CHAPTER-1

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Plant human interactions has been in existence since antiquity but recognition of such relationship as a distinct field of study was realized only in 1895 with the introduction of the term “Ethnobotany” by Dr John Harshberger from University of Pennsylvania. In his address to the University Archaeological Association, Pennsylvannia he used the word “Ethnobotany” to describe the study of plants used by aboriginal people (Harshberger, 1896). Since then the scope of the subject has expanded tremendously and today ethnobotany is related with almost all field of studies. Richard Evans Schultes, often referred to as the "father of ethnobotany", also defined simply ethnobotany as investigating plants used by societies in various parts of the world. Dr. Sudhansu Kumar Jain known as “father of Indian ethnobotany” defined ethnobotany as the study of the direct relationship between plants and man. Spiritual relationship of man with his environment is also studied under the broad realm of ethnobotany. The Rig Veda written between 4500 and 1600 BC is probably the oldest record where some information on plant based medicine was documented. Other ancient literatures worth mentioning include the Atharba Veda, Sursuta Samhita and Saraka Samhita which includes some remarkable scientific information on plant based medicine and pharmaceuticals and their usage as therapeutic agents. Since ancient times, ethnic communities have relied heavily on native flora for medicine and other necessities of daily living (Thakur, 2015; Abu-Rabia, 2005). As a result, human dependence on plants is an age-old relationship that is referred to as "ethnobotany." Ethnobotany is derived from the term ethnology which means the study of culture and is a scientific study of plants and human relationships that demonstrates plants as a fundamental source of need. Ethnobotany is concerned with a variety of topics one of which is the study and use of ethnomedicine.

1.1. CONCEPT OF ETHNOMEDICINE

Ethnomedicine is the study of indigenous beliefs, thoughts, knowledge and practices among tribal and rural ethnic groups in order to prevent, cure and treat diseases. Various tribes have historically employed herbs as ethnomedicine in various places including India (Ekor, 2014). Ethnomedicine is the study of traditional medicine with an emphasis on how different cultures perceive health, illness and disease as well as how individuals receive healthcare and participate in healing rituals (Krippner and Staples, 2003). There has been a tremendous growth in both research interest and activity in the field of ethnomedicine during the last ten years. According to World Health Organisation (WHO) data, ethnomedicine has remained popular throughout the developing world and is rapidly expanding in industrialized nations (WHO, 2003). The importance of ethnomedicine in the treatment of many human ailments is widely acknowledged among ethnic groups. They have a strong faith in traditional medicine and rely only on their own herbal medicines (Majumdher *et al.,* 1978). The World Health Organisation reports that the majority of rural people in underdeveloped countries rely on ethnomedicinal plants to meet their fundamental medical needs (WHO, 2000). The use of ethnomedicinal plants has proved crucial in treating a number of disorders related to physical and psychological health among rural people. A number of essential modern medications have been identified from medicinal plants since the beginning of ethnobotany and documentation of traditional medical knowledge through plants (Flaster, 1996; Cox, 2000). Ethnomedicinal research is important for the discovery of novel crude medicines derived from indigenous medicinal herbs. Currently, roughly 25% of medications in an international pharmacopoeia are plant derived, and many others are synthetic analogues based on lead structure molecules isolated from plants (WHO, 2002). The revival of interest in traditional health practices around the world has redirected scientists' attention to ethnomedicine and the application of herbal treatments in the current situation. Vinblastine and Vincristine from *Catharanthus roseus* (the periwinkle) used for treating acute lymphoma, acute leukaemias, reserpine from *Rauwolfia serpentina* (Indian snake root) used for treating hypertension, aspirin from *Salix purpurea*

(willow) used for treating inflammation, pain and thrombosis and quinine from *Cinchona pubescens* (cinchona) used for treating malaria are some notable medicinal drugs that have been developed from the ethno medicines.

