

# 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 corresponding 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 quantities, 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
-	<i>Acacia concinna</i> (Willd.) DC.	Ref.: <i>Acacia sinuata</i>
20	<i>Acacia sinuata</i> (Lour.) Merr. [= <i>A. concinna</i> (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)
<i>Gymnema sylvestre</i> R.Br. ex Schult.	Gudmar, Meshashringi	Leaf	Wild	500-1000 [≈2700]
<i>Ocimum tenuiflorum</i> L. [= <i>Ocimum sanctum</i> 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).

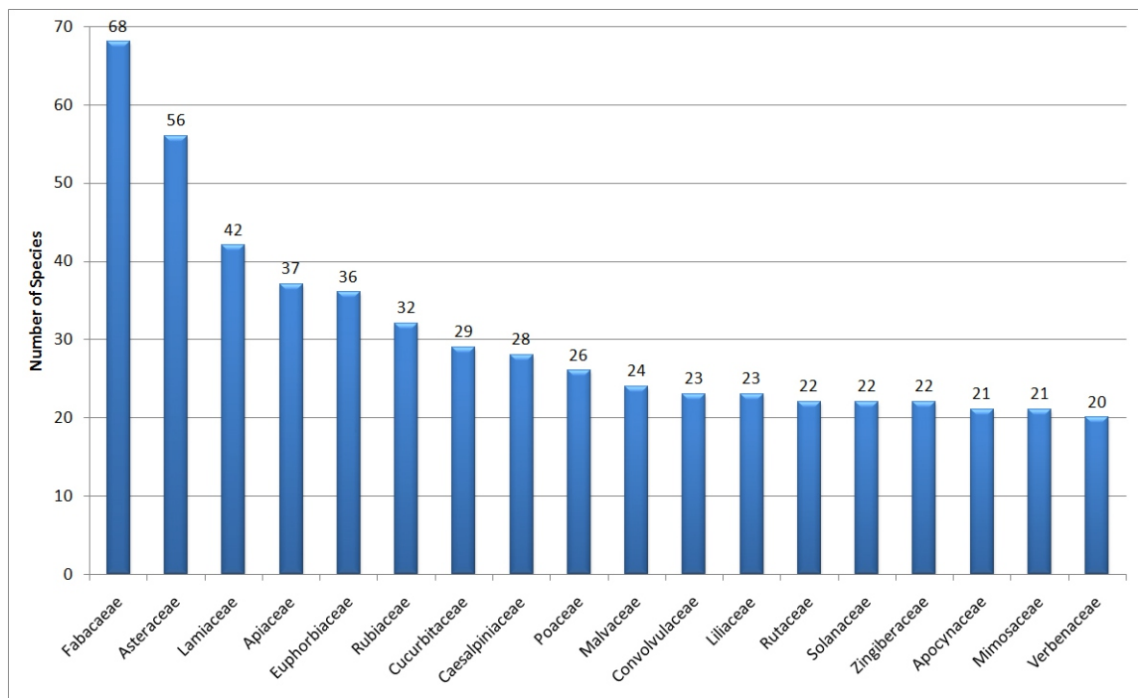


Fig. 11.1: Families with 20 or more number of species enlisted in the inventory

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).



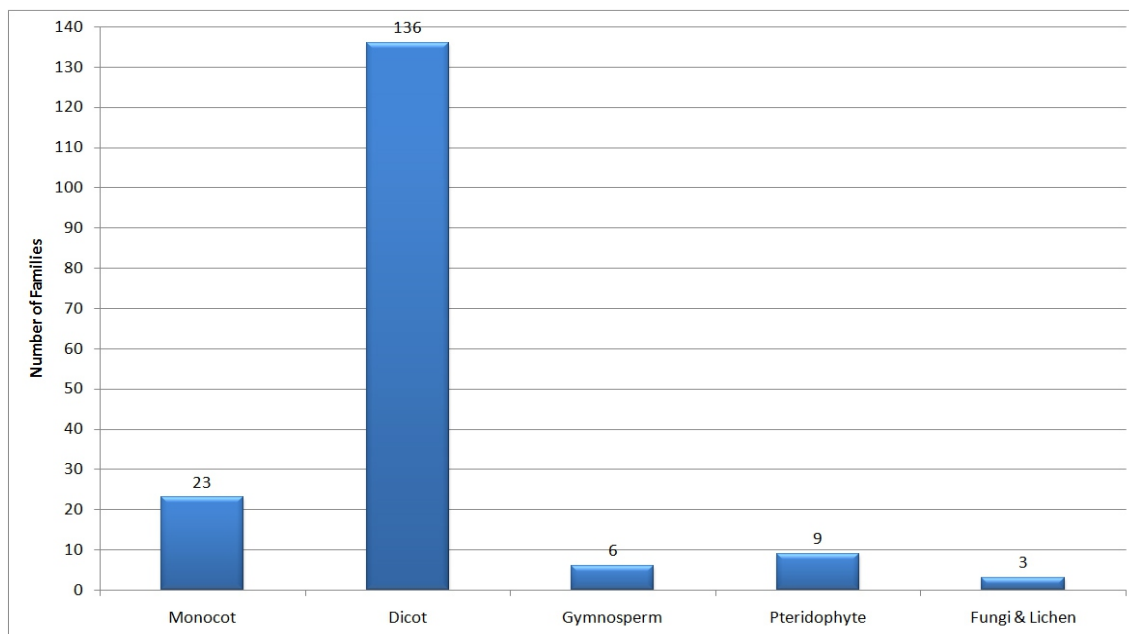


Fig. 11.2: Plant Group-wise Distribution of Families

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.

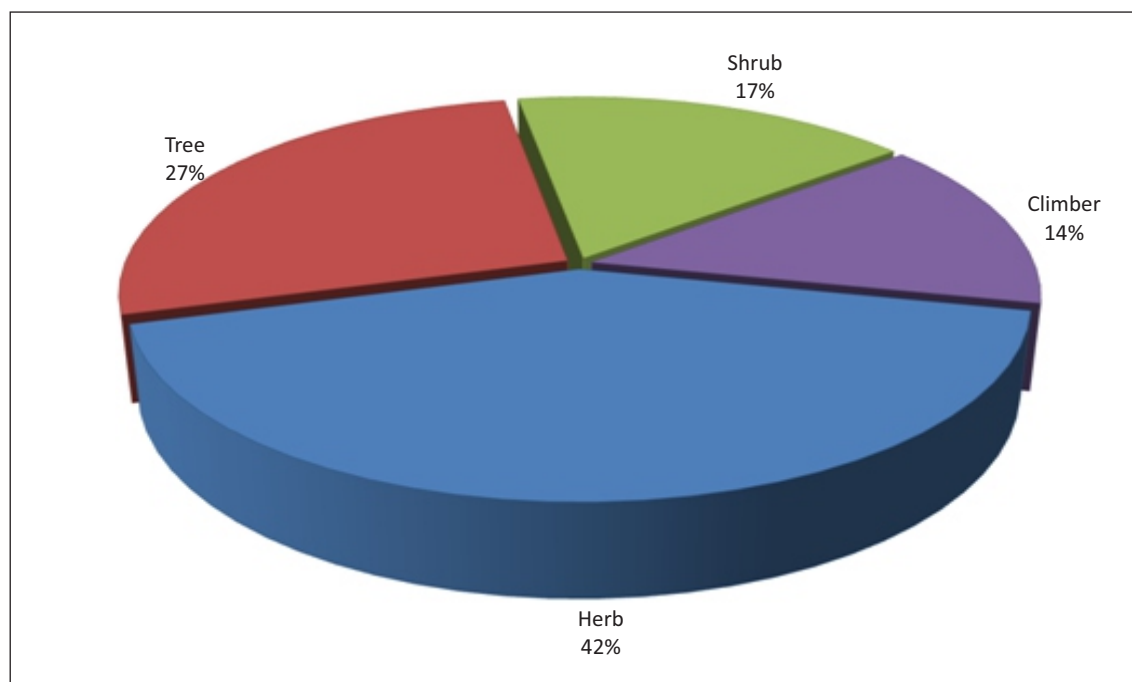


Fig. 11.3: Life Form-wise Distribution of Species

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):

