1. Introduction
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Human beings have relied on natural products as a resource of drugs for thousands of years. Plant-based drugs have formed the basis of traditional medicine systems that have been used for centuries in many countries such as Egypt, China and India (Balandrin et al., 1993).

Long before the development of modern medicines, India in ancient times was entirely dependent on herbal medicines for health care. Many scripts carry elaborate prescriptions of herbal medicines for treating very complex diseases. India was the leader in health care through ayurveda. Apart from such systematic therapies, specific herbal therapies developed by individuals were used for treating the sick and these secret therapies were passed on from the older generation to the younger generation, without disclosing them to the outsiders. Even today, herbal medicines play a significant role in India. A similar practice was also prevalent in China and many other countries in Asia and Africa. With the advancement of science, allopathic medicine gained prominence over herbal medicines. With larger commercial interest, the western countries promoted modern medicine, in spite of its high cost and side effects. However, realizing the drawbacks of allopathic medicine, the world is turning back to herbal medicines. Presently, about 80% of the world population is still dependent on medicinal plants for health care and 20% of the drugs in pharmaceutical firms are of plant origin, either extracted from the plants or synthetic derivatives of these plant species (Shankar and Majumdar, 1997; Gauniyal et al., 1991).
1.1. **New sources of tribal medicine for future investigation**

Tribal healers in most of the countries, where ethnomedical treatment is frequently used to treat cut wounds, skin infection, swelling, aging, mental illness, cancer, asthma, diabetes, jaundice, scabies, eczema, venereal diseases, snakebite and gastric ulcer, provide instructions to local people as how to prepare medicine from herbal samples (Puspangadan and Atal, 1984; Perumal Samy and Ignacimuthu, 1998). They keep no records and the information is mainly passed on verbally from generation to generation (Dhar *et al.*, 1973; Sofowara, 1982). World Health Organization (WHO) has shown great interest in documenting the use of medicinal plants used by tribals from different parts of the world (Kaido *et al.*, 1987). Many developing countries have intensified their efforts in documenting the ethnomedical data on medicinal plants. Research to find out scientific evidence for claims by tribal healers on Indian herbs has been intensified. Once these local ethnomedical preparations are scientifically evaluated and disseminated properly, people will be better informed regarding efficacious drug treatment and improved health status (Manandhar, 1987).

1.2. **Modern medicine from higher plants**

Medicinal plants play a vital role for the development of new drugs. During 1950-1970 approximately 100 plants based new drugs were introduced in the USA drug market including deserpidine, reseinnamine, reserpine, vinblastine and vincristine which are derived from higher plants. From 1971 to 1990 new drugs such as ectoposide, E-guggulsterone, teniposide, nabilone, plaunotol, Z-guggulsterone, lectinan, artemisinin and ginkgolides appeared all over the world. 2% of drugs were introduced from 1991 to 1995 including paciltaxel, topotecan, gomishin, irinotecan etc. Plant based drugs provide outstanding contribution to modern therapeutics; for example: serpentine isolated from the roots of Indian plant *Rauwolfia serpentina* in 1953 was a revolutionary event in the treatment of hypertension and lowering of blood pressure. Vinblastine isolated from the *Catharanthus roseus* (Farnsworth and Blowster, 1967) is used for the treatment of Hodgkins choriocarcinoma, non-hodgkins lymphomas, leukemia in children, testicular and neck cancer. Vincristine is recommended for acute lymphocytic leukemia in
childhood advanced stages of Hodgkin's lymphosarcoma, small cell lung cancer, cervical and breast cancer (Farnsworth and Bingel, 1977). Podophyllotoxin is a constituent of *Podophyllum emodi* currently used against testicular, small cell lung cancer and lymphomas. Indian indigenous tree of *Nothapodytes nimmoniana* (*Mappia foetida*) are mostly used in Japan for the treatment of cervical cancer (Table 1). Plant derived drugs are used to cure mental illness, skin diseases, tuberculosis, diabetes, jaundice, hypertension and cancer. Medicinal plants play an important role in the development of potent therapeutic agents. Plant derived drugs came into use in the modern medicine through the use of plant material as indigenous cure in folklore or traditional systems of medicine.

