II. Review of Literature
II.1. History:

A growing plant is very powerful because it is alive and has various potent properties. Plants have been used as charms, healers and symbols of love. The use of herbs goes far into the mists of time. It is difficult to pin-point the period when humanity first discovered medicinal plants. Man has been using different types of herbs valued for their medicinal and magical properties, from time immemorial. Each of them has a distinct flavor, medicinal and health giving properties.

In olden times, the knowledge of plants seems to have transmitted from generation to generation by word of mouth and later from written records. This seems to have led to the herbalists’ knowledge of plants today.

Various plants are being used as healing agents from very early times and it is necessary to study them in detail to know the different types and to recognize them accurately.

Ayurveda is recognized as one of the major systems of alternative and complementary medicine. It has its origins in ancient Indian history and its base in medicinal plants. Rigveda, written between 4500-1500 BC, mentions the use of sixty seven plants for therapeutic use and Yajurveda enlists eighty on plants whereas Atharvaveda written during 122 BC, describes two hundred and ninety plants of medicinal values (Handa and Kapoor, 1989). Rigveda, one of the oldest treaties in the world, contains intelligent observations on plague, malaria, tuberculosis, cancer, diabetes, etc. (Greenspan and Aruoma, 1994; Cragg et al, 1996; Rao et al, 1997; Hallock et al, 1998; Das et al, 2001; Raul and Heble, 2001). Many varieties of medicinal plants are known to be natural sources of ointments, inhalations and sneezing powders for curing various diseases (Dhawan and Rastogi, 1991; Varshney et al, 2001). Charaka Samhita (900 BC), the ancient classic, is the oldest text available on the complete treatment of diseases. It describes 341 medicinal plants and specifies the use of hundreds of herbs in the complete treatment of bacterial diseases like
leprosy, diarrhoea and tuberculosis. The next landmark in Ayurveda is Shushruta Samhita, written in 600 BC, which enlists 395 medicinal plants. The first scientific literature on medicinal plants can be linked to the record on Egyptian Papyri dating from 2000 BC. A Chinese herbal, Tzu I Pen Tshao Ching, appeared later in 500 BC (Handa and Kapoor, 1989). Various quotes depicting the significance of plants as medicines, have been recorded in Bible – “There are herbs that are harmless, the use of which will tide over many apparently serious difficulties (manuscript 86, 1897); The Lord has provided anti-dotes for diseases in simple plants (manuscript 65, 1899)” (White, 1897). A large number of fruits of herbs and medicinal plants have been reported, for treatment of diseases like worms, respiratory disorders, colitis, jaundice, fever, diabetes, leprosy, impotency, urinary troubles, skin diseases, syphilis, gonorrhoea and other bacterial infections (Baskar and Chezhiyan, 2002-b). Researchers in the field have continuously worked on and interpreted the therapeutic values cited in the ancient texts and compiled medicinal herbs used as anti-bacterial drugs. Ayurveda has given due importance to the use of medicinal plants in the treatment of various infectious diseases. Between fifth and sixth century, Dioscorides Anazarbeus, in Materia Medica, compiled an assembly of 600 plants, their names, botanical and habitat descriptions, preparations, medicinal and aromatic uses. Gaius Plinius in his “Natural history” gave an encyclopedic account of knowledge about the vegetable world. During 372-286 BC, systematic separation and characterization of herbs and other plants according to their morphological traits first appeared in the publication of Historia Plantarum and De Causis Plantarum, written by Theophrastus of Eresus, a colleague of Aristotle in Pluto’s academy. In 1470, “The encyclopedia of Bartholomaeus Anglicus (1470)” was compiled by a monk Bartholomew de Glanville. In 1475, “The book of nature” was printed by Hanns Bamler at Augsburg. In fifteenth century, “The Herbarium of Apuleius Platonicus” was compiled based on the classical writings of Dioscorides and Pliny. Three works of great importance published at Mainz in Germany were Latin ‘Herbarius’ (1484), German
"Herbarius" (1485) and "Hortus Sanitatis" (1491). Nehemiah Grew (1641-1712) was one of the founders of the Science of Plant Anatomy (Agnes, 2003). An ancient India's Atharvavedic hym appropriately depicts the importance of medicinal plants (Chomchalow and Henle, 1993);

Well doth the wild boar know a plant,  
The mongoose knows the healing herbs,  
I call to aid this man, the plant which  
Serpents and Gandharvas know.

Plants of Angirasas which hawks celebrate  
Plants which eagles are in an aspiration  
Plants known to swan and lesser fowls  
Plants known to all the birds that fly,  
Plants that are known to sylval beasts.

I call them all to aid this man  
The multitudes of herbs, all that  
Are food and medicines for goat and sheep  
So many plants, brought hither will  
Shelter and defend this man and thee.

(Griffiths: Atharvaveda, English translation)

In 2700 BC, Legendary Chinese Emperor, Shen Nung Pen Tsao, composed the oldest medical herbal of over hundred items. The period from 1470-1670 is known as a "Period of Evolution of Printed Herbal in Europe", which gives a general sketch of history of herbals. Later, the "Herbarum Vivae Eicones", produced by Otto Brunfels in 1530 gave an accurate illustration of plants. From 1544 to 1588, Matthiolus and Petrus Andreas recorded various aspects of plant study, in "Materia Medicinale Tradotta". In 1597, "Herball" of John Gerard was published which was later expanded by Thomas Johnson in 1633, followed by "Herball" of Nicholas Culpeper, in 1652. From 1641-1712, Nehemiah Grew, recorded the study of plant anatomy. Later, in 1889, Peters Hermann gave a pictorial history of "Ancient Pharmacy". In 1898, Giacosa, Piero, Magistri Salernitani nondum edited a catalogue on "Regional Medicinal Plants". In 1899, Henslow, G.
recorded the medical works of the fourteenth century together with a list of plants collected from contemporary writings, with their identifications. In 1904, Schelenz, Hermann, recorded pharmaceutical aspects of plants in Berlin. In 1910, Wootton A.C. published the “Chronicles of Pharmacy” in London (Agnes, 2003). In 1980, a “Compendium of Indian Medicinal plants” was published (Rastogi and Mehrotra, 1980).

The search for bio-active products from the universe of natural products has been remarkably successful. Over half of world’s best-selling pharmaceuticals are either natural products or derived from natural products. Presently, over 7500 species of medicinal plants are estimated to be of use in India. 95% of the raw material like the entire plant, rhizome, tuber, roots or other reproductive parts like fruits and seeds required for drug manufacturing is collected from the wild forests.

II.2. Antimicrobial factors:

A popular Chinese folk wisdom song depicts psychological benefits obtained from interaction with plants;

“If you wish to be happy for a day, kill a pig;
If you wish to be happy for a week, take a wife;
If you wish to be happy for a lifetime, plant a garden.”

(Baskar and Chezhiyan, 2002-e)

Plants were used as medicines in China, Egypt and Greece, much before the beginning of Christian era. Between 15th and 17th century, in Europe, Herbals recorded the healing properties of plants. In the early 19th century, it was realized that healing properties of medicinal plants were due to minute active ingredients. With the development of organic chemistry at the beginning of this century, extraction and fractionation techniques improved significantly. It became possible to isolate and identify many of the active constituents from plants.

In 1947, “Investigation on plant antibiotics” was reported (George et al, 1947). Skinner (1955) reported the historical landmarks in the development of antibiotics. In 1887, Martini first used Thymol, a simple phenol, present in the essential oils of many plants, as an antiseptic and a preservative.
Some plant extracts and exudates like those of neem were observed to have some anti-fungal and anti-bacterial properties. A simplified method of evaluating dose-effect experiments and the procedure for LD\textsubscript{50} determination of seed extracts was prescribed (Litchfield and Wilcoxon, 1949; Salimath et al, 1986). Antibiotic sensitivity testing by a standardized single disc method then came into use (Bauer et al, 1966). Antimicrobial activity of some N - substituted amides of long-chain fatty acids was reported by Novak et al (1969).

In a bibliographic review of the scientific literature on herbs of the temperate zone, 10,000 authors published research articles (Harbourne, 1973).

It was reported that many medicinal plants owe their physiological activities, molecular interactions between alkaloid molecules and chemically defined components of the affected organisms, to their content of alkaloids. Flavonoids, a class of natural products of high pharmacological potency are reported to exert multiple biological effects such as anti-inflammatory, anti-oxidant, anti-allergic, anti-viral and anti-cancer (Havsteen, 1983). Free radical scavenging activity has been ascribed extensively to two classes of natural compounds i.e. flavonoids and polyphenolics (Clark et al, 1985). Zaika (1988) reported that Gram negative bacteria are more susceptible to the antimicrobial activity of most of the essential oils. Tannins and alkaloids, which are plant secondary metabolites, are known to possess anti-microbial activity (Cowan, 1999). Antimicrobial and immunomodulatory effects of medicinal plants, due to phyto-chemicals like plant alkaloids and flavonoids, have been linked to the effect on eicosanoid metabolism that influences immune functions in various ways (Ali et al, 2000). Tiwari (2001) reported that antioxidant principles from natural resources correct the imbalance between pro-oxidant and antioxidant homeostasis, responsible for most of the diseases. Purified secondary metabolites like silybin, dihydroquercetin, catechin, epicatechin, spermine, ferulic acid, chromo-saponin, emblican A and B, punigluconin, pedunculagin, curcumin, gallic acid, bengalenoside are
known anti-oxidants with proven protective activity (Ciddi and Kaleab, 2005). Sulphanilamide group has been reported to have all the structural pre-requisites for anti-bacterial action. All members of sulfonamide group differ in the nature of $N$ substitution, which governs solubility, potency and pharmacokinetic property. A free amino group in the para position is required for anti-bacterial activity. Amide (NH$_2$) group has variable effects on antibacterial activity of a molecule (Goodman and Gilman, 2006). Aromatic Nitro, Nitrobenzene group is reported to be responsible for antimicrobial activity (Tripathi, 2008). Caffeic acid has been reported as showing a high inhibitory activity against Staphylococcus aureus and Candida albicans. Octadecenoic acid has been reported as a promising antifungal and antimicrobial agent (Ahmed et al, 2001). Benzopyran, an ingredient of pigments like coumarins is an antimicrobial, antifungal agent (Satoh et al, 1996). A sesquiterpene, Caryophyllene, present in essential oils is an anti-fungal, anti-microbial agent, known to inhibit E. coli, Salmonella typhi and Shigella species (Sabulal et al, 2006). Antimicrobial activities of naturally occurring plant substances like Caryophyllene, Hexadecenoic acid, Germacrene, Pentanone have been reported (Formisano et al, 2006; Hegazi and Abd El Hady, 2001).