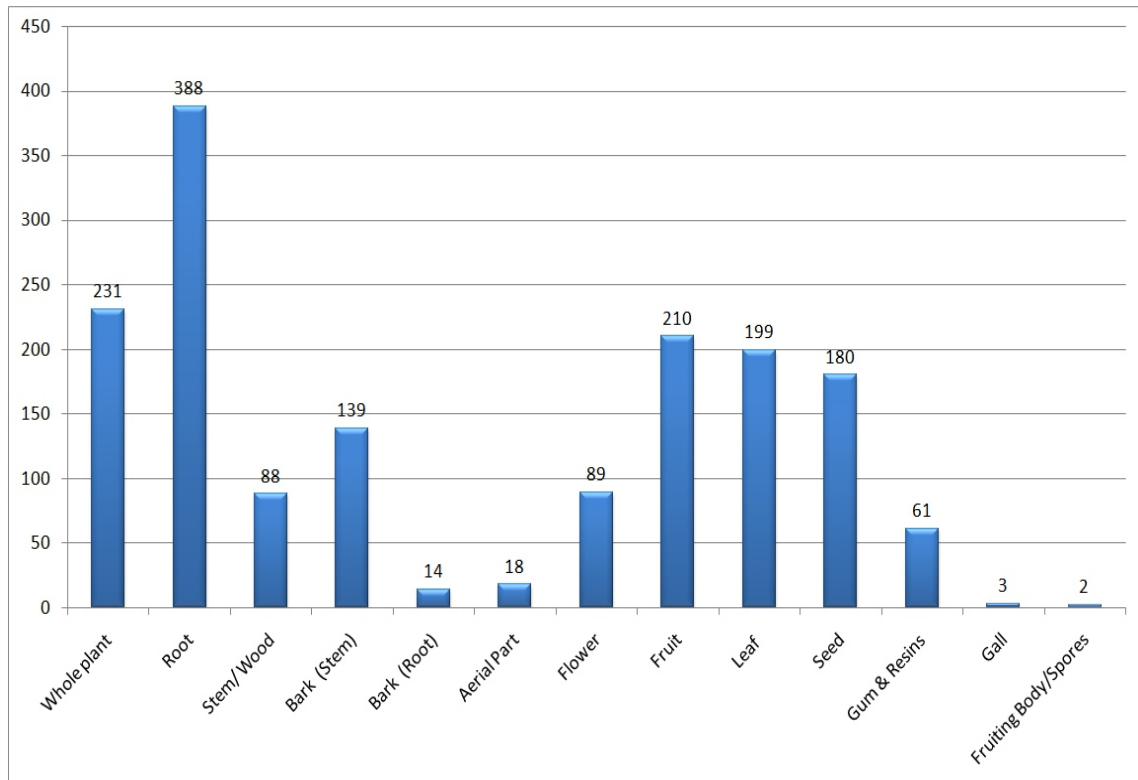


Fig. 11.4: Part-wise Distribution of Herbal Raw Drugs in Commercial Demand

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 COMMERCIAL 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)
<b>Total (Consumption)</b>		<b>4,97,000</b>	
<b>Average Wastage during Handling</b>		<b>14,910</b>	@3% as assessed during interactions with wild gatherers, traders and managers of herbal units.
<b>Total (Demand)</b>		<b>5,11,910</b>	

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
<b>Herbal Industry</b>	1,95,000	1950.00	on an average procurement rate of ₹ 100 per kg
<b>Rural Households</b>	1,67,500	1675.00	
<b>Wastage</b>	14,910	149.00	
<b>Exports</b>	1,34,500	3211.00	As per actual
<b>Total:</b>		<b>6,985.00</b>	

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 PRACTITIONERS 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	<i>Withania somnifera</i>	Amukkuraa, Ashwagandha	Root	6455
2	<i>Aloe vera</i> [= <i>Aloe barbadensis</i> ]	Gritkumari	Leaf	4205
3	<i>Terminalia bellirica</i>	Thandrikaai, Beheda	Fruit	547
4	<i>Terminalia chebula</i>	Kadukkaai, Harda	Seed, Fruit (de-seeded)	542
5	<i>Zingiber officinale</i>	Sukku, Saunth, Haihing, Satianda	Rhizome	505
6	<i>Piper longum</i>	Pipli	Flower, Fruit, Seed	456
7	<i>Phyllanthus emblica</i> [= <i>Emblica officinalis</i> ]	Aonla, Nelli	Fruit (fresh and dry)	407
8	<i>Tinospora cordifolia</i>	Giloe, Amruthvalli, Seendhil, Iraking phum	Stem, Root, Leaf	298
9	<i>Aegle marmelos</i>	Bel	Bark, Fruit Pulp, Leaf	233
10	<i>Alpinia galanga</i>	Perarathai, Kulanjan, Rasna	Rhizome, Root	222
11	<i>Asparagus racemosus</i>	Shatawar	Root/Rhizome, Leaf, Stem	166
12	<i>Plantago ovata</i>	Isobgol	Husk, Seed	136

S. No.	Botanical Name	Local Name	Part Used	Total Annual Consumption (Dry Wt. in Kg)
13	<i>Phyllanthus amarus</i> [= <i>Phyllanthus fraternus</i> ]	Keezhaa nelli, Bhui aonala	Whole Plant	103
14	<i>Swertia chirayita</i>	Chiretta	Whole Plant, Aerial Parts	97
15	<i>Mucuna pruriens</i>	Krouch/ Bidung	Leaf, Seed	91
16	<i>Azadirachta indica</i>	Neem, Vaeppan, Maha Neem	Leaf, Bark, Fruit, Stem	63
17	<i>Saraca asoca</i>	Ashok	Bark, Leaf	60
18	<i>Barleria prionitis</i>	Daskaranta	Whole Plant	60
19	<i>Picrorhiza kurroa</i>	Kutki, Hongbu	Root, Leaf	52
20	<i>Nardostachys jatamansi</i>	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:

- 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).
- 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).
- 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).
- 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	<i>Cymbopogon citratus</i>	Serai, Rohisha, Kattrna	Herb	C	100-200 [≈135]
2	<i>Cymbopogon flexuosus</i>	Lemon grass	Herb	C	100-200
3	<i>Mentha arvensis</i>	Pudina, Podina pati	Herb	C	5000-10000
4	<i>Mentha piperita</i>	Menthol, Peppermint	Herb	C	2000-5000
5	<i>Mentha spicata</i>	Pudina, Pudinah	Herb	C	500-1000
6	<i>Rosa centifolia</i>	Gulab ,Satapatrika	Shrub	C	500-1000
7	<i>Rosa damascena</i>	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	<i>Abelmoschus esculentus</i>	Bhindi	Shrub	C	100-200
2	<i>Allium cepa</i>	Onion	Herb	C	200-500
3	<i>Allium sativum</i>	Lasun, Velathulli, Lasuna	Herb	C	200-500
4	<i>Amomum subulatum</i>	Elachi Badi, Sthulaela	Herb	C	100-200
5	<i>Ananas comosus</i>	Ananas, Pineapple	Herb	C	100-200
6	<i>Anethum graveolens</i>	Sowa, Satahva	Herb	C	200-500
7	<i>Apium graveolens</i>	Ajmoda, Celery, Karaphsa	Herb	C	1000-2000
8	<i>Areca catechu</i>	Supari, Puga	Tree	C	100-200
9	<i>Benincasa hispida</i>	Kumpalanga pacha, Kusmanda	Climber	C	100-200
10	<i>Brassica juncea</i>	Kaduku, Sasuve Bili	Herb	C	100-200
11	<i>Brassica rapa</i>	Sarsapa	Herb	C	500-1000
12	<i>Brassica nigra</i>	Sarson	Herb	C	200-500
13	<i>Camelia sinensis</i>	Tea	Shrub	C	100-200
14	<i>Capsicum annuum</i>	Mirch	Herb	C	100-200
15	<i>Carthamus tinctorius</i>	Kusum phool, Kusumbha	Shrub	C	100-200
16	<i>Citrus aurantifolia</i>	Limbu	Tree	C	200-500
17	<i>Citrus limon</i>	Lemon, Nimbu	Tree	C	500-1000
18	<i>Citrus medica</i>	Matunga, Mahnimbu, Bijapura	Tree	C	1000-2000
19	<i>Coccinia grandis</i>	Kovai, Bimba, Bimbi	Climber	C	100-200
20	<i>Cocos nucifera</i>	Nariyal, Narikela	Tree	C	>10000
21	<i>Coriandrum sativum</i>	Dhaniya, Dhana,	Herb	C	500-1000
22	<i>Cucumis sativus</i>	Dhanyaka Beej Kheera, Trapusam	Climber	C	100-200
23	<i>Cuminum cyminum</i>	Jeera, Shahjeera, Svetajiraka	Herb	C	1000-2000
24	<i>Curcuma longa</i>	Arishna, Haldi, Karimanjal, Haridra	Herb	C	1000-2000
25	<i>Daucus carota var. sativa</i>	Gaajar Beej	Herb	C	100-200
26	<i>Dolichos biflorus</i>	Kulthi, Muthira, Kulattha	Herb	C	200-500
27	<i>Elettaria cardamomum</i>	Elachi Chhoti, Ilaychi, Suksmaila	Herb	C	200-500
28	<i>Foeniculum vulgare</i>	Badiyan Khatal, Saunf, (Variyali), Misreya	Herb	C	500-1000
29	<i>Gossypium herbaceum</i>	Kapas, Karpasa	Shrub	C	100-200
30	<i>Helianthus annuus</i>	Sunflower	Shrub	C	200-500
31	<i>Hordeum vulgare</i>	Jau, Yava	Herb	C	200-500
32	<i>Lagenaria siceraria</i>	Bottlegourd, Sorakkai, Tumbini	Climber	C	200-500
33	<i>Linum usitatissimum</i>	Alsi, Atasi	Herb	C	100-200
34	<i>Malus domestica</i>	Apple, Seb	Tree	C	100-200
35	<i>Mangifera indica</i>	Aamba, Amra	Tree	C	5000-10000
36	<i>Maranta arundinacea</i>	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	<i>Momordica charantia</i>	Karela, Karavallaka	Climber	C	500-1000
38	<i>Nigella sativa</i>	Kalonji, Upakuncika	Herb	C	2000-5000
39	<i>Oryza sativa</i>	Aval, Akki, Thavidu, Sali	Herb	C	>10000
40	<i>Phoenix sylvestris</i>	Khajur	Tree	C	100-200
41	<i>Piper betle</i>	Betle, Nagavalli	Climber	C	200-500
42	<i>Piper nigrum</i>	Pipal Gol, Kalimirch, Marica	Climber	C	1000-2000
43	<i>Prunus dulcis</i>	Badam, Magaj badam	Tree	C	1000-2000
44	<i>Ricinus communis</i>	Arand, Eranda	Shrub	C	1000-2000 [>1400]
45	<i>Saccharum officinarum</i>	Sugar cane, Karumbu, Iksu	Herb	C	5000-10000
46	<i>Sesamum indicum</i>	Til, Tila	Herb	C	>10000
47	<i>Tamarindus indica</i>	Imli, Cinca	Tree	C	1000-2000
48	<i>Trachyspermum ammi</i>	Ajmod, Ajwayan, Yavani	Herb	C	1000-2000
49	<i>Trachyspermum roxburghianum</i>	Sath Ajwayan, Ajmod, Radhuni	Herb	C	100-200
50	<i>Trapa natans</i>	Singhada, Srngataka	Herb	C	100-200
51	<i>Trichosanthes dioica</i>	Patol (Kadu Parval)	Climber	C	100-200
52	<i>Trigonella foenum-graecum</i>	Methi	Herb	C	500-1000
53	<i>Vigna mungo</i>	Urd	Herb	C	100-200
54	<i>Vigna trilobata</i>	Mudgaparni	Herb	C	100-200
55	<i>Vitis vinifera</i>	Draksh, Draksa	Climber	C	1000-2000
56	<i>Zea mays</i>	Maize	Herb	C	2000-5000
57	<i>Zingiber officinale</i>	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	<i>Bambusa arundinacea</i>	Bansalochan, Tabashir	Tree	?	1000-2000
2	<i>Cinnamomum camphora</i>	Kapur, Karpura	Tree	?	2000-5000
3	<i>Gaultheria fragrantissima</i>	Gandhapura Patra Taila	Shrub	?	2000-5000
4	<i>Gaultheria procumbens</i>	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	<i>Abelmoschus moschatus</i>	Muskdana, Kasturilatika Kasthuri vendai	C	100-200	100-150
2	<i>Abies spectabilis</i>	Talispatra, Talisa	HF	100-200	50-60
3	<i>Abrus precatorius</i>	Kunnimuthu, Kundumani, Gundumani, Gunja	W	200-500 [≈110]	90-110
4	<i>Abutilon indicum</i>	Tutti Atibala	W	100-200	10-25
5	<i>Acacia catechu</i>	Katha	TF	500-1000	750-1600
6	<i>Acacia nilotica</i> subsp. <i>indica</i>	Babul, Kikar, Babbula, Karuvelum	TF	1000-2000 [≈520]	75-125
7	<i>Acacia senegal</i>	Gum Arabic, Char Gond	I	>20000	100-300
8	<i>Acacia seyal</i>	Gum Arabic, Talha Gum	I	2000-5000	100-300
9	<i>Acacia sinuata</i>	Shikakai	TF	1000-2000 [≈90]	25-95

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
10	<i>Acalypha indica</i>	Khokali, Haritamanjari	W	100-200 [≈365]	
11	<i>Achillea millefolium</i>	Brinjasif, Yarrow	HF	100-200	150-250
12	<i>Achyranthes aspera</i>	Puthkanda, Apamarga Nayuruvi	W	200-500 [≈2750]	25-35
13	<i>Aconitum heterophyllum</i> <sup>1</sup>	Atis, Ativisa	HF	100-200	3500-10500
14	<i>Acorus calamus</i>	Bach, Ghorbach, Vaca	C	500-1000 [≈165]	50-65
15	<i>Aegle marmelos</i>	Bael, Belgiri, Bilva Vilvam, Bael guda Bael Patti	TF	2000-5000 [≈10600]	15-35
16	<i>Aerva lanata</i>	Cheroola, Pattura	W	100-200 [≈200]	
17	<i>Albizia amara</i>	Krishnasirish, Usilai	TF	100-200	10-15
18	<i>Alhagi pseudalhagi</i>	Durlabha, Yavasaka	W	100-200	
19	<i>Aloe vera</i>	Kumari, Gwarpatha, Kanyasara, Elva, Kumari, Soththu katrazhai	C	>10000 [≈3260]	8-10
20	<i>Alpinia calcarata</i>	Chittaratha Granthimula	C	100-200	
21	<i>Alpinia galanga</i>	Rasnamool, Kulanjan Perarathai	C	200-500	100-130
22	<i>Amorphophallus paeoniifolius</i>	Surankand, Surana	TF	200-500 [≈90]	
23	<i>Anacyclus pyrethrum</i>	Akarkara, Akarkarabha Akraram	I	200-500	200-250
24	<i>Andrographis paniculata</i>	Kalmegh, Neela vembu	TF	2000-5000 [≈2080]	10-30
25	<i>Argyreia elliptica</i>	Bondvel	W	100-200	
26	<i>Arnebia benthamii</i>	Gauzaban	HF	100-200	150-220
27	<i>Artemisia annua</i>	Artemisia	C	1000-2000	150-200
28	<i>Asparagus adscendens</i>	Musali safed, Satawar	HF	200-500	250-400
29	<i>Asparagus racemosus</i>	Shatavari, Shatawar, Satavari	TF	2000-5000 [≈675]	300-500
30	<i>Atropa belladonna</i>	Belladonna	I	200-500	150-200
31	<i>Azadirachta indica</i>	Neem, Vaeppan Nimba	C	2000-5000 [≈9090]	15-30
32	<i>Baccharoides anthelmintica</i>	Kali zeeri, Somnay Vanyajiraka	W	200-500	80-500
33	<i>Bacopa monnieri</i>	Jal Brahmi, Brahmi	W	1000-2000 [≈140]	30-50
34	<i>Baliospermum montanum</i>	Dantimool, Danti	TF	100-200	
35	<i>Barleria prionitis</i>	Vajradanti, Sahacara	W	100-200	
36	<i>Bauhinia variegata</i>	Kachnar, Kancanara	TF	100-200 [≈20]	180-250
37	<i>Berberis aristata</i> <sup>2</sup>	Daruhalidi, Daruharidra	HF	1000-2000 [≈50]	15-55

