CHAPTER-II
REVIEW OF LITERATURE
The history of Indian medicine can be traced back 4500 B.C. Since very early days, the knowledge of ethnomedicine has been passed on from generation to generation among the tribals and it survived in certain restricted aboriginal habitations. Ethnobotany may be defined as an anthropocentric approach to botany, concerned with gathering of information on plants and their uses. Powers (1873-1874) used the term “Aboriginal botany”, refers study of all the forms of vegetable world which the aborigines used for medicines, textile, fabrics, ornaments, etc., while the term “Ethnobotany” was first coined by Harshberger in 1896. Cotton (1996-97) reviewed various definitions given by earlier workers like Robbins et al., (1916), Jones (1941), Schultes (1960), Bye (1992) etc., and defined as “the area which encompasses all the studies concerning with the mutual relationship between plants and traditional people”.

The Oshadi Suktam of the Rigveda, the ancient repository of the India wisdom, perhaps the oldest scientific account on the classification of medicinal plants. A scientific and detailed account of medicinal plants was given in Charaka Samhita (Raghunathan, 1987). Sushruta Samhita (800-700 B.C.) described about Myriads of drugs like Opium, Rauwolfia, Strychnos nux-vomica, Aconite, Hasish, Datura, Mustard seeds, Lemon, Antimony, Sulphur, Gold, Human milk, Blood, etc (Showkat et al., 2002). Later Siddha system of medicine was evolved by sages in South India while Unani system was developed by Muslim physicians during the Mohammaden rule as a parallel system of
medicine. The allopathic system of medicine originated in Europe and became dominant in India with the establishment of British Empire.

Coming back to the Mesopotamian civilisation, the Sumerians (3000 – 1970 B.C.) and Babylonians and Assyrians (1970 – 539 B.C.) found the plants used as medicines and amulets. The first evidence, Neanderthals living 60,000 years ago in present day Iraq used plants such as holly hock (Stockwell, 1988 & Thomson, 1978). These plants are still widely used in ethnomedicine around the world. Hippocrates (460-372 B.C.) a great medicine man, was called by the Hakims (Mohammadan physician) as Abu-At-Tab (Father of medicine), mentioned 300 to 400 medicinal plants. This invention laid the foundation of medicine in Greece which spread over the world. Dioscorides, a Greek physician who lived in the first century A.D. wrote his "De Materia Medica" a medicinal plant catalog, describes 600 plants with their medicinal properties.

In 9th century A.D., Rhazes came forward as a noted physician among Arabs. Later Avicenna (980 – 1037 A.D.) was the greatest physician who wrote his famous Al-quanum fi al-Tibb (The cannon of medicine), which was utilized as a textbook till late 16th century in the European medical schools (Dogramach, 1981). Arabs brought with them, their learning and practice of medical treatment during Moghul period to India. In the 8th or 9th century A.D. Charak’s work was translated and was popularised in Arabia. Rhazes (865-925 A.D) calls him Scarak, Avicenna (980-1037 A.D) quotes him as Scirak and Serapion mentions Charak by the name of Zarch. The fact that several standard Hindu works on medicine and Materia Medica were translated in to Arabic and that several Indian drugs like pepper, lac, nard, liquorice, asafoetida, Ocimum sanctum, Cinnamon, myrrh, red sander, Calamus and the chebulic myrobalans indicates the extent of influence of Hindu medicine on Arab medicine (Prasad, 1949).

The remarkable progress of the Hindu medicine declined with the invasion of the Greeks, Scythians, Huns, Moghuls and Europeans. However, with the establishment of British rule in India, there was further intermingling and also introduction of some new medicinal plants constituting the present indigenous drugs. Organised study and research in ethnobotany with emphasis on tribal systems of medicine and culture are of recent origin. Ethnobotanical explorations with special reference to tribal medicine were carried out by a
number of investigators all over the world. Thus the term *Materia Medica* (meaning medicinal materials) was synonymous with the substances and products derived from natural sources and were employed by the physicians of that era. Interestingly, however, most of the medicinally active substances identified in the 19th and 20th centuries were used in the form of crude extracts.

The potentiality of the Indian medicinal plants was, however, realised during the British period and since then many workers have attempted to find out the botanical source of many of the more important drug plants through the help of Voids, Hakims, Pansarles and local people (Chopra et al., 1956). Sir William Jones (1799) was one of the earliest contributors in this direction and his memoir on “Botanical observation of select plants” may be considered a starting point in such a direction. Some of the important contributions hitherto made in this field are John Fleming’s “Catalogue of medicinal plants” (1810), Ainsile’s “*Materia Medica of the Hindustan*” (1813), Roxburgh’s “*Flora Indica*” (1832), Wight’s “*Icones Plantarum Indae Orientalis*” (1838-1858) and later the works of Royle’s “*An Essay on the Antiquity of Hindu medicine*” (1837, 1845 & 1854).

