Medicinal and Aromatic Plants in India

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Introduction
Medicinal and aromatic plants play a significant role in the life of people and are present in innumerable forms. In Indian traditions, all the plants in this earth are considered as medicinal [Jivak in Astanga Hriday (Sutra:9-10)]. However, a simplest definition of the medicinal plant would be “Medicinal plants are those plants which are used in official and various traditional systems of medicines throughout the world”. Other definition could be “Medicinal plants are plants that provide people with medicines - to prevent disease, maintain health or cure ailments”. In one form or another, they benefit virtually everyone on earth. No exact definition of Medicinal Plant is possible. There are related issues, such as for nutrition, toiletry, body care, incense and ritual healing. Aromatic plants are a special class of plants used for their aroma and flavour. Many of them are exclusively used also for medicinal purposes in aromatherapy as well as in various systems of medicine. Similarly a number of medicinal plants also produce essential oils as well as being used for perfumery e.g. Petroselinum sativum, Daucus carota, Anethum graveolens and Pimpinella anisum, etc. In this chapter we shall deal these special classes of plants together as medicinal and aromatic plants (MAP).

India has been considered as treasure house of a large number of valuable medicinal and aromatic plant species. Ministry of Environment and Forests has identified and documented over 9500 plant species considering their importance in the pharmaceutical industry. MAP species are still by and large gathered and collected from the wild and relatively a few are cultivated in farmland. The exploitation from the nature coupled with increasing urbanization has led to steady erosion and loss of MAPs biodiversity from the natural habitat. It is, therefore, relevant that these valuable plant species are not only preserved but also their cultivation practices are developed in order to meet the entire demand of the domestic industries as also to harness the bright prospect for current export. Shift from collection to cultivation of MAP will also ensure purity, authenticity and sustainable supply of raw drugs. Foreign exchange earning potential from these groups of plants in India is estimated to be over US$ 3000 million per annum.

Distribution of Medicinal and Aromatic Plants (MAP)
An analysis of distribution of MAP in natural habitat showed that about 70% of India’s MAPs are found in tropical forests of Western and Eastern ghats, the Vindhya, Chotta Nagpur plateau, Aravallis and the Himalayas. Studies also showed that a large percentage of known MAPs occur in the dry and moist deciduous vegetation area compared to evergreen and temperate regions. Habit-wise classification showed that about 33% are trees, 32% herbs, 20% shrubs, 12% creepers and 3% others (Fig. 1).
An analysis of 386 families and 2200 genera in which MAPs are recorded showed that Asteraceae family possess highest number of species (Fig. 2).

Crude drugs marketed are usually dried parts of MAPs such as roots, stems, wood, bark, seeds, fruits, flowers, leaves, rhizome, whole plant etc., (Fig. 3) that form the essential raw material for the production of medicines in various systems such as Ayurveda, Siddha, Unani, Tibetan, Tribal, and Homeopathy.

**Cultivation**
Cultivation of MAPs is different than that of other agricultural crops. These plants are grown unlike the other crops for secondary metabolites and do not desire to have even stress quantity of pesticides or heavy metals. Therefore, WHO has insisted to develop Good Agricultural Practices (GAP) for MAPs to guarantee quality of raw drug and to facilitate the standardization of quality of ISM drugs for acceptance to science led world. A large number of State Agricultural Universities, ICAR and CSIR institutes are engaged in developing GAP for MAPs. However, the cultivation is not gaining due momentum in the country due to prevailing unorganised marketing arrangements. Agro technologies for cultivation of several such crops have been developed by CSIR and ICAR institutions.
Conservation
Conservation of MAPs is necessary for the posterity of the future generation. Several issues have consistently been raised in the various sets of recommendations compiled to promote the conservation of MAPs. These include:

- The need for a coordinated conservation action based on both "in situ" and "ex situ" strategies.
- The inclusion of community and gender perspectives in the development of policies and programmes.
- The development of sustainable harvesting practices.
- The need for more information on the medicinal plant trade - establishing systems for inventorying and monitoring the status of stocks of medicinal plants.
- Encouraging micro-enterprise development based on sustainable resource use by indigenous and rural communities.
- Protection of traditional resources and the intellectual property rights.

Medicinal Plant Board
A Medicinal Plants Board has been created in 2000 in the Department of Indian Systems of Medicines & Homeopathy to address all the issues related to MAP sectors.

Major Medicinal Plants of India
1. Isabgol (Plantago ovata Forsk.)
Isabgol belongs to family Plantaginaceae is an annual herb grown during the rabi season. It is a native of the Mediterranean region and West Asia. Seed coat, which is known as isabgol husk under trade, is medicinally important. The swelling property of the husk after absorption of water is the cause of its use as a famous medicine against constipation and gastrointestinal irritations. It is also used for the treatment of number of other stomach related disorders. Various polysachcharides and amino acids are reported from its seeds. In addition, it is used in food...
industries for the preparation of ice creams, candy, etc. The raw drug is collected solely from cultivation. Its commercial cultivation is restricted to the districts of Banaskantha and Mehsana in Gujrat. It is also grown to a small extent in Patiala district of Punjab and Hisar district of Haryana and in some places of Uttar Pradesh. It is cultivated in the drier tracts of North Gujarat, adjoining Rajasthan and Madhya Pradesh over an area of about 1,00,000 ha. A number of high yielding varieties are available in the crop for cultivation. Average seed yield of the crop is about 10-15 q per ha. India is the leader in Isabgol production and largest exporter of husk. Country earns on an average Rs. 170 crores annually from its export.