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
38	<i>Berberis lycium</i> <sup>2</sup>	Daryhaldi, Chitra	HF	1000-2000 [≈285]	15-55
39	<i>Bergenia ciliata</i>	Pashnabhed, Pasanabheda	HF	1000-2000 [≈125]	35-55
40	<i>Betula utilis Bhojpatra</i>	Bhurjah	HF	100-200	125-300
41	<i>Boerhavia diffusa</i>	Punarnava, Mukarattai Punarnava rakta	W	2000-5000 [≈1050]	35-45
42	<i>Bombax ceiba</i>	Mochras, Semal, Salmali	TF	100-200 [≈445]	140-160
43	<i>Boswellia serrata</i>	Guggul dhupa, Mani kundrikam Kunduru	TF	500-1000	100-300
44	<i>Buchanania cochinchinensis</i>	Chironji, Priyala	TF	100-200	450-500
45	<i>Butea monosperma</i>	Tesu phool, Palas phool, Murukkam, Palasa	TF	200-500 [≈605]	15-20 35-45 150-350
46	<i>Caesalpinia bonduc</i>	Sagargota, Kalaachi kaai Latakaranja	TF	100-200 [≈715]	80-120
47	<i>Calendula officinalis</i>	Gulasharfi, Genda Marigold	C	100-200	10-15
48	<i>Capparis spinosa</i>	Kanther, Himsra	W	500-1000	
49	<i>Cardiospermum halicacabum</i>	Mudakkathan, Karnasphota	W	100-200 [≈4500]	15-30
50	<i>Cassia fistula</i>	Amalthas Aragvadha	TF	200-500 [≈840]	10-15
51	<i>Catharanthus roseus</i>	Sadabahar, Vinca	C	200-500 [≈250]	125-175
52	<i>Cedrus deodara</i>	Devdar, Devadaru	HF	1000-2000	25-40
53	<i>Celastrus paniculatus</i>	Vaaluluvai, Malkangani, Jyotismati	TF	200-500	110-200
54	<i>Centella asiatica</i>	Brahmibooti, Vallaarai Mandukaparni	W	500-1000 [≈1870]	200-250 50-100
55	<i>Chaemecrista absus</i>	Chaksoo	W	100-200	350-450
56	<i>Chlorophytum borivillianum</i>	Safed musali	C	100-200	700-1800
57	<i>Chlorophytum tuberosum</i> <sup>3</sup>	Safed musali	TF	200-500	700-1800
58	<i>Chrysopogon zizanioides</i>	Lavanha, Khas, Usira	C	200-500 [≈1355]	70-100
59	<i>Cichorium intybus</i>	Kasani	C	500-1000	75-140
60	<i>Cinnamomum cassia</i>	Dalchini	I	100-200	150-175
61	<i>Cinnamomum sulphuratum</i> <sup>4</sup>	Dalchini, Tejpatta	TF	100-200	150-200
62	<i>Cinnamomum tamala</i> <sup>5</sup>	Tejpatta Tvakapatra	HF	2000-5000 [≈155]	65-80
63	<i>Cinnamomum verum</i>	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	<i>Cissus quadrangularis</i>	Hutjodi, Pirandai, Asthisamhrta	W	200-500 [≈5270]	40-55
65	<i>Citrullus colocynthis</i>	Indrayan, Indravaruni	W	200-500 [≈520]	20-30
66	<i>Clerodendrum phlomidis</i>	Arni, Arnimul, Agnimantha	W	200-500	35-45
67	<i>Clerodendrum serratum</i>	Bharangi, Bharangi	W	100-200	35-45
68	<i>Coleus forskohlii</i>	Gandira Pashan Bhedi	C	100-200	60-190
69	<i>Commiphora wightii</i>	Guggul, Guggulu	TF	1000-2000	650-1000
70	<i>Convolvulus prostratus</i> <sup>6</sup>	Shankapushpi, Sankhapuspi	W	500-1000	20-30
71	<i>Coptis teeta</i>	Mamira, Rohini	HF	100-200 [≈70]	500-600
72	<i>Crateva religiosa</i>	Varun chhal, Varuna	TF	200-500	30-50
73	<i>Cullen corylifolium</i>	Bawachi, Bakuchi	W	200-500	55-75
74	<i>Curculigo orchioides</i>	Nilapanai Kali musali, Talamuli	TF	200-500 [≈135]	180-220
75	<i>Curcuma zerumbet</i>	Kachur Karcura	C	200-500	25-35
76	<i>Cymbopogon citratus</i>	Rohisha, Kattrna	C	100-200 [≈135]	120-150
77	<i>Cymbopogon flexuosus</i>	Lemon grass	C	100-200	120-150
78	<i>Cynodon dactylon</i>	Doob, Durva	W	100-200 [≈2950]	20-25
79	<i>Cyperus rotundus</i>	Motha, Korai kizhangu	W	500-1000 [≈1350]	25-30
80	<i>Cyperus scariosus</i>	Nagarmotha	W	200-500	25-30
81	<i>Datura metel</i>	Duttura, Oomaththai, Umatham Dhattura	W	200-500	50-70
82	<i>Decalepis hamiltonii</i>	Magali	TF	100-200	-
83	<i>Desmodium gangeticum</i>	Salparni, Salaparni	TF	500-1000	30-40
84	<i>Didymocarpus pedicellatus</i>	Shilapushpi, Pasanphodi	HF	100-200	
85	<i>Dioscorea bulbifera</i>	Varahi kand, Varahi	TF	200-500	40-45
86	<i>Eclipta prostrata</i>	Bhringaraj, Karisaalai Bhrngaraja	W	2000-5000 [≈2480]	25-40
87	<i>Embelia ribes</i>	Vaividang, Vavuvidan Vidanga	TF	100-200	450-550
88	<i>Embelia tsjeriam-cottam</i> <sup>7</sup>	Vaividang	TF	500-1000	500-600
89	<i>Ephedra gerardiana</i>	Somalatha	HF	100-200	25-35
90	<i>Erythrina variegata</i>	Murikkila, Paribhadra	TF	100-200 [≈80]	-
91	<i>Eucalyptus globulus</i>	Eucalyptus, Tailaparnah	C	2000-5000	70-100
92	<i>Ferula assa-foetida</i>	Hing, Hingu	I	500-1000	12000
93	<i>Ficus benghalensis</i>	Vadachhal, Nyagrodha	TF	200-500 [≈340]	-
94	<i>Ficus religiosa</i>	Lakh pipal, Arasu, Asvattha	C	200-500 [≈1390]	150-250
95	<i>Flickingeria macraei</i> *	Jivanti	TF	100-200	250-300
96	<i>Fumaria indica</i>	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	<i>Garcinia gummi-gutta</i>	Kokam, Kodampuli	TF	2000-5000	200
98	<i>Garcinia indica</i>	Kokam, Cambogie	TF	100-200 [≈260]	50-65
99	<i>Gloriosa superba</i>	Kalihari, Langali	C	100-200	25-30 200-500
100	<i>Glycyrrhiza glabra</i>	Mulathi, Adhi Madhuarm Yasti	I	2000-5000	100-180
101	<i>Gmelina arborea</i>	Ghambar chal, Gambhari	TF	500-1000	35-40
102	<i>Gymnema sylvestre</i>	Gudmar, Sarkarai kolli, Siru kurinjaan Mesarngi	TF	500-1000 [≈2750]	50-55 90-100
103	<i>Hedychium spicatum</i>	Kapoor kachri, Sati	HF	200-500	150-200
104	<i>Helicteres isora</i>	Marodphali Valampuri-Idampuri	TF	100-200	20-30
105	<i>Hemidesmus indicus</i>	Anatmool, Sveta sariva Nannari, Maahaali, Murod Phah	TF	500-1000 [≈40]	290-300
106	<i>Hibiscus rosa-sinensis</i>	Jashwanti, Japa	C	500-1000 [≈1950]	125-250
107	<i>Holarrhena pubescens</i>	Inderjao, Indirayan Beej Kutaja, Indrayava	TF	500-1000 [≈55]	325-350
108	<i>Holoptelea integrifolia</i>	Aavitholi, Cirabilva	TF	100-200	
109	<i>Homalomena aromatica</i>	Sugan mantri	C	200-500 [≈45]	180-200
110	<i>Hygrophila schulli</i>	Tal makhana, Kokilaksa	W	200-500 [≈170]	250-300
111	<i>Hyoscyamus niger</i>	KhursaniAjwain Parasikayavani	HF	100-200	65-140
112	<i>Indigofera tinctoria</i>	Akika, Nili	C	100-200	50-70
113	<i>Inula racemosa</i>	Pushkarmool Puskara	C	200-500	180-220
114	<i>Ipomoea mauritiana</i>	Palmudhukkan Kshiravidari	TF	200-500	35-50
115	<i>Ipomoea nil</i>	Kaladana	W	100-200	80-140
116	<i>Jasminum officinale</i>	Ban chameli, Jati	C	50-100	325-375
117	<i>Jasminum sambac</i>	Mallika, Mogra	C	100-200	325-375
118	<i>Juniperus communis</i>	Hauber, Hapusa	HF	100-200	80-100
119	<i>Justicia adhatoda</i>	Adusa, Basuti, Vasa	C	2000-5000 [≈1975]	15-25
120	<i>Justicia beddomei</i>	Vasa	C	100-200	15-25
121	<i>Kaempferia galanga</i>	Kachora, Kapoor Kachri No 1	C	100-200	115-220
122	<i>Lactuca sativa</i>	Tukhm-Kahoo	I	100-200	200-550
123	<i>Lawsonia inermis</i>	Henna, Mehendi, Maruthondri Madaynati	C	2000-5000 [≈990]	45-75
124	<i>Lepidium sativum</i>	Asaliya, Candrasura	C	1000-2000	95-110
125	<i>Leptadenia reticulata</i>	Paalai kodi, Jivanti	TF	200-500 [≈220]	100-400
126	<i>Litsea glutinosa</i>	Maida chhal, Medasakah	TF	500-1000	65-75
127	<i>Madhuca indica</i>	Madhuka, Madhuka	TF	200-500	75-100