II.3. Plants as healers:

Toxic substances obtained from various plant species have been reported to control many fungal diseases of crop plants (Chary et al, 1984; Singh and Dwivedi, 1990). A number of plant species have been reported to possess some natural substances in their leaves which are toxic to many microorganisms causing diseases. Plant produced compounds are of interest as a source of safer or more effective substitutes for synthetically produced antimicrobial agents (Heisey et al, 1992). Secondary metabolites like flavonoids, phenols, phenolic glycosides, unsaturated lactones, sulphur compounds, saponins, cyanogenic glycosides and glycosinolates produced by plants have known antifungal activity (Osbourne, 1996).

Indiscriminate use of chemicals is not only hazardous to living beings but adversely affects the microbial population in the ecosystem. The inherent
danger, in the use of these chemicals has brought forth an awareness to find out alternatives like biological agents to control the disease (Ansari, 1995). Medicine is known to have its roots in natural plant products. The secondary metabolite is more important to serve the plant as a bio-chemical interface between the producing plant and its surrounding environment. Quinone alkaloid, vinblastine, vincristine, dimeric indole alkaloids, curcumol, citral are reported to have anti-cancerous properties (Mondal and Mukherjee, 1992). Plant cells are highly sophisticated chemical factories which produce secondary metabolites including alkaloids, steroids, terpenoids, oxygen heterocycles like flavonoids, xanthones and coumarins which possess significant biological properties (Baskar and Chezhiyan, 2002-c). The relationship between human immune system and plant antioxidants, especially those derived from Indian medicinal plants was reported (Devasagayam and Sainis, 2002). Some natural cinnamic acids like 4-coumarins, caffeic, ferulic and sinapic acids, are found in plants in free forms and in a range of esterified forms. Purine alkaloids - caffeine, theobromine and theophylline, are methyl derivatives of xanthine and co-occur in a plant. Immunostimulant, anti-inflammatory, anti-bacterial, antiviral effects of plants is assigned to lipophilic alkylamides, polar caffeic acid derivatives, high molecular weight polysaccharide material or a combination of these. The stimulant properties are due to water-soluble alkaloids. Caffeine is used as a CNS stimulant, combined with other therapeutic agents, as in compound analgesic preparations. Caffeine is mainly combined with chlorogenic acid which is decomposed to quinic acid and caffeic acid (Kokate et al, 2001).

Basic plant constituents like flavonoids have been reported as a major class of phenolic compounds present in many fruits and vegetables. They have a major role in prevention of several forms of cancers, cardiovascular diseases and cytotoxicity of Low Density Lipids (LDL). They are hydrogen donating free radicals with free hydroxyl groups and catechol moiety in the ring B of flavonoid nucleus (Shetgiri and D'Mello, 2003). Flavon-3-ols like catechin (Shetgiri and D'Mello, 2003), flavonols like quercitin and rutin
(Jadhav and Kharya, 2005) show very good free radical-scavenging activity. Many traditional medicinal plants have been reported to have strong antiviral activity and some are being used to treat viral infections (Jassim and Naji, 2003). Clinically, antimicrobial therapy is going through a crisis due to rapid development of resistance to existing antimicrobial agents (Bonjar, 2004).

Foods such as betel nuts and herbal teas help in defense mechanism against microbial infections. The antimicrobial, anti-oxidant, anti-mutagenic and anti-carcinogenic effects of plants have been reported. In Australia, plants have been tried out as an alternative cancer treatment (www.vidyya.com).

II. 4. Plants under investigation:

1. *Allium sativum*:

   यथायुतम राहोरूमुद्वृत्तीयना गुणधे पविता गलत
   अम्रुतस्य कणा धुमौऽे रसोन्त्स्वा मयात :
   द्विजा नाम्नति तमले देच्येहसम्मुद्यङ्गः
   साख्यरूत संयुतेप्रेममिति : सा रसायन
   यथायुतम वैलेयो जहर सुर्न्तामत
   तदत्तो प्रतिघिदुः सा रसोन्तो भक्तिमुः। (भा प्रा)
   लशुनस्य रसोन्त्स्युद्वृत्तांद्यः महोदयम
   आरिष्टो स्लेच्चकंदस्त्वा यवनेष्टो रसोन्तकः। (भा प्रा)

*(Varier, 1995)*

*Allium sativum* (Lasoon) belongs to family Liliaceae. It is a glabrous, bulbous herb, with flat narrow and long leaves. Bulbs with bulblets, within a whitish skin are called cloves. The herb grows to a height of 30 cm. It is reported to contain essential oil and Sulphur, Allyl propyl disulphide, Di-allyl disulphide, Allicin, Allisatin I and Allisatin II. It is known to kill or expel worms from the body, prevent or cure spasms. It stimulates flow of saliva, digestion, relieves flatulence and gripping pains from stomach and bowels. It promotes flow of urine, removal of mucous secretions from bronchial tubes, reduces fever and promotes dissipation of a growth or a swelling. It is excellent for treating colds, sore throat, hoarseness and
tonsillitis. It is a natural antibiotic, antiseptic agent preventing cancer and hypertension. It is known to give relief from deafness, earache, skin problems and delays graying of hairs. It reduces cholesterol in the body. Garlic juice is used raw, internally and externally, as decoction in coconut oil, as garlic tea and externally as a poultice (Kurian, 1999).

A number of authors have reported the antimicrobial properties of garlic extract (Rao, 1947; Wills, 1956; Fliermans, 1973; Tansey and Appleton, 1975). Extracts of various spices, one of which is garlic (Sastri, 1952) have been reported as antioxidants of non-enzymatic category.

Since olden times, garlic has been prescribed for some diseases like chronic bronchitis, tuberculosis, pneumonia, asthma, other respiratory ailments, gastritis, cholera and typhoid (Nadkarni, 2004, Kurian, 1999). Enzyme inhibition by allicin, the active principle of garlic, was studied (Wills, 1956). Inhibition of fungal growth was reported by garlic extract (Tansey and Appleton, 1975). The presence of antimicrobial factors were investigated in garlic as it was recommended for the treatment of infectious diseases (Murthy, 1982). Garlic extract was reported to inhibit *Mycobacteria* (Delaha and Garagusi, 1985). It is a traditional component of Indian diet with a broad spectrum antibiotic action, inhibiting the growth of variety of organisms. Allicin is responsible for the odour of the herb and its antimicrobial properties (Block, 1985). Agar-cup diffusion assay method was first designed for garlic extract and adapted for all plant extracts with modifications (Finegold and Baron, 1986). Anti-microbial activity of *A. sativum* was reported by many workers (Ghannoum, 1988; Rees et al, 1993; Anesini and Perez, 1993; Jain, 1993; Nagoba et al, 1994; Deshmukh et al, 1995; Augusti, 1996; Koch et al, 1996). The effect of crude bulb extract of garlic was studied against standard strains of microorganisms (Rees et al, 1993). Allicin, a constituent of garlic is a powerful antioxidant, mopping up highly reactive Oxygen free radicals known to cause a range of diseases. Garlic prevents infections by blocking a group of enzymes used to invade the host cells by bacteria, viruses, protozoa and fungi. (Lowson, 1993; Dhuley et al, 1999). Activity of garlic against five
drug resistant strains *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Citrobacter frendii*, *Edwardsiella tarda*, *Klebsiella aerogenes* and *Pseudomonas aeruginosa* has been reported (Jain, 1993). Sensitivity of food pathogens (Kumar and Berwal, 1998), lactic acid bacteria and contaminants of fermented milk to garlic extracts were reported (Ganapaty et al, 1998). Application of garlic preparation against human tumor cell proliferation has been found effective (Sieges et al, 1999).

Garlic has been used for centuries as a culinary herb and for medicinal purposes. In the middle ages, it was eaten daily as a protection against the plagues that ravished the European continent. Louis Pasteur described its antibacterial properties in 1858. Tons of garlic was used in World War I in field dressings to prevent infection. Its constituents, Alliin and allicin are antibacterial and anti-fungal. Garlic is effective in lowering blood pressure, blood sugar, cholesterol, and is known to boost the immune system. The activity of garlic against *Helicobacter pylori*, the causative agent of chronic gastritis, gastric and duodenal ulcers was reported. A very important report about garlic states that acquired antibiotic resistance to garlic is unlikely because of chemical complexity of garlic materials and their broad-spectrum effectiveness (O’Gara et al, 2000). Bulbs of *A. sativum* are reported to improve complexion, appetite, voice, cure joint pain and paralysis (Mukundan et al, 2002).

