CHAPTER I
INTRODUCTION & REVIEW OF LITERATURE

1.1 MEDICINAL PLANTS

India is a vast repository of medicinal plants. ‘Ayurveda’ is one of the oldest herbal medical systems. The by-products of plants and animals have been used for the treatment of human disease. Traditional knowledge can serve as powerful search engine, which will greatly facilitate intentional, focused and safe natural product drug discovery. These traditions of medicinal plants utility have been stored in database, along the description of botanical material. Today many diseases can be cured from compounds obtained from natural resources (Kubmarawa et al., 2007). India is tenth among the plant rich countries of the world and fourth among the Asian countries.

The term "herb" refers to a plant used for medicinal purposes. Medicinal plants have been used for primary health since pre-historic times and still the practice has been continued in China, Egypt, India and other developing countries. One of the main sources used to isolate bioactive organic compounds, is from plants due to their chemical diversity (Basso et al., 2005).

Each species possess its own genetic constituents that govern the presence of chemical components or bioactive molecules. In addition, the effects of environment and differences among varieties or cultivars within each species create variations in the quantity of compounds present. Thus, each plant species or variety produces chemical compounds differently, and some plants produce medicinally useful compounds, others do not or do so in very small quantities (Thomas, 2002). The therapeutic benefits are generally traced to specific plant compounds; but are specifically due to the active constituents of the plants (Mary et al., 2012).

In India tradition medical system practioners give their own formula and provide their own recipes. Hence this requires research and proper documentation to dispense herbal medicine.
1.2 IMPORTANCE OF MEDICINAL PLANTS

From ancient time man has been using plant sources for maintenance of proper health (Sofowara, 1982; Hill, 1989). Both developed and developing countries have great demand for herbal medicine as a source of primary health care (Lai and Roy, 2004; Tapsel et al., 2006). Medicines derived from plants are widely famous due to their safety, easy availability and low cost (IWU et al., 1999).

Plants contain many bioactive compounds which are used as herbal drugs in different countries (Mahesh and Satish, 2008). In rural areas of developed countries, traditional medicine play an important role everyday life for primary health needs (Maurice et al., 1999; Mann et al., 2008). In developing countries there is a belief that herbal products are more effective and superior to synthetic drugs. Rural people from their ancestors have known the importance of traditional remedies from natural products to maintain health and they know the effective therapeutic dosages; but they don’t know actual science behind these medicines (Maheshwari et al.,1986; Van Wye et al., 2008).

Due to cultural factors in rural areas, humans encourage the use of plant products such as “Man-Earth” -relationship between environment and culture (Gester, 1992). The medicinal preparations based on these raw materials were in the form of crude drug. The drug discovery is possible with advances in science and technology, arisen quality, efficacy and safety of herbal medicine; largely responsible for the increase use of medicinal plants (WHO, 2002; WHO, 2005).

The early drugs such as aspirin, vincristine, vinblastine, quinine are also used till today (Newman et al., 2000; Butler 2004; Samuelsson 2004; Gilani & Rahman 2005). Morphine isolated from *Papaver somniferum* is used as a painkiller, while aspirin is considered to be one of the most effective anti-inflammatory, antipyretic and analgesic agents in modern medicine (Gilani and Rahman, 2005).

1.3 INDIGENOUS MEDICAL SYSTEM

Ayurveda, Siddha, Unani and Folk (tribal) medicines are the major systems of indigenous medicines. Ayurveda is most developed and widely practiced in India. (Joy et al., 1998).
1.3.1 Ayurveda:

The main goal of ayurveda is to keep up the functional and the structural entities in the case of functional state of equilibrium, which signifies good health. Diseases are caused by internal and external factors. It is mainly based on the theory of pancha bhootas ,five element theory- earth, water, fire, air and ether of all living bodies possessed (Underwood & Rhodes, 2008).

1.3.2 Siddha:

This system of medicine mainly speaks about the medical treatment which orients not merely diseases but also has to take into account of the patient’s environment, age, habit and physical conditions. The Tamil literature consists of siddha and practiced by Tamilians settled all over the world (Siddha-origin, 2011)

1.3.3 Unani:

This system is based on the establishment of knowledge and practices related to cure of diseases and positive health. This system which originated in Greece passed on to many countries. It is practised by Arabs with experience and it was brought to India during the medieval period. Unani system mainly emphasizes the use of herbal medicines naturally occurring, as it utilizes the ingredients of animal and marine region (Hakim Syed Zillur Rahman, 2001).

1.3.4 Homeopathy:

Homeopathy believes in a specialized method of treating disease. The application of potency drugs, have been investigated to posses the power of providing similar artificial systems on humans (Ernst E, 2002).

