trader/ exporter. In such cases the seller is required to prepare an

Affidavit on Stamp Paper as proof of the transfer of ownership of the material under export. This affidavit is needed for procuring CLP.

Transit Pass: It is a document issued by the designated authority – usually the concerned Divisional Forest Officer – to a farmer or a buyer to enable him to transport a specified quantity of medicinal plant material from one location (origin) to another (destination). This Transit Pass is presented at the Forest check posts along the given transportation route for verification and is got stamped as a proof that the material under transportation has actually come from the source stated in the Pass.

Usually such transit is allowed from the depot of the trader/ exporter. Thus, it is necessary for the trader/ exporter to get his Depot registered with the concerned authority – usually the local Forest Office.

CITES Export Permit: This permit is issued by the CITES Management Authority to the exporter as a proof of the source of the medicinal plant material under export. The Permit is valid for shipment of the concerned consignment and for every subsequent shipment a fresh Export Permit is needed.

The Director (WL) has four Regional Deputy Directors and four sub-regional offices of wildlife preservation, these serving as assistant CITES Management Authorities.

Registration of Companies for Export: The companies wishing to export medicinal plant material need to register their authorized dealership with the Customs. Copies of various documents like VAT/ sales tax registration, income tax returns, company's balance sheet of the previous years are needed for such registration. In case exports are intended for the USA, the exporting companies also need to be registered with the US Food and Drug Administration (FDA) under the US Bioterrorism ACT. As required by the US Customs, a Certificate of Analysis (CoA) is also needed for exporting medicinal plant material to the US. The exporter also needs to have an EXIM Code to effect exports.

In case of plant species listed under Appendix II of CITES, and not listed in Schedule VI of the Wildlife (Protection) Act, 1972 or Schedule 2 (Appendix 2) of the EXIM policy, export is allowed irrespective of the wild or cultivation origin of the produce, provided the exporter fulfils the following –

- The exporter must have a Certificate of Legal Procurement (CLP) issued by the jurisdictional DFO.
- In case of material obtained from cultivation, the exporter is required to have a Certificate of Cultivation from the District Agriculture Officer, District Horticulture Officer or the DFO.

The export of derivatives, extracts and formulations 'which may contain portions/extracts of plants on the prohibited list but only in unrecognizable and physically inseparable form' is allowed and that 'no certificate from any authorities whatsoever shall be required for their [formulations'] export'. It needs to be remembered that export of CITES listed medicinal plants is allowed only through 7 ports i.e. Mumbai, Calcutta, Cochin, Delhi, Chennai, Tuticorin and Amritsar.

All violations of the EXIM policy constitute an offence under the Customs Act and are dealt with by

Customs officials. Inspection of consignments by Wildlife Inspectors may also be carried out at border crossings.

Import of CITES listed Medicinal Plants

The rules and guidelines regarding import of medicinal plants are given in the ITC (HS) Import Schedule-I. The import of plants, their products and derivatives, except Kuth (*Saussurea costus*), had been free and it was only in 2006 that the CITES-related import controls were established. In 2006, the classifications of Export and Import Items were amended and imports of medicinal plants like Rauvolfia spp., Kuth (*Saussurea costus*) roots, Cacti, Agarwood and Agar oil are now subject to CITES provisions (Ministry of Commerce & Industry Department of Commerce Notification No. 42 RE-2005/2004-09). There is, however, no negative list of imports. The import of CITES listed medicinal herbs is, however, subject to fulfillment of the following legal requirements –

-Import Permit under CITES from the Regional Deputy Director (Wildlife)
-Export Permit of CITES from the exporting country.
-For import of seeds for planting/ sowing, Import Permit under 'Plants, Fruits and Seeds (Regulation of Import into India) Order, 1989' is also required.

Several categories relevant to CITES-listed species have been identified as goods allowed to be imported without restriction (i.e. free of import duties or quotas), e.g. “medicinal plants, fresh or dried, whether or not cut, crushed or powdered” (Schedule 1 Chapter 12), lac, gums, resins and other vegetable extracts (Schedule 1, Chapter 13), pharmaceutical products (Schedule 1, Chapter 30) and essential oils (Schedule 1, Chapter 33).

Issues Pertaining to Procedural Delays

Export of cultivated medicinal plant material in respect of CITES listed species holds a good revenue generation potential. Large efforts have also been made to promote cultivation of such species in the country. The success of these efforts has, however, not been commensurate with the efforts made. Firstly, there are propagation issues concerning the CITES listed species. Much more research inputs are required to develop their commercially viable cultivation models. Secondly and more importantly, the challenges in obtaining the necessary documents for the produce cultivated at huge expenses, act as dampeners to take up such cultivation on a larger scale. The long delays usually involved in procuring necessary documents make it difficult for the exporter to offer a reliable and timely supply to the buyers.

Interactions with various field officers during the course of this study revealed that much of the delays are caused by non-availability to them of comprehensive guidelines giving details and procedure for making various documents for export of such species. It seems very important to develop and effectively disseminate guidelines on the subject to the government field agencies and the exporters to facilitate the documentation process. It also would be a good idea to organize capacity building programs for the concerned officers from the field and the exporters to understand the documentation process for effecting export of CITES listed medicinal plant species.

Treatment of Trade with Nepal

India and Nepal entered into trade agreement, called the 'Indo-Nepal Treaty of Trade' in 2009 for an initial period of 7 years with a provision for automatic extension for seven year periods at a

time, unless it is revoked by either of the parties after giving due notice. 27 routes/ border posts have also been defined for such trade. Under Article IV of the treaty, both Nepal and India have agreed to, on a reciprocal basis, to exempt from basic customs duty as well as from quantitative restrictions the import of such primary products as may be mutually agreed upon, from each other. And the 'protocol to the treaty' elaborates upon the scope of Article IV and provides a list of the primary products agreed upon for preferential treatment under Article IV. “Herbs, ayurvedic and herbal medicines, including essential oils and its extracts” (Sr. No. 11) are also included in this list.

Under this agreement, a large number of botanical raw drugs were being imported from Nepal through designated check posts along the Indo-Nepal border. Record of such imports was also being maintained at some of the forest check posts. However, due to some newly introduced regulatory regime by the UP Forest Department viz. making transit permit from the department mandatory for such traded items has resulted in procedural inconvenience for Nepalese exporters and has adversely impacted the imports of herbal raw drugs from Nepal. The issue was also discussed during the meeting of Nepal-India Inter-Governmental Committee (IGC) on Trade, Transit and Cooperation to Control Unauthorized Trade held in Kathmandu on December 21-22, 2013. The issue was proposed to be resolved through a consultative meeting with the Government of Uttar Pradesh. However, result of such meeting, if any held, could not be located. The result of his impasse is that record of import of herbal raw drugs from Nepal is no more available with the Forest Check Posts. It is believed that the material continues to arrive in various herbal markets in India in a clandestine manner.

8. THE HS CODES: ADEQUACY FOR RECORDING FOREIGN TRADE OF BOTANICAL RAW DRUGS AND A SUGGESTIVE MODEL FOR IMPROVEMENT THEREOF

All commodities under foreign trade are assigned a unique code under Harmonized Commodity Description and Coding System, also known as the Harmonised System (HS) of tariff nomenclature, developed and maintained by the World Customs Organization (WCO). The various entities in foreign trade have been classified under different chapters with efforts made to accord a unique HS code to all entities in such trade. To achieve this, the WCO uses a six-digit universal HS Code to assign unique HS codes to as many entities as possible. The large diversity of bioresources that form an important part of the foreign trade have been classified under different chapters, with Chapter-12 entitled “Oil Seeds and Oleaginous Fruits; Miscellaneous Grains, Seeds and Fruit; Industrial or Medicinal Plants; Straw and Fodder” covering a major diversity of plants and plant material in foreign trade.

Let's take Chapter-12 as an example to explore the efficacy of the present HS coding system to bring out the identity of all bioresources traded under the coding system provided in this chapter. Narrowing our search to medicinal plants, we find that heading 1211 under this Chapter titled “Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fungicidal or similar purpose, fresh or dried, whether or not cut, crushed or powdered” is more specific to this group of plants. The WCO has further expanded the heading 1211 to six digits with a view to assign unique HS Codes at 6-digit level (universal code) to plant entities in foreign trade. However, issues still remain to segregate species-wise data of botanical raw drug entities in foreign trade.

Issue-1

A review of the six-digit coding level would reveal that it has been able to assign universal HS codes

to the following four items only:

1211.10	Liquorice roots (*Glycyrhiza glabra*)
1211.20	Ginseng roots (*Panax pseudoginseng*; *Panax* spp.)
1211.30	Coca leaf (*Erythroxylum cocoa*)
1211.40	Poppy straw (*Papaver somniferum*)

The large diversity of other medicinal herbs and parts thereof under foreign trade has been clustered under the following six-digit HS Code:

1211.90	Other

It is, thus, HS Code 1211.90 (Other) under which most of the medicinal plants and parts thereof are grouped together for foreign trade. Thus, whether it is Neem or Nux-vomica seeds, Belladona, Senna or Gymnema leaves, Psyllium husk, Serpentine roots, or Sandal wood chips, the foreign trade of all these items happens under this one HS code. Thus, this six-digit universal coding system is deficient in providing entity wise/ species wise information on the medicinal plant entities/ species in foreign trade.

The issue to provide more specific entity-wise codes has been sought to be addressed by the various national governments by adding another 2 or more digits to the six-digit universal codes. The Government of India has developed its own Indian Trade Classification of HS system - ITC (HS) - by adding two additional digits to the six-digit universal code to further classify the medicinal herbs by parts. The universal six-digit code 1211.90 (Other) has been, therefore, expanded to an eight-digit ITC (HS) coding system. For example, ITC (HS) codes from 1211.90.11 to 1211.90.19 have been assigned to Seeds of Medicinal Plants, as detailed below:

1211.90.11 to 1211.90.19 : Seeds of Medicinal Plants	
1211.90.11	Ambrette Seeds (Musk grains of vgtbl kngdm)
1211.90.12	Nux vomica Seeds
1211.90.13	Psyllium Seeds
1211.90.14	Neem Seeds
1211.90.15	Jojoba Seeds
1211.90.16	-
1211.90.17	-
1211.90.18	-
1211.90.19	Other Seeds FRSH/ DRD W/N Cut Crshd/ Pwdrd used in Perfmry, Pharm Etc/

And, as detailed below, HS Codes 1211.90.21 to 1211.90.29 have been assigned to the leaves of medicinal plants:

1211.90.21 to 1211.90.29 : Leaves of Medicinal Plants	
1211.90.21	Belladona Leaves
1211.90.22	Senna Leaves and Pods
1211.90.23	Neem Leaves/ Powder
1211.90.24	Gymnema Powder
1211.90.25	Cubeb Powder
1211.90.26	Pyrethrum

1211.90.27	-
1211.90.28	-
1211.90.29	Other LEVS, PWDR, FLRS & Pods FRSH/ DRD W/N Cut Crshd/ Pwdrd

Similarly, HS Codes 1211.90.31 to 1211.90.39 are assigned to the Bark/ Fruit Rind/ Husk of medicinal plants; HS Codes 1211.90.41 to 1211.90.49 are assigned to the roots/ rhizomes of medicinal plants, etc.

It is very clear from the above that even this eight-digit ITC (HS) coding system is highly inadequate in recording all medicinal plant entities under foreign trade by species. Continuing with the examples of ITC (HS) codes from 1211.90.11 to 1211.90.19, assigned for foreign trade of medicinal seeds, it can be noted that this system is able to provide data in respect of medicinal seeds for only five species, whereas trade data of the seeds of possibly 100 other species is presently being clubbed under ITC (HS) code 1211.90.19 (Other Seeds). There are, however, three codes i.e. from 1211.90.16 to 1211.90.18 that have not yet been allocated to any entity. The same is true for the foreign trade of medicinal leaves, roots and rhizomes, bark, whole plants, etc. where the trade data of a large number of species is clubbed under ITC (HS) Codes 1211.90.29, 1211.90.39, 1211.90.49, and 1211.90.99. Some blank codes are also available in these categories also.

The present form of maintenance of foreign trade data of medicinal plants by the Director General of Commercial Intelligence and Statistics (DGCIS) is able to provide information in respect of only about 30 medicinal plant entities under the head 1211.90. Whereas it is a definite improvement over the universal coding system, it requires more refinement to be able to record entity-wise/ species-wise information. It needs no emphasis that species-wise information about the botanical raw drugs in foreign trade is very essential for managing their resource base, including initiating their cultivation. This information is also necessary to track the species-wise export/ import trends to support necessary policy inputs to safeguard their domestic trade and to keep a check on the trade of species in the negative list and those that are assessed as red-listed.

Issue-2

The other area where the present system of tariff nomenclature put in place by the Indian Trade Classification is the assignment of ITC (HS) codes by Common Names to different botanical raw drugs. Even as the common names are easy to pronounce and sometimes have a charm about them, their use frequently leads to confusion and misunderstanding about the correct identity of the plant species these refer to. Plants with common names almost always tend to have several common names that vary from region to region, and country to country. In a number of instances, the same common name often refers to several different species, not to one specific plant, with some unrelated plants also sharing the same common name. Let's take the following examples to elucidate this issue.

Close analysis of the foreign trade of entities assigned ITC (HS) tariff nomenclature of 'Pepper Long' and 'Gum Arabic' reveals that the material being imported and exported under the HS Codes assigned to these entities, in fact, belongs to different botanical species. Whereas, Pepper Long in export most likely refers to Piper longum, the entity being imported under the same common name and the same ITC (HS) code most likely pertains to Piper retrofractum. This inference has been drawn from the price difference in the material exported and imported as Pepper Long and digging up information about the country of import, etc. Similarly, Gum Arabic of import is traditionally linked to the gum obtained from the trees of Acacia senegal. However, the per unit price variation in various import consignments reveals that the Gum Arabic of import very likely

refers to the gum obtained from various other species of *Acacia* viz. *A. seyal* or *A.polyacantha*.

This problem could be addressed if ITC (HS) codes, assigned to the bioresources in trade, use the scientific botanical names of these entities. It is, thus, necessary that the bioresource entities be traded only under their botanical names to know their exact identity.

Deciphering Identity of Botanical Raw Drugs in Foreign Trade

The issue of deciphering the exact identity of the botanical entities in foreign trade has been drawing attention of stakeholders in medicinal plant trade as well as in their conservation for long. Realizing that the foreign trade data, compiled and published by DGCIS in its present form, is highly inadequate in revealing the proper identity of most of the bioresources, including the medicinal plants, the National Biodiversity Authority (NBA) commissioned a study to examine in detail the primary data relating to the Exports and Imports of bioresources during the year 2013-14. This study, based on a thorough review of the primary data available in the Daily Trade Returns (DTRs) obtained from 106 ports, has checked a total of 21831 DTRs that have been classified under HS code 1211, covering the period 1/4/2013 to 31/3/2014. Examination of these DTRs revealed that it was possible to link 17607 DTRs to a total of 64 different entities, still leaving a sizeable number of 4224 DTRs to be appropriately correlated to the entities. The successful linking of botanical raw drugs to their specific entities based on scrutiny of 17607 DTRs points towards the possibility of linking the bioresources to their unique identity. However, two issues still remain to be addressed even after this detailed and long drawn exercise. These issues are (a) the continuing ambiguity in terms of correlating the specific entities to their botanical nomenclature as most of the DTRs use the common names for the traded botanical raw drugs; and (b) surprising inclusion of some records of medicaments and finished products under the HS Code 1211.90 pointing towards the need to build capacity of the port authorities in data recording.

The NBA team subsequently scrutinized the remaining 4224 DTRs that could not be linked to corresponding entities due to use of common/ vernacular names internally using the nomenclature correlation between botanical and vernacular names of medicinal plants given on the FRLHT-ENVIS website (envis.frlht.org/databasesearch.frlhtenvis.nic.in). This exercise resulted in establishing tentative linkages of a further 3473 DTRs to 457 botanical nomenclatures, some of these being synonyms needing further cleaning. This effort, however, suggests that, with little improvement in the ITC (HS) coding system, there is a possibility of reflecting proper species-wise identity of botanical raw drugs in our foreign trade data.

Previous Suggestions to Improve ITC (HS) Coding System

Various suggestions to improve the current ITC (HS) system of classification have been made in the past. The Ayurvedic Drug Manufacturers' Association (ADMA), an important stakeholder in the botanical raw drug trade, has suggested classifying the trade of medicinal herbs by Ayurvedic Pharmacopoeia using prominent Ayurvedic names. The suggestion, however, suffers from the same issues as with the use of common names as different texts of ISM use different name for the same entity. Bringing in nomenclature uniformity in respect of botanical raw drugs in foreign trade will not be possible if foreign trade of botanical raw drugs is recorded by Ayurvedic names.

A suggestion for revising the existing 8-digit ITC (HS) coding by way of adding another 4 or more digits to specify the precise taxonomic entity, its part/s and source (cultivation and/ or wild) has also been made under the NBA sponsored study (draft report presented in the eighth meeting of the Expert Committee on Normally Traded Commodities held at Hyderabad on 13 November

2014). This suggestion may involve an exhaustive listing of biological resources using their scientific nomenclature along with specific parts and source (wild/cultivation) and may result in addition of another 8 digits to the existing 8-digit ITC (HS) codes. This system would need clubbing all botanical raw drug entities obtained from the same plant e.g. leaves, bark, seeds, seed oil and extract of Neem (*Azadirachta indica*) that are presently traded as distinct entities under different ITC (HS) codes together. It would, thus, require exhaustive modifications in the existing ITC (HS) code structure, that itself will be a long drawn affair.

Possible Solution to Improve ITC (HS) Code 1211.90 – A Proposal

We believe that any approach to provide unique tariff nomenclature to botanical raw drug entities known to be in foreign trade must be dynamic enough to be able to incorporate new entities that will keep on entering the foreign trade in future. We also believe that interventions that fit into the existing ITC (HS) Coding structure and that do not require any major changes in the existing structure would be easier to implement. The following suggestive model keeps these issues in view.

We have taken the existing ITC (HS) code 1211.90 as a pilot case to explain our proposal for the reason that it is under this code that most of the botanical raw drugs are traded. As at present, it is believed that more than 400 botanical raw entities are exported and imported under this code. We propose the following two pronged strategy to address this issue:

The first is to assign the available un-allotted 8 digit ITC (HS) codes under seed, leaves, bark, root, whole plant categories to those important medicinal plants under foreign trade that are presently being clubbed under 'others'. A limited review of the already assigned ITC (HS) codes can also be simultaneously undertaken to ensure that specific 8-digit codes are allocated to entities under high foreign trade. For example, ITC (HS) Code 1211.90.15 has been allocated to 'Jojoba Seeds', perhaps on the strength of its large foreign trade from 2003-04 to 2005-06. The foreign trade of this entity, with entire seed supplies coming from cultivation in Rajasthan, has come to almost nil from 2009-10 onwards with no likelihood of its revival in the near future, as its cultivation has drastically reduced. Thus, the item 'Jojoba Seeds' could be re-allocated under ITC (HS) Code 1211.90.19 and the code presently allocated to 'Jojoba seeds' can be assigned to some other promising botanical entity. The seeds of Ocimum basilicum, known in trade as 'Tukmaria', have been wrongly assigned the ITC (HS) code 1211.90.92 and should be shifted to take place of 'Jojoba Seeds' under ITC (HS) code 1211.90.15. Similarly, ITC (HS) codes from 1211.90.11 to 1211.90.19 have been assigned to 'Leaves of Medicinal Plants'. However, the ITC (HS) code 1211.90.25 has been assigned to 'Cubeb Powder', which is powder of fruiting spikes of Piper cubeba and NOT leaves and should, therefore, be shifted to ITC (HS) code 1211.90.92, to be vacated after the shift of 'Tukmaria' to ITC (HS) code 1211.90.15.

Secondly, we propose a selective introduction of 2 more digits to the existing eight digit ITC (HS) codes under the head 1211.90 and present below **a combination of eight-digit and ten-digit coding system** to account for maximum botanical entities under foreign trade. This proposal is based on the gains achieved by the addition of two digits under ITC (HS) code to this six-digit universal code. The addition of two additional codes to the six-digit universal code 1211.90 has helped in deciphering the identity of about 30 botanical raw drug entities. For example, the ITC (HS) code 1211.90.11 has been assigned to Ambrette Seeds. Similarly, specific ITC (HS) codes 1211.90.12 to 1211.90.15 respectively refer to the seeds of Nux vomica, Psyllium, Neem and Jojoba. The issue, however, is with the ITC (HS) code 1211.90.19, under which all 'other seeds'

used as raw drugs have been clubbed. The same issue holds good for the ITC (HS) codes 1211.90.29 (other leaves); 1211.90.39 (other bark/ rind, etc.); 1211.90.49 (other roots/ rhizomes), etc. under which the entities that have not been assigned unique code have been clustered.

We propose to add two more digits to the 8-digit ITC (HS) codes 1211.90.19, 1211.90.29, 1211.90.39, 1211.90.49, 1211.90.99, etc. to make these into ten-digit ITC (HS) codes. This simple intervention provides an opportunity to assign unique ITC (HS) code to nearly 100 more botanical entities under each of the categories i.e. seeds, leaves, bark/ rind, root/ rhizome, whole plants, etc. We also propose to use the scientific botanical nomenclature for assigning the unique ITC (HS) codes. An illustrative example is given below to explain the point:

Seeds of Medicinal Plants (ITC (HS) Codes 1211.90.11 to 1211.90.19)			
Existing Provisions		**Proposed Provisions**	
1211.90.11	Ambrette Seeds (musk grains of vgtbl kngdm)	1211.90.11	*Abelmoschus moschatus* [Ambrette/ musk seeds]
1211.90.12	Nux vomica Seeds	1211.90.12	*Strychnos nux-vomica* [Nux vomica seeds]
1211.90.13	Psyllium Seed	1211.90.13	*Plantago ovata* [Psyllium seeds]
1211.90.14	Neem Seeds	1211.90.14	*Azadirachta indica* [Neem seeds]
1211.90.15	Jojoba Seeds	1211.90.15	*Ocimum basilicum* [Tukmaria]
1211.90.16	-	1211.90.16	*Embelia tjerium-cottam* [Vai vidang]
1211.90.17	-	1211.90.17	*Gloriosa superba* [Kalihari seeds]
1211.90.18	-	1211.90.18	*Peganum harmala* [Lal dana/ Harmal]
1211.90.19	Other Seeds Fresh/ Dried W/N Cut Crshd/ Pwdrd used in Perfmry, Pharm Etc/	1211.90.19.01	*Abrus precatorius* [Gunja]
		1211.90.19.02	*Aesculus indica* [Khanor]
		1211.90.19.03	*Amaranthus paniculatus* [Ramdana]
		-	*Anethum graveolens* [Sowa]
		-	
		-	*Lallemantia royleana* [Tukhme-balanga]
		-	
		-	*Pongamia pinnata* [Karanj]
		-	
			Ricinus communis [Arind]
		-	
		1211.90.19.95	*Silybum marianum* [Milk thistle]
		1211.90.19.98	*Simmondsia chinensis* [Jojoba]
		1211.90.19.99	Other seeds fresh/ dried w/n cut crshd/ pwdrd used in perfmry, pharma, etc./

Leaves of Medicinal Plants (ITC (HS) Codes 1211.90.21 to 1211.90.29)			
Existing Provisions		**Proposed Provisions**	
1211.90.21	Belladona Leaves	1211.90.21	*Atropa belladona* [Belladona Leaves]
1211.90.22	Senna Leaves and Pods	1211.90.22	*Senna alexdandrina* [Senna Leaves and Pods]
1211.90.23	Neem Leaves/ Powder	1211.90.23	*Azadirachta indica* [Neem Leaves/ Powder]
1211.90.24	Gymnema Powder	1211.90.24	*Gymnema sylvestris* [Gymnema Leaves/ Powder]
1211.90.25	Cubeb Powder	1211.90.25	
1211.90.26	Pyrethrum	1211.90.26	*Tanacetum cinerarifolium* [Pyrethrum]
1211.90.27	-	1211.90.27	
1211.90.28	-	1211.90.28	
1211.90.29	Other LEVS, PWDR, FLRS & Pods FRSH/ DRD W/N Cut Crshd/ Pwdrd	1211.90.29.01	
		1211.90.29.02	
		1211.90.29.03	
		-	
		-	
		-	
		-	
		-	
		1211.90.29.98	
		1211.90.29.99	Other LEVS, PWDR, FLRS & Pods FRSH/ DRD W/N Cut Crshd/ Pwdrd

As can be noted from the above example, it is possible to assign species-specific 10-digit ITC (HS) codes to as many as 100 species each traded for their medicinal seeds and for their medicinal leaves without disturbing the basic structure of the existing ITC (HS) codes. The code allocated to 'jojoba seeds', an entity no more in high foreign trade due to decline in its cultivation in India, can also be re-allocated to some other entity in high foreign trade. A similar species-specific ITC (HS) coding system could be worked out for the medicinal plant entities traded as roots/ rhizomes, bark, flowers, whole plants, etc. accounting for almost all the 400 odd medicinal plant species in foreign trade.

The ITC (HS) Code 1302.19.19, under which 'other extracts' are exported/ imported, also suffers from similar identity issues of various high value extracts clubbed under the head. A review and updating of this code is also essential to know correct identity of the material being exported/ imported under this code.

Suggested Course for Detailed Development of the above Indicative Model

The following course, in the form of a dedicated time bound assignment, would need to be adopted for refining and finalization of the above proposal:

- Exhaustive analysis of the existing codes, scrutiny of the DTRs for at least one year from across

various ports in the country, and selective interactions with leading importing/ exporting firms to enlist and confirm the identities of various botanical raw drug entities in foreign trade.

- To record volumes of annual exports/ imports to arrive at some workable threshold of annual trade volumes to prioritise allocation of ITC (HS) codes to new entities and to prevent entities in negligible or one time trade from cluttering the database.
- Consultations with different stakeholders to build consensus and to create awareness.
- Development of a handbook on the ITC (HS) code-wise botanical raw drug entities in foreign trade along with photographs of plants and traded parts to act as a reference and educational material for the port authorities, as well as traders.
- Capacity building programs for the port authorities to impress upon the need for correct recording of entities under foreign trade vis-à-vis their allocated ITC (HS) codes from resource conservation and development point of view.

The development and implementation of the above proposal is feasible, as the DGFT has been empowered to effect changes in the ITC-HS Codes including changes in the commodity description, weeding out of defunct codes, and addition of new codes. The updating of ITC (HS) codes is, in fact, required to be carried out periodically as a part of the ongoing process.

Ambrette/ Musk Seeds (*Abelmoschus moschatus*)

Table 8.6 a: Export Volume of Medicinal Plants from 2005-06 to 2014-15

ITCHS	Item	2005-06	2006-07	2007-08
		QTY (MT)	QTY (MT)	QTY (MT)
09041110	Pepper long	718.57	320.75	285.06
09109915	*Cassia tora* seed	2083.28	6496.23	4803.53
12112000	Ginsng roots frsh/drid w/n cut crshd/pwdrd	11.09	5.74	5.93
12113000	Coca Leaf Frsh/Drid w/n Cut Crshd/Pwdrd	0.00	0.10	0.21
12114000	Popy straw frsh/drid w/n cut crshd/pwdrd	1.20	0.00	0.00
12119011	Ambrette seeds (musk grains of vgtbl kngdm)	30.43	72.84	23.16
12119012	Nux-vomica dried ripe seeds	16.00	22.23	24.00
12119013	Psyllium seed (isobgul)	760.51	1122.56	638.87
12119014	Neem seed	100.20	56.70	36.52
12119015	Jojoba seed	390.34	105.68	162.84
12119019	Other seeds frsh/drid w/n cut crshd/pwdrdusd in perfmry,pha	1686.18	3503.53	647.71
12119021	Beladona leaves	5.45	122.04	8.26
12119022	Senna leaves and pads	11430.18	9398.89	10006.28
12119023	Neem leaves/powder	373.97	245.19	171.50
12119024	Gymnema powder	59.23	53.14	23.67
12119025	Cubeb powder	0.00	5.00	17.71
12119026	Pyrethrum	958.97	579.00	259.40
12119029	Other levs, pwdr, flurs & pods frsh/drd w/n cut crshd/pwdrd	1105.22	1941.25	1221.05
12119031	Cascara sagrada bark	1.13	0.00	0.25
12119032	Psyllium husk (isobgul husk)	24959.91	19926.06	29245.82
12119033	Cambodge fruit rind/the dried pericap of the fruits of garc	16.66	7.09	12.44
12119039	Othr bark, husk & rind fresh/dried w/n cut crshd/powdered	747.47	348.33	385.18
12119041	Belladona roots	17.58	4.75	164.77
12119042	Galangal rhizomes & rts incl. Greater gala	360.98	472.46	329.81
12119043	Ipecac dried rhizome & roots	10.51	0.20	0.00
12119044	Serpentina roots	0.91	1.68	6.30
12119045	Zedovary roots	92.42	53.25	115.72
12119046	Kuth root	0.01	0.05	5.70
12119047	Sarsaparilla	36.49	13.90	50.09
12119048	Sweet flag rhizome	29.00	55.20	120.87
12119049	Other roots & rhizomes frsh/drd w/n cut crshd/pwdrd	665.03	909.43	764.24

(Quantity in MT)

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)
189.37	128.43	85.97	107.17	272.38	170.88	1205.29
8441.86	20557.91	35637.23	21694.84	38572.46	38313.02	28190.32
0.13	8.36	2.37	0.07	1.78	0.31	0.10
0.19	0.00	0.00	0.10	0.00	0.23	0.00
3.00	0.00	0.02	0.13	0.80	15.20	0.02
3.96	1.34	12.73	61.58	47.95	18.01	64.76
18.70	0.80	1.50	0.06	0.00	0.05	0.25
672.60	466.65	726.67	538.58	565.86	632.31	998.49
26.17	1.41	3.19	7.71	36.25	0.88	0.06
52.38	3.00	0.00	0.60	0.51	0.04	0.01
3178.75	1069.60	1876.19	3045.09	2685.61	3301.72	5114.52
18.34	34.90	3.53	19.31	10.58	32.31	21.43
12286.83	12653.46	15048.58	13576.09	11975.64	11214.63	13243.56
294.69	147.88	71.26	143.21	96.64	116.25	63.06
25.44	35.29	31.19	24.07	39.20	52.34	46.51
0.00	0.00	0.10	10.40	0.45	1.03	1.05
330.14	165.27	212.51	9.41	107.54	41.04	33.77
1637.02	1826.93	2335.67	3015.52	3302.69	5290.13	9935.54
4.01	24.40	0.00	0.00	5.27	0.06	15.02
26216.06	20679.12	28415.74	29342.47	39670.74	32465.58	32325.64
51.56	38.98	20.43	83.12	41.58	25.96	36.96
716.76	520.99	739.33	778.95	1051.22	927.72	1792.54
0.00	0.15	0.02	0.16	0.19	0.13	0.00
563.38	597.33	1189.75	2133.58	3094.92	1874.77	705.45
0.33	10.20	5.72	2.26	5.19	10.71	3.70
0.00	0.07	0.31	0.70	1.52	0.16	0.55
183.62	206.32	421.29	382.35	1180.07	512.73	1124.12
5.00	6.06	0.61	10.14	17.03	12.35	11.30
39.00	9.23	54.67	40.27	30.84	84.22	48.47
60.50	42.00	53.49	19.40	101.00	306.02	226.58
887.16	694.12	1251.75	1636.23	2030.32	2174.16	3523.61

ITCHS	Item	2005-06	2006-07	2007-08
		QTY (MT)	QTY (MT)	QTY (MT)
12119050	Sandal wood chips and dust	170.04	113.81	43.28
12119060	Vinca rosea (herbs)	1335.47	1027.75	754.60
12119070	Mint,incl. Leaves(all species)	14.01	21.89	228.11
12119080	Agarwood (incldng chips & dust)	8.65	0.22	1.49
12119091	Chirata	34.03	19.23	6.00
12119092	Tukmaria	230.23	297.10	524.29
12119093	Unab (indian jujube or chinese dates)	29.34	0.46	0.50
12119094	Basil, hyasop, rosemary sage, savory	112.72	204.59	164.95
12119095	Lovage	0.00	2.00	1.00
12119096	Garcenia	64.00	31.07	8.82
12119099	Othr prts of plants usd in perfmry, pharma-cutical etc,frsh/d	3439.60	3917.98	4893.86
13012000	Gum arabic	58.15	95.88	91.54
13019011	Asian gum	252.84	361.70	414.65
13019012	African gum	1.44	1.00	22.36
13019013	Asafoetida	723.20	491.07	832.98
13019014	Benjamin ras	10.00	0.00	2.55
13019015	Benjamin Cowrie	0.00	0.00	0.00
13019016	Karaya gum (indian tragacanth) hastab	1269.42	932.22	862.32
13019017	Tragacanth (adraganth)	0.65	0.20	0.20
13019018	Storax	0.00	0.05	0.00
13019019	Other natural gums	689.50	335.30	682.12
13021100	Saps & extracts of opium	71.07	66.51	62.22
13021200	Saps & extracts of liquorice	1.33	0.75	2.63
13021911	Extracts belladona	31.61	29.38	7.54
13021912	Extracts cascara sagrada	0.03	0.13	0.00
13021913	Extracts Nux-vomica	0.00	0.02	0.10
13021914	Ginseng extract including powder	0.63	16.81	32.28
13021915	Agarose	0.00	0.05	0.00
13021916	Extracts, neem	18.20	59.84	113.41
13021917	Gymnema extract,	42.92	93.59	48.10
13021918	Cambodge extract	672.65	946.88	581.68
13021919	Other extracts	736.78	1108.33	1124.36
14049021	Soap nut powder	29.69	124.89	89.15
14049029	Other soap nuts	283.33	541.51	482.89

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)	QTY (MT)
33.37	22.38	158.09	50.36	38.45	78.25	74.51
650.40	313.50	412.07	521.21	864.46	903.30	569.60
98.12	29.58	51.37	35.22	66.95	41.19	38.94
2.70	53.77	7.59	12.90	18.42	16.10	18.89
10.99	1.72	3.51	12.03	1.89	7.58	8.20
571.57	517.18	587.74	664.72	489.84	711.27	433.28
15.63	0.21	33.75	10.08	0.01	3.84	0.46
52.33	149.84	331.54	414.26	295.00	495.26	1294.15
0.00	12.50	2.00	0.10	0.00	0.00	0.00
10.41	21.20	10.89	3.77	25.30	103.10	93.28
4785.27	7507.51	6829.39	8719.25	12219.35	10986.59	16906.06
1592.04	633.54	1383.55	730.00	237.15	887.33	398.65
381.00	336.90	533.21	747.27	633.50	683.40	405.60
0.00	18.85	1.63	0.61	0.10	5.70	0.50
840.09	1135.08	1190.96	911.91	1584.52	983.45	893.07
3.22	0.80	1.00	0.00	0.08	3.00	0.00
0.00	0.00	1.00	0.00	0.00	0.00	0.00
984.08	1016.99	1036.35	921.18	576.40	517.10	198.02
0.30	0.30	0.64	0.94	4.68	2.73	0.12
0.10	3.30	4.00	5.20	1.30	5.09	8.17
1537.29	1859.08	1140.75	2099.14	971.13	1139.35	3062.81
72.88	141.40	118.92	282.60	462.37	347.51	165.32
13.86	24.68	18.34	93.27	4.49	19.83	36.68
5.84	8.84	2.99	20.67	3.14	12.69	5.47
0.03	0.00	0.00	0.33	0.00	0.00	0.00
0.00	0.41	4.53	0.53	1.47	1.80	0.02
0.00	1.11	0.11	1.51	0.31	0.31	0.05
0.07	0.00	0.00	0.00	0.00	0.00	0.00
84.68	130.74	94.99	201.36	298.06	648.97	181.93
82.45	39.71	54.89	97.64	90.03	92.19	97.69
1314.64	475.80	585.63	592.06	561.50	1725.41	5053.92
1142.49	1243.80	1318.70	1925.66	3216.92	4570.91	6098.28
348.60	115.79	507.05	850.64	549.74	236.93	175.89
421.71	348.86	1207.14	2292.66	2302.38	1185.11	656.87

Table 8.6 b: Export Value of Medicinal Plants from 2005-06 to 2014-15

ITCHS	Item	2005-06	2006-07	2007-08
09041110	Pepper long	652.34	356.61	333.28
09109915	*Cassia tora* seed	357.39	1006.73	973.97
12112000	Ginsng roots frsh/drid w/n cut crshd/pwdrd	12.27	14.20	19.26
12113000	Coca Leaf Frsh/Drid w/n Cut Crshd/Pwdrd	0.00	0.02	2.02
12114000	Popy straw frsh/drid w/n cut crshd/pwdrd	0.31	0.00	0.00
12119011	Ambrette seeds(must grains of vgtbl kngdm)	102.26	62.81	286.92
12119012	Nux vomica dried ripe seeds	1.76	17.74	12.82
12119013	Psyllium seed (isobgul)	601.15	606.19	471.51
12119014	Neem seed	44.79	80.15	35.73
12119015	Jojoba seed	389.28	101.06	213.95
12119019	Other seeds frsh/drid w/n cut crshd/pwdrd usd in perfmry, pha	935.67	994.02	736.50
12119021	Beladona leaves	8.19	105.18	8.11
12119022	Senna leaves and pads	2392.97	2670.43	3070.69
12119023	Neem leaves/p0wder	130.97	91.78	74.02
12119024	Gymnema powder,	71.10	105.96	24.21
12119025	Cubeb Powder	0.00	0.16	2.13
12119026	Pyrethrum	436.08	294.66	164.38
12119029	Other levs, pwdr, flurs & pods frsh/drd w/n cut crshd/pwdrd	791.24	1492.96	1225.45
12119031	Cascara sagrada bark	5.31	0.00	0.37
12119032	Psyllium husk (isobgul husk)	20906.17	25468.65	34665.56
12119033	Cambodge fruit rind/the dried pericap of the fruits of garc	19.81	19.32	16.21
12119039	Othr bark, husk & rind fresh/dried w/n cut crshd/powdered	323.80	219.33	210.40
12119041	Belladona roots	6.88	1.73	39.89
12119042	Galangal rhizomes & rts incl. Greater gala	257.03	322.01	203.19
12119043	Ipecac dried rhizome & roots	27.27	0.44	0.00
12119044	Serpentina roots	0.95	0.78	2.72
12119045	Zedovary roots	35.85	24.72	36.61
12119046	Kuth root	0.02	0.05	10.49
12119047	Sarsaparilla	32.58	10.18	41.52
12119048	Sweet flag rhizome	10.16	29.75	59.20
12119049	Other roots & rhizomes frsh/drd w/n cut crshd/pwdrd	516.34	626.05	738.18
12119050	Sandal wood chips and dust	3532.14	2444.77	962.48

(₹ in Lakh)

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
274.46	171.49	138.99	293.33	613.90	762.73	1267.57
1142.07	2772.83	5557.55	4322.84	8814.99	8817.61	12399.21
0.29	9.79	1.43	0.99	1.97	39.15	0.13
0.45	0.00	0.00	0.35	0.00	0.43	0.00
1.14	0.00	0.07	0.13	0.51	3.51	0.31
65.01	3.48	21.75	94.43	112.12	58.20	102.91
10.01	4.39	3.84	0.02	0.00	0.08	0.22
772.03	498.59	571.57	638.88	577.44	854.81	1170.70
6.49	0.64	2.70	74.50	16.33	15.71	0.15
104.02	5.24	0.00	1.58	0.83	1.91	0.05
1230.42	918.22	1283.08	1751.86	1974.99	2687.28	2985.75
8.91	64.35	7.38	24.67	20.00	58.32	72.12
4907.41	4653.98	4496.19	5100.24	6736.40	7769.58	8817.39
108.39	33.71	28.00	56.78	70.63	89.99	134.44
30.96	31.00	43.92	28.10	48.20	100.76	97.13
0.00	0.00	0.16	2.33	0.04	0.23	0.63
160.75	82.79	174.20	5.48	74.54	37.68	21.75
1549.29	1276.67	1784.70	2469.44	3585.86	6777.40	8977.98
6.78	47.72	0.00	0.00	1.95	0.84	26.70
44662.40	38122.85	45467.01	54879.98	80014.63	75936.05	92411.35
53.58	43.27	28.41	127.43	56.54	51.71	85.72
532.36	564.27	663.21	1019.56	1075.09	1037.64	1155.76
0.00	0.28	0.85	6.47	10.44	0.16	0.00
281.82	426.89	1018.30	1855.77	2605.28	1801.32	793.77
67.63	77.33	244.02	112.51	201.33	156.52	18.84
0.00	3.14	2.63	0.71	10.01	21.64	25.24
71.25	134.91	404.59	382.10	1234.29	638.63	1379.26
9.77	21.92	2.01	21.30	73.46	63.71	61.21
42.15	15.14	134.34	72.72	86.70	351.00	215.73
32.15	19.86	27.08	7.04	54.47	187.24	105.06
638.66	514.40	1027.65	1831.74	2457.95	2955.48	4582.65
1232.76	505.72	924.37	1153.98	617.56	1504.52	2400.79

ITCHS	Item	2005-06	2006-07	2007-08
12119060	Vinca rosea (herbs)	485.21	398.20	314.34
12119070	Mint, incl. Leaves(all species)	9.63	21.37	211.15
12119080	Agarwood (incldng chips & dust)	71.60	0.23	1.67
12119091	Chirata	5.81	5.11	6.25
12119092	Tukmaria	63.59	97.16	189.66
12119093	Unab (indian jujube or chinese dates)	6.41	0.41	1.62
12119094	Basil,hyasop,rose mary sage,savory	472.66	370.63	276.65
12119095	LOVAGE	0.00	0.60	0.51
12119096	Garcenia	467.09	134.25	57.90
12119099	Othr prts of plants usd in perfmry, pharma-cutical etc,frsh/d	1810.33	2003.33	2949.25
13012000	Gum arabic	75.06	124.95	90.65
13019011	Asian gum	256.87	371.80	524.01
13019012	African gum	0.68	0.32	23.97
13019013	Asafoetida	888.17	917.62	1137.67
13019014	Benjamin ras	21.17	0.00	1.82
13019015	Benjamin Cowrie	0.00	0.00	0.00
13019016	Karaya gum(indian tragacanth) hastab	1743.85	1508.69	1267.76
13019017	Tragacanth (adraganth)	0.76	0.30	0.35
13019018	STORAX	0.00	0.48	0.00
13019019	Other natural gums	383.51	197.52	472.67
13021100	Saps & extracts of opium	1637.31	1899.92	1544.37
13021200	Saps & extracts of liquorice	10.59	4.15	4.88
13021911	Extracts belladona	2261.41	453.09	203.43
13021912	Extracts cascare sagrada	0.81	3.27	0.00
13021913	Extracts Nux-vomica	0.00	0.33	1.41
13021914	Ginseng extract including powder	7.41	165.45	29.13
13021915	Agarose	0.00	0.51	0.00
13021916	Extracts, neem	425.95	1232.09	1178.75
13021917	Gymnema extract,	253.94	558.44	354.56
13021918	Cambodge extract	3257.34	5265.09	2856.26
13021919	Other extracts	11604.17	19755.60	16935.84
14049021	Soap nut powder	12.18	122.80	80.84
14049029	Other soap nuts	250.47	490.51	425.27

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
343.77	171.76	192.40	384.06	819.93	964.11	567.21
166.24	127.12	377.41	53.27	207.32	150.37	147.81
4.18	122.56	93.71	144.11	271.62	274.51	332.38
9.96	4.09	6.29	1.69	2.61	15.78	20.08
277.16	351.40	410.20	520.87	425.56	885.69	831.67
4.53	0.24	8.51	11.39	0.01	12.70	2.37
129.62	169.27	313.72	395.64	414.37	698.80	2437.81
0.00	5.79	1.20	0.08	0.00	0.00	0.00
64.71	84.15	51.70	20.48	59.75	577.27	799.22
2692.50	3676.32	4361.08	7694.33	9851.99	10336.26	17079.95
2223.49	1014.71	1901.66	1536.44	457.80	2281.64	1099.32
695.65	602.15	1012.17	2866.61	3380.01	4484.65	1775.30
0.00	12.29	18.06	1.12	0.16	12.76	0.81
1355.19	1728.31	1960.95	2020.78	2928.66	3448.79	4104.90
2.41	0.41	2.80	0.00	0.35	6.87	0.00
0.00	0.00	1.94	0.00	0.00	0.00	0.00
1833.74	2299.46	3312.23	3902.24	2220.80	2038.93	770.63
0.48	0.75	1.88	2.76	6.51	4.63	0.24
0.10	19.75	3.19	4.46	1.06	6.71	9.88
1601.09	1613.09	2169.88	3444.00	2347.42	2073.60	4841.57
2253.72	4758.45	3295.45	8200.89	15824.35	15496.69	8052.20
52.27	690.60	28.43	168.96	43.78	74.33	106.50
122.74	98.35	124.66	256.16	308.05	577.11	316.56
2.09	0.00	0.00	4.28	0.00	0.00	0.00
0.00	113.98	22.72	3.67	4.85	244.86	0.29
0.00	12.78	1.07	21.24	9.95	1.76	1.98
0.32	0.04	0.00	0.00	0.00	0.00	0.00
1018.58	2297.75	2144.34	2174.94	4143.36	3739.76	4547.56
506.06	354.96	413.09	764.95	996.65	1146.55	1336.59
7529.37	2848.35	3371.65	4805.47	4401.45	15680.12	12960.32
23611.86	24775.34	28925.46	50161.35	87538.14	105649.61	124412.23
182.00	176.20	513.07	743.14	338.26	207.62	143.56
439.34	355.69	840.36	1860.17	1894.46	1295.78	883.05

Table 8.7a: Import Volume of Medicinal Plants from 2005-06 to 2014-15

ITCHS	Item	2005-06	2006-07	2007-08
09041110	Pepper long	3307.19	1614.45	734.64
09109915	*Cassia tora* seed	0.00	25.13	0.00
12112000	Ginsng roots frsh/drid w/n cut crshd/pwdrd	0.79	23.11	1.01
12113000	Coca leaf frsh/drid w/n cut crshd/pwdrd	3.99	0.00	0.00
12119011	Ambrette seeds(must grains of vgtbl kngdm)	20.84	64.72	108.93
12119013	Psyllium seed (Isobgul)	0.30	0.00	0.00
12119014	Neem seed	0.00	0.00	0.00
12119019	Other seeds frsh/drid w/n cut crshd/pwdrd usd in perfmry, pha	603.78	293.41	835.56
12119021	Beladona leaves	0.00	0.00	0.00
12119022	Senna leaves and pads	2.00	0.00	11.00
12119025	Cubeb powder	150.11	169.98	136.91
12119026	Pyrethrum	260.31	232.68	169.07
12119029	Other levs, pwdr, flurs & pods frsh/drd w/n cut crshd/pwdrd	5463.51	3242.74	6119.93
12119031	Cascara sagrada bark	0.00	0.00	0.00
12119032	Psyllium husk (Isobgul husk)	0.04	9.00	1.00
12119033	Cambodge fruit rind/the dried pericap of the fruits of garcinia	0.00	0.00	0.00
12119039	Othr bark, husk & rind fresh/dried w/n cut crshd/powdered	3765.55	4058.27	4801.65
12119041	Belladona roots	0.00	0.50	0.00
12119042	Galangal rhizomes & rts incl. Greater gala	184.12	217.85	157.16
12119043	Ipecac dried rhizome & roots	0.48	0.47	2.63
12119044	Serpentina roots	36.00	0.00	0.00
12119045	Zedovary roots	0.00	0.00	19.26
12119046	Kuth root	172.50	112.95	40.70
12119047	Sarsaparilla	9.93	6.74	3.16
12119049	Other roots & rhizomes frsh/drd w/n cut crshd/pwdrd	600.71	833.18	1741.26
12119050	Sandal wood chips and dust	32.47	81.24	57.35
12119060	Vinca rosea (herbs)	0.00	0.00	0.00
12119070	Mint,incl. Leaves(all species)	17.50	41.54	58.77
12119080	Agarwood (incldng chips & dust)	34.59	64.51	33.56
12119091	Chirata	27.65	83.27	173.80
12119092	Tukmaria	279.33	33.30	91.31
12119093	Unab (Indian Jujube or Chinese Dates)	61.46	83.46	71.20

(Quantity in MT)

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
716.17	930.53	1100.42	808.74	566.49	890.06	851.74
0.00	0.00	0.00	20.00	0.00	0.00	0.00
1.38	2.38	0.00	2.60	10.83	31.63	0.08
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	32.64	0.00	87.50	26.00	46.93	68.44
3.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.01	0.00	0.00	7.00	0.00
421.89	391.06	51.62	551.18	519.54	421.31	359.93
0.00	0.00	0.00	0.01	0.00	0.01	0.00
10.00	15.15	0.00	59.60	0.00	254.00	317.90
11.00	55.10	64.95	72.00	197.04	505.17	282.19
99.21	153.05	50.00	6.00	67.15	96.00	12.02
4185.45	9046.57	2659.81	4319.11	3880.41	4065.72	3487.39
0.00	0.00	0.00	0.00	0.00	0.00	0.02
104.44	12.55	0.00	0.00	1566.55	171.00	193.57
0.00	79.00	20.00	156.00	40.00	0.00	0.35
5418.74	4892.29	10313.32	8963.76	9009.10	9316.09	9633.39
3.06	0.00	0.00	0.00	0.00	0.00	0.00
115.45	253.71	150.50	267.22	101.00	206.12	381.42
9.12	6.69	8.86	52.61	3.59	1.40	1.88
0.00	0.00	0.00	0.00	0.00	0.00	0.00
19.79	0.00	0.00	0.00	25.00	0.00	0.00
0.00	58.00	52.00	0.00	0.00	0.00	0.00
0.00	8.89	0.00	6.41	0.00	0.00	9.49
3438.08	4583.38	16258.78	3454.37	5813.49	4865.07	5437.11
194.03	56.80	92.30	161.74	131.78	180.75	310.01
0.00	0.00	0.00	0.00	18.60	0.00	0.00
24.02	16.02	18.93	37.46	46.42	109.16	154.84
6.54	34.01	21.55	81.48	26.00	62.57	50.67
74.63	90.93	298.19	110.29	426.71	301.95	175.80
120.71	326.99	217.45	373.17	272.22	179.96	106.58
43.20	75.40	194.96	37.05	27.00	91.00	67.00

ITCHS	Item	2005-06	2006-07	2007-08
12119094	Basil, hyasop, rosemary sage, savory	300.63	204.11	223.80
12119095	Lovage	64.00	0.00	27.95
12119096	Garcenia	878.20	2585.68	911.42
12119099	Othr prts of plants usd in perfmry, pharma-cutical etc,frsh/d	3646.34	3830.56	4666.57
13012000	Gum arabic	14825.84	18840.06	14876.37
13019011	Asian gum	30.00	88.06	96.80
13019012	African gum	0.00	0.00	100.00
13019013	Asafoetida	528.52	688.00	927.16
13019014	Benjamin ras	60.09	3.00	5.30
13019015	Benjamin cowrie	40.00	0.00	0.00
13019016	Karaya gum (indian tragacanth) hastab	0.00	0.00	0.00
13019017	Tragacanth (adraganth)	10.82	2.10	3.75
13019018	Storax	0.00	0.00	0.00
13019019	Other natural gums	414.38	468.59	623.89
13021200	Saps & extracts of liquorice	12.93	16.09	18.36
13021911	Extracts belladona	0.00	0.00	0.00
13021913	Extracts nux-vomica	0.00	0.00	0.00
13021914	Ginseng extract including powder	10.37	14.06	19.38
13021915	Agarose	0.00	0.01	0.00
13021916	Extracts, neem	0.20	0.00	0.06
13021917	Gymnema extract	0.00	0.00	0.08
13021918	Cambodge extract	0.00	20.10	20.00
13021919	Other extracts	106.82	104.25	141.52
14049029	Other soap nuts	179.39	1154.11	643.08

Table 8.7b: Import Value of Medicinal Plants from 2005-06 to 2014-15

ITCHS	Item	2005-06	2006-07	2007-08
9041110	Pepper long	1695.54	995.77	259.90
9109915	*Cassia tora* seed	0.00	6.36	0.00
12112000	Ginsng roots frsh/drid w/n cut crshd/pwdrd	6.06	23.06	5.42
12113000	Coca leaf frsh/drid w/n cut crshd/pwdrd	2.23	0.00	0.00
12119011	Ambrette seeds (must grains of vgtbl kngdm)	23.79	147.48	303.56
12119013	Psyllium seed (isobgul)	0.08	0.00	0.00
12119014	Neem seed	0.00	0.00	0.00
12119019	Other seeds frsh/drid w/n cut crshd/pwdrd usd in perfmry,pha	195.49	118.66	129.04

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
177.97	296.56	320.87	568.50	840.46	669.58	1491.01
3.00	0.00	10.80	10.13	16.75	15.91	23.28
2992.10	1412.27	1320.55	891.58	1726.00	3652.85	1780.36
5646.72	5903.67	3495.26	2963.38	4085.98	4376.34	3483.50
15803.50	20999.54	19171.21	26031.45	22892.14	33132.62	31007.75
127.24	5.90	0.00	20.00	11.00	36.26	46.97
33.00	0.00	0.00	0.00	0.00	73.00	315.00
653.70	534.89	899.83	1027.72	940.39	1147.11	1029.27
0.00	6.08	0.00	0.00	5.00	38.99	2.30
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1.09	8.25	66.67	71.92	421.78	586.28
2.00	9.17	2.32	2.00	2.05	0.00	2.35
6.44	0.00	4.37	4.14	0.60	3.63	4.00
344.09	209.84	337.25	250.08	338.16	234.08	309.64
14.64	9.07	17.49	35.97	74.07	7.14	8.21
0.00	0.00	0.00	0.00	0.00	0.50	0.00
0.00	0.00	0.00	0.00	0.15	1.00	0.00
14.30	27.16	22.62	23.46	31.92	33.23	17.57
1.16	1.85	0.31	3.15	2.92	2.40	0.48
0.00	0.00	25.00	1.18	0.46	0.00	0.00
0.35	1.00	0.00	0.40	0.00	0.00	63.00
0.02	21.94	42.32	56.26	0.00	0.00	0.04
367.33	181.16	271.28	236.59	176.02	1284.38	1603.55
1103.38	1245.30	553.55	1932.33	808.06	1275.55	868.96

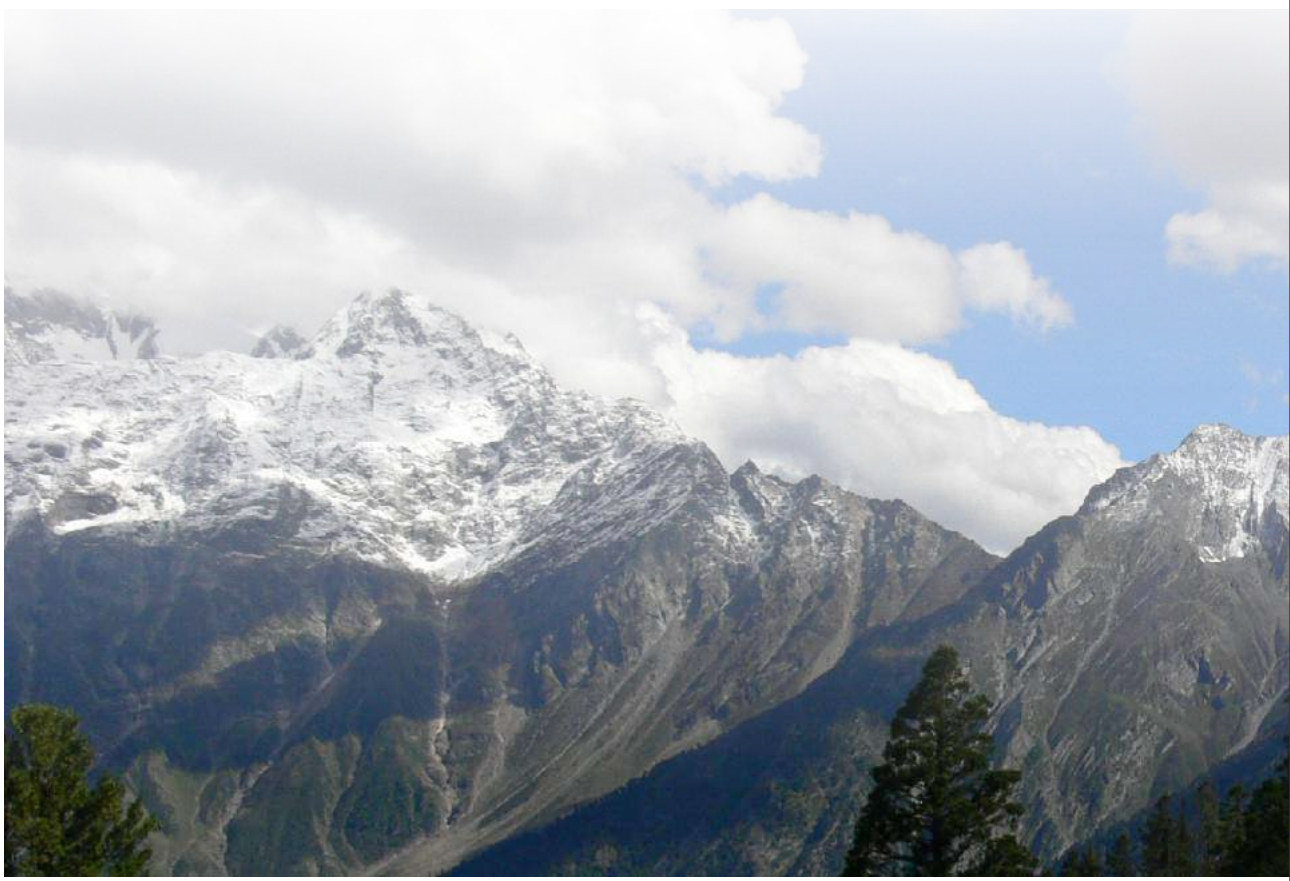
(₹ in Lakh)

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
280.27	391.67	492.58	492.82	418.23	697.61	615.49
0.00	0.00	0.00	5.29	0.00	0.00	0.00
11.45	12.17	0.04	1.06	22.68	52.46	7.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	117.47	0.00	30.26	4.38	18.65	38.35
1.65	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.14	0.00	0.00	1.33	0.00
308.32	274.10	254.55	642.03	515.18	591.67	599.92

ITCHS	Item	2005-06	2006-07	2007-08
12119021	Beladona leaves	0.00	0.00	0.00
12119022	Senna leaves and pads	2.58	0.00	3.48
12119025	Cubeb powder	97.91	120.43	85.47
12119026	Pyrethrum	211.09	177.44	239.77
12119029	Other levs, pwdr, flurs & pods frsh/drd w/n cut crshd/pwdrd	3150.13	3045.17	3673.93
12119031	Cascara sagrada bark	0.00	0.00	0.00
12119032	Psyllium husk (isobgul husk)	0.05	25.34	2.64
12119033	Cambodge fruit rind/the dried pericap of the fruits of garcinia	0.00	0.00	0.00
12119039	Othr bark, husk & rind fresh/dried w/n cut crshd/powdered	1876.02	2282.63	3147.64
12119041	Belladona roots	0.00	0.59	0.00
12119042	Galangal rhizomes & rts incl. Greater gala	85.72	98.93	68.52
12119043	Ipecac dried rhizome & roots	7.66	14.86	93.26
12119044	Serpentina roots	16.42	0.00	0.00
12119045	Zedovary roots	0.00	0.00	7.51
12119046	Kuth root	22.58	59.26	16.61
12119047	Sarsaparilla	5.82	5.06	2.35
12119049	Other roots & rhizomes frsh/drd w/n cut crshd/pwdrd	355.33	869.95	493.90
12119050	Sandal wood chips and dust	358.37	548.40	453.42
12119060	Vinca rosea (herbs)	0.00	0.00	0.00
12119070	Mint,incl. Leaves(all species)	7.34	57.49	66.32
12119080	Agarwood (incldng chips & dust)	55.78	320.82	49.36
12119091	Chirata	6.50	19.98	61.59
12119092	Tukmaria	39.34	3.39	10.71
12119093	Unab (indian jujube or chinese dates)	12.80	13.36	7.55
12119094	Basil, hyasop, rosemary, sage,savory	141.03	81.53	123.39
12119095	Lovage	13.46	0.00	2.52
12119096	Garcenia	348.66	982.71	294.18
12119099	Othr prts of plants usd in perfmry, pharma-cutical etc,frsh/d	1215.49	1706.21	1645.39
13012000	Gum Arabic	4218.83	5327.16	3802.08
13019011	Asian gum	10.14	59.70	76.72
13019012	African gum	0.00	0.00	20.55
13019013	Asafoetida	3527.88	7473.49	11128.05

2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
0.00	0.00	0.00	0.06	0.00	0.07	0.00
38.69	11.19	0.00	15.91	0.00	85.77	206.47
5.71	39.19	40.58	69.50	135.72	444.02	401.03
59.37	134.57	54.38	16.22	98.63	150.82	19.32
5167.30	4299.61	4023.24	5452.12	7694.81	11179.07	11146.36
0.00	0.00	0.00	0.00	0.00	0.00	0.12
59.84	30.84	0.00	0.00	813.54	89.19	100.12
0.00	24.62	18.06	180.90	39.75	0.00	0.35
4613.37	3705.48	5949.95	6656.27	6929.49	7874.91	9139.14
10.04	0.00	0.00	0.00	0.00	0.00	0.00
49.93	205.24	187.22	462.98	95.15	329.80	281.89
364.06	392.51	545.24	184.88	227.13	99.40	156.41
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.62	0.00	0.00	0.00	6.54	0.00	0.00
0.00	35.58	38.61	0.00	0.00	0.00	0.00
0.00	5.63	0.00	5.44	0.00	0.00	8.84
1138.60	1390.53	2173.68	1651.73	3475.02	3698.91	5543.82
361.09	204.69	458.54	1020.26	1349.12	1773.48	2334.11
0.00	0.00	0.00	0.00	9.96	0.00	0.00
26.95	22.90	24.02	59.73	160.59	303.70	457.51
11.94	60.38	35.99	62.89	73.82	139.12	155.89
24.16	50.80	200.22	99.33	269.21	325.81	157.67
19.07	130.68	104.23	133.73	98.38	65.14	36.84
5.38	12.96	20.80	7.60	6.34	24.61	15.68
117.24	134.19	211.96	381.83	557.61	543.23	2114.06
2.49	0.00	47.40	47.91	63.19	59.21	75.14
998.99	452.70	757.38	904.18	1434.84	4893.27	3449.04
1783.37	2423.16	2334.37	2159.81	3154.21	3550.15	5471.33
4443.00	6604.55	5839.62	7569.28	8118.33	13378.41	12872.35
146.98	1.66	0.00	46.81	4.56	21.46	31.52
4.50	0.00	0.00	0.00	0.00	20.78	92.90
10894.96	13047.18	20532.74	23246.10	22146.42	35090.94	39891.82

ITCHS	Item	2005-06	2006-07	2007-08
13019014	Benjamin ras	18.49	1.23	1.78
13019015	Benjamin cowrie	11.44	0.00	0.00
13019016	Karaya gum (indian tragacanth) hastab	0.00	0.00	0.00
13019017	Tragacanth (adraganth)	6.45	1.20	2.22
13019018	Storax	0.00	0.00	0.00
13019019	Other natural gums	309.92	343.58	710.85
13021200	Saps & extracts of liquorice	45.92	59.17	63.40
13021911	Extracts belladona	0.00	0.00	0.00
13021913	Extracts nux-vomica	0.00	0.00	0.00
13021914	Ginseng extract including powder	328.80	396.09	446.90
13021915	Agar se	0.00	4.41	0.00
13021916	Extracts Neem	0.92	0.00	6.14
13021917	Gymnema extract	0.00	0.00	10.80
13021918	Cambodge extract	0.00	7.72	4.47
13021919	Other extracts	718.00	510.32	987.64
14049029	Other soap nuts	15.65	247.90	140.89



2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
0.00	2.08	0.00	0.00	2.13	50.21	17.97
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	8.89	62.13	134.60	197.86	308.07	394.67
1.38	6.85	1.40	1.58	4.01	0.00	3.10
165.01	0.00	96.85	84.11	11.88	76.42	77.07
681.56	333.80	600.89	334.90	505.90	623.21	639.35
49.92	42.40	123.71	192.62	240.92	54.68	61.11
0.00	0.00	0.00	0.00	0.00	3.44	0.00
0.00	0.00	0.00	0.00	1.67	10.96	0.00
316.87	737.12	587.94	1017.82	2325.74	2739.78	1792.49
1.17	13.33	25.06	19.79	84.89	62.59	25.31
0.00	0.00	14.03	8.86	46.00	0.00	0.00
10.53	2.36	0.00	2.78	0.00	0.00	168.16
0.12	34.92	204.04	188.24	0.00	0.00	0.52
3046.57	2165.30	2847.02	5068.10	5936.81	7203.05	8737.83
234.20	245.21	198.95	777.72	296.75	237.16	233.13

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9

Controversial Herbal Raw Drugs (Substitutes, Equivalents, Adulterants)

Authenticity of the herbal raw drugs used in preparation of herbal health care and wellness products is presently the major concern of the growing herbal sector in the country. Whereas some substitutes (*Withania somnifera* in place of *Lilium polyphyllum* as 'Kakoli,) and geographic equivalents (*Pluchea lanceolata* in north India and *Alpinia galanga* in south India as 'Rasna') are officially recognised, there are a number of herbal raw drugs which are freely traded and used as equivalents and many others that fall in the category of adulterants. Some of the commonly used equivalents noted during the survey include different species of *Berberis* as 'Daruharidra', different species of *Tribulus* as 'Gokshura', and use of different species like *Holostemma ada-kodien*, *Flickingeria mackraei* and *Leptadenia reticulata* as 'Jivanti'. A major proportion of the adulteration seems to be due to inexperience of wild gatherers who make the collection of similar looking plants at the time of collection. It becomes difficult to separate the adulterated material once it is dried and aggregated. Some cases of adulteration due to similarity of names have also been noted during the survey (viz. trade of flowers of *Rhododendron arboreum* in place of flowers of *Hibiscus rosa-sinensis*, known as 'Gularh phool' and 'Gurhal phool' respectively). Some cases of seemingly deliberate mixing of similar looking herbal raw material were also noted (viz. mixing of fruiting spikes of different *Piper* species with Pippali). The issue, if not addressed soon, can have serious implications on the further growth of the sector.