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
128	<i>Madhuca longifolia</i>	Mahua phool Iluppai	TF	100-200	40-60
129	<i>Martynia annua</i>	Kaknasa, Kakanasika	W	100-200	60-100
130	<i>Melaleuca leucadendra</i>	Cajuput	I	100-200	-
131	<i>Melia azedarach</i>	Bakain, Mahanimba	C	100-200 [≈390]	10-20
132	<i>Mentha longifolia</i>	Jangli Pudina,	HF	100-200 [≈60]	20-85
133	<i>Mesua ferrea</i>	Nagakesari, Nagkeshar	TF	200-500	250-325
134	<i>Mimusops elengi</i>	Bakul	TF	200-500 [≈20]	40-50
135	<i>Morinda citrifolia</i>	Canary wood, Noni	C	500-1000	200-220
136	<i>Morinda coreia</i>	Manjanatthi, Nunna	TF	200-500 [≈295]	-
137	<i>Moringa oleifera</i>	Sahenjana, Murungai Sigru	C	500-1000 [≈8650]	400-500 90-130
138	<i>Mucuna pruriens</i> var. <i>utilis</i>	Kavach beej, Kaunch beej, Atmagupta	TF	500-1000 [≈30]	60-100
139	<i>Murraya koenigii</i>	Kariveppila, Mitha Neem, Kari Patta, Karuvepilai Saurabha-nimba	C	200-500 [≈540]	25-35
140	<i>Myristica fragrans</i>	Jatipatre, Jaathikaai, Jaiphal, Javitri Jatiphala	C	200-500	475-550 850-950
141	<i>Nardostachys jatamansi</i>	Balchad, Jatamansi	HF	500-1000	850-900
142	<i>Nelumbo nucifera</i>	Kamal phul, Kamalgatta Kamala	C	100-200	80-100
143	<i>Neopicrorhiza</i> <i>scrophulariiflora</i>	Kutki	HF	100-200	800-900
144	<i>Ocimum americanum</i>	Bantulsi	W	200-500 [≈95]	10-20
145	<i>Ocimum basilicum</i>	Sweet basil, Kali tulsi, Tukmaria	C	200-500 [≈75]	120-225
146	<i>Ocimum gratissimum</i>	Vana tulasi, Tukmaria	C	1000-2000	90-110
147	<i>Ocimum tenuiflorum</i>	Tulsi, Tulasi	C	2000-5000 [≈30000]	50-75
148	<i>Onosma bracteata</i>	Gazbaan, Gojihva	I	100-200	240-270
149	<i>Onosma hispida</i>	Ratan jot	HF	100-200	225-250
150	<i>Operculina turpethum</i>	Nishoth, Shivadi Trivrta	TF	500-1000 [≈120]	115-180
151	<i>Oroxylum indicum</i>	Tetuchaal, Syonaka	TF	500-1000 [≈310]	30-40
152	<i>Paederia foetida</i>	Prasaarani, Prasarini	TF	100-200 [≈510]	30-40
153	<i>Parmelia perlata</i>	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	<i>Pedaliium murex</i>	Gokhru bada Annai nerunji, Peru nerinjal	W	100-200 [≈160]	160-200
155	<i>Peganum harmala</i>	Harmal, Lal dana	W	100-200	60-80
156	<i>Phyllanthus amarus</i> <sup>8</sup>	Bhumiamla, Keezhaa nelli, Tamalaki	W	1000-2000 [≈265]	30-40
157	<i>Phyllanthus emblica</i>	Amla, Nelli Amalaki	TF	>10000 [≈11980]	50-80
158	<i>Phyllanthus maderaspatensis</i>	Kanocha, Meeva nelli	W	1000-2000	-
159	<i>Picrorhiza kurroa</i> <sup>9</sup>	Kutki, Katuka	HF	1000-2000	800-900
160	<i>Pinus roxburghii</i>	Gandabiroja, Sarala	HF	1000-2000	70-80
161	<i>Piper chaba</i>	Sheetal chini, Cubub, Kabab chini, Chavya	I	200-500	850-900
162	<i>Piper longum</i>	Pipal, Pippali, Pippalimula	C	1000-2000 1000-2000	625-850 100-300
163	<i>Pistacia integerrima</i>	Kakarsinghi, Karkatasrangi	HF	200-500	800-1000
164	<i>Plantago ovata</i>	Isabgol	C	>30000	100-200
165	<i>Pluchea lanceolata</i>	Rasna	W	200-500	25-30
166	<i>Plumbago indica</i>	Chitrak, Rakta Citraka	C	100-200	90-150
167	<i>Plumbago zeylanica</i>	Chitrak, Kodiveli, Chitramulam Citraka	W	500-1000 [≈1345]	35-135
168	<i>Polygonatum cirrhifolium</i>	Salam Mishri, Meda, Mahameda	HF	100-200	250-350
169	<i>Pongamia pinnata</i>	Honge beej, Karanja	C	500-1000	35-45
170	<i>Premna corymbosa</i>	Munnai, Arni	TF	100-200	25-30
171	<i>Premna serratifolia</i>	Arnimool, Agnimantha	TF	100-200	-
172	<i>Prunus armeniaca</i>	Chuli	C	100-200	-
173	<i>Prunus cerasoides</i>	Padamkasht, Padmaka	HF	100-200	75-85
174	<i>Pseudarthria viscida</i>	Moovila	W	200-500	-
175	<i>Pterocarpus marsupium</i>	Bijasal, Asana	TF	200-500 [≈1410]	30-40
176	<i>Pterocarpus santalinus</i>	Lal chandan, Raktachandana	TF	200-500	150-300
177	<i>Pueraria tuberosa</i>	Patal, Vidari Vidhari kanda	TF	500-1000	35-50
178	<i>Punica granatum</i>	Dadam, Dadima	HF	500-1000 [≈300]	450-500
179	<i>Quercus infectoria</i>	Majuphal, Mayakku	I	100-200	475-550
180	<i>Rauvolfia serpentina</i>	Pagal Buti, Sarpagandha	TF	200-500 [≈25]	800-850
181	<i>Rheum australe</i> <sup>10</sup>	Revan chini, Dolu, Padamchal	HF	100-200 [≈35]	100-250
182	<i>Rhododendron arboreum</i>	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	<i>Rubia cordifolia</i>	Majith, Manjistha	TF	1000-2000	160-180
184	<i>Salacia reticulata</i>	Pitila	TF	100-200	550-650
185	<i>Salix caprea</i>	Baid-mushk	I	200-500	-
186	<i>Santalum album</i>	Chandan, Sveta candana	TF	500-1000	10000
187	<i>Sapindus mukorossi</i> <sup>11</sup>	Aretha mota, Reetha, Soapnut	C	200-500 [≈115]	30-35
188	<i>Saraca asoca</i>	Ashoka	TF	1000-2000	65-150
189	<i>Saussurea costus</i>	Kuth, Uplet, Kustha	C	100-200	250-350
190	<i>Scindapsus officinalis</i>	Gaj pipal Gajapippali	TF	100-200	20-30
191	<i>Semecarpus anacardium</i>	Balave, Bhallataka	TF	200-500	15-20
192	<i>Senna alexandrina</i>	Sona patta, Svarnapatri	C	>10000	80-125
193	<i>Senna auriculata</i>	Avarai, Aavaarai	W	500-1000	20-30
194	<i>Senna occidentalis</i>	Kasondi, Kasmardah	W	200-500	-
195	<i>Senna tora</i>	Chakoda Beeja, Prapunnada	W	>20000	45-55
196	<i>Shorea robusta</i>	Raal, Sala	TF	100-200	50-70 215-350
197	<i>Sida acuta</i>	Bala	W	100-200	10-20
198	<i>Sida cordifolia</i>	Bala, Beej Bandh, Kharetti	W	1000-2000	10-20
199	<i>Sida rhombifolia</i> <sup>12</sup>	Bala, Mahabala	W	1000-2000	10-20
200	<i>Smilax china</i>	Chobchini, Madhusuhi	I	100-200	300-600
201	<i>Solanum anguivi</i>	Katheli badi, Brhati	W	500-1000 [≈130]	70-80
202	<i>Solanum nigrum</i>	Makoi, Kakamaci	W	2000-5000 100-200 [≈1685]	110-120 20-25
203	<i>Solanum virginianum</i>	Kateli, Kantakari	W	500-1000 [≈295]	30-35
204	<i>Spermacoce hispida</i>	Thaarthaaval	W	100-200	-
205	<i>Sphaeranthus indicus</i>	Gorakmundi, Munditika	W	200-500	30-40
206	<i>Stereospermum chelonoides</i> <sup>13</sup>	Patala, Padal fali, Patalai	T	500-1000	16-20
207	<i>Stereospermum tetragonum</i>	Patala, Patalai	TF	200-500	-
208	<i>Strobilanthes ciliata</i>	Kurinji, Sahchara	TF	200-500	-
209	<i>Strychnos nux-vomica</i>	Kuchla, Nirmali, Visamusti	TF	500-1000	55-75
210	<i>Strychnos potatorum</i>	Nirmali, Thaethaan Kataka	TF	100-200	120-140
211	<i>Swertia chirayita</i> <sup>14</sup>	Chiraiyata, Kiratatikta	HF	500-1000 [≈145]	300-325
212	<i>Symplocos cochinchinensis</i>	Lodhra	TF	100-200	45-55
213	<i>Symplocos racemosa</i> <sup>15</sup>	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	<i>Syzygium cumini</i>	Jamun, Jambu	C	500-1000 [≈860]	30-40
215	<i>Tamarix gallica</i>	Manna Plant, Jhav, French Tamarisk	I	100-200	-
216	<i>Tamarix indica</i>	Jhan	W	100-200	-
217	<i>Tanacetum cinerariifolium</i>	Pyrethrum	C	200-500	-
218	<i>Taxus wallichiana</i>	Talispatra, Sthauneya	HF	100-200	45-50
219	<i>Tecomella undulata</i>	Rohida, Rohitaka	TF	100-200	-
220	<i>Tephrosia purpurea</i>	Sarad foka, Sarpankha, Kozhinji, Surphanka	W	200-500	10-20
221	<i>Teramnus labialis</i>	Masaparni	W	100-200	40-50
222	<i>Terminalia arjuna</i>	Arjun, Arjuna	TF	2000-5000 [≈2750]	20-25
223	<i>Terminalia bellirica</i>	Behdea, Bibhitaka	TF	2000-5000 [≈5780]	10-30
224	<i>Terminalia chebula</i>	Harda, Haritaki	TF	5000-10000 [≈5740]	15-30
225	<i>Tinospora cordifolia</i> <sup>16</sup>	Giloy, Amruthvalli, Seendhil Guduci	W	1000-2000 [≈2330]	35-40
226	<i>Tinospora sinensis</i>	Amrata, Giloy	W	1000-2000	35-40
227	<i>Tragia involucrata</i>	Barhanta, Vrscikalli	W	200-500	-
228	<i>Trianthema decandra</i>	Saaranaï ver,	W	100-200 [≈55]	-
229	<i>Tribulus lanuginosus</i>	Gokhru, Seru nerunjil	W	200-500	100-120
230	<i>Tribulus terrestris</i> <sup>17</sup>	Gokhru, Gokshura	W	2000-5000 [≈80]	100-120
231	<i>Trichosanthes cucumerina</i>	Patol panchang	W	100-200	35-40
232	<i>Trillidium govanianum</i>	Nag Chhatri, Satva	HF	200-500	2000-2500
233	<i>Uraria picta</i>	Prshniparni, Prsniparni	C	200-500	
234	<i>Valeriana jatamansi</i> <sup>18</sup>	Musakbala, Tagar ganth, Sugandhbala, Asaroon, Tagara	HF	1000-2000	370-425
235	<i>Viola pilosa</i> <sup>19</sup>	Banafasha	HF	100-200	850-1200
236	<i>Vitex negundo</i>	Neergundi, Nirgundi, Renuka	C	500-1000 [≈760]	25-30
237	<i>Withania somnifera</i>	Ashwagandha, Amukkuraa, Asvagandha	C	2000-5000 [≈20]	225-350
238	<i>Woodfordia fruticosa</i>	Dhaiphool, Thaathiri Dhataki	TF	2000-5000	60-70
239	<i>Wrightia tinctoria</i>	Indrajau	TF	200-500	60-65
240	<i>Zanthoxylum armatum</i>	Tejbal, Timur Tejovati	HF	200-500 [≈220]	100-200
241	<i>Zingiber zerumbet</i>	Narkachur	C	1000-2000	38-40