1.2. INDIGENOUS KNOWLEDGE AND SCIENTIFIC METHODS

In the developed field of research in medicinal plant, information gathered through ad hoc bio-prospecting or from indigenous knowledge holders, have contributed in recognizing useful medicinal plants and their associated phytochemicals (Artuso, 2002). In disparity, the specific expertise owned by indigenous knowledge holders has served as the initial spur to carry out further research for the progress in medicinal plants research. Communities who at a standstill retain this ancient traditional knowledge have done, and has continued to do so through techniques as oral traditions of passing secret information from generation to generations. This body of information wedged within the group of local indigenous people is known, by some variations, as aboriginal, traditional, local knowledge or indigenous knowledge. Generally, this type of knowledge is witnessed as separate from the body of information created through scientific methods. Scientific knowledge is generated through a rigid process of setting hypotheses and testing through experimentation and observation (Snively and Corsiglia 2000). The results and generated theory are validated through thorough peer review process. Such kind of scientific knowledge is in general disseminated through proper written documents by means of books and journals by schools and universities (Machlup and Leeson, 1978). Whereas in contrast, indigenous, traditional or local knowledge is obtained through informal or improper learning processes (Reyes-Garcia *et al.*, 2010). But it would be wrong to assume that since a particular body of indigenous or traditional knowledge was developed in a particular area it may only be appropriate to that scenario (Agrawal, 1995). Indigenous testing as opposed to the scientific methodology have, until recent times been seen as discrete and challenging job to combine (Stevenson, 1996). Belatedly, however, some authors Agrawal (2008) and Becker and Ghimire (2003) have articulated eloquently that the Indigenous testing and the scientific methodology share many commonalities and need to be combined to meet up common

challenges. The results thus become useful bodies of knowledge generation. Finding solutions to challenges should as a result draw on all kind of knowledge.

In all segments of developing world, it is seen that the rural communities are reliant to a greater degree on locally produced natural resources (Twine *et al.*, 2003) and an emerging body of scientific literature gives support to the notion that traditional indigenous knowledge is significant and often crucial for the marginalized communities (Byers, 1996 and Usher, 2000). Not necessarily, indigenous knowledge should be called 'old' knowledge, but this is a means of acquired knowledge that are unique to each indigenous tradition (Stevenson, 1996). For rural people who do not have proper access to formal education or have been forced to leave school at an early age, indigenous knowledge plays a proportionately larger role.

Indigenous knowledge and scientific knowledge combine to inform actions. This research homes in on the central area of scientific knowledge generation all the way, through indigenous knowledge practitioners and application of scientific methodology.

1.3. ROLE OF ETHNOMEDICINE IN THE WORLD

Ethnomedicine has been widely practiced in many historical cultures from Indian Ayurveda to Traditional Chinese Medicine (TCM) of China, from Muti of Africa to Unani medicine of Mughal India. According to data released by the World Health Organization (WHO), ethnomedicine has maintained its popularity in all regions of the developing world and its use is rapidly expanding in the industrialized countries with traditional herbal preparation accounting for 30-50% of total medicinal consumption in China. Herbal medication is the first-line treatment for 60% of children with malaria in Ghana, Mali, Nigeria and Zambia. 70% of people living with AIDS/HIV in San Francisco, London and South Africa use traditional medicine. Between 3000 and 2730 BC, the ancient Chinese utilized Hydnocarpus species for the treatment of leprosy. The discovery of opium poppy and castor bean in Egyptian tombs proved that phytomedicine was used in Africa as early as 1500 BC. The use of medicinal herbs and their cultivation is also mentioned in the Old Testament. Ayurveda, India's oldest surviving medical system dating

back to around 5000 BC, on the other hand employs around 750 plants such as Aconitum, Clitoria, Cosinium, Shorea and many others. Ayurveda is the basic tenant of Ayur Bijnan (Science of Life) not just the judicious use of medicinal plants. Its purpose is to keep the human body and mind in harmony with all the elements of the universe which can aid in the management of lifestyle or microbial diseases such as viral fever, meningitis, genital lesions, amoebiasis, leishmaniasis, high blood pressure, asthma, diabetes and even cancer (Jiang *et al.*, 2013). Ancient Chinese Traditional Medicine (CTM), like Ayurveda and African Traditional Medicine is based on harmony or balance between the body and soul, as well as the usage of herbs. Herbs, as well as other practices such as acupuncture, tai-chi, and ai-gong, are used by traditional Chinese healers to treat and/or prevent disease. Acupuncture is the stimulation of specific nerve sites on the body, whereas tai-chi and ai-gong are gentle dance-like bodily motions accompanied by mental attention, breathing, and relaxation. Yoga, recorded in the Rig Veda and practiced by the Indus-Sarasvati civilization in Northern India over 5000 years ago, functioned as mainstream medical practice to sustain health and lifespan. Chinese medicine, specifically CTM, has been shown to treat a variety of dermatological problems, coronary heart disease, hypertension, stroke, diabetes, atherosclerosis, and other conditions (Gong *et al.*, 2017). Traditional Korean medicine, Arabic medicine, Haitian folk medicine, Uyghur traditional medicine, Celtic medicine, Japanese Kampo medicine and many other schools of traditional medicine exist. The yearly global market for herbal medicine now exceeds U€60 billion. According to Sadeghi and Mahmood (2014), more than 50,000 plant species have been identified as having therapeutic significance around the world. Many countries have started scientific studies on medicinal plants because of their significance to health care.