2. Senna (*Cassia angustifolia* Vahl)
The herb is a member of family, Fabaceae and native to Yemen and parts of Pakistan, Gujarat and Saudi Arabia. In India the species is cultivated both as irrigated and rain fed crop in Tamil Nadu, Rajasthan and Gujarat. The plant is under large-scale cultivation in districts of Tinnervelly, Madurai and Tiruchirapalli in South India. Dried young leaves, flowers and 3-5 days old pods are used as source of raw drug. It contains sennosides, which is responsible for the purgative action. The drug is used as a cathartic in giving relief to constipation. In European Countries, it is used as herbal tea. In world market, there are two sources of senna raw drug, one is Tinnevely Senna, which has gone from India and the other is Alexandrian senna that has gone from Arabian Countries. The former species is *Cassia angustifolia* and the latter is *Cassia acutifolia*. 

(Source: Digital Photo Library, NRCMAP)
3. Aloe (Aloe barbadensis Mill)

Aloe – a member of the family Liliaceae is indigenous to African countries and naturalized in India. The plant is common along the coastal areas of Tamil Nadu and West India, but has been introduced all over country. The plant is perennial herb with fleshy leaves and condensed stem. Flowering occurs in winter and the inflorescence stack is about 90-150 cm long with orange coloured flowers. Leaves contain gel (polysaccharides) and leaf exudates contain aloins, which are commercially useful. Gel has a cooling and moisturizing action and hence used in cosmetic industries and the leaf exudates contains aloins and aloe emodine, which are used as pain killer and purgative. The crop is under cultivation in Gujarat, Rajasthan, Madhya Pradesh and Uttar Pradesh. Raw material is collected both from wild and cultivation for the industry.

![Aloe barbadensis](Source: Digital Photo Library, NRCMAP)

4. Ashwagandha (Withania somnifera Dunal)

Ashwagandha (Withania somnifera Dunal), a member of family Solanaceae and is distributed throughout India. It is cultivated in northwestern and central India. The species is an annual to perennial branched under shrub to herb of about 30 cm to 120 cm height. Root is the major medicinally important part in addition to leaves and seeds. Alkaloids (withanoloids and withanins) present in the roots are believed to be effective in treatments of stress induced
disorders, fatigue, dropsy, male impotency, neurosis, etc. It is commonly used as a general tonic. It is traditionally cultivated in Madhya Pradesh near Mandsaur and Neemach. However, its cultivation has been extended to most of the states now because of availability of new high yielding and high quality varieties.

5. Safed musli (*Chlorophytum borivilianum* Santapu& Fern.)
There are a number of *Chlorophytum* species, which are known under the trade ‘safed musli’ of which *C. borivilianum* is the commercially utilized species. The plant, a member of family Liliaceae is a perennial herb with condensed stem disc and a whirl of sessile leaves. Fasciculated roots contain saponins and are medicinally important. It is used as a general tonic and is a well-known aphrodisiac. The species is naturally distributed in the forest areas of Maharashtra, MP, Rajasthan and Gujarat. Raw drug is collected both from wild as well as from cultivation. The plant is propagated by the stem disc with the attached fleshy roots as well as by seeds. Unorganized collection of the species from the natural habitat has caused endangered species status.

6. Guggal (*Commiphora wightii* (Arn.) Bhandari =*Commiphora mukul* Hook ex Stock)
Guggal is one of the important medicinal plants belongs to family Burseraceae. It is a perennial shrub or small size tree of about 5 m height. It is a slow growing plant with crooked and knotty branches ending in sharp spines. The species contains male, female and hermaphrodite plants in
the population. Propagation is done by seed as well as stem cuttings. The oleo-gum resin of guggal having chief constituents like myrcene and dimyrcene is known to be highly effective in the treatment of obesity, arthritis and several other diseases in Indian system of medicine. The species is included in the Red data book (IUCN) as over exploited species in the country. Africa and Asia are the centers of origin of Commiphora spp. In India, Guggal is distributed in dry areas of Gujarat, Rajasthan and Madhya Pradesh. Guggal gum usually called in trade is a mixture of 61 % resins and 29.3 % gum, in addition to 6.1% water, 0.6 % volatile oil and 3.2 % foreign matter. Guggulosterol and guggulostereone are the important active ingredient of the gum resin.

