

**RECENT ADVANCES IN
FOLK MEDICINE
RESEARCH
IN NORTH EAST INDIA**

Editors:

**Amal Bawri
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NORTH EASTERN INSTITUTE OF FOLK MEDICINE,
PASIGHAT,
ARUNACHAL PRADESH

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Recent Advances in Folk Medicine Research in North East India

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Preface

Folk medicine is the mixture of traditional healing practices and beliefs that involve herbal medicine, spirituality and manual therapies or exercises in order to diagnose treat or prevent an ailment or illness (WHO, 2008). According to World Health Organization (WHO, 2008), it is mostly practiced by indigenous or native populations and as much as 80% of the population in certain countries within Asia and Africa rely on it for primary care. Folk medicine takes different forms in different regions, and the documentation and preservation of traditional medical practices and knowledge is utmost essential for safeguarding intangible heritage and recognizing and promoting cultural diversity. Traditional medicine or folk medicine is a system of medicine developed over generations, thousands of years ago within various civilizations, societies, communities, tribes, clans' spreading to all the nooks and corners of India before the era of Modern medicine came in its present shape. The practice of ritualistic healing and folk remedies has been an integral part of different ethnic communities in the India. North East India comprises of the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura located between 21°34 'N to 29°50 'N latitude and 87°32 'E to 97°52 'E longitudes occupies an area of about 2,62,060 sq. km. About 8% of the country's total geographical area is represented by the N.E. region.

North East India represents the transitional zone between the Indian, Indo-Myanmar and Indo-Chinese biogeographic regions. The area is highly rich in vegetation with different type of forest vegetation. This very rich floral and faunal diversity has led it to be designated as one of the biodiversity hotspots of the world. The region is very rich in different ethnic groups and culture. Out of 450 tribal communities in India, the region alone provides the dwelling place of about 200 ethnic communities. Most of the ethnic peoples have their own traditional medicine and healing practices. Due to rich biodiversity and cultural diversity, the region attracts the attention of ethnobotanists, ethnozoologist, etc. and the region becomes a centre of frontier areas of research in folk medicine. Consistent R & D activities on plant and Animal wealth and their traditional utilization pattern of this region have added abundant return to the basic knowledge in several aspects of ethnobotany and folk medicine. Research in this field has diversified during the last few decades and many potential areas have emerged. This has opened up new horizons in understanding the nature and uses of plant and animal resources. It does hold great significance and explore innovative strategies for resources conservation and preservation of traditional knowledge.

During the last two decades number of active researchers in different field of ethno- biology pertaining to North-eastern India have been working and quite a good number of their publications have appeared in different reputed journals. The present volume is the outcome of an endeavour to highlight the works of such upcoming workers engaged in botanical, ethnobotanical, ethnozoological research in this region. The volume has 19 research articles focussing on different field's viz. *ethnobotany*, *ethnozoology*, *Ayurveda*, and *Photochemistry*. It is hope that this volume has

comprehensively highlight the ethno-biological Research and Development of this region.

We gratefully acknowledge to all contributors for sharing their views for our endeavours. We also express our sincere thanks to the Ministry of AYUSH, Government of India for their constant support.

Editors

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Chapter 1

Folk Medicine: A Potential Alternative Healthcare System

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Abstract

Folk Medicine has originated from primitive man's reactions to natural events. The magical and witchcraft practices played an important role in Folk Medicine. The society, where witchcraft and religious beliefs are of great importance, disease and health are explained by external factors. The efforts of the people to find solutions of the illness or diseases resulted in setting up the basis of folk medicine. In a traditional societies opinion on disease and health were born as a part of folk culture. Hence, practices related to such issue are the domination of anthropological, ethnological and sociological factors. Therefore, the original of all forms of healthcare system is rooted to folk medicine. The folk medicine still dominated major parts of healthcare system all over the world.

Keywords: Traditional Medicine, Indian System of Medicine, Status.

Introduction

The Folk Medicine or folk healing practice is an established vital and important part of healthcare systems all over the world. It has been the lifeline in healthcare delivery system before the introduction of the modern medicines. In the present context also this healthcare delivery system is popularly running parallel with the modern system.

Folk medicine refers to health practices, methods, knowledge and beliefs incorporating natural resource based medicines, spiritual therapies, manual techniques and exercises, applied singularly as well as in combination to treat, diagnose and prevent illnesses or maintain well-being (WHO, 2002a). This system of health practices originated long before the civilization of human society. In due course of time, it closely associated with the human culture and social system. The human use of plants as medicines may be traced back at least 60,000 years as per fossil records, (Fabricant & Farnsworth, 2001; Shi et. al., 2010). The use of natural products as medicines have presented a great challenge to society of earlier days. There had been higher probability of consuming poisonous plants, on seeking food, that might result to vomiting, diarrhea, coma, or other toxic reactions or even death. However, this way reasoned for development of knowledge about edible items and natural medicines (Gao et.al., 2007).

Folk healing system is being practiced through a person termed as "Traditional Healer". A Traditional Healer is someone who is recognized by the community wherein he lives and is competent to provide health care by using plant, animal and mineral substances and certain other methods based on the social, cultural and religious backgrounds. In addition, the healer has the prevailing knowledge, attitudes and beliefs regarding physical, mental and social well-being and the interconnection of disease and disability in the community. Traditional healers used diverse medicinal combination from natural resources. They have vast knowledge and experience on the use of bio resources for healing and nutritional purposes.

The northeastern part of India is dominated by tribes with unique culture and identity. This part of the country is a place with lesser connectivity with the mainland India until 90s. Therefore, in many places of this region there is still lack of modern healthcare facilities. Hence, the people in the region are largely depending on the Traditional Healthcare System.

Folk Medicine in Global context

Folk medicine is the oldest form of health care in the world and it is used in the prevention, and treatment of physical as well as mental illnesses. It is also variously known as complementary and alternative, or ethnic medicine, and it still plays a key role in many countries today (Abdullahi, 2011). Traditional medicines have been used in many countries throughout the world over many centuries. According to the World Health Organization (WHO), 65 % to 80% of the world's healthcare practice involves the use of traditional medicine (WHO, 2019). Traditional medicine is widely used in the prevention, diagnosis, and treatment of an extensive range of ailments. There are many advocates that have playing a significance role in the wide acceptability and increasing appeal of traditional and folk medicine throughout the world, particularly in recent two decades. In some regions, traditional medicine is more accessible. World Bank and WHO reported that, one-third of the world's population and over half of the populations of the neediest parts of Asia and Africa do not have consistent access to essential drugs. However, the most reported reasons for using traditional and medicine are that it is more reasonable, within the range to the patient's ideology than allopathic medicine.

Traditional medicine has also been reported to be used in the treatment of life-threatening illnesses like Malaria and AIDS. In Ghana, Mali, Nigeria and Zambia, herbal medicines are the first line treatment for more than 60% of children with high fever. Studies in Africa and North America have revealed that up to 75% of individuals living with HIV/AIDS use Folk medicine alone or in combination with other medicines for various symptoms (WHO, 2019).

Today, traditional medicine has become an indispensable part of our health management. It has been well known that traditional medicine covers a wide array of therapies and practices which vary from culture to culture and country to country. According to WHO, in China, folk medicine accounts for around 40% of all health care delivered (WHO, 2019). In Chile 71% and Colombia 40% populace, have used folk medicine. In India, 65% of the population in rural areas uses Ayurveda and medicinal plants meet their primary health care requirement. In developed it becomes more popular. The percentage of the population that has used folk medicines at least once is Australia 48%, Belgium 31%, Canada 70%, France 49% and 42% in the United States of America (WHO, 2002b; WHO, 2013).

Supported by several World Health Associations and Executive Board resolutions, WHO has developed and issued a series of technical guidelines for the assessment of herbal medicines, evaluating the safety and efficacy of herbal medicines, and for clinical acupuncture research. In 1997, WHO developed draft guidelines for "methodology on research and evaluation of traditional medicine" that

was finally approved in April, 2000 with target to promote the proper development, registration, and use of traditional medicines and to blend the use of certain terms in traditional medicine. In 2006, WHO established a global network called the International Regulatory Cooperation for Herbal Medicines (IRCH) to allow communication and exchange between worldwide regulatory authorities responsible for the regulation of herbal medicines. WHO follows a comprehensive approach on traditional systems and considers various traditional system like traditional Chinese medicine, Indian Ayurveda and Unani medicine as well as the various other forms of traditional healing systems globally identical in the group of complementary and alternative medicine. However, the development of health care into an integrated, inclusive, or tolerant system in any country depends on the extent to which the traditional healing can be officially recognized as a component of health care rather than an alternative one.

Folk Medicine in India

India is a big country and is a land of different group of people having their own religion, faith and beliefs, culture, language, and dialects. This uniqueness has resulted in developing diverse medicinal systems in this region. Several medicinal systems were also introduced in India from outside world due to territorial invasions. This helped in enriching Indian traditional healthcare system. From ancient time, Indian society remain depended on traditional medicinal systems practiced here (Pandey et al., 2013). The introduction of allopathic drug during British rule and disregarding Indian traditional medicine by Britishers can be accounted responsible for significant destruction of Indian traditional medicine. Significant scientific development in allopathic medicine and modern healthcare facilities had also resisted the growth of traditional medicine. About 70% rural populations of India are dependable in traditional medicine for primary healthcare (Mafuva & Marima-Matarira, 2014). The knowledge of therapeutic, toxicological effect of plants, and other substances are dated back to the prehistoric periods when people have migrated into the Indian subcontinent. Several evidences indicated that, in Indian subcontinent medical intervention like dentistry and trepanation were exercised as early as 7000 BC (Sen & Chakraborty, 2017). Current records of archaeo-botanical excavations pointed towards the evidence of medicinal plants uses in the Middle Gangetic region since the 2nd millennium BC. These practices are still found in Ayurvedic folk medicine (NCBS, 2015).

Even before the codification of medical knowledge into the canonical texts of Ayurveda, there were abundant sources on its knowhow in the subcontinent. Healings are practiced by people from all levels of society that live and work intimately with their environment. They vary from home remedies connected with nutrition and treatment of minor illnesses, to sophisticated procedures like midwifery,

bone setting and treatment of snake bites and mental disorders. There were also specialists in bloodletting, physical medical practices and others with good knowledge of medicinal plants. All these field of folk practices have their specific folklore that preserved and helps in transmitting the knowledge. There were many healing practices that were considered to be consecrated and were linked with many forms of rituals that helped safeguard them. It is interesting to note that in folk traditions there is considerable overlap between healing plants and sacred plants, and certain healing plants were venerated (Singh & Lahiri, 2010). In many regions of India, the practices of folk medicine still dominate the healthcare practices.

Discussion

Folk medicine is different in comparison to advanced medicine. It had lived with the people as a part of their culture and traditions, and still persists in its original forms. In traditional societies, any information about a disease is shared to others orally. This information is passed through generation after generation. People acquire knowledge on popular medicine in the same way, and they learn other cultural components too. Folk medicine that exists today is the results of trials and errors of ethnic groups which inherited from generation to generation orally. The reason for folk or traditional medicine's acceptability can be explained by the fact that beliefs change very slowly. In many countries, especially in conservative communities, existence of large forms of folk medicine practices can still be seen.

The use of traditional medicines has extended globally and has gained attention in the last few years. These practices have not only continued to be used for primary healthcare in developing countries, but have also been used in nations where conventional medicines are predominant in the healthcare system. With this incredible expansion in the use of traditional medicines worldwide, its safety and efficacy as well as quality control medicines and procedure-based therapies have become important concerns. For the reason, the World Health Organization has increasingly involved in developing international standards and technical guidelines for these types of medicines. They are also working for increasing communication and cooperation between various nations. The challenge now is to ensure that folk medicines are used properly. It is also to determine the way for research and the evaluation of folk medicines that is to be carried out.

Today, these medicines still exist an essential part of healthcare in many countries. More than 100 nations have guidelines for herbal medicines. But their practices vary greatly from region to region, as they are influenced by various factors such as culture, history, philosophy, etc. However, while it is often necessary to adapt regulation for good propagation of this august practices and preservation of traditional medicine system at individual country wise, several themes and issues are common,

such as the importance of practitioner training, the issues linked with safety, the demand of research into both products and practices for development, and the status of labeling.

Despite a few efforts from the non-governmental organization and regional interest groups in various parts of the world, the traditional healers are sidelined in the policy framework and left to the regional discretion of integration. These knowledge systems are considered to be the fragments form of knowledge prior to the present scientific era and overlooked by the researchers, medical professions and policymakers. Only in recent time there has been a resurgence of scientific interest in traditional healing. Given their importance, national and international organizations like, WHO and WIPO have advocated their preservation and development. In 1998, health ministers of commonwealth countries established a working group on 'Traditional and Complementary Health Systems' to guide legislators towards integrating traditional and complementary medicines into mainstream of national health care for reform health sector. In 2020 WHO announced for setting up of a Global Centre for Traditional Medicine in India. This is being witness as India moving towards achieving the Centre for global wellness.

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Chapter 2

Ethnomedicinal Database of Antidiabetic Plants of Northeastern India (EDADPNI): A List of 284 Anti-Hyperglycemic Antidiabetic Plants in Practice

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Abstract

Antidiabetic plants have been reported in the literature from different ethnic groups in North Eastern Region of India. Preserving and upgrading aboriginal traditional knowledge is a priority. The data is scattered all over literature and more data is needed to be updated every time a new data is discovered. The Ethnomedicinal Database of Antidiabetic Plants of Northeast India (EDADPNI) is an online database of 284 anti-diabetic plants from North Eastern Region. The database will help to identify the variety of antidiabetic plants available in the North Eastern Region in one place by state, ethnic group, usage etc. It will help to compare and choose plants for the discovery of new therapeutic formulas and can be used as a reference. Our database mentions the highest number of antidiabetic plants from North Eastern Region. The database is available at <https://omicsbase.com/DADPNEI/>.

Keywords: Diabetes, Medicinal Plant, Northeast India, Folk medicine, Bioinformatics Database

Introduction

World Health Organization (WHO) in 2016 GLOBAL REPORT ON DIABETES mentioned that “globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980. This reflects an increase in associated risk factors such as being overweight or obese. Diabetes caused 1.5 million deaths in 2012. Higher-than-optimal blood glucose caused an additional 2.2 million deaths, by increasing the risks of cardiovascular and other diseases. Forty-three percent of these 3.7 million deaths occur before the age of 70 years. The percentage of deaths attributable to high blood glucose or diabetes that occurs prior to age 70 is higher in low- and middle-income countries than in high-income countries. Because sophisticated laboratory tests are usually required to distinguish between type 1 diabetes (which requires insulin injections for survival) and type 2 diabetes (where the body cannot properly use the insulin it produces), separate global estimates of diabetes prevalence for type 1 and type 2 do not exist. The majority of people with diabetes are affected by type 2 diabetes. This used to occur nearly entirely among adults but now occurs in children too” (WHO, 2020).

The American Diabetes Association recommends that diabetes testing starts at age 45 years for all adults who are overweight (body mass index [BMI] ≥ 25 kg/m²) and have any of the following additional risks factors: physical inactivity, hypertension, or history of cardiovascular disease, low levels of high-density lipoprotein cholesterol, and high triglycerides, first-degree relative with diabetes, history of previous elevated blood glucose level or HbA1c measurement, women with polycystic ovarian syndrome, history of gestational diabetes, or giving birth to a baby weighing more than 4.082 kg (9 lb), member of an ethnic or minority racial group (Tuso, 2014). Currently, the majority of strategies approved by the FDA for autoimmune diseases have focused on non-antigen-specific immune suppression. Although this was found to be partially effective in inhibiting autoreactivity, these compounds have numerous side effects and long-term treatment remains challenging.

Diabetes drugs include:

Sulfonylureas - glimepiride, glipizide, glyburide.

Biguanides - metformin.

Thiazolidinediones (Tzd) - pioglitazone, Actos generic.

Alpha-glucosidase inhibitors - Acarbose.

Meglitinides - nateglinide.

Combination of sulfonylureas plus metformin - known by generic names of the two drugs.

The limitation of currently available oral antidiabetic agents either in terms of efficacy/safety coupled with the emergence of the disease into global epidemic have encouraged alternative therapy that can manage diabetes more efficiently and safely (Tripathi et. al., 2011). Long term use of any drugs is also leads to severe complications. Prediabetes is now recognized as a reversible condition that increases an individual's risk for development of diabetes (Arkin et. al., 2014).

Diabetes in the world

The number of people living with diabetes and pre-diabetes has increased worldwide. About 5% of the global population is affected by diabetes (Chakraborty & Rajagopalan, 2002) and management of diabetes with no side-effect is still a challenge (Kameswararao et al., 2003). The number of people with diabetes rose from 108 million in 1980 to 422 million in 2014 (WHO, 2020). Between 2000 and 2016, there was a 5% increase in premature mortality from diabetes. Almost half of all deaths attributable to high blood glucose occur before the age of 70 years (WHO, 2020). WHO estimates that diabetes was the seventh leading cause of death in 2016 (WHO, 2020).

According to the IDF Diabetes Atlas Ninth edition 2019 Diabetes caused 4.2 million deaths and 374 million people are at increased risk of developing type 2 diabetes. In 2019, Approximately 463 million adults (20-79 years) were living with diabetes; by 2045 this will rise to 700 million. The proportion of people with type 2 diabetes is increasing in most countries. 79% of adults with diabetes were living in middle- and low- income countries. 1 in 5 of the people who are above 65 years old has diabetes. 1 in 2 (232 million) people with diabetes were undiagnosed. Diabetes caused at least USD 760 billion dollars in health expenditure in 2019 – 10% of total spending on adults. More than 1.1 million children and adolescents are living with type 1 diabetes. More than 20 million live births (1 in 6 live births) are affected by diabetes during pregnancy.

Table 2.1. Estimates of diabetes across the globe.

At a glance	2019
Total world population	7.7 billion
Adult population (20–79 years)	5.0 billion
Diabetes (20–79 years)	
Global Prevalence	9.30%
Number of people with diabetes	463.0 million
Number of deaths due to diabetes	4.2 million

Total health expenditures for diabetes ⁱ	USD 760.3 billion
Hyperglycaemia in pregnancy (20–49 years)	
Proportion of live births affected	15.80%
Number of live births affected	20.4 million
Impaired glucose tolerance (20–79 years)	
Global prevalence	7.50%
Number of people with impaired glucose tolerance	373.9 million
Type 1 diabetes (0–19 years)	
Number of children and adolescents with type 1 diabetes	1,110,100
Number of newly diagnosed cases each year	128,900

ⁱHealth expenditures for people with diabetes are assumed to be on average two-fold higher than people without diabetes.

*Data is from IDF Diabetes Atlas, 9th edition, 2019.

Table 2.2. Number of adults (20–79 years) with diabetes as per World Bank income classification in 2019.		
World Bank income classification	Prevalence of diabetes (%)	Number of people with diabetes (millions)
High-income countries	10.4 (8.6–13.3) ⁱ	95.2 (78.7–120.9)
Middle-income countries	9.5 (7.6–12.3)	353.3(280.1–455.3)
Low-income countries	4.0 (2.8–6.7)	14.5 (10.0–24.3)

ⁱ95% confidence intervals are reported in brackets.

*Data is from IDF Diabetes Atlas, 9th edition, 2019.

Table 2.3. Number of men and women (20–79 years) with diabetes in 2019.		
	Number of people with diabetes (millions)	Prevalence (%)
Men	240.1	9.6
Women	222.9	9

*Data is from IDF Diabetes Atlas, 9th edition, 2019.

Table 2.4. Top 10 countries or territories for number of adults (20–79 years) with diabetes in 2019.

Country or territory	Number of people with diabetes (millions)
China	116.4 (108.6–145.7) ⁱ
India	77.0 (62.4–96.4)
United States of America	31.0 (26.7–35.8)
Pakistan	19.4 (7.9–30.4)
Brazil	16.8 (15.0–18.7)
Mexico	12.8 (7.2–15.4)
Indonesia	10.7 (9.2–11.5)
Germany	9.5 (7.8–10.6)
Egypt	8.9 (4.8–10.1)
Bangladesh	8.4 (7.0–10.7)

ⁱ95% confidence intervals are reported in brackets.

*Data is from IDF Diabetes Atlas, 9th edition, 2019.

Diabetes in India

"Nearly one million people in India die annually due to diabetes. It is projected that India will become the home to 109 million diabetic patients by 2035 (Indiatimes, 2017)". 1 in 6 adults with diabetes in the world come from India (IDF DIABETES ATLAS 9th edition 2019). India is one of the epicentres of the global diabetes mellitus pandemic. Increased susceptibility for Indian individuals, along with rapid socioeconomic development and demographic changes has led to the explosive increase in the prevalence of diabetes mellitus in India over the past four decades (Unnikrishnan et al., 2016). Type 2 diabetes mellitus in Asian Indian people is characterized by a young age of onset and occurrence at low levels of BMI (Unnikrishnan et al., 2016). Available data also suggest that the susceptibility of Asian Indian people to the complications of diabetes mellitus differs from that of white populations (Unnikrishnan et al., 2016). Management of this disease in India faces multiple challenges, such as paramedical staff, low levels of awareness and paucity of trained medical, and unaffordability of medications and services (Unnikrishnan et al., 2016). In a developing nation like India, the majority of diabetes patients also experience a substantial cost burden from out-of-pocket (OOP). Also, the dearth of insurance policies and schemes escalate the cost of diabetes care (Kumpatla et al., 2013). Many traditional medicines in use are derived from medicinal plants, minerals and organic matter (Grover et al., 2002). A number of medicinal plants, traditionally used for over 1000 years named rasayana are present in herbal

preparations of Indian traditional health care systems (Scartezzini&Speroni, 2000). In Indian systems of medicine most practitioners formulate and dispense their own recipes (Scartezzini&Speroni, 2000). The WHO (World Health Organization) has listed 21,000 plants, around the world which are used for medicinal purposes (Scartezzini&Speroni, 2000). Among these 2500 species are in India, out of which 150 species are used commercially on a fairly large scale (Scartezzini&Speroni, 2000). India is the largest producer of medicinal herbs and is called as botanical garden of the world (Seth & Sharma, 2004). Many important aspects of diabetes in India remain uninvestigated (Unnikrishnan and Mohan, 2020).

Diabetes in Northeastern India and healthcare practices of the people

The Indian Council of Medical Research–IndiaDIABetes study (ICMR–INDIAB) study is the largest nationally representative study of diabetes in India (Anjana et al., 2017). The aim of the ICMR–INDIAB study is to establish the national and state-specific prevalence of diabetes and prediabetes in India (Anjana et al., 2011). The Northeastern phase (Phase III) sampling for which was done between Jan 5, 2012, and July 3, 2015 included six states and found prevalence of diabetes in the following order- Tripura (9.4 %), Mizoram (5.8 %), Assam (5.5 %), Arunachal Pradesh (5.1 %), Manipur (5.1 %) and Meghalaya (4.5 %) (Anjana et al., 2017). Such data will offer not only a more comprehensive understanding of disease burden, but also provide opportunities to explore state-level and individual level variation in diabetes and prediabetes (Anjana et al., 2017).

Table 2.5. Prevalence of diabetes (%) in urban and rural areas from ICMR–INDIAB study in Northeastern phase.

Prevalence of diabetes (%)	Urban areas		Rural areas	
	Low socio-economic status	High socio-economic status	Low socio-economic status	High socio-economic status
Tripura*	15.0	7.7	5.1	8.4
Manipur*	13.7	12.4	3.0	4.6
Arunachal Pradesh*	8.7	16.2	2.7	5.6
Assam*	8.1	7.4	1.9	5.3
Mizoram*	5.6	8.3	1.3	4.5
Meghalaya*	4.4	9.2	1.1	4.3

India has a renowned custom of using traditional medicines and is well known for some highly established ethnomedicinal systems, namely, Ayurveda, yoga and naturopathy, Unani, Siddha, and homeopathy (AYUSH) which have been an indispensable part of Indian healing cultures (Bordoloi et. al., 2020). The North-east region of India comprises eight sister states, namely, Assam, Meghalaya, Mizoram, Nagaland, Sikkim, Arunachal Pradesh, Manipur, and Tripura, which are considered as the treasure house of many medicinal plants with tremendous potential in the industrial sector (Bordoloi et. al., 2020). Around 40% of the total geographical area of the North-east region is inhabited by evergreen forest which harbors diverse and very rich natural resources including various endemic species of flora and fauna (Bordoloi et. al., 2020). Moreover, the Indo-Burma hotspot region falls in the North-east region, which is ranked 2nd among the total 25 biodiversity hotspots identified worldwide (Bordoloi et. al., 2020). North-east states of India are inhabited by more than 180 major ethnic tribal communities such as Garo, Dafla, Abor, Khasi, Mishi, Naga, Kuki, Rabha, Apatani, etc., and each tribal group is known by their own languages, rituals, cultures, ensembles, and housing patterns (Mondal et al. 2013). The North-east people of different ethnic groups utilize a variety of folk medicines as a remedy for several ailments (Bordoloi et. al., 2020). These ethnic communities have been practicing the traditional healing system since time immemorial (Bordoloi et. al., 2020). Here we attempt to present the existing information regarding the medicinal plants of North-east Indian states which have been in use as the source of herbal medicines for the management of diabetes and its associated complications since ages (Bordoloi et. al., 2020).

Materials and Method

Study Area:

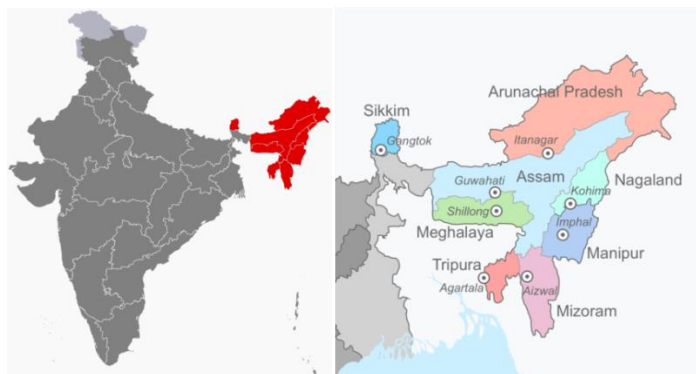


Fig. 2.1. Map of Northeast India showing the study area. (Image source: Wikipedia)

Northeast India (officially North Eastern Region, NER) is the easternmost region of India representing both a geographic and political administrative division of the country. It comprises eight states – Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura (Fig. 2.1). The Table 2.6 presented below shows the ethnic population and richness of plant resources of the region.

Table 2.6. Ethnic population and richness of plant resources in the Northeast Indian States.

State	Total Area (Sq. Km.)	**Tribal population (%)	*Forest Cover (%)
Assam	78,438	12.45	35.83
Arunachal Pradesh	83,743	68.79	79.96
Manipur	22,327	40.88	77.69
Meghalaya	22,429	86.15	76.76
Mizoram	21,081	94.43	86.27
Nagaland	16,579	86.48	75.33
Sikkim	7,096	33.8	47.13
Tripura	10,486	31.76	73.68
	262,179	455	553

**Tribal population (%) as per Census India 2011.

*The forest cover (% in square kilometers) in 2017 in India by state and union territory as published by the Forest Survey of India.

We searched Pubmed and Google to collect the relevant literature manually and identified the ethnomedicinal antidiabetic plants in practice by various ethnic groups in Northeast India. Used search terms in a combination are i) Anti-diabetic plants + Northeast India, ii) Antidiabetic plants + Northeast India, iii) Antidiabetic plants + Northeast India + “&&” and iv) Anti-diabetic plants + Northeast India + “&&”. Here “&&” means either Assam or Arunachal Pradesh or Manipur or Meghalaya or Mizoram or Nagaland or Sikkim or Tripura. A detailed literature search was carried out to validate the scientific names of the antidiabetic plants (Kumar et al., 2019). All updated botanical name of plants were cross-checked from the Plant List, a working list of all plant species. Based upon the literature survey, selected antidiabetic activity-based data and plant names have been included in **EDADPNI** for the scientific validation of traditional knowledge.

To develop EDADPNEI web search engine - PHP Version 7.2.34 and MySQL database has been used. EDADPNI web interface allows users to search,

cross-check or compare antidiabetic plants from the NER region by "Botanical name", "Family", "Genus", "Found in NER State(s)", "Local name", "Tribes/community using the plant", "Plant Part(s) used", "Mode of use/Preparation", "Life form / Habit", "Reference(s)", "Plant Image(s)", "The Plant List - Page Link", plants "Wikipedia" Page Link. The simple EDADPNEI web search options appear on the left-hand side and users can put text and or select more than one of these features through the checkbox, and get results on the right-hand side after clicking the search button.

Results

EDADPNEI INTERFACE

EDADPNEI Web Search Interface (Fig. 2.2 & 2.3) has following pages

- (1) Home: The EDADPNEI Web Search Interface appears in the Home page. The select and search feature is described below.
- (2) About: About Page introduces you about EDADPNEI.
- (3) Data Statistics: Various types of graphs are there about EDADPNEI plants, location and usage.
- (4) Acknowledgment: This page acknowledges the resources used in EDADPNEI.
- (5) Help: This page guides you about how to use EDADPNEI.
- (6) Contact page is given for easy communication, information exchange about new discoveries.

E-DAD-P-NEEthnomedicinal Database Of Antidiabetic Plants Of
Northeast India

[Home](#)
[About](#)
[Data Statistics](#)
[Acknowledgment](#)
[Help](#)
[Contact](#)

Select & Search

Category Search

☐ Antidiabetic Plants
☐ Botanical name
☐ Family
☐ Image
☐ India
☐ Local name
☐ Northeast
☐ Arunachal Pradesh
☐ Assam
☐ Manipur
☐ Meghalaya
☐ Mizoram
☐ Nagaland
☐ Sikkim
☐ Tripura
☐ Plant part used: Flower
☐ Plant part used: Leaf
☐ Plant part used: Rhizome
☐ Plant part used: Root
☐ Plant part used: Seed
☐ Plant part used: Whole plant
☐ Preparation: Decoction
☐ Preparation: Juice
☐ Preparation: Powder
☐ Preparation: Pulp
☐ Uncategorized

Text Search

***Andrographis paniculata* (Burm.F.) Nees**

Botanical name: *Andrographis paniculata* (Burm.f.) Nees
 Family: AcanthaceaeGenus: *Andrographis*State(s) (Found in): TripuraLocal name: KalmeghTribes/community using the plant: TripuriPart(s) used: Whole plantMode of use/Preparation: JuiceLife form / Habit: Reference: Ghosh Tarafdar, R., ...

***Justicia Adhatoda* L.**

Botanical name: *Justicia adhatoda* L. Family: AcanthaceaeGenus: *Justicia*State(s) (Found in): TripuraLocal name: Vasak pataTribes/community using the plant: Chakma; HalamPart(s) used: Root, leaf, flowerMode of use/Preparation: DecoctionLife form / Habit: Reference: Ghosh ...

Tag Cloud

Antidiabetic Plants
Northeast

Tripura
Uncategorized

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Cookie settings

Fig. 2.2. EDADPNEI Web Search Interface.

Discussion and Conclusion

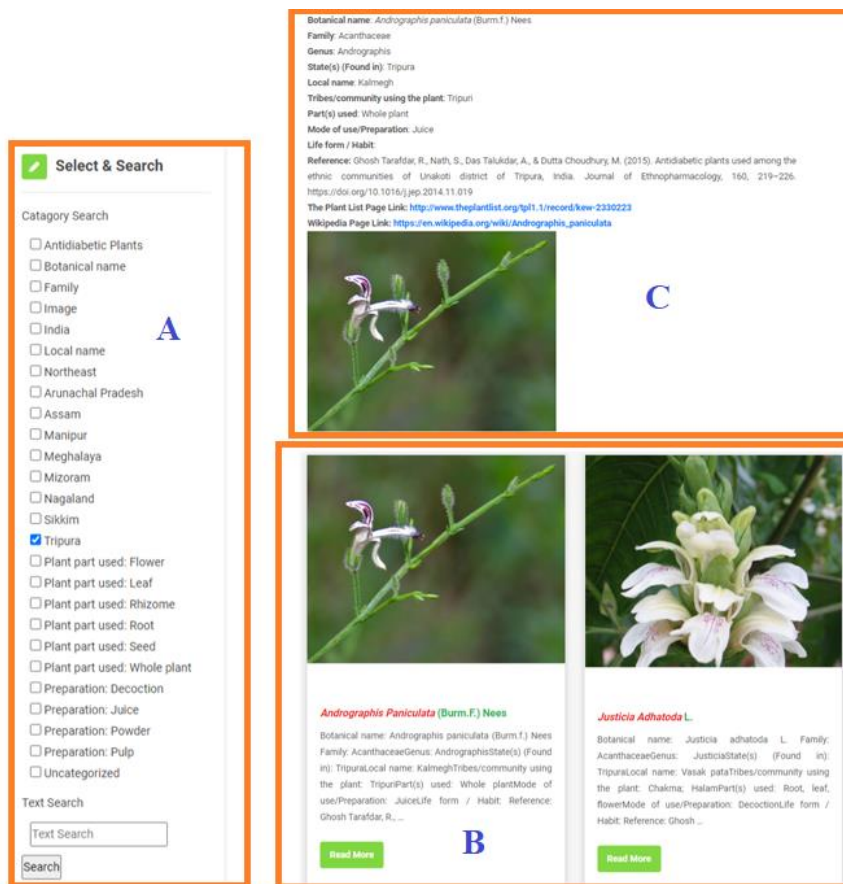


Fig.

Fig. 2.3. EDADPNI web interface (Details).

EDADPNI web interface (Fig.2.3.) allows users to check or compare antidiabetic plants from NER by "Botanical name", "Family", "Genus", "Found in NER State(s)", "Local name", "Tribes/community using the plant", "Plant Part(s) used", "Mode of use/Preparation", "Life form / Habit", "Reference(s)", "Plant Image(s)", "The Plant List - Page Link", plants "Wikipedia" Page Link. A. Users can use checkbox or text search tool in left hand side (LHS) to search. B. For example we want to check all the plants in Tripura, so we selected Tripura in check box and clicked search button in A. Here B is the output of our search (only two plants are shown here). (C) On Clicking read more we will find more details about the plant as shown in C.

A total of 284 plants belonging to 113 genera and 87 families used in traditional medicine for diabetes management in NER were identified. Different plant parts such as the leaf, root, bark and fruit and in some cases whole plant were used for making the herbal preparations (Bora et. al., 2005). All crude preparations were made using water as the medium (Bora et. al., 2005). The preparations were orally administered either as a plant crude extract, juice and decoction or leaf infusion (Bora et. al., 2005).

We found that ethnic groups are not well aware of all ethnomedicinal plants found in Northeast India related to diabetes. So, another important and relevant issue in ethnobotany is to study the transmission of cultural information (Santoro et al., 2018), and for this Database of Antidiabetic Plants of Northeast India (**EDADPNI**) is helpful to encourage the transmission of cultural information for effective disease management. Local practitioners and scientists can use the data as a starting point. The knowledge of important ethnomedicinal plants in one platform like **EDADPNI** can help in the selection of plants for culture as a source of income.

Limitation of EDADPNI: Antidiabetic activities of these plants are well established from all the aspect of therapeutic intervention; however, the molecular modulation remains unknown (Afolayan&Kibiti, 2015). It is envisaged that the use of herbal therapy will encourage good health and improve the status of diabetic patients (Afolayan&Kibiti, 2015). We are working to elaborate the database by incorporating all available data on antidiabetic disease targets of phytochemicals and phytopeptides of the geographic location from the selected medicinal plants to enhance the usability of the web interface for both everyday ethnomedicinal practitioners and scientists for targeted research on these plants. Regardless of having good awareness regarding diabetes mellitus in general, the information level on risk factors was not satisfactory and needs further improvement (Debbarma et al., 2019). Therefore, a special drive has to be given for imparting knowledge to the community people regarding risk factors as this could prevent further occurrence or progression of diabetes (Debbarma et al., 2019). So, EDADPNI fits into the future expectations. And additional Search and retrieval features will enhance the utility of the web interface.

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Chapter 3

Traditional eye care practices in Northeastern India- An overview

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Abstract

The present paper presented the first comprehensive report of the medicinal plants used in eye treatments in the entire North East India. Traditional eye medicines still remain the most affordable and easily accessible source of eye treatment among the underprivileged rural population. This paper recorded 75 phytomedicines which have the potential to cure many eye problems from eight states of North East India. Traditional eye medicines are therapies derived from both plant and animal products. Conjunctivitis, cataract, glaucoma, eye allergies and eye inflammation are common eye problems. Concoction, decoction and juice extracted from leaves, stems, roots and flowers are the various forms of traditional eye medicines. Animal products known for curing eye problems include honey, breast milk and urine. Information generated from this paper will help to fill the gap in the knowledge of traditional eye care practices, and will give maximum benefits to those underprivileged rural population who still rely on traditional healing practices for their primary health care. However, there is limited information on plants parts used, method of preparation, methods of application and quantity/doses of application. There is a need for further research to ascertain the efficacy and safety of several traditional eye care practices and herbal formulations used in various eye treatments.

Keywords: Folk medicines, Traditional healers, eye inflammation, conjunctivitis.

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Introduction

North East India comprises of eight states- Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura (Fig. 3.1). The region ($23^{\circ}51'$ N- $25^{\circ}41'$ N and $93^{\circ}3'$ E- $94^{\circ}4'$ E) lies in the lower Himalayan hill ranges, and has diverse vegetation ranging from humid evergreen forest to temperate and alpine vegetation. The region is one of the mega biodiversity hot spots of the world, and is the repository of diverse flora and fauna and large number of endemic species. North East India is the homeland of diverse ethnic groups which belong to different racial stocks, speak different dialects and have varied socio-cultural traditions (Bhuyan, 2015). More than 130 major tribes have been living in the region for thousands of years, for example- Abor, Khasi, Mishing, Rabha, Naga, Apatani, Meitei etc. (Kala, 2005). In addition to cultural diversity, there is diverse healing practices among the different tribes of North East India. Traditional healthcare practices use folk medicines and other methods based on the socio-cultural and religious backgrounds as well as the knowledge, attitudes and beliefs regarding physical, mental and social well-being and the causation of disease and disability in the community (Ramashankar, 2015). Tribal people live in harmony with nature and develop a close link with environment. Animism, symbolism and superstitious beliefs form an important part of tribal culture. They have deep faith in their traditional method of healing which often involves superstitions (Rout et al., 2009).

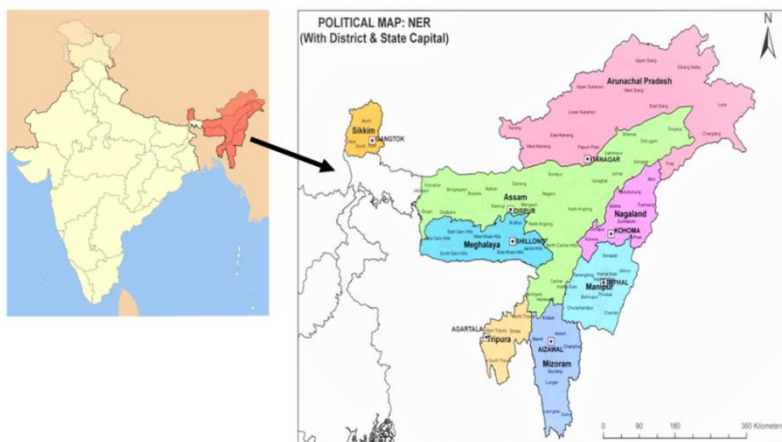


Fig. 3.1. Map showing the eight states of North East India.

