Review of Literature
2. REVIEW OF LITERATURE

Medicinal plants have been considered as the cornerstone in the development of the pharmaceutical sciences which began around 3000 BC (Rang et al., 2003). Primary studies focused on the natural flora of a specific region or country as studies on medicinal plants from Argentina (Salvat et al., 2004); Brazil (Duarte et al., 2005); Cameroon (Nkou-Akenji et al., 2001); Columbia (Lopez et al., 2001); Ghana (Konning et al., 2004); Lebanon (Barbour et al., 2004); Malaysia (Wiart et al., 2004); Peru (Rojas et al., 2003); Qatar (Mahasneh, 2002); The Democratic republic of Congo (Otshudi et al., 2000); Thailand (Wannissom et al., 2005); The Ivory Coast (Atindehou et al., 2002); Turkey (Uzun et al., 2004); Uganda (Olila et al., 2001) and The Democratic republic of Congo (Otshudi et al., 2000), while few studies covered wider regions as Asia (Almas, 2001); Africa (Tshibangu et al., 2002) and Siberia (Kokoska et al., 2002).

The use of medicinal plants in the world and especially in India, contributes significantly to primary health care. It is interesting to determine whether the traditional uses of medicinal plants is supported by actual pharmacological effects or is merely based on folklore experiences (Jain, 1970; Mauri and Pietta, 2000).

In a tribal habitat, a person is usually considered to be afflicted with a disease if he cannot attend to his routine work. Symptoms such as pains, weakness, loss of appetite, nausea, scabies, prolonged cough, mild fevers and wounds are not considered seriously as symptoms of diseases as Measles, Tuberculosis, Malaria, Jaundice, Diarrhoea and Cholera. The fate of the individuals and the community depends on their relation with unseen forces. The tribes believe in the presence of benevolent and malevolent spirits, the former playing a protective role while the latter, responsible for causing disease and epidemics. Despite spectacular bio-medical advances and improved health services to people in the tribal areas, they only depend on traditional system of medicine (Varalakshmi and Aruna, 1997).

The popularly used health care practices in Andhra Pradesh were mainly home remedies, manthras, allopathy or a combination of these. The Gaddi tribe of Himachal
Pradesh believed that diseases were caused by spirits, dayand deities and to appease them, sacrificed birds and animals and resorted to only herbs and roots for cure (Sonia Kaushal, 2004). The tribes in Manipur adhered to their traditional health care practices as this proved to be convenient and most accessible to them. A comprehensive and comparative study on the ‘Nutritional Status of the tribes in Western India’ residing in the states of Rajasthan, Gujarat, Maharashtra, Goa, Daman and Diu revealed that that the Sahariyas of Rajasthan, the Dubla and kokni of Gujarat and the Dubla and Warli of Maharashtra was deplete of fat, calcium and low in calories (Thilak and Mandal, 1998). A comprehensive and comparative health related study on the tribal groups residing in Tamil Nadu- Yelagiri and Javadhu hills (Malayali tribes), Kerala – Attapadi hills (Irula and Kurumba), Andhra Pradesh- Araku Valley ( Valmiki, Nukadora, Kondadora, Parangi Porja, Bagatha and Dhulia tribes) and in Karnataka- Biligiri Rangana hills (Soliga) revealed that their diets were deficient in Calcium, Vitamin A, Vitamin C and animal protein (Subramaniyam Naidu, 1999).

Numerous encouraging leads have come up with the convergence of empirical uses of various species in various parts of the globe showing potential antimicrobial property (Nair and Bhinde, 1996; Almeida et al., 1995; Nostro et al., 2000). Bioprospection studies aimed at identifying plants from which new drugs may be produced and correlating the phytochemical constituents of a medicinal plant with its pharmacological activity (Nogueira et al., 2008; Costa et al., 2008; Al-Bayati and Al-Mola 2008; Chen et al., 2008; Pesewu et al., 2008; Turker and Usta 2008) has served as a valuable tool in the discovery of new drugs from plants (Jiet al., 2009). Several compounds with antimicrobial activity were isolated from the traditional medicinal plants (Ngwendson et al., 2003), as their essential oils (Alma et al., 2003), alkaloids (Klausmeyer et al., 2004), flavonoids (Sohn et al., 2004), sesquiterpene lactones (Lin et al., 2003), tri-terpenes (Katerare et al., 2003), or naphthoquinones (Machado et al.,2003), among others. The compounds antimicrobial activity was detected through bio- guided isolation.
2.1. A family-wise review of literature on the traditional medicinal plants used by the tribal communities in the present study area (Javadhu hills, Tamil Nadu)

2.1.1. **Family Acanthaceae**: *Justicia adhatoda* (*Adathoda vasica*) and *Adathoda zeylanica*, are being used in the treatment of cold, cough, asthma and tuberculosis (Sharma *et al.*, 1992; Karthikeyan *et al.*, 2009). *A vasica* has found its use in Ayurvedic and Unani medicines (Claeson *et al.*, 2000). The source of the drug ‘Vasaka’ is well known in the indigenous system of medicine against bronchitis (Kumar *et al.*, 2005). Antimicrobial studies revealed that the crude ethanol extracts of the leaves were active against *Staphylococcus epidermidis*, *Bacillus subtilis*, *Proteus vulgaris* and *Candida albicans* (Karthikeyan *et al.*, 2009) and the methanolic extracts active against *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Bacillus subtilis* (Shinwari *et al.*, 2009).