7. Tinospora (Tinospora cordifolia Miers ex Hook f. & Thoms.)
It is a deciduous perennial climber belongs to the family Menispermaceae. It is distributed throughout tropical India. The species produces a lot of aerial roots. It is propagated by stem cuttings as well as by seeds. The stem and leaves are medicinally used as raw drug. Tinospora stem is a common constituent of a number of ayurvedic vital tonics for the treatment of general debility, dyspepsia, fevers and urinary diseases. Starch called as “Sat Giloe” present in the stem along with alkaloids is the active principle of the species. Major constituents are tinosporon, tinosporic acid, tinosporoside, tinosporin and cordifolide. Leaf also contains a number of alkaloids. Leaf is used for the treatment of gout, jaundice and rheumatism. Raw drug is mainly obtained from the wild habitats of the species.

8. Satavary (Asparagus racemosus Willd.)
Satavary is a perennial spiny woody climber belongs to the family Liliaceae. The plant is common at low altitudes in shade and in tropical climate through out India. Cladodes are in tufts of 2-6 and leaves are reduced to spines. Fasciculated roots are medicinally important.
It contains saponins and is used for the treatment of dysentery, tumours, rheumatism and kidney and liver disorders. Powdered roots are a common ingredient of a number of vital tonics, which are believed to cure sexual weaknesses, leucorrhoea and increase lactation in feeding mothers.

9. **Brahmi** (*Bacopa monnieri* (L.) Pennel)

Brahmi, a member of Scrophulariaceae family is a creeping, branched succulent perennial herb distributed in wet and marshy lands throughout India. It is propagated stem cuttings. The whole herb is the source of the ayurvedic drug ‘Brahmi’. It is used in improving memory and intelligence and also in the treatment of dermatosis, anaemia, diabetics and insanity. Bacoposide is considered as the major active ingredient in this plant. Raw drug is mainly collected from the wild.

10. **Mandookaparni** (*Centella asiatica* L.)

Mandookaparni, a member of family Apiaceae is a prostrate slightly aromatic, perennial herb commonly found as a weed creeping on ground in crop fields. The species is common in moist shady places all over India, particularly during rainy season. The species is widely distributed in India. It is propagated both by stolons as well as by seeds. It is used for the treatment of leprosy, skin diseases and to improve memory. It is also used against cholera, ulcers, bronchitis,
leucorrhoea and kidney troubles. Asiaticoside, indocentelloside, thankuniside are the major glycosides responsible for the medicinal properties.

11. Kalmegh (*Andrographis paniculata* Nees)
Kalmegh belongs to family Acanthaceae is a branched annual undershrub of about 30-100 cm tall. The species is distributed in India, Sri Lanka, Bangladesh and Malaysia. In India it is found in the plains of Himachal Pradesh to Assam and Mizoram and also in Peninsular India. It is also cultivated as kharif season crop in Gujarat, Uttar Pradesh, West Bengal, Madhya Pradesh, Orissa, Andhra Pradesh and Tamil Nadu. Harvesting is done in the month of October-November. The whole herb is medicinally useful. Andrographolide is the active principle having the therapeutic action. The herb is used for treating diabetics, bronchitis, pile, jaundice and fever. It is considered as a blood purifier and used for the treatment of skin diseases.

12. Chiraita (*Swertia chirayita* (Roxb.ex Flem.) Karst.)
It is an erect annual herb belongs to family Gentianaceae. It is distributed in temperate Himalayas from Kashmir to Bhutan between 1200-3000 m. The plant is propagated by seeds. It grows well in moist, temperate forests of Himachal Pradesh.
Dried herbage portion is used as raw drug. Flowering occurs in July to October and the raw drug is collected when the capsules are fully formed. The drug is extremely bitter in taste. Chiraita is also known as brown or white chiraita to distinguish it from ‘green chaaita’, which is the dried herbage of *Andrographis paniculata*. The bitter tonic made from the raw drug improves bile secretion and used for the treatment of bronchial asthma, liver disorders, and anaemia. The juice of fresh plant or infusion of dry plants is prescribed as a “blood purifier” in skin diseases. The active ingredient of the raw drug includes ophelic acid, glucosides, etc. Cultivation also has been initiated in the species and seeds are used for propagation.

13. Kauch (*Mucuna pruriens* Bak.)
The species is a pubescent annual climber liana belongs to Fabaceae family. The fruit (pod) is curved on both ends as letter ‘S’ and is densely covered with persistent, irritant bristles. It is distributed almost throughout India and also cultivated in limited areas.

![Kauch](Source: Digital Photo Library, NRCMAP)

The active principle is L-Dopa. The seeds are used to treat, Parkinson disease, sexual disorders, cholera, urinary troubles and liver and gall bladder diseases. L-dopa present in the seeds is the active principle responsible for therapeutic action.

The plant is a small perennial herb belongs to family Gentianaceae. It is a native of North-

![Indian Gentian](Source: Digital Photo Library, NRCMAP)

Western Himalaya. The dried rhizome and roots are known under the trade name ‘Indian
Gentian’ and is used as a bitter tonic. Gentiopicrin and tannins are present in the raw drug. Rhizome is used as a gastric stimulant and improves appetite. The raw drug is mainly collected from the wild. It is also used for the treatment of fever, abdominal pains, and for the purification of blood.

