ABSTRACT

Medicinal plants are local heritage with global importance because they provide an infinite source of drugs in terms of both variety and mechanism of action. *Sophora interrupta* is an endemic medicinal plant widely distributed in Seshachalam Hills. The Water (WE), ethanolic (EE) and methanolic (ME) extracts of *S. interrupta* were assessed for phytochemical constituents, antioxidant and *in vitro* free radical scavenging activities by using different assay methods and this was significantly correlated with DNA damage protection. The water extract showed potential radical quenching property when compared to other extracts. Induction of apoptosis is the key success of plant products as anticancer agents. MCF-7 cells were cultured in the presence of *S. interrupta* leaf extract at various concentrations for 24 h and the percentage of cell viability was evaluated by MTT and LDH assays which showed a dose-dependent inhibition of cell MCF-7 cells proliferation. The morphology of apoptotic cell and nucleus was identified by employing acridine orange and ethidium bromide staining. The degree of DNA fragmentation was analyzed using agarose gel electrophoresis. Pretreatment of *S. interrupta* aqueous extract has ameliorated the oxidative stress, by decreasing lipid peroxidation and promotion of antioxidant enzyme activities such as Glutathione Peroxidase, Catalase and Superoxide Dismutase and levels of Glutathione content in liver and kidney compared to cadmium treated group. *S. interrupta* leaf extract also reduced the activities of marker enzymes such as Alanine Transaminase and Aspartate Transaminase, suggesting the decrease in tissue damage. All these results significantly associate with histopathological observations of liver and kidney. These findings suggest that *S. interrupta* can be claimed as a therapeutic target for cancer treatment and the study also suggests that pre-treatment of *S. interrupta* can effectively control the acute cadmium nitrate induced oxidative stress.
INTRODUCTION

During the last few decades there has been an exponential growth in the field of herbal medicine and it is getting popularized in developing countries owing to its natural origin and lesser side effects. In ancient times, vaidhyas used to treat patients on individual basis by preparing drugs according to the requirement of the patient. But the present scenario has changed. Herbal medicines are being manufactured on a large scale in pharmaceutical units, where manufacturers come across many problems such as availability of good quality raw material, authentication of raw material, availability of standards, proper standardization methodology of single drugs and formulation and quality control parameters. Ayurveda emphasizes the relationship between man and plants throughout the development of human culture. The use of herbal medicine, due to high toxicity and side effects of allopathic medicines, has led to sudden increase in the number of herbal drug manufactures. Herbal medicines as the major remedy in traditional system of medicine have been used in medical practices since antiquity. The practices continue today because of its biomedical benefits as well as its place in cultural beliefs in many parts of world and have made a great contribution towards maintaining human health and wealth (Dhore, 1986).

Herbal medicines often complement the conventional modern treatments providing safe, well-tolerated remedies for many chronic diseases like liver disorder, asthma, rheumatoid arthritis, diabetes, obesity, cardiovascular, neurological disorders and cancer. The ability of herbal medicines to affect the body systems depends on the secondary metabolites constituents they contain. Hence, at this juncture, research into the isolated plant constituents is of great importance. Many of today’s medicines are either obtained directly from a natural source or are developed from a lead compound originally obtained from a natural source (Handa, 2008).
The use of traditional medicine has increased in developed countries, mainly due to the failure of modern medicine to provide effective treatment for chronic diseases and emergence of multi-drug resistant against various diseases and pathogens. The adverse effects of chemical drugs, questioning of the approaches and assumptions of allopathic medicine, their increasing costs and greater public access to information on traditional medicine also led to an increase interest in alternative treatments (WHO, 2002). Plants that have medicinal properties with an optimum active ingredient in some form or another are regarded as medicinal plants. These are invaluable natural resources; they are exhaustible if overused and sustainable if the juxtaposition of present and future needs takes place within the behavioural pattern of various kinds of users. Herbal medicines are popular remedies for treatment of diseases used by a vast majority of the world’s population. In this traditional system of Indian medicine, herbal formulation and extracts of plants are used as drugs of choice. Studies suggest that using a plant in whole form or as complex extracts may offer many benefits due to the presence of multiple active components (Satheesh and Veeranjaneyalu, 2009). While this process of gradual loss of medicinal plants is continuing unabated, the demand for medicinal plants and plant-derived drugs is increasing rapidly with the current resurgence of traditional medicines all over the world. There is unprecedented demand for natural medicines, green health products, pharmaceuticals, food supplements, cosmetics, and herbal pesticides, which is bringing about this alarming loss of plant biodiversity. It is estimated that 70-80% of people worldwide rely chiefly on traditional, largely herbal medicine to meet their primary healthcare needs. The global market for herbal medicine is not only large but expanding by 15-20% annually.