*Andrographis paniculata* has been used as a medicinal herb for treatment of upper gastro-intestinal tract and upper respiratory infections, fever, herpes and other chronic diseases. It has a broad range of pharmacological effects and some of them are extremely beneficial, such as anti-inflammatory (Chiou *et al.*, 1998; Chiou *et al.*, 2000; Shen *et al.*, 2000; Shen *et al.*, 2002; Sheeja *et al.*, 2006); Anti-diarrhoeal (Gupta *et al.*, 1990; Gupta *et al.*, 1993); Antiviral (Wiart *et al.*, 2005); Anti-malarial (Misra *et al.*, 1992; Rahman *et al.*, 1999); Hepatoprotective (Handa and Sharma, 1990; Kapilet *et al.*, 1993; Chander *et al.*, 1995; Trivedi and Rawal, 2000; Trivedi and Rawal, 2001; Visen *et al.*, 2007); Cardio-vascular (Zhang and Tan, 1997; Tan and Zhang, 2004); Anti-cancer (Kumar *et al.*, 2004; Li *et al.*, 2003) and immune-stimulatory activities (Calabrese *et al.*, 2000; Iruretagoyena *et al.*, 2005). Male reproductive toxicity (Akbarsha and Murugaian, 2000) and cytotoxicity (Nanduri *et al.*, 2004) of this plant have been reported as well. The primary medicinal component of *A. paniculata* is andrographolide, which is a diterpene lactone. Andrographolide has been reported for its anti-cancer (Sheeja and Kuttan 2007), anti-HIV (Calabrese *et al.*, 2000), cardioprotective (Yoopen *et al.*, 2007) and hepatoprotective (Trivedi *et al.*, 2007) properties among others.

2.1.2. **Family Amaranthaceae**: *Achyranthes aspera*, is widely used in the traditional healing system and is known to possess hepatoprotective, antitussive, anti-
inflammatory, antibacterial and antifungal properties. The juice of the plant is also used to treat boils, dysentery, diarrhea, hemmorhoids, rheumatic pains, itches and skin eruptions (Londonkar et al., 2011).

*Alternanthera sessilis* has been reported to be used in indigestion problems (Anand Kumar and Sachidanand, 2001). The leaves were used in eye diseases; healing of cuts and wounds (Sunil *et al.*, 2008); as antidote to snake bite and skin diseases (Gupta, 2004) and also showed anti-microbial property (Srinivasan *et al.*, 2001; Castello *et al.*, 2002; Adeyele *et al.*, 2003; Ramzi and Lindequist, 2005; Wagate *et al.*, 2008; Mahesh and Satish, 2008).

**2.1.3. Family Anacardiaceae:** The bark of the stem in *Mangifera indica* has been found to possess anti-helminthic and anti-allergic properties (Garcia *et al.*, 2003). It was also observed that the aqueous extract of the leaves reduced the blood glucose levels (Aderibigbe *et al.*, 2001). The leaves of *M. indica* have been reported to possess antibacterial activity against *E. coli* and other bacteria in the family Enterobacteriaceae and the bioactive component mangiferin which was isolated from *M. indica* was reported to possess remarkable anti-influenza activity. The acetone and methanol extracts inhibited the growth of gram positive bacteria, with acetone extract exerting more activities on all the Gram positive bacteria than the Gram negative bacteria (Doughari and Manzara, 2008). Ojewole, 2005, found anti-inflammatory, analgesic and hypoglycemic effects on the aqueous extract of the stem-bark of *M. indica*. The stem bark of *M. indica* showed significant antibacterial and antifungal activities against *Streptococcus pneumonia*, *Enterobacter aerogenes*, *Klebsiella pneumonia* and *Candida albicans* (Singh *et al.*, 2010).

**2.1.4. Family Annonaceae:** The crushed young roots of *Annona squamosa* have been used as a drastic purgative (Raj *et al.*, 2009). The crushed seeds have proved to be effective as insecticides and a paste applied to the head to kill lice and destroy worms infecting the wounds in cattle (Parvin *et al.*, 2003). The leaves of *Annona squamosa* have been known to possess various types of flavonoids, some of which have shown significant anti-microbial and insecticidal properties (Kuroyanagi *et al.*, 1999; Padmavati and Reddy, 1999). Custard apple (*Annona squamosa* L.) extracts have shown promising results against a range of insect pests. Laboratory and
field tests showed that extracts from custard apple kernels were effective against crop pests like spotted stem borer, *Chilo partellus* (Swin.); leafhopper, *Nilaparvata lugens* (Stal.), *Spodopteralitura* (Fab.), *S. frugiperda*, *Helicoverpa armigera* (Hubner), hairy caterpillar, *Spilosoma obliqua* (Wk.); Brinjalspotted leaf beetle, *Henosepilachna viginti Octopunctata* (Fabr.); cotton boll worm, *Dysdercus koenigii* (Fab.); semi-looper *Achaea janata* Linn. and Aphids (Saito et al., 1989; Rao et al., 1990; Bhagawan et al., 1992; Ghatak and Bhusan 1995b; Hiremath et al., 1997; Bhatnagar and Sharma 1997; Mathew et al., 1999; Ramanet al., 2000; Sonkamble et al. 2000; Bhuiyan et al., 2001).