The term ethno-medicine refers to traditional health care practices based on ethnic beliefs and practices and behaviour towards health and disease as conceived in the tribal, peasant and pre-industrial societies (Gogoi, 2014). Ethno-medicines

incorporate plants, animals and mineral based medicines, spiritual therapies and method therapies, manual techniques and exercises to diagnose, treat and prevent illnesses for the maintenance of health (AYUSH, 2003). The ethno-medicinal systems are vital for the healthcare of local communities around the globe who rely mainly on folk medicines including various medicinal plants mostly collected from the wild (Amritesh et al., 2018). Most of these medicinal plants constitute a part of socio-cultural heritage of the local tribes who are well aware of their medicinal properties (Zhasa et al., 2015). The traditional knowledge of folk medicine has evolved over many centuries with trials and errors and observations by traditional healers, and passed on to generations. Facilities of modern medicines are not available in many remote rural areas in North East India due to geographical isolation, poor infrastructural support and poor transportation systems. Therefore, traditional medicine remains the most affordable and easily accessible source for the treatment of various ailments and diseases such as cold and cough, malaria, diarrhoea, fever, asthma, diabetes, high blood pressure, urinary diseases, cancer, eye problems etc. among the rural population in the region.

Many studies reported the use of various traditional medicines for the treatment of common eye diseases such as conjunctivitis, cataract, glaucoma, eye allergies and eye inflammation (LeBeau, 1998; Kickbusch, 2003; Fokunang et al., 2011; Gupta et al., 2017; Dorcas et al., 2019). Traditional healers provide eye cares and treatments by using a variety of plant and animal products in different forms, for example- decoctions, concoctions or juice extracted from leaves, stems, roots or flowers as eye washes or eye drops, fume baths and for direct application to the eye (Houghton, 1995; Dorcas et al., 2019). Traditional eye medicines are biologically derived therapies which include various phytomedicines and products of animal or human origin such as breast milk, saliva and urine (Prajna et al., 1999; Bharathi et al., 2007). However, the products used for eye treatment vary from place to place and healer to healer (MINSANT, 2007). Although, in the present times, popularity of traditional eye medicines has been increasing due to the adverse side effects of modern drugs (Dorcas et al., 2019), some studies have shown the complication of eye problems like corneal infections due to indiscriminate use of traditional eye medicines (Prajna et al., 1999; Bharathi et al., 2007; Gupta et al., 2017).

Common eye problems and their management

Eye has natural processes of defence against potential infections or trauma with the help of lysozymes and interferons present in tears, eyelids and eyelashes, which are capable of eye protection against infections (Agyare et al., 2009). Eye inflammation is usually caused by disruption of the eye defence mechanism (Dorcas et al., 2019). Eye infection can be caused by various causal organisms like bacteria, fungi and viruses.

Bacterial ocular infection is caused by *Streptococcus pneumonia*, *Haemophilus influenza*, *Staphylococcus aureus* and *Escherichia coli* (Achoundong et al., 2003). Symptoms of bacterial eye infections include burning, irritation, tearing and mucopurulent discharge (Bodeker, 1994). Fungal species that cause eye infections are *Fusarium solani*, *Fusarium oxysporium*, *Aspergillus niger*, *Aspergillus flavus*, *Candida albicans* and *Penicillium notatum* (Dorcas et al., 2019). Symptoms of fungal infection usually include severe redness, blurring vision and photophobia (CIFOR, 2005). Viral infection is caused by herpes simplex virus1, adenovirus and coxsackie virus (Bodeker, 1994). Viral eye infections can be very contagious and can be transmitted easily through contact with objects that are in contact with the infected patients' eye secretions (Burkill, 2000). Eye cataract is also another serious eye issue which is usually treated by couching (the dislocation of eye lens).

Dorcas et al. (2019) reported that the potentials of bilberry (*Vaccinium myrtillus*) for eye treatments. Bilberry helps to protect retina and improves poor night vision. Further, bilberry helps to manage cataracts, glaucoma and diabetic retinopathy (Kokwaro, 1993). In Cameroon and other West African regions, traditional healers successfully use eyebright (*Euphrasia officinalis*) for the treatment of conjunctivitis (Dorcas et al., 2019). It is reported that eyebright is used to prepare homeopathic eye drops. Studies have shown that *Ginkgo biloba* contains flavonoids which help to reduce some retinal problems due to the complications of diabetes and macular degeneration (WHO, 2001; Ukponmwan & Momoh, 2010; Tsabang et al., 2016). Traditional healers of Cameroon consider *Ginkgo biloba* to be very effective for the treatment of eye infections (Dorcas et al., 2019). *Lycium barbarum* has been reported to be useful in the treatment of eye infections. Passionflower has been reported from Northwest region of Cameroon for the treatment of blurred vision and stressed watery eyes. *Coleus forskohlii* is used to prepare eye drops which help to reduce the production of fluid within the eye there by reducing pressure and to treat the problem of glaucoma (Dorcas et al., 2019). *Cannabis sativa* contains cannabinoids which can reduce pressure within the eyes of glaucoma patients. This can be attributed to the presence of receptors for cannabinoids in the eyes. *Cannabis sativa* has the potential for the development of phytomedicine eye drops (Dorcas et al., 2019). Studies have shown that *Camellia sinensis* contains great amount of antioxidants which reduce free radicals responsible for the so-called oxidative damage (Kickbusch, 2003). This indicates the potential of *Camellia sinensis* for the treatment of many chronic diseases including glaucoma, macular degeneration and cataract. Polyphenol present in *Camellia sinensis* can protect retinal cells from damage caused by UV light that can increase the risk of macular degeneration (Kickbusch, 2003). *Hydrastis canadensis* consists of an active biomolecule (berberine), which has anti-bacterial and anti-fungi properties, and is used as eye wash for the treatment of roughening of conjunctiva,

cornea and eyelids caused by *Chlamidia trachomatis* (Dorcas et al., 2019). Flavonoids, linoleic acid, Vit E, and oligomeric proanthro cyanidins present in grape seeds help in the treatment of cataract, diabetic retinopathy, macular degeneration and eye strain (Dorcas et al., 2019). Some studies have shown that garlic can help to prevent cataracts. Turmeric contains the potent anti-oxidant known as curcumin which has been shown to protect against cataracts (Dorcas et al., 2019).

Gupta et al. (2017) reported the wide use of traditional eye practices among the Indian population irrespective of age, gender, level of education, religion or marital status. Similar findings were reported mainly from Asian and African countries and also from other developing countries of the world (Carvalho et al., 2009). In these countries, most people visit and consult with traditional healers and seek treatment at a modern health facility only when the traditional medicines could not help them (Bodeker, 1994). Common traditional eye medicines included *kajal*, honey, ghee, rose water, alum water, milk, saline water, breast milk, turmeric, jaggery, curd, garlic, goat's milk, *neem*, powdered horn of deer, excreta of donkey, lemon juice, turpentine oil, coconut oil, warm tea leaves, ginger juice, onion juice, ash of *hukkah*, mustard oil, fenugreek and carom seeds (*ajwain*) (Gupta et al., 2017). Carvalho et al. (2009) reported the use of homemade, traditional products like boric acid, normal saline and herbal infusions for ophthalmic emergencies. However, traditional eye medicine has some health issues since traditional medication is often contaminated and can promote the spread of pathogenic organisms that can lead to vision impairment in the patient (Nkongmeneck et al., 2007; Focho et al., 2009). In most cases, traditional medication does not pay particular attention to the mode of action (antibiotic or steroid), concentration, and sterility as some of concoctions (mixture of various substances which may be plant or animal extracts) are made by using contaminated water, local gin, saliva and even urine (Kickbusch, 2003). Self-medication by using traditional eye medicines without any advice from experts could be harmful and lead to blindness. Therefore, there is a need for creating awareness and imparting proper health education amongst the people and traditional healers about safe traditional eye cares and early referral of any complication.

Traditional healthcare practices in North-East India

Each ethnic group of North East India has its own unique indigenous healing practices. In general, traditional healers treat all age group and all ailments and diseases by using traditional methods and prescribe locally available and affordable ethno-medicines. Traditional healing practices involve ritual sacrifice to pacify the ancestors, ritual and magical strengthening of people, spiritual sanctification, steaming, inhaling of substances, cuts, wearing charms and piercing (Shankar et al., 2012). Herbalist, diviner and traditional birth attendant are the three main types of

traditional healers prevalent in North East India (Ramashankar et al., 2015). Herbalists are traditional medicine practitioners who acquire good knowledge of ethno-medicines but they are not necessarily possessing mystical power, and they are common in every state of North East India. They can diagnose and prescribe indigenous herbal medicines for common ailments and illnesses. Some herbalists inherit the gift of mystical incantation, and they are expected to prevent or alleviate misfortune or evil, to provide protection against witchcraft and misfortune, and to bring prosperity and happiness. Ingredients of some ethno-medicines are believed to be endowed with magical powers, and thus mystical techniques are considered to play a role in healing process. Diviners are prevalent in remote villages of Assam, Arunachal Pradesh and Manipur. They serve as mediators between humans and the supernatural, and diagnose the unexplainable illness through the analysis of causes of specific events and the interpretation of messages of the ancestors. They explain the illness through their power of divination. After diagnosis they provide the medication for the illness. They also do prayer for the treatment of ailments. Traditional birth attendants mainly serve in isolated and remote areas where no modern health care services are available. In urban/semi-urban communities, which despite their exposure to modern health care services, people still prefer traditional birth attendants (Ramashankar et al., 2015).

Some important traditional healing methods prevalent in North East India include herbal therapy, zootherapy, reflexology system/body massage system and magico-religious/psychotherapist system of folk medicine (Ningombam et al., 2014; Verma et al., 2014). In herbal therapy traditional healers treat different ailments and diseases by providing folk medicines made from herbs, vegetables, spices etc., and other preparations of different mono-herbal and poly-herbal formulations. Formulations are taken internally in form of decoction, concoction and simply boiled with or without spell (Ningombam et al., 2014). Zootherapy is very common among the Karbi tribes of Assam, Chakhesang and Ao tribes of Nagaland, and Nyishi and Galo tribes of Arunachal Pradesh (Verma et al., 2014). Ethno-medicines prepared from vertebrate resources are used for treating various ailments including body pain, rheumatism, asthma, eczema, tuberculosis, paralysis, skin disease, stomach disorder, jaundice, night blindness, bone fracture, malaria, dysentery, kidney trouble, breathing problem, stammering, piles and general weakness. Warm fat of buffalo, pig, domestic fowl is externally applied for relieving pain. Cooked flesh, milk, urine and fresh blood of some animals are taken to get rid of general weakness and other diseases (Verma et al., 2014). In reflexology system, the practitioners massage the body along with fruits, seed oil and crushed part of plants. This may give certain nourishing effect to the skin and other body systems. Believing that navel is the centre where human soul lies, the practitioner's massage firstly on the navel part with or without spell after which the

massaging proportions are changed from navel to belly, belly to abdomen and abdomen to other problematic part of the body (Ningombam et al., 2014). It has been reported that reflexology system is helpful in digestion, stomach problems, irregularity in menstruation, delivery problems, joints, muscle pains and for effective vibrating and re-healing activity of the human nervous system. Magico-religious/psychotherapist system of folk medicine is the use of unseen powers to cure diseases, and this practice involves incantation, oracles, performing rituals, prayer, offering devils' gift, food vegetables, flowers, etc. (Ningombam et al., 2014).

Rural people still rely on the traditional eye care practices for the treatment of various eye diseases such as cataract and correction of eye vision, since they could not afford expensive modern eye treatments. Although, many ethnobotanical and ethnopharmacological investigations reported large number of medical plants used in traditional healing practices for the treatment of various diseases, there is no detailed review available on the traditional eye medicines from North East India. This paper attempts to review the traditional eye care practices in North East India. This will provide information on the potential importance of ethno-medicines in eye cares for underprivileged section of rural population in the region.

Methods

The present study attempted to gather and document widely scattered information from various ethnobotanical investigations and ethnopharmacological reports. Several web databases such as Google Scholar, ResearchGate, ScienceDirect, Pubmed, Academia, Biomedcentral and India Biodiversity Portal were used for searching relevant secondary data on traditional healing practices particularly eye care practices in North East India. Important key words used for searching secondary data included traditional eye medicines, traditional healing practices, traditional methods of healing, herbal medicines for eye care, traditional healing practices in North East India and medicinal plants of Assam, Manipur, Nagaland, Mizoram, Tripura, Arunachal Pradesh, Meghalaya and Sikkim. Thirty-two relevant published research articles could be obtained from Google Scholar, 12 from Researchgate, 5 from Academia, 2 from Biomedcentral and 1 each from Science Direct, Pubmed and India Biodiversity Portal.

Traditional eye care practices

The present study revealed diverge traditional eye medicines used by different ethnic groups of North East India. Traditional eye medicines are derived from both plant and animal sources. Majority of ethno-medicines used for eye treatment are derived from different parts of the plants, and they are prepared in different forms for administering to the eyes, for example- decoction, concoction, latex and juice extracted from leaves,

stems, roots or flowers which are used as eye wash, eye drops or eye tonic. Honey, breast milk and human urine are also used as important traditional eye medicines. Studies have shown that application of honey to eyes can improve eyes sight; and application of urine to the injured eyes can heal the injury faster. Large number of phytomedicines that have curative properties of eyes and their methods of usage have been reported from eight states of North East India. Treatment of eye injury, conjunctivitis, sore eyes, eye ache and eye infection by using decoction or leaf juice of *Centella asiatica* is reported from Assam, Meghalaya, Mizoram and Tripura, whereas in Manipur, Mizoram and Nagaland bark or root of *Phyllanthus emblica* is boiled and the liquid is splashed on the eyes repeatedly in the early morning, afternoon and bed time or few drops of extracted gooseberry juice are applied directly on the eyes 2-3 times a day to cure sore eyes and cataract. Use of paste formed by crushing the rhizomes along with the leaves of *Cyperus rotundus* for the treatment of swellings in the eyelids is reported from Manipur, whereas use of root juice of *Commelina benghalensis* in eyelid sores is reported from Assam. Juice of *Vanda coerulea* flowers parts is used to control glaucoma and cataract in Assam, Arunachal Pradesh and Nagaland. *Cyanthillium cinereum* and *Piper betle* are reported from Mizoram to be useful in the treatment of night blindness. *Amomum aromaticum*, *Emilia sonchifolia* and *Peperomia pellucida* are reported from Manipur, Assam and Nagaland respectively for their uses in the treatment of eye inflammation. Some tribes of North East India perform superstitious ritual practices to cure various eye problems. Hmar tribes of North Cachar Hills in Assam use seven clean leaves of *Ficus glomerata* to make a cone shaped container, and fill the container with water and heated after which the water is applied on the eyes to cure any eye problems. Dimasa and Jaintia tribes of Assam cut onion bulb into two halves and hold near the eyes to cause tears to flow which is believed to cleanse the eye of all its impurities and evil eye (Rout et al., 2009).

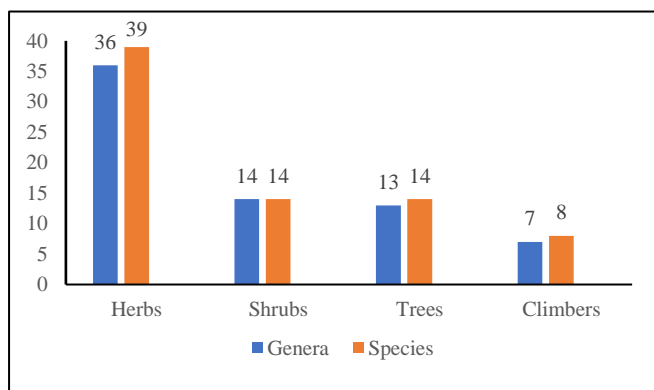


Fig.3.2. Distribution of medicinal plants reported from North East India.

Phytomedicines used in traditional eye treatment

The present study collected secondary data of medicinal plants used in eye treatments from different sources and recorded 75 species belonging to 69 genera under 46 families (**Table 3.1**). Asteraceae represented with highest number of species (8) followed by Orchidaceae (4), Rutaceae, Poaceae, Lamiaceae and Piperaceae (3 each), Malvaceae, Araliaceae, Liliaceae, Zingiberaceae, Apocynaceae, Berberidaceae, Phyllanthaceae, Commelinaceae, Convolvulaceae and Combretaceae (2 each) and rest of the plant families are represented by one each. The highest number of species was reported from Assam (29) followed by Mizoram (19), Nagaland (17), Manipur (9), Arunachal Pradesh (6), Sikkim and Tripura (4 each). Distribution of habit of medicinal plants included herbs, shrubs, climbers and tree (**Fig. 3.2**). Notable eye phytomedicines are *Azadirachta indica* (cataract), *Acanthopanax aculeatus* (eye infection), *Berberis aristata* (eye lotion), *Emilia sonchifolia* (eye inflammation), *Floscopa scandens* (sore eyes). Among the plant parts used the most widely used parts were leaves which were followed by stems, roots, fruits and flowers (Fig. 3.3). In the present study, we observed that a single medicinal plant did not have the potential for curing many of the eye problems rather it was found be useful for the treatment of only few specific eye problems. Interestingly, the medicinal plants reported from eight states of North East India, include all those potential plants which can be used for the treatment of various specific eye diseases. Reporting of less number of medicinal plants known for their use in eye care from each state indicates lesser availability of potential phytomedicines which can be used for the treatment of common eye problems in each state. The present study highlighted good number of important medicinal plants from North East India which were reported to be useful for the treatment of various eye problems. Figure 3. 4 shows the numbers of species used in the treatment of major eye ailments.

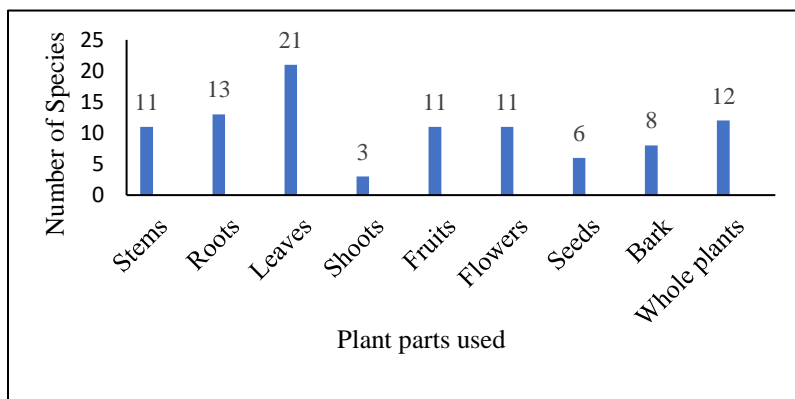


Fig. 3.3. Medicinal plant parts used in treatment of eye ailments.

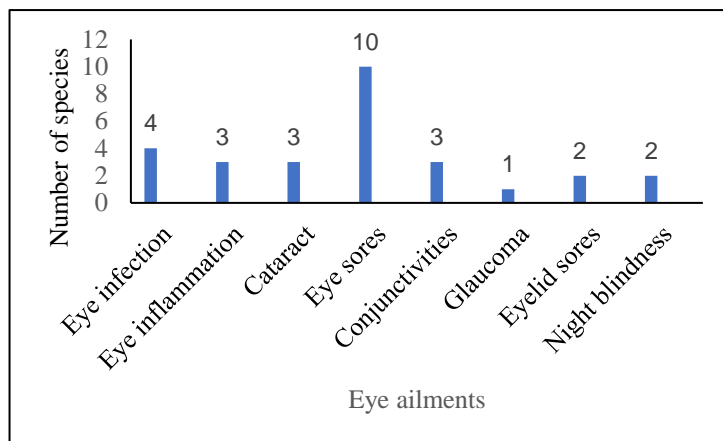


Fig. 3.4. Major types of eye ailments.

Table 3.1. Traditional eye phytomedicines reported from 8 states of North East India.

Name of plants [Family]	Parts used	Ethnomedicinal preparation and use	State	References
<i>Abelmoschus esculentus</i> (L.) Moench [Malvaceae]	Shoot	Tender shoot extract in water is boiled reduce the volume to half and the luke-warm liquid is used as eye drops to treat eye- ache.	Manipur	Singh et al., 2003
<i>Acampepapillosa</i> (Lin dl.) Lindl. [Orchidaceae]	Roots	Eye diseases.	Nagaland	Nongda, 2014
<i>Acanthopanax aculeatus</i> (Aiton) Witte. [Araliaceae]	Stem	Few drops of stem extract is applied on the infected eyes.	Arunachal Pradesh	Ghosh et al., 2014
<i>Aegle marmelos</i> (L.) Correa [Rutaceae]	Fruit, leave s and root	Eye diseases.	Assam, Manipur	Hazarika et al., 2012
<i>Ageratum conyzoides</i> (L.) L. [Asteraceae]	Leav es	Leaf juice is applied in eye trouble.	Assam	Das et al., 2008

<i>Allium cepa</i> L. [Liliaceae]	Bulb	The bulb is cut into half and hold near the eyes. This causes tears to flow which is believed to cleanse the eye of all its impurities and evil eye.	Assam	Rout et al., 2009
<i>Allium sativum</i> L. [Liliaceae]	Bulb	The extract obtained by frying the bulbs in sesame oil is used as ear drops in otitis.	Manipur	Singh & Sharma, 2018
<i>Aloe barbadensis</i> Mill. [Xanthorrhoeaceae]	Leaves	Fresh leaf juice is helpful ophthalmia.	Sikkim	De, 2016
<i>Amomum aromaticum</i> Roxb. [Zingiberaceae]	Rhizome	Crushed juice is used as droplets to treat eye inflammation.	Manipur	Ningombam et al., 2014
<i>Aquilaria malaccensis</i> Lam. [Thymelaeaceae]	Wood	Eye diseases.	Mizoram	Rai & Lalramnghinglova, 2011
<i>Asclepias curassavica</i> L. [Apocynaceae]	Flower	Flower is boiled in water, cooled and used as eye drops.	Manipur	Singh et al., 2003
<i>Averrhoa carambola</i> L. [Oxalidaceae]	Fruits	Eye cleaner.	Assam, Manipur	Hazarika et al., 2012
<i>Asparagus racemosus</i> Willd. [Asparagaceae]	Roots	Roots decoction for ophthalmic.	Mizoram	Amrithesh et al., 2018
<i>Azadirachta indica</i> A. Juss. [Meliaceae]		Gum demulcent tonic is useful in cataract.	Tripura	Das & Choudhury, 2012
<i>Berberis aristata</i> DC. [Berberidaceae]	Bark	Crushed bark mixed with water is used as eye lotion.	Arunachal Pradesh	Khongsai et al., 2011
<i>Bidens biternata</i> (Lour.) Merr. & Sherff [Asteraceae]		Fresh plant juice is used as eye drops.	Arunachal Pradesh, Assam, Mizoram	Ghosh et al., 2014; Das & Hazarika 2015; Lalramnghinglova, 2016
<i>Bidens Pilosa</i> L. [Asteraceae]	Leaves	Leaves juice mixed with water is used for eye problems.	Arunachal Pradesh, Mizoram	Khongsai et al. 2011; Rai & Lalramnghinglova,

				2011
<i>Breynia patens</i> (Roxb.) Benth. & Hook. f. [Phyllanthaceae]	Stems	Stem juice for eye diseases.	Nagaland	Shankar & Devalla, 2012
<i>Bryophyllum calycinum</i> Salisb. [Crassulaceae]	Leaves	Leaves are crushed and apply to eye sores, eye pain or eye itching twice daily.	Assam	Sajem & Gosai, 2006
<i>Celosia argentea</i> L. [Amaranthaceae]	Flower	Good for eyes.	Nagaland	Lanuinla, 2021
<i>Centella asiatica</i> (L.) Urb. [Apiaceae]	Whole plants	Decoction of leaves and juice of leaves to cure eye injury, conjunctivitis, sore eyes, eye ache, eye infection.	Meghalaya, Assam, Mizoram, Tripura	Bhuyan, 2015; Sajem & Gosai, 2006; Mipun et al., 2019; Lalramnghinglova, 2016; Choudhury et al., 2015
<i>Commelinabenghalensis</i> L. [Commelinaceae]	Roots	Root juice is applied in eye-lid sores.	Assam	De, 2016
<i>Cucurbita maxima</i> var. <i>boliviana</i> Zhit. [Cucurbitaceae]	Fruits and leaves	Fruits/leaves decoction for eye problem.	Mizoram	Amrithesh et al., 2018; Rai & Lalramnghinglova, 2011
<i>Curculigo orchoides</i> Gaertn. [Hypoxidaceae]	Roots	Eye problems.	Nagaland	Zhasa et al., 2015
<i>Curcuma longa</i> L. [Zingiberaceae]	Rhizome	Fresh extract of the rhizome in mixed with sesame oil to treat eye diseases.	Manipur	Singh & Sharma, 2018
<i>Cuscuta reflexa</i> Roxb. [Convolvulaceae]	Whole plant	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Cyanthillium cinereum</i> (L.) H. Rob. [Asteraceae]		Night-blindness.	Mizoram	Chea et al., 2006

<i>Cymbidium aloifolium</i> (L.) Sw. [Orchidaceae]	Whole plants	Weakness of eyes.	Nagaland	Chowdhery, 2001
<i>Cymbidium ensifolium</i> (L.) Sw. [Orchidaceae]	Flowers	Decoction of flowers to control eye sores.	Nagaland	Nongdam, 2014
<i>Cynodondactylon</i> (L.) Pers. [Poaceae]	Roots and leaves	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Cyperus rotundus</i> L. [Cyperaceae]	Whole plant	The paste formed by crushing the rhizomes along with the leaves is used in swellings in the eyelid.	Manipur	Singh & Sharma, 2018
<i>Datura metel</i> L. [Solanaceae]	Roots, bark, fruit and seed	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Diplazium esculentum</i> (Retz.) Sw. [Athyriaceae]	Leaves	Useful for good vision.	Assam	Gogoi et al., 2019
<i>Emilia sonchifolia</i> (L.) DC. ex DC. [Asteraceae]		Eye inflammation.	Assam	Sarkar & Devi, 2017
<i>Fagopyrum esculentum</i> Moench [Polygonaceae]	Flower	Combined with lime flower has specific treatment for haemorrhage into retina.	Nagaland	Sumi & Shohe, 2018
<i>Ficus glomerata</i> Roxb. [Moraceae]	Leaves	Seven clean leaves are made into a cone. It is then filled with water and heated. This water is then applied in the eye for any eye problems.	Assam	Rout et al., 2009
<i>Floscopa scandens</i> Lour. [Commelinaceae]	Stem	Crushed stem is used to treat sore eyes.	Assam, Tripura	Sarkar & Devi 2017; Choudhury et al., 2015
<i>Hydrocotyle javanica</i> Thunb.	Whole	Crushed juice is used as eye drops.	Mizoram	Lalramnghin glova, 2016

[Araliaceae]	plant			
<i>Ipomoea aquatica</i> Forssk. [Convolvulaceae]	Aerial plant	Cooked herb, taken as vegetable for eye sight.	Assam	Shankar et al., 2012
<i>Linderniaruelloides</i> (Colsm.) Pennell [Linderniaceae]	Whole plant	Whole plant is used internally for eye problems.	Mizoram	Rai & Lalramnghinglova, 2011
<i>Linum usitatissimum</i> L. [Linaceae]	Whole plant and seed	Eye diseased.	Assam	Das & Hazarika, 2015
<i>Lippia alba</i> (Mill.) N.E.Br. ex Britton & P. Wilson [Verbenaceae]	Leaves	Juice of leaves is used for conjunctivitis.	Assam	Mipun et al., 2019
<i>Maesachisia</i> Buch.-Ham. ex D. Don [Primulaceae]	Stem bark	Eye disease.	Nagaland	Shankar & Devalla, 2012
<i>Leucoscepttrum canum</i> Sm. [Lamiaceae]	Stem	Watery extract of stem is used to cure eye problems.	Arunachal Pradesh	Ghosh et al., 2014
<i>Mahonia sikkimensis</i> Takeda [Berberidaceae]	Bark	Bark is placed in distilled or boiled water to make eye drops for eye diseases.	Sikkim	Singh et al., 2002
<i>Marsilea minuta</i> L. [Marsileaceae]	Whole plant	Juice is used as eye drops to cure eye sores.	Mizoram	Lalramnghinglova, 2016
<i>Meriandra bengalensis</i> (J. Koenig ex Roxb.) Benth. [Lamiaceae]	Leaves	Leaf juice is used in eye troubles.	Tripura	Guha et al., 2018
<i>Micheliachampaca</i> (L.) Baill. ex Pierre [Magnoliaceae]	Flower	The flower oil is used in Ophthalmia.	Nagaland	Sumi & Shohe, 2018
<i>Mikania micrantha</i> Kunth [Asteraceae]	Leaves	Leaf juice is useful in eye trouble.	Assam	Das et al., 2008
<i>Moringa oliefera</i> Lam. [Moringaceae]	Roots, bark, leave	Water extract of root, bark, leaves, flowers and fruits for ophthalmia.	Nagaland	Zhasa et al., 2015

	s, flowe rs and fruits			
<i>Mussaenda frondosa</i> L. [Rubiaceae]	Roots	Root juice is used in eye troubles.	Nagaland	Sumi & Shohe, 2018
<i>Oxalis corniculata</i> L. [Oxalidaceae]	Whole shoot	Whole plant except root is used against eye trouble, juice of leaves is used for sore eyes.	Assam	Das et al., 2008; Mipun et al., 2019
<i>Pandanus fascicularis</i> Lamk. [Pandanaceae]	Roots	Root juice for eye diseases.	Nagaland	Shankar & Devalla, 2012
<i>Peperomia pellucida</i> (L.) Kunth [Piperaceae]	Whole plant	Eye inflammation.	Nagaland	Zhasa et al., 2015
<i>Phyllanthus emblica</i> L. [Phyllanthaceae]	Bark, Root, Fruit, seed	Sore Eyes: boil the gooseberry bark or root and splash the liquid on the eyes repeatedly while washing the face in the early morning, afternoon and bed time till cured; apply few drops of extracted gooseberry juice directly on the sore eyes 2-3 times a day till cured. Believed to cure even cataract, seed decoction is used as eye wash.	Manipur, Nagaland, Mizoram	Yuhlung & Bhattacharya, 2016; Shankar & Devalla, 2012; Rai & Lalramnghinglova, 2011
<i>Piper betle</i> L. [Piperaceae]	Leaves, roots	Eye pain, night blindness.	Mizoram	Rai & Lalramnghinglova, 2011
<i>Piper longum</i> L. [Piperaceae]		Eye diseases.	Assam	Hazarika et al., 2012
<i>Punica granatum</i> L. [Lythraceae]	Leaves, flower, fruits	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Sphaeranthus indicus</i>	Whole	Eye diseases.	Assam	Das &

L. [Asteraceae]	e plant and seed			Hazarika, 2015
<i>Saccharum officinarium</i> L. [Poaceae]	Leav es	The leaf ash is used to treat sore eyes.	Nagaland	Sumi &Shohe, 2018
<i>Sesbania grandiflora</i> (L.) Pers. [Fabaceae]	Root, leave s, flowe r	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Sidacordifolia</i> L. [Malvaceae]	Whol e plant	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Swertiachirata</i> Buch.- Ham. ex Wall. [Gentianaceae]	Whol e plant	Improve eye sight.	Sikkim	De, 2016
<i>Symplocos laurina</i> (Retz.) Wall. ex G. Don [Symplocaceae]	Bark	Ophthalmic.	Meghalay a	Singh et al., 2017
<i>Tabernaemontana divaricata</i> (L.) R.Br. ex Roem. &Schult. [Apocynaceae]	Flow er, bar k, leave s and roots	Juice of flower is used for sore eyes, sap mixed with oil is rubbed on the forehead to treat pain in the eyes, milky juice is used to treat eye diseases.	Assam, Mizoram	Mipun et al., 2019; Rai & Lalramnghinglova, 2011
<i>Tagetes patula</i> L. [Asteraceae]	Leav es, flowe r and seed	Eye diseases.	Assam	Das & Hazarika, 2015
<i>Terminalia bellirica</i> (Gaertn.) Roxb. [Combretaceae]	Seed, fruit	Seed powder is soaked in overnight in water and filtered, and the filtrate is used as eye lotion, fruit is taken for treatment of eye diseases.	Sikkim, Mizoram	Singh et al., 2002; Rai & Lalramnghinglova, 2011
<i>Terminalia chebula</i> Retz. [Combretaceae]	Fruit	Conjunctivitis, fruit extract is applied to watering eyes.	Assam, Mizoram	Singh, 2002; Sarkar & Devi, 2017; Rai

				&Lalramnghinglova, 2011
<i>Thunbergia grandiflora</i> (Roxb. ex Rottl.) Roxb. [Acanthaceae]	Stem, leaves	Sap of stem cut apply on eyes to treat eye-ache wounds, leave juice is used to treat eye diseases.	Mizoram	Lalramnghinglova 2016; Rai & Lalramnghinglova 2011
<i>Thysanolaena maxima</i> (Roxb.) Kuntze [Poaceae]	Stems	Young stem juice is applied on the eyes when eyes become red and dirty.	Meghalaya	Hynniewta & Kumar, 2008
<i>Vanda coerulea</i> Griff. ex. Lindl. [Orchidaceae]	Flowers	Juice of flowers parts used as eye drops to control glaucoma, cataract and blindness.	Nagaland, Assam, Arunachal Pradesh	Nongdam 2014; Sharma & Das, 2018
<i>Vitex negundo</i> L. [Lamiaceae]	Leaves	Eye diseases.	Mizoram	Lalramnghinglova, 2016
<i>Vitis vinifera</i> L. [Vitaceae]	Stem	Exudates of stem when apply to the eyes cures the eyes sores.	Nagaland	Zhasa et al., 2015
<i>Zanthoxylum acanthopodium</i> DC. [Rutaceae]	Fruits	Eye diseases.	Nagaland	Shankar & Devalla, 2012
<i>Zanthoxylum armatum</i> DC. [Rutaceae]	Fruits	Fruit is used to treat eye diseases.	Mizoram	Rai & Lalramnghinglova, 2011

The present paper documented pretty good numbers of phytomedicines which have the potential to cure many eye problems. However, there is limited information on the plant parts used, method of preparation and application, and quantity/doses of application. Confirmation and systematic preclinical tests of these medicinal plants are yet to be scientifically validated till date. Health seminars or workshops can be organised to educate the traditional healers, and this will help to improve their healing practices and also to avoid any form of indiscriminate use of traditional medicines which can cause serious health issues. North East India witnesses rich cultural diversity, and also serves as a huge repository of traditional knowledge of ethnomedicines. Tribal people of North East India living in remote places hardly receive proper modern healthcare facilities. Therefore, they still rely on their traditional healing practices. Since tribal people are dwelling in the forests, they are acquainted with the uses of large number of bioresources for both food and ethno-

medicines. There is a need for further investigation on the potent active compounds present in all medicinal plants reported, and these medicinal plants can be potential candidates to look for the future development of drugs for various eye diseases. This will help in effective utilization of these valuable resources of traditional phytomedicines in the treatment of various ailments and diseases.

Conclusion

The present paper is first comprehensive report of medicinal plants used in eye treatments in the entire North Eastern region India. Medicinal plants contribute major proportion to traditional eye medicines as compared to animal sources. Seventy-five species of medicinal plants used in various eye treatments have been recorded from eight states of North East India. However, the number of potential medicinal plants used in eye treatments reporting from each state is less as compared to the number of medicinal plants used in other diseases. Baseline data generated from this review will help to fill the knowledge gap in traditional eye care practices and will give maximum benefits to those underprivileged rural population who still rely on traditional healing practices for their primary health care. In addition, this will enlighten general people in the preparation of simple home remedies for the treatment of minor eye problems. However, there is a need for further research to ascertain the efficacy and safety of several traditional eye care practices and herbal formulations used in various eye treatments

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Chapter 4

Diversity of medicinal plants traditionally used for respiratory disorders in North East India: a review

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Abstract

Respiratory disease is a major public health problem and affects millions of patients every year worldwide. As per the Global Burden of Disease (GBD) survey data, in India, the problem of respiratory diseases is huge. In the present study target was made to listed the diversity of medicinal plants used to treat respiratory disorders by the ethnic peoples in North East India. The results of medicinal plant species diversity analysis showed the occurrence of 382 plant species. Most of the plants belong to the Lamiaceae and Zingiberaceae are the most dominant family contributing 22 species each followed by Asteraceae (18), Solanaceae (15), Leguminosae (12), Poaceae (12), Rosaceae (11), Rutaceae (10), Malvaceae (9) and Lauraceae (9). Among the all parts, leaves are the most used part with a percentage of 29%, followed by the roots (18%), fruits (16%), whole plant (11%), bark (9%),

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rhizome (8%), seed (6%), stem (4%), flower (3%) and shoot (3%). Total 12 different respiratory disorders are treated traditionally. Cough was the disorder treated by the highest number of species (270) followed by asthma (93), cold (58), bronchitis (53), Pneumonia (18), Sore throat (13), whopping cough (7), Tuberculosis (4), Chest Pain (4), Throat infection (3), Pharyngitis (1) and Lung inflammation (1) and breathing problems (16). Total 296 plants out of 382 plant species have been found on which pharmacological studies were conducted to evaluate their antioxidant, antiviral, antifungal, anti-inflammatory, antibacterial, antimicrobial, anti-allergic, anti-histaminic. However, details study in terms of clinical study is yet to be carried out. Medicinal plants and traditional medicine can be a promising alternative option for treatment of respiratory disorder. Overall, this review can serve as a baseline database for further studies.

Keywords: Respiratory disorders, Medicinal plants, traditional knowledge, ethnobotany, Pharmacological evaluation.

Introduction

Respiratory disease

Respiratory disease is a major public health problem and affect millions of patients every year worldwide (Annesi-Maesano et al., 2014). According to the Forum of International Respiratory Societies, respiratory diseases are one of the leading causes of death and disability in the world. Respiratory diseases enforce an enormous worldwide health burden. Among all the respiratory disease, five diseases (Chronic obstructive pulmonary disease (COPD), asthma, acute lower respiratory tract infections, tuberculosis (TB), lung cancer) are most common causes of severe illness and death worldwide (Forum of International Respiratory Societies, 2017). About 65 million people suffer from COPD, 334 million from asthma, 10.4 million from TB in the world (Forum of International Respiratory Societies, 2017).

The problem of respiratory diseases in India is huge. As per the Global Burden of Disease (GBD) survey data, both acute and chronic respiratory diseases are prevalent in considerable number in India (Dandona et al., 2017). Chronic respiratory diseases, especially asthma and chronic obstructive pulmonary disease (COPD), are one of the leading causes of variations in morbidity and mortality in many states of India (Salvi et al., 2018).

Traditional herbal medicines in respiratory disease management

Traditional herbal medicine and indigenous knowledge of traditional healers have been considered as a key healthcare supportive skill for rural population in most developing countries in world (Tilburt & Kaptchuk, 2008). A number of reviews on medicinal plants and traditional knowledge used in the management of respiratory disorders in different parts of the world available (Bussmann & Glenn, 2010; Alamgeer et al., 2018; Lawal et al., 2020).

These studies have highlighted the dependence of a good percentage of the world population on herbal medicine for management of respiratory disease, which is also same with the WHO report, where they estimate that about 80% of the population in African countries use some form of traditional herbal medicine for their primary healthcare (WHO, 2008).

In India, ethnobotanical survey of plant traditionally used to treat various disease have been carried out (Chhetri, 2005; Singh & Devi, 2015; Abatet al., 2017; Dahal, 2019). There is lack of specific research on use of ethno-medicine on particular diseases like respiratory disorder. The objective of this paper is to collate as much as possible, available information about medicinal plants traditionally used for the management of respiratory disorder in North East India.

