2. LITERATURE SURVEY
2.1 Herbal medicine

Biodiversity of natural resources has served not only for the primary human needs but also for health care, since time immemorial. The Indian subcontinent, with the history of one of the oldest civilization, harbors many traditional health care systems. There development was supported by the diverse biodiversity in flora and fauna due to variations in geographical landscaping. Renewed interest of developing as well as developed countries in the natural resources has opened new horizons for the exploration of natural sources with the perspective of safety and efficacy. The development of these traditional systems of medicines with the perspectives of safety, efficacy and quality will help not only to preserve this traditional heritage but also to rationalize the use of natural products in the health care. Until recent past, the nature was considered as a compendium for templates of new chemical entities. The plant species mentioned in the ancient texts of Ayurveda and other Indian system of medicines may be explored with the modern scientific approach for better leads in health care (Mukherjee et al., 2006, Sunil et al., 2007).

In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularised in developing as well as in developed countries owing to its natural origin and lesser side effect.

In olden times, vaidyas used to treat patients on individual basis and prepare drug according to the requirement of the patient. But the scenario has changed; herbal medicines are being manufactured on the large scale in pharmaceutical units where manufacturers come across many problem such as availability of good quality raw material, authentication of raw material, availability of standards, proper standardisation methodology of single drugs and formulation, quality control parameters (Agarwal et al., 2007).

Ayurveda emphasis the relationship between man and plants throughout the development of human culture. The use of herbal medicine due to toxicity and side effects of allopathic medicines, has led to sudden increase in the number of herbal drug manufactures. Herbal medicines as the major remedy in traditional system of medicine have been used in medical practices since antiquity. The practices continue today because of its biomedical benefits as well as place in cultural beliefs in many parts of world and have made a great contribution towards maintaining human health (Sapana et al., 2007).
WHO has defined herbal medicine as finished labeled medicinal product that contain active ingredients, aerial or underground parts of the plant or other plant material or combinations. In the western world, as the people are becoming aware of the potency and side effects of synthetic drugs, there is an increasing interest in the natural product remedies with a basic approach towards the nature. Natural products from the plant, animal and minerals have been the basis of the treatment of human diseases. Today estimate that about 80% of people in developing countries still relays on traditional medicine based largely on species of plants and animals for their primary health care. Alternative medicine is the needs of the day. Herbal medicines are currently in demand and their popularity is increasing day by day. In the healthcare sector, WHO recommends and encourages the use of traditional herbs or remedies because huge amount of raw material is easily available. They are comparatively safe because of their low toxicities. Till today most of the villagers rely on herbal remedies as these have psychological effect on the common man in mind that it will spared of the side effects of allopathic drugs and will magically cured (Kamboj et al., 2000).

2.1.1 Advantages of herbal medicine

1. Herbal medicines have long history of use and better patient tolerance as well as acceptance.
2. Medicinal plants have renewable source, which is our only hope for sustainable supplies of cheaper medicines for the world of medicines for the world growing population.
3. Availability of medicinal plants is not a problem especially in developing countries like India have rich agro-climatic, cultural and ethnic biodiversity.
4. The cultivation and processing of medicinal herbs and herbal products is environmental friendly.
5. Prolong and apparently uneventful use of herbal medicines may offer testimony of their safety and efficacy.
6. Through out the world, herbal medicines has provided many of the most potent medicines to the vast arsenal of drugs available to modern medical science, both in crude form and as a pure chemical upon which modern medicines are structured (Agarwal et al., 2007, Cohen et al., 2000).
2.1.2 Limitations of herbal medicines:

Herbal medicine has its own limitations arising out of its own technical constituents. The prominent limitations of herbal medicines are (Mohanty et al, 1998, Mukherji, 2001, Agarwal et al., 2007):

1. Ineffective in acute medical care:
   Herbal medicines are not effective to treat acute illness. As most of the medicines are designed to work at the molecular level of physiology, the drug takes its time to deliver the results. However there are few herbal medicines which work instantly in acute conditions like diarrhoea.

2. Inadequate standardisation and lack of quality specifications:
   This is the most often criticized aspect of herbal medicines. Each herbal ingredient in the herbal preparation has an array of chemical constituents with complex molecular formulae. Each herbal preparation is a source of polypharmacy within itself. As results, standardization of herbal preparation or its ingredients become a highly complex issue.

3. Lack of scientific data:
   Literature on herbal medicines lacks in scientific data in support of medicinal activity claimed and their safety and efficacy assumed. Hence, there is a need to incorporate certain parameters of the pharmacological evaluation.

2.2 Standardization of Herbal drugs

Plants are very complex in their composition and their therapeutic activity depends on their chemical constituents, according to age, geographical location and harvesting processes. Also improper authentication of herbs, adulterations by microorganisms, pesticide residues, has made standardization of herbal drug of primary importance (Agarwal et al., 2007, Nadkarni, 1954).