Garlic was reported as having a broad spectrum antibiotic action, inhibiting the growth of variety of organisms. *A. sativum* was one of the twenty seven plant extracts which revealed high potential of anti-bacterial activity against standard cultures of *S. aureus* (NCTC-3750), *E. coli* (ATCC-1948), *P. mirabilis* (NCIM-2087), *B. subtilis* (NCIM-2063), *B. stereothermophilus* (NCIM –2328), clinical isolates of *K. aerogenes*, *K. pneumoniae*, *Vibrio*, *Sal. typhimurium*, *Sal. paratyphi* and *Sh. flexneri*. Direct crude aqueous extracts of garlic exhibited highest degree of antibacterial activity which confirms traditional therapeutical claims for aqueous dose forms of these plant extracts. High diffusion rate is associated with soluble agents in aqueous agar media (Tumane et al, 2000). Cloves of garlic were found to
be superior over commercial antifungal products, neemark and phytolan, in inhibition of spore germination of two fungal species, *Aspergillus flavus* and *Curvularia lunata*. Both aqueous and acetone extracts of *A. sativum* were found to be most effective showing 100% efficiency (Karade et al, 2001). Bulb extract of *A. sativum* was reported to be effective against almost all clinical microbial isolates which were resistant to one or more antibiotics (Tumane et al, 2002). Anti-bacterial activities of *A. sativum* were studied as a means to develop effective and safe antimicrobial drug (Pal-Datta et al, 2002). Garlic was reported to show highest activity against *V. cholerae* amongst twenty one different plant extracts screened for their anti-bacterial activity. Active principles like tannin, aliphatic ketones, beta-carotenoids, fatty acids, essential oils and phenolic compounds in the extract were reported to influence the anti-bacterial activity (Banginwar and Tambekar, 2003). Low conc. of aqueous garlic extract was found to be inhibitory and lethal to *Candida albicans* (Vijaykumar et al, 2004). Crude extracts of *A. sativum* have been reported to inhibit antibiotic resistant clinical strains of *Salmonella, Shigella, Vibrio* (Jha et al, 2005). Aerial parts and roots of *A. sativum* checked for anti-oxidant activity showed inhibition of lipid peroxidation (Ciddi and Kaleab, 2005). Marketed products of *A. sativum* show antimicrobial activity against *S. aureus*. Anti-microbial efficacy in the form of MIC values were detected at 24 and 48 hrs. and found to be time-dependent and dose dependent (Wattamwar and Sangamwar, 2005). *A. sativum* has been reported to be most anti-microbially effective against *E. coli, B. subtilis, S. aureus, Ps. aeruginosa, C. albicans* and *Asp. niger* (Kothari et al, 2005). The anti-bacterial effect of garlic extract when tested against various bacterial milk contaminants namely, *S. aureus, Ent. fecalis, Sal. enteritidis, Micrococcus luteus, B. subtilis, B. cereus* and *E. coli*, in different concentrations like 1%, 2%, 3%, 4% and neat showed inhibition at all concentrations, maximum against *S. aureus* (Ebenezer et al, 2005; Kirubhakaran et al, 1999). Aqueous extract of garlic shows more antibacterial activity than alcoholic extract. It inhibits *B. cereus, S. aureus, Sal. typhi, E. coli, K. pneumoniae, Ps. aeruginosa* and
P. vulgaris but is more effective against B. cereus, S. aureus, Sal. typhi and P. vulgaris (Patil and Mali, 2006). Bulb of A. sativum is reported to carry allelochemicals which can be used as pesticides (Kumar, 2006). Some of the plant products (Naik, 2003) or spice extracts (Chawla et al, 1987; Salimath et al, 1986) as garlic (Sastri, 1952) have been reported as antioxidants of non-enzymatic category. Garlic was found to inhibit the growth of Staphylococcus, Bacillus, Brucella and Vibrio species, E. coli, Salmonella, Enteritidis, Klebsiella, Mycobacteria, Candida albicans, Aspergillus and Saccharomyces cerevisiae. Garlic is suggested in ayurveda as a plant with curing capacity. It is used to lower cholesterol level in blood, for treating respiratory diseases and disorders, to treat skin diseases like eczema and viral skin infections. It has antimicrobial activity against infecting bacteria and at the same time protects the body from the poisons that are causing the symptoms. It is reported that freshly cut garlic can kill bacteria at a distance of 20 cm. Bacillus anthracis was reported to be most sensitive to garlic (Jha et al, 2005). Aqueous bulb extract of garlic showed anti-dandruff activity under conditions (Samuel et al, 2005). Garlic showed the highest anti-candidal activity and combination of garlic and onion followed (Joshi and Shete, 2006). Aqueous and alcoholic extracts of A. sativum were found to have broad anti-microbial spectrum against Gram positive and Gram negative pathogens, more against Gram negative ones. Aqueous extract was found to be more efficient, inhibiting B. cereus, S. aureus, Sal. typhi, P. vulgaris, E. coli, Kl. pneumoniae and Ps. aeruginosa, in that order. (Waghmare, 2007).

2. Aloe vera:

कुमारि बेदानिन सितंतिका नेत्रया रसावनि
महुरा बुःनि बल्या बुःनि वातिः वदनुः प्रणुः ।
गृह्विनियोक्तिस्प्रद्योक्तितरत्रका गम्यति
बालपितकोम्प्रक्षिप्य कुमारिकुशमुग्ना । (भ. प्र.)

(Varier, 1995)
A member of family Liliaceae, *Aloe vera* (Korfad) is a short stemmed plant with spiny teethed, very succulent and juicy leaves. It has yellow and matured drooping flowers. Plant grows from the erect middle stalk, which is one meter in height. Fruit is an oval capsule with numerous seeds. It is cultivated for ornamental and medicinal purposes. *A. vera* juice is applied externally, for burns, cuts, wounds, eczema, falling hair, while leaf pulp and cuticle is used as a suppository in haemorrhoids or piles. It is used to treat indigestion, dandruff, nausea, acidity and anaemia. It brings about blood purification, good hair growth and good sleep. It is found to contain aloin, isobarbaloin, emodin, gum, resin, anthroquinone derivatives, chrysophanic acid, oxidase, catalase, sugars and crystalline glycoside barbaloin (Kurian, 1999). *Aloe vera* is used for wound healing. Its leaf juice forms an important constituent of preparations of cosmetic industry for burns, hair growth, wound healing without scar formation, piles, cough and cold (Raina, 1982). Leaf gel of *A. vera* was checked for anti-oxidant activity and was reported to show free radical scavenging activity (Ciddi and Kaleab, 2005). Anti-bacterial activities of *A. vera* were studied as a means to develop effective and safe antimicrobial drug (Pal-Datta et al, 2002). It has been used for thousands of years, in traditional medicines, as a laxative, skin protector, for treating sinusitis, fever and muscular pain (Mukundan et al, 2002). Leaf juice has moisturizing, emollient properties and anti-ageing effects on the skin (Canigueral and Vila, 1994). Active principles in leaves are aloesone, aloesin, barbuloin, used as a purgative, in treatment of liver disorders, rheumatism, hair growth, chronic ulcers, intestinal worms and cold. Mucilagenous substance obtained from leaves is commercially used as a base material for vanishing creams and moisturizer (Baskar et al, 2002-d). Aqueous, alcohol, xylene, hexane, chloroform and ether leaf extracts of *A. vera* showed antimicrobial activity against *S. aureus* ATCC 25923, *Ps. aeruginosa* ATCC 27853, *St. pneumoniae* ATCC 49619 and *Yersinia enterocolitica* (Tambekar and Saratkar, 2005). Fresh juice is useful in fever as a cooling agent and for healing wounds. Pulp of leaves is useful in menstrual suppression (Jeeva et al, 2005). Freshly
The expressed juice of *A. vera* is used as an external refrigerant application for all local inflammations. Tender pulp is eaten in rheumatism and piles (Sonawane et al., 2006).

Originally from Africa, *A. vera* is a clump forming perennial with rosettes of thick, fleshy, spiky and gray-green leaves. Young specimens are red spotted and the plant bears yellow tubular flowers in summer. The fresh leaf gel and latex are used for many purposes. It is a bitter herb with anti-inflammatory, astringent, emollient, anti fungal, antibacterial and antiviral properties. It is a great multi-vitamin skin food containing a host of biologically active compounds that include enzymes, amino acids, vitamins B₁, B₂, B₆, C, E, folic acid, choline and beta carotene, minerals such as calcium, sodium, manganese, magnesium, zinc, copper, chromium and essential fatty acids. Aloe is used externally for the treatment of skin irritation, burns, scalds, sunburn, wounds, eczema, psoriasis, acne, dermatitis, ulcers and to stimulate cell regeneration. The gel can be applied directly to the skin as a softening agent. For burns and other wounds aloe is particularly effective as it activates the macrophages which fight bacterial infection, increases circulation to the area which results in accelerated healing. Enzymes - carboxypeptidase and bradykininase reduce swelling, itching, reducing inflammation and pain. Traumatic and surgical wounds treated with aloe heal faster. This may be due to vitamin E, C, zinc and polysaccharides that reduce inflammation and stimulate fibroblast, epidermal growth and repair process. The juice is effective for the treatment of minor wounds and insect bites by forming a "natural plaster" over the wound. It has good astringent qualities and in combination with other ingredients makes an excellent, soothing treatment for the skin and piles. *A. vera*, on investigation, showed a marked remission in skin cancers and superb anti-oxidant effect preventing skin damage from X-rays and other radiations. Regular application in psoriasis and eczema relieves pain and inflammation (Dweck, 1994).
3. *Andropogon citratum*:

*Andropogon citratum* (Gavati chaha) belongs to the family Gramineae. It is a popular perennial, medicinal grass, cultivated for fragrant leaves which are a meter long. A lemon-like fragrance is emitted when the leaves are crushed. It strengthens and tones the stomach, expels gases, flatulence and gripping pains from stomach and bowels. It gives vitality to the body, lowers body heat, prevents and cures spasms. It is recommended for treating vomiting, diarrhoea, headache, dysmenorrhoea, chronic rheumatism, sprains, correcting lumbago, insomnia and other painful conditions. Leaf-extract is used internally with herbal tea or milk. *A. citratum* is reported to have antimutagenic, anti-flatulence, anti-emetic, anti-arthritic activities and known to decrease menstrual complaints. It contains essential oil, citral and verbena (Kurian, 1999).

Leaf extracts of lemon grass were found superior to commercial antifungal products neemark and phytolan, in inhibition of spore germination when tested against two fungal species, *Aspergillus flavus* and *Curvularia lunata*. Both aqueous and acetone extracts showed some efficiency (Karade et al, 2001). Its active principle is citral and whole herb is used as a source of Vitamin A in soaps and cosmetics (Baskar et al, 2002-d). Paste of plant leaves is used in poisonous bites, bronchitis, leprosy, epilepsy, sprains and skin diseases (Jeeva et al, 2005).

4. *Azadirachta indica*:

निम्नलिखित कः कद्दुपाके लघुभांतोनिमित्तःः

प्रशालरथो जायेत पितकमनेहजवकृमिन

कुष्ठकरकरकसुतालशयथुगण

ग्रिहप्रदलग निम्बस्य रक्तपितककृमिन

कुष्ठकनीताती वातजनम नेत्ररोग विनाशद्वेत

पक्क्तोषुसुधुरसः स्यद बलपुष्पिलिहिप्रदः | (रा.नि.)

कर्मरस्य फलम चम्म प्रहास्लम वाताशकम

उष्म ितकसरम चैव तपकसम भद्रपकः

आप्लम च बलपुष्पिनम रुचेयश्चित्रि तु वर्धककम् | (नि.आ.) (Varier, 1995)
A member of family Meliaceae, *Azadirachta indica* (Kadu nimb) is a native of Persia and Asia minor. It occurs wild in dry forests and is planted all over India. It is a perennial, ever-green big tree found in Indian ghats. It shows flowering and fruiting in March, April and May. It is a drupe, fruits glabrous, fleshy, light yellow, smooth and oval-elongated. It has one white, ellipsoid / sub-ellipsoid seed. Its young fruit is used as an astringent, tonic, purgative, seeds as laxative, emetic and anti-helmenthic (Das et al, 1999). It has primary, secondary roots and rhizoids. It has a medium height, bark dark green to brown, with lateral straight scars, soft hairy tops. Its leaves are tri -lobed, cut at sides, rounded at tips, rituparni. The flowers are maroon, light violet, smell like honey, have soft hairy petals, pubescent, staminal tube purple, central rod blue. Fruits are Ashmagarbhi, drupe, oblong, yellowish and poisonous. Its seed-oil has fatty acids, stearic, oleic, lauric, butyric, valeric acids and volatile fatty principles (Das and Agarwal, 1985). It contains Azaridine, resin, tannin, meliotannic acid, benzoic acid, bakayanin, sterols, margosine and fixed oil with Sulphur (Sawant, 1974). Neem oil contains glycerides of saturated and unsaturated fatty acids as active constituents (Kokate et al, 2001). Neem seeds and leaves contain different quantities of azadirachtin (insect repellant), meliatriol and salanin (anti-feedants), nimbin and nimbidin (anti-virals). Seed kernels contain azadirachtin, triterpenoid, nimbolide, olichinolide B, nimbin, 6-deacetyl nimbin, salanin, azadiradione. Active principles are nimbicidin and azadirachtin. Barks, flowers, seed oil and tender twigs are used as antiseptic, antifungal, blood purifying agents, in skin diseases, cosmetics and as bio-pesticides (Baskar et al, 2002-d). It is globally used for skin allergy, as an antidote for insect bites and asthma (Baskar and Chezhiyan, 2002-b).