2.1.5. Family Apocynaceae: *Catharanthus roseus* (Vinca) is cultivated mainly for its alkaloids, which are known to possess anticancer properties (Jaleel et al., 2009). The extracts of Vinca have demonstrated significant anti-cancer activity against numerous cell types (El-Sayed and Cordell, 1981). Muhammad et al. (2009) reported the antibacterial potential in crude extracts of different parts (viz. leaves, stem, root and flower) of *Catharanthus roseus* against clinically significant bacterial strains. High concentrations of *Catharanthus roseus* extracts exhibited maximum inhibitory activity against *Bacillus subtilis*, *Klebsiella* species, *Staphylococcus aureus* and *Streptococcus species* (Sathiya et al., 2008). The vasodialating and memory enhancing properties of *Catharanthus roseus* have been shown to eliminate Dementia and Alzheimer’s disease (Hindmarch et al., 1991; Fischhoff et al., 1996).

*Nerium oleander* produces secondary metabolites some of which are of pharmacological interest. Their important pharmacological activities being anti-inflammatory, antibacterial, anticancerous and CNS depressant. The leaves and the flowers of *Nerium oleander* are cardiotonic, diaphoretic, diuretic, anticancer, antibacterial (Chopra et al., 1986) and antifungal (Wang et al., 2000). Hussain and Gorski (2004) reported the antimicrobial activity of leaves and roots against *Bacillus pumilus*, *B. subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Aspergillus niger*.

2.1.6. Family Aristolochiaceae: *Aristolochia bracteata* is commonly called as “worm killer” in English and ‘aaduthendapaalai’ in Tamil, due to supposed antihelminthic activity and trypanocidal effect (Samia et al., 2006). The whole plant was used as puragative and anthemintic, antipyretic and anti-inflammatory agents.
Aristolochia bracteata Retz, is used in traditional medicine as gastric stimulant and in the treatment of cancer, lung inflammation, dysentery and snake bites (Negi et al., 2003). Root powder is combined with honey and given internally in the case of gonorrhea, boils, ulcers and other skin diseases. (Sankarnarayanan et al., 2010). In indigenous system of medicine, it is reported that leaves were used for skin diseases, rheumatism and as analgesic (Manikandar et al., 2006). It also possessed a potent anti allergic activity (Chitme et al., 2010) and has pronounced antibacterial and antifungal activities (Kavitha and Nirmaladevi, 2007).

2.1.7. Family Asclepiadaceae: Calotropis gigantea is traditionally used alone or with other medicinal plants (Caius 1986) to treat common disease such as fevers, rheumatism, indigestion, cough, cold, eczema, asthma, elephantiasis, nausea, vomiting, diarrhoea (Das 1996). Antimicrobial activity was reported in the methanol, petroleum ether, chloroform and ethyl acetate fractions of the root bark (Ashraful et al., 2008). Leaves, roots, stem, flowers and latex of C. gigantean are used in traditional medicinal system to cure several diseases and medicinal potential of the C. gigantea, have been proved scientifically. The flowers of the C. gigantea are used in stomachic, bechic, anti-asthmatic, analgesic activities (Pathak and Argal, 2007); Roots, in the treatment of lupus, tuberculoses, leprosy and syphilitic ulceration. Roots also contain anti-pyretic activity (Chitme et al., 2005), cytotoxic activity (Wang et al., 2008); antimicrobial activity (Alam et al., 2008; Gaurave et al., 2010; Gaurav et al., 2010), CNS activity (Pathak and Argal, 2006); and pregnancy interceptive properties (Srivastava et al., 2007); The leaves and aerial parts of the plant are used in the treatment of external swellings and diarrhoea (Chitme et al., 2004); Latex is reported to contain purgative properties, procoagulant activity (Rajesh et al., 2005) and wound healing activity. C. gigantea is also used to cure toothache, ear-ache, sprains, anxiety, pain, epilepsy and mental disorders (Saratha et al., 2009).

Gymnema sylvestre is used as an important ingredient in most of the Ayurvedic preparations. It neutralizes the excess of sugar present in the body in cases of Diabetes mellitus. Gymnemic acids belonging to a group of compounds called glycosides, isolated from the leaves, were known to reduce cravings for sugar by blocking the sugar receptors. It is useful in dyspepsia, constipation and jaundice, haemorrhoids, renal and vesicle calculi, cardiopathy, asthma, bronchitis,
amenorrhoea, conjunctivitis and leucoderma (Nadkarni, 1993; Chopra et al., 1992; Saneja et al., 2010) and anti-allergic (Porchezhian and Dobriyal, 2003). The plant has been reported to possess antimicrobial (Satdive et al., 2003), antieurodonic (Miyoshi et al., 1987) and antiviral effects.

It is also used for controlling obesity in the form of Gymnema tea. The active compound of the plant is a group of acids termed as gymnemic acid. Secondary metabolites like alkaloids, terpenoids, phenolics, steroids and flavonoids play an important role in interaction of the plant with its environment (Meena et al., 2010). The active compound of the plant is a group of acids termed as gymnemic acid. Secondary metabolites like alkaloids, terpenoids, phenolics, steroids and flavonoids play an important role in interaction of the plant with its environment (Meena et al., 2010). In Gymnema species a number of phytochemical constituents have been reported. Phytochemicals such as saponins, terpenoids, flavonoids, tannins, steroids and alkaloids have anti-inflammatory effects (Liu, 2003; Manach, 1996). Saponins possess hypocholesterolemic and antidiabetic properties (Shinde et al., 2003). The terpenoids have also been shown to decrease blood sugar level in animal studies. The steroids and saponins are responsible for central nervous system activities (Sapan and Pathak, 2006).