**Table 1. Some of the important medicinal plants used for the preparation of major modern drug for cancer**

<table>
<thead>
<tr>
<th>Plant Name/Family</th>
<th>Drugs</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Catharanthus roseus</em> L. (Apocynaceae)</td>
<td>Vinblastine and vincristine</td>
<td>Hodgkins, Lymphosarcomas and children leukemia</td>
</tr>
<tr>
<td><em>Podophyllum emodi</em> Wall. (Beriberidaceae)</td>
<td>Podophyllotoxin,</td>
<td>Testicular cancer, small cell lung cancer and Lymphomas</td>
</tr>
<tr>
<td><em>Taxus brevifolius</em> (Taxaceae)</td>
<td>Paclitaxel, taxotere</td>
<td>Ovarian cancer, lung cancer and malignant melanoma.</td>
</tr>
<tr>
<td><em>Mappia foetida</em> Miers.</td>
<td>Comptothecin, lrentece and topotecan</td>
<td>Lung, ovarian and cervical cancer.</td>
</tr>
<tr>
<td><em>Comptotheca acuminata</em></td>
<td>Quinoline and compthecin alkaloids</td>
<td>Cervical cancer</td>
</tr>
<tr>
<td><em>Jamperus communis</em> L. (Cupressaceae)</td>
<td>Teniposide and etoposide</td>
<td>Lung cancer</td>
</tr>
</tbody>
</table>

In recent years, there is a tremendous interest in the possible role of nutrition and herbal medicines in prevention of diseases. In this context, antioxidants especially derived from natural sources such as medicinal plants and herbal drugs derived from
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them require special attention. Antioxidants neutralize the toxic and 'volatile' free radicals. Antioxidants have many potential applications, especially in relation to human health, both in terms of prevention of disease and therapy (Sies, 1996; Halliwell and Gutteridge, 1997). In biological systems oxygen gives rise to a large number of free radicals and other reactive species collectively known as ‘Reactive Oxygen Species’ (ROS). Another group of reactive species are termed as ‘Reactive Nitrogen Species’ (RNS) (Devasagayam et al., 2004; Kelly et al., 1998). In a normal healthy human, the generation of ROS and RNS are effectively kept in check by the various levels of antioxidant defense. However, when the humans get exposed to adverse physiochemical, environmental or pathological agents this delicately maintained balance is shifted in favour of pro-oxidants resulting in oxidative stress (Sies, 1996). Cellular damage induced by oxidative stress has been implicated in the etiology of a large number (>100) of human diseases as well as the process of ageing. Various antioxidants may prevent and/or improve diseased status (Thomas and Kalyanaraman, 1997; Yoshikawa et al., 2000). These include the intracellular antioxidant enzymes and the dietary or oral supplements in the form of vitamin C, vitamin E, β-carotene, zinc and selenium (Knight, 2000; de La Fuente and Victor, 2000). Antioxidants also can act at different levels of protection such as prevention, interception and repair. Mounting experimental evidence suggest that antioxidants present in food act as chemopreventive agents independent of their ability to scavenge ROS. Many of them interfere with signal transduction regulation at different levels: modulate hormones/ growth factor activities, inhibit oncogenes and activate tumour suppressor genes, induce terminal differentiation, activate apoptosis, restore immunoresponse, inhibit angiogenesis, decrease inflammation. Plant polyphenolic antioxidants represent one of the major classes of dietary components characterized by a double function: antioxidant and regulators detoxifying enzymes (e.g., GST, NADPH: quinone oxidoreductase and hemeoxygenase). Although evidence shows that antioxidant treatment results in cytoprotection, the potential clinical benefit deriving from both nutritional and supplemental antioxidants is still under wide debate.