Decoction of the bark is used to expel worms from the body, to reduce burning sensation near the heart, fever, cough, ulcers, inflammation and leprosy. Infusion of leaves is used as an insecticide, for treating eye-problems; swelling, inflammation of liver and skin diseases. Consumption of ripe and unripe fruits functions as a purgative, to treat urinary problems,
tumours, piles and tooth-ache. The lactic secretion is useful against TB and leprosy, cures diseases of uterus in post-natal period and is anti-snake poison. Its seed-oil is used as local stimulant, anti-helmenthic and antiseptic. It is used to treat skin diseases, headache, as an anti-lice, for dressing in leprosy, tetanus, suppurating scrofulous glands, urticaria, chronic forms of skin diseases like eczema, ring-worms, scabies, erysipelas and sloughing ulcers. Natives of India use *A. indica* leaves as poultices, ointments and liniments for leprosy, burns, gangrene, scabies, herpes lesions, eczema and skin ulcers. Its use dates back to antiquity in Hindu ayurvedic medicine. Seed oil is widely used in Asian medicine and therapeutically it has been confirmed as an anti-inflammatory and antibacterial agent (Martindale, 1989).

Neem plant extract and exudates were reported to contain compounds with anti-microbial, anti-bacterial, anti-fungal, anti-nematodes and spermicidal activity (Fawcett and Spencer, 1966; Ahmed et al, 1995). Seed kernel extracts were observed to be superior over commercial antifungal products, neemark and phytolan in inhibition of spore germination in *Aspergillus flavus* and *Curvularia lunata*. Both aqueous and acetone extracts showed 38% and 32% efficiency (Karade et al, 2001). Anti-bacterial activities of *A. indica* were tested as a means to develop effective and safe antimicrobial drug (Pal-Datta et al, 2002). Leaf extract of neem is found to be active against a number of DNA viruses like small pox, chicken pox, herpes virus and RNA virus like Poliomyelitis virus (Rao et al, 1969; Kaii-a-Kamb et al, 1992). Biotoxicity of aqueous extracts of green leaves is more against foliar pathogens at all concentrations while tender twigs, neem seeds, dry leaves, were inhibitory at 75- 100% concentration over the control (Bipte and Musaddiq, 2005). Neem extract showed significant parasitocidal activity on chloroquine resistant *Plasmodium falciparum* isolates (Mohite et al, 2005). Methanolic extract of leaves showed anti-acne activity. It is inhibitory against *Propionibacterium acne* with MIC of 600 µgm/ml, as compared to Erythromycin which is effective in 1.5 µgm/sq. ml concentration (Kumar and Khanum, 2004). Stem bark of *A. indica* was
checked for anti-oxidant activity and inhibits lipid peroxidation (Ciddi and Kaleab, 2005). *A. indica* has been reported to contain maximum Zinc concentration and is used to cure cough, asthma, rheumatism, skin diseases, diarrhea, piles, ulcer, stomachic, rheumatism, hernia and as a blood purifier (Udayakumar and Begum, 2003). When seeds of affected legumes like groundnuts, grams and green grams were treated with crude aqueous extracts of *A. indica* for various time intervals like 5, 10, 15 minutes, growth of dominant fungi like *Asp. flavus*, *Asp. niger*, *Fusarium moniliforme* was inhibited within 30 minutes. This may be due to the bioactive compounds present in the leaves (Muley and Pawar, 2005). Aqueous, alcohol, xylene, hexane, chloroform, ether leaf extracts of *A. indica* showed antimicrobial activity against *E. coli* ATCC 25922, *S. aureus* ATCC 25923, *Ent. fecalis*, *Sal. typhi*, *V. cholerae*, *P. mirabilis*, *Ps. aeruginosa* ATCC 27853, *St. pneumoniae* ATCC 49619 and *Yersinia enterocolitica* (Tambekar and Kharate, 2005).

Leaf paste of neem is applied on ringworm and wounds. Fresh tender twigs are used to clean teeth particularly in pyorrhoea (Sonawane et al, 2006). Leaves, seeds and bark is reported to carry allelochemicals to be used as pesticides (Kumar, 2006). Antibacterial activity of aqueous and alcoholic extracts of neem were tested against many pathogens and aqueous extracts showed highest activity against *P. vulgaris*, *Ps. aeruginosa*, *S. aureus*, *B. anthracis*, *P. mirabilis*, *Sal. paratyphi B*, *Sal. paratyphi A* and *Kl. pneumoniae* sequentially and acetone extracts against *Sal. paratyphi A*, *S. aureus*, *P. vulgaris*, *Kl. pneumoniae*, *B. anthracis*, *P. mirabilis* and *Sal. paratyphi B* respectively (Gharge and Gune, 2007).

The seed oil has been widely used in asian medicine as an anti-inflammatory and antibacterial agent. It has been reported that the plant has insecticidal and spermicidal properties. A tincture of *A. indica* when compared with aspirin (200 mg/kg gave 10%) and indomethacin (4 mg/kg gave 29%) reduced inflammation by 18% for 800 mg/kg of dry extract in rats. The inner bark of this tree is extensively used in India as a febrifuge and tonic, in the form of powder or decoction. The roots are said to be
vermifuge, seeds yield oil largely used for lighting purposes and medicine. The Pharmaceutical Codex of 1923, mentions neem, as a simple bitter, administered usually in the form of tincture or infusion (Dweck, 1994).

5. Calotropis gigantea:

Calotropis gigantea (Rul) belongs to family Asclepiadaceae. The plant is wild in tropical countries of Asia. It is a medium sized shrub about three meters high. It has a pale bark and heart-shaped leaves. Leaves are cottony on under-surface, pointed at the tip with axillary simple or compound flowers. Seeds are ovate with white-silky coma or floss. Its leaves, roots and juice of young floral buds has medicinal properties. It gives relief from abdominal pains, ulcers, earache and some skin diseases. It soothes wounds and is a digestive. Its latex contains resins, uscharin, catachin, alpha calotripeol, beta-calotripeol, beta amyrin, Ca-oxalate and stem bark contains alpha calotripeol, beta-calotripeol, beta amyrin and root bark contains beta amyrin (Kurian, 1999). Ethanolic extracts of latex extracts exhibited greater free radical scavenging activity while leaf extract showed moderate activity (Mueen et al, 1985). Ethanol extracts of flowers showed significant bacterial activity against Bacillus species, Pseudomonas species and S. aureus. Traditionally, this plant is used alone or in combination to treat fever, indigestion, cold, cough, asthma, nausea, vomiting and diarrhea (Caius, 1986). Leaves are useful in the treatment of paralysis, swelling and intermittent fever. Flowers are bitter, digestive and astringent (Agarkar, 1991; Warrier et al, 1994). They show anti-inflammatory activity (Mascolo et al, 1988). The major constituents present in C. gigantea are cardenolides, lignans and flavanol glycosides which fulfill the structural criteria for being a good antioxidant (Sen et al, 1992), responsible for correcting the
imbalance between pro-oxidant and antioxidant homeostasis, which is responsible for diseases (Tiwari, 2001). This plant is well known in the ayurvedic medical system as Arkah (Kurian, 2004), found sculpted on Shiva temple symbolising mythological and medicinal value enjoyed by the plant in ancient India. Ethanolic extract of the roots of \textit{C. gigantea} has analgesic and anti-inflammatory activities (Kamath and Rana, 2003). Alcoholic extract, as compared to the standard drug, Diclofenac Sodium, indicated promising anti-inflammatory activity, as studied in animals (Argal and Pathak, 2005-b). On phytochemical screening, flowers showed the presence of flavonoids, tannins, steroids, saponins and sterols. They showed high degree of activity against all microbial pathogens under investigation (\textit{E. coli}, \textit{B. subtilis}, \textit{Kl. pneumoniae}, \textit{S. aureus}, \textit{Asp. niger} and \textit{Rhizopus} species) at all concentrations (Uma and Sasikumar, 2005). Alcoholic extract of flowers was found to reduce the number, frequency and wetness of faeces in diarrhoea (Argal and Pathak, 2005-a). Warm leaves of rui are used as a poultice on edematous regions (Sonawane et al, 2006).

\textbf{6. \textit{Cassia auriculata}:}

Belonging to family \textit{Leguminosae}, \textit{Cassia auriculata} (Tarwad) exists as a herb and a shrub. It is found in saline soils and shallow soil regions. Very frequently it is found in ghats and Konkan region, of Sangli district, Baramati, Indapur and Kankavali. It has primary, secondary roots and rhizoids. The tree is two-four meters tall, upright with a reddish, smooth and branched stem. It possesses unipinnate leaves with hairy stems, green on top, light green under-side. Flowers are raceme, zygomorphic, poly-petalous with imbricate aestivation, smallest being innermost. Flowering occurs in the period from January to July. The fruit-pod is 20-25 cm. long with marginal placentation, obliquely sepalated containing rhonebohedral seeds. Extract of the bark is used for gargling in throat infections, is anti-diabetic, reduces thirst, urine and mucous in stools and used in male infertility. Bark has 15.2 - 19.1% tannin (Kurian, 1999).
The antimicrobial potency of ethanol extract of Cassia species was checked against *E. coli*, *S. aureus*, *Ps. aeruginosa*, *C. albicans*, *Asp. niger* and *Asp. flavus* by disc diffusion method and was found to show significant activity (Selvamani and Latha, 2004). Methanolic extract of *C. auriculata* flowers revealed significant laxative activity on rats in dose dependent manner (Ganapaty and Vidyadhar, 2004).