*Hemidesmus indicus*, commonly referred to as Nannari, is used for flavouring medicinal mixtures. Broad spectrum antibacterial and antifungal activity was exhibited by the root and leaf extracts (Ashajyothi et al., 2012). H. indicus root has anti-mycobacterial (Gupta, 1981) and anti-Propionibacterium acne activity (Jain and Basel, 2003). The root extract exhibited significant activity against *E.coli*, *Bacillus subtilis* and *Pseudomonas aeruginosa* (Kavitha et al., 2010). It was also reported to exhibit anti-oxidant and anti-thrombotic properties (Mary et al., 2003). Earlier, anti-enterobacterial activity of the crude methanol extract of *H. indicus* root and the interference of natural glyciosides (isolated from *H. indicus* root extract) with host-bacterial interactions was reported (Das and Devaraj, 2006).

2.1.8. **Family Asteraceae**: The juice of the plant *Eclipta alba*is used as a popular remedy for jaundice, fever, painful swelling, anemia, dysentery, eye diseases, asthma and liver cirrhosis (XL, 2000). The juice of *Eclipta* together with honey is
used to treat upper respiratory congestion in children. Root has been reported to possess emetic and purgative properties (McGuffin et al., 1997). The tincture of the plant is used for liver and kidney problems (Saxena et al., 1993). The shoot extract of *E. alba* showed antimicrobial (Wiart et al., 2004), antifungal activity (Venkatesan and Ravi, 2004) and antibacterial (Kumaret et al., 2007) activities.

2.1.9. Family Cucurbitaceae: The seeds, fruit, leaves, and root of *Momordica charantia* (Bitter gourd) have been used in traditional medicine for microbial infections, sluggish digestion and intestinal gas, menstrual stimulation, wound healing, inflammation, fever reduction, hypertension, and as a laxative and emetic (http://wikipedia.org/wiki/Bitter_melon) Clinical conditions for which *M. charantia* extracts (primarily from the fruit) are currently being used include diabetes, dyslipidemia, microbial infections, and potentially as a cytotoxic agent for certain types of cancer (Ahmed et al., 2001; Chaturvedi et al., 2004; Oishi et al., 2007). Its fruits and leaves have been shown to exhibit anti-diabetic, anti-rheumatic, anti-ulcer, anti-inflammatory and anti-tumor properties (Okabe et al., 1980; Ambasta, 1986). A decoction of the leaves is used to treat diabetes, to expel intestinal gas, promote menstruation, and as antiviral agent against measles and hepatitis viruses (Ahmed et al., 2001).

2.1.10. Family Euphorbiaceae: *Acalypha indica* is traditionally used as an expectorant against asthma and pneumonia and also as an emetic, emenagogue and anthelmintic (Shivayogi et al., 1999). It has been reported to exhibit post-coital anti-fertility effect (Bedon and Hatfield, 1982), anti-venom effect (Annie et al., 2004), wound healing effect (Suresh et al., 2002), antioxidant activities (Marwah et al., 2007), anti-inflammatory effects (Mohana Vamsi et al., 2008), acaricidal effects (Singh et al., 2004), diuretic effects (Das et al., 2005) and antibacterial activities (Govindarajan et al., 2008).

*Euphorbia hirta* widely used as a traditional medicine herb in all the tropical countries (Loh et al., 2009). The different parts of the plant are used for curing various ailments (Upadhyay et al., 2010). The aerial parts of the plant show analgesic, anti-pyretic, anxiolytic, sedative, anti-inflammatory, inhibitory action on platelet aggregation, anti-mutagenicity (Loh et al., 2009) and antioxidant (Basma et al., 2009).
Antibacterial activity and toxicological potentials of crude ethanolic extracts of *E. hirta* against *S. aureus, E. coli, P. aeruginosa, Salmonella typhi,* and *Bacillus subtilis* (Ogueke et al., 2007). Aqueous, methanol, hexane, and amoxicillin extracts of *E. hirta* have been found to be active against *E. coli, P. mirabilis, Shigella dysentriae, Salmonella typhi,* and *Klebsiella pneumonia* (Abubake, 2009). Methanolic extract of leaf inhibited the growth of *S. aureus, E. coli,* and *B. subtilis* (Upadhyay et al., 2010).

*Phyllanthus amarus* is traditionally used around the world in the treatment of liver ailments and kidney stones. It has also shown to work as an effective antifungal, antibacterial and antiviral agent (Houghton et al., 1996). In India, it is traditionally used to treat cardiovascular problems (Chevallier, 2000). This popular medicinal herb is also a remedy around the world for influenza,dropsy, diabetes and jaundice (Foo, 1993). All parts of the plant are used therapeutically (Leaman et al., 1995). In traditional medicine an herbal decoction is taken to treat bladder and kidney disorders (Heyde, 1990).