15. Indian valerian (Valerianawallichii DC. V. jatamansi Jones )
Indian valerian belongs to family Valerianaceae is a perennial herb of about 45 cm height and rootstock is thick, nodular and aromatic. The species is distributed in the Himalayan region found in some localities of Kashmir at an altitude of 2400-2700 m. Roots of the species are

(Source: Digital Photo Library, NRCMAP)

useful in diseases related to eye, blood, liver and spleen. Leaves are used for the treatment of headache. Valepotriates are obtained from roots and rhizomes. Roots are also used in aromatic industry. Raw drug is collected mainly from the wild since cultivation is not yet popularized.

16. Bankakri (Podophyllum hexandrm Royle= P. emodi)
The species belongs to family Berberidaceae is an erect, succulent herb with creeping perennial

(Source: AICRP on MAP, Dr. YSPUHF, Solan)
rhizome bearing numerous roots. The species is distributed in the inner ranges of Himalayas from Kashmir to Sikkim in an altitude of 3000-4200 m. The rhizome and the root constitute the raw drug source of resin, podophyllin or podophyllin resin. Podophyllotoxin is the active principle of podophyllin. The raw drug is used for the treatment of ulcers, cuts and wounds. It is a purgative and is used in curing skin diseases and tumor growth. Podophyllin has acquired special attention during recent time due to its action against cancers. The raw drug is collected mainly from the wild since the cultivation is not gained momentum. The under ground rhizome remain dormant during winter. Seeds and rhizome are used for the propagation.

17. Madhunasini (*Gymnema sylvestis* Retz.)

It is a woody climber of family Asclepiadaceae distributed in hill regions of Bihar, Orissa, Madhya Pradesh and southern parts of India. Two allied species *G. hirsutum* found in Bundelkhand, Bihar and Western Ghats and *G. montanum* growing wild in Western Ghats and Konkan are also used for the same purposes and are also called ‘Gumar’. The leaves when chewed temporarily cease one’s ability to sense sweet taste. The species gained importance, since it is used to cure diabetics. Leaves are used for the treatment of diabetics. Gymnemic acid present in the leaves is believed to reduce blood glucose level. Leaves and roots are also used to treat headache, polyuria, leprosy, wounds and pruritis. The raw drug is mainly collected from the wild.

18. Atis (*Aconitum heterophyllum* Wall.ex Royle)

It is a biennial herb with fleshy roots belongs to family Ranunculaceae. The plant was common
at 2000-3000 m all over the western Himalaya but now because of indiscriminate collection, it is sparsely distributed. Roots are used medicinal purposes. It is used in diarrhoea, dysentery and gastric pain. It is used as a bitter tonic to combat debility after malaria and other fevers. It is also used against hysteria, dyspepsia, vomiting and cough. Wild habitats are the sole source of the raw drug since the plant is not in cultivation. Price of the raw drug is also very high (about Rs 2000 per kg) since the collection from the wild is also very difficult due to the inaccessibility of the wild habitats. Alkaloids (heterophyllisine, atidine and atisine) present in the rhizome are the active ingredient.

19. Behda (*Terminalia bellerica* (Gaertn.) Roxb.)
Behda is a deciduous tree of the family Combretaceae that grows up to 40m heights. The species is distributed throughout the greater part of India in plains and lower hills. It grows wild up to 1000 m, all over India except dry and marshy areas. The species is propagated by seeds. The fruit of the species is commercially known as myrobalan or belliric myrobalan and is medicinally important. It is anticancerous, and used against heart diseases, anaemia and rheumatism. Beta sitosterol, gallic acid and bellericanin are the major active ingredients of the raw drug. Raw drug is mainly collected from the forests.

20 Harde (*Terminalia chebula* Retz.)
Harde is a tree of about 15-24 m tall belongs to the family Combretaceae. It is distributed throughout the greater part of India. The tree grows wild in the sub-Himalayan tracts up to 1000
m and in the deciduous forests. In combination with Emblic myrobalan (*Emblica officinalis*) and belliric myrobalan (*Terminalia bellirica*), under the formulation ‘triphala’ (three fruit), *T.chebula* is is used extensively in a number of ailments. The main purgative ingredient of triphala is harde and the purgative principle is in the pericarp of the fruit, which is a glycoside similar to sennoside A of Senna (*Cassia angustifolia*). Chebulin, chebulinic acid, tannic acid and behin acid are the major active ingredient of the raw drug. Forests are the main sources of raw drug collection.