1.4. ROLE OF ETHNOMEDICINE IN INDIA

Plants have been used for medicinal purposes and human nourishment in India since Vedic times. India is one of the world's 12 biodiversity hotspots, divided into 11 separate phyto-geographical zones, with about 45000 different plant species, yet traditional societies only employed 7000-7500 of them for medicinal purposes (Singh and Negi, 2019). Rig Veda and Atharveda were the

first to discuss plant medicine (Wani *et al.,* 2016). In India, more than 400 species and traditional medicines are used in the creation of Ayurvedic, Siddha and Unani medical systems, with around 25% of plants from temperate forests and 75% from tropical forests (Topwal and Uniyal, 2018). According to the Floral Statistics of India (BSI, Kolkata 2019), there are 2,68,600 flowering plants with 18,666 of them exist in India. Many Indian groups use 50% of plant species in ethnomedicine, tribal cultures use over 7500 species in primary health care and over 2000 species are used in Indian traditional systems of medicine.

Plants are used extensively in indigenous Indian medical systems. Every year the medicinal plant trade expands rapidly and while India's portion of the global market is small (approximately 0.5-1%), demand for these goods is expanding at an alarming rate (Singh *et al.,* 2003). Rural tribal people value ethnomedical knowledge which has been demonstrated to be useful in the treatment of various diseases and the creation of medications in India on occasion. For the treatment of many diseases, rural populations rely heavily on herbal resources. This culture is still practiced today in the form of folk medicine in various regions of the world and it has contributed to the formation of traditional medical systems. India has a wide range of traditional medical systems (http://indianmedicine.nic.in), and the majority of these systems rely heavily on plants (Prajapati *et al.,* 2003). Ayurveda, Homoeopathy, Siddha, Unani and Tibetan medical traditions have been claimed to use up to 8000 plants (Pandey *et al.,* 2013; Gairola *et al.,* 2014). According to Agarwal and Ghosh (1985), 75% of the 2000 medications used in human medicine in India are plant-based. Plant-based remedies are more easily available, less expensive and have greater community acceptance (Karunamoorthi and Tsehaye, 2012; Gumisiriza *et al.,* 2019), as well as less adverse effects than contemporary medicine (Karunamoorthi and Tsehaye, 2012; Rao *et al.,* 2015). As a result, 60-80% of India's rural population still relies on traditional medicinal systems (Gaur and Sharma, 2011; Pandey *et al.,* 2013).

Every tribal culture has a distinct method of using plants. This knowledge method is also used in other states with a large indigenous population. According to Lawal (2013), tribals also have ethno-medicinal knowledge

(ethnogynaecology) for female health difficulties and gynaecological problems such as menstrual pain, menopause, leucorrhoea, infertility, delivery, and abortion, among other things. Gonds, Kamars, Murias, Marias, Halbas, Saoras, Birhors, Baigas, and Binjhwars treat these ailments with flower, stems, roots, leaves, pulp, bark and other plant and herb parts.

1.5. ROLE OF ETHNOMEDICINE IN NORTH EAST INDIA

The North Eastern Region (NER) of India, rich with varied ethnic groupings and socio-cultural complexities, preserves the oldest and most diverse traditions linked with ethno-medicinal plant use. The existence and reliance on a significant number of traditional practices might be viewed as an alternative sort of medicine with minimal cost and adverse effects. The NER is one of the biodiversity hotspot regions and the states in this region have a lot of natural resources. The indigenous herbs of this region have been extensively employed by the native people for the treatment of numerous diseases since ancient times.