S. No.	Botanical Name	Trade Name(s)	Major Supply Source*	Estimated Annual Trade (MT)*	Rate (₹/Kg)
242	<i>Ziziphus mauritiana</i>	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 volume 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 quantities 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 'extracts' 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 Categories 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	<i>Aconitum chasmanthum</i>	Ranunculaceae	H	CR
2	<i>Aconitum heterophyllum</i>	Ranunculaceae	H	CR
3	<i>Justicia beddomei</i>	Acanthaceae	S	CR
4	<i>Aquilaria malaccensis</i>	Aquilariaceae	T	CR
5	<i>Arnebia benthami</i>	Boraginaceae	H	CR
6	<i>Arnebia euchroma</i>	Boraginaceae	H	CR
7	<i>Atropa acuminata</i>	Solanaceae	H	CR
8	<i>Betula utilis</i>	Betulaceae	T	CR
9	<i>Chlorophytum borivillianum</i>	Liliaceae	H	CR
10	<i>Cochlospermum religiosum</i>	Cochlospermaceae	T	CR
11	<i>Commiphora wightii</i>	Lauraceae	S	CR
12	<i>Coscinium fenestratum</i>	Menispermaceae	C	CR
13	<i>Cycas circinalis</i>	Cycadaceae	T	CR
14	<i>Dactylorhiza hatagirea</i>	Orchidaceae	H	CR
15	<i>Embelia ribes</i>	Myrsinaceae	C	CR
16	<i>Gentiana kurroo</i>	Gentianaceae	H	CR
17	<i>Holostemma ada-kodien</i>	Asclepiadaceae	C	CR
18	<i>Illicium griffithii</i>	Illiciaceae	T	CR
19	<i>Lilium polyphyllum</i>	Liliaceae	H	CR
20	<i>Litsea glutinosa</i>	Lauraceae	T	CR
21	<i>Malaxis muscifera</i>	Orchidaceae	H	CR
22	<i>Nardostachys jatamansi</i>	Valerianaceae	H	CR
23	<i>Panax pseudoginseng</i>	Araliaceae	H	CR
24	<i>Picrorhiza kurroo</i>	Scrophulariaceae	H	CR
25	<i>Pterocarpus marsupium</i>	Fabaceae	T	CR
26	<i>Pterocarpus santalinus</i>	Fabaceae	T	CR
27	<i>Pueraria tuberosa</i>	Fabaceae	C	CR
28	<i>Rauvolfia serpentina</i>	Apocynaceae	H	CR
29	<i>Saraca asoca</i>	Caesalpiaceae	T	CR
30	<i>Saussurea costus</i>	Asteraceae	H	CR
31	<i>Saussurea obvallata</i>	Asteraceae	H	CR
32	<i>Podophyllum hexandrum</i>	Podophyllaceae	H	CR
33	<i>Smilax glabra</i>	Smilacaceae	C	CR
34	<i>Swertia chirayita</i>	Gentianaceae	H	CR
35	<i>Symplocos racemosa</i>	Symplocaceae	T	CR
36	<i>Taxus wallichiana</i>	Taxaceae	T	CR
37	<i>Aconitum palmatum</i>	Ranunculaceae	H	EN
38	<i>Aconitum heterophyloides</i>	Ranunculaceae	H	EN
39	<i>Aconitum ferox</i>	Ranunculaceae	H	EN
40	<i>Aconitum lethale</i>	Ranunculaceae	H	EN
41	<i>Acorus calamus</i>	Acoraceae	H	EN
42	<i>Alpinia calcarata</i>	Zingiberaceae	H	EN
43	<i>Angelica glauca</i>	Apiaceae	H	EN
44	<i>Asparagus racemosus</i>	Liliaceae	C	EN
45	<i>Boswellia serrata</i>	Burseraceae	T	EN
46	<i>Bunium persicum</i>	Apiaceae	H	EN
47	<i>Celastrus paniculatus</i>	Celastraceae	C	EN