At present no official standard are available for the herbal preparation. Manufacturers engaged in testing of their formulation, have fixed their own parameters, most of them are only preliminary in nature. At present it is very difficult to identify the presence of all the ingredients as claimed in a formulation.
Different analytical methods can be applied for qualitative and quantitative estimation of bioactive group of compounds like alkaloids, flavonoids, polyphenolic components or estimation of particular compound (Kokate et al., 2007, Agarwal et al., 2007).

In recent years there is spurt in the interest regarding survival of an Ayurvedic form of medication. In the global perspective, there is a shift towards the use of medicines of herbal origin, as the dangers and shortcoming of modern medicines have started getting more apparent.

Herbal product has been enjoying renaissance among the customers throughout the world. However, one of the impediments in the acceptance of the Ayurvedic formulation is the lack of standard quality control profile. Due to complex nature of and inherent variability of the constituents of plant based drugs, it is difficult to establish quality control parameter. Plant contains mixture of different secondary metabolites that can vary considerably depending on environmental and genetic factors. Furthermore, the constituents responsible for the claimed therapeutic effects are frequently unknown or only partly explained. These complex positions of quality aspects of herbal drugs are further complicated by the use of combination of herbal ingredients as are being used in traditional practice. Batch to batch variation starts from the collection of raw material itself in the absence of any reference standard for identification. These variations multiply during storage and further processing (Sapana et al., 2007).

Owing to long standing and time proven uses of herbal drugs along with higher safety margins, WHO has taken necessary steps to ensure quality control with modern techniques and application of suitable standards, shown in Table 5 (Agarwal et al., 2007).
### Table 5: Test for standardization of herbal drugs

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Test</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Macro and microscopic examination</td>
<td>Identification of right variety and search of adulterants</td>
</tr>
<tr>
<td>2.</td>
<td>Foreign organic matter</td>
<td>Removal of matter other than source plant to get the drug in pure form</td>
</tr>
<tr>
<td>3.</td>
<td>Ash value (total ash, sulfated ash, water soluble ash and acid insoluble ash)</td>
<td>Judge the identity and purity of crude drug</td>
</tr>
<tr>
<td>4.</td>
<td>Moisture content</td>
<td>Check moisture content helps to prevent degradation of product</td>
</tr>
<tr>
<td>5.</td>
<td>Extractive values</td>
<td>Indicating the approximate measure of chemical constituents of crude drug</td>
</tr>
<tr>
<td>6.</td>
<td>Crude fiber</td>
<td>Determine excessive woody material criteria for judging purity</td>
</tr>
<tr>
<td>7.</td>
<td>Qualitative chemical evaluation</td>
<td>Identification and characterization of crude drugs with respect to phytochemicals constituents</td>
</tr>
<tr>
<td>8.</td>
<td>Chromatographic examination</td>
<td>Identification of crude drugs based on use of major chemical constituents as marker</td>
</tr>
<tr>
<td>9.</td>
<td>Qualitative chemical evaluation</td>
<td>Estimate amount of the major class of constituents</td>
</tr>
<tr>
<td>10.</td>
<td>Toxicological studies</td>
<td>Identification of pesticide residues, potentially toxic elements, metals and microbial count and to minimize their effect in final product</td>
</tr>
</tbody>
</table>

Evaluation of drug means confirmation of its identity and determination of its quality and purity and detection of nature of adulteration. The evaluation of a crude drug is necessary because of three main reasons (Harborne, 2005):

1. Biochemical variation in the drug
2. Deterioration due to treatment and storage
3. Substitution and adulteration, as a result of carelessness, ignorance and fraud.
The crude drugs can be identified on the basis of their morphological, histological, chemical, physical and biological studies. The different techniques involved in standardization of crude drug are as follows (Kokate et al., 2007, Mohammed, 2008):

2.2.1 Morphological or organoleptic evaluation

It refers to evaluation of drugs by colour, odour, taste, size, shape and special features like touch, texture etc. It is a technique of qualitative evaluation based on the study of morphological and sensory profiles of whole drugs.

2.2.2 Microscopic evaluation

The method allows more detailed examination of a crude drug and it can be used to identify the organized drugs by their known histological characters. It is mostly used for qualitative evaluation of organized crude drugs in entire and powdered forms.

2.2.3 Physical evaluation

Physical standards are rarely constant for crude drugs, but may help in evaluation, specifically with reference to moisture content, viscosity, melting point, solubility, optical rotation, refractive index, ash values, extractive value, volatile oil content, and foreign organic matter. The different chromatographic technique and different spectrophotometric methods are also included in physical evaluation.

2.2.4 Chemical evaluation

It comprises of different chemical tests and chemical assays. The isolation, purification and identification of active constituents. Preliminary phytochemical screening carried out for establishing chemical profile of crude drugs is a part of chemical evaluation. The purity of crude drug is ascertained by quantitative estimation of active chemical constituents present in them.