Because NER is one of the most ethnically and botanically varied regions on the earth, it is difficult to generalize about the use of medicinal herbs here. Since the 1970s, researchers have been studying the indigenous uses of plants in NER. Numerous plants with ethno-medical significance that can be used to treat a range of diseases have been identified in Northeast India (Das, 2008; Buragohain *et al.,* 2011; Chakraborty *et al.,* 2012). Traditional medicine is widely employed in India particularly in the rural northeastern (NE) region due to the availability of a diversity of vegetation and the socioeconomic situations of the local population (Ningombam and Singh, 2014). *Ageratum conyzoides* (flowers, leaves, roots, and whole plant) is used to treat throat pain, helminth infections, arthritis, fever, malaria treatment, diarrhea and liver disease is one of the most widely cited species in surveys (Choudhury *et al.,* 2017). Studies have identified this plant as anticancer properties (Adebayo *et al.,* 2010). *Mimosa pudica* is a sensitive plant that is used to cure skin infections, helminths, urological disease, toothache and as a contraceptive. *Acorus calamus* rhizome (calamus or Vaca in Sanskrit) has been used to treat cough, cold, snake bite, asthma, rheumatic fever and haemorrhoids as reported by Choudhury *et al.* (2017). Despite its usage in NER traditional medicine and

Ayurveda (Khare, 2004), calamus is reported to be particularly anti carcinogenic and anti angiogenesis (Haghighi *et al.,* 2017). *Andrographis paniculata* has traditionally been used to treat stomach pain, malaria and jaundice. *Callicarpa arborea*, another plant frequently mentioned in ethnobotanical studies used to cure skin illness, leucorrhea and scorpion stings (Choudhury *et al.,* 2017). The Meithei Manipuri people use single plant species and multi-species mixtures to create herbal vapours for the treatment of 41 ailments. Diarrhoea, dysentery, throat soreness, headaches and fish bones caught in the throat are all treated with Rhododendron arboretum as mentioned by Choudhury *et al.* (2017).

Several workers in India's North Eastern area particularly Assam have also collected numerous ethnomedicinal data (Choudhury *et al.,* 2012). The ethnic groups in Assam are known for adopting ethnic customs to treat a wide range of fundamental healthcare issues and they have access to a wealth of traditional knowledge systems. The rural people of Assam also consume many herbs as nutritional diet viz. *Bacopa monnieri* (L.) Penn., *Centella asiatica* (L), *Dioscorea bulbifera* Linn., *Emblica officinalis* Gaertn, *Eryngium foetidum* Linn., *Terminalia chebula* Retz., *Zanthoxylum alatum* Roxb., *Mentha spicata* Linn., *Ocimum sanctum* Linn., *Terminalia bellirica* (Gaertn.) Roxb., *Paederia foetida* Linn., *Euryale ferox* Salisb., *Solanum nigrum* Linn., *Piper longum* Linn., *Garcinia cowa* Roxb. Ex D.C.,*Garcinia morella* (Gaertn.) Desr., *Garcinia pedunculata* Roxb., *Dillenia indica* Linn., *Calamus rotang* Linn., *Parkia roxburghii* G. Don., *Alpiniaallughas* Rosc., *Clerodendrum glandulosum* Lindl., etc. (De, 2016). These traditional edible herbal plants are a gift from nature to mankind and can be used as nutritious supplements to a balanced diet as an alternative to staple foods in times of food constraint. In addition to providing a healthy diet, these plants are used as a traditional herbal medical base in rural areas to treat a variety of ailments. The global knowledge of herbal medicines and their usage has grown in recent years, since numerous plant-based conventional pharmaceuticals such as aspirin, digoxin, quinine, morphine, artemisinin and others have been successfully used to treat a variety of health problems.

1.6. INTRODUCTION TO THE STUDY SITE

The NER, one of the world's biodiversity hotspots supports over 50% of India's biodiversity (Mao and Hynniewta, 2000). NER is made up of eight separate states: Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Sikkim. This area is home to a diverse array of plants and animals. Assam, India's second largest state is located between 21°34° and 29°50°N latitude and 87°32° and 97°50°E longitude. It covers a total area of 262,060 square kilometers of which 23,688 square kilometres are covered by forest (Mao and Hynniewta, 2000). Assam is home to many rare and unique plants, making it a biodiversity hotspot on the planet. The bulk of such plants and their medical benefits are only known to natives and tribes living in various parts of Assam. Because indigenous tribes dwell in NER and the area is one of the Indo-Burma Hot Spots of Biodiversity it presents a vast opportunity for ethnobotanical study (Deka and Kalita, 2013).