S. No.	Species	Family	Habit	Threat Category Assigned
48	<i>Chlorophytum arundinaceum</i>	Liliaceae	H	EN
49	<i>Chonemorpha fragrans</i>	Apocynaceae	C	EN
50	<i>Cinnamomum wightii</i>	Lauraceae	T	EN
51	<i>Clerodendrum serratum</i>	Verbenaceae	S	EN
52	<i>Coptis teeta</i>	Ranunculaceae	H	EN
53	<i>Decalepis hamiltonii</i>	Periplocaceae	C	EN
54	<i>Dendrobium nobile</i>	Orchidaceae	H	EN
55	<i>Didymocarpus pedicillata</i>	Gesneriaceae	H	EN
56	<i>Dioscorea deltoidea</i>	Dioscoreaceae	C	EN
57	<i>Dysoxylum malabaricum</i>	Meliaceae	T	EN
58	<i>Entada pursaetha</i>	Mimosaceae	C	EN
59	<i>Ephedra gerardiana</i>	Ephedraceae	S	EN
60	<i>Flickingeria fugax</i>	Orchidaceae	H	EN
61	<i>Fritillaria roylei</i>	Liliaceae	H	EN
62	<i>Fumaria indica</i>	Fumaricaceae	H	EN
63	<i>Garcinia pedunculata</i>	Clusiaceae	T	EN
64	<i>Gloriosa superba</i>	Liliaceae	C	EN
65	<i>Gymnema sylvestre</i>	Asclepiaceae	C	EN
66	<i>Habenaria intermedia</i>	Orchidaceae	H	EN
67	<i>Homalomena aromatica</i>	Araceae	H	EN
68	<i>Hyoscyamus niger</i>	Solanaceae	H	EN
69	<i>Juniperus polycarpus</i>	Cupressaceae	S	EN
70	<i>Jurinea dolomiaea</i>	Asteraceae	H	EN
71	<i>Leptadenia reticulata</i>	Asclepiadaceae	C	EN
72	<i>Luffa echinata</i>	Cucurbitaceae	C	EN
73	<i>Manilkara hexandra</i>	Sapotaceae	T	EN
74	<i>Meconopsis aculeata</i>	Papaveraceae	H	EN
75	<i>Mesua ferrea</i>	Clusiaceae	T	EN
76	<i>Michelia champaca</i>	Magnoliaceae	T	EN
77	<i>Mucuna pruriens</i>	Fabaceae	C	EN
78	<i>Nervilia aragoana</i>	Orchidaceae	H	EN
79	<i>Nilgirianthus ciliatus</i>	Acanthaceae	S	EN
80	<i>Mappia foetida</i>	Icacinaceae	T	EN
81	<i>Operculina turpethum</i>	Convolvulaceae	C	EN
82	<i>Oroxylum indicum</i>	Bignoniaceae	T	EN
83	<i>Desmodium oojeinense</i>	Fabaceae	T	EN
84	<i>Paris polyphylla</i>	Liliaceae	H	EN
85	<i>Piper longum</i>	Piperaceae	H	EN
86	<i>Piper nigrum</i>	Piperaceae	C	EN
87	<i>Coleus forskohlii</i>	Lamiaceae	H	EN
88	<i>Plumbago indica</i>	Plumbaginaceae	H	EN
89	<i>Polygonatum cirrhifolium</i>	Liliaceae	H	EN
90	<i>Rheum australe</i>	Polygonaceae	H	EN
91	<i>Rheum moorcroftianum</i>	Polygonaceae	H	EN
92	<i>Rhododendron anthopogon</i>	Ericaceae	S	EN
93	<i>Salacia reticulata</i>	Hippocrateaceae	S	EN
94	<i>Santalum album</i>	Santalaceae	T	EN
95	<i>Sterculia urens</i>	Sterculiaceae	T	EN



S. No.	Species	Family	Habit	Threat Category Assigned
96	<i>Stereospermum tetragonum</i>	Bignoniaceae	T	EN
97	<i>Tecomella undulata</i>	Bignoniaceae	T	EN
98	<i>Trichopus zeylanicus</i>	Trichopodaceae	H	EN
99	<i>Zanthoxylum armatum</i>	Rutaceae	S	EN
100	<i>Zanthoxylum rhetsa</i>	Rutaceae	S	EN

Source: FRLHT database

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/ degradation 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	<i>Abies spectabilis</i>	-	19	<i>Nardostachys jatamansi</i>	CR
2	<i>Achillea millefolium</i>	-	20	<i>Neopicrorhiza scrophulariiflora</i>	-
3	<i>Aconitum heterophyllum</i>	CR	21	<i>Onosma hispida</i>	-
4	<i>Asparagus adscendens</i>	-	22	<i>Parmelia perlata</i>	-
5	<i>Arnebia benthamii</i>	CR	23	<i>Picrorhiza kurroa</i>	-
7	<i>Berberis lyceum</i>	-	25	<i>Pistacia integerrima</i>	-
8	<i>Bergenia ciliata</i>	-	26	<i>Polygonatum cirrhifolium</i>	EN
9	<i>Betula utilis</i>	CR	27	<i>Prunus cerasoides</i>	-
10	<i>Cedrus deodara</i>	-	28	<i>Punica granatum</i>	-
11	<i>Cinnamomum tamala</i>	-	29	<i>Rheum australe</i>	EN
12	<i>Coptis teeta</i>	EN	30	<i>Rhododendron arboreum</i>	-
13	<i>Didymocarpus pedicellatus</i>	EN	31	<i>Swertia chirayita</i>	CR
14	<i>Ephedra gerardiana</i>	EN	32	<i>Taxus wallichiana</i>	CR
15	<i>Hedychium spicatum</i>	-	33	<i>Trillidium govanianum</i>	-
16	<i>Hyoscyamus niger</i>	EN	34	<i>Valeriana jatamansi</i>	VU
17	<i>Juniperus communis</i>	-	35	<i>Viola pilosa</i>	-
18	<i>Mentha longifolia</i>	-	36	<i>Zanthoxylum armatum</i>	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	<i>Aconitum chasmanthum</i>	CR	13	<i>Gentiana kurroo</i>	CR
2	<i>Aconitum ferox</i>	EN	14	<i>Habenaria intermedia</i>	EN
3	<i>Aconitum heterophyloides</i>	EN	15	<i>Juniperus polycarpus</i>	EN
4	<i>Aconitum lethale</i>	EN	16	<i>Jurinea dolomiaea</i>	EN
5	<i>Aconitum palmatum</i>	EN	17	<i>Lilium polyphyllum</i>	CR
6	<i>Angelica glauca</i>	EN	18	<i>Malaxis muscifera</i>	CR
7	<i>Arnebia euchroma</i>	CR	19	<i>Meconopsis aculeata</i>	EN
8	<i>Atropa acuminata</i>	CR	20	<i>Paris polyphylla</i>	EN
9	<i>Bunium persicum</i>	EN	21	<i>Podophyllum hexandrum</i>	CR
10	<i>Dactylorhiza hatageria</i>	CR	22	<i>Rheum moorcroftianum</i>	EN
11	<i>Dioscorea deltoidea</i>	EN	23	<i>Rhododendron anthopogon</i>	EN
12	<i>Fritillaria roylei</i>	EN	24	<i>Saussurea obvallata</i>	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 edgeworthii*)



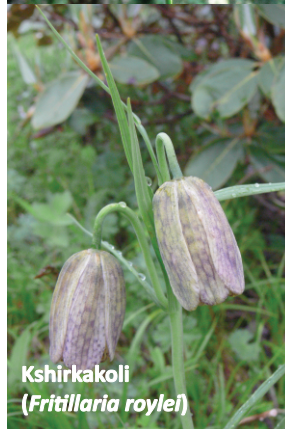
Kshirkakoli  
(*Lilium polyphyllum*)



Jeevak (*Crepidium acuminatum*)



Risbak (*Malaxis muscifera*)



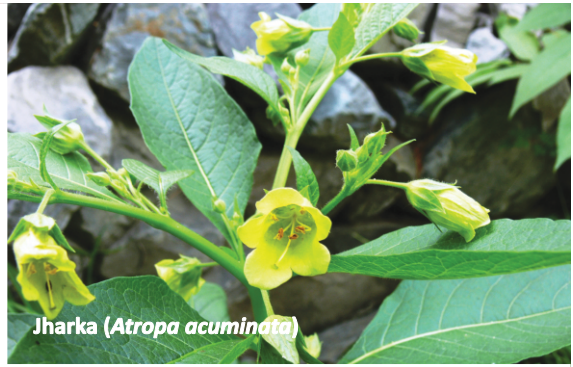
Kshirkakoli  
(*Fritillaria roylei*)

Ashtavarga - A Red-Listed Group of Himalayan Medicinal Plants





Triaman (*Gentiana kurroo*)