2.2.5 Biological evaluation

When the estimation of potency of crude drug or its preparation is done by means of its effect on living organisms like bacteria, fungal growth or animal tissue or entire animal, it is known as bioassay. This method is generally called for, when standardization is not adequately done by chemical or physical means and for conformity of therapeutic activity of raw material and finished product. It is the measure of sample being tested capable of
producing biological effect as that of the standard preparation. In standardization or evaluation of herbal drugs, assessment of biological efficacy is found to be most assuring method (Mohammed, 2008).

2.3 Ayurveda

Ayurveda, which literally means the science of life, is one of the oldest systems of medicines in India. This system of using natural resources for betterment of health was developed through the experimentation and experiences of day to day life style of Indian people. It is a holistic system of health care with the concept, that the human body is a matrix of seven basic tissues (‘Rasa’, ‘Rakta’, ‘Mansa’, ‘Meda’, ‘Asthi’, ‘Majja’, ‘Shukra’) and the waste products of the body, such as faeces, urine and sweat which are derived by the five basic elements ether, air, fire, water, earth and three basic types of energies or functional principles “vata, pittta, and kapha” (Tridosha). Any imbalance or disturbances in these basic principles of body causes disease. In Ayurveda the basic treatment is employed to regain the balance of basic elements and functional principles of the body. The growth and decay of this body matrix and its constituents revolve around food which gets processed into humors, tissue and wastes. Ingestion, digestion, absorption, assimilation and metabolism of food have interplay in health and disease, which are significantly affected by psychological mechanisms as well as by bio-fire ‘agni’. Natural resources which are also believed to be composed of these five elements and three functional principles are used for treating the diseases in Ayurveda (Lad, 2002, Pulok et al., 2006).

Ayurveda is based on experience from the time immemorial, some of which has been proven experimentally. Formulations and dosage forms have great importance in Ayurveda. Generally Ayurvedic formulations are multi-component mixtures, containing plant and animal-derived products, minerals and metals. Ancient text like ‘Rig Veda’, ‘Athrava Veda’ and official compendia like Ayurvedic pharmacopeia, Ayurvedic formulary shows dominance of plant derived products In Ayurveda treatment is done by use of drugs, diets and practices (Mukherji, 2001, Prakash et al., 1998).

Athraveda (around 1200 BC), Charak Samhita and Sushrut Samhita (100 - 500 BC) are the main classics that give detailed descriptions of over 700 herbs and it has highlighted use of plants and polyherbal formulation for healthcare. Researchers on pharmacognosy, chemistry, pharmacology and clinical therapeutics have been carried out on ayurvedic medicinal plants and many of the major pharmaceutical corporations have renewed their
strategies in favour of natural products drug discovery (Narayana et al., 1998). Numerous drugs have entered the international pharmacopeia through the study of ethnopharmacology and traditional medicine. The research and development thrust in the pharmaceutical sector is focused on development of new innovative or indigenous plant based drugs through investigation of leads from the traditional system of medicine (Mohanty et al., 1998, Prakash et al., 1998).

2.3.1 Diarrhoea (Atisar) in Ayurveda
According to Ayurveda, there are 6 types of diarrhea, Vataja, Pittaja, Kaphaja, Tridoshaja, Bhayaja (caused by fear), Shokaja (caused by grief), and Raktatisara (diarrhoea associated with bleeding).

a) Vataja- It is characterised by abdominal cramping and gas in the abdomens. It contains more water and less fecal matter.
b) Pittaj- It is characterised by yellowish stools and offensive odour.
c) Kaphaj- It is characterised by stools whitish in colour with mucous along with it.
d) Tridoshaj- Has all the features simultaneously (it is manifested with symptoms of all doshas).
e) Shokaj and Bhayaja- Vayu get vitiated quickly by fear & anxiety. This diarrhea caused by fear and anxiety are psychic & exogenous. The mind disordered by fear causes increase of pitta & vayu which cause the faeces to become liquid & produce diarrhea, elimination is quick, faeces is warm, fluid like, floating (on water).
f) Raktaj- It is characterised by blood mixed fecal matter.

While vitiation of any of the three doshas can cause diarrhea, In India, the basic dosha involved is vata dosha because it brings more water to the intestines and lowers the digestive fire which causes diarrhea (Swami Sadasiv, 2004).
2.4 Herbal drugs in diarrhoea

It is well accepted that herbal remedies are relatively safe, affordable and easily accessible to layman when compared with that of chemical drugs. Moreover, the plant remedies or naturally sourced products are known to contain synergistic and/or side effects neutralizing potentials, and usually offer their pharmacological actions mediated through multiple pathways (Malik et al., 2010).