Methods

Ethnopharmacological data sources and collection

Systematic literature searches relevant to the field of ethnobotany were carried out and the available information on various plants traditionally used for respiratory disorders was collected from different bibliographical databases via electronic search (using Pubmed, SciFinder, Scopus, Scirus, ScienceDirect, Google Scholar and Web of Science) and a library search for articles published in peer-reviewed journals and also locally available books. The phytochemicals and pharmacological activities, which are considered as helpful for the treatment of respiratory disorder are reported in this review include: Antioxidant, Anti-bacterial, Anti-inflammatory and antimicrobial activity.

Systematization of plant names and chemical structures

For the systematization of plant names and to check the status of plants gathered in this review, the database: The Plant list (<http://www.theplantlist.org/2020>) was used. Only the accepted names and family of plants species highlighted in this database were retained to be listed in this review.

Results and Discussion

Ethnobotanical data of medicinal plants used for respiratory disease treatment in North East India

The results of medicinal plant species diversity analysis showed the occurrence of 382 plant species in this review used to treat Respiratory disorder in North Eastern, India (Table 4.1) Among the 382 recorded plants, 367 species are under angiosperms, 7 are pteridophytes, 5 are gymnosperms, 2 are fungi and 1 is lichen. The species are organized with the alphabetical order of scientific name with family, part use, disease, mode of uses and pharmacological effect/ phytochemical Constituent with reference. Lamiaceae and Zingiberaceae are the most dominant family contributing 22 species each followed by Asteraceae (18), Solanaceae (15), Leguminosae (12), Poaceae (12), Rosaceae (11), Rutaceae (10), Malvaceae (9) and Lauraceae (9). Other dominant families are Acanthaceae (8), Euphorbiaceae (8), Moraceae (8), Piperaceae (7), etc. The remaining families represented by two to six plant species (e.g., Amaryllidaceae) or just a single one (e.g., Magnoliaceae, Acoraceae, Adoxaceae, etc.) (Fig. 4.1).

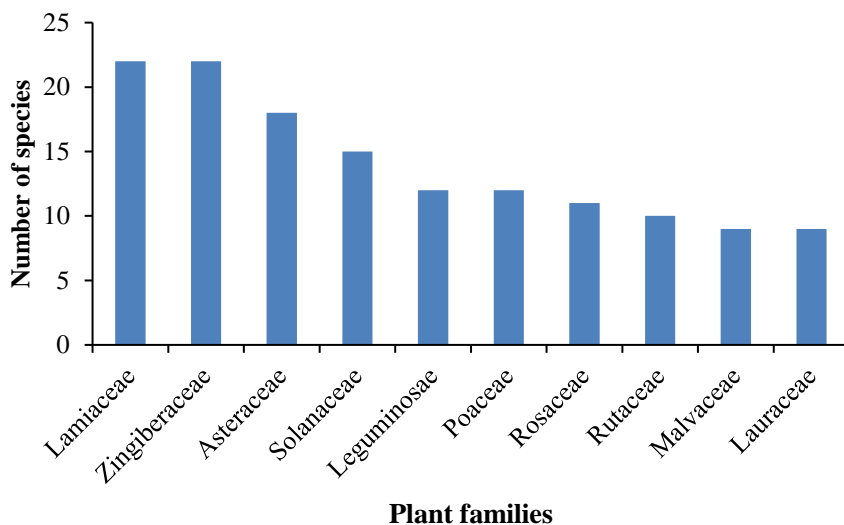


Fig. 4.1. Ten Dominant families of medicinal plants used in the treatment of respiratory disorder in North East India.

The predominance of these families could be justified by the fact that they embrace the group of species that are widely used in traditional folk healing practices

among the ethnic groups in this region (Chhetri, 2005, Singh & Devi, 2015, Abat et al., 2017, Dahal, 2019).

Plant's parts, Use and mode of preparation and Pharmacological evaluation

The leaves are the most used by population of North east India with a percentage of 29%, followed by the roots (18%), fruits (16%), whole plant (11%), bark (9%), rhizome (8%), seed (6%), stem (4%), flower (3%) and shoot (3%) (**Fig. 4.2**).

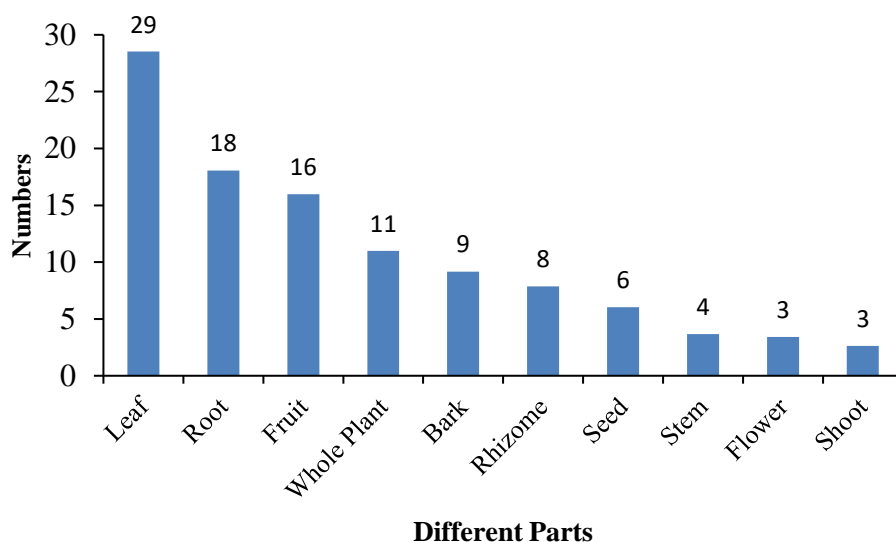


Fig. 4.2. Plant parts used as medicine.

The results of the present study are supported with the finding of another systematic review of medicinal plants traditionally used to treat respiratory disorder in Pakistan (Alamgeer et al., 2018).

The reported plants were used in 12 different respiratory disorders. The highest number of medicinal plants documented are being employed in the treatment of cough (270) followed by asthma (93), cold (58), bronchitis (53), Pneumonia (18), Sore throat (13), whooping cough (7), Tuberculosis (4), Chest Pain (4), Throat infection (3), Pharyngitis (1) and Lung inflammation (1) and breathing problems (16). The results of the present study are supported with the finding of another systematic review of medicinal plants traditionally used to treat respiratory disorder in Pakistan

(Alamgeer et al., 2018), where they also reported highest number of medicinal plants employed in the treatment of cough. Numbers of plants used in ethno-medicine for the treatment of different respiratory conditions is shown in Fig. 4.3.

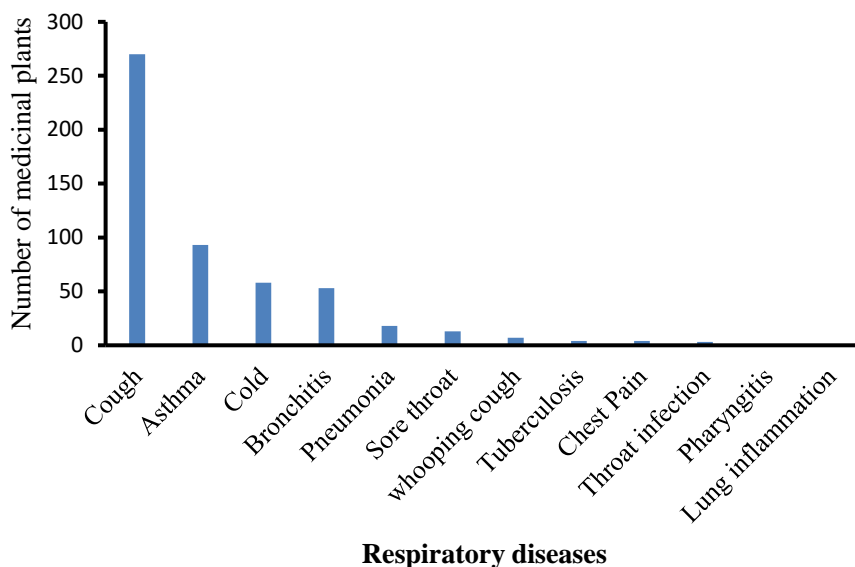


Fig. 4.3. Number of medicinal plants and different respiratory diseases treated traditionally.

Pharmacological evaluation

An attempt has been made to review the pharmacological activity of the medicinal plants recorded based literature review to confirm their traditional use against respiratory conditions. Total 296 plants out of 382 plant species have been found on which pharmacological studies were conducted to evaluate their antioxidant, antiviral, antifungal, anti-inflammatory, antibacterial, antimicrobial, anti-allergic, anti-histaminic, bronchodilator and antioxidant properties as these properties are useful for the treatment of respiratory disorders. Remaining 86 species highlighted in the table yet to be evaluated pharmacologically in order to confirm their folkloric claim (Table 4.1).

Table 4.1. Diversity of medicinal plants traditionally used for respiratory disorders.

Sl. No	Species with family	Part use	Disease	Mode of uses with reference	Pharmacological effect/ Phytochemical Constituent with reference
1.	<i>Abies densa</i> Griff. (Pinaceae)	Leaf	Cold, Cough & Bronchitis	Leaf juice taken orally to cure cough, cold, nasal congestion, asthma, bronchitis (Dahal, 2019)	Not reported.
2.	<i>Abies spectabilis</i> (D.Don) Mirb. (Pinaceae)	Needle	Cough and Bronchitis	Decoction of the needle is taken orally for the treatment of cough and bronchitis (Chhetri, 2005)	Antioxidant effect and Phenol content (Dall'Acqua et al., 2012).
3.	<i>Abrus precatorius</i> L. (Leguminosae)	Roots & Seeds	Cold, Cough & Pneumonia	Root used against cold, cough (Dahal, 2019). Seeds are used to cure Pneumonia (Dahal, 2019).	Alkaloids, Flavonoids, Steroids, Tannins, Terpenoids (Nassir et al., 2017). Anti-viral effect (Premanand& Ganesh, 2010) Antioxidant activity (Nassir et al., 2017).
4.	<i>Abutilon indicum</i> (L.) Sweet (Malvaceae)	Roots & Seeds	Fever & Cough	Decoction of roots and seeds are used in the form of	Alkaloids, glycosides, carbohydrates, tannins, phenolic compounds, proteins, amino acids,

				decoction to cure fever and cough. (Abatet al., 2017).	saponins, flavonoids, terpenoids, gums and mucilages (Chakraborty et al., 2009). Anti-bacterial activity (Pratap et al., 2014).
5.	<i>Acalypha indica</i> L. (Euphorbiaceae)	Whole plant	Cough	Herb extract given in severe cough (Singh, 1990).	Anthraquinones, Alkaloids, Catachols, Flavonoids, Phenolic compounds, Saponins, Steroids, Tannins, Triterpenoids (Chekuri et al., 2016). Antioxidant and Anti-bacterial activity (Chekuri et al., 2016).
6.	<i>Acanthospermum hispidum</i> DC. (Asteraceae)	Leaf	Cough and fever	Leaf extract with honey is given in cough and fever (Singh & Devi, 2015).	Alkaloids, Sterols, Carbohydrate and glycosides, Fixed oils and fats, Phenolic compounds, Tannins, Triterpenoids and saponins, Flavones and flavonoids and antioxidant activity (Gomathi et al., 2013).
7.	<i>Achyranthes aspera</i> L. (Amaranthaceae)	Whole plant	Pneumonia	The decoction of the herb is used (Zhasa et al., 2015).	Tannin, phlobatannin, terpenoid, flavonoid, cardiac glycoside, phenol, alkaloid and antimicrobial activity (Baraik et al., 2014).
8.	<i>Aconitum dissectum</i> D.Don (Ranunculaceae)	Tuber	Cough and asthma	Tuberous root used externally for rheumatism and	Not reported

				internally to relieve cough, asthma and fever (Dahal, 2019).	
9.	<i>Aconitum heterophyllum</i> Wall. ex Royle (Ranunculaceae)	Rhizome	Cough & cold	Rhizome is dried up and taken to relieve body-ache, fever, cold, cough, nose discharge etc. (Pradhan and Badola, 2008).	Alkaloids, Carbohydrate, Protrine & Amino acid, Saponins, Glycosides, Quinones, Flavonoids, Terpenoids (API, I (I)). Anti-inflammatory activity (Verma et al, 2010).
10.	<i>Acorus calamus</i> L. (Acoraceae)	Rhizome	Cough	Rhizome is used in respiratory disease (Ramashankar et al., 2015).	Glycosides, carbohydrate, phenolic compound, saponins, alkaloids, flavonoid, tannins, saponins, steroids, triterpenoids (Saxena & Saxena, 2012) Antioxidant activity and antimicrobial activity (Funde, 2015).
11.	<i>Acmella paniculate</i> (Wall. ex DC.) R.K. Jansen (Asteraceae)	Stem	Cough	Freshly collected young stem juice is taken 2 teaspoonfuls thrice daily after of before food along with honey to the	Alkaloids, flavonoids, tannins, saponins and Antibacterial activity (Mamidala & Gujjeti, 2013).

				patient suffering from Cough. (Deka&Nath, 2014).	
12.	<i>Justicia adhatoda</i> L. (Acanthaceae)	Leaves	Cold cough	Leaves extract is taken for cold and cough (Khongsai et al., 2011).	Alkaloids, anthraquinones, flavonoids, saponins, phytosterols, triterpenoids and poly-phenols (Jayapriya & Shob, 2015)
13.	<i>Adiantum capillus-veneris</i> L. (Pteridaceae)	Whole plant	Bronchitis	Boiled and decoction is prescribed to treat bronchitis (Ningombam et al., 2014).	Flavonoids, terpenoids, saponins, tannins and reducing sugar (Rajurkaret al., 2012). Antioxidant activity (Rajurkaret al., 2012). Antibacterial activity (Shirazi et al., 2011).
14.	<i>Adiantum lunulatum</i> Burm. f. (Pteridaceae)	Leaves & Aerial part	Cough, throat infection & bronchitis,	Leaves are used (Zhasa et al., 2015). Decoction of aerial part used against cough, bronchitis, dysentery, sore throat (Dahal, 2019).	Tannin, Flavonoid, Steroid, Saponin, Anthocyanin, Phlobatannins, Alkaloids, Phenols, Terpenoid, Anthraquinones, Glycosides (Mengane, 2016)
15.	<i>Adiantum raddianum</i> C. Presl	Whole Plant	Pulmonary, cough	Whole plant is used to treat cough	Flavonoids, Phenols, Sterols, steroid

	(Pteridaceae)		and respiratory problems.	& respiratory problems (Zhasa et al., 2015).	(Thomas, 2014).
16.	<i>Aerva lanata</i> (L.) Juss. (Amaranthaceae).	Twig	Cough & Sore throat	Decoction is orally taken to treat cough & sore throat (Ningombam et al., 2014).	Phenolic compounds, saponins, flavonoids, tannins and phytosterols (Kumar et al., 2013). Antioxidant activity (Kumar et al., 2013).
17.	<i>Ajuga macrosperma</i> Wall. ex Benth. (Lamiaceae)	Aerial Plant	Cough	The extracts of the plant is given in fever and cough (Singh, 1990).	Not reported.
18.	<i>Alangium chinense</i> (Lour.) Harms (Cornaceae)	Leaves	Cough and cold	Fresh leaves of about 200gm are boiled in two litres of water for 25 mins and the decoction of about 200ml is taken twice daily for a week in cough and cold. (Salam, 2013).	Not reported.
19.	<i>Albizia lebbek</i> (L.) Willd.	Stem bark	Cough,	Decoction of stem bark used (Rama	Alkaloids, Glycoside, Tannin, Saponin, Flavanoids,

	(Leguminosae)			Shankar & Devalla, 2012) Crushed stem bark and roots are used orally to treat cough (Jamir et al., 2010)	Carbohydrates, Amino acids, Proteins (Chulet et al., 2010). Antibacterial activity (Chulet et al., 2010). Anti-inflammatory activity (Karuppannan et al., 2013). Antioxidant activity (Karuppannan et al., 2013).
20.	<i>Albizia odoratissima</i> (L.f.) Benth. (Leguminosae)	Bark	Cough	Leaf juice with butter used to treat cough (Dahal, 2019). Decoction of bark used to treat cough (Dahal, 2019).	Alkaloids, Carbohydrate, Phytosterol, Saponins, Phenolic compound, Tannins, Flavonoid, Proteins, Terpenoid, Cardial glycosides, Steroids (Powar et al., 2020). Antioxidant activity (Banothuet al., 2017). Antimicrobial activity (Banothuet al., 2017).
21.	<i>Allium cepa</i> L. (Amaryllidaceae)	Bulb	Cold	Bulb eaten raw to treat common cold, cough, bronchitis and flu. (Tsering, 2017).	Flavonoids, phytosterols and saponins Antioxidant and antimicrobial activity (Marrelliet al., 2019).
22.	<i>Allium hookeri</i> Thwaites (Amaryllidaceae)	Bulb	Cough & Cold	Crushed juice of the leaves is taken for fever and	Alkaloids, Steroids, Flavonoids, Terpenoids, Tannins, Polyphenols (Swarnalataet al., 2016).

				cough (Singh & Devi, 2015).	
23.	<i>Allium prattii</i> C.H.Wright (Amaryllidaceae)	Bulbs, leaves & flowers	Cough and cold	Bulbs, leaves and flowers boiled in water and used as bath in cough and cold (Dahal, 2019).	Not reported.
24.	<i>Allium sativum</i> L. (Amaryllidaceae)	Bulb	whooping cough	100 gm garlic cloves pounded with 250 gm of sugar and heated. After cooling down it is prescribed in whooping cough (one teaspoonful for adults and half a teaspoonful for children twice daily for a fortnight). (Nath et al., 2008). In Meghalaya, Bulb is fried in mustard oil; oil is used for	Sulfur-containing compounds (El-SaberBatiha et al., 2020), Carbohydrates, Proteins, Amino acids, Volatile oil, Saponins, Terpenoids, Steroids, Enzymes (Kadam et al., 2019). Antibacterial, Antioxidant and Anti-inflammatory Activity ((El-SaberBatiha et al., 2020).

				massaging newborns and is taken orally for cough. Bulb is also taken with hot milk to relieve cough. Rawbulb is chewed for mouth sores. (Hynmewta& Kumar, 2008).	
25.	<i>Allium tuberosum</i> Rottl. ex Sprengel (Amaryllidaceae)	Bulb	whooping cough	Bulb pounded with equal parts of rhizome of <i>Costus speciosus</i> (Koen. ex Retz.) J.E. Smith and given in whooping cough (twice daily till cure (Nath et al., 2008)).	Sulfides, saponins, linalool, flavonoid glycosides, essential oils, (Jannat et al., 2019). Antibacterial activity (Nauman et al., 2014).
26.	<i>Alpinia galanga</i> (L.) Willd. (Zingiberaceae).	Rhizome	Cough	Fresh rhizome is eaten to cure cough (Devi, 2013).	Antimicrobial, anti-inflammatory, Anti-oxidant activity (Chouni& Paul, 2018). Alkaloids, carbohydrates, saponins, tannins, protein, glycosides,

					flavonoids, steroids and terpenoids (Subash et al., 2012).
27.	<i>Alpinia officinarum</i> Hance (Zingiberaceae)	Rhizome	Cough	Dried rhizome paste is chewed against fever, cough (Singh & Devi, 2015).	Alkaloids, Terpenoids, Saponins, Tannins, Protein and amino acids, Flavonoids, Steroids, antioxidant and antimicrobial activity (Srividya et al., 2010).
28.	<i>Alstonia scholaris</i> (L.) R. Br. (Apocynaceae)	Bark & latex	asthma	Fresh barks are cut into small pieces and decoction is prepared which is later filtered through a cloth, concentrated and dried in shade; out of this small pill (each of ca 1–1.5 g) are made, three pills a day (for adults) is the recommended dosage for curing asthma (Sajem & Gosai, 2006) Latex mixed with cow's milk	Alkaloids, Dragendorff reagent, Flavonoids, Tannin, Protein, Saponin, Glycosides, Phenols, Steroids, Carbohydrate, Antioxidant activity (Antony et al., 2011). Antituberculosis activity (Macabeo et al., 2008). Antibacterial activity (Gami & Parab, 2011).

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				and given in asthma (two teaspoonfuls of latex in 100 ml of milk, once daily for three weeks). (Nath et al., 2008).	
29.	<i>Amaranthus viridis</i> L. (Amaranthaceae)	Leaf	Cough	Leaf, take as a curry, and juice of the leaves used to cure cough (Swargiary et al., 2019).	Tannins, resins, reducing sugars and amino acids (Sowjanya et al., 2014). Antioxidant & Antimicrobial Activity (Iqbal et al., 2012)
30.	<i>Amomum subulatum</i> Roxb. (Zingiberaceae).	Seed	Cough & asthma	Powdered seeds taken with warm water to cure cough, asthma (Dahal, 2019)	Carbohydrates, flavonoids, amino acids, steroids, triterpenoids, glycosides, tannins, anthocyanins, aurone, flavanone, alkaloids, fixed oil and fats (Bisht et al., 2011). Anti-inflammatory (Alam et al., 2011). Antimicrobial activity (Kumar et al., 2010). Antioxidant activity (Verma et al., 2010)

31.	<i>Anacardium occidentale</i> L. (Anacardiaceae)	Leaves	Sore throat	Decoction of leaves is used for gargle to treat sore throat (Lalramnghinglova, 1998)	Alkaloids, carbohydrates, tannins, terpenoids, flavonoids, phenols, steroids, glycosides, volatile oils and xanthoprotein (Doss &Thangavel, 2011). Antioxidant & Antimicrobial activity (Doss et al, 2011).
32.	<i>Ananas comosus</i> (L.) Merr. (Bromeliaceae)	Fruits	Bronchial asthma	Decoction (15-20 ml.) of the fruits and of the stalk of <i>Colocasia esculenta</i> (L.) Schott is mixed with sugar and taken orally in bronchial asthma. (Sharma et al., 2001).	Alkaloids, Carbohydrate, Coumarins, Flavonoid, Glycosides, Phenols, Quinine, Saponins, Steroids, Tannins, Terpenoids (Jenitha&Anusuya, 2016)
33.	<i>Anaphalis contorta</i> (D. Don) Hook.f. (Asteraceae)	Whole plant	Cough	Plant paste taken with honey to cure cough (Dahal, 2019)	Antioxidant activity (Rawat et al., 2017)
34.	<i>Anemone rivularis</i> Buch.-Ham. ex DC. (Ranunculaceae)	Whole plant	Cough	Plant paste taken against headache, cough and fever (Dahal, 2019).	Essential oil, antimicrobial activity and antioxidant activity (Shi et al., 2012)

35.	<i>Anethum graveolens</i> L. (Apiaceae)	Leaves	Leaf	Leaves is useful in asthma, cold and cough (Nonibala, 2010)	Essential oils, fatty oil, moisture (8.39%), proteins (15.68%), carbohydrates (36%), fiber (14.80%), ash (9.8%) and mineral elements Antimicrobial activity (Stavri & Gibbons, 2005). Anti-inflammatory (Valady et al., 2010).
36.	<i>Anisochilus carnosus</i> (L.f.) Wall.	Whole plant	Cough	The plant extracts are given in cough especially for children (Singh, 1990).	Alkaloids, carbohydrates, flavonoids, glycosides, saponins, steroids, tannins, phenols, triterpenoids (Kiruthiga & Sekhar, 2014)
37.	<i>Aquilaria malaccensis</i> Lam. (Thymelaceae)	Stem	Asthma, Pneumonia,	Oil extract is used to treat asthma and Pneumonia (Zhasa et al., 2015). Whole plant is crushed, and the decoction is taken orally (Jamir et al., 2010).	Alkaloids, terpenoids, flavonoids, steroids, saponins and tannins (Nik Wil et al., 2014). Antioxidant activity (Nik Wil et al., 2014).

38.	<i>Areca catechu</i> L. (Arecaceae)	Root		Decoction of root with bark of <i>Albizia lebbek</i> (L.) Willd., root of each of <i>Citrus medica</i> L. and <i>Piper longum</i> L., rhizome of <i>Zingiber officinale</i> Rosc. and leaf of <i>Justicia adhatoda</i> L. in equal parts is administered in asthma (four teaspoonfuls, thrice daily for a month or even more if required) (Nath et al., 2008).	Alkaloids, saponins, phenol, reducing sugar, triterpenoids and glycosides (Rajamani et al., 2016). Antibacterial activity (Lalitha kumari et al., 1965).
39.	<i>Arenga pinnata</i> (Wurmb) Merr. (Arecaceae).	Root	Bronchitis	Root decoction is taken orally to treat bronchitis (Lalramnghinglova, 2001)	Anti-inflammatory activity (UmiKalsum et al., 2018)
40.	<i>Argemone mexicana</i> L.	Seed	Asthma,	Pounded seed used	Alkaloids, flavanoids, tannins and

	(Papaveraceae).		eczema & cough	against asthma, cough (Dahal, 2019).	Phenolic compounds, Phytosterols, saponins, Anthraquinone, glycosides and antibacterial activity (Saranya et al., 2012). Antioxidant activity (Perumal et al., 2010)
41.	<i>Aristolochia indica</i> L. (Aristolochiaceae)	Root	Asthma & whooping cough	Root decoction mixed with juice of ginger in equal parts with a pinch of each of black and longpepper is given in asthma and also in whooping cough of children (one teaspoonful, twice or thrice daily for three weeks). (Nath et al., 2008).	Alkaloids, Anthocyanins, Anthocyanidins, Anthracene glycosides, Anthraquinones, Cardiac glycosides, Carotenoids, Coumarins, Flavonoids, Steroids, Tannin, Triterpenoids, Volatile oil (Bawankule & Chaturvedi, 2014).
42.	<i>Artemisia indica</i> Willd. (Asteraceae)	Leaf	Asthma	Leaf is used (Kala, 2005)	Carbohydrate, Reducing sugars, Amino Acids, Saponins, Flavonoids, Alkaloids, Tannins, Sterols, Triterpenoids, Phenolics, Glycosides (Ruwali et al., 2015). Antioxidative activity (Ruwali et al., 2017).

43.	<i>Artemisia nilagirica</i> (C.B.Clarke) Pamp.	Leaf	Cough, Asthma	Leaf decoction is used in cough (Kala, 2005; Jeeva et al, 2006). In Manipur, Youg shoot is boiled and taken as vegetable to cure asthma (Devi, 2013).	Tannins, alkaloids, flavanoids, terpenoids, glycosides and antibacterial activity (Arokiyaraj et al., 2012).
44.	<i>Artemisia vulgaris</i> L. (Asteraceae)	Leaf		Leaf juice is used in the treatment of asthma (Sailo et al., 2017). Decoction of plant used in cough (Dahal, 2019)	Flavonoids, flavonols, phenolic acids, Sesquiterpene lactone, alkaloids, coumarins, saponins, sterols, tannins, terpenoids (Ekiert et al., 2020). Antioxidant (Temraz and El-Tantawy, 2008) Antibacterial (Raj Singh et al., 2011) Antispasmodic and bronchodilator activities (Khan and Gilani, 2009)
45.	<i>Artocarpus heterophyllus</i> Lam. (Moraceae)	Root	Asthma	Roots decoction are used (Zhasa et al., 2015)	Anthraquinone, Phytosterols, Terpenoids, Phenols, Glycosides, Flavonoids, Diterpenes and antibacterial activity (Sivagnanasundaram&

					Karunanayake, 2015).
46.	<i>Artocarpus lacucha</i> Buch.-Ham. (Moraceae)	Seeds and bark	Asthma	Seeds and barks are used for treatment of asthma (Zhasa et al., 2015).	Tannins, alkaloids and antibacterial activity (Kumar et al., 2010).
47.	<i>Artocarpus integer</i> (Thunb.) Merr.	Fruit	Asthma	Fruits is taken in asthma (Hazarika & Dutta, 2016).	Steroids, Triterpenoids, Saponins, Alkaloids, Tannins and Phenolic compounds, Flavonoids, Proteins, Carbohydrates (Sundarraaj & Thottiam, 2017).
48.	<i>Arundo donax</i> L. (Poaceae)	Young Shoot	Cough	Boiled extract of shoot and <i>Piper betle</i> leaf is used in cough (Nonibala, 2010).	Antibacterial activity (Shirkani et al., 2014).
49.	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	Leaves	Cough	Decoction of leaves is orally administered thrice daily for about 7 days as cure for cough (Salam, 2013).	Saponins, Tannins, Flavonoids, and Antimicrobial activity (Galeane et al., 2017).
50.	<i>Bacopa monnieri</i> (L.) Wettst. (Plantaginaceae)	Leaves and shoot	Asthma, bronchitis	Leaf juice is used to cure asthma (Swargiary et al.,	Tannin, Phlobetannin, Saponin, Flavonoid, Cardiac glycoside, Phenol, Steroid, Alkaloid,

				2019). Juice of shoot and leaf is given in bronchitis to infants and children (three teaspoonfuls, twice or thrice daily for a fortnight).(Nath et al., 2008).	Carbohydrate and antioxidant activity (Jain et al., 2017).
51.	<i>Balanophora dioica</i> R. Br. Ex Royle (Balanophoraceae)	Flowers/Inflorescences	Cough	Flowers/ Inflorescences are used for remedy (Zhasa et al., 2015).	Not reported.
52.	<i>Bambusa tulda</i> Roxb. (Poaceae)	Leaf	Cold	Leaf decoction is used to treat (Kichu et al., 2015)	Saponins, Steroids, Alkaloids, Tannins, Carbohydrates, Flavonoid, Anthraquinone, Glycosides, Reducing sugars (Dey et al., 2015) Antioxidant activity (Dey et al., 2015).
53.	<i>Bambusa vulgaris</i> Schrad. (Poaceae)	Shoot	Asthma	Bamboo shoot decoction along with honey is used to treat asthma (Swargiary et al., 2019).	Alkaloids, Tannins, Flavonoids, Phenols, Terpenoids (Owolabi & Lajide, 2015). Antimicrobial activity (Owolabi & Lajide, 2015).

54.	<i>Barleria cristata</i> L. (Acanthaceae)	Leaf	Cough	The boiled extract of the leaf is used in cough and chest pain (Nonibala, 2010). The infusion of leaves and roots is given in cough (Singh, 1990).	Alkaloids, carbohydrates, glycosides, phytosterols, flavanoids, phenolic compounds, terpenoids, anthraquinones and saponins (Kumudhaveni et al., 2020). Anti-oxidant activity (Doss & Amutha, 2009) Anti-microbial activity (Sulthana, 2017) Anti-inflammatory activity (Gambhire et al., 2009).
55.	<i>Barleria prionitis</i> L. (Acanthaceae)	Leaf	Cough	Leaf is used in the treatment of cough (Kala, 2005).	Flavonoid, glycoside, saponin, tannins and steroid (Maji et al., 2011). Antioxidant activity (Chetan et al., 2011). Antibacterial activity (Panchal & Singh, 2015). Antiviral activity (Chen et al., 1998).
56.	<i>Basella alba</i> L. var. <i>rubra</i> (L.) Stewart (Basellaceae)	Leaf		About 10 ml leaf juice mixed with 25 ml root juice of <i>Clitoria ternatea</i> L., a little water and goat's milk is given in	Anti-inflammatory activity (Krishna, 2012) Antioxidant activity (Reshmi et al., 2012)

				whooping cough (thrice daily for a fortnight). (Nath et al., 2008).	
57.	<i>Bauhinia purpurea</i> L. (Leguminosae)	Root	Sore throat	Root decoction is taken as an astringent and to relieve sore throat (Chankija, 1999).	Carbohydrate, alkaloid, steroid and sterol, Glycoside, saponin, flavonoid, tannin and phenolic compound, protein and amino acid (Marimuthu & Dhanalakshmi, 2014).
58.	<i>Begonia roxburghii</i> A.DC. (Begoniaceae)	Leaves	Cough	Leaves is used in the treatment of cough (Zhasa et al., 2015).	Alkaloids, Carbohydrates, Flavonoid, Glycosides, Tannins, Saponins (Mobarak et al., 2018)
59.	<i>Benincasa hispida</i> (Thunb.) Cogn. (Cucurbitaceae)	Leaf, Fruit & Root	Cough & Fever	Leaf juice (5ml) is taken orally to treat cough (Dolui et al., 2004). Fruit juice also useful in asthma, cough (Dahal, 2019). Infusion of the root (5 ml, 3-4 times daily) is given orally in asthma (Sharma et	Volatile oils, flavonoids, glycosides, saccharides, proteins, carotenes, vitamins, minerals, β -sitosterin and uronic acid (Rana & Suttee, 2012). Antioxidant activity (Mandana et al., 2012). Antiasthmatic activity (Kumar & Ramu, 2002).

				al., 2001).	
60.	<i>Berberis angulosa</i> Wall. ex Hook.f. & Thomson (Berberidaceae)	Root	Cough & cold	Root used to cure cough, cold (Dahal, 2019).	Not reported.
61.	<i>Betula alnoides</i> Buch.- Ham. ex D. Don (Betulaceae)	Bark	Cough	Decoction of bark used against cough (Dahal, 2019).	Antioxidant, antimicrobial activity (Ghimire et al., 2012).
62.	<i>Bidens biternata</i> (Lour.) Merr. & Sherff (Asteraceae)	Leaves	Cough	The extract of leaves is given in cough and fever by the Rongmeis in Manipur (Singh, 1990).	Not reported.
63.	<i>Bischofia javanica</i> Blume (Phyllanthaceae)	Leaf	Sore throat & cough	The leaf juice is used in the treatment of sore throat and cough (Zhasa et al., 2015).	Carbohydrates, cholesterol, proteins, flavonoids, alkaloids, phenols, saponins, tannins, and fatty acids (Chowdhury et al., 2020).
64.	<i>Blumea balsamifera</i> (L.) DC. (Asteraceae)	Whole Plant	Cold & Asthma	Entire plant used as an expectorant and in the treatment of colds. (Neogi et	Terpenoids, fatty acids, phenols, alcohols, aldehydes, ethers, ketones, pyridines, furans, alkanes, Flavonoids (Pang et al., 2014).

				al., 1989). Decoction of the leaves (10 ml, 3-4 times daily) is given orally in asthma and cough (Sharma et al., 2001).	Antioxidant, anti-microbial and anti-inflammation Activity (Pang et al., 2014).
65.	<i>Blumea fistulosa</i> (Roxb.) Kurz (Asteraceae)	Root	Cough	The boiled extract of the fresh leaf is prescribed orally in fever and cough (Nonibala 2010).	Not reported.
66.	<i>Blumea lanceolaria</i> (Roxb.) Druce (Asteraceae)	Leaves	Asthma & bronchitis	Extract of leaves is given in asthma and bronchitis (Singh, 1990).	Alkaloids, steroids, terpenoids and cardiac glycosides, tannins and phenolic compounds (Yadav et al., 2018) Antioxidant and antibacterial activity (Mishra et al., 2015).
67.	<i>Blumeopsis flava</i> (DC.) Gagnep. (Asteraceae)	Leaves	Dry cough	Boiled decoction of leaves is given for dry cough (Pfoze, 2012).	Alkaloids, Tannins, Saponins, Steroids, Phlobatannins, Terpenoids, Flavonoids, Cardiac Glycosides (Shantabi et al., 2014).
68.	<i>Boerhavia diffusa</i> L. (Nyctaginaceae)	Root	Asthma	Root Pounded and given in asthma (10 gm) thrice	Phenolic glycoside, terpenoids, organic acids, boeravinones A-J (a group of rotenoids), flavone,

				daily for three weeks). However, some medicine-men prescribed the powdered dry root. (Nath et al., 2008).	isoflavone, flavonol, flavonoid, glycoside, xanthone, Lignin, purine nucleoside, sterol, sterol ester, ecdysteroid, fatty acid, hydrocarbons (Nandi & Ghosh, 2016). Antiasthmatic, Anti-inflammatory, Antimicrobial, Antioxidant activity (Govindarajan et al., 2005).
69.	<i>Boerhavia repens</i> Linn. (Nyctaginaceae)			Leaves juice are used in asthma, (Sailo et al., 2017)	Not reported.
70.	<i>Bombax ceiba</i> L. (Malvaceae)	Root	Asthma	Roots of young plants are used (Zhasa et al., 2015).	Steroids, saponins, flavanoids, cardiac glycosides, tannins and phenolics (Jain et al., 2011). Antibacterial Activity (Islam et al., 2011). Antiviral activity (Said et al., 2011).
71.	<i>Brassaiopsis glomerulata</i> (Blume) Regel (Araliaceae)	Fruit	Cough	Fruit is used in the treatment of cough (Kala, 2005).	Not reported.
72.	<i>Breonia chinensis</i> (Lam.) Capuron (Rubiaceae)	Bark	Cough	Decoction of bark used against fever and cough (Dahal, 2019).	Not reported.

73.	<i>Caesalpinia crista</i> Linn. (Leguminosae).	Seed	Cough & Whooping cough	Seed is used in the treatment of cold, cough and whooping cough. (Gogoi et al., 2019)	Alkaloids, carbohydrates, flavonoids, tannins, proteins, reducing sugars, phytosterols, saponins, coumarins and triterpenoids (Ishan et al., 2013). Antibacterial activity (Ishan et al., 2013).
74.	<i>Cajanus cajan</i> (L.) Mill. (Leguminosae).	Seed	Cough	Seed useful against cough (Dahal, 2019).	Antimicrobial Activity (Zu et al., 2010). Antioxidant activity (Sarkar et al., 2009)
75.	<i>Calamus viminalis</i> Willd. (Arecaceae)	Leaf	Asthma	About one cup of leaf decoction along with half spoonful of black salt and one spoonful of honey is given for the treatment of asthma and cough (Majumdar & Datta, 2007).	Not reported.
76.	<i>Calotropis gigantea</i> (L.) Dryand. (Apocynaceae)	Root bark, Dry leaf, Flower	Asthma & Cough	<ul style="list-style-type: none"> • Powder of root bark mixed with fresh latex of the plant and 	Alkaloids, Glycosides, Tannins, Saponins, Flavonoids (Kori & Alawa, 2014). Antimicrobial activity (Kori & Alawa, 2014).

				<p>smoked like tobacco in asthma (once or twice daily to reduce the severity of attack). (Nath et al., 2008).</p> <ul style="list-style-type: none"> • One dry leaf is pounded with about 10 gm each of black pepper, fruit bark of <i>Sapindus mukors</i> Gaertn. and common salt made into pills of about 3 gm each and are given in cough and breathing trouble (one or two pills, twice daily for 7 to 10 days). (Nath et 	
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				al., 2008). • Flower with few drops of honey is taken in cough and asthma (Sen et al., 2011)	
77.	<i>Canavalia gladiata</i> (Jacq.) DC. (Leguminosae).	Root	Asthma	Root juice is given in asthma (two teaspoonfuls, with a pinch of common salt, twice daily for a fortnight or more) (Nath et al., 2008).	Antioxidant activity (Gan et al., 2016)
78.	<i>Capsicum chinense</i> Jack. (Solanaceae)	Fruit	Asthma	Regular eating of the fruit cure asthma (Singh et al., 2015).	Alkaloids, tannins, flavonoids, saponins, phenol, carbohydrate, protein, reducing sugar and capsaicin (Sen et al., 2016).
79.	<i>Capsicum frutescens</i> Linn. (Solanaceae)	Fruit	Sore throat	Fruit is recommended for regular eating in respiratory disorder (Sailo et al., 2017).	Alkaloids, tannins, flavonoids, saponins, phenol, carbohydrate, protein, reducing sugar and capsaicin (Sen et al., 2016).
80.	<i>Cardamine hirsuta</i> L. (Brassicaceae)	Leaf	Cough	Leaf juice taken against cough	Not reported.

