REVIEW OF LITERATURE

A review of published literature on the plants dealt in this study is presented in this chapter. The last part of this chapter deals with some controversial plants with respect to their Sanskrit names.

*Acorus calamus* Linn.

Family : Araceae

Vernacular names

San. : *Vacha, Uragandha*

Mal. : *Vayambu*

Tam. : *Vasampu*

Eng. : The sweet flag

Hin. : *Vekhand*

*Acorus calamus* Linn. is a semi aquatic rhizomatous, perennial herb. It is a native of Eastern Europe and distributed throughout Europe, Central Asia and is found in India both in wild and cultivated state. It grows from sea level to an altitude of 200 m or more (Kokate *et al.*, 1997).

This plant has a cylindrical or slightly compressed, branched aromatic, spongy, rhizome with deep longitudinal wrinkles. Leaves are bright green, acute at tip, amplexicaul at base and develop leaf scars on the surface of the rhizome. Flowers are pale green, fragrant and arranged compactly on a sessile cylindric stumpy spadix.

Commercial drug is much shrivelled, breaks easily with a short fracture exhibiting dull pinkish, white to pale brown porous interior. In cross section the
rhizome consists of a single row of epidermis followed by a broad cortex and a
large stele. Cortical cells towards the periphery are collenchymatous, where as
those in the inside are rounded and form a network. A distinct endodermis with
casparian strips separates cortex and stele. Stele comprises parenchymatous cells
with starch grains, large air spaces and concentric type vascular bundles i.e. phloem
surrounded by xylem (Aiyer et al., 1957).

Major ingredients of *A. calamus* are 2 to 4% of volatile oil, starch, resin and
tannin. Calamus oil contains a number of sesquiterpenes, asarone and eugenon.
The bitter principle of *A. calamus* is due to the presence of acorin – a glucoside
(Kokate et al., 1990). The studies of Nigam et al. (1990) revealed the presence of
8 known compounds, β-asarone being the major, besides four unidentified
sesquiterpene alcohols.

This drug is used for various ailments in various parts of the globe, which
include Persia, Egypt, Europe etc. (Ainslie, 1826). The term ‘vacha’ indicates its
property of making speech clear. *Vacha* is considered from time immemorial as an
important *medhya* drug, which improves cognitive and memory power.
Administering the paste of *A. calamus* in honey to infants is one of the first post-
natal practices of Indian mothers for the proper intellect of the child (Sivarajan and
Balachandran, 1994).

The drug is used in the name *Wuz* in various preparations in unani medicine
(Ali, 1990). It is also reported as an effective drug in chronic diarrhoea, abdominal
obstructions, dyspepsia, infantile disorders and bronchial asthma. Being a nerve
tonic, it is very effective in epilepsy, delirium, amnetia, convulsions, depression and
other mental disorders (Dymock et al., 1890; Kirtikar and Basu., 1991). Vennila (2001) reported the use of *A. calamus* as an insecticide against pulse beetle.

Important ayurvedic formulations in which this drug is included are *Aswangandharishtam, Maharasnadi Kwath, Vachadi thailam, Ayaskriti* (Vaidyan, 1974; 1980).

Arora *et al.* (1986) and Prasad and Chakraborty (1992) have clinically established the hypo-cholesterolaeic and hypotensive effect of *A. calamus* whereas Boyuan and Yaoyuan reported the carcinogenic effect of this drug (Sivarajan and Balachandran, 1994).

According to Aiyer *et al.* (1957) and Geeta (1998a), this plant is well adapted to the marshy places and semi water logged areas. According to Philip *et al.* (1992), planting rhizome bits with growing tops and leaves influenced the growth yield of the crop. Tiwari *et al.* (1999) opined that application of nitrogen has great influence in the rhizome yield of *A. calamus*.

**Adhatoda spp.**

a) *Adhatoda beddomei* C.B.Clark

  = *Justica beddomei* Clark

b) *Adhatoda zeylanica* Medicus

  = *Justica adhatoda* Linn.

  = *Adhatoda vasica* Nees

Family : Acanthaceae

Vernacular names

San. : *Sinha, Vasa, Vasaka, Bhishkmata*

Mal. : *Adalodakam*
Ayurveda upholds the virtues of pranayama or breathing exercises, which nourishes the nervous system, tones up mental faculties and enhances memory and alertness. For practising such yogas human beings should be healthy and for healthy lungs ayurvedic physicians prefer vasa (Naveen, 1993).

In ancient Ayurvedic pharmacopoeias, only one type of vasa has been described. Later Desai described two types of vasa such as svet (Justicia picta) and kala (Justicia gendarussa Linn.). (Pandya and Chunekar, 1985). Watt (1893) considered that the scientific name Adhatoda is derived from the Tamil name adhathodau. Vaidya (1982) described a red variety of vasa (Rektha vasa). However, Kerala physicians use two different plants of the family Acanthaceae as ‘vasa.’ They are Adhatoda zeylanica Medicus, locally known as Adalodakam or Valiya adalodakam and Adhatoda beddomei C.B.Clarke. (Warrier et al., 1993) known as chittadalodakam. Amalraj et al. (1991) reported that A. beddomei is very rare and after an extensive survey of the Southern Western ghats, their team could not find a single plant of this species. Sivarajan and Balachandran (1994) authenticated that what we call as ‘chittadalodakam’ is only a different form of A. zeylanica since A. beddomei differed substantially from our chittadalodakam.

According to Aiyer and Kolammal (1963), A. beddomei can be distinguished from A. zeylanica by the following features.

a) Plants are smaller with glabrous branches.
b) Leaves are smaller which are less than 15 cm long, about 3.8 cm broad having 8 to 10 pairs of secondary nerves.

c) Spikes and bracts are shorter.

Both the upper and lower epidermis of *A. zeylanica* leaf shows the presence of diacytic stomata. Palisade tissue consists of two layers of cells whereas 3-5 layers of cells comprise the spongy mesophyll. Below the epidermis, in the mid-rib region there are 4-6 layers of collenchyma cells. Vascular bundles vary from 3-5 of which the central one is the largest. Elongated cystoliths, acicular and prismatic forms of calcium oxalate crystals are present in the mesophyll. (Reg hunath and Mitra, 1982; Sukhdev *et al.* 1998).

Histology of leaves and the roots of *A. zeylanica* and *A. beddomei* are almost similar. But they differ in the following characters.

Anatomical differences of leaf and root of *A. zeylanica* and *A. beddomei*.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th><em>A. zeylanica</em></th>
<th><em>A. beddomei</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stomata absent in the upper epidermis of leaf</td>
<td>Occasionally found in the upper epidermis</td>
</tr>
<tr>
<td>2</td>
<td>Phellem or cork layer is thin, being about 120 μ in thickness</td>
<td>They are thick (300-350μ)</td>
</tr>
<tr>
<td>3</td>
<td>Lenticels are fewer in number</td>
<td>They are more in number</td>
</tr>
<tr>
<td>4</td>
<td>In the root cortex, cystoliths are generally absent.</td>
<td>Cystoliths are very common.</td>
</tr>
<tr>
<td>5</td>
<td>Stone cells are larger in size.</td>
<td>They are smaller than <em>A. zeylanica</em></td>
</tr>
<tr>
<td>6</td>
<td>Acicular fibres are fewer in number (5-15) and larger in size.</td>
<td>Acicular fibres are more (10-30) and smaller in size.</td>
</tr>
</tbody>
</table>

Different parts of the plant such as leaf, root and flowers are used in classical ayurvedic preparations. Both fresh and dried leaves of *Adhatoda*, are considered as expectorant, antiseptic, bronchodilator, antihistaminic, stimulant,
slight hypotensive and abortifacient (Reghunathan and Mitra, 1982; Nadkarni 1954).