1.3.5 Yoga and naturopathy:

Yoga is a way of life which has the potential for improving the organized behaviour, physical health by promising the better circulation of oxygenated blood in the body, rejuvenating the organs and there by inducing peace and quietness of mind. Naturopathy is also a way of life which uses no medicine for curing diseases. Naturopathy focuses on eating
and living habits, maintenance, use of water therapy, baths, massages, etc (P.K. Abdul Kareem, IES.1996).

1.4 ROLE OF WORLD HEALTH ORGANIZATION IN HERBAL MEDICINE

World Health Organization (WHO) has reported guidelines for studying the characteristics, and potency of herbal medicines. It aimed at helping governing authorities, scientists and pharmaceutical companies (Akerele, 1993). The important features of WHO guidelines were: characteristics evaluation, stability, safety assessment, assessment of efficacy. W H O (2002) determines that greater than 90% of therapeutic drugs derive from natural products.

1.5 TRADITIONAL MEDICINE

The traditional knowledge of medicine has helped for origin of new drugs, alternative medicine, and herbal preparations. It is also an important source for drug research and development, not only when plant constituents are used directly or indirectly as raw materials for the synthesis of therapeutic drugs (Mukherjee, 2003).

In India there are many traditional medicinal systems - The Folk (tribal) system includes various practices of tribal communities. Tribals (folk) use huge number of medicinal plants in daily life (Prakash et al., 2008). All these systems of medicine provide good base for scientific exploration of medicinally important molecules from nature (Haque, 2006). Also the traditional information and plant species diversity helps in improving herbal medicine trade in pharmaceutical companies (Tabuti et al., 2003).

Chinese medicine and Indian Ayurvedic or Arabic Unani medicine refer to traditional medicine. In many countries traditional medicine is often known as complementary or alternative or conventional medicine, where allopathic or traditional medicine are not incorporated in healthcare system (WHO, 2002 a; Alves and Rosa, 2006).

The use of traditional medicine is spread worldwide. Plants constitute a huge repository of naturally producing anti-oxidants that might serve as resources for drug
development. Traditional medicine systems are part of India’s culture. Indian Ayurveda system is practised all over the world and other traditional health systems. This usage is increasing day by day.

Plants have been studied for characteristics like vipaka (metabolic property), rasa (taste), prabhava (biological effect), virya (potency) and guna (quality). Nature is considered as exhaustive repository of therapies against human welfare (Kokate et al., 2002).

1.6 NATURAL PRODUCTS ROLE IN HEALTH

Plant products play a key role in health care systems. Natural products produced by plants, fungi, bacteria, protozoans, insects and animals have been isolated as biologically active constituents. Overall, more than 2000 plants have been listed in the traditional (Herbal/Alternative) systems of medicine and some of these were providing comprehensive relief to the people suffering from cancer (Mahmood et al., 2010). However, to ensure common health protection, the quality and safety of herbal plants, particularly those used for treatment, are to be determined. To date, toxicological data on the identification of genotoxic and tumorigenic ingredients in many raw herbs and of carcinogenic components in herbal plants is timely and important (Yasrib Qurishi et al., 2010). Natural products still play a major role as starting material for drug discovery.

1.6.1 Anti-Inflammatory Agents

Inflammation is known to be one of the important causes responsible for many diseases (Paul AT et al., 2006). Natural products used for inflammation includes Withanolides from Withania somnifera. They are found to be active in arthritis and are potent inhibitor of angiogenesis, inflammation and oxidative stress. Inhibition of NFkB and NFkB regulated gene expression is primarily responsible for their anti arthritis action (Oh JH et al., 2009). Another prominent example is Salai guggal (Boswellia serrata) show anti arthritis action (Atal CK et al., 1980). Alkaloid, berberine from Berberis aristata also have anti inflammatory action by inhibition of NFkB, COX2, TNF, IL-1, IL-6 (Kim et al., 2008).

1.6.2 Cardio-Vascular Agents

Cardiac glycosides or cardenolides inhibit the membrane bond Na-K ATPase pump resulting in depletion of intracellular K and increase in serum K which result in decrease electrical
conductivity through a decrease in heart rate and increase cardiac output (Soerd L et al., 1962). Yellow oleander plant (*Thevetia* nerifolia) have thevetin A, B and peruvoside which are potent cardiac glycoside (Bose T K et al.,1999).

1.6.3 Anti Diabetic Agents
India is a ‘Diabetic capital of world’ several remedies are used for their treatment. *Trigonella foneum–graecum* commonly known as fenugreek shows potent anti diabetic action (Fikreselassie M, et al., 2012). Andrographolide, a di-terpenoid lactone from *Andrographis Paniculata* has been found to exhibit significant hypoglycaemic activity (Zhang Z et al., 2009).

1.6.4 Anti Obesity Agents
There are many natural products that have been used for anti obesity agent. Tea polyphenolics like 3-o-gallate show a potent lipase inhibitor activity (Nakai M et al., 2005).