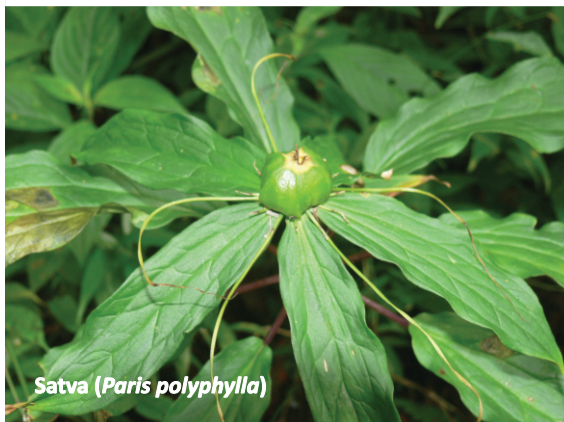
Jharka (*Atropa acuminata*)



Ban kakri (*Podophyllum hexandrum*)



Ghugi (*Saussurea simpsoniana*)



Satva (*Paris polyphylla*)



Dhoop (*Jurinia macrocephala*)



Jatamansi  
(*Nardostachys jatamansi*)



Bhoj Patra (*Betula utilis*)



Ratanjot (*Arnebia benthamii*)

Some Red-Listed Himalayan Medicinal Plants



(*Pinus roxburghii*) are spread over vast expanses and are under silvicultural 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 adulteration. 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	<i>Acacia catechu</i>	-	40	<i>Leptadenia reticulata</i>	EN
2	<i>Acacia nilotica subsp. indica</i>	-	41	<i>Litsea glutinosa</i>	CR
3	<i>Acacia sinuata</i>	-	42	<i>Madhuca indica</i>	-
4	<i>Aegle marmelos</i>	VU	43	<i>Madhuca longifolia</i>	VU
5	<i>Albizia amara</i>	-	44	<i>Mesua ferrea</i>	EN
6	<i>Amorphophallus paeoniifolius</i>	VU	45	<i>Mimusops elengi</i>	-
7	<i>Andrographis paniculata</i>	VU	46	<i>Morinda coreia</i>	-
8	<i>Asparagus racemosus</i>	EN	47	<i>Mucuna pruriens</i>	EN
9	<i>Baliospermum montanum</i>	VU	48	<i>Operculina turpethum</i>	EN
10	<i>Bauhinia variegata</i>	-	49	<i>Oroxylum indicum</i>	EN
11	<i>Bombax ceiba</i>	-	50	<i>Paederia foetida</i>	VU
12	<i>Boswellia serrata</i>	EN	51	<i>Phyllanthus emblica</i>	VU
13	<i>Buchanania cochinchinensis</i>	VU	52	<i>Premna corymbosa</i>	-
14	<i>Butea monosperma var. lutea</i>	EN	53	<i>Premna serratifolia</i>	
15	<i>Caesalpinia bonduc</i>	-	54	<i>Pterocarpus marsupium</i>	-
16	<i>Cassia fistula</i>	-	55	<i>Pterocarpus santalinus</i>	CR
17	<i>Celastrus paniculatus</i>	EN	56	<i>Pueraria tuberosa</i>	CR
18	<i>Chlorophytum arundinaceum</i>	EN	57	<i>Rauvolfia serpentina</i>	CR
19	<i>Cinnamomum sulphuratum</i>	VU	58	<i>Rubia cordifolia</i>	CR
20	<i>Commiphora wightii</i>	CR	59	<i>Salacia reticulata</i>	VU

S. No.	Species	Threat Status	S. No.	Species	Threat Status
21	<i>Crateva religiosa</i>	-	60	<i>Santalum album</i>	EN
22	<i>Curculigo orchioides</i>	-	61	<i>Saraca asoca</i>	EN
23	<i>Decalepis hamiltonii</i>	EN	62	<i>Scindapsus officinalis</i>	CR
24	<i>Desmodium gangeticum</i>	-	63	<i>Semecarpus anacardium</i>	VU
25	<i>Dioscorea bulbifera</i>	VU	64	<i>Shorea robusta</i>	-
26	<i>Embelia ribes</i>	CR	65	<i>Stereospermum chelonoides</i>	-
27	<i>Embelia tsjeriam-cottam</i>	VU	66	<i>Stereospermum tetragonum</i>	-
28	<i>Erythrina variegata</i>	-	67	<i>Strobilanthes ciliata</i>	EN
29	<i>Ficus benghalensis</i>	-	68	<i>Strychnos nux-vomica</i>	-
30	<i>Flickingeria macraei</i>	EN	69	<i>Strychnos potatorum</i>	VU
31	<i>Garcinia gummi-gutta</i>	-	70	<i>Symplocos cochinchinensis</i>	VU
32	<i>Garcinia indica</i>	VU	71	<i>Symplocos racemosa</i>	-
33	<i>Gmelina arborea</i>	-	72	<i>Tecomella undulata</i>	CR
34	<i>Gymnema sylvestre</i>	EN	73	<i>Terminalia arjuna</i>	EN
35	<i>Helicteres isora</i>	-	74	<i>Terminalia bellirica</i>	VU
36	<i>Hemidesmus indicus</i>	-	75	<i>Terminalia chebula</i>	-
37	<i>Holarrhena pubescens</i>	-	76	<i>Woodfordia fruticosa</i>	VU
38	<i>Holoptelea integrifolia</i>	-	77	<i>Wrightia tinctoria</i>	-
39	<i>Ipomoea mauritiana</i>	-	78	<i>Ziziphus mauritiana</i>	-

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 endemics 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	<i>Aquilaria malaccensis</i>	CR	3	<i>Holostemma ada-kodien</i>	CR
2	<i>Coscinium fenestratum</i>	EN	4	<i>Panax pseudoginseng</i>	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.

Availability 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 tetragonum*) 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 quantities 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	<i>Abrus precatorius</i>	31	<i>Ocimum americanum</i>
2	<i>Abutilon indicum</i>	32	<i>Pedaliium murex</i>
3	<i>Acalypha indica</i>	33	<i>Peganum harmala</i>
4	<i>Achyranthes aspera</i>	34	<i>Phyllanthus amarus</i>
5	<i>Aerva lanata</i>	35	<i>Phyllanthus maderaspatensis</i>
6	<i>Alhagi pseudalhagi</i>	36	<i>Pluchea lanceolata</i>
7	<i>Argyrea elliptica</i>	37	<i>Plumbago zeylanica</i>
8	<i>Baccharoides anthelmintica</i>	38	<i>Pseudarthria viscida</i>
9	<i>Bacopa monnieri</i>	39	<i>Senna auriculata</i>
10	<i>Barleria prionitis</i>	40	<i>Senna occidentalis</i>
11	<i>Boerhavia diffusa</i>	41	<i>Senna tora</i>
12	<i>Capparis spinosa</i>	42	<i>Sida acuta</i>
13	<i>Cardiospermum halicacabum</i>	43	<i>Sida cordifolia</i>
14	<i>Centella asiatica</i>	44	<i>Sida rhombifolia</i>
15	<i>Chaemecrista absus</i>	45	<i>Solanum anguivi</i>
16	<i>Cissus quadrangularis</i>	46	<i>Solanum nigrum</i>
17	<i>Citrullus colocynthis</i>	47	<i>Solanum virginianum</i>
18	<i>Clerodendrum phlomidis</i>	48	<i>Spermacoce hispida</i>
19	<i>Clerodendrum serratum</i>	49	<i>Sphaeranthus indicus</i>
20	<i>Convolvulus prostratus</i>	50	<i>Tamarix indica</i>
21	<i>Cullen corylifolium</i>	51	<i>Tephrosia purpurea</i>
22	<i>Cynodon dactylon</i>	52	<i>Teramnus labialis</i>
23	<i>Cyperus rotundus</i>	53	<i>Tinospora cordifolia</i>
24	<i>Cyperus scariosus</i>	54	<i>Tinospora sinensis</i>
25	<i>Datura metel</i>	55	<i>Tragia involucrata</i>
26	<i>Eclipta prostrata</i>	56	<i>Trianthema decandra</i>
27	<i>Fumaria indica</i>	57	<i>Tribulus lanuginosus</i>
28	<i>Hygrophila schulli</i>	58	<i>Tribulus terrestris</i>
29	<i>Ipomoea nil</i>	59	<i>Trichosanthes cucumerina</i>
30	<i>Martynia annua</i>		

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, fungicides and herbicides, many of the waste lands and road/ rail/ canal sides have come under discharge of industrial effluents 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 scariosus*, *Phyllanthus amarus*, *Solanum nigrum*, 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 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 segregate 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 in India can not be interpreted through these two studies.