Large doses of fresh juice of leaves have been used in tuberculosis, in bleeding gums, anaemia and haemorrhage (Anonymous, 1992). Due to the bronchodilatory activity, they are widely used in cough syrup like Glycodin. Recent studies have shown that vasa is effective against non ulcer dyspepsia (Sivarajan and Balachandran, 1994). Generally ayurvedic drug manufacturers use fresh leaf juice and dried root of Adhatoda in various pharmaceutical preparations. According to Sharrngadhara (Warrier, 1995), fresh leaf juice of Adhatoda along with honey is an effective remedy for cough, bronchitis, tuberculosis, jaundice and fever. Same property is attributed to roots also. In siddha medicine, separate references are there for the leaves and roots of Adhatoda (Anuraaga, 1999).

Leaves contain quinazolinic derivatives such as vasicine, vasicinone, 6 – hydroxy vasicine, volatile oil, betain, vasakin and adhatodic acid (Basu et al., 1947; Chopra et al.1956; Anonymous, 1992; 1996; Reghunathan and Mitra, 1982).

A detailed pharmacological activity of leaves and root has been discussed by Reghunathan and Mitra (1982). Vasicine possess broncho-dilatory, stimulant, hypotensive, marked uterine stimulant as well as abortifacient activities. Uterine stimulant activity has been comparable to that of oxytocin and methergin.

The important classical formulations are Vasarishtam, Chyavanaprasam, Gulguluthikthaka Ghritham, Mahatriphala Ghritham, Vasachandanadi Thailam, Mahathikthaka Ghritham (Vaidyan, 1974; 1980).

This plant is not cultivated on commercial scale. It is generally procured from the wild source. Owing to great demand, the production of medicines that
include *Adhatoda* has increased. Hence there is need for the large scale cultivation of this plant to ensure availability of genuine material for drug manufacturing.

*Aloe barbadensis* Mill.

= *Aloe vera* (Linn.)Burm.

Family : Liliaceae

Vernacular names

San. : Kumari, Ghritakumari

Mal. : Kattuvazha, Kattarvazha

Tam. : Kattalai, Sirukattalai

Eng. : Indian Aloe, Curacao aloe, Barbados aloe, Jaffrabad aloe

Hin. : Ghee-kunvar

Ainslie (1826) described two types of aloes – *A. barbadensis* and *A. spicata*. Of this, the later is considered as the supreme one. They are inhabitant of Socotoria, Yemen, Arabia and South Africa. Insipissated juice of this aloe is reddish brown in colour with aromatic odour. Indian aloe (*A. barbadensis*), which is treated as inferior lacks the particular aroma and is bitter in taste.

Indians were not familiar with this drug until the Arabs introduced it to India. The Sanskrit synonyms such as Kumari, Taruni, Kanyaka, Ghritakumari etc. compare the plant to a beautiful girl or to the virgin *Durga* and hence Dymock *et al.* (1890) considered this plant as a native of India.

Though Hyppocrates (460-360 BC) and Theophrastus did not mention these plants, Dioscorides (first century AD) and Pliny were well acquainted with this
drug. Alexander (the Great) on the recommendation of Aristotle, settled their colony of Greek at Socotoria and cultivated this plant (Dymock et al., 1890).

Bombay is the centre of aloe where Socotoria aloe is imported and then exported to European countries. Indian aloe is cultivated in the hot, dry valley of northwestern Himalayas and to a lesser extent in the central table extending to the southern tip (Dymock et al., 1890).

*Aloe barbadensis* is an inhabitant of Eastern and Southern Africa. It is cultivated in the hot dry valleys of northwestern Himalayas and to a lesser extent in the central table extending to the southern tip. It is a perennial herb, extending to a height of 30-150 cm. It has long narrow, fleshy leaves with thorns on the margin and a sharp apex. (Wallis, 1985). Both the surfaces of the leaf are strongly cuticularized. Vascular bundles are isolated and form a line parallel with epidermis at a short distance within the mesophyll. Each vascular bundle has a pericycle formed of thin walled, large cells filled with a yellow fluid – aloetic juice. This fluid contains crystals in the form of innumerable needles, which vary in shape and size. When the leaf base is cut, the aloetic juice is drained from the entire system of pericyclic cells (Wallis, 1985).

Aloes are used to be planted in graveyards as a symbol of patience and swung over house doors to ward off evil spirits. Mohammedan physicians described the plant as aperient and anthelmintic. It is often employed in inflammatory swellings (Dymock et al., 1890).

Chemical constituents of aloe include hydroxy anthraquinone derivatives. 7–hydroxy aloin isomers, aloe emodin, chrysophanol, chronone derivatives viz. aioresine b with its p-coumarin derivatives aioresins A and C and aglycone
Indian aloes contain aloinosides as major constituents with only traces of aloin (Sukhdev et al., 1998). Lee et al. (1996) derived sufficient guidelines on field and shade culture ingredients of aloe.

Leaf juice is bitter, cooling, purgative, deobstruent, diuretic, hair growth stimulant, emmenagogue and anthelmintic. Dried leaf juice is the elio (Sanskrit – Krisnabolah, Malayalam – Chenninayakam), which is effectively employed in painful inflammations of the body, chronic ulcers, eye affections, splenic enlargement etc (Nadkarni, 1954; Uduppa et al., 1994). Hypoglycaemic and antiatherosclerotic effect of A. barbadensis has been reported by Moosa (1985).

The main ayurvedic formulations using A. barbadensis are Kumariyasavam, Karuthamarmani pills, Manjishtadi thaliam, Murivenna (Vaidyan, 1974; 1980).

**Alpinia spp.**

Family : Zingiberaceae

*Alpinia officinarum* Hance.

Vernacular names

San. : Rasna

Mal. : Chittaratha

Tam. : Shittarattai

Eng. : Lesser galangal

Hin. : Pankijer, Kulinjan

*Alpinia officinarum* Hance. is a native of northern China and South West India. Although this drug has been so long known, its botanical source was discovered only in 1870 by Hance H.F. (Dymock et al., 1890).
It is a perennial herb attaining a height of 1-2 m. Rhizome is branched, cylindrical and tapering or enlarged (Dymock \textit{et al.}, 1890; Wallis, 1985). The smoothed transverse surface exhibits a stele, occupying about one third of the diameter and a wide cortex. In both of these regions paler fibro vascular bundles and numerous deep, red, resin cells are seen (Wallis, 1985).

Lesser galangal promotes digestion, gives fragrance to the breath and warms the kidneys. It has got stimulant and carminative properties and effective in flatulent dyspepsia (Dymock \textit{et al.}, 1890; Wallis, 1985). This drug has wide application in medicine in many European countries, China and Malaya (Kirtikar and Basu, 1991).

Kokate \textit{et al.} (1997) reported that this plant has anti-bacterial property and is widely used in India in the treatment of rheumatism and catarrhal affections.

Rhizome contains volatile oil and 48% of the oil is methyl cinnamate, cineole (25%), camphor and pinene. It also contains resin, oily pungent galangol, alpinol, yellow crystalline substance, galangin and dioxyflavanol.