Apart from the literature available in the form of Ethics, Books, Journals, a wide range of electronic information systems which cover different aspects of Ethnobotany like SEPSAL (Survey of Economic Plants for Arid and Semi Arid Lands) developed by Wickens et al., (1985), NAPRALERT (Natural Products Alert) given by Loub et al., 1985, PLANIMAL (Plant animal interactions) designed by Cotton and Hodgson (1994), while in India TBGRI (Tropical Botanical Garden and Research Institute, Trivandrum) created a data base i.e., INMEDPLAN and then FRLHT (Foundation for Revitalization of Local Health Traditions, Bangalore), MEDFLOR – INDIA data base has been setup by IHS (Institute of Health systems, Hyderabad) sponsored by Girijan Cooperative Corporation (GCC) etc. All such data bases comprises of anthropological, botanical and pharmacological references.
MEDICOBOTANICAL STUDIES

FOREIGN

The well-known ethnobotanist Richard Evan Schultes conducted ethnobotanical explorations in Oklahoma, Oaxaca, Mexico, Amazon and in other regions of America (Schultes 1938, 1954, 1956, 1962 & 1963). Some of the important contributions to ethnobotanical studies in recent times include Berlin et al., 1974; Anderson (1985); Capitanio et al., 1989; Mc Clung de Tapia (1990); Bhat et al., 1990; Holloway and Alexander, 1990; Joshi and Edington, 1990; Holdsworth, 1990, 1991; Haji Mohiddin et al., 1991, 1992; Abbas et al., 1992; Cunningham, 1993; Gill et al., 1993; Manandhar, 1994; Martin, 1995; Velasco et al., 1995; Boudry et al., 1996; Cotton, 1997; Daniel Clement, 1998; David et al., 1999; Maliwichi, 2000; Siwakoti and Siwakoti, 2000; Gilani et al., 2001; Manandhar, 2002; Ramihantaniariyo et al., 2003; Manuel Pardo et al., 2004; Guarrera et al., 2005; Ibrahim et al., 2007; Syed Zahoor Husain et al., 2008; Khan and Khatoon, 2008; Birendra and Chhetri (2009); Rahmatullah et al., 2009; Biswas et al., 2010; Jeruto Pascaline et al., 2010; Osawaru and Dania-Ogbe., 2010; Kuben and Roger, 2011; Cristiane, 2011; Ong et al., 2011; Oztuk and Olcucu., 2011; Prabhat kumar and Lalramnghinglova (2011).

INDIA

The Pioneer of Indian ethnobotany is Janaki Ammal (1956) and there after Jain (1963 & 1965) documented diversified knowledge on crude drugs with the help of Ministry of Environment and Forests, Government of India. A good number of scientists worked on ethnobotany of different tribes inhabited in various forests and hills and reported several interesting drug yielding plants used for different ailments some of the important contributions are as follows

Bodding (1925); Guha (1939); Bhattacharya (1955); De (1962); Gupta (1964); Malhotra & Mitra (1973); Bhattacharjee et al., 1980; Tarafder & Rai (1981); Rai (1987); Saxena & Tripathi (1989); Hosagoudar & Henry (1993); Sivarajan & Balachandran (1994); Girach et al., 1998 & 1999; Bhatt (1999); Fawar and Patil (2001); Viswanathan et al., (2002); Mohanty (2003); Jain (2004); Khan and Khan (2004); Nayak et al., (2004);
ANDHRA PRADESH

Andhra Pradesh State received little attention in ethnobotanical studies particularly on folklore survey. Roxburgh (1795-1820 & 1832) initiated the ethnobotanical investigations in the state and reported on therapeutical uses of certain plants used by the local tribes.


(2011) documented indigenous phytotherapy for bone fractures from Eastern Ghats, Andhra Pradesh. Venkata Subbaiah and Savithramma (2012) recorded bio-prospecting and documentation of traditional medicinal plants used to treat itching, psoriasis and wounds by ethnic groups of Kurnool district, Andhra Pradesh, India.

**PHYTOCHEMICAL STUDIES**

Natural products have been the source of most of the active ingredients of medicines. This is widely accepted to be true when applied to drug discovery in 'olden times' before the advent of high throughput screening and the post-genomic era; more than 80% of drug substances were natural products or inspired by a natural compound (Sneader, 1996), which include compounds from plants (including elliptinium, galantamine and huperzine), microbes (daptomycin) and animals (exenatide and ziconotide), as well as synthetic or semi-synthetic compounds based on natural products (tigecycline, everolimus, telithromycin, micafungin and caspofungin). They cover wide range of therapeutic indications: anti-cancer, anti-infective, anti-diabetic, among others and indicated a great diversity of chemical structures. The chemical properties of the small-molecule natural products have recently been developed into drugs have been analysed (Ganesan, 2008).