Goalpara is an administrative district in the Indian state of Assam. It is located on the south bank of the Brahmaputra River between latitude 25°53 to 26°30 N and longitude 90°07 to 91°05 E. The district which covers an area of 1,824 square kilometres is bounded on the south by the Meghalaya districts of West and East Garo Hill, on the east by the Kamrup district, on the west by the Dhubri district and on the north by the great Brahmaputra. Goalpara is a densely populated district of Assam of which 90% of the population depends on agriculture for their livelihood. Various ethnic groups live in the district. Rabha, Bodo, Koch Rajbongshi and Garo are important residents of this district other tribes and communities such as Hajong, Santhal, Muslim communities, Kalita and Hindu Bengalis also coexist. In this region, traditional herbal practices remain a primary source of healthcare. Despite contemporary medical facilities, people in this part of Assam still rely on locally available plant resources and traditional healers to treat various ailments.

Traditional herbal healers are typically referred to as Bej, Oja or Kobiraj and they generally prescribe and supply remedies to patients. Many of the herbs and shrubs in this area are used to cure common illnesses due to their

medicinal properties. Herbal plants are grown at the household level in Goalpara by rural people as a kind of self-help. People in this region use herbal plants on a daily basis to maintain their bodies healthy and to prevent illnesses. According to Basumatary *et al.* (2004), 33 plants species of 22 genera are being used by Bodo communities of Goalpara district of Assam.

1.7. IMPORTANCE OF AUTHENTICATING MEDICINAL PLANTS

Northeast India has a lot of traditional knowledge regarding the use of plants to heal various illnesses due to the significant diversity of tribes and plants. Such much knowledge has gone untapped and unfinished. Furthermore, herbal medicine providers have a tendency to keep their knowledge hidden from the general population. The precise identification of the parent plant is critical for the herbal medicine's uses and efficacy. Identification of medicinal plants is required since medicinal plants are used to treat nearly 80% of the world's population. Traditional methods of identification include organoleptic, microscopic, macroscopic and chemical procedures that necessitate taxonomic expertise, meticulous examination and costly lab studies. This can lead to species misidentification. The use of wrong species is expressly mentioned in WHO guidelines as a concern to consumer safety (Palhares *et al.*, 2015). Previously, plant identification was based on physical traits that could be seen visually. Traditional plant identification by taxonomists requires the collection of proper morphological data during their growing season with reproductive organs such as flowers and fruits, which is often difficult, time consuming and frequently unavailable during field surveys (Gonzalez *et al.*, 2009; Hebert *et al.*, 2003).

Furthermore, traditional techniques of employing medicinal plants to cure various diseases are prevalent but the herbal sector suffers from replacement and adulteration of medicinal herbs with closely related species due to a lack of adequate taxonomic identification (Techen *et al.*, 2014). A remarkable proof of the identification of medicinal plants using molecular markers occurred recently. A technique called DNA barcoding that employs a short DNA sequence from a common locus to identify species (Hebert *et al.*, 2003). Kress *et al.* (2014), Taberlet *et al.* (2007) and Fazekas *et al.* (2012) previously proposed nuclear DNA (ITS and

ITS2 sections) and plastid DNA (rbcL, matK, trnL, and trnH-psbA regions) as potential DNA barcode sites for use in plants. In 2009, the Plant Working Group of the Consortium for the Barcode of Life proposed rbcL, matK, and the two-locus combination matK + rbcL as major DNA barcodes for plants.

1.8. ROLE OF BIOACTIVE COMPOUNDS FROM PLANTS

Ethnomedicinal plants have long been used in the study of natural products goods and the development of novel medications. Natural herb-based treatments have enhanced human health tremendously. Plants have long been recognized as a rich source of physiologically active chemicals with low toxicity, high stability and few adverse effects. Alkaloids, flavonoids, phenols, saponins, tannins and terpenoids are only a few of the bioactive compounds found in medicinal plants that give them their therapeutic properties (Karthikeyan *et al.,* 2009). Traditional plant species have medicinal characteristics due to phytochemical components that have definite pharmacological activity on the human body (Naseem, 2014).

Today, there is a growing interest in medicinal plant research. Phytochemical screening based on ethnomedicinal data is regarded as an efficient method for discovering novel therapeutic agents (Savithramma *et al.,* 2012). It is imperative to initiate an urgent step for screening of plants for secondary metabolites. The phytochemical components of medicinal plants were studied in order to identify and extract the drug lead chemicals and components from various parts of the plant. The phytochemical components of plants help identify their distinct biological activity. Tannins, alkaloids, saponins, cardiac glycosides, steroids, terpenoids, flavonoids, phlobatannins, anthraquinones and reducing sugars are the principal phytochemical components found in medicinal plants and they have numerous disease preventative activities (Barbosa *et al.,* 2013).