\textit{Alpinia calcarata} \textbf{Rosc.}

Family : Zingiberaceae

Vernacular names

San. : \textit{Rasna}

Mal. : \textit{Nadanchittaratha}

Tam. : \textit{Shittarattai}

Eng. : Lesser galangal

Hin. : \textit{Kulinjan}
*A. calcarata* is a perennial rhizomatous herb growing to a height of 1m - 1.3m. Leaves are oblong, lanceolate, glabrous, acuminate, 30 - 40 cm in length, 2.5-5.5 cm in breadth, very short petioled. Flowers are fragrant, white with pinkish red veined lips, borne on dense panicles.

Tewari *et al.* (1999) reported about the volatile constituents of *A.calcarata*. Rath *et al.* (1994) carried out analysis on cultivated *A.calcarata*

An extensive study on the market samples of *rasna* in the state of Kerala revealed that three principal types of *rasna* are sold as raw drug viz., *Bengal aratha*, *Chuvannaratha* and *Wild aratha* (Peraratha). No report is available regarding the commercial cultivation and use of *A.calcarata* as a source of *rasna*. 
**Alpinia galanga Sw.**

Family: Zingiberaceae

Vernacular names

San.: Rasna

Mal.: Peraratha

Tam.: Peerarattai

Eng.: Greater galangal

Hin.: Barakulinjan

According to various authorities *A. galanga*, is the *kulanjan of Raja nirghanta* and *Sugandha vacha* and *Malabar vacha* of *Bhavaprakasha*. Though this plant is found wild in the Western ghats, it is not used in formulations on the assumption that it is not a native of India (Dymock *et al.*, 1890). Pruthi (1992) reported that this plant reached in the European market as a spice along with pepper quite earlier time. Greater galangal and lesser galangal were known by the same name in China and they treated lesser galangal produced from China as more potent than greater galangal (less aromatic and thicker) from Java. According to Sivarajan and Balachandran (1994), these plants are seen both in cultivated and in wild state.

*Alpinia galanga* is a perennial rhizomatous drug reaching to a height of 2.5 to 3m with lower position covered with smooth leaf sheath. Leaves are broadly lanceolate 30 to 60cm long and 10 to 15cm broad. Flowers arise in erect terminal panicle with numerous dichotomous branches each with 2 to 6 pale greenish white, faintly fragrant flowers. Fruits are 1.25 cm long, oblong, constricted in the middle, three sided and deep orange red in colour (Kritikar and Basu, 1991).
As the Sanskrit synonyms *elaparni* and *sugandha* suit this plant well, most of the South Indian physicians consider this plant as the ayurvedic drug *rasna* (Sivarajan and Balachandran, 1994).

The volatile oil from the rhizome contains methyl cinnamate, cineol, camphor, d-pinene (Pruthi, 1992). Kokate et al. (1997) reported that unlike *A. officinarum*, flavanoids are absent in *A. galanga*. Syamasundar et al. (1999) worked out on the volatile constituents of *A. galanga* flower oil.

Rhizomes are aromatic, pungent and bitter. They are used in rheumatism, catarrhal affection and bronchial disorders (Kokate et al., 1997). According to Achuthan and Padikkala (1995), *A. galanga* together with *Kaempferia galanga* exhibit hypo-lipidaemic effect. Anti-diabetic, anti-ulcer and cyto protective activity of *A. galanga* is reported by Chatterjee (1996).

*Anisomeles malabarica* (Linn.) R.Br.ex.Sims

= *Nepeta malabarica* Linn.

Family : Lamiaceae

Vernacular names

San. : *Sprikka, Vaikunthah, Mahadronah*

Mal. : *Karimtumba*

Tam. : *Peyimartti, Peyameratti*

Eng. : Malabar catmint

*Sprikka* is a potent drug used in ayurveda and sidha systems of medicine. Rheede (1690) described *Adenosoma indiana* (Lour.) Merr. (Scrophulariaceae) under the local name *karimtumba* as the source plant. According to Sivarajan and
Balachandran (1994) and Pandey (1990), *A. malabarica* is the genuine source of *Sprikka*. However both plants are used in different parts of Kerala.

*A. malabarica* is widely distributed in Srilanka, Malayan peninsula, Mauritius etc. In India, they are found in Deccan, N.India, South Carnatic region, Tamilnadu and southern Kerala.

Plant is a shrub with tomentose, tetrangular stem. Leaves are simple, opposite, thick, aromatic and woolly. Flowers are purple in dense whorls of interrupted spikes. Fruits are ellipsoid. Stem and leaves are covered with woolly soft and white hairs (Warrier *et al.*, 1993).

Pharmacognostic studies of *A. malabarica* have been reported by Brinda *et al.* (1981). Plants show characteristic anatomical features of Lamiaceae family such as quadrangular stem with glandular, curved trichomes. Cortical region is not well developed when compared to wood and pith. Four large vascular bundles are seen in the angles of the young stem. They are separated from one another by sclerenchyma with several secondary vascular strands embedded in it. Pith is homogenous and purely parenchymatous.

Plants yield an essential oil containing citral and geranic acid. It also contains macrocyclic diterpenedilactone – ovatodiolide with two β-unsaturated lactone emoieties. Two diterpenoid compounds, ovatodiolide and anasomelic acid have been isolated from *A. malabarica*. Alcohol extract of the plant showed significant anti cancer activity (Brinda *et al.*, 1981; Pandey, 1990). Essential oil has proven anti microbial activity (Yadava and Barsainy, 1998).
Plants are cooling, stomachic, bitter, aphrodisiac and intellect promoting. They are effective in epilepsy, hysteria, amnesia, anorexia, dyspepsia, internal worms, fever arising from teething in children etc. (Nadkarni, 1954; Pandya and Chunekar, 1985; Warrier et al., 1993).

According to Brinda et al. (1981), infusion of the drug has various therapeutic applications such as affections of the stomach and bowels, in catarrh and intermittent fevers. Decoction of the plant is an excellent fomentation for rheumatic joints.

Chattterjee (1996) reported that plants excluding roots show spermicidal activity to human and rat semen. He also found that saponin from the plant exhibited spermicidal activity to human semen.

*Sprikka* comes under the *surasadigana* of Vagbhata. It is used in formulations like *Surasadi Thailam, Pathadi Gulika, Nirgundyadi Ghritham* and *Nirgunyadi Gulika*.

Raw drug (leaves with stem) are usually collected from Tamilnadu as and when required. However no report is available regarding the cultivation of these plants in Kerala.

*Bacopa monnieri* (L.) Pennell.

= *Lysimachia monnieri* Linn.

= *Herpestris monniera* (Linn.) Kunth.

Family : Scrophulariaceae

Vernacular names

San. : *Brahmi, Saraswathi*

Mal. : *Nirbrahmi, Brahmi*
Bacopa monnieri is a creeping succulent herb, which grows in wet areas of India, Srilanka, Pakistan etc. up to an elevation of 1200 m. In Kerala it is naturally seen in moist waste lands, tanks, brooks, paddy fields etc in Thiruvanathapuram, Kollam, Alappuzha, Pathanamthitta, Kottayam, Ernakulam, Thrissur, Palakkad, Malappuram and Kasargod Districts. They can tolerate saltish water to some extent.

Plants are much spreading, prostrate or creeping, glabrous, annual with numerous ascending, upright branches and adventitious roots at almost every node. Leaves are entire and opposite with round apex. Flowers are pale blue, axillary and solitary on long pedicels of varying length, corolla gamopetalous, five lobbed, two lipped, stamens four didynamous, ovary bicarpellary, syncarpous, two chambered with many ovules. Fruits are ovoid, acute, two celled, two valved capsules (Nambiar et al., 2000).