*C. auriculata* was one of the active plants, amongst eighteen, which exhibited antimicrobial activity against *B. subtilis*, *S. aureus*, *S. epidermidis*, *Ent. fecalis*, *E. coli*, *K. pneumonia*, *Ps. aeruginosa*, *Erwinia species* and *P. vulgaris* at three different concentrations of 1.25, 2.5 and 5 mg / disc (Sarny and Ignacimuthu, 2000 ; Duraipandiyan et al, 2006). It is a globally popular herbal fruit drug reported to contain Calcium sennoides as its active constituents (Baskar and Chezhiyan, 2002-b). Leaf extract is applied on ringworm and itch. Seed paste is applied externally in skin diseases. Seeds are given to the animals for inducing fats (Jeeva et al, 2005). The efficiency of aqueous and acetone extracts on the candidial and other superficial mycoses was studied by Murugan et al (2006). It was observed that growth of the fungus decreased with increase in extract concentration and both the extracts exhibited significant antifungal activity comparable with the standard antibiotics. Bark of *C. auriculata* is used as a gargle in sore throat. Decoction of the flower buds has been tried with good results in diabetes (Sonawane et al, 2006).

7. *Catharanthus roseus* / *Vinca rosea*:

A member of family Solanaceae, *Catharanthus roseus* (Sadaphuli) is a small plant which thrives without much care. It grows in gardens, on seashores and in sandy areas. It has a bad odour and has gained great popularity for its medicinal values. It has a few branches and grows to a
fifty cm. height. It has oblong, glossy leaves, flowers, white or purplish pink, fruit cylindrical, length 2-3 cm. Its various parts are used for medicinal purposes. The whole plant, including the roots, may be used in medicine. In India, the juice of fresh *C. roseus* leaves has been applied topically to treat venomous insect bites. In the West Indies, its flowers are used in eye preparations. In various parts of the world, a solution made from the whole plant has been used to control bleeding and as a mouthwash to ease sore throats. It is known to promote menstrual flow, softens swollen parts and relieves pains in the muscles. It works as a good laxative, kills or expels worms from the body, heals wounds, fresh cuts, soothes burns, cures eczema, falling hair and eye-diseases. It checks growth of tumours, enlargement of the spleen, liver complaints, asthma, leprosy and jaundice (Kurian, 2004).

*C. roseus* has made important contributions in the areas beyond anti-infectives, such as cancer therapies. The antileukaemic alkaloids, vinblastine and vincristine are obtained from *C. roseus*. Leaf-extract is anticarcinogenic, anti-diabetic and anti-hypertensive. Leaf-infusion is used in diarrhoea and diabetes. It expels worms from the body. Root-decoction is used as a vermifuge, is good for relieving tooth-ache and as a purgative. It is known to contain 20 dimeric indole, dihydroindole alkaloids, vincristine, vinblastine, catharanthine, vindoline, ajmalicine, lochnerine, serpentine and tetra-hydro-alstonine. Leaves and roots are mostly used as anti-spasmodics, hypotensives, against leukemia and Hodgkin's disease (Baskar et al, 2002). Redkar and Jolly (2003) stated that *C. roseus* is a promising candidate for development as a chemotherapeutic agent for protection against cancer. The extract of the fresh leaf is anticarcinogenic. Infusion of the leaf is used in diabetes and diarrhea (Jeeva et al, 2005). Sadaphuli leaves are used in diabetes to remove sugar (Sonawane et al, 2006). Traditionally, it has been used in folk medicine to treat diabetes and high blood pressure. It is believed to promote insulin production or to increase the body's utilization of sugars from food. *C. roseus* has some diuretic action, promoting the loss of urine from the body which may help
to relieve high blood pressure. During the 1950s, C. roseus was discovered to contain a number of chemicals in the alkaloid class. Alkaloids are bitter-tasting plant compounds that contain nitrogen, having pain-relieving or anticancer properties. Two of the alkaloids (vinblastine and vincristine) have been isolated and developed into prescription anti-cancer drugs which work in several ways that interfere with the division of cancer cells. Chemicals in C. roseus may prevent the growth of new blood vessels that support tumor growth (Mandal et al, 2002).

8. **Cleome viscosa / Gynandrotropis pentaphylla / Gynandrotropis gynandra**

Cleome viscosa (Tilwan) belongs to the family Capparidaceae. It is an annual herb, found in fields, as a weed. It is 30-90 cm in height and has slits on the bark. It has primary, secondary roots and rhizoids. It has oblong leaves with top leaves big in size. It has an axillary raceme, yellow flowers with four veined petals, flowering from September to June. Fruits are capsules, hairy, oily and tapering. Seeds are kidney shaped, black and wrinkled.

In traditional medicine, its leaf-juice and oil is used for the treatment of ear-ache in ointments, as an anti-snake-venom and as a digestive. It prevents
pus formation and encourages wound healing. Seeds are known to contain Viscosic acid and Viscosin. It is reported to exhibit antibacterial activity (Rao and Babu, 1998). *C. viscosa* has been reported to contain maximum manganese concentration and is used to cure skin diseases, scabies, psoriasis, bilious afflictions, piles, fever, rheumatism and as an astringent (Udayakumar and Begum, 2003). The leaf juice is applied to relieve ear-ache, to cure boils and as counter-irritant. It is used as vermifuge and seed paste in worm infestations. Plant juice is administered to treat cough (Jeeva et al, 2005; Sonawane et al, 2006). *C. viscosa* is reputed for its rubefacient, vesicant, anti-helminthic properties. All parts of the plant are used for ailments like rheumatism, scabies, inflammations and in external applications for wounds. Methanol extract showed antimicrobial activity against *E. coli, Shigella* species, effective in the treatment of diarrhoea and dysentery. It showed anti-fungal activities against *Penicillium notatum, Penicillium chrysogenum, Asp. niger* and *C. albicans* (Parimala devi et al, 2006).

9. *Curcuma longa*:

Belonging to family Scitamineae, *Curcuma longa* (Haladi) is an annual, medicinal herb planted in plenty in Konkan, Satara and Sangli region. It has fibrous roots, modified stem, rhizome and main stem. It has nodes and peri-nodes, axillary buds, scaly leaves and lives for many years. Some specific properties of the plant are simple leaves, alternate, pinnate venation and strong aroma. It is a perennial plant with irregular tubers, lanceolate, long,
smooth, uniform green leaves, floral bracts pale-green, flowers pale yellow, about the length of the bracts. Fruits are tri-lobed capsules. The plant has a peculiar odour, slightly bitter and acidic. The plant is cultivated for the rhizome and ornamental purpose. It is applied externally and consumed internally. Moist roots are dried and used (Sathe, 1998).

Medicinally it is used to expel gases, flatulence, gripping pains from the stomach and bowels, alters the process of nutrition and excretion, restoring the normal functions of the body. It is used to treat bronchitis, diarrhoea, intermittent fever, abnormal accumulation of fluids in cellular tissue, jaundice and liver problems. It is used against chest-pain, cold, cough, diabetes, scabies, itch, pustules of smallpox, chicken-pox and measles. It is anti-mucous, anti-snake venom, anti-scorpion bite and is rich in Vitamin A. It is useful for treatment of urinary diseases, healing wounds, sprains, rheumatism and pain of the facial nerves.

Rhizome of *C. longa* is externally used as a powder, paste, lotion or oil, ointment and decoction (Sawant, 1974). It is effective in traditional medicine. It is known to be a blood purifier and along with neem fruits, consumed in case of scabies, itching and applied topically. Worms are traditionally treated with haladi and jaggery. It is used in cases of excessive incontinence, poisoning, conjunctivitis, piles and as an antiseptic in peri and post-delivery cases (Sathe, 1998).

It contains curcumin, alkalies, essential oil, ketone and alcohol. Fresh haldi contains zingiberine, oil (antiseptic), carmin (antacid), p-tolylmethyl carbinol. (Sawant, 1974). It has a long tradition of use in the Chinese and ayurvedic systems of medicine. Extracts of various spices as turmeric (Sastri, 1952) have been reported as antioxidants of non-enzymatic category. It is known to exhibit significant anti-inflammatory and potential antioxidant activity (Salimath et al, 1986; Chawla et al, 1987). Clinical bacteriological study of *C. longa* showed that it is effective in conjunctivitis (Shrinivas and Prabhakaran, 1987). *C. longa* exhibits wound healing, contraceptive and lactation stimulating activities. Leaves are used as counter-irritants to suppress milk secretion in mammary abscesses
It is reported to have insecticidal activity (Chander et al., 1991). In East Asia, the rhizomes of *C. longa* are considered to have natural antibacterial, anti-inflammatory, antineoplastic and analgesic activities because of monoterpenoids, sesquiterpenoids, and curcuminoids (Tang and Eisenbrand, 1992). Curcumin, a constituent of turmeric, chemically diferuloyl methane, is reported as an effective natural anti-inflammatory agent which inhibits lipid peroxidation and scavenges oxygen-free radicals (Reddy and Lokesh, 1992; Ciddi and Kaleab, 2005). Extracts of *C. longa* (5-10 mg/ml) greatly reduced aflatoxin production in *Asp. parasiticus* by more than 90% (Soni et al., 1992). Antimicrobial activity of the essential oil of *C. longa* leaves has been reported (Iyengar et al., 1995). Antibacterial activity of *C. longa* stem and root extract was found against *S. aureus*, *E. coli* and a wide variety of pathogenic bacteria (Chandi et al., 1999). Its rhizome is reported to improve complexion (Mukundan et al., 2002). Methanol extract of the dried powdered turmeric rhizome and curcumin inhibited the growth of all strains of *H. pylori*, with a MIC range of 6.25 - 50 µg/ml (Mahady et al., 2002). Curcuminoids, a Group of phenolic compounds isolated from the roots of *C. longa*, exhibit a variety of beneficial effects on health and prevention of diseases (Joe et al., 2004). A study by Limtrakul et al. (2004) showed that three curcuminoids isolated from *C. longa* inhibited multidrug resistance -1 (MDR-1) gene expression.

Wound healing and detoxifying properties of curcumin have received considerable attention (Bone, 1991; Joe et al., 2004). When used as one of the ingredients of a herbal facial scrub, it was found comparable with popularly used marketed scrub, showing excellent effects on acne, healing and prevention of pimples, giving fairness, smoother complexion, helping exfoliation (Rawat et al., 2005). Antimicrobial properties of essential oils of *C. longa* studied against *S. typhi*, *Kl. pneumoniae*, *E. coli*, *S. aureus* and *B. subtilis* in different concentrations have showed antimicrobial activity against all and maximum against *E. coli* (Dubey et al., 2005).