9.1. THE ISSUE

Authenticity of the herbal material forms the very foundation on which the trust about the use of herbals for health care, food and cosmeceuticals is based. The days when the herbal healer would himself collect the material from the wild to prepare his own formulations have long given way to the practitioner making prescriptions of the commercially produced herbal formulations requiring bulk supplies of raw material got collected from various parts of the country. The onus of making authentic collections and keeping trust has thus shifted from the one intimately knowledgeable about the plants to a large body of wild gatherers who are guided by economic interests and who are not necessarily proficient in plant identification. The impact of this shift of onus is visible in respect of many wild collected herbal raw drugs in trade where the supposedly authentic raw drug is a mixture of material pertaining to more than one plant species. There is also a growing practice of using replacement herbal raw drugs, especially in cases where the authentic herbal raw drug is not available in required quantities.

These practices where material obtained from different species is traded as single herbal raw drug make the concerned herbal raw drug controversial. The fact that the 'sandigdha dravays', as the controversial herbal raw drugs are called, are in active trade itself is a pointer towards their commercial use. In a study, it was noticed that 11.5% of herbal raw drug samples collected from the market were spurious *(Dr. H. B. Singh, Chief Scientist NISCAIR (Retd.) – per. comm. during National Workshop of Stakeholders of Medicinal and Aromatic Plants, held at Delhi on 28 May 2015)*. The major problem is with the material that is collected from the wild with most of the organised wild collection happening based on the local names of the plants and not on their botanical identity.

The sector that already is being called upon to verify its efficacy on standard modern parameters, the issue of using controversial herbal raw drugs is likely to have serious implications on the growth of the sector. The issue needs to be urgently addressed.

9.2. SUBSTITUTES, EQUIVALENTS AND ADULTERANTS

The category of the controversial raw drugs varies from the recognised 'substitutes', to plants freely used as 'equivalents', and to the plants qualifying as 'adulterants'.

9.2.1. Substitutes

In many cases, where the original herbal raw drug is not available due to population reduction or due to geographical considerations, the use of 'pratinidhi dravaya' or the 'substitute' is allowed and in such cases the plant source of the original herbal raw drug and the one that is used as substitute are well known. As an example, 'ashwagandha' (*Withania somnifera*) is recognised as a substitute in place of 'kshir kakoli' (*Lilium polyphyllum*), a Himalayan herb no more available in commercial quantities. The plant sources of both these herbal entities are clearly known. Identification, recognition and validation of 'substitute' herbal raw drugs

Lilium polyphyllum (Kshir Kakoli) | *Roscoea purpurea* (Kakoli) | *Withania somnifera* (Substitute)

is a long drawn process that is based on assessment of similarity of properties like 'rasa', 'guna', 'virya' and 'vipaka' in both the original and the substitute drug. Thus, substitutes for original herbal raw drug can belong to different plant species in the same family or different families. Treatise by scholars like Bhavaprakasha, Yogaratnakara and Bhaishajya Ratnavali contain detailed description of many 'substitute' drugs.

Aconitum heterophyllum (Atees)
authentic raw drug

Cyperus rotundus (Musta)
substitute

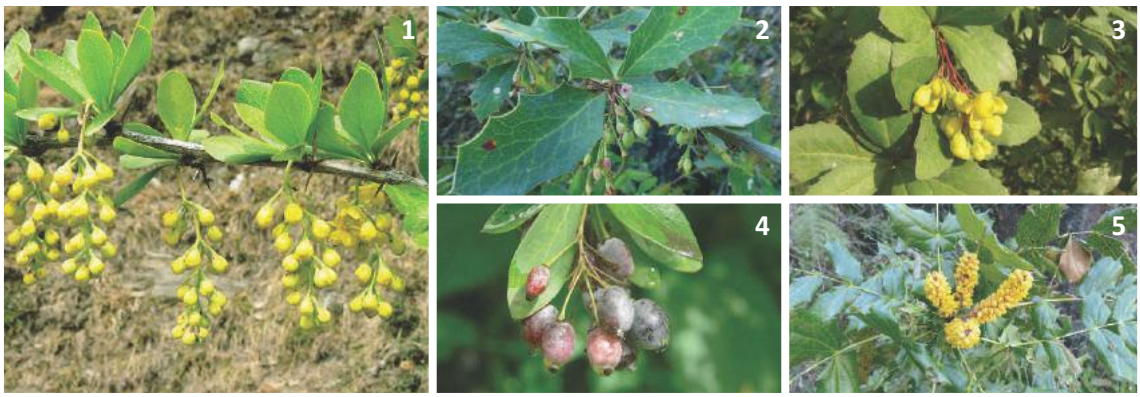
Chaerophyllum villosum (Mithi Patish)
adulterant

The use of accepted 'substitutes' in many cases has become so common that the original raw drug is almost forgotten. For example, the entire 'ashtavarga' group, consisting of underground parts of Himalayan herbs, is substituted by other plant raw drugs viz. 'kakoli' and 'kshirkakoli' by 'ashwagandha' (*Witahnia somnifera*) and 'riddhi' and 'vriddhi' by 'varahi kand' (*Dioscorea bulbifera*). The use of 'mustaka' (*Cyperus rotundus*) as a substitute of 'ativisha' (*Aconitum heterophyllum*) is also recognised. Some of the other commonly used substitutions are 'jhinghan' (*Lannea coromandelica*) in place of 'murva' (*Marsdenia tenacissima*); 'pippal mool' (*Piper longum*) in place of 'chavya' (*Piper chaba*); 'yavasaka' (*Alhagi pseudalhagi*) in place of 'dhanvayasah' (*Fagonia cretica*); etc. Plant sources of all the above mentioned original herbal raw drugs and the species used as their substitutes are well known.

In the case of 'equivalents' and the 'adulterants', on the other hand, the plant source of the raw drug is usually ambiguous.

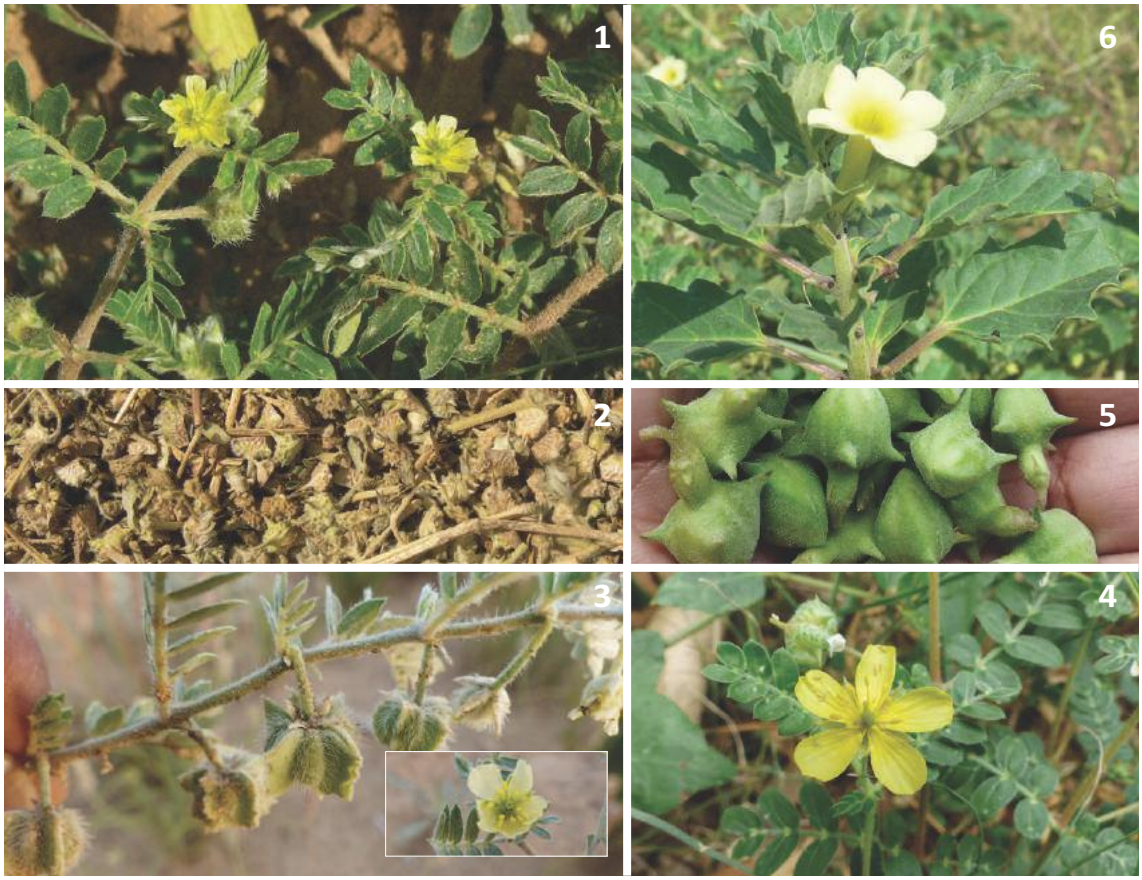
9.2.2. Equivalents

The use of herbal raw drug material considered to be 'equivalent' to the originally accepted herbal raw drug brings in another level of ambiguity to the herbal sector in the country. Many cases of the use of various types of 'equivalents' came to the notice during the present study. The first type of



1. Barberis aristata; 2. B. asiatica; 3. B. chitria; 4. B. lycium; 5. Mahonia sp.

'equivalents' pertain to the herbal material obtained from similar looking plants of the same or similar genus. For example, the plant drug 'daruhardira' is officially correlated to *Berberis aristata*. However, stem and roots of many other species of *Berberis* growing in the same habitat are also being collected and freely used as 'daruharidra' equivalent.

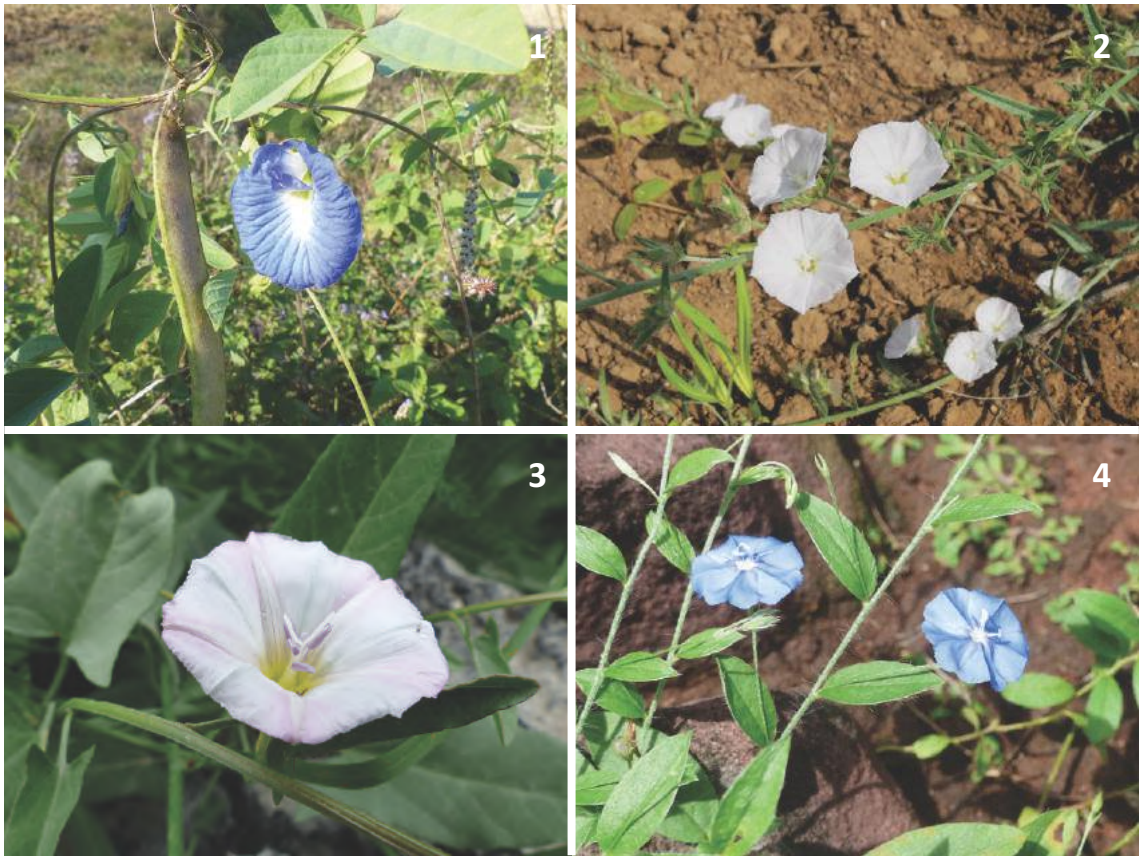


Various plant species used as 'Gokshura' (1. *Tribulus terrestris*; 2. Fruits of *Tribulus terrestris*; 3. *T. alatus*; 4. *T. lanuginosus*; 5. Fruits of *Pedalium murex* (bara gokhru); 6. *Pedalium murex)*

Similarly, material from different species of genus *Tribulus* is collected and freely used as 'gokshura', even as the officially recognised herbal raw drug must be obtained only from *Tribulus terrestris*.

Another example of use of equivalents taken from different species of the same genus as herbal raw drug is of 'bala' that should be collected only from *Sida rhombifolia*. However, the material collected from other species of *Sida* is also freely used as 'bala'. Herbal raw drug 'bhumi amla' is another example where the herbal material from many herbaceous species of genus *Phyllanthus* is freely collected and used as 'bhumi amla' even as the official source of the raw drug is *Phyllathus amarus*. Trade of 'Shankpushpi' is another example of use of various equivalents. In all the above cases, it is not possible to segregate the material species-wise after it has been aggregated.

The second type of 'equivalents' pertain to using material obtained from other alternative plants in place of the accepted ayurvedic herbal raw drugs. For example, unrelated species like *Holostemma ada-kodien*, *Flickingeria mackraei* and *Leptadenia reticulata* are used as 'Jivanti' in different parts of the country. Similarly, *Pluchea lanceolata* is used as 'rasna' in north India and *Alpinia galanga*, considered to be geographic equivalent of 'rasna', is used as 'rasna' in southern



Various plant species used as 'Shankpushpi' (1. *Clitoria ternatea*; 2. *Convolvulus prostratus*; 3. *Convolvulus arvensis*; 4. *Evolvulus alsinoides)*

India (Prakash *et al.*, 2013). 'Parpata', widely used in fever and treatment of gastritis, diarrhoea, and excessive thrust, is another herbal raw drug where many 'equivalents' were noted in trade. Some of the raw drugs traded as 'parpata' or 'parpataka' that could be critically correlated with the taxonomic identity of the plants from which these are sourced are *Fumaria indica* and *Fumaria officinalis* (Fumariaceae) *Polycarpaea corymbosa* (Caryophyllaceae), *Oldenlandia corymbosa* (Rubiaceae), and *Mollugo cerviana* (Molluginaceae).

'Chiretta', another important herbal raw drug, is officially correlated to the Himalayan herb *Swertia chirayita* with material obtained from *Swertia cordata* as recognised substitute. However, material obtained from many other species of genus *Swertia* as well as that obtained from allied species like *Helenia elliptica*, and *Enicostemma axillare* is also used as 'Chiretta'. Many a times, material obtained from a tropical herb *Andrographis paniculata*, known in trade as 'kalmegh' or 'tikt-chiretta', is also clubbed with the material obtained from true 'chiretta'. Pant (2005) reports that material from 9 different species of *Swertia* is traded as 'chiretta' in Nepal. Khanal *et al*. (2014) report that material from 12 different species of *Swertia* is traded as 'chiraito' in Nepal and such adulteration is as high as 20%. Government of Nepal has forbidden the wild collection and trade of *Swertia chirayita* from May to September every year. More than 80% of 'chiretta' collected from Nepal is exported to India.

The presence of common medicinal properties in the form of the same or similar active principles in unrelated plants as per interpretations and discussions in one or the other classical texts

Various plant species used as 'Chiretta' (1. *Swertia chirayita*; 2. *S. cordata*; 3. *S. tetragona* 4. *S. ciliata*; 5. *S. paniculata*; 6. *Enicostemma* sp.; 7. *Andrographis paniculata*)

perhaps lends some sanctity to the use of unrelated species as 'equivalents'. For example, plant material obtained from species pertaining to three different genera i.e. *Berberis*, *Mahonia* and *Coscinium* is used as 'daruhardira' as all these plants contain 'berberin' as the major organic

compound. In such cases herbal raw drugs obtained for any of these plant species is used depending upon the geographical availability. It needs, however, to be noted that use of many of these 'equivalents' has not been officially recognised in the Ayurvedic Pharmacopoeia of India.

9.2.3. Adulterants

'Adulterants' is the third and the most worrisome category of controversial herbal raw drugs. The extent of adulteration varies from the unintended mixing of foreign material with the accepted herbal raw drug due to inexperience of wild gatherers who sometimes gather similar looking plants at the time of collection to the deliberate mixing of foreign material or inferior quality material in the accepted herbal raw drug with the intent to make profit. 'Adulteration' also varies from small percentage of foreign material, including non-accepted parts of the same plant, added to the main herbal raw drug to the entire lot being spurious. 'Adulterants' cause debasement of the accepted herbal raw drugs adversely impacting their therapeutic and chemical properties. Irrespective of the intent behind adulteration of the herbal raw drug material, it is very difficult to separate the adulterated material once it is dried and aggregated. Many instances of 'adulterants' were noticed during the current study. One such instance related to market samples with seemingly deliberate mixing of similar looking fruiting spikes of different *Piper* species with Pippali (*Piper longum*).

'Pippali' plant and Authentic Sample of 'Pippali'

Spurious 'Pippali' Samples from the Market

Flowers of *Hibiscus rosa-sinensis*, known as 'Gurhal phool', form an important herbal raw drug used in various classical herbal health care formulations. However, during survey of herbal mandis, it was noticed that the raw drug being usually sold as 'Gurhal phool' was actually the flowers of *Rhododendron arboreum*, a Himalayan tree bearing large scarlet flowers. Retracing the line of supply, it came out that the major supply of the material being sold as 'Gurhal phool' was being obtained from Chamba district in Himachal Pradesh. Further enquiries from the field revealed that the *Rhododendron arboreum* flowers, commonly known as 'Burash phool', are

locally known as 'Gularh phool' in Chamba district in Himachal Pradesh. The mix up, seemingly due to similarity of names, also explains the vast difference in rates of this herbal raw drug in the market.

Hibiscus - fresh and dried flowers

Rhododendron - fresh and dried flowers

Dr. H. B. Singh, Chief Scientist NISCAIR (Retd.), based on his detailed study of market samples, informed about the mixing of the leaves of *Malva rotundifolia*, *Malva pusila*, *Merremia emarginata*, and *Evolvulus nummularis* with those of 'brahmi' (*Centella asiatica*); adulteration of 'rakta punarnava' (*Boerhavia diffusa*) samples with those pertaining to *Trianthema portulacastrum*, and so on. (pers. comm. during National Workshop of Stakeholders of Medicinal and Aromatic Plants, held at Delhi on 28 May 2015). Naitahani and Bisen (2005) had recorded the trade of *Blepharispermum subsessile* as 'rasna' in place of *Pluchea lanceolata*, the accepted source of 'rasna' from Jagdalpur and Dhamtari herbal mandis in Chhattisgarh. Khare (2007) has also reported the trade of *Blepharispermum subsessile* as an 'adulterant' of 'rasna' from herbal mandis in Madhya Pradesh.

Roots of *Murdannia edulis* (=*Aneilema scapiflora*), a common herb of Sal forests, are reported to be collected and traded as 'musli'.

The case of 'asoka chhal' (*Saraca asoka*), used by domestic herbal industry in large quantities every year, continues to baffle, especially as the species has very limited wild populations and no known commercial cultivation. It is suspected that bark of some other tree species, including that of *Polyalthea longifolia*, *Bauhinia variegata*, *Trema orientalis*, and *Shorea robusta* might be used as 'asoka' bark (Dubey and Sawant, 2015).

Supply of 'Ashoka Chhal', bark of *Saraca asoka*, a small indigenous tree of moist tropical regions, to meet annual requirement of about 2000 MT of the domestic herbal industry engaged in making ASU formulations, continues to intrigue. Close monitoring of the wild populations of the species in its range of distribution in Kerala, Karnataka, Maharashtra, Goa and Odisha does not indicate any significant collection from its wild populations. The species is not reported to be under any significant cultivation. It sure raises a suspicion about the authenticity of the material being used as 'Ashoka Chhal'. Thus, the question that 'from where Ashoka Chhal come', raised by Ved and Goraya (2008), is still un-answered.

Ativisa/ Atees

'Atees', the dried tuberous roots of high Himalayan herb *Aconitum heterophyllum*, is an important herbal raw drug and commands a market price ranging from ₹ 3000 to ₹ 4000 per kg. Rhizomes of 'Musta' (*Cyperus rotundus*), a member of the family Cyperaceae, are also in trade as 'ativisa' substitute.

However, material obtained from some other plant species is also traded as 'atees' or 'ativisa' in different markets in the country. For example, survey of Chennai market revealed the trade of the corms of *Cryptocoryne spiralis*, a member of Family Araceae as 'atees' substitute, under the name of 'Atividayam' with a market price of ₹ 200-300 per kg. Also known as 'nattativitayam' in Kerala, the corms of *Cryptocoryne spiralis* are used in place of Ativisha (*Aconitum heterophyllum*) by the domestic herbal industry in southern India. The fact has also been recorded by Anandakumar *et al.* (1982) and Prasad *et al.* (2012). Nair (2004), taking note of this trade, had opined that since *Cryptocoryne spiralis* was an advanced monocot and was taxonomically very distant from *Aconitum heterophyllum*, a primitive dicot, it should be treated as 'adulterant' of the true drug.

Aconitum heterophyllum

Cryptocoryne spiralis

Chaerophyllum villosum

Similarly, in the Delhi market, roots of *Chaerophyllum villosum*, a member of family Apiaceae, were noticed to be sold as another adulterant of 'Atees' under the name 'Mithi-Patish'.

The domestic herbal industry uses very high quantities of (a) 'banslochan' or 'tabashir', the silicaceous intermodal exudates of some species of bamboo (*Bambusa arundinacea*, *Melocanna bambusoides*, *Bambusa balcooa*, etc.); (b) 'gandhapura patra taila', the oil extracted from different species of *Gaultheria* (*G. fragrantissima* and *G. procumbens*); and (c) 'kapur', the oil

extracted from *Cinnamomum camphora*. However, no record of harvest of any of these species for extraction of 'banslochan', 'gandhipura patra taila' and 'kapur' respectively could be found during the current study. Similarly, no data of import of these entities in such large volumes also could be tracked. It is suspected that most of the material being used as 'banslochan', 'gandhipura patra taila' and 'kapur' as herbal raw drugs may not be of plant origin. The issue needs to be thoroughly investigated and resolved.

Banslochan/ Tabasheer

An estimated 2000 MT of Banslochan or Tabashir is used annually by the herbal industry in India making Ayurvedic, Siddha and Unani formulations. True 'banslochan' or 'tabasheer' is a translucent whitish substance (sometimes with bluish tint that is considered to be of superior quality) composed mainly of silica and water with traces of lime and potash, collected from the nodal joints of various bamboo species viz. *Bambusa bambos*, *Bambusa balcooa*, *Melocanna bambusoides*, etc. However, neither any record of wild collection of 'banslochan' in the country is available nor such collection has come to the notice during extensive field surveys during the course of this study. Similarly, analysis of foreign trade data does not show any record of import of such large quantities of 'banslochan'. Huge quantities of 'banslochan', nevertheless, continues to be traded in the market under various names like 'banslochan asli', 'vanshlochan singapuri', 'banslochan desi', 'tawasheer', 'bamboo-manna', etc. with different varieties commanding highly variable prices ranging from less than ₹ 100 per kg to more than ₹ 10,000 per kg.

Different grades of 'banslochan' recorded in Trade

Informal interactions with traders and experts reveal that most of the material sold as 'banslochan' may not be a plant product at all. The issue needs investigation and early resolution

9.3. DISCUSSION

The increasing use of 'sandigdha dravays' or controversial herbal raw drugs has become a cause of serious concern.

A major part of the problem is due to the use of local names at different stages of the movement of herbal material from primary production sites to the end users. The local names vary from region to region adding complexity to the issue. For example, 'guduchi' (*Tinospora cordifolia*), a very common ayurvedic herbal raw drug, is known as 'amrutha', 'giloe', 'gulje' and 'amritahballi' in different parts of the country. 'Ratanjot' is known to be obtained from *Arnebia benthami*, a Himalayan herb. However, in Rajasthan the produce from *Jatropha curcus* is also known as 'ratanjot' with no similarity with the original produce.

The use of local names also creates confusion about the true botanical identity of the herbal raw drug material in trade and use. For example, *Holostema ada-kodien* is a climber found in the southern western ghats of India. During the current study, large quantities of this species were recorded to be in trade as 'jivanti' in one of the herbal raw drug mandis in northern India. Close scrutiny of the material revealed that the material in trade in this particular mandi was not *Holostemma ada-kodien* but *Flickingeria mackraei*, also a candidate for 'jivanti'. It was due to correlation of 'jivanti' with *Holostemma ada-kodien* in some of the texts that the traders had named the material in trade actually pertaining to *Flickingeria mackraei* as *Holostemma ada-kodien*. This type of wrong correlation of herbal raw drugs in trade is very common and adds to the complexity of the entire herbal raw drug sector.

The possible solution to the problem lies in the following:

(a) All trade and use of herbal raw drugs should be under their standard binomial botanical nomenclature. As at present, the traders tend to rely upon various available publications on medicinal plants, Indian and foreign, many a times correlating entities derived from Indian plant species to some European and other foreign species. It would be highly desirable to publish an authentic illustrated **'Compendium of Traded Medicinal Plants in India'** for the benefit of all stakeholders involved with medicinal plants. The compendium, in addition to description of plants and updated botanical nomenclature, should include authentic references to local names, trade names, API names, etc. and also photographs of important herbal raw drugs and their plant sources. Publication of such compendium will be an arduous work needing intensive table work and extensive field visits to various parts of the country and may need 2-3 years for completion. NMPB should take up this challenge and identify appropriate agency for this work.

(b) Herbal raw drugs in trade and use must have a tag of backward linkages in the form of Chain of Custody along the supply chain from the level of primary production to various nodes along value chain to arrive at the identity of the raw drug in case of doubt.

(c) The API needs to be updated to include the traditionally used equivalents/ substitutes.

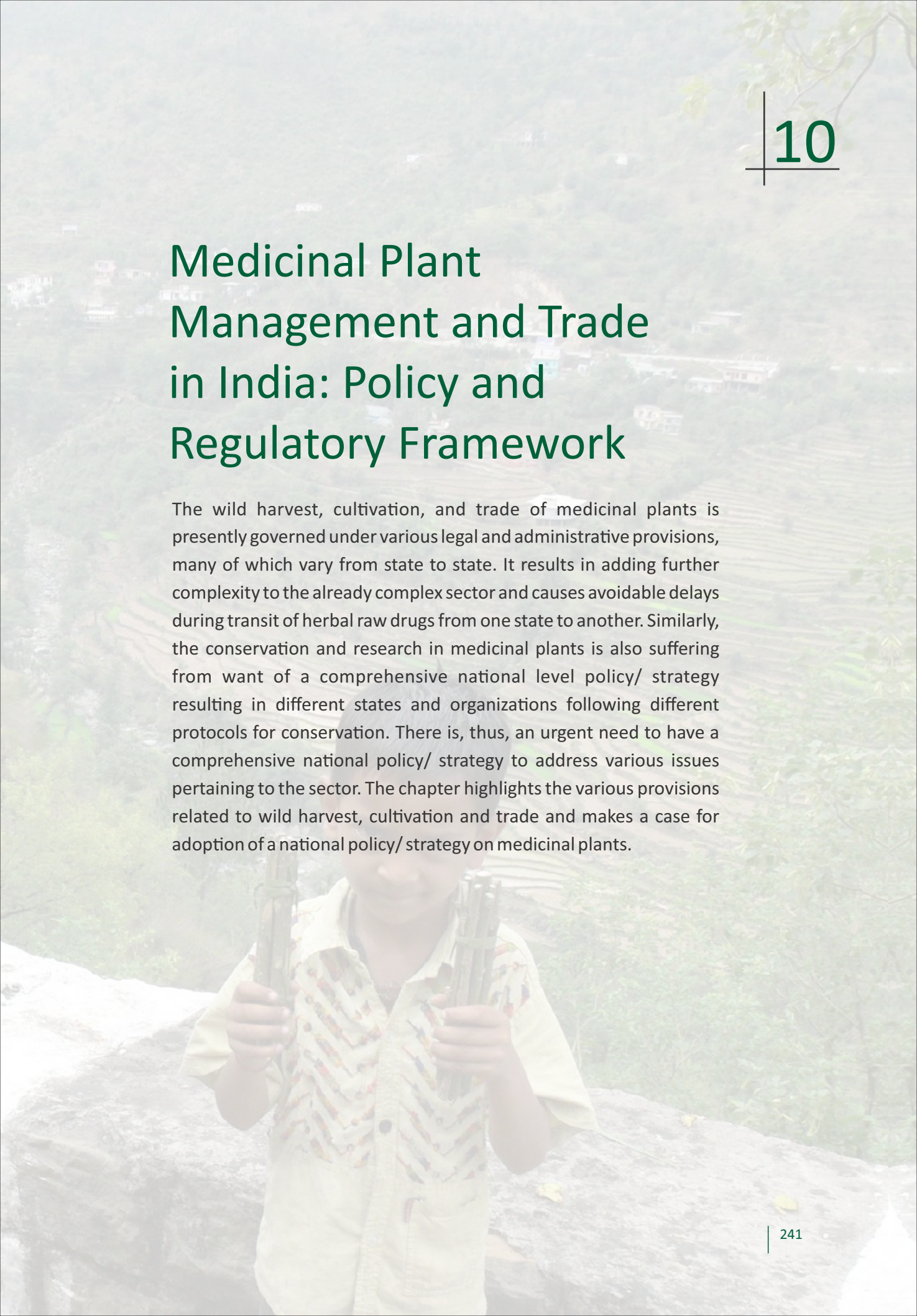
A very urgent action to address the issue of controversial herbal raw drugs is warranted.

G. S. Goraya & D. K. Ved

10

Medicinal Plant Management and Trade in India: Policy and Regulatory Framework

The wild harvest, cultivation, and trade of medicinal plants is presently governed under various legal and administrative provisions, many of which vary from state to state. It results in adding further complexity to the already complex sector and causes avoidable delays during transit of herbal raw drugs from one state to another. Similarly, the conservation and research in medicinal plants is also suffering from want of a comprehensive national level policy/ strategy resulting in different states and organizations following different protocols for conservation. There is, thus, an urgent need to have a comprehensive national policy/ strategy to address various issues pertaining to the sector. The chapter highlights the various provisions related to wild harvest, cultivation and trade and makes a case for adoption of a national policy/ strategy on medicinal plants.



10.1. Introduction

A large diversity of herbal raw drugs obtained from nearly 1200 medicinal plant species are in commercial use for production of health care formulations under Indian Systems of Medicine in the country. These diverse herbal raw drugs are collected from the wild, cultivated, or imported and transported through a labyrinth of trade channels to various parts of the country for use by domestic herbal industry, processing for export, or retail sale. The production including cultivation and import, trade, consumption and exports of the medicinal plants, usually covered as a sub-set of Non Timber Forest Produce (NTFP), is subject to various policy and regulatory regimes put in place by the national or the state governments. An overview of these policy and regulatory regimes applicable to the medicinal plant sector in the country is given below.

10.2. Management and Harvest of Wild Medicinal Plants

Results of this study reveal that nearly 90% of the medicinal plants used by the rural communities and the folk healers/ traditional practitioners – both by species and quantities consumed – are sourced from the wild. In respect of consumption of herbal raw drugs by the domestic herbal industry, 72% of the medicinal plant species and 50% of the annual quantities consumed are also sourced from the wild. The study also reveals that the herbal sector in the country has grown at a rate of about 10% over the past decade and that it is projected to grow further. An increase in cultivation of medicinal plant species over the past decade has also been recorded. However, number of wild collected species of conservation concern taken up for successful cultivation is far too low to make any significant ameliorative impact on wild collections. With nearly 50% of the wild collections being of destructive nature i.e. where roots/ rhizomes/ bulbs, whole plants, bark, wood, etc. is harvested, the pressure on the wild medicinal plant resources is also increasing. Wild populations of many key Indian medicinal plant species are reported to have declined due to over-collection to supply domestic and foreign medicinal markets (TRAFFIC India, 1998). 344 medicinal plant species have already been assessed to be facing different categories of threat to their very existence (FRLHT database).

The forests form the single major source of wild harvests. Different states in the country have different policies and guidelines for management and harvest of medicinal plants. In most of the States, however, a 3-4 year rotation is prescribed under the Forest Working Plans for wild harvest from a forest area in respect of the species that involve destructive harvests to facilitate regeneration and recouping of wild populations. In case of species like Tamarind, Mahua, Sal, Amla, etc. where the produce is in the form of fruits or flowers, annual wild harvesting is permitted. State Forest Departments, as custodians of forest land, have been collating and maintaining information in respect of wild harvest of all forest produce, including medicinal plants, on annual basis and incorporating the same in their Annual Administration Reports.

Harvesting of self grown medicinal plants from landscapes outside forests including agriculture fields, fallow lands, road sides, water bodies, waste lands, etc., forming another important supply source of botanical raw drugs is, however, goes on without any regulatory mechanism. Thus, no record of harvest from such areas is maintained by any agency.

In addition to the harvesting regulations prescribed under the Forest Working Plans, the wild harvest and mechanism of wild harvest is also subject to regulations under the following legislations:

The Indian Forest Act, 1927: This federal Act empowers the government to notify 'forests' and vests the government with the authority on forest produce of such notified forests. Nearly 24% of the country's geographical area is notified as forest and is under the administrative control of forest departments of different States. Most medicinal plants are covered under sub-section 2(4)(b) of the Act, and are not subject to regulations unless extracted from the forests. However, some items such as kuth, myrobalans, bark and wood-oil from certain trees are covered under sub-section 2(4)(a) of the Act; and subsequent State amendments to the Act have added several medicinal species to this sub-section subjecting these species to regulations regardless of origin. The Act also empowers the government to regulate through appropriate Rules the harvesting of trees notified as 'reserved' or collection of other NTFPs.

The Act, as part of settlement of rights at the time of constitution of forests into 'reserve' or 'protected', admits some rights of local communities to make wild collection of forest produce for self use and/ or barter, except in case of species that are 'reserved', 'nationalised' or prohibited for collection under other Acts. Wild collection, however, is formalised and regulated in different ways in different States. In some States like Himachal Pradesh, the local wild gatherers get registered with the local forest department and get permits to make wild collections in the given time frame only. In some other States like Uttarakhand, the local Van Panchayats have been entrusted with the responsibility of wild harvests through local communities. In Madhya Pradesh and Chhatisgarh, local communities can make free wild harvest of medicinal plants. However, in case of 'nationalised' species, the collection is through JFMCs. In States like Karnataka, the wild collection in respect of 'nationalised' species is done through auction of forest blocks.

The Wildlife (Protection) Act, 1972: This federal Act, while making no specific mention of medicinal plants, protects 'specified' plants species, as enlisted in Schedule-VI of the Act, prohibits picking, uprooting, etc. of such listed plants growing in the wild. Specific provisions related to 'protection of specified plants' have been made in Sections 17A to 17H (Chapter IIIA) of the Act, of which those related to wild harvest, and trade are as follows:

Section 17A: Prohibition of picking, uprooting etc. of specified plants. Save as otherwise provided in this chapter, no person shall -

a) Willfully pick, uproot, damage, destroy, acquire or collect any specified plant from forest land and area specified by notification by the central government.
b) Possess, sell, offer for sale, or transfer by way of gift or otherwise, or transport any specified plant, whether alive or dead, or part of derivative thereof.

Section 17D: Dealing in specified plants without license prohibited.

(1) No person shall, except under and in accordance with a license granted by the chief wild life warden or any other officer authorized by state government in this behalf, commence or carry on business or occupation as a dealer in a specified plant or part or derivative thereof.

In as far as medicinal plants are concerned, one very important Himalayan medicinal plant species i.e. Kuth (*Saussurea costus*) is enlisted in the Schedule-VI of the Act. Many State governments have enlisted more number of state-specific species of conservation concern under Schedule-VI of the Act.

The Biological Diversity Act, 2002: This federal Act envisages achieving three main objectives, i.e. (a) conservation of biodiversity; (b) sustainable use of biological resources; and (c) equity in

sharing benefits from such use of resources. Section 38 of the Act provides for notifying species of conservation concern and prohibiting their wild collection and trade. Currently 118 plant species have been notified under this section across the country vide State-wise notifications in respect of 17 states.

Biological Diversity Rules, 2004: These Rules outline the procedures to be followed for access to biological resources (wild plants and animals, crops, medicinal plants, etc), their commercial utilization, transfer of rights of research, and intellectual property rights related to biodiversity. At the local level the Act provides for the constitution of Biodiversity Management Committee (BMC) for the purpose of promoting conservation including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms. As per Sec 41(1) of the Rules "every local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling of knowledge relating to biological diversity".

'Local bodies' means 'Panchayats' and 'Municipalities' and in the absence of any Panchayats or Municipalities, 'institutions of self-government' constituted under any other provision of the Constitution or any Central Act or State Act. Though the Section 41 (v) of the rules envisages a broad role of the BMC, the main function of the BMC is to prepare People's Biodiversity Register (PBR) in consultation with local people. The Register is to contain comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them.

Panchayat (Extension to Scheduled Areas) Act, 1996 (PESA): This Act extends the provisions of the 73rd Constitutional Amendment 1993 to the Schedule V Areas of the country, and accords statutory status to the Gram Sabhas in Schedule V areas and recognises the prevailing traditional practices and customary laws. State governments are required to pass suitable legislations to make the provisions of other policies and programmes consistent with PESA. It provides for the management and control of all the natural resources in the hands of people living in the Schedule Areas. The Act creates scope for community based conservation measures, and intends to hand over the ownership rights over Minor Forest Produce (MFP) to local Gram Sabhas and recognizes the indigenous systems and local best practices. Under the Act the Gram Sabha is empowered to sanction/ or dismiss lease agreements and development projects (such as mining, sand quarrying etc.) and has the powers to articulate measures to prevent land alienation. Some of its key provisions spell out the extent to which the Gram Sabha can exercise control over community resources and MFPs.

Some states, like Himachal Pradesh, have devolved powers to manage MFPs to Panchayats through notifications. However 'MFP' per se remains undefined under the Act, leaving States to develop their own lists of entities as MFPs. Implementation of the provisions of this Act in as far as MFPs are concerned is rather limited due to weak enabling environment. The Act is wished to be implemented with a mere notification based on a make-belief that communities have adequate knowledge and resources to manage MFPs. Thus, implementation of the Act does not have any program to build capacity of the Panchayats in effective implementation of the MFP conservation protocols and management of database of wild harvests.

Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, (FRA): The FRA recognizes and vests secure community tenure on 'community forest resources', which are defined as common forest land within the traditional or customary boundaries of the village or seasonal use of landscape in case of pastoral communities, including reserved forests, protected forests and protected areas such as sanctuaries and national parks to which the community had traditional access. The FRA provides for restitution of traditional forest rights to forest dwellers across India, including individual rights to cultivated land in forested landscapes and collective rights to control, manage and use forests and its resources as common property. The salient provisions related to community rights, listed in Chapter 2 of the Act, cover the following rights over all forest lands that forest-dwelling scheduled tribes (ST) and other traditional forest dwellers are entitled to.

Relevant Sections of the FRA

Section 2 (i) defines MFPs to include all non-timber forest produce of plant origin, including bamboo, brushwood, stumps, cane, tussar, cocoons, honey, wax, lac, tendu or kendu leaves, medicinal plants and herbs, roots, tubers and the like.

Sub-Section 1 (b) of Section 3 provides for community rights such as usufruct (nistar), and confers the right of ownership and access to collect, use and dispose of MFPs traditionally collected within or outside the village boundary.

Sub-Section 1 (c) of Section 3, further clarified under Rule 2 (d) covers local-level processing, value addition and transportation of MFPs in forest areas by head-loads, bicycle and handcarts for use or sale by the gatherer or community for their livelihood. The use of motor vehicles is regulated by existing transit rules.

Sub-Section 1 (d) of Section 3 covers other community rights for use or entitlements, such as fish and other products of water bodies, grazing (both settled and transhuman) and access to traditional seasonal resources by nomadic or pastoral communities.

Sub-Section 1 (g) of Section 3 covers rights to convert pattas, leases or grants of forest lands issued by a local authority or state government into titles.

Sub-Section 1 (i) of Section 3 covers the right to protect, regenerate, conserve or manage any community forest resource that forest dwellers have been traditionally protecting and conserving for sustainable use.

Sub-Section 1 (k) of Section 3 covers the right of access to biodiversity and community rights to intellectual property and traditional knowledge related to biodiversity and cultural diversity.

Sub-Section 1 (l) of Section 3 covers any other traditional rights customarily enjoyed by STs or other traditional forest dwellers that are not mentioned in the earlier clauses, excluding the traditional right to hunt, trap or extract a part of the body of any species of wild animal.

Issues: Field visits and discussions with stakeholders about the efficacy of implementation of the legislative provisions in respect of wild harvest of medicinal plants bring out the following issues:

- Implementation of Working Plan Prescriptions: Working plan prescriptions about rotational harvest from the forests are far from fully implemented due to staff constraints in many States, resulting in clandestine removals from even areas that are officially closed for harvesting during a particular year. The wild populations of many species viz. *Paris polyphylla*, *Trillidium govanianum*, and *Fritillaria roylei* have succumbed to this high annual harvesting pressure pushing these species towards possible extinction.

- Restrictions under Schedule-VI of Wildlife (Protection) Act, 1972 and Biological Diversity Act, 2002: The federal Act has listed Kuth (*Saussurea costus*) under this schedule. With wild populations of Kuth limited to small pocket in Kashmir valley, the major Kuth supplies in trade come from cultivation in Lahaul valley in Himachal Pradesh with some supplies coming from Uttarakhand. However, its extent of cultivation is getting reduced every year due to complex and long drawn formalities required for trade of the cultivated material. The regulatory regime under the Act needs review to facilitate cultivation of such species of conservation concern. A similar action to review Section 38 of the Biological Diversity Act, 2002 is also required, so that species of conservation concern can be brought under 'Action List' from the present passive 'Negative List'.

- Data Gap in Respect of Wild Harvest: Consequent upon the implementation of PESA and FRA, powers to manage MFPs have been devolved to the Panchayats and the traditional forest dwellers. Guidelines and protocols of maintaining database of wild harvests by Panchayats and traditional forest dwellers under this new arrangement and its state level compilation are, however, yet to be developed and institutionalized. With the State Forest Departments no gathering and collating the same, there is a huge data gap in respect of the wild harvest of medicinal plants from forests. Appropriate provisions to bridge this gap are urgently needed to be put in place.

10.3. Cultivation of Medicinal Plants

Cultivated medicinal plants make significant contribution towards supplies of many herbal raw drugs. The supply source of some of the medicinal plants like Isabgol, Tulasi, Senna, Mentha, etc. is only cultivation and their cultivation has been well integrated into local agricultural practices. The produce in respect of such species is treated as normally traded commodity under section 40 of the Biological Diversity Act, 2002. As such cultivation of all such species that are not found in the wild in India is free from any forest and biodiversity related regulations and can be freely practiced to fulfill market needs.

Many other medicinal plant species like Amla, Bach, Basuti, Musli, Kuth, Ashvagandha, Shatavari, etc. are found in the wild but are also cultivated. The market demand of such species is met from both the wild collections as well as from cultivation. It is the cultivation of such species that are also found in the wild that attracts regulations under forest and biodiversity Acts.

Cultivation of specified species enlisted in Schedule-VI of the Wildlife (Protection) Act, 1972, viz. 'Kuth' is regulated in accordance with Section 17C (Chapter IIIA) of the Act:

Section 17C: Cultivation of specified plants without license prohibited.

(1) No person shall cultivate a specified plant except under and in accordance with a license granted by chief wild life warden or any other officer authorized by state government in this behalf.

(2) Every licence granted under this section shall specify the area in which and the conditions, if any, subject to which the licensee shall cultivate a specified plant.

Some States, like Himachal Pradesh, have notified their own lists of medicinal plants and made it mandatory for the farmers to get registered with the Forest Department before taking up their cultivation. Many State governments like Madhya Pradesh have, however, exempted cultivation of medicinal plant species from under the purview of any such regulatory mechanisms to enable farmers to practice their cultivation freely. The notification of some species of conservation concern under Section 38 of the Biological Diversity Act, 2002, however, brings such notified species under strict trade regulations, putting a dampener on their cultivation.

10.4. Transportation and Trade of Medicinal Plants

The herbal raw drugs harvested from wild resources or from cultivation are required to be transported from production sites to the trade and eventual consumption centres including exports. Such transportation and trade is governed under various regulations and international conventions.

Forest Produce Transit Rules: Export of wild collected medicinal plants, and the native cultivated medicinal plants, is regulated under the Forest Produce Transit Rules made under the Indian Forest Act, 1927. These Rules prescribe procedure for storage and export of herbal raw drugs from the production site, and each consignment of herbal raw drug should be transported under an Export Permit issued by the authorized officer on deposit of some notional Export Permit Fee. The State of Himachal Pradesh has put in practice dual system of issuance of Export Permit. Whereas, the authority to issue Export Permit in respect of common listed species has been devolved to the Panchayat Pradhans, the authority to issue Export Permits in respect of medicinal plant species of conservation concern lies with the Divisional Forest Officer. The government of Madhya Pradesh has done away with the system of Export Permits expect in case of transport of 'notified' species. In most of the other States, the Divisional Forest Officers continue to issue Export Permits.

Transit Rules also provide authority to the government to prohibit the export of forest produce obtained from a species considered to be of conservation concern. It has resulted in different States notifying different species for trade prohibition. For example, the trade of *Taxus wallichiana* is prohibited in Himachal Pradesh, whereas it is allowed in Uttarakhand. Similarly, the trade of 'Kuth' is prohibited in Jammu & Kashmir where the species is found in the wild. However, 'Kuth' is extensively cultivated in Lahaul (Himachal Pradesh) and its trade is allowed under provisions of Wildlife (Protection) Act, 1972. This type of non-uniformity in the Transit Rules, especially in neigbouring States, results in clandestine removals and trade on one hand and avoidable delays at State borders during inter-state transportation of the material on the other. There is an urgent need to harmonise these Rules to facilitate smooth movement of herbal raw drugs across various states in the country.

Indian Forest Act 1927 and State Transit rules Provisions of Transit rules for movement of medicinal plants for some States	
State Rules	**Regulatory provisions**
The West Bengal Forest Produce Transit Rules, 1955	Permit required for movement of produce within area specified.
	Certificate of origin required for Forest produce from depot, private lands and khas mahal forests in area specified.
	Species: Chirata, Manjista, Cinnamon, Piper longum, Rauvolfia serpentina
Maharashtra Forest Rules 2014	Transit Pass required for movement of forest produce into or from or within any district
	No Transit pass required for transport of forest produce within the limits of village/town
	Species regulated : Rosha grass including oil, Rauvolfia serpentine
The Rajasthan Forest Produce (Transit) Rules, 1957	No forest produce shall be moved into or from or within any area in the State without a pass issued by a Forest Officer or person duly authorized and in accordance with the conditions of such pass, including route and destination specified.
	No pass shall be required for the removal of any forest produce which has been extracted from the forest for consumption
Kerala Forest Produce Transit Rules, 1975	Transit pass required for any movement of the forest produce
	Separate passes for forest produce from Government land and private land
	In case trader/purchaser also wishes to export from India, clearance order required from DFO
The Orissa Timber and other Forest Produce Transit Rules, 1980	No transit permit shall be required to cover transit of forest produce for transport of minor forest produce within the district except lac, tassar, Myrabolans, gums and resin, Sal seed, Tamarind, Gums, roots of Patal garuda, Sandalwood
	All forest produce in transit by land, rail or water shall be covered by a “Transit Permit” issued free of cost by the DFO or by the ACF
The HP Forest Produce Transit (Land Route) Rules, 2013	Regulate the movement of forest produce by land routes into from and within the territories of HP.
	Schedule I of the rules provides the list of plant species growing on private land to be exempt from transit pass. Certification of cultivation required for their movement
	Schedule II of the rules provides a list of species which attract permit/pass for movement. Private cultivators of these species to be registered with concerned DFO.
The Arunachal Pradesh Forest Act, 2014	Prohibits the import, export, collection or moving of forest produce without a pass
	Prescribes the routes by which alone forest produce may be

	imported into, exported from or moved within the territories
Andaman and Nicobar Island Forest Produce Transit Rules, 1966	Requirement of a transit pass applies to any movement of forest produce from any source
	TP issued by Forest department on payment of a specific fee.

Trade of Plants listed in CITES Appendices: India as a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has put in place provisions related to export of plants, plant portion and their derivatives and extracts obtained from the wild. CITES is implemented in India through a combination of the Wildlife (Protection) Act, 1972 and the Export and Import Policy (EXIM) of the Foreign Trade (Development and Regulation) Act, 1992 and the Customs Act, 1962. The Wildlife (Protection) Act prohibits wild harvest of and regulates export of all six CITES Appendix-I plant species native to India, of which one, 'Kuth' (*Saussurea costus*), is an important medicinal plant. The regulations prescribed for export of species enlisted in CITES Appendix-I are given below.

Trade in CITES Appendix-I Species

Export of Appendix-I Specimens (Article III.2):

The export of any specimen of a species included in Appendix-I shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:

(a) Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;
(b) Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora;
(c) Management Authority of the State is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and
(d) Management Authority of the State of export is satisfied that an import permit has been granted for the specimen

Import of Appendix-I Specimens (Article III.3):

The import of any specimen of a species included in Appendix-I shall require the prior grant and presentation of an import permit and either an export permit or a re-export certificate. An import permit shall only be granted when the following conditions have been met:

(a) Scientific Authority of the State of import has advised that the import will be for purposes which are not detrimental to the survival of the species involved;
(b) Scientific Authority of the State of import is satisfied that the proposed recipient of a living specimen is suitably equipped to house and care for it; and
(c) Management Authority of the State of import is satisfied that the specimen is not to be used for primarily commercial purposes.

Re-export of Appendix-I Specimens (Article III.4): The re-export of any specimen of a species included in Appendix I shall require the prior grant and presentation of a re-export certificate. A re-export certificate shall only be granted when the following conditions have been met:

(a) Management Authority of the State of re-export is satisfied that the specimen was imported into that State in accordance with the provisions of the present Convention;
(b) Management Authority of the State of re-export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and
(c) Management Authority of the State of re-export is satisfied that an import permit has been granted for any living specimen.

In addition to the plant species listed in CITES Appendix-I, there is a long list of plants of conservation concern that have been enlisted under CITES Appendix-II. Foreign trade of these species is also regulated. The Ministry of Environment, Forest and Climate Change has notified the following list of 113 species of conservation concern vide its circular dated 04.10.2000, the export of which requires 'Certificate of Cultivation' or 'Legal Procurement Certificate' from the designated authorities of the Forest Departments.

1 *Aconitum* species	31 *Curcuma caesia*	61 *Hyoscyamus niger*
2 *Atropa* species	32 *Cayratia pedata*	62 *Inula racemosa*
3 *Aristolochia* species	33 *Coscinium eenestratum*	63 *Ilex khasiana*
4 *Angiopteris* species	34 *Cyclea fissicalyx*	64 *Iphignia indica*
5 *Arundinaria jaunsarensis*	35 *Decalepis hameltonii*	65 *Janakia arayalpathra*
6 *Acorus* species	36 *Diptreocarpus indicus*	66 *Kampferia galanga*
7 *Artemisia* species	37 *Dyzoxylum malabaricum*	67 *Kingiodendron pinnatum*
8 *Aquilaria malaccensis*	38 *Drosera* species	68 Kuth *(Saussurea lappa)*
9 *Angelica glauca*	39 *Didymocarpus pedicellata*	69 Ladies slipper orchid
10 *Arnebia benthamii*	40 *Dolomiaea pedicellata*	70 *Luvunga scandens*
11 *Adhatoda beddomei*	41 *Dioscorea deltoidea*	71 *Lamprachaenium microcephalum*
12 *Ampelocissus indica*	42 *Epedra* species	
13 *Berberis kashmirana*	43 *Euphorbia* species	72 *Meconopsis aculeate*
14 *Berberis petiolaris*	44 *Eulophia cullenii*	73 *Madhuca diplostemon*
15 *Berberis lycium*	45 *Eulphia ramentacea*	74 *Madhuca longifolia*
16 *Bunium persicum*	46 *Fritillaria roylei*	75 *Meconopsis betonicifolia*
17 *Balanophora* species	47 *Frerea indica*	76 *Nardostachys* species
18 *Berberis aristata*	48 *Gynocardia odorata*	77 *Nervilia aragoana*
19 *Beddomes cycad*	49 *Gentiana kurroo*	78 *Niligirianthus ciliatus*
20 *Blue vanda*	50 *Gloriosa superba*	79 *Osmunda* species
21 *Coscinium fenestratum*	51 *Gnetum* species	80 *Orchidaceae* species
22 *Costus speciosus*	52 *Garcinia travancorica*	81 *Pterocarpus santalinus*
23 *Colchicum luteum*	53 *Gymnema khandalense*	82 *Physochlaina praealta*
24 *Commiphora whightii*	54 *Gymnema montanum*	83 *Praltia serpumlia*
25 *Coptis* species	55 *Hedychium coronarium*	84 *Pitcher* plant
26 *Ceropegia* species	56 *Hedychium spicatum*	85 *Podophyllum hexandrum*
27 *Cyatheaceae* species	57 *Hellotrophium keralense*	86 *Prezwalskia tangutica*
28 *Cycadacea* species	58 *Humboldtia vahliana*	87 *Panax pseudo ginseng*
29 *Coptis teeta*	59 *Hydnocarpus alpina*	88 *Picrorhiza kurroa*
30 *Craterostigma plantagineum*	60 *Hydnocarpus* species	89 *Piper barberi*

90 *Rheum nobile*	98 *Salacia oblonga*	106 *Taxus wallichiana*
91 *Rhododendron* species	99 *Salacia reticulata*	107 *Trichopus zeylanicus*
92 *Rheum emodi*	100 *Shorea tumbugaia*	108 *Trichosanthes anamalaiensis*
93 *Red vanda*	101 *Strychhnos aenea*	109 *Utleria salicifolia*
94 *Rauvolfia serpentina*	102 *Swertia lawii*	110 *Urginea* species
95 *Saussurea gossyphora*	103 *Syzygium travancoricum*	111 *Valeriana iatamansi*
96 *Saussurea abvallata*	104 *Strychnos potatorum*	112 *Valeriaia leschenaultii*
97 *Saussurea simpsoniana*	105 *Swertia chirata*	113 *Vateria macrocarpa*

Trade in plants and plant portions of species listed in the Wildlife (Protection) Act, 1972 or in the in Appendix-I of the CITES or in the Export Licensing Note I is allowed if the produce is obtained from cultivation carried out in accordance with the rules. For such export, the exporter must have Certificate of Legal Possession issued by the jurisdictional DFO. For species listed under Schedule VI of the Wildlife (Protection) Act, 1972, the trader needs to comply with provisions under Section 17-A of the Wildlife (Protection) Act, 1972. For cultivation of CITES Appendix-I species, the nursery/ land where the plants acquired are maintained and multiplied/ cultivated is required to be registered with the Assistant Management Authority. The CITES Appendix-I and WPA Schedule-VI plants cultivated this way are eligible for export, subject to obtaining a transit pass from the concerned DFO if the plants were cultivated on sites within forests, or a Certificate of Cultivation from a District Agriculture, Horticulture or Forest Officer if cultivated at sites outside forests. Export Licensing Note 2 included in the schedule states that "…however, in respect of CITES species, a CITES permit of export shall be required". In respect of the foreign trade in derivatives, extracts and formulations prepared out of plant species listed under WPA or CITES Appendix-I, the trade is free provided the 'formulations' mean and are limited to the "products which may contain portions/ extracts of plants on the prohibited list but only in unrecognizable and physically inseparable form" and "value-added formulations as well as herbal Ayurvedic" (Chapter 12, Export Licensing Note 3). The provisions further make it clear that "no certificate from any authorities whatsoever shall be required for their [formulations] export," implying that no CITES permits would be required for such exports.