Cross section of the stem consist of uniseriate epidermis and wide cortex with abundant inter cellular spaces. Inner to this, there is single layered endodermis followed by 1-2 layers of cortex. Vascular bundles are collateral and open with 1-2 layers of indistinct cambium. Pith is well developed with plenty of intercellular spaces. Leaves show characteristic features of common dicotyledons plants with uniseriate epidermis, multi cellular and sessile, glandular trichomes. Stomata are of the ranunculaceous type present on both surfaces. Palisade tissues are two layered. Spongy tissue consists of plenty of inter-cellular spaces. Vascular bundles are C-
shaped with poorly developed vascular elements. Stomatal index of upper epidermis of *B. monnieri* is 471 and that of lower epidermis is 11.54. They also posses diagnostic palisade ratio (1.38) and vein-islet number (4.2).

The main ingredients of *B. monnieri* are alkaloids brahmine, herpestine and a mixture of three other alkaloids. It also contain saponins bacoside A and B, which on acid hydrolysis yield triterpenoid aglycone bacogenins A and B (Kokate *et al.*, 1997).


Based on bacoside A content morphotypes of *B. monnieri* have been worked out (Rajesh and Sangwan, 1997).

*B. monnieri* is astringent, bitter, sweet, cooling, purgative, intellect promoting and is useful in vitiated conditions of *vata* and *kapha*, epilepsy, insanity and neuralgia (Warrier *et al.*, 1993; Aiyer and Kolammal, 1964; Kurup *et al.*, 1979). Medicated oil prepared using the fresh juice of *B. monnieri* is an effective external application for blackening the hair and to cool the brain. (Kurup *et al.*, 1979). Kumar *et al.* (1998), reported that ethnolic extract of *B. monnieri* exhibits cytotoxic and anti tumour properties.

According to Tripathi *et al.* (1995) *B. monnieri* is a promising antioxidant. Sarin (1996) reported that this drug can be successfully used for enhancing the power of speech, arresting process of aging and overcoming conditions of stress.
According to Kokate et al. (1997), *B. monnieri* increases the receptive, cognitive and retentive power of mind and brain and hence impart longevity of life. It is used as a nervine tonic, in the treatment of asthma, epilepsy and insanity. It is also reported as diuretic, laxative, digestive, emmenagogue, anti-inflammatory, carminative and cardiac tonic.

*Holostemma ada-kodien* Schultes

Family - Asclepiadaceae

Vernacular names

San. : *Jivanti, Arkapushpi*

Mal. : *Adapathiyan, Adakodien*

Tam. : *Palaikkiari*

Hin. : *Chirvel*

*Holostemma ada-kodien* Schultes is found in the moist deciduous forests, scrub jungles and foothills of the dry deciduous forest. It is a perennial, laticiferous, twinning, shrub with large conspicuous flowers. Leaves are simple, opposite, large, cordate. Flowers are purple in axillary, umbellate cymes. Calyx deeply 5 – partite. Corolla gamopetalous, deeply 5 lobed, pinkish outside and purplish within. Stamens are, adnate to the base of the corolla tube. Pistil bicarpellary. Fruits are thick, follicle, cylindrical and bluntly pointed containing numerous flattened cosmose seeds (Kolammal, 1979; Sivarajan and Balachandran, 1994; Warrier et al., 1995).

Leaves are used as vegetable. Tuberous roots are the medicinally useful part. They are fairly long, yellowish brown in colour, irregularly bent and cylindrical. Fresh roots have a sweetish, starchy taste.
Detailed pharmacognostical study was carried out by Kolammal (1979). Cork or phellem comprises rectangular to tangentially elongated cells. Phellogen is not distinct. 3 – 6 rows of large cells with high deposition of starch grains constitute phelloderm. Some of the inner most cells contain calcium oxalate also. Adjacent to these, patches of sclerides are seen. Inner to this there is a large zone of rectangular, thin walled parenchyma. Pericyclic cells are with abundant starch grains. Phloem consists of regular phloem elements with, uniseriate and biseriate phloem rays. Cambium consists of two rows of tangentially elongated thin walled cells. Xylem (wood) constitute the major part of the root, which is not very hard due to the absence of lignified elements. Bulk of the xylem tissues comprises of thin walled parenchymatous strands except few patches of lignified elements located at the centre. The core or patch of wood situated in the centre of the root shows a diarch primary xylem surrounded by secondary xylem. Abundant starch grains are seen in wood parenchyma also. Starch grains are fairly large and made of 2-4 components. Along with these, smaller grains are also seen. The larger components have distinct eccentric hilum.

It is reported that the tubers of *Holostemma ada-kodien* contains 4.07% protein, 24 % sugar, 35.4% starch and 3.07% ash. Besides the tubers showed the presence of α - amyrin, lupeol, β - sitosterol and six aminoacids - alanine, aspartic acid, threonine, glycine, serine and valine (Pandey, 1990).

Roots are used as tonic, laxative, aphrodisiac and expectorant, cooling, ophthalmic, emollient, tonic, stimulant, and galactogogue. It also cures fever, burning sensation of eyes and stomach ache (Warrier et al., 1995). The leaves, flowers and fruits are eaten as vegetable (un published data).
Acute scarcity of this drug has resulted in the supply of sub standard varieties. So far no serious attempt has been made to meet its requirement by cultivation.

**Indigofera tinctoria** Linn.

Family: Fabaceae

Vernacular names

San. : *Nili, Nilini*

Mal. : *Neelamari, amari*

Tam. : *Avari, Nili*

Eng. : Indian indigo

Hin. : *Nil*

*Indigofera tinctoria* Linn. is the source plant of the dye Indigo. According to Cole Brooke H.T, Indians were familiar with the manufacturing of Indigo and from India the plant got the scientific name *Indigofera tinctoria* Linn. (Ainslie, 1826).

According to Pliny (AD 70) Indigo is a colour most esteemed in India (Naveen, 1994). Commercial indigo is prepared from the leaves of *Indigofera tinctoria* in two processes viz. wet plant process and dry leaf process. These processes involve the use of fresh leaves as well as dry leaves.

Indigo plant is mentioned as having been a popular export from India to Egypt and Sir John Gardner Wilkinson notes in his book *Ancient Egypt* (1878) that the dye was used in Egyptian mummy cloths.

The plant indigo is mentioned in Indian sculptures as early as 300 BC, and the wide variety of colours which can be obtained from the many species of
this tall standing shrub, often grown in Indian houses, having the colour of reflection of the sky in water to the deep midnight blue which verges on black which is the divine colour of Vishnu, the preservor.

As a cosmetic, indigo is used to make the hair dye, most commonly used by Indians for premature greying. Indigo leaf extract is blended in to various herbal oil and rubbed on to the scalp to prevent hair loss after child birth or a serious illness or to inhibit premature balding, as the plant is thought to have properties that strengthen the roots of hair (Naveen, 1993).

Ayurvedic medicine describes applying the dye to soothe burns, scalds and insect, as it is antiseptic and anti-inflammatory. It also ascribes to this plant a medicine, for leucoderma.

Medicinal value of this plant was well established by many workers of the 18th and 19th centuries. It is used as a purgative and also considered as an antidote to poison of all kinds.

According to Bhavamisra, nili is purgative in action used in various dermatological complaints, asthma, whooping cough, palpitation of heart etc.

The term nili is attributed to the blue black colour of the stem and leaves and dye Indigo. Indigofera tinctoria is the accepted source of nili (Rheede, 1692). But Aiyer and Kolammal (1960) refers to two distinct varieties of the drug namely white and black. But ayurvedic manufacturers and practioners in Kerala use both varieties indiscriminately in their formulations. (Sivarajan and Balachandran, 1994).

