CHAPTER I

Introduction
1.1 Importance of medicinal plants

Plants, a sole source of food for human beings have also occupied an important position in the field of medicine. They form the potent source of drugs in traditional medicines as well as in modern medicines, as intermediates in pharmaceuticals, entities for synthetic drugs, nutraceuticals and also as food supplements (Joshi et al., 2011). They have been found to possess a wider application in therapeutics since ancient times and continue till to-date. Primarily plants were used as herbal teas and other form of homemade remedies with cranberry, feverfew, garlic etc., (Rates, 2001; Fabricant & Farnsworth, 2001) and were also used in pharmaceutical preparations like tinctures, powders, fluid extracts and capsules to treat various diseases (Rates, 2001). Later on most interestingly, the pure active compounds from plants were isolated and are being used as a drug directly e.g., being digoxin, quinine etc., (Rates, 2001), as drug precursors in hemisynthetic processes e.g., diosgenin (to synthesis progesterone), as drug prototypes e.g., camptothecin and guanidine (used to yield their stronger analog drugs - topotecan and metformin) and also as a pharmacologic tools e.g., genistein, phorbol esters etc., (Salim et al., 2008). With these properties and applications medicinal plants play a vital role in health aspects and are the subject of ongoing scientific research.

Their usages as therapeutic agent are known since the time immemorial (Kaur et al., 2011). Indian, Egyptian, Chinese, Syrian and Greek texts dates back to about 5000 years of recorded evidence for the usage of natural botanicals as drugs (Kamboj, 2000). Arabic, African, Europeans traditional system of medicine have also been reported to incorporate medicinal plants for their therapeutic purpose (Ramawat et al., 2009). However, the history on usage of medicinal plants may practically dates back to the existence of human civilization (Lahlou, 2013). Before understanding the presence of pharmacologically active molecules in plants responsible for their medicinal property, the “doctrine of signatures” was used to identify plants for treating diseases. For example, herbs with red colour were used for treating blood diseases, liver disorders were treated with liverwort plants etc., (Salim et al., 2008). The use of specific plants, their application method for specific disease were passed down orally to the next generations and later on their information were recorded in herbals (Ramawat et al., 2009). After several decades, the active principle with
therapeutic potential from the medicinal plants came into existence based on their traditional uses.

About 25% of the total drugs used in the developed countries, such as United States, is of plant origin, whereas in fast developing countries like India and China, their contribution is higher as 80%. These two countries form the major centers of medicinal plants and provide two-third of the plants used in modern medicine system (Kumar et al., 2012). India being one of the prime hot spot, with its rich diversity of medicinal plants, is called as ‘Botanical Garden of the World’ (Saravananan et al., 2013). It is endowed with enormous wealth of botanicals which are widely used by all sections of people either directly as folk remedies or indirectly in the pharmaceutical preparations of modern medicines (Jayanthi et al., 2012). It consists of two hotspots (Westrn Ghats and Eastern Himalaya) of plant biodiversity in the world. Interestingly, among the 16 mega diverse countries, it has occupied the seventh position. Ayurveda, the world’s most ancient traditional medicine system is known to be practiced by this country (Jachak & Saklani, 2007). Along with Ayurveda, even other systems of medicine (incorporating plant as a source of medicine) are practiced since ancient times and include Unani, Siddha, Amchi and folk medicine (Samy et al., 2008). More than 1000 plant species are used in Ayurveda (Reddy et al., 2012), 700 species in Unani system, 600 species in Siddha system and 600 species in Amchi system to treat various ailments (Samy et al., 2008). About 25,000 potent plant based formulations, have been estimated to be followed in folk medicine and by rural groups in India and also it has been reported that India to consists 7800 medicinal drug manufacturing units consuming about two thousand tonnes of herbs yearly (Wakdikar, 2004).

