1.1. Introduction

Medicinal plants as a source of medicine have been associated with mankind from prehistoric times. Plant based medicinal treatment of various diseases is regarded as one of the most primitive form of the health care system. In many of the developing countries, especially in rural areas, traditional remedies still continues to be a primary source of medicine. Even in developed countries, medicinal plant extracts are used as a raw materials for manufacturing essential drugs. The popularity of herbal medicines is connected with their easy access, therapeutic efficiency, relatively low cost and the assumption for absence of toxic side effects. According to the World Health Organization (WHO) nearly 80% of the world’s population are dependent on traditional medicines for primary health care need, most of which are plant extracts (Farnsworth et al., 1985).

There are approximately 4,22,000 flowering plant species identified so far and about 70,000 plants are used worldwide for the medicinal purpose (Schippmann et al., 2006) and less than about 0.5% of these have been chemically investigated (Comer and Debus, 1996). About 7800 higher plant species have been used currently by the industries for large scale production of herbal products (Ramakrishnappa, 2002). Plants represent the principal means of therapy in traditional medicine. The chemical constituents in medicinal plants usually explain the rationale for the use of the plants in traditional medicine. The phytochemists exploit medicinal plants and isolate bioactive compounds from which different analogues are synthesized with the aim of obtaining agents with better actions or even different biological properties. The active constituents seen in plants thus serve as templates for drug developments. The ethnobotany and ubiquitous plants provide a rich resource for natural drug research and development. Collection of information from ethnic group or indigenous people and
preparation of data bank is the primary need but to make a successful use of it, these information should be subjected to biological screening to verify the authenticity of the report on which further steps for newer drugs discovery depend. Moreover, since the isolation of active compound is guided by ethnobotany i.e. the plant source has been in use by mankind since time immemorial, it is quite unlikely for the compound to be toxic. The system of medicine practised by the primitive “Folk healers”, Medicine men”, and “old villagers”, has been called as the “Folklore medicine” or “Traditional medicine”. Since ancient times, traditional medicine has its own views as per as the causation of disease and its own diagnostic tools is concerned. They usually comes from persons who have had no official training or apprenticeship in a recognised system of medicine. In villages “Folk healers” or “Vaidayas” are said to have knowledge of such plants which are used in treatment of different diseases. Such a vast resource of knowledge of natural product uses from medicinal plants is a result of numerous experimentation by mankind through trial and error for centuries often resulting in palatability trials or untimely deaths, searching for available foods for the treatment of diseases (Kinghorn et al., 2011). In recent times, focus on the use of traditional medicine knowledge on plant research has again generated considerable interest among the researchers worldwide. Plant extracts or their bioactive compound forms a major part of using plants as medicines.

1.2. History of world medicinal plants

Traditional knowledge of plant as a source of medicine has been an integral part in the development of human civilization since time immemorial. A large number of medicinal plants have been used for treatment of a wide variety of diseases owing to its high medicinal value. The evidences of such early association of natural plant products with disease can be traced back to 60000 years ago in the grave of a Neanderthal man
buried during that period. The medicinal value of numerous plants buried with the corpse were ascertained by the pollen analysis. The earliest documentation of natural products have been described on a 4000-year-old Sumerian clay tablet that recorded plant remedies for numerous illnesses. By the time of the ancient Egyptian civilization, a great wealth of information was thought to be already existing on medicinal plants such as garlic for the treatment of heart and circulatory disorders and mandrake for pain relief. This information, along with hundreds of other remedies, have been preserved in the Ebers papyrus since a period of about 3500 years ago. Western medicine can be traced back to the Greek physician Hippocrates (460-377 BC), popularly known as the ‘Father of Medicine’. Hippocrates believed that a disease had a natural cause and he used various herbal formulations in his treatments. Early Roman writing also influenced the development of Western medicine, chief being the works of Dioscorides (1st century AD). Although being Greek by birth, Dioscorides was a Roman military physician whose prolonged travels with the army brought him in contact with many useful plants and its medicinal potential. He compiled his findings in De Materia Medica, which contained an account of over 600 species of plants with medicinal value. De Materia Medica, is a pharmaceutical record was written dated from 1100 B.C in China explaining the practices of about 1,094 medicinal plants in the treatment of various diseases. The monasteries in England, Ireland, France and Germany preserved this Western knowledge during the Dark and Middle Ages whilst the Arabs preserved the Greco-Roman knowledge and expanded the uses of their own resources, together with Chinese and Indian herbs that were unfamiliar to the Greco-Roman world (Kong, 2003; Cragg et al., 1997).
1.3. History of Indian System of medicine

The traditional systems of medicine are normally found in the countries having long history and culture. Mankind became more and more health conscious with gradual development and progress. People started exploring newer health care options for better quality of life.

