Chapter - 1

INTRODUCTION

India has a rich floristic diversity with 46,550 plant species that accounts for about 11% of the total world flora of which 28% are endemic to the country. All known types of agroclimatic, ecologic and edaphic conditions are met within India (Mukherjee and Wahile, 2006). The biogeographic position of India is so unique that contains all known types of ecosystems range from coldest place like the Nubra Valley with -57°C, dry cold deserts of Ladakh, temperate and Alpine and subtropical regions of the North-West and trans-Himalayas, rain forests with the world’s highest rainfall in Cherrapunji in Meghalaya, wet evergreen humid tropics of Western Ghats, arid and semiarid conditions of Peninsular India, dry desert conditions of Rajasthan and Gujrat to the tidal mangroves of the Sunderban. India is rich in all the three levels of biodiversity such as species diversity, genetic diversity and habitat diversity (Mukherjee and Wahile, 2006).

It is further known that India possesses rich bioresources and diversified genetic resources that can be sustainably used for food and nutritional supplements with the wide variety of biological communities (Ramachandran and Udhayavani, 2013). The high biodiversity in India is largely due to their varied geographical and physical environment in terms of latitudes, longitude, altitude, geology and climate (Rodgers, 1991). One such are with rich biodiversity which runs majestically parallel to the West Coast of India, the Western Ghats. The richness of the Western Ghats is further increased by exclusive varieties of medicinal plants that the Ghats has to its credit.

The Western Ghats or the Sahyadri are mountain range along the western side of India. They are the world Heritage site and are one of the eight hottest hotspots of biological diversity in the world (UNESCO, 2007). The Western Ghats is richly credited with varied kind of vegetation and unimaginable topographical features. The Western Ghats, a valuable repository for biodiversity after the Himalayas, is one of the 34 mega diversity hot spots of the world (Myers et al., 2000; Behera et al., 2002). This mountain range hosts nearly 4,500 flowering plants endowed with high degree of endemism with nearly 1,500 species (Mackinnon and Mackinnon, 1986). The main centers of endemism of Western Ghats are Agastyamala hills, Anaimalai high ranges and Nilgiris silent valley-Wayanad-Kodagu (Nayar, 1996; 1997). Biogeographically, the hill chain of the Western Ghats constitutes the Malabar province of the Oriental realm, running parallel to
West Coast of India from 8°N to 21°N latitudes, 73°E to 77°E longitude for around 1600km rising up from a relatively narrow strip of coast at its western border, the hills reach up to a height of 2800m before merge to the east with Deccan plateau at an altitude of 500-600m. The average width of this mountain range is about 100km.

The Nilgiris, a region of the Western Ghats is also known as the Nilagiri Malai, is a great emporium and treasure house of ethnobotanical wealth. The Nilgiris is commonly termed as ‘Blue Mountains’ which is the highest mountain ranges of southern India and it has been declared as Biosphere Reserve in the year, 1986 for biodiversity conservation owing to high species richness with high degree of endemism (Lengerke and Blasco, 1989). A large part of the areas are covered by forest and few patches are used for tea plantations. Many types of vegetations like thorny scrub jungles, tropical moist and dry deciduous forests, tropical rain forests, temperate forests, grasslands etc. are distributed in Nilgiris in different altitudes (Champian, 1936).

Medicinal plants have been proved to be an important source in the search of new drugs, mainly because of the diversity of pharmacological properties and chemical structures (Balunas and Kinghorn, 2005; Adeneye et al., 2006). The therapeutic property of the medicinal plants is the outcome of the active constituent and these pharmacologically active constituents were synthesized and stored in different plant parts. Researchers are trying to explore this treasure of bioactive molecules to convert the natural chemicals in a useful form for modern system of medicine. The chemical constituents of herbal drugs were believed to have better compatibility with the human body and hence less side effects associated with them. Hence, there is a growing trend in screening new herbs with subsequent isolation of the bioactive molecules from them.

The continued growth of human populations and of per capita consumption has resulted in unsustainable exploitation of Earth’s biological diversity, exacerbated by climate change, ocean acidification and other anthropogenic environmental impacts (Rands et al., 2010). Conservation of medicinal plants can be accomplished by the ex situ, that is, outside the natural habitat by cultivating and maintaining plants through long-term preservation of plant propagules in plant tissue culture repositories (Rands et al., 2010). Although species conservation is achieved most effectively through the management of wild populations and natural habitats (in situ conservation), ex situ techniques can be used to complement in situ methods and, in some instances may be the only option for some species (Fay, 1992; Negash et al., 2001; Sarasan et al., 2006).
Plant tissue culture technology is being widely used for large scale plant multiplication. Apart from its use as a tool of research, plant tissue culture techniques have in recent years, become of major industrial importance in the area of plant propagation, disease elimination, plant improvement and production of secondary metabolites (Pierik, 1988). A single explant can be multiplied into several thousand plants in relatively short time period and space under controlled conditions, irrespective of the season and weather on a year round basis (Akin-Idowu et al., 2009). Endangered, threatened and rare species have successfully been grown and conserved by micropropagation because of high coefficient of multiplication and small demands on number of initial plants and space.

Development of micropropagation techniques will ensure abundant supply of the desired plant species. In some crop species seed propagation has not been successful so the development of artificial seed production technology is currently considered as an effective and efficient alternate method of propagation (Saiprasad, 2001). It is suggested as a powerful tool for mass propagation of elite plant species with high commercial value and also employed as a suitable alternative for the use of somatic embryos (Srivastava et al., 2009).

_Hypochaeris radicata_ L. is one such important medicinal species found in the forest margins of Nilgiris, the Western Ghats, Tamil Nadu, India at 2000m above msl. In spite of high medicinal values, this species has not been worked much for its phytochemical constituents. Further, no work has been carried out for mass production to meet the demand by employing tissue culture technology. In addition, the current availability status of this species in Nilgiris is also not known. Therefore, the present investigation was designed to provide scientific evidence for its use as a traditional folk remedy by therapeutic potential and phytochemistry, biological activities and _in vitro_ regeneration.

The major objectives of the study are given below:

- to know the ecological attributes like the level of distribution, density and basal area of _H. radicata_ in relation to other associated plant species in high hills of Nilgiris.
- to evaluate the preliminary phytochemical study through qualitative, TLC, HPTLC and GC-MS and quantitative analysis of _H. radicata_.

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➢ to isolate, purify and identify the phytochemicals by column chromatography and thin layer chromatography

➢ to elucidate the structures of bioactive compounds by $^1$HNMR, $^{13}$CNMR, IR and MS studies.

➢ to understand the protective effect of *H. radicata* by studying biological activities such as antimicrobial, antioxidant, acute toxicity and antiinflammatory.

➢ to standardize the MS medium for the effective propagation through employing tissue culture technology.

➢ to prepare synthetic seeds by encapsulating *in vitro* derived leaf, root and callus explants.