Diarrhoea is a commonly occurring disorder, which needs a prompt treatment to avoid complications arising from loss of body water. Several antidiarrhoeals are available in both modern and traditional medicines. Synthetic antidiarrhoeals used in modern medicines however show adverse effects like paralytic ileus, nausea, vomiting and abdominal cramps (Larry 2001, Paul et al., 2000). Their chronic use as in ulcerative colitis leads to the risk of physical dependence. Larger doses of synthetic modern drugs have been reported to cause CNS side effects (Friedi et al., 1980). Antidiarrhoeal medications such as loperamide, diphenoxylate, or codeine phosphate are widely used by adults with acute diarrhoea, but are contraindicated in infants and young children because of concerns about the possible central effects of opiate or opioid antidiarrhoeal agents and the fact that administration of these drugs to a child might detract from the importance of giving the life-saving intervention, namely oral rehydration therapy. Despite the availability of vast spectrum of approaches for diarrhoeal management, a vast majority of the people in developing countries rely on herbal drugs for the management of diarrhoea (Rouf et al., 2007, Mukhergi et al., 1998). WHO has encouraged studies for the treatment and prevention of diarrhoeal diseases using traditional medical practice (Vareishang et al., 2004, Sairam et al., 2003, Das et al., 1999).

In recent years, there has been a surge of interest in herbal remedies for a number of ailments. Use of herbal drugs has been an inseparable part of human civilization as many food materials like ginger, garlic, etc. have long been used as medicines. There are large numbers of epidemiological and experimental evidence pertaining to world-wide acute diarrhoeal disease, which is one of the principal causes of death in the infants, particularly in malnourished and which is of critical importance in developing countries (Sairam et al., 2003, Wet et al., 2010, Tetali et al., 2009, Sing, 2000, Lutterodt, 1989). It thus becomes important to identify and evaluate commonly available natural drugs as an alternative to
currently used anti-diarrhoeal drugs which are not completely free from adverse effects (Gilman, 1996).

As the use of herbal formulations in diarrhoea is more safe and effective than allopathic drugs, antidiarrhoeal herbal formulation like Mebarid syrup (Mebarid), Enterocin syrup (Enterocin) and Kutajarishta syrup (Kutajarishta) are widely used in treating the diarrhoea and dysentery in children and adults (Figure 20).

Mebarid (Mebarid syrup) contains Ajmoda, Bael, Lodhara, Dadim, Badishep, Daruhalad, Jaiphal, Sunth, Ativish, and Kuda as the active ingredients.

Chief constituents of Enterocin (Enterocin syrup) are Vidangphal, Daruhalad, Dhaiphool, Kuda, Mustamool, Lodhara, Ativish, and Sunth.

Kutajarishta (Kutajarishta syrup) contains Kurchi as an active constituent of the formulation.
2.5 Ajmoda

Synonym:

Anamoda, Randhuni, Celery seed.

Biological source:

It consists of dried seeds of Apium graveolens, family Umbelliferae.

Macroscopic characters:

The rigid fruit is small, ovoid, 1 to 1.5 mm long, 2 mm in diameter, contains a small brown seed. The dried seed is dark brown with light ridges. It has a harsh, penetrating, spicy aroma and a warm bitter taste that leaves a burning sensation. The seeds have a stronger and more intense flavor (Kokate et al., 2007).

Chemical nature:

It contains volatile oil, albumin, mucilage, coumarins, furano coumarins, flavonoids, choline, myristic acid, myristoleic acid, stearic acid, isoquercetin, apigenin, apigravin. Volatile oil (1.5 – 3%) contains limonene, phthalides, beta-selinene. It also contains calcium, vitamin A, vitamin C, iron, magnesium, sodium, potassium and phosphorus (Kokate et al., 2007, Agarwal et al., 2005).

Uses:

The volatile oil is responsible for the potential actions of the drug. It possesses carminative, purgative and aphrodisiac activity. Traditionally used as a sedative for nervousness or to promote sleep. It reduces swelling and used to treat gout and arthritis. It is a popular spice in food and beverages (Kokate et al., 2007, Agarwal et al., 2005).
2.6 Ativish

**Synonym:**
Atis, Aativasa, Indianatees.

**Biological source:**
It consists of dried tuberous roots of *Aconitum heterophyllum* family Ranunculaceae.

**Macroscopic characters:**
An erect stemmed herbaceous plant grows up to 55 cm in height. Roots tuberous, whitish or grey, smooth, cross section pure white in which 2 – 6 blackish vascular supplies are seen arranged in a discontinuous ring, cylindric-oblong or conic, up to 2.5 cm long and 0.5 – 1.5 cm thick. It breaks very easily and tastes very bitter.

**Chemical nature:**
Ativish contains heteratisine, hestisine, heterophyloisine, heterophylline, atiine, non toxic alkaloid atisine, aconitic acid, tannic acid, pectous substance, abundant starch, fat, mixtures of oleic, palmitic, stearic glycerides and mucilage. The root of plant contains steroids, terpenoids and quaternary alkaloids (Agarwal et al., 2005).