Among the early and ancient civilizations in the world, India has been known to be a rich heritage of traditional medicines and herbal plants. The country is enriched with flora and therefore, herbal remedies have been used since ancient time for the treatment of human ailments. In India, Aryans of Indus valley wrote the three treaties viz. Rig-Veda (2000 B.C.), Atharvaveda (2000-1000 B.C.) and Ayurveda (1000-600 B.C.) which accounted for several medicinal plant and their uses. It has various indigenous medicine system such as Ayurveda, Siddha and Unani, reporting about 7,500 plant species. Among the indigenous medicine systems, Ayurveda is the most developed and widely practiced in India.

After the Vedas, there was no significant information on the development of this science in India for a period of about 1000 years (Jain, 1985). Then came the two most important work on Indian systems of medicine, the works of Charak and Susruta viz. the “Charak-Samhita” (1000-800 B.C.) and Susruta-Samhita” (800-700 B.C.). The Charaka Samhita recorded the practice of about 1100 species and Susruta-Samhita described about 1270 species of medicinal plants in the Ayurvedic system of medicine. With the passing of time, more and more plants found entry into native medicine, taking the number of Indian medicinal herbs to about 2000. Later during the Buddhist period, considerable progress was made progress and medicinal plants were cultivated under the direction of highly qualified specialists such as Bhikshu Atreya, Patanjali,
Nagarjun, Madhavaskar, Chakradatta, Sarangadhar, Sankara and Bangasen (500-100 B.C.), who expanded the vegetable *material-medica* of the Hindus. Contacts with Greece and Rome, and later with Arabia and Persia, contributed to the enrichment of the Indian *Materia Medica* and large number of vegetable and other products came into use for treatment of disease (Chopra et al., 1956).

**1.4. Medicinal plants wealth of India**

India is one of the largest reservoirs of medicinal plants and considered as richest countries in the world with regards to genetic resources of medicinal plants having all the three elements that contribute to the richness of an area – floristic diversity, ethnic diversity, and rich tradition. India has a great variety of climatic and physiographical condition: from cold, arid inner valleys in the far northern Himalaya to the warm and humid Western Ghats; from hot, dried areas of western Rajasthan to the wettest spot in the world (Cherrapunji) in the east; from the lofty Himalayas and the Gangetic plains in the north, across the plateau in the Peninsular region to the long coastline and the island (Jain, 1994). India is recognized as one of the 34 mega diversity countries in the world. The two “Biodiversity Rich Hotspots” are the Western Ghats and the Indo-Burmese region which include Assam and all the North-Eastern State. Because of the unique biogeographic position of India, the country is rich in all the three levels of biodiversity such as species diversity, genetic diversity and habitat diversity (Krishnaraju et al., 2005). Approximately 3000 plant species have been officially recognized in India for their medicinal properties. In this country, the total number of 45,000 species of plants, including about 15,000 species flowering plants have been reported. Of these, approximately 7,500 species, representing over 1,000 genera and 250 families, have been used in traditional medicine (Dubey et al., 2004) and about 90 % of medicinal plants provide for herbal pharmaceutical, which is
collected from the wild habitat. The snakeroot, *Rauwolfia serpentina* is one of the most useful plants in Indian herbal medicine for its sedative effects. Today the active components in snakeroot are widely used in Western medicine for treatment of high blood pressure.

1.5. Phytochemicals and medicinal values of plants

Phytochemicals are defined as non-nutritive bioactive plant chemicals found in fruits, vegetables, grains and other plants parts having therapeutic properties, protective or disease preventive properties and are considered to reduce the risk of chronic diseases (Balandrin *et al.*, 1985). Most of the bioactive substances are secondary metabolites, which provide definite physiological action on the human body (Krishnaraju *et al.*, 2005) and these substances include tannins, alkaloids, terpenoids, steroids, flavonoids and phenolic compounds.

Synthesis of secondary metabolites occurs by the following pathways (Heldt, 2005):

1) The shikimic acid pathway- alkaloids, phenols, flavonoids, tannins, lignins, coumarins and many aromatics.

2) The acetate malonate pathway- phospholipids, glycolipids, glycerides, waxes and fatty acids and

3) The acetate mevalonate pathway- sesquiterpenes and sterols.