*Phyllanthus emblica* is the highest source of Vitamin C (Throat et al., 1995). The fruits are used to treat diseases like diarrhoea, dysentery, diabetes, asthma, bronchitis, cardiac disorders and haemorrhage (Parmar and Kaushal, 1982; Anjaria et al., 2002) and are anti-inflammatory (Mishra, 2004). The extracts of *P.emblica* posses several pharmacological properties like anti-viral, anti-mutagenic, anti-allergic and anti-bacterial (Khopde et al., 2000). *Phyllanthus emblica* is known to contain a different class of secondary metabolites (Calixto et al., 1998). Raghu and Ravindra (2010) stated that *P. emblica* fruits have been used for various disorders. According to their findings, *P. emblica* methanol extract exhibited a significant antimicrobial activity against the gram positive and negative microbes. The aqueous fruit extracts of *P.emblica* showed antibacterial activity against *Bacillus* sp., *Lactobacillus* sp., *Pseudomonas* sp., *Proteus* sp., and *Streptococcus* sp. The ethanol and acetone extracts of *P.emblica* possessed antibacterial activity (Hossain et al., 2012). The antibacterial activity of tannins isolated from the leaves and fruits of *P.emblica* exhibited antibacterial activity (Saheb et al., 2010). The expressed juice of the fruit along with other ingredients is used to cure cough, hiccups, asthma and other diseases. Chaudhuri, 2004 reported the effectiveness of a standardized antioxidant fraction of *P.emblica* as a skin lightener. *P. emblica* is also used as a febrifuge, as an anti-
inflammatory, anti-diuretic and preventive tonic against loss of hair (Tsarong, 1994). In vitro antimicrobial and antioxidant properties of the Super fluid Critical Extract (SFE) and methanol extracts prepared from P. emblica proved as a unique natural source that possessed strong antimicrobial and antioxidant substances. The SFE extract had a strong and broad spectrum of antimicrobial activity, and in some cases, even found to have similar activity to the antibiotics ampicillin and nystatin (Xiaoli et al., 2009).

2.1.11. Family Fabaceae: In traditional system of medicine, leaves of Pongamia pinnata are used in the treatment of eczema, scabies, leprosy, piles and ulcers (Nadkarni, 1976); In ayurveda and Unani, as an anti-inflammatory (Srinivasan et al., 2001). Leaves are also used in the treatment of rheumatic pains (Kirtikar et al., 2004). Phytochemical screening of the leaves revealed the presence of flavonoids from the chloroform extract and tannins from acetone extract (Arote et al., 2009). The chloroform and acetone extracts of Pongamia pinnata exhibited strong activity against bacteria and fungi (Chandrashekar et al., 2010) and the zone of inhibition was comparable with the standard drug. Tannins and flavonoids have been reported to possess potent antimicrobial activity (Thiem and Grosslinka, 2003). Since the acetone extract of Pongamia pinnata contain tannins as the major constituent, the antimicrobial activity of the extract may be due to presence of tannins. Flavonoids are known to inhibit nucleic acid synthesis, inhibit cytoplasmic membrane function and also inhibit energy metabolism in microorganisms (Tim and Lamb, 2005).

Seshania grandiflora is used as carminative, anti-helminthic, astringent, anti-inflammatory, antimicrobial, anti-fertility, demulcent and purgative. It is also given as a medicine and against fever. The dried leaves of S. grandiflora are used in some countries as a tea which is considered to have antibiotic, anthelmintic, (Baker et al., 1995; Obal and Arina, 2001; Gupta et al., 2008) anti-tumor (Baker et al., 1995) and contraceptive properties. The juice of the leaves is considered anthelmintic and tonic and is used to treat worms, biliousness, fever, gout, itchiness, and leprosy (Duke, 1983). The semisolid mass containing powdered roots of S. grandiflora in an appropriate amount of water demonstrated a decrease of rheumatic swelling when applied externally with moderate rubbing to the lesion (Kasture et al., 2002).
2.1.12. **Family Malvaceae:** *Hibiscus rosa-sinensis* possesses many biological activities, such as anti-complementary, anti-diarrheic and anti-phlogistic activity (Shimizu et al. 1993). Traditionally the flowers can be used as anti-asthmatic agents (Mukesh and Patil, 2011). Many chemical constituents such as cyanidin, quercetin, hentriacontane, calcium oxalate, thiamine, riboflavin, niacin and ascorbic acids have been isolated from this plant (Zhoa et al., 2010). It has also been reported that the flowers possess anti-spermatogenic, androgenic (Sachdeva & Khemani 2003), anti-tumour and anti-convulsant properties; in addition, the leaves and flowers have been found to be hair growth promoters and aid in the healing of ulcers (Kurup et al., 1979).

2.1.13. **Family Meliaceae:** Almost every part of *Azadirachta indica* has been in use since ancient times to treat a number of human ailments and also as a household pesticide (Chattopadhyay et al., 1993; Venugopal and Venugopal, 1994). The bark and leaf extracts have been used as folk medicine to control diseases such as leprosy, blood morbidity, itching, skin ulcer, burning sensation, and respiratory disorders. This extract is also fungi-static, antibacterial, and a general health promoter (Subapriya and Nagini, 2005). It has been used in the treatment of rheumatism, chronic syphilitic sores, and ulcers (Kausik et al., 2002; Biswas et al., 2002). Although every part of neem tree is known to have medicinal properties, extracts from neem leaf, bark, twigs, fruits and oils are most commonly documented in literature for their antibacterial effects. From previous studies it is found that different neem extracts have antibacterial activities against a moderate range of bacterial species (Wolinsky et al., 1996; Okemo et al., 2001; Helmy et al., 2007). Nimbolide has shown antibacterial activity against *S. aureus* and *S. coagulase* (Govindachari, 1992).

*Melia azedarach* L., is traditionally been used as anthelmintic, antilithic diuretic, astringent and stomachic (Warrier et al., 1995). Various scientific studies reported the anticancer (Ntalli et al., 2010), antimalarial activity, analgesic and anti-inflammatory activity (Vishnukanta, 2010).