Natural products are generally either of pre-biotic origin or originate from plants, microbes and animals (Nikanishi, 1999). As chemicals, natural products include such classes if compounds as terpenoids, phenolic compounds, amino acids, peptides, proteins, carbohydrates, lipids, nucleic acids, etc (Jarvis, 2000). Natural products derived from plants are the basis of many standard drugs used in modern medicine. The use of plant and plant derived products as medicines started from ancient human civilizations. Before the isolation of the first chemical substance, benzoic acid from plants in 1560, plants used as medicines in raw form. Later the search for useful drugs if known structure did not begin until 1804 when morphine was separated from *Papaver somniferum*. Since then many drugs from higher plants have been discovered but less than 100 of defined structures are in common use today (Fransworth *et al.*, 1985).
The period 1817-1837 may be regarded as the most significant period in the discovery of alkaloids. The work on glucosides started in 1837 by Liebig and Wohler. The systematic work on essential oils and the preparation of their individual components was done by Wallach (Nayak & Thirumala Rao, 1980). In India screening of drugs started from the beginning of 19th century. The drug yielding plants were screened for the analysis of secondary metabolites like alkaloids, saponins, flavonoids, terpenoids etc (Amarasingham et al., 1964; Kapoor et al., 1969; Das and Bhattacharjee, 1970; O’debeyi & Sofowora, 1978; Tripathi and Rastogi, 1981). The Tanzanian medicinal plants were screened for different secondary metabolites by Chhabra et al., (1984). Harborne (1984) expressed the significance of phytochemical analysis and its importance for the establishment of alternative medicine.


ANTIMICROBIAL STUDIES

The medicinal value of plants lies in some chemical substrates that produce a definite physiological action on the human body. The use of plant extracts and phytochemicals, with established antimicrobial properties, could be of great significance in preventive and/or therapeutic approaches. The most important antimicrobial compounds of plants are alkaloids, flavonoids, tannins and phenolic compounds (Ates and Erdogrul, 2003). The increasing prevalence of multi-drug resistant strains of bacteria and the recent appearance of strains with reduced susceptibility to antibiotics raised the spectre of ‘untreatable’ bacterial infections and adds, urgency to the search for new infection-fighting strategies. Contrary to synthetic drugs, antimicrobials of plant origin usually are not associated with many side effects and have an enormous anti-infective potential in numerous infectious diseases. Based on World Health Organization (WHO) reports, more than 80% of the world population relies on traditional medicine for their primary health care needs (Duraipandiyian et al., 2006).
A continued search for medicinal plants during last several years has given an innumerable number of plants which are of great use in the treatment of diseases and promotion of health. Such investigations are likely to lead not only to discover new drugs but also reveal new types of chemical substances having some biological activity (Nayak & Tirumala Rao, 1980).

In India herbal medicines have been the basis of treatment and cure for various diseases in traditional methods practiced such as Ayurveda, Unani and Siddha. Although reports of antibacterial activity of indigenous plants have been published from many regions (Nadakarni, 1908; Dhar et al., 1968) they have not been systematically conducted, except in few cases, there by leading to confusion in drawing meaningful conclusions (Padmaja et al., 1993; Vijaya et al., 1995). In recent years, antifungal properties of medicinal plants have been reported from different parts of the world (Qamar & Chaudhary, 1991; Desta, 1993). However, such reports are available only on few Indian medicinal plants (Dayal & Purohit, 1971; Ahmed et al., 1995; Suresh et al., 1995; Mehmood et al., 1999).

Several phytochemists and pharmacologists isolated novel antimicrobial natural products from several plant species which are used in different traditional system of medicines. Those products are alkaloids (Omulokoli et al., 1997), flavonoids (Rukachaisiririkul et al., 2005), coumarins (Appendino et al., 2004), amides (Navickiene et al., 2000), essential oils (Bakshu & Venkata Raju, 2002) and saponins (Jun-Dong Zhang et al., 2006).

Dhar et al., (1968 & 1974) and Bhakuni et al., (1969) assayed certain potential crude drugs based on bioassay studies. Antifungal activity of some selected plants from West Bengal was carried out by Gupta and Banerjee (1972). Ikram and Inamul (1980) conducted preliminary screening of some medicinal plants for antimicrobial activity. Antibacterial and antifungal activity of South American plants was carried out by Gutkind et al., (1981), while Verporte et al., (1982) and Farouk et al., (1983) studied on wild plants of Surinam and Sudan respectively. The crude drug extracts were bio- assayed using pathological strains in order to evaluate the potential properties against the organisms (Atal, 1982; Mossa et al., 1983). The comprehensive data on antibacterial properties of
Hungarian flora and Sudanese plants were reported by Kulscar and Jenossy (1983) and Alamagboul et al., (1985) respectively. Saxena and Vyas (1986) conducted antibacterial screening of seeds of some ethnomedicinal plants. Antimicrobial activity of flavonoids extracted from certain medicinal plants was reported by Barnabas and Nagarjan (1988). 176 crude plant extracts and 42 purified principles were reported from 64 Indian medicinal plants by Naqvi et al., (1991) for antibacterial, antifungal and anthelmintic effects. Caceres et al., (1993) reported anti-dermatophytic properties of seven American plants.

