

### **1.1. Medicinal plants in prevention and treatment of diseases**

The life of an individual is concerned with 'health'. The idea of ill-health disturbs the rhythm of life and the performance capabilities of the individual being. After the basic need for survival is met i.e., food, cloth, and shelter, the human community feels the need for medicine to prevent diseases and illness and lead a healthy life. All human groups, no matter how small or technologically primitive, have always been devising ways and means for taking care of health because health is a property and illness is a state. Health and illness have close linkages with therapeutic and preventive practices, which have shown variations throughout the ages. Human beings over the ages have used the plants in their surroundings to treat and prevent different diseases they suffer from. They have acquired the experience to use herbal medicine against different diseases through their continuous usage and observations regarding the diseases, their symptoms, and the particular herbal drugs to cure them. At present, a major part of the world's population depends upon the traditional system of medicine. So, it is important to protect and preserve the traditional knowledge for health care of people and this can be achieved only by recording ethnobotanical knowledge scientifically (Dutta and Dutta, 2005).

In developing countries, there is an increasing attempt to incorporate traditional medicines, especially herbal preparations, into the local health care systems. Many modern researchers are involved to explore the huge potential of ethnobotanical knowledge for treating various diseases (Dutta and Dutta, 2005; Jain et al., 2010; Jeyaprakash et al., 2011). However, the ethnomedicinal plants are under threat due to deforestation, overgrazing, and their reckless utilization. This indicates the urgent need for their conservation. Conservation of biological resources as well as their sustainable use is important in the preservation of traditional knowledge (Payyappallimana and Fadeeva, 2013).

## **1.2. Heritage of natural remedies in India**

India is known for its rich heritage of knowledge of natural products, particularly herbal medicine. Indian people have been using medicinal plants from prehistoric periods (Singh and Lahiri, 2010). Tribals, living mostly in remote forest areas, still depend on the indigenous system of medication to a great extent. Indigenous healing practices have been culturally accepted during all phases of human civilization and environmental evolution. About 85% of traditional medicines are plant- derived (Fransworth, 1988). Medicinal plants have a long-standing history in many indigenous communities and are an integral part of treating various diseases, particularly to cure daily ailments; and this practice of traditional medicine is based on hundreds of years of belief and observations. With enormously diversified ethnic groups and rich biological resources, India represents one of the great emporia of ethnobotanical wealth (Kala, 2005).

## **1.3. Phytopharmacological studies in today's world**

Today, medicinal plants have considerably high importance in international trade; and their therapeutic, pharmaceutical and economic values are increasing day by day. It is evident, that natural resources will continue to play an important role as a health aid. Research on medicinal plants is based on their phytopharmacological studies because validation of medicinal plants and evolution of the active constituents in them are revealed by phytochemical analysis. So, for pharmacological research, drug development, or industrialized investigation on complementary or alternative medicinal invention, phytochemical studies are the basic steps (Ali et al., 2008). Phytochemical analysis shows that mainly the secondary metabolites of medicinal plants confer therapeutic properties in them, and so intake of vegetables and plants as food or therapy may offer protection from different health hazards. For example, oxidative stress or imbalanced production of superoxides or free radicals causes tissue damage, biodegradation of membrane lipid, protein, or DNA, giving rise to early aging, diseases, or health hazards. But intake of

natural antioxidants, present in fruits, green leafy vegetables, and green tea may delay or reduce the decay. Studies show that the antioxidant property of plant and phenolic content has established a co-relation (Govindarajan et al., 2005). Moreover, evidence suggested that medicinal plants have microbicidal effects too. Virus, bacteria, parasites, or fungus-infected diseases are long being treated by plant extracts by indigenous people of countries of Asia, Europe, or other continents. Ancient documentation has revealed information about plants with active effects on microbes. More advanced studies may explore some new lines of treatment against such dangerous microbes which are emerging as threats to mankind, such as the parasite-infected disease leishmaniasis (Govindarajan et al., 2005).

#### **1.4. Prospect of natural remedies in treatment of leishmaniasis and opportunistic fungal infections**

Leishmaniasis is responsible for the second-highest number of deaths due to parasitic infection globally and is overwhelmingly associated with poverty. It has an estimated prevalence of 12 million humans infected and causes a burden estimated at 2,357,000 disability-adjusted life years (WHO, 2009). Visceral leishmaniasis (VL) is almost always fatal if not treated, and morbidity caused by cutaneous leishmaniasis (CL) is also important. Treatments for all forms of leishmaniasis are few, toxic, and/or expensive; and furthermore, drug resistance is on the rise (Croft et al., 2006). There is no vaccine available for the disease, and the medications of the first choice - the pentavalent antimonials - are toxic and administered exclusively by the parenteral route (Rocha et al., 2005; Kumar et al., 2009; Joshi et al., 2006). Moreover, resistance to these medications has been reported - which is increasing for all forms of leishmaniasis, especially in areas endemic to such threats to human health (Brendle et al., 2002). Leishmaniasis emerged as a threat to mankind when studies revealed that AIDS and VL work in a vicious cycle of mutual reinforcement (Fuzibet et al., 1988; Lindoso et al., 2009). Though the parasite is sensitive to humoral defence mechanisms, its intracellular habitat offers almost complete protection. Only if the macrophages are activated, the

parasite may be killed and degraded by the host cell (Olliaro et al., 1993; Ram et al., 1992; Braconier and Miomer, 1993; Badirzadeh et al., 2020). Moreover, opportunistic fungal infections, mainly caused by the species of *Candida*, *Cryptococcus*, and *Aspergillus*, are life-threatening in immuno-compromised patients (with AIDS, cancer, visceral leishmaniasis, or organ transplant) (Badiee et al., 2014). Macrophage activation and destruction of the intracellular parasite may be a potent mode of therapy against microbial infections like leishmaniasis and related co-infections. Laboratory experiments showing immunomodulatory activities in many plant extracts (Khoshzaban et al., 2011) attract the attention of researchers to test the natural resources for their microbicidal effects which are nontoxic, less costly, and more effective.

### 1.5. Objective

The present work aims to explore the indigenous knowledge of our rich culture and community and use the natural resources to fight against infectious microbial agents, stress and hazards caused by adverse environmental conditions of present time. The focus is also on search of active novel molecules and their mode of action to offer a new dimension to the modern science of pharmacology, drug designing and therapeutic approach. So, the basic objectives of the present study are -

1. Ethno-botanical studies on plant species used as antileishmanial and antifungal agents among tribal population of North Bengal.
2. *In vitro* screening of potential plant preparations for antileishmanial and antifungal activities.
3. Purification and characterization of bioactive molecules from plant extracts.
4. Evaluation of plant extract under *in vivo* condition in suitable animal model.
5. Study the immunomodulatory role and possible side effects, if any, of the purified substance.