Anti-inflammatory, anti-diabetic, anti-aging, antimicrobial, antiparastic, antidepressant, anticancer, antioxidant, and wound healing are all essential preventative activities (Bahramsoltani *et al.,* 2014). Furthermore, they play an important function in plant stress tolerance and are abundant in many fruits and vegetables that contain bioactive chemicals. According to Herrero *et al.* (2013), an

increasing number of scientific studies demonstrating the positive effects of bioactive compounds on health have recently stimulated interest in the production of these molecules from natural sources. Bioactive components in medicinal plants or herbal medicines have the potential to reduce oxidative stress and inflammatory processes (Ghuman *et al.,* 2019), inhibit infections and promote blood clotting and speed up wound healing by repairing tissues and regenerating damaged skins as mentioned by Bowler *et al.* (2001). Bioactive compounds obtained from natural sources can also be used to treat a variety of human illnesses. Anticancer, antibacterial, antiviral, anti-inflammatory and antioxidant activities are among these compounds (Casuga *et al.,* 2016; Kavitha, 2021). Screening of bioactive components from a certain plant is critical for developing a novel medicinal drug to cure a specific condition. The screening of plant extracts is a revolutionary strategy for discovering therapeutically beneficial compounds in various plant species. One of the most difficult tasks is identifying and sorting out potential bioactive compounds to cure certain diseases. Recent research developments have enabled the extraction of medically important bioactive components from plants employed in traditional medicinal practices.

1.9. ROLE OF FOOD NUTRIENTS IN PLANTS

Calls to raise the levels of food production is becoming imperative in the facade of a global human population rapidly exceeding 7 billion (U.S. Census Bureau, 2022) and world leaders, nutritionist and scientists are in search of new and innovative resources to feed the world and resurrect traditional practices bearing relevance to human health and nutrition (Hodges, 2005).

Since the beginning of human civilization plants have contributed immensely to human health and overall well-being. Plants are considered to be a storehouse of vitamins, carbohydrates, fats, fibers and proteins that are essential for developmental and physiological processes in the body. Plants are a rich source of essential minerals and nutrients that contribute to an individual's dietary needs and well-being. The upsurge in attention given to medicinal plants as food is thereby consequently understandable. To understand the nutritional value of any plant, proximate and mineral assays play a significant role. The proximate composition of

any plant gives an overview of such biomolecules that provide energy and drive the life processes (Novak and Haslberger, 2000). Analysis of mineral elements and proximate value of the plants becomes necessary in the understanding of nutritional and pharmacological value of a plant. Proximate value gives an insight into the nutritional and mineral constituents of plants utilized by the people of the region. The mineral composition in plant that comprises both macro and microelements play a crucial role in the various vital functions of the body. The tribal people of North-East India rely largely on nature to meet their basic needs. Many edible plants or their parts are used to treat a variety of ailments in traditional systems of North East India, so there is a growing interest in learning about the additional health benefits of the plants. However, literature study suggests that many of the plants are yet to be evaluated for their nutritional compositions.

1.10. ETHNOMEDICINAL PLANTS IN GOALPARA

The vegetation in the Goalpara district is primarily semi-evergreen, mixed deciduous and other subtypes. In terms of floristic variety, it is a particularly rich district of the state of Assam. It is common to find that the diverse ethnic groups of Western Assam's tribal-dominated district of Goalpara rely on plant resources for a variety of ailments. The majority of the plants they employ are herbaceous in nature. The most widely used parts are the leaves, roots, stems, bark and seeds. Extracts obtained from diverse parts of shrubs and trees, however are also employed. Although they pick these species from the adjacent jungle they occasionally cultivate them in their home garden. They mostly rely on wild naturally occurring edible plant resources for their daily needs. There are now no restrictions on gathering any medicinal or edible plants in Goalpara, either historically or legally imposed by the government. Such limits may not be as vital as preserving medicinal plants and their ecosystem, but they may become required in the future as harvesting pressures increase.