Presently, Ethno pharmacology is an interdisciplinary area of research that deals with the identification, description, observation and investigation of ingredients used in various recipes of traditional medicine and their effects on animal models. It is also the
study of the relevant forms of knowledge, practice and cultures implementing them. The role of natural products, herbal medicine, tribal and traditional medicines is being increasingly appreciated in recent years for the prevention and cure of human ailments. Our country has a long tradition of using herbal products for healthcare. There is an increasing awareness of the significance of ethnic and traditional knowledge in the development of therapeutics. In the current scenario of globalization, information technology and knowledge system on traditional medicine have significant importance. Many herbs have been scientifically proven to possess general pharmacological properties. Phytochemical studies on such plants show the presence of a plethora of chemical compounds. Some of these compounds show beneficial properties individually and some in combination with other compounds when treated in suitable animal models. The ongoing research in biotechnology indicates the importance of herbal medicine. Several laboratories are involved in the screening and evaluation of medicinal plant to develop new herbal drugs both in India and abroad. There are extensive scientific reports available on these areas in many species of plants. However, there still a large number of plants species which have been untouched for such investigation. Plant genus *Clerodendrum* (Family: Verbenaceae) comprises several species, among them only a few have been explored substantially for their medicinal properties using approved pharmacological parameters. Most of the other species have remained scientifically untouched despite they have been reported to possess some curative abilities in traditional medicine. In view of the available reports on the phytochemical screening and pharmacological evaluation of few species of the genus *clerodendrum*, the present investigation has been carried out in *Clerodendrum infortunatum* L.

The plant *Clerodendrum infortunatum* L. has been chosen with a presumption that it may also possess medicinal and other beneficial properties. The available literature revealed that, the plant as a whole and many parts of it find applications for the treatment of tumours and certain skin diseases. Fresh fruit juice is used to remove ascrids in traditional medicine (Kirtikar and Basu, 1991; Chopra *et al.*, 1956; Prajapati and Kumar 2005). In Ayurveda system of medicine, bark is used for diabetes (Yoganarasimhan, 1996). Furthermore, this plant is growing abundantly in the surroundings of Shimoga district, which comes under the jurisdiction of Kuvempu University. Kuvempu University
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Campus is situated in the heart of Malnad region, and a part of Bhadra Reservoir Project (BRP) has enormous source of medicinal plants. More than 50% of the flora in this region may be useful to humans for the treatment of simple and complex diseases starting from simple cold and cough to very complicated diseases like cancer and AIDS. *Clerodendrum infortunatum* L. is abundant in the fields, which are uncultivated for many years.

The available reports suggest that no systematic approach has been employed to evaluate the, antioxidant, hepatoprotective, wound healing, anti-tumour and antimutagenic activities of this plant. Therefore it is imperative to fill the lacunae and scientifically check the traditional reports, the present investigations have been undertaken to screen and characterize phytochemical constituents and evaluate their general pharmacological activities along with anti-tumour abilities in suitable animal models. The following objectives have been framed to carry out investigations.

**Objectives of the Research Work**

1. To sequentially extract the crude mixture of compounds from roots and leaves using different solvents
2. To conduct pilot experiments for the evaluation of some of the pharmacological properties using the crude extracts.
3. To carry out qualitative analysis of phytochemical groups from the extracts.
4. To isolate, characterize and identify the chemical constituents from the active extracts by using appropriate analytical and spectroscopic analysis such as: UV, IR, $^1$HNMR, $^{13}$C-NMR and Mass spectrographic studies.
5. To evaluate the pharmacological properties of the characterized chemical constituents in animal models employing antioxidant, hepatoprotective and wound healing parameters in animal models.
6. To evaluate the anti-tumour and antimutagenic ability of the chemical constituents in animal models.