Cancer is the second leading cause of death, where one in four deaths is due to cancer (Cancer Facts & Figures, 2013). Advancements in scientific research, however, have enabled
researchers to begin characterizing and understanding the mechanisms that cause cancer. Finally, the “black box” has been opened and scientists can begin formulating a true understanding of the underlying causes of cancer. The first written records on the medicinal uses of plants appeared in about 2600 BC. The “Ebers Papyrus”, the best known Egyptian pharmaceutical record, which documented over 700 drugs, represents the history of Egyptian medicine dated from 1500 BC. The Chinese *Materia Medica*, which describes more than 600 medicinal plants, was well documented with the first record dating from about 1100 BC. Documentation of the Ayurvedic system recorded in Susruta and Charaka dated from about 1000 BC. The Greeks also contributed substantially to the rational development of the herbal drugs. Dioscorides, the Greek physician (100 A.D.), described in his work “De Materia Medica” more than 600 medicinal plants.

Traditional medicine (TM) refers to the application, approach, knowledge, and belief in incorporating plant or animal based properties in remedies, singularly or in combination, for the purpose of treating or preventing disease as well as to maintain the well-being of an individual. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. As such herbal remedies have been used to cure a variety of disorders or conditions such as diabetes, cardiovascular problems, weight control, dermal infirmities, sexual malfunction, and of course cancer. According to the World Health Organization, more than 70% of the world’s population uses TM in order to fulfill their health necessities. In various oriental countries such as China, traditional medicine accounts for about 30%-50% of total medicinal intake. Other countries like the United Kingdom have an annual
expenditure on traditional medicine of US$ 230 million. In the United States, it is estimated that 158 million of the adult population use traditional medicine as alternative or complementary medicines and according to the USA Commission for Alternative and Complementary Medicines, close to US$ 17 billion was spent on traditional remedies in 2000. Natural products, especially those from plants, have been a valuable source of new cancer drugs for many decades. Medicinal plants are the most exclusive source of life saving drugs for the majority of the world’s population. The use of plant products in the treatment of cancer has been of recent interest.

Herbal medicine refers to using a plant's seeds, berries, roots, leaves, bark, and/or flowers for medicinal purposes. Herbalism has a long tradition of use outside of conventional medicine. It is becoming more main stream as improvements in analysis and quality control along with advances in clinical research show the value of herbal medicine in the treating and preventing disease. A number of constituents of various medicinal plants are used as hepato and nephro protective, antioxidant and anticancer agents. *Cajanus indicus* (Chatterjee et al., 2006), *Phyllanthus niruri* (Sarkar and Sil, 2007) and *Silybium marianum* (Kang et al., 2008) are some of the plant species tested for hepatoprotective that gave encouraging results. Included among there is *S interrupta* which is an endemic plant.

*S. interrupta* belongs to the family; *Fabaceae* (*Leguminaceae, Papilonaceae*) and is commonly called *Edwardsia maderaspatana* Wight, Pili Girgoli. There are approximately 219 species in this genus Sophora. *S. interrupta*, is available exclusively in Seshachalam Hill ranges of Tirumala. This plant is a woody perrenial shrub with pinnate leaves, sub-opposite leaflets, broadly ovate and golden yellow flowers. It has multifarious medicinal properties including antibacterial (Deena et al., 2011), anti cancer (Tse et al., 2006), anti inflammatory (Sato et al.,
1995) and antioxidant properties (Ren-You Gan et al., 2010). Very little literature available on S. interrupta, since this plant is endemic and it has very high medicinal values.

In light of this, it is essential to comprehend and evaluate the importance of various medicinal properties and its bioactive components in the plant which are predominantly chemotherapeutic and chemo preventive.

Therefore, the present study was undertaken to investigate the antioxidant and anticancer properties of crude extracts of S. interrupta.