A diluted infusion of leaves of *Melia azedarach* has been used in the past to induce uterus relaxation (Russell et al., 2008). Extracts from neem leaf, seed, and bark
possess a wide spectrum of antibacterial action (Biswa et al., 2002; Mahfuzul et al., 2007).

2.1.14. Family Moraceae: The latex of the leaves of Ficus benghalensis contain resin, albumin, cerin, sugar, and malic acid which is used in Ayurveda for the treatment of diarrhoea, dysentery, and piles (Hussain et al., 1992; Mukherjee et al., 1998) and as a hypoglycemic (Geetha et al., 1994). The bark extracts exhibited the anti-inflammatory activity (Patil et al., 2009); inhibited insulinase activity from the liver and kidney (Achrekar et al., 1991); inhibited the lipid peroxidation (Shukla et al., 2004) and was used against stress and allergy in asthma (Taur et al., 2007). It was also found to inhibit the lipid peroxidation (Shukla et al., 2004). Studies have been carried out to shed light on its antibacterial activity (Ghosh et al., 2008; Rajendran and Ramakrishnan, 2009; Gayathri and Kannabiran, 2009; Uma et al., 2009; Saifi et al., 2010; Rakesh and Geeta, 2010; Shandavi et al., 2010).

The fruit extract of Ficus religiosa demonstrated anti-tumour activity (Gupta and Sharma, 2009). Fibre from Ficus religiosa leaves produces hyper lipidaemia. Leaves are laxative and a tonic. The decoction of the leaves is highly effective in relieving palpitation of the heart and cardiac weakness (Krishnamurthy, 2009) and the bark of the stem in the treatment of ulcers (Khan et al., 2011). The leaf juice has been used for the treatment of asthma, cough, sexual disorders, diarrhoea, haematuria, ear-ache and toothache, migraine, eye troubles, gastric problems and scabies. Leaf decoction has been used as an analgesic for toothache. Fruits for the treatment of asthma, other respiratory disorders and scabies. Stem bark is used in gonorrhoea, bleeding, paralysis, diabetes, diarrhoea, bone fracture, antiseptic, astringent and antidote (Ripu and Rainer, 2006). The fruit extract demonstrated antitumour activity in potato disc bioassay. Fiber from Ficus religiosa produces hyper lipidaemia (Gupta and Sharma, 2009). The antitumor activity conducted by crown gall potato disc assay proved that all the three extracts viz., aqueous, methanol and chloroform were efficient in reducing the tumors formed (Hemaishwarya et al., 2008).

2.1.15. Family Myrtaceae: Eugenia jambolana had been reported to contain phytochemicals like coumarin, flavanoids, glycosides, phenols, tannins and steroids (Mohamed et al., 2010). The various part of Eugenia jambolana had got therapeutic
applications. The bark of *Eugenia jambolana* was used for anaemia and diabetes, the fruit was used for dysentery and leaves show antibacterial properties as well as used for increasing the strength of teeth and gums (Burkill, 1997). Seeds of *Eugenia jambolana* was reported to have hypoglycemic (Ravi et al., 2004), anti-inflammatory (Pavan Kumar et al., 2010), antibacterial (Mohamed et al., 2010; Ugbabe et al., 2010; Jeethu et al., 2012), antiviral (Sood et al., 2012) activity. It was reported earlier that the leaves of *Eugenia jambolana* had antimicrobial activity against *Salmonella typhi*, *Shigella dysenteriae*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus subtilis* and *Staphylococcus aureus* (Jeethu et al., 2012).

The leaf of *Psidium guajava*, is used traditionally to manage, control, and/or treat a plethora of human ailments, including diabetes mellitus and hypertension (Ojewole, 2005); In the treatment of diarrhoea and stomach-aches due to indigestion (Mejia and Rengifo, 2000, Mitchell and Ahmad, 2006a and Mitchell and Ahmad, 2006b); Guava jelly as tonic to the heart and constipation (Conway, 2002). The inhibitory effects of aqueous and alcoholic extracts of the *Psidium guajava* (root as well as leaves) on the growth of *Staphylococcus aureus*, *Streptococcus mutans*, *Pseudomonas aeruginosa*, *Salmonella enteritidis*, *Bacillus cereus*, *Proteus spp.*, *Shigella spp.* and *Escherichia coli*, causal agent of intestinal infections in humans were examined using the in vitro agar well diffusion method (Chah et al., 2006). Methanolic root extract was further separated by column chromatograph, yielding four antibacterial compounds. Three antibacterial substances have been detected in the leaves which are derivatives of quercetin (Prabu et al., 2006 and Arima and Danno, 2002). The bark tincture showed fungicidal activity at different concentrations but exhibited only fungistic activity in case of *Candida albicans* (Dutta and Das, 2000). Ethanolic extract from the shell of ripe fruit presenting activity on *Streptococcus mutans* and *Escherichia coli* (Neira and Ramirez, 2005). Results supported the utilization of *Psidium guajava* in traditional medicine for intestinal diseases produced by microorganisms.