1.6.5 Anti Malarial Agents
Neem which have nimbolides is used as an anti-malarial agent (Rochanakij S et al., 1985). Quinine from *Cinchona officinalis* is a potent anti-malarial agent (Buss AD et al., 1995).

1.6.6 Immunomodulators
An immune modulator is defined as a biological or non-biological substance that directly influences a specific immune function or modifies one or more components of immune regulatory network to achieve an indirect effect on a specific immune function (Fauci AS et al., 1985 & Fauci AS, 1987). The immuno-modulatory activity of *Piper betle* leaves, *Zingiber aramatica rhizome*, *Allium sativum* and *Andrographis paniculata* was displayed by their stimulation of humoral immune response by the “microtitration hematoglutinin test” (Sutrajadi et al., 1991).

1.7 PLANTS OF NALLAMALA FOREST
The Eastern Ghats are a discontinuous range of mountains along India’s eastern coast. They run from West Bengal state in the north, through Odisha and Andhra Pradesh to Tamil Nadu in the south passing some parts of Karnataka. In peninsular India, four well known
rivers, the Godavari, Mahanadi, Krishna, and Kaveri are flowing in the eastern ghats. Trees contribute major part of forests.

The forests are the chief source of valuable medicinal plants. The Nallamalla consist of in the Eastern ghats extending between latitude 15° 13’ 16° 30’ N, and longitude 78° 30’ - 80° 10’E, in Rayalaseema districts of Andhra Pradesh (Anitha R et al., 2012). Eastern Ghats has tropical climate. The tribals of Nallamala region collect different plant products based on their ancient culture and ethnic practices and earn their economy (Jayasimha et al., 2012). Ellis (1987) in Flora of Nallamala recorded 743 taxa under 109 families. The presence of 1541 angiosperms taxa conclude that Nallamala is one of the rich flora in Peninsular India (K. Thulsi Rao et al., 2007). Ethnobotanically, this region is very much potential. (Reddy & Raju., 2000; Reddy et al., 2005; Reddy et al., 2007). That’s why I selected eight different species of plants from the koyathanda in Nallamala forest region, Andhra Pradesh, India.

1.7.1 *Ipomea obscura*

The herb belongs to family Convolvulaceae and in telugu commonly called as nallaKokkita, golla jiddu aaku.

**Botanical description:**

It is commonly known as “Laksmana” in Ayurveda. This is slender climbing vine, with small cordinate leaves and acuminate apex. The flowers may be solitary or grouped, white or pale yellow in colour and funnel shaped. The flowers are rounded, hairless, point-tipped seed capsules with reflexed sepals. Seeds ovoid, black, thinly pubescent.

**Therapeutic uses:**

*I. obscura* is used to treat diarrhoea by traditional healers in Uganda. Leaves paste is applied on ulcers, haemorrhoids and swellings (Christophe W., 2002). Fruits and seeds are helpful in difficult breathing, relive pain and improve vision. Attractive flowers give it an ornamental plant. This plant affects central nervous system (Shahina A., 1994) and also actively used as an antioxidant (Srinivasan R et al., 2008).

1.7.2 *Biophytum sensitivum*
This plant belongs to family Oxalidaceae and telugu name is attapatti, chumi, jalapuspa.

**Botanical description:**

It is an annual herb which looks like miniature palm with unbranched stems. The leaves are compound, numerous, crowded, at the apex of the stem. The leaflets are somewhat curved. The leaflets close when touched. The flowers are many, 5 rounded petals are with red indications. The fruit is a capsule. The flower of this plant is considered as one of the ten sacred plants which are called as Dasapushpam in tradition and culture of Kerala state in India.

**Therapeutic uses:**

It has many medicinal properties namely antiseptic properties, asthma and phthisis (Pullaiah T., 2002), inflammatory diseases, and diabetes (Kirtikar K.R.et al.,1984, Mitra A.P et al., 1988, Puri D et al.,1997). The medicinal plant is used traditionally in a number of ailments, such as joint pains, fever, malaria, wounds, stomach ache, gonorrhea, tuberculosis, convulsion, thirst, tumor, burns, snake bite, insomnia, arthritis, back pain, carpal tunnel syndrome, cervical spondylitis, degenerative diseases, fibromyalgia and leg cramps (Visharad SB, 2003; Dr. Duke's, 1998). It is an important medicinal plant in Ayurveda.

**1.7.3 Blepharis molluginifolia Pers.( Blepharis intergofolia)**

This plant belongs to family Acanthaceae.

**Botanical description:**

This is much branched creeping herb. It has wiry prostate branches with whorled leaves and solitary flowers with three or four pairs of decussating bracteoles and corolla with three-lobed lower tip and without upper one. Flowers are violet / purple in colour. Flat seeds orbicular, rectangular.