It is an erect shrub reaching to a height of about 2 m. Leaves alternate, stipulate, imparipinnate, leaf lets opposite, membraneous and bluish green in
colour. Flowers numerous in sessile lax, spicate, recemes. Corolla pink, papilionaceous, stamens diadelphous, ovary sessile with short incurved style and capitate stigma. Pods linear 2 – 3.5cm long, deflexed and 8-12 seeded (Kirtikar and Basu, 1991; Sivarajan and Balachandran 1994).

*Indigofera tinctoria* contains a blue dye stuff which is produced during fermentation from another agent existing in the plant known as indicans. It is an amorphous, yellow material with a nauseous bitter taste and an acid reaction. Plants also contain indirubin (Nadkarni, 1954; Thomas *et al*., 2000). Leaves and root of *Indigofera tinctoria* have different pharmacological action, the later being used as an antiseptic and antidote in cases of urinary diseases, poisoning etc.

The leaves are externally applied as poultice in various skin affections like scabies and it can heal wounds and ulcers. Juice of the leaves is given in asthma, whooping cough, palpitation of the heart, lung diseases and kidney complaint. Root is used in hepatitis, difficult micturition, snakebite, caries of the teeth, consumption etc. (Anonymous, 1959; Kirthikar and Basu, 1991; Nadkarni, 1954; Aiyer and Kolammal 1964; Sivarajan and Balachandran, 1994). Watt (1893) reported that infusion of root can be used in arsenic poisoning. Kapoor *et al*. (1969, 1971) reported about the saponin and alkaloid content of *Indigofera tinctoria*.

The oil extracted from the seeds is used in bronchitis and as an ointment in sores. It is also used in epilepsy, other nervous disorders and as a hair growth stimulant. The famous ayurvedic preparation, *Neelabhringadi oil* makes use of these virtues of *Indigofera tinctoria* Linn. together with some other herbal
gradients, where the fresh plant juice is used. The colour of Neelabhringadi oil is greatly dependant on the quality of Indigofera used.

Pharmacological studies conducted in Indigofera tinctoria have been reviewed by Satyavati et al. (1987) and Chatterjee (1996).

In the Sanskrit name ‘nili’, Indigofera tinctoria is widely used in ayurvedic preparations such as Neelibhringadi Thailam, Chemparathyadi Keram, Neelinirgunyadi Thailam etc.

Occurrence and cultivation of this plant was known even before the dawn of this century especially in Bengal. (Dymock et al., 1890). Detailed information on the method of cultivation is lacking.
**Kaempferia rotunda** Linn.

Family : Zingiberaceae

Vernacular names

San. : Hallakam, Kalhara, Bhumichampaca, Bhuchampaca

Mal. : Chengalneer kizhange

Tam. : Nerppicin

Eng. : Indian crocus

Hin. : Bhuyicampa

*Kaempferia rotunda* Linn. is popularly known as *bhumichampaca* or *bhuchampaca* in ayurvedic formularies due to its similarity with the flowers of *chamapaka* (*Michelia champaka* Linn.). Its Sanskrit synonyms include *hallakam* (flowers are frequently visited by bees), *kalharam* (water plant) etc. Rheede (1692) misinterpreted this plant with the vernacular name ‘malankoova’ which is actually *Zingiber zerumbet* (Zingiberaceae), in his historic book *Hortuse Malabaricus* (Sivarajan and Balachandran, 1994). *Lagenandra toxicaria* Dalz. (Araceae), a marshy plant is also used as *kalhara* by certain physicians. However, Kerala physicians use *Kaempferia rotunda* as *kalhara* or *bhuchampaca* (Rheede 1692; Dymock *et al.* 1890; Ainslie 1826; Nadkarni 1954; Sivarajan and Balachandran 1994).

*K. rotunda* is distributed throughout the tropics and subtropics and grows in the forest of Southern India. In Kerala it is found in Silent Valley, Nelliyampathy, Kalpetta and Peechi (Nambiar *et al.*, 2000). It is also cultivated in some parts of Tamil Nadu (Warrier *et al.*, 1995). It is a perennial aromatic herb with tuberous root stock. Leaves are simple, erect, oblong, accumulate with purplish green below
and variegated green above. Flowers spikate with lilac tip. They are trimerous and fragrant. Rhizome tuberous with many roots, bearing small oblong tubers. These tubers are used as the crude drug.

Detailed pharmacognostical studies of rhizome and roots were carried out by Nambiar et al. (2000). Rhizome cross section is circular in outline with 7-10 layers of exodermis. Ground tissue is composed of thin walled cells with large air spaces, starch grains and oil globules. Vascular bundles are collateral, closed and surrounded by a single layer of parenchymatous cells. These cells are devoid of starch grains. Central portion of rhizome is occupied by numerous scattered vascular bundles.

Tuberous roots also contain 4-6 layers of epidermis. Cortex comprises a large zone of parenchymatous cells with abundant starch grains and oil globules. But in the cortical region of normal roots only lesser percentage of oil globules and starch grains are seen.

The main ingredients of tubers are crotopoxide and β sitosterol. They also contain essential oil, which gives a compound with melting point 149°C and it yielded benzoic acid on hydrolysis (Thomas et al., 2000).

Tubers are thermogenic, stomachic, anti-inflammatory and emetic. They are used in gastropathy, dropsy, inflammation, wound, ulcer, clotting of blood, tumours, and cancerous swellings (Warrier et al., 1995).

This drug was widely used in Indian medicines (Dymock et al., 1890) as a local application to tumours and wounds. Rheede (1692) reported that dried and powdered tubers of *K. rotunda* have antiseptic and blood purifying properties and are used both internally and externally. An ointment preparation “Hallakam” made
out of this drug is a popular medicine in wound and bruises and swellings (Sivarajan and Balachandran, 1994) reported that *K. rotunda* improves complexion, cures burning sensation, mental disorders and insomnia.

*Chyvanaprasa, Asokarishtam, Kalyanaghritham* and *Bala-dhathryadi thailam* are some of the classical ayurvedic formulations using this drug (Vaidyan *et al.* 1974).

*Mentha arvensis Linn.*

*Family*: Lamiaceae

*Vernacular names*

Mal. : Peppermint

Eng. : Mint, Peppermint

Hin. : Paparaminta

*Mentha arvensis* grows wild in Europe, while it is cultivated in Japan, Russia, USA and in some regions of Europe. In India this exotic medicinal herb is cultivated near Jammu, Tarai district of Uttar Pradesh, parts of Punjab and Himachal Pradesh. But it is commercially cultivated only in Uttar Pradesh that too in some regions of Tarai Dist. It generally favours an altitude of 250-400 m and a temperature of 15-25°C (Kokate *et al.*, 1990).

This plant is not used in classical ayurvedic formulations but *Sidhabheshajamanimala* mentions the use of a species of *Mentha* as digestive. *Ayurvedavigjyanam* gives an account of the plant as nervine tonic and rejuvenator. It is also described as digestive and nervine tonic (Sharma, 1982).
M. arvensis is a herbaceous perennial with creeping rhizome and opposite decussate shortly petiolate leaves. Inflorescences are ovoid, cylindrical, terminal heads.

The chief chemical constituents of M. arvensis are peppermint oil containing menthol at the extend of 70% in free as well as in the form of isomers. According to Bhasker and Putivsky (1978) there is seasonal variation in the yield of essential oil. Besides menthol the oil contain menthone, menthofuran, jasmone, menthyl, isovalerate, menthyl acetate and several other terpene derivatives. The menthofuran causes resinification and develops dirty smell (Kokate et al., 1990).

