CHAPTER 1

INTRODUCTION

Human beings came on this earth as guests of plants is a monumental ancient aphorism. Nature is the supreme creation and man has completely been dependent on plants. As population increased, he has learnt to implicit natural resources and to make use of every bit of it. Man since creation has depended on plants for food, drinks, shelter, clothing, equipment, dental care and medicine (Gbile, 1986). In fact from the start of life to the last breath, almost every aspect of human life is deeply associated with plants. Primitive man tried to cure diseases from plants growing abundantly around him. His experience through trial taught him a lot about the medicinal properties of different plants. India is endowed with vast resources of medicinal and aromatic plants. These plants have been used in Indian health systems. The great interest in the use and importance of Indian medicinal plants by world health organization in many developing countries has let to intensify efforts on the documentation of ethno medicinal data of medicinal plants (Perumalsamy and Ignacimuthu, 2000).

Our forefathers were depending on plants for treatment of various diseases before the introduction of orthodox medicine. Ancient literatures of world on medicines suggest that the primitive people of antiquity and those of earlier centuries have been using several kinds of medicinal plants for combating diseases. China used drug plants as early as 5000 to 4000 BC. India has over 3000 year-old medicinal heritage based on herbs. The sacred Vedas and other
ancient Indian treatises give many references of these medicinal plants. The ancient Indian treatise ‘Rig veda’ deals with medicinal plants. Indians classified plants into three groups on the basis of their usage as ‘Ubhdida’ (botanical), ‘Annapanandi’ (dietic) and ‘Virechandi’ (medicinal). Parashara wrote ‘Virkshayerveda’ describing medicinal plants much before the beginning of Christian era (Saxena, 1989). There are references of miracle herbs and wonder drugs in the ancient Indian literatures which had magical properties and were used to cure some of the incurable diseases from tip to the toe, to increase longevity and even to bring the dead back to life. The charak and sushrut samhitras were written between 700-200 BC, and include accounts of the discovery of medicinal plants (Pandey and Verma, 2005). The Assyrians, Babylonians and Ancient Hebrews were all familiar with the usage of plants. The Greeks were familiar with many of the present day drugs, as evidenced by the works of Aristotle, Hippocrates (Father of medicine), Pythagoras, Theophrastus, Pleny and Galen. In 77 BC Dioscorides wrote his great treatise, “De Materia Medica” which dealt with the nature and properties of all the medicinal substances known at that time. The foremost classical work in botany of medicinal flora in the world ‘Hortus Malabaricus’ was written by Heinrich Van Rheede in Kerala, India. India is now beginning to search her roots in the past and revive her lost glory of the traditional system of medicine which flourished here for several centuries and contributed much to the development of medicinal science to the world. From this crude beginning the study of drugs and drug plants has progressed until now as pharmacognosy and pharmacology which are the essential branches of medicine.
The most valuable of the drug and drug plant has been standardized as a result of the Pure Food and Drug act of 1906 (Hill, 1972).

Herbal medicine is known in every village and communes of India and every village has elders both men and women who have acquired knowledge about the medicinal properties of plants through long tradition and experience. In the past, sickness was viewed as a punishment of the God and hence was treated with prayers and rituals that included what may have been considered “magic portion” prepared from local herbs (Sandhya et al., 2010). Plants produce a wide variety of compounds that can act on different systems of the body and have high therapeutic activity. More than 2,40,000 plants are considered to be growing in different parts of the world. Only about 5-10 percent of them have been screened for chemical or biological activity. Herbal medicine cures the root cause of a disease and not merely providing symptomatic relief, as does the modern synthetic medicine. Thus, traditional medicine not only cures but also rejuvenates the body’s defense system. The medicine and aromatic plants sector has traditionally occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives of India (Battacharrya et al., 2005).

Nature keeps ready within its ‘green bag’ substances which would promptly act to neutralize the effect of any such substance proving unsuitable and non-compatible to the human body. Chemical investigations of wild medicinal plants used by the indigenous people of world shows unknown compounds with promising biological activity. Indigenous culture has provided several ‘miracle plants’ of immense food and medicinal value to the modern civilization. Seventy
four percent of 119 plant derived drugs were discovered as a result of chemical studies to isolate the active substances responsible for their traditional use (Farnsworth and Soejarto, 1991). So, plants, especially the higher plants contain a variety of substances, which are useful as food additives, perfumes and in treatment of various diseases as medicines due to their versatile therapeutic potential (Mukherjee and Wahile, 2006). The active secondary metabolites possess various medicinal applications as drugs or as model compounds for drug synthesis. Large scale evaluation of the local flora exploited in traditional medicine for various biological activities is a necessary first step in the isolation and characterization of the active principle and further leading to drug development. The identification of drug yielding plants, crude drugs obtained from them, identification of crude drugs, extraction of the principle drugs, study of their antimicrobial activities and their potential use as antioxidants are essential to evolve new natural curatives instead of antibiotics. The worldwide experiments in these fields are related to pharmacognosy, phytochemistry, and pharmacological investigations.