The significance of ethnomedicinal studies in Assam's Goalpara district has received little attention; nonetheless, there are few reports accessible (Mallick and Ojah, 2022; Bhuyan, 2021; Swargiary *et al.*, 2019; Deka and Nath, 2014; Basumatary *et al.*, 2004). However, the nutritional, anti-nutritional,

therapeutic and pharmacological potential of the majority of these traditional edible herbal plant resources has yet to be determined. Although these local resources have a long history of traditional applications as nourishing food and medicine by the inhabitants, moleecular authentication of the plant species is also absent. Several studies have showed that several Goalpara tribal tribes remain undiscovered in terms of ethnobotanical, ethnomedicinal, biochemical and molecular research (Swargiary *et al.*, 2019; Basumatary *et al.*, 2004; Deka and Nath, 2014).

In the present study, three plants were chosen for detailed analyses on biochemical, pharmacological and molecular profiles due to their popularity as a local food and medicinal source as indicated by local residents in a random ethnobotanical survey done between 2019 and 2023.

1.11. MOTIVATION FOR THE STUDY

The wealth of information possessed by people of Goalpara district in Assam about medicinal herbs of the area is by and large a permutation of folklore or ethnicity passed down through generations, collectively with the new knowledge acquired from working directly with the medicinal plants as a resource for treatment and food. The communities of the area in general have pitiable access to the wide-ranging, specialist collection of knowledge assembled by modern researchers. Combining indigenous knowledge with up to date research will lead to enhanced understanding of the role of such medicinal plants, both as a source of medicine and also specifically as an important food resource for mankind. This will empower the researcher as well as the local people of the ethnic community.

Research into medicinal plant resource will be valuable in that it will:

1. Contribute to regional, countrywide and worldwide knowledge on medicinal plants and their compounds.
2. Promote the value of this local medicinal and food resource.
3. Document the aspects of indigenous knowledge of the medicinal plants.
4. Provide information to make sure the sustainable management of this plant resource.

Today, more people are turning to plant-based traditional remedies and it is predicted that 80% of the world's population would use herbal products for wellness and healthcare.

1.12. STATEMENT OF PROBLEM:

Although various researchers have documented medicinal plants used by various tribes of different regions of the world, systematic investigation on application of medicinal plants against different ailments and their phytochemistry and an active compounds present in plants are still in its infancy especially with respect to the people of Goalpara district of North-eastern region of India. Nevertheless, very few studies are carried out on the scientific validation of medicinal plants by means of biochemical and pharmacological screening to validate the healing folklore medicine. The plants selected for the present study viz. *Zanthoxylum oxyphyllum* Edgew, *Rotheca serrata* (L.) Steane & Mabb and *Blumea lanceolaria* (Roxb.) Druce are locally used as medicine as well as food plant. Owing to their importance the present study proposes in-vitro screening of these three plants selected on the basis of their ethno medicinal importance to analyze the findings of the traditional information through proximate and pharmacological assessments.

1.13. GENERAL AIMS AND OBJECTIVES

AIM:

The general aim was to document indigenous knowledge on the utility of three medicinal plants from Goalpara district of Assam, India and explores the bioactive compounds associated with them through scientific investigation in order to build up an understanding of the potential resource they possess and how they can be scientifically enhanced for the utilization of mankind.

OBJECTIVES:

1. Sample collection and authentication of plant species through morphological and molecular taxonomy.
2. Evaluation of nutritional and anti-nutritional properties of the collected plant species.

3. Evaluation and identification of bioactive compounds in extracts from the selected plant samples.
4. To test the cytotoxicity of plant extracts in cancer cell lines.

SPECIFIC OBJECTIVES:

1. Sample collection and authentication of plant species through morphological and molecular taxonomy.
   1.1. Collection of selected plant samples from Goalpara District, Assam.
   1.2. Morphological identification
   1.3. DNA barcoding
2. Evaluatation of nutritional and anti-nutritional properties.
   2.1. Proximate composition analysis.
   2.2. Minerals estimation.
   2.3. Amino acid estimation.
   2.4. Fatty acid estimation.
   2.5. Anti-nutritional factors estimation.
3. Evaluation and identification of bioactive compounds in extracts from the selected plant samples.
   3.1. Qualitative phytochemical screening test.
   3.2. Quantitative phytochemical test.
   3.3. In- vitro antioxidant activity test.
   3.4. Identification of bioactive compounds by GC-MS.
   3.5. Identification of functional group in bioactive compounds by FT-IR.
4. To test the cytotoxicity test of plant extracts in cell lines.
   4.1. Anticancer effects.
   4.2. Apoptosis inducing activity.