Due to their therapeutic potential, vast number of Indian medicinal plants have great demand and to name some of them are Asparagus racemosus (Shatawar), Azadirachta indica (Neem), Ocimum sanctum (Tulasi), Tinospora cardifolia (Guduchi), Withinia somnifera (Aswagandha), Woodfordia fruticosa (Dhataki) etc., (Pandey et al., 2007). India has maintained its position in herbal market not only due to its medicinal plants, but also due to its naturally occurring wide variety of spices like turmeric, garlic, pepper, coriander, ginger, cinnamon etc. These spices are not only known for their flavor and culinary taste but also act as preventive agents/source for treating various health disorders. Turmeric, an important spice known by synonyms such as Indian
saffron, Kitchen Queen etc., is known for its use in India from long back as medicine and cooking spice. In Ayurveda, it is referred against many health problems ranging from constipation to diseases of the skin. About 326 of biological activities have been reported from turmeric (Lal, 2012). Ginger, another spice is reported to be used against cancer, heart diseases, infectious diseases, hypertension, arthritis etc. Coriander has found its traditional application in the treatment of diabetes and cholesterol. Its seeds are reported to exhibit significant hypolipidemic action (Vasanthi & Parameswari, 2010). The above promising features of Indian medicinal plants and spices, indicates the therapeutic prosperity of Indian biodiversity.

The healing properties of the medicinal plants lies in their secondary metabolites like phenolics, flavonoids, alkaloids, sterols, tannins, terpenes etc., and are known to produce a defined physiological effect on human system. Thus are called as the active principles/bioactive compounds of plant (Ramawat et al., 2009). These metabolites are the products obtained by the primary metabolism of plants and are not usually responsible for metabolic activity of the plants but possess various health-related effects such as anticarcinogenic, antithrombotic, antioxidative, antihypertensive and antimicrobial activities etc., (Ramawat et al., 2009; Wendakoon et al., 2012; Haghju & Almas, 2015). Thus plants and their active compounds represent the major source of pharmaceuticals, and also have found their way in food additives, fragrances and pesticides (Ramawat et al., 2009).

The development of adverse effects, microbial resistance to the chemically synthesized drugs, and the high costs of pharmaceuticals have made men turn towards ethnopharmacology. The structural complexity (with more number of chiral centers) of natural products, making them expensive and difficult to synthesize on an industrial scale, their advanced binding characteristics compared with synthetic ones, their drug relevant features which is unsurpassable by any synthetic compound and the alternative drug discovery methods failure to deliver many lead compounds in in vital therapeutic areas like immunosuppression, metabolic diseases and antiinfectives has made natural products to occupy a place of effective drug in the field of medicine and may contribute to their historical success in drug discovery. As such these natural products accounts for about 45% of today’s best-selling drugs of market (Lahlou, 2013).
Several agencies of government like Council of Scientific and Industrial research (CSIR), Department of Biotechnology (DBT), Ministry of Health and Family Welfare and Department of Ayurveda, Unani, Siddha and Homeopathy (AYUSH) have initiated their efforts on bioprospecting of medicinal plants. Even various Universities and other R&D institutions have also initiated drug discovery coordinated programmes in the field of traditional medicine to isolate new bioactive molecules from plants, microbes, insects etc., (Jachak & Saklani, 2007). Thus, these companies, agencies and institution emphasize the need or importance of natural products by their continuous research in the relevant field.

The isolation of bioactive compound from plant is enlarging with the advent of various techniques previously, which was a tedious, time and money consuming aspects. This was also one of the reason for opting synthetic drug for their quick synthesis and ofcouse, many of them are based on natural product with structural modification. The advancement in technologies now has made possible to determine upto 100,000 test substances per week against several different targets with as low as a few micrograms of test sample per assay (Lahlou, 2013). So far more than 50,000 structures of secondary metabolites or bioactive compounds of plant origin have been identified and the number is expected to exceed 100,000 structures (Yazdani et al., 2011).

Along with this, the lesser adverse effect, better compatibility, accessibility, efficacy of drugs from medicinal plants, availability of larger percentage of medicinal plant species (about half million plants) needed for their medicinal value investigation and the increasing demand of the export–import criteria of plant originated products has enhanced the medicinal plant research. Where, Indian global trade of plant products is expected to reach 3 trillion US $ by the end of 2015 (Kamboj, 2000; Adhikari et al., 2012; Agarwal et al., 2013; Lahlou, 2013). Thus, India with its rich biodiversity provides an unique opportunity for natural drug discovery.