Peppermint oil and dried plants are antiseptic, carminative, refrigerant, stimulant, diuretic and has wide application in pharmaceuticals, confectionary, flavour industry and the manufacture of commodities like tooth paste, tooth powder, shaving cream, chewing gum and jellies. Synthetic menthol is generally substituted for natural menthol although it has different flavour (Pruthi, 1992).

Recently this plant is used in certain ayurvedic patent products (Naturone – a paediatric syrup of KAPL). Since this plant is not cultivated in Kerala, it was felt to undertake its cultivation on experimental basis.

According to Perrin and Colson(1991) the optimal harvest time is when the calyces are only barely visible at the stem extremity. The quantity of the essential oil accumulated is maximum at that time. Kothari et al. (1996) worked on the effect of raw spacing and nitrogen fertilisation on the growth and oil yield of Japanese mint.

Vadiel et al. (1980) reported that 15 cm rows spacing is ideal for getting maximum herbage yield. The spacing provides proper utilisation of nutrients and
moisture and thereby more vegetative growth. According to Pruthi (1992), mint plants should be harvested when it has just reached the flowering stage. Cultivation and yield of *Mentha* in Punjab is reported by Randhwa. *et al.* (1984).

Mint is known to grow luxuriantly in tropical and sub tropical climate (Pruthi, 1992). Although it is cultivated luxuriantly in North Indian plains (Muni Ram *et al.*, 1999), its growth in Kerala is found to be greatly influenced by climatic and environmental changes.

*Operculina turpethum* (Linn.) Silva Manso

(=*Merremia turpethum* (Linn.) G.L.Shah and R.G.Bhat)

Family : Convolvulaceae

Vernacular names

San. : *Trivrit*

Mal. : *Trikolpakonna*

Tam. : *Sidatai, Kumdam*

Eng. : Indian Jalap, Turpeth

Hin. : *Nishoth*

*Operculina turpethum* (Linn.) Silva Manso is distributed widely all over India up to an altitude of 1000m. It is a perennial twiner with milky juice.

Stems are twisted, angled, pubescent and brown in colour. Leaves are simple, large with variable shape. They are mucronate, more or less pubescent on both sides. Leaf base is cordate or truncate. Inflorescence are white, few flowered cymes. Outer sepals are much enlarged in flowers. The three inner sepals are small and membranous. Corolla is long and companulate. Roots are long, slender and fleshy (Regahunathan and Mitra, 1982; Satyavati *et al.*, 1987; Warrier *et al.*, 1995).
Cross section of *Operculina turpethum* stem is light brown in colour with thin bark, large diffuse porous wood and central hollow pith. Abnormal vascular bundles are seen in the stem. Resin cells are present in the parenchymatous cortex and phloem. Xylem possess large vessels with tylosis. Phloem consists of soft parenchymatous tissue. Medullary rays are uniseriate. Large number of secretory cavities is seen in the pith.

Root in cross section shows a single layer of epidermis and 3-4 layers of cortex with a distinct endodermis and pericycle. Stele is triarch to pentarch. In mature roots the cork is 3-5 cells thick and the phelloderm consists of 4-5 layers of tangentially elongated cells. Vascular bundles are arranged in a circle and uniseriate medullary rays traverse through them. Within these bundles some more vascular bundles originate and as a result vascular bundles form discontinuous rings. Xylem shows 3-5 radiating arms and several patches of embedded delignified parenchyma. (Reghunathan and Mitra, 1982).

Resin of the *Operculina turpethum* contains glucosides, turpethin, α turpethin and β turpethin. It also contains coumarin, scopoletin, glucose, rhamnose and fucose (Satyavati *et al.*, 1987).

*Operculina turpethum* roots are bitter, acrid, sweet, expectorant, anti pyretic, hepatic stimulant and hydragogue. They are widely used in colic, constipation, dropsy, vitiated conditions of vata, paralysis, myalgia, arthralgia, intermittent fever, leucoderma, pruritus, haemorrhoids, consumption and ophthalmia (Nadkarni, 1954; Chopra *et al*. 1956; Warrier *et al*., 1995).
Pharmacological studies of *Operculina turpethum* were carried out by Khare *et al.* (1982). Aqueous and ethereal extract were found to be highly effective in inflammation.

*Trivrit* enter into the composition of various ayurvedic preparations such as *Avipathi choornam, Kalyanagulam, Bahusalagulam, Trivrit lehyam, Manibhadram, Aragwadarishtam* etc in the form of *choornam, gulika, lehyam* and *arishtam*. Most of these preparations are useful in curing piles and gastro intestinal disorders. (Vaidyan, 1974; 1980).

Most of the ayurvedic treatises mention only as *trivrit* and only a few specify it as root bark. According to Sharngadhara "Bhage anukthae jatabhavael" means if the official part of a plant is not specified, root is the therapeutically active part and for very large plants, instead of root, root bark ("twachonathu") should be used in formulations (Warrier, 1955). Extensive market study revealed that most of the *trivrit* in the drug market consists only of dried stem of these plants. Reghunathan and Mitra (1982) reported that the glycosidic resin responsible for the pharmacological action is concentrated mostly in the bark of the root. Hence the root should be used in ayurvedic preparations to assure maximum efficacy.

**Piper spp.**

Family : Piperaceae

a) *Piper longum* Linn.

= *Chavica roxburghii* Miq.

b) *Piper chaba* Hunt.

= *Piper retrofractum* Vahl.
Piper officinarum DC.

Vernacular names
San. : Pippali, Magadhi, Kola
Mal. : Thippali
Tam. : Vettalai
Eng. : Long pepper
Hin. : Peepal

Rajanighantu describes four different types of pippali viz. pippali, vanapippali, saimhali and gaja pippali. Of these the former three are identified as Piper longum Linn., Piper sylvaticum Roxb, and Piper retrofractum Vahl. respectively (Sharma, 1983). The identity of gaja pippali is highly controversial. Balanophora fungosa J.R and G.Forst (Balanophoraceae), Scindapsis officinalis Schott and Rhabidophora pertusa (Araceae) are used in different parts of Kerala as gaja pippali. However, Piper longum Linn. is the accepted source of pippali in Kerala.

Trikatu, a common herbal combination of Piper nigrum Linn., Piper longum Linn. and Zingiber officinale Rosc and its individual components are widely used in various ayurvedic preparations (Sivarajan and Balachandran, 1994). Other main compound herbal preparations include Agasthyarasayanam, Abhyarishtam, Chyvanaprasam, Pippalyasavam etc.

Pipalli also enhances the bioavailability of other drugs. The biochemical basis of this enhanced drug bioavailability is through the interaction of the active ingredient piperine with enzymatic drug biotransforming reactions (Atal et al., 1981, 1984, 1985). Vardhamana pipalli – therapeutic application of pippali in
increased doss is an accepted treatment in respiratory disorders (Anushman et al., 1984).

Anti inflammatory, anti fertility, anti spasmodic and hypotensive action of different spp. of *Piper* are reported by Satyavati *et al.* (1987).

*P. longum* is a native of Indo-Malaya region. But it was very early introduced to Europe and was treated as a valuable spice. It grows wild in tropical rain forests of Assam, West Bengal, Uttar Pradesh etc. They are glabrous, perennial under shrub with creeping or trailing branches, rooting below. Inflorescence is spike with unisexual flowers which develop into a small greyish, green or darker grey berries.