2.1.16. Family Nyctaginaceae: *Boerhaavis diffusa* is used to treat asthma, urinary disorders, leukorrhoea, rheumatism and encephalitis. The ethyl acetate extract of the roots was found to be most effective. The aqueous and ethanolic extracts of the leaves at different concentrations were effective against *Escherichia coli*,

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Streptococcus aureus and Pseudomonas aeruginosa. E. coli displayed the highest susceptibility in ethanolic extract, followed by S. aureus and P. aeruginosa. The antimicrobial activity of the different extracts increased with increase in concentration (Akinnibosun et al., 2009; Mahesh et al., 2012).

2.1.17. Family Poaceae: Cynodon dactylon exhibits a wide spectrum of medicinal properties. It has been proved to show effective antiestrogenic, antimicrobial, anathematic, antiemetic, antipyretic, antidiabetic and antioxidant activities (Chopra et al., 1999; Kirtikar and Basu, 2001; Pal, 2008; Pal et al., 2008; Chaudhari et al., 2011) The plant also showed broad antibacterial activity against Gram positive and Gram negative bacteria (Renu and Prakash, 2012). The ethanolic, butanolic and methanolic extracts of the leaves of Cynodon dactylon exhibited broad spectrum of antibacterial activity against pathogenic bacteria and this may be due to the presence of polar compounds as saponins present in the extracts (Singh et al., 2008).

2.1.18. Family Punicaceae: The aqueous and organic extracts from the roots and fruits of Punica granatum were effective in controlling diarrhoea (Qnais et al., 2007; Bhandary et al., 2012). Their activity against Gram-positive and Gram-negative bacteria can be attributed to the presence of water soluble tannins which are well known to possess antimicrobial properties (Djipa et al., 2000 and Otshudi et al., 2000). New gallotannins and ellagitannins isolated from Punica granatum fruit rind have been reported to be the principal components responsible for the antimicrobial action (Hussein et al., 1997, Machadoet et al., 2003 and Vidal et al., 2003).

2.1.19. Family Rutaceae: In Aegla marmelos, the essential oils obtained from the leaves have shown a broad spectrum of anti-bacterial and anti-fungal activities (Pattnaik et al., 1996; Rana et al., 1997). Investigations on the antibacterial activity of the polar solvent extracts of the leaf, stem and root against a reference standard drug, Amoxycillin revealed that the antibiotic efficacy of the petroleum ether extract of the leaf was significant and nearer to the standard drug tested (Gavimath et al., 2008) and was more active on the gram negative than gram positive bacteria. The methanol extract of Aegle marmelos showed high antibacterial activity (Senthilkumar and Reetha, 2009). The leaf extract showed maximum zone of inhibition against Gram
positive bacteria the maximum being, *Staphylococcus aureus* whereas the root extract showed maximum activity against *Klebsiella pneumonia* (Ashajyothi et al., 2012).

*Murraya koenigii* (Curry leaf) is traditionally used as an analgesic, febrifuge, stomachic, carminative and for the treatment of dysentery and skin eruptions (The Wealth of India, 1962). Carbazole alkaloids (Ito et al., 1993), the major constituents of the plant are known to possess cytotoxic, antioxidative, antimutagenic and anti-inflammatory activities (Chakrabarty et al., 1997; Arulselvan and Subramanian, 2007). The leaves are rich in mono-terpenoids and ses-querpenoids which exhibited antifungal activities (Goutam and Purohit, 1974). Minor furano-coumarins are also reported from seeds (Adebajo and Reisch, 2000). The roots of *M. koenigii* possess compounds with antimicrobial properties which are effective against infectious diseases (Basri and Fan, 2005). The methanol of the root of *M. koenigii* showed more pronounced antimicrobial activity than the aqueous, chloroform and hexane extracts. Among the tested bacterial strains, the most susceptible bacterium to the extract was *Staphylococcus aureus*, which is known to play significant role in skin diseases (Basri and Fan, 2005). It indicates that roots of *M. koenigii* may possess compounds with antimicrobial properties which are effective against infectious diseases.

### 2.1.20. Family Sapotaceae:

The bark of the stem in *Mimusops elengi* is used to increase fertility in women and known to have antiulcer activity (Shah et al., 2003). A pentacyclic triterpene 3β, 6β, 19α, 23-tetrahydroxy-urs-12-ene reported from bark recorded moderate inhibiting activity against β-glucuronidase enzyme associated with gastric ulcers (Jahan et al., 2001). Seeds of *Mimusopsis* known to contain several saponins such as mimusin Mi-saponin A and 16α-hydroxy Mi-saponin A (Sahu et al., 1997), taxifolin, α-spinasterol glucoside, Mi-glycoside 1, mimusopside A and B (Sahu, 1996). Seed kernel also reported to have saponins (Lavaud et al., 1996).

### 2.1.21. Family Solanaceae:

The generic name Solanum is considered to be derived from the Latin “Solamen” to refer to the quieting or sedative effects associated with many species (Edmunds and Chweya, 1997). *Solannum nigrum* has been extensively used in traditional medicine of India and other parts of the world to cure liver disorders, chronic skin ailments (Psoriasis and Ringworm), inflammatory conditions, fever, painful periods, eye disorders etc. (Bhattacharjee, 2001). *S. nigrum*
elaborated a wide spectrum of medicinal properties such as anticancer, antioxidant (Al-Qirim et al., 2008) neuroprotective (Jainu and Devi, 2005), antimicrobial, and antipyretic properties. S. nigrum has been used as the important ingredient for herbal formulations in India, namely Liv. 52, which is mainly used for treating liver diseases (Ikeda et al., 1992). Six different solvent extracts of Solanum nigrum leaf, seed and roots tested against pathogenic bacteria such as B subtilis, B megaterium, Proteus vulgaris, Staphylococcus aureus, Klebsiella pneumonia and E.coli showed antibacterial activity. The ethanolic extract of leaf showed highest activity compared to the seed and root. (Sridhar et al., 2011).