The plant is a small to medium sized deciduous tree belongs to family Euphorbiaceae. The species is a native of India, Sri Lanka, China and Indonesia. In India the plant is found wild as well as in organized cultivation. Flowers are unisexual. Flowering mostly occurs during March to June and fruits ripen in the coming winter. The fruit commonly known as *amla* or emblic myrobalan is a highly reputed drug of Indian Systems of Medicines. There are two forms of Amla, the wild one with smaller fruits and the cultivated form sometimes called ‘Banarasi’ with large fruits. It is one of the richest sources of vitamin C. The fruits, leaves and bak are rich in tannins, root contains ellagic acid and lupeol. The fruits are used for the treatment of vomiting, biliousness, urinary discharges, constipation, leprosy, piles and diseases related to eyes. Triphala, an ayurvedic formulation includes amla as one of the three constituents.

22. Long pepper (*Piper longum L.*)
Long pepper is a slender aromatic perennial undershrub belonging to the family Piperaceae. It is distributed in Central Himalayas, Assam, Khasi hills, Bengal, Western Ghats and Andaman and Nicobar Islands. Raw drug is collected both from the wild and cultivated areas. The crop is under
cultivation in parts Maharashtra, Kerala, Assam and Tamil Nadu. Stem cuttings are used for the propagation of the species. Ripened green fruits and roots are used as the raw drug. India imports a large quantity of raw drug from Malaysia and Singapore. The fruits are used as spice also. It has a pepper like taste. Commercially, the raw drug of long pepper is mixed with material from *P. retrofractum* or *P. peepuloides*, and it is very difficult to distinguish the raw drug from these different species. Piperine and piplartine are the two important alkaloids responsible for the therapeutic action. In addition also the raw drug contains a number of essential oils. The fruits as well as the roots are used for the treatment of diseases related respiratory tracts viz., bronchitis, asthma, cough, etc. It is also used in muscular pains, inflammations, drowsiness, epilepsy, leprosy, dysentery and ailments related gall bladder and bile duct.

23. Bala (*Sida cordifolia*)
Bala is an annual herb and member of Malvaceae family. There are four different varieties viz. *bala, atibala, nagabala* and *mahabala* of which *bala* is most widely used. *Sida cordifolia* is considered as the source of raw drug bala in North India while in South India *Sida rhombifolia* is accepted as the source of the raw drug. All the *Sida* species are widely distributed as a weed in the tropical and subtropical regions of India. Cultivation in limited scale has been initiated in the species in some parts of India. The root of the species is used as the raw drug for the treatment rheumatism. It imparts strength to the body and is useful in the treatment of facial paralysis, general debility, sciatica, headache, uterine disorders, etc.

24. Vasaka (*Adhatoda vasica Nees* = *A. zeylanica Medic.*)
It is an evergreen, perennial shrub belongs to family Acanthaceae. It grows well in wastelands
and also used as a hedge plant. The species is a source of a well-known raw drug ‘vasaka’ which is mainly used for the treatment of bronchitis, asthma, cold, cough and whooping cough. Fresh or dried leaves are used mainly as the raw drug. It is used in the form of fresh juice, decoction, infusion or powder. The leaf juice is also used to cure dysentery, diarrhoea and glandular tumour. A number of alkaloids are present in the raw drug of which vascine and vasicinone are important.

25. Vach (Acorus calamus L.)
The species is a native of Europe belongs to family Araceae. It is a small perennial plant with creeping and extensively branched aromatic rhizome. Aromatic herb grown naturally in marshy fields up to 2000 m altitude in the Himalayas, Manipur, Naga Hills and in some parts of south India. The species is cultivated in some parts of India mainly in Andra Pradesh and Tamil Nadu. The dried rhizomes constitute the commercial raw drug of ‘Calamus’. α and β asarone, acoric acid and choline are the major active principle of the raw drug. It is believed to improve memory power and intellect. It is also useful in the treatment of diarrhoea, dysentery, abdominal obstructions and colic. Anticarcinogenic property of the species is also reported recently.

26. Asoka (Saraca asoca (Roxb.) De Wilde)
It is a medium size, evergreen tree with black bark belongs to family Fabaceae. Flowers are orange- yellow with bronze colored tender shoots. It is distributed through out India particularly
in humid areas. The plant is considered as sacred tree of Hindus and Buddhists. Asoka bark is widely used in Indian medicines for the treatment of uterine disorders. Flowers are also used for the treatment of bleeding piles and skin diseases. The activity of the drug is due to the presence of steroidal component and calcium salt. Bark also contains tannins. It is propagated by seeds and is also cultivated as an ornamental plant. The increased demand of the raw drug in recent years has caused overexploitation of the species in wild habitats. It one of the flagship species targeted for wide scale cultivation in south India.

27. Sarpagandha (*Rauvolfia serpentina* (L.) Benth.ex. Kurz.)
Sarpagandha a member of family Apocynaceae is a perennial under shrub with irregular tubular roots distributed throughout out India. The plat grows wild upto 1200 m in deciduous forests of the sub-Himalayan tracts up to Nepal, the Gangetic plains, and Eastern and Western Ghats. The species attain a height of about 75 cm –1 m with inflorescence arranged in cymes with deep red flowers. Roots contain alkaloids (reserpine, desrpidine and reseinamine) which a sedative and used to control high blood pressure. It is also used for the treatment of insomnia, asthma and acute stomachache. Ruthless collection of the species from its wild habitats and the Government of India has prohibited its collection from the wild. The crop is under cultivation and propagated by seeds.