*P. chaba* is known as Java long pepper. It is an inhabitant of Malaya. They are glabrous climbers with long leaves and adhesive roots. Here the spikes are reddish brown to greyish brown, compact and the epicarp of fruitlets fused to form a continuous layer. Dried fruiting spikes are sold under the name large peepel (Satyavati *et al.*, 1987).

The main ingredients of *P. longum* are the alkaloids piperine, piperlongamine, N- isobutyldeca trans-2-trans-4 dienamide and a terpenoid substance. Piperine and piperlongamine are reported in roots also (Anonymous, 1992). Fruits of *P. chaba* also contain piperine, β sitosterol, caryophyllene oxide and piperlongamine (Satyavati *et al.*, 1987). In addition, petroleum ether extract yielded five new compounds, which were later confirmed by synthesis (Vig *et al.*, 1980).
Though the great classic of ayurveda give a slightly different mode of action to \textit{P. longum} and \textit{P. chaba} in the Sanskrit synonyms \textit{upakulya} and \textit{ephagana} (Pandya, 1985), but according to Dymock \textit{et al.} (1890).

\textit{P. chaba} is the European long pepper and it has the same properties of \textit{P. longum}. Where as Chandhoka \textit{et al.} (1978) and Chatterjee (1996) reported that \textit{P. chaba} shows more anti fertility effect in rats than \textit{P. longum}. Pharmacological study of \textit{P. chaba} is also carried out by Tewari \textit{et al.} (1964).

Successful cultivation of \textit{Piper longum} in mountain region and that in Kerala are reported by Pande \textit{et al.} (1995) and Viswanathan (1996) respectively, whereas no report is available regarding the commercial cultivation of \textit{P. chaba} in Kerala.

\textbf{\textit{Pogostemon patchouli} Pellet}

\textbf{= \textit{Pogostemon cablin}}

Family : Lamiaceae

Vernacular names

San. : \textit{Pathra};
Mal. : \textit{Pachila}
Tam. : \textit{Pachai}
Eng. : Patchouli
Hin. : \textit{Pacholi}

\textit{Pogostemon patchouli} Pellet is extensively cultivated in Indonesia, Malaysia, Madagascar, Seychelles etc. It is a herbaceous, odorous plant reaching to a height of 1m and ascending to an altitude of about 1500 m. Stem and branches are obtusely quadrangular and usually purple. Leaves are 2-4” long and 1 \(\frac{1}{4}\) - 3 \(\frac{1}{2}\)
broad. Margin is slightly lobbed and the lobes have crenate – serrate teeth. Hairs are abundant on the under surface along the ribs and give the leaves a pale appearance (Guenther; 949). Micro morphological studies of Pogostemon were carried out by Tahir et al. (1995).

Five cultivars of P. patchouli are available viz., Johre, Malaysian, Indonesian, Java and Singapore. Pooled analysis of 2 years data in open as well as under shade in coconut garden showed performance of the varieties to be stable irrespective of season. Field experiments conducted at Bangalore, Trichur and Goa established the superiority of Singapore variety over the other varieties. At Bangalore, maximum herbage yield was obtained for Singapore and Java cultivars. At Trichur, the maximum leaf yield (16.681 t/ha) was observed in the case of Singapore cultivar (Viswanathan et al., 1993). According to Guenther (1949), root, stem, branches and leaves of patchouli plant contain essential oil, but in varying proportions. Oil from root and stem has very high specific gravity and sub normal quality. So only the tops are used for oil extraction. The first 5 pairs of leaves have maximum oil content and it being constant, he recommended cutting the plant at this stage.

Patchouli oil contain and α and β pinene, camphene, β elemene, caryophyllene, α and β patchoulenes, α quaiene, α bulnesene, allo – aromadendrene and α gurjunene (Tsubaki et al., 1967). Recently isolated norpatchoulenol is the true odour carrier of the patchouli oil. (Sarwar et al., 1983).

Plants especially the leaves and dried tops are carminative, diuretic and used effectively in scanty urine and biliousness (Nadkarni, 1954).
Patchouli is an important naturally occurring base material used in perfumery (Arctander, 1960). The oil is extensively used as a flavour ingredient in major food products including alcoholic and non-alcoholic beverages, candy, baked goods, pudding and meat products. In Chinese medicine, it is used as decoction with other drugs to treat nausea, vomiting, diarrhoea, abdominal pain etc. It is also used as an after dinner candy to treat bad breath, as a masking agent for alcoholic breath, onion or garlic odours (Anand and Rakesh, 1984).

Pharmacological studies of different sp. of *Pogostemon* were carried out by Bhatnagar *et al.* (1961) and Dhar *et al.* (1968 and 1974).

Cultivation of patchouli was first reported from Java in 1895 with planting materials imported from Singapore. But the species is uncertain (Anand and Rakesh, 1984). The first attempts to introduce this plant in India were made in 1941 in Madhya Pradesh. But the result was not encouraging. Later in 1962 plant introduction and Agro technology were studied by CIMAP Regional Centre, Bangalore. They planted it as an inter crop in coconut garden. It is reported that the crop suffered heavily due to the attack of root–knot nematodes (Sarwar *et al.*, 1983).

According to Guenther (1949) patchouli plant flourishes well under damp and warm climate preferably 22°C – 28°C with evenly distributed rainfall. Being a soil exhaustible plant, application of fertiliser and harvesting before the leaves turn brown seemed to be worth. The growth hormone gibberellin has great influence in growth and yield characteristics of *Pogostemon patchouli* (Misra, 1995). Bhaskar (1995 a and b) reported the herbage and oil yield of patchouli. Genetic barriers and
export potential of patchouli have been discussed by Bhaskar and Vasantha kumar (1999).

*Rheum emodi* Wall. ex Meissn

Family - Polygonaceae

San. : *Amlaparni*

Mal. : *Chuvannaratha*

Tam. : *Natti-eravalchinni*

Eng. : Indian Rhubarb

Hin. : *Ravanadchini*

*Rheum emodi* Wall. ex Meissn is a native of China, grows at an altitude of above 3000 m. Now it is cultivated in India, West Germany and other European countries. In India it is cultivated in Kashmir, Kulu and Manali areas. Indian Rhubarbs are light in weight and show slight variation in biochemicals also (Kokate *et al.*, 1997).

Dymock *et al.* (1890) reported three different types of rhubarbs, Chinese, Khorasan and Indian. Of which Indian is considered to be less effective.

Rhizomes are compact, cylindrical and barrel shaped with longitudinally wrinkled outer surface. Internally the drug contains parenchymatous cortical cells with rich deposition of starch grains, tannins and calcium oxalate crystals. Vessels and tracheids possesses helical and spiral thickenings (Sukhdev *et al.*, 1998)

As *amalaparni*, *R. emodi* is used in classical formulations in North India where as literature is lacking regarding the use of this plant in South India as *amalaparni* (Sharma, 1982; Sivarajan and Balachandran, 1994). But the drug *chuvannaratha*, widely used as a substitute to *bengalaratha* (*rasana*) is
authentically identified as the rhizome bits of *Rheum emodi* (Sanjappa, BSI, Howrah, 1999 – Personal communication).

Rhubarb contains anthraquinone glycosides, astringent principles, gallic acid, tannin, catechin and epicatechin. It is used as a bitter, stomachic in the treatment of diarrhoea and as a purgative (Kokate *et al*., 1990). Chrysophanic acid isolated from *R. emodi* exhibits anti-inflammatory and anti-coagulant activity. This drug is contra indicated in arthritis, intestinal obstructions and renal disorders (Sukhdev *et al*, 1998).