1.1. Pharmacognosy:

Pharmacognosy is defined as the scientific and systematic study of structural, physical, chemical and sensory characters of crude drugs along with their history, method of cultivation, collection and preparation for the market (Evans, 1996). Identification of drugs can be done by morphological, histological and chemical testing. There are five methods of evaluation crude drugs namely
Morphological or Organoleptic, Microscopical or Histological, Physical, Chemical and Biological.

Organoleptic evaluation means the study of morphological characteristics by which the drugs are identified. It also includes those of colour, odour, taste, consistency of powdered drug, size, shape etc. Micorscopical evaluation is useful for organized drugs. If the drug is in entire form which we can take transverse or longitudinal sections and study the cellular structures. Surface preparations can be studied for stomata or trichomes. If the drug is in powder form, microscopic identification is done to identify the parts of the crude drug. The measurement of length, diameter of structures also helps in identification. Physical standards are studied as under refractive index, moisture content, viscosity, melting point, optical rotation and solubility of crude drugs. The evaluation of drug can be done by chemical method such as assays, extractive values, volatile oil content, ash content and drugs standardized by chemical tests. In the biological method of estimation of potency of a crude drug is done by means of its effect on living organisms such as other plants, animals, microbes etc.

1.2. Phytochemistry:

Phytochemistry includes drug development from natural origin, establishment of botanical identity of herbs, phytochemical isolation and identification, screening of herbal formulations and isolated compounds. Phytochemicals (or) secondary metabolites are a wide range of low molecular weight chemical compounds that are produced and accumulated by the plants. These include alkaloids, phenolic acids, flavanoids, steroids, terpenoids and
saponins. Phytochemical analysis of plants, used in folklore has yielded a number of compounds with various pharmacological activities. Hence medicinal plants are important substances for the study of their traditional uses through the verification of pharmacological effects and can be natural composite sources that act as a disease curing agents. About 3000 materials from 2764 plant species have been screened for their pharmacological and chemotherapeutic properties (Anon, 1988). Traditionally used medicinal plants produce a variety of compounds of known therapeutic properties (Iyengar, 1976; Harbone, 1989; Chopra et al., 1992).

1.2.1. Phytochemical Revolution:

Even modern medicines and some very valuable drugs such as morphine, digitoxin, reserpine, vinblastine, quinine etc. are obtained from the plants. Cocaine derived from *Erythroxylum cacao* lead to the synthesis of procaine and other related anesthetics. Salicin obtained from *Salix purpurea*, lead to the synthesis of acetyl salicylic acid (aspirin). Morphine and codeine from *Papaver somniferum* and *P. bracteatum* lead to the synthesis of pain killer. Anti cancerous drug taxol is obtained from *Taxus wallichiana* and *T. buccata*. Synthetic anti cholinergic drugs like atropine and scopolamine are obtained from *Atropa belladonna* and *A. acuminata*. *Tinospora cordifolia* has been reported to stimulate indigenous insulin secretion by the pancreas (Gupta, 1967).

1.3. Pharmacology

Pharmacology is the study of the relevant forms of knowledge, practice and cultures implementing them the role of natural products, herbal medicines, tribal
and traditional medicines is being increasingly appreciated during the recent years for the prevention and cure of human ailments (Janardhanan et al., 2006)

1.3.1. Antioxidant Activity

Antioxidation compounds in food play an important role as a health protecting factor. Scientific evidence suggests that antioxidants reduce the risk for chronic diseases including cancer and heart disease. Primary sources of naturally occurring antioxidants are whole grains, fruits and vegetables. Plant sourced food antioxidants like vitamin C, vitamin E, carotenes, phenolic acids, phytate and phytoestrogens have been recognized as having the potential to reduce disease risk. Most of the antioxidants in a typical diet are derived from plant sources and belong to various classes of compounds with a wide variety of physical and chemical properties. Some compounds, such as gallates, have strong antioxidant activity, while others, such as the mono-phenols are weak antioxidants. The main characteristic of an antioxidant is its ability to trap free radicals.

In recent years, there has been great interest in screening various plant extracts for natural antioxidants because of their great free radical scavenging properties (Jia et al., 2007). Antioxidants neutralize reactive oxygen which cause stress, diseases of our cells and inflict damage to biomolecules, resulting in aging and genetic changes that lead to cancer. Common sources of antioxidants are fruits, vegetables and medicinal plants. Therefore, a great number of different spices and aromatic herbs have been investigated for antioxidant activity (Erdemoglu et al., 2006). Antioxidants are widely used as food additives to
provide protection against oxidative degradation of foods by free radicals (Gulcin et al., 2002).