*Solanum trilobatum* contains rich amount of calcium, iron, phosphorus, carbohydrates, fat, crude fiber and minerals in the leaves (Jawahar et al., 2004). It is used to cure asthma, arrest blood vomiting, to reduce blood glucose level and bilious matterphlegmatic rheumatism and several kinds of leprosy. It is also antibacterial, antifungal, antimitotic, antioxidant and antitumours (Shahjahan et al., 2004; Shahjahan et al., 2005).

The fruits of *Solanum torvum* are edible and have been traditionally used in the treatment of abscesses, jigger, wounds, skin infections and athletes foot (Chah et al., 2000). Pharmacological studies revealed anti-viral (Arthan et al., 2002), immune-secretory (Israf et al., 2004), anti-oxidant (Sivapriya and Srinivas, 2007), analgesic, anti-inflammatory (Ndebia et al., 2007) and anti-ulcerogenic activities (Nguelefack et al., 2008). *Solanum torvum* (leaf, stem and roots) showed antibacterial and antifungal activity (Bari et al., 2010). The leaves of *S. torvum* have reported for its antimicrobial activity. The antibacterial activity of aqueous and solvent extracts that were tested against *Xanthomonas campestris pv oryzae* by cup diffusion method, revealed that only the ethanol and methanol extracts showed high activity (Lalitha et al., 2010).

2.1.22. Family Verbenaceae:*Vitex negundo* is used for treating stored garlic against pests and as a cough remedy in the Philippines. Roots and leaves used in eczema, ringworm and other skin diseases, liver disorders, spleen enlargement, rheumatic pain, gout, abscess, backache; seeds used as vermicide. Different parts of the plant especially leaves, fruits, roots and seeds possess anti-inflammatory and anti-
arthritic activity. However, possible mechanism of anti-inflammatory activity was indicated (Telang et al., 1999) as an inhibitory action on prostaglandin biosynthesis. Recently, Dharmasiri et al., 2003 suggested that leaves have anti-inflammatory and analgesic properties mediated via PG synthesis inhibition, antihistamine, membrane stabilizing and antioxidant activities. *V. negundo*, which is known to act by prostaglandin inhibition, may be expected to cause gastric damage but on the contrary it produced no histomorphological changes in the stomach even in toxic doses (Tandon & Gupta, 2004).

2.1.23. **Family Vitaceae:** Roots, fruits, flowers, leaves and bark of *Vitex negundo* have great medicinal value and are used for medicinal and insect repellent purposes (Dharmasiri et al., 2003; Gupta and Tandon, 2005; Tandon and Gupta, 2006; Karunamoorthi et al., 2008; Aswar et al., 2009; Raghavendra et al., 2010; Arulvasu et al., 2010; Vishwanathan and Basavaraki, 2010; Arun Prabhu and Prem Rajan, 2010; Chougale, 2010).

2.1.24. **Family Zingiberaceae:** *Curcuma longa*, commonly known as 'turmeric', is widely used as a spice and colouring agent and is well known for its medicinal properties (Luthra et al., 2001). Components of turmeric are named curcuminoids, which include mainly curcumin (diferuloyl methane), demethoxycurcumin, and bisdemethoxycurcumin (Chainani-Wu, 2003). Curcumin is the most important fraction which is responsible for the biological activities of turmeric. It is soluble in ethanol and acetone, but insoluble in water (Joe et al., 2004). It contains a mixture of powerful antioxidant phyto-nutrients known as curcuminoids and inhibits cancer at initiation, promotion and progression stages of tumor development. It is a strong anti-oxidant, which supports colon health, exerts neuro-protective activity and helps to maintain a healthy cardiovascular system (Luthra et al., 2001).

*Zingiber officinale* (Ginger) compounds are active against specific type of diarrhoea which is leading to cause death in infant in developing countries. Moreover, it has been found that ginger is effective in treating nausea caused by sea sickness, morning sickness and chemotherapy, though it was found superior over a place for post operative nausea (Sebiomo et al., 2011). In addition, it has been reported that the
main ingredients of ginger like volatile oil, gingerol, shogaol and diarylheptanoids work as antioxidant, anti-inflammatory, anti-lipid, anti-diabetic, analgesic, antipyretic and anti-tumor (Lee et al., 1986; Penn et al., 2003; Kadnur and Goyal, 2005; Islam and Choi, 2008; Kim et al., 2008; Isa et al., 2008; Wang et al., 2009; Demin and Yingying, 2010; Sasidharan and Nirmala, 2010; Shim et al., 2011 and Sebiomo et al., 2011). Antifungal activity assays showed that the extracts of Zingiber officinale had inhibitory effects on the growth of Candida albicans. The inhibitory effect observed may be a result of monoterpane which is reported to have a wide range of antifungal activity accomplished through the disruption of fungal membrane Integrity (Deba et al., 2008). Some reports available on the antimicrobial property of the volatile oil from the rhizomes of ginger on antimicrobial activity were studied against Aspergillus niger, Saccharomyces cerevisiae, Mycoderma sp., Lactobacillus acidophilus and Bacillus cereus by paper agar diffusion method (Guptha and Ravishankar, 2005).