Foreign trade in respect of species listed in Appendix II and III of CITES whether wild or cultivated is regulated only to the extent that the exporter needs to have Certificate of Legal Possession issued by jurisdictional DFO, and the export is subject to CITES provisions. The regulations further stipulate the exports to be only from the ports of Mumbai, Nhava Sheva, Kolkata, Cochin, Delhi, Chennai, Tuticorin, Amritsar, Calicut and Thiruvananthapuram. Violations of the provisions of the EXIM Policy constitute an offence under the Customs Act and are dealt with by Customs officials.

Import of CITES listed plants, their products and derivatives are subject to the provisions of CITES. There is, however, no negative list of imports. The legal requirements for import of medicinal includes Import permit of CITES issued by the Regional Deputy Director (Wildlife), Export permit of CITES by exporting country. For import of seeds for planting/ sowing import permit under Plants, Fruits and Seeds (Regulation of Import into India) Order, 1989, is required. Similarly, Import license is required for import of seeds for consumption purpose.

The EXIM Policy - Plants Prohibited for Exports: Policy on Foreign trade in wildlife and wildlife products, prepared by the Ministry of Commerce, is established via the EXIM policy, which is revised periodically. This policy, is decided in consultation with the Director of Wildlife Preservation of the Government of India, and the CITES Management Authority for CITES

implementation in the country. The Director of Wildlife Preservation has four Regional Deputy Directors and four sub-regional offices of wildlife preservation, serving as assistant CITES Management Authorities. The EXIM policy is put into effect via the provisions of the Foreign Trade (Development and Regulation) Act (1992) and enforced via the Customs Act. The current policy is effective from 1st April, 2015 - 31st March, 2020

The Ministry of Commerce, vide its Notification No.24 (RE-98)/1997-2002, dated the 14.10.1998 (See Chapter 8 for full Notification) has placed 29 medicinal plant species in the negative list of export under Section 5 of the Foreign Trade Development & Regulation Act, 1992 (No.22 of 1992) read with Paragraph 4.1 of the Export and Import Policy 1997-2002. The list of these 29 species is given in Schedule 2 Appendix 2 of the book titled "ITO (HS) Classification of Export and Import Items 1997-2002" relating to export of plants, plant portion sand their derivatives and extracts obtained from the wild. The notification, thus, prohibits the export of 29 plants, plant portions and their derivatives and extracts as such obtained from the wild except the formulations made therefrom.

Government of India
Ministry of Commerce
Notification No.24 (RE-98)/1997-2002
New Delhi, Dated the 14.10.98

S.O (E). Attention is invited to para 4 of Notification no.2 (RE - 98)/1997-2002 dated the 13th April, 1998 relating to export of plants, plant portion and their derivatives and extracts obtained from the wild.

In exercise of the powers conferred under Section 5 of the Foreign Trade (Development & Regulation) Act, 1992 (No.22 of 1992) read with Paragraph 4.1 of the Export and Import Policy 1997-2002, the Central Government hereby makes the following amendment in the Schedule 2 Appendix 2 of the book titled "ITC (HS) Classification of Export and Import Items 1997-2002" relating to export of plants, plant portion sand their derivatives and extracts obtained from the wild.

The export of under mentioned 29 plants, plant portions and their derivatives and extracts as such obtained from the wild except the formulations* made therefrom, is prohibited:

1	Beddomes' cycad (*Cycas beddomei*)	16	Pterocarpus santalinus (Red Sanders)
2	Blue Vanda (*Vanda coerulea*)	17	*Taxus wallichiana* (Common Yew or Birmi leaves)
3	*Saussurea costus*	18	*Aquilaria malaccensis* (Agarwood)
4	Ladies slipper orchids (*Paphiopedilium* species)	19	*Aconitum* species
5	Pitcher plant (*Nepenthes khasiana*)	20	*Coptis teeta*
6	Red Vanda (*Renathera imschootiana*)	21	*Coscinium fenestratum* (Calumba wood)
7	*Rauvolfia serpentina* (Sarpagandha)	22	*Dactylorhiza hatagirea*
8	*Ceropegia* species	23	*Gentiana kurroo* (Kuru, Kutki)
9	*Frerea indica* (Shindal Mankundi)	24	*Gnetum* species
10	*Podophyllum hexandrum* (emodi) (Indian Podophyllum)	25	*Kamphergia galenga*
11	Cyatheaceae species (Tree Ferns)	26	*Nardostachys grandiflora*

12	Cycadaceae species	27	*Panax* pseudoginseng
13	*Dioscorea deltoidea* (Elephant's foot)	28	*Picrorhiza* kurrooa
14	*Euphorbia* species (Euphorbias)	29	*Swertia chirata* (Charayatah)
15	Orchidaceae species (Orchids)		

*The term "Formulation" used here shall include products which may contain portions/extracts of plants on the prohibited list but only in unrecognizable and physically inseparable from.

ii) Plants and Plant portions, derivatives and extracts of the cultivated varieties on the above plant species (excluding SI. No. 16) will be allowed for export subject to production of a Certificate of Cultivation from the Regional Deputy Director (Wildlife), or Chief Conservator of Forests or Divisional Forest Officers of the State concerned from where these plants and plant portions have been procured. However, in respect of the cultivated varieties of the species as covered by Appendix 1 (Sl. No.1 to 6 of Paragraph 2 (1) above and Appendix 2 (SI. No.7 to 18 and SI. No. 26 & 28) of Para 2 (1) above, of CITES Permit for export will also be required.

iii) The value added formulations, as defined under sub-para (1) of paragraph 2 above, made out of imported species of plants and plant portions as specified in Sub-para (1) Paragraph 2 now will be allowed to be exported freely without any restriction subject to furnishing of an affidavit to the Customs authorities at the time of export that only the imported plant species as above have been used for the manufacture of value added formulations being exported. In the event of affidavit proving to be false, on the basis of random sample tests, actions would be initiated against the firm under the Foreign Trade (Development & Regulation) Act, 1992.

iv) All formulations - herbal/ Ayurvedic medicines, where the label does not mention any ingredients extracted from these prohibited plants shall be freely exportable without the requirement of any certification from any authorities whatsoever.

v) Export allowed only through the ports of Mumbai, Calcutta, Cochin, Delhi, Chennai, Tuticorin and Amritsar.

3. This issues in public interest.

Sd/-
(N.L. Lakhanpal)
Director General of Foreign Trade

The Negative List of Exports as mentioned above was initially a part of the EXIM Policy 1997-2002. The list, however, continues to be operative since then. It is high time that this Negative List is revisited.

10.5. Foreign Trade under ITC (HS) Codes and its Limitations

Import and export restrictions for specific products in India are established via Indian Trade Classification (ITC) developed in accordance with the internationally standardized tariff nomenclature, known as Harmonized System of Coding (HS), developed and maintained by the World Customs Organization (WCO), an independent intergovernmental organization based in Brussels, Belgium, with over 200 member countries. Under the HS Convention, the contracting parties are obliged to base their tariff schedules on the HS nomenclature, although parties set their own rates of duty. India has adopted the foreign trade coding system in the form of ITC (HS) Codes for its import-export operations. Indian Customs, the designated agency to control and regulate import-export, currently uses a system of an eight digit ITC (HS) Codes for the purposes of foreign trade.

Foreign trade of medicinal plants in India also takes place under this 8-digit ITC (HS) Codes, even as this trade

does not get enlisted fully under any specific major category of ITC (HS) Codes. Analysis of the data of foreign trade compiled and published by the DGCIS reveals that the major diversity of medicinal plants in foreign trade is traded under ITC (HS) Code 1211 and its subsets (39 items) under Chapter 12. Some entities linkable to medicinal plants also get traded under Chapter 9, 13, and 14.

The existing trade classification system tends to club many medicinal plant entities in trade under the heads 'Others' viz. 121190.19, 121190.29, 121190.39, etc. As such, this 8-digit ITC (HS) Code is limited in its applicability to 400-odd medicinal plant entities that are under foreign trade to and from India. This inability of the existing ITC (HS) Codes to provide medicinal plant entity-wise data of exports/ imports is coming in the way of designing and implementing appropriate strategies for development and management of medicinal plant resources in the country. The issue has been discussed in detail in Chapter-8 of this report. There is an imminent need to revisit the ITC (HS) Code and selectively add 2 more digits to some of these Codes to be able to capture the diversity of medicinal plant entities in foreign trade. An indicative model of selective introduction of 2 more digits to the system without any change in the basic structure of to the existing ITC (HS) Codes has been suggested in Chapter-8.

***Gentiana kurroo* - A Red-Listed Himalayan Medicinal Herb**

10.6. Conservation and Research

Many of the medicinal plants have been assessed as Red-Listed and are enlisted in the IUCN Appendices and under the Wildlife (Protection) Act, 1972. However, the immediate response to address the conservation issue related to these plants is to put these under 'Negative' lists. There is no national policy to effect long-term conservation of such threatened medicinal plants. The Foundation for Revitalisation of Local Health Traditions (FRLHT) has, since 1994 under various projects, helped the State Forest Departments of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Chhattisgarh, Arunachal Pradesh and Uttarakhand to establish Medicinal Plant Conservation Areas (MPCAs) as an *in situ* conservation measure of priority medicinal plant species. The National Medicinal Plants Board (NMPB) has also sponsored establishment of MPCAs in other States. However, in the absence of a comprehensive policy and guidelines on the subject, these conservation efforts have become state-specific lacking the national linkages so very important for a national program. Whereas some of the States are maintaining the MPCAs as 'hands off' areas, some other States are undertaking augmentation plantations in these areas.

Similarly, various organizations in the country are working on some or the other aspects of medicinal plants. In the absence of any national strategy on the subject, the organizations are left to themselves to decide upon and carry out research as they deem fit. Whereas there always is a concern about the possible duplication of the efforts, the subjects taken up for research are too varied and far too scattered to result into any tangible result at national level.

10.7. Conclusion

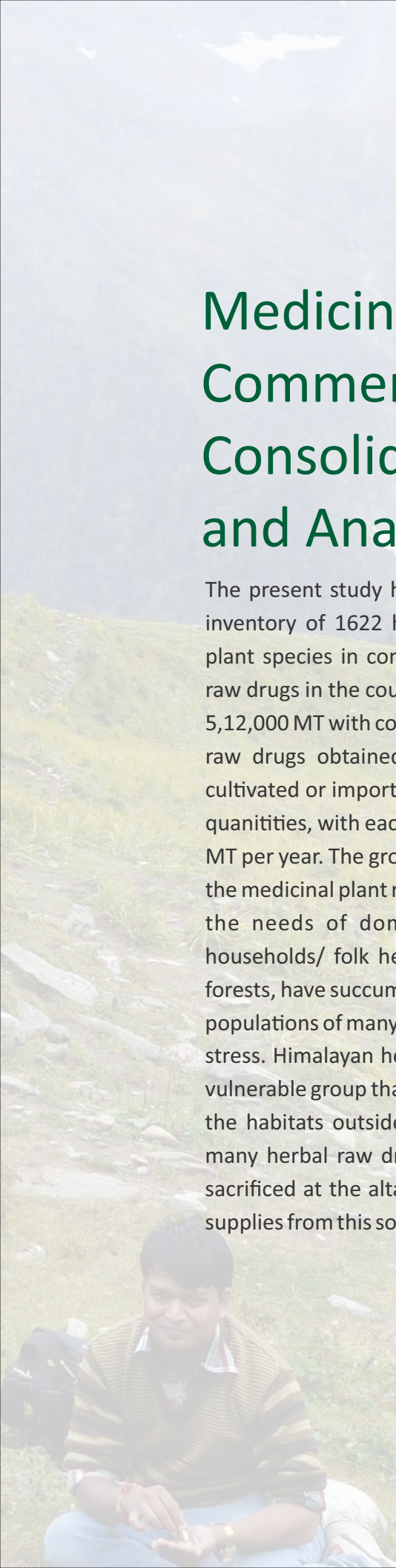
There is, thus, an urgent need to develop a national policy/ strategy for development of medicinal plant sector in the country covering the following broad aspects:

- Long-term *in situ* conservation and *ex situ* conservation
- Medicinal plant conservation areas
- Temporal considerations for long-term availability of medicinal plants for local and commercial use through creation of favourable economic environment for the large-scale cultivation of medicinal plants
- Access for primary health care needs
- Scientific studies and monitoring
- Post harvest handling and value addition
- Rules and guidelines concerning wild harvest, cultivation, and trade – including foreign trade
- Market linkages
- Provisions for quality control
- Awareness generation

11

Medicinal Plant Species in Commercial Demand: Consolidated Inventory and Analysis

The present study has resulted in compilation of a comprehensive inventory of 1622 herbal raw drugs correlated to 1178 medicinal plant species in commercial demand. Total consumption of herbal raw drugs in the country for the year 2014-15 has been estimated at 5,12,000 MT with corresoponding trade value of ₹ 7,000 crore. Herbal raw drugs obtained from 242 medicinal plant species collected, cultivated or imported largely for use in health care are used in high quanitities, with each species being used in quantities exceeding 100 MT per year. The growth of the sector calls for active management of the medicinal plant resource so as to ensure sustained supply to meet the needs of domestic herbal industry, exports and of the households/ folk healers. Many of the species collected from the forests, have succumbed to destructive harvesting pressure with wild populations of many of these species having come under tremendous stress. Himalayan herbs and tropical medicinal trees form the most vulnerable group that needs immediate conservation action. Many of the habitats outside forests, hitherto forming abundant source of many herbal raw drugs, have either become polluted or have got sacrificed at the altar of development, making the herbal raw drug supplies from this source a scarcity.



11.1. INVENTORY OF MEDICINAL PLANT SPECIES IN COMMERCIAL DEMAND

Trade in herbal raw drugs in the country to meet the demands of the domestic herbal industry and for export market largely occurs under the trade names that are usually specific to the region and keep on changing along the trade chain. For example, seeds of 'Indian Liquorice' or 'Red Bead Vine' (*Abrus precatorius*), are traded under the names 'Ratti', 'Chirmati', 'Chinnoti', 'Gundumani' and 'Gunja' in different herbal raw drug markets. As can be noted these names are not just dialectal variations, these are the names assigned to this entity in different native languages. On the other end of the spectrum are herbal raw drug entities derived from different plant sources but having a common trade name. For example, whole plants of *Holostemma ada-kodien'* (a twiner), *Leptadenia reticulata'* (a large climber), and '*Flickingeria macraei*' (an orchid) are traded as 'Jivanti'. Phonetic variations in respect of names of some entities along the trade chain only add to the complexity. For example, one of the trade names of the flowers of Hibiscus rosa-sinensis is 'Gurhal Phool'. However, the flower of *Rhododendron arboreum* that are also red in colour and are locally known as 'Gularh phool', get traded as the flowers of *Hibiscus rosa-sinensis* due to phonetic closeness of the names of these two entities. All these scenarios i.e. single entity having multiple trade names, multiple entities having single trade name, or names with phonetic closeness, make it difficult to correlate the entities in trade to their taxonomic nomenclature. This scenario has serious implications on (a) the authenticity of the material being used by the industry, and (b) the management of the resource in wild as well as under cultivation.

Need for comprehensive inventory of the botanicals in commercial demand (i.e all those herbal raw drugs that are in active/ potential trade for use by end users) duly correlated to their taxonomic identities has long been felt. Ved and Goraya (2008) made the first serious attempt in making such an inventory that listed 1289 raw drug entities correlated to 960 plant species. This work remains seminal and forms base for the current study also.

Consolidated Inventory of Medicinal Plant Species in Commercial Demand in India for the year 2014-15 enlists 1622 herbal raw drug entities correlated to 1178 plant species.

Synthesis of the data gathered under the present study with respect to (a) consumption by the domestic herbal industry (Chapter-3) and by rural households (Chapter-4), (b) botanicals collected from the wild (Chapter-5) and under cultivation (Chapter-6), (c) botanicals recorded from trade for commercial use in Indian Systems of Medicine (Chapter-7), and (d) botanicals in foreign trade (Chapter-8) has resulted in an inventory of 1622 botanicals correlated to 1178 plant species. Some species reported to be in use in very small quantities and where samples could not be procured for confirmation have not been included in the consolidated inventory.

Consolidated Inventory of Medicinal Plant Species in Commercial Demand in India for the year 2014-15 is placed as Annexure-I.

This comprehensive inventory has resulted in addition of 218 medicinal species in commercial trade to the previous inventory prepared by Ved and Goraya (2008). This increase in the number of species captured during the survey is primarily on account of the larger sample size of domestic herbal industry and the herbal mandis. The herbal raw drug consumption data being maintained by the domestic herbal units pursuant to the addition of Section 157 (A) to the Drug and Cosmetics Act, 1945 in July 2008 has also helped in better documentation of the herbal raw drugs in trade.

A critical review of this inventory of 1178 species reveals that 150 species recorded in trade in the previous inventory by Ved and Goraya (2008) have not been recorded either as being consumed by the domestic herbal industry or as being traded in the herbal mandis under the present survey. Whereas part of this could be ascribed to the limitations of the sampling design, significant part of this is due to the issues pertaining to equivalents and substitutes and correlation of traded raw drug entities to their botanical nomenclature. All these 150 species, not recorded in active commercial trade under the present study, have, however, been retained in the consolidated inventory as historical record and to enable further investigations.

The botanical nomenclature in respect of plants enlisted in the consolidated inventory of medicinal plant species in commercial demand has been updated in accordance with the nomenclature being currently followed by the Botanical Survey of India, and the Plant List, 2013. The commonly used synonyms recorded during survey of herbal mandis and the domestic herbal industry have been retained in the form of equivalents. For example, for 'Shikakai', the more prevalent botanical name used in trade is *Acacia concinna*, even as its accepted botanical nomenclature has long been updated to *Acacia sinuata*. To maintain the confidence and familiarity of the traders and domestic herbal units about the herbal raw drugs they trade/ use, the issue has been addressed as under:

S. No.	Botanical Name	Family
-	*Acacia concinna* (Willd.) DC.	Ref.: *Acacia sinuata*
20	*Acacia sinuata* (Lour.) Merr. [= *A. concinna* (Willd.) DC.]	MIMOSACEAE

Thus, any person searching for trade of *Acacia concinna* will get directed to *Acacia sinuata*, the currently accepted name for 'Shikakai'. A total of 237 such taxonomical names have also been included in the consolidated inventory of traded medicinal plants to address the issue of commonly used synonyms. These 237 names are in addition to the list of 1178 species.

An effort has also been made to quantify the trade volumes in respect of species enlisted in the consolidated inventory of traded medicinal plants. Since such quantification is based on limited sampling, the estimated quantification has been given in the form of 12 ranges of estimated trade volumes (dry weight) in metric tonnes (MT), viz. <10, 10-50, 50-100, 100-200, 200-500, 500-1000, 1000-2000, 2000-5000, 5000-10000, >10000, >20000, and >30000. This estimation is based on the data in respect of consumption by the herbal industry and the trade, both domestic and foreign. Estimation of consumption of herbal raw drugs at rural household level has been done separately and has been given separately in brackets for each entity to have better appreciation of the magnitude of such demand. For example -

Botanical Name	Trade Name	Part Used	Source	Trade Volume in Dry Wt. (MT)
Gymnema sylvestre R.Br. ex Schult.	Gudmar, Meshashringi	Leaf	Wild	500-1000 [≈2700]
Ocimum tenuiflorum L. [= *Ocimum sanctum* L.]	Tulsi, Tulasi	Leaf, Seed, Whole Plant	Cultivated	2000-3000 [≈30000]

The commercial demand of 'Gudmar' and 'Tulsi' for the year 2014-15 has been estimated as 500-1000 MT and 2000-3000 MT respectively. However, based on rural household survey, it has been

estimates that an additional ≈2700 MT of 'Gudmar' and ≈30000 MT of 'Tulsi' is being consumed by the rural households across the country for healthcare purposes. This additional information has been provided with a view to create appreciation about the total quantum of herbal raw drug material required annually to meet the commercial and non-commercial needs and to enable the policy makers and the managers better plan resource management through conservation or cultivation.

Herbal raw drug entities like Isabgol (*Plantago ovata*), Senna leaves & pods (*Senna alexandrina*), Chakoda Beej (*Senna tora*), Amla (*Phyllanthus emblica*), Ghritkumari (*Aloe vera*), and Gum Arabic (*Acacia senegal*) remained the top entities in commercial demand with each of these having an annual trade level of around 20000 MT or more.

11.1.1. Profile of Medicinal Plant Species enlisted in the Consolidated Inventory of Medicinal Plant Species in Commercial Demand in India for the year 2014-15

The 1178 medicinal plant species/ taxa enlisted in the consolidated inventory of traded medicinal plants have been subjected to taxonomical profiling, and it has been found that these species/ taxa pertain to 781 genera spread over 177 families. There are 18 families with 20 or more number of enlisted medicinal plant species each (Fig. 11.1).

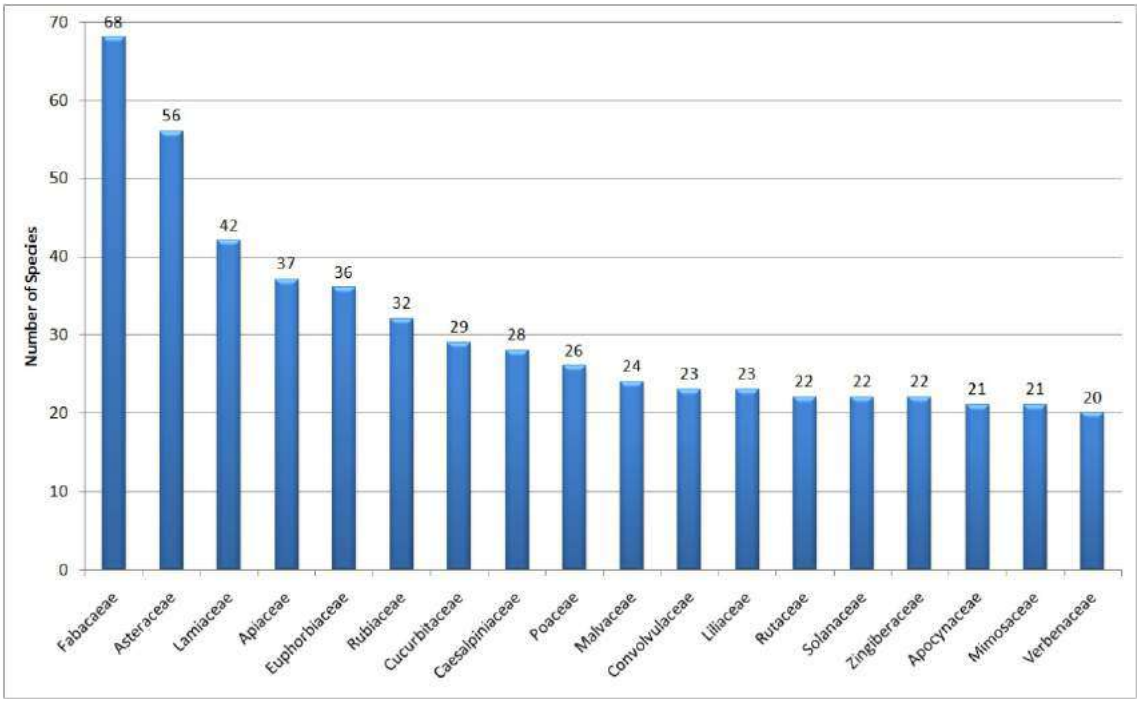


Fig. 11.1: Families with 20 or more number of species enlisted in the inventory

Comparison of the data presented in Fig. 11.1 with the top ten families worked out by Ved & Goraya (2008) reveals that the top ten families continue to account for about one third (32%) of the total species recorded in commercial demand in the country. Moreover, Fabaceae, Asteraceae and Lamiaceae continue to be the top three families in respect of medicinal plant species in commercial demand in the country. The total number of families documented in the present study is 8 more than the 169 families recorded by Ved and Goraya (2008). Analysis of these families as to the group of plants these belong to brings out that 159 of these families belong to 'Angiosperms', of which 136 are dicots and 23 are monocots. Further, 6 families fall under 'Gymnosperms', 9 under 'Pteridophytes', and 3 under 'Fungi and Lichen' group of plants (Fig. 11.2).

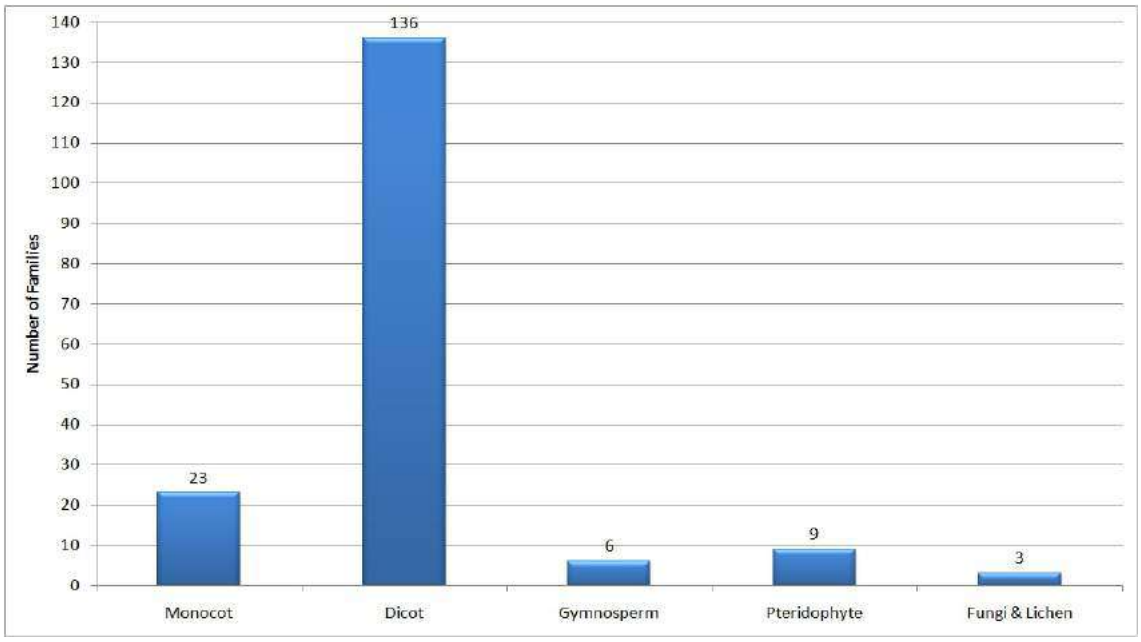


Fig. 11.2: Plant Group-wise Distribution of Families

Of the eight families documented in addition to the ones documented by Ved & Goraya (2008), 6 belong to 'Dicots', 1 to 'Monocots', and 1 to 'Gymnosperms'.

Life form wise analysis of the 1178 medicinal plant species in commercial demand brings out that 314 of the enlisted species are trees, 200 species are shrubs, 166 species are climbers and lianas, and 498 species are herbs including grasses and sedges.

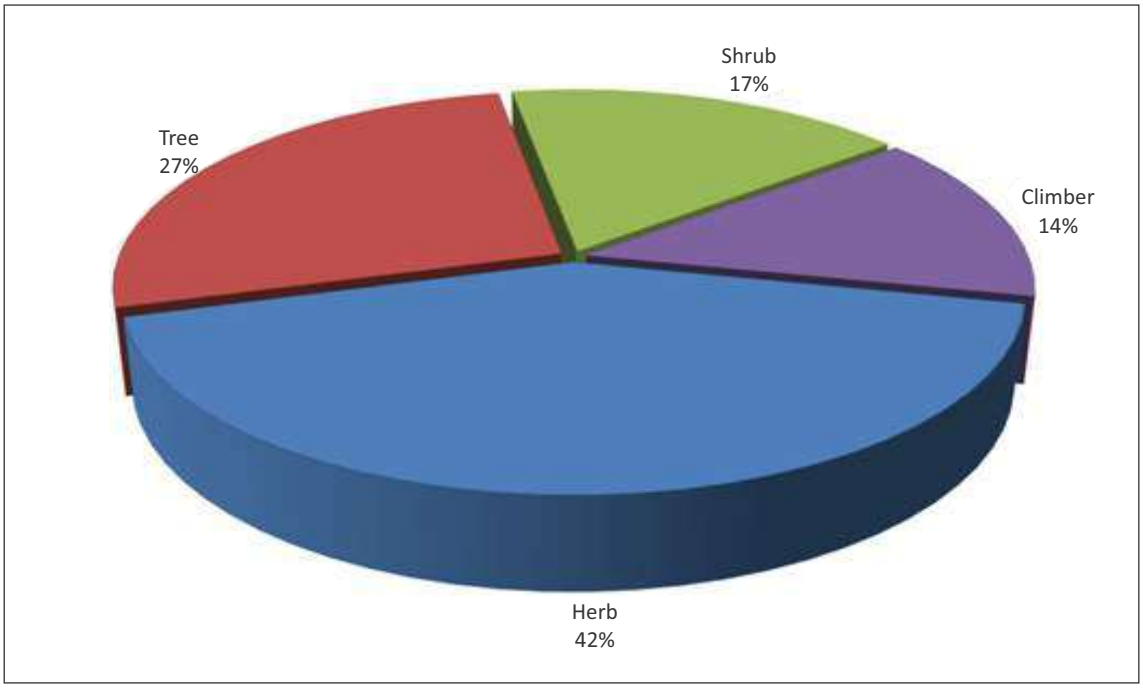


Fig. 11.3: Life Form-wise Distribution of Species

The percentage representation of various life forms in the consolidated inventory of medicinal plant species in commercial demand, despite addition of 218 species to the inventory,

corroborates the percentage of different life forms worked out by Ved & Goraya (2008) i.e. herbs (41%), shrubs (18%), climbers (15%), and trees (26%).

11.1.2. Profile of Herbal Raw Drug Entities enlisted in the Consolidated Inventory of Medicinal Plant Species in Commercial Demand in India for the year 2014-15

The 1622 herbal raw drug entities recorded in commercial demand pertain to different parts of the plants, including whole plants. Part-wise analysis of the 1622 herbal raw drug entities is given below (Fig. 11.4):

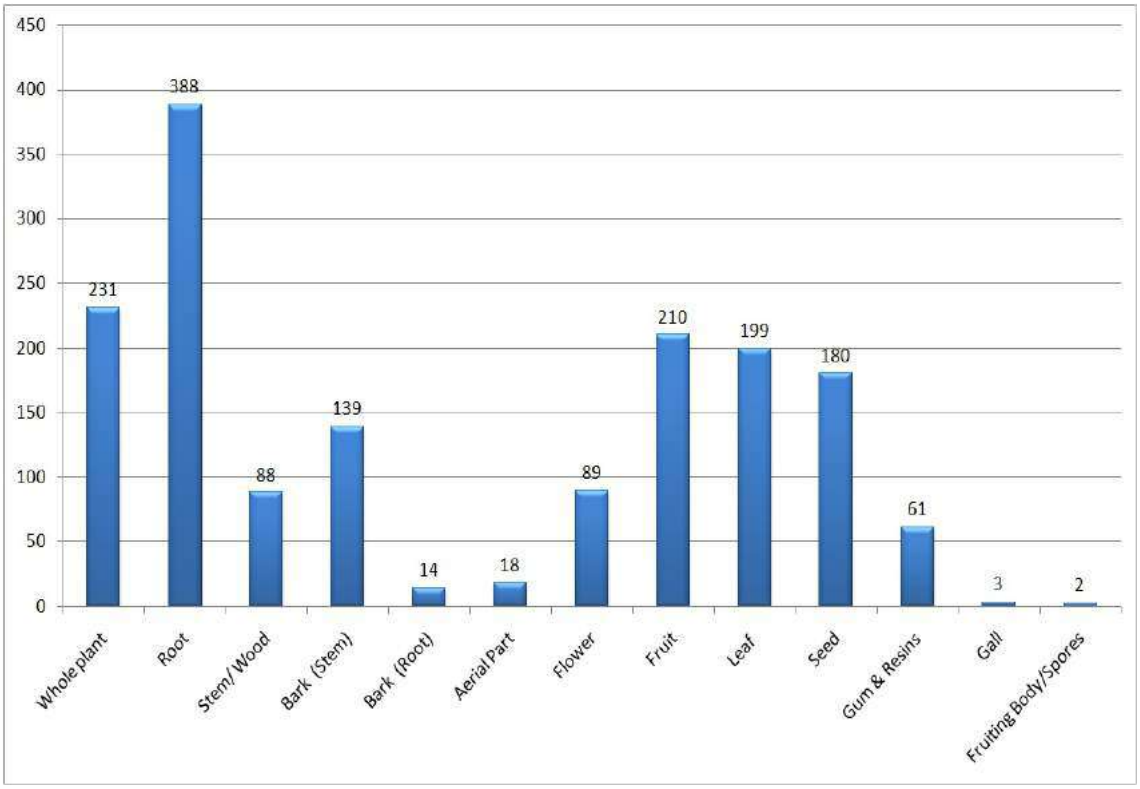


Fig. 11.4: Part-wise Distribution of Herbal Raw Drugs in Commercial Demand

As can be noted from the above, roots/ rhizomes/ tubers/ bulbs and root bark form about 24.8% of the 1622 herbal raw drugs in commercial demand. Similarly, wood and stem bark form 13.9%, and whole plants form 14.2% of the total entities in trade. Harvesting of plants for underground parts, wood, bark or whole plants is essentially destructive in nature, and 52.9% of the medicinal plant species in commercial demand are required to be subject to destructive harvesting to get the required herbal raw drugs. This percentage becomes much higher if the cultivated and imported entities are taken out from the consolidated inventory of medicinal plants in commercial demand. The major sufferers of such destructive harvesting are the trees, where wood or bark forms the herbal raw drug, and their extraction results in death of the tree. Wild populations of many of such trees species have already critically dwindled, putting these tree species under threat of extinction.

11.2. CONSOLIDATED COMMERCIL DEMAND OF HERBAL RAW DRUGS FOR THE YEAR 2014-15

It is well known that large quantities of herbal raw drugs are (a) consumed by the domestic herbal industry, (b) exported to other countries, and (c) used at household and folk healer level for

primary health care. Almost all the herbal raw drug entities consumed by the herbal industry or exported to other countries pass through various trade channels and form major part of the commercial demand of these entities. Rural communities on the other hand are known to use a large number of plant species, mostly specific to the area. Most of these species are neither in foreign trade nor used in making any commercial herbal formulations. The rural communities also use some 296 medicinal plant species that are in active trade for export or use by the herbal industry. Whether the rural communities collect such species themselves or buy these from the market, their consumption by the rural households does add to their commercial demand.

The consolidated commercial demand of herbal raw drugs in the country for the year 2014-15 has been estimated by collating the following components:

- Consolidated estimated consumption of herbal raw drugs by the domestic herbal industry as arrived at in Chapter-3.

- Consolidated data of herbal raw drugs in export, including gums and extracts (Chapter-8).

- Consolidated estimation of consumption of species in commercial trade by the rural households (Chapter-4).

- Wastage during handling of herbal raw drugs during its trade chain from primary production (wild gathering/ cultivation) to the end users on account of loading, unloading & transportation (2-3 times) and storage (at 2-3 places) has been estimated at an average of 3% for all entities (Chapter-7).

The species falling in the following categories have, however, been excluded for computing the consolidated commercial demand of herbal raw drugs in the country:

- Cereals, pulses, fruits, vegetables, and vegetatable oils having major use elsewhere and of which relatively a small proportion is used as 'herbal raw material'. It is assumed that these entities, already under sizeable cultivation, will continue to be available to meet the demand of domestic herbal industry without any further intervention.

- The large number of species that are consumed by the rural households/ folk healers, but are not enlisted in the consolidated inventory of the traded medicinal plants. It is assumed that such species are locally available for use and their wild collection presently does not have any impact on the availability of species in commercial demand.

All raw drug entities recorded in commercial demand were reduced to their dry weight to arrive at uniform values of demand. Based on the above principles, the consolidated commercial demand of herbal raw drugs in the country for the year 2014-15 has been computed and presented in table 11.1. The estimated commercial demand of herbal raw drugs for the year 2014-15 has shown an increase of 62 percent in volume over the estimation of similar demand worked out by Ved & Goraya (2008) for the year 2005-06. The major increase has been in case of exports where the export volume has increased from 56,500 MT in 2005-06 to 1,34,500 MT in 2014-15, registering an increase of 238 percent.

Total commercial demand of medicinal plant species for the year 2014-15 has been estimated as 5,12,000 MT

Table-11.1: Estimate of Consolidated Commercial Demand of Herbal Raw Drugs for the year 2014-15

S. No.	Categories of Consumers	Estimated Demand (MT)	Basis of Estimates
1	Domestic Herbal Industry	1,95,000	Estimated annual consumption of 8610 registered herbal units based on collation of consumption data of 692 sampled herbal units
2	Exports	1,34,500	Collation of DGCIS data relating to export of commodities during 2014-15
3	Rural Households	1,67,500	Estimated annual consumption based on herbal raw drug consumption by 2450 sampled rural households (15 states)
Total (Consumption)		**4,97,000**	
Average Wastage during Handling		**14,910**	@3% as assessed during interactions with wild gatherers, traders and managers of herbal units.
Total (Demand)		**5,11,910**	

Or say 5,12,000 MT

11.3. CONSOLIDATED TRADE VALUE OF HERBAL RAW DRUGS IN COMMERCIAL TRADE FOR THE YEAR 2014-15

The following rates have been worked out to calculate the trade value of the herbal raw drugs worked out in table 11.1 above to be in commercial demand:

(a) In respect of herbal raw drugs consumed by the domestic herbal industry, and by the rural households, an average procurement rate of ₹ 100 per kg for all herbal raw drugs at factory gate has been used, and (b) In respect of herbal raw drugs exported from the country during the year 2014-15, the actual export value as provided in the DGCIS data has been used.

Based on the above rates, annual trade value of the herbal raw drugs in commercial demand for the year 2014-15 has been worked out in table 11.2.

Table-11.2: Estimate of Annual Trade Value of Herbal Raw Drugs in Commercial Demand (2014-15)

Categories of Consumers	Estimated Demand (MT)	Trade Value (Rs. in crore)	Remarks
Herbal Industry	1,95,000	1950.00	on an average procurement rate of ₹ 100 per kg
Rural Households	1,67,500	1675.00	
Wastage	14,910	149.00	
Exports	1,34,500	3211.00	As per actual
Total:		**6,985.00**	

Or say 7000 crore

The trade value of herbal raw drugs in commercial demand for the year 2014-15, estimated at ₹ 7,000 crore is about seven times higher than the trade value for commercially traded herbal raw drugs for the year 2005-06 as worked out by Ved and Goraya (2008). The major increase has been in the export value which has increased from ₹ 354.80 crore in 2005-06 to ₹ 3211 crore in 2014-15, registering a nine fold increase in ten years.

Total trade value of herbal raw drugs in commercial demand for the year 2014-15 has been estimated at ₹ 7000 crore!

11.4. CONSUMPTION OF HERBAL RAW DRUGS BY TRADITIONAL/ FOLK PRACITIONERS AND ITS POTENTIAL IMPACT ON ESTIMATED ANNUAL COMMERCIAL DEMAND

India has a very strong living tradition of dispensation of health care formulations through millions of Practitioners of Codified Indian Systems of Medicine as well as Folk Healers, who themselves make their recipes and formulations for various ailments. Many of these practitioners, especially the folk healers, do collect a part of their herbal raw drugs themselves from the nearby forest and non-forest landscape. However, many of the species used by them are also in active commercial demand. With no database or inventory of such practitioners in the country, and almost every other village harbouring a couple of them specialising in treatment of one or more ailments, it is not possible to estimate annual demand of herbal raw drugs by them in absence of nation wide sampling requiring a major data collection effort with corresponding time and cost involvement. Such usage of herbal raw drugs by this group of practitioners is believed to significantly impact their commercial demand.

To flag this issue, we have made an attempt to gather, as part of the household survey, information in respect of folk healers from the selected villages using a priori information. Data gathered from 89 such practitioners from across different states has resulted in documentation of 583 herbal raw drug entities corresponding to 386 plant species being used by these folk healers. Of these, 206 species are from the species enlisted in the consolidated inventory of herbal raw drugs in commercial demand. The number of herbal raw drug entities used by the surveyed folk practitioners ranged from 1 to 36 with an average of 6 entities used by them. The average annual per capita consumption of all herbal raw drug entities consumed by them was 109 kg with some folk practitioners using quantities as high as 3000 kg per year. The top 20 medicinal plant species recorded in use by folk healers as a part of this survey (Table 11.3) make for more than 90% of the total consumption of herbal raw drugs by them. 'Ashwagandha' is the herbal raw drug entity in the highest use.

Table 11.3: Top 20 Medicinal Plant Species used by 89 sampled Folk Healers/ Traditional Practitioners

S. No.	Botanical Name	Local Name	Part Used	Total Annual Consumption (Dry Wt. in Kg)
1	*Withania somnifera*	Amukkuraa, Ashwagandha	Root	6455
2	*Aloe vera* [= *Aloe barbadensis*]	Gritkumari	Leaf	4205
3	*Terminalia bellirica*	Thandrikaai, Beheda	Fruit	547
4	*Terminalia chebula*	Kadukkaai, Harda	Seed, Fruit (de-seeded)	542
5	*Zingiber officinale*	Sukku, Saunth, Haihing, Satianda	Rhizome	505
6	*Piper longum*	Pipli	Flower, Fruit, Seed	456
7	*Phyllanthus emblica* [= *Emblica officinalis*]	Aonla, Nelli	Fruit (fresh and dry)	407
8	*Tinospora cordifolia*	Giloe, Amruthvalli, Seendhil, Iraking phum	Stem, Root, Leaf	298
9	*Aegle marmelos*	Bel	Bark, Fruit Pulp, Leaf	233
10	*Alpinia galanga*	Perarathai, Kulanjan, Rasna	Rhizome, Root	222
11	*Asparagus racemosus*	Shatawar	Root/Rhizome, Leaf, Stem	166
12	*Plantago ovata*	Isobgol	Husk, Seed	136

S. No.	Botanical Name	Local Name	Part Used	Total Annual Consumption (Dry Wt. in Kg)
13	*Phyllanthus amarus* [= *Phyllanthus fraternus*]	Keezhaa nelli, Bhui aonala	Whole Plant	103
14	*Swertia chirayita*	Chiretta	Whole Plant, Aerial Parts	97
15	*Mucuna pruriens*	Krouch/ Bidung	Leaf, Seed	91
16	*Azadirachta indica*	Neem, Vaeppan, Maha Neem	Leaf, Bark, Fruit, Stem	63
17	*Saraca asoca*	Ashok	Bark, Leaf	60
18	*Barleria prionitis*	Daskaranta	Whole Plant	60
19	*Picrorhiza kurroa*	Kutki, Hongbu	Root, Leaf	52
20	*Nardostachys jatamansi*	Jatamansi	Root/ Rhizome	44

All the species listed in the above table have also been recorded under high commercial trade. Whether collected by self or procured from the market, there is a definite impact of such use by the folk practitioners on the overall commercial demand of these entities with implications on the management of the resource.

11.5. MEDICINAL PLANTS IN HIGH COMMERCIAL DEMAND (ANNUAL TRADE OF >100 MT) IN INDIA

Synthesis of the data pertaining to consumption of botanicals by domestic herbal industry, botanicals in foreign trade and the botanicals recorded from trade for commercial use in Indian Systems of Medicine has resulted in listing of 1013 botanicals pertaining to 310 species that are in high commercial demand i.e. in quantities i.e. more than 100 MT per year.

Close scrutiny of the list, however, brings out the following:

a) 7 species recorded in use as botanicals are cultivated primarily as aromatic plants with larger use in perfumery, food and confectionary industry (Table 11.4).

b) 57 species are cultivated for primary use as spices, cereals, pulses, fruits, vegetables, and vegetable oils and only a small proportion of these species is used as herbal raw drugs (Table 11.5).

c) Supply sources of 4 raw drug entities recorded in high trade, and reported as herbal raw drugs, could not be verified either from wild collections, cultivation or imports (Table 11.6).

d) 242 species are wild collected, cultivated or imported primarily for use as herbal raw drugs (Table 11.7).

Of the medicinal plant species in high trade, 242 species are wild collected, cultivated or imported primarily for use as 'herbal raw drugs'

11.5.1: Plants Collected/ Cultivated/ Imported with Main Use as Aromatics

The 7 species enlisted in the Table 11.4 are primarily collected/ cultivated for use in perfumery, food or confectionary purposes. Even as these species are produced in large quantities, only a small part of their annual production is used as herbal raw drugs. It is assumed that these species will continue to be produced in required quantities for use as herbal raw drugs till their other major use remains remunerative.

Folk Healer with freshly collected plant of *Polygonatum verticillatum*

Table 11.4: Plant Species cultivated primary as aromatic plants

S. No.	Botanical Name	Trade Name(s)	Habit	Major Supply Source*	Estimated Annual Demand as Herbal Raw Drug (MT)*
1	*Cymbopogon citratus*	Serai, Rohisha, Kattrna	Herb	C	100-200 [≈135]
2	*Cymbopogon flexuosus*	Lemon grass	Herb	C	100-200
3	*Mentha arvensis*	Pudina, Podina pati	Herb	C	5000-10000
4	*Mentha piperita*	Menthol, Peppermint	Herb	C	2000-5000
5	*Mentha spicata*	Pudina, Pudinah	Herb	C	500-1000
6	*Rosa centifolia*	Gulab ,Satapatrika	Shrub	C	500-1000
7	*Rosa damascena*	Gulab, Rose flowers	Shrub	C	1000-2000

* C – Cultivated

11.5.2: Plants Cultivated for Main Use as Spices, Cereals, Pulses, Fruits, Vegetables, and Vegetable Oils

A very large number of species that normally fall in the category of spices, cereals, pulses, vegetables and vegetable oils are used as herbal raw drugs by the domestic herbal industry in various health care formulations in significant quantities. 57 such entities, given in Table 11.5 below, have been documented during the current study as being used in quantities more than 100 MT per year as herbal raw drugs. Since various government departments and research organisations are already working on these species, it is assumed that these may not need any further focus to promote their cultivation specifically for herbal raw drugs.

Table 11.5: List of 57 Plant Species Cultivated for Main Use as Spices, Cereals, Pulses, Fruits, Vegetables, and Vegetable Oils with Small Proportion Used as Herbal Raw Drugs

S. No.	Botanical Name	Trade Name(s)	Habit	Major Supply Source*	Estimated Annual Demand as Herbal Raw Drug (MT)*
1	*Abelmoschus esculentus*	Bhindi	Shrub	C	100-200
2	*Allium cepa*	Onion	Herb	C	200-500
3	*Allium sativum*	Lasun, Velathulli, Lasuna	Herb	C	200-500
4	*Amomum subulatum*	Elachi Badi, Sthulaela	Herb	C	100-200
5	*Ananas comosus*	Ananas, Pineapple	Herb	C	100-200
6	*Anethum graveolens*	Sowa, Satahva	Herb	C	200-500
7	*Apium graveolens*	Ajmoda, Celery, Karaphsa	Herb	C	1000-2000
8	*Areca catechu*	Supari, Puga	Tree	C	100-200
9	*Benincasa hispida*	Kumpalanga pacha, Kusmanda	Climber	C	100-200
10	*Brassica juncea*	Kaduku, Sasuve Bili	Herb	C	100-200
11	*Brassica rapa*	Sarsapa	Herb	C	500-1000
12	*Brassica nigra*	Sarson	Herb	C	200-500
13	*Camelia sinensis*	Tea	Shrub	C	100-200
14	*Capsicum annuum*	Mirch	Herb	C	100-200
15	*Carthamus tinctorius*	Kusum phool, Kusumbha	Shrub	C	100-200
16	*Citrus aurantiifolia*	Limbu	Tree	C	200-500
17	*Citrus limon*	Lemon, Nimbu	Tree	C	500-1000
18	*Citrus medica*	Matunga, Mahnimbu, Bijapura	Tree	C	1000-2000
19	*Coccinia grandis*	Kovai, Bimba, Bimbi	Climber	C	100-200
20	*Cocos nucifera*	Nariyal, Narikela	Tree	C	>10000
21	*Coriandrum sativum*	Dhaniya, Dhana, Dhanyaka	Herb	C	500-1000
22	*Cucumis sativus*	Beej Kheera, Trapusam	Climber	C	100-200
23	*Cuminum cyminum*	Jeera, Shahjeera, Svetajiraka	Herb	C	1000-2000
24	*Curcuma longa*	Arishna, Haldi, Karimanjal, Haridra	Herb	C	1000-2000
25	*Daucus carota* var. *sativa*	Gaajar Beej	Herb	C	100-200
26	*Dolichos biflorus*	Kulthi, Muthira, Kulattha	Herb	C	200-500
27	*Elettaria cardamomum*	Elachi Chhoti, Ilaychi, Suksmaila	Herb	C	200-500
28	*Foeniculum vulgare*	Badiyan Khatal, Saunf, (Variyali), Misreya	Herb	C	500-1000
29	*Gossypium herbaceum*	Kapas, Karpasa	Shrub	C	100-200
30	*Helianthus annuus*	Sunflower	Shrub	C	200-500
31	*Hordeum vulgare*	Jau, Yava	Herb	C	200-500
32	*Lagenaria siceraria*	Bottlegourd, Sorakkai, Tumbini	Climber	C	200-500
33	*Linum usitatissimum*	Alsi, Atasi	Herb	C	100-200
34	*Malus domestica*	Apple, Seb	Tree	C	100-200
35	*Mangifera indica*	Aamba, Amra	Tree	C	5000-10000
36	*Maranta arundinacea*	Citalapattiri, Ararota	Herb	C	100-200

S. No.	Botanical Name	Trade Name(s)	Habit	Major Supply Source*	Estimated Annual Demand as Herbal Raw Drug (MT)*
37	*Momordica charantia*	Karela, Karavallaka	Climber	C	500-1000
38	*Nigella sativa*	Kalonji, Upakuncika	Herb	C	2000-5000
39	*Oryza sativa*	Aval, Akki, Thavidu, Sali	Herb	C	>10000
40	*Phoenix sylvestris*	Khajur	Tree	C	100-200
41	*Piper betle*	Betle, Nagavalli	Climber	C	200-500
42	*Piper nigrum*	Pipal Gol, Kalimirch, Marica	Climber	C	1000-2000
43	*Prunus dulcis*	Badam, Magaj badam	Tree	C	1000-2000
44	*Ricinus communis*	Arand, Eranda	Shrub	C	1000-2000 [>1400]
45	*Saccharum officinarum*	Sugar cane, Karumbu, Iksu	Herb	C	5000-10000
46	*Sesamum indicum*	Til, Tila	Herb	C	>10000
47	*Tamarindus indica*	Imli, Cinca	Tree	C	1000-2000
48	*Trachyspermum ammi*	Ajmod, Ajwayan, Yavani	Herb	C	1000-2000
49	*Trachyspermum roxburghianum*	Sath Ajwayan, Ajmod, Radhuni	Herb	C	100-200
50	*Trapa natans*	Singhada, Srngataka	Herb	C	100-200
51	*Trichosanthes dioica*	Patol (Kadu Parval)	Climber	C	100-200
52	*Trigonella foenum-graecum*	Methi	Herb	C	500-1000
53	*Vigna mungo*	Urd	Herb	C	100-200
54	*Vigna trilobata*	Mudgaparni	Herb	C	100-200
55	*Vitis vinifera*	Draksh, Draksa	Climber	C	1000-2000
56	*Zea mays*	Maize	Herb	C	2000-5000
57	*Zingiber officinale*	Soonth, Sonth, Sunthi	Herb	C	2000-5000

* C – Cultivated

11.5.3: Plants Reported in High Consumption by Herbal Industry with Ambiguous Supply Sources

Domestic herbal industry consumes entities like 'bansalochan', 'karpura', and 'gadhapura taila' in high quantities (Table 11.6). Correlation of these entities to their traditionally known plant sources has also been provided. Authentic samples of these entities could not, however, be accessed during survey of herbal mandis under the present study. Our field enquiries revealed that domestic production of 'bansalochan' from the given bamboo species was highly sporadic and non-significant. Similarly, no wild harvest of Himalayan Gaultheria species for extraction of oil came to notice during the current study. The situation leaves import as the only source of supply for such material. However, data related to import of these commodities in such large quantities did not get reflected in the foreign trade data compiled and reported by DGCIS. Informal discussions with traders indicated that the source of these entities could be largely synthetic. The supply source of these entities, therefore, remains ambiguous, needing further investigation.

Table 11.6: List of 4 Plants Reported in High Consumption by Herbal Industry with Ambiguous Supply Source

S. No.	Botanical Name	Trade Name(s)	Habit	Major Supply Source*	Estimated Annual Trade (MT)*
1	*Bambusa arundinacea*	Bansalochan, Tabashir	Tree	?	1000-2000
2	*Cinnamomum camphora*	Kapur, Karpura	Tree	?	2000-5000
3	*Gaultheria fragrantissima*	Gandhapura Patra Taila	Shrub	?	2000-5000
4	*Gaultheria procumbens*	Gandhapura Patra Taila	Shrub	?	2000-5000

* ? = Source not confirmed

11.5.4: Species Collected, Cultivated or Imported primarily for use as Herbal Raw Drugs

Leaving aside 64 species in high trade that are sourced primarily from cultivation and have larger use for purposes other than medicinal, and 4 species where supply source could not be verified, the remaining 242 medicinal plant species as mentioned under (a) above are wild collected, cultivated or imported primarily for use as 'herbal raw drugs' (Table 11.7). Major source of supply in respect of these species has been given, even as part requirement of some of the listed species is met from more than one source. For example, 'makoi' (*Solanum nigrum*) is found naturally growing in habitats outside forests and as agriculture weed, and it is this wild grown population that forms the major source of its supply to the end users. This species has, however, been recently brought under cultivation also primarily to meet part supply of its fruits. Similarly, some cultivation of Atees (*Aconitum heterophyllum*), a Red-listed Himalayan species, has been initiated, even as major supplies of this entity continue to be met from wild collections. The figures given in brackets under the column 'Estimated Annual Trade' pertain to the estimated quantities consumed by the rural households and are in addition to those recorded in trade.

This comprehensive documentation of 242 species in high trade as herbal raw drugs is an improvement over the previous such documentations by Ved and Goraya (2008) wherein 178 such species were enlisted.