				(Dahal, 2019).	
81.	<i>Careya arborea</i> Roxb. (Lecythidaceae)	Flower & Bark	Cough, mouth and throat infection	Crushed flower and bark are soaked overnight in water and used (Das et al., 2009).	Triterpenoids, steroids, tannins terpenes, sterols, tannins and saponins (Khaliq, 2016). Anti-inflammatory (Sambath kumaret al., 2006). Antibacterial & antioxidant activity (Kumar et al., 2006).
82.	<i>Cassia fistula</i> L. (Leguminosae)	Fruit pulp	Asthma & Cough	Fruit pulp useful in asthma and cough (Dahal, 2019).	Alkaloids, Carbohydrates and glycosides, Fats, Saponins, Tannins, Flavonoids, Phenolics compounds, Proteins and amino acids (Kulkarni et al., 2015). Antimicrobial & antioxidant activity (Kulkarni et al., 2015).
83.	<i>Castanopsis echinocarpa</i> Miq. (Fagaceae)	Young stem	Pneumonia	Young stem is cut to produce juice which is taken orally for Pneumonia (Lalrinkima, 2013).	Not reported.
84.	<i>Castanopsis tribuloides</i> (Sm.) A.DC. (Fagaceae)	Stem	Cough	Stem decoction is used to treat cough (Kala, 2005)	Not reported.
85.	<i>Catharanthus roseus</i>	Leaves	Asthma &	The decoction of	Anti oxidant activity

	(L.) G. Don. (Apocynaceae)		dry cough	the fresh leaves is used to treat asthma (Jamir et al., 2012). Boiled decoction of tender leaves is prescribed for fevers and dry cough (Pfoze, 2012).	(Bhutkar&Bhise, 2011). & Anti-microbial activity (Patil & Ghosh, 2010).
86.	<i>Cautleya gracilis</i> (Sm.) Dandy (Zingiberaceae)	Rhizome	Cough	The rhizome is eaten raw to relieve cough (Rai & Lalramnghinglova, 2010)	Not reported.
87.	<i>Centella asiatica</i> (L.) Urb. (Apiaceae)	Whole plant	Asthma	Decoction of the plant is taken in Asthma (Sen et al., 2011).	Alkaloids, Carbohydrate, Flavanoids, Glycosides, Phenolic compound, Saponins, Steroids, Tannins, Terpenoids (Saranya et al., 2017). Antioxidant activity (Jayashree et al., 2013) Antiviral activity (Yoosook et al., 2000). Antiinflammatory activity (Guo et al., 2004).

88.	<i>Cereus repandus</i> (L.) Mill. (Cactaceae)	Leaf	Cough	Fleshy leaf of <i>Cereus peruvianus</i> , roasted over flame. The withered leaves are then squeezed and a greenish juice is obtained. This juice is prescribed to take with honey at the rate of one teaspoonful twice daily for 3-4 days. This is often seen to be practiced among children which is a very effective preparation against cough. (Deka & Nath, 2014).	Phenolic, flavonoid, tannin, alkaloid, anthocyanin, antioxidant, antimicrobial activity (El-Beltagi et al., 2019)
89.	<i>Cinnamomum glanduliferum</i> (Wall.) Meisn. (Lauraceae)	Bark & Young leaves	Cough, bronchitis & pneumonia	Stem bark juice and juice of fresh young leaves (5 ml, 3 times daily)	Antimicrobial activity (Taha & Eldahshan, 2017). Anti-inflammatory (Azab et al., 2017).

			a	is given orally in cough, bronchitis and pneumonia. The is also given orally forthe same purposes (Sharma et al., 2001).	
90.	<i>Cinnamomum glaucescens</i> (Nees) Hand.-Mazz. (Lauraceae)	Bark	Bronchitis , Pnemonia and cough	Juice of the bark taken orally to treat bronchitis, pneumonia and cough (Lalramnghinglova , 2001).	Antimicrobial activity & antioxidant activity (Prakash et al., 2013).
91.	<i>Cinnamomum tamala</i> (Buch.-Ham.) T. Nees&Eberm. (Lauraceae)	Leaves & Bark	Asthma, Cough& Cold	In Meghalaya, Barks decoction is taken 1 tea spoonful twice daily at least three days for relief cough. (Samati, 2007). In Manipur, the boiled extract of the leaves is given	Terpenoids, Tannins, Phenol/Polyphenols, Flavonoids, Alkaloids, Saponin (Mishra et al., 2010). Antibacterial activity (Mishra et al., 2010). Antioxidant activity (Chakraborty & Das, 2010).

				in cold, cough and diuretic (Nonibala, 2010). The dried bark powder mix with honey in a dose of 3-5 g to treat cough and asthma. (Swargiary et al., 2019)	
92.	<i>Cinnamomum verum</i> J. Presl (Lauraceae)	Bark & Leaves	asthma, coughing, and tuberculosis is	The bark is dried, made into powder, then smoked along with tobacco to treat asthma, coughing, and tuberculosis (Chankija, 1999). Infusion of leaves taken against cough (Lalzarzovi & Lalramnghinglova, 2016).	Alkaloid, Flavonoid, Tannins, Saponin, Glycoside, Anthrocyenin, Coumarins, Terpenoids, Essential oil, Phenol (Ahmed et al., 2020). Antimicrobial activity (Ahmed et al., 2020)
93.	<i>Cissampelos pareira</i> L. (Menispermaceae)	Root	Cough	The root paste is given orally as	Anti-oxidant activity (Hussain et al., 2010).

				tonic in cough (Singh, 1990).	Antimicrobial activity (Kumar et al., 2006). Anti-dengue activity (Soodet al., 2015).
94.	<i>Cissusquadrangularis</i> L. (Vitaceae)	Whole plant	Asthma	Whole plant is used in the treatment of asthma (Zhasa et al., 2015).	Alkaloids, Flavonoids, Tannins, Terpenoids, Saponins, Cardiac glycosides, Proteins, Carbohydrates, Phenols (Prabhavathi et al., 2016).
95.	<i>Citrullus colocynthis</i> (L.) Schrad. (Cucurbitaceae).	Seed	Cough	Sun-dried seeds were chewed regularly (Thokchom et al., 2015).	Amino acids, saponins, alkaloids, flavonoids, flavones, tannins, sterols, triterpenes (Satti&Edriss, 2014). Antioxidant activity (Kumar et al., 2008).
96.	<i>Citrus maxima</i> (Burm.) Merr. (Rutaceae)	Fruit and Root	Cough, throat infection, Bronchial problem	Fruits are used (Zhasa et al., 2015). Decoction of root mixed with salt is given in cough and bronchial problem (four teaspoonfuls, once daily on empty stomach in the morning for	Reducing sugar, flavonoid, antraquinone, tannins, terpenoid, saponin and alkaloid (Othman et al., 2008). Antioxidant activity (Othman et al., 2008). Antibacterial Activity (Barrion et al., 2014).

				three weeks). Root juice is given to get relief from cough and bronchitis (three teaspoonfuls, twice or thrice daily for a week). (Nath et al., 2008).	
97.	<i>Citrus hystrix</i> DC. (Rutaceae)	Root	Whooping cough	Root of <i>C. hystrix</i> and outer cover of <i>C. reticulata</i> fruit are grinded together in equal amount and the juice obtained is taken 2 teaspoon twice daily for whooping cough for 7 days (Salam, 2013).	Antioxidant &Antimicrobial Activities (Uddin et al., 2014).
98.	<i>Citrus indica</i> Yu. Tanaka(Rutaceae)	Root	Asthma	Root Pounded with roots of <i>Alstonia scholaris</i> (L.) R. Br., <i>Justicia</i>	Not reported.

				<i>adhatoda</i> L., <i>Solanum</i> <i>Surattense</i> Burm.f., <i>Capsicum</i> <i>annuum</i> L., <i>Entada</i> <i>pursaetha</i> DC. and <i>Heliotropium</i> <i>indicum</i> L., black and long pepper in equal amount, made into pills of about 5 gm each and given in asthma (two pills, thrice daily for three weeks). (Nath et al., 2008).	
99.	<i>Clausena heptaphylla</i> (Roxb.) Wight & Arn. (Rutaceae)	Fruit	Cough & asthma	Fruit juice with rock slat is taken internally for the treatment of cough and asthma (Choudhury, 1999).	Flavonoids, alkaloids, saponins & steroids (Fakruddin et al., 2012). Antibacterial & antioxidant activity (Fakruddin et al., 2012).
100.	<i>Clerodendrum</i> <i>glandulosum</i> Lindl.	Leaf	Cough	Leaf decoction is used to treat cough	Polyphenols, steroids, flavonoids, saponins & antioxidant activity

	(Lamiaceae)			(Kala, 2005).	(Jadeja et al., 2009).
101.	<i>Clerodendrum indicum</i> (L.) Kuntze (Lamiaceae)	Leaves & Stem	Asthma, Bronchitis , Cough	Juice from leaves with ginger juice (1:2) is taken on cough or asthmatic condition (Sen et al., 2011). The plant stem is dried and smoked to cure asthma. The root extract is also believed to cure asthma and bronchitis (Devi, 2013). Root juice is given in asthma (two teaspoonfuls, twice daily regularly for a month). (Nath et al., 2008)	Triterpenoids, steroids, steroid glycosides, flavonoids (Somwong et al., 2015). Antimicrobial activity (Pal et al., 2012).
102.	<i>Clerodendrum infortunatum</i> L. (Lamiaceae)	Leaves	asthma	Leaves are taken raw or are mixed with vegetable for curing asthma (82%)	Phenolic content & antioxidant activity (Gouthamchandra et al., 2010)

				(Sajem & Gosai, 2006). Leaf past is also used to treat cough (Deka & Nath, 2014).	
103.	<i>Clitoria ternatea</i> L. (Leguminosae)	Root	Whooping cough	Root juice is given in whooping cough (two teaspoonfuls, thrice daily for a fortnight). (Nath et al., 2008).	Tannins, phlobatannin, carbohydrates, saponins, triterpenoids, phenols, flavanoids, flavonol glycosides, proteins, alkaloids, anthraquinone, anthocyanins, cardiac glycosides, Stigmast-4-ene-3,6-dione, volatile oils and steroids (Al-Snafi, 2016). Antibacterial activity (Anand et al., 2011). Antihistaminic and antiasthmatic (Taur & Patil, 2011)
104.	<i>Coccinia grandis</i> (L.) Voigt (Cucurbitaceae)	Leaves	Cough & respiratory tract infection	Decoction of the leaves, fruits and stem (5-10 ml, 3 times daily) is given orally in cough treatment (Sharma et al., 2001). The fruit is eaten also in cough	Antimicrobial and antioxidant activity (Sakharkar & Chauhan, 2017). Carbohydrates, Proteins, Alkaloids, Cardiac Glycosides, Flavonoids, Tannins, Phlobatannins, Resins, Saponins, Terpenoids, Steroids (Sakharkar & Chauhan, 2017).

				and respiratory tract infection (Sharma et al., 2001).	
105.	<i>Codonopsis clematidea</i> (Schrenk) C.B. Clarke (Campanulaceae).	Whole plant	Cough & Cold	Decoction of whole plant used against cough, cold (Dahal, 2019)	Not reported.
106.	<i>Codonopsis foetens</i> Hook. f. et Thomson (Campanulaceae).	Whole plant	Cough & Cold	Decoction of whole plant used against cough, cold (Dahal, 2019)	Not reported.
107.	<i>Colocasia affinis</i> Schott (Araceae)	Leaf	Fever, respiratory disorder	Leaf is eaten raw to cure respiratory disorder (Kala, 2005)	Not reported.
108.	<i>Colocasia esculenta</i> (L.) Schott (Araceae)	Root	Pharyngitis	Roots are effective in treatment of Pharyngitis (Sailo et al., 2017)	Alkaloids, Glycoside, Flavonoids, Terpenes, Saponins, Phenol (Krishnapriya & Suganthi, 2017).
109.	<i>Commelina benghalensis</i> L. (Commelinaceae).	Whole plant	Cough	Plant extract is effective in cough (Devi 2013). Extract with honey taken to cure cough (Dahal,	Oils and fats, Alkaloids, Lactones and coumarins, Triterpenoids and steroids, Resins, Reducing agents, Phenols and tannins, Amino acids, Quinones, Astringents, saponins (Cuellar et al., 2010).

				2019).	Antimicrobial activity (Cuellar et al., 2010). Antioxidant activity (Sahu et al., 2013). Anti-viral activity (Batool et al., 2018).
110.	<i>Cordia dichotoma</i> G. Forst. (Boraginaceae)	Fruit	Cough	Fruit powder taken with water to cure dry cough (Dahal, 2019).	Pyrrolizidine alkaloids, coumarins, flavonoids, saponins, terpenes and sterols (Ganjare & Raut, 2019). Antibacterial (Parekh & Chanda, 2007). Antioxidant activity (Sharma et al., 2007).
111.	<i>Cheilocostus speciosus</i> (J. Koenig) C.D. Specht (Costaceae)	Rhizome	Bronchitis	Rhizome cut and ground into pieces and the powder is eaten against bronchitis (Kayang et al, 2005).	Alkaloids, glycosides, steroids, phenolic, flavonoids, polyphenols, tannins, and β -carotene, Diosgenin, β -sitosterol, furostanol saponins-costusosides, β -D-glucoside, prosapogenins, dioscin, gracillin, dihydrophytylplastoquinone, and α -tocopherolquinone (El-Far, 2018).
112.	<i>Crateva unilocularis</i> Buch.-Ham.	Stem bark	Cough & asthma	Decoction or infusion of stem	Antibacterial activity (Bhattarai et al., 2009)

	(Capparaceae).			bark taken against cough and asthma (Dahal, 2019).	
113.	<i>Crawfurdia speciosa</i> C. B. Clarke (Gentianaceae)	Flower	Lung inflammation	Flowers used against lung disorders including lung inflammation and dry cough (Tsering, 2017).	Not reported.
114.	<i>Crinum asiaticum</i> L. (Amaryllidaceae)	Bulb	Fever, headache and cough, pneumonia	Bulb (Kalita, N., Kalita, M.C., 2014).	Carbohydrates, Alkaloids, Flavonoid, Saponins, Tannins, Sterols (Priya & Rao, 2017). Antibacterial activity (Ilavenil et al., 2010).
115.	<i>Curcuma angustifolia</i> Roxb. (Zingiberaceae)	Flower	Cough	Used for treating severe cough (Myrchiang et al., 2018). The boiled extract of flower and rhizome is used in cough (Nonibala, 2010).	Flavonoid, Carbohydrate, Protein, Alkaloid, Steroid, Tanin, Saponin (Mehra & Jain, 2019).
116.	<i>Curcuma caesia</i> Roxb.	Rhizome	Cough,	Rhizome is used	Alkaloids, flavonoids, saponins,

	(Zingiberaceae)		asthma	(Kala, 2005)	terpenoids, steroids, proteins; Antimicrobial, Antioxidant, Anti-asthmatic and anti-inflammatory activity (Tomar & Moin, 2021).
117.	<i>Curcuma decipiens</i> Dalzell (Zingiberaceae)	Rhizome	Cold &Cough	Rhizome decoction is used orally to treat cold & cough disease (Myrchiang et al., 2018)	Flavanoid, Carbohydrate, Protein, Alkaloid, Steroid, Tanin, Saponin (Mehra & Jain, 2019).
118.	<i>Curcuma longa</i> L. (Zingiberaceae)	Rhizome	Bronchitis & Cough,	Rhizome and Leaves juice with honey is used in cough and fever. (Sailo et al., 2017). Rhizome powder mixed with cow's milk is given in bronchitis (one teaspoonful of powder mixed with 200 ml om milk in a dose twice daily for three weeks) (Nath et al., 2008).	Anti-inflammatory activity (Bagad et al., 2013) Antimicrobial activity (Jalaluddin et al., 2019).

119.	<i>Curcuma zedoaria</i> (Christm.) Roscoe (Zingiberaceae)	Rhizome	Cold, cough	Rhizome is used (Kala, 2005)	Anti-inflammatory activity (Mau et al., 2003). Antimicrobial activity (Wilson et al., 2005)
120.	<i>Cuscuta reflexa</i> Roxb. (Convolvulaceae)	Stem	Cough	Juice of the stem is taken in jaundice and cough (Sen et al., 2011).	Lauric acid, ester compound, alkanes, phenolic compound, myristic acid, plasticizer compound, palmitolic acid, palmitic acid, diterpene, stearic acid, mono unsaturated fatty, chlorine compound, steroid, alkaloid, triterpenes and amino compound (Rai et al., 2016). Antioxidant activity (Tanruean et al., 2017).
121.	<i>Cyanthillium cinereum</i> (L.) H. Rob. (Asteraceae)	Whole plant	Cough	The boiled extract of the plant is used in cough. (Nonibala, 2010)	Steroid, flavonoid, glycoside, saponins and tannin (Roy et al., 2019). Antioxidant activity (Guha et al., 2011)
122.	<i>Cymbopogon citratus</i> (DC.) Stapf (Poaceae)	Whole plant	Cough	Hot decoction (c 10 ml) is taken orally twice a day for the treatment of cough and cold (Choudhury,	Ketones, alcohols, phenols, terpenes, flavonoids, saponins, steroids, tannins, alkaloids, geranial, terpenoids, polyphenols, esters, aldehyde and fatty acids (Oladeji et al., 2019).

				1999).	Anti-bacterial activity (Ambade & Bhadbhade, 2015). Antioxidant activity (Lu et al., 2014).
123.	<i>Cymbopogon flexuosus</i> (Nees ex Steud.) W. Watson Poaceae	Leaves	Respiratory infections as sore throats, pneumonia	Leaves (Kalita, N., Kalita, M.C., 2014)	Not reported.
124.	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Whole plant	Cough	Whole plant crushed with water and the filtrate is taken 3-5 teaspoon twice daily at least 3 days for relief of cough. Plant juice with honey is given in morning to reduce cough (Sen et al., 2011).	Proteins, carbohydrates, minerals, flavonoids, carotenoids, alkaloids, glycosides and triterpenoids (Kumar et al., 2013). Antioxidant activity (Bhalerao et al., 2011).
125.	<i>Cyperus esculentus</i> L. (Cyperaceae)	Rhizome	Cough	Rhizome is used in case of fever, cold and coughs	Alkaloides, Cyanogenic glycosides, Resins, Tannins, Sterols, Saponins (Chukwuma et al., 2010).

				problems (Devi, 2013).	
126.	<i>Cyperus haspan</i> L. (Cyperaceae)	Rhizome	Cough	The extract of rhizome is given with honey in cough (Singh, 1990).	Not reported.
127.	<i>Cyperus rotundus</i> L. (Cyperaceae)	Rhizome	Cough	Fresh rhizome extract is given in cough (Devi, 2013)	Protein, carbohydrate, phenole, flavonoid, alkaloid, terpenoid, and Saponin (Prakash et al., 2019).
128.	<i>Cyphomandra betacea</i> (Cav.) Sendtn. (Solanaceae)	Fruit	Cold, sore throat	Fruits are used to treat cold and sore throat (Zhasa et al., 2015).	Antioxidant activity (Ordóñez et al., 2010)
129.	<i>Dactyloctenium aegyptium</i> (L.) Willd. (Poaceae)	Culm with bark	Asthma	Decoction of culm with bark of <i>Terminalia arjuna</i> (Roxb.) Wt. et Arn. in equal quantities is given in asthma of children (20 ml, thrice daily for two to three months). (Nath et al., 2008).	Carbohydrates, proteins, amino acids, terpenoids, alkaloids, saponins, tannins, flavonoids, steroids, fixed oils and phenols (Nagarjuna et al., 2015). Antimicrobial activity (Kumar et al., 2015), antioxidant activity (Al-Snafi, 2017).
130.	<i>Datura stramonium</i> L.	Fruit, Dried leaf,	Asthma	Fruit juice is used	Tropane alkaloids, amino acids,

	(Solanaceae)	Seed		in treatment of asthma (Sailo et al., 2017). Dried leaf powder is smoked in asthma. Seed paste is given in asthma with goat's milk (5 gm paste in 250 ml of milk, once daily for a week or more). (Nath et al., 2008).	tannin, phytic acids, carbohydrates (Singh & Singh, 2013). Antibacterial activity (Reddy, 2010). Antioxidant activity (Kumar et al., 2008).
131.	<i>Daucus carota</i> L. (Apiaceae)	Seed	Cough	Seeds used in the treatment of cough (Dahal, 2019).	Alkaloids, carbohydrate, phenol, flavonoids, coumarin, chlorogenic acid and terpenoid (Sivanantham and Thangaraj, 2015)
132.	<i>Dendrobium nobile</i> Lindl. (Orchidaceae).	Flower	Bronchitis & Cough	Infusion of flowers with honey taken against bronchitis and cough (Dahal, 2019).	Reducing sugar, Flavonoid, Tannin, Glycosides, Alkaloids, Steroids, Phytosterols, Antibacterial activity, Antioxidant activity, Antiviral activity (Meitei et al., 2019).
133.	<i>Desmodium heterocarpon</i> (L.) DC. (Fabaceae)	Leaves	Cough & cold	Leaves and bark extracts are used to treat cough & cold (Zhasa et al.,	Antimicrobial activity (Arora et al., 2014). Antioxidant Activity (Hasan et al., 2011).

				2015).	
134.	<i>Dillenia indica</i> L. (Dilleniaceae)	Dried Fruit	Cough	The dried fruits are chewed during severe cough (Khongsai et al., 2011). Decoction of tender shoot is orally taken twice daily among the Meitei community in Manipur in the treatment of asthma (Ningombam et al., 2014).	Glycosides, Steroids, Flavonoids, Saponins, Reducing Sugar (Bose et al., 2010). Anti oxidant activity (Das et al., 2012).
135.	<i>Dioscorea pentaphylla</i> L. (Dioscoreaceae)	Root	Asthma and cough.	Root is used in the treatment of asthma and cough (Rama Shankar & Devalla, 2012).	Antibacterial activity (Prakash & Hosetti, 2012). Terpenoids, Tannin, Saponin, Glycosides, Reducing Sugar, Flavonoid, Phenolic compounds (Kumar et al., 2013).
136.	<i>Docynia indica</i> (Wall.) Decne. (Rosaceae)	Fruit/ Young leaves	Cough	Fruit is taken as raw during cold & cough (Neogi et al., 1989).	Total phenolics and flavonoids, antioxidant activity, Antibacterial activity (Shende et al., 2016).
137.	<i>Drymaria cordata</i> (L.)	Whole plant	Cough	Decoction of Plant	Alkaloids, flavonoids, phenols,

	Willd. ex Schult. (Caryophyllaceae)			is used in the treatment of cough (Rama Shankar & Devalla, 2012).	tannins and saponins (Bhattacharyya et al., 2019).
138.	<i>Eclipta prostrata</i> (L.) L. (Asteraceae)	Leaf	Cough	Leaf extract along with little honey is given against cough (Devi, 2013).	Alkenynes, alkaloids, cardiacglycosides, flavonoids, coumestans, lipids, polyacetylene, steroids, saponins, steroidal alkaloids, phytosterol, triterpenes (Chung et al., 2017).
139.	<i>Elaeocarpus floribundus</i> Blume (Elaeocarpaceae)	Fruit	Cough	Ripe fruits are eaten raw and are prescribed as remedy for dry cough (Pfoze, 2012).	Cardiac glycosides, Anthraquinone-glycosides, Steroids, Terpenoids, Quinones, Phenol and antibacterial activity (Sircar & Mandal, 2017).
140.	<i>Elaeocarpus serratus</i> L. (Elaeocarpaceae)	Fruit	Cough	Fruit is useful in cough (Dahal, 2019).	Alkaloid, Glycoside, Tannin, Saponin, Flavonoid, Carbohydrate and antibacterial activity (Biswas et al., 2012).
141.	<i>Elephantopus scaber</i> L. (Asteraceae)	Root	Cough & Cold	Root useful in cough and cold (Dahal, 2019).	Alkaloids, Flavonoids, Tannins, quinones, and carbohydrates oils and antioxidant activity (Gangarao et al., 2012). Antibacterial activity (Jenny et al., 2012).

142.	<i>Elsholtzia blanda</i> (Benth) Benth. (Lamiaceae)	Leaf	Cough	Leaf juice is taken orally in cough. (Khomdram et al., 2011)	Not reported
143.	<i>Ensete superbum</i> (Roxb.) Cheesman (Musaceae)	Exudate	Cough	The exudate (2-5 ml.) is given orally (2-3 times daily) in the treatment of cough.	Sterol, Flavonoid, Alkaloid, Carbohydrate, Glycosides, Tannin, Protein, Antioxidant activity (Sethiya et al., 2016).
144.	<i>Ephedra gerardiana</i> Wall. ex Stapf (Ephedraceae)	Whole Plant	Asthma	Decoction of the plants is used against asthma (Dahal, 2019).	Antioxidant and antibacterial activity (Khan et al., 2017).
145.	<i>Equisetum ramosissimum</i> Desf. (Equisetaceae)	Whole Plant	Cough	Decoction of plant is used in cough (Zhasa et al., 2015).	Flavonoids, alkaloids, phenolic proteins, triterpenoids, saponins, phytosterols (Yusuf et al., 2020).
146.	<i>Erythrina stricta</i> Roxb. (Papilionaceae)	Stem bark	Asthma	Stem bark paste is used (Jamir et al., 2010).	Antimicrobial and antioxidant activity (Akter et al., 2016).
147.	<i>Eucalyptus tereticornis</i> Sm. (Myrtaceae)	Leaf	Asthma & Cough	The leaves are boiled and steam is used in treatment of cough and asthma (Nonibala, 2010).	Saponins, tannins, steroids, cardiacglycosides flavonoids and antimicrobial activity (Jain et al., 2010).

148.	<i>Euphorbia hirta</i> L. (Euphorbiaceae).	Whole plants	Bronchitis & Asthma	The plant extract is mixed with water and is taken for bronchial & asthma. (Khongsai et al., 2011). Leaf juice is taken to reduce cough (Sen et al., 2011).	Reducing sugars, terpenoids, alkaloids, steroids, tannins, flavonoids, phenolic compounds and antioxidant activity (Basma et al., 2010).
149.	<i>Euphorbia neriiifolia</i> L. (Euphorbiaceae)	Latex	Cough	Latex mixed with latex of <i>Jatropha curcas</i> L., stem of <i>Tinospora cordifolia</i> Miers. Andhoney in equal parts is given in asthma (one or two teaspoonfuls, twice daily for a month). (Nath et al., 2008). Oven heated leaves are placed on the chest to control cough (Das & Choudhury, 2012).	Flavonoids, phlobatannins, saponin, tannins, cardenoloids, phenol, terpenoids, antimicrobial activity (M. Swamy et al., 2011).
150.	<i>Fagopyrum esculentum</i>	Leaf	Cough	The extract of the	Antioxidant activity (Watanabe,

	Moench. (Polygonaceae)			leaf juice is used to treat cough (Jamir et al., 2012).	1998).
151.	<i>Ficusbenjamina</i> L. (Moraceae)	Tender Shoots	Cough	The tender Shoots are taken as raw (Jamir et al., 2012)	Tannins, carbohydrates, phytosterols, flavonoids, phenolics, oils and fats, saponins, Antioxidant activity (Jain et al., 2013). Antimicrobial activity (Imran et al., 2014).
152.	<i>Ficus carica</i> subsp. <i>Rupestris</i> (Hauskn.) Browicz (Moraceae)	Fruit	Bronchitis	Fresh green fruit (3 to 4) are taken raw with a little salt at bed time is good for bronchitis (Singh et al., 2015).	Not reported.
153.	<i>Ficus hispida</i> L.f. (Moraceae)	Fruit and Bark	Asthma & Cough	2-3 fresh hypanthodia crushed and taken with common salt twice daily against mild cough (Choudhury, 1999). Decoction of bark with pinch of powdered <i>Piper</i>	Alkaloids, flavonoids, flavonols, resins, saponins, proanthocyanidins, glycosides, steroids, tannins, Antioxidant activity (Tasmin et al., 2018).

				<i>nigrum</i> and honey is orally taken for 7 days to treat asthma among Meitei community in Manipur (Ningombam et al., 2014).	
154.	<i>Ficus religiosa</i> L. (Moraceae)	Fruit, Bark and Root	Asthma, Cough & respiratory troubles	Decoction of the bark is given orally in cough (Sharma et al., 2001). The fruit juice (5 ml,) 3-5 times daily is given orally in asthma and other respiratory troubles. Decoction of the root (5-10 ml, 3-4 times daily) mixed with a little salt is given orally in asthma (Sharma et al., 2001).	Phenols, tannins, steroids, alkaloids, flavonoids, protein, flavonols, phytosterols (Chandrasekar et al., 2010). Antibacterial activity (Farrukh & Iqbal, 2003). Antioxidant activity (Bushra & Muhraf, 2009).
155.	<i>Flacourtia jangomas</i>	Dried leaves	Bronchitis	Dried leaves are	Not reported.

	(Lour.) Raeusch. (Flacourtiaceae)			effective in bronchitis. (Swargiary et al., 2019).	
156.	<i>Flueggea virosa</i> (Roxb. ex Willd.) Royle (Phyllanthaceae).	Leaves	Cough	The extract of leaves is given in cough (Singh, 1990)	Alkaloids, triterpenoids, tannins, flavonoids and saponins, resins, steroids, cardiac glycosides, anthraquinones, antioxidant activity, antimicrobial activity (Renu et al., 2018). Anti-inflammatory activity (Yerima et al. 2009).
157.	<i>Fragaria nubicola</i> (Lindl. ex Hook.f.) Lacaita (Rosaceae)	Fruit	Cold, cough & fever	Fresh fruit of <i>F. nubicola</i> , dried roots of <i>G. elatum</i> and leaves of <i>P. peduncularis</i> are crushed together to prepare a paste. Paste is taken orally to treat cold, cough, and fever (Chakraborty et al., 2017).	Flavonoid, Terpenoid, Glycoside, Quinone, Polyphenol, Saponin (Giri & Rajbhandari, 2020). Antioxidant activity (Anees et al., 2018).
158.	<i>Garuga pinnata</i> Roxb. (Bursaraceae)	Leaf	Asthma	Leaf juice with honey is given for	Flavonoid, Reducing sugar, Glycosides, Tannins (Upadhye &

				asthma (Kayang et al., 2005). Leaf juice mixed with sugar is taken to cure asthma (Lalfakzuala et al., 2007).	Rajopadhye, 2010). Antioxidant activity (Kathad et al., 2010).
159.	<i>Gaultheria fragrantissima</i> Wall. (Ericaceae).	Leaves	Cough	Crushed leaves with water taken to cure cough (Dahal, 2019).	alkaloids, Saponin, Protein, Quinone, Sterols, flavonoids and terpenoids, steroids, Cardiac glycoside, Reducing sugar, tannin Antioxidant & antibacterial activity (Pandey et al., 2017).
160.	<i>Gaultheria trichophylla</i> Royle. (Ericaceae)	Leaves & Fruits	Cough & Cold	Leaves and fruits used to heal wounds and cure cough and cold (Dahal, 2019).	Alkaloids, flavonoids, tannins, saponins terpenoids, and anthraquinones (Alam& Saqib, 2015).
161.	<i>Gelsemium elegans</i> (Gardner & Chapm.) Benth. (Gelsemiaceae)	Leaf	Asthma	The leaf is processed like tobacco leaf for smoking, which is then smoke like cigarette to cure asthma (Lalrinkima,	

				2013).	
162.	<i>Gentiana depressa</i> D. Don (Gentianaceae).	Dried roots	Cold & Cough	Dried roots of <i>Gentiana depressa</i> , <i>Gentiana ornata</i> , <i>Gentiana phyllocalyx</i> and <i>Gentiana tubiflora</i> are crushed and then mixed with local millet wine and water. Small round pills are prepared and sun dried. pills are used to treat cough, cold, and headache (Chakraborty et al., 2017).	Reducing sugar, alkaloids, saponin, catholic, tannin, flavonoids, steroids and antibacterial activity (Lamichhane et al., 2014).
163.	<i>Gentiana kurroo</i> Royle (Gentianaceae)	Whole Plant	Cough	Decoction or infusion taken orally to treat cough (Tsering, 2017).	Anti-inflammatory (Khan et al., 2014). Tannins, flavonoids, phenolics, cardiac glycosides, saponin, terpenes, alkaloids and carbohydrate (Wani et al., 2011).

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164.	<i>Gentiana urnula</i> Harry Sm. (Gentianaceae)	Cough & Cold	Whole plant; medicine	Water decoction taken orally to treat cough, cold and fever (Tsering, 2017).	Tannin (Wangchuk, 2014)
165.	<i>Geranium wallichianum</i> D. Don ex Sweet (Geraniaceae)	Root	Cold & Cough	Decoction of root is taken in cold and cough (Chhetri, 2005).	Antimicrobial activity (Ismail et al., 2012).
166.	<i>Gerardiana diversifolia</i> (Link) Friis (Geraniaceae)			Decoction of root taken against asthma and sore throat (Dahal, 2019).	Phenol, flavonoids, tannin, terpenoid, amino acid, tocopherol, carotenoids content and antioxidant and antibacterial activity (Thakur et al., 2020).
167.	<i>Globba multiflora</i> Wall. ex Baker (Zingiberaceae).	Rhizome	Hooping Cough	Hot decoction of rhizome is taken internally, half cup (c 20 ml) twice daily for the treatment of hooping cough (Choudhury, 1999).	Not reported.

168.	<i>Gmelina arborea</i> Roxb. (Lamiaceae)	Root bark & Leaves	Cough	Root bark decoction is one of the important constituents of Dasmula Quath. (Rama Shankar &Rawat, 2013). In Meghalaya, Khasi people used to take leaves juice (10 ml, thrice daily) in the treatment of cough.	Lignans, iridoid, glycoside, flavonoids, flavons, flavone glycoside and sterols (Arora &Tamrakar, 2017). Antimicrobial activity (El-Mahmood et al., 2010). Antioxidant activity (Ghareeb et al., 2014).
169.	<i>Grewia nervosa</i> (Lour.) Panigrahi	Root	Cough	Decoction of root used in cough (Choudhury, 1999).	Saponins, tannins, flavonoids, terpenoids, phlobatannins, carbohydrates, coumarins, proteins, emodins, anthraquinones, anthocyanins, alkaloids and antioxidant activity (Ahammed et al., 2018).
170.	<i>Gymnopetalum chinense</i> (Lour.) Merr. (Cucurbitaceae)	Root	Pneumonia	Root paste is used in the treatment of pneumonia (Sailo et al., 2017).	Phenolic compounds, tannin, saponin, flavonoids, glycosides (Kumar et al., 2017).
171.	<i>Hedychium coccineum</i> Buch. -Ham. ex Sm.	Young shoots	Asthma	Young shoots are eaten raw to treat	Not reported.

	(Zingiberaceae)			Asthma (Tag & Das, 2004)	
172.	<i>Hedychium coronarium</i> Koenig. (Zingiberaceae)	Rhizome	Cough	Rhizome useful in cough (dahal, 2019).	Carbohydrates, flavonoids, saponins, steroid, alkaloids (Dash & Sheikh, 2015).
173.	<i>Hedychium gracile</i> Roxb. (Zingiberaceae)	Roots	Chest pain	Roots pounded into paste and juice extract taken for relief of chest pain locally known as Dawaiigutrupai. (Samati, 2007).	Not reported.
174.	<i>Hedychium spicatum</i> Sm. (Zingiberaceae)	Rhizome	Chest Pain, Cold, Cough, bronchitis & tuberculosis is	Raw rhizome is crushed and small round pills are prepared and sun dried. Pills are taken orally for treatment of chest pain, cough and cold (Chakraborty et al., 2017). Decoction of rhizome is given twice a day to treat	Essential oil & Antioxidant activity (Rawat et al., 2011).

				bronchitis and tuberculosis (Chhetri,2005).	
175.	<i>Hedychium villosum</i> Wall. (Zingiberaceae)	Rhizome	Asthma	Rhizomes are washed thoroughly in running water and eaten raw or crushed with water and used to cure asthma (Neogi et al., 1989).	Not reported.
176.	<i>Hedyotis scandens</i> Roxb. (Zingiberaceae)	Leaves	Cough & Cold	Leaves juice is used to treat cold & cough (Jeeva et al., 2006). Decoction of the dried leaves is taken for cough and cold (kayang, 2005).	Antimicrobial activity (Subba& Basnet, 2014).
177.	<i>Hedyotis uncinella</i> Hook. & Arn. (Zingiberaceae)	Root	Cough	Roots pounded and juice extract taken 2-3 teaspoon twice daily for relief	Not reported.

				from cough, locally known as Dawaikyoh (Samati, 2007).	
178.	<i>Helianthus annuus</i> Linn. (Asteraceae)	Root	Cough & Cold	Root decoction as a gargle relieves toothache; dried flower chewed cures ulcers, fever, cough and cold (Pradhan and Badola, 2008).	Saponins, tannins, alkaloids flavonoids, anthraquinones, reducing sugars and terpenoids (Verma et al., 2017).
179.	<i>Hemiphragma heterophyllum</i> Wall. (Plantaginaceae)	Fruit	Cold and Cough	Fruit taken to cure throat pain, cold and cough (Dahal, 2019).	Not reported.
180.	<i>Heracleum wallichii</i> DC. (Apiaceae)	Fruit	Cold and Cough	Fruits taken against cold & cough (Dahal, 2019).	Antibacterial activity (Sharma, 2013).
181.	<i>Hibiscus cannabinus</i> L. (Malvaceae)	Leaves	Cough.	Extract of leaves are used to treat cough (Zhasa et al., 2015).	Flavonoids, tannins, anthroquinone & antioxidant activity (James et al., 2013).
182.	<i>Hibiscus macrophyllus</i> Roxb. ex Hornem.	Leaves	Cough	Leaf extract is administered to	Not reported.

	(Malvaceae)			reduce cough (Sen et al., 2011).	
183.	<i>Hibiscus rosa-sinensis</i> L. (Malvaceae)	Bark	Asthma	Bark extract mixed with paste of roasted leaves of <i>Sansevieria roxburghiana</i> Schult. f., seed of <i>Luffa acutangula</i> (L.) Roxb. and bark of <i>Litsea salicifolia</i> (Roxb.ex. Nees) Hook. f. in equal parts is given in asthma (about 20 gm, twice daily for a month). (Nath et al., 2008).	Alkaloids, glycosides, flavonoids, tannin, phenols protein, steroid, carbohydrate and antibacterial activity (Tiwari et al., 2015).
184.	<i>Hippophae salicifolia</i> D. Don (Elaeagnaceae)	Fruit	Asthma, Bronchitis, cold, cough	Fruits juice used to treat asthma, bronchitis, hypertension, cold, cough (Dahal, 2019).	Steroid, Phenolic compound, Saponins, Flavonoids, Coumarin glycosides, Proteins, Carbohydrates (Iango et al., 2013). Antioxidant and antibacterial activity (Saikia and Handique, 2013).
185.	<i>Hippophae tibetana</i>	Fruit	Asthma,	Fruit juice used to	Not reported.