28. Periwinkle (*Catharanthus roseus* (L) G.Don)
Periwinkle belongs to the family Apocynaceae is an erect annual or perennial herb with white or pink flowers. It flowers throughout the year with profuse flowering mainly during rainy season.
It is a native of Madagascar and brought to cultivation in many of the tropical countries including India during eighteenth century. All parts of the plant, especially roots contain alkaloids. Leaves are used to treat menorrhagia and the plants are also used to treat diabetics in Ayurveda. However, the alkaloids vincristine and vinblastine present mainly in the roots of the plant is used to treat various types of cancers including leukaemia in modern medical systems. The plant is mainly cultivated for its alkaloids and sometimes as an ornamental. The major cultivation areas are Tamil Nadu, West Bengal, Assam and Karnataka. It is propagated through seeds or by cuttings.

29. Bhui amla (Phyllanthus amarus Schum.& Thom.)

![Phyllanthus amarus](image1)

(Source: Digital Photo Library, NRCMAP)

It is a small herb of about 60 cm height and belongs to the family Euphorbiaceae. The species is distributed throughout India and grows as weed in the cultivated lands. The whole herb is used for the medicinal purposes. It is bitter in taste and is used mainly for the treatment of jaundice. It is also used in dyspepsia, diarrhoea and dysentery. The herbage portion contains the bitter principle phyllanthin which is responsible for the therapeutic action.

30. Tulsi (Ocimum sanctum L.)

It is an erect highly branched aromatic perennial herb belongs to the family Lamiaceae. Two plant types are commonly available, one is with green leaves and the other one is with purple leaves. It is distributed throughout India and is also under cultivation. Leaves, flowers and occasionally the whole plant are medicinally used to treat heart diseases, leucoderma, asthma, bronchitis and fever. The leaves and tender parts of the shoots are economically important and it yields essential oils. The essential oils obtained have immense value in aroma industry. The
chemical constituents of the essential oils are monoterpenes, sesquiterpenes and phenols with their alcohols, esters, aldehydes, etc. Propagation is mainly done both by seeds.

31. Belladona (*Atropa belladonna* Linn.)
A perennial branching herb growing to 5 feet tall, with 8 inch long ovate leaves, belongs to family Solanaceae. Although chiefly a native of the southern counties, being almost confined to calcareous soils, it has been introduced and cultivated in Kashmir and Himachal Pradesh in India. The medicinal properties of Belladonna depend on the presence of Hyoscyamine and Atropine. Belladonna is a most valuable plant in the treatment of eye diseases, Atropine, obtained during extraction, being its most important constituent on account of its power of dilating the pupil.

(Source: CIMAP, Lucknow)

32. Quinine (*Cinchona officinalis*)
*Cinchona officinalis* (Quinine Bark) is a tree native to Amazon Rainforest vegetation, belongs to family Rubiaceae. The plant is cultivated at 270 m in Nilgiri Hills. This plant is used for the production of quinine, which is an anti-fever agent especially useful in the prevention and treatment of malaria. There are a number of various other chemicals which are made from this tree, and they include cinchonine, cinchonidine and quinidine.
33. Opium poppy (*Papaver somniferum*)
The plant is an erect herb characterized by a drooping bud and grey latex, from the family Papaveraceae. The dry latex obtained by scratching the capsule is called opium. The plant is never found in wild but cultivated in warmer parts. In medicine, opium as such, the capsule after the recovery of opium and the seeds are used. It is a well-known sedative, having a constipating effect, so used in diarrhoea and pains in the body; the dry capsule may be used where mild action is required. The major alkaloids are morphine, thebaine, noscapine and papaverine.

![Opium Poppy](source: Digital Photo Library, NRCMAP)

34. Purple foxglove (*Digitalis purpurea*)
It is a perennial herb, up to 2 m high, which in the first year bears rosette of radical and somewhat downy leaves. It belongs to family Scrophulariaceae. The species is cultivated between 1500 to 1800 m in Kashmir and Himanchal Pradesh as an ornamental plant. Due to the presence of the cardiac glycoside digitoxin, the leaves, flowers and seeds of this plant are all poisonous to humans and some animals and can be fatal if eaten. In alopathy, cardiac-glycoside digitoxin isolated from the leaves or seeds is used for various heart troubles.

![Purple Foxglove](source: AICRP on MAP, Dr. YSPUHF, Solan)
Major Aromatic plants

1. Muskdana (*Abelmoschus moscatus* Medic.)
Muskdana belongs to family Malvaceae is an erect perennial herb with fruits similar to Lady’s finger but smaller in size. It is distributed throughout peninsular India and Himalayan foot hills. The plant is in cultivation in limited areas of Maharashtra, Madhya Pradesh, and Uttar Pradesh. Seeds are used commercially both in medicine as well as in perfumery. Seeds are musk scented and are used to flavour food and as a substitute of musk. It is used to treat intestinal problems, stomatitis and heart diseases. In Unani, it is also used to treat dyspepsia, urinary discharges, gonorrhoea, leucoderma and itching.