Table 11.7: List of 242 Plant Species Wild Collected/ Cultivated/ Imported for Main Use as Herbal Raw Drugs

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
1	*Abelmoschus moschatus*	Muskdana, Kasturilatika Kasthuri vendai	C	100-200	100-150
2	*Abies spectabilis*	Talispatra, Talisa	HF	100-200	50-60
3	*Abrus precatorius*	Kunnimuthu, Kundumani, Gundumani, Gunja	W	200-500 [≈110]	90-110
4	*Abutilon indicum*	Tutti Atibala	W	100-200	10-25
5	*Acacia catechu*	Katha	TF	500-1000	750-1600
6	*Acacia nilotica* subsp. *indica*	Babul, Kikar, Babbula, Karuvelum	TF	1000-2000 [≈520]	75-125
7	*Acacia senegal*	Gum Arabic, Char Gond	I	>20000	100-300
8	*Acacia seyal*	Gum Arabic, Talha Gum	I	2000-5000	100-300
9	*Acacia sinuata*	Shikakai	TF	1000-2000 [≈90]	25-95

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
10	*Acalypha indica*	Khokali, Haritamanjari	W	100-200 [≈365]	
11	*Achillea millefolium*	Brinjasif, Yarrow	HF	100-200	150-250
12	*Achyranthes aspera*	Puthkanda, Apamarga Nayuruvi	W	200-500 [≈2750]	25-35
13	*Aconitum heterophyllum*[1]	Atis, Ativisa	HF	100-200	3500-10500
14	*Acorus calamus*	Bach, Ghorbach, Vaca	C	500-1000 [≈165]	50-65
15	*Aegle marmelos*	Bael, Belgiri, Bilva Vilvam, Bael guda Bael Patti	TF	2000-5000 [≈10600]	15-35
16	*Aerva lanata*	Cheroola, Pattura	W	100-200 [≈200]	
17	*Albizia amara*	Krishnasirish, Usilai	TF	100-200	10-15
18	*Alhagi pseudalhagi*	Durlabha, Yavasaka	W	100-200	
19	*Aloe vera*	Kumari, Gwarpatha, Kanyasara, Elva, Kumari, Soththu katrazhai	C	>10000 [≈3260]	8-10
20	*Alpinia calcarata*	Chittaratha Granthimula	C	100-200	
21	*Alpinia galanga*	Rasnamool, Kulanjan Perarathai	C	200-500	100-130
22	*Amorphophallus paeoniifolius*	Surankand, Surana	TF	200-500 [≈90]	
23	*Anacyclus pyrethrum*	Akarkara, Akarkarabha Akraharam	I	200-500	200-250
24	*Andrographis paniculata*	Kalmegh, Neela vembu	TF	2000-5000 [≈2080]	10-30
25	*Argyreia elliptica*	Bondvel	W	100-200	
26	*Arnebia benthamii*	Gauzaban	HF	100-200	150-220
27	*Artemisia annua*	Artemisia	C	1000-2000	150-200
28	*Asparagus adscendens*	Musali safed, Satawar	HF	200-500	250-400
29	*Asparagus racemosus*	Shatavari, Shatawar, Satavari	TF	2000-5000 [≈675]	300-500
30	*Atropa belladonna*	Belladona	I	200-500	150-200
31	*Azadirachta indica*	Neem, Vaeppan Nimba	C	2000-5000 [≈9090]	15-30
32	*Baccharoides anthelmintica*	Kali zeeri, Somnay Vanyajiraka	W	200-500	80-500
33	*Bacopa monnieri*	Jal Brahmi, Brahmi	W	1000-2000 [≈140]	30-50
34	*Baliospermum montanum*	Dantimool, Danti	TF	100-200	
35	*Barleria prionitis*	Vajradanti, Sahacara	W	100-200	
36	*Bauhinia variegata*	Kachnar, Kancanara	TF	100-200 [≈20]	180-250
37	*Berberis aristata*[2]	Daruhaldi, Daruharidra	HF	1000-2000 [≈50]	15-55

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
38	*Berberis lycium*[2]	Daryhaldi, Chitra	HF	1000-2000 [≈285]	15-55
39	*Bergenia ciliata*	Pashnabhed, Pasanabheda	HF	1000-2000 [≈125]	35-55
40	*Betula utilis Bhojpatra*	Bhurjah	HF	100-200	125-300
41	*Boerhavia diffusa*	Punarnava, Mukarattai Punarnava rakta	W	2000-5000 [≈1050]	35-45
42	*Bombax ceiba*	Mochras, Semal, Salmali	TF	100-200 [≈445]	140-160
43	*Boswellia serrata*	Guggul dhupa, Mani kundrikam Kunduru	TF	500-1000	100-300
44	*Buchanania cochinchinensis*	Chironji, Priyala	TF	100-200	450-500
45	*Butea monosperma*	Tesu phool, Palas phool, Murukkam, Palasa	TF	200-500 [≈605]	15-20 35-45 150-350
46	*Caesalpinia bonduc*	Sagargota, Kalaachi kaai Latakaranja	TF	100-200 [≈715]	80-120
47	*Calendula officinalis*	Gulasharfi, Genda Marigold	C	100-200	10-15
48	*Capparis spinosa*	Kanther, Himsra	W	500-1000	
49	*Cardiospermum halicacabum*	Mudakkathan, Karnasphota	W	100-200 [≈4500]	15-30
50	*Cassia fistula*	Amalthas Aragvadha	TF	200-500 [≈840]	10-15
51	*Catharanthus roseus*	Sadabahar, Vinca	C	200-500 [≈250]	125-175
52	*Cedrus deodara*	Devdar, Devadaru	HF	1000-2000	25-40
53	*Celastrus paniculatus*	Vaaluluvai, Malkangani, Jyotismati	TF	200-500	110-200
54	*Centella asiatica*	Brahmibooti, Vallaarai Mandukaparni	W	500-1000 [≈1870]	200-250 50-100
55	*Chaemecrista absus*	Chaksoo	W	100-200	350-450
56	*Chlorophytum borivilianum*	Safed musali	C	100-200	700-1800
57	*Chlorophytum tuberosum*[3]	Safed musali	TF	200-500	700-1800
58	*Chrysopogon zizanioides*	Lavancha, Khas, Usira	C	200-500 [≈1355]	70-100
59	*Cichorium intybus*	Kasani	C	500-1000	75-140
60	*Cinnamomum cassia*	Dalchini	I	100-200	150-175
61	*Cinnamomum sulphuratum*[4]	Dalchini, Tejpatta	TF	100-200	150-200
62	*Cinnamomum tamala*[5]	Tejpatta Tvakapatra	HF	2000-5000 [≈155]	65-80
63	*Cinnamomum verum*	Dalchini, Tvak	C	200-500	170-190 250-300

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
64	*Cissus quadrangularis*	Hutjodi, Pirandai, Asthisamhrta	W	200-500 [≈5270]	40-55
65	*Citrullus colocynthis*	Indrayan, Indravaruni	W	200-500 [≈520]	20-30
66	*Clerodendrum phlomidis*	Arni, Arnimul, Agnimantha	W	200-500	35-45
67	*Clerodendrum serratum*	Bharangi, Bharangi	W	100-200	35-45
68	*Coleus forskohlii*	Gandira Pashan Bhedi	C	100-200	60-190
69	*Commiphora wightii*	Guggul, Guggulu	TF	1000-2000	650-1000
70	*Convolvulus prostratus*[6]	Shankapushpi, Sankhapuspi	W	500-1000	20-30
71	*Coptis teeta*	Mamira, Rohini	HF	100-200 [≈70]	500-600
72	*Crateva religiosa*	Varun chhal, Varuna	TF	200-500	30-50
73	*Cullen corylifolium*	Bawachi, Bakuchi	W	200-500	55-75
74	*Curculigo orchioides*	Nilapanai Kali musali, Talamuli	TF	200-500 [≈135]	180-220
75	*Curcuma zerumbet*	Kachur Karcura	C	200-500	25-35
76	*Cymbopogon citratus*	Rohisha, Kattrna	C	100-200 [≈135]	120-150
77	*Cymbopogon flexuosus*	Lemon grass	C	100-200	120-150
78	*Cynodon dactylon*	Doob, Durva	W	100-200 [≈2950]	20-25
79	*Cyperus rotundus*	Motha, Korai kizhangu	W	500-1000 [≈1350]	25-30
80	*Cyperus scariosus*	Nagarmotha	W	200-500	25-30
81	*Datura metel*	Duttura, Oomaththai, Umatham Dhattura	W	200-500	50-70
82	*Decalepis hamiltonii*	Magali	TF	100-200	-
83	*Desmodium gangeticum*	Salparni, Salaparni	TF	500-1000	30-40
84	*Didymocarpus pedicellatus*	Shilapushpi, Pasanphodi	HF	100-200	
85	*Dioscorea bulbifera*	Varahi kand, Varahi	TF	200-500	40-45
86	*Eclipta prostrata*	Bhringaraj, Karisaalai Bhrngaraja	W	2000-5000 [≈2480]	25-40
87	*Embelia ribes*	Vaividang, Vavuvidan Vidanga	TF	100-200	450-550
88	*Embelia tsjeriam-cottam*[7]	Vaividang	TF	500-1000	500-600
89	*Ephedra gerardiana*	Somalatha	HF	100-200	25-35
90	*Erythrina variegata*	Murikkila, Paribhadra	TF	100-200 [≈80]	-
91	*Eucalyptus globulus*	Eucalyptus, Tailaparnah	C	2000-5000	70-100
92	*Ferula assa-foetida*	Hing, Hingu	I	500-1000	12000
93	*Ficus benghalensis*	Vadachhal, Nyagrodha	TF	200-500 [≈340]	-
94	*Ficus religiosa*	Lakh pipal, Arasu, Asvattha	C	200-500 [≈1390]	150-250
95	*Flickingeria macraei**	Jivanti	TF	100-200	250-300
96	*Fumaria indica*	Shahtara, Parpata, Pittapapda	W	200-500	10-20

*includes *Holostemma ada-kodien* also traded as Jivanti

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
97	*Garcinia gummi-gutta*	Kokam, Kodampuli	TF	2000-5000	200
98	*Garcinia indica*	Kokam, Cambogie	TF	100-200 [≈260]	50-65
99	*Gloriosa superba*	Kalihari, Langali	C	100-200	25-30 200-500
100	*Glycyrrhiza glabra*	Mulathi, Adhi Madhuarm Yasti	I	2000-5000	100-180
101	*Gmelina arborea*	Ghambar chal, Gambhari	TF	500-1000	35-40
102	*Gymnema sylvestre*	Gudmar, Sarkarai kolli, Siru kurinjaan Mesarngi	TF	500-1000 [≈2750]	50-55 90-100
103	*Hedychium spicatum*	Kapoor kachri, Sati	HF	200-500	150-200
104	*Helicteres isora*	Marodphali Valampuri-Idampuri	TF	100-200	20-30
105	*Hemidesmus indicus*	Anatmool, Sveta sariva Nannari, Maahaali, Murod Phah	TF	500-1000 [≈40]	290-300
106	*Hibiscus rosa-sinensis*	Jashwanti, Japa	C	500-1000 [≈1950]	125-250
107	*Holarrhena pubescens*	Inderjao, Indirayan Beej Kutaja, Indrayava	TF	500-1000 [≈55]	325-350
108	*Holoptelea integrifolia*	Aavitholi, Cirabilva	TF	100-200	
109	*Homalomena aromatica*	Sugan mantri	C	200-500 [≈45]	180-200
110	*Hygrophila schulli*	Tal makhana, Kokilaksa	W	200-500 [≈170]	250-300
111	*Hyoscyamus niger*	KhursaniAjwain Parasikayavani	HF	100-200	65-140
112	*Indigofera tinctoria*	Akika, Nili	C	100-200	50-70
113	*Inula racemosa*	Pushkarmool Puskara	C	200-500	180-220
114	*Ipomoea mauritiana*	Palmudhukkan Kshiravidari	TF	200-500	35-50
115	*Ipomoea nil*	Kaladana	W	100-200	80-140
116	*Jasminum officinale*	Ban chameli, Jati	C	50-100	325-375
117	*Jasminum sambac*	Mallika, Mogra	C	100-200	325-375
118	*Juniperus communis*	Hauber, Hapusa	HF	100-200	80-100
119	*Justicia adhatoda*	Adusa, Basuti, Vasa	C	2000-5000 [≈1975]	15-25
120	*Justicia beddomei*	Vasa	C	100-200	15-25
121	*Kaempferia galanga*	Kachora, Kapoor Kachri No 1	C	100-200	115-220
122	*Lactuca sativa*	Tukhm-Kahoo	I	100-200	200-550
123	*Lawsonia inermis*	Henna, Mehandi, Maruthondri Madaynati	C	2000-5000 [≈990]	45-75
124	*Lepidium sativum*	Asaliya, Candrasura	C	1000-2000	95-110
125	*Leptadenia reticulata*	Paalai kodi, Jivanti	TF	200-500 [≈220]	100-400
126	*Litsea glutinosa*	Maida chhal, Medasakah	TF	500-1000	65-75
127	*Madhuca indica*	Madhuka, Madhuka	TF	200-500	75-100

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
128	*Madhuca longifolia*	Mahua phool Iluppai	TF	100-200	40-60
129	*Martynia annua*	Kaknasa, Kakanasika	W	100-200	60-100
130	*Melaleuca leucadendra*	Cajuput	I	100-200	-
131	*Melia azedarach*	Bakain, Mahanimba	C	100-200 [≈390]	10-20
132	*Mentha longifolia*	Jangli Pudina,	HF	100-200 [≈60]	20-85
133	*Mesua ferrea*	Nagakesari, Nagkeshar	TF	200-500	250-325
134	*Mimusops elengi*	Bakul	TF	200-500 [≈20]	40-50
135	*Morinda citrifolia*	Canary wood, Noni	C	500-1000	200-220
136	*Morinda coreia*	Manjanatthi, Nunna	TF	200-500 [≈295]	-
137	*Moringa oleifera*	Sahenjana, Murungai Sigru	C	500-1000 [≈8650]	400-500 90-130
138	*Mucuna pruriens* var. *utilis*	Kavach beej, Kaunch beej, Atmagupta	TF	500-1000 [≈30]	60-100
139	*Murraya koenigii*	Kariveppila, Mitha Neem, Kari Patta, Karuvepilai Saurabha-nimba	C	200-500 [≈540]	25-35
140	*Myristica fragrans*	Jatipatre, Jaathikaai, Jaiphal, Javitri Jatiphala	C	200-500	475-550 850-950
141	*Nardostachys jatamansi*	Balchad, Jatamansi	HF	500-1000	850-900
142	*Nelumbo nucifera*	Kamal phul, Kamalgatta Kamala	C	100-200	80-100
143	*Neopicrorhiza scrophulariiflora*	Kutki	HF	100-200	800-900
144	*Ocimum americanum*	Bantulsi	W	200-500 [≈95]	10-20
145	*Ocimum basilicum*	Sweet basil, Kali tulsi, Tukmaria	C	200-500 [≈75]	120-225
146	*Ocimum gratissimum*	Vana tulasi, Tukmaria	C	1000-2000	90-110
147	*Ocimum tenuiflorum*	Tulsi, Tulasi	C	2000-5000 [≈30000]	50-75
148	*Onosma bracteata*	Gazbaan, Gojihva	I	100-200	240-270
149	*Onosma hispida*	Ratan jot	HF	100-200	225-250
150	*Operculina turpethum*	Nishoth, Shivadi Trivrta	TF	500-1000 [≈120]	115-180
151	*Oroxylum indicum*	Tetuchaal, Syonaka	TF	500-1000 [≈310]	30-40
152	*Paederia foetida*	Prasaarani, Prasarini	TF	100-200 [≈510]	30-40
153	*Parmelia perlata*	Jhula, Chhadila, Dagarphool, Kalpaasi, Mehndi, Pathar ka Phool, Shilapushpa, Stone Flower Saileya	HF	500-1000	150-300

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
154	*Pedalium murex*	Gokhru bada Annai nerunji, Peru nerinjal	W	100-200 [≈160]	160-200
155	*Peganum harmala*	Harmal, Lal dana	W	100-200	60-80
156	*Phyllanthus amarus*[8]	Bhumiamla, Keezhaa nelli, Tamalaki	W	1000-2000 [≈265]	30-40
157	*Phyllanthus emblica*	Amla, Nelli Amalaki	TF	>10000 [≈11980]	50-80
158	*Phyllanthus maderaspatensis*	Kanocha, Meeva nelli	W	1000-2000	-
159	*Picrorhiza kurroa*[9]	Kutki, Katuka	HF	1000-2000	800-900
160	*Pinus roxburghii*	Gandabiroja, Sarala	HF	1000-2000	70-80
161	*Piper chaba*	Sheetal chini, Cubub, Kabab chini, Chavya	I	200-500	850-900
162	*Piper longum*	Pipal, Pippali, Pippalimula	C	1000-2000 1000-2000	625-850 100-300
163	*Pistacia integerrima*	Kakarsinghi, Karkatasrngi	HF	200-500	800-1000
164	*Plantago ovata*	Isabgol	C	>30000	100-200
165	*Pluchea lanceolata*	Rasna	W	200-500	25-30
166	*Plumbago indica*	Chitrak, Rakta Citraka	C	100-200	90-150
167	*Plumbago zeylanica*	Chitrak, Kodiveli, Chitramulam Citraka	W	500-1000 [≈1345]	35-135
168	*Polygonatum cirrhifolium*	Salam Mishri, Meda, Mahameda	HF	100-200	250-350
169	*Pongamia pinnata*	Honge beej, Karanja	C	500-1000	35-45
170	*Premna corymbosa*	Munnai, Arni	TF	100-200	25-30
171	*Premna serratifolia*	Arnimool, Agnimantha	TF	100-200	-
172	*Prunus armeniaca*	Chuli	C	100-200	-
173	*Prunus cerasoides*	Padamkasht, Padmaka	HF	100-200	75-85
174	*Pseudarthria viscida*	Moovila	W	200-500	-
175	*Pterocarpus marsupium*	Bijasal, Asana	TF	200-500 [≈1410]	30-40
176	*Pterocarpus santalinus*	Lal chandan, Raktachandana	TF	200-500	150-300
177	*Pueraria tuberosa*	Patal, Vidari Vidhari kanda	TF	500-1000	35-50
178	*Punica granatum*	Dadam, Dadima	HF	500-1000 [≈300]	450-500
179	*Quercus infectoria*	Majuphal, Mayakku	I	100-200	475-550
180	*Rauvolfia serpentina*	Pagal Buti, Sarpagandha	TF	200-500 [≈25]	800-850
181	*Rheum australe*[10]	Revan chini, Dolu, Padamchal	HF	100-200 [≈35]	100-250
182	*Rhododendron arboreum*	Buras, GularrhPhool	HF	100-200 [≈20]	250-280

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
183	*Rubia cordifolia*	Majith, Manjistha	TF	1000-2000	160-180
184	*Salacia reticulata*	Pitila	TF	100-200	550-650
185	*Salix caprea*	Baid-mushk	I	200-500	-
186	*Santalum album*	Chandan, Sveta candana	TF	500-1000	10000
187	*Sapindus mukorossi*[11]	Aretha mota, Reetha, Soapnut	C	200-500 [≈115]	30-35
188	*Saraca asoca*	Ashoka	TF	1000-2000	65-150
189	*Saussurea costus*	Kuth, Uplet, Kustha	C	100-200	250-350
190	*Scindapsus officinalis*	Gaj pipal Gajapippali	TF	100-200	20-30
191	*Semecarpus anacardium*	Balave, Bhallataka	TF	200-500	15-20
192	*Senna alexandrina*	Sona patta, Svarnapatri	C	>10000	80-125
193	*Senna auriculata*	Avarai, Aavaarai	W	500-1000	20-30
194	*Senna occidentalis*	Kasondi, Kasmardah	W	200-500	-
195	*Senna tora*	Chakoda Beeja, Prapunnada	W	>20000	45-55
196	*Shorea robusta*	Raal, Sala	TF	100-200	50-70 215-350
197	*Sida acuta*	Bala	W	100-200	10-20
198	*Sida cordifolia*	Bala, Beej Bandh, Kharetti	W	1000-2000	10-20
199	*Sida rhombifolia*[12]	Bala, Mahabala	W	1000-2000	10-20
200	*Smilax china*	Chobchini, Madhusnuhi	I	100-200	300-600
201	*Solanum anguivi*	Katheli badi, Brhati	W	500-1000 [≈130]	70-80
202	*Solanum nigrum*	Makoi, Kakamaci	W	2000-5000 100-200 [≈1685]	110-120 20-25
203	*Solanum virginianum*	Kateli, Kantakari	W	500-1000 [≈295]	30-35
204	*Spermacoce hispida*	Thaarthaaval	W	100-200	-
205	*Sphaeranthus indicus*	Gorakmundi, Munditika	W	200-500	30-40
206	*Stereospermum chelonoides*[13]	Patala, Padal fali, Patalai	T	500-1000	16-20
207	*Stereospermum tetargonum*	Patala, Patalai	TF	200-500	-
208	*Strobilanthes ciliata*	Kurinji, Sahchara	TF	200-500	-
209	*Strychnos nux-vomica*	Kuchla, Nirmali, Visamusti	TF	500-1000	55-75
210	*Strychnos potatorum*	Nirmali, Thaethaan Kataka	TF	100-200	120-140
211	*Swertia chirayita*[14]	Chiraiyata, Kiratatikta	HF	500-1000 [≈145]	300-325
212	*Symplocos cochinchinensis*	Lodhra	TF	100-200	45-55
213	*Symplocos racemosa*[15]	Pathani lodh, Lodhra	TF	500-1000	45-55

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
214	*Syzygium cumini*	Jamun, Jambu	C	500-1000 [≈860]	30-40
215	*Tamarix gallica*	Manna Plant, Jhav, French Tamarisk	I	100-200	-
216	*Tamarix indica*	Jhan	W	100-200	-
217	*Tanacetum cinerariifolium*	Pyrethrum	C	200-500	-
218	*Taxus wallichiana*	Talispatra, Sthauneya	HF	100-200	45-50
219	*Tecomella undulata*	Rohida, Rohitaka	TF	100-200	-
220	*Tephrosia purpurea*	Sarad foka, Sarpankha, Kozhinji, Surphanka	W	200-500	10-20
221	*Teramnus labialis*	Masaparni	W	100-200	40-50
222	*Terminalia arjuna*	Arjun, Arjuna	TF	2000-5000 [≈2750]	20-25
223	*Terminalia bellirica*	Behdea, Bibhitaka	TF	2000-5000 [≈5780]	10-30
224	*Terminalia chebula*	Harda, Haritaki	TF	5000-10000 [≈5740]	15-30
225	*Tinospora cordifolia*[16]	Giloy, Amruthvalli, Seendhil Guduci	W	1000-2000 [≈2330]	35-40
226	*Tinospora sinensis*	Amrata, Giloy	W	1000-2000	35-40
227	*Tragia involucrata*	Barhanta, Vrscikalli	W	200-500	-
228	*Trianthema decandra*	Saaranai ver,	W	100-200 [≈55]	-
229	*Tribulus lanuginosus*	Gokhru, Seru nerunjil	W	200-500	100-120
230	*Tribulus terrestris*[17]	Gokhru, Gokshura	W	2000-5000 [≈80]	100-120
231	*Trichosanthes cucumerina*	Patol panchang	W	100-200	35-40
232	*Trillidium govanianum*	Nag Chhatri, Satva	HF	200-500	2000-2500
233	*Uraria picta*	Prshniparni, Prsniparni	C	200-500	
234	*Valeriana jatamansi*[18]	Musakbala, Tagar ganth, Sugandhbala, Asaroon, Tagara	HF	1000-2000	370-425
235	*Viola pilosa*[19]	Banafasha	HF	100-200	850-1200
236	*Vitex negundo*	Neergundi, Nirgundi, Renuka	C	500-1000 [≈760]	25-30
237	*Withania somnifera*	Ashwagandha, Amukkuraa, Asvagandha	C	2000-5000 [≈20]	225-350
238	*Woodfordia fruticosa*	Dhaiphool, Thaathiri Dhataki	TF	2000-5000	60-70
239	*Wrightia tinctoria*	Indrajau	TF	200-500	60-65
240	*Zanthoxylum armatum*	Tejbal, Timur Tejovati	HF	200-500 [≈220]	100-200
241	*Zingiber zerumbet*	Narkachur	C	1000-2000	38-40

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
242	*Ziziphus mauritiana*	Ber, Kola	TF	200-500 [≈40]	15-25

* HF – Himalayan Forests; TF (Tropical Forests); W – Habitats outside Forests (farm lands, road/ rail sides, canal banks, marsh lands, ponds, wastelands, etc); C – Cultivated; I – Imported.

Notes:

1. Includes *Aconitum kashmericum*, *Delphinium denudatum*, *Chaerophyllum villosum*, the probable 'patis' adulterants
2. Includes other species of *Berberis* viz. *B. chitria*, *B. asiatica*, being traded as 'daruhaldi'
3. Includes *Chlorophytum borivilianum* and *C. arundinaceum*
4. Leaves of other species of *Cinnamomum* viz. *C. zeylanica*, *C. malabathrum* are also traded as 'tejpatta'
5. Bark of other species of *Cinnamomum* viz. *C. cassia*, *C. zeylanica*, *C. malabathrum* is also traded as 'dalchini
6. Includes *Evolvulus alsinoides*, *Clitoria ternatea*, *Canscora decussata* traded as 'shankhapushpi'
7. Includes the fruits of *Embelia ribes*, the most accepted candidate for 'Vaividang'
8. Includes other herbaceous species of *Phyllanthus* viz. *P. urinaria*, *P. reticulatus*, *P. virgatus*, *P. debilis* and *P. madraspatensis*
9. Also includes *Picrorhiza scrophulariiflora*
10. Includes other species of *Rheum* viz. *R. moorcroftianum* and *R. webbianum*, being traded as 'revandchini'
11. Includes *Sapindus emarginatus* and *Sapindus laurifolius*
12. Includes *Sida acuta*, *Sida cordifolia*, *Sida cordata*, etc., being traded as 'bala'
13. Includes *Stereospermum colais*
14. Also includes other species of *Swertia* viz. *S. angustifolia*, *S. alata*, etc
15. Includes *Symplocos cochinchinensis* and *Symplocos paniculata*
16. Also includes *Tinospora sinensis*
17. Includes other species of *Tribulus* viz. *T. lanuginosus*, *T. subramanyamii*, *T. alatus*, being traded as 'gokhru'
18. Includes *Valeriana hardwickii*
19. Includes other species of *Viola* viz. *V. odorata*, *V. canescens*, *V. biflora*, *V. betonicifolia* etc. traded as 'banafsha'

Analysis of the above list of 242 species recorded under high commercial demand reveals that the major supply source of 15 of these species is imports, and that 54 of these species are largely sourced from cultivation. The major source of supply of the remaining species is wild collections from forests (114 species) or other landscapes outside forests (59 species). Further analysis of the 114 species that are primarily sourced from forests brings out that 36 of these species are gathered from Himalayan forests and 78 species are gathered from Tropical forests.

Supply Sources of 242 Herbal Raw Drugs in High Demand

Analysis of the major supply source of the 242 species in high demand (>100 MT per year) for manufacture of health care and wellness formulations and for exports reveals that herbal material pertaining to 72% of these species is sourced entirely or largely from the wild (Similar analysis in respect of demand for herbal raw drugs by the domestic herbal industry for manufacture of classical ASU formulations reveals that herbal raw drugs pertaining to more than 85% of medicinal plant species used in such formulations continue to be sourced from the wild). An important

inference from this analysis is that with bulk of cultivated species viz. *Aloe vera*, *Mentha*, etc. finding major use in wellness formulations rather than in classical ASU formulations, it is imperative to conserve and strengthen the wild medicinal plant resources for sustenance of classical Indian health care systems.

The bulk production and consumption of cultivated species like 'ghritkumari', 'isabgol', 'mentha', 'henna', 'senna', etc. recorded under this study take the percentage share of the volume contributed by the cultivated species to nearly 40% of the total herbal raw drugs consumed by the sector during 2014-15. As already inferred from the data, the major consumption of the material from these cultivated species is in the wellness sector either in the form of raw drugs or as 'extracts' and needs to be treated separately from the consumption by the herbal units making classical ASU formulations. In as far as classical Indian health care systems are concerned, the percent share of vulume contributed by the wild collected herbal raw drugs continues to be more than 70%. This is in broad agreement with the analysis presented by Ved and Goraya (2008) wherein more than 80% dependence on wild resources, both by diversity of species used and by quantum of use, was worked out. The slight reduction in the percent share of quanitities of herbal raw drugs collected from the wild being consumed by the herbal industries making classical ASU formulations seems to be on account of two major factors. Firstly, there has been some increase in the cultivation area under medicinal plant species like *Piper longum*, *Withania somnifera*, *Acorus calamus*, etc. that have been largely sourced from cultivation since long. Secondly, many of the medicinal plant species in high consumption like *Phyllanthus amarus*, *Solanum nigrum*, *Centella asiatica*, etc. found wild in plenty in habitats outside forests have been brought under cultivation to meet the growing demands of 'extarcts' that depends upon sustained supplies of herbal material of consistently good quality that over a long-term is possible only through cultivation.

There also seems to be an increasing reliance upon importing quality herbal raw drug material from even distant countries. Import of raw drugs of native species like *Centella asiatica* leaves, *Zanthoxylum armatum* fruits, etc. is an example of such trend.

11.6. MEDICINAL PLANTS OF CONSERVATION CONCERN (RED-LISTED) IN TRADE

The increasing annual consumption levels of wild collected herbal raw drugs accompanied by general habitat degradation has caused decline in wild populations of many medicinal plant species. The dwindling wild populations of these species has become a cause of serious concern from the conservation and utilisation point of view. The FRLHT has, since 1995, conducted threat assessment exercises using IUCN Red List Categries and Criteria in respect of wild medicinal plant species of 18 states of the country. These assessments have resulted in categorising 344 medicinal plant species as threatened at the regional, national and/ or the global level. Many of these Red-listed medicinal plant species continue to be in active commercial trade putting further pressure on their wild resource.

The consolidated inventory of medicinal plant species in commercial demand worked out under this study includes 100 species that have been assessed as 'Red-Listed'. Of these 100 species, 36 have been assessed as 'Critically Endangered' and 64 assessed as 'Endangered' regionally, nationally or globally. List of these 100 Red-Listed medicinal plant species is given in Table 11.8.

Table 11.8: List of 100 Species of Conservation Concern in Commercial Demand for Herbal Raw Drugs

S. No.	Species	Family	Habit	Threat Category Assigned
1	*Aconitum chasmanthum*	Ranunculaceae	H	CR
2	*Aconitum heterophyllum*	Ranunculaceae	H	CR
3	*Justicia beddomei*	Acanthaceae	S	CR
4	*Aquilaria malaccensis*	Aquilariaceae	T	CR
5	*Arnebia benthami*	Boraginaceae	H	CR
6	*Arnebia euchroma*	Boraginaceae	H	CR
7	*Atropa acuminata*	Solanaceae	H	CR
8	*Betula utilis*	Betulaceae	T	CR
9	*Chlorophytum borivillianum*	Liliaceae	H	CR
10	*Cochlospermum religiosum*	Cochlospermaceae	T	CR
11	*Commiphora wightii*	Lauraceae	S	CR
12	*Coscinium fenestratum*	Menispermaceae	C	CR
13	*Cycas circinalis*	Cycadaceae	T	CR
14	*Dactylorhiza hatagirea*	Orchidaceae	H	CR
15	*Embelia ribes*	Myrsinaceae	C	CR
16	*Gentiana kurroo*	Gentianaceae	H	CR
17	*Holostemma ada-kodien*	Asclepiadaceae	C	CR
18	*Illicium griffithii*	Illiciaceae	T	CR
19	*Lilium polyphyllum*	Liliaceae	H	CR
20	*Litsea glutinosa*	Lauraceae	T	CR
21	*Malaxis muscifera*	Orchidaceae	H	CR
22	*Nardostachys jatamansi*	Valerianaceae	H	CR
23	*Panax pseudoginseng*	Araliaceae	H	CR
24	*Picrorhiza kurrooa*	Scrophulariaceae	H	CR
25	*Pterocarpus marsupium*	Fabaceae	T	CR
26	*Pterocarpus santalinus*	Fabaceae	T	CR
27	*Pueraria tuberosa*	Fabaceae	C	CR
28	*Rauvolfia serpentina*	Apocynaceae	H	CR
29	*Saraca asoca*	Caesalpiniaceae	T	CR
30	*Saussurea costus*	Asteraceae	H	CR
31	*Saussurea obvallata*	Asteraceae	H	CR
32	*Podophyllum hexandrum*	Podophyllaceae	H	CR
33	*Smilax glabra*	Smilacaceae	C	CR
34	*Swertia chirayita*	Gentianaceae	H	CR
35	*Symplocos racemosa*	Symplocaceae	T	CR
36	*Taxus wallichiana*	Taxaceae	T	CR
37	*Aconitum palmatum*	Ranunculaceae	H	EN
38	*Aconitum heterophyloides*	Ranunculaceae	H	EN
39	*Aconitum ferox*	Ranunculaceae	H	EN
40	*Aconitum lethale*	Ranunculaceae	H	EN
41	*Acorus calamus*	Acoraceae	H	EN
42	*Alpinia calcarata*	Zingiberaceae	H	EN
43	*Angelica glauca*	Apiaceae	H	EN
44	*Asparagus racemosus*	Liliaceae	C	EN
45	*Boswellia serrata*	Burseraceae	T	EN
46	*Bunium persicum*	Apiaceae	H	EN
47	*Celastrus paniculatus*	Celastraceae	C	EN

S. No.	Species	Family	Habit	Threat Category Assigned
48	*Chlorophytum arundinaceum*	Liliaceae	H	EN
49	*Chonemorpha fragrans*	Apocynaceae	C	EN
50	*Cinnamomum wightii*	Lauraceae	T	EN
51	*Clerodendrum serratum*	Verbenaceae	S	EN
52	*Coptis teeta*	Ranunculaceae	H	EN
53	*Decalepis hamiltonii*	Periplocaceae	C	EN
54	*Dendrobium nobile*	Orchidaceae	H	EN
55	*Didymocarpus pedicillata*	Gesneriaceae	H	EN
56	*Dioscorea deltoidea*	Dioscoreaceae	C	EN
57	*Dysoxylum malabaricum*	Meliaceae	T	EN
58	*Entada pursaetha*	Mimosaceae	C	EN
59	*Ephedra gerardiana*	Ephedraceae	S	EN
60	*Flickingeria fugax*	Orchidaceae	H	EN
61	*Fritillaria roylei*	Liliaceae	H	EN
62	*Fumaria indica*	Fumaricaceae	H	EN
63	*Garcinia pedunculata*	Clusiaceae	T	EN
64	*Gloriosa superba*	Liliaceae	C	EN
65	*Gymnema sylvestre*	Asclepiacaceae	C	EN
66	*Habenaria intermedia*	Orchidaceae	H	EN
67	*Homalomena aromatica*	Araceae	H	EN
68	*Hyoscyamus niger*	Solanaceae	H	EN
69	*Juniperus polycarpos*	Cupressaceae	S	EN
70	*Jurinea dolomiaea*	Asteraceae	H	EN
71	*Leptadenia reticulata*	Asclepiadaceae	C	EN
72	*Luffa echinata*	Cucurbitaceae	C	EN
73	*Manilkara hexandra*	Sapotaceae	T	EN
74	*Meconopis aculeata*	Papaveraceae	H	EN
75	*Mesua ferrea*	Clusiaceae	T	EN
76	*Michelia champaca*	Magnoliaceae	T	EN
77	*Mucuna pruriens*	Fabaceae	C	EN
78	*Nervilia aragoana*	Orchidaceae	H	EN
79	*Nilgirianthus ciliatus*	Acanthaceae	S	EN
80	*Mappia foetida*	Icacinaceae	T	EN
81	*Operculina turpethum*	Convolvulaceae	C	EN
82	*Oroxylum indicum*	Bignoniaceae	T	EN
83	*Desmodium oojeinense*	Fabaceae	T	EN
84	*Paris polyphylla*	Liliaceae	H	EN
85	*Piper longum*	Piperaceae	H	EN
86	*Piper nigrum*	Piperaceae	C	EN
87	*Coleus forskohlii*	Lamiaceae	H	EN
88	*Plumbago indica*	Plumbaginaceae	H	EN
89	*Polygonatum cirrhifolium*	Liliaceae	H	EN
90	*Rheum australe*	Polygonaceae	H	EN
91	*Rheum moorcroftianum*	Polygonaceae	H	EN
92	*Rhododendron anthopogon*	Ericaceae	S	EN
93	*Salacia reticulata*	Hippocrateaceae	S	EN
94	*Santalum album*	Santalaceae	T	EN
95	*Sterculia urens*	Sterculiaceae	T	EN

S. No.	Species	Family	Habit	Threat Category Assigned
96	*Stereospermum tetargonum*	Bignoniaceae	T	EN
97	*Tecomella undulata*	Bignoniaceae	T	EN
98	*Trichopus zeylanicus*	Trichopodaceae	H	EN
99	*Zanthoxylum armatum*	Rutaceae	S	EN
100	*Zanthoxylum rhetsa*	Rutaceae	S	EN

Source: FRLHT datatbase

It is interesting to note that nearly 50% of species assessed as 'Critically Endangered' are sourced from the Himalayan region. One fourth of the Red-listed species are trees and another one fourth is shrubs and large climbers. Some of the species enlisted above, like *Fumaria indica*, seem to be commonly growing in landscapes outside forests. However, the wild populations of these species have drastically declined due to high demand and loss of their habitats to development and degradation. Species like *Piper longum* and *Piper nigrum*, which are under extensive cultivation, are fast losing their wild germplasm, very important to conserve their genetic base for their long term survival and for development of newer varieties using germplasm.

These species require urgent management interventions for their conservation, sustainable availability to the herbal sector, and continuous cash income to thousands of wild gatherers. Government of India has notified some of these species under Section 38 of The Biological Diversity Act, 2002 and their wild harvest and trade prohibited. Some of these species have been notified under 'Negative List of Exports' also. However, what is required is to put these species in 'Action Lists' for proactive action towards their conservation, building of their wild populations, developing sustainable harvest practices and rooting these practices in the local communities usually associated with their wild harvest.

11.7. FOREST BASED MEDICINAL PLANT SPECIES FOR PRIORITISED MANAGEMENT INTERVENTIONS

The increasing use of medicinal plants in curative and preventive herbal formulations as well as in the lifestyle related cosmeceutical and nutraceuticals products has a corresponding impact on the sustained availability of these botanicals of these plants. Whereas the market economy largely takes care of the medicinal plant species under cultivation - farmers adjusting their acreage as per projected demand and rates of particular species, it is the medicinal plant species collected from the wild that are of concern. With local communities having rights over their collection and little focus on their sustainable management, increasing wild collections and the general habitat degradation has brought wild populations of many of the wild collected species under stress. All such species that are collected from the forests need urgent management intervention. To facilitate better appreciation of the species of Himalayan region and tropical region, the discussion on the subject has been grouped under the following two heads:

11.7.1: Himalayan Forest Species in High Trade needing Priority Management Interventions

Of the 114 medicinal plant species in high annual trade that are sourced primarily from forests, 36 of these species are sourced from the Himalayan forests and it include 15 'Red-listed' species. In addition, 24 other 'Red-listed' Himalayan species have also been recorded in trade, with lesser annual trade quantities. However, populations of these 24 'Red-listed' species are reported to be fast declining on account of habitat loss/ degaradation coupled with unsustainable harvesting. The list of 36 species in high trade and 24 'Red-listed' species sourced from the Himalayan region needing priority management interventions is given in Tables 11.9a and 11.9b.

Table 11.9a: Himalayan Forest Species in High Trade needing Priority Management Interventions

S. No.	Species	Threat Status	S. No.	Species	Threat Status
1	*Abies spectabilis*	-	19	*Nardostachys jatamansi*	CR
2	*Achillea millefolium*	-	20	*Neopicrorhiza scrophulariiflora*	-
3	*Aconitum heterophyllum*	CR	21	*Onosma hispida*	-
4	*Asparagus adscendens*	-	22	*Parmelia perlata*	-
5	*Arnebia benthamii*	CR	23	*Picrorhiza kurroa*	-
7	*Berberis lyceum*	-	25	*Pistacia integerrima*	-
8	*Bergenia ciliata*	-	26	*Polygonatum cirrhifolium*	EN
9	*Betula utilis*	CR	27	*Prunus cerasoides*	-
10	*Cedrus deodara*	-	28	*Punica granatum*	-
11	*Cinnamomum tamala*	-	29	*Rheum australe*	EN
12	*Coptis teeta*	EN	30	*Rhododendron arboreum*	-
13	*Didymocarpus pedicellatus*	EN	31	*Swertia chirayita*	CR
14	*Ephedra gerardiana*	EN	32	*Taxus wallichiana*	CR
15	*Hedychium spicatum*	-	33	*Trillidium govanianum*	-
16	*Hyoscyamus niger*	EN	34	*Valeriana jatamansi*	VU
17	*Juniperus communis*	-	35	*Viola pilosa*	-
18	*Mentha longifolia*	-	36	*Zanthoxylum armatum*	EN

Table 11.9b: Red-listed Himalayan Forest Species for Priority Management Interventions even though presently in Lesser Trade

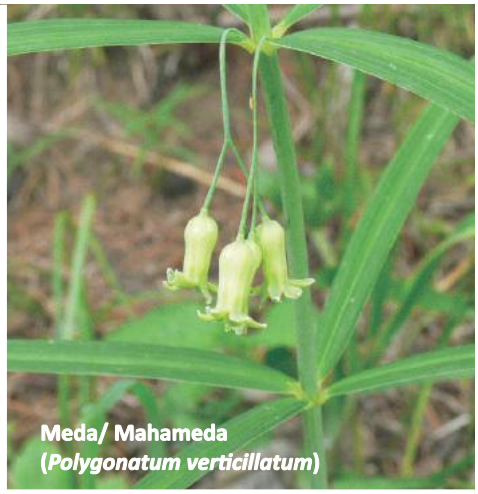
S. No.	Species	Threat Status	S. No.	Species	Threat Status
1	*Aconitum chasmanthum*	CR	13	*Gentiana kurroo*	CR
2	*Aconitum ferox*	EN	14	*Habenaria intermedia*	EN
3	*Aconitum heterophyloides*	EN	15	*Juniperus polycarpos*	EN
4	*Aconitum lethale*	EN	16	*Jurinea dolomiaea*	EN
5	*Aconitum palmatum*	EN	17	*Lilium polyphyllum*	CR
6	*Angelica glauca*	EN	18	*Malaxis muscifera*	CR
7	*Arnebia euchroma*	CR	19	*Meconopis aculeata*	EN
8	*Atropa acuminata*	CR	20	*Paris polyphylla*	EN
9	*Bunium persicum*	EN	21	*Podophyllum hexandrum*	CR
10	*Dactylorhiza hatageria*	CR	22	*Rheum moorcroftianum*	EN
11	*Dioscorea deltoidea*	EN	23	*Rhododendron anthopogon*	EN
12	*Fritillaria roylei*	EN	24	*Saussurea obvallata*	CR

In addition to the species for priority action tabulated above (table 11.9a & 11.9b), two other medicinal plant species need to be taken up for priority action. The first is 'Kuth' (*Saussurea costus*) - the commercial supplies of which are almost entirely being met from cultivation – for the reason that its wild populations continue to shrink due to illicit harvest and regular infusion from wild resources is needed to broaden genetic base of material under cultivation. The second such species is 'Wild Apricot' (*Prunus armeniaca*) that is presently widely cultivated and has become a species of choice for planting along farm bunds in the Himalayan region and is extensively used for medicinal and other purposes at local level. There is a need to develop better cultivars of this species to further encourage farmers to adopt the species under agroforestry.

Of the 62 species listed above, Deodar (*Cedrus deodara*), Talispatra (*Abies spectabilis*), and Chir


Kakoli (*Roscoea alpina*)


Meda/ Mahameda (*Polygonatum cirrhifolium*)


Meda/ Mahameda (*Polygonatum verticillatum*)


Kakoli (*Roscoea procera*)


Vridhi (*Habenaria intermedia*)


Ridhi (*Platanthera edgeworthi*)


Kshirkakoli (*Lilium polyphyllum*)


Kshirkakoli (*Fritillaria roylei*)


Jeevak (*Crepidium acuminatum*)


Risbak (*Malaxis muscifera*)

Ashtavarga - A Red-Listed Group of Himalayan Medicinal Plants

Some Red-Listed Himalayan Medicinal Plants

(*Pinus roxburghii*) are spread over vast expanses and are under silvicultual management by the State Forest Departments of the Himalayan states. The Himalayan tree species including Bhojpatra (*Betula utilis*) and two species of Juniper are very slow growing, hard to propagate and, thus, are best managed in their natural habitat. *In situ* conservation, with active support of the local communities, seems to be the best method to manage these tree species. Birmi Talish (*Taxus wallichiana*), in addition to its commercial demand, is used locally as incense during religious programs. Wild harvest results in extensive damage to the trees. Limited cultivation of the species has also been attempted, that should be further promoted. One of the ways is to encourage State Forest Departments to plant this species at close spacing to create its hedges that can be periodically harvested. Padamkashath (*Prunus cerasoides*) and Anar (*Punica granatum*) exist naturally in the north-west Himalayan States. Produce from both these species is in large demand. Both these species have good economic potential for strengthening their populations both on forest and non-forest land, which should be encouraged.

The supplies of 'kakarsingi' (*Pistacia integerrima*) are not commensurate with its demand. Firstly, the number of trees has been on the decline due to inadequate management focus and secondly, the leaf gall formation has also declined over the years due to reasons which need to be studied. Whereas the wild populations of this species need to be strengthened through plantation drive, the causes for reducing incidence of gall formation need to be investigated.

With its GI registration in Uttarakhand, Tejpatta (*Cinnamomum tamala*) has come to occupy a premium place in trade and its cultivation is likely to pick up on the strength of its rising prices.

Berberis is a difficult group, with almost all its species being collected as 'daruhaldi'. API, however, does not recognise all *Berberis* species as equivalents. Most of the wild collections, therefore, amount to adultration. There is, thus, a need to bring the API approved species under cultivation. Wild populations of Timbre (*Zanthoxylum armatum*) have drastically dwindled over the years, and these need to be re-established through augmentation plantations in the forests.

The lichens (*Parmelia* group) is a very complex group with limited expertise to identify the species in the field. This group of species is presently under extensive destructive harvest. As no known technique to propagate species of this group is available, these would best be managed in situ for which sustainable harvest techniques would need to be developed.

Most of the herbaceous species listed above are best managed through sustainable harvesting practices in their natural habitats. However, in view of the increasing harvesting pressure and the general habitat degradation, some species/ species groups like Aconites, Arnebias, Ashtavarga (*Malaxis muscifera*, *Habenaria intermedia*, *Lilium polyphyllum*, *Fritillaria royei*, *Polygonatum cirrhifolium*), *Dactylorhiza hatageria*, *Angelica glauca*, *Atropa acuminata*, *Bunium persicum*, *Gentiana kurroo*, *Nardostachys jatamansi*, *Picrorhiza kurroa* (including *Neopicrorhiza scrophulariiflora*), *Podophyllum hexandrum*, *Rheum* spp. *Swertia chirayita*, etc. need to be considered for serious promotion of their cultivation.

11.7.2: Tropical Forest Species in High Trade needing Priority Management Interventions

Tropical forests in the country are a large repository of medicinal plants of commercial importance, and an estimated 78 medicinal plant species in high commercial demand are sourced from the tropical forests. In addition, there are many Red-listed species like 'Musli' (Chlorophytum spp.), 'Sugandmantri' (Homalomena aromatica), etc. that are eventhough presently under cultivation, yet their wild stock continues to be exploited to meet local demands. The list of species

sourced from the Tropical forests and requiring priority management intervention is given in Tables 11.10a & 11.10b.

Red-Listed Tropical Medicinal Plants

Table 11.10a: Tropical Forest Species in High Trade needing Priority Management Interventions

S. No.	Species	Threat Status	S. No.	Species	Threat Status
1	*Acacia catechu*	-	40	*Leptadenia reticulata*	EN
2	*Acacia nilotica subsp. indica*	-	41	*Litsea glutinosa*	CR
3	*Acacia sinuata*	-	42	*Madhuca indica*	-
4	*Aegle marmelos*	VU	43	*Madhuca longifolia*	VU
5	*Albizia amara*	-	44	*Mesua ferrea*	EN
6	*Amorphophallus paeoniifolius*	VU	45	*Mimusops elengi*	-
7	*Andrographis paniculata*	VU	46	*Morinda coreia*	-
8	*Asparagus racemosus*	EN	47	*Mucuna pruriens*	EN
9	*Baliospermum montanum*	VU	48	*Operculina turpethum*	EN
10	*Bauhinia variegata*	-	49	*Oroxylum indicum*	EN
11	*Bombax ceiba*	-	50	*Paederia foetida*	VU
12	*Boswellia serrata*	EN	51	*Phyllanthus emblica*	VU
13	*Buchanania cochinchinensis*	VU	52	*Premna corymbosa*	-
14	*Butea monosperma* var. *lutea*	EN	53	*Premna serratifolia*	
15	*Caesalpinia bonduc*	-	54	*Pterocarpus marsupium*	-
16	*Cassia fistula*	-	55	*Pterocarpus santalinus*	CR
17	*Celastrus paniculatus*	EN	56	*Pueraria tuberosa*	CR
18	*Chlorophytum arundinaceum*	EN	57	*Rauvolfia serpentina*	CR
19	*Cinnamomum sulphuratum*	VU	58	*Rubia cordifolia*	CR
20	*Commiphora wightii*	CR	59	*Salacia reticulata*	VU

S. No.	Species	Threat Status	S. No.	Species	Threat Status
21	*Crateva religiosa*	-	60	*Santalum album*	EN
22	*Curculigo orchioides*	-	61	*Saraca asoca*	EN
23	*Decalepis hamiltonii*	EN	62	*Scindapsus officinalis*	CR
24	*Desmodium gangeticum*	-	63	*Semecarpus anacardium*	VU
25	*Dioscorea bulbifera*	VU	64	*Shorea robusta*	-
26	*Embelia ribes*	CR	65	*Stereospermum chelonoides*	-
27	*Embelia tsjeriam-cottam*	VU	66	*Stereospermum tetargonum*	-
28	*Erythrina variegata*	-	67	*Strobilanthes ciliata*	EN
29	*Ficus benghalensis*	-	68	*Strychnos nux-vomica*	-
30	*Flickingeria macraei*	EN	69	*Strychnos potatorum*	VU
31	*Garcinia gummi-gutta*	-	70	*Symplocos cochinchinensis*	VU
32	*Garcinia indica*	VU	71	*Symplocos racemosa*	-
33	*Gmelina arborea*	-	72	*Tecomella undulata*	CR
34	*Gymnema sylvestre*	EN	73	*Terminalia arjuna*	EN
35	*Helicteres isora*	-	74	*Terminalia bellirica*	VU
36	*Hemidesmus indicus*	-	75	*Terminalia chebula*	-
37	*Holarrhena pubescens*	-	76	*Woodfordia fruticosa*	VU
38	*Holoptelea integrifolia*	-	77	*Wrightia tinctoria*	-
39	*Ipomoea mauritiana*	-	78	*Ziziphus mauritiana*	-

Note: The threat status of the species reflected in the table is limited to the specific state (s) for which rapid threat assessment has been undertaken and does not represent their global Red List status except endemcs like *Pterocarpus santalinus*, *Cinnamomum sulphuratum*, etc.

Table 11.10b: Red-listed Tropical Forest Species for Priority Management Interventions even though presently in Lesser Trade

S. No.	Species	Threat Status	S. No.	Species	Threat Status
1	*Aquilaria malaccensis*	CR	3	*Holostemma ada-kodien*	CR
2	*Coscinium fenestratum*	EN	4	*Panax pseudoginseng*	CR

The list above includes a large number of trees, which should ideally be conserved in their natural habitats. However, some tree species like Bael (*Aegle marmelos*), Kachnar (*Bauhinia variegata*), Amaltas (*Cassia fistula*), Amla (*Phyllanthus emblica*), Harar (*Terminalia chebula*), Ber (*Zizyphus mauritiana*), etc. have a good economic potential and could be taken up for large scale promotion as agroforestry component also.

Avaialability of authentic material of 'Brht-panchmula' component of the 'Dashamula' species remains an area of concern. Some trials to test efficacy of younger plants of these species (*Oroxylum indicum*, *Premna serratifolia*, *Stereospermum chelonoides*, *Stereospermum tetargonum*) have been carried out over the past few years. These need to be continued and the results verified as a priority so that the policy on planting of these species could be appropriately revised.

'Agar' (*Aquilaria malaccensis*) and 'Guggal' (*Commiphora wightii*) continue to be in high demand with domestic production only a fraction of the total annual demand. Both these high value entities are imported in large quanitities to meet their demand. Initiatives to strengthen the resource base of these species need to be further strengthened. There is also a need to develop

sustainable methods of tapping 'guggul'. There is also a need to develop protocols for early development of fungus-infested agarwood.

11.8. SELF-GROWN MEDICINAL PLANT SPECIES SOURCED FROM HABITATS OUTSIDE FORESTS

Habitats outside forests that include agricultural farms, fallow lands, road sides, canal banks, ponds and lakes, waste lands, etc. form an important source of a large number of medicinal plant species. The species growing in these habitats are known to be aggressive colonisers, and in normal circumstances would continue to grow in abundance. The list of 59 such self-grown species in high trade that are sourced from habitats outside forests is given in Table 11.11.

Table 11.11: List of 59 Self-grown Species in High Trade Sourced from Habitats outside Forests

S. No.	Species	S. No.	Species
1	*Abrus precatorius*	31	*Ocimum americanum*
2	*Abutilon indicum*	32	*Pedalium murex*
3	*Acalypha indica*	33	*Peganum harmala*
4	*Achyranthes aspera*	34	*Phyllanthus amarus*
5	*Aerva lanata*	35	*Phyllanthus maderaspatensis*
6	*Alhagi pseudalhagi*	36	*Pluchea lanceolata*
7	*Argyreia elliptica*	37	*Plumbago zeylanica*
8	*Baccharoides anthelmintica*	38	*Pseudarthria viscida*
9	*Bacopa monnieri*	39	*Senna auriculata*
10	*Barleria prionitis*	40	*Senna occidentalis*
11	*Boerhavia diffusa*	41	*Senna tora*
12	*Capparis spinosa*	42	*Sida acuta*
13	*Cardiospermum halicacabum*	43	*Sida cordifolia*
14	*Centella asiatica*	44	*Sida rhombifolia*
15	*Chaemecrista absus*	45	*Solanum anguivi*
16	*Cissus quadrangularis*	46	*Solanum nigrum*
17	*Citrullus colocynthis*	47	*Solanum virginianum*
18	*Clerodendrum phlomidis*	48	*Spermacoce hispida*
19	*Clerodendrum serratum*	49	*Sphaeranthus indicus*
20	*Convolvulus prostratus*	50	*Tamarix indica*
21	*Cullen corylifolium*	51	*Tephrosia purpurea*
22	*Cynodon dactylon*	52	*Teramnus labialis*
23	*Cyperus rotundus*	53	*Tinospora cordifolia*
24	*Cyperus scariosus*	54	*Tinospora sinensis*
25	*Datura metel*	55	*Tragia involucrata*
26	*Eclipta prostrata*	56	*Trianthema decandra*
27	*Fumaria indica*	57	*Tribulus lanuginosus*
28	*Hygrophila schulli*	58	*Tribulus terrestris*
29	*Ipomoea nil*	59	*Trichosanthes cucumerina*
30	*Martynia annua*		

The reduced herbal raw drug availability of some of these seemingly abundant self-grown species growing in habitats outside forests has now become a cause of concern. In some cases, viz. *Fumaria indica*, *Alhagi pseudalhagi*, *Convolvulus prostratus*, *Citrullus colocynthis*, *Tribulus* spp., etc., the very habitat has significantly shrunk over the recent years due to intensification of agriculture involving large chunks of hitherto fallow lands that have been brought under plough. The availability of some species like *Cissus quadrangularis* and *Cardiospermum halicacabum* is also declining due to over-collection to meet the rising commercial and household demand.

Increasing contamination and pollution of the landscapes outside forests has become another issue of serious concern. While the agricultural lands have become much exposed to overdoses of fertilisers, insecticides, fungisides and weedisides, many of the waste lands and road/ rail/ canal sides have come under discharge of industrial affluents and sewer water, making the medicinal plants growing in these habitats unsuitable for use as herbal raw drugs.

Pilot cultivation of some of these species like *Bacopa monnieri*, *Centella asiatica*, *Cyperus scariousus*, *Phyllanthus amarus*, *Solanum nigrun*, etc. to get authentic and unadulterated material has already been initiated. Many species of *Sida* are used as 'bala' and there is need to develop resource base of species of *Sida* used by herbal industry as per API. Resource base of many of these species would need to be strengthened and more species from this supplu source may need to be brought under domestication/ cultivation to get authentic and non-contaminated material.

11.9. LIMITATIONS OF THE INVENTORY AND ASSESSED TRADE QUANTUM

The consolidated inventory of medicinal plants in commercial demand for the year 2014-15 has been worked out based on a comprehensive sampling design followed by intensive field work. Concerted efforts have been made to correlate the herbal raw drug samples and their trade names with their botanical sources. The inventory and trade quantum also corroborates the earlier work on the subject carried out by Ved and Goraya (2008) with trade volumes of most of the species remaining within the old trade volume range. Major variations in trade volume from the previous report have been noticed in case of species like Aloe vera that has come to be used in lifestyle related recipes.

The major limitation of the inventory and estimating trade volumes is in respect of the use of equivalents by the herbal industry. For example, herbal raw drug 'bala' is sourced from many species of *Sida*, the prominent being *S. acuta*, *S. cordifolia* and *S. rhombifolia*. Material from all or any of these species is used as 'bala'. It has, however, not been possible to seggeragate the material obtained from different species of Sida for estimating species-wise trade volume for this entity. The estimation in such cases has, therefore, been made on the basis of information provided by the traders and herbal industry, moderated with priori knowledge of the field teams about the range of occurrence of the species.

Trade/ use of some raw drug entities in small quantities under trade names that could not be correlated to their exact botanical identity came to notice during the study. However, such entities where botanical correlation could not be established with the entity have not been included in the survey.

The study, based on only two sets of data, the first one pertaining to 2004-05 as reported by Ved and Goraya (2008) and the second one 2014-15 as gathered during this current study, does provide a comparative analysis of the medicinal plant trade in the country over the last decade. However, annual fluctuations in trade or demand of herbal raw drugs n India can not be interpreted through these two studies.

12

Discussion and Recommendations

Turnover of the domestic herbal industry in the country, estimated at ₹ 20,000 crore for the year 2014-15, has registered a growth of about 11% over the past ten years. Herbal sector is poised to grow further globally. India, with strong traditional base in the use of herbals for health care, has an excellent opportunity to meet the global expectations through enhanced exports of quality herbal material and products and by developing world class herbal based health care facilities within the country. This requires demonstrating the fair trade practices and quality, authenticity and sustainability of herbal produce. The herbal raw drug trade in the country, however, is seen as secretive, with chain of custody of the material linking it to the source being not visible. If the country has to reap benefits of the potential this sector has, immediate interventions would need to be made in the area of wild harvests, trade, cultivation, and policy and law. Support would also need to be provided to research and development initiatives on various aspects related to the sector.

12.1. HERBAL SECTOR IN INDIA ON A PATH OF GROWTH

Herbal sector in the country is on a path of growth. The estimated annual trade volume has grown from 317,500 MT in 2004-05 to 512,000 MT in 2014-15 with a corresponding increase in the estimated trade value from ₹ 1,070 crore in 2004-05 to ₹ 7,000 crore in 2014-15. Whereas the domestic herbal industry has registered a three-fold increase in trade value of the herbal raw drugs consumed by it over the ten year period from 2004-05 to 2014-15, the trade value on account of exports registered a nine-fold increase over the same period. Based on the estimated consumption of herbal raw drugs, the total estimated turnover of the domestic herbal industry in the country for the year 2014-15 stands at ₹ 20,000 crore! Comparison with the estimated turnover of the domestic herbal industry as worked out by Ved and Goraya (2008) reveals that the sector has grown at a healthy 11% per year over the ten year period from 2004-05 to 2014-15.

Total turnover of the domestic herbal industry in the country for the year 2014-15 is estimated at ₹ 20,000 crore!

The country sees a great potential for further expansion of this sector. However, alongside the increasing demand for herbals are corresponding concerns about sustainable harvesting practices, quality, authenticity, and ethical trade practices related to the herbal material. It is, therefore, worthwhile to list out the strengths and weaknesses of the sector to identify the areas for improvement to ensure that the herbal sector continues to follow a growth path.

12.1.1: Strengths

- India has a very strong ancient tradition of plant use for health care and well being with a very large number of its population continuing to rely upon this tradition.
- Diverse agro-climatic zones in the country make India a very rich repository of medicinal plants that form basis of the country's health care traditions.
- Cultivation of many species of medicinal plants is already seen as a way of life in various parts of the country, and millions of hard working farmers are eager to take up cultivation of medicinal plant species suitable to their area.
- India has a very strong existence of herbal raw drug mandis and a vast network of highly experienced herbal traders, who provide an effective and efficient link between the primary producers and the end users.
- India has a very strong network of research organisations dealing with various aspects of medicinal plants and herbal raw drugs.

12.1.2: Weaknesses

- Depleting populations of many wild collected medicinal plant species due to unorganised wild collection that may result in non-availability of key herbal raw drugs and adversely affect the sector.
- Weak protocols with respect to post harvest handling resulting in loss of quality and damage to the harvested produce.
- Complex state-wise regulatory regimes for wild collection, cultivation, transport and trade of herbal raw drugs.
- Apparently non-transparent trade practices, coupled with absence of any mandi-level centralised record keeping system of trade along the trade chain.
- Increasing concerns about quality and authenticity of the herbal raw drugs used in the herbal formulations.

- Inadequacy of ITC (HS) system to maintain species-wise record of exports, making it difficult for the planners and managers to plan resource management regimes for medicinal plant species.
- Lack of national policy on medicinal plants, with the effect that different organisations focus on their own agendas without any national focus.

12.1.3: Opportunities

- The global demand of herbal products for health care and life style related issues is likely to grow further and if positioned well, India can be a leader in fulfilling this demand.
- Many CBOs/ NGOs have initiated programs to organise wild gatherers/ farmers for sustainable harvest/ cultivation, and to develop processes to follow fair trade protocols.
- Domestic herbal industry, represented by more than 8,600 registered units, has started adopting good manufacturing practices, including the one related to maintenance of record of herbal raw drugs consumed by the Industry during the year.
- Government has come forward to support medicinal plant conservation and cultivation programs with a view to strengthen the herbal raw drug resource base.

12.1.4: Threats

- Continuation of 'no change' in the current practices attitude may turn many a followers of 'herbal' away from the sector.
- Any further dithering to adopt a national medicinal plant policy may result in country losing the initiative to be a major player in the growing global herbal sector.
- The ongoing processes of developing synthetic drugs may adversely impact demand of medicinal plant species under large scale cultivation.
- The current government policies of harvest, domestic use and export of plant material may hamper primary production and consumption of such material.

12.2. RECOMMENDATIONS

Based on the outcomes of the study as brought out in previous chapters and the SWOT analysis of the sector, there is a need to support and act upon the following action points for further strengthening and promotion of herbal sector in the country:

12.2.1: Management of Wild Resource

Wild collected medicinal plants remain the mainstay of herbal health care systems in the country due to their easy accessibility to the local populations for their self-use and for trade to fulfil the requirements of the herbal industry and other end users. Over-harvesting and inadequate management focus on this 'minor forest produce' has brought many of these species under serious threat of extinction. The most vulnerable of these 'threatened' species are trees, other long-gestation species and the Himalayan herbs. At the current level of understanding, the best viable method of their conservation and development is to conserve these species in their natural habitats. One such initiative has been establishment of Medicinal Plant Conservation Areas (MPCAs) around viable populations of the threatened species. MPCAs have been established across the country with the objective to conserve the wild populations of 'threatened' medicinal plant species in situ under various externally funded project. NMPB is also supporting establishment of Medicinal Plant Conservation and Development Areas (MPCDAs) in many states. However, the status of these in situ medicinal plant conservatories, both MPCAs and MPCDAs, needs to be evaluated.

With communities having been devolved the right over the 'minor forest produce' no conservation effort would be successful unless taken up along with the local communities. Forest Departments of the states being the custodians of the forest land would also need to be actively involved. Research organisations with clear mandate and good strength in field botany would need to be involved in organising threat assessment exercises, in undertaking population surveys and in developing sustainable harvest methods. Local CBOs/ NGOs would need to be involved for initial organisation of the local communities, their hand holding during the program and for providing technical, organisational and marketing support. The available instrument of Joint Forest Management (JFM) provides a good option to involve local communities in managing the MPCAs/ MPCDAs and in strengthening wild resources of medicinal plants in the form of Community Medicinal Plant Reserves (CMPRs) for sustainable harvest of threatened species in forest/ common land.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Initiate and support a country-wide program to strengthen wild populations of (a) medicinal trees, (b) other long gestation medicinal plant species, and (c) high Himalayan herbs in the form of CMPRs in forest land through JFM	Encourage and facilitate the SFDs to select suitable CBOs/ NGOs - 2 or more per state (@ one for 2-3 districts) - and enter into long-term agreement with them to organise, energise, and train local JFM committees in managing CMPRs in the assigned forest land for strengthening wild populations of native tree species of medicinal value, other long-gestation species and high Himalayan herbs including their sustainable harvest.	2017
		Provide financial support to the JFM Committees for strengthening of medicinal tree resources.	2017-2026 (10 years)
		Provide financial support to SFDs in strengthening and expanding the *in situ* conservation network of priority medicinal plants.	2017-2026 (10 years)
b	Support workshops to assess threat status of the wild collected medicinal plant species and to prioritise conservation action at regional and national level.	Identify suitable national agency to anchor the threat assessment program.	2017
		Identify a core group of resource persons to steer this specialised job.	2017
		Provide financial support for organising such threat assessment workshops and developing Red-lists for priority action.	2017-2022 (5 years)
c	Support population surveys to identify viable wild populations of medicinal plant species assessed 'Red-listed' and initiate their conservation action	Identify a suitable national agency to anchor, and 3-4 regional agencies to carry out population surveys in respect of Red-listed medicinal plant species.	2017
		Provide financial support to the selected organisations for carrying out population surveys.	2017-2022 (5 years)

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
		Equip the State Forest Departments in undertaking *in situ* conservation and resource enhancement measures.	2019-2030 (12 years)
d	Support research on development of forest-type specific forest management/ silviculture systems for integrating management of native medicinal plants.	Assign this work with necessary financial support to national forestry research organisations like ICFRE for development of appropriate forest management systems in a time bound manner.	2016-2030 (15 years)
e	Putting in place long-term mechanism for monitoring and evaluating efficacy of MPCAs/ MPCDAs in conserving priority Red Listed medicinal plant species	Identify appropriate organisations at national and regional level for periodic monitoring and evaluation of conservation status of Red Listed medicinal plant species.	2016-2030 (15 years)
		Prepare triennial report on such status, to identify and address gaps.	2020-2030

12.2.2: Promotion of Commercial Cultivation of Medicinal Plants

Cultivation of many medicinal plant species where adequate supplies from the wild are becoming difficult to get and where authentic material gets a premium has become a necessity. NMPB has played a stellar role in promoting commercial cultivation of medicinal plants since its inception about 15 years ago. The Board now supports commercial cultivation of 116 listed species under 3 sets of subsidy regimes. It has come out very clearly during the study that commercial cultivation of medicinal plants could be successfully introduced only in those new areas where some local CBO/ NGO came forward and steered the process of cluster formation with or without subsidy support, and provided technical and marketing support to the farmers.

Lack of adequate quantities of authentic and good quality seed/ planting material came out as one of the important stumbling blocks in promoting cultivation of medicinal plants. On-field demonstration trials of integrated cultivation of medicinal plant species with conventional crops are required to be set up to promote cultivation of medicinal plants.