	Schltdl. (Elaeagnaceae)		Cold & Cough	treat asthma, cough and cold (Dahal, 2019).	
186.	<i>Hordeum vulgare</i> Linn. (Poaceae)	Cereal	Bronchial cough	Gruel is made by the powdered grains and given in case of painful indigestion. Barley water with honey is prescribed in bronchial coughs (Pradhan and Badola, 2008).	Carbohydrates, Starch, Sucrose, Other sugars, Water-soluble polysaccharides, Alkali-soluble polysaccharides, Cellulose, β -glucan, Lipids, Nonpolar lipid (NL), Glycolipids (GL), Albumins and globulins, Prolamins (hordeins), Glutelins (hordenins), Antioxidant & antibacterial activity (Rashid et al., 2017).
187.	<i>Houttuynia cordata</i> Thunb. (Saururaceae)	Rhizome	Cough	Rhizome is eaten as raw for cough. (Khongsai et al., 2011).	Anti-viral activity (Ren et al., 2011), anti-inflammatory activity (Shin et al., 2010), Anti-oxidant antibacterial, activity (Kumar et al., 2014).
188.	<i>Hyptis suaveolens</i> (L.) Poir. (Lamiaceae)	Leaf	Cold, cough	Leaf is used (Kala, 2005)	Essential oils, alkaloids, flavonoids, phenols, saponins, terpenes, sterols, Antimicrobial activity, Anti-oxidant activity (Sharma et al., 2013).
189.	<i>Imperata cylindrica</i> (L.) Rausch. (Poaceae)	Rhizome	Cough	Rhizome juice taken against cough (Dahal, 2019).	Tannins, saponins, flavonoids, alkaloids, quinines, glycosides, terpenoids, phenols, coumarin, steroids and antioxidant activity

					(Ravi et al., 2018).
190.	<i>Indigofera dosua</i> D. Don (Leguminosae)	Leaves	Cough	The extracts of leaves are given to cough (Singh, 1990).	Not reported.
191.	<i>Iris domestica</i> (L.) Goldblatt et Mabb. (Iridaceae).	Rhizome	Cough & Sore throat	Decoction of rhizome used against cough, fever, sore throat (Dahal, 2019).	Not reported.
192.	<i>Jatropha curcas</i> L. (Euphorbiaceae)	Leaves	Cough	Decoction of leaves used against cough (Dahal, 2019).	Total phenols, tannins, free amino acids and phytic acid (Tomar et al., 2015).
193.	<i>Juniperus communis</i> L. (Cupressaceae)	Fruit	Sore throat and throat pain	Dried fruit is chewed as a nut in case of sore throat and throat pain (Chhetri, 2005).	Alkaloid, Glycosides, Tannin, Sugar, Terpenoid, Flavonoid, Coumarin (Meena
194.	<i>Justicia adhatoda</i> L. (Acanthaceae)	Leaf	Cold, Cough and asthma	Leaf juice is used in treatment of cold and cough (Sailo et al., 2017). Mature leaves are sun dried and smoked in a pipe	Alkaloids, Glycosides, Steroidal/triterpenes, Phenolic & tannins, Resins (Gupta et al., 2014).

				to relieve asthma (Chankiga, 1999). Leaf juice is given in bronchitis (20 ml, twice daily for a month). (Nath et al., 2008).	
195.	<i>Justicia procumbens</i> L. (Acanthaceae)	Leaf	Asthma & Cough	The leaf infusion is given in asthma, cough (Singh, 1990).	Antiviral activity (Asano et al., 1996).
196.	<i>Kaempferia galanga</i> L. (Zingiberaceae)	Rhizome	Asthma	Rhizome juice is used to treat cough (Rama Shankar & Rawat, 2013). Rhizome is also used in asthma (Ramashankar et al., 2015).	Antimicrobial, antioxidant, anti-inflammatory, anti-tuberculosis activity (Kumar, 2020)
197.	<i>Lantana camara</i> L. (Verbenaceae)	Tender leaves	Cough	Decoction of the flowers is used in the treatment of cough (Jamir et al., 2012). Tender leaves decoction is taken against	Antibacterial and Antiinflammatory activity (Patel et al., 2010).

				fevers and dry cough (Pfoze, 2012).	
198.	<i>Leea indica</i> (Burm. f) Merr. (Vitaceae)	Whole plant	Cough	Whole Plant is used (Rama Shankar & Devalla, 2012)	Antioxidant and Antimicrobial activity (Rahman et al., 2013).
199.	<i>Leonurus japonicus</i> Houtt. (Lamiaceae)	Leaves	Cough	Decoction of leaves is used as against cough (Khomdram et al., 2011).	Alkaloids, diterpenes, flavones, phenylethanoid glycosides, essential oils and Antibacterial activity, Anti-inflammatory activity (Shang et al., 2014).
200.	<i>Leucas aspera</i> (Willd.) Link (Lamiaceae)	Whole plant	Sinusitis	Whole plant juice is used to treat sinusitis. (Sailo et al., 2017)	Tannins, flavonoids, glycosides, cardiac glycosides, saponins, alkaloids, reducing sugar, phenols, terpenoids, antioxidant and antimicrobial activity (Chetia & Saikia, 2020).
201.	<i>Licuala peltate</i> Roxb. ex Buch.-Ham. (Arecaceae)	Seeds	Cough, asthma and fever	Seeds are used (Zhasa et al., 2015).	Not reported.
202.	<i>Lindenbergia griffithii</i> Hook. f. (Orobanchaceae)	Wholeplant	Bronchitis	The juice of the plant is used in bronchitis. (Neogi et al., 1989).	Not reported.

203.	<i>Litsaea cubeba</i> (Lour.) Pers. (Lauraceae)	Fruit	Cold and cough	Mixture of about 5 gm of the ripe fruit with equal proportions of garlic and ginger is eaten twice daily to cure cough. (Rout et al., 2012)	Alkaloids, monoterpenes, sesquiterpenes, diterpenes, flavonoids, amides, lignans, steroids, fatty acids and anti-inflammatory, antimicrobial and antioxidant activity (Li et al., 2014; Kamle et al., 2019).
204.	<i>Litsea khasyana</i> Meisn. (Lauraceae)	Root	Chronic bronchitis.	Powdered roots along with <i>Piper nigrum</i> and sugar candy is given for chronic bronchitis (Kayang et al, 2005).	Not reported.
205.	<i>Litsea lancifolia</i> (Roxb. ex Nees) Fern.-Vill. (Lauraceae)	Leaves	Cough	The extracts of leaves are given in cough troubles (Singh, 1990).	Not reported.
206.	<i>Litsea salicifolia</i> (J. Roxb. ex Nees) Hook. f. (Lauraceae)	Bark	Asthma	Bark powder mixed with powder of seed of <i>Luffa acutangula</i> (L.) Roxb. in equal parts is given in	Carbohydrates (monosaccharides, reducing sugars), alkaloids, tannins, flavonoids, saponin and Antioxidant and antibacterial Activity (Uddin et al., 2016).

				asthma (four teaspoonfuls mixed with water, twice daily for a month). (Nath et al., 2008)	
207.	<i>Lobelia angulata</i> G. Forst. (Campanulaceae)		Asthma, Cough & Pneumonia,	The fruit together with <i>Centella asiatica</i> made into paste is taken orally to cure tonsillitis, pneumonia, asthma and lungs trouble at the dose of one teaspoon thrice daily (Lalrinkima, 2013).	Not reported.
208.	<i>Lomatogonium carinthiacum</i> (Wulfen) A. Braun (Gentianaceae)	Dried Roots	Cold, cough	Dried roots are crushed and small round pills are prepared and sun dried. Pills are taken orally to treat cold, cough, and	Flavones, Xanthones, iridoids (Li et al., 2011)

				fever (Chakraborty et al., 2017).	
209.	<i>Lycianthes laevis</i> (Dunal) Bitter (Solanaceae)	Twig	Cough	The extract of tender twigs are given in cough (Singh, 1990).	Not reported.
210.	<i>Lygodium japonicum</i> (Thunb.) Sw. (Lygodiaceae)	Whole plant	Cough	The fresh whole plant is pounded and the juice obtained is given 2 tea spoonfuls thrice daily for one week as expectorant in cough (Salam, 2013).	Not reported
211.	<i>Machilus gamblei</i> King ex Hook. f. (Lauraceae)	Bark	Asthma	Bark crushes are used in Asthma (Singh, 1990)	Antioxidant and antibacterial activity (Joshi et al., 2010).
212.	<i>Magnolia champaca</i> (L.) Baill. ex Pierre (Magnoliaceae)	Leaves, Bark and fruit	Asthma	Leaves, bark and fruits are used (Zhasa et al., 2015). The powdered bark (2 gm) mixed with honey is taken	Alkaloids, Glycosides, Carbohydrates, Amino acids, Flavonoids, Sterols, Sesquiterpenes (Shejale&Yeligar, 2019).

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				orally (3 times daily) in cough (Sharma et al., 2001).	
213.	<i>Mahonia napaulensis</i> DC. (Berberidaceae)	Bark	Cough and bronchitis	Decoction of bark taken against cough, bronchitis (Dahal, 2019).	Alkaloids, Steroids, Polyphenols, Quinones, Glycoside, Flavonoid, Terpenoid and Cardiac Glycoside (Thusa&Mulmi, 2017).
214.	<i>Majorana hortensis</i> Moench (Lamiaceae)	Leaf	Cough	Leaf juice is used (Rama Shankar & Devalla, 2012)	Antioxidant, Antimicrobial and Anti-inflammatory Activity (Bina & Rahimi, 2017),
215.	<i>Mangifera indica</i> L. (Anacardiaceae)	Seeds	Asthama	Seeds dried and pounded into powder then mixed with water in the ratio of 1:4 and solution is taken, 2 - 3 teaspoonfuls twice daily for three days to get relief from asthma (Samati, 2007)	Saponins, glycosides, sterols, polyphenols, mangiferine, tannins and anti-oxidant, anti-microbial, gastro protective activity (Mahalik et al., 2020).
216.	<i>Meconopsis horridula</i> Hook. f. & Thomson (Papaveraceae)	Flower	Fever, Cough and Cold	Infusion of flower taken against fever, cough	Flavonoids, alkaloids, terpenoids (Guo et al., 2014)

				and Cold (Dahal, 2019).	
217.	<i>Melastomama labathricum</i> L. (Melastomataceae)	Tender leaves	Cold and Cough	Decoction of tender leaves taken against cough, cold (Dahal, 2019)	Flavonoids, Flavan-3-ols, Triterpenes, Tannins, Anthocyanins, Saponins, Alkaloids, Steroids, Glycosides, Phenolics (Joffry et al., 2012). Antibacterial Activity (Grosvenor et al., 1995) Antiviral activity (Loh´ezic-Le D´ev´ehat et al., 2002) Antioxidant activity (Susanti et al., 2007)
218.	<i>Melia azedarach</i> L. (Meliaceae)	Juice of root bark and Wood extract	Asthma and Cough	Wood extract is used (Sumi & Shohe, 2018.). Juice of root bark used to treat asthma and cough (Dahal, 2019).	Terpenoids, flavonoids, steroids, acids, anthraquinones, alkaloids, saponins, tannins (Sharma & Paul, 2013). Antioxidant activity (Nahak et al., 2010)
219.	<i>Melissa axillaris</i> (Benth.) Bakh.f. (Lamiaceae)	Leaf	Bronchitis and Tuberculosis	Leaf decoction is used in bronchitis and tuberculosis (Chhetri, 2005).	Not reported
220.	<i>Melocalamus compactiflorus</i> (Kurz)	Sap	Cough	The sap oozing out of the cut-stem is	Not reported

	Benth. (Poaceae)			given to children for influenza, cough and chest complaints (Lalrinkima, 2013).	
221.	<i>Mentha arvensis</i> L. (Lamiaceae)	Whole plant	Ashma	Eaten to cure asthma (Nanda et al., 2013).	Alkaloids, Tannins, Phenolics, Flavonoids, Cardiac Glycosides, Terpenoids, Steroid, Saponins, Carbohydrates, Proteins, Fats and Antioxidant activity (Dar et al., 2014).
222.	<i>Mesua ferrea</i> L. (Calophyllaceae)	Flower	Cough	Flower astringent used in cough (Rama Shankar & Rawat, 2013). Decoction of the flower is prescribed twice daily for 2 weeks in bronchitis (Salam, 2013).	Phenyl coumarins, xanthenes, triterpenoids, fats and flavonoids (Chahar et al., 2013). Antioxidant activity (Cullen et al., 1997).
223.	<i>Microsorium superficiale</i> (Blume) Ching (Polypodiaceae)	Fresh rhizome	Cough	About 20 gm paste obtained by crushing fresh rhizome along	Not reported.

				with seeds of <i>Piper nigrum</i> is taken orally to cure cough and cold. It should be taken thrice a day till the disease is cured (Shil & Choudhury, 2009).	
224.	<i>Mimosa pudica</i> L. (Mimosaceae)	Whole plant	Asthma	Decoction of whole plant is given with honey in asthma (about 20 ml, twice daily for amonth). (Nath et al., 2008; Choudhury et al., 2015).	Terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins, and coumarins (Ahmad, 2012). Antimicrobial activity (Ahmad, 2012).
225.	<i>Mimusops elengi</i> L. (Sapotaceae)	Fruit Juice	Cough	Fruit juice is taken in Cough (Sen et al., 2011).	Antioxidant activity (Chaiyan et al., 2009)
226.	<i>Mirabilis jalapa</i> L. (Nyctaginaceae)	Rhizome	Pneumonia	Rhizome, leaves (Kalita, N., Kalita, M.C., 2014)	Alkaloids, flavonoids, phenols, tannins, and Saponins (Kumar & Fathima, 2017).
227.	<i>Momordica dioica</i>	Fruit	Cough	Boiled extract of	Carbohydrates, glycosides, phenolic

	Roxb. ex Willd. (Cucurbitaceae).			the fruit with little common salt is prescribed in fever and cough by the Meitei communities and Kabui tribes (Khan, 2005).	compounds, flavonoids, alkaloid, proteins, saponins, lipids, tannins, and steroids (Rathee & Kamboj, 2017).
228.	<i>Morinda angustifolia</i> Roxburgh (Rubiaceae)	Leaf	Asthma and Bronchial trouble	Leaf pounded with root of <i>Solanum torvum</i> Sw., <i>S. surattense</i> Burm. f. and <i>Nelumbo nucifera</i> Gaertn., leaf of <i>Trichosanthes dioica</i> Roxb., and nut of <i>Pistacia chinensis</i> Bl. in equal parts and the extract is given in asthma and bronchial trouble (four teaspoonfuls, twice daily till cure). (Nath et	Antimicrobial activity (Xiang et al., 2008).

				al., 2008)	
229.	<i>Morus australis</i> Poir. (Moraceae)	Root	Cough	Root juice taken in cough (Dahal, 2019)	Not reported.
230.	<i>Mucuna pruriens</i> (L.) DC. (Fabaceae)	Seeds	Bronchitis , pneumonia	Seeds (Kalita, N., Kalita, M.C., 2014)	Alkaloids, Glycosides, Terpenoids, Steroids, Flavonoids, Tannins, Saponins, Reducing sugars (Kumar et al., 2009). Antioxidant activity (Tripathi & Upadhyay, 2001). Antimicrobial activity (Rajeshwar et al., 2005).
231.	<i>Murraya paniculate</i> (L.) Jack (Rutaceae)	Leaves	Cough	The extracts of leaves given in cough (Singh, 1990).	Coumarins, alkaloids, phenols, terpenoids and flavonoids (Sayaret al., 2014). Antioxidant activity (Rohman & Sugeng, 2005). Antimicrobial activity (Zhang et al., 2011).
232.	<i>Musa acuminata</i> Colla (Musaceae)	Flower	Bronchitis	Flower extract is used in bronchitis (Sen et al., 2011).	Alkaloids, Saponins, Phenols, Tannins, Flavonoids and Antibacterial activity (Umamaheswari et al., 2017).
233.	<i>Musa balbisiana</i> Colla (Musaceae)	Root & Bark	Cough	Roots juices are used to treat pneumonia.	Protein, carbohydrates, phenolics, and flavonoid and Antioxidant activity (Daimari & Swargiary,

				(Gogoi et al., 2019) Alkali solution prepared from the ash of dried and burnt fruit bark mixed with mustard oil is given in cough (about 15 ml, twice daily till cure). (Nath et al., 2008)	2020)
234.	<i>Mussaenda frondose</i> Linn. (Rubiaceae)	Shoots	Cough	Decoction of dried shoots is used (Chankija, 1999; Sumi & Shohe, 2018.)	Carbohydrates, Steroids, Alkaloids, Saponins, Terpenoids, Tannins, Flavanoid, Polyphenols and Antioxidant activity (Sijuet al., 2010) are reported.
235.	<i>Mussaenda treutleri</i> Stapf. (Rubiaceae)	Leaf	Bronchitis and Cough	Leaf extract is taken to cure bronchitis and cough (Chhetri, 2005)	Not reported.
236.	<i>Myrica esculenta</i> Hamilton ex D. Don		Asthma & Bronchitis	Decoction of bark is used ((Rongsensashi et	Phenolic compounds, flavonoids, flavonols alkaloids, glycosides,

	(Myricaceae)			al., 2016). About 5/10 fruits are eaten raw $\frac{3}{4}$ times in a week for asthma and bronchitis (Singh et al., 2015).	diarylheptanoids, ionones, steroids, saponins, triterpenoids, volatile compounds (Sood & Shri, 2018). Antimicrobial activity & Antiinflammatory activity (Agnihotri et al., 2012) Antioxidant activity (Mann et al., 2015)
237.	<i>Myricaria rosea</i> W.W. Sm. (Tamaricaceae).	Young shoots	Throat Pain	Young shoots are chewed in case of throat pain (Chhetri, 2005)	Not reported
238.	<i>Nardostachys jatamansi</i> (D. Don) DC. (Caprifoliaceae)	Rhizome	Bronchitis , Cold & Cough	Powder of rhizomes (1-2 gm per dose) is taken orally twice or thrice daily in case of bronchial complaints, cold and cough (Maity, 2004).	Sugars, amino acids and tannins alkaloids (Jha et al., 2012). Anti-inflammatory (Rajnish et al., 2014) Antibacterial and Antioxidant activity (Parveen et al., 2011)
239.	<i>Nasturtium officinale</i> R. Br. (Brassicaceae)	Leaves & Stem	Cough	Decoction of leaves and stem taken to cure cough (Dahal, 2019).	Glucosinolates, carotenoids, polyphenols, Vitamin C, Vitamin A, α -tocopherol, tannins, flavonoids, terpenoids, glycosides

					(Chaudhary et al., 2018). Antioxidant activity (Zeb, 2015). Antibacterial activity (Penecilla & Magno, 2011).
240.	<i>Neopicrorhiza scrophulariiflora</i> (Pennell) D. Y. Hong (Plantaginaceae)	Rhizome	Cough	Rhizome chewed to cure cough (Dahal, 2019).	Hydroxycinnamate, Phenylethanoid glycoside, Phenol, Phenyl glycoside, Iridiod, Steroidal glycoside, Coumarin, Flavonoid, Ferulic acid, Phytosterol, Alcohol, Fatty acid, Sugar and Anti-oxidative, Antimicrobial, Anti-inflammatory activity (Rokaya et al., 2020)
241.	<i>Nephrolepis auriculata</i> (L.) Trimen (Nephrolepidaceae)	Root	Cold, cough	Warmed juice of root tuber taken against cold, cough (Dahal, 2019)	Not reported.
242.	<i>Nyctanthes arbor-tristis</i> L. (Oleaceae)	Leaves	Cough	Leaves juice is used in treatment of cough (Gogoi et al., 2019)	Alkaloids, glycosides, flavonoids, phytosterols, phenolics, tannins, saponins (Rani et al., 2012). Antioxidant activity (Thangavelu & Thomas, 2010). Anti-inflammatory activity (Singh et al., 1984). Antiviral activity (Gupta et al.,

					2005).
243.	<i>Ocimum basilicum</i> L. (Lamiaceae)	Leaves	Cough, bronchitis and hiccough	Leaf juice mixed with honey is given in cough and bronchial congestion. Decoction of leaf is also taken in hiccough (Three teaspoonfuls, twice daily for three days). (Nath et al., 2008).	
244.	<i>Ocimum gratissimum</i> L. (Lamiaceae)	Leaves	Cough and asthma	Leaves juice is used in treatment of cough (Gogoi et al., 2019)	Alkaloids, flavonoids, saponin, tannins, terpenoids, phlobatannins, steroids (Akinmoladun et al., 2007) Antioxidant activity (Akinmoladun et al., 2007). Antibacterial activity (Orafidiya et al., 2006).
245.	<i>Ocimum sanctum</i> L. (Lamiaceae)	Leaves and flower	Cold and cough	Leaves, flowers juice are used to cure Cold and cough. (Gogoi et al., 2019).	Essential oil, saponins, flavonoids, triterpenoids, phenolic compounds and tannins (Bhattacharyya & Bishayee, 2013). Antioxidant activity (Trevisan et al., 2006)

					Antimicrobial activity (Singh et al., 2005)
246.	<i>Oenanthe javanica</i> (Blume) DC. (Apiaceae)	Stem	Cough	Stems juice is taken orally to treat cough (Tsering, 2017).	Amino acids, Carbohydrates, Proteins, Flavonoids, Phenolic compounds, Steroids and Terpenoids, Saponins, Tannins, Cardiac glycosides (Bhaigyabati et al., 2017) Antioxidant activity (Bhaigyabati et al., 2017) Antiviral activity (Lu and Li, 2019).
247.	<i>Onosma hookeri</i> C.B. Clarke (Boraginaceae)	Root	Cough	Roots used to treat blood cough (Tsering, 2017)	Not reported.
248.	<i>Ophiocordyceps sinensis</i> (Ophiocordycipitaceae)	Fruiting Body	Cough, Cold, Respiratory problems	Fruiting body consumed during cough, cold, respiratory problems, stress and chronic fever. (Tsering, 2017).	Nucleoside, polysaccharide, sterol, protein, amino acid and polypeptide (Liu et al., 2015). Anti-inflammatory and antioxidant activity (Liu et al., 2015).
249.	<i>Ophiorrhiza ochroleuca</i> Hook.f. (Rubiaceae)	Leaves and twigs	Cough	The extract of leaves and twigs is given in cough by the Rongmeis in	Not reported.

				Manipur (Singh, 1990).	
250.	<i>Opuntia monacantha</i> (Willd.) Haw. (Cactaceae)	Ripe fruit	Bronchitis and cough	Ripe fruit taken with honey to cure bronchitis and cough (Dahal, 2019).	Not reported.
251.	<i>Oroxylum Indicum</i> (L.) Vent. (Bignoniaceae)	Bark	Cough and pneumonia	Bark is used in cough and pneumonia (Kalita, N., Kalita, M.C., 2014).	Alkaloids, flavonoids, glycosides, tannins, terpenoids and Antimicrobial activity (Harmandar et al., 2011). Anti-inflammatory activity (Upananlawar et al., 2009) Antioxidant activity (Upananlawar&Tenpe, 2007)
252.	<i>Osbeckia chinensis</i> L. (Melastomataceae)	Whole plant	Cough	Whole plant extract is used commonly in cold and cough (Devi, 2013)	Alkaloids, saponins, tannins, steroids, terpenoids and flavonoids (Saio & Syiem, 2015) are reported.
253.	<i>Oxalis corniculata</i> L. (Oxalidaceae)	Leaves	Chronic cough	Leaves decoction are used in treating chronic cough (Neogi et al., 1989).	Carbohydrate, glycosides, phytosterols, phenolic compounds, flavonoids, proteins, amino acids, volatile oil, tannins, palmitic acid stearic acids (Srikanth et al., 2014)

					Antioxidant Activity (Borah et al., 2012) Antimicrobial activity (Raghavendra et al., 2006)
254.	<i>Paederia foetida</i> L. (Rubiaceae)	Young Shoot	Asthma	A decoction about 10 ml of the young shoot is taken orally daily in treatment of asthma (Sharma et al., 2001).	Iridoid glycosides, sitosterol, stigmasterol, alkaloids, carbohydrates, proteins, amino acids and volatile oils and antioxidant activity are reported (Wang et al., 2014).
255.	<i>Panax ginseng</i> C.A. Mey. (Araliaceae)	Root	Tuberculosis,	The roots are dried and made into a powder that is taken orally to treat tuberculosis (Chankiga, 1999).	Polysaccharides, ginsenoside, alkaloids, glucosides, peptides, phenolic acid and ligand (Ru et al., 2015) are reported.
256.	<i>Panax pseudoginseng</i> Wall. (Araliaceae)	Root	Asthma	Tuber/Root decoction are used to treat asthma (Zhasa et al., 2015).	Not reported.
257.	<i>Pandanus furcatus</i> Roxb. (Pandanaceae)	Fruit	Asthma and Cough	Fruit useful in asthma and cough (Dahal, 2019)	Not reported.
258.	<i>Papaver somniferum</i> L. (Papaveraceae)	Seed	Cough	Seed paste taken to cure cough (Dahal,	Alkaloids, various acids like Meconic acid, Lactic acid, Malic

				2019).	acid, Tartaric acid, Citric acid, Acetic acid, Succinic acid, Sulphuric acid, Phosphoric acid (Masihuddin et al., 2018).
259.	<i>Paris polyphylla</i> Sm. (Melanthiaceae)	Root	Bronchitis	Root extract is used (Zhasa et al., 2015). Decoction of the rhizome is given thrice daily for one week in bronchitis (Salam, 2013).	Alkaloids, carbohydrates, cardiac glycosides, Flavonoids, glycosides, phenols, quinones, saponins, sterols, tannins and terpenoids (Rajsekhar et al., 2016) and antioxidant activity (Devi et al., 2018) are reported.
260.	<i>Paris quadrifolia</i> L. (Melanthiaceae)	Roots	Bronchitis	Root extract is used (Zhasa et al., 2015).	Flavonoid, Saponin and Glycosides (Nohara et al., 1982) are reported.
261.	<i>Passiflora edulis</i> Sims. (Passifloraceae)	Roots	Asthma	Roots are dried, mixed with tobacco, and smoked in a pipe to treat asthma (Chankija, 1999).	Carbohydrates, lipids, carboxylic acids, polyphenols, volatile compound, protein and amino acids, vitamins, mineral, flavonoids, triterpenoids, carotenoids (He et al., 2020) and Antioxidant (Thomas et.al., 2019), Anti-Inflammatory (Herawaty&Surjanto, 2017) and Antimicrobial Activity (Jagessar et al., 2017) are reported.
262.	<i>Passiflora foetida</i> L.	Fruit	Respirator	Fruit is used (Kala,	Reducing sugars, alkaloids,

	(Passifloraceae)		y disorder	2005)	flavonoids, tannins, steroids, gums and glycosides (Asadujjaman et al., 2014)
263.	<i>Perilla frutescens</i> (L.) Britton (Lamiaceae)	Seed	Cough	Seed taken to cure cough (Dahal, 2019).	Carotenoids, essential oils, triterpenes, phytosterols, phenolic acids, flavonoids, fatty acids, tocopherols, policosanols and antioxidant, antimicrobial, anti-allergic, antidepressant, anti-inflammatory are reported (Ahmed, 2018)
264.	<i>Phlogacanthus curviflorus</i> (Wall.) Nees (Acanthaceae)	Leaves	Cough & fever	The leaves boil and the decoction are taken in fever and cough (Nonibala, 2010).	Not reported.
265.	<i>Phlogacanthus thyrsoformis</i> (Roxb. ex Hardw.) Mabb. (Acanthaceae)	Leaf	Cough.	Leaf juice/ decoction is used in the treatment of cough (Rama Shankar & Devalla, 2012).	Flavonoids, tannins, phytosterols, phenol, glycosides, fatty acids, galacto-glycero lipid and volatile oil and antibacterial and antioxidant activity are reported (Gogoiet al., 2013).
266.	<i>Phlogacanthus tubiflorus</i> Nees (Acanthaceae)	Leaves & bark	Asthma	Decoction of bark four teaspoonfuls twice daily is taken in asthma. Leaf	Not reported.

				powder is smoked in asthma. (Nath et al., 2008)	
267.	<i>Phlomis rotata</i> Benth. ex Hook.f. (Lamiaceae)	Aerial Part	Cough	Decoction of aerial part is taken in cough (Dahal, 2019)	Not reported.
268.	<i>Phyllanthus emblica</i> L. (Euphorbiaceae)	Root and Fruit	Bronchial asthma	Root juice 25 ml is given daily for a month in treatment of bronchial asthma. Root pounded with that of <i>Citrus grandis</i> (L.) Osb. and rhizome of <i>Zingiber officinale</i> Rosc. in equal parts, fruit of <i>Terminalia chebula</i> (Gaertn.) Roxb. 5 nos., and a small amount of rock salt is given about 50 gm twice	Fixed oils, phosphatides, essential oils, tannins, minerals, vitamins, amino acids, fatty acids, glycosides and antimicrobial, antioxidant, Anti-inflammatory (Gaire & Subedi, 2014) are reported.

				daily for a month in bronchial asthma. (Nath et al., 2008). Dried fruits are soaked in mustared oil which is then massaged on the chest and the throat to get relief from bronchitis (expectorant effect) and sore throat.	
269.	<i>Phyllanthus fraternus</i> G.L. Webster (Euphorbiaceae)	Whole plant	Asthma, Bronchitis , hiccough	Juice of whole plant is taken in bronchitis, asthma, and hiccough (Lalzarzovi & Lalramnghinglova, 2016)	Alkaloid, tannins, terpenoids, steroids and saponins and antimicrobial activity (Kavit et al., 2012) are reported.
270.	<i>Phyllanthus niruri</i> L. <i>Euphorbiaceae</i>)	Roots	Cough	Roots decoction (about 20 ml) is taken thrice daily to cure fever & cough (Sajem &	Alkaloids, flavonoids, lignans, tannins, coumarins, terpenes, saponins and phenylpropanoids (Bagalkotkar, 2006). Antioxidant activity are also reported (Mehta et

				Gosai, 2006).	al., 2019).
271.	<i>Picrorhiza scrophulariiflora</i> Pennell	Leaves	Cold & Cough	Decoction of leaves (10-15 Gm per dose) is used twice or thrice daily for the treatment of cold & cough (Maity, 2004).	Not reported.
272.	<i>Pinus kesiya</i> Royle ex Gordon (Pinaceae)	Young shoots	Cough	Young shoots are taken early in the morning to get relieve from cough in children. (Hynmewta & Kumar, 2008)	Alkaloid, Cardiac Glycoside, Flavonoid, Tannin (Velasco et al., 2018) are reported.
273.	<i>Pinus roxburghii</i> Sarg. (Pinaceae)	Resin	Bronchitis	Resin with common salt boiled in water and taken before bed time to cure cough and also useful in chronic bronchitis (Dahal, 2019).	Flavonoids, essential oil tannins, terpenoids, xanthones (Kaushik et al, 2013) and antimicrobial (Zafar et al., 2013) and antioxidant (Maimoona et al., 2011) are reported.

274.	<i>Piper betle</i> L. (Piperaceae)	Fruit & Leaves	Cough	Fruit used in cough (Choudhury, 1999). The leaf is crushed along with ginger and honey is taken orally in the treatment of cough (Nonibala, 2010)	Alkaloids, Carbohydrates, Proteins, Phytosterols, Flavonoids, Tannis and phenol, Volatile oils (Saini et al., 2016) and antimicrobial and antioxidant activity (Chakraborty & Shah, 2011) are also reported.
275.	<i>Piper brachystachyum</i> Vahl (Piperaceae)	Leaves	Cough & Bronchitis	Leaf decoction is used as a tonic for cough and bronchitis (Khongsai et al., 2011). Seed is used in the treatment of cough (Kala, 2005).	Not reported.
276.	<i>Piper griffithii</i> C. DC. (Piperaceae)	Fruit	Cough	Dried fruit pounded into powder and mixed with wild honey in proportions 1:4 and then taken 2-3 teaspoonful twice daily at least three	Not reported.

				days for curing cough and cold. ((Samati, 2007). Dried seeds are powdered and mixed with honey and the yolk of egg and this is taken for severe cough.	
277.	<i>Piper longum</i> L. (Piperaceae)	Leaves, Fruit	Pneumonia, cough and respiratory diseases	Leaves (Kalita, N., Kalita, M.C., 2014). Fruits are ground and made into powder mix with honey to treat respiratory infection and cough (Sen et al., 2011).	Alkaloids, Saponins, Carbohydrates, Volatile oil, starch, protein, amygdalin, piperine, piperlongumine, piperlonguminine, methyl-3, 4, 5 – trimehoxycinnamate (Chatterjee & Dutta, 1963, 1967) and antibacterial activity (Reddy et al., 2001) are also reported.
278.	<i>Piper mullesua</i> Buch.-Ham. ex D. Don (Piperaceae)	Dried Seed	Bronchitis & Cough	The seed powder mixed with honey is taking against cough and bronchitis problem (Khongsai et al.,	Not reported.

				2011).	
279.	<i>Piper nigrum</i> Linn. (Piperaceae)	Fruit	Cough	Fruit is used (Deka & Nath, 2014). Dried fruits powder mixed with honey and egg yolk taken 2-3 teaspoonful twice daily at least three days for curing severe cough (Smati, 2007).	Various phytochemicals like Alkaloids, amides, propenylphenols, lignans, neolignans, terpenes, steroid, kawapyrone, piperolides, chalcones, dihydrochalcones, brachyamide, dihydropiperidine, 3,4-dihydroxy-6 (N-ethylamine), benzamide, (2E, 4E)-N-eicosadienylpiperidine, N-trans-feruloyltryamine, N-formyl piperidine, guineensine, (2E, 4E)-N-5[(4-Hydroxyphenyl)-pentadienyl] piperidine, (2E, 4E)-N-isobutyldecadienamide, (2E, 4E)-N-isobutyl-eicosadienamide, (2E,4E,8Z)-N-isobutyl-eicosatrienamide, (2E, 4E)- N-isobutyloctadienamide, piperamide, piperamine, piperettine, piperidine, piperine, piperolein, trichostachine, sarmentine, sarmentosine, tricholein, retrofractamide (Ganesh et al., 2014; Pino et al., 2003) are reported. Antibacterial (Karsha&

					Laxmi, 2010) and antioxidant (Shanmugapriya et al., 2012) activities are also reported.
280.	<i>Piper trioicum</i> Roxb. (Piperaceae)	Root	Cough	Root decoction is used in the treatment of cough (Kala, 2005).	Alkaloids, steroids, flavonoids, phenolic compounds, carbohydrates, tannins and glycosides (Kumar et al., 2011) are reported.
281.	<i>Pittosporum napaulense</i> (DC.) Rehder & E.H. Wilson (Pittosporaceae)	Stem	Bronchitis	Decoction of stem bark taken orally to treat bronchitis (Lalramnghinglova, 2016)	Alkaloids, flavonoids, phenols, lignins, anthraquinones, steroids, tannins, saponins, fixed oils and glycosides (Gunsai et al., 2020) and antibacterial activity (Singh & Diwakar, 2009) are reported.
282.	<i>Plantago erosa</i> Wall. (Plantaginaceae)	Whole plant & Root	Cough	Decoction of roots is taken orally to treat cough (Sumi & Shohe, 2018.). Decoction of whole plant is taken orally to treat dry cough (Pfoze, 2012).	Not reported.
283.	<i>Platycodon grandifloras</i> (Jacq.) A. DC.	Root	Cough	Decoction of the root is prescribed against cough and	Steroidal saponins, flavonoids, phenolic acids, polyacetylenes, and sterols (Zhang et al., 2015) and

	(Campanulaceae)			cold. (Salam, 2013).	Antioxidant activity (Lee et al., 2004) are reported.
284.	<i>Plumeria rubra</i> L. (Apocynaceae)	Bark & Fruit	Cough	Fruit powder is used in the treatment of cough (Nonibala, 2010). Boiled extract of bark is prescribed in asthma (Singh, 1990).	Alkaloids, carbohydrates, cyanogenetic glycosides, flavonoids, protein, saponins, sterols, tannins, mucilage and volatile oils. (Venkatachalam et al., 2018) are reported.
285.	<i>Polycarpon prostratum</i> (Forssk.) Asch. & Schweinf. (Caryophyllaceae)	Leaf	Sore throat	Leaf juice is mixed with littlesalt and used to treat sore throat (Debbarma et al., 2017).	Not reported.
286.	<i>Polygonum capitatum</i> Buch.-Ham. ex. D. Don (Polygonaceae)	Whole plant	Cold	Whole plant decoction is used to treat cold (Zhasa et al., 2015).	Butyl glycosides, lignans, liposoluble compounds, flavonoids, phenolic acids, volatile oils (Yang et al., 2015), antibacterial and anti-inflammatory activity are reported (Liao et al., 2011).
287.	<i>Polygonum hydropiper</i> L. (Polygonaceae)	Leaves	Pneumonia	Leaves decoction are used to treat pneumnia (Kalita,	Not reported.