The rhizome of *C. longa* has been used as a medicine, spice and colouring agent for thousands of years. A native of India and Southeast Asia, it is
now cultivated in many countries, but India still accounts for a large percentage of world production. In India, turmeric is regarded as a stomachic, tonic and blood purifier, used for improving poor digestion, fevers, skin conditions, vomiting in pregnancy and liver disorders. Externally it is used for conjunctivitis, skin infections, cancer, sprains, arthritis, haemorrhoids and eczema. Turmeric has a warm, bitter taste and is a primary component of curry powders and some mustards. The powders and its oleoresins are used extensively as food and flavourings in the culinary industry. The spice has a long history of traditional use in Asian medicine. It has been used topically as a poultice, as an analgesic and to treat ringworms. Among the dark races of India, turmeric has been used since time immemorial to treat skin problems. Both the Ayurvedic and Unani practitioners use a paste of powdered turmeric or a decoction of the whole plant as a local application in the treatment of leprosy and cobra bites. It is especially useful for indolent ulcers on the surface of the skin and gangrene in the flesh. A paste made from the powdered rhizomes along with caustic lime forms a soothing remedy for inflamed joints. It is externally applied to suppress the unwelcome growth of facial hairs and upper lip moustaches. In Northern India the rhizome is used by many natives for treating cuts, burns and scalds. The plant is utilized by the natives of Samoa as powdered rhizome to sprinkle on new-born infants to help heal a recently cut umbilical cord, to prevent nappy rash from occurring and to keep the skin soft and resilient. The powder is used as a paste or poultice to treat skin ulcers and extensive skin eruptions. In Africa, turmeric is used for healing rashes due to allergies, inflammation in psoriasis and itching (Dweck, 1994).

10. *Eucalyptus globulus*:

१० एयकल्प्टस ग्लोबलसः कुण्डी डव्वेरा हरित पर्यक्षा

चुजिलिक्षमात्रेन नीलिन्ध्यांस इत्यतः। (३. वि.)

हरिदुधो ज्वारवर्याश्च तिलकका

कक्ष्यतहस्तःस्तिक्ता सुगंधा पुलिनशास्त्राः।
Eucalyptus globulus (Nilgiri) belongs to family Myrtaceae. Originally, *E. globulus* was a native plant of Australia and tropical countries. In India, it was found only in Nilgiri ranges, Annamalai, Simla, Assam but is now planted all over India for its aesthetic view, forest wealth and use in paper industry. It is planted in backyards, giving durable timber and sold at a good price. It is an ever-green tree, tall, about 15 meters high. It has about 400 species with same medicinal properties. Its oil is medicinal but evaporates fast, is colourless, with a strong camphor-like odour. Initially it has a strong taste on consumption and then a sense of coldness is experienced. It is always stored in air-tight bottles. The leaves are fatty, warm, used externally and internally for cough, mucous, flu, typhoid, indigestion, arthritis, diarrhea and worms. It is used in the treatment of Asthma, inflammation of mucous membrane with free discharge, gland, bladder, urinary bladder, bronchitis, whooping cough, dysentry, TB, diabetes, fever, cold, malaria, inflammation of kidneys, nose-lining, joints, rheumatism, respiratory problems and infection of sciatic nerve. It is used as a disinfectant for washing hands, wounds, sores, ulcers and for healing. It reduces or eliminates fever, gives tone and vitality to the body. It is used to prevent pyorrhea and burns. It is used as a leaf-infusion, decoction, as vapours for external application and oil extract (Sawant, 1974).
Theoretically, it contains volatile oil, cineol, eucalyptol, cajeputol, tannins and resins (Sathe, 1998).

Leaf extracts were reported superior over commercial antifungal products, neemark and phytolan in inhibition of spore germination in *Asp. flavus* and *Curvularia lunata*. Acetone extract was found effective showing 30% efficiency (Karade et al, 2001). Leaves of *E. globulus* exhibited free radical scavenging activity (Dessi et al, 2001). Activity of essential oil of Eucalyptus was studied against *E. coli*, *Salmonella* species, *Shigella* species, *P. vulgaris*, *Ps. aeruginosa*, *S. aureus*, *B. cereus*, *B. subtilis*, Corynebacterium NCIM 2640 and fungi *Asp. niger*, *Asp. terrus*, *P. chrysogenum* and the results were found to be very encouraging (Timande and Nafde, 2004). Excision, incision and granuloma wound models showed significant wound healing activity of ethyl acetate fraction of *E. globulus* ethanol leaf extract. Aqueous extract is found effective against wound pathogens, *Pseudomonas* species, *Enterococcus* species, *Actinomycetel* species and two unidentified species (Akki et al, 2004). Active principles are Citronellol, Citronellal, Germaniol and leaves are used in perfumery, soaps and cosmetics (Baskar et al, 2002-d).

11. *Phyllanthus niruri*:

Belonging to family Euphorbiaceae, *Phyllanthus niruri* (Bhui-awala) is an annual plant, found in Konkan region. Farmers consider it as a problematic weed but it is a valuable medicinal plant for herbalists. It grows as weeds, in gardens, in farms and waste-lands. It is 30-60 cm. in height, branching at the stem. It has a main root, secondary roots and rhizoids. It has tiny fruiting bodies or capsules located under the surface of bipinnately compound leaves. It bears very tiny pale green or white flowers. It has oblong leaves in two rows. Flowers are monoecious, many, yellowish, at
the crux. Fruits are capsular, very small, smooth and soft. Seeds are triangular, with lateral wrinkles, blackish on the backside (Kurian, 1999). Seed to seed cycle occurs in two or four weeks. The flowering time in India is July to August. Its roots, leaves, fruits, milky juice and whole plants are used as medicine. It contains an important bitter bio-active constituent phyllanthin in fresh leaves, hypo-phyllanthin and phyllanthin in dried leaves. It reportedly contains catechin, gallo catechin, limonene, norserurinine, hydroxy-lintetralin, hydroxy-sesamin, isopropyl- cholesterol, ascorbic acid, astragalin, corilagin, sitosterol, cymene, ellagic acid, estradiol, gallic acid, geranin, hinokinin, hypophyllanthin, linoleic acid and nirphyllin (Sawant, 1974). Phyllanthin in the leaves is known to exhibit hepato-protective activity (Aeri et al, 2005). It is used as a diuretic, in diseases of urinary tract and jaundice (Jeeva et al, 2005).

It holds a reputed position in both Ayurvedic and Unani systems of medicine. According to Ayurvedic system of medicine it is cooling, useful in thirst, bronchitis, leprosy, anemia, urinary discharge, anuria, biliousness, asthma and for hiccups. According to Unani system, the herb is good for treating sores, chronic dysentery and fruits for tubercular ulcers, wounds, sores, scabies and ring worm (Agarkar, 1991). The fresh root is believed to be an excellent remedy for jaundice. A poultice of the leaves with salt cures scabby affliction and without salt, is applied on bruise and wounds. The milky juice is applied for offensive sores. The bark yields bitter principle phyllanthin. The infusion of roots and leaves is a good tonic and diuretic when taken cold in repeated doses. It has a rich medicinal tradition in different parts of India, especially in Chhattisgarh state (Caius, 1986). It is a major component of many popular liver tonics in India including Liv-52. Fresh juice and powder of dried plant are used in ayurvedic preparations. Keys for identification of different species of *Phyllanthus* have been elaborated (Caius, 1986; Agarkar, 1991). *P. niruri* has shown clinical efficacy in viral Hepatitis B (Paranjpe, 2001). It is used as leaf and seed decoction, milky latex externally and young leaves for fevers. Fresh roots are used against hepatitis, seeds against leucorrhoea, irregular menses,
malária, burning micturition and boils. It promotes the flow of urine, strengthens and tones the stomach, promotes menstrual flow, reduces or eliminates fever, stones in kidneys and gall bladder (Kurian, 1999).

It is a mild laxative, relieves kidney colic and acute kidney pains. It checks cystitis, inflammation of urinary bladder, dropsy, abnormal accumulation of liquid in the cellular tissue, prostate problems and uro-genital diseases. It is used in early stages of jaundice, indigestion, dysentery, gonorrhoea, diabetes, sores and fevers (Sawant, 1974).

12. *Piper betel*:

- **Tambūlikā**: नामविल महति पिपरिल भवेत (आ. म.)
- **Nāmavilil**: तांबुलिली नामविली नागिनी नागवल्लरी (भ. प्रा.)
- **Nāmavilil kuduvīkṣaṇa**: तिल्का पीनचालकीत
- **Kapakšara**: रुच्या वत्सूर्वीयनिपि परा।
- **śatāntītattvācāśītām**: मुखुर्ज हवालवहम दोष्कूद्रद
- **dāhrodcārādārī**: मलाकृतिहस्तम्भ वतिश्रविदम
- **yadāyugō**: जयपन पोशित रसम तक्षेषितः प्रोतिसम
- **tambūlilumānanda**: संधिकूद मण्या त्रिदोषारतिनु ल।

**Kūraṇa Pārṇa**: तिल्कुभवमग्नाद् काष्ठाय चलने बाहर वातङ्गांगायंभ मलपंचा
- **Shūbh Pārṇa**: शेषवातमश्यामम पथ्यम वट्यान वायुनम च
- **Shīraṃgaśṭha**: शीरोल्लयम कुर्यात्मसहस्सरद्रशा
- **व्यायाम तत्त्वाश्रयम तस्या भविष्यते च शीततम सदा। (स. निर्म..)
- **न नेतृरोगो न च**: रक्तपित्ते क्षते न वाते न भोगो ओषे
- **मदलये नापि च मोलुक्का वत्सासेः तम्बुल्मुनानंतीच्छा च। (सुर्वेशदेवा)