2. Lemongrass (*Cymbopogon flexuosus* Nees ex. Steud Wats.)
Lemongrass belongs to family Poaceae and there are three species of *Cymbopogon* ie., *C.flexuosus, C.citratus and C. pendulus*, commonly known as lemongrass. The odour of the oil extracted from the leaves are lemon scented and hence the name ‘lemongrass’. *C.flexuosus, C.citratus* are under cultivation. The species are perennial grass of about 2 m long with profuse tillering habit. *C. flexuosus* (East Indian lemongrass or true lemongrass) is more preferred by the industry due its superior oil quality. Lemongrass is distributed commonly in tropical and subtropical Asia, Africa and America. *C. flexuosus* is present in wild state in Western Ghats, Sikkim and Arunachal Pradesh. Commercial cultivation of the species is spread to Kerala, Assam, Maharashtra, Uttar Pradesh and Gujarat. *C. pendulus* is distributed naturally in West Bengal, Sikkim, Assam and Madhya Pradesh and cultivated in parts of Jammu. Citral extracted from the oil is of commercially importance. The oil is used in flavouring and medicinal industry and also for production of...
Vitamin A and synthetic violets. India is one of the major suppliers of lemongrass oil in the world market. A large number of high yielding varieties are available for cultivation.

3. **Palmarosa** (*Cymbopogon martini* Stapf. Var. Motia)
Palmarosa or Rosha grass is a tall perennial herb belongs to family Poaceae. It is distributed in most parts of subtropical India. Distillation of herbs with the flowering parts yields sweet, colourless to pale (greenish) yellow scented oil which is rich in geraniol. The oil has high demand in perfumery, soap, cosmetics and blending tobacco products industries. Owing to its low cost, in western countries palmarosa oil is preferred over sandalwood oil and true geranium oil, hence referred to as East Indian Geranium oil in commerce. The species is under cultivation in Central, western and southern states of India.

4. **Geranium** (*Pelargonium graveolens* L. Herit.)
The geranium of trade is the common name given to a number of species belonging to the genus *Pelargonium* belonging to the family Pelargoniiaceae. The major species that is cultivated for the commercial geranium oil is *P. graveolens* L’ Herit.

The crop is grown as rain fed crop in hilly areas and as irrigated crop in plains. There are two types of *P. graveolens* ie., Algerian or Tunisian and Bourbon or Reunion. The former is with dark pink flowers, not suitable for wet conditions and cultivated in higher elevations and the latter is with light pink flowers, suitable for wet conditions and cultivated in plains. Egyptian type is another strain identified for cultivation in plains, which is rich in geraniol and resistant to wilt compared to Bourbon. The plant is bushy in nature growing to a height of 1 m. Stem is cylindrical, green when young and turned to brown when matured. Flowering is more profuse in
higher altitudes. Rose scented essential oil, extracted from its leaves and tender shoots are commercially important. The crop is propagated by stem cuttings and root suckers. Geranium oil contains 60-70% alcohols like, citronellol, geraniol; 20-30% esters like, geranyl tiglata, geranyl acetate, citronellyl acetate and the rest aldehydes and ketones, etc.

5. Patchouli (Pogostemon patchouli Pellet.= P.cablin Benth.)
The plant belongs to family Lamiceae is a perennial erect or ascending herb. Commercial cultivation in India was first attempted by Tata Oil Mills in 1942. Oil distilled from shade dried leaves is used in perfumery to give a solid foundation and lasting character of other fragrances since it has a fixative property to prevent the rapid evaporation of perfumes. The patchauli oil is generally blended with other essential oils like geranium oil or clove oil before use. the oil possesses antibacterial activity and is used an ingredient in insect-repellent preparations. The oil is also used in major food products as a flavouring agent. Currently India is producing only a part of its annual requirement and about 20 tonnes of patchouli oil is importing to meet the requirements. It is propagated by shoot tip cuttings. Common strains available for cultivation are Singapore, Johore, Indonesian, Java and Malaysian strains.

6. Mint (Mentha arvensis L.)
Mentha or mints includes a number of aromatic perennial herbs belonging to family Lamiaceae. **Mentha arvensis** var. *piperascense* (Japanese mint), *M. piperita* (Pepper mint), *M. spicata* (Spearmint) and *M. citrata* (bergot mint) are the common cultivated species of Mentha. Japanese mint has high percentage of menthol and is used in cold and cough drops, mouth washes, cosmetics, tobacco flavouring. Peppermint oil is carminative, antiseptic and gastro-stimulant properties and used in confectionaries, alcoholic drinks, dental creams and mouthwashes. Spearmint oil is rich in carvone and has digestive and gastrostimulant properties, It is used in
confectionary, chewing gum and tooth pastes. Bergamot mint oil is rich in linalyl acetate and linalool and mainly used in cosmetic industry. Mints were first introduced to India in 1952 by the Regional Research Laboratory, Jammu. At present, the crop is mainly cultivated in Tarai regions, Indo-Gangetic plains, Punjab and in Northwestern India. The herbage of the plants are economically useful which yields essential oils. The chief chemical constituents of the essential oils are menthol, carvone, linalyl acetate and linalool and they are highly demanded in pharmaceutical, food flavour, cosmetics, beverages and related industries. A number of high yielding varieties are now available for cultivation.