Dispensation of subsidy, especially getting the second instalment released due to complex inspection protocols, was cited by small farmers as a major dampener in utilising the available subsidy. The subsidy regime would need to continue especially in respect of newly introduced Red-listed species where risk of low returns is higher. The subsidy regime, however, would need to be revisited and alternative methods of its dispensation would need to be studied.

Medicinal Plants Nursery

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Support development and production of high quality planting material of medicinal plant species to be promoted for cultivation	Assign the task of developing high quality certified planting material to selected research organisations and provide to them financial support for the job.	2017-18
		Support establishment of institutional medicinal plant nurseries for commercial production of initial stock of high quality planting material.	2018-2025 (7 years)
b	Support local CBOs/ NGOs for organising farmers and to provide them technical and marketing support.	Select local CBOs/ NGOs @ one per 3-4 districts, and arrange training programs for them in understanding key issues related to cultivation of medicinal plants.	2016-17
		Retain these selected CBOs/ NGOs at nominal monthly fee to develop clusters of at least 1000 farmers in their allocated districts.	2017-18
		Support the cultivation promotion programs through these selected CBOs/ NGOs.	2018-2027 (10 years)
c	Support processes for certification of cultivated herbal raw drug material	Identify a nodal agency to develop scope and protocols for certification of medicinal plant cultivation.	2017-18
		Support pilot scale certification of 4-5 village clusters in different regions of the country	2018-20
d	Support setting up of on-farm demonstration trials of different agro-forestry models with medicinal plants.	Formulate and support research program for setting up on-farm demonstration trials showing intercropping of medicinal plants with conventional agri-crops as collaborative program between the concerned research organisation, local CBO/ NGO and the state medicinal plants board. A pilot program for10 species for different agro-climatic zones may be initiated to start with.	2017-2026 (10 years)
e	Evolve suitable farmer cluster based and production-linked subsidy dispensation mechanism instead of the present individual and cultivation-linked mechanism	Initiate a process of national consultation on the issue.	2017-18

12.2.3: Supporting Good Post Harvest Handing Practices and Infrastructure

The present study has brought out very clearly that the herbal raw drug material suffers substantial wastage and loss of quality due to poor post harvest handling of the material. It is an issue of serious concern from both wild harvest and cultivation point of view. Whereas wastage of the wild collected material has adverse impact on the wild resource, wastage of cultivated

material impacts the economic returns to the farmer. Farmers and wild gatherers expressed their ignorance about the existence of any 'good post harvest handing practices' protocols, pointing to an urgent need for initiating nation-wide training-cum-capacity building programs for the wild gatherers and the farmers.

Acute lack of even simple facilities like driers and drying yards was noticed, creating difficulties for the wild gatherers and the farmers in drying the harvested material. Many a times, due to rains, the fresh material is kept in bundles indoors resulting in its getting fungal infestation, and damage to the material. Dried material is usually kept in shoddy packing material at all available spaces in the house till it is lifted by the traders. There are no laboratory facilities near production centres making wild gatherers/ farmers vulnerable to exploitation on account of lower quality assessed at the end of the large traders/ users.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Support development of post harvest handing facilities at key medicinal plant growing clusters	Select local CBOs/ NGOs for anchoring the facilities.	2017
		Create a minimum of 100 post harvest handling centres with each centre to have chopping machines, drying courtyards, covered drying platforms, solar dryers, weighing scales, godowns, etc.	2017-20 (3 years)
		Train the farmers in good post harvest handling practices.	2017-22 (5 years)
b	Support mobile laboratories to test quality of medicinal plant produce before its dispatch to bulk buyers	Deploy on pilot basis mobile laboratories equipped with necessary equipment and	2017-18
		trained technicians to undertake testing of medicinal plant produce at farm gate.	

12.2.4: Fair Trade Practices

The herbal raw drug trade in the country is far from transparent, with little demonstrable mechanism to reflect fair trade practices, with inadequate mechanisms to follow the movement of material along the trade chain and to link the material in trade to its phyto-geographic production source, and with no mechanism of managing trade data in respect of conventional herbal mandis.

The inadequacy of data availability and no systems to trace backward linkages of the herbal raw drug material in place, confirming authenticity of the material remains a challenge, and the question raised by Ved and Goraya (2008) that 'from where does Asoka Chhal come' remains unanswered even after ten years. The origin, authenticity and botanical correlation of the herbal raw drug entities actually used as 'Jivanti', 'Vidari', 'Shakhapuspi', 'Daruharidra', etc. also remains questionable. With supplies of wild collected produce in adequate quantities becoming scarcer, the problem is only expected to become more serious.

In the absence of firm protocols to establish backward linkages of the material at any stage in the trade, questions about the source of the material, about its authenticity, and about the fair returns to the primary producers will continue to be asked.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Develop and put in place an effective 'trade record management system' in place in respect of conventional herbal raw drug mandis.	Assign the task of developing prototype of 'trade record management system' to some suitable organisation.	2017-18
		Initiate national consultation on the issue and finalise the 'trade record management system' for implementation.	2018-19
b	Develop and implement chain of custody protocols in respect of traded herbal raw drugs.	Assign the task of developing prototype of 'chain of custody protocols' to some suitable organisation.	2017-18
		Initiate national consultation on the issue and finalise the 'chain of custody protocols' for implementation.	2018-19
c	Launch a national capacity building program for frontline staff of SFDs and the Panchayat functionaries in identification and documentation of medicinal plants harvested from the forests towards developing chain of custody regime at the primary production level.	Assign the task of developing prototype of 'capacity building module' and 'training-cum-reference material for the trainees' to some suitable organisation.	2017-18
		Organise these capacity building programs in collaboration with Panchayati Raj Institutions.	2018-22 (5 years)
		Organise capacity building programs for SFD personnel through training institutions of repute.	2018-22 (5 years)

12.2.5: Research & Development

Research and development aspects related to medicinal plant sector in the country have not received due focus in the past. Various past efforts on the subject have been far too scattered, too small and too short-lived failing to make the desired mark. Various organisations are involved in research on the subject in pursuit of their own independent agendas often with duplication of efforts and little coordination amongst them. A lot more research work needs to be carried out to resolve the issues related to entities used in the controversial herbal raw drug groups like 'Jivanti', 'Daruharidra', 'Shankhapushapi', 'Vidari', etc. Research inputs are also needed to enhance availability of raw drugs from many species like 'Kakarshingi'. The subject of developing high yielding germplasm of species proposed to be brought under cultivation also needs to be strengthened. There is an acute shortage of repositories of herbal raw drug for reference and authentication of traded material.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Support developing a network of agencies engaged in research in medicinal plants.	Designate a national nodal agency to develop and service the network.	2017
		Engage with the managements of all such research organisations to bring them together for following a common research agenda.	2017-2018 (2 years)
		Support the nodal agency and the research organisations in conducting annual common research review and planning seminars.	2017-2026 (10 years)
b	Support projects to resolve the issues of plants used as part of the controversial herbal raw drug groups.	Support studies on controversial raw drug groups to firmly establish botanical identities of plant species used in these groups.	2017-2026 (10 years)
		Sponsor development of field character based identification keys to facilitate identification of the entities during handling at various stages.	2017-2020 (3 years)
c	Support setting up of traded herbal raw drug repositories	Develop ToRs for setting up of one central and 4-5 regional herbal raw drug repositories.	2016-17
		Assign the task of developing these repositories as per finalised ToRs to identified research organisations having good experience of working on medicinal plants and having good strength in field botany, and provide financial support for the purpose.	2017-2022 (5 years)
d	Initiate and support program for long-term conservation of seeds of Red-listed medicinal plant species	Enter into long-term MoU with NBPGR or other national research organisation having similar seed storage facilities for long-term storage of seeds of Red-listed medicinal plant species.	2017
		Support research organisations with strong field botany mandate for collection of seeds of Red-listed medicinal plant species from across various provenances towards conservation of their genetic diversity for future germplasm developmental programs.	2017-2026 (10 years)
e	Support triennial review of demand and supply of herbal raw drugs.	Appoint a national nodal agency on long-term basis (min. 10 years) to coordinate and steer the triennial review and prepare final triennial reports.	2017-2026 (10 years)
		Identify and support appropriate organisations to carry out subject-specific review-cum-assessment of demand and supply of medicinal plants in the country for (a) assessing consumption by domestic herbal industry, (b) assessing species-wise imports and exports	2017-2026 (10 years)

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
		using DGCIS data, DTRs data from key ports, and interactions with exporters, © assessing household consumption, (d) assessing consumption by folk healers and ISM practitioners, (e) assessing wild collected supplies from forests and non-forest landscapes, (f) assessing supplies from cultivation, and (g) study of trade, and (h) review of policy and legislative framework impacting the sector.	

12.2.6: Policy and Regulatory Regime

The medicinal plant sector in the country has lacked vision and focus due to lack of national medicinal plants policy/ strategy. This has led different organisations dealing with medicinal plants to work on their independent agendas with no mechanisms for pooling the same at national level. Whereas there always are chances of duplication of work in such situations, most of such work remains confined to the labs.

Data management in respect of wild collected medicinal plants has also become an area of concern. With the devolving of rights over 'minor forest produce' to the communities, the State Forest Departments, which used to pool such information at the State level, have stopped maintaining records of herbal raw drugs wild collected from the forests in the State. The transit regulations are very complex and vary from state to state, requiring the consignments to stop at every State border for checking causing deterioration of the herbal material. There is a need to have uniform transit rules across the country.

The notifications under section 38 of the Biological Diversity Act, 2002 have put many an important medicinal plant species under strict regulation, amounting to a virtual ban on their collection, cultivation and trade. Many of these species are under active cultivation promotion by the NMPB in a virtually conflicting situation. These notifications need to be reviewed and turned into 'Action Lists' for proactive interventions to save Red-listed medicinal plant species from extinction and also to fulfil needs of the herbal sector. Wild populations of 'Kuth' have survived only because the species was brought under active cultivation more than 70 years back and that its commercial demand is now fully met from cultivation! Similarly, there is a dire need to review and make more comprehensive the list of 'Normally Traded Commodities' as defined under the Biological Diversity Act to facilitate the development of the Herbal Sector in the country.

The ITC (HS) Codes under which foreign trade of medicinal plants takes place are too restrictive to lead to the specific entities in trade, impacting the management actions for the species under foreign trade. The subject needs at least one time thorough study of the species in foreign trade based on DGCIS record, DTR records of key ports and interactions with exporters and importers.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Develop and adopt a national medicinal plant policy/ strategy	Identify a suitable organisation for the purpose and initiate national consultation on	2017-18
		the subject. Prepare draft national medicinal plant policy and seek public views on the draft.	2018-19
		Adopt the policy	2018-19
b	Develop appropriate data management procedures for maintenance of data of all wild harvests of medicinal plants from forests	Sponsor a study to review the various policies and legislations under which communities have been granted rights over 'minor forest produce', and ways to build in data management procedures in the rules.	2017-18
		Initiate national consultation on the issue and finalise the draft data management procedures for implementation.	2018-19
		Finalise the procedure and circulate these for implementation	2019-20
c	Harmonisation of Forest Produce Transit Rules	Assign the task of compiling the transit rules in operation in different states and to work out prototype of National Transit Rules.	2017-18
		Initiate national consultation on the issue and finalise the prototype of the National Transit Rules for implementation.	2018-19
		Finalise the procedure and circulate these for implementation	2019-20
d	Review notifications under different sections of the Biological Diversity Act, 2002.	Initiate dialogue with the National Biodiversity Authority on the issue and review the notifications issued under section 38 of the BDA, 2002, and on the enlistment of 'Normally Traded Commodities'.	2016-17
		Turn the lists of notified species for strict regulation into 'Action Lists' to facilitate conservation, cultivation, and research initiatives in respect of these species.	2017-18
e	Improve ITC (HS) system of classification for herbal raw drugs in foreign trade	Sponsor a comprehensive study to bring out the various herbal raw drug entities in foreign trade along with their botanical correlation	2017-19
		Based on this study, develop a comprehensive ITC (HS) coding to record species-wise export/ import of herbal raw drug entities.	2019-20

12.2.7: Capacity Building

Many of the issues pertaining to medicinal plant sector are due to lack of awareness about these issues amongst the stakeholders. For example, the Panchayat functionaries endowed with right to issue transit passes for transportation of the herbal material are not aware about the data management systems. The traders and customs officials are not generally aware of the botanical correlations of the entities in trade. The wild gatherers sometimes are not aware of the adverse impacts of destructive harvesting on the resource. There is, therefore, a felt need to initiate an awareness-cum-capacity building campaign to make various stakeholders aware of the issues related to medicinal plant sector.

Development and distribution of illustrated posters on sustainable harvest practices, good post-harvest handing practices and organisaing awareness-cum-training programs for different stakeholders is propose. It is also recommended that an Illustrated Compendium of Traded Medicinal Plants in India be published for use by traders, domestic herbal units, resource managers, customs officials, researchers, and others.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Support capacity building programs for different stakeholder groups in management of medicinal plant resources and data management	Identify agencies to develop and implement the capacity building programs at national and state levels – - For forest field staff - For Panchayat functionaries - For wild gatherers - For traders - For Customs officials at Ports	2017-2022 (5 years)
		NMPB may initiate action to get standard training modules developed for different stakeholder categories.	2017-2019 (2 years)
b	Support publication of an Illustrated Compendium of 1178 Traded Medicinal Plants in India recorded under the present study	Identify an organisation/ core group for the purpose.	2017-18
		Support preparation of the manuscript of the illustrated Compendium	2017-18 (2 years)
		Get the manuscript reviewed and support its printing (at least 2000 copies)	2019-20
c	Support development and printing of posters/ brochures on good harvesting and post harvest handling practices and their distribution upto the level of Panchayats.	Identify appropriate organisations at national and state levels to develop posters/ brochures in vernacular.	2017-18
		Support development of a prototype of the posters/ brochures at national level.	2017-18
		Support development/ printing of state-specific posters/ brochures in vernacular broadly based on the national prototype and their distribution upto Panchayat level.	2018-19

12.2.8: Institutional Mechanisms

The medicinal plant sector is a very diverse sector. On one end of this diverse spectrum is the vast array of medicinal plant species that are either collected from the wild with its own complexities and forming the major source of cash income to millions of wild gatherers, or are cultivated or imported to meet the demands, and on the other end of the spectrum is the complex web of consumers of this resource varying from households to folk practitioners and the herbal units. There is a complex regulatory mechanism from wild collection/ cultivation to trade that varies from state to state, with a part under regulation by the National Biodiversity Authority, and under the negative lists of exports. There are questions about the authenticity of the material. There are researchers on the subject and there are users of the resource. These diverse functions require specialised inputs to strengthen the hands of NMPB, the key organisation dealing with medicinal plant sector in the country. Whereas there is a need to strengthen the in-house team and infrastructure of NMPB, establishing of regional Medicinal Plant Technical Support Groups (MP-TSGs) to support NMPB in achieving its mandate in a time bound and effective way would be required. These MP-TSGs, to be developed as 'Centres of Excellence' of the NMPB, would ideally be located in the existing Organisations/ Institutions that already have medicinal plants/ NTFPs as one of their core mandates. There is presently no institutional mechanism to collate and make use of the data being submitted by the domestic herbal units in the form of annual returns under section 157 A of the Drug & Cosmetic Rules, 1945. A web-base portal for data uploading by the industry will go long way in collating the data at national level and making it useful.

S. No.	Recommendation	Action Points	Suggested Time Line (15 years i.e.upto 2030)
a	Support establishment of regional Medicinal Plant Technical Support Groups (MP-TSG) in existing Institutions for strengthening NMPB's research, extension and development agenda	Prepare ToRs for the MP-TSGs though a consultative process.	2017
		Identify suitable existing organisations to be supported as MP-TSGs and enter into long-term agreement with them for the purpose. Support the MP-TSGs to act as Centres of Excellence of the NMPB in allocated areas. These MP-TSGs would also be good nodes to carry out periodic review of the demand and supply of medicinal plants in the country.	2017-18 2018-2027 (10 years)
b	Strengthen NMPB with infrastructure and manpower to enable it to increase its reach and to enhance the scope of its activities	Develop a 10-year institutional consolidation plan for NMPB	2017-18
c	Develop and put in place a web-based National MedPlant Portal for online submission of annual returns by the domestic herbal industry under section 157A of the Drug and Cosmetic Rules, 1945	Identify and support a national nodal agency for developing the web-portal.	2017-18
		Identify and support on long term basis a national agency to monitor data submission by herbal industry, collate, verify and analyse data, and bring out periodic – annual – bulletins on the subject.	2018-2025 (7 years)

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Amaltas (*Cassia fistula*)

Babool (*Acacia nilotica*)

Anar (*Punica granatum*)

Ashwagandha (*Withania somnifera*)

Atees (*Aconitum heterophyllum*)

Bach (*Acorus calamus*)

Ban kakri (*Podophyllum hexandrum*)

Some Medicinal Plants with Raw Drugs

Bael (*Aegle marmelos*)

Kafal (*Myrica esculenta*)

Khurasani Ajwain (*Hyoscyamus niger*)

Kuchla (*Strychnos nux-vomica*)

Majith (*Rubia cordifolia*)

Bhutkeshi (*Selinum vaginatum*)

Birmi Talish (*Taxus wallichiana*)

Some Medicinal Plants with Raw Drugs

Daruhaldi (*Berberis lycium*)

Dhatki (*Woodfordia fruticosa*)

Bana (*Vitex negundo*)

Inderjao talakh (*Holarrhena pubescens*)

Khanor (*Aesculus indica*)

Giloe (*Tinospora cordifolia*)

Guggul (*Commiphora wightii*)

Some Medicinal Plants with Raw Drugs

Jeera Shingu (*Carum carvi*)

Chikory (*Cichorium intybus*)

Kalahari (*Gloriosa superba*)

Kapur Kachri (*Hedychium spicatum*)

Vatsnabh (*Aconitum heterophyyloides*)

Banafsha (*Viola canescens*)

Kali Zeeri (*Baccharoides anthelmintica*)

Some Medicinal Plants with Raw Drugs

Kari patta (*Murraya koenigii*)

Karu (*Picrorhiza kurroa*)

Ratanjot (*Arnebia benthamii*)

Salam panja (*Dactylorhiza hatagirea*)

Upmarga (*Achyranthes aspera*)

Timru (*Zanthoxylum armatum*)

Vasa (*Adhatoda zeylanica*)

Some Medicinal Plants with Raw Drugs

Mithi Patish (*Chaerophyllum villosum*)

Mushakbala (*Valeriana jatamansi*)

Padal (*Stereospermum* chelonoides)

Panir dodi (*Withania coagulans*)

Pashan Bhed (*Bergenia stracheyi*)

Musli (*Asparagus adscendens*)

Nag Chhatri-Satva (*Trillium govanianum*)

Some Medicinal Plants with Raw Drugs

Consolidated Inventory of the Medicinal Plants in Commercial Demand

1. Under the Column 'Botanical Name', the names given in brackets are the commonly used synonyms of the species.
2. Under the Column 'Trade Name(s)', the names given in italics are the names of plants given in Ayurvedic Pharmacopea of India.
3. Under the Column 'Estimated Annual Trade (MT)', the figures given in brackets pertain to demand of the species by Rural Households. These figures are in addition to the annual estimated demand of the species by domestic herbal industry and exports given in the column.

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
1	*Abelia chinensis* R.Br.	CAPRIFOLIACEAE	Tree	I	Chinese Abelia	Aerial Part	<10
2	*Abelmoschus esculentus* (L.) Moench [= *Hibiscus esculentus* L.]	MALVACEAE	Shrub	C	Bhindi, Ochra, Vendaikkai	Root, Whole Plant	100-200
3	*Abelmoschus ficulneus* (L.) Wight & Arn. [= *Hibiscus ficulneus* L.]	MALVACEAE	Shrub	W	Kattu Vendai, Jangli Bhindi	Seed	<10
4	*Abelmoschus moschatus* Medik. [= *Hibiscus abelmoschus* L.]	MALVACEAE	Shrub	C/W	Muskdana, Latakasturi *Kasturilatika*	Seed	100-200
5	*Abies densa* Griff [= *Abies spectabilis* Subsp. *densa* (Griff.) Silba]	PINACEAE	Tree	W	Talisa, Talispatra	Leaf (Needle)	**
6	*Abies pindrow* (Royle ex D.Don) Royle	PINACEAE	Tree	W	Granthiparna, Talisa, Tosh,	Leaf (Needle)	<10
7	*Abies spectabilis* (D.Don) Mirb. [=*Abies webbiana* (Wall. ex D.Don) Lindl.]	PINACEAE	Tree	W	Talispatra, Talispatri, Talisa	Leaf (Needle)	50-100
-	*Abies spectabilis* Subsp. *densa* (Griff.) Silba	Ref.: *Abies densa*	-	-	-	-	-
-	*Abies webbiana* (Wall. ex D.Don) Lindl.	Ref.: *Abies spectabilis*	-	-	-	-	-
8	*Abroma augusta* (L.) L.f. [= *Ambroma augustum* (L.) L.f.]	MALVACEAE	Shrub	C/W	Ulatkambal	Root, Stem (Bark)	10-50 [≈*5*]
9	*Abrus precatorius* L.	FABACEAE	Climber	C/W	Chirmati, Chinnoti, Ratti, Gundumani, Kundumani, *Gunja*	Seed, Root	200-500 [≈*100*]
10	*Abutilon indicum* (L.) Sweet	MALVACEAE	Shrub	W	Tutti, Thuthi, *Atibala*	Root, Whole Plant	100-200 [≈*12*]

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
-	*Acacia arabica* var. *indica* Benth.	Ref.: *Acacia nilotica* subsp. *indica*	-	-	-	-	-
11	*Acacia caesia* (L.) Willd.	MIMOSACEAE	Shrub	W	Incha, Indu, Singapore pattai, *Khadira*	Bark (Stem)	<10
12	*Acacia catechu* (L.f.) Willd.	MIMOSACEAE	Tree	W	Katha, Khair, Khair gum, *Khadira*	Heart Wood, Wood Extract	500-1000 [*≈5*]
13	*Acacia chundra* (Roxb. ex Rottler) Willd.	MIMOSACEAE	Tree	W	Khadir	Wood	<10
-	*Acacia concinna* (Willd.) DC.	Ref.: *Acacia sinuata*	-	-	-	-	-
14	*Acacia farnesiana* (L.) Willd.	MIMOSACEAE	Tree	C	Irmed	Bark (Stem)	10-50 [*≈60*]
15	*Acacia leucophloea* (Roxb.) Willd.	MIMOSACEAE	Tree	I	Reonj, Safed Babul, *Arimeda*	Bark (Stem) (Extract)	<10
16	*Acacia nilotica* subsp. *indica* (Benth.) Brenan [= *A. arabica* var. *indica* Benth.]	MIMOSACEAE	Tree	W/C	Babul, Kikar, Karuvelum, Babool gum, Babbula	Bark (Stem), Gum	1000-2000 [*≈500*]
17	*Acacia polycantha* Willd. [= *A. suma* (Roxb.) Voigt.]	MIMOSACEAE	Tree	I	White Thorn, *Kadarah*	Heart Wood, Root (Extract)	<10
18	*Acacia senegal* (L.) Willd.	MIMOSACEAE	Tree	I/W	Gum Arabic, Kumtha, Char gond, Kordofan, Kitir	Gum	>20000 [*≈60*]
19	*Acacia seyal* Delile	MIMOSACEAE	Tree	I	Gum Arabic, Talha Gum, Nigerian Gum Arabic	Gum	2000-5000
20	*Acacia sinuata* (Lour.) Merr. [= *A. concinna* (Willd.) DC.]	MIMOSACEAE	Climber	W	Chikakai, Shikakai	Fruit	1000-2000 [*≈90*]
-	*Acacia suma* (Roxb.) Voigt.	Ref.:*Acacia polycantha*	-	-	-	-	-
21	*Acacia xanthophloea* Benth.	MIMOSACEAE	Tree	I	Fever Tree	Root (Extract)	<10
22	*Acalypha fruticosa* Forssk.	EUPHORBIACEAE	Shrub	W	Cinni, *Laghu Haritamanjari*	Root	**
23	*Acalypha indica* L.	EUPHORBIACEAE	Herb	W	Khokali, Arishtamanjari, Kuppai Maeni, *Haritamanjari*	Whole Plant	100-200 [*≈360*]
24	*Achillea millefolium* L.	ASTERACEAE	Herb	W	Brinjasif, Yarrow	Whole Plant	100-200

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
25	*Achyranthes aspera* L.	AMARANTHACEAE	Herb	W	Puthkanda *Apamarga*	Root, Whole Plant	200-500 [*≈2750*]
26	*Achyranthes bidentata* Blume	AMARANTHACEAE	Herb	W	Apamarga	Whole Plant	<10
27	*Acmella oleracea* (L.) R.K.Jansen [= *Spilanthes oleracea* L.; *Spilanthes acmella* Murr. var. *oleracea* C.B.Clarke]	ASTERACEAE	Herb	C/W	Akarkara, Sarahattika, Vana-mugali	Flower, Root, Leaf	50-100 [*≈15*]
-	*Aconitum balfourii* Stapf	Ref.: *Aconitum lethale*	-	-	-	-	-
-	*Aconitum bisma* (Buch.-Ham.) Rapaics	Ref.: *Aconitum palmatum*	-	-	-	-	-
28	*Aconitum chasmanthum* Stapf	RANUNCULACEAE	Herb	W	Vatsnabha, Bikh, *Vatsnabha*	Root	<10
-	*Aconitum deinorrhizum* Stapf	Ref.: *Aconitum heterophyyloides*	-	-	-	-	-
-	*Aconitum falconeri* Holmes ex Stapf	Ref.: *Aconitum lethale*	-	-	-	-	-
29	*Aconitum ferox* Wall. ex Ser.	RANUNCULACEAE	Herb	W	Vachhnag, Meetha zehar, Chandog, Atis	Root	50-100
30	*Aconitum heterophyyloides* (Bruhl.) Stapf [= *Aconitum deinorrhizum* Stapf ; *Aconitum laciniatum* Stapf; *Aconitum spicatum* (Bruhl) Stapf]	RANUNCULACEAE	Herb	W	Vatsnabha, Kalo Bikhmo	Root	10-50
31	*Aconitum heterophyllum* Wall. ex Royle	RANUNCULACEAE	Herb	W	Atis, Aconite, Ativish, Atees, Bonga kanpo, Athividayam, *Ativisa*	Root (Tuber)	100-200 [*≈25*]
-	*Aconitum laciniatum* Stapf	Ref.: *Aconitum heterophyyloides*	-	-	-	-	-
32	*Acontum lethale* Griff. [= *Aconitum balfourii* Stapf; *Aconitum falconeri* Holmes ex Stapf]	RANUNCULACEAE	Herb	W	Vatsnabha, Bonga marpo, Bish	Root	<10
33	*Aconitum palmatum* D.Don [= *Aconitum bisma* (Buch.-Ham.) Rapaics]	RANUNCULACEAE	Herb	W	Bikhma, Vachnag	Root	10-50

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
-	*Aconitum spicatum* (Bruhl) Stapf	Ref.: *Aconitum lethale*	-	-	-	-	-
34	*Aconitum violaceum* Jacq. ex Stapf	RANUNCULACEAE	Herb	W	Mitha Telia, Dudhia Mohra, Dudhia-bis	Root	10-50 [*≈5*]
35	*Acorus calamus* L.	ARACEAE	Herb	C/W	Vach, Bach, Ghor bach, Vekhand, Vasambu, Vaj, Sweet Flag, *Vaca*	Root (Rhizome)	500-1000 [*≈150*]
-	*Actiniopteris dichotoma* Mett.	Ref.: *Actiniopteris radiata*	-	-	-	-	-
36	*Actiniopteris radiata* (Sw.) Link.	ACTINIOPTERIDACEAE	Herb	W	*Mayurpankhi*	Whole Plant	<10
37	*Actinoscirpus grossus* (L.f.) Goetgh. & D.A. Simpson	CYPERACEAE	Herb	W	*Keshur*	Root	<10
38	*Adansonia digitata* L.	BOMBACACEAE	Tree	C	Gorakimli	Fruit	<10
39	*Adenanthera pavonina* L.	MIMOSACEAE	Tree	C/W	Kamboji, Tamaraka	Wood	<10
40	*Adenia hondala* (Gaertn.) W.J. de Wilde	PASSIFLORACEAE	Climber	W	Vidari	Root (Tuber)	<10
-	*Adhatoda beddomei* C.B.Clarke [= *Justicia beddomei* (C.B.Clarke) Bennet]	Ref.:*Justicia beddomei*	-	-	-	-	-
-	*Adhatoda vasica* Nees	Ref.: *Justicia adhatoda*	-	-	-	-	-
-	*Adhatoda zeylanica* Medik.	Ref.: *Justicia adhatoda*	-	-	-	-	-
41	*Adiantum capillus-veneris* L.	ADIANTACEAE	Herb	W	Hanraj, Parshoshan, *Bijapatra*	Whole Plant	<10
42	*Adiantum lunulatum* Burm.f . [= *A. philippense* L.f.]	ADIANTACEAE	Herb	W	Hansraj, *Hamsapadi*	Whole Plant	<10
-	*Adiantum philippense* L.f	Ref.: *Adiantum lunulatum*	-	-	-	-	-
43	*Adiantum venustum* D.Don.	ADIANTACEAE	Herb	W	Hansraj	Whole Plant	<10
44	*Aegle marmelos* (L.) Correa	RUTACEAE	Tree	C/W	Bael, Belgiri, Vilvam, Koovalam, *Bilva*	Fruit, Leaf, Bark (Root, Stem)	2000-5000 [*≈10500*]
45	*Aerva lanata* (L.) Juss.	AMARANTHACEAE	Herb	W	Cheroola,Chiru poolai, *Pattura*	Whole Plant	100-200 [*≈200*]

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
46	*Aesculus indica* (Wall. ex Cambess) Hook.	HIPPOCASTANACEAE	Tree	C/W	Indian Horse Chesnut, Khanor, Ghoon, Bankhor, Pangar	Seed	<10
47	*Aganosma dichotoma* (Roth) K.Schum.	APOCYNACEAE	Climber	W	Malti	Leaf	<10
48	*Ageratum conyzoides* L.	ASTERACEAE	Herb	W	Visamustih, Goat weed, Ukhal booti, Visadodi	Whole Plant	<10 [*≈580*]
49	*Aglaia elaeagnoidea* (A.Juss.) Benth.	MELIACEAE	Tree	W	Priyangu	Fruit	<10
50	*Aglaia odorata* Lour.	MELIACEAE	Tree	C	Pishthparni, Pithavan	Leaf	<10
51	*Aglaia odoratissima* Blume	MELIACEAE	Tree	C	Priyangu, Tottila, Anganapriya		<10
52	*Ailanthus excelsa* Roxb.	SIMAROUBACEAE	Tree	C/W	Aralu, *Araluka*	Root, Bark	<10 [*≈20*]
53	*Ailanthus triphysa* (Dennst.) Alston	SIMAROUBACEAE	Tree	C/W	Guggula Dhup	Bark (Stem)	<10
54	*Ainsliaea aptera* DC.	ASTERACEAE	Herb	W	Sathjalari	Root	**
55	*Ajuga bracteosa* Benth.	LAMIACEAE	Herb	W	Nilkanthi, Neel kanthi	Whole Plant	<10
56	*Alangium salvifolium* (L.f.) Wang.	ALANGIACEAE	Tree	W	Ankodah, Azhinjal, Dirghakilaka, *Ankolah*	Leaf, Root	<10
57	*Albizia amara* (Roxb.) Boivin	MIMOSACEAE	Tree	W	Krishnasirish, Usilai	Leaf	100-200 [*≈10*]
58	*Albizia chinensis* (Osbeck) Merr.	MIMOSACEAE	Tree	W	Sirisah	Bark (Stem)	<10
59	*Albizia lebbeck* (L.) Benth.	MIMOSACEAE	Tree	C/W	Vaakaveru, Siris, Shirish, *Sirisa*	Leaf, Bark (Stem)	50-100 [*≈1*]
-	*Albizia marginata* Merr.	Ref.: *Albizia chinensis*	-	-	-	-	-
60	*Albizia odoratissima* (L.f.) Benth.	MIMOSACEAE	Tree	C/W	Sirisa	Bark (Stem)	**
61	*Aleurites moluccanus* (L.) Willd.	EUPHORBIACEAE	Tree	W	Kukui, Jangli akhrot, Indian walnut, Candle nut	Fruits (Nuts)	<10
62	*Alhagi maurorum* Medik. [= *Alhagi pseudalhagi* (M.Bieb.) Fisch.]	FABACEAE	Shrub	W	Durlabha, Yavasaka	Whole Plant	10-50
63	*Alhagi pseudalhagi* (M.Bieb.) Desv. ex B. Keller & Shap.	FABACEAE	Shrub	W	Durlabha, Yavasaka	Whole Plant	100-200
-	*Alhagi pseudalhagi* (M.Bieb.) Fisch.	Ref.: *Alhagi maurorum*	-	-	-	-	-

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
64	*Alkanna tinctoria* (L.) Tausch	BORAGINACEAE	Herb	I	Ratanjot	Root	<10
65	*Allium ampeloprasum* L.	LILIACEAE (Alliaceae)	Herb	C	Leek, Levant garlic	Root (Bulb)	<10
66	*Allium cepa* L.	LILIACEAE (Alliaceae)	Herb	C	Onion, Pyaaz, Chuneennulli	Root (Bulb)	200-500
67	*Allium sativum* L.	LILIACEAE (Alliaceae)	Herb	C	Lasun, Velathulli, *Lasuna*	Root	200-500
68	*Allium stracheyi* Baker	LILIACEAE (Alliaceae)	Herb	W	Jambu	Root	<10
-	*Aloe barbadensis* Mill	Ref.: *Aloe vera*	-	-	-	-	-
69	*Aloe vera* (L.) Burm.f. [= *Aloe barbadensis* Mill.]	XANTHORRHOEACEAE	Herb	C/W	Ghikanvar, Kumari, Elva, Ghritkuwari, *Kanyasara*	Leaf	>10000 [*≈3200*]
70	*Alpinia calcarata* (Haw.) Roscoe	ZINGIBERACEAE	Herb	C	Chittaratha, Aratha, *Granthimula*	Root (Rhizome)	50-100 [*≈10*]
71	*Alpinia galanga* (L.) Willd.	ZINGIBERACEAE	Herb	C/W	Koshtakulinjan, Perarthai, Rasnamool, *Kulanjan*	Root (Rhizome)	200-500 [*≈10*]
72	*Alpinia officinarum* Hance	ZINGIBERACEAE	Herb	I	Khulinjan	Root (Rhizome)	<10
73	*Alstonia scholaris* (L.) R.Br.	APOCYNACEAE	Tree	W/ C	Saptaparnachal, Satveen, Saitan, *Saptaparna*	Bark (Stem), Leaf	10-50 [*≈350*]
74	*Alstonia venenata* R.Br.	APOCYNACEAE	Shrub	W	Anadana, Raja - adana Saptaparna	Bark (Stem), Fruit	**
75	*Alternanthera sessilis* (L.) R.Br. ex DC.	AMARANTHACEAE	Herb	W	Ponnanganni, *Matsyaki*	Whole Plant	<10 [*≈1900*]
76	*Althaea officinalis* L.	MALVACEAE	Herb	C/W	Resha-Khatami, Gul-e-khatmi, Shilaras, *Khatmi*	Root, Seed	10-50
77	*Altingia excelsa* Noronha	ALTINGIACEAE	Tree	C/W	Silaras	Resin	**
-	*Amaranthus gangeticus* L.	Ref.: *Amaranthus tricolor*	-	-	-	-	-
-	*Amaranthus mangostanus* L.	Ref.: *Amaranthus tricolor*	-	-	-	-	-
78	*Amaranthus paniculatus* L.	AMARANTHACEAE	Herb	C	Chaulai, Ramdana	Seed	<10
79	*Amaranthus spinosus* L.	AMARANTHACEAE	Herb	W	Cholai, Bhandira	Root	<10
80	*Amaranthus tenuifolius* Willd.	AMARANTHACEAE	Herb	W	Cholai	Root	<10

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81	*Amaranthus tricolor* L. [= *A. gangeticus* L.; *A. mangostanus* L.]	AMARANTHACEAE	Herb	C	Lal sag, Alpamarisa, Sirukeerai, *Ramasitalika*	Seed, Aerial Part	<10
82	*Amaranthus viridis* L.	AMARANTHACEAE	Herb	C	Jangli Cholai, Ranbhaji, Tanduliya, Kuppaikeerai	Seed, Aerial Part	<10
-	*Ambroma augustum* (L.) L.f.	Ref.: *Abroma augusta*	-	-	-	-	-
83	*Ammannia baccifera* L.	LYTHRACEAE	Herb	W	Kurand ghas	Whole Plant	<10
84	*Ammi majus* L.	APIACEAE	Herb	C	Ammi	Fruit	**
85	*Amomum aromaticum* Roxb.	ZINGIBERACEAE	Herb	W	Bengal cardamom, Brhdela	Fruit	<10
86	*Amomum compactum* Sol. ex Maton	ZINGIBERACEAE	Herb	I	Elachi	Fruit (Seed)	<10
-	*Amomum kepulaga* Sprague & Burkill	Ref.: *Amomum compactum*	-	-	-	-	-
87	*Amomum subulatum* Roxb.	ZINGIBERACEAE	Herb	C/W	Elachi Badi, Sthulaela	Fruit (Seed)	100-200
88	*Amomum pterocarpusm* Thwaites	ZINGIBERACEAE	Herb	C/W	Perelam, Elaichi badi, *Sthulaela*	Fruit (Seed)	<10
-	*Amoora rohituka* (Roxb.) Wight & Arn.	Ref.: *Aphanamixis polystachya*	-	-	-	-	-
-	*Amorphophallus campanulatus* Blume ex Decn.	Ref.: *Amorphophallus paeoniifolius*	-	-	-	-	-
-	*Amorphophallus dubius* Blume	Ref.: *Amorphophallus paeoniifolius* var. *paeonifolius*	-	-	-	-	-
89	*Amorphophallus paeoniifolius* (Dennst.) [= *Amorphophallus campanulatus* Blume ex Decn.]	ARACEAE	Herb	C/W	Arsghna, Surankand, Olkochu, Zaminkand, *Surana*	Root (Corm), Flower	200-500 [≈*80*]
90	*Amorphophallus paeoniifolius* (Dennst.) Nicolson var. *paeonifolius* [= *Amorphophallus dubius* Blume]	ARACEAE	Herb	W	Surom (subs.)	Root	<10
91	*Amorphophallus sylvaticus* (Roxb.) Kunth	ARACEAE	Herb	W	Kaadu suvarna gedde, Aracokanakku, Adavi chaama	Root (Tuber)	<10

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92	*Anacamptis laxiflora* (Lam.) R.M. Bateman, Pridgeon & M.VW. Chase	ORCHIDACEAE	Herb	I	SalambMishri	Root (Tuber)	<10
93	*Anacardium occidentale* L.	ANACARDIACEAE	Tree	C	Kaju	Bark (Stem), Gum	10-50
94	*Anacyclus pyrethrum* (L.) Lag.	ASTERACEAE	Herb	I	Akarkara, *Akarkarabha*	Stem, Root	200-500 [≈*5*]
95	*Anamirta cocculus* (L.) Wight & Arn.	MENISPERMACEAE	Climber	W	Rakthala	Fruit, Resin	<10
96	*Ananas comosus* (L.) Merr.	BROMELIACEAE	Herb	C	Ananas, Pineapple	Fruit	100-200
97	*Anchusa strigosa* Labill.	BORAGINACEAE	Herb	I	Gaozaban (subs.)	Leaf, Fruit	<10
98	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	ACANTHACEAE	Herb	W/C	Kalmegh, Neela vembu	Whole Plant	2000-5000 [≈*2000*]
99	*Anemone obtusiloba* D.Don	RANUNCULACEAE	Herb	W	Ageli, Kakrya, Kanchphool, Ratanjot	Root	<10
100	*Anethum graveolens* L. [= *A. sowa* Roxb. ex Flem.]	APIACEAE	Herb	C	Sowa, Suva, *Satahva*	Seed, Fruit	200-500
-	*Anethum sowa* Roxb. ex Flem.	Ref.: *Anethum graveolens*	-	-	-	-	-
101	*Angelica archangelica* L.	APIACEAE	Herb	W	Conda, Angelica, *Canda*	Root	<10
102	*Angelica glauca* Edgew.	APIACEAE	Herb	W	Chaura, Choru, *Corakah*	Root	10-50 [≈*10*]
103	*Anisomeles malabarica* (L.) R.Br. ex Sims	LAMIACEAE	Shrub	W	Karimthumpa, *Sprkka*	Whole Plant, Root	10-50 [≈*75*]
104	*Annona squamosa* L.	ANNONACEAE	Tree	W	Sharifa, Sitaphal, Sitapalam, Custard Apple	Leaf	<10
105	*Anodendron paniculatum* A.DC.	APOCYNACEAE	Climber	W	Sarakkodi, Kavali	Whole Plant	**
106	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr.	COMBRETACEAE	Tree	W	Dhawada, Dhaura, *Dhava*	Bark (Stem), Gum	<10
-	*Anthemis nobilis* L.	Ref.: *Chamaemelum nobile*	-	-	-	-	-

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-	*Anthocephalus cadamba* (Roxb.) Miq.	Ref.: *Neolamarckia cadamba*	-	-	-	-	-
107	*Antiaris toxicaria* Lesch.	MORACEAE	Tree	W	Bhramaramari, Upas Tree, Valkala	Wood	<10
108	*Aphanamixis polystachya* (Wall.) Parker [= *Amoora rohituka* (Roxb.) Wight & Arn.]	MELIACEAE	Tree	C/W	Rakta Rohida, Rohitak, Harinkhana	Bark (Stem)	10-50
109	*Aphananthe cuspidata* (Blume) Planch.	ULMACEAE	Tree	W	Peenari	Bark (Stem), Gum	<10
110	*Apium graveolens* L.	APIACEAE	Herb	C/W	Ajmoda, Celery, *Karaphsa*	Fruit	1000-2000
-	*Aquilaria agallocha* Roxb.	Ref.: *Aquilaria malaccensis*	-	-	-	-	-
111	*Aquilaria malaccensis* Lam. [= *Aquilaria agallocha* Roxb.]	THYMELAEACEAE	Tree	I/W	Agar, Agar kala, Akil, Sanchi, Sasi, Ood, *Agaru*	Bark (Stem), Heart Wood	50-100
112	*Arachis hypogaea* L.	FABACEAE	Herb	C	Moogphali, Singdana, Ground nut	Seed (Extract)	50-100
113	*Arachis villosulicarpa* Hoehne	FABACEAE	Herb	C	Ugani balli	Seed	<10
114	*Arctium lappa* L.	ASTERACEAE	Herb	W	Phaggarmul	Fruit	**
115	*Ardisia solanacea* (Poir.) Roxb.	MYRSINACEAE	Shrub	W	Bisi, Kolarakku	Stem, Root, Bark (Root)	<10
116	*Areca catechu* L.	ARECACEAE	Tree	C	Supari, Adike, Kamuk, Ghonta, Betel nut, *Puga*	Seed, Root	100-200
117	*Argemone mexicana* L.	PAPAVERACEAE	Herb	W	Brhami Dandi, Brahma dandu, Kusme Beeja	Seed, Stem	10-50 [≈*3*]
118	*Argyreia elliptica* Arn. ex Choisy	CONVOLVULACEAE	Shrub	W	Kedari, Bondvel, Unnayankoti	Seed	100-200
119	*Argyreia nervosa* (Burm.f.) Bojer [= *Argyreia speciosa* (L.f.) Sweet]	CONVOLVULACEAE	Shrub	W	Samudraphal, Samundra Sokh, Vidhara, *Bastantri*	Root, Seed, Whole Plant	50-100 [≈*20*]
-	*Argyreia speciosa* (L.f.) Sweet	Ref.: *Argyreia nervosa*	-	-	-	-	-
120	*Arisaema tortuosum* (Wall.) Schott	ARACEAE	Herb	W	Baag Mingari, Bagh Jandhra, Sardacha-jad	Tube	r<10 [≈*20*]

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121	*Aristolochia bracteolata* Lam.	ARISTOLOCHIACEAE	Herb	W	Kidamari, Aaduthinnapaalai, *Kitamari*	Leaf, Root, Whole Plant	50-100 [*≈15*]
122	*Aristolochia indica* L.	ARISTOLOCHIACEAE	Climber	W	Ishwarmool, Eeswamooli, *Isvari*	Root, Stem, Fruit	50-100
123	*Aristolochia rotunda* L	ARISTOLOCHIACEAE	Climber	W	Zarawand	Root	<10
124	*Aristolochia tagala* Cham.	ARISTOLOCHIACEAE	Climber	W	Aadutheendapalai, Puliphum	Root	<10
125	*Arnebia benthamii* (Wall. ex G.Don) I.M.Johnst.	BORAGINACEAE	Herb	W	Gauzaban, Ratanjot	Root, Whole Plant	100-200 [*≈10*]
126	*Arnebia euchroma* (Royle) I.M.Johnst.	BORAGINACEAE	Herb	W	Gaozaban, Ratanjot	Root	<10
127	*Arnebia nobilis* Rech.f.	BORAGINACEAE	Herb	I	Ratan jyothi, Ratanjot	Root	<10
128	*Arnica montana* L.	ASTERACEAE	Herb	I	Arnica, Mountain Tobacco	Rhizome	<10
129	*Artabotrys hexapetalus* (L.f.) Bhandari	ANNONACEAE	Shrub	C/W	Harichampa, Madanmast	Fruit	**
130	*Artemisia absinthium* L.	ASTERACEAE	Shrub	W	Afsanteen, Tethwan, *Dvipantara Damanaka*	Whole Plant	<10
131	*Artemisia annua* L.	ASTERACEAE	Shrub	C	Seeme davana	Whole Plant	1000-2000
132	*Artemisia maritima* L. ex Hook.f.	ASTERACEAE	Herb	W	Ajavayana, Chauhara, Cina, Makkipoovu	Seed, Whole Plant	<10
133	*Artemisia nilagirica* (C.B.Clarke) Pamp.	ASTERACEAE	Herb	W	Thavanam	Flower, Whole Plant	50-100
134	*Artemisia pallens* Wall. ex DC.	ASTERACEAE	Herb	C	Davna, Marukozhunthu	Leaf, Flower	<10
135	*Artemisia parviflora* Roxb. ex D.Don	ASTERACEAE	Shrub	W	Pati	Whole Plant	**
136	*Artemisia sieversiana* Ehrh.	ASTERACEAE	Shrub	W	Dauna, Agnidamanaka	Whole Plant	<10
137	*Artocarpus heterophyllus* Lam.	MORACEAE	Tree	C/W	Kathal, Jackfruit, *Panasa*	Bark (Root), Fruit	<10
138	*Artocarpus integer* (Thunb.) Merr.	MORACEAE	Tree	W	Kathar, Kathal, Cempedak	Fruit	<10
139	*Arundo donax* L.	POACEAE	Shrub	W	Dhamana, Baranal, Nala	Root (Rhizome)	<10
140	*Asarum europaeum* L.	ARISTOLOCHIACEAE	Herb	I	*Pinda* Tagara	Root (Rhizome)	<10
141	*Asclepias curassavica* L.	ASCLEPIADACEAE	Shrub	C	Kaakanaasikaa, Pivla chitrak, Kaakatundi, Krishnachura	Flower, Leaf, Root, Latex	<10

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142	*Asparagus adscendens* Roxb.	LILIACEAE (Asparagaceae)	Climber	W	Musali safed, Satrouri, Satawar	Root	200-500
143	*Asparagus gonoclados* Baker	LILIACEAE (Asparagaceae)	Climber	W	Shatavari	Root	<10
144	*Asparagus racemosus* Willd.	LILIACEAE (Asparagaceae)	Climber	W/C	Shatavari, Satawar, Shatavar, *Satavari*	Root	2000-5000 [*≈675*]
145	*Asparagus sarmentosus* L.	LILIACEAE (Asparagaceae)	Climber	W	Satawari, Shakakul	Root	**
-	*Asteracantha longifolia* (L.) Nees	Ref.:*Hygrophila schulli*	-	-	-	-	-
146	*Astracantha gummifera* (Labill.) Podlech	FABACEAE	Herb	W/C	Kitr	Root	<10
147	*Atalantia monophylla* (L.) DC.	RUTACEAE	Tree	W	Kurandubeeja	Fruit	**
148	*Atropa acuminata* Royle ex Lindl.	SOLANACEAE	Herb	C/W	Jharka	Leaf	**
149	*Atropa belladonna* L.	SOLANACEAE	Herb	I	Belladona	Root	200-500
150	*Atylosia goensis* (Dalzell) Dalzell	FABACEAE	Climber	I/C	Katttupaayar	Root	<10
151	*Atylosia scarabeoides* (L.) Benth.	FABACEAE	Climber	W	Ban kulatha	Root	**
152	*Avena sativa* L.	POACEAE	Herb	C	Jai, Javi, Oats	Seed	10-50
153	*Ayapana triplinervis* (Vahl) R.M.King & H. Rob.	ASTERACEAE	Herb	C	Ayapan	Leaf, Flower, Whole plant	<10
154	*Azadirachta indica* A.Juss.	MELIACEAE	Tree	C/W	Neem, Vembu, Margosa, *Nimba*	Fruit (Pulp) Seed, Flower, Bark (Stem), Leaf	2000-5000 [*≈9000*]
155	*Azima tetracantha* Lam.	SALVADORACEAE	Shrub	W	Kanta-gur-kamai, Kantangur, Kundali	Leaf, Bark (Stem), Root	<10 [*≈30*]
156	*Baccharoides anthelmintica* (L.) Moench [= *Centratherum anthelminticum* (L.) Kuntze; *Vernonia anthelmintica* (L.) Willd.]	ASTERACEAE	Herb	W	Kali zeeri, Kattu siragam, *Vanyajiraka*	Seed	200-500 [*≈2*]
157	*Bacopa monnieri* (L.) Wettst.	SCROPHULARIACEAE	Herb	W/C	Jal Brahmi, Nir brahmi, *Brahmi*	Whole Plant	1000-2000 [*≈140*]

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158	*Balanites aegyptiaca* (L.) Delile	BALANITACEAE	Tree	W	Hingan, Hingol, Hingot, Ingua, Nanjunda maram	Semi-Ripe Fruit	10-50
159	*Balanophora fungosa* J.R.Forst. & J.G.Forst.	BALANOPHORACEAE	Herb	W	Thippali	Whole Plant	**
160	*Baliospermum montanum* (Willd.) Mull.Arg. [= *B. solanifolium* (Geiseler) Suresh]	EUPHORBIACEAE	Shrub	W	Dantimool, Nagadanti, *Danti*	Root	100-200
-	*Baliospermum solanifolium* (Geiseler) Suresh	Ref.: *Baliospermum montanum*	-	-	-	-	-
-	*Bambusa arundinacea* (Retz.) Willd.	Ref.:*Bambusa bambos*	-	-	-	-	-
161	*Bambusa bambos* (L.) Voss [=*Bambusa arundinacea* (Retz.) Willd.]	BAMBUSEACEAE	Tree	W	Bansalochan, Tabashir	Silica deposit	1000-2000 [≈*630*]
-	*Bandeiraea simplicifolia* (DC.) Benth.	Ref.: *Griffonia simplicifolia*	-	-	-	-	-
162	*Barleria courtallica* Nees	ACANTHACEAE	Shrub	W	Chethasahacharam, Venkurunji, Sahacarah	Root	<10
163	*Barleria cristata* L.	ACANTHACEAE	Shrub	W	Raktapushpa, Sweta Saireyaka	Whole Plant	<10
164	*Barleria prionitis* L.	ACANTHACEAE	Shrub	C/W	Vajradanti, Daskranta, *Sahacara*	Whole Plant	100-200 [≈*2*]
165	*Barleria strigosa* Willd.	ACANTHACEAE	Shrub	W	Bala, Dasi, Amli, *Nilajhint*	Whole Plant	<10
166	*Barringtonia acutangula* (L.) Gaertn.	BARINGTONIACEAE	Tree	W	Samudraphal, Nicula	Fruit	10-50
167	*Barringtonia racemosa* (L.) Spreng.	BARINGTONIACEAE	Tree	W	Samuthira palam	Fruit (Seed)	**
168	*Basella alba* L.	BASELLACEAE	Climber	C	Pasalai, Vasalacheera pacha	Whole Plant	<10
-	*Bassia latifolia* Roxb.	Ref.: *Madhuca indica*	-	-	-	-	-
169	*Bauhinia malabarica* Roxb.	CAESALPINIACEAE	Tree	W	Amlosa, Asmantaka	Bark (Stem)	**
170	*Bauhinia purpurea* L.	CAESALPINIACEAE	Tree	C/W	Sonachal	Bark (Stem)	<10
171	*Bauhinia racemosa* Lam.	CAESALPINIACEAE	Tree	W	Kachnar, *Pita-kancanara*	Flower, Leaf, Bark (Stem)	10-50
172	*Bauhinia tomentosa* L.	CAESALPINIACEAE	Shrub	W	Kachnar, Kanchana, Thiruvaatchi	Root, Leaf	10-50 [≈*60*]

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173	*Bauhinia vahlii* Wight & Arn.	CAESALPINIACEAE	Climber	W	Adda	Leaf	**
174	*Bauhinia variegata* L.	CAESALPINIACEAE	Tree	C/W	Kachnar, Karial, *Kancanara*	Bark (Stem), Flower Bud	100-200 [≈*19*]
175	*Benincasa hispida* (Thunb.) Cogn.	CUCURBITACEAE	Climber	C	Kumpalanga pacha, Petha, *Kusmanda*	Fruit	100-200
176	*Berberis aristata* DC.	BERBERIDACEAE	Shrub	W	Daruhaldi, Rasnajan, Kilmora, Zarisuk, *Daruharidra*	Root, Stem, Fruit	1000-2000 [≈*50*]
177	*Berberis asiatica* Roxb. ex DC.	BERBERIDACEAE	Shrub	W	Daru haldi, Rasout	Root, Stem	<10
178	*Berberis chitria* Buch.-Ham. ex Lindl.	BERBERIDACEAE	Shrub	W	Daruhaldi, Rasaut	Root, Stem	<10
179	*Berberis lycium* Royle	BERBERIDACEAE	Shrub	W	Daruhaldi, Chitra	Root, Stem	1000-2000 [≈*285*]
180	*Berberis tinctoria* Lesch.	BERBERIDACEAE	Shrub	W	Daruhaldi, Rasaut	Root, Stem	**
181	*Berberis umbellata* Wall. ex G.Don	BERBERIDACEAE	Shrub	W	Daruhaldi, Rasaut	Root	**
182	*Berberis vulgaris* L.	BERBERIDACEAE	Shrub	I	Zarishk	Dried Berry	<10
183	*Bergenia ciliata* (Haw.) Sternb.	SAXIFRAGACEAE	Herb	W	Pashnabhed, Sifora, Pathhar Chatta, *Pasanabheda*	Root (Rhizome), Whole Plant	1000-2000 [≈*125*]
184	*Bergenia stracheyi* (Hook.f. & Thomson) Engl.	SAXIFRAGACEAE	Herb	W	Pashnabheda	Root, Leaf	<10
185	*Beta vulgaris* L.	CHENOPODIACEAE	Herb	C	Beet Root, Chukandar	Root	<10
186	*Betula utilis* D.Don	BETULACEAE	Tree	W	Bhojpatra, *Bhurjah*	Bark (Stem)	100-200
187	*Biophytum sensitivum* (L.) DC.	OXALIDACEAE	Herb	W	Mukkutti	Whole Plant	10-50
188	*Bistorta amplexicaulis* (D.Don) Greene	POLYGONACEAE	Herb	W	Anjubar	Root	**
189	*Bixa orellana* L.	BIXACEAE	Shrub	C	Sindhuri, Latkan dana, Annato, Jaffra vedai	Seed	<10
190	*Blepharis edulis* (Forssk.) Pers. [= *Blepharis persica* (Burm.f.).Kuntze.]	ACANTHACEAE	Herb	I	Uttangan, *Utingana*	Fruit (Seed)	<10 [≈*2*]
-	*Blepharis persica* (Burm.f.) Kuntze.	Ref.: *Blepharis edulis*	-	-	-	-	-

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191	*Blumea lacera* (Burm. f.) DC.	ASTERACEAE	Herb	W	Kakranda, Jangli muli, Kukurmuta	Whole Plant, Leaf, Root	<10
192	*Boerhavia chinensis* (L.) Rottb. [= *Boerhavia repanda* Willd.]	NYCTAGINACEAE	Herb	W	Cattaranai, Varakanputu	Root, Whole Plant	<10
193	*Boerhavia diffusa* L.	NYCTAGINACEAE	Herb	W	Punarnava, *Punarnava rakta*, *Raktapunarnava*	Root, Whole Plant	2000-5000 [*≈1040*]
194	*Boerhavia plumbaginea* Cav.	NYCTAGINACEAE	Herb	W	Punarnava	Leaf, Root	<10
-	*Boerhavia repanda* Willd.	Ref.: *Boerhavia chinensis*	-	-	-	-	-
195	*Bombax ceiba* L. [= *Bombax malabaricum* DC.]	BOMBACACEAE	Tree	W	Mochras, Semal, Simbal, Semal Musli, *Salmali*	Bark (Stem), Flower, Root Gum, Fruit (Juvenile)	100-200 [*≈440*]
-	*Bombax malabaricum* DC.	Ref.: *Bombax ceiba*	-	-	-	-	-
196	*Borago officinalis* L.	BORAGINACEAE	Herb	I	Gaozabaan	Leaf, Flower	10-50
197	*Borassus flabellifer* L.	ARECACEAE	Tree	C/W	Palmyra palm, Tad, Tala, Tadbali	Infloresence, Fruit, Stem, Endosperm	<10
-	*Borreria hispida* (L.) K.Schum.	Ref.: *Spermacoce hispida*	-	-	-	-	-
-	*Boswellia carteri* Birdw.	Ref.: *Boswellia sacra*	-	-	-	-	-
198	*Boswellia frereana* Birdw.	BURSERACEAE	Tree	I	African elemi	Oleo-Gum Resin	<10
199	*Boswellia sacra* Flueck. [= *Boswellia carteri* Birdw.]	BURSERACEAE	Tree	I	Sali guggul	Oleo-Gum Resin	<10
200	*Boswellia serrata* Roxb. ex Colebr.	BURSERACEAE	Tree	W	Gugguldhupa, Salai Guggul, Mani kundrikam, *Kunduru*	Oleo-Gum Resin	500-1000 [*≈15*]
201	*Bougainvillea spectabilis* Willd.	NYCTAGINACEAE	Climber	C	Booganbel, Cherei	Leaf	<10
-	*Brassica alba* (L.) Rabenh	Ref.: *Sinapis alba*	-	-	-	-	-

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-	*Brassica campestris* L.	Ref.: *Brassica rapa*	-	-	-	-	-
202	*Brassica juncea* (L.) Czern.	BRASSICACEAE	Herb	C	Kaduku, Sasuve Bili	Seed	100-200
203	*Brassica rapa* L. [= *Brassica campestris* L.]	BRASSICACEAE	Herb	C	*Sarsapa*	Seed	500-1000
204	*Brassica nigra* (L.) K. Koch	BRASSICACEAE	Herb	C	Raai	Seed	200-500
205	*Breynia retusa* (Dennst.) Alston	EUPHORBIACEAE (Phyllanthaceae)	Shrub	W	Bahuprajaa, Kaamboji, Kangli, Perunirui	Leaf, Stem	<10 [≈*6*]
206	*Briedelia montana* (Roxb.) Willd.	EUPHORBIACEAE (Phyllanthaceae)	Tree	W	Gondni, Geia	Wood (Heartwood)	<10
207	*Bridelia stipularis* (L.) Blume	EUPHORBIACEAE (Phyllanthaceae)	Climber	W	Ghonta, Harinhara	Root, Leaf, Bark	<10
-	*Brugmansia arborea* (L.) Steud.	Ref.: *Datura arborea*	-	-	-	-	-
208	*Bryophyllum pinnatum* (Lam.) Oken	CRASSULACEAE	Herb	C	Patharchur, Pathar chatt	Leaf, Whole Plant	<10 [≈*90*]
209	*Buchanania cochinchinensis* (Lour.) M.R. Almeida [= *Buchanania lanzan* Spreng.; *Buchanania latifolia* Roxb.]	ANACARDIACEAE	Tree	W	Chironji, Charoli, *Priyala*	Seed, Bark (Stem)	100-200
-	*Buchanania lanzan* Spreng.	Ref.: *Buchanania cochinchinensis*	-	-	-	-	-
-	*Buchanania latifolia* Roxb.	Ref.: *Buchanania cochinchinensis*	-	-	-	-	-
210	*Bunium bulbocastanum* L.	APIACEAE	Herb	C/W	Kala-zirah, Shah-zirah, Kala Jeera	Fruit	<10
211	*Bunium persicum* (Boiss.) B.Fedtsch.	APIACEAE	Herb	C/W	Kala-zirah, Shah-zirah	Fruit	<10
-	*Butea frondosa* Willd.	Ref.: *Butea monosperma*	-	-	-	-	-