				N., Kalita, M.C., 2014)	
288.	<i>Potentilla fruticosa</i> var. <i>arbuscula</i> (D. Don) Maxim. (Rosaceae)	Whole plant	Sore throats, cough and cold	Useful in sore throats, cough and cold (Dahal, 2019).	Antioxidant activity are reported (Miliauskas et al., 2004).
289.	<i>Potentilla peduncularis</i> D. Don (Rosaceae)	Whole plant	Sore throat, cough & cold.	Decoction of whole plant is useful in sore throats, cough and cold (Dahal, 2019).	Not reported.
290.	<i>Potentilla lineata</i> Trevir (Rosaceae)	Root	Sore throats, cold and cough	Fresh root chewed to get relief from sore throats, cough and cold (Dahal, 2019).	Not reported.
291.	<i>Prunus cerasoides</i> Buch.-Ham. ex D. Don (Rosaceae)	Bark	Cough	Decoction of bark is orally taken against cough (Dahal, 2019).	Flavonoids, glycosides, steroids, terpenoids, polyphenolics, antimicrobial and antioxidant activity are reported (Joseph et al., 2019).
292.	<i>Prunus domestica</i> L. (Rosaceae)	Fruit	Asthma	Fruits are used in the treatment of asthma. (Khangte &	Anthocyanin, alkaloid, Phenolic, flavonoid, tannin, antioxidant antimicrobial activity are reported (El-Beltagi et al., 2019)

				Lalramnghinglova, 2017)	
293.	<i>Prunus persica</i> (L.) Batsch (Rosaceae)	Leaves	Asthma	Dried leaves smoked for asthma (Khangte & Lalramnghinglova, 2017)	Alkaloid, steroids, terpenoids, tannins, flavonoids, coumarins, anthracenosides, anthocyanosides and fatty acids and antioxidant activity are reported (Benmehdi et al., 2017).
294.	<i>Psidium guajava</i> L. (Myrtaceae)	Leaves	Cough	Decoction of leaves with Citrus fruit juice and salt (Namsa et al., 2011).	Alkaloids, flavonoids, glycoside, tannins, terpenoids, saponins, and antimicrobial activity are reported (Kenneth et al., 2017)
295.	<i>Pterocephalus hookeri</i> (C.B. Clarke) Diels (Caprifoliaceae)	Aerial part	Cold & cough	Infusion of aerial part taken to cure cough, cold (Dahal, 2019)	Not reported.
296.	<i>Punicagranatum</i> L. (Lythraceae)	Leaves & fruit	Sore throat	Leaves and fruits are used in the treatment of sore throat (Zhasa et al., 2015).	Alkaloids, Phenols, Flavonoids, Quinones, Tannins, Saponins, Terpenoids, Steroids and antioxidant are reported (Jayaprakash & Sangeetha, 2015).
297.	<i>Pyrrosia adnascens</i> (Forst.) Ching (Polypodiaceae)	Rhizome	Cold & Cough	Decoction of rhizome mixed with powdered seeds of <i>Piper</i>	Alkaloids, anthraquinones, phenolics, saponins, tannins and terpenoids are reported (Cruz et al, 2017)

				<i>nigrum</i> is taken during cough and cold twice a day for 7 days (Shil & Choudhury, 2009).	
298.	<i>Quercus serrata</i> Thunb. (Fagaceae)	Exudate	Cough	Juice released from cut branches is collected and used as remedy for dry cough (Pfoze, 2012).	Flavonoid, phenol and antioxidant activity are reported (Pandey et al., 2017).
299.	<i>Rheum emodi</i> Wall. (Polygonaceae)	Leaves	Cold and cough	Leaves are cooked and eaten as a curry in cold and cough (Chhetri, 2005).	Alkaloids, Carbohydrates, Tannins, Steroids, Flavonoids, Terpenes, Glycoside, Terpenoids, Anthraquinones, Saponins and antibacterial activity are reported (Malik et al., 2018).
300.	<i>Rheum nobile</i> Hook. f. & Thomson (Polygonaceae)	Roots	Cold, Cough,	Decoction of root consumed during common cold, cough, throatpain, tonsillitis (Tsering, 2017)	Not reported.
301.	<i>Rhododendron anthopogon</i> D. Don (Ericaceae)	Leaf	Cold and cough	Leaf decoction is used in cold and cough (Chhetri,	Polyphenols, reducing compounds, quinones, sterol, triterpenes, fatty acids and antimicrobial activity are

				2005)	reported (Baral et al., 2014).
302.	<i>Rhododendron arboretum</i> Smith (Ericaceae)	Root Bark	Pneumonia	Juice of root bark taken to cure pneumonia. Snuff made from the bark excellent cold reliever and the juice taken to relieve cough (Dahal, 2019).	Phytosterols, flavonoids, phenols, alkaloids, carbohydrate, glycoside, sterols and steroids, terpenoids, tannin and Anti-inflammatory, anti-bacterial activity (Agarwal & Kalpana, 1988) are reported.
303.	<i>Rhododendron campanulatum</i> D. Don (Ericaceae)	Leaves	Cough	Fresh leaves chewed to relieve cough (Dahal, 2019).	Carbohydrate, terpenoids, coumarine, flavonoid and phenol (Painuli, 2017)
304.	<i>Rhus chinensis</i> Mill. (Anacardiaceae)	Fruit	Cough	Boiled decoction of ripe fruits mixed with honey or sugar is given for dry cough (Pfoze, 2012)	Not reported.
305.	<i>Ricinus communis</i> L. (Euphorbiaceae)	Leaves	Asthma	Leaves rubbed with mustard oil and warmed in fire then massage over the chest of children for curing	Steroids, Saponins, Alkaloids, Flavonoids, Glycosides, Anti-inflammatory activity, Antioxidant activity, Antimicrobial activity (Suvarna et al., 2018)

				asthma (Samati, 2007; Lalrinkima, 2013).	
306.	<i>Rorippa indica</i> (L.) Hiern (Brassicaceae)	Seed	Asthma	The extract of seeds is used in the treatment of asthma (Singh, 1990)	Not reported.
307.	<i>Rosa sericea</i> Wall. ex Lindl. (Rosaceae)	Fruit	Cough	Fruit taken to cure cough (Dahal, 2019)	Antiviral activity are reported (Rajbhandari et al., 2007).
308.	<i>Rotheca serrata</i> (L.) Steane & Mabb. (Lamiaceae)	Leaf & Stem	Cough, Asthma & Bronchitis	Leaf extract is taken with little honey against cough. Semi-dried stem is burned and smoked to cure asthma and bronchitis. (Devi, 2013)	Not reported
309.	<i>Rubus ellipticus</i> Sm. (Rosaceae)	Roots	Cold & Cough	Roots are mixed with the roots of <i>Rubus paniculatus</i> together and crushed to prepare a thick	Total Phenolic compound, flavonoid and antioxidant activity are reported (Badhani et al., 2015).

				syrup. syrup is used for treatment of cold and cough (Chakraborty et al., 2017)	
310.	<i>Rubus paniculatus</i> Sm. (Rosaceae)	Roots	Whooping Cough	Infusion of root taken against whooping cough (Dahal, 2019).	Not reported.
311.	<i>Sagittaria sagittifolia</i> L. (Alismataceae)	Tuber	Cough	Tuber decoction is taken with little honey in cough (Devi, 2013).	Tannin, Saponins, Flavonoids, Phenols, Steroids, Glycosides, Protein, Amino-acids, Starch, reducing sugars and Alkaloids are reported (Rao & Pandey, 2017).
312.	<i>Salvinia cucullata</i> Roxb. (Salviniaceae)	Whole plant	Cough	Decoction of the plant is used in cold cough (Devi, 2013)	Not reported.
313.	<i>Sapindus mukorossi</i> Gaertn. (Sapindaceae)	Bark, Fruit	Hooping-Cough Asthma	Bark pounded with black pepper, leaf of <i>Calotropis gigantea</i> (L.) R.Br. ex Ait. in equalparts with a little rock salt and made into pills of	Alkaloids, phytosterols, phenolic compounds, tannins, flavonoids, saponins and antibacterial activity are reported (George & Shanmugam, 2014).

				<p>about 10 gm each, which are administered in Hooping-Cough and asthma (three pills, thrice daily for 3 to 15 days or more). (Nath et al., 2008).</p> <p>One or two fruits are soaked in water overnight and the water is then used for gargle in cough and tonsillitis (Sharma et al., 2001).</p>	
314.	<i>Schefflera venulose</i> (Wight & Arn.) Harms (Araliaceae)	Bark	Cough	Decoction of bark is used to treat cough (Zhasa et al., 2015).	Saponins, tannins, flavonoids, alkaloids, cardiac glycosides, reducing sugars and antioxidant activity are reported (Deepa and Nalini, 2013).
315.	<i>Schyzophyllum communie</i> (Schizophyllaceae)	Fruiting body	Cough	Decoction of the fruiting body is used in cough (Nonibala, 2010;	Antioxidant activity (Chandrawanshi et al., 2017).

				Rajkumari et al., 2013).	
316.	<i>Scoparia dulcis</i> L. (Scrophulariaceae)	Whole plant	Cough & Fever	Leaf juice is used in treatment of Fever & cough (Gogoi et al., 2019)	Amino acids, carbohydrates, coumarins flavonoid, phenols, tannins, terpenes, steroids saponins, scopadulcic acids A and B, scopadiol, scopadulciol, scopadulin, scoparic acids A – C, betulinic acid.
317.	<i>Scutellaria discolor</i> Colebr. (Lamiaceae)	Whole plant	Cough	Decoction of the whole plant (half cup) is taken twice daily for 7 days against cough (Salam, 2013)	Tannin, flavonoid, alkaloid, lignan, saponin, cardiac glucoside, terpenoid and antibacterial activity are reported (Devi & Singh, 2014)
318.	<i>Selinum wallichianum</i> (DC.) Raizada & H.O. Saxena (Apiaceae)	Root	Cough	Decoction of roots taken against cough (Dahal, 2019)	Essential oil and antimicrobial activity are reported (Singh et al., 2012)
319.	<i>Semecarpus anacardium</i> L.f. (Anacardiaceae)	Fruit	Asthma & Cough	Fruit powder taken with water to cure piles, cough and asthma (Dahal, 2019).	Anthraquinones, Phenols, Steroids & Triterpenoids, and antimicrobial activity (Bagewadi et al., 2012) are reported.
320.	<i>Senna occidentalis</i> (L.) Link	Seeds	Cough	Seeds are useful in cough (Sen et al.,	Alkaloids, saponins, tannins, reducing sugar, phenols,

	(Leguminosae)			2011).	anthraquinones, glycosides, resins and antioxidant (Odeja et al., 2014).
321.	<i>Sida acuta</i> Burm.f. (Malvaceae)	Roots	Asthma	Roots decoction is used to treat breathing disorders. (Abat et al., 2017). The decoction of the leaves and root is used for bronchial cough (Nonibala, 2010).	Alkaloids, Flavonoids, Glycosides, Phenols, Steroid, Terpenoids (Senthilkumar et al., 2018) and antibacterial (Hoffman et al., 2004), Anti-inflammatory (Obob and Onwulame, 2005), Antioxidant (Konate et al., 2010) activity are reported.
322.	<i>Sida rhombifolia</i> L. (Malvaceae)	Leaves and Roots	asthma, bronchitis and pneumonia	Root and leaf extracts are used for asthma, pneumonia and bronchitis	Alkaloid, Carbohydrate, flavonoid, Glycosides, Proteins, Saponin (Sundaraganapathy et al., 2013), and Antimicrobial (Cáceres et al., 1987), Antioxidant (Dhalwal et al., 2007), Antitubercular activity (Paphita et al., 2013) are reported.
323.	<i>Sinopodophyllum hexandrum</i> (Royle) T.S. Ying (Berberidaceae)	Rhizome	Cough	Pounded rhizome taken with water to cure cough (Dahal, 2019).	Podophyllotoxin, picropodophyllotoxin, 4-demethyl podophyllotoxin glucoside, deoxypodophyllotoxin, isopicropodophyllone (Rather & Amin, 2016) and antioxidant (Ganie

					et al., 2012) and Antiviral activity are reported (Bedows & Hatfield, 1998)
324.	<i>Smilax perfoliata</i> Lour. (Smilacaceae)	Root	Asthama	Roots pounded and juice extract taken 2-3 teaspoon twice daily several days for relief from asthma, locally known as Dawaisahiaiw. (Samati, 2007).	Various phytochemical like Alkaloids, Carbohydrates, Flavonoids, Glycosides, Steroids, Tannins (Sharma & Kalita, 2014) & Antimicrobial and antioxidant activity (Barkataky, 2014)
325.	<i>Solanum aethiopicum</i> L. (Solanaceae)	Twigs	Cough	Extract of the young twigs is given in cough (Nonibala, 2010).	Not reported.
326.	<i>Solanum anguivi</i> Lam. (Solanaceae)	Fruit	Cough	Crushed fruit mixed with honey is taken to treat cough (Devi, 2003)	Various chemicals alkaloids, flavonoids, glycosides, phenols, steroids, saponins, tannins, triterpenoids (Oyeyemi et al., 2015) and antioxidant activity (Elekofehinti et al., 2013)are reported.
327.	<i>Solanum kurzii</i> Prain (Solanaceae)	Fruit	Cough	Fruit is used (Kala, 2005)	Not reported

328.	<i>Solanum nigrum</i> L. (Solanaceae)	Fruit and Root	Asthma and Cough	Raw fruits are crushed, mixed with little amount of water, and the strained liquid is drunk to get relief from cough. Roots (10 g) are crushed, macerated overnight with milk 50 ml, and taken for 3-10 days (depending upon the severity of the disease) for the treatment of asthma in children (Jamir et al., 1999).	Various chemical Steriodalglyco-alkaloid, Steroidal saponins, Sterols, Flavonoids, Carotenoids, Vitamin C, Fatty Acids, Triterpenes, Carbohydrates and anti-tubercular, antihistaminic, anti-allergic and anti-inflammatory activity are reported (Yadav, 2014).
329.	<i>Solanum rudepannum</i> Dunal (Solanaceae)	Fruit	Cough	Fruit extract is given in cough and tonsillitis (Devi, 2013)	Not reported.
330.	<i>Solanum stramonifolium</i> Jacq.	Whole plant	Asthma	Whole plant is boiled in water till	Not reported

	(Solanaceae)			it reduces into paste and this paste is taken with honey to treat asthma (Das et al., 2009)	
331.	<i>Solanum surattense</i> Burm. f. (Solanaceae)	Seed	Asthma	Dried seed is burn in charcoal and smoke is allowed to enter mouth to treat asthma (Ningombam et al., 2014)	Various chemicals Alkaloids, Flavonoids, Triterpenoids, Tannins, Saponins, Glycosides, and steroids (Ghildiyal& Joshi, 2014) and Antibacterial activity (Sheeba, 2010) are reported.
332.	<i>Solanum virginianum</i> L. (Solanaceae)	Leaves	Asthma & Cough	The boiled extract of the leaves is used in cough (Nonibala, 2010) Juice of roots and leaves used in treatment of asthma (Sailo et al., 2017). Stem juice is boiled in water till reduces into paste and equal amount of	Various phytoconstituents Carbohydrates, alkaloids, Terpenoids, Flavonoids, Tannins, Saponins, Proteins and amino acids, Glycoside and antioxidant and antibacterial activity (Patel et al., 2019).

				honey is added and taken in the treatment of asthma (Das et al., 2009).	
333.	<i>Solanum indicum</i> Linn. (Solanaceae)	Fruits, leaves, Roots	Asthma, Bronchitis , Cough, pneumonia	Roots are used in asthma (Sailo et al., 2017). The fruit juice along with honey is used in cough (Nonibala, 2010).	Various phytoconstituents Saponins (Yahara et al., 1996), glycoside (Saran et al.), phenolic compounds (Syu et al., 2001) are reported.
334.	<i>Solanum torvum</i> Sw. (Solanaceae)	Root, Fruit	Cough, headache, pneumonia	Roots (Kalita, N., Kalita, M.C., 2014). Fruit boiled and given in bronchial asthma (about 10 – 12 fruits daily for a month). (Nath et al., 2008)	Various chemicals alkaloids, flavonoids, saponins, tannins, and glycosides are reported (Chah et al., 2000). Antimicrobial (David et al., 1998), Antiviral activity are reported (Arthan et al., 2002).
335.	<i>Sonchus wightianus</i> DC. (Asteraceae)	Seed and Whole plant	Cough and bronchitis.	Crushed seed taken against cough (Dahal, 2019). Decoction of	Various chemical like Carbohydrates, Proteins, Glycosides, Phenols, Flavonoids, Terpenoids & Steroids are reported (Bolleddu et al., 2018).

				whole plant is used to treat cough and bronchitis (Zhasa et al., 2015).	
336.	<i>Stellaria media</i> L. (Caryophyllaceae)	Whole plant	Bronchitis, chest pain and cough	Cooked plants against bronchitis (Rajkumari et al., 2013). Infusion of aelial part taken against chest pain and cough (Dahal, 2019).	Various chemicals like Flavonoid, oligosaccharide stellariose, anthraquinone derivatives, fatty acid, steroid saponinsand phenolic compounds (Singh & Yadav, 2010 and . anti-inflammatory, antioxidant, antimicrobial activities (Oladeji&Oyebamiji, 2020)
337.	<i>Stephania elegans</i> Hooker f. & Thomson (Menispermaceae)	Tuber	Asthma	Juice extract from tuber is used (Rongsensashi et al., 2016)	Not reported.
338.	<i>Stephania glandulifera</i> Miers (Menispermaceae)	Tuber	Asthma	Powder of tuber mixed with honey is given in asthma (about 2 gm with one teaspoonful of honey, twice daily for a month). (Nath et al., 2008).	Not reported.

339.	<i>Stephania japonica</i> (Thunb.) Miers (Menispermaceae)	Tuber	Fever	<i>Tuber bitter used in fever</i> (Rama Shankar &Rawat, 2013)	Alkaloids, glycosides, flavonoids, fats, steroids and tannins (Moniruzzaman et al., 2016)and antioxidant and anti-Inflammatory activity (Ahmed et al., 2011).
340.	<i>Stictia nylanderiana</i> Zahlbr. (Lobariaceae)	Thallus	Cough	Crushed thallus taken to cure cough (Dahal, 2019).	Not reported.
341.	<i>Swertia chirayita</i> (Roxb. ex Flem.) Karst. (Gentianaceae)	Whole plants	Malaria, fever	Plant decoction is taken in fever (Nungki et al.,2015). Decoction of dried plant taken daily for few days to treat high fever, cough, malarial fever and high blood pressure (Tsering, 2017).	Xanthones, lignans, alkaloids, flavonoids, terpenoids, iridoids, secoiridoids, chiratin, ophelicacid, palmitic acid, oleic acid, stearic acid (Pant et al., 2000; Patil et al., 2013), Anti-inflammatory and antimicrobial activity are reported (Holanda et al., 2008).
342.	<i>Swertia multicaulis</i> D. Don (Gentianaceae)	Root	Cough, cold, bronchitis	Decoction of root taken to cure cough, cold, bronchitis (Dahal, 2019).	Not reported.

343.	<i>Syzygium jambos</i> (L.) Alston (Myrtaceae)	Flower, Seed, Fruit	Cough	Flowers, seed and fruit are used (Zhasa et al., 2015).	Polyphenols, anthraquinones, tannins steroids and antibacterial activity are reported (Wamba et al., 2018).
344.	<i>Tabernaemontana divaricata</i> (Apocynaceae)	Leaves, Seed, Roots	Cough	Leaves, seeds and roots used in the treatment of cough (Zhasa et al., 2015).	Alkaloids, proteins, amino acids, flavonoids, saponins, phenols, glycosides, tannis, steroids, triterpenoids, fixed oils and fats (Chanchal et al., 2015).
345.	<i>Tagetes erecta</i> L. (Asteraceae)	Leaves	Bronchitis	Leaves are used (Zhasa et al., 2015). Leaf juice taken against cough (Dahal, 2019).	Alkaloids, Carbohydrate, Tannins, Phenolic compound, flavonoids and antibacterial activity (Ramya et al., 2012).
346.	<i>Tamarindus indica</i> L. (Leguminosae)	Leaf	Cough	Leaf juice taken against cough (Dahal, 2019).	Alkaloid, glycoside, saponin, tannin, anthraquinone, steroid, terpenoid, phenol and Antibacterial activity (Abdallah & Muhammad, 2018).
347.	<i>Tectona grandis</i> L.f. (Lamiaceae)	Flower	Bronchitis & Cough	Infusion of flowers taken against cough and bronchitis. (Dahal, 2019).	Alkaloids, carotenoids and tannins (Ogunmefun et al., 2017). Antimicrobialactivity (Danlami& Simon, 2017).
348.	<i>Terminalia bellirica</i>	Fruit	Cough	Juice of fruit and	Tannin, Glucoside (bellericanin),

	(Gaertn.) Roxb. (Combretaceae)			raw fruit is taken to reduce cough (Sen et al., 2011).	Ellagic acid, Gallic acid, Lignans (API, 2001) and Anti-microbial (Elizabeth et al. 2005), Antioxidant (Fahmy et al., 2015).
349.	<i>Terminalia chebula</i> Retz. (Combretaceae)	Fruit	Cough	Fruit is used in the treatment of cough (Kala, 2005)	Various chemicals Glycosides, Chebulinic acid, tannins, anthraquinones, ellagic, gallic acid (API, 2001) and antioxidant (Chang & Lin, 2010), antibacterial (Malckzadeh et al., 2001), Antiviral (Jeong et al., 2002) activity are reported.
350.	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn. (Combretaceae)	Bark	Bronchitis	Bark powder mixed with leaf juice of <i>Justicia adhatoda</i> L. in the ratio of 1:5 and again dried under sunlight, about 2 gm of this preparation mixed with little honey and palm-candy is administered once daily in chronic bronchitis till cure.	Antioxidant (Kumar et al., 2009), antimicrobial (Gauthaman et al., 2005).

				(Nath et al., 2008).	
351.	<i>Terminalia bellirica</i> (Gaertn.) Roxb.(Combretaceae)	Cotyledons	Asthma	Crushed cotyledons about 5 gm mixed with hot water is taken in common cold and asthma thrice daily till cure (Nath et al., 2008).	Various chemicals like glycosides, flavonoids, tannins, phenolic compound, amino acids saponins and Antispasmodic and bronchodilatory, Anti-microbial (Gilani et al., 2008) antimicrobial activity (Sabnis 2014).
352.	<i>Tetradium fraxinifolium</i> (Hook.) Hartley (Rutaceae)	Fruit	Cough & Cold	Fruit or fruit powder with water taken to cure cough and cold (Dahal, 2019).	Not reported.
353.	<i>Thalictrum foliolosum</i> DC. (Ranunculaceae).	Root	Cold & Cough	About 200 g root is boiled with 1.5 litres of water and the decoction 250ml is given twice daily for one week in cold and cough with fever and	Antimicrobial activity (Joshi & Sati, 2014).

				stomachache (Salam, 2013). Decoction of root taken to cure cough (Dahal, 2019).	
354.	<i>Thysanolaena latifolia</i> (Roxb. ex Hornem.) Honda (Poaceae).	Root	Bronchial problem, Cough	Decoction of roots taken against fever and cough (Dahal, 2019). A decoction of 200-300 gm of young roots for one dose is used twice in case of bronchial problem (Maity, 2004).	The plant reported terpenoids, carbohydrates, tannins, flavonoids, saponins, glycosides chemical compounds, antioxidant and antibacterial activity (Hoque et al., 2016).
355.	<i>Tinospora cordifolia</i> (Willdenow) Hook. f. et Thomson (Menispermaceae)	Stem	asthma, bronchitis, cough	Stem juice useful against asthma, bronchitis, cough (Dahal, 2019).	The plant reported containing chemical compound including Alkaloids, Terpenoids, Lignans, Steroids, glycosides, steroids, phenolics, aliphatic compounds, polysaccharides (Chaudhary et al., 2014) and antioxidant (Mehra et al., 2013), antimicrobial activity and antibacterial activity (Duraipandiyar et al., 2012).

356.	<i>Toonaciliata</i> M. Roem. (Meliaceae)	Bark	Bronchitis , cough	Decoction of bark used against bronchitis, cough (Dahal, 2019).	Various chemicals Phytosterol, phenols, tenins, alkaloids, anthraquinone and antibacterial activity (Gautam et al., 2010).
357.	<i>Tricholepidium superficiale</i> (Blume) Fraser-Jenk. (Polypodiaceae)	Rhizome	Cough & Cold	About 20 gm paste obtained by crushing fresh rhizome along with seeds of <i>Piper nigrum</i> is taken orally to cure cough and cold. It should be taken thrice a day till the disease is cured (Choudhury, 1999).	Not reported
358.	<i>Trichosanthes tricuspidata</i> Lour. (Cucurbitaceae)	Leaves	Asthma and cough	The smoke of dried leaves is inhaled to get relief of asthmatic attack by the local people in the Nungba and Irang areas (Rongmei) in Manipur (Singh,	Anti-Inflammatory (Ahuja et al., 2019).

				1990). Dried leaves smoked ascigrettes to cure asthma and cough (Dahal, 2019).	
359.	<i>Tridax procumbens</i> (L.) L. Asteraceae	Flower	Cough & Cold	Flowers head chewed to treat cough and cold (Dahal, 2019).	<i>T. procumbens</i> contains flavone glycosides, chromone glycosides, sterols and polysaccharides (Agrawal et al., 2010) Antimicrobial (Perumal et al., 1999) Antiinflammatory (Margaret et al., 1998), Antioxidant (Agrawal et al., 2009) activity are reported.
360.	<i>Trigonella foenum- graecum</i> L. (Fabaceae)	Seed	Bronchitis	Infusion of seed powder is given in bronchitis and influenza (five teaspoonfuls, once ortwice daily till cure). (Nath et al., 2008)	Antioxidant (Baquer et al., 2011), anti-inflammatory (Vyas et al., 2008), antibacterial (Haouala et al. 2008) effect are reported.
361.	<i>Tropaeolum majus</i> L. (Tropaeolaceae)	Leaf	Bronchitis and cough.	Leaf or flower juice taken with honey against indigestion, cough	Biologically active compounds such as flavonoids, glucosilones, fatty acids, essential oil, chlorogenic acid, amino acids, cucurbitacins,

				and bronchitis. (Dahal, 2019).	proteins and carotenoids are reported (Brondani, 2016). Antioxidant, anti-inflammatory, and antimicrobial activity are also reported (Bazylko et al., 2013).
362.	<i>Tylophora indica</i> (Burm. f.) Merr. (Apocynaceae)	Leaf	Asthma	Leaf juice is used in Asthma (Rama Shankar & Rawat, 2013).	The plant has been reported to contain various alkaloid viz Tylophorine, tylophorinine, tylophorinidine, septicine, isotylocrebrine, tylophorinicine, sterols, flavanoids, wax, resins, and tannins (Govindhari et al., 1975). Antibacterial (Balasubramanian et al., 2010), Antiallergic (Nayampalli et. al., 1979) property are reported.
363.	<i>Urena lobata</i> L. (Malvaceae)	Leaves and Root	Cough	Juice of the fresh leaves along with honey is given to cure cough (Nonibala, 2010). Root chewed to cure cough (Dahal, 2019).	Chemical Alkaloids, flavonoids, saponins, tannins and biological effect like Anti-inflammatory (Babu et al. 2016), Antioxidant (Lissy et al. 2006), Antimicrobial (Adewale et al. 2007) are reported.
364.	<i>Urtica dioica</i> Linn. (Urticaceae)	Whole plant	Cough	Decoction is used against cough (Pradhan and	Antioxidant (Mavi et al., 2004), anti-inflammatory, antiviral (Krystofova et al., 2010),

				Badola, 2008). Boiled leaves taken to cure cough, cold (Dahal, 2019).	antibacterial and antimicrobial (Kukrik et al., 2012).
365.	<i>Verbascum Thapsus</i> L. (Scrophulariaceae).	Leaves	Asthma and spasmodic cough	Dried leaves smoke to relieve irritations of upper respiratory tract, in asthma and spasmodic cough (Dahal, 2019)	Various chemical constituents like saponins, iridoid and phenylethanoid glycosides, flavonoids, vitamin C, minerals and anti-inflammatory, antioxidant (Kumar and Singh, 2011), antimicrobial (Khan et al., 2011), antiviral properties (Rajbhandari et al., 2009) are reported.
366.	<i>Chrysopogon zizanioides</i> (L.) Roberty (Poaceae)	Root	Asthma, cough	Decoction of root taken against asthma, cough (Dahal, 2019).	Antioxidant (Luqman et al., 2009), antibacterial (Luqman et al., 2005), anti-inflammatory properties (Balasankar et al., 2013).
367.	<i>Viburnum foetidum</i> Wall (Adoxaceae)	Leaves & Root	Anti-spasmodic and asthma.	Leaves and roots are used (Zhasa et al., 2015).	Not reported.
368.	<i>Viola diffusa</i> Ging. (Violaceae)	Root	Cough	Infusion of root useful in treating cough (Dahal, 2019).	Anti-hepatitis B virus activities (Dai et al., 2015).

369.	<i>Viola pilosa</i> Blume. (Violaceae)	Whole plant	Cough	The crushed extract of the plant is used in cough and cold (Devi, 2013). Decoction of whole plant taken against asthma, cough (Dahal, 2019).	Various bioactive compounds flavonoids, glycosides, proteins, fats, alkaloids, steroids, saponins, carbohydrates, tannins and antimicrobial activity are reported (Bakht et al., 2017).
370.	<i>Vitex peduncularis</i> Wall. (Verbenaceae)	Bark	Chest pain	The bark juice is applied externally in chest pain (Sharma et al., 2001).	Biologically active chemical constituents pachypodol, ursolic acid, 2 α -hydroxyursolic acid, vitexin and peduncularcin are reported (Meena et al., 2011); Antioxidant activity (Haque, 2012).
371.	<i>Vitex negundo</i> (Linn.) (Verbenaceae)	Leaves	Cough	Leaf juice taken to cure cough (Dahal, 2019).	Anti-inflammatory Activity (Chawla et al., 1992), Antioxidant Activity (Zheng et al., 1999; Zheng and Luo, 1999; Onu et al., 2004).
372.	<i>Xanthium strumarium</i> L. (Asteraceae)	Shoot	Cough	Infusion of shoot effective against cough (Tsering, 2017).	Antioxidant, antimicrobial, Antimalarial, Antiallergic activity (Kamboj&Saluja, 2010).
373.	<i>Xylosma longifolia</i> Clos (Salicaceae)	Leaf	Bronchitis & Cough	About 100 ml decoction of the	Antimicrobial, Antioxidant and anti-dermatophytic properties (Devi

				leaf is prescribed once daily for 5-7 days incough, bronchitis in Manipur (Salam, 2013).	et al., 2013)
374.	<i>Zanthoxylum khasianum</i> Hook. f. (Rutaceae)	Fruits	Cold & Cough	Dried fruit is chewed orally to treat cough (Myrchiang et al., 2018)	Not reported.
375.	<i>Zanthoxylum acanthopodium</i> DC. (Rutaceae)	Fruit	Cough	Fruit are used in toothache and cough (Nonibala, 2010). The seed and leaves are used in chronic fever, indigestion, cough and bronchitis (Sinha, 1996). Leaves are boiled with <i>Phlogacanthusthyr siflorus</i> leaves and the decoction is prescribed among	Anti-inflammatory activity (Dutta et al., 2013).

				the Kom community in Manipur (Kom et al., 2018).	
376.	<i>Zanthoxylum armatum</i> DC. (Rutaceae)	Dried fruit	Cough, Bronchitis and throat pain	The dried fruits are warmed and eaten against cough, bronchitis and throat pain (Khongsai et al., 2011).	Antibacterial, antiviral, antifungal and cytotoxic activities (Phuyal et al., 2018).
377.	<i>Zanthoxylum nitidum</i> (Roxburgh) DC. (Rutaceae)	Root		Root pounded and made into paste with one or two cloves, shoots of <i>Ocimum basilicum</i> L. and a little common salt is given in asthma (5 gm, twice daily for a month). (Nath et al., 2008).	5,6-dihydro-6-methoxynitidine (1), dictamnine (2), gamma-fagarine (3), skimmianine (4), and 5-methoxydictamnine (5), were isolated from the roots of <i>Zanthoxylum nitidum</i> (Yang & Cheng, 2008); Antiviral and antifungal effects (Yang & Cheng, 2008).
378.	<i>Zingiber gracile</i> Jack (Zingiberaceae)	Leaves	Cough & Bronchitis	Aromatic oil extracted from leaves taken orally (Lalramnghinglova	Not reported.

				, 2016)	
379.	<i>Zingiber montanum</i> (J. Koenig) Link ex A. Dietr. (Zingiberaceae)	Rhizome	Cough & Cold	Decoction of rhizome is warmed and taken orally to cure cough and cold. The powder of tuber is mixed with honey and taken orally to treat cough among Kom community in Manipur (Kom et al., 2018).	Antioxidant activity and major volatile oil components (Manochai et al., 2010).
380.	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.			Rhizome roasted and chewed to treat cough (Dahal, 2019).	Antipyretic, Anti-inflammatory, Antibacterial activity (Haque & Jantan, 2017).
381.	<i>Zingiber officinale</i> (Zingiberaceae)	Rhizome	Cough, fever & Bronchitis	Juice of rhizome mixed with leaf juice of <i>Ocimum basilicum</i> L., <i>Leucas plukenetii</i> (Roth.) Spr., and <i>Justicia adhatoda</i> L. (10 ml each) is given to	Antimicrobial activity (Riaz et al., 2015), Anti-inflammatory effect (Penna et al., 2003), Anti-viral effect (San Chang et al., 2013).

				control bronchitis (twice daily tillcure). (Nath et al., 2008). Rhizome is consumed as raw with honey for treatment of cough, bronchitis, fever, influenza and other throat problem. (Khongsai et al., 2011). Rhizomes are consumed raw or cooked for immediate cure from cough and cold (Wangpan et al., 2019).	
382.	<i>Zizyphus mauritiana</i> Lam.	Fruit	Cough	Ripe fruit paste taken against cough (Dahal, 2019).	Flavonoids, glycosides, saponins, phenols, lignins, sterols and tannins were reported (Rathore et al., 2012).

Conclusions

In this review, we described the medicinal plants used to treat respiratory disorders in North East India. Local people or traditional healers are using plants without any scientific base. There is a gap between traditional use of plants and scientific evaluation in terms of pharmacological investigation. Although maximum species reported in this review are scrutinized for phytochemicals property, but details study leading to the discovery of novel active biocompound is yet to be carried out. In recent time during this COVID pandemic, it is important to collect the valuable knowledge from traditional healers regarding medicinal use of plants to treat respiratory problems and should focus on the useful pharmacological and phytochemical evaluation of medicinal plants for the identification of novel compounds as well as for their protection, usefulness and effectiveness of this disease. This review provides a baseline data for initial screening of promising plants used in respiratory disorders in this north eastern region, India.

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Chapter 5

A Review on Entomotherapeutic practices by Ethnic Tribes of North East India

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Abstract

Traditional medicine has been practiced in India since time immemorial and even today, a majority of the tribal populations of North East India rely on this age-old system for treating several ailments. This knowledge has played an important role in identifying biological resources for commercial exploitation. Entomotherapy is one of the traditional medical practices that play a crucial role in healing various human diseases in this region. The present chapter reviews the use of different insects by different tribal communities of North East India, their preparation methods and the diseases for which these insects are consumed either as food or medicine. Due to the increasing urbanization there is a rapid degradation of natural resources therefore, there is an urgent need to record the knowledge that rests with these ethnic communities and to conserve the endemic bio-resources for the benefit of mankind. Though, these medicines have been used by traditional healers, there is a need to validate them scientifically to find out the active components of these insects responsible for its action so that the knowledge can be put to use for researching and developing drugs or treatments for many diseases.

Keywords: Traditional medicine, Traditional Knowledge, Biodiversity, Entomotherapy.

Introduction

India occupies only 2.4% of the total world's land area yet its contribution in terms of biological diversity is immense (Chinlampainga *et al.*, 2013). Biodiversity has proved to be boon to a mankind not only for food resources but also as a reservoir of medicines which has been explored both traditionally as well as scientifically. Amongst this biodiversity, globally, insects alone make up more than 50% of the floral and faunal diversity put together (Grimaldi *et al.*, 2005). 59,353 species of insects belonging to 619 families have been reported from India alone (Alfred *et al.*, 1998). This diversity of insects is greater in Northeastern states and in Western Ghats. Northeastern region lies between 20°50'- 29°30'N latitude and 89°49'- 9°30'E longitudes (Hazarika, 2018). This region which lies in mid to high latitude tends to have abundance of insects due to warm temperature and humid climate (Deutsch *et al.*, 2008). Many of these insects possess many medicinal properties that are exploited by the local tribes of these regions and also used as a food source (Rahman *et al.*, 2018). Use of insects as a food is very common among the ethnic people of North East India According to a report, total of 255 different insect species are taken as food by different tribes of India (Hazarika, 2018). Among all the edible insects, the most commonly consumed insects belong to the family Coleoptera (34%) followed by Orthoptera (24%), Hemiptera (17%), Hymenoptera (10%), Odonata (8%), Lepidoptera (4%) and Isoptera (2%) (Hazarika, 2018; Sangma *et al.*, 2016). The method of preparation of all these edible insects varies among different communities- some being roasted, some are deeply fried, some are ground into paste and some are eaten raw. Ethno-medicine deals with the use of plants, animals, minerals and insects etc. for treating different ailments (Werner, 1970; Solanki & Chutia, 2009). Traditional medicines and their practitioners reflect cultural expressions through indigenous beliefs, concepts, knowledge and practices prevailing among the ethnic people for preventing or curing disease (Solanki & Chutia 2009; Young, 1983). The vast knowledge base of use of insects in ethno-medicine that lies with the different ethnic tribes of North Eastern states are being reviewed in the following sections.

A. Insects in traditional medicines used by different communities of Arunachal Pradesh

Arunachal Pradesh is the largest state in North East India that lies between 26°28' and 29°30' N latitude and 90°30' and 97°30' E longitude and is situated in the Eastern Himalayan province, a region characterized by mountains and valleys of variable elevation (50 to 7000 m) (Chakravorty *et al.*, 2011a). By virtue of this geographical location, climatic condition and altitudinal variation, this region is very rich in biodiversity and regarded as global biodiversity hotspot (Myers *et al.*, 2000). This state is not only biologically diverse but also known for its variety of traditional

communities with 26 tribes and 110 subtribes. Among all the tribes- *Adi, Nyishi, Monpa, Tagin, Idu, Khampati, Tangsa, Nocte, Singpho, Mishmi, Miji, Wangcho, Apatani, Aka, Sherdukpen, Khawa, Hill Miri* (Mahanta & Tiwari, 2005, Singh et al., 2010), *Galo, Memba and Khamba* (Kato & Gopi, 2009) are the main tribes. These communities are close with nature and get minimal access to modern medical and food facilities due to their remote location. Hence, they are mostly dependent on locally available resources for food and medicines. Use of different insects in treating different ailments by the tribal communities of this region is given in the Table 5.1.

Adi people use larvae of *Oecophylla smaragdina* as a medicine to a person suffering from malaria and even the adult ants are used to make the patient get bitten by them so that the acids/ hormones injected by these ants raise the body heat of the malaria patient which is believed to help patient in getting cured. Traditional healers also restrict the consumption of bamboo shoot (fresh/ fermented) to avoid malaria relapse (Chinlampaing et al., 2013). They also use *tari* insect (*Aspongopus janus*) for treating malaria after mixing it with local plants (eg- origin- *Clerodendrum colebrookiantum*, bangko- *Solanum spirale* etc).

Jugli et al. (2019) reported the entomotherapeutic practices of two of the tribes – *Wancho* and *Tangsa* of Arunachal Pradesh. *Tangsa* tribe alone uses total of 55 different animal species (including vertebrates and invertebrates) in different diseases and out of that, 15% are insects. Some of the commonly used insects are *Apis cerana*, *Apis mellifera*, *Apis dorsata*, *Apis florea*, *Apis andreniformis*, *Vespa orientalis*, *Chondracris rosea* and *Blattid* sp. Similarly, *Wancho* tribe is reported to use 20 different species, out of which ~20% are insects, viz- *Macrocheraia grandis*, *Melamphaus rubrocinctus*, *Apis cerana*, *Apis mellifera* and *Apis dorsata* (Jugli et al., 2019). The preparation method of the insects and the name of diseases for which these insects are used is given on the Table 5.1. In majority of the tribes, insects belonging to the order Hymenoptera are used for therapeutic purpose.

Table 5.1. List of insects used for medicinal purpose by different tribes of Arunachal Pradesh.

Name of insect	Body part used	Tribe	Preparation method	Disease cured	Author
<i>Apis cerana</i> , <i>Apis florea</i> , <i>Apis mellifera</i> ,	Honey, wax,	Galo and Nyishi	Raw honey is taken 2/3 times daily and for skin irritation, honey is directly	Cough, fever, stomachache, skin irritation, stomach cleanser	Chakravorty et al., 2011b

			applied to skin		
<i>Bathroponeraru fipes</i>	Whole body		Insects are crushed into paste and applied on the affected areas, 1/2 ants are eaten for high blood pressure, ground -up ants are mixed with water and gurgled for toothache and crushed ants are mixed with other edibles and orally taken during morning time is good for malaria.	Scabies, toothache, High blood pressure, boils. Wounds, malaria, dysentery and chest pain	-do-
<i>Vespa orientalis</i>	Whole body		Insects are directly allowed to sting the person suffering from cough and cold	Cough and cold, stomach disorder	-do-
<i>Oecophylla smaragdina</i>	Whole insect		One full colony is fried without oil; Smoked dried, mixed with salt and taken as small amount once a day till	Stomach pain and fever	do-

			recovered		
<i>Catharsius</i> sp.	Whole insect without body cover		Wet paste is made and given during acute diarrhoea	Diarrhoea	-do-
<i>Ephemera danica</i>	Nymph		Roasted or boiled nymphs are consumed	Stomach disturbance	-do-
<i>Melampus rubrocinctus</i>	Hemolymph	Wancha	Haemolymph is squeezed out by gently pressing the abdominal portion of the insect. Then it is consumed either mixed with water or directly	Cough and cold	Jugli et al., 2019
<i>Macrocheria grandis</i>	Haemolymph		-do-	-do-	-do-
<i>Apis cerana</i> , <i>Apis mellifera</i> , <i>Apis dorsata</i>	Honey		Fresh honey is taken orally	-do-	-do-
<i>Apis cerana</i> , <i>Apis mellifera</i> , <i>Apis dorsata</i> , <i>Apis florea</i> , <i>Apis andreniformis</i>	Honey and sting	Tangsa	Honey along with Tulsi leaves (<i>Ocimum sanctum</i>) is a good remedy for cough and cold; honey is also used as ointment for eye problem Once a year,	Cough and cold, eye problem	-do-

			sting was thought to prevent septic problems		
<i>Vespa orientalis</i>	Whole insect		Insect paste is applied to the affected skin in case of spider bites	Antivenom	-do-
<i>Chondracris rosea</i>	Whole insect		Fresh or roasted	Allergy	-do-
<i>Blattid</i> sp.	Whole insect		Roasted insects are given to children	Prevent drooling in children	-do-
<i>Oecophylla smaragdina</i>			-	Given to old people to cure digestive problems	Chinlambia et al., 2013
<i>Aspongopus janus</i>		Adi	Insect is mixed with leaves of some local plants like- <i>Clerodendrum colebrookianum</i> and <i>Solanum spirale</i>	malaria	-do-
<i>Polistes</i> sp.	Whole insect	Galo	Insects are allowed to bite directly to the person suffering from cold	Cough, cold, stomach disorder	Chakravorty et al., 2011b
<i>Cantharid</i> sp.	Whole body	Galo	-	Skin allergy	-do-
<i>Lepidiota</i> sp.	Whole body	Galo	-	Skin allergy	-do-

B. Insects in traditional medicines used by different communities of Assam:

Assam is one of the mega hotspot regions and is known for its rich culture with numbers of different tribes varying in their traditional culture, food habit and traditional knowledge. Zootherapy is a part of local culture among different tribes and the information about the insect or animal and their uses is passed down generation to generation through folklore or shared by word of mouth mainly among the older generation. In Asaam, Karbi, Dimasa, Bodo, Mann Tai, Kuki, Rengma, Jayantia, Hmar, Adivasi, Rabha, Miris, Sonowal Kochari, Mishng are the main tribes. All these tribes have their own traditional knowledge of using locally available insects for the ailment of many diseases.