*Ruta chalepensis* Linn.

=*Ruta graveolens* Linn. var.*angustifolia* sensu Hook f.

Family - Rutaceae

San. : *Gucchapatra, Sitab*

Mal. : *Arootha*

Tam. : *Aruvadam*

Eng. : Common Rue, Garden Rue, Bitterwart

Hin. : *Pismarum*

*Ruta chalepensis* Linn. popularly known as the rue plant is a native of South East Europe. It is now cultivated in Indian gardens. It was described by Hippocrates, the father of medicine as resolvent, diuretic and effective in female diseases. Indians used the dried and burnt leaves for fumigating children suffering from catarrh (Ainslie, 1826). Pliny found out a close relationship between rue and fig tree as the former flourished well under the fig tree. According to Dioscorides, rue seeds when administered together with *Aconitum lycotonum* Linn. and *Aconitum napelles* Linn., forms an efficacious antidote against the bites of
scorpions and snakes. In Europe these plants were used by priests to make mops to sprinkle holy water and hence the name *Herb of grace*. (Singh, 1996). In Unani medicine, it is used in the name *sudaba* (Ali, 1990).

Plants are perennial herbs growing up to 80cm in height with short petiolate, compound leaves and yellow flowers. Fruits are capsules and short pedicelled (Warrier *et al*., 1996).

A major constituent of this herb is ‘Rue oil’ which contain methyl nonyl ketone and a small amount of methyl heptyl ketone. Baser *et al*.(1996) identified 24 compounds from steam distilled essential oil of *R. chalepensis* by GC/GC/MS. Phytochemical studies of essential oil of *R. chalepensis* was carried out by Basu *et al*.* (1996).

The leaves are employed in cookery as a condiment due to the high dose of vitamin C content (480mg/100g). Due to its pleasing odour it is also used to garnish food (Ambasta, 1986).

This plant is widely used in homeopathic medicine owing to its action in sprain, injuries, skin problems, depression, anxiety etc. It also strengthens the eye muscles and restores the sight (Singh, 1996).

Ancient ayurvedic treatises describes this plant as digestive, rejuvenative, nervine tonic, anthelmintic, abortive (Sharma, 1982), anti rheumatic and as an antidote (Data Raman, 1867). But only restricted use is seen in classical wordings except in certain paediatric formulations described in Arogyarakshakalpadrumam (Gopalapillai, 1993). However, this plant especially plant juice and leaves are considered as abortive, digestive, stimulant, expectorant, carminative, laxative and has wide application in infantile disorders like epilepsy, convulsion and other
nervine disorders, odontalgia, otalgia, bronchitis, helminthic infections, sprue etc. (Watt, 1867; Nadkarni, 1954; Warrier et al., 1996). So there is great demand for this plant as single drug. Shankara and Nair (1981) reported that villagers of Bangalore, Mysore and Tunker districts use this plant for various ailments such as alopaeia, eczema, hysteria, poliomylitis, paralysis, fever, sciatica and as an effective contraceptive.

According to Kumar et al. (1996), growth-regulating substances has great influence on the rooting of stem cuttings. But being an introduced plant, great care is necessary to rear it.

**Vanda tessellata (Roxb) Hook ex. Don**

= *V.roxburghii* R.Br.

Family - Orchidaceae

San. : Rasna, Atirasa, Surassa

Mal. : Maravazha

Eng. : Vanda

Hin. : Banda, Rasna

*Vanda tessellata* (Roxb) Hook ex. Don is an epiphytic orchid distributed all over India and in Sri Lanka. It is often cultivated for its handsome flowers. Dried pieces of aerial and clinging root, stems and leaves comprise the commercial *rasnas* of North India (Chopra et al., 1956; Kirtikar and Basu 1991; Reghunathan and Mitra, 1982; Anonymous, 1992).

Stem is climbing, 1 – 2 feet in height giving rise to many thick, fleshy roots (clinging and aerial roots). Both types contain special absorptive tissue known as
velamen, which absorbs water like a sponge (Dymock *et al.*, 1890; Reghunathan and Mitra, 1982).

Detailed pharmacognostical studies in rasna was carried out by Prasad *et al.* (1968). Raphides and volatile oil are present in the paraenchymatous tissues of the leaves, stems and root. Large thick walled, lignified cells and small thin walled non lignified cells with scattered vascular bundles are present in the ground tissues of the stem.

The main biochemicals in the plant includes alkaloids, glycosides, tannins, saponins, sterols, fatty oils, resins and colouring matter (Anonymous, 1992).

Anti-inflammatory effect of *V. tessellata* is reported by Sharma and Sharma (1977). Their study proved that *V. tessellata* is the least effective among the rasna drugs. Plants have direct action on the smooth muscles and are an effective stimulant to liver (Anonymous, 1992). Kirtikar and Basu (1991) reported that rasna is effective in rheumatism and other nervous disorders. It is an ingredient of several medicated oils for external application in rheumatism and diseases of the nervous system.

**Wedelia chinensis (Osbeck) Merrill.**

= *W. calendulacea* (Linn.)Less.

Family - Compositae

San. : *Pitabhringi, pitabringa*

Mal. : *Mannakkayyunai*

Tam. : *Manjalkorisalai*

Hin. : *Pitabhamgara*
**Wedelia chinensis** (Osbeck) Merrill is found in wet places and hence grow well in costal areas throughout India. It is a procumbent, perennial herb growing up to 1 meter in height and rooting at the lower nodes. Leaves are opposite, hairy and lanceolate. Flowers are yellow, borne on axillary or terminal heads. Fruits are tubercled achenes. Prabhakar et al., (1992) derived sufficient guidelines for the pharmacognosy of *W. chinensis* and *E. prostrata*. Root, stem and leaves both plants possess similar anatomical characteristics. Not much variation was found in stomatal indices, palisade ratios, vein-islet number and palisade cell lengths. But striking differences are noticed in their UV absorption pattern and TLC.

Presence of wedelolactone (C\textsubscript{16} H\textsubscript{10} O\textsubscript{7} ) was first reported from *W. chinensis*. Later it was reported in *Eclipta* also. Plants also contain norwedeloactone, benzofuran, norwedlic acid (Govindachari et al., 1956). Wedelolactone has potent antiphlogistic and antiallergic activity due to its 5-lipoxygenase inhibitory activity and hence act as an effective antioxidant (Wagner et al., 1986). The leaves are considered as tonic, alterative and are used in cough, cephalalgia, skin diseases etc (Kritikar and Basu, 1991). *W. chinensis* are hepatoprotective, cholagogue and can be successively used against catarrhal jaundice, anaemia, spleenomegaly, colic, alopecia, premature greying of hair and dandruff (Chatterjee, 1996). Hedge et al. (1994) reported the anti-ulcer and cyto protective effect of *W. chinensis*. Now a days *W. chinensis* has gained much importance over *E. prostrata* owing to the high pharmacological action. A 5% ethnolic extract of *W. chinensis* inhibits the growth of Ehrlch’s ascites carcinoma (Narayanappa and Veluchamy, 1987).
Not much literature is available on the commercial cultivation of this plant except for brief reports by Narayanappa and Veluchamy (1987). Madhavan and Balu (1995) developed a rapid multiplication method of *W. chinensis* (Osbeck) Merr. by treating the stem cuttings with different concentration of IBA and GA. Accordingly, 100ppm IBA treatment greatly enhanced root production and quick establishment of the plant. However most of the requirement of this plant is met by wild collection.