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212	*Butea monosperma* (Lam.) Taub. [= *Butea frondosa* Willd.]	FABACEAE	Tree	W	Tesu phool, Palash, Lac, Murukkam, Kamarkas, *Palasa*, *Palasah*	Bark (Stem), Flower, Root, Seed, Wood, Gum	200-500 [*≈600*]
213	*Butea superba* Roxb. ex Willd.	FABACEAE	Climber	W	Phul kesu, Tesu phool, Kodi murukkam	Flower	<10
214	*Caccinia crassifolia* (Vent.) C.Koch	BORAGINACEA	Climber	I	Gaozaban	Leaf, Flower	<10
215	*Cadaba fruticosa* (L.) Druce [= *Cadaba indica* Lam.]	CAPPARACEAE	Shrub	W	Kodham, Pulika, Vizhudhi	Leaf	** [*≈42*]
-	*Cadaba indica* Lam.	Ref.: *Cadaba fruticosa*	-	-	-	-	-
216	*Caesalpinia bonduc* (L.) Roxb.	CAESALPINIACEAE	Shrub	W	Sagargota, Gatran, Karanjua, kalaachi kaai, Nataphal, *Latakaranja*	Seed	100-200 [*≈700*]
217	*Caeselpinia crista* L.	CAESALPINIACEAE	Shrub	W	*Putikaranja*	Bark (Stem)	<10
218	*Caesalpinia digyna* Rottler.	CAESALPINIACEAE	Climber	W	Teripods, Teri Beej	Fruit	<10
219	*Caesalpinia pulcherrima* (L.) Sw.	CAESALPINIACEAE	Shrub	C	Gultora, Krishnachura, Peacock flower	Root	<10
220	*Caesalpinia sappan* L.	CAESALPINIACEAE	Tree	C	Pathimugam, *Pattanga*	Heart Wood	50-100 [*≈10*]
221	*Cajanus cajan* (L.) Millsp.	FABACEAE	Shrub	C	Arhar, Tur, *Adhaki*	Root, Seed	<10
222	*Calamus rotang* L.	ARECACEAE	Shrub	W	Pirapan, Kizhangu, Bet, vetra	Root, Fruit (Seed), Tender Plant	<10 [*≈50*]
223	*Calendula officinalis* L.	ASTERACEAE	Herb	C	Gulasharfi	Flower	100-200 [*≈1*]
224	*Callicarpa macrophylla* Vahl	VERBENACEAE	Tree	W	*Priyangu*	Flower, Fruit (Seed)	50-100
225	*Calophyllum apetalum* Willd.	CLUSIACEAE	Tree	W	Cherupunna	Fruit	<10
226	*Calophyllum inophyllum* L.	CLUSIACEAE	Tree	C/W	Punnappoovu, Nag champa	Flower, Fruit	<10

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227	*Calotropis gigantea* (L.) W.T. Aiton	ASCLEPIADACEAE	Shrub	W	Erukkin veru, Akanda, Erukkam, Aak	Flower, Bark (Root), Stem Leaf, Latex	50-100 [≈*360*]
228	*Calotropis procera* (Aiton) W.T.Aiton	ASCLEPIADACEAE	Shrub	W	Akada Phool, Aak, Aken, *Arka*	Root, Leaf, Bark (Stem), Flower, Latex	50-100 [≈*520*]
229	*Calycopteris floribunda* (Roxb.) Poir.	COMBRETACEAE	Climber	W	Pullaaniyila, *Pullani*	Fruit, Leaf	<10
230	*Camelia sinensis* (L.) Kuntze	THEACEAE	Shrub	C	Tea, Cha	Leaf	100-200
231	*Canarium indicum* L.	BURSERACEAE	TreeI	C	anarium nut	Bark	<10
232	*Canarium strictum* Roxb.	BURSERACEAE	Tree	W	Dhoop, Raldhoop	Resin, Wood	<10
-	*Canella alba* Murray	Ref.:*Canella winterana*	-	-	-	-	-
233	*Canella winterana* (L.) Gaertn. [= *Canella alba* Murray]	CANELLACEAE	Tree	I	Kiliyuram pattai	Bark (Stem)	**
234	*Cannabis sativa* L.	CANNABINACEAE	Shrub	C/W	Maya, Bhang, *Vijaya*	Whole Plant, Seed	<10 [≈*140*]
235	*Canscora alata* (Roth.) Wall. [= *Canscora decussata* Schult. & Schult.f.]	GENTIANACEAE	Herb	W	Shankhuli, Nakuli, Shankahpuspi	Whole Plant	10-50
-	*Canscora decussata* Schult. & Schult.f.	Ref.: *Canscora alata*	-	-	-	-	-
236	*Canthium coromandelicum* (Burm. f.) Alston	RUBIACEAE	Shrub	W	Kara Sinhala, Nagabala, Karemullu	Leaf	<10
237	*Capparis decidua* (Forssk.) Edgew.	CAPPARACEAE	Shrub	W	Karel, Karir, Kair, Dele	Leaf, Root, Bark (Root)	<10
238	*Capparis divaricata* Lam.	CAPPARACEAE	Tree	W	Turatti	Leaf	**
239	*Capparis moonii* Wight	CAPPARACEAE	Climber	W	Rudanti	Fruit	<10
240	*Capparis roxburghii* DC.	CAPPARACEAE	Shrub	W	Rudanti (Subs.)	Fruit	**
241	*Capparis sepiaria* L.	CAPPARACEAE	Shrub	W	Karungurai	Bark (Stem)	<10
242	*Capparis spinosa* L.	CAPPARACEAE	Shrub	W	Kanther, *Himsra*	Root, Fruit	500-100
243	*Capparis zeylanica* L. [= *Capparis horrida* L.]	CAPPARACEAE	Climber	W	Sivappu Boomi Sakkarai Kizhangu, *Vyaghranakha*	Fruit, Root	<10

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-	*Capparis horrida* L.	Ref.:*Capparis zeylanica*	-	-	-	-	-
244	*Capsicum annuum* L.	SOLANACEAE	Herb	C	Mirchi	Fruit	100-200
245	*Caralluma adscendens* (Roxb.) R. Br.	APOCYNACEAE	Herb	W	Maakada Singi. Mangana kodu, Kaarallamu	Stem, Latex	<10
246	*Carapichea ipecacuanha* (Brot.) L. Andersson [= *Cephaelis ipecacuanha* (Brot.) A. Rich.; *Psychotria ipecacuanha* (Brot.) Standl.]	RUBIACEAE	Shrub	C	Ipecacuanha	Root	**
247	*Cardiospermum halicacabum* L.	SAPINDACEAE	Climber	W	Mudakkathan, *Karnasphota*	Root, Seed, Whole Plant	100-200 [*≈4500*]
248	*Carduus nutans* L.	ASTERACEAE	Herb	W	Musk thistle, Scotch thistle	Root	**
249	*Careya arborea* Roxb.	LECYTHIDACEAE	Tree	W	Vaaikumbha, Kumbhiphoo, *Kumbhikah*	Seed, Bark (Stem)	<10
250	*Carica papaya* L.	CARICACEAE	Tree	C	Papaya, Papita, *Eranakarkati*	Fruit, Root	10-50
251	*Carissa carandas* L.	APOCYNACEAE	Shrub	W/C	Christ's thorn, Karanda *Karamarda*, *Karinkara*	Root, Bark (Stem)	** [*≈40*]
252	*Carthamus tinctorius* L.	ASTERACEAE	Shrub	C	Kusum phool, *Kusumbha*	Fruit, Leaf, Flower	100-200
253	*Carum carvi* L.	APIACEAE	Herb	C/W	Shahjeera, Kalazira, Shingu Jeera, *Krsnajiraka*	Fruit	50-100 [*≈5*]
254	*Carum strictocarpum* C.B.Clarke	APIACEAE	Herb	W	Kalzira (Subs.)	Fruit	**
255	*Caryota urens* L.	ARECACEAE	Tree	W/C	Toddy Palm, Mari	Leaf, Fruit	<10
256	*Cascabela thevetia* (L.) Lippold	APOCYNACEAE	Shrub	C	Kaner, Peeli kaner	Bark, Seed	<10
257	*Casearia esculenta* Roxb.	FLACOURTIACEAE	Shrub	W	Saptarangi	Root	10-50
-	*Cassia absus* L.	Ref.: *Chaemecrista absus*	-	-	-	-	-
-	*Cassia alata* L.	Ref.:*Senna alata*	-	-	-	-	-
-	*Cassia angustifolia* Vahl	Ref.:*Senna alexandrina*	-	-	-	-	-
-	*Cassia auriculata* L.	Ref.:*Senna auriculata*	-	-	-	-	-

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258	*Cassia fistula* L.	CAESALPINIACEAE	Tree	W/C	Amaltas, Amalthasphali, Sonari chal, Gur Lakkar, Konna, *Aragvadha*	Fruit (Pulp), Bark (Stem)	200-500 [*≈840*]
-	*Cassia italica* (Mill.) Lam. ex Andr.	Ref.:*Senna italica*	-	-	-	-	-
-	*Cassia obtusifolia* L.	Ref.:*Senna obtusifolia*	-	-	-	-	-
-	*Cassia obtusus* Roxb.	Ref.:*Senna italica*	-	-	-	-	-
-	*Cassia occidentalis* L.	Ref.:*Senna occidentalis*	-	-	-	-	-
-	*Cassia siamea* Lam.	Ref.:*Senna siamea*	-	-	-	-	-
-	*Cassia sophera* L.	Ref.:*Senna sophera*	-	-	-	-	-
-	*Cassia tora* L.	Ref.:*Senna tora*	-	-	-	-	-
-	*Cassia senna* L.	Ref.:*Senna alexandrina*	-	-	-	-	-
259	*Cassytha filiformis* L.	CASSYTHACEAE	Climber	W	Astimu, Akash bel	Whole Plant	<10
260	*Catharanthus roseus* (L.) G.Don [= *Vinca rosea* L.]	APOCYNACEAE	Herb	C	Sadabahar, Nithyakalayani, Vinca	Leaf, Root, Whole Plant	200-500 [*≈250*]
261	*Catunaregum spinosa* (Thunb.) Tirveng. [= *Xeromphis spinosa* (Thunb.) Keay]	RUBIACEAE	Shrub	W	Mainphal, Maggare, Bilmora, Kaarai, *Madana*	Fruit	<10
262	*Cayaponia laciniosa* (L.) C. Jaffery	CUCURBITACEAE	Climber	W	Shivlingi	Seed	10-50
263	*Cayratia carnosa* (Wall.) Gagnep. ex Wight	VITACEAE	Climber	W	Amal ved, Amal bel, Gutt	Bark (Stem)	<10
264	*Cayratia pedata* (Lam.) A.Juss. ex Gagnep.	VITACEAE	Climber	W	Suvaha, Gummatige	Whole Plant	<10
-	*Cedrela toona* Roxb.	Ref.: *Toona ciliata*	-	-	-	-	-
265	*Cedrus atlantica* (Endl.) Manetti ex Carriere	PINACEAE	Tree	I	Cedar	Heart Wood	<10
266	*Cedrus deodara* (Roxb.) G.Don	PINACEAE	Tree	W	Deodar, Diar, Devdar, Kelon, *Devadaru*	Heart Wood	1000-2000
267	*Ceiba pentandra* (L.) Gaertn. [= *Eriodendron pentandrum* (L.) Kurz]	BOMBACACEAE	Tree	C	Safed semal	Fruit	<10
268	*Celastrus paniculatus* Willd.	CELASTRACEAE	Climber	W	Malkangani, Jyothismathi, Bavanthi beeja, *Jyotismati*	Seed	200-500 [*≈1*]
269	*Celosia argentea* L.	AMARANTHACEAE	Herb	W/C	*Sitivaraka*	Seed	<10

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270	*Celtis philippensis* Blanco	ULMACEAE (Cannabaceae)	Tree	W	Kakamushti (Subs.)	Wood	<10
271	*Celtis timorensis* Span.	ULMACEAE (Cannabaceae)	Tree	W	Heikreng	Leaf	<10
272	*Centaurea behen* L.	ASTERACEAE	Herb	I	Behmen Safed, Bavan	Root	20-50
273	*Centella asiatica* (L.) Urb.	APIACEAE	Herb	C/W	Brahmi, Brahmi booti, Vallarai, *Mandukaparni*	Leaf, Whole Plant	500-1000 [*≈1870*]
-	*Centratherum anthelminticum* (L.) Kuntze	Ref.: *Baccharoides anthelmintica*	-	-	-	-	-
-	*Cephaelis ipecacuanha* (Brot.) A.Rich. [= *Psychotria ipecacuanha* (Brot.) Standl.]	Ref.: *Carapichea ipecacuanha*	-	-	-	-	-
274	*Ceratonia siliqua* L.	FABACEAE	Tree	C	Kharnub Shaami	Fruit, Seed	<10
275	*Chaemecrista absus* (L.) H.S Irwin & Barneby [= *Cassia absus* L.]	CAESALPINIACEAE	Herb	W	Chaksoo, Chaksu	Fruit (Seed), Root	100-200
276	*Chamaecrista mimosoides* (L.) Greene	CAESALPINIACEAE	Herb	W	Tea Senna, Patwa Ghas	Leaf, Root	<10
277	*Chamaemelum nobile* (L.) All. [= *Anthemis nobilis* L.]	ASTERACEAE	Herb	C/W	Babuna, Gulbabuna	Flower, Leaf	<10
278	*Chenopodium album* L.	CHENOPODIACEAE	Herb	C	Bathuaa	Leaf	<10
279	*Chaerophyllum villosum* Wall. ex DC.	APIACEAE	Herb	W	Mithi patis	Root	**
280	*Cheilocostus speciosus* (J.Koenig) C. Specht [= *Costus speciosus* (J.Konig) Sm.]	COSTACEAE	Shrub	W	Kustha, Koshtum, Kuth, Dev dhonki, *Kebuka*	Root(Rhizome), Aerial Part	<10 [*≈190*]
281	*Chlorophytum arundinaceum* Baker	LILIACEAE (Anthericaceae)	Herb	C/W	Safed musali, Musli	Root	10-50
282	*Chlorophytum borivilianum* Santapau & R.R.Fern.	LILIACEAE (Anthericaceae)	Herb	C/W	Safed musali	Root	100-200 [*≈25*]
283	*Chlorophytum tuberosum* Baker	LILIACEAE (Anthericaceae)	Herb	W/C	Safed musali, Musli	Root	200-500 [*≈1*]
284	*Chonemorpha fragrans* (Moon) Alston	APOCYNACEAE	Climber	W	Murva	Root	10-50
285	*Chrozophora plicata* (Vahl) A.Juss.ex Spreng.	EUPHORBIACEAE	Herb	W	Nilakanthi	Root	<10

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286	*Chrozophora prostrata* Dalzell & A.Gibson	EUPHORBIACEAE	Herb	W	Neelkanthi	Whole Plant	<10
-	*Chrysanthemum cinerariifolium* (Trevis) Vis.	Ref.: *Tanacetum cinerariifolium*	-	-	-	-	-
287	*Chrysanthemum indicum* L.	ASTERACEAE	Herb	C	*Guladaudi*	Leaf	<10 [*≈40*]
288	*Chrysopogon zizanioides* (L.) Roberty [= *Vetiveria zizanioides* (L.) Nash]	POACEAE	Herb	W/C	Lavancha, Khas, Vettiver, Vilaamicham, Usira	Root	200-500 [*≈1350*]
289	*Cicer arietinum* L.	FABACEAE	Herb	C	Chana, *Canaka*	Whole Plant	10-50
290	*Cichorium endivia* L.	ASTERACEAE	Herb	C	Kasini, Endive	Fruit (Seed)	<10
291	*Cichorium intybus* L.	ASTERACEAE	Herb	C/W	Kasni, Kasani	Flower, Leaf, Root, Fruit (Seed)	500-1000 [*≈20*]
292	*Cinchona calisaya* Wedd. [= *Cinchona ledgeriana* (Howard) Bern. Moens ex Trimen]	RUBIACEAE	Tree	I	Cinchona	Bark (Stem)	<10
-	*Cinchona ledgeriana* (Howard) Bern. Moens ex Trimen	Ref.: *Cinchona calisaya*	-	-	-	-	-
293	*Cinchona officinalis* L.	RUBIACEAE	Tree	I	Cinchona bark	Bark (Stem)	<10
294	*Cinnamomum camphora* (L.) J. Presl	LAURACEAE	Tree	C	Kapur, *Karpura*	Stem, Root (Root-crystal)	2000-5000
295	*Cinnamomum cassia* (Nees & T.Nees) J.Presl	LAURACEAE	Tree	I	Dalchini	Bark (Stem)	100-200
296	*Cinnamomum glaucenscens* (Nees) Hand.-Mazz.	LAURACEAE	Tree	W	Sugandhakabila, Kokila (Sugandh)	Fruit	<10
297	*Cinnamomum macrocarpum* Hook.f.	LAURACEAE	Tree	W	Lavang	Leaf	<10
298	*Cinnamomum malabathrum* (Lam.) J.Presl	LAURACEAE	Tree	W	Dalchini, Tejpatta	Bark (Stem)	<10
299	*Cinnamomum sulphuratum* Nees	LAURACEAE	Tree	W	Dalchini, TejpattaLeaf,	Bark (Stem)	100-200
300	*Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm.	LAURACEAE	Tree	W/C	Tamal patra, Tejpatra *Tvakapatra*	Leaf, Bark (Stem)	2000-5000 [*≈155*]

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301	*Cinnamomum verum* J.Presl [= *Cinnamomum zeylanicum* Blume]	LAURACEAE	Tree	C	Dalchini, Elavangam, *Tvak*	Bark (Stem), Leaf	200-500 [*≈6*]
302	*Cinnamomum wightii* Meisn.	LAURACEAE	Tree	W	Dalchini, Tejpatta	Bark (Stem)	<10
-	*Cinnamomum zeylanicum* Blume	Ref.: *Cinnamomum verum*	-	-	-	-	-
303	*Cipadessa baccifera* (Roth) Miq.	MELIACEAE	Shrub	W	Adusoge soppu	Leaf	<10
304	*Cissampelos pareira* L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman	MENISPERMACEAE	Climber	W	Pahad mool, *Patha*	Root, Leaf, Stem	10-50
305	*Cissus quadrangularis* L.	VITACEAE	Climber	W	Pirandai, Hutjodi, *Asthisamhrta*	Stem	200-500 [*≈5200*]
306	*Citrullus colocynthis* (L.) Schrad.	CUCURBITACEAE	Climber	W	Indrayan, Kumatti, Tumma, Kaurtumma, *Indravaruni*	Fruit, Root, Leaf	200-500 [*≈520*]
307	*Citrullus lanatus* (Thunb.) Matsumara & Nakai	CUCURBITACEAE	Climber	C	Terbuz, Matira, Water melon	Root	10-50
-	*Citrus acida* Pers.	Ref.:*Citrus aurantiifolia*	-	-	-	-	-
308	*Citrus aurantiifolia* (Christm.) Swingle [= *Citrus acida* Pers.]	RUTACEAE	Tree	C	Limbu	Fruit (Fruit Rind)	200-500
309	*Citrus aurantium* L.	RUTACEAE	Tree	C	Narangi	Fruit	<10
310	*Citrus bergamia* Risso.	RUTACEAE	Tree	C/W	Limbu chaal, Jambeeram	Fruit	<10
311	*Citrus limon* (L.) Burm.f.	RUTACEAE	Tree	C	Lemon, *Nimbu*	Fruit	500-1000
312	*Citrus medica* L.	RUTACEAE	Tree	W	Matunga, Mahnimbu, *Bijapura*	Fruit	1000-2000
313	*Citrus reticulata* Blanco	RUTACEAE	Tree	C	Santra, Orange	Fruit	50-100
314	*Citrus sinensis* (L.) Osbek	RUTACEAE	Tree	C	Santra	Fruit	10-50
315	*Clausena dentata* (Willd.) Roem.	RUTACEAE	Shrub	W	Mahasindur	Root	**
316	*Cleistanthus collinus* (Roxb.) Hook. f.	EUPHORBIACEAE	Tree	W	Kutaja, Garbar	Bark (Stem), Fruit	** [*≈1*]
317	*Clematis gouriana* Roxb. ex DC.	RANUNCULACEAE	Climber	W	Morvel	Whole Plant	<10
318	*Clematis heynei* M.A.Rau [= *Clematis triloba* B. Heyne ex Roth]	RANUNCULACEAE	Climber	W	Morvel	Whole Plant	<10

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-	*Clematis triloba* B. Heyne ex Roth	Ref.: *Clematis heynei*	-	-	-	-	-
319	*Cleome gynandra* L. [= *Gynandropsis pentaphylla* (L.) DC.]	CLEOMACEAE	Herb	W	Cat whiskers, Ridhi, *Ajagandha*	Seed, Whole Plant	10-50 [≈*1120*]
320	*Cleome viscosa* L.	CLEOMACEAE	Herb	W	Nai kadugu, Jakhiya	Root, Fruit (Seed)	<10 [≈*135*]
321	*Clerodendrum indicum* (L.) Kuntze	VERBENACEAE	Shrub	W/C	Bharangi	Root	10-50
322	*Clerodendrum inerme* (L.) Gaertn.	VERBENACEAE	Shrub	C/W	Nir-Notsjil, Sangan-Kuppi, Agnimanth	Whole Plant	<10
323	*Clerodendrum infomtunatum* L.	VERBENACEAE	Shrub	W	Bhanpatra, Titabhant, Bhant, Batigosh	Flower, Leaf	<10 [≈*640*]
324	*Clerodendrum phlomidis* L.f.	VERBENACEAE	Shrub	W	Arnimul, *Agnimantha*	Root	200-500 [≈*5*]
325	*Clerodendrum serratum* (L.) Moon	VERBENACEAE	Shrub	W	Bharangi, Cheruthecke, *Bharangi*	Root	100-200
326	*Clinopodium nepeta* (L.) Kuntze	LAMIACEAE	Herb	W	Basil	Whole Plant	<10
327	*Clitoria ternatea* L.	FABACEAE	Climber	C/W	Kajli, Sankhpushpam, Kakkattaan, *Aparajita*	Leaf, Root, Flower, Seed	10-50 [≈*2*]
328	*Coccinia grandis* (L.) Voigt [= *Coccinia indica* W. & A.]	CUCURBITACEAE	Climber	C/W	Kovai, Kanduri, Bimba, *Bimbi*	Whole Plant	100-200
-	*Coccinia indica* W. & A.	Ref.: *Coccinia grandis*	-	-	-	-	-
329	*Cocculus hirsutus* (L.) W. Theob.	MENISPERMACEAE	Climber	W	Vasanvel	Leaf	10-50 [≈*10*]
330	*Cochlospermum religiosum* (L.) Alston	COCHLOSPERMACEAE	Tree	W/C	Katira, Goond katira	Gum	<10
331	*Cocos nucifera* L.	ARECACEAE	Tree	C	Nariyal, *Narikela*	Endosperm, Flower	>10000
332	*Coffea arabica* L.	RUBIACEAE	Shrub	C	Coffee	Seed	10-50
333	*Coffea travancorensis* Wight & Arn.	RUBIACEAE	Shrub	W	Katu-mulla, Tsjeru-mulla	Root	<10
334	*Coix lacryma-jobi* L.	POACEAE	Herb	W	Sankhlu, Dabhir *Gavedhuka*	Root, Fruit	**
335	*Colchicum autumnale* L.	LILIACEAE (Colchicaceae)	Herb	I	Meadow saffron	Whole Plant	<10

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336	*Colchicum luteum* Baker	LILIACEAE (Colchicaceae)	Herb	W	Suranjan, Hiran tutiya, Kukum, Meadow saffron	Root	50-100
337	*Colchicum robustum* (Bunge) Stef.	LILIACEAE (Colchicaceae)	Herb	I	Meadow saffron	Whole Plant	<10
338	*Coleus forskohlii* (Willd.) Briq. [= *Plectranthus barbatus* Andrews]	LAMIACEAE	Herb	C	Patharchur, Makandi, *Gandira*	Root	100-200 [≈*2*]
339	*Coleus zeylanicus* (Benth.) Cramer	LAMIACEAE	Herb	W	Valakah	Whole Plant	10-50
340	*Combretum decandrum* Roxb. non Jacq.	COMBRETACEAE	Climber	W	Korakukundi	Seed	**
341	*Commiphora caudata* (Wight & Arn.) Engler	BURSERACEAE	Tree	W	Kiluvai, Kondamavu	Bark (Stem)	<10
-	*Commiphora mukul* (Hook. ex Stocks) Engl.	Ref.: *Commiphora wightii*	-	-	-	-	-
342	*Commiphora myrrha* (T.Nees) Engl.	BURSERACEAE	Tree	I	Hirabol	Oleo-Gum Resin	10-50
343	*Commiphora wightii* (Arn.) Bhandari [= *Commiphora mukul* (Hook. ex Stocks) Engl.]	BURSERACEAE	Shrub	I/W	Guggul, *Guggulu*	Oleo-Gum Resin, Stem, Root	1000-2000 [≈*5*]
344	*Conium maculatum* L.	APIACEAE	Herb	W	Khardmaanaa, Shuk, Hemlock	Whole Plant	<10
345	*Convolvulus arvensis* L.	CONVOLVULACEAE	Climber	C/W	Chandvel (Prasarni)	Leaf	**
-	*Convolvulus microphyllus* Sieb. ex Spreng.	Ref.: *Convolvulus prostratus*	-	-	-	-	-
-	*Convolvulus pluricaulis* Chois.	Ref.: *Convolvulus prostratus*	-	-	-	-	-
346	*Convolvulus prostratus* Forssk. [= *Convolvulus microphyllus* Sieber ex Spreng.; *Convolvulus pluricaulis* Chois.]	CONVOLVULACEAE	Herb	W	Shankapushpi, *Sankhapuspi*	Whole Plant	500-1000
347	*Convolvulus scammonia* L.	CONVOLVULACEAE	Climber	I	Saqmunia	Gum Resin	<10
348	*Coptis teeta* Wall.	RANUNCULACEAE	Herb	C/W	Mamira, Peetha Rohini	Root	100-200 [≈*70*]

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349	*Corallocarpus epigaeus* (Rottl. & Willd.) C.B.Clarke	CUCURBITACEAE	Climber	W	Akasgaddah, Patalagaruda, *Sukanasa*	Root	<10
350	*Corchorus depressus* (L.) Stocks	TILIACEAE	Herb	W	Bahuphali	Aerial Part	<10
351	*Corchorus trilocularis* L.	TILIACEAE	Shrub	W	Arenukam	Whole Plant	<10
352	*Cordia angustifolia* Roxb.	CORDIACEAE	Shrub	I	Basora	Leaf	<10
353	*Cordia dichotoma* G.Forst. [= *Cordia obliqua* var. *wallichii* (G.Don) C.B.Clarke; *Cordia wallichii* G.Don]	CORDIACEAE	Tree	W/C	Lasora, Sapistan, *Slemataka*	Fruit	10-50 [*≈1*]
354	*Cordia monoica* Roxb.	CORDIACEAE	Tree	W	Narivari	Bark (Stem)	**
355	*Cordia myxa* L.	CORDIACEAE	Tree	W	Lasodaa, Lasora	Fruit, Leaf, Bark	10-50
-	*Cordia obliqua* Willd. var. *wallichii* (G.Don) C.B.Clarke	Ref.: *Cordia dichotoma*	-	-	-	-	-
-	*Cordia wallichii* G.Don	Ref.: *Cordia dichotoma*	-	-	-	-	-
-	*Cordyceps sinensis* (Berk.) Saac	Ref.: *Ophiocordyceps sinensis*	-	-	-	-	-
356	*Coriandrum sativum* L.	APIACEAE	Herb	C	Dhaniya, Dhana, *Dhanyaka*	Fruit	500-1000
357	*Corylus avellana* L.	BETULACEAE	Tree	I	Filbert, Findak, Funduq, Bunduq, Hazlenut	Fruit, Bark	<10
358	*Corylus jacquemontii* Decne.	BETULACEAE	Tree	W	Findak (Subs.), Kabasi, Bhotia badam	Fruit	<10
359	*Coscinium fenestratum* (Gaertn.) Colebr.	MENISPERMACEAE	Climber	W	Maramanjal, Daruharidra, *Kaliyaka*	Stem, Root	10-50
-	*Costus speciosus* (J.Konig) Sm.	Ref: *Cheilocostus speciosus*	-	-	-	-	-
-	*Crataegus oxyacantha* L.	Ref.: *Crataegus rhipidophylla*	-	-	-	-	-
360	*Crataegus rhipidophylla* Gand. [= *Crataegus oxyacantha* L.]	ROSACEAE	Tree	C/W	Hawthorn	Fruit, Flower	<10
-	*Crateva nurvula* Buch. - Ham.	Ref.: *Crateva religiosa*	-	-	-	-	-

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361	*Crateva religiosa* G.Forst. [= *Crateva nurvula* Buch. - Ham.]	CAPPARACEAE	Tree	W/C	Varun chhal, Varunah, Neermathalam, *Varuna*	Bark (Stem), Leaf, Seed	200-500 [≈*25*]
362	*Crepidium acuminatum* (D.Don) Szlach. [= *Malaxis acuminata* D. Don]	ORCHIDACEAE	Herb	W	Jeevak, Jeevakah	Pseudobulb	50-100
363	*Cressa cretica* L.	CONVOLVULACEAE	Shrub	W	Rudravanti	Whole Plant	<10
364	*Crinum asiaticum* L.	AMARYLLIDACEAE	Herb	W	Naagapatra, Nagadamani, Vishamoongil.	Bulb, Seed, Root	<10
365	*Crinum latifolium* L.	AMARYLLIDACEAE	Herb	W	Sudarshana, Vishamoongil, Madhuparnika	Bulb, Leaf, Root	<10
366	*Crocus sativus* L.	IRIDACEAE	Herb	C	Kesar, Zafran, Saffron, Zainbed, *Kunkuma*	Flower (Stigma & upper Style)	50-100
367	*Crotalaria juncea* L.	FABACEAE	Herb	C/W	Dhanahari, Patashan, Sana	Seed	<10
368	*Crotalaria retusa* L.	FABACEAE	Herb	W	Rattle weed, Ghunghunia	Whole Plant	<10
369	*Crotalaria verrucosa* L.	FABACEAE	Herb	W	Banshana, San, Sanpushpi	Fruit (Seed)	<10
-	*Croton oblongifolius* Roxb.	Ref.: *Croton persimilis*	-	-	-	-	-
370	*Croton persimilis* Müll.-Arg. [= *Croton oblongifolius* Roxb.]	EUPHORBIACEAE	Tree	W	Bhutankusha	Bark (Root)	**
371	*Croton tiglium* L.	EUPHORBIACEAE	Tree	C	Jamlghota, Japala, Nervalum, *Jayapala*	Seed	10-50 [≈*5*]
372	*Cryptocoryne spiralis* (Retz.) Fisch. ex Wydler	ARACEAE	Herb	W	Natti-ati-Vasa, Naatu athividayam	Root	<10
-	*Cryptolepis buchananii* Roem. & Schult.	Ref.: *Cryptolepis dubia*	-	-	-	-	-
373	*Cryptolepis dubia* (Burm.f.) M.R. Almeida [= *Cryptolepis buchananii* Roem. & Schult.]	PERIPLOCACEAE	Climber	W	Medaksinghi, Sariva, *Krsnasariva*	Root	10-50
374	*Cucumis melo* L. [= *Cucumis trigonus* Roxb.]	CUCURBITACEAE	Climber	C	Jangli-Indrayan	Fruit (Seed), Stem	<10
375	*Cucumis melo* L. var. *momordica* (Roxb.) Duthie & Fuller	CUCURBITACEAE	Climber	C/W	Kakadi beej, Magaj Kharbuja, *Ervaru*	Seed	10-50

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376	*Cucumis myriocarpus* Naudin	CUCURBITACEAE	Climber	C/W	Indravarruni, Khar Indrayan, wild cucumber		<10
377	*Cucumis sativus* L.	CUCURBITACEAE	Climber	C	Beej Kheera, *Trapusam*	Fruit (Seed)	100-200
-	*Cucumis trigonus* Roxb.	Ref.: *Cucumis melo*	-	-	-	-	-
378	*Cucurbita maxima* Duchesne	CUCURBITACEAE	Climber	C	Kaddu, Pumpkin	Fruit	<10
379	*Cucurbita moschata* Duchesne	CUCURBITACEAE	Climber	C	Kaddu, Kumrah	Fruit (Seed)	<10
380	*Cucurbita pepo* L.	CUCURBITACEAE	Climber	C	Safed Kaddu	Seed	<10
381	*Cullen corylifolium* (L.) Medik. [= *Psoralea corylifolia* L.]	FABACEAE	Herb	W/ C	Bawachi, Bavanchi Bakuchi	Fruit	200-500 [≈*1*]
382	*Cuminum cyminum* L.	APIACEAE	Herb	C	Jeera, Shahjeera, *Svetajiraka*	Fruit	1000-2000
383	*Curculigo orchioides* Gaertn.	HYPOXIDACEAE	Herb	W	Kali musali, Musli shiya, Nilapanai, *Talamuli*	Root	200-500 [≈*135*]
384	*Curcuma amada* Roxb.	ZINGIBERACEAE	Herb	C/W	Amba haldi, *Amra Haridra*	Root (Rhizome)	50-100
385	*Curcuma angustifolia* Roxb.	ZINGIBERACEAE	Herb	W/C	Tikhur, Ya-pansut	Root (Rhizome)	10-50 [≈*60*]
386	*Curcuma aromatica* Salisb.	ZINGIBERACEAE	Herb	C/W	Amba haldi, Kasturi manjal, Kasturi arishna, Kapu-kachri	Root (Rhizome)	50-100
387	*Curcuma caesia* Roxb.	ZINGIBERACEAE	Herb	W	Nar-kachura, Kala-haldi	Root (Rhizome)	<10 [≈*100*]
388	*Curcuma longa* L.	ZINGIBERACEAE	Herb	C	Arishna, Haldi, Karimanjal, *Haridra*	Root (Rhizome)	1000-2000
-	*Curcuma zedoaria* (Christm.) Roscoe	Ref.: *Curcuma zerumbet*	-	-	-	-	-
389	*Curcuma zerumbet* Roxb. [= *Curcuma zedoaria* (Christm.) Roscoe]	ZINGIBERACEAE	Herb	C/W	Kachur kachari, Poolan kizhangu, *Karcura*	Root (Rhizome)	200-500
390	*Cuscuta epithymum* (L.) L.	CONVOLVULACEAE	Climber	W	Aakaashvalli, Amarvalli, Amarvela	Whole Plant	<10
391	*Cuscuta reflexa* Roxb.	CONVOLVULACEAE	Climber	W	Aftimoon, Tukhme-Kasus Amar bel, Akash bel	Whole Plant	<10 [≈*140*]
392	*Cyamopsis tetragonoloba* (L.) Taub.	FABACEAE	Herb	C	Guar, Cluster bean	Seed	10-50
393	*Cyathula prostrata* (L.) Blume	AMARANTHACEAE	Herb	W	Kadalaavanakkin veru	Root	<10

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394	*Cycas circinalis* L.	CYCADACEAE	Tree	W	Madhana kama poo	Flower, Pith	<10
395	*Cyclea peltata* (Lam.) Hook.f. & Thomson	MENISPERMACEAE	Climber	W	Paada kizhangu	Root	50-100
396	*Cyclospermum leptophyllum* (Pers.) Sprague	APIACEAE	Herb	W	Fir-Leaved Celery, Ajmoda	Seed	<10
-	*Cydonia oblonga* Mill.	Ref.: *Pyrus cydonia*	-	-	-	-	-
397	*Cymbopogon citratus* (DC.) Stapf	POACEAE	Herb	C/W	Serai, Rohisha, *Kattrna*	Whole Plant	100-200 [*≈130*]
398	*Cymbopogon flexuosus* (Nees ex Steud.) W. Watson	POACEAE	Herb	W	Lemon grass	Whole Plant	100-200
399	*Cymbopogon martinii* (Roxb.) W. Watson	POACEAE	Herb	W	Ginger grass, *Rohisa*	Whole Plant	<10
400	*Cymbopogon schoenanthus* (L.) Spreng.	POACEAE	Herb	W	Rohisha, Russa ghaas	Whole Plant	<10
401	*Cynodon dactylon* (L.) Pers.	POACEAE	Herb	C/W	Durva, Doob, Karuka, *Durva*	Whole Plant	100-200 [*≈2950*]
402	*Cynometra iripa* Kostel.	CAESELPINIACEAE	Shrub	W	Madhuka, Irippa	Aerial Part	<10
403	*Cyperus esculentus* L.	CYPERACEAE	Herb	W	Musta	Root	<10
404	*Cyperus rotundus* L.	CYPERACEAE	Herb	W	Nagarmotha, Motha, Korai kizhangu, Mustha, *Musta*	Root (Rhizome)	500-1000 [*≈1350*]
405	*Cyperus scariosus* R.Br.	CYPERACEAE	Herb	W	Nagarmotha	Root	200-500
406	*Dactylorhiza hatagirea* (D.Don.) Soo	ORCHIDACEAE	Herb	W	Salampanja, Hathpanja, Wanpolagpa	Root (Tuber)	10-50 [*≈10*]
407	*Dactylorhiza incarnata* (L.) Soo	ORCHIDACEAE	Herb	W	Bhunjatak	Root (Tuber)	<10
408	*Daemonorops draco* (Willd.) Blume	ARECACEAE	Climber	W	Raktaniryaas, Khoonkharaaba, Heeraadokhi, Gum dragon	Resin	<10
409	*Dalbergia lanceolaria* L.f.	FABACEAE	Tree	W	Bithua, Bitwa, Takoli	Heart Wood, Leaf, Bark, Seed	10-50 [*≈5*]
410	*Dalbergia latifolia* Roxb.	FABACEAE	Tree	W	Kala Sheeshan, Rosewood	Bark (Stem)	**
411	*Dalbergia sissoo* DC.	FABACEAE	Tree	C/W	Shisham, *Simsapa*	Heart Wood, Bark (Stem)	10-50 [*≈285*]

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412	*Datura arborea* L. [= *Brugmansia arborea* (L.) Steud.]	SOLANACEAE	Shrub	I	Datura, Umathi	Whole Plant	<10
413	*Datura innoxia* Mill.	SOLANACEAE	Herb	W	Datura	Leaf, Flower, Fruit (Seed)	<10
414	*Datura metel* L.	SOLANACEAE	Herb	W	Duttura, *Dhattura*	Seed, Whole Plant	200-500 [≈*25*]
415	*Datura stramonium* L.	SOLANACEAE	Herb	W	Datura, Umathi	Leaf, Fruit (Seed), Stem	50-100 [≈*3*]
416	*Daucus carota* L. var. *sativa* DC.	APIACEAE	Herb	C	Gaajar Beej	Fruit (Seed)	100-200
417	*Decalepis hamiltonii* Wight & Arn.	PERIPLOCACEAE	Climber	W	Magali, Maredugeddalu	Root	100-200
418	*Delonix elata* (L.) Gamble	CAESALPINIACEAE	Tree	C	Sanchal, Vaadha naraayanan	Leaf	** [≈*517*]
419	*Delphinium denudatum* Wall. ex Hook.f. & Thomson	RANUNCULACEAE	Herb	W	Jadwar, Jadavar kath, Nirbishi	Root (Tuber)	<10
-	*Dendrobium macraei* auct. non Lindl., sensu Hook.f.	Ref.: *Flickingeria nodosa*	-	-	-	-	-
420	*Dendrobium nobile* Lindl.	ORCHIDACEAE	Herb	W	-	Whole Plant	**
421	*Dendrophthoe falcata* (L.F) Blume	LORANTHACEAE	Shrub	W	Bandaka, *Vanda*	Stem, Whole Plant	<10
-	*Derris indica* (Lam.) Benn.	Ref.:*Pongamia pinnata*	-	-	-	-	-
422	*Derris scandens* (Roxb.) Benth.	FABACEAE	Climber	W	Gonj	Whole Plant	**
423	*Desmodium gangeticum* (L.) DC.	FABACEAE	Herb	W	Salparni, *Salaparni*	Root, Whole Plant	500-1000
424	*Desmodium oojeinense* (Roxb.) H. Ohashi [= *Ougeinia dalbergioides* Benth.; *Ougeinia oojeinensis* (Roxb.) Hochr.]	FABACEAE	Tree	W	Sandan, *Tinisah*	Wood	<10
425	*Desmodium pulchellum* (L.) Benth.	FABACEAE	Shrub	W	Lodhra, Kheri	Root	<10
426	*Desmodium triflorum* (L.) DC.	FABACEAE	Herb	W	Hamsapapdi	Whole Plant	<10
427	*Desmostachya bipinnata* (L.) Stapf	POACEAE	Herb	W	Dharbha, *Kusa*	Root	10-50

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428	*Dichrostachys cinerea* (L.) Wight & Arn.	MIMOSACEAE	Shrub	W	Virtuli	Stem, Leaf	<10
429	*Didymocarpus pedicellatus* R.Br.	GESNERIACEAE	Herb	W	Shilapushpi, Pathar phori, Pasanphodi	Root	100-200
430	*Dillenia pentagyna* Roxb.	DILLENIACEAE	Tree	W	Nagkesaram	Fruit, Flower, Bark (Stem)	** [*≈40*]
431	*Dioscorea alata* L.	DIOSCOREACEAE	Climber	C/W	Sewalli kodi	Root, Stem	**
432	*Dioscorea bulbifera* L.	DIOSCOREACEAE	Climber	C/W	Varahi kand, *Varahi*	Root	200-500
433	*Dioscorea deltoidea* Wall. ex Griseb.	DIOSCOREACEAE	Climber	C/W	Shingli mingli, Nepal yam	Root	10-50
434	*Dioscorea oppositifolia* L.	DIOSCOREACEAE	Climber	W	Sarpahya	Root	**
435	*Dioscorea pentaphylla* L.	DIOSCOREACEAE	Climber	W	Kanta alu	Root, Stem	<10 [*≈3*]
436	*Diospyros buxifolia* (Blume) Hiern	EBENACEAE	Tree	W	Elichevian	Fruit	**
437	*Diospyros ebenum* J. Koenig ex. Retz.	EBENACEAE	Tree	W	Abnus	Wood	**
438	*Diospyros lotus* L.	EBENACEAE	Tree	W	Amlok	Fruit	**
439	*Diospyros malabarica* (Desr.) Kostel.	EBENACEAE	Tree	W	Kulattha, Kulittha, Khalva, Vardhipatraka	Seed	<10
440	*Diospyros melanoxylon* Roxb.	EBENACEAE	Tree	W	Tendu, Kendu, Temru, Ebony	Leaf	<10
441	*Diplocyclos palmatus* (L.) C.Jeffrey	CUCURBITACEAE	Climber	W	Shivling beej	Seed	<10
-	*Dodonaea angustifolia* (L.f.) Benth.	Ref.: *Dodonaea viscosa* Jacq. subsp. *angustifolia*	-	-	-	-	-
442	*Dodonaea viscosa* Jacq. subsp. *angustifolia* (L. f.) J. G. West [= *Dodonaea angustifolia* (L.f.) Benth.]	SAPINDACEAE	Shrub	W	Aliar, Mehndu, Jangli-anar	Leaf	<10 [*≈30*]
443	*Dolichos biflorus* L. [= *Macrotyloma uniflorum* (Lam.) Verdc.; *Vigna unguiculata* (L.) Walp.]	FABACEAE	Herb	C	Kulthi, Muthira, *Kulattha*	Seed	200-500
444	*Dorema ammoniacum* D.Don	APIACEAE	Herb	I	Ushaq	Gum	<10

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445	*Dregea volubilis* (L.f.) Benth. ex Hook. f. [= *Marsdenia volubilis* (L.f.) Cooke; *Wattakaka volubilis* (L.f.) Stapf	ASCLEPIADACEAE	Climber	W	Murva, Harandodi, Nak shikni	Leaf, Root	10-50
446	*Drimia indica* (Roxb.) Jessop [= *Urginea indica* (Roxb) Kunth.]	LILIACEAE	Herb	W	Janglipyaz, Pei vengaayam, White squills	Root	<10 [≈*20*]
447	*Drosera peltata* Thumb.	DROSERACEAE	Herb	W	Drosera	Whole Plant	**
448	*Drynaria quercifolia* (L.) J. Sm.	POLYPODIACEAE	Herb	W	Basket Fern, Asvakatri, Katikapan	Rhizome	<10
449	*Dryobalanops aromatica* C.F. Gaertn	DIPTEROCARPACEAE	Tree	I	Baraas (Bhimseni kapoor)	Exudate	<10
450	*Dryopteris filix-mas* (L.) Schott	DRYOPTERIDACEAE	Herb	W	Shield fern, Hirvi, *Sphitakitari*	Root	<10
-	*Drypetes roxburghii* (Wall.) Hurus.	Ref.: *Putranjiva roxburghii*	-	-	-	-	-
451	*Dysolobium pilosum* (Willd.) Marechal [= *Vigna pilosa* (Klien ex Willd.) Baker	FABACEAE	Herb	W	Kattucherupayar, Ban moong	Seed, Root	10-50
452	*Dysoxylum malabaricum* Bedd. ex C.DC.	MELIACEAE	Tree	W	Vellakil	Wood (Heart Wood)	<10
-	*Ecbolium linneanum* Kurz	Ref.: *Ecbolium viride*	-	-	-	-	-
453	*Ecbolium viride* (Forssk.) Alston [= *E. linneanum* Kurz]	ACANTHACEAE	Herb	W	Udajati, Sahacarah	Flower	<10
454	*Echinacea purpurea* (L.) Moench	ASTERACEAE	Herb	I	Eastern Purple Coneflower	Root	<10
455	*Echinops echinatus* Roxb.	ASTERACEAE	Herb	W	Utkanta	Whole Plant	<10
-	*Eclipta alba* Hassk.	Ref.: *Eclipta prostrata*	-	-	-	-	-
456	*Eclipta prostrata* (L.) L. [= *Eclipta alba* Hassk.]	ASTERACEAE	Herb	W	Bhringaraj, Karisaalai, Kayyonni, *Bhrngaraja*	Whole Plant	2000-5000 [≈*2480*]
457	*Elaeis guineensis* Jacq.	ARECACEAE	Tree	C	African oil palm	Fruit	<10
-	*Elaeocarpus ganitrus* Roxb. ex G.Don	Ref.: *Elaeocarpus sphaericus*	-	-	-	-	-
458	*Elaeocarpus sphaericus* (Gaertn.) K. Schum. [= *Elaeocarpus ganitrus* Roxb. ex G. Don]	ELAEOCARPACEAE	Tree	C/W	Rudraksh, *Rudraksa*	Seed	<10
459	*Elaeocarpus variabilis* Zmarrzty	ELAEOCARPACEAE	Tree	W	South Indiam Marblel Tree	Fruit	<10

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460	*Eleocharis dulcis* (Burm.f.) Trin. ex Hensch.	CYPERACEAE	Herb	I	Singapuri Keysur	Tuber	<10
461	*Elephantopus scaber* L.	ASTERACEAE	Herb	W	Gjihiva, Anachuvadi	Whole Plant	<10 [≈*220*]
462	*Elettaria cardamomum* Maton	ZINGIBERACEAE	Herb	C/W	Elachi Chhoti, Ilaychi, *Suksmaila*	Fruit (Seed)	200-500
463	*Eleusine coracana* (L.) Gaertn.	POACEAE	Herb		Mandua, Koda, *Madhulika*	Root	10-50
464	*Eleutherococcus senticosus* (Rupr. & Maxim.) Maxim	ARALIACEAE	Shrub	I	Ginseng	Root	**
-	*Embelia basaal* (Roem. & Schult.) A. DC.	Ref.: *Embelia tsjeriam cottam*	-	-	-	-	-
465	*Embelia ribes* Burm.f.	MYRSINACEAE	Climber	W	Vaividang, *Vidanga*	Fruit	100-200 [≈*2*]
466	*Embelia tsjeriam-cottam* (Roem. & Schult.) A. DC. [= *Embelia basaal* (Roem. & Schult.) A.DC.]	MYRSINACEAE	Shrub	W	Vaividang, Vaayu vilngam	Fruit	500-1000
-	*Emblica officinalis* Gaertn.	Ref.: *Phyllanthus emblica*	-	-	-	-	-
467	*Emilia sonchifolia* (L.) DC.	ASTERACEAE	Herb	W	Muyalcheviyan	Whole Plant	<10
468	*Enicostemma axillare* (Lam.) A. Raynal [= *Enicostemma littorale* non Blume; *Enicostemma hyssopifolium* (Willd.) Verd.]	GENTIANACEAE	Herb	W	Mamejava, Vellaragu, Chiretta, *Nahi*	Whole Plant	50-100 [≈*2*]
-	*Enicostemma hyssopifolium* (Willd.) Verd.	Ref.: *Enicostemma axillare*	-	-	-	-	-
-	*Enicostemma littorale* non Blume	Ref.: *Enicostemma axillare*	-	-	-	-	-
-	*Entada pursaetha* DC.	Ref.: *Entada rheedei*	-	-	-	-	-
469	*Entada rheedei* Spreng. [= *Entada pursaetha* DC.; *Entada scandens* auct. non Benth.]	MIMOSACEAE	Climber	W	Yaanai Kazharchi Kaai	Fruit (Seed)	<10
-	*Entada scandens* auct. non Benth.	Ref.: *Entada rheedei*	-	-	-	-	-

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470	*Ephedra distachya* L.	EPHEDRACEAE	Shrub	I	Horse Tail	Whole Plant	<10
471	*Ephedra equisetina* Bunge	EPHEDRACEAE	Shrub	W	Somalatha (Subs.)	Stem, Leaf, Flower, Fruit	<10
472	*Ephedra gerardiana* Wall. ex J.A. Mey	EPHEDRACEAE	Shrub	W	Somalatha, Somlata	Whole Plant	100-200
473	*Ephedra intermedia* Schr. & Mey	EPHEDRACEAE	Shrub	W	Somalatha	Stem, Leaf, Flower, Fruit	<10
474	*Ephedra sinica* Stapf	EPHEDRACEAE	Shrub	I	Ephedra	Stem, Leaf, Fruit	<10
-	*Ephemerantha macraei* (Lindl.) P.F. Hunt & Summerh	Ref.: *Flickingeria macraei*	-	-	-	-	-
475	*Epimedium sagittatum* (Siebold & Zucc.) Maxim	BERBERIDACEAE	Shrub	I	Horny Goat Weed	Leaf	<10
476	*Equisetum arvense* L.	EQUISETACEAE	Herb	W	Bottle brush, Horse tail	Whole Plant	<10
-	*Eriodendron pentandrum* (L.) Kurz	Ref.:*Ceiba pentandra*	-	-	-	-	-
-	*Ervatamia coronaria* (Jacq.) Stapf	Ref.:*Tabernaemontana divaricata*	-	-	-	-	-
477	*Eruca vesicaria* (L.) Cav.	BRASSICACEAE	Herb	W	Tara Mira, Duan, Gohawa, Sebuwa	Whole Plant	<10
478	*Erysimum cheiri* (L.) Crantz.	BRASSICACEAE	Herb	C	Todri lal, Wall Flower	Flower, Stem	<10
-	*Erythrina indica* Lam.	Ref.: *Erythrina variegata*	-	-	-	-	-
479	*Erythrina suberosa* Roxb.	FABACEAE	Tree	W	Pangra, Dhaul dhak, Vellaimurukku	Bark (Stem)	<10
480	*Erythrina variegata* L. [= *Erythrina. indica* Lam.]	FABACEAE	Tree	C/W	Murikkila, *Paribhadra*	Bark (Stem), Leaf	100-200 [*≈80*]
481	*Eucalyptus citriodora* Hook.	MYRTACEAE	Tree	C	Eucalyptus	Leaf	<10
482	*Eucalyptus globulus* Labill	MYRTACEAE	Tree	C	Eucalyptus, Nilgiri, *Tailaparnah*	Bark (Stem), Leaf Oil	2000-5000 [*≈360*]
-	*Eugenia caryophyllaea* Wight	Ref.:*Syzygium caryophyllatum*	-	-	-	-	-
483	*Eulaliopsis binata* (Retz.) C.E.Hubb.	POACEAE	Herb	W	Bal vaja	Whole Plant	**

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-	*Eulophia campestris* Wall. ex Lindl.	Ref.: *Eulophia dabia*	-	-	-	-	-
484	*Eulophia dabia* (D.Don) Hochr. [= *Eulophia campestris* Wall. ex Lindl.]	ORCHIDACEAE	Herb	W	Salam mishri	Root (Rhizome)	10-50
485	*Euphorbia antiquorum* L.	EUPHORBIACEAE	Tree	W	Kallippalaveru	Stem	10-50 [*≈7*]
486	*Euphorbia hirta* L.	EUPHORBIACEAE	Herb	W	Dudhi, Dudhika, Ammaan pacharisi, *Brhat Dugdhika*	Whole Plant	10-50 [*≈10*]
487	*Euphorbia neriifolia* L.	EUPHORBIACEAE	Shrub	C/W	Pattankisend, Nanda, Siju, Garbhans, *Snuhi*	Stem, Latex	<10 [*≈265*]
488	*Euphorbia nivulia* Buch.-Ham.	EUPHORBIACEAE	Tree	W	Sehunda, *Patra snuhi*	Latex, Stem	**
489	*Euphorbia thymifolia* L.	EUPHORBIACEAE	Herb	W	Choti - Dudhi	Whole Plant	<10
490	*Euphorbia tirucalli* L.	EUPHORBIACEAE	Shrub	C	Modu kalli, Paithangali	Whole Plant, Latex	<10 [*≈35*]
491	*Euphorbia tortilis* Rottler ex Ainslie	EUPHORBIACEAE	Shrub	W	Tirugakalli, Vajratunda	Stem	**
492	*Euryale ferox* Salisb. ex K.D. Koenig	NYMPHAEACEAE	Herb	C/W	Phoolmakhana	Fruit (Seed)	<10
493	*Eurycoma longifolia* JackSI	MAROUBIACEAE	Shrub	I	Tongkat ali, Pasak bumi	Root	<10
494	*Evolvulus alsinoides* (L.) L.	CONVOLVULACEAE	Herb	W	Shankhavali, Shankha-pushpi, Vishmukiranthi	Whole Plant	50-100
495	*Excoecaria agallocha* L.	EUPHORBIACEAE	Tree	W	Agaru, Tejbala	Bark (Stem)	<10
496	*Fagonia arabica* L.	ZYGOPHYLLACEAE	Herb	W	Dhamasa	Whole Plant	10-50
497	*Fagonia cretica* L.	ZYGOPHYLLACEAE	Herb	W	Dhamasa, *Dhanvayasah*	Whole Plant	10-50
498	*Fagus sylvatica* L.	FAGACEAE	Tree	I	Beech	Bark	<10
-	*Feronia elephantum* Correa	Ref.: *Limonia acidissima*	-	-	-	-	-
-	*Feronia limonia* (L.) Swingle	Ref.: *Limonia acidissima*	-	-	-	-	-
499	*Ferula assa-foetida* L.	APIACEAE	Shrub	I	Hing, Hingu	Oleo-Gum Resin	500-1000

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500	*Ferula foetida* (Bunge) Regel.	APIACEAE	Shrub	I	Hing hira (Baandani), *Hingu*	Oleo-Gum Resin	50-100
501	*Ferula jaeschkeana* Vatke	APIACEAE	Shrub	W	Hingu, *Hingupatri*	Leaf, Oleo-Gum Resin	<10
502	*Ferula narthex* Boiss.	APIACEAE	Herb	I	Sahasravedhi	Root	50-100
503	*Ferula persica* Willd.	APIACEAE	Herb	I	Sagapenum	Resin	<10
504	*Ficus amplissima* Sm. [= *Ficus tsiela* Roxb. ex Buch.-Ham.]	MORACEAE	Tree	W	Plaksha	Bark (Stem)	<10
505	*Ficus arnottiana* (Miq.) Miq.	MORACEAE	Tree	W	Kallaltholi, *Nandi*	Root, Bark (Stem)	<10
506	*Ficus benghalensis* L.	MORACEAE	Tree	W/C	Bargad, Vata, Vatathwak, Aal, *Nayagrodha jata*, *Nyagrodha*	Aerial Root, Bark (Stem), Exudate	200-500 [*≈340*]
507	*Ficus carica* L.	MORACEAE	Tree	C	Anjeer, AnjooraBark (Stem),	Root (Aerial Root)	50-100
508	*Ficus gibbosa* Blume	MORACEAE	Tree	W	Ithitholi, Athi	Bark (Stem)	<10
-	*Ficus glomerata* Roxb.	Ref.: *Ficus racemosa*	-	-	-	-	-
509	*Ficus hispida* L.f.	MORACEAE	Tree	W	Dimaru, *Phalgu*	Fruit, Root	<10 [*≈5*]
510	*Ficus lacor* Buch.-Ham.	MORACEAE	Tree	W	*Plaksa*	Bark (Stem), Fruit	<10
511	*Ficus microcarpa* L.f.	MORACEAE	Tree	W	Plaksha, Kal ichi, Itti, Kamarup	Leaf, Bark (Root)	10-50
512	*Ficus mollis* Vahl	MORACEAE	Tree	W	Kaaduatthi	Fruit	<10
513	*Ficus racemosa* L. [= *Ficus glomerata* Roxb.]	MORACEAE	Tree	C/W	Gular, Umbar chal, Lakh papal, *Udumbara*	Fruit, Bark (Stem)	50-100 [*≈40*]
514	*Ficus religiosa* L.	MORACEAE	Tree	C/W	Pipal, Arayal, Lakh pipal, Arayaalin tholi, Arasu, *Asvattha*	Bark (Stem), Leaf, Root, Latex	200-500 [*≈1390*]

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515	*Ficus retusa* L.	MORACEAE	Tree	W	Indian Laurel Fig	Leaf, Bark	<10
516	*Ficus rumphii* Blume	MORACEAE	Tree	W	Kabaipipal, Bettaarli	Fruit, Latex	<10
-	*Ficus tsiela* Roxb. ex Buch.-Ham.	Ref.: *Ficus amplissima*	-	-	-	-	-
517	*Ficus tsjakela* Burm.f.	MORACEAE	Tree	W	Pilkhan, Kapitanah	Bark (Stem), Exudate	**
518	*Flacourtia indica* (Burm.f.) Merr.	FLACOURTIACEAE	Shrub	W	Kattar, *Sruvavrksa*	Leaf, Fruit, Bark (Stem)	10-50 [*≈15*]
519	*Flacourtia jangomas* (Lour.) Raeusch.	FLACOURTIACEAE	Tree	W	Talish pattar, Brahmi Talispatar	Leaf	<10
520	*Flemingia chappar* Buch.-Ham. ex Benth.	FABACEAE	Shrub	W	Salpan (Subs.)	Root	**
521	*Flemingia grahamiana* Wight & Arn.	FABACEAE	Herb	W	Warrus/ Varus	Fruit	**
522	*Flemingia macrophylla* (Willd.) Kuntze ex Merr.	FABACEAE	Shrub	W	Varrus / Varus	Fruit	**
523	*Flemingia semialata* Roxb. ex W.T.Aiton	FABACEAE	Herb	W/C	Salpan (Subs.)	Root	**
524	*Flickingeria fugax* (Rchb.f.) Seidenf.	ORCHIDACEAE	Herb	W	Jivanti	Root	**
525	*Flickingeria macraei* (Lindl.) Seidenf. [= *Ephemerantha macraei* (Lindl.) P.F. Hunt & Summerh]	ORCHIDACEAE	Herb	W	Jivanti	Whole Plant	100-200
526	*Flickingeria nodosa* (Dalzell) Seidenf. [= *Dendrobium macraei* auct. non Lindl.]	ORCHIDACEAE	Herb	W	Jivanti	Whole Plant	10-50
527	*Flueggea leucopyrus* Willd. [= *Securinega leucopyrus* (Willd.) Mull.-Arg.]	EUPHORBIACEAE	Shrub	W	Hartho, Bhuriphali	Leaf, Fruit	**
-	*Flueggea microcarpa* Blume	Ref.: *Flueggea virosa*	-	-	-	-	-
528	*Flueggea virosa* (Roxb. ex Willd.) Royle [= *Flueggea microcarpa* Blume]	EUPHORBIACEAE	Shrub	W	Dalme, Patali, Patala	Leaf	** [*≈10*]
529	*Foeniculum vulgare* Mill.	APIACEAE	Herb	C	Badiyan Khatal, Saunf, Fennel, Variyali, *Misreya*	Fruit	500-1000
530	*Fritillaria roylei* Hook.	LILIACEAE	Herb	W	Kakoli, Van lahsun, *Ksirakakoli*	Root (Bulb)	<10
531	*Fumaria indica* (Hausskn.) Pugsley [= *Fumaria parviflora* Lam.]	FUMARIACEAE	Herb	W	Pitpapda, Shahtara, *Parpata*	Whole Plant	200-500