*Varier, 1995*

*Piper betel* (Nagvalli) belongs to the family Pipereceae and is abundantly grown in Sangli, Miraj, Solapur, Kolhapur, Pune and Konkan regions. *P. betel* is a perennial root-climber, trained on poles or trees in a hot but shady environment, grown in farms with a continuous water supply. It has a main root, secondary roots and rhizoids. Leaves have a smooth margin, are thin and alternate. Leaves stimulate saliva, are digestive, anti-colic, relieve ear-ache and stomach-ache. It is used as contraceptive, enhances lactation and
reduces production of cough. It is used as anti-snake-venom and against mental disorders. Leaf juice is anti-bacterial and good remedy in diphtheria. It is reported to contain essential oil and chavicol enzymes. Antibacterial activity of P. betel leaf extract was exhibited against S. aureus and E. coli (George et al, 1947). P. betel leaves are used for treating infections, stomach problems, as an aphrodisiac, in asthma, eye disorders and as a tonic (Kirtikar and Basu, 1992). Essential oil of P. betel showed biological activity and antimicrobial activity against E. coli, B. subtilis, S. aureus, V. cholerae and Asp. niger (Gangwar and Kumar, 2006). Leaf extracts of Piper betel showed activity against S. aureus and essential oil against E. coli, Sal. typhi, Ps. aeruginosa (Ahmed et al, 1998). Antibacterial activity of P. betel leaf extract was found against S. aureus, E. coli and a wide variety of pathogenic bacteria (Chandi et al, 1999). Leaves of P. betel are known to cure eye diseases, strengthen teeth, relieve cerebral congestion and used as a brain tonic (Mukundan et al, 2002). P. betel has been used as a contraceptive and stimulates lactation. Leaves are used as counter-irritants to suppress milk secretion in mammary abscesses and have a wound-healing property (Santhanum and Snagarajan, 1990; Rastogi and Mehrotra, 1995; Prajapathi and Kumar, 2003). It was reported that active principles in the extract like tannin, aliphatic ketones, beta-carotenoids, fatty acids, essential oils and phenolic compounds influence the antibacterial activity. Various Piper species are known to have broad spectrum anti-bacterial activity (Wiart et al, 2004). Betel leaf extract was one of the twenty one different plant extracts that showed highest anti-bacterial effect on the growth of Vibrio cholerae (Banginwar and Tambekar, 2003; Burade et al, 2005). Alcoholic extracts of the leaf were reported to show high degree of activity against pathogens (Burade et al, 2005). Activity of P. betel ethanolic extract cream showed significant anti-fungal activity against C. albicans and C. krusei as compared to Griseofulvin (Mullaicharam et al, 2005). Leaf extract of P. betel on phytochemical screening showed the presence of carotenoids, flavonoids, fixed oils, steroids, alkaloids, phenolic compounds and saponins. They showed high degree of activity against
microbial pathogens *E. coli*, *B. subtilis*, *Kl. pneumoniae*, *S. aureus*, *Asp. niger* and *Rhizopus species*, at all concentrations (Uma and Sasikumar, 2005). Aqueous, alcohol, xylene, hexane, chloroform and ether leaf extracts of *Piper betel* showed antimicrobial activity against *E. coli* ATCC 25922, *S. aureus* ATCC 25923, *Ent. fecalis*, *S. typhi*, *V. cholerae*, *P. mirabilis*, *Ps. aeruginosa* ATCC 27853, *St. pneumoniae* ATCC 49619 and *Yersinia enterocolitica* (Tambekar and Kharate, 2005).

Leaves of *P. betel* were checked for anti-oxidant activity and exhibited free radical scavenging activity and inhibition of lipid peroxidation. *P. betel* shows medicinal use in asthma, bronchitis, hyperlipidemia, ophthalmic complaints, sexual disorders, impaired intellect, as antiseptic etc. Different doses are reported to show significant reduction in lipid levels, lipid peroxidation, increase in anti-oxidants like glutathione, Vitamin C, E, superoxide dismutase etc. (Bodhankar et al, 2006).

13. *Pongamia pinnata* / *glabra*:

करंज कठुलिक्कनों वीर्यांणे योनिदोषहरुत
कुष्टो दवसमगमस्त्रांक्रियाकारहा तत्ततः।
कप्पाताशहुकुमशाशकाङ्क परम
मेहानम कठुकम पाके वीर्यांणे पित्तलम लागु :।
तत्ततां कप्पाताङ्क मेहार्शहुकुमकुण्ड्जीत। (भ. प्रा.)

(Varier, 1995)

*Pongamia pinnata* or *P. glabra* (Karanj) is a member of family Leguminosae. It is a handsome, medium height, perennial tree normally found growing on the banks of rivers and streams, sea-coast, forest locality, cold and moist conditions. It is found in large numbers in Konkan and ghat regions. It is a native of western ghats, distributed all over India. It is 15-18 meters tall with bushy tops. Leaves are present throughout the year, opposite each other, with sharp ends. Leaves are pinnately compound placed alternately. The 5-9 leaflets are ovate-oblong. The white or purple flowers are found in axillary racemes. Flowers are at the apex, white, blue, maroon, with standard sepals, wide wings, keel type inflorescence, long, joint petals,
appearing in May and June. Fruits are leguminous, thick, woody, flat, apex acute, obliquely oblong and smooth. They are one seeded, seed medium sized, brown, wrinkled, semi-circular and kidney shaped. The pod is obliquely oblong, bilaterally compressed and woody. It has primary, secondary roots and rhizoids.

Medicinally, every part of this tree is useful;
(a) Decoction of root and bark is useful in expelling worms from the body, for treating diseases of the eye, vagina, skin, for tumors, piles, wounds, ulcers, itching, ascitis or accumulation of liquid in the abdominal cavity, enlargement of spleen, abdomen and congestion of the liver. Fresh barks and leaves are used against piles and antisepsis.
(b) Decoction of tender shoots or sprouts is useful for strengthening and giving tone to the stomach, is an appetizer, checks edema, toxicosis or poisons.
(c) Infusion of leaves is a mild laxative, is useful as an agent for digestion and for expelling worms.
(d) Infusion of flowers is used for treating diabetes, biliousness, congestion of liver, hair scalp infections, whooping cough and as an anti-snake venom (Das and Agarwal, 1991).
(e) Decoction of seeds is useful for purifying blood, cures earache, chest complaints, chronic fevers and hydrocele. Seed extracts are found useful as a remedy in infections of skin, wounds, eyes and nose. Powdered seeds are used as febrifuge and tonic. Externally seed crush paste is used for treatment of leprosy sore, skin diseases, relief of painful and rheumatic joints (Clare and Wood, 1992).
(f) Seed-oil is useful for rheumatic pains, leukoderma, itching, leprosy, ulcers, lumbago, urinary disorders, headaches, chronic fevers, pain in the liver, wounds and skin diseases (Sawant, 1974). It is stimulant, antiseptic, anti-parasitic, used against bronchitis and whooping cough. It is used in treatment of scabies, herpes, eczema, ulcers and maggot infested sores. Mixture of oil with lemon juice is used in rheumatic pain, porrigo capitis,
psoriasis, pityriasis and prurigo. Internally it is used as a stomachic and to treat liver dysfunction. Its roots are known to strengthen gums (Mukundan et al, 2002). *P. pinnata* contains fatty, bitter oil, essential oil, karangin, pongamol, glabrin, pongamin, quasitine (Kurian, 1999). *P. pinnata* oil showed the presence of 9-octadecenoic acid, methyl ester in maximum concentration by GCMS analysis and high degree of anti-fungal and anti-bacterial activity against *Asp. niger, Asp. fumigatus, S. aureus, Ps. aeruginosa* (Wagh et al, 2005).

*P. pinnata* is used internally in bleeding piles and beriberi. Stem bark reveals the presence of flavonoids, phenyl propanoids and alkaloids. Crude alkaloids extracted from *P. pinnata* bark showed zones of inhibition for *B. subtilis, S. aureus, Ent. fecalis, E. coli, Ps. aeruginosa* and *Kl. pneumoniae* but not against *C. albicans* (Krishna and Grampurohit, 2006). Seeds and bark of *P. pinnata* is reported to carry allelochemicals to be used as pesticides (Kumar, 2006). Antimicrobial effects of *Pongamia pinnata* seeds when tested against acne-inducing, pus-forming bacteria, *Propionibacterium acnes* and *Staphylococcus epidermidis*, showed MIC and MBC of 2.5; 5.0, 2.5, 5.0 mg / ml against them respectively (Kumar et al, 2007).

*P. pinnata* seed oil is commonly used in Indian Ayurvedic medicine for the treatment and protection of skin and rheumatic pain. It is taken internally for bronchitis and whooping cough. Its extract enhances the UV absorbing properties of a conventional sunscreen, broadening the UV protection. The seeds crushed to a paste are used for leprosy, skin disorders and painful rheumatic joints. A paste of crushed leaves is applied as a poultice to wounds and a hot infusion of leaves is used as a medicated bath for relieving rheumatic pains, cleaning foul ulcers and sores. The seeds are high in non-edible oil which is used in the preparation of soap. *P. pinnata* is used in the Ayurveda and Siddha traditional medicine systems, for treatment of clinical lesions of skin and genitalia. A crude aqueous seed extract of *P. pinnata* completely inhibited the growths of Herpes Simplex
Virus types -1 and 2 (HSV-1, 2) as shown by complete absence of cytopathic effect (Dweck, 1994).

14. **Terminalia arjuna:**

Belonging to family Combretaceae, *Terminalia arjuna* (Arjun) is a large tree with spreading branches. It has smooth and grey bark. Leaves are sub-opposite to each other and oblong. Flowers are stalk-less, in clusters or in axillary spikes, fruit drupe, with five projecting wings for dispersal.

It is useful as a tonic, to treat dysentery, fractures, ulcers, blood diseases, liver congestion, painful or difficult urination, heart diseases, anemia, asthma, tumors, leukoderma and relieves fatigue. Decoction of the bark, juice of fresh leaves is used as an expectorant, for wounds, as a wash in ulcers, for reducing or eliminating fevers and for relieving ear-ache. Bark of this tree is used as a febrifuge (Kurian, 1999).

Barks of *T. arjuna* were checked for anti-oxidant activity and exhibited free radical scavenging activity and inhibition of lipid peroxidation. (Ciddi and Kaleab, 2005). Antifungal activities of aqueous extract of *Terminalia* species were reported (Shyamsundar et al, 2005). Species of *Terminalia* belonging to family Combretaceae have antibacterial and useful skin properties. A decoction of the *T. arjuna* bark is used to wash ulcers (Dweck, 1994-a).

15. **Triphala:**

Three myrobalans frequently used in traditional medicine - *Emblica officinalis*, *Terminalia chebula* and *Terminalia belerica* have been mixed in equal proportion to prepare Triphala churna (Baskar and Chezhiyan, 2002-b). Antimicrobial efficacy of Triphala was reported by Mehta et al (1993). Animal studies showed that, Triphala significantly increased cellular immunity by facilitating foot pad thickness response to sheep RBcs in sensitized rats. Oral administration showed a significant increase in neutrophil adhesion and delayed type hypersensitivity response (Shivaprasad et al, 2005). Considering the basic philosophy followed by herbal vendors, “clean the stomach, cure the diseases” and “keeping a
balance between hot and cold makes the body more bold", medicinal herbs have been included in most of their preparations (Patnaik, 1997).

Components of Triphala,

**a) Emblica officinalis:**

Belonging to family Euphorbiaceae, *Emblica officinalis* (Awala) is a deciduous, small or medium sized tree with spreading branches. The bark is light grey, peeling off in flakes, wood hard and red in colour. It has bipinnately compound leaves, 10-13 cm. long, with small leaf-lets. It has small, greenish yellow, monoecious flowers, in axillary fascicles. The fruit is pale yellow, a rich source of Vitamin C, with a hard seed, globose, fleshy and 1.4 – 3.0 cm in diameter (Kurian, 1999).

