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 food, medicines, textile, fabrics, shelter, 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, 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 Mohammedan 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 (Stock well, 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 (Mohammaden physician) as Abu-At-Tab (Father of medicine), mentioned about 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 “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 Mughul 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, Avicenea (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. Organized 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 used orally or through external application.
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 Vaidos, 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 was 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.

**Ethno – medico – botanical 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);
India

The Pioneer of Indian ethnobotany, Janaki Ammal (1956) followed by Jain (1963 & 1965) have 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); Bhattcharya (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); Viswanathan et al., (2002); Mohanty (2003); Jain (2004); Ayyanar & Ignacimuthu (2005); Patil & Patil (2005); Chandra Prakash et al., (2006); Mukhergee & Wahile (2006); Patil & Bhaskar (2006); Muralidhara Rao & Pullaiah (2007); Choudhary et al., (2008); Deka et al., (2008); Farida Ahmed et al., (2008); Mao et al., (2009); Medhi & Syamali Chakrabarti (2009); Jain et al., (2010); Jain & Singh (2010); Jay Krishnan Tiwari et al., (2010); Khan & Singh (2010); Meena & Yadav (2010 & 2011); Savitha Sangwan et al., (2010);

**Andhra Pradesh**

In Andhra Pradesh, information on 1600 plants of medicinal importance (AP-CF/Checklist-Revised by Foundation for Revitalisation of Local Health Traditions Bangalore, 2002) is available. Roxburgh (1795-1820 & 1832) initiated the ethnobotanical investigations in the state and reported on therapeutic uses of certain plants used by the local tribes.

medicinal plant species of Kakinada region, while Ravishankar and Henry (1992) reported 30 potential plant species from Adilabad district.


**Pharmacognostic studies**

**Epidermology**

The crude drugs can be identified on the basis of their morphological, histological and chemical studies (Kokate *et al.*, 1999). The details of the earlier workers on the various foliar epidermal features have been briefly reviewed here.


**Petiole and leaf anatomy**

Vesque (1883); De Bary (1884); Engler (1886); Preimer (1893); Goebel (1905); Solereder (1908) Small (1913); Meyer (1923); Arber (1925); Ramayya (1926 b; 1968); Charlschenko (1932); Trapp (1933); Moser (1934); Browsn (1938); Bailey *et al* (1994); Metcalfe & Chalk (1950); Youngken (1950); Bisht & Kundu (1952); Wallis (1967); Tutayuk & Sadykhov (1969); Inandar (1969); Tomlinson (1961, 1966, 1969); Cutler (1969); Sabnis (1971); Ayensu (1972); Pasquale *et al*., (1974); Fahn (1974); Rajagopal (1975); Rajagopal (1978); Bhat *et al*., (1979); Mathew & Shaw (1979); Mathew & Shaw (1982); Ramayya *et al*., (1983); Prabhakar *et al*., (1984); Kaushal & Tripathi (1984).
Leelavathi et al. (1984, 1985); Moura et al. (2005); Ibrahim (2005); Priyanka & Arvind (2005, 2011); Hajiboland et al. (2012); Sac and Scoffoni (2013).

Bark anatomy


**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).


**Total phenolic, flavonoids and 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 ageing 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 of 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 (Velioglu et al., 1998; Kitts et al., 2000; Lee & Shibamoto, 2000; Wang & Jiao, 2000; Lee et al., 2003). Medicinal plants constitute one of the main sources of new pharmaceuticals and health care products. Vani et al., (1997) studied antioxidant properties of the ayurvedic formulation Triphala and its constituents. Khopde et al., (2001) published characterizing the antioxidant activity of amla (Phyllanthus emblica) extract.

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 neutraceuticals. 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). Vani et al., (1997) reported antioxidant properties
of ayurvedic formulation of triphalachurna and its constituents. Lin et al., (1997) studied
the evaluation of the antioxidant and hepatoprotective activity of T. catappa. Ram et al.,
(1997) studied hypocholerolaemic effects of T. arjuna bark.

Saleem et al. (2002) studied the inhibition of cancer cell growth by crude extract
and phenolics of Terminalia fruit. Hushum Cheng et al., (2003) conducted antioxidant
and free radical scavenging activities of T. chebula. Sroka et al., (2003) studied
experiments on hydrogen peroxide scavenging, antioxidant and antiradical activity of
some phenolic acids. Cheng et al., (2003) studied antioxidant and free radical scavenging
activities of T. chebula. Desouza and Degivani (2004) studied antioxidant properties of
complexes of flavonoids with metal ions. Naik et al., (2004) conducted studies on the
aqueous extracts of T. chebula as a potent antioxidant and the probable radioprotector.
Ramesh chander et al., (2004) evaluated antidyslipidemic and antioxidant activities of
different fractions of T. arjuna stem. Suchalatha and Devi (2005) conducted antioxidant
activity of ethanolic extract of T. chebula fruit against isoproterenol-induced oxidative
stress in rats. Kaur et al., (2005) studied the in vitro cytotoxic and apoptotic activity of
triphala. Lee et al., (2005) shown antioxidant effects of aqueous extract of T. chebula in
vivo and in vitro.

Some of the notable works on antioxidant activity of wild medicinal plants are
note worthy: Atawodi (2005) investigated antioxidant potential of African medicinal
plants. The in virto screening for acetyl cholin-esterase inhibition and antioxidant activity


**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 (Duraipandiyan 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). Bauer et al., (1966) studied antibiotic susceptibility testing by standardized single disc method. Miglani et al., (1971) studied purgative action of oil obtained from T. chebula. Taylor et al., (1995) conducted antibiotic activity of methanolic extracts of the bark of Terminalia alata found in Nepal. Higuti (1997) conducted experiments on extraction and purification of effective antimicrobial constituents of T. chebula against methilicin-resistant Staphylococcus aureus. Kaur et al., (1998) conducted studies on antimutagenecity of hydrolysable tannins from T. chebula in Salmonella typhimurium.

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 (Rukachaisirikul 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 plant 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 herbal plant extracts 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