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532	*Fumaria officinalis* L.	FUMARIACEAE	Herb	I	Pittapapdo ghas, Pitpapra	Whole Plant	10-50
-	*Fumaria parviflora* Lam.	Ref.: Fumaria indica	-	-	-	-	-
533	*Fumaria vaillantii* Loisel.	FUMARIACEAE	Herb	I	Pittapaaparaa	Whole Plant	<10
-	*Garcinia cambogia* (Gaertn.) Desr.	Ref.: *Garcinia gummi-gutta*	-	-	-	-	-
534	*Garcinia gummi-gutta* (L.) Roxb. [= *Garcinia. cambogia* (Gaertn.) Desr.]	CLUSIACEAE	Tree	C/W	Kokam, Kodampuli, Cambodge	Fruit, Resin	2000-5000
535	*Garcinia indica* (Dup.) Choisy	CLUSIACEAE	Tree	W/C	Kokam, Cambogie	Fruit (Peel)	100-200 [*≈260*]
536	*Garcinia morella* (Gaertn.) Desr.	CLUSIACEAE	Tree	W	Kadukaai puli	Fruit, Resin	<10
537	*Garcinia pedunculata* Roxb. ex Buch.-Ham.	CLUSIACEAE	Tree	W	Amlavetasa, *Vrantamlaphala*	Fruit (Rind), Fruit	10-50 [*≈220*]
538	*Gardenia gummifera* L.f.	RUBIACEAE	Tree	W	Dekamalli, Dikamali, *Nadihingu*	Resin exudate	10-50
539	*Gardenia resinifera* Roth	RUBIACEAE	Tree	W	Dikamali, Jaysendha	Gum	<10
540	*Gaultheria fragrantissima* Wall.	ERICACEAE	Shrub	I	*Gandhapura Patra Taila*	Leaf Oil	2000-5000
541	*Gaultheria procumbens* L.	ERICACEAE	Shrub	I	Gandhapura, *Gandhapurna*, Kolakkaai, Gandapuro	Leaf Oil	2000-5000
542	*Garuga pinnata* Roxb.	BURSERACEAE	Tree	W	Ghoghar, Kharpat	Oleo-Gum-Resin, Root	**
-	*Gendarussa vulgaris* Nees	Ref.: *Justicia gendarussa*	-	-	-	-	-
543	*Gentiana kurroo* Royle	GENTIANACEAE	Herb	W	Trahimaan, Kadu, Katuki, Katukarohini, *Trayamana*	Root, Whole Plant	<10
544	*Gentiana olivieri* Griseb.	GENTIANACEAE	Herb	I	Gul-e-ghafis, Asberg	Root	<10
545	*Geophila reniformis* D.Don [= *Geophila repens* (L.) I.M.Johnst]	RUBIACEAE	Herb	W	Kakamaci	Root	**
-	*Geophila repens* (L.) I.M.Johnst	Ref.: *Geophila reniformis*	-	-	-	-	-
546	*Ginkgo biloba* L.	GINKGOACEAE	Tree	I	Maidenhair tree, Balkuwari	Seed, Leaf	<10

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547	*Girardinia diversifolia* (Link) Friis [= *Girardinia heterophylla* Decne.]	URTICACEAE	Herb	W	Gaddanelli, Anachoriyan	Bark (Stem)	**
-	*Girardinia heterophylla* Decne.	Ref.: *Girardinia diversifolia*	-	-	-	-	-
548	*Givotia rottleriformis* Griff. ex Wight	EUPHORBIACEAE	Tree	W	Polki	Bark (Stem)	**
549	*Glinus lotoides* L.	AIZOACEAE	Herb	W	Gandhi-Buti, *Usandi*	Whole Plant	<10
550	*Glinus oppositifolius* (L.) Aug.DC.	AIZOACEAE	Herb	W	Ushnasundara	Whole Plant	**
551	*Gloriosa superba* L.	LILIACEAE (Colchicaceae)	Climber	C/W	Kalihari, Agni shikha, *Langali*	Root, Seed	100-200
552	*Glossocardia bosvallia* (L.f.) DC.	ASTERACEAE	Herb	W	Parpataka	Whole Plant	<10
553	*Glycine max* (L.) Merr.	FABACEAE	Herb	C	Soyabean	Seed	50-100
-	*Glycosmis arborea* (Roxb.) DC.	Ref.: *Glycosmis pentaphylla*	-	-	-	-	-
554	*Glycosmis pentaphylla* (Retz.) DC. [= *Glycosmis arborea* (Roxb.) DC.]	RUTACEAE	Shrub	W	Potali, Kupilah	Root	<10
555	*Glycyrrhiza glabra* L.	FABACEAE	Shrub	I	Mulathi, Jeshtimadhu, Gulegafis, *Yasti*	Root, Stem	2000-5000 [*≈5*]
556	*Glycyrrhiza uralensis* fisch. ex DC.	FABACEAE	Shrub	I	Mulathi, Jeshtimadhu, Gulegafis	Root	**
557	*Gmelina arborea* Roxb.	VERBENACEAE	Tree	W/C	Ghambar chal, Gamhar, Kumbil, Shivan, *Gambhari*	Bark (Root), Stem, Fruit	500-1000 [*≈15*]
558	*Gmelina asiatica* L.	VERBENACEAE	Shrub	W	Kapas Beej	Bark (Root)	<10
559	*Gossypium arboreum* L.	MALVACEAE	Shrub	C	Kapas	Flower	10-50
560	*Gossypium herbaceum* L.	MALVACEAE	Shrub	C	Kapas, *Karpasa*	Seed	100-200
561	*Gossypium hirsutum* L.	MALVACEAE	Shrub	C	Kapas	Fruit (Fruit Coat)	<10
562	*Gouania microcarpa* DC.	RHAMNACEAE	Climber	W	Sinhanbali	Leaf	**
563	*Grewia asiatica* L. var. *asiatica* [= *Grewia subinaequalis* DC.]	TILIACEAE	Tree	W	Phalsa chhaal	Bark (Stem)	<10

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-	*Grewia asiatica* var. *vestita* (Wall. ex Brandis) Mast.	Ref.: *Grewia eriocarpa*	-	-	-	-	-
-	*Grewia elastica* Royle	Ref.: *Grewia eriocarpa*	-	-	-	-	-
564	*Grewia eriocarpa* Juss. [= *Grewia asiatica* L. var. *vestita* Mast.; *Grewia elastica* Royle]	TILIACEAE	Tree	C/W	Phalsa chhaal	Bark (Stem)	<10
-	*Grewia microcos* L.	Ref.: *Grewia nervosa*	-	-	-	-	-
565	*Grewia nervosa* (Lour.) Panigrahi [= *Grewia microcos* L.]	TILIACEAE	Shrub	W	Asolin	Leaf	**
-	*Grewia subinaequalis* DC.	Ref.: *Grewia asiatica* var. *asiatica*	-	-	-	-	-
566	*Grewia tenex* (Forssk.) Fiori	TILIACEAE	Tree	W	*Gangeru*	Bark (Stem)	<10
567	*Griffonia simplicifolia* (DC.) Baill [= *Bandeiraea simplicifolia* (DC.) Benth.	CAESALPINIACEAE	Climber	I	Griffonia	Fruit (Seed)	<10
568	*Gymnema sylvestre* R.Br. ex Schult.	ASCLEPIADACEAE	Climber	W	Gudmar, Sirukurinjan, Sarkarai kolli, *Mesarngi*	Leaf, Root	500-1000 [*≈2700*]
-	*Gynandropsis pentaphylla* (L.) DC.	Ref.: *Cleome gynandra*	-	-	-	-	-
-	*Habenaria edgeworthii* Hook.f. ex Collett	Ref.: *Platanthera edgeworthii*	-	-	-	-	-
569	*Habenaria intermedia* D.Don	ORCHIDACEAE	Herb	W	Vriddhi, *Riddhi*	Root (Tuber)	10-50
570	*Haldinia cordifolia* (Roxb.) Ridsdale	RUBIACEAE	Tree	W	Haldu	-	<10
571	*Hamamelis virginiana* L.	HAMAMELIDACEAE	Tree	I	Witch-hazel	Leaf, Twig, Bark (Stem)	<10
-	*Hedychium acuminatum* Roscoe	Ref.: *Hedychium spicatum*	-	-	-	-	-
572	*Hedychium coronarium* J.Konig	ZINGIBERACEAE	Herb	W	Garland flower, Common Ginger Lily	Flower	**
573	*Hedychium spicatum* Sm. [= *Hedychium acuminatum* Roscoe]	ZINGIBERACEAE	Herb	W	Kantapalci, Kapoor kachri, *Sati*	Root(Rhizome)	200-500

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-	*Hedyotis corymbosa* (L.) Lam.	Ref.: *Oldenlandia corymbosa*	-	-	-	-	-
-	*Hedyotis herbacea* L.	Ref.: *Oldenlandia herbacea*	-	-	-	-	-
-	*Hedyotis puberula* (G.Don) Arn.	Ref.: *Oldenlandia umbellata*	-	-	-	-	-
574	*Helianthus annuus* L.	ASTERACEAE	Shrub	C	Suraj mukhi, Sunflower	Fruit (Seed)	200-500
575	*Helicteres isora* L.	STERCULIACEAE	Shrub	W	Murudshing, Marodphali, Valampuri-Idampuri	Fruit	100-200 [*≈5*]
576	*Heliotropium indicum* L.	BORAGINACEAE	Herb	W	Thekkada, *Hastiundi*	Whole Plant	10-50
577	*Heliotropium strigosum* Willd.	BORAGINACEAE	Herb	W	Chitiphul, Chitiphal, Safed bhangra	Whole Plant	<10
578	*Helleborus niger* L.	RANUNCULACEAE	Herb	I	Katuka Rohini	Root	<10
579	*Hemidesmus indicus* (L.) R.Br. ex Schult.	PERIPLOCACEAE	Climber	W	Anatmool, Sariwa, Sarasaparilla roots, Nannari, *Sveta sariva*	Root	500-1000 [*≈40*]
580	*Hemionitis arifolia* (Burm. f.) T. Moore	HEMIONITIDACEAE	Herb	W	Akhukarni, Pattsjivi-Maravara	Leaf	**
581	*Heracleum candolleanum* (Wight & Arn.) Gamble	APIACEAE	Herb	W	Kattumalli (Subs.)	Fruit (Seed)	<10
582	*Heracleum lanatum* Michx.	APIACEAE	Herb	C/W	Krandel, Cow parsnip	Whole Plant	**
583	*Heracleum rigens* Wall.ex DC.	APIACEAE	Herb	W	Cittrelam	Fruit (Seed)	**
-	*Hibiscus abelmoschus* L.	Ref. *Abelmoschus moschatus*	-	-	-	-	-
-	*Hibiscus esculentus* L.	Ref. *Abelmoschus esculentus*	-	-	-	-	-
-	*Hibiscus ficulneus* L.	Ref. *Abelmoschus ficulneus*	-	-	-	-	-
584	*Hibiscus rosa-sinensis* L.	MALVACEAE	Shrub	C	Jashwanti, Jaswand, Japa, Gudhal	Flower, Leaf	500-1000 [*≈1940*]
585	*Hibiscus subdariffa* L.	MALVACEAE	Shrub	C	Kasarakeerai, Lal ambari, *Ambasthaki*	Root, Leaf, Aerial Part	<10 [*≈125*]

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586	*Hibiscus surattensis* L.	MALVACEAE	Shrub	W	Ranbhindi	Stem, Leaf	<10
587	*Hibiscus tiliaceus* L.	MALVACEAE	Herb	W	Parutti	Root	**
588	*Hippophae rhamnoides* L.	ELAEAGNACEAE	Shrub	W	Chharma, Leh berry, Sea Buckthorn	Fruit	50-100
589	*Hippophae salicifolia* D.Don	ELAEAGNACEAE	Shrub	C/W	Sea Buckthorn	Fruit	**
-	*Holarrhena antidysenterica* (Wall. ex DC.) Wall.	Ref.: *Holarrhena pubescens*	-	-	-	-	-
590	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G.Don [= *Holarrhena antidysenterica* (Wall. ex DC.) Wall.]	APOCYNACEAE	Shrub	W	Inderjao talakh, Kadwa, Kudachal, *Kutaja, Indrayava*	Seed, Bark (Stem)	500-1000 [≈*55*]
591	*Holoptelea integrifolia* (Roxb.) Planch.	ULMACEAE	Tree	W	Aavitholi, Aval, *Cirabilva*	Fruit, Bark (Stem)	100-200
592	*Holostemma ada-kodien* Schult. [= *Holostemma annulare* (Roxb.) K. Schum.; *Holostemma rheedii* Wall.]	ASCLEPIADACEAE	Climber	W	Jeevanti, Atapathiyan	Tuber, Root	10-50
-	*Holostemma annulare* (Roxb.) K.Schum.	Ref.: *Holostemma ada-kodien*	-	-	-	-	-
-	*Holostemma rheedii* Wall.	Ref.: *Holostemma ada-kodien*	-	-	-	-	-
593	*Homalomena aromatica* Schott	ARACEAE	Herb	C	Sugan mantri, Anchiri	Rhizome	200-500 [≈*45*]
594	*Homonoia riparia* Lour.	EUPHORBIACEAE	Shrub	W	Serna, Pashanbhedaka	Root	<10
595	*Hordeum vulgare* L.	POACEAE	Herb	C	Jau, Barley, *Yava*	Fruit (Seed)	200-500
596	*Hugonia mystax* L.	LINACEAE	Shrub	W	Kamsamrah	Root	10-50
597	*Hybanthus enneaspermus* (L.f.) F. Muell.	VIOLACEAE	Herb	W	Ratanpurus, Padmacarini, Sthlapdmak	Whole Plant	<10
598	*Hydnocarpus kurzii* (King) Warb.	FLACOURTIACEAE	Tree	W	Nirati, Chaulmoogra	Fruit	<10
599	*Hydnocarpus pentandrus* (Buch.-Ham.) Oken	FLACOURTIACEAE	Tree	W	Marotti, Chalmugra, Neerotti, *Tuvaraka*	Fruit	<10

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600	*Hydnocarpus wightianus* Blume	FLACOURTIACEAE	Tree	W	Jangli Almond, Calmogara	Seed	<10
601	*Hydrastis canadensis* L.	RANUNCULACEAE	Herb	I	Goldenseal, Eye-balm, Indian turmeric	Whole Plant	<10
602 -	*Hydrocotyle javanica* Thunb. *Hygrophila auriculata* (Schumach.) Heine [= *Hygrophila schulli* (Buch.-Ham.) M. R. Almeida & S.M. Almeida; *Asteracantha longifolia* (L.) Nees]	APIACEAE Ref.:*Hygrophila schulli*	Herb -	W -	Brahma manduki -	Whole Plant -	10-50 -
603	*Hygrophila schulli* (Buch.-Ham.) M.R. & S.M. Almeida	ACANTHACEAE	Herb	W	Tal makhana, Nirmulli, Vayalchully, *Kokilaksa*	Root, Seed, Whole Plant	200-500 [*≈170*]
604	*Hygroryza aristata* (Retz.) Nees ex Wight & Arn.	POACEAE	Herb	W	Janli dal	Root	<10
605	*Hymenodictyon excelsum* (Roxb.) Wall.	RUBIACEAE	Tree	W	Kuthan	Bark (Stem)	**
606	*Hyoscyamus muticus* L.	SOLANACEAE	Herb	I	Parasikaya	Fruit	<10
607	*Hyoscyamus niger* L.	SOLANACEAE	Herb	C/W	Khursani ajwain, *Parasikayavani*	Seed	100-200
608	*Hyoscyamus reticulatus* L.	SOLANACEAE	Herb	C/W	Khurasani ajwain	Seed	<10
-	*Hyperanthera pterygosperma* (Gaertn.) Oken	Ref.: *Moringa oleifera*	-	-	-	-	-
609	*Hypericum perforatum* L.	HYPERICACEAE	Herb	W	Basant, Choli phulya, St. John's wart	Flower	<10
610	*Hyssopus officinalis* L.	LAMIACEAE	Shrub	C/W	Zoofa, Jupha	Fruit (Seed), Whole Plant	10-50
611	*Ichnocarpus frutescens* (L.) W.T. Aiton	APOCYNACEAE	Climber	W	Dudhi, Sariva, Anant mool	Root	50-100
612	*Illicium griffithii* Hook.f. & Thomson	MAGNOLIACEAE	Tree	W	Star Anise (Subs.)	Fruit	<10 [*≈5*]
613	*Illicium verum* Hook.f.	MAGNOLIACEAE	Tree	I	Badiyan, Star Anise, *Takkola*	Fruit	10-50
614	*Imperata cylindrica* (L.) Raeusch.	POACEAE	Herb	W	Thatch grass, *Darbha*	Root	<10
615	*Indigofera tinctoria* L.	FABACEAE	Shrub	C	Akika, Avuri, Neelamari, *Nili* Whole Plant	Leaf, Root,	100-200
616	*Inula racemosa* Hook.f.	ASTERACEAE	Herb	C	Pushkarmool, Pokharmool, *Puskara*	Root	200-500

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617	*Inula royleana* DC.	ASTERACEAE	Herb	W	Pushkarmool	Root	**
618	*Ipomoea aquatica* Forssk. [= *Ipomoea reptans* Poir.]	CONVOLVULACEAE	Herb	C/W	Kalashaka	Leaf	10-50 [*≈235*]
-	*Ipomoea biloba* Forssk.	Ref.: *Ipomoea pes-caprae*	-	-	-	-	-
-	*Ipomoea digitata* L.	Ref.: *Ipomoea mauritiana*	-	-	-	-	-
-	*Ipomoea hederacea* (L.) Jacq.	Ref.: *Ipomoea nil*	-	-	-	-	-
619	*Ipomoea marginata* (Desr.) Verdc. [= *Ipomoea sepiaria* Roxb.]	CONVOLVULACEAE	Climber	W	Thiruthaali	Whole Plant	<10 [*≈100*]
620	*Ipomoea mauritiana* Jacq. [= *Ipomoea digitata* L.]	CONVOLVULACEAE	Climber	W	Palmudhukkan kizhangu, Bidarikand, *Kshiravidari*	Root (Tuber)	200-500
621	*Ipomoea nil* (L.) Roth [= *Ipomoea hederacea* (L.) Jacq.]	CONVOLVULACEAE	Climber	W	Kaladana	Seed	100-200
622	*Ipomoea obscura* Ker-Gawl.	CONVOLVULACEAE	Climber	W	Laksmana	Whole Plant	<10
623	*Ipomoea pes-caprae* (L.) R.Br. [= *Ipomoea biloba* Forssk.]	CONVOLVULACEAE	Climber	W	Dopatilata	Root, Whole Plant	10-50
624	*Ipomoea pes-tigridis* L.	CONVOLVULACEAE	Climber	W	Pulichuvadan	Whole Plant	<10
625	*Ipomoea petaloidea* Choisy	CONVOLVULACEAE	Herb	W	Vrddhadaru	Root	<10
-	*Ipomoea reptans* Poir.	Ref.:*Ipomoea aquatica*	-	-	-	-	-
-	*Ipomoea sepiaria* Koenig. ex Roxb.	Ref.: *Ipomoea marginata*	-	-	-	-	-
626	*Iris ensata* L.	IRIDACEAE	Herb	W	Marjal, Unarja, *Baalbach*	Aerial Part, Root	<10
627	*Iris germanica* L.	IRIDACEAE	Herb	W	Puskaramulam	Root	10-50
628	*Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill.	IRVINGIACEAE	Tree	I	African Mango	Leaf, Fruit, Bark, Root	<10
629	*Ixora coccinea* L.	RUBIACEAE	Shrub	W	Thechippoovu	Root	10-50
630	*Jacquemontia paniculata* (Burm.f.) Hallier f.	CONVOLVULACEAE	Climber	W	Mauve Clustervine	Rhizome	<10

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631	*Jasminum angustifolium* (L.) Willd.	OLEACEAE	Climber	C/W	Ban-mallika	Flower, Root	<10
632	*Jasminum arborescens* Roxb.	OLEACEAE	Climber	W	Nagamalli, Chameli		<10
633	*Jasminum grandiflorum* L.	OLEACEAE	Climber	C/W	Chameli phool	Flower, Leaf, Root	10-50
634	*Jasminum officinale* L.	OLEACEAE	Climber	C/W	Ban chameli, *Jati*	Leaf	50-100
635	*Jasminum sambac* (L.) Aiton	OLEACEAE	Climber	C/W	Mallika, Mogra	Flower	100-200
636	*Jatropha curcas* L.	EUPHORBIACEAE	Shrub	C	Nepalam seed, Ratanjot	Bark (Stem), Seed, Whole Plant	10-50 [≈*320*]
637	*Juglans regia* L.	JUGLANDACEAE	Tree	C/W	Akhrot, Dandasa, *Aksoda*	Bark (Stem), Seed Kernal	10-50 [≈*3*]
638	*Juniperus communis* L.	CUPRESSACEAE	Tree	W	Hauber, Juniper berry, *Hapusa*	Fruit	100-200
-	*Juniperus macropoda* Boiss.	Ref.: *Juniperus polycarpos* var. *seravschanica*	-	-	-	-	-
639	*Juniperus polycarpos* var. *seravschanica* (Kom.) Kitam. [= *Juniperus macropoda* Boiss.]	CUPRESSACEAE	Tree	W	Hapusa, Shur, Dhoop	Mature Fruit	**
640	*Juniperus virginiana* L.	CUPRESSACEAE	Tree	I	Pencil Cedar	Leaf, Twig	<10
-	*Jurinea dolomiaea* Boiss.	Ref.: *Jurinea macrocephala*	-	-	-	-	-
641	*Jurinea macrocephala* DC. [= *Jurinea dolomiaea* Boiss.]	ASTERACEAE	Herb	W	Dhoop	Root	50-100 [≈*10*]
642	*Justicia adhatoda* L. [= *Adhatoda vasica* Nees; *Adhatoda zeylanica* Medik.]	ACANTHACEAE	Shrub	W/C	Adusa, Basuti, *Vasa*	Leaf	2000-5000 [≈*1970*]
643	*Justicia beddomei* (C.B.Clarke) Bennet	ACANTHACEAE	Shrub	W	Vasa	Leaf	100-200
644	*Justicia gendarussa* Burm.f. [= *Gendarussa vulgaris* Nees]	ACANTHACEAE	Shrub	C/W	Nilanirgundi	Leaf, Root	10-50 [≈*50*]

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645	*Kaempferia galanga* L.	ZINGIBERACEAE	Herb	C	Kachora, Narkachur, Kapoor Kachri No 1	Root	100-200
646	*Kaempferia rotunda* L.	ZINGIBERACEAE	Herb	C	Bhuichampa	Root(Rhizome)	10-50
-	*Kalanchoe laciniata* (L.) DC.	Ref.: *Kalanchoe schweinfurthii*	-	-	-	-	-
647	*Kalanchoe schweinfurthii* Penz. [= *Kalanchoe laciniata* (L.) DC.]	CRASSULACEAE	Herb	W	Hemsagara, Pathar chatt	Leaf	<10
648	*Kedrostis rostrata* (Rottler) Cogn.	CUCURBITACEAE	Climber	W	Arunkovai	Whole Plant	<10
-	*Kirganelia reticulata* (Poir.) Baill.	Ref.: *Phyllanthus reticulatus*	-	-	-	-	-
649	*Kyllinga odorata* Vahl	CYPERACEAE	Herb	I	Fragrant Spikesedge	Leaf	<10
650	*Lablab purpureus* (L.) Sweet	FABACEAE	Climber	C	Hyacinth Bean	Gum/Resin	<10
651	*Lactuca sativa* L.	ASTERACEAE	Herb	C	Tukhm Kahoo, Salad	Seed	100-200
652	*Lactuca serriola* L.	ASTERACEAE	Herb	W	Wild Lettuce	Seed	<10
653	*Lagenaria siceraria* (Molina) Standley	CUCURBITACEAE	Climber	C	Bottlegourd, Sorakkai,Tumbini	Fruit, Leaf, Tender Plant	200-500
654	*Lagerstroemia speciosa* (L.) Pers.	LYTHRACEAE	Tree	W	Jarul	Bark (Stem)	<10
655	*Lagotis glauca* Gaertn.	SCROPHULARIACEAE	Herb	W	Kutki (Adulterant)	Root	<10
656	*Lallemantia royleana* (Wall.ex Benth)Benth.	LAMIACEAE	Herb	C/W	Tukhme-Balanga	Fruit (Seed)	<10
657	*Lannea coromandelica* (Houtt.) Merr.	ANACARDIACEAE	Tree	C/W	Jingini, Jhingan, Movai	Bark (Stem)	<10 [*≈40*]
658	*Lantana camara* L.	VERBENACEAE	Shrub	W	Lantana, Kuri ghas	Leaf	<10
659	*Lathyrus sativus* L.	FABACEAE	Climber	C	Lakh, Khesari	Fruit (Seed)	**
660	*Laurus nobilis* L.	LAURACEAE	Tree	I	Hub-ul-ghar	Fruit	<10
661	*Lavendula angustifolia* Mill.	LAMIACEAE	Herb	C	Lavender	Floral twig, Seed	<10
662	*Lavandula stoechas* L.	LAMIACEAE	Herb	W	Ustakuthus	Flower	10-50
663	*Lawsonia inermis* L.	LYTHRACEAE	Shrub	C	Henna, Mehndi, *Madaynati*	Leaf	2000-5000 [*≈990*]

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664	*Lens culinaris* Medik.	FABACEAE	Climber	C	Masur, Lentil, *Masura*	Seed	10-50
665	*Leonotis nepetifolia* (L.) R. Br.	LAMIACEAE	Herb	W/C	Lal gumma, *Granthiparni*	Root	<10
666	*Leonurus cardiaca* L.	LAMIACEAE	Herb	W	Motherwort	Whole Plant, Seed	<10
667	*Lepidium meyenii* Walp.	BRASSICACEAE	Herb	W	Maca	Root	<10
668	*Lepidium sativum* L.	BRASSICACEAE	Herb	C	Kurassaani, Halam, Halon, Asaliya, *Candrasura*	Seed, Leaf, Root	1000-2000
669	*Leptadenia reticulata* (Retz.) Wight & Arn.	ASCLEPIADACEAE	Climber	W	Paalai kodi, *Jivanti*	Root, Stem, Whole Plant	200-500 [*≈220*]
670	*Leucas aspera* (Willd.) Link	LAMIACEAE	Herb	W	Dharanpushpi, Dronpushpi	Whole Plant	<10 [*≈400*]
671	*Leucas cephalotes* (Roth) Spreng.	LAMIACEAE	Herb	W	Goma, Bishkhapru, *Dronapuspi*	Whole Plant	10-50
672	*Lilium polyphyllum* D.Don	LILIACEAE	Herb	W	Kakoli, Kshirkakoli, *Kakoli*	Root (Tuber)	<10
673	*Limonia acidissima* L. [= *Feronia elephantum* Correa; *Feronia limonia* (L.) Swingle]	RUTACEAE	Tree	C/W	Kaith, Villa, Wood apple, *Kapittha*	Fruit Pulp	10-50
674	*Linum usitatissimum* L.	LINACEAE	Herb	C	Alsi, *Atasi*	Seed	100-200
675	*Liquidambar orientalis* Mill.	ALTINGIACEAE	Tree	I	Storax, Oriental Sweet Gum	Gum Resin	<10
676	*Liquidambar styraciflua* L.	ALTINGIACEAE	Tree	I	Sweetgum	Gum Resin	<10
-	*Litsea chinensis* Lam.	Ref.: *Litsea glutinosa*	-	-	-	-	-
677	*Litsea glutinosa (*Lour.) C.B.Rob. [= *Litsea chinensis* Lam.]	LAURACEAE	Tree	W	Maida lakadi, Naramamidi, Maidachal, *Medasakah*	Bark (Stem), Wood	500-1000 [*≈8*]
678	*Lobelia nicotianaefolia* Roth ex Roem. & Schult.	LOBELIACEAE	Shrub	W	Lobelia leaves	Leaf	<10
679	*Lodoicea maldivica* (J.F.Gmel.) Pers. ex H.Wendl.	ARECACEAE	Tree	I	Dariai narial, *Aklari*	Fruit	<10
680	*Luffa acutangula* (L.) Roxb.	CUCURBITACEAE	Climber	C	Tori, *Kosataki*	Whole Plant, Fruit	<10
-	*Luffa aegyptiaca* Mill.	Ref.: *Luffa cylindrica*	-	-	-	-	-

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681	*Luffa cylindrica* (L.) M. Roem. [= *Luffa aegyptiaca* Mill.]	CUCURBITACEAE	Climber	C	Ghia- tori, Patuli	Fruit	**
682	*Luffa echinata* Roxb.	CUCURBITACEAE	Climber	W	Loofah	Fruit (Seed)	<10
683	*Luvunga scandens* (Roxb.) Buch.-Ham. ex Wight & Arn.	RUTACEAE	Shrub	W	Sugandh-kokila	Fruit	<10
684	*Lycopodium clavatum* L.	LYCOPODIACEAE	Herb	W	Foxtail	Whole Plant	**
685	*Lygodium flexuosum* (L.) Sw.	LYGODIACEAE	Climber	W	Tsjeru-Valli-Panna	Spore, Root	**
-	*Macrotyloma uniflorum* (Lam.) Verdc.	Ref.: *Dolichos biflorus*	-	-	-	-	-
686	*Madhuca indica* J.F.Gmel. [= *Bassia latifolia* Roxb.]	SAPOTACEAE	Tree	C/W	Madhuka, *Madhuka*	Flower	200-500
687	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	SAPOTACEAE	Tree	C/W	Mahua phool, Mahuda, Iluppai	Flower, Fruit, Heart Wood, Seed	100-200
688	*Magnolia champaca* (L.) Baill. ex Pierre [= *Michelia champaca* L.]	MAGNOLIACEAE	Tree	C/W	Champa, Sampige, *Champaka*	Flower	<10
689	*Mahonia leschenaultii* (Wall. ex Wight & Arn.) Takeda ex Dunn	BERBERIDACEAE	Shrub	W	Daruharidra	Root	**
690	*Malabaila secacul* (Mill.) Boiss.	APIACEAE	Herb	I	Secacaul	Aerial Part, Flower	<10
-	*Malaxis acuminata* D.Don	Ref.: *Crepidium acuminatum*	-	-	-	-	-
691	*Malaxis muscifera* (Lindl.) Kuntze	ORCHIDACEAE	Herb	W	Risbak, Rshbhak	Root (Tuber)	<10
692	*Mallotus philippensis* (Lam.) Mull.-Arg.	EUPHORBIACEAE	Tree	W	Kameela, *Kampilla*	Fruit (Gland)	10-50
693	*Malus domestica* Borkh.	ROSACEAE	Tree	C	Apple, Seb	Fruit	100-200
694	*Malus sylvestris* (L.)	MillROSACEAE	Tree	C	Crab Apple	Fruit	<10
695	*Malva pusilla* Sm.	MALVACEAE	Herb	I	Round Leaf Mallow	Leaf	<10
696	*Malva sylvestris* L.	MALVACEAE	Herb	C/W	Khawaji, Khubaji	Fruit	<10
697	*Mammea suriga* (Buch.-Ham. ex Roxb.) Kosterm.	CLUSIACEAE	Tree	W	Nagakesr (subs.)	Flower	<10

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698	*Mangifera indica* L.	ANACARDIACEAE	Tree	C/W	Aamba, Amb, Mango, *Amra*	Fruit, Seed	5000-10000
699	*Manilkra hexandra* (Roxb.) Dubard	SAPOTACEAE	Tree	W	Khirni, Ksirini, Drirh	Leaf	50-100 [*≈15*]
700	*Mappia foetida* (Wight) Miers [= *Nothapodytes nimmoniana* (J.Graham) Mabb.]	ICACINACEAE	Tree	W	Ghanera	Root	**
701	*Maranta arundinacea* L.	MARANTACEAE	Herb	C	Citalapattiri, *Ararota*	Root	100-200
702	*Marsdenia roylei* Wight	ASCLEPIADACEAE	Climber	W	Murva	Root	<10
703	*Marsdenia tenacissima* (Roxb.) Moon	ASCLEPIADACEAE	Climber	W	Nishod, Sufed Murva, *Murva*	Root	10-20
-	*Marsdenia volubilis* (L.f.) T.Cooke	Ref.: *Dregea volubilis*	-	-	-	-	-
704	*Marsilea quadrifolia* L.	MARSILEACEAE	Herb	W	Cupatiya	Whole Plant	< 10 [*≈10*]
705	*Martynia annua* L.	PEDALIACEAE	Herb	W	Kaknasa, *Kakanasika*	Seed	100-200
706	*Matthiola incana* (L.) R. Br.	BRASSICACEAE	Herb	I	Todri safed	Seed	<10
707	*Matricaria chamomilla* L.	ASTERACEAE	Herb	C	Babuna	Whole Plant	<10
708	*Maytenus emarginata* (Willd.) Ding Hou	CELASTRACEAE	Shrub	W	Kattangi, Kankero	Leaf	**
709	*Meconopsis aculeata* Royle	PAPAVERACEAE	Herb	W	Kunda, Himalayan blue poppy	Root	**
710	*Medicago sativa* L.	FABACEAE	Herb	C	Alfalfa	Leaf	10-50
711	*Melastoma malabathricum* L.	MELASTOMATACEAE	Shrub	W	Palore, Nakkukaruppan, Phutki	Leaf, Flower, Fruit	10-50 [*≈8*]
712	*Melaleuca alternifolia* (Maiden & Betche) Cheel	MYRTACEAE	Tree	I	Tea Tree	Oil	<10
713	*Melaleuca leucadendra* (L.) L.	MYRTACEAE	Tree	I	Cajuput	Oil	100-200
714	*Melia azedarach* L.	MELIACEAE	Tree	C	Bakayan phal, Bakain, Malaivembu, *Mahanimba*	Bark (Stem), Fruit, Leaf	100-200 [*≈388*]
715	*Melocanna bambusoides* Trin.	POACEAE	Tree	W	Bansalochan	Siliceous Deposition on Culms	<10

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-	*Melothria maderaspatana* (L.) Cogn.	Ref.: *Mukia maderaspatana*	-	-	-	-	-
716	*Memecylon umbellaum* Burm.f.	MELASTOMATACEAE	Tree	W	Anjani, Alli, Kaya	Leaf Extract	<10
717	*Mentha aquatica* L.	LAMIACEAE	Herb	I	Watermint	Aerial Part	<10
718	*Mentha arvensis* L.	LAMIACEAE	Herb	C	Pudina, Podina pati	Aerial Part	5000-10000 [≈*300*]
719	*Mentha longifolia* (L.) Huds	LAMIACEAE	Herb	W	Jangli Pudina	Aerial Part	100-200 [≈*60*]
720	*Mentha piperita* L.	LAMIACEAE	Herb	C	Menthol, Peppermint	Aerial Part	2000-5000 [≈*310*]
721	*Mentha spicata* L. [= *Mentha viridis* (L.) L.]	LAMIACEAE	Herb	C	Pudina, *Pudinah*	Aerial Part	500-1000
-	*Mentha viridis* (L.) L.	Ref.: *Mentha spicata*	-	-	-	-	-
722	*Merremia emarginata* (Burm.f.) Hallier f.	CONVOLVULACEAE	Herb	W	Underkarni, Mooshkarni	Whole Plant	<10
723	*Merremia hederacea* (Burm.f.) Hallier f.	CONVOLVULACEAE	Climber	W	Kudici-Valli	Whole Plant	**
724	*Merremia tridentata* (L.) Hallier f.	CONVOLVULACEAE	Herb	W	Prasarani, *Matsyapatrika*	Whole Plant	10-50
-	*Merremia turpethum* (L.) Shah & Bhat	Ref.: *Operculina turpethum*	-	-	-	-	-
725	*Merremia umbellata* (L.) Hallier f.	CONVOLVULACEAE	Climber	C	Jalap (Subs.)	Root	<10
726	*Mesua ferrea* L. [= *Mesua nagassarium* (Burm.f.) Kosterm.]	CLUSIACEAE	Tree	W	Nagakesari, *Nagakesar*	Flower (Stamen)	200-500
-	*Mesua nagassarium* (Burm.f.) Kosterm.	Ref.: *Mesua ferrea*	-	-	-	-	-
-	*Michelia champaca* L.	Ref.: *Magnolia champaca*	-	-	-	-	-
-	*Micromeria biflora* (Buch.-Ham. ex D.Don) Benth.	Ref.: *Micromeria imbricata*	-	-	-	-	-

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727	*Micromeria imbricata* (Forssk.) C.Chr. [= *Micromeria biflora* (Buch.-Ham. ex D.Don) Benth.]	LAMIACEAE	Herb	W	Indian Wild Thyme	Whole Plant	**
728	*Mimosa pudica* L.	MIMOSACEAE	Herb	W	Lajwanti, Touch-me-not, *Lajjalu*	Whole Plant	50-100 [≈*60*]
729	*Mimusops elengi* L.	SAPOTACEAE	Tree	W/C	Bakul, Magudam poo	Bark (Stem), Flower	200-500 [≈*20*]
730	*Mirabilis jalapa* L.	NYCTAGINACEAE	Herb	C/W	Gulabash, Four O'clock	Whole Plant	** [≈*6*]
731	*Mitragyna parvifolia* (Roxb.) Korth.	RUBIACEAE	Tree	C/W	Kadamb, Kaim	Leaf	<10
732	*Mollugo cerviana* (L.) Ser.	MOLLUGINACEAE	Herb	W	Parpata, *Grimachatraka*	Whole Plant	<10
733	*Mollugo pentaphylla* L.	MOLLUGINACEAE	Herb	W	Turapoondu	Whole Plant	**
734	*Momordica charantia* L.	CUCURBITACEAE	Climber	C	Karela, Bitter gourd, *Karavallaka*	Fruit, Leaf	500-1000
735	*Momordica dioica* Roxb. ex Willd.	CUCURBITACEAE	Climber	W/C	Jangli-Kareli, *Karkasa*	Root	<10
736	*Monochoria hastaefolia* C.Presl.	PONTEDERIACEAE	Herb	W	Karinkuvalum	Whole Plant	<10
737	*Monochoria vaginalis* (Burm.f.) C.Presl.	PONTEDERIACEAE	Herb	W	Kolai, *Indivara*	Root	<10
738	*Morchella esculenta* (L.) Pers.	HELVELLACEAE	Herb	W	Guchhi	Fruiting Body	**
739	*Morinda citrifolia* L.	RUBIACEAE	Tree	W/C	Canary wood, Noni	Fruit	500-1000
740	*Morinda coreia* Buch.-Ham. [= *Morinda pubescens* J.E.Sm.; *Morinda tinctoria* Roxb. var. *tomentosa* (Heyne ex Roth) Hook.f.]	RUBIACEAE	Tree	W	Manjanatthi, Nunna	Root, Wood, Leaf, Fruit	200-500 [≈*295*]
-	*Morinda pubescens* J.E.Sm.	Ref.: *Morinda coreia*	-	-	-	-	-
-	*Morinda tinctoria* Roxb. var. *tomentosa* (Heyne ex Roth) Hook.f.	Ref.: *Morinda coreia*	-	-	-	-	-
741	*Moringa concanensis* Nimmo ex Dalzell & A.Gibson	MORINGACEAE	Tree	W	Kadvo saragvo	Bark (Stem)	**

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742	*Moringa oleifera* Lam. [= *Hyperanthera pterygosperma* (Gaertn.) Oken]	MORINGACEAE	Tree	C/W	Sahenjana, Murungai, Sainja, Drumstick, *Sigru*	Leaf, Seed, Bark (Stem)	500-1000 [≈*8600*]
743	*Morus alba* L.	MORACEAE	Tree	C	Toot, Shatoot	Bark (Stem)	<10
744	*Mucuna pruriens* (L.) DC. var. *utilis* (Wall. ex Wight) Baker ex Burck [= *Mucuna utilis* Wall. ex Wight]	FABACEAE	Climber	W/C	Kavach beej, Kaunch beej, Naikkurana, *Atmagupta*	Root, Seed	500-1000 [≈*25*]
-	*Mucuna utilis* Wall. ex Wight	Ref.: *Mucuna pruriens* var. *utilis*	-	-	-	-	-
745	*Mukia maderaspatana* (L.) M.Roem. [= *Melothria maderaspatana* (L.) Cogn.]	CUCURBITACEAE	Climber	W	Mucukkai, Musumusukkai	Leaf, Root, Fruit (Seed)	10-50 [≈*100*]
746	*Murraya koenigii* (L.) Spreng.	RUTACEAE	Tree	C/W	Kadipatta, Kariveppila, Mitaha neem, Karuvepilai, *Saurabhanimba*	Leaf	200-500 [≈*538*]
747	*Musa paradisiaca* L.	MUSACEAE	Tree	C	Kela, Kadali, Banana	Flower, Rhizome	10-50
748	*Musa sapientum* L.	MUSACEAE	Herb	W	Kadali	Flower	10-50
749	*Mussaenda frondosa* L.	RUBIACEAE	Shrub	W	Sribati	Leaf	**
750	*Myrica esculenta* Buch.-Ham. ex D.Don [= *Myrica nagi* auct. non Thunb.]	MYRICACEAE	Tree	W	Kaiphal, Kaphal, *Katphala*	Bark (Stem), Fruit	10-50
-	*Myrica nagi* auct. non Thunb.	Ref.: *Myrica esculenta*	-	-	-	-	-
751	*Myristica beddomei* King [= *Myristica dactyloides* auct. non Gaertn.]	MYRISTICACEAE	Tree	W	Jaiphal, Javatri, Nutmeg	Fruit (Aril/ Mace, Kernel)	<10
-	*Myristica dactyloides* auct. non Gaertn.	Ref.: *Myristica beddomei*	-	-	-	-	-
752	*Myristica fragrans* Houtt.	MYRISTICACEAE	Tree	C	Jatipatre, Jaiphal, *Jatiphala*	Seed	200-500 [≈*3*]
753	*Myristica malabarica* Lam.	MYRISTICACEAE	Tree	W	Rampatri	Bark (Stem), Fruit, Seed	<10
754	*Myrsine africana* L.	MYRSINACEAE	Tree	W	Chapra, Vidanga	Fruit	<10

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755	*Myrsine capitellata* Wall.	MYRSINACEAE	Shrub	W	Vidanga (Subs.)	Fruit	**
756	*Myrtus communis* L.	MYRTACEAE	Tree	I	Gandhamalti, Myrtle	Leaf	<10
-	*Myxopyrum serratulum* A.W.Hill	Ref.: *Myxopyrum smilacifolium*	-	-	-	-	-
757	*Myxopyrum smilacifolium* Blume [= *Myxopyrum serratulum* A.W.Hill]	OLEACEAE	Shrub	W	Chathuravalli	Root	<10
758	*Nannoglotis hookeri* (Hook.f.) Kitam	ASTERACEAE	Herb	W	Darunaj Akrabi	Root	<10
759	*Narvelia zeylanica* (L.) DC.	RANUNCULACEAE	Climber	W	Dhanvalli	Whole Plant	50-100
-	*Nardostachys grandiflora* DC.	Ref.: *Nardostachys jatamansi*	-	-	-	-	-
760	*Nardostachys jatamansi* (D.Don) DC. [= *Nardostachys grandiflora* DC.]	VALERIANACEAE	Herb	W	Balchad, *Jatamansi*	Root(Rhizome)	500-1000 [*≈10*]
761	*Naringi crenulata* (Roxb.) Nicolson	RUTACEAE	Tree	W	Kadunimba	Fruit	**
762	*Nelumbo nucifera* Gaertn.	NELUMBONACEAE	Herb	W/C	Kamal phul, Coldoda, Kamal kand, *Kamala*	Flower, Root (Rhizome)	100-200
763	*Neolamarckia cadamba* (Roxb.) Bosser [= *Anthocephalis cadamba* (Roxb.) Miq.]	RUBIACEAE	Tree	C/W	Kadam, Kadamba, Maravuri, Roghu	Bark (Stem), Root	<10
764	*Neopicrorhiza scrophulariiflora* (Pennell) D. Y. Hong [= *Picrorhiza scrophulariiflora Pennell*]	SCROPHULARIACEAE	Herb	W	Kutki	Root(Rhizome)	100-200
765	*Nepeta cataria* L.	LAMIACEAE	Herb	C/W	Badranjboya	Fruit	**
766	*Nepeta ciliaris* Benth.	LAMIACEAE	Herb	W	White leaved catmint, Nueet, Juffa Yabis	Whole Plant	<10
767	*Nepeta hindostana* (B.Heyne ex Roth) Haines	LAMIACEAE	Herb	W	Badranjboya	Whole Plant	10-50
-	*Nerium indicum* Mill.	Ref.: *Nerium oleander*	-	-	-	-	-
768	*Nerium oleander* L. [= *Nerium indicum* Mill.]	APOCYNACEAE	Shrub	W/C	Oleander, Kaner, *Karavira*	Root, Leaf	<10
769	*Nervilia aragoana* Gaudich.	ORCHIDACEAE	Herb	W	Sthalapadma	Root	<10

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770	*Nervilia plicata* (Andrews) Schltr.	ORCHIDACEAE	Herb	W	Padmacarini	Leaf	**
771	*Nicotiana tabacum* L.	SOLANACEAE	Herb	C	Tambaku, Tobacco	Leaf	<10 [≈*3*]
772	*Nigella sativa* L.	RANUNCULACEAE	Herb	C	Kalonji, *Upakuncika*	Seed	2000-5000
-	*Nilgirianthus ciliatus* (Nees) Bremek.	Ref.: *Strobilanthes ciliata*	-	-	-	-	-
-	*Nilgirianthus heyneanus* (Nees) Bremek.	Ref: *Strobilanthes heyneanus*	-	-	-	-	-
-	*Nothapodytes nimmoniana* (Grah.) Mabb.	Ref.: *Mappia foetida*	-	-	-	-	-
773	*Nyctanthes arbor-tristis* L.	OLEACEAE (Nyctanthaceae)	Tree	C/W	Paruatak pan, Harsingar, Singar kali	Leaf, Bark, Flower	10-50 [≈*3260*]
774	*Nymphaea alba* L.	NYMPHAEACEAE	Herb	W	Neel kamal, Neelofar, Nilopher, *Kumuda*	Flower	10-50 [≈*5*]
775	*Nymphaea nouchali* Burm.f. [= *Nymphaea stellata* Willd.]	NYMPHAEACEAE	Herb	W/C	Niloth phal, Nilofar, Ambal, *Utpala*	Flower	50-100
-	*Nymphaea stellata* Willd.	Ref.: *Nymphaea nouchali*	-	-	-	-	-
776	*Nymphoides cristata* (Roxb.) Kuntze	MENYANTHACEAE	Herb	W	Kumudini	Whole Plant	<10
777	*Nymphoides indica* (L.) Kuntze	MENYANTHACEAE	Herb	W	Kumudini	Whole Plant	<10
778	*Ochreinauclea missionis* (Wall.ex G.Don) Ridsdale	RUBIACEAE	Tree	W	-	Bark	<10
779	*Ocimum americanum* L. [= *Ocimum canum* Sims.]	LAMIACEAE	Herb	W	Kali tulsi, Bantulsi, Ganjam thulasai	Whole Plant, Leaf, Flower	200-500 [≈*100*]
780	*Ocimum basilicum* L.	LAMIACEAE	Herb	C/W	Sweet basil, Kali tulsi, Marua, Niazbo, Tukmaria	Leaf, Root, Whole Plant, Fruit (Seed)	200-500 [≈*75*]
-	*Ocimum canum* Sims.	Ref.: *Ocimum americanum*	-	-	-	-	-

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781	*Ocimum gratissimum* L.	LAMIACEAE	Shrub	C/W	Vana tulasi, Tulsa, Tukmaria	Seed, Whole Plant	1000-2000
782	*Ocimum kilimandscharicum* Gurke	LAMIACEAE	Shrub	C	Karpoora tulasi	Whole Plant	<10
-	*Ocimum sanctum* L.	Ref.: *Ocimum tenuiflorum*	-	-	-	-	-
783	*Ocimum tenuiflorum* L. [= *Ocimum sanctum* L.]	LAMIACEAE	Herb	C	Tulsi, Thulasi, *Tulasi*	Leaf, Seed, Whole Plant	2000-3000 [≈*30000*]
784	*Oenothera biennis* L.	ONAGRACEAE	Herb	I	Evening Primrose	Seed	<10
785	*Oldenlandia corymbosa* L. [= *Hedyotis corymbosa* (L.) Lam.]	RUBIACEAE	Herb	W	Pitpapra, Impooral	Whole Plant	50-100 [≈*10*]
786	*Oldenlandia herbacea* (L.) Roxb. [= *Hedyotis herbacea* L.]	RUBIACEAE	Herb	W	Pippapada	Whole Plant	<10 [≈*25*]
787	*Oldenlandia umbellata* L. [= *Hedyotis puberula* (G.Don) R.Br. ex Arn.]	RUBIACEAE	Herb	W	Impural	Whole Plant	<10
788	*Olea dioica* Roxb.	OLEACEAE	Tree	W	Koli, Itala, Edala	Bark (Stem)	<10
789	*Olea europaea* L.	OLEACEAE	Tree	I	Olive	-	50-100
790	*Onosma bracteata* Wall.	BORAGINACEAE	Herb	I/W	Gazbaan, Gul-e-gazabaan, *Gojihva*	Leaf, Flower	100-200
791	*Onosma echioides* L.	BORAGINACEAE	Herb	W	Ratanjot	Root	<10
792	*Onosma hispida* Wall. ex G.Don	BORAGINACEAE	Herb	W	Ratan jot	Root	100-200
793	*Operculina turpethum* (L.) J.Silva Manso [= *Merremia turpethum* (L.) Shah & Bhat]	CONVOLVULACEAE	Climber	W	Nishoth, Shivadi, *Trivrta*	Root, Stem	500-1000 [≈*120*]
794	*Ophiocordyceps* sinensis (Berk.) GH Sung, JM Sung, Hywel- Jones & Spatafora [= *Cordyceps sinensis* (Berk.) Sacc.]	CLAVICIPITACEAE	Herb	W	Yarsa gomba, Yartsa gumba, Keera jari	Fruiting Body	<10
795	*Opuntia dillenii* (Ker Gawl.) Haw.	CACTACEAE	Shrub	W	Prickly Pear, Nag Phan, Chhitar Thohr	Fruit	<10
796	*Orchis mascula* (L.) L.	ORCHIDACEAE	Herb	I	Salam misri	Root	10-50
797	*Origanum majorana* L.	LAMIACEAE	Herb	C	Gandhira, Sweet Marjoram	Whole Plant	<10
798	*Origanum vulgare* L.	LAMIACEAE	Herb	W	Sattar Patti, Oregano	-	10-50

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799	*Oroxylum indicum* (L.) Benth. ex Kurz	BIGNONIACEAE	Tree	W	Tetuchaal, Arlu, *Syonaka*	Root, Bark (Stem), Fruit (Pod)	500-1000 [≈*310*]
-	*Orthosiphon glabratus* Benth.	Ref.: *Orthosiphon thymiflorus*	-	-	-	-	-
800	*Orthosiphon thymiflorus* (Roth) Sleesen [= *Orthosiphon glabratus* Benth.]	LAMIACEAE	Herb	W	Pratanika	Whole Plant	<10
801	*Oryza sativa* L.	POACEAE	Herb	C	Aval, Akki, Thavidu, Dhan, Rice, *Sali*	Fruit (Grain), Root	>10000
-	*Ougeinia dalbergioides* Benth.	Ref: *Desmodium oojeinense*	-	-	-	-	-
-	*Ougenia oojeinensis* (Roxb.) Hochr.	Ref: *Desmodium oojeinense*	-	-	-	-	-
802	*Oxalis corniculata* L.	OXALIDACEAE	Herb	W	Puliyaarila, Araa Keerai, *Cangeri*	Whole Plant	<10 [≈*320*]
803	*Pachygone ovata* (Poir.) Miers ex Hook.f. & Thomson	MENISPERMACEAE	Climber	W	Kadukkodi, Pedda dusar tree	Leaf	**
804	*Paederia foetida* L.	RUBIACEAE	Climber	W	Prasaarani, Lokolast, Bhadai lota, *Prasarini*	Whole Plant [≈*510*]	100-200
805	*Paederia scandens* (Lour.) Merr.	RUBIACEAE	Shrub	W	Prasaarani	Whole Plant [≈*40*]	**
806	*Paeonia emodi* Wall. ex Royle	PAEONIACEAE	Shrub	W	Ud saleev, Himalayan peony	Root	<10
807	*Paeonia officinalis* L.	PAEONIACEAE	Shrub	I	Peony	Root	<10
808	*Panax ginseng* C.A.Mey.	ARALIACEAE	Herb	I	Ginseng	Root	<10
809	*Panax pseudoginseng* Wall.	ARALIACEAE	Herb	W	Ginseng	Root	**
-	*Pandanus fascicularis* Lam.	Ref.:*Pandanus odorifer*	-	-	-	-	-
810	*Pandanus odorifer* (Forssk.) Kuntze	PANDANACEAE	Shrub	W	Kewada, Ketaki	Flower, Stem	10-50 [≈*2*]
811	*Pandanus tectorius* Parkinson ex Du Roi	PANDANACEAE	Shrub	I	*Ketaki*	Root (Stilt)	<10

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812	*Papaver somniferum* L.	PAPAVERACEAE	Herb	C	Postdana, Khas khas, Afeem dana, *Khaskhasa*	Seed	10-50
813	*Paris polyphylla* Sm.	MELANTHIACEAE	Herb	W	Daiswa paris, Svetavaca, Satua, Satva	Root(Rhizome)	10-50 [≈*6*]
814	*Parmelia kamstchadalis* Ach.	PARMELIACEAE	Herb	W	Chhadila, Dagadphool (Subs.)	Fruiting Thallus	**
815	*Parmelia perforata* Ach.	PARMELIACEAE	Herb	W	Chhadila, Dagadphool (Subs.)	Fruiting Thallus	<10
816	*Parmelia perlata* (Huds.) Ach.	PARMELIACEAE	Herb	W	Chhadila, Jhula, Mehndi, Shilapushpa, Dagadphool, Kalpaasi, *Saileya*	Fruiting Thallus	500-1000
817	*Paspalum scrobiculatum* L.	POACEAE	Herb	C	*Kodravah*	Seed (Grain)	<10
818	*Passiflora foetida* L.	PASSIFLORACEAE	Climber	W	Foul passiflora	Whole Plant	**
819	*Passiflora incarnata* L.	PASSIFLORACEAE	Climber	C/W	Passion flower	Flower, Stem	<10
820	*Pastinacea sativa* L.	APIACEAE	Herb	I	Parsnip	Root	<10
821	*Pausinystalia johimbe* (K.Schum.) Pierre ex Beille	RUBIACEAE	Tree	I	Yohimba	Bark (Stem)	<10
822	*Pavonia odorata* Willd.	MALVACEAE	Herb	W	Moramasi, Sugandhabala *Gandhasipha*	Whole Plant	10-50 [≈*18*]
823	*Pavonia zeylanica* (L.) Cav.	MALVACEAE	Herb	C/W	Sitranmuttiver	Root	**
824	*Pedalium murex* L.	PEDALIACEAE	Herb	W	Gokhru bada, Annai nerunji Aerial Part	Fruit, Root,	100-200 [≈*160*]
825	*Peganum harmala* L.	ZYGOPHYLLACEAE	Herb	W	Harmal, Lal dana	Fruit	100-200
826	*Pentapetes phoenicea* L.	STERCULIACEAE	Herb	C/W	Dopohoria, Pushparakta	Flower	<10
827	*Pentatropis capensis* (L.f.) Bullock	APOCYNACEAE	Climber	W	Ambervel, Kakanasika, Paparam	Whole Plant	<10
828	*Pergularia daemia* (Forssk.) Chiov.	ASCLEPIADACEAE	Climber	W	Atrilal, Uthaamani, *Visanika*	Whole Plant, Leaf	<10 [≈*37*]
829	*Pericampylus glaucus* (Lam.) Merr.	MENISPERMACEAE	Climber	W	Barakkanta	Root	**
830	*Peristrophe bicalyculata* (Retz.) Nees	ACANTHACEAE	Herb	W	Atrilal, *Kakajangha*	Root, Seed	<10
831	*Persea americana* Mill.	LAURACEAE	Tree	C	Avocado	-	<10

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832	*Peucedanum grande* (Dalzell & A.Gibson) C.B.Clarke	APIACEAE	Herb	W	Baphli	Fruit	<10
-	*Phaseolus mungo* L.	Ref.: *Vigna mungo*	-	-	-	-	-
-	*Phaseolus radiatus* L.	Ref.: *Vigna radiata*	-	-	-	-	-
833	*Phaseolus vulgaris* L.	FABACEAE	Herb	C	Rajma, Bakla	Seed	<10
834	*Phoenix dactylifera* L.	ARECACEAE	Tree	C	Khajur, Dates, *Kharjura*	Fruit	50-100
-	*Phoenix farinifera* Roxb.	Ref.: *Phoenix pusilla*	-	-	-	-	-
-	*Phoenix humilis* Royle var. *pedunculata* Beccari	Ref.: *Phoenix loureirii*	-	-	-	-	-
835	*Phoenix loureiroi* Kunth [= *Phoenix humilis* Royle var. *pedunculata* Beccari]	ARECACEAE	Tree	W	Sitreechu	Fruit	<10
836	*Phoenix pusilla* Gaertn. [= *Phoenix farinifera* Roxb.]	ARECACEAE	Shrub	W	Chitteenth	Root	<10
837	*Phoenix sylvestris* (L.) Roxb.	ARECACEAE	Tree	C/W	Khajur	Root (Tuber/Pith)	100-200
838	*Phyla nodiflora* (L.) Greene	VERBENACEAE	Herb	W	Chota-okra, Poduthalai, *Jalpippali*	Whole Plant	<10 [≈*180*]
839	*Phyllanthus amarus* Schumach. & Thonn. [= *Phyllanthus fraternus* Webst.]	EUPHORBIACEAE (Phyllanthaceae)	Herb	W/C	Bhumiamla, Keezaa nelli, *Tamalaki*	Whole Plant	1000-2000 [≈*270*]
840	*Phyllanthus debilis* Klein ex Willd.	EUPHORBIACEAE (Phyllanthaceae)	Herb	W	Bhumiamla	Whole Plant	**
841	*Phyllanthus emblica* L. [= *Emblica officinalis* Gaertn.]	EUPHORBIACEAE (Phyllanthaceae)	Tree	W/C	Amla, Anwala, Aonla, Amalaki, Nelli	Fruit	>10000 [≈*11900*]
-	*Phyllanthus fraternus* Webst.	Ref.: *Phyllanthus amarus*	-	-	-	-	-
842	*Phyllanthus maderaspatensis* L.	EUPHORBIACEAE (Phyllanthaceae)	Herb	W	Kanocha, Meeva nelli, Bhumiamla	Whole Plant	1000-5000 [≈*10*]

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843	*Phyllanthus reticulatus* Poir. [= *Kirganelia reticulata* (Poir.) Baill.]	EUPHORBIACEAE (Phyllanthaceae)	Shrub	W	Buinowla	Whole Plant	<10 [*≈10*]
844	*Phyllanthus urinaria* L.	EUPHORBIACEAE (Phyllanthaceae)	Herb	W	Lal bhuin anvalah, Hajarmani	Whole Plant	50-100 [*≈17*]
845	*Phyllanthus virgatus* G.Forst.	EUPHORBIACEAE (Phyllanthaceae)	Herb	W	Niruri, Bhui amla	Whole Plant	**
846	*Phyllostachys bambusoides* Siebold & Zucc.	POACEAE	Herb	W	Banslochan (Subs.)	Exudate	<10
847	*Physalis alkekengi* L.	SOLANACEAE	Herb	I	*Kakanaja*	Fruit	<10
848	*Physalis minima* L.	SOLANACEAE	Herb	W	Tulatipati, Tankari	Leaf, Whole Plant	10-50 [*≈8*]
849	*Physochlaina praealta* (Decne.) Miers	SOLANACEAE	Herb	W	Lal tang, Bajar Bang	Whole Plant	**
850	*Picrasma quassioides* (D.Don) Benn.	SIMAROUBACEAE	Tree	W	Bharangi, Kadavi	Bark (Stem)	<10
851	*Picrorhiza kurroa* Royle ex Benth.	SCROPHULARIACEAE	Herb	W	Kutki, Karu, *Katuka*	Root(Rhizome)	1000-2000 [*≈15*]
-	*Picrorhiza scrophulariiflora* Pennell	Ref.: *Neopicrorhiza scrophulariiflora*	-	-	-	-	-
852	*Pimenta dioica* (L.) Merr.	MYRTACEAE	Tree	I	Allspice, Jamaica Pepper	Fruit	<10
853	*Pimpinella anisum* L.	APIACEAE	Herb	C/W	Ajamoda, Badiyan Khathayi, *Anisuna*	Fruit	10-50
854	*Pinus gerardiana* Wall. ex D.Don	PINACEAE	Tree	W	Chilgoza, Neoja, *Nikocaka*	Seed	<10
855	*Pinus palustris* Mill.	PINACEAE	Tree	I	Long leaf Pine	Oleo-Resin	<10
856	*Pinus roxburghii* Sarg.	PINACEAE	Tree	W	Gandabiroja, Chirpine, *Sarala*	Oleo-Resin, Root	1000-2000
857	*Pinus sylvestris* L.	PINACEAE	Tree	I	Scot's Pine	Oleo-Resin	10-50
858	*Piper attenuatum* Buch.-Ham. ex Miq.	PIPERACEAE	Climber	W	Kattumulaku	Fruit	<10
859	*Piper betle* L.	PIPERACEAE	Climber	C	Paan, Betle, *Nagavalli*	Leaf	200-500
-	*Piper brachystachyum* Wall. ex Hook.f.	Ref: *Piper mullesua*	-	-	-	-	-
860	*Piper chaba* Hunter [= *Piper retrofractum* Vahl]	PIPERACEAE	Climber	I	Kabab chini, Gajpippal, Chavya, *Cavya*	Fruit, Stem	200-500
861	*Piper cubeba* L.f.	PIPERACEAE	Climber	I	Tailed pepper, *Kankola*	Fruit	50-100