These secondary metabolites are generally not essential for the growth, development or reproduction of an organism and are produced either as a result of the organism adapting to its surrounding environment or are produced to serve as a plant defence mechanism against predation by microorganisms, insects, and herbivores (Dias *et al.*, 2012). Out of the various bioactive compounds only about 12,000 secondary
metabolites have been isolated which are less than 10% of the total available natural resource (Lai, 2004). The bioactive compound may be effective in combating or preventing disease due to their antioxidant effect (Halliwell et al., 1992). The most important bioactive constituents induce different biological activities including antioxidant, anti-inflammatory, antimicrobial, antibiotic, hormonal and insecticidal properties. The knowledge associated with traditional medicine (complementary or alternative herbal products) has prompted further investigations of medicinal plants as potential medicines and has led to the isolation of many natural products that have become well-known pharmaceuticals. For example, morphine (1) is the first medically useful compound isolated from *Papaver somniferum* L. (opium poppy) by Friedrich Wilhelm Sertturner about 200 years ago (Hartmann, 2007). The anti-malarial drug quinine (2) was isolated from the bark of *Cinchona succirubra* Pav. Ex Klotsch, used for centuries for the treatment of malaria, fever, indigestion, mouth and throat diseases and cancer. The most widely used breast cancer drugs are Paclitaxel (Taxol) (3) isolated from the bark of *Taxus brevifolia* (Dias et al., 2012).
A Search of antimicrobial and antioxidant is highly demanded in the present day situation. Antioxidant phytochemical has gained enough thrust due to the free radical imbalance in the metabolic system due to different endogenous and exogenous factors appeared, leading to the generation of disease and disease complexity.

1.6. Antimicrobials agent

Infectious diseases, (also known as communicable diseases, transmissible diseases or contagious diseases) comprise clinically evident illness resulting from the infection, presence, and growth of pathogenic biological agents in an individual host organism. Infectious diseases caused by various microorganism are still a major risk to public health. Transmission of pathogen can occur in different ways including physical contact, body fluids, contaminated food, through vector organisms or airborne inhalation (Ryan and Ray, 2004). World’s leading cause of premature deaths is a result of infectious diseases, killing almost 50,000 people every day (Ahmad and Beg, 2001). Bacteria have remarkable ability to develop resistance to most of the pharmaceutical antibiotics. An increase in such antibiotic resistant bacteria is menacing human population with the recurrence of infectious diseases that were once thought to be under control, at least in developed countries (Pinner et al., 1996).
In recent years, antimicrobial drug resistance is a global concern as they resistant microorganism cause many health problems throughout the world because of their genetic plasticity (Blodeau, 1999). Antimicrobial resistance has been reported for the most predominant pathogenic microorganisms like *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *klebsiella pneumoniae*, *Candida albicans*, *Cryptococcus neoformans* (Okeke *et al*., 2005; Syed *et al*., 2010; Khan *et al*., 2014). Many disease cannot cured by the antibiotic. These synthetic drugs/antibiotics also have side effects on human such as allergic reactions, depletion of beneficial gut and mucosal microorganism hypersensitivity, and immunosuppression (Lopez *et al*., 2001). Natural products from both microbial and plants sources (either as pure or crude extracts) are used in pharmaceutical preparations.

Antimicrobial agents are chemicals that kill or inhibit the growth of microorganisms and are used to treat various microbial infections. While some are produced naturally by microbes, many are synthetic in nature. They include antibiotics, antivirals, antifungals and other natural plant bioactive compounds such as phenolics or their oxygen-substituted derivatives. The limitless ability of plants to synthesize chemicals substances act as plant defence mechanisms against predation by various microorganisms, insects, and herbivores. Some, such as terpenoids, give plants their respective odours; others (quinones and tannins) are responsible for plant pigmentation.

Long before mankind discovered the existence of microbes, the fact that certain plants have therapeutic potential was a well-accepted fact. Mankind has been using medicinal plants as renowned natural sources for the treatment of various infectious diseases since time immemorial. Some of these traditional medicines are still included as part of the habitual treatment of various maladies in present time. Plants are produced
many chemical compounds such as phenol, alkaloids, and terpenoids, to protect themselves from the microbial infection. These natural product compounds are the promising sources in the search for new biologically active antimicrobial compounds. The plant product antimicrobial compounds can destroy/inhibit the microbial growth by diverse mechanisms than those synthetic antibiotics and are cheap, safe, and have lesser side effects. These drugs may have significant clinical value for the treatment of resistant microbial (Iwu et al., 1999).

Well-known examples of plant-derived medicines include quinine (from *Chincona* species), morphine and codeine (from *Opium* species), colchicines (from *Colchicum autumnale*), atropine (from the Solanaceae family), reserpine (from *Rauwolfia serpentine*), saliein (from *Salix alba*) and digoxin (from *Digitalis purpurea*) (Dewick, 2002; Simpson and Ogorzaly, 2001; Van Wyk and Wink, 2004).