**Uses:**
It possesses significant antidiarrhoeal action. The decoction of atis, ginger, kuchi bark, tubers of mastuka and gulanca is used as an antidiarrhoeal. The aqueous extract of the plant completely inhibits acetylcholine induced contraction of frog skeletal muscle. The ethanolic extract of the root stimulates phagocytic function and inhibits the humoral component of the immune system. The ethanolic and aqueous extract of the root and leaf have shown antibacterial activity against certain bacteria like *Staphylococcus aureus* and *Escherichia coli* (Agarwal et al., 2005, Swami Sadashiv, 2004).
2.7 Bael

**Synonym:**

Bael fruits, Bel, Indian bael, Bengal quince.

**Biological source:**

Bael consists of unripe or half ripe fruits of the plant known as *Aegle marmelos* belonging to family Rutaceae.

**Macroscopic characters:**

It has a smooth, woody shell with a green, grey or yellow peel. The shell is so hard it must be cracked with a hammer. The fibrous yellow pulp is very aromatic. Numerous hairy seeds are encapsulated in slimy mucilage. It is having astringent and pungent taste (Kokate et al., 2007).

**Chemical nature:**

The chief constituent of the drug is marmelosin (0.5%) which is furocoumarin. Other coumarins are marmesin, psoralin, umbelliferone. The drug also contains carbohydrates (11 to 17%), protein, volatile oil and tannins. The pulp also contain good amount of vitamin C and vitamin A. two alkaloids O-methylhalfordinol and isopentylhalfordinol have been isolated from fruits. Alkaloids reported in the drugs are angelenin, marmeline and dictamine (Kokate et al., 2007, Agarwal et al., 2005).

**Uses:**

It is used as digestive, appetizer and also used in the treatment of diarrhea and dysentery (Nadkarni, 1954, Tetali et al., 2009, Mujmudar et al., 2006). It is also a tonic. The ripe fruit is aromatic, astringent which helps construction of skin, coolant, antihemmetic (Lamba et al., 1969). The unripe or half ripe fruit is digestive, stomachic which improves appetite and antiscorbutic (which helps to fight scurvy caused due to vitamin C deficiency) (Kokate et al., 2007, Agarwal et al., 2005, Swami Sadashiv, 2004, Chopra et al., 1982).
2.8 Badishep

**Synonym:**
Fennel fruits, Fructus foeniculum, Fennel, Saunf.

**Biological source:**
Fennel consists of dried ripe fruits of the plant known as *Foeniculum vulgare* belonging to family Umbellifereae.

**Macroscopic characters:**
It is five sided fruit in the form of cremocarps with pedicles and rarely found in the form of mericarps. Fruits are glabrous with straight prominent, yellow coloured five primary ridges. Colour – green to yellowish brown
Odour – sweet aromatic
Taste – strongly aromatic
Shape – straight or slightly curved (Kokate et al., 2007).

**Chemical nature:**
Fennel consists of 3 to 7% of volatile oil, about 20% each of proteins and fixed oil. The chief active constituent of the volatile oil is ketone, fenchone (about 20%) and a phenolic ether anethole (about 50 %). The other constituents are phellandrene, limonene, methyl chavicol, anisic aldehyde. Fenchone is a colourless pungent liquid with aromatic odour. The anethole is sweet in odour and taste (Kokate et al., 2007).

**Uses:**
It is used as a carminative, aromatic and stimulant. It is also an expectorant. Pharmaceutically it is used as flavoring agent (Kokate et al., 2007).
2.9 Dadim

**Synonym:**

Anar, Pomegranate, Dadima

**Biological source:**

It consists of dried seeds and flowers of *Punica granatum*, family Puniacaceae

**Macroscopic characters:**

The colour of the drug is blackish-brown or grayish-black. It is aromatic and pungent. The berries are 3.5 - 6 mm in diameter, globular and coarsely reticulately wrinkled with remains of stigma at apex. The pericarp is thin with a single white kernel. The kernel is hollow at the centre, entirely consisting of perisperm and a small endosperm and embryo.

**Chemical nature:**

The plant contains apigenin, betulinic acid, calistephin, cyanthamine, conine, cyaniding and its diglucoside, elagic acid, pelargonin, estradiol, pelletierine, polyphenols (flavonoids and tannins) and lipids (Agarwal et al., 2005, Ashish et al., 1999).

**Uses:**

It possesses antipyretic, memory improving, astringent and antidiarrhoeal properties (Das et al., 1999, Fernando et al., 2010). It cures thirst, burning sensation and fever, removes bad smell. It is the chief component of the preparation known as Dadimastaka used in chronic bowel complaints. It is one of the ingredients of the preparations known as Diarex for diarrhoea and dysentery (Pillai, 1992, Agarwal et al., 2005, Tetali et al., 2009).
2.10 Dahiphool

Synonym:

Dhya, Dhalas, Fire flame bush.