1.3.2. Anti-Depressant Activity

According to the World Health report (WHO, 2001), approximately 450 million people suffer from mental or behavioral disorder, yet only a small minority of them receive even the most basic treatment. This amounts to 12.3% of the global burden of disease, and will rise to 15% by 2020 (Reynolds, 2003). Major depression, a debilitating psychiatric disorder, is predicted to be the second most prevalent human illness by the year 2020. Various antidepressants, ranging from monoaminoxidase inhibitors to recently developed dual reuptake inhibitors, are prescribed for alleviating the symptoms of depression. The common symptoms of major depression include depressed or irritable mood, decreased interest in pleasurable activities, significant weight loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feeling of worthlessness or excessive guilt, decreased concentrating power, and increase in suicidal tendencies. Earlier, major depression was considered to be an old-age disease. However, current trends reveal an increased percentage of younger populations being affected from its consequences. Major depression is relatively common among patients with a diagnosis of dementia (Ballard et al., 1996, Stepaniuk et al., 2008) and also may pose a risk factor for development of dementia (Kokmen et al., 1996). Despite the availability of these blockbuster molecules, approximately 30% of depressed patients do not respond to the existing drug therapies and the remaining 70% fail to achieve complete remission
(Kulkarni et al., 2009). Herbal drug used in depression are *Centella asiatica*, *Hypericum perforatum*, *Rhodiola rosea*, *Pfaffia paniculata*, *Rauwolfia serpentina*, *Rhododendron molle*, *Schizandra chinesis*, *Thea sinensis*, *Uncaria tomentosa*, *Valeriana officinalis* and *Withania somnifera* (Mamedov, 2005). Moreover, antidepressants are associated with a plethora of side effects and drug-drug/drug-food interactions. In this context, novel approaches are being tried to find more efficacious and safer drugs for the treatment of major depression.

1.3.3. Anti-Diabetic Activity

In India, the prevalence of diabetes mellitus is on increase and needs to be addressed appropriately. A study of ancient literature indicates that diabetes (madhumeha) was fairly well known and well conceived as an entity in India. The knowledge of the system of diabetes mellitus, as the history reveals, existed with the Indians since prehistoric age. 'Madhumeha' is a disease in which a patient passes sweet urine and exhibits sweetness all over the body, i.e. in sweat, mucus, breathe, blood, etc. Diabetes mellitus is a serious complex chronic condition that is a major source of ill health worldwide. This metabolic disorder is characterized by hyperglycemia and disturbances of carbohydrate, protein, and fat metabolisms, secondary to an absolute or relative lack of the hormone insulin. Besides hyperglycemia, several other factors including dislipidemia or hyperlipididemia are involved in the development of micro and macrovascular complications of diabetes that are the major causes of morbidity and death (Kameswararao, 2003). According to WHO projections, the prevalence of diabetes is likely to increase by 35%. Currently, there are over 150 million diabetic patients worldwide and this is
likely to increase to 300 million or more by the year 2025. Statistical projection about India suggests that the number of diabetics will rise from 15 million in 1995 to 57 million in the year 2025, the highest number of diabetics in the world (Satyanarayana, 2006). Reasons for this rise include increase in sedentary lifestyle, consumption of energy-rich diet, obesity, higher life span, etc. Other regions with greatest number of diabetics are Asia and Africa, where diabetes mellitus rates could rise to twofold to threefold than the present rates (Eidi, 2006). Evaluation of plant products to treat diabetes mellitus is of growing interest as they contain many bioactive substances with therapeutic potential. In recent years, several authors evaluated and identified the antidiabetic potential of traditionally used Indian medicinal plants using experimental animals. Previous studies confirmed the efficacy of several medicinal plants in diabetes mellitus. Although a large number of medicinal plants have been already tested for their antidiabetic effects, these effects remain to be investigated in several other Indian medicinal plants (Sharma, 1994). Herbal remedies are considered convenient for management of type 2 diabetes with postprandial hyperglycemia due to their traditional acceptability and availability, low costs and lesser side effects.

The application of systems biology technologies and approaches, that is, genomics, proteomics and metabolomics, to phytomedicine research may greatly assist evidence-based phytotherapeutics, and such research may also lead to a change of paradigm in the development and application of complex plant/phytochemical compound mixtures in modern medicine (Ulrich et al., 2007). So
the present work has been taken up to evaluate the medicinal potential of

*Tricalysia spherocarpa* (Dalzell ex Hook. F.) Gamble