Known to be a very useful tree, its various parts are medicinally significant. Raw fruits expel gases, flatulence, gripping pains of stomach and bowels, have a laxative action, act as a tonic, prevent or reduce fever, check vomiting, liver-congestion, leprosy, constipation, inflammations, contagious, subcutaneous skin diseases, piles, anemia, painful or difficult urination, anuria, heart and liver diseases, cold, nasal hemorrhages, poisoning and eye-diseases. Some other magical properties of the plant include its use in asthma, bronchitis, leucorrhoea, as a relief in throat infections or as an aid in digestion. A rich source of Vitamin C, its seeds contain fisceal oil, tannin, phosphides and essential oil. Its extract is a component of Triphala. *E. officinalis* is the richest natural source of Vitamin C and is known for its antioxidant and immunostimulant properties. Since time immemorial, it is extensively used in Indian ayurvedic medicines (Reddy and Lokesh, 1992). Antibacterial activity of *E. officinalis* fruit extract was reported against *S. aureus*, *K. aerogenes*, *E. coli*, *S. typhi*, *Sh. dysenteriae* and *V. cholerae* (Mehta et al, 1993). It is one of the six plants, aqueous extracts of which was found to be active against all of the test organisms (Desta, 1993). Topical application of *E. officinalis* in treatment of Acne vulgaris was reported (Paranjpe, 1997). It is regarded as a “rasayana”, a drug capable of preventing diseases. It is externally used in alopecia, tooth ache, ophthalmic conditions and
internally for altered gastro-intestinal motility, liver disorders, leucorrhoea, anemia, renal dysfunction, anti-inflammatory, anti-stress agent, as a remedy against fever, tuberculosis, chest infections and for general health maintenance (Chakraborthi, 1997). Leaf extracts were superior over commercial antifungal products neemark and phytolan in inhibition of spore germination in Asp. flavus and Curvularia lunata. Both aqueous and acetone extracts of E. officinalis showed 95% and 100% efficiency (Karade et al, 2001). Its fruits and seeds are used for strengthening and promoting hair growth, useful in the complaints of eyes and digestion problems (Mukundan et al, 2002). Fruits are used in cases of jaundice (Baskar and Chezhiyan, 2002-b). Study on anti-bacterial activities of E. officinalis was carried out to check if it could be used as a means to develop effective and safe antimicrobial drug (Pal-Datta et al, 2002). Fruit and leaf extract of E. officinalis showed antimicrobial activity against E. coli, S. aureus, B. subtilis, Sal. typhi and Ps. aeruginosa (Chavan et al, 2005). Leaves of E. officinalis exhibited antimicrobial activity against B. cereus NCIM 2322, S. aureus ATCC 6538, P. vulgaris MTCC 742, E. coli NCIM 2931, Ps. aeruginosa NCIM 2200 (Deshpande et al, 2005). Aqueous, alcohol, xylene, hexane, chloroform and ether extracts of E. officinalis leaves showed antimicrobial activity against E. coli ATCC 25922, S. aureus ATCC 25923, Ent. fecalis, Sal. typhi, V. cholerae, P. mirabilis, Ps. aeruginosa ATCC 27853, St. pneumoniae ATCC 49619 and Yersinia enterocolitica (Tambekar and Saratkar, 2005). Good antimicrobial activity of chloform extract of E. officinalis roots was reported for S. aureus, B. subtilis, E. coli, Ps. aeruginosa, C. albicans and Asp. niger (Ganapaty et al, 2005). The paste prepared by mincing fresh plants has an anti-inflammatory effect, may be applied on insect bites, stings, swellings and other skin diseases. In Ayurveda, it is mainly used in hair oil, while in the Unani system, the juice is used in "Hab Miskeen Nawaz" with aconite, Croton tiglium, Piper nigrum, Piper longum, Zingiber officinale and minerals like mercury, sulphur, arsenic, borax, for various types of pains in the body. It is a
constituent of "Roghan Amla Khas", for applying on the hair (Dweck, 1994).

b) *Terminalia chebula* :

*Terminalia chebula* (Hirda) belongs to family Combretaceae. It is a perennial, large, spreading tree with good foliage. It is more common in konkan regions with good rains and fertile soil. It is found everywhere in India from Kashmir to Assam and even at a height of 1500 meters. It is 7-10 meters high. It has dark brown bark with slits. Leaves are opposite, thin, peaked. The leaves fall in February and new ones appear in April and May. It has white or yellowish flowers, spike terminal, 5-10 cm. long. It has obovoid fruits containing tannin, astringent substances, chebulinic acid, tannic acid, gallic acid and resins. It is known to increase heart functioning, improve digestion, used to brush teeth, make gums strong, heal wounds, boils and skin infections (Sawant, 1974).

It is used for local application in chronic ulcers, wounds, as a gargle in stomatitis, in caries, bleeding of gum ulcers etc. Fruits contain 30% chebulinic acid with anthraquinone (Das and Agarwal, 1991). It is used as an appetizer, to treat diarrhoea and worm infestation (Deshpande et al, 1998). It is used as a tonic and to cure cases of leprosy (Baskar and Chezhiyan, 2002-b). Active principles are chebulin and phenolic compounds. Fruit pulp and bark is used as a laxative, stomachic, tonic, diuretic, against asthma and other respiratory disorders (Baskar et al, 2002-d). Studies on aqueous extract of dried fruits of *T. chebula* against four dermatophytes revealed that, *Trichophytton tonsurans* and *T. rubrum* reported Minimum Fungicidal Timing (MFT) of 24 and 48 hours, *Microsporum fulvum* shows no effect upto 48 hours while *M. gypseum* reported MFT as 1 hour (Dutta et al, 2004). Aqueous, alcohol, xylene, hexane, chloroform and ether leaf extracts of *T. chebula* showed antimicrobial activity against *E. coli* ATCC 25922, *S. aureus* ATCC 25923, *Ent. fecalis*, *Sal. typhi*, *V. cholerae*, *P. mirabilis*, *Ps. aeruginosa* ATCC 27853, *St. pneumoniae* ATCC 49619 and *Yersinia enterocolitica* (Tambekar and Saratkar, 2005). *T. chebula* showed a protective activity
when applied to the epithelial cells against cytopathic effects caused by Influenza A virus (Kondawar et al, 2006). Extracts of amla (Sastri, 1952) have been reported as antioxidants of non-enzymatic category. Finely powdered T. chebula fruits are used as a dentifrice for carious teeth, bleeding and ulceration of the gums. The ashes of the fruit mixed with butter form a good ointment for sores. Regular use of the powder with king - coconut water is supposed to improve the complexion (Dweck, 1994-a).

c) Terminalia belerica:

*Terminalia belerica* (Behada) belongs to family Combretaceae. It is found in Konkan regions and forests. It is a very tall, beautiful, big, perennial tree, 18-40 meters in height. It has bluish bark with lateral slits and hairy stems. Its leaves are alternate, leather-like and semi-circular. Flowers are greenish yellow, hairy, with a strong odour. Flowering occurs from February to May. Fruits are oblong with five corners and become powdery on drying. It is used as a digestive aid, a sedative, in treatment of eye diseases and cough. Theoretically, fruits and oils have 17% tannin. It is a component of Triphala (Sawant, 1974). It has been reported to contain active compound Lignana, having anti-HIV activity (Eapen and George, 1998). It is used to cure cases of leprosy and eye infections (Baskar and Chezhiyan, 2002-b). Barks of *T. belerica* were checked for anti-oxidant activity and were reported to exhibit free radical scavenging activity and inhibition of lipid peroxidation (Ciddi and Kaleab, 2005). The pericarp of the dry fruit of *T. belerica* is an ingredient of many decoctions used for a variety of diseases. It is one of the myrobalans which go to form the "Thippal" which is largely used by every ayurvedic physician in many of their stock preparations, for diseases of the human body. The seed extract oil is considered a beneficial application for hair and rheumatism (Dweck, 1994-a).

II. 5. Use of plants in burns:

Natives of India used *A. indica* leaves as poultices, ointments and liniments for burns (Martindale, 1989). Nagoba et al (1998) hinted at the use of plants in the treatment of a severe electric burn case complicated by multiple antibiotic resistant *Ps. aeruginosa* infection. They observed improvement
with the use of citric acid. *Aloe* has been reported to relieve pain, reduce inflammation, decrease redness, swelling and itching due to the presence of enzymes like carboxypeptidase and bradykininase. *Aloe* gel has antibacterial and antifungal properties, which might help in preventing burns from getting infected (Dweck, 1994). *Aloe* is the first-choice herb for burns, in every kitchen, the place where most household burns occur. *Aloe* is particularly effective for burns and other wounds as it activates and increases circulation of macrophages to the area, accelerating healing. The juice forms a "natural plaster" over the wound, stimulates fibroblasts, epidermal growth and repair process (Dweck, 1994). Garlic has been applied directly to burns as it has undeniable antiseptic properties. To apply plants on a burn, they are mashed and the paste applied as a poultice. Bonjar et al (2003) reported the use of plants in treatment of burns, dermatophytic and infectious diseases, as antiseptic and anti-inflammatory agents. *Ps. aeruginosa* is the most prevalent pathogen capable of causing life-threatening illnesses, wounds and burns infections, giving rise to blue-green pus, meningitis, fatal sepsis, septicemia and pneumonia in cystic fibrosis and immunocompromised patients. Use of "Hingavadya ghrita", a polyherbal formulation, in wound healing activity of rats, showed positive healing of excision and incision wounds, supported by pathological studies (Fulzele et al, 2002). Clinical healing of burns wound becomes a major problem because of infections or use of healing suppressants, however, when *Tridax procumbens* was tried out on rat burn wound model, it positively influenced the burn healing process (Babu et al, 2003). A study was conducted to evaluate methanolic extracts of *Ageratum conyzoides, Anthocleista djalonensis, Napoleona imperialis, Ocimum gratissimum* and *Psidium guajava* for antibacterial and wound healing properties, using the excision wound model, against eleven wound isolates, *S. aureus* (four strains), *E. coli* (two strains), *Ps. aeruginosa* (one strain), *Proteus* species (three strains), and *Shigella* species (one strain). Extract of *Napoleona imperialis* inhibited the growth of all test bacterial strains recording more than 90% wound healing (Chah et al, 2006).
Mother earth has bestowed us with a rich treasure of flora and fauna. A major section of the flora includes medicinal plants. Rapid progress is being made in studying these plants. In time, it will provide new avenues for rationalization and standardization of novel antimicrobial drugs developed from these plants. Meanwhile, we can strive to be one step ahead of the micro-organisms responsible for diseases, by testing the plant extracts with which to treat, at a reasonable cost, infections caused by them. Antimicrobial vaccines for each pathogen are still a hope. Exploring medicinal plants for protecting mankind can be one of our goals.