Biological source:

It consists of dried flowers of *Woodflora floribunda*, family Lythraceae.

Macroscopic characters:

It is a leafy shrub with white pubescent young branches. Deep orange red flowers in 2–15 flowered cymes arising from the axils of leaf scars in leaflet portion of stem and an ellipsoidal capsule covered by the calyx enclosing many small obovoid seeds.

Chemical nature:

It contain glycosides of cyaniding, pelargonidin, quercetin, myricetin, chrysophanol, ellagittannins and β-sitosterol

Uses:

It is used to stimulate the digestive system, treat diarrhoea. It is employed in conditions like wounds, ulcers, menorrhagia, liver diseases, leukorrhea, internal bleeding, herpes, hemorrhoids, fever, headache, fever, and dysentery (Agarwal et al., 2005, Swami Sadashiv, 2004).
2.11 Daruhalad

**Synonym:**

Daruhaldi, Daruharidra, Indian beryberry.

**Biological source:**

It consists of dried roots of *Berberis aristata*, family Berberidaceae.

**Macroscopic characters:**

It is characterised by an erect spiny shrub, ranging between 2 and 3 meters in height. It is a woody plant with bark that appears yellow to brown from the outside and deep yellow from the inside. The bark is covered with three branched thorns.

**Chemical nature:**

Root and wood are rich in a yellow alkaloid berberine, berbadine, candaine, hydrastine and resins (Agarwal et al., 2005).

**Uses:**

It is a good antidiarrhoeal agent and could be easily administered in children in the form of palatable suspension. It is tonic, stomachic, astringent, antiperiodic and diaphoretic. It possesses antipyretic and hepatoprotective property. In powder form it is applied to ulcers. It is also used in inflammation, fever, kidney stones and external injuries (Sabir et al., 1977, Swami Sadashiv, 2004, Agarwal et al., 2005).
2.12 Jaiphal

**Synonym:**

Myristica, Jatiphala, Nutmeg.

**Biological source:**

Nutmeg consists of dried kernels of the seeds of *Myristica fragrans* family Myristicaceae.

**Macroscopic characters:**

Colour – externally the kernels are greenish-brown or brown
Odour – strongly aromatic
Taste – pungent and aromatic
Shape – ellipsoidal
The kernels are externally covered with small irregular patches or lines (Kokate et al., 2007).

**Chemical nature:**

Nutmeg contains 5 to 16% of volatile oil, and about 30% of fat. The volatile oil contains about 4 to 8% myricin, elimicin and safrole. The fatty acid constituents of the fixed oil are myristic (about 60%), palmitic, oleic, lauric and other acids. The fat of the nutmeg is also known as nutmeg butter. The other constituents of the drug are protein and starch (Suchendra et al., 2007, Kokate et al., 2007).

**Uses:**

It is used as an aromatic, stimulant, carminative, flavouring agent, astringent and aphrodisiac. It is used in tonics and forms a constituent of preparations prescribed for dysentery, stomachache, flatulence, nausea and vomiting (Gupta et al., 1992, Kokate et al., 2007, Suchendra et al., 2007).
2.13 Kuda

**Synonym:**

Kurchi, Holarrhena.

**Biological source:**

It is the dried stem bark of *Holarrhena antidyseentrica* belonging to family Apocynaceae.

**Macroscopic characters:**

Kurchi bark appears buff to pale brown on outer surface while slightly brownish on inner surface. The outer surface is longitudinally wrinkled and bears horizontal lenticles. The pieces are recurved with varying size and thickness. The drug shows a short and granular fracture. It has no odour, but bitter and acrid taste (Kokate et al., 2007).

**Chemical nature:**

Kurchi contains about 25 alkaloids (1.5 to 3%). They are C$_{21}$ group steroidal alkaloids. The active alkaloids are connessine (kurchicine), norconessine, isoconessine, dioxyconnesine, conessimine, holarrhimine and holarrhidine.

**Uses:**

Kurchi is antiprotozoal in activity and used to treat amoebic dysentery. Connessine is highly active against *Entamoeba histolytica*. A traditional preparation of kurchi bark, “Kutajarishta” is commonly used, specifically for chronic amoebiasis (Kokate et al., 2007, Kirtikar et al., 1988).
2.14 Lodhara

**Synonym:**

Tilava, Shavara, Rodhra, Srimata, Lodh tree.

**Biological source:**

It consist of dried barks of *Symplocos racemosa* family Symplocaceae

**Macросscopic characters:**

It is an evergreen tree or shrub. Bark greyish, lenticellate, blaze cream.

**Chemical nature:**

It contains three alkaloids, loturine, loturidine and colloturine. It also contains phenolic glycoside and c-glycoside.