Hazarika & Goyari (2017) reported that Bodo tribe of Udalguri district of Assam uses 23 insect species belonging to the order *Hemiptera*, *Coleoptera*, *Hymenoptera*, *Orthoptera*, *Lepidoptera*, *Isoptera* and *Odonata* comprising of 21 genera and 16 families as food resources. The insects which they eat as food is a good resource of monounsaturated and/or polyunsaturated fatty acids and a rich source of micronutrients like copper, iron, magnesium, manganese, phosphorous, selenium, zinc, riboflavin, pantothenic acid, biotin and in some cases folic acid (Hazarika & Goyari, 2017, Rumpold & Schluter, 2013). These insects are therefore eaten as dietary supplements.

Bodo community use ‘*Sosroma*’ (*Gryllotalpa africana*) in a fried or roasted form as a therapeutic medicine for curing certain childhood diseases (Narzari & Sarmah, 2015). In Dhemaji district of Assam which is dominated by *Mishng*, *Lalong*, *Koch* and *Ahom* community, 16 species of insect belonging to 6 orders are reported to be consumed by different communities for the treatment of different kinds of diseases-like whooping cough and asthma. Interestingly, pupae and larvae of Eri silkworm (*Samia Cynthia ricini*) are used to cure ‘*Dudmur*’ disease in children (Dutta et al., 2016). In another study by Doley & Kalita, (2012) total 15 edible insects were reported from Dhemaji district by *Mishng* people, out of which, 7 species were for therapeutic purpose. *Mishng* and *Ahom* tribe eat eggs of red tree ants (*Oecophylla smaragdina*) during Assamese festival of Bohag Bihu and believe that these insects keep them healthy. The formic acid produced by these ants have a shown to have potent effect on curing ailments like scabies, malaria, tooth aches, stomach disorder, blood pressure anomalies etc. (Chakravorty et al., 2011b; Doley & Kalita, 2012).

Karbi Anglong district is the largest among 27 districts of Assam and *Karbi* is the main tribe in this district. 8 different insects are reported to be used for traditional treatment [Table 5.2] (Verma et al., 2014). Bhuyan (2016) reported total 4

insects (*Apis sp.*, *Antheraea assama*, *Periplaneta americana* and *Philosomia ricini*) with therapeutic use along with other vertebrates that are commonly used by *Tai Ahom* people. Honey is seen to be commonly consumed or applied by the Ahoms for curing cough, snake bites and skin problems. Extract of the roasted cockroaches (*Periplaneta americana*) and *Philosomia ricini* and *Antheraea assama* are consumed after boiled or fried to cure weakness and anaemia Table 5.2 gives the comprehensive list of insects utilized for therapeutic purpose by different tribes of Assam.

Table 5.2. List of insects used for medicinal purpose by the tribes of Assam.

Name of insect	Body part used	Tribe	Preparation method	Diseased cured	Author
<i>Achaeta sp.</i>	Hind leg	Karbi	Burn on fire and eaten	Diuretic	[Verma et al., 2014]
<i>Aeshma mixta</i>	Whole body	Karbi, Rengma and Mishin g	-	For anti-diuretic drug in children	[Ronghang and Ahmed, 2010]
<i>Antheraea assama</i>	Whole	Ahom	Boiled and fried	Weakness, anaemia	[Bhuyan, 2016]
	Silk and pupa	Karbi and Rengma	Chutney and baking	Diet supplement	[Ronghang and Ahmed, 2010]
	Larva, pupae and adult	Mishin g, Lalong, Koch	Frying and boiling	Constant itching, soreness of throat and diet supplement	[Doley and Kalita, 2012; Dutta et al., 2016]
<i>Apis sp.</i>	Whole body	Ahom	Honey is taken and applied. Powder of the roasted animal is mixed	Cough, snakebite, skin disease	[Bhuyan, 2016]

			with honey and applied.		
<i>Apis indica</i>	Honey , Beewax	Mishin g	-	Cough, cold and fever	[Doley and Kalita, 2012]
<i>Apis indica</i>	Egg, larvae, honey	Mishin g, Lalong, Koch	Crushed and mixed with honey	Whooping cough	[Dutta et al., 2016]
<i>Apis mellifera</i>	Honey , egg, larva and pupa	Karbi, Rengma	Chutney and baking	Cold, flu, cough, face facial	[Ronghang and Ahmed, 2010; Verma et al., 2014]
<i>Bombyx mori</i>	Larvae, pupae and adult	Mishin g, Lalong, Koch	Frying and boiling	Cure constant itching and soreness of throat	[Dutta et al., 2016]
<i>Coridius chinensis</i>	Adult	Miris	Eaten cooked	Cures Urino-genital problems	[Senthilkumaret al., 2008]
<i>Dorylus orientalis</i>	Eggs, adults	Mishin g	-	Protect against small pox, chicken pox. Adults in stomachache, dysentery.	[Doley and Kalita, 2012]
<i>Eumenes petiolatus</i>	Eggs, larvae	Mishin g	-	Protect from headache, burn relief	[Doley and Kalita, 2012]
<i>Eumenes</i> sp.	Nest	Karbi	Nest is	Stomach	[Dutta et al.,

		and Rengma	mixed with local herbs and consumed	problem, cough and cold	2016]
<i>Gryllotalpa africana</i>	Larvae	Bodo	Wings are removed then fried or roasted	Certain childhood diseases	[Narzari and Sarmah, 2015]
<i>Hierodula westwoodi</i>	Adult	Sonowal-kachari	Eaten roasted	Strengthens kidney and relieve convulsions	[Senthilkumaret al., 2008]
<i>Lytta vesicatoria</i>	Whole insect	Karbi	Crushed, dissolved and orally consumed	Anticancer, increase sexual pleasure	[Verma et al., 2014]
<i>Musca domestica</i>	Whole body	Karbi and Rengma	Roasted	Baldness	[Verma et al., 2014]
<i>Myrmica rubra</i>	Larva and pupa	Karbi, Rengma and Mishin g	Roasting and deep frying	Consumed for improving potency	[Ronghang and Ahmed, 2010]
<i>Mylabris cichorii</i> <i>Epicauta tereticornis</i>	Whole insect	Karbi and Rengma	Crushed, dissolved and orally consumed	Anticancer, warts, rabies	[Verma et al., 2014]
<i>Neurathemis fluctuans</i>	Whole body	Karbi and Rengma	Raw	Urinary disorder cure in children	[Ronghang and Ahmed, 2010]
<i>Periplaneta americana</i>	Whole insect	Karbi, Mishin g, Lalong, Koch	Boiled/ burned, fried and consumed	Asthma, Tuberculosis	[Verma et al., 2014; Dutta et al., 2016]
	Whole	Ahom	Extract of	Asthma,	[Bhuyan,

	insect		the roasted insect with water is consumed	Tuberculosis	2016]
<i>Pediculus</i> sp.	Whole insect	Karbi and Rengma	Eaten alive	Clears urinary tract obstructions	[Verma et al., 2014]
<i>Philosomiaricini</i>	Whole	Ahom	Boiled and fried	Weakness, anaemia, stomach disorder	[Bhuyan, 2016]
	Coccon and coccon ash	Karbi	Cooked, baked, chutney and curry	For prevention of evil spirit	[Ronghang and Ahmed, 2010]
	Larvae, pupae and adult	Mishin g, Lalong, Koch	Frying and boiling	Infection of tongue and mouth	[Dutta et al., 2016]
<i>Poecillocerus pictus</i>	Whole insect	Karbi	Fried	Lung infection	[Verma et al., 2014]
<i>Pomponia</i> sp.	Adult	Mishin g, Lalong and Koch	Wings and intestine removed and fried in oil	Food values	[Dutta et al., 2016]
<i>Pseudacanthotermes</i> sp.	Whole body	Karbi	Fried	Asthma	[Verma et al., 2014]
<i>Reticulitermes flavipes</i>	Whole body	Karbi and Rengma	Chutney and simple dry fry	Diet supplement	[Ronghang and Ahmed, 2010]
<i>Rhynchophorus phoenicis</i>	Larva	Karbi and Rengma	Chutney and baking	-do-	[Ronghang and Ahmed, 2010]

<i>Samia cynthiaricini</i>	Pupae, cocoon and cocoon ash	Mishin g	-	Protect the liver. Cocoon and cocoon ash used to protect children from evil spirit.	Doley and Kalita, 2012
<i>Schistocerca gregaria</i>	Whole body and body oil	Karbi, Rengma and Mishin g	Chutney and roasting	For lip cracking	[Ronghang and Ahmed, 2010; Doley and Kalita, 2012]
<i>Trigona spinipes</i>	Honey	Karbi	Raw honey consumed	Throat inflammation	[Verma et al., 2014]
<i>Ocecophylla smaragdina</i>	Weaver ant and their eggs	Karbi, Rengma and Mishin g	Chutney, baking and curry	Diet supplement	[Ronghang and Ahmed, 2010]
<i>Vespa orientalis</i>	Eggs and larvae	Mishin g, Lalong and Koch	Crushed and boiled and then consumed	Stomach problem, cough, cold	[Doley and Kalita, 2012; Dutta et al., 2016]
<i>Vespa magnifera</i>	Eggs and larvae	-do-	-do-	Stomach problem, cough, cold	[Dutta et al., 2016]

C. Insects in traditional medicines used by different communities of Manipur:

Manipur is a distinct part of Indo-Burma biodiversity hotspot and is very rich in diversity of insect fauna. There are 30 different ethnic communities with different identity, culture and food habits (Shantibala et al., 2012). So, entomophagy and entomotherapy is seen to be commonly practiced by these ethnic people. Out of all these communities *Meitei*, *Tarao*, *Tangkhul*, *Chothe* and *Thadou* consumes

approximately 28-30 species in comparison to 9-26 species consumed by other ethnic communities. There are total 11 species of medicinal insects found to be used by these peoples which belongs to six orders -*Orthoptera*, *Hemiptera*, *Coleoptera*, *Lepidoptera*, *Hymenoptera* and *Isoptera* (Table 5.3).

Table 5.3. List of insects used for medicinal purpose by tribes of Manipur [Singh, 2015].

Name of insect	Body part used	Disease cured
<i>Antheraea proylei</i>	Young stages	Relief from bronchitis & pneumonia
<i>Apis mellifera</i>	Honey	Memory enhancer, relief from gastric troubles
<i>Cimex lectularius</i>	Whole body	Relief from toe pains associated with nail problems or other injuries
<i>Gryllotalpa orientalis</i>	Body except head and appendages	Recovery from sprains, dropsy & anaemia
<i>Hydrophilus olivaceous</i>	Body except head and appendages	Dietary supplements, recovery from appetite loss
<i>Locusta migratoria</i>	-do-	Dietary supplement to alleviate nutritional deficiencies
<i>Lethocerus indicus</i>	-do-	Recovery from appetite loss and nutritional supplementary
<i>Odontotermes formosanus</i>	Mud from the inner side of the nest	Recovery of external inflammations
<i>Prionosomapodopioides</i>	Abdomen	Recovery from white patches on the body skin
<i>Polistesannularis</i>	Larvae & Pupae	Recovery from nerve weakness & recovery from appetite loss
<i>Samia cynthiarecini</i>	Young stages	Hemorrhages& relief from bronchitis &pneumonia

D. Insects in traditional medicines used by different communities of Meghalaya:

Meghalaya state is bounded by Assam state in north and Bangladesh in south. This state has three major tribes- *Garo*, *Khasi* and *Jayantia* living on the western, central and eastern hills of Meghalaya (Singh et al., 2010). Out of these three communities Khasi people are reported to use different insects in healing different diseases. According to Khasi traditional practitioners, a particular type of cockroach is used in whooping cough. Cockroaches, deep fried in mustard oil are used as a cure

for many diseases (1 & Keshan, 2017). To remove wooden or iron splinters from flesh, they use paste of fresh stick insects (*Carausius* sp.) to the wound and keep it overnight. Some type of rashes which is accompanied by bleeding and pain and common in men is cured by the use of the intestine of an insect called '*niang-saw-khlieh*'. One insect called '*niangkhap*' similar to '*niangkhapskhor*' is also seen to be used by Khasi tribe to cure dark blemishes/ pigmentation on the cheeks of women. Garo tribe use honey for treating 'dudmur' (infection of mouth and tongue in children) (Ghosh & Deka, 2015).

E. Insects in traditional medicines used by different communities of Mizoram:

Mizoram is the last frontier of Himalayan range surrounded by Bangladesh in the west, Myanmar in the east and south and Assam in the north. The *Mizos* formerly known as *Lushais*, are the main tribe that resides here. According to a report given by Lalramnghinglova (1999), they use 31 different invertebrates for the treatment of over 40 kinds of diseases. Out of all these, total 5 different insect species are used for healing diseases like pain, wound, stomach problem, asthma etc. Insects are crushed into paste and directly applied to affected area or sun-dried or boiled and that water is taken as tea. In the Table 5.4, insects name with their body part used and their preparation methods is mentioned.

Table 5.4. List of insects used for medicinal purpose by Mizo tribe of Mizoram.

Name of the insect	Part of the body used	Preparation method	Diseased cured	Author
<i>Carausius morosus</i>	Whole body	Insect is grounded into paste and applied directly on the body	Wounds, prickling spines	Lalramnghinglova, 1999; Chinlampaingaet al., 2013
<i>Periplaneta americana</i>	Body	Insect is killed, sundried, boiled and water is taken as tea	Asthma, stomach ache, saliva exuding out of mouth in children	-do-
<i>Cimexlectularis</i>	Whole part	Bugs are crushed and applied on the affected area	Inflammatory glands, boils & ulcers	-do-

<i>Myrmeleonformicarius</i>	Whole part, Posterior end of the body	Crushed and applied on the warts	Removal of warts or verrucose	-do-
<i>Apis mellifera</i>	Bee wax, Honey	Honey is mixed with ginger or alcohol (traditional beverage) or turmeric powder and taken orally	To relieve and heal the pain, throat pain, irregular menstruation, burns and cuts	-do-
<i>Gryllus pennsylvanicus</i>	Whole insect	Roasted and taken orally	Chest problem	Chinlampi angaet al., 2013

F. Insects in traditional medicines used by different communities of Nagaland:

Nagaland is surrounded by Assam in the west, Arunachal and Assam in the north, Myanmar in the east and Manipur in the south. Tribal people of Nagaland have been consuming insects since time immemorial as their traditional food but in recent time people have realized its benefit to human health. In Nagaland, *Angami*, *Ao*, *Chakhesang*, *Khiamnuingan*, *Konyak*, *Lotha*, *Sumi* (Mozhuet al., 2021), *Sera Naga* (Senthilkumar et al., 2008; Ao & Singh, 2004) are the main tribe that occupy different sections of the state. Meyer-Rochow and Changkija (1997) documented 42 types of insects that are used as food by Ao Naga tribe of Nagaland state. They also make use of insects in healing different diseases. *Darthula hardwickii* or treehopper, commonly called as ‘*Longmi*’ is used as an appetizer and also claimed to cure diabetes and high blood pressure. This insect has a queer odour but after several washes, smell disappears and can be cooked (Pongener et al., 2019). Such use of insects in different diseases is listed in Table 5.5

Table 5.5. List of insects used as medicine by different communities of Nagaland.

Name of insect	Body part used	Preparation method	Disease cured	Author
<i>Tessarotoma javanica</i>	Body secretion	Directly used on the skin	Remove warts	[Pongener et al., 2019]
<i>Oecophylla</i>	Adult	Not known	Cure high	[Pongener et

<i>smargdina</i>			blood pressure in adult and asthma in children	al., 2019]
		Filtred after boiling used while bathing as an antiseptic	To cure chicken pox	[Pongener et al., 2019]
<i>Prionoxystus robiniae</i>	-do-	Not known	Tuberculosis, anaemia, believe to cause miscarriage in pregnant women	[Pongener et al., 2019]
	Caterpillar	Broth after boiling is rubbed	Arthritis and body pain	[Pongener et al., 2019]
<i>Cossus sp.</i>	Larvae	Raw	Crtain ailments	[Pongener et al., 2019]
		Boiled water of larvae	Used as a Balm for muscle aches and join pain	[Pongener et al., 2019]
<i>Batocera rubra</i>	Larvae	Eaten alive (Ao tribe)	Wounds	[Senthilkumae ret al., 2008]
<i>Batocera titana</i>	-do-	-do- (Ao and Sema Naga)	-do-	-do-
<i>Coelosterna scubrata</i>	-do-	Crushed live and applied (Ao Naga)	Burns	-do-
<i>Neocerambyx paris</i>	-do-	Tonic used (Ao Naga)	Expectorant	-do-
<i>Xystrocera</i>	-do-	Crushed	Antiseptic	-do-

<i>globosa</i>		and applied (Ao Naga)		
<i>Balaninus c- album</i>	-do-	Tonic used (Ao Naga)	Respiratory disorder	-do-
<i>Rhynchophorus ferugineus</i>	-do-	-do-	Bronchial catarrh	-do-
<i>Oryctes rhinoceros</i>	-do-	Crused and applied (Ao Naga)	Dissipates clots and bruises	-do-
<i>Xylotrupes gideon</i>	-do-	Tonic used (Ao Naga)	Scofula and ulcer	-do-
<i>Hierodula coaretata</i>	Adult	Crushed and applied (Ao Naga)	Resolves bruises and clots	-do-
<i>Eupolyphaga sinensis</i>	-do-	Crushed and applied (Sema Naga)	Stop bleeding, heal bone fractures and swelling	-do-
<i>Blatta orientalis</i>	-do-	Roasted (Ao Naga)	Milk inducer	-do-
<i>Lethocerus indicus</i>	-do-	Tonic by Ao Naga	Health tonic	-do-
<i>Betastoma indica</i>	-do-	Roasted (Ao Naga and SemaNaga)	Dietary supplement	-do-
<i>Antheraea assama</i>	Pupa	Eaten alive (Ao Naga)	Impotence	-do-
<i>Antheraea paphia</i>	-do-	Eaten cooked (Ao Naga)	Diarrhea	-do-
<i>Antheraea roylei</i>	-do-	-do-	Stomach disorder	-do-
<i>Samia Cynthia ricini</i>	-do-	Eaten cooked	Back pain	-do-
<i>Pericyma cruegri</i>	-do-	-do- (Ao and Sema	Stomach disorder	-do-

		Naga)		
<i>Acisomapanorpoi des</i>	Nymph	Tonic (Ao Naga)	Blood purifier	-do-
<i>Aechnepetulure</i>	-do-	Tonic (Ao Naga)	Anaemia	-do-
<i>Hieroglyphus banian</i>	Adult	Eaten roasted (Ao /Sema Naga)	Liver disorder	-do-
<i>Acrida exaltata</i>	-do-	-do- (Ao Naga)	Anaemia	-do-
<i>Acridium malanocorne</i>	-do-	-do-	Protein supplement	-do-
<i>Acridium peregrinum</i>	-do-	-do-	-do-	-do-
<i>Locusta migratoria</i>	-do-	-do-	Substitute for fish meat as protein supplement	-do-
<i>Dolycoris indicus</i>	Adult	Not known (Ao Naga)	Paralysis	-do-
<i>Bagrada picta</i>	-do-	Eaten cooked	Goiters (Ao Naga)	-do-
<i>Gerriss pinole</i>	-do-	Eaten roasted (Ao Naga)	General weakness	-do-
<i>Erthesina fulo</i>	-do-	Eaten roasted (Ao Naga)	Paralysis	-do-
<i>Nepa cinerea</i>	-do-	-do-(Ao / Sema Naga)	Protein supplement	-do-
<i>Lohita grandis</i>	-do-	Crushed live and applied (Ao Naga)	Arrest bleeding	-do-
<i>Cicada verides</i>	Adult	Crushed live for skin disorder,	For skin eruption and ulcers,	-do-

		tonic for indigestion (Ao Naga)	urticarial, deafness with running pus from ear, indigestion and vomiting and clear lungs	
<i>Apis dorsata</i>	Larva and pupa	Tonic (Sema Naga)	Fatigue and sun's heat	-do-
<i>Cerana indica</i>	Bee sting, venom and wax	Live animal sting and application of wax on knees (Ao /Sema Naga)	Arthritis, Rheumatoid arthritis	-do-
<i>Apis mellifera</i>	Egg, larva, pupa and beehives	Decoction, Live hives eaten (Ao/ Sema Naga)	Spleen and stomach disorders relieves flatulence counteracts toxicities and kills worms	-do-
<i>Vespa orientalis</i>	Larvae	Crushed live and applied (Ao Naga)	Arthritis	-do-
<i>Vespa mangifica</i>	Larvae	Tonic (Ao/ Sema Naga)	Bone building	-do-
<i>Odontotermes feae</i>	Adult	_Fried (Ao/ Sema Naga)	Anaemia	-do-
<i>Oecophylla smaragdina</i>	Larvae, adult	Tonic / eaten roasted (Ao/Sema	Resistance to fatigue and sun heat	-do-

		Naga)		
<i>Macrotermes gilvus</i>	Adult	Fried (Ao/Sema Naga)	Anaemia and weakness	-do-
<i>Macrotermes obesi</i>	Adult	Eaten alive (Sema Naga)	Antidiarrhoeal agent	-do-
<i>Diacrisic oblique</i>	Pupa	Eaten cooked (Ao Naga)	Cough, shortness of breath	-do-
<i>Malacosoma indica</i>	Pupa	-do-	Weak lung and kidneys	-do-
<i>Bombyx mori</i>	Pupa	-do-	Relieves flatulence and loosens congestion	-do-
<i>Schistocerca gregaria</i>	Nymph, adult	Roasted (Ao Naga)	Substitute for fish meat as protein supplement	-do-
<i>Thylotropides vericornis</i>	-do-	-do-	General weakness	-do-
<i>Holochlora albida</i>	-do-	Fried (Ao Naga)	Ulcer	-do-
<i>Mecapoda elongata</i>	-do-	Tonic (Ao Naga)	Health tonic	-do-
<i>Holochlora indica</i>	-do-	-do- (Ao/Sema Naga)	Ulcer	-do-
<i>Lima cordid</i>	-do-	Roasted (Ao Naga)	Protein supplement	-do-
<i>Acheta domestica</i>	-do-	Cooked (Ao Naga)	Promotes diuresis	-do-
<i>Gryllus bimaculatus</i>	-do-	Crushed live and applied (Ao/ Sema Naga)	Skin disease	-do-

<i>Brachytrypes portentosus</i>	-do-	-do- (Ao Naga)	-do-	-do-
<i>Gryllodes singullatus</i>	-do-	-do-	-do-	-do-
<i>Liogryllus saussure</i>	-do-	-do-	Eliminates oedema	-do-
<i>Gryllotalpa fossor</i>	-do-	-do- (Ao / Sema Naga)	Wound	-do-
<i>Gryllotalpa ornate</i>	-do-	-do- (Ao Naga)	Wound	-do-
<i>Hydropsyche sikkimensis</i>	-do-	Tonic (Ao Naga)	Stomach disorder	-do-

G. Insects in traditional medicines by different communities of Sikkim:

Sikkim, the north eastern state of India is surrounded Tibet in north, Bhutan in the east, Nepal in the west and West Bengal in the south. Different communities of people living in Sikkim constitute homogeneous blend. The main communities are Lechas, Bhutias and Nepalis (Dhakalet *al.*, 2020). The people of Sikkim mainly rely on their rich faunal diversity for the use of traditional medicine. Males of the local communities were more dominant in the knowledge regarding the use of traditional medicine than the females. Dhakal and his team reported total 59 animal species which were used in zoo-therapy and out of these, total 12 were insects, amphibians, reptiles and mollusks etc. though not much studies are reported from this state and more such studies need to be carried out.

H. Insects in traditional medicines by different communities of Tripura:

Tripura is a part of Indo- Burma biodiversity hotspot region in north eastern part of India and total 19 different ethnic communities are there. These communities have gifted the state with advantage for evolving innumerable knowledge on ethnozoology. They have developed their own practice through their own traditional knowledge system. Out of all the communities- *Tripuri, Reang, Jamatia, Naotia, Lusai, Uchai, Chaimal, Halam, Kukis, Garos, Mogand Chakmacan* can be categorized as aboriginal tribes and on the otherhand, the tribes like *Bill, Munda, Orang, Santal, Lepcha, Khasia* and *Bhutias* can be categorized as immigrant tribes (Das, 2015). 5 arthropods are reported to be used as traditional medicine. The tribal people use these insects along with other animals for the treatment of 23 different kinds of disease like-

asthma, paralysis, cough, fever, wound healing etc. Roasted crickets (*Gryllus* sp.) mixed with honey is used as a rub for infants to cure pneumonia. Ash of cockroach (*Periplaneta americana*) is used with honey and consumed for healing urinary obstruction (Das, 2015).

Conclusion:

Use of insects in traditional medicine for their therapeutic values cannot be ignored as these communities are using these homemade remedies since time immemorial and this knowledge is being passed from generations. Studies reveal that same insects are used differently by different communities for different diseases. Benefit of using these insects for so many generations must be associated with the presence of some active components which is responsible for the cure of several ailments. Hence these traditional practices are relevant to science and human society for bringing better understanding of traditional medicines and its relationship from sociological, economical, anthropological and environmental viewpoints. So, it is of utmost importance that we must record the traditional knowledge of the ethnic people and to conserve these natural resources for the therapeutic purposes. Hence the knowledge and expertise of the folk healers should also be researched and scientifically validated in the laboratory to not only preserve the ancient healing technology but also to explore the possibilities of developing drugs for serious diseases like cancer. The potential that rests with these insects hold promising outcomes in the field of research and medical sciences.

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Chapter 6

Diversity of medicinal plants traditionally used to treat hemorrhoids among the ethnic groups in North East India: A review

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Abstract:

North east India is considered as the hub of medicinal and aromatic plant resources. Local people here primarily visit traditional and folk healers for the treatment of different ailments. Piles or hemorrhoid is one of the most common health ailments now a days prevailing both in rural as well as urban localities. People use both allopathic and herbal treatments for the cure of this disease. Therefore, present review investigates the indigenous knowledge on medicinal plants used by the ethnic people to treat hemorrhoids in North East India. It has been shown that 104 medicinal plants belonging to 59 families have been used to cure hemorrhoids. More than 20 plants are commonly used in all the states for this treatment. All the plants used exhibits scientific evidence of gastrointestinal curative as well as wound healing properties apart from the other pharmacological properties. Hence it is urgent need to compile all the available traditional knowledge for the treatment of hemorrhoids for the discovery of novel compound, which will be helpful for formulation of new drugs.

Keywords: Piles, hemorrhoid, traditional medicine, North East India

Introduction

North East India comprises of eight states viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. This region is famous for its rich biodiversity. The rich floristic diversity is because of the unique geographical location wide range of forest comprising of tropical to alpine serve as a repository of vast diversity of plants. It is considered as an important part of the Indian Floristic Zone and has been identified as one of the twelve “Genetic Epicenters” for the evolution of world flora (Hazarika et al., 2012). Over 6000 plants in India are extensively used in traditional, folk and herbal medicine, representing about 75% of the medicinal needs of the Third World countries (Bharat, 2014). North-Eastern Indian sub-continent harbours 50% of the plant wealth of India (Rao, 1981).

The Merck Manual defines hemorrhoid as “Varicosities of the veins of the hemorrhoidal plexus, often complicated by inflammation, thrombosis, and bleeding” (Berkow, 1992). Simplified definition of hemorrhoid or piles is vascular cushions, consisting of thick submucosa containing both venous and arterial blood vessels (Thomson, 1975). Hemorrhoid is a life style related ailment that causes swollen rectum develops from the lining of the anus and lower rectum that causes excruciating pain and bleeding to the patients. It is a common health disorder among adults and sometimes observed in children also (Bharat, 2014). Almost fifty percent of the men and women above 50 years and older will experience hemorrhoid at least once in their lifetime (Bailey, 2004). In spite of advancement in medical science, the actual cause of hemorrhoids is not known (Madoff et al., 2004). Some of the probable causes may be temperament, body habits, customs, passions, sedentary life, tight-laced clothes, climate, and seasons (Dennison et al., 1989). People having constipation, chronic diarrhea, poor bathroom habits, postponing bowel movements, poor-fiber diet and patients with spinal-cord injuries are reported to develop the symptoms of hemorrhoids very often (Yarnell, 2000). Recent findings suggest that hemorrhoids may develop due to the implicate gravity intrinsic weakness of the blood vessel wall, genetic predisposition and hereditary history, increased intra-abdominal pressure from many causes, including prolonged forceful Valsalva defecation, obstruction of venous outflow secondary to pregnancy and constipated stool in the rectal ampulla (Bharat, 2007). Though several surgical and nonsurgical techniques are available to treat hemorrhoids but the best treatment of hemorrhoid is always prevention (Brisinda, 2000). Some common operative and intervention treatments for hemorrhoids are; Sclerotherapy, Cryotherapy, Rubber Band Ligation (RBL), Bipolar Diathermy, Direct-Current electrotherapy, Infrared photocoagulation (IRC) etc. (Bharat, 2014). Due to high cost, co operative and post operative pain, complications and discomforts,

recurrence of the symptoms even after the treatment patients are often attracted to the herbal, folk and traditional healing systems.

Ethno-medico-botany deals with the relationship of plants and human to prevent and cure ailments (Alcorn, 1981; Jain, 1986). Herbal treatment is the most common and popular method for healthcare among the ethnic and tribal communities. According to WHO, rural people in developing countries, comprising about 80% of the world's population, prefers folk and traditional methods as primary means of treatment for health ailments. From time immemorial plants have been extensively used to cure a variety of ailments but the people in ancient time keep no records and the information is mainly passed on verbally from generation to generation (Puspangadan & Atal, 1984). The traditional knowledge and folk narratives were transmitted from one generation to another only verbally and with the advent of modernization the traditional knowledge is vanishing with time. Lots of research works have been carried out on various utilization of medicinal plant by the indigenous tribes of north east India for different ailments, and therefore, a comprehensive review has been prepared on the different herbal treatments applied for cure of piles or hemorrhoids.

Various states and communities using folk treatment for hemorrhoid:

Assam is known for its rich diversity in forests and vegetation because of its unique topography, climate and altitude patterns (Mao & Hynniewta, 2000). This region of India serves as homeland of people belonging to more than 100 ethnic tribes and sub tribes (Dutta & Nath, 1998). Folk remedies for hemorrhoid have been practiced in several districts of Assam by the rural local people since generations with a notable degree of efficiency in preventing or in controlling the symptoms (Devi et al. 2018).

Mishing community of Assam and foothills of East Siang District of Arunachal Pradesh uses *Pedilanthus tithymaloides* or *Devil's Backbone* for curing hemorrhoids. Tribal communities of Kamrup district of Assam use several traditional methods for healing hemorrhoids (Das, 2017). Piles is locally known as “Kesumuria” in villages of Assam and is one of the commonest diseases. Native people often use to take treatment from local folk healers for its treatment and they use medicinal plants as well as animal products for preparing the medicine (Das, 2017). Medicines can be applied locally or can be taken orally. One of the common ingredients is *Lumbricus terrestris*, (Common name: Earthworm) which has anti-inflammatory properties as mentioned in Ayurveda (Sharma, 2001).

Meghalaya comes under the globally recognized Indo-Burma biodiversity hotspot within the 17 mega biodiversity countries of the world due to its abundant floral and faunal diversity. The tribal communities of Meghalaya consist of the native people of Garo Hills, Khasi Hills and Jaintia Hills who use to practice enough traditional and folk herbal treatments in their day-to-day life (Roy et al., 2017).

The state of Manipur is included under the “Indo-Burma Hot spot” and hence exhibits a rich biodiversity in flora and fauna harboring over 3500 species of higher plants including many medicinally important plant species (Singh et al., 2000). Traditional medicinal treatments are done through traditional healers “Maiba” (male medical practitioners) and “Maibis” (female medical practitioners) (Singh et al., 2014). In Manipur Chakpa community uses *Acorus calamus*, *Melia azedarach* and *Ocimum basilicum* in the treatment of hemorrhoids (Thokchom et al., 2015). Herbal medicines are also popular among the scheduled caste people ‘Lois’ of Andro Village in Imphal East district and they treat the ailment successfully with traditional herbal procedures (Singh et al., 2014).

Mizoram lies in the extended Himalayan southern tip of North East India. The state is a part of Indo-Burma Hotspots Region comprising a rich wealth of flora and fauna. Several herbal treatments for piles are practiced in the states which includes extensive uses of *Amorphophallus poeniifolius*, *Averrhoa carambola*, *Bauhinia variegata*, *Curcuma zedoaria* etc. (Lalramnghinglova, 2016; Devi et al., 2018; Kayang, 2005).

In Tripura “Ochoi” prescribed traditional herbal remedies for the treatment of health ailments. They use *Alstonia scholaris*, *Mangifera indica*, *Psidium guajava* are extensively used in the healing in the treatment of pile. (Acharyya et al., 2004; Debberma et al., 2017; Debberma et al., 2017).

Sikkim, ‘the cradle of flowering plant’ is the land of traditional faith healer comprises of vast resources of herbal medicine, perhaps due to the physiographical isolation. Due to geographical isolation native people have to rely on the medicinal properties of the available plants around them (Bharati & Sharma, 2010). Over twenty ethnic tribes reside here, the major ones being the Bhutias, Lepchas, Limboos, Nepalese and Tibetans (Mandal et al., 2013).

Conducive ecological and climatic conditions gifted Nagaland as a rich repository of biodiversity, including medicinal plants. Indigenous knowledge about the local medicinal plants and their uses in curing different ailments is very rich among the native tribes in Nagaland viz. *Angami*, *Zeliang*, *Ao*, *Lotha*, *Sangtam*, *Konyak*, *Chakhesang*, *Rengma*, and *Khamniungam* (Zhasa et al., 2015). Their

traditional recipes and ingredients of folk herbal medicines are usually restricted to the Local Medicine Men/Local Healers, village head or “Gaon Burha” and village elders (Zhasa et al., 2015).

Ethnobotanical of medicinal plants used for piles treatment

In the present study 103 plants belonging to 59 families have been found to be used all over the eight states in North East India for the treatment of piles or hemorrhoid by the traditional and folk healers. This is the first of its kind attempt to document the available ethno medicinal knowledge for the treatment of hemorrhoid or piles prevailing in the native people of NE India. Botanical data along with method of uses, important phytochemicals present and the reported pharmacological properties of the plants have been listed in Table 6.1.

Out of the 59 families, most predominant are Zingiberaceae (7 spp.), Euphorbiaceae (6 spp.), Lamiaceae (6 spp.), Liliaceae (5 spp.), Amaranthaceae (4 spp.), Mimosaceae (4 spp.), Solanaceae (4 spp.), Araceae (3 spp.), Verbanaceae (3 spp.) and Rutaceae (3 spp.) in terms of number of species (Fig.6.1). Among the plants used for the treatment of hemorrhoid majority are herbs (34 spp.), tree (25 spp.) and shrubs (23 spp.) and a few are perennial herbs (7 spp.) and climbers (Fig. 6.2). One succulent herb *Kalanchoe pinnata* is also used in Assam for the treatment of piles.

Table 6.1: Ethnopharmacological details of the studied plants.

Sl. No	Scientific name	Family	Local name	States used	Habit	Plant parts used	Mode of uses with reference	Phytochemical constituent/ Pharmacological properties with reference
1	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	Japabandha (AS)	AS	Shrub	Root, seed	Root juice (20 ml) or fruit powder (4-6 gm) along with jaggery is to take in the morning (Devi et al., 2018).	Carbohydrates, proteins and amino acids, saponins, flavanoids, glycosides, phytosterols and phenolic compounds; Hepatoprotective, wound healing, immunomodulatory, analgesic, antimicrobial (Ramasubramania&Kailasam, 2015).
2	<i>Acacia farnesiana</i> Linn.	Mimosaceae	Chingon gleihang ampal (MN)	MN	Tall shrub	Leaves	Decoction of the leaves is used (Singh et al., 2014)	Alkaloids, saponin, carotenoids, flavonoids, terpenoids, acasiane, farnesirane, anti spasmodic, antiinflammatory, antioxidant properties (Sharmin&Syeda, 2018).
3	<i>Acarynthus aspera</i>	Amaranthaceae	Uktihor (AS), Pickles chaff flower, Aokrhua (NG), Latjera	AS, MZ, MG, NG	Shrub	Root, seed, leaf, root, whole plant	Root of <i>Acarynthus aspera</i> , head of <i>Lumbricust errestries</i> (Local name-Kesu) and (C3H) n (Local name-Elandhu) are burnt together and ash is applied locally. Crushed juice	Alkaloids, flavonoids, saponins, steroids and terpenoids; purgative, diuretic, antispasmodic, antibacterial (Ratra et al. 1970; Narayana et al. 2001; Londonkar et al. 2011).