7. Rose (*Rosa damascena* Mill.)
Rose belongs to family Rosaceae and among flowers it has a reputed position because of its colour, fragrance, economic benefits and religious significance. It is a perennial hardy shrub of about 2.5 to 3 m height. Half opened flowers have more fragrance and oil yield than the fully opened flowers. In India about 1500 to 2000 hectares of land is under rose cultivation, which is mainly located in Uttar Pradesh for extraction of rose oil, rose water, absolute and rose concrete. Other commercially important Roses are *R. centifolia* L., and *R. bourboniana* Desp. (Edward Rose). Different perfumery products obtaine from rose are rose attar, Gulkhand, Gul-rogan, Punkhuri and Otto rose. Propagation of roses are mainly done by stem cuttings.

8. Jasmine (*Jasminum sambac* L.)
The species belongs to family Oleaceae and subfamily Jasminoideae and it is a more or less scandent shrub with highly fragrant flowers. It is commonly known as French Jasmine.
The species is originated in Indo-Burman region in the foothills of Himalayas. Other important species of the genus are *J. grandiflorum*, *J. auriculatum* and *J. odorotissimum*. The essential oils obtained from the flowers are used in perfumery and are export oriented also. In India, organised cultivation of the species was started in Tamil Nadu. Plant starts blooming in the first year of planting and full yield will be in the third year and the crop sustains up to 15 years. Good varieties for higher production are available in south India. Plant is propagated by stem cuttings.

9. **Tuberose** (*Polianthus tuberosa* L.)

It is a short-stemmed plant with underground bulbs belongs to family Amaryllidaceae. Flowers arranged in racemes are aromatic and cultivated for the extraction of highly valued natural flower oil. In India it is cultivated in parts of West Bengal, Tamil Nadu, Karnataka and Maharashtra. The flowers are also used for the making garlands, bouquets and decorations. The fresh flowers yield about 0.08 to 0.11 percent oil. There are different varieties in tuberose based on the number of petal whorls or petal type viz. Calcutta single, Single Mexican, semi-double, Variegated, Pearl double, Rajat Rekha and Swarna Rekha. The plant is propagated mainly by bulbs.

10. **Vetiver** (*Vetiveria zizanioides* (L.) Nash.)

It is a tall perennial grass of about 1.5 to 2.0 m height belongs to family Poaceae. In India it is widely seen in wet and damp places, however, it tolerates extreme conditions. The wild variety grows especially in Rajasthan and Uttar Pradesh. The species is used against soil erosion because of its roots’ soil binding property. The aromatic roots are traditionally used for making mats, fans, door-screens which produce fragrance imparting a cooling effect during extreme summer when sprinkled with water. The roots on distillation produce volatile oils. The oil finds extensive use in perfumery as a fixative and as an odour contributor in bases, and also as a raw material for the isolation of vetiverol and vetiverone. It is also medicinal and used against flatulence and
coli
colic pains. Sugandha and Nilambore are the two high yielding varieties available for
cultivation. Plant is propagated by root cuttings.

11. *Cymbopogon winterianus* Citronella
It is a perennial herb from the family Poaceae; Leaf-blades drooping for two-thirds their length.

![Citronella Plant](image)

(Source- plant photos-asian region inventory of medicinal and aromatic plants and polyherbal
formulations, CIMAP)

Geographic origin of the plant is Nepal, now it is being cultivated (medicultured) in many
temperate & tropical regions of Asia. Citronella oil is obtained by steam distillation of partially
wilted leaves. The oil whose ingredients are citronellal, citronellol and geraniol are employed in
the manufacture of soap, pharmaceuticals, and perfumery, cosmetic and flavouring agents.

12. *Lavandula angustifolia*
It is a perennial aromatic herb from the family Lamiaceae. True lavender is one of the most
important essential oils used in the perfumery industry. In India, Kashmir and low rainfall areas
and slopes of hills of Himanchal Pradesh and Uttar Pradesh are the suitable locations for
cultivation, as the climate prevailing there is favorable to lavender. Major components of the
essential oil are linalool and linayl acetate. The essential oil is antiseptic and antispasmodic.

Important Websites:
- [www.nrc-map.org](http://www.nrc-map.org)
- [www.hort.purdue.edu/newcrop/med-aro/default.html](http://www.hort.purdue.edu/newcrop/med-aro/default.html)
- [www.cimap.res.in](http://www.cimap.res.in)