**Uses:**

It is an astringent, expectorant, anti-inflammatory, hypothermic, febrifuge, haemostatic and stomachic. It is used to treat hemorrhage, acne and pimples, skin diseases, asthma, bronchitis, fever, menstrual disorders, liver diseases, diarrhoea, dysentery and bowel complaints. A decoction of the bark is used as a gargle for giving firmness to spongy and bleeding gums. It is one of the constituent of a plaster used to promote maturation of boils (Agarwal et al., 2005, Swami Sadashiv, 2004).
2.15 Mustamool

**Synonym:**

Nagarmotha, Moth, Mustak, Nut grass.

**Biological source:**

It consists of dried tubers of *Cyperus rotundus* family Cyperaceae

**Macroscopic characters:**

A perennial herb grows 0.33-1 meter tall, branches long and with three edges. The rhizomes are blackish, hard, fragrant and aerial stems triquetrous with astringent taste. The fruits are small, ovoid and the seeds tiny and numerous (Kokate et al., 2007).

**Chemical nature:**

Fat, carbohydrates, essential oil, albminous matter, starch. The rhizome yields an essential oil consisting of cyperene, cyperol, α-cyperene, cineol and L-α-pinene (Agarwal et al., 2005).

**Uses:**

It is a stimulant, tonic, demulcent, diuretic, stomachic, carminative, diaphoretic, astringent, emmenagogue and vermifuge. It is used in diarrhoea, dysentery, gastritis and menstrual disorders. It lowers blood pressure. The decoction of the tuber of the plant is a highly valuable remedy for fever. It is one of the ingredients of the preparations known as Diarex (Agarwal et al., 2005, Swami Sadashiv, 2004).
2.16 Sunth

Synonym:

Zingiber, Ginger.

Biological source:

Ginger consists of *Zingibe rofficinale* family Zingiberaceae.

Macroscopic characters:

Colour – externally it is buff coloured
Odour – agreeable and aromatic
Taste – agreeable and pungent
Shape – the rhizomes are laterally compressed, bearing short flat, ovate and oblique branches on the upper side with bud at the apex.
Fracture – short and fibrous (Kokate et al., 2007).

Chemical nature:

Ginger consists of volatile oil (1-4%), starch (40-60%), fiber (5%), inorganic material (6%), residual moisture (10%) and acrid resinous matter (5-8%). Ginger oil is constituted of monoterpenic hydrocarbons, sesquiterpene hydrocarbons, oxygenated mono and sesquiterpenes and phenyl propanoids. Sesquiterpene hydrocarbon includes α-zingiberene, β-bisabolene, α-farnesene, β-sesquiphellandrene and α-curcumene. Aroma and flavor are the main characters of ginger. Aroma is due to fragrant principles of volatile oil while the flavor, pungency and pharmacological action is exerted by phenolic ketones of oleoresin. Phenolic ketones of oleoresin include gingerols like shogaols, zingerone, paradols, gingediols, hexahydro curcumin and also o-methyl ethers of these compounds (Francesca et al., 2004, Agarwal et al., 2005).

Uses:

Ginger is used as a stomachic, an aromatic, a carminative, stimulant and flavouring agent, antidiarrhoeal (Tetali et al., 2009, Borelli et al., 2004). Ginger oil is used in mouth washes, ginger beverages and liquors.
Ginger powder has been reported to be effective in motion sickness. It has been suggested that absorbent, aromatic and carminative properties of ginger on gastrointestinal tract cause absorption of toxins. These may have probably blocking effects of gastrointestinal tract reactions and nausea (Hashimoto et al., 2002, Kokate et al., 2007, Agarwal et al., 2005).
2.17 Vidang

**Synonym:**
Baybiyanga, Vavdinga, Babreng.

**Biological source:**
It consists of dried fruits of *Embelia ribes*, family Myristicaeae.

**Macroscopic characters:**
It is a large scandent shrub with slender branches. The fruit is globular and wrinkled, varying in colour from dull red to nearly black, a short pedicle often present. The pericarp is brittle enclosing a single seed covered with a membrane.

**Chemical nature:**
The fruit contains embelin, embolic acid, quercitol, tannins, fatty ingredients, a resin and minutes quantities of volatile oil. It also contains alkaloid, christembine, embelin and 2, 5-isobutylamine salts (Agarwal et al., 2005).

**Uses:**
It has hepatoprotective activity. It is carminative, anthelmintic and stimulant. It is reported to be effective against tapeworm, roundworm or hookworm. Shusruta described the fruit as anthelmintic, alterative and tonic and recommended its use along with liquorice for the purpose strengthening the body and preventing the effects of aging (Agarwal et al., 2005).
2.18 Black pepper

**Synonym:**
Mire, Kali mirch

**Biological source:**
Black pepper is the dried unripe fruit of perennial climbing *Piper nigrum* family Pipereraceae. Black pepper is rightly considered as the ‘King of Spices’ as judged from the volume of international trade, being the highest among all the spices known (Pruthi, 1998).