**Therapeutic uses:**

This is equated with uttangana. Leaves of Blepharis molluginifolia crushed and the paste is applied for head ache (Senthilkumar M et al., 2006). It is used to treat skin problems,
fractured bones, urinary problems and allergies (Pattar P V et al., 2011). Flat branches of the plant is heated and tied in case of joint pains. Leaves are roasted and then extract is obtained, this extract is drunk as a remedy against flatulence. Roots are employed as antidote to snake-bite (Suriyavathana M et al., 2010).

1.7.4 Carchorus acutangulus (Lam). (Corchorus aestuans)

This plant belongs to family Malvaceae.

**Botanical description:**

The plant is tall, unbranched or with only a few side branches. The leaves are alternate, simple, lanceolate, with an acuminate tip and lobed margin. The flowers are small, yellow, with five petals; the fruit is a many-seeded capsule. It is an annual herb.

**Therapeutic uses:**

In Ayurveda, roots and leaves of this plant cure Gonorrhea. The seeds are stomachic and are used in the treatment of Pneumonia (Dr.K.Madhava Cheffy; Pancho et al., 1995).

1.7.5 Desmodium triflorum (creeping tick trefoil)

This plant belongs to family Fabaceae and called as moordoo, muntamandu in telugu.

**Botanical description:**

A perennial legume with a woody taproot. It has strong branched stems frequently rooting at the nodes. Leaves are trifoliate with leaflets. Flowers are cluster of 1–3 pink to purple flowers in leaf axils. Pods are segmented, flat and covered with minute hooked hairs. Seeds are quadrangular.

**Therapeutic uses** (K.Trout, 2004; Kirtikar and Basu, 1999)

This is used to prevent various health problems. A decoction made with the roots of *Desmodium triflorum* can help treat respiratory problems, such as asthma and coughing. This decoction can also be consumed in order to treat stomach aches or rheumatism. The leaves are known to help with dysentery, indigestion, and diarrhoea. They can even be used
to treat children who are having these problems. The plant has antiseptic properties. Therefore, by using the leaves, you can also treat skin problems. A leaf paste can help with wounds, sores, itches, abscesses, ulcers, and skin eruptions.

1.7.6 *Hybanthus enneaspermus* (Spade flower)

This plant belongs to family Violaceae and called as ratnapurusha in telugu.

*Botanical description*:

A small perennial herb, with ascending branches. Leaves linear, entire or serrate. Flowers are rose-coloured, axillary, solitary; petals unequal.

*Therapeutic uses* (*Kirtikar KR and Basu BD*, (1957)):

This plant gives remedy to vatta, pitta described in Ayurveda. The whole plant is used for dysentery, epilepsy, asthma, cough and urinary problems.

1.7.7 *Aristolochia bracteolate* (Worm killer)

This plant comes from family Aristolochiaceae and known as gadaparku in telugu.

*Botanical description*:

The plant is perennial herb distributed throughout India. The leaves are cordate, entire and petiolate. Flowers are solitary brown tubular flowers.

*Therapeutic uses*:

The whole plant was used as antipyretic, purgative, anthelmintic and anti-inflammatory agents. The root part was used to treat gonorrhea, syphilis and also used during labours to increase uterine contraction. Decoction of the whole plant is given in fever, worms, skin disease and snake bite (*Alagesaboopathi, 2009*).

1.7.8 *Daemia extensa* (Pergularia)

This plant belongs to family Asclepiadaceae and called as jittupaku, dustapuchettu in telugu.
**Botanical description:**

The plant is a twining herb, stem hairy with milky juice. Thin leaves are broadly heart shaped, below velvety. Flowers are sweet aroma, corolla is greenish yellow or dull white tube. Fruits paired with follicules.

**Therapeutic uses:**

It is used in folk medicine to cure liver disorders. It is believed in Ayurveda that this whole plant increases defence against many ailments. Latex is used for boils and sores (Girach *et al.*, 1994). The whole plant is used asthma , poisoning ,convulsion; the root used in anaemia, piles, leprosy and mental disorders(Yoganarasimhan , 2000). The Stem bark also be used as remedy for cold (Dokosi, 1998). Leaf paste is applied to joints in inflammation, liver complaints, spleen enlargement (Pandey, 2001).

1.8 OBJECTIVES

**The objectives of present work are:**

- Qualitative phytochemical analysis of eight medicinal plants from koyathanda in the Nallamala forest region, Andhra Pradesh, India.

- To study the antioxidant activities of plant sources.

- To investigate antimicrobial activities of plant sources.

- Purification and structure elucidation of bioactive constituent(s) from potential plant(s).

- To determine antioxidant and antimicrobial activities of the purified compound(s).

- *In silico* studies of pharmacokinetic properties and Molecular Docking of purified compound(s).