### 1.7. Antioxidant agent

Free radicals are electrically charged atoms, molecules, or ions which contain unpaired electrons that are highly unstable and active towards chemical reactions with other molecules (Patil et al. 2003). They are derived mainly from three elements: oxygen, nitrogen, and sulphur, thus creating reactive oxygen species (ROS), reactive nitrogen species (RNS) and reactive sulphur species (RSS). Different living organisms produce different kinds of reactive oxygen species (ROS), such as superoxide radicals (O$_2^-$), hydrogen peroxide (H$_2$O$_2$) and hydroxyl radicals (OH$^-$), singlet oxygen, nitric oxide radical, hypochlorite radical, and various lipid peroxides that are generated constantly and spontaneously inside all enzymatically active structures such as lysosome, mitochondria, peroxisomes etc. inside the all metabolically active cells; and also due to exposure to sunlight (Ultra Violet rays), pollutants in the ambient
environment, smoking, stress, drugs, alcohol, exercise and viral infections (Halliwell, 1996). The human body also has an effective enzymatically defence system to counter the damaging effect of reactive oxygen species (ROS) but works well up to a point. However, when the production of free radicals exceeds due to various environmental and human induced factors as mentioned above, that are common in modern lifestyles, the natural defence system fails to successfully neutralize them all. ROS are continuously produced in the body which are potentially very toxic to cells creating oxidative stress that may lead to aging and can also cause significant damage to the cell membrane and DNA by inducing oxidation leading to membrane lipid peroxidation, decreased membrane fluidity, and DNA mutations. Oxidative damage to biological molecules, especially to DNA, lipids, and protein inside the cell is believed to be the primary factor for the creation of various disease manifestations in humans. Direct damage to chromosomes and DNA can cause a mutation which if unregulated may lead to the development of cancers. Endothelial damage inside the vessels can cause atherosclerosis, vascular blockade, loss of vessel integrity, bleeding, etc, and various other cardiovascular diseases. Free radicals have also been attributed for cataracts, Alzheimer's disease, neurodegenerative diseases, kidney tubular dysfunction, connective tissue diseases, age-related eye disease, etc. (Aruoma, 1998; Pulido et al. 2000).

Antioxidants are a molecule which can delay or prevent the oxidation of other molecules by inhibiting the initiation or propagation of oxidizing chain reactions. They have the capability to defend the human body from oxidative damage by scavenging the free radicals and inhibiting peroxidation and other radical mediated processes (Asiedu-Gyekye et al., 2012). Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions by being
oxidized themselves. Phenolic components such as flavonoids (Pietta, 1998) and phenolic acids (Shahidi et al., 1992) are responsible for antioxidative effect by chelating metal ions, improve endogenous antioxidant system and prevent radical formation (Al-Azzawie and Mohamed-Saiel, 2006).

Antioxidants, especially derived from natural product (medicinal plants) has been growing interests in research, dietary, cosmetic and pharmaceutical areas (Suhaj, 2006), nutraceutical and functional foods (Espin et al., 2007) which are much safer and cheap as compared to synthetic antioxidant additives like, BHA, BHT and propyl gallate which are carcinogenic (Tadhani et al., 2007). Phenolic compounds are possibly the major group of phytochemicals with proven antioxidant properties which are usually found in both edible and non-edible plants. Although phenolic compounds do not have any nutritional function, they have become the focus of current therapeutic interest largely due to their disease preventing and health promoting effects. The antioxidant activity of dietary polyphenolics is raising interest among scientists, food manufacturers, and consumers because of their beneficial health effect (Parr and Bolwell, 2000).

1.8. Statement of Problem and Hypothesis

The Assam, one of the North Eastern state of India is a region of many culture and tradition, races, an ethnic tapestry of many hues and shades. The folk culture is still vital in this region. The Mising are the one of the major ethnic tribe of Assam. Most of the Mising people are still dependent on traditional knowledge pertaining to the use of natural resources as medicines for community welfare. Because of their scattered and far flung settlements, and problems arising due to transportation and communication, traditional medicine has remained as the most affordable and easily accessible source
of treatment. For their livelihood these people are totally dependent on the forest & its resources. They perform number of religious practices in their life. The practices are comprised of various rites and rituals with prayer, offerings & sacrifices. Many plants used by them in ritual purposes have medicinal properties. There is a numbers of report have been found on documentation of the medicinal plants. However less phytochemicals investigation were reported on the Mising traditional medicinal plants. The bioactivity investigation can may lead to isolation of new compound which may have therapeutic and pharmacological properties.

1.9. Objectives

The present programme of study is designed with following objectives.

1. Documentation of the medicinal plants used by Mising tribe of Assam.
2. To select plant based on their ethnomedicinal uses and information on antimicrobial application.
3. Screening and validation of the potential medicinal plants for antimicrobial and antioxidant activity
4. To study the active chemical constituents of few selected medicinal plant species.
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