**Macroscopic characters:**
Black pepper comes from the pepper plant, a smooth woody vine that can grow up to 33 feet in hot and humid tropical climates. They begin to bear small white clustered flowers after 3 to 4 years and develop into berries known as peppercorns. Ground peppercorns produce the spice we call pepper. Black pepper, green pepper and white pepper corns are actually the same fruit (*Piper nigrum*); the difference in their color is a reflection of varying stages of development and processing methods.

Black peppercorns are made by picking the pepper berries when they are half ripe and just about to turn red. They are then left to dry which causes them to shrivel and become dark in color. Black pepper is the most pungent and flavorful of all types of peppers and it is available as whole or cracked pepper corns or ground into powder (Kokate et al., 2008).

The colour of the drug is blackish-brown or grayish-black. It is aromatic and pungent. The berries are 3.5 - 6 mm in diameter, globular and coarsely reticulately wrinkled with remains of stigma at apex. The pericarp is thin with a single white kernel. The kernel is hollow at the centre, entirely consisting of perisperm and a small endosperm and embryo (Kokate et al., 2007).

**Chemical nature:**
Black pepper contains an alkaloid piperine (5 - 9%), volatile oil (1 – 2.5%), pungent resin (6%), piperidine and starch (about 30%). The volatile oil which is yellowish in colour contains mainly *l*-phellandrene and caryophyllene. It also contains monoterpenes hydrocarbons such as sabinene, pinene, terpenene, limonene, mercene etc that gives
aromatic property to the pepper. Black pepper is an excellent source of manganese, a very good source of iron and vitamin K, and a good source of dietary fiber (Pruthi, 1998, Agarwal et al., 2005).

**Uses:**

The fruits are used as aromatic, stimulant, stomachic and carminative. It causes feeling of warmth and used as condiment. It also stimulates taste-buds, with increase gastric juice. It is mainly used as spice due to pungent taste. It is reported to enhance bio-availability of certain drugs (Vladimir et al., 2000). It is believed to cure illness such as constipation, diarrhea, earache, gangrene, heart disease, hernia, hoarseness, indigestion, insect bites, insomnia, joint pain, liver problems, lung disease, oral abscesses and sunburn (Kokate et al., 2007).

It is used for treating colds. It is a mucolytic and expectorant so helps to break up congestion in the chest and sinuses. It is a warming diaphoretic, so best used when there is fever but without a productive sweat and with cold extremities. It boosts circulation throughout the system but is especially nice for people with cold hands and feet. It’s also thermogenic, increasing fat metabolism and helping weight loss (Pruthi, 1998).

It is analgesic and has a history of traditional use for toothache where the powder is applied to the sore tooth. Sometimes it is added to mouthwashes for its antibacterial effects and its ability to protect against tooth decay.

Stimulating to the digestion, pepper is seen primarily as a remedy for indigestion, bloating, gas and malabsorption. Studies have shown that it not only increases the appetite and production of hydrochloric acid but improves digestion of many key nutrients such as the B vitamins, beta-carotene and selenium and various phytochemicals from other spices and green tea. This is primarily due to the piperine content which is also anti-carcinogenic, due to its ability to increase absorption of other beneficial compounds and partly due to its own anti-oxidant property. Also it inhibits pro-inflammatory cytokines that are produced by tumor cells (Agarwal et al., 2005).
2.19 Piperine

Piperine was discovered in 1819 by Hans Christin Orsted, who isolated it from the fruits of Piper nigrum. Piperine is a pungent alkaloid present in *Piper nigrum* and is thought to be the active ingredient found in black pepper. This discovery has prompted numerous scientific studies into piperine’s possible therapeutic effects with the principle effects seeming to be as a bioavailability enhancer. The natural concentration of piperine in black pepper is around 5 – 9% (Kokate et al., 2007).

The alkaloid piperine is considered to be the major constituent responsible for the biting taste of black pepper. Piperine is sparingly soluble in water, readily soluble in alcohol and on hydrolysis splits into piperidine and piperic acid. Piperine is at first tasteless but on prolonged contact develops a sharp biting taste. Alcoholic solution of piperine is intensely pungent (Mohammed, 2008).

Molecular formula: C_{17}H_{19}NO_{3}

Molar mass: 285.34 g mol$^{-1}$

Density: 1.193 g/cm$^3$

Melting point: 130 °C

Boiling point: decomposes.

A recent study found that piperine, extracted from black pepper, caused an increase in bioavailability for ions and macromolecules. Piperine has the ability to increase the bioavailability of certain nutrients. It has increased the plasma levels of coenzyme Q-10. The bioenhancing effect is may be due to inducing alterations in membrane dynamics and permeation characteristics (Vladimir et al., 2000, Johri et al., 1992). It reduces inflammation and pain. It possesses anticonvulsant and antiulcer activity and protects liver. It is known as central nervous system depressant and has good anticonvulsant and...
antimicrobial property. It stimulates both digestive and circulatory system (Ravindran, 2001).