The antimicrobial properties of certain Indian medicinal plants were reported based on folklore information (Hook & Thomos 1995; Reddy 1995) and specific inhibitory activity against certain pathogenic bacteria and fungi was reported (Taylor et al., 1995; Geeta et al., 1996). Mahasneh et al., (1996) reported antimicrobial activity of extracts of herbal plants used in the traditional medicine of Bahrain. Lirio et al., (1998) studied the antibacterial activity of aqueous extracts of 36 medicinal plants of Philippines, while 34 plant species of folklore importance were bio-assayed and evaluated for antibacterial activity by Perumal Samy et al., (1998 and 1999). Antibacterial activity of the acetone extracts of 6 selected Indian medicinal plants against *Staphylococcus aureus* and *E. coli* were carried out by Rajendran et al., (1998). Ahmad and Mohammed (1998) conducted screening of some Indian medicinal plants for their antimicrobial properties. Farooq and Pathak (1998) analyzed a comparative study of *in vitro* antimicrobial activity of total solvent extracts of some medicinal plants with Asava and Aarishta preparations. Thomas et al., (1999) conducted *in vitro* antibacterial activity of certain medicinal plants. Zaiba et al., (1999) studied antimicrobial potency of selected medicinal plants with special interest in activity against phytopathogenic fungai. Aqueous and alcoholic crude extracts of 37 Indian traditional medicinal plants were screened for antifungal activity against the pathogenic *Candida albicans* and dermatophytes by Mehmood et al., (1999).

The antimicrobial activity of flavonoids in medicinal plants from Tafi del Valle (Tukuman, Argentina) were conducted by Nancy et al., (2000). Ahmed et al., (2000) conducted antimicrobial potency and synergistic activity of five traditionally used Indian medicinal plants. Iwalokun et al., (2004) conducted *In vitro* antimicrobial properties of aqueous garlic extract against multi-drug resistant bacteria and *Candida* species from


**ANTIOXIDANT ACTIVITY**

The oxidative stress, defined as “the imbalance between oxidants and antioxidants in favour of the oxidants potentially leading to damage” has been suggested to be the cause of aging and various diseases in humans. Free radicals or reactive oxygen species (ROS) are formed in our body as a result of biological oxidation. The over production of free radicals such as hydroxyl radical, super oxide anion radical, hydrogen peroxide can cause damage to the body and contribute to oxidative stress (Diplock, 1994; Thomson, 1995). Oxidative damage proteins, DNA and lipid is associated with chronic degenerative diseases including cancer, coronary artery disease, hypertension, diabetes etc., (Lee *et al.*, 2000) and compounds that can scavenge free radicals have great potential in ameliorating these disease processes (Krish-Etherton *et al.*, 2002; De Malteo and Esposito, 2003; Behera *et al.*, 2006). In modern western medicine, the balance between antioxidation and oxidation is believed to be a critical concept maintaining a healthy biological system (Ahmad, 1995; Davis, 2000; Dreosti, 1991; Finkel, 2000; Sies, 1982; Tiwari, 2001).

The similar concept of balance called yin-yang was very famous in traditional Chinese medicine for more than 2000 years. Prior and Cao (2000) and Ou *et al.*, (2003) have shown that the effective composition of the yin-tonic herbs are mainly flavonoids which are phenolic compounds with strong antioxidant activity. Many plants have been identified as having potential antioxidant activities and their consumption recommended
Medicinal plants constitute one of the main sources of new pharmaceuticals and health care products.


A whole range of plant derived dietary supplements, phytochemicals and pro-vitamins that assist in maintaining good health and combating disease are now being described as functional ingredients and nutraceuticals. The role of medicinal plants in disease prevention or control has been attributed to antioxidant properties of their constituents (Ivanova et al., 2005). The protective effect of plant products are due to the presence of several compounds such as enzymes, proteins, vitamins (Halliwell, 1996), carotenoids (Edge et al., 1997), flavonoids (Zhang and Wang, 2002).

Bioactive phenols, especially bioflavonoids are very interesting as antioxidants because of their natural origin and the ability to act as efficient free radical scavenger (Hertog et al., 1993; Langley-Evans, 2000). The antioxidant activity of polyphenols is mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donors, singlet oxygen quenchers, metal chelators and reductants of ferryl haemoglobin (Rice-Evans et al., 1995).