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862	*Piper longum* L.	PIPERACEAE	Shrub	C/W	Pipal, Thippili, Pipalmool, *Pippali*, *Pippalimula*	Fruit, Root	2000-5000 [≈*230*]
863	*Piper mullesua* Buch.-Ham. ex D.Don [= *Piper brachystachyum* Wall. ex Hook.f.]	PIPERACEAE	Climber	W/C	Katuthippali, Gol pippali	Fruit	50-100
864	*Piper nigrum* L.	PIPERACEAE	Climber	C/W	Pipal Gol, Kalimirch, *Marica*	Fruit, Stem	1000-2000
865	*Piper peepuloides* Roxb.	PIPERACEAE	Climber	W	Pippali (Subs.)	Fruit	10-50
-	*Piper retrofractum* Vahl	Ref.: *Piper chaba*	-	-	-	-	-
866	*Piper sylvaticum* Roxb.	PIPERACEAE	Climber	W	Pippali	Fruit	<10
867	*Piper wallichii* (Miq.) Hand.-Mazz.	PIPERACEAE	Climber	W	Renukbeej (Nagodbeej)	Fruit	<10
-	*Pistacia chinensis* Bunge var. *integerrima* Brandis	Ref.: *Pistacia integerrima*	-	-	-	-	-
868	*Pistacia integerrima* J.L. Stewart ex Brandis [= *Pistacia chinensis* subsp. *integerrima* (J. L. Stewart ex Brandis) Rech. f.]	PISTACIACEAE	Tree	W	Kakarsinghi, *Karkatasrngi*	Gall	200-500 [≈*20*]
869	*Pistacia lentiscus* L.	PISTACIACEAE	Shrub	I	Mastangi, *Rumimastagi*	Gum	10-50
870	*Pistacia vera* L.	PISTACIACEAE	Shrub	I	Magaj Pista Irani	Seed	<10
871	*Pistia stratiotes* L.	ARACEAE	Herb	W	*Jal kumbhi*	Whole Plant	<10
872	*Pisum sativum* L.	FABACEAE	Climber	C	Pea, Matar	-	10-50
873	*Plantago amplexicaulis* Cav.	PLANTAGINACEAE	Herb	I	Isabgol	Seed	<10
874	*Plantago lanceolata* L.	PLANTAGINACEAE	Herb	W	Baltanga, English plantain, Vanya-asvagola	Leaf	<10
875	*Plantago major* L.	PLANTAGINACEAE	Herb	W	Lahuriya	Seed, Leaf, Whole Plant	<10 [≈*26*]
876	*Plantago ovata* Forssk.	PLANTAGINACEAE	Herb	C	Isabgol	Seed, Seed Husk	>30000 [≈*320*]
877	*Platanthera edgeworthii* (Hook.f. ex Collett) R.K.Gupta [= *Habenaria edgeworthii* Hook.f. ex Collett]	ORCHIDACEAE	Herb	W	Riddhi	Root (Tuber)	10-50

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878	*Plectranthus amboinicus* (Lour.) Spreng.	LAMIACEAE	Shrub	C	Patharcur, Parnayavani	Leaf, Root	10-50 [≈*137*]
-	*Plectranthus barbatus* Andrews	Ref.: *Coleus forskohlii*	-	-	-	-	-
879	*Plectranthus hadiensis* (Forssk.) Schweinf. ex Sprenger [=*Plectranthus zeylanicus* Benth.]	LAMIACEAE	Shrub	C	Iriveriya	Leaf	<10
880	*Plectranthus vettiveroides* (Jacob) N.P.Singh & B.D.Sharma	LAMIACEAE	Herb	C	Vettiver, Black Iribeli, Harivera	Root	10-50
-	*Plectranthus zeylanicus* Benth.	Ref.: *Plectranthus hadiensis*	-	-	-	-	-
881	*Pleurospermum angelicoides* (Wall ex DC.) Benth ex C.B. Clarke	APIACEAE	Herb	W	-	Leaf, Flower, Fruit	**
882	*Pluchea lanceolata* (DC.) Oliv. & Hiern	ASTERACEAE	Herb	W	*Rasna*	Leaf, Root	200-500
883	*Plumbago auriculata* Lam.	PLUMBAGINACEAE	Shrub	C	Nila Chitrak	Root, Aerial Part	<10
884	*Plumbago indica* L. [=*Plumbago rosea* L.]	PLUMBAGINACEAE	Herb	C/W	Chitrak, *Rakta Citraka*	Root	100-200
-	*Plumbago rosea* L.	Ref.: *Plumbago indica*	-	-	-	-	-
885	*Plumbago zeylanica* L.	PLUMBAGINACEAE	Herb	W	Chitrak, Chitramulam, Kodiveli, *Citraka*	Root , Whole Plant	500-1000 [≈*1345*]
-	*Podophyllum emodi* Wall. ex Honig.	Ref.: *Podophyllum hexandrum*	-	-	-	-	-
886	*Podophyllum hexandrum* Royle [= *Podophyllum emodi* Wall. ex Honig.]	BERBERIDACEAE	Herb	W	Bankakri, Vanatrapusi, Laghu patra	Fruit, Root	10-50
887	*Pogostemon cablin* (Blanco) Benth. [= *Pogostemon patchouly* Pellet.]	LAMIACEAE	Herb	C	Patchouli	Leaf	<10
888	*Pogostemon heyneanus* Benth.	LAMIACEAE	Herb	W/C	Patchouli	Whole Plant	<10
-	*Pogostemon patchouly* Pellet.	Ref.: *Pogostemon cablin*	-	-	-	-	-

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889	*Polyalthia longifolia* (Sonn.) Thwaites	ANNONACEAE	Tree	C	False Ashok (Subs.)	Bark (Stem)	10-50
890	*Polycarpaea corymbosa* (L.) Lam.	CARYOPHYLLACEAE	Herb	W	Bugyale, Parpatta	Whole Plant	<10
891	*Polygonatum cirrhifolium* (Wall.) Royle	LILIACEAE	Herb	W	Salam Mishri, *Meda*, *Mahameda*	Root(Rhizome)	100-200
892	*Polygonatum multiflorum* (L.) All.	LILIACEAE	Herb	W	Solomnons seal	Root	10
893	*Polygonatum verticillatum* (L.) All.	LILIACEAE	Herb	W	*Meda*, *Mahameda*	Root	<10
894	*Polygonum alatum* Buch.-Ham. ex Spreng.	POLYGONACEAE	Herb	W	Chonakappulu	Whole Plant	<10
895	*Polygonum aviculare* L.	POLYGONACEAE	Herb	W	Anjbar	Seed, Stem	<10
896	*Polygonum glabrum* Willd.	POLYGONACEAE	Herb	W	Raktha rohitha	Root	<10
897	*Polygonum punctatum* Buch.-Ham. ex D.Don	POLYGONACEAE	Herb	W	Kangani machan-pillu	Whole Plant	**
898	*Polygonum viviparum* L.	POLYGONACEAE	Herb	W	Unjwar, Anjbar	Root	10-50
899	*Polypodium vulgare* L.	POLYPODIACEAE	Herb	W	Bisphaiz	Root(Rhizome)	<10
-	*Pongamia glabra* Vent.	Ref.:*Pongamia pinnata*	-	-	-	-	-
900	*Pongamia pinnata* (L.) Pierre [= *Pongamia glabra* Vent.; *Derris indica* (Lam.) Benn.]	FABACEAE	Tree	C/W	Honge beej, Karanji, Pongum seed, Karanj, *Karanja*	Bark (Stem & Root), Seed, Leaf, Root	500-1000 [*≈30*]
901	*Portulaca oleracea* L.	PORTULACACEAE	Herb	W	Lonika, Kulfa, *Kozuppa*	Whole Plant	<10 [*≈400*]
902	*Portulaca quadrifida* L.	PORTULACACEAE	Herb	W	Pasalai	Whole Plant	<10 [*≈630*]
903	*Potentilla nepalensis* Hook.	ROSACEAE	Herb	W	Dori ghas	Root	**
-	*Pothos pertusus* Roxb.	Ref.: *Rhaphidophora pertusa*	-	-	-	-	-
904	*Pothos scandens* L.	ARACEAE	Climber	W	Bendarli	Leaf	<10
905	*Premna corymbosa* Rottler & Willd.	VERBENACEAE (Lamiaceae)	Shrub	W	Munnai, Arni	Root, Bark (Root)	100-200
906	*Premna herbacea* Roxb.	VERBENACEAE (Lamiaceae)	Herb	W	Bhumijanbuk, Bhujam	Root	<10

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907	*Premna flavescens* Ham.	VERBENACEAE (Lamiaceae)	Tree	W	Arnimool	Bark (Root)	**
908	*Premna mollissima* Roth [= *Premna latifolia* Roxb.]	VERBENACEAE (Lamiaceae)	Tree	W	Bakar	Root, Bark (Root)	<10
-	*Premna latifolia* Roxb.	Ref.: *Premna mollissima*	-	-	-	-	-
-	*Premna integrifolia* L.	Ref.: *Premna serratifolia*	-	-	-	-	-
909	*Premna serratifolia* L. [= *Premna integrifolia* L.]	VERBENACEAE (Lamiaceae)	Shrub	W	Arnimool, Agnimantha	Root	100-200
910	*Premna tomentosa* Willd.	VERBENACEAE (Lamiaceae)	Tree	W	Sonachal	Bark (Stem)	<10
911	*Prosopis cineraria* (L.) Druce	MIMOSACEAE	Tree	W	Jhand, Chonkar, *Sama*	Leaf, Stem	<10
-	*Prunus amygdalus* Batsch	Ref.: *Prunus dulcis*	-	-	-	-	-
912	*Prunus armeniaca* L.	ROSACEAE	Tree	C	Chuli, Wild apricot	Seed (Kernel)	100-200
913	*Prunus avium* (L.) L.	ROSACEAE	Tree	W	Wild cherry, Aileya *Elavalukam*	Seed, Root, Bark (Stem)	<10
914	*Prunus cerasoides* Buch.-Ham. ex D.Don	ROSACEAE	Tree	C/W	Padamkasht, Paja, *Padmaka*	Heart Wood	100-200
915	*Prunus domestica* L.	ROSACEAE	Tree	C	Alu Bukhara, Plum	Seed Oil	<10
916	*Prunus dulcis* (Mill.) D.A.Webb. [= *Prunus amygdalus Batsch*]	ROSACEAE	Tree	C	Badam, Magaj badam	Bark (Stem), Fruit, Oil	1000-2000
917	*Prunus mahaleb* L.	ROSACEAE	Tree	C	Mahaleb, Priyangu	Fruit	<10
918	*Pseudarthria viscida* (L.) Wight & Arn.	FABACEAE	Shrub	W	Moovila, Muvila, Salaparni	Leaf, Root	200-500
919	*Psidium guajava* L.	MYRTACEAE	Tree	C	Gujava, Amrud, Jamphal	Leaf	10-50
-	*Psoralea corylifolia* L.	Ref.:*Cullen corylifolium*	-	-	-	-	-
-	*Psychotria ipecacuanha* (Brot.) Standl.	Ref.: *Carapichea ipecacuanha*	-	-	-	-	-
920	*Pterocarpus marsupium* Roxb.	FABACEAE	Tree	W	Damul-akhwain, Bijasal, Vijaysar, Venga, *Asana*	Heart Wood, Bark (Stem)	200-500 [≈*1400*]

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921	*Pterocarpus santalinus* L.f.	FABACEAE	Tree	W	Lal chandan, *Raktachandana*	Heart Wood	200-500
922	*Pterospermum acerifolium* (L.) Willd.	MALVACEAE	Tree	C	Muchakunda, Kanak Champa	Flower	<10
923	*Pueraria lobata* (Willd.) Ohwi	FABACEAE	Climber	C/W	Mudgaparni, Surpaparni	Root, Whole Plant	<10
924	*Pueraria tuberosa* (Roxb. ex Willd.) DC.	FABACEAE	Climber	W	Patal Kumbha, *Vidari*, *Vidarikanda*	Root (Tuber)	500-1000
925	*Punica granatum* L. [= *Punica granatum* L. var. *nana* Pers.]	LYTHRACEAE (Punicaceae)	Shrub	W/C	Dadam chal, Anardana, Maadulam, Anaar, Pomegranate, *Dadima*	Fruit Rind, Seed, Leaf	500-1000 [≈*300*]
-	*Punica granatum* L. var. *nana* Pers.	Ref.: *Punica granatum*	-	-	-	-	-
926	*Pupalia lappacea* (L.) Juss.	AMARANTHACEAE	Herb	W	Nagdamini, Chirchitta	Leaf Extract	<10
927	*Putranjiva roxburghii* Wall. [= *Drypetes roxburghii* (Wall.) Hurus.]	EUPHORBIACEAE	Tree	C/W	Putrjivak, Karupaali	Bark (Stem), Fruit	10-50
928	*Pyrus cydonia* L. [= *Cydonia oblonga* Mill.]	ROSACEAE	Tree	C	Bee dana	Seed	<10
929	*Quassia indica* (Gaertn.) Noot.	SIMAROUBACEAE	Tree	W	Lokhanti	Wood	<10
930	*Quercus infectoria* G. Olivier	FAGACEAE	Tree	I	Majuphal, *Mayakku*	Gall	100-200
931	*Raphanus raphanistrum* subsp. *sativa* (L.) Domino	BRASSICACEAE	Herb	C	Raddish, *Mulaka*	Whole Plant, Root, Seed	50-100
-	*Rauvolfia densiflora* (Wall.) Benth. ex Hook.f.	Ref.: *Rauvolfia verticillata*	-	-	-	-	-
932	*Rauvolfia micrantha* Hook.f.	APOCYNACEAE	Shrub	W	Sarpagandha, Pagal Buti	Root	**
933	*Rauvolfia serpentina* (L.) Benth. ex Kurz	APOCYNACEAE	Shrub	W/C	Pagal Buti, Amalpori, *Sarpagandha*	Root, Leaf	200-500 [≈*25*]
934	*Rauvolfia tetraphylla* L.	APOCYNACEAE	Shrub	C/W	Barachandrika	Root	**
935	*Rauvolfia verticillata* (Lour.) Baill. [= *Rauvolfia densiflora* (Wall.) Benth. ex Hook.f.]	APOCYNACEAE	Shrub	W	Sarpagandha, Pagal Buti	Root	<10
936	*Rhamnus pushiana* DC. [= *Frangula purshiana* Cooper]	RHAMNACEAE	Shrub	I	Cascara Sagrada	Bark	<10
937	*Rhamnus wightii* Wight & Arn.	RHAMNACEAE	Tree	W	Rakta Rohida, Kokkuvalli	Bark	<10

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-	*Rhaphidophora laciniata* (Burm.f.) Merr.	Ref.: *Rhaphidophora pertusa*	-	-	-	-	-
938	*Rhaphidophora pertusa* (Roxb.) Schott [= *Rhaphidophora laciniata* (Burm.f.) Merr.; Pothos pertusus Roxb.]	ARACEAE	Climber	C/W	Ganeshkanda	Whole Plant	<10
939	*Rheum australe* D.Don [= *Rheum emodi* Wall. ex Meissn.]	POLYGONACEAE	Herb	W	Revan chini, Dolu	Root(Rhizome)	100-200 [≈*35*]
-	*Rheum emodi* Wall. ex Meissn.	Ref.: *Rheum australe*	-	-	-	-	-
940	*Rheum moorcroftianum* Royle	POLYGONACEAE	Herb	W	Revand chini, Amlaparni	Root(Rhizome)	<10
941	*Rheum palmatum* L.	POLYGONACEAE	Herb	W	Revand chini	Root(Rhizome)	**
942	*Rheum spiciforme* Royle	POLYGONACEAE	Herb	W	Amlaparni, Revand chini	Root(Rhizome)	**
943	*Rheum webbianum* Royle	POLYGONACEAE	Herb	W	Revand chini	Root(Rhizome)	<10
944	*Rhinacanthus nasutus* (L.) Kurz	ACANTHACEAE	Shrub	C/W	Juyiparni, Vitamallikai	Leaf, Root	**
945	*Rhododendron anthopogon* D.Don	ERICACEAE	Shrub	W	Talisapatra	Leaf	**
946	*Rhododendron arboreum* Sm.	ERICACEAE	Tree	W	Buras, Gularrh Phool	Flower	100-200 [≈*20*]
947	*Rhododendron campanulatum* D.Don	ERICACEAE	Shrub	W	Cherailu	Leaf, Wood	10-50
948	*Rhododendron lepidotum* Wall. ex G. Don	ERICACEAE	Shrub	W	Talisa (Subs.)	Leaf	**
949	*Rhus coriaria* L.	ANACARDIACEAE	Tree	I	Sicilian Sumac	Fruit	<10
950	*Rhus succedanea* L.	ANACARDIACEAE	Tree	W	Karkataka shringi	Fruit, Gall	10-50
951	*Ribes nigrum* L.	GROSSULARIACEAE	Shrub	C	Blackcurrant	Fruit	<10
952	*Ricinus communis* L.	EUPHORBIACEAE	Shrub	C/W	Arand, Arind, *Eranda*	Leaf, Seed Oil & Seed, Root	1000-2000
953	*Rosa alba* L.	ROSACEAE	Shrub	C	Gulseoti	Flower	<10
954	*Rosa centifolia* L.	ROSACEAE	Shrub	C	Gulab, *Satapatrika*	Flower	500-1000
955	*Rosa chinensis* Jacq. [= *Rosa indica* L.]	ROSACEAE	Shrub	C	Gulab	Flower	<10
956	*Rosa damascena* Mill.	ROSACEAE	Shrub	C	Gulab, Rose flowers Oil	Flower, Petal,	1000-2000

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-	*Rosa indica* L.	Ref.: *Rosa chinensis*	-	-	-	-	-
957	*Roscoea alpina* Royle	ZINGIBERACEAE	Herb	W	Kakoli, Kshirkakoli	Root	50-100
958	*Roscoea purpurea* Sm.	ZINGIBERACEAE	Herb	W	Kakoli, Kshirkakoli	Root	<10
959	*Rosmarinus officinalis* L.	LAMIACEAE	Shrub	I	Rosemary	Flower, Oil	50-100
960	*Rotula aquatica* Lour.	LYTHRACEAE	Herb	W	Pasanbheda	Root	<10
961	*Rourea santaloides* (Vahl) Wight & Arn.	CONNARACEAE	Climber	W	Varadara	Root	<10
962	*Rubia cordifolia* L.	RUBIACEAE	Climber	W	Majith, Madder, *Manjistha*	Stem, Root	1000-2000
963	*Rubia sikkimensis* Kurz	RUBIACEAE	Climber	W	Naga madder, Moyum	Root	**
964	*Rubia tinctorum* L.	RUBIACEAE	Climber	I	Madder	Root(Tincture)	<10
965	*Rumex nepalensis* Spreng.	POLYGONACEAE	Herb	W	Jangli palak, Yellow dock (Subs.)	Root	<10
966	*Ruta graveolens* L.	RUTACEAE	Herb	C	Sadab, Arvada	Whole Plant	10-50
967	*Saccharum bengalensis* Retz. [= *Saccharum munja* Roxb.]	POACEAE	Herb	W	Amaveru, Sarkanda, *Sara*	Root	<10
-	*Saccharum munja* Roxb.	Ref.: *Saccharum bengalensis*	-	-	-	-	-
968	*Saccharum officinarum* L.	POACEAE	Herb	C	Karumbu, Sugar cane, *Iksu*	Root, Stem	5000-10000
969	*Saccharum spontaneum* L.	POACEAE	Herb	W	Kusha, *Kasa*	Root	10-50
970	*Salacia chinensis* L.	CELASTRACEAE	Climber	W	Courondi, Koranti	Root	50-100
971	*Salacia oblonga* Wall. ex Wight & Arn.	CELASTRACEAE	Climber	W	Kadalainjil	Wood	10-50
972	*Salacia reticulata* Wight	CELASTRACEAE	Shrub	W	Pitila, Ekanayakam	Bark (Stem), Root	100-200
973	*Salix caprea* L.	SALICACEAE	Tree	I	Baid-mushk	Flower	200-500
974	*Salix tetrasperma* Roxb.	SALICACEAE	Tree	W	Indian willow	Bark (Stem)	<10
975	*Salvadora oleoides* Decne.	SALVADORACEAE	Tree	W	Pilu	Fruit, Leaf	** [≈*20*]
976	*Salvadora persica* L.	SALVADORACEAE	Tree	W	Goni, Bann, Meswak, *Piluh*	Bark (Root), Root, Leaf, Fruit	50-100 [≈*30*]

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977	*Salvia aegyptiaca* L.	LAMIACEAE	Herb	W	Balangoo	Seed	<10
978	*Salvia haematodes* L.	LAMIACEAE	Herb	I	Behman	Seed	<10
979	*Salvia moorcroftiana* Wall. ex Benth.	LAMIACEAE	Herb	W	Tuk marian, Tuth	Leaf, Seed	**
980	*Salvia plebeia* R.Br.	LAMIACEAE	Herb	W	Kachora	Seed	<10
981	*Salvia sclarea* L.	LAMIACEAE	Herb	I	Behman safed	Seed	<10
982	*Sansevieria roxburghiana* Schult. & Schult.f.	ASPARAGACEAE	Herb	C	Marul, Mokya	Leaf	<10 [≈*130*]
983	*Santalum album* L.	SANTALACEAE	Tree	W	Chandan, Sandalwood, *Svetacandana*	Heart Wood	500-1000
984	*Sapindus emarginatus* Vahl	SAPINDACEAE	Tree	W/C	Reetha, Soapnut	Bark (Stem), Fruit, Leaf	50-100
985	*Sapindus mukorossi* Gaertn.	SAPINDACEAE	Tree	C/W	Aretha mota, Reetha, Soapnut	Fruit, Seed	200-500 [≈*115*]
986	*Sapindus trifoliatus* L.	SAPINDACEAE	Tree	C/W	Boondokottai, Ritha, Soapnut	Fruit	50-100
987	*Saraca asoca* (Roxb.) W.J.de Wilde	CAESALPINIACEAE	Tree	W	Sita Ashok, *Ashoka*	Bark (Stem)	1000-2000
988	*Sarcostemma acidum* (Roxb.) Voigt	ASCLEPIADACEAE	Climber	W	Soma, Somalatha	Whole Plant	10-50
989	*Sarcostemma viminale* (L.) R.Br.	ASCLEPIADACEAE	Climber	W	Soma, Somalatha	Whole Plant	**
990	*Saussurea costus* (Falc.) Lipsch. [= *Saussurea lappa* (Decne.) Sch.Bip.]	ASTERACEAE	Herb	C	Kuth, Uplet, Rauta, *Kustha*	Root	100-200
991	*Saussurea hypoleuca* Spreng. ex DC.	ASTERACEAE	Herb	W	Kuth (Subs.)	Root	<10
-	*Saussurea lappa* (Decne.) Sch.Bip.	Ref.: *Saussurea costus*	-	-	-	-	-
992	*Saussurea obvallata* (DC.) Edgew.	ASTERACEAE	Herb	W	Brahmkamal	Whole Plant	<10
993	*Schizachyrium exile* (Hochst.) Pilg.	POACEAE	Herb	W	Sprkka	Whole Plant	<10
994	*Schizandra chinensis* (Turcz.) Baill.	SCHISANDRACEAE	Climber	I	Five Flavour Berry	Fruit (Berry)	<10
995	*Schleichera oleosa* (Lour.) Oken	SAPINDACEAE	Tree	W	Kusum beeja	Seed	<10
996	*Schrebera swietenoides* Roxb.	OLEACEAE	Tree	W	Ghanti phal	Bark (Stem), Fruit	<10
997	*Scindapsus officinalis* (Roxb.) Schott.	ARACEAE	Climber	W	Gaj pipal, *Gajapippali*	Fruit	100-200

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-	*Securinega leucopyrus* (Willd.) Mull.-Arg.	Ref.: *Flueggea leucopyrus*	-	-	-	-	-
998	*Selinum candollei* DC.	APIACEAE	Herb	W	*Mura*	Root	<10
999	*Selinum vaginatum* (Edgew.) C.B. Clarke	APIACEAE	Herb	W	Butkesh, *Bhutakesi*	Fruit, Root(Rhizome)	<10
1000	*Semecarpus anacardium* L.f.	ANACARDIACEAE	Tree	W	Balave, Bhilavan, Bhilawa, Marking nuts, *Bhallataka*	Fruit	200-500 [*≈2*]
1001	*Senna alata* (L.) Roxb. [= *Cassia alata* L.]	CAESALPINIACEAE	Shrub	C/W	Dadmurdan, Dat-ka-pat, Khorpat	Leaf, Root, Fruit	10-50
1002	*Senna alexandrina* Gars. ex Mill. [= *Cassia angustifolia* M. Vahl]	CAESALPINIACEAE	Herb	C	Sona patta, Sonamukhi, Senna, Sanaay, *Svarnapatri*	Leaf, Fruit (Pod)	>10000 [*≈35*]
1003	*Senna auriculata* (L.) Roxb. [= *Cassia auriculata* L.]	CAESALPINIACEAE	Shrub	W	Avarai	Bark (Stem), Leaf, Flower, Seed	500-1000 [*≈630*]
1004	*Senna italica* Mill. [= *Cassia italica* (Mill.) Lam. ex Andr.; *Cassia obtusus* Roxb.]	CAESALPINIACEAE	Herb	W	Nila aavaarai, Nila vagai	Leaf, Fruit	<10
1005	*Senna obtusifolia* (L.) Irwin & Barneby [= *Cassia obtusifolia* L.]	CAESALPINIACEAE	Shrub	C/W	Panevar, Taga, Omam	Fruit	<10
1006	*Senna occidentalis* (L.) Link [= *Cassia occidentalis* L.]	CAESALPINIACEAE	Herb	W	Kasondi, Kasmardah, Ponnavarai	Seed, Leaf	200-500 [*≈940*]
1007	*Senna siamea* (Lam.) Irwin & Barneby [= *Cassia siamea* Lam.]	CAESALPINIACEAE	Tree	C	Kassod	Leaf	**
1008	*Senna sophera* (L.) Roxb. [= *Cassia sophera* L.]	CAESALPINIACEAE	Shrub	W	Kasodi, Ponthakaram	Whole Plant	<10
1009	*Senna tora* (L.) Roxb. [= *Cassia tora* L.]	CAESALPINIACEAE	Herb	W	Chakoda Beeja, Pawad, Chankuda, Chakramard, *Prapunnada*	Seed, Root, Leaf	>20000
1010	*Serenoa repens* (W.Bartram) Small	ARECACEAE	Tree	I	Saw Palmetto	Fruit	<10

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1011	*Sesamum indicum* L. [= *Sesamum orientale* L.]	PEDALIACEAE	Herb	C	Til, *Tila*	Seed, Seed Oil	>10000
-	*Sesamum orientale* L.	Ref.:*Sesamum indicum*	-	-	-	-	-
1012	*Sesbania grandiflora* (L.) Pers.	FABACEAE	Tree	C	Agase, Agathi, *Itkata*	Seed, Leaf	<10 [≈*410*]
1013	*Sesbania speciosa* Taub.	FABACEAE	Tree	W/C	Seemai agathi	Whole Plant	<10
1014	*Seseli diffusum* (Roxb. ex Sm.) Santapau & Wagh	APIACEAE	Herb	W	Kirmani, Ajwain	Fruit	**
1015	*Setaria italica* (L.) P. Beauv	POACEAE	Herb	C	Kangni	Seed	<10
1016	*Shorea robusta* Gaertn.	DIPTEROCARPACEAE	Tree	C/W	Sal, Raal, *Sala*	Resin, Bark (Stem)	100-200 [≈*10*]
1017	*Sida acuta* Burm.f.	MALVACEAE	Herb	W	Bala	Root, Whole Plant	100-200
1018	*Sida cordata* (Burm.f.) Borss. Waalk.	MALVACEAE	Herb	W	Bala	Whole Plant	<10
1019	*Sida cordifolia* L.	MALVACEAE	Herb	W	Bala, Beej band	Root, Whole Plant	1000-2000 [≈*15*]
1020	*Sida rhombifolia* L.	MALVACEAE	Herb	W	Bala, *Mahabala*	Root, Whole Plant	1000-2000
1021	*Sida spinosa* L.	MALVACEAE	Herb	I	Prickly Fanpetals	Whole Plant	<10
1022	*Silybum marianum* (L.) Gaertn.	ASTERACEAE	Herb	C/W	Milk thistle	Seed	<10
1023	*Simmondsia chinensis* (Link) C.K. Schneid.	SIMMONDSIACEAE	Shrub	C	Jojoba	Fruit	<10
1024	*Sinapis alba* L. [= *Brassica alba* (L.) Rabenh]	BRASSICACEAE	Herb	C/W	Safedrai, Yellow mustard	Seed	<10
1025	*Sisymbrium irio* L.	BRASSICACEAE	Herb	W	*Khubkalan*	Seed	<10
1026	*Skimmia laureola* (DC.) Siebold & Zucc. ex Walp.	RUTACEAE	Shrub	W	Ner, Patrang, Barru	Leaf	**
1027	*Smilax aristolochiifolia* Mill.	SMILACACEAE	Climber	I	Gray Sarsaparilla	Root	<10
1028	*Smilax aspera* L.	SMILACACEAE	Climber	W	Chopchini (Subs.)	Root	**
1029	*Smilax china* L.	SMILACACEAE	Climber	I	Chobchini, *Madhusnuhi*	Root (Tuber)	100-200

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1030	*Smilax glabra* Roxb.	SMILACACEAE	Climber	W	Chobchini, Lokhandi	Root, Whole Plant	<10 [≈*188*]
1031	*Smilax ornata* Lem.	SMILACACEAE	Climber	I	Jamaican Sarsaparilla	Root	<10
1032	*Smilax zeylanica* L.	SMILACACEAE	Climber	W	Chopchini (Subs.)	Root	<10
1033	*Solanum anguivi* Lam. [= *Solanum indicum* auct. non L].	SOLANACEAE	Shrub	W	Katheli badhi, Karimulli, *Brhati*	Whole Plant, Root, Fruit	500-1000 [≈*130*]
-	*Solanum indicum* auct. non L.]	Ref.: *Solanum anguivi*	-	-	-	-	-
1034	*Solanum melongena* L.	SOLANACEAE	Herb	C	Baingan, Brinjal	Fruit, Leaf	100-200
1035	*Solanum nigrum* L.	SOLANACEAE	Herb	W/C	Makoi, Kakamachi, *Kakamaci*	Whole Plant, Fruit	2000-5000 [≈*1680*] 100-200
-	*Solanum surattense* Burm.f.	Ref.: *Solanum virginianum*	-	-	-	-	-
1036	*Solanum torvum* Sw.	SOLANACEAE	Shrub	C/W	Padarchunda, Sundakaai	Fruit, Root, Leaf	<10 [≈*20*]
1037	*Solanum trilobatum* L.	SOLANACEAE	Climber	W	Alarka, Thudhuvalai	Root, Leaf, Whole Plant	<10 [≈*100*]
1038	*Solanum virginianum* L. [= *Solanum xanthocarpum* Schrad. & H. Wendl.; *Solanum surattense* Burm.f.]	SOLANACEAE	Herb	W	Kateli, Shankar namoli, *Kantakari*	Whole Plant, Fruit, Root	500-1000 [≈*290*]
-	*Solanum xanthocarpum* Schrad. & H.Wendl.	Ref.: *Solanum virginianum*	-	-	-	-	-
1039	*Solena amplexicaulis* (Lam.) Gandhi	CUCURBITACEAE	Climber	W	Van Kakri, Tarali, Amlavetasah	Root, Leaf, Seed	<10
1040	*Soymida febrifuga* (Roxb.) A.Juss.	MELIACEAE	Tree	W	Rohan	Fruit, Bark	<10 [≈*11*]
1041	*Spatholobus parviflorus* (DC.) Kuntze [= *Spatholobus roxburghii* Benth.]	FABACEAE	Climber	W	Mula	Bark (Stem)	**

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-	*Spatholobus roxburghii* Benth.	Ref.: *Spatholobus parviflorus*	-	-	-	-	-
1042	*Spermacoce articularis* L.f.	RUBIACEAE	Herb	W	Tukah	Whole Plant	**
1043	*Spermacoce hispida* L. [= *Borreria hispida* (L.) K.Schum.]	RUBIACEAE	Herb	W	Thaarthaaval, Nathai choorie	Fruit (Seed), Whole Plant	100-200
1044	*Sphaeranthus africanus* L.	ASTERACEAE	Herb	W	Mundi	Flower	<10
1045	*Sphaeranthus amaranthoides* Burm.	ASTERACEAE	Herb	W	Cevayam	Flower	**
1046	*Sphaeranthus indicus* L.	ASTERACEAE	Herb	W	Gorak mundi, *Munditika*	Whole Plant, Leaf	200-500 [*≈10*]
-	*Spilanthes acmella* Murr. var. *oleracea* C.B. Clarke	Ref.: *Acmella oleracea*	-	-	-	-	-
-	*Spilanthes oleracea* L.	Ref.: *Acmella oleracea*	-	-	-	-	-
1047	*Spinacia oleracea* L.	AMARANTHACEAE	Herb	C	Palak, Spinach	Leaf	<10
1048	*Spondias pinnata* (L.f.) Kurz	ANACARDIACEAE	Tree	W	Amate, Mathimaangaa, Amora, *Amrata*	Stem, Leaf, Bark (Stem), Fruit	<10 [*≈122*]
1049	*Stephania glabra* (Roxb.) Miers	MENISPERMACEAE	Climber	W	Patha, Rajapatha	Root	**
1050	*Sterculia foetida* L.	STERCULIACEAE	Tree	W/C	Janlibadam, Java olive	Fruit, Wood	<10
1051	*Sterculia urens* Roxb.	STERCULIACEAE	Tree	W	Karaya, Kulu, Kateera	Gum	<10
1052	*Stereospermum chelonoides* (L.f.) DC. [= *Stereospermum suaveolens* (Roxb.) DC.]	BIGNONIACEAE	Tree	W	Patala, Padal fali, *Patalai*	Bark (Stem), Root	500-1000 [*≈20*]
-	*Stereospermum colais* (Buch.-Ham. ex Dillw.) Mabb.	Ref.: *Stereospermum tetargonum*	-	-	-	-	-
-	*Stereospermum suaveolens* (Roxb.) DC.	Ref.: *Stereospermum chelonoides*	-	-	-	-	-
1053	*Stereospermum tetargonum* DC. [= *Stereospermum colais* (Buch.-Ham. ex Dillw.) Mabb.]	BIGNONIACEAE	Tree	W	Patala, *Patalai*	Root	200-500
1054	*Stevia rebaudiana* (Bertoni) Bertoni	ASTERACEAE	Herb	C	Meethi Patti, Stevia	Leaf	<10

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1055	*Streblus asper* Lour.	MORACEAE	Tree	W	Bajradanti, *Sakhotaka*	Bark (Stem), Root, Latex	10-50 [≈*3*]
1056	*Strobilanthes ciliata* Nees [= *Nilgirianthus ciliatus* (Nees) Bremek.]	ACANTHACEAE	Shrub	W	Kurinji, Karvi, Sahchara	Whole Plant	200--500
1057	*Strobilanthes heyneanus* Nees [= *Nilgirianthus heyneanus* (Nees) Bremek.]	ACANTHACEAE	Shrub	W	Kurinji (Subs.), Karun kurinji	Whole Plant	50-100
1058	*Strophanthus wightianus* Wall. ex Wight	APOCYNACEAE	Climber	W	Naithal kizhangu	Root	<10
1059	*Strychnos nux-blanda* A.W.Hill	LOGANIACEAE	Tree	W	Kuchla, Itti beeja (Subs.)	Seed	<10
1060	*Strychnos nux-vomica* L.	LOGANIACEAE	Tree	W	Kuchla, Itti beeja, *Visamusti*	Seed	500-1000
1061	*Strychnos potatorum* L.f.	LOGANIACEAE	Tree	W	Nirmali, Cleaning nuts Thaethaan, *Kataka*	Seed	100-200 [≈*25*]
1062	*Stylocoryna lucens* (Hook.f.) Gamble [= *Tarenna alpestris* (Wight) N.P.Balakr.]	RUBIACEAE	Shrub	W	Paphanals	Root	**
1063	*Swertia alata* (Royle ex D.Don) C.B. Clarke	GENTIANACEAE	Herb	W	Kiratatikta	Whole Plant	<10
1064	*Swertia angustifolia* Buch.-Ham. ex D. Don	GENTIANACEAE	Herb	W	Chiraeta shireen	Whole Plant	<10
1065	*Swertia chirayita* (Roxb. ex Fleming) H.Karst.	GENTIANACEAE	Herb	W/C	Chiraiyata, Chiretta, Kiriyath, *Kiratatikta*	Whole Plant	500-1000 [≈*145*]
1066	*Swertia cordata* (Wall. ex G. Don) C.B.Clarke	GENTIANACEAE	Herb	W/C	Chiraiyata, Kiratatikta	Whole Plant	50-100
1067	*Symplocos cochinchinensis* S. Moore	SYMPLOCACEAE	Tree	W	Lodhra	Bark (Stem)	100-200
1068	*Symplocos paniculata* (Thunb.) Miq.	SYMPLOCACEAE	Tree	W	Lodhra, Lodhra pathani, Lodh	Bark (Stem)	<10
1069	*Symplocos racemosa* Roxb.	SYMPLOCACEAE	Tree	W	Pathani lodh, *Lodhra*	Bark (Stem)	500-1000
1070	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	MYRTACEAE	Tree	C	Laung, Cloves, *Lavanga*	Flower (Bud)	500-1000
1071	*Syzygium caryophyllatum* (L.) Alston [= *Eugenia caryophyllaea* Wight]	MYRTACEAE	Tree	W	Clove, Lavang	Stem, Flower (Bud)	10-50
1072	*Syzygium cumini* (L.) Skeels	MYRTACEAE	Tree	W/C	Jamun, Naaval, *Jambu*	Seed, Bark (Stem)	500-1000 [≈*860*]
1073	*Syzygium jambos* (L.) Alston	MYRTACEAE	Tree	C	Jambu	Fruit (Seed)	10-50

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1074	*Tabernaemontana divaricata* (L.) R.Br. ex M.Roem. & Schult. [= *Ervatamia coronaria* (Jacq.) Stapf]	APOCYNACEAE	Shrub	C	Candni, Kathane	Root	<10 [≈*6*]
1075	*Tacca aspera* Roxb. [= *Tacca integrifolia* Ker Gawl.]	TACCACEAE	Herb	W	Varahikand, Dukarkand	Root (Tuber)	10-50
-	*Tacca integrifolia* Ker Gawl.	Ref.: *Tacca aspera*	-	-	-	-	-
1076	*Tagetes erecta* L.	ASTERACEAE	Herb	C	African Marygold, Genda, Sandu	Flower	10-50 [≈*625*]
1077	*Tagetes minuta* L.	ASTERACEAE	Herb	C/W	Stinking roger	Flower	**
1078	*Tamarindus indica* L.	CAESALPINIACEAE	Tree	C/W	Imli, *Cinca*	Fruit (Pulp)	1000-2000
1079	*Tamarix gallica* L.	TAMARICACEAE	Shrub	I	Manna Plant, Jhav, French Tamarisk	Leaf, Flower	100-200
1080	*Tamarix indica* Roxb.	TAMARICACEAE	Shrub	W	Jhan, Jhau, Aphalah	Bark (Stem)	100-200
1081	*Tanacetum cinerariifolium* (Trevir.) Sch. Bip. [= *Chrysanthemum cinerariifolium* (Trevis.) Vis.]	ASTERACEAE	Herb	C	Pyrethrum	Flower	200-500
1082	*Tanacetum vulgare* L.	ASTERACEAE	Herb	I	Tansy	Flower	**
1083	*Taraxacum officinale* F.H.Wigg.	ASTERACEAE	Herb	C/W	Kanphul, Dudhal	Root(Rhizome)	<10
-	*Tarenna alpestris* (Wight) Balak.	Ref.:*Stylocoryne lucens*	-	-	-	-	-
-	*Taxus baccata* L.	Ref.: *Taxus wallichiana*	-	-	-	-	-
-	*Taxus contorta* Griff.	Ref.: *Taxus wallichiana*	-	-	-	-	-
1084	*Taxus wallichiana* Zucc. [= *Taxus baccata* L.; *Taxus contorta* Griff.]	TAXACEAE	Tree	W/C	Talispatra, Thuna, Birmi, Rakhal, Yew, *Sthauneya*	Leaf	100-200
1085	*Tecomella undulata* (Sm.) Seem.	BIGNONIACEAE	Shrub	W	Rohida, *Rohitaka*	Bark (Stem)	100-200
1086	*Tectona grandis* L.f.	VERBENACEAE	Tree	C/W	Sagwan, Teak, *Saka*	Heart Wood	10-50
1087	*Tephrosia purpurea* (L.) Pers.	FABACEAE	Herb	W	Sarad foka, Sarpankha, Kozhinji	Leaf, Root, Seed	200-500
1088	*Teramnus labialis* (L.f.) Spreng.	FABACEAE	Climber	W	*Masaparni*	Whole Plant	100-200
1089	*Terminalia arjuna* (Roxb. Ex DC.) Wight & Arn.	COMBRETACEAE	Tree	W/C	Arjun, Marudham, *Arjuna*	Bark (Stem)	2000-5000 [≈*2740*]

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1090	*Terminalia bellirica* (Gaertn.) Roxb.	COMBRETACEAE	Tree	W/C	Behda, Bahera, Thandrikaai, *Bibhitaka*	Fruit, Seed	2000-5000 [≈*5780*]
1091	*Terminalia chebula* Retz.	COMBRETACEAE	Tree	W	Harda, Harar, Kadukkaai, Himaj, *Haritaki*	Fruit	5000-10000 [≈*5740*]
1092	*Terminalia crenulata* Roth	COMBRETACEAE	Tree	W	Asan	Bark (Stem)	<10
1093	*Terminalia elliptica* Willd. [= *Terminalia tomentosa* (Roxb. ex DC.) Wight & Arn.]	COMBRETACEAE	Tree	W	Asan, Sain, Saja	Bark (Stem)	10-50
1094	*Terminalia paniculata* Roth	COMBRETACEAE	Tree	W	Vanmaruthu	Bark (Stem)	<10
-	*Terminalia tomentosa* (Roxb. ex DC.) Wight & Arn.	Ref.: *Terminalia elliptica*	-	-	-	-	-
1095	*Thalictrum foliolosum* DC.	RANUNCULACEAE	Herb	W	Mamira	Root	<10
1096	*Thespesia populnea* (L.) Sol. ex Correa	MALVACEAE	Tree	C	Phalisa-Chhal, *Kapitan*	Bark (Stem)	50-100 [≈*75*]
1097	*Thuja occidentalis* L.	CUPRESSACEAE	Tree	I	Mor pankhi, Thuja	Leaf	<10
1098	*Thymus serpyllum* L.	LAMIACEAE	Herb	W	Ban ajwain, Satar farsi	Whole Plant	50-100 [≈*15*]
1099	*Tiliacora acuminata* (Poir.) Miers	MENISPERMACEAE	Climber	C/W	Kappatiga, Bagamushada	Leaf	<10
1100	*Tinospora cordifolia* (Willd.) Miers ex Hook.f. & Thomson	MENISPERMACEAE	Climber	W	Giloy, Amrithaballi, Seendhil, Gulje, Galo, *Guduci*	Stem	1000-2000 [≈*2330*]
1101 -	*Tinospora crispa* (L.) Hook.f. & Thomson *Tinospora malabarica* (Lam.) Hook.f. & Thomson	MENISPERMACEAE Ref.:*Tinospora sinensis*	Climber -	W -	Giloy, Amrithaballi, Guduchi -	Stem -	** -
1102	*Tinospora sinensis* (Lour.) Merr. [= *Tinospora malabarica* (Lam.) Hook.f. & Thomson]	MENISPERMACEAE	Climber	W	Amrata, Giloy	Stem	1000-2000
1103	*Toddalia asiatica* (L.) Lam.	RUTACEAE	Shrub	W	Jangli kalimirch, *Katugulma*	Whole Plant, Root	<10 [≈*1*]

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1104	*Toona ciliata* M.Roem. [= *Cedrela toona* Roxb.]	MELIACEAE	Tree	W	Thooniyanoikam, Tuni	Bark (Stem)	<10
1105	*Trachyspermum ammi* (L.) Sprague	APIACEAE	Herb	C	Ajmo, Ajwayan, Omam, *Yavani*	Fruit	1000-2000
1106	*Trachyspermum roxburghianum* (DC.) H. Wolff	APIACEAE	Herb	W	Sath Ajwain	Fruit	100-200
1107	*Tragia involucrata* L.	EUPHORBIACEAE	Climber	W	Barhanta, Koduthoova, *Vrscikalli*	Whole Plant, Root	200-500
1108	*Trapa natans* L.	TRAPACEAE	Herb	C/W	Singhada, *Srngataka*	Seed	100-200
1109	*Trianthema decandra* L. [= *Zaleya decandra* (L.) Burm.f.]	AIZOACEAE	Herb	W	Saaranai ver, Vellai Saranai, *Laghupatra-vasabhu*	Whole Plant	100-200 [≈*55*]
1110	*Trianthema portulacastrum* L.	AIZOACEAE	Herb	W	Lalsabuni, *Varsabhu*	Root, Aerial Part	<10 [≈*95*]
-	*Tribulus alatus* Del.	Ref.: *Tribulus pentandrus*	-	-	-	-	-
1111	*Tribulus lanuginosus* L.	ZYGOPHYLLACEAE	Herb	W	Gokhru	Fruit, Root, Whole Plant	200-500
1112	*Tribulus pentandrus* Forssk. [= *Tribulus alatus* Del.]	ZYGOPHYLLACEAE	Herb	W	Gokhru kalan	Fruit, Stem	<10
1113	*Tribulus rajasthanensis* M.M. Bhandari & V.S.Sharma	ZYGOPHYLLACEAE	Herb	W	Gokhru (Subs.)	Fruit, Root, Whole Plant	**
1114	*Tribulus subramanyamii* P. Singh, G.S.Giri & V.Singh	ZYGOPHYLLACEAE	Herb	W	Gokhru (Subs.)	Fruit, Root, Whole Plant	**
1115	*Tribulus terrestris* L.	ZYGOPHYLLACEAE	Herb	W	Gokhru, Gokshura, Seru nerunjil, *Goksura*	Fruit, Root, Whole Plant	2000-5000 [≈*80*]
1116	*Trichodesma indicum* (L.) Lehm.	BORAGINACEAE	Herb	W	Adhapushpi, Andhahuli, Chhota kalpa	Whole Plant	<10
1117	*Trichodesma zeylanicum* (Burm.f.) R.Br.	BORAGINACEAE	Herb	W	Dhadhona	Whole Plant	**
1118	*Trichopus zeylanicus* Gaertn.	DIOSCOREACEAE	Herb	W	Arogyapacha	Root	**

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-	*Trichosanthes anguina* L.	Ref.: *Trichosanthes cucumerina*	-	-	-	-	-
-	*Trichosanthes bracteata* (Lam.) Voigt	Ref.: *Trichosanthes tricuspidata*	-	-	-	-	-
1110	*Trichosanthes cordata* Roxb.	CUCURBITACEAE	Climber	W	Vidari	Stem, Root (Tuber)	**
1120	*Trichosanthes cucumerina* L. [= *Trichosanthes anguina* L.]	CUCURBITACEAE	Climber	W	Patol panchang, Peipudal, Kattupavalam, Snakegourd	Whole Plant	100-200 [≈*5*]
1121	*Trichosanthes dioica* Roxb.	CUCURBITACEAE	Climber	C	Patol (Kadu Parval)	Root, Leaf	100-200
1122	*Trichosanthes lobata* Roxb.	CUCURBITACEAE	Climber	W	Patola, Tiktapatola	Leaf	10-50
1123	*Trichosanthes tricuspidata* Lour. [= *Trichosanthes bracteata* (Lam.) Voigt]	CUCURBITACEAE	Climber	W	Indrayan, Mahakal, *Visala*	Root	<10
1124	*Tridax procumbens* L.	ASTERACEAE	Herb	W	Jayanti	Whole Plant	<10 [≈*535*]
1125	*Trigonella corniculata* (L.) L.	FABACEAE	Herb	W/C	Kasuri Methi	Whole Plant	**
1126	*Trigonella foenum-graecum* L.	FABACEAE	Herb	C	Uluva, *Methi*	Seed, Aerial Part	500-1000
1127	*Trillium govanianum*Wall. ex D.Don [= *Trillidium govanianum* (Wall. ex D.Don) Kunth]	LILIACEAE	Herb	W	Nag chhatri, Satva	Root(Rhizome)	200-500
1128	*Triticum vulgare* Vill.	POACEAE	Herb	C	Gandum, Gehun, Kanak, Wheat	Seed	50-100
1129	*Tulipa clusiana* DC. [= *Tulipa stellata* Hook.]	LILIACEAE	Herb	W	Meethi Suranjan	Whole Plant	**
-	*Tulipa stellata* Hook.	Ref.: *Tulipa clusiana*	-	-	-	-	-
-	*Tylophora asthmatica* (L.f.) Wight & Arn.	Ref.: *Tylophora indica*	-	-	-	-	-
1130	*Tylophora indica* (Burm.f.) Merr. [= *Tylophora asthmatica* (L.f.) Wight & Arn.]	ASCLEPIADACEAE	Climber	W	Antamul, Nanju murichaan, Country Ipecacuahna	Root	10-50 [≈*2*]
-	*Typha australis* K.Schum. & Thonner	Ref.:*Typha elephantina*	-	-	-	-	-

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1131	*Typha elephantina* Grah. non Roxb. [= *Typha australis* K.Schum. & Thonner]	TYPHACEAE	Herb	W	Anaikkorai, *Potagala*, *Gundrah*	Root(Rhizome)	<10
1132	*Typhonium trilobatum* (L.) Schott	ARACEAE	Herb	W	Karunai kizhangu, *Slipadarikanda*	Root (Tuber)	<10
1133	*Uncaria elliptica* R.Br. ex G.Don [= *Uncaria gambier* Thwaites]	RUBIACEAE	Climber	I	Kath	Bark (Stem)	<10
-	*Uncaria gambier* Thwaites	Ref.: *Uncaria elliptica*	-	-	-	-	-
1134	*Uraria lagopodoides* (L.) DC.	FABACEAE	Herb	W	Kalasi	Whole Plant	10-50
1135	*Uraria picta* (Jacq.) DC.	FABACEAE	Herb	W	Prshniparni, *Prsniparni*	Whole Plant, Root	200-500
1136	*Uraria rufescens* (DC.) Schindl.	FABACEAE	Herb	W	Kalasi (Subs.)	Root	**
-	*Urginea indica* (Roxb) Kunth.	Ref.: Drimia indica	-	-	-	-	-
1137	*Urtica dioica* L.	URTICACEAE	Herb	W	Bichhu buti, Bichhu ghas, Nettle	Leaf, Root	<10 [≈*135*]
1138	*Valeriana hardwickii* Wall.	VALERIANACEAE	Herb	W	Tagar ganth, Nihani	Root(Rhizome)	<10
1139	*Valeriana jatamansi* Jones [= *Valeriana wallichii* DC.]	VALERIANACEAE	Herb	W	Musakbala, Tagar, Sugandhbala, *Tagara*	Root(Rhizome)	1000-2000
1140	*Valeriana officinalis* L.	VALERIANACEAE	Herb	I	Valerian	Root	<10
1141	*Valeriana pyrolifolia* Decne.	VALERIANACEAE	Herb	W	Mushkabala (Subs.)	Root	<10
-	*Valeriana wallichii* DC.	Ref.: *Valeriana jatamansi*	-	-	-	-	-
1142	*Vanda tessellata* (Roxb.) Hook. ex G.Don	ORCHIDACEAE	Herb	W	Rasna	Root	10-50
1143	*Vateria indica* L.	DIPTEROCARPACEAE	Tree	C/W	Mandadhupa, Dupa, Vellai kungilyam, *Saraja*	Exudate, Root	50-100
1144	*Ventilago maderaspatana* Gaertn.	RHAMNACEAE	Climber	W	Pitti, Penge	Root, Stem	<10
-	*Vernonia anthelmintica* L.	Ref.: *Baccharoides anthelmintica*	-	-	-	-	-
1145	*Vernonia cinerea* (L.) Less. [= *Vernonia conyzoides* DC.]	ASTERACEAE	Herb	W	Dandotpala, Kali jeeri, *Sahadevi*	Leaf, Root, Seed	50-100
-	*Vernonia conyzoides* DC.	Ref.: *Vernonia cinerea*	-	-	-	-	-

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-	*Vetiveria zizanioides* (L.) Nash	Ref.: *Chrysopogon zizanioides*	-	-	-	-	-
1146	*Viburnum foetidum*Wall.	ADOXACEAE (Caprifoliaceae)	Shrub	W	Dieng-soh-lang	Leaf, Aerial parts	<10
1147	*Vigna mungo* (L.) Hepper [= *Phaseolus mungo* L.]	FABACEAE	Herb	C	Urd, Mash	Seed	100-200
-	*Vigna pilosa* (Klein ex Willd.) Baker	Ref.: *Dysolobium pilosum*	-	-	-	-	-
1148	*Vigna radiata* (L.) R. Wilczek [= *Phaseolus radiatus* L.]	FABACEAE	Herb	C	Masha, *Mudga*	Seed	50-100
-	*Vigna radiata* (L.) R. Wilczec var. *sublobata* (Roxb.) Verdc.	Ref.: *Vigna sublobata*	-	-	-	-	-
1149	*Vigna sublobata* (Roxb.) Babu & Sharma [= *Vigna radiata* (L.) Wilczec var. *sublobata* (Roxb.) Verdc.]	FABACEAE	Herb	C	Masaparni	Root, Seed	<10
1150	*Vigna trilobata* (L.) Verdc.	FABACEAE	Herb	C	*Mudgaparni*	Whole Plant	100-200
-	*Vigna unguiculata* (L.) Walp.	Ref.: *Dolichos biflorus*	-	-	-	-	-
1151	*Vigna vexillata* (L.) A.Rich.	FABACEAE	Herb	W	Kattupayar	Root	<10
-	*Vinca rosea* L.	Ref.: *Catharanthus roseus*	-	-	-	-	-
1152	*Viola canescens* Wall.	VIOLACEAE	Herb	W	Banafasha	Flower	<10
1153	*Viola cinerea* Boiss.	VIOLACEAE	Herb	W	Banafasha phool	Flower, Leaf, Whole Plant	**
1154	*Viola odorata* L.	VIOLACEAE	Herb	W/C	Banafasha	Flower	50-100
1155	*Viola pilosa* Blume	VIOLACEAE	Herb	W	Banafasha	Flower	100-200 [*≈15*]
1156	*Vitex agnus-castus* L.	VERBENACEAE	Shrub	I	Chaste tree	Fruit	10-50
1157	*Vitex altissima* L.f.	VERBENACEAE	Tree	W	Myrole	Whole Plant	**

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
1158	*Vitex negundo* L.	VERBENACEAE	Shrub	W/C	Neergundi, Bana, *Nirgundi*, *Renuka*	Leaf, Root, Seed	500-1000 [≈*760*]
1159	*Vitis vinifera* L.	VITACEAE	Climber	C	Draksh, Kishmish, Monakka, *Draksa*	Fruit	1000-2000
1160	*Walsura trifoliolata* (A.Juss.) Harms	MELIACEAE	Tree	W	Valsura	Whole Plant	<10
-	*Wattakaka volubilis* (L.f.) Stapf	Ref.: *Dregia volubilis*	-	-	-	-	-
-	*Wedelia calendulacea* Less.	Ref.: *Wedelia chinensis*	-	-	-	-	-
1161	*Wedelia chinensis* (Osbeck) Merr. [= *Wedelia calendulacea* (L.) Less.]	ASTERACEAE	Herb	C/W	Bhangra, *Kesarsja*	Whole Plant, Leaf	10-50 [≈*990*]
1162	*Withania coagulans* (Stocks) Dunal	SOLANACEAE	Shrub	I/ W	Paneer dodi	Fruit	10-50
1163	*Withania somnifera* (L.) Dunal	SOLANACEAE	Shrub	C/W	Ashwagandha, Asgandh, *Asvagandha*	Root, Leaf, Seed	2000-5000 [≈*20*]
-	*Woodfordia floribunda* Salisb.	Ref.: *Woodfordia fruticosa*	-	-	-	-	-
1164	*Woodfordia fruticosa* (L.) Kurz [= *Woodfordia floribunda* Salisb.]	LYTHRACEAE	Shrub	W	Dhaiphool, Dhavadiphool, Thaathiri, *Dhataki*	Flower	2000-5000
1165	*Wrightia arborea* (Dennst.) Mabb.	APOCYNACEAE	Tree	W	Kutajah	Seed, Bark (Stem)	<10
1166	*Wrightia tinctoria* (Roxb.) R.Br.	APOCYNACEAE	Tree	C/W	Indrajau shirin, Veppalai	Leaf, Seed, Bark (Stem)	200-500 [≈*10*]
-	*Xeromphis spinosa* (Thunb.) Keay	Ref.: *Catunaregum spinosa*	-	-	-	-	-
1167	*Xylia xylocarpa* (Roxb.) Taub.	MIMOSACEAE	Tree	W	Trumullu	Bark (Stem)	<10
-	*Zaleya decandra* (L.) Burm.f.	Ref.: *Trianthema decandra*	-	-	-	-	-
1168	*Zanthoxylum acanthopodium* DC.	RUTACEAE	Shrub	W	Kabab Khandan, Tummad	Fruit	<10
1169	*Zanthoxylum armatum* DC.	RUTACEAE	Shrub	W	Tejbal, Timru, *Tumburu*, *Tejovati*	Fruit, Root, Bark (Stem), Leaf	200-500 [≈*220*]
1170	*Zanthoxylum nitidum* (Roxb.) DC.	RUTACEAE	Shrub	W	Kumkumada, Tegmui	Bark (Stem)	**

S. No.	Botanical Name	Family	Habit	Source*	Trade/ Local Name(s) API Name	Part (s) Used	Estimated Annual Trade (MT)
1171	*Zanthoxylum rhetsa* (Roxb.) DC.	RUTACEAE	Tree	W	Tejbal	Fruit, Flower	50-100
1172	*Zea mays* L.	POACEAE	Herb	C	Maize	Seed	2000-5000
1173	*Zehneria umbellata* (Klein) Thwaites	CUCURBITACEAE	Climber	W	Karuvikkilannu	Root	<10
1174	*Zingiber officinale* Roscoe	ZINGIBERACEAE	Herb	C	Soonth, Sonth, *Sunthi*	Root(Rhizome)	2000-5000
1175	*Zingiber zerumbet* (L.) Roscoe ex Sm.	ZINGIBERACEAE	Herb	C/W	Narkachur	Fruit	1000-2000
-	*Ziziphus jujuba* (L.) Gaertn.	Ref.: *Ziziphus mauritiana*	-	-	-	-	-
1176	*Ziziphus jujuba* Mill. [= *Ziziphus sativa* Gaertn.; *Ziziphus vulgaris* Lam.]	RHAMNACEAE	Tree	I	Unnab	Fruit	**
1177	*Ziziphus mauritiana* Lam. [= *Ziziphus jujuba* (L.) Gaertn.]	RHAMNACEAE	Tree	C/W	Ber, *Kola*	Fruit (Pulp), Bark(Stem)	200-500
-	*Ziziphus sativa* Gaertn.	Ref.: *Ziziphus jujuba*	-	-	-	-	-
-	*Ziziphus vulgaris* Lam.	Ref.: *Ziziphus jujuba*	-	-	-	-	-
1178	*Ziziphus xylopyrus* (Retz.) Willd.	RHAMNACEAE	Shrub	W	Ghontaphala, *Ghonta*	Fruit	<10

* C – Cultivated; I – Improted; W – Wild; C/W - Cultivated and Wild; W/C - Wild and Cultivated; I/C - Imported and Cultivated; I/W - Imported and Wild

** Not recorded in the current survey.

Notes

National Medicinal Plants Board set-up in November 2000 by the Government of India has the primary mandate of coordinating all matters relating to medicinal plants and support policies and programmes for growth of trade, export, conservation and cultivation. The Board is located in the Ministry of Ayurveda, Yoga & Naturopathy, Unani, Siddha & Homeopathy (AYUSH), Government of India.

Indian Council of Forestry Research and Education - an autonomous body of the Ministry of Environment, Forest and Climate Change, Government of India - is an apex national forestry research body that is mandated to undertake solution based forestry research on various issues pertaining to forestry including contemporary global concerns pertaining to climate change, biological diversity, desertification, forest based livelihoods and sustainable management of natural resources.

Dr. G. S. Goraya, a member of the Indian Forest Service belonging to the Himachal Pradesh cadre, has more than thirty years experience in managing forestry resources. He has been involved in conservation and management of medicinal plant resources since 1994 and has been on the expert panels on medicinal plants of the National Biodiversity Authority and the National Medicinal Plants Board. Presently he is working as Deputy Director General (Research) in the Indian Council of Forestry Research and Education, Dehradun.

Mr. D. K. Ved has been a member of the Indian Forest Service belonging to the Jammu and Kashmir cadre where he handled various positions related to forest management. He has been, since 1993, working with the Foundation for Revitalisation of Local Health Traditions and has been steering pioneering programs related to conservation and management of medicinal plants in the country. He has been on the expert panels on medicinal plants of the Ministry of Environment, Forest and Climate Change, National Biodiversity Authority and the National Medicinal Plants Board.