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			(AS), Buchhaw l				taken Orally, The decoction of the herb is used (Das, 2017; Singh et al., 2016; Chopra, 2002; Lalramnghinglova, 2016.)	
4	<i>Acorus calamus</i> L.	Acoraceae	Ok-hidak (MN)	MN	Herb	Rhizome	For non bleeding piles 50 g rhizome boiled in 500 ml of water till to reduce the volume to 1/5. The concentrated liquid applied to the anus with the help of cotton. For bleeding piles 20 g rhizome boiled in 500 ml of water. 100 ml of the filtrate sweeten with honey was taken once daily for 5 days (Thokchom et al., 2015)	Flavonoid, monoterpene, quinone, sesquiterpene and phenylpropanoid, sedative, acetylcholinesterase inhibitory, anti-inflammatory, antioxidant, antispasmodic, antidiarrheal (Patra & Mitra, 1981; Pandit et al., 2011).
5	<i>Aegle Marmelos</i> Linn.	Rutaceae	Bel (AS), Heirikha gok (MN)	AS, MN	Tree	Fruit, leaves and root	Juice of 9 leaves to be taken daily (Das, 2017; Hazarika et al., 2012.).	Saponin, tannin, terpenoids, cardiac glycosides, reducing sugar, steroid, anthraquinone, flavanoids, alkaloids, antioxidant, antimicrobial, hepato protective, analgesic, immuno modulatory (Emurotuet al., 2017; Swarnkar et al., 2019).
6	<i>Albizia lebbbeck</i> (L.)	Mimosaceae	Sirish (AS)	AS	Tree	Bark and	2-4 gm seed powder is mixed with fresh bark	Melacacidin, D-catechin, β -sitosterol, albiziahexoside,

	Benth.					seed	juice and taken (Devi et al., 2018).	betulnic acid, echinocystic acid glycosides; anti-inflammatory, anti-diarrhoeal, antiseptic (Vema et al., 2013).
7	<i>Allium sativum</i> Linn.	Liliaceae	Chanam (MN)	MN	Perennial herb	Bulbs	The bulb of the plant cooked in milk and eaten (Singh et al., 2014).	Alkaloids, glycosides, essential oil, saponins, tannins, steroids, terpenoids, resins, flavonoids, proteins; antioxidant, renoprotective, antibacterial. (Fadiji, 2019; El-SaberBatiha et al., 2020).
8	<i>Allium cepa</i> L.	Liliaceae	Naharu (AS)	AS	Herb	Rhizome	Fruit of <i>Piper nigrum</i> is burnt along with rhizome of <i>Allium cepa</i> , stem of <i>Tinospora cordifolia</i> and Externaludate of <i>Cinnamomum camphora</i> , ash is mixed with camphor and coconut oil and applied locally (Das, 2017).	Alkaloids, flavonoids, steroids, phenols, amino acids, glycosides, tannins triterpanoids and carbohydrates; Antimicrobial, antioxidant, analgesic, anti-inflammatory, and immunoprotective (Panya&Gadhavi, 2015).
9	<i>Allium tuberosum</i> Rottb. External Spreng.	Liliaceae	Maroina kuppi (MN)	MN	Soft leather y herb	Leaves	Boiled Extract of the leaves is prescribed Orally against piles (Singh et al., 2014).	Sulfides, linalool, flavonoid glycosides, steroids, spirostanol saponins, lignan, volatile compounds, essential oils; antioxidant (Singh et al., 2014).

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10	<i>Alocasia macrorrhizos</i> (L.) G. Don	Araceae	Mankachu (AS)	AS	Shrub	Tuber	Four (4) gram dried corm powder is mixed with a cup of milk, to take twice daily for 10 days (Devi et al., 2018).	Alkaloids, flavonoids, saponins, tannins, quinones, triterpenoid; antimicrobial (Fitria et al., 2019).
11	<i>Alpinia galanga</i> (Linn.) Swartz.	Zingiberaceae	Kanghu (MN)	MN	Herbaceous having tuberos aromatic root stocks	Rhizomes	Boiled Extract of the rhizome is prescribed Orally (Singh et al., 2014).	Pentadecane, α -humulene, acetoxyeugenol acetate, phenol, flavonoids, terpenoids, saponins, phenolic acids and essential oils Aphrodisiac, carminative, antipyretic and anti-inflammatory (Singh et al., 2014; Tang et al., 2018).
12	<i>Alpinia nigra</i> (Gaertn.) Burt	Zingiberaceae		AS	Herb		Whole plant is used (Sahoo et al., 2013).	Alkaloids, glycosides, cardiac glycosides, flavonoids, steroids, tannins, anthraquinone glycosides and saponins; antibacterial, analgesic (Ahmed et al., 2015).

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13	<i>Alstonia scholaris</i> (L.) R.Br.	Apocynaceae	Chatim (TR)	TR	Tree	Plant extract, shoot	The plant extract is used in the preparation of piles medicine (Debberma et al. 2017).	Glycosides, alkaloids, saponins, terpenoids, anthraquinones, reducing sugars and steroids, alkaloids, carbohydrates, tannins, phenolic compounds, terpenoids, cardiac glycosides and amino acids; Antioxidant, analgesic, anti-inflammatory, antiulcer (Debberma et al., 2017; Bagheri et al. 2020; Shang et al., 2010).
14	<i>Amaranthus gangeticus</i> Linn.	Amaranthaceae	Chengkr ukangan gba (MN)	MN	Herb	Stem and leaves	Boiled extract of the stem and leaves is mixed with an equal volume of the boiled extract of whole plant of <i>Centella asiatica</i> (Linn.) Urban (Local name-Peruk) (MN) and the decoction mixture is taken one yaum (approximately equal to 5 or 6 teaspoon) per day for 4 to 6 days in constipation and piles (Singh et al., 2014).	Phenols, tannins and flavonoids, protein, carotenoids, vitamin C, dietary fiber, minerals such as calcium, iron, zinc and magnesium, carotenoids, ascorbic acid and phenolic acids; anti-inflammatory, antioxidant activity (Singh et al., 2014; Al-Mamun et al., 2016).
15	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Maon, yankhiso ulpa	AP,	Weed	Whole plant	Whole plant is used (Kongsaiet al. 2011, Perme et al., 2015).	Terpenes, alkaloids, glycosides, and sugars; Emollient poultice, antimalarial, antioxidant, anti-

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								inflammatory, antimicrobial, antihepatic (Perme et al., 2015).
16	<i>Amorphophallus poeniifolius</i> (Bennst) Nichol.	Araceae	Telhawng (MZ)	MZ	Herb	Rhizome, tuber	Powder rhizomes mixed with water taken orally crushed fresh tuber applied externally (Lalramnghinglova, 2016).	Carbohydrates, proteins, alkaloids, flavonoids, sterols, phenolic compounds and tannins; Anti-inflammatory and antioxidant (Jhade et al., 2011; Dey et al., 2012).
17	<i>Asparagus racemosus</i> Willd.	Liliaceae	Satmul (AS), Nunggar ei (MN)	AS, MN	Herb	Roots, tubers, rhizome	Whole plant is used (Hazarika et al., 2012).	Saponin, tannins, alkaloids, protein, isoflavone, sterols, Racemosol, trace minerals such as copper, zinc, cobalt with magnesium, calcium, ketone, aldehyde, Quercetin, Hyperoside and Rutin, flavonoid; Anticancer, antiulcer, antioxidant, antidiarrhoeal, antibacterial, anti-inflammatory (Hazarika et al. 2012; Ratdiya & Aher, 2020).
18	<i>Averrhoa carambola</i> L.	Oxalidaceae	Kordoi (AS), Theiharwt (MZ)	AS, MZ	Small tree	Fruits, leaves	Fruit juice or raw decoction is taken for bleeding piles (Devi et al., 2018; Lalramnghinglova, 2016.).	Flavonoids, steroids, alkaloids, saponins, tannins, vitamins C and A, calcium and potassium; Antioxidant, antimicrobial, emulsifier, anti-inflammatory, antifungal, astringent, antidiarrheal, antiseptic, antioxidant (Devi

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							et al., 2018; Lalramnghinglova, 2016; Silva et al., 2021).
19	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Nim (AS)(MN)	MN	Tree	Tender branches	The patient is made to be seated in the concentrated hot decoction for a few minute daily for about one week (Singh et al. , 2014). Flavonoid, Quercetin and sitosterol, Azadirachtin, nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinat, gedunin, salannin, and quercetin; Antibacterial, anti-inflammatory, antigastric ulcer, antibacterial, and antitumour (Srivastava et al. 2020).
20	<i>Bauhinia variegata</i> (L.)	Caesalpinaceae	Diengtharlong (MG), Vauvavang (MZ)	MG, MZ	Tree	Flower, bud	Flowers are boiled and eaten for piles for dysentery. One tea spoon of powdered dried buds taken with fresh water thrice a day as a remedy for piles and dysentery (Kayang, 2005; Shankar, 2013). Terpenoids, flavonoids, tannins, saponins, reducing sugars, steroids and cardiac glycosides; Anticancer, antioxidant, hypolipidemic, antimicrobial, anti-inflammatory, hepatoprotective, antiulcer and wound healing effects (Ali, 2013; Shankar, 2013).
21	<i>Carica papaya</i> Linn.	Caricaceae	Awathabi (AS), Amita (AS)	MN	Tree	Milky latex	Whole plant (Singh et al., 2014). Glucosinolates, tocopherols, carotenoids, and benzyl isothiocyanate, phenolics, flavonoids and alkaloids; Antioxidant, antibacterial, anticancer activity, anti-inflammatory, antiulcer,

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								hepatoprotective (Singh et al., 2014; Sharma et. al, 2020)
22	<i>Careya arborea</i> Roxb	Lecythidaceae	Ghimbee l (MG)	MG	Tree	Bark	Decoction (Roy et al., 2017).	Phenol, sterols, terpenes, saponins and tannins; anti-inflammatory, analgesic, antibacterial, antifungal, antioxidant, hepatoprotective, cytotoxic (Roy et al., 2017).
3	<i>Cassia occidentalis</i> L.	Fabaceae	-	TR	Shrub	Leaves	Leaf paste used externally (Debberma et al., 2017).	Achrosin, aloemodin, emodin, anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiolin, chryso-obtusin, chrysophanic acid, chrysarobin, chrysophanol, chrysoeriol, carbohydrates, saponins, sterols, flavonoids, resins, alkaloids, terpenes, anthraquinones, glycoside and balsam; antidiabetic, antimicrobial, antioxidant, anti-inflammatory (Singh, et. al., 2016; Debberma et al., 2017).
24	<i>Celtis australis</i> Linn.	Ulmaceae	Heikreng (MN)	MN	Large tree	Leaves	Decoction of the leaves is used externally (Singh et al., 2014).	Aliphatic hydrocarbons, alcohols, ketones, fatty acids and terpenes (Margarita et al., 2018).
25	<i>Centella asiatica</i>	Careya	Peruk (MN),	MN	Small soft		Whole plant is used (Singh et al., 2014).	Sesquiterpenes, plant sterols, pentacyclic triterpenoids and

	(Linn.)		Manimu ni (AS)		herb			saponins, eugenol derivatives, caffeoylquinic acids and flavonoids; the plant is effective in the treatment of venous disorder. (Gray et al., 2018, Moayyedkazemi et al., 2020).
26	<i>Chamaesce hirta</i> (L.) Mills Syn. <i>Euphorbia hirta</i> L. <i>E. pilulifera</i> L	Euphorbi aceae	Pakhangl eiton (MN)		Soft herb	Whole plant	Decoction of the plant is taken orally (Singh et al., 2014).	Alkanes, triterpenes, phytosterols, tannins, polyphenols, alkaloids and flavonoids; antibacterial, antimalarial, anti-inflammatory, antioxidant, antiamebic (Kumar et al. 2010).
27	<i>Cissus quadrangular is</i> L.	Vitaceae	Haljora (MG)	MG	Climb er	Whole plant	Whole plant is used (Sharma et al., 2013).	Alkaloids, tannins, proteins, phenolic compounds and flavonoids; antioxidant, antibacterial, anti-inflammatory (Talreja et al., 2016).
28	<i>Clerodendru m colebrookianu m</i> Walp.	Lamiace ae.	Kuthap (MN)	MN	Shrub	Leave s	Patients suffering from piles and worm infections are made to sit in the hot decoction of the leaves for 10 to 15 minutes. It will reduce irritation (Singh et al., 2014).	Alkaloids, flavonoids, phenols, saponin, glycosides, carbohydrates, proteins and amino acids, fixed oils and fats; antimicrobial, antioxidant, anthelmintic, anti-inflammatory. (Prashith&Sudharshan, 2018; Payum et al., 2020).

29	<i>Clerodendrum infortunatum</i> L.	Lamiaceae	Bhektita (AS)	AS	Shrub	Root	Root of <i>Clerodendrum infortunatum</i> (Local name Bhekita) along with stem of <i>Solanum tarvum</i> (Local name Bhetkuri), root of <i>Leucas aspera</i> (Local name Doron), fruit of <i>Piper nigrum</i> (Local name- Jaluk), rhizome of <i>Lasia spinosa</i> (Local name Chengmora) and head of <i>Lumbricus terrestres</i> are powdered and taken two spoonful twice daily in empty stomach for three days (Das, 2017;).	Limonene, phytol, catechol, hexadecanoic acid, squalene, dodecanoic acid, vitamin E, hydroxymethylfurfural, stigmasterol, phenolics and phenolic acid derivatives. Inflammatory activity (Das, 2017; Dey et al., 2015).
30	<i>Clerodendrum viscosum</i> Vent.	Verbanaceae	Vetmali (AS)	AS	Shrub	Leaf	45-50 grams of fresh leaves are crushed, filtered, mixed with ½ glass of water and a pinch of salt, taken orally 1 cup thrice daily before lunch continuously for three days (Devi et al., 2018).	Flavonoids. viz apigenin, acacetin, quercetin, scutellarin, hispidulin-7-O-glucuronide and cabruvin, terpenoids such as clerodin, phenolic compounds such as fumeric acid, stearic acid and caffeic acid; antimicrobial, analgesic, anti-inflammatory, wound healing, hepatoprotection, antioxidant (Devi et al., 2018; Nandi & Lyndem, 2016).

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31	<i>Coptis teeta</i> Wall.	Ranunculaceae	Mishmit eeta, Manbai, Ayaro/Aro (AP)	AP	Herb	Root	The root extract with bear liver juice is taken to cure piles problem (Ghosh et al., 2014).	Alkaloids such as berberine, palmatine, jatrorrhizine, coptisine, columbamine, and epiberberine and various secondary metabolites, lignans, phenylpropanoids, flavonoids, phenolic acids, saccharides and steroids; antimalarial, antiinflammatory (Ghosh et al., 2014; Bajpay et al., 2019).
32	<i>Cordyline terminalis</i> (L.) Kunth	Agavaceae	Horisankar (AS)	AS	Shrub	Stem bark	10gm of bark of <i>Cordyline terminalis</i> and <i>Kalanchoe pinnata</i> are crushed finely, liquid extract is to take 2 teaspoonfuls thrice daily continuously for three days (Devi et al., 2018).	Polyphenol; Antipyretic, analgesic, antioxidant, antibacterial activities (Devi et al., 2018; Reddy et al., 2016).
33	<i>Curculigo orchioides</i> Gaertn.	Hypoxidaceae	-	SK	Herb	Rhizome	Infusion of rhizome taken twice daily (Pradhan and Badola, 2008).	Flavones, glycosides, steroids, saponins, triterpenoids and other secondary metabolites; Antimicrobial activity (Susindran & Ramesh, 2014).
34	<i>Curcuma caesia</i> Roxb.	Zingiberaceae	KaloHar di, Halaydo (SK, Nepali)	SK	Perennial herb	Rhizome	Rhizome is used in preparation of the medicine (Mandal et al. 2013).	Carbohydrates, proteins, starch, amino acids, steroids glycosides, flavonoids, alkaloids, tannins, phenols, and resins; treating tumours, piles, bruises etc. (Mandal et al., 2013).

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35	<i>Curcuma zedoaria</i> (Christ.) Rosc.	Zingiberaceae	Aidizing (Lalram) (MZ)	MZ	Herb	Rhizome	Cold infusion taken internally (Lalramnghinglova, 2016)	Terpenoids, specially sesquiterpenoids; antiulcer, hepatoprotective (Navarro, 2002)
36	<i>Cycas pectinata</i> Griff.	Cycadaceae	Yendang (MN)	MN	Tree	Female cones	Boiled extract of the female cone with honey is prescribed against piles (Singh et al., 2014)	Alkaloids, glycosides, terpenoids, steroids, flavonoids, reducing sugar and tannin (Singh et al., 2014; Bhowmik & Datt, 2014).
37	<i>Cynodon dactylon</i> Linn	Poaceae	Dub, Dubari (AS), Tingthou (MN)	AS, MN	Herb	Root, whole plant	The fresh juice extract of the whole plant along with honey is prescribed orally against uterine bleedings and piles (Singh et al., 2014; Chopra, 2002)	Flavanoids, alkaloids, glycosides, terpenoids, triterpenoids, steroids, saponins, tannins, resins, phytosterols, reducing sugars, carbohydrates, proteins, volatile oils and fixed oils; antimicrobial, antioxidant, anti-inflammatory, analgesic antipyretic (Singh et al., 2014; Chopra, 2002; Snafi, 2016).
38	<i>Desmodium triquetrum</i> L.	Papilionaceae	Ulucha (AS)	AS	Shrub	Leaf	Leaf extract of <i>Desmodium triquetrum</i> is mixed with fruit powder of <i>Embilica officinalis</i> and <i>Terminalia bellirica</i> with 50ml of honey or jaggery and to be taken after meal (Devi et al., 2018)	Flavonoids, alkaloids, steroids, terpenoids, phenylpropanoids, pterocarpanes, coumarins and volatile oil; anti-leishmanial, anti-inflammatory (Vedpal et al., 2016; Devi et al., 2018).

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39	<i>Dioscorea alata</i> L.	Dioscoreaceae		SK	Herb	Whole plant	Whole plant is used (Pradhan and Badola, 2008)	Phenolic compounds, flavonoids, coumarins, quinines and other polyphenols, nitrogen compounds (alkaloids and amines), vitamins, terpenoids; antimicrobial, laxative and vermifuge, antioxidant, anti-diarrhea, (Das. et al., 2014; Saklani et al., 2013).
40	<i>Dioscorea transversa</i> R.Br.	Dioscoreaceae	Pencil yam, Pokmaso (NG)	NG	Vine	Seed	Seeds and tuber are used in piles (Zhasa et al., 2015).	Flavonoids, alkaloids, terpenoids, cardiac glycoside, steroids and saponins; antispasmodic, aphrodisiac, purgative, anti-helminthic, deflatulent, rejuvenating, antioxidant, antiinflammatory, anti-phlogistic and antibacterial activity (Chinthaet al., 2018).
41	<i>Diplazium polypodioides</i> Blume	Athyriaceae	-	TR	Herb	Leaves	Whole plant is used (Debberma et al., 2017).	Antioxidant (Debberma et al., 2017; Baskaran, 2018).
42	<i>Eclipta alba</i> (L.) Hassk.	Asteraceae	Kehraji (AS)	AS	Herb	Whole plant	50 ml Juice of <i>Eclipta alba</i> (Local name Kehraji) and <i>Mimosa Pudica</i> (Local name Lajukibon) taken daily until cure (Das, 2017).	Alkaloids, flavonoids, saponins, tannins, glycosides, terpenoids, reducing sugars, anthraquinones, and cardiacyglycoside); analgesic, antimicrobial (Das, 2017; Hussain et. al., 2011).

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43	<i>Eclipta prostrata</i> L.	Asteraceae	Kehraj (AS)	AS	Herb	Leaf and Stem	Whole plant is used (Borah and Saikia, 2020).	Carbohydrates, Aminoacids, Alkaloids, Tannis, Phenolic compounds, Terpenoids, Steroids, Flavanoids Cardiac glycosides, Saponins and Anthraquinone glycosides; Antiulceractivity (Borah & Saikia, 2020; Herapathdeniya et al., 2020).
44	<i>Elsholtzia blanda</i> (Benth.) Benth. Syn. <i>Perilla elata</i> D. Don	Lamiaceae	Kanghu man (MN)	MN	Small shrub	Inflorescence	Extract of the inflorescence is used (Singh et al., 2014).	Antibiotic, antiinflammatory, (Singh et al., 2014).
45	<i>Emblica officinalis</i> Gaertn.	Euphorbiaceae	Aamlokh i (AS)	AS	Tree	Fruit	Leaf extract of <i>Desmodium triquetrum</i> is mixed with fruit powder of <i>Emblica officinalis</i> and <i>Terminalia bellirica</i> with 50ml of honey or jaggery and to be taken after meal (Devi et al., 2018).	Higher amount of polyphenols like gallic acid, ellagic acid, different tannins, minerals, vitamins, amino acids, fixed oils, and flavonoids like rutin and quercetin; used in the treatment of inflammation, lifestyle diseases, parasitic and other infectious disorders. (Variya et al. 2016; Devi et al., 2018).

46	<i>Garcinia pedunculata</i> Roxb.	Clusiaceae	Bortheker (AS)	AS	Shrub	fruit	Fruit is crushed with dried head of <i>Amphipnous cucchia</i> and nine granules are prepared. One granule is taken orally three times a day before meal (Acharyya et al., 2004.)	Hydroxycitric acid, benzophenones, garcinol, pedunculol, and isogarcinol, pedunculol, garcinol, cambogin; antioxidant activity, used in gastrointestinal disorders, diarrhea (Acharyya et al., 2004; Santo et al., 2020).
47	<i>Gloriosa superba</i> L.	Liliaceae	Agnisikha or Ulatsondal (AS)	AS	Perennial herb	Rhizome	Root decoction Glory lily is mixed with 10 gm of ginger and to be given three tea spoonful three times in a day (Devi et al., 2018).	Colchicines and Gloriosine, salicylic acid, sterols, tannins and superbine; antioxidant, antibacterial, antimicrobial, anthelmintic, purgative, cholagogue, anthelmintic, astringent and germicidal properties (Devi et al., 2018; Ashokkumar, 2015).
48	<i>Glycosmis arborea</i> (Roxb.) DC., Syn. <i>G. pentaphylla</i> Corr.	Rutaceae	Chauldha (AS)	AS	Shrub	Bark	50 grams of stem bark of <i>Glycosmis arborea</i> grinded along with ten fruits of <i>Piper nigrum</i> and ten fruits of <i>Piper longum</i> to prepare a paste. Paste is mixed with 1 litre of water and boil to make the volume about half litre. Half cup of this juice is to be taken for 10-12 days twice daily (Devi et al.,	Glybomines, carbazole, quinazoline, furoquinoline, quinolone, and acridone; Antitumor (Devi et al., 2018; Ito et al. 2004).

							2018).	
49	<i>Gmelina arborea</i> L.	Verbenaceae	Thlan-vawng (MZ), Gomari (AS)	MZ	Tree	Bark, fruit	Crushed juice of bark, fruits and a decoction of the roots is taken (Laldinsanga et al. 2018).	Tannins, phenols, flavonoids, saponins, reducing sugar and anthraquinones; astringent, analgesic, antipyretic, anti-inflammatory (Laldinsanga et al., 2018; Lawal et al., 2016).
50	<i>Hedychium coronarium</i> Koenig External Retz.	Zingiberaceae	Takhellei angouba (MN)	(MN)	Perennial herb	Rhizomes	Decoction of the rhizomes is taken (Singh et al., 2014).	Labdane-type diterpenes, sesquiterpenes, diarylheptanoids, phenolics, fatty acids and steroids; antioxidant, antibacterial, antifungal, larvicidal, anthelmintic, analgesic, anti-inflammatory, hepatoprotective activities (Singh et al. , 2014; Chan and Wong , 2015).
51	<i>Hedyotis diffusa</i> Willd.	Rubiaceae	Sarpajiva (AS)	AS	Herb	Root	Applied locally (Das, 2017).	Iridoids, flavonoids, anthraquinones, phenolics and their derivatives, volatile oils; antioxidant, anti-inflammatory (Das, 2017; Chen et al. 2016).
52	<i>Houttuynia cordata</i> Thunb	Saururaceae	Mosondoi (AS)	AS	Herb	Whole plant	Whole plant is used (Borah and Saikia, 2020)	Essential oil, flavonoids and other polyphenols, fatty acids and alkaloids; antitumor, antimicrobial, anti-inflammatory and antioxidative (Chen et al.,

								2016).
53	<i>Hydrocotyle rotundifolia</i> Roxb.	Araliaceae	Saru Manimu ni (AS)	AS	Herb	leaves	Applied locally (Das, 2017).	Phenolics, flavonoids, sterol, alkaloid and tannins; antimicrobial (Das, 2017; Sood&yadav, 2014).
54	<i>Hypericum japonicum</i> Thunb.	Hypericaceae	Asoy bon (AS)	AS	Herb	Whole plant	The plant along with <i>Lasia spinosa</i> (Local name Chengmora), head of <i>Lumbricus Terrestris</i> (Local name - Kesu), bud of <i>Ricinus communis</i> and extract of <i>Oecophylla smaragdina</i> (Local name- Amroliporua) allowed to prepare decoction and taken 30 ml twice daily for 5-7 days (Das, 2017;).	Flavonoids, phloroglucinols and xanthenes; hepatoprotective, anti-tumor, antibacterial, antioxidant activities (Das, 2017; Liu et al. 2014).
55	<i>Indigofera prostrata</i> Willd.	Fabaceae	Sekhupthur (MZ)	MZ	Perennial herb	Seed	Boiled seeds are taken orally in piles and fistula (Shankar, 2013.).	
56	<i>Iresine herbstii</i> Hook.	Amaranthaceae	Bishohori (AS)	AS	Herb	Leaf	One kg leaves of <i>Iresine herbstii</i> , ½ kg dried flowers of <i>Nelumbo nucifera</i> , 3 litres water and 25 gm black salt is boiled till the volume reaches about 2 litres, filtered to get a clean juice. One cup of this juice is to take	Dimethoxy-6,7-(methylenedioxy)-isoflavone; acylated betacyanins, iresinin I, C15 -epimer iresinin II, amino acids, steroids, triterpenoids, alkaloids and coumarins; wound healing, low antioxidant activity, astringent, spasmolytic, anti-

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							thrice daily before food continuously for three days (Devi et al., 2018).	inflammatory(Dipankar et al. 2011; Devi et al., 2018).
57	<i>Jasminum multiflorum</i> (Burm.f.) Andrews	Oleaceae	Kundo (MN)		Scandent shrub	Flowers	Boiled Extract of the flowers is prescribed orally (Singh et al., 2014).	Secoiridoids, 10-hydroxy-oleoside derivatives, 7-methyl oleosidederivatives , secoiridoid lactones, jasmolactone A, B, C and D; laxative, alexipharmic, depurative and digestive . (Singh et al., 2014; Singh, 2016).
58	<i>Jatropha curcus</i> L.	Euphorbiaceae	Bongaliera (AS), awakege (MN)	AS, MN	Shrub	Leaves and twigs, seed	Mentioned plant parts are used after processing (Hazarika et al., 2012.).	Palmitic acid, stearic acid, arachidic acid, oleic acid, and linoleic acid, n tannin, saponin, steroids, tannins, glycosides, alkaloids and flavonoids; antioxidant, anti-inflammatory (Hazarika et al., 2012; Najda et al., 2013).
59	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Pategoja (AS)	AS	Succulent herb	Leaf	10gm of bark of <i>Cordyline terminalis</i> and <i>Kalanchoe pinnata</i> are crushed finely, liquid extract is to take 2 teaspoonfuls thrice daily continuously for three days (Devi et al., 2018).	Alkaloids, triterpenes, glycosides, flavonoids, steroids, bufadienolides, lipids and organic acids; analgesic, antimicrobial, antiinflammatory, antitumorous, antiulcerous, antibacterial, antifungal, gastroprotective, muscle relaxant, sedative (Pattewar,

							2012; Devi et al., 2018).
60	<i>Lantana camara</i> Linn.	Verbenaceae	Thirei /Nongba nlei (MN)	MN	Shrub	Leave s/shoot tips	Fresh Extract of the leaves or shoot tip is mixed with honey and taken orally. It is given one yaum (5 to 6 teaspoonfuls) two to three times a day for 4 to 7 days. Also, the patient is advised to sit in the hot decoction of the leaves in a wide tub (Singh et al., 2014). Triterpenes like lantadenes A, B, C, and D, alkaloids, flavonoids, saponins, tannins, germacrene A, B and D and chief compounds are valencene and γ -gurjunene; antibacterial, antioxidant, antipyretic, antimicrobial, wound healing (Singh et al., 2014; Ved et al. 2018).
61	<i>Lasia spinosa</i> (L.) Thwaites	Araceae	Chengm ora (AS), Zawngzang (MZ)	AS, MZ	Herb	Rhizome, root, leaves	Taken orally with other ingredients (AS), Decoction of root and leaves taken internally (MZ) (Das, 2017; Lalramnghinglova, 2016). Alkaloids, carbohydrates, saponins, glycosides, tannins, phenolic compounds and flavonoids; anti-helminthic, anti-bacterial, anti-inflammatory, anti-oxidant, anti-tumor (Lalramnghinglova, 2016; Kankanamge & Amarathunga, 2017).
62	<i>Leucaena leucocephala</i> (Lamk.) de Wit	Mimosaceae	Chingon gleiangoba (MN)	MN	Shrub	Leaves	Decoction of leaves is used (Singh et al., 2014) 2(H)-benzofuranone-5,6,7,7a-tetrahydro-4,4,7a-trimethyl, pentadecanoic acid-14-methyl-methyl ester, and 6,10,14-trimethyl-2-pentadecanone a ketone (Singh et al., 2014; Salem et al., 2011).

63	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Doron (AS)	AS	Herb	Root	Taken Orally with other ingredients (Das, 2017; Borah P. and Saikia M. 2020)	Triterpenoids, oleanolic acid, ursolic acid and b-sitosterol, nicotine, sterols, glucoside, diterpenes, phenolic compounds; antifungal, antioxidant, antimicrobial (Das, 2017; Borah and Saikia, 2020).
64	<i>Mallotus phillippinensis</i> Muell.-Arg.	Euphorbiaceae	Yuduk-changne (AP)	AP	Tree	Bark	Bark is used (Doley et al. 2014)	Rottlerin, citric acid, mallotoxin, kamalin, Oleic, lauric, myristic, palmitic acid, stearic acid, crotoxinogenin, rhamnoside, coroghcnigin, octa cosanol, homorottlerin, tannins, citric, oxalic acid; antioxidant, antibacterial, anti-fungal, antimicrobial, hepatoprotective activities (Sharma & Varma, 2011; Doley et al., 2014).
65	<i>Mangifera indica</i> Linn.	Anacardiaceae	Aam (AS), Ammgach (TR)	AS, TR	Tree	Fruit, Bark	Ripe fruit (25 gm), juice of <i>Zingiber officinale</i> Rosc. rhizome (25 gm) and curd (25 gm) are mixed and taken orally twice daily before meal. Juice prepared from bark is taken with sugar to treat bleeding piles (Acharyya et al. 2004; Guha and	Carbohydrates, proteins, amino acids, lipids, fatty, and organic acids), micronutrients (vitamins and minerals), and phytochemicals (phenolic, polyphenol, pigments, and volatile constituents), omega-6 fatty acid; antioxidant and organoleptic activity (Acharyya et al., 2004; Guha

							Chakma, 2015).	& Chakma, 2015; Maldonado-Celis, 2019).
66	<i>Melia azedarach</i> Blanco	Meliaceae	Seizrak (MN)	MN	Tree	Leaf	For internal piles 20 g of the leaf crushed with little common salt and the poultice was slightly inserted inside the anus (Thokchom et al., 2015.).	Benzyl 3-O- β -D-glucopyranosyl-7-hydroxybenzoate, spathulenol, 1,7,8-trihydroxy-2-naphthaldehyde, quercetin, astragalin and 2-methoxy-4-(2-propenyl)phenyl β -D-glucoside; antibacterial, antifungal and antioxidant (Zeng et al., 2019).
67	<i>Mesua ferrea</i> L.	Clusiaceae	Herhse (MZ)	MZ	Tree	Flower	Infusion of flowers taken internally (Lalramnghinglova, 2016).	Alkaloids, glycosides, reducing sugar, tannins, phenolics, coumarins, sterols, xanthenes, volatile oil, triterpenoids, resins, and saponins, α -copaene and germacrene D, β -amyrin, and β -sitosterol, mesuanic acid, mesuferrols, mesuaxanthenes, mesuaferrins, mesuaferrones, mesuarin, mesuol; anti-inflammatory, anti-hemorrhoid, antiulcer, antioxidant, antibacterial (Lalramnghinglova, 2016; Kshirsagar & Patil, 2020).

68	<i>Mimosa pudica</i> Linn.	Mimosaceae	Lajukibon (AS), Kangpha lekaithabi (MN), Hlonuar (MZ), Lajjalu (AP)	MN, MZ, AP, AS	Herb	Whole plant, leaf and root	51 ml Juice of <i>Eclipta alba</i> (Local name Kehraji) and <i>Mimosa Pudica</i> (Local name Lajukibon) taken daily until cure (AS). The whole plant is mixed with the leaves of <i>Eucalyptus globulus</i> Labill. (Local name-Nasik) and boiled for a long time and the decoction is used in bleeding piles (MN). Root and leaf decoction is taken directly (MZ) (Das, 2017; Subhose et al. 2005; Samy et al. 2008; Singh et al., 2014; Rai P. K. and Lalramnghinglova; Shankar and Rawat, 2008.)	Tannins, steroids, flavonoids, triterpenes, and glycosylflavones; antioxidant, antibacterial, antifungal, anti-inflammatory, hepatoprotective, antidiarrheal (Das, 2017; Subhose et al., 2005; Samy et al., 2008; Singh et al., 2014; Rai & Lalramnghinglova; Shankar & Rawat, 2008; Muhammad et al. 2016).
69	<i>Mimusops elengi</i> L.	Sapotaceae	Bakul (AS)	AS	Tree	Flower	Bakul flower, fruit of <i>Piper nigrum</i> (Local name Jaluk), leaves of <i>Hydrocotyl rotundifolia</i> (Local name - Saru Manimuni) and root <i>Hedyotis diffusa</i> (Local name Sarpajiva) crushed together, make a paste and applied locally on anus	Taraxerone, taraxerol, betulinic acid and spinasterol, sodium salt of betulinic acid and urosolic acid, Fatty acid esters of alpha-spinasterol, triterpenoids, alpha cadinol, tau muurolol, hexadecanoic acid, diisobutyl phthalate, octadecadienoic acid;

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							(Das, 2017;).	analgesic, antibiotic, anti-inflammatory, antimicrobial, antioxidant, antipyretic, gingival bleeding, gastric ulcer, hypotensive activity (Kadam et al. 2012; Das, 2017).
70	<i>Momordica charantia</i> L.	Cucurbitaceae	Kolacita (MG)	MG	Climber	Leaf	Juice is used (Roy et al. 2016)	Momordicolide, monordicophenoide, dihydrophaseic acid 3-O-beta-D-glucopyranoside, blumenol (Roy et al., 2016).
71	<i>Moringa oleifera</i> Lam.	Moringaceae	Sojina (AS)	AS	Tree	Leaf	Leaf decoction is applied twice daily over the effected area for fortnight in alternate days (Kalita & Phukan, 2009).	Flavonoids, glucosides, and glucosinolates; antioxidant, anti-inflammatory (Kalita&Phukan, 2009; Zahirah et al., 2018).
72	<i>Myrica esculenta</i> Buch.-Ham. Ex. D. Don	Myricaceae	Keifang (MZ)	MZ	Tree	Stem bark	Decoction of stem bark taken internally (Lalramnghinglova, 2016; Laldinsanga et al. 2018.)	Steroids, reducing sugars, tannins, glycosides, saponins and volatile oils; antioxidant, antibacterial, anti-helminthic, anti-inflammatory, antimicrobial (Lalramnghinglova, 2016; Laldinsanga et al., 2018; Kabra et al., 2019).
73	<i>Nardostachys jatamansi</i> (D.	Valerianaceae	Atamansi	SK	Herb	Root	Dried root powder is used (Mandal et al., 2013)	Sesquiterpene, jatamansone, nardostachone; stimulant,

	Don) DC.		(Nepali), Pangtey (Bhutia), Spango (Lepch)					antispasmodic, tonic, laxative, antiepileptic, hepatoprotective, antimicrobial, antifungal, anticonvulsant (Mandal et al., 2013; Sahu et al., 2016).
74	<i>Nelumbo nucifera</i> Gaertn.	Nympha eaceae	Padum, Kamal (AS)	AS	Aquati c	Rhizo me, flower	One kg leaves of Iresineherbstii, ½ kg dried flowers of <i>Nelumbo nucifera</i> , 3 litres water and 25 gm black salt is boiled till the volume reaches about 2 litres, filtered to get a clean juice. One cup of this juice is to take thrice daily before food continuously for three days (Chopra, 2002; Devi et al., 2018).	Alkaloids, flavonoids, asteroidal triterpenoid; anti- inflammatory, astringent, emollient (Chopra, 2002; Paudel&Panth, 2015; Devi et al., 2018).
75	<i>Nicotiana plumbaginifol ia</i> Viv.	Solanace ae	Meitei hidak mana (MN)	MN	Annua l herb	Leave s	A mixture of the dried leaves along with those of <i>Azadirachta indica</i> A. Juss. (Local name-Nim) (MN) are roasted together in a closed container. The steam or smoke coming out through a small hole is allowed to come in contact with the anus of persons suffering from piles	Tannins, anthocyanins, aurones, hydroxycoumarins, flavanoids, flavones; antimicrobial and antioxidant (Singh et al. , 2014; Ajaib et al., 2016).

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							(Singh et al., 2014).	
76	<i>Nymphaea rubra</i> Roxb. Ex. Andrews	Nympha caceae	Seluk, Rangabh et (AS), Tharoan gangba (AS)	AS	Aquati c	Rhizo mes, root stock	Powder from dried root stock is to given twice a day (Hazarika et al. 2012; Devi et al., 2018)	Anti-diabetic and anti- inflammatory, hepatoprotective (Hazarika et al., 2012; Devi et al., 2018; Cheng et al., 2012).
77	<i>Ocimum basilicum</i> L.	Lamiace ae	Naosekle i (MN)	MN	Shrub	Shoot	Fresh 5 -10 young shoots were taken Orally as salad till cured (Thokchom et al., 2015)	Terpenoids, alkaloids, flavonoids, tannins, saponin glycosides and ascorbic acid; hepatoprotective, antitoxic, anti-inflammatory, antibacterial & antifungal. (Khair-ul-Bariyah et al., 2012).
78	<i>Oroxylum indicum</i> (Linn.) Vent	Bignonia ceae	Archang kawm (MZ), Samba (MN), Totola (Nepali), Phaagok oong (Lepcho) , Paksam (Bhutia) SK)	MZ, MN, SK	Tall tree	Bark, fruit	Decoction of the bark and fruit is used (Mandal et al., 2013; Singh et al., 2014; Lalramnghinglova, 2016; Laldinsanga et al. 2018).	Lipids, fats, waxes, Glycosides, Terpenoids and Phenols, Alkaloids; Antimicrobial (Radhika et al. 2011).

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79	<i>Pedilanthus tithymaloides</i> , Syn. <i>Euphorbia tithymaloides</i>	Euphorbiaceae	Atobulo (AP)	AS, AP	Shrub	External parts	Applied locally (Shankar et al., 2012)	Triterpenes, steroids, saponins, tannin and coumarins; antihypertensive, antibacterial and antifungal (Shankar et al., 2012; Matisui et al., 2017).
80	<i>Piper longum</i> L.	Piperaceae	Pipoli (AS), Uchithi (MN)	AS, MN	Climber	Fruits, stem, root	50 grams of stem bark of <i>Glycosmis arborea</i> grinded along with ten fruits of <i>Piper nigrum</i> and ten fruits of <i>Piper longum</i> to prepare a paste. Paste is mixed with 1 litre of water and boil to make the volume about half litre. Half cup of this juice is to be taken for 10-12 days twice daily (Hazarika et al. 2012; Devi et al., 2018)	Piperine, piperlongumine, sylvatin, sesamin, diaeudesminpiperlonguminine, pipermonaline, and piperundecalidine; antipyretic, analgesic, anti-inflammatory, antioxidant, hepatoprotective (Hazarika et al., 2012; Devi et al., 2018; Gani et al., 2019.)
81	<i>Piper nigrum</i> L.	Piperaceae	Jaluk (AS)	AS	Climber	Fruit	50 grams of stem bark of <i>Glycosmis arborea</i> grinded along with ten fruits of <i>Piper nigrum</i> and ten fruits of <i>Piper longum</i> to prepare a paste. Paste is mixed with 1 litre of water and boil to make the volume about half litre. Half cup of this juice is to be taken for 10-12 days	Alkaloids, steroids, tannins, phenol compounds, flavonoids, steroids, resins, and fatty acids; hepatoprotective, carminative, antimicrobial, stomachic, digestive (Ganesh et al., 2014).

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							twice daily. Fruit of <i>Piper nigrum</i> is burnt along with rhizome of <i>Allium sepa</i> , stem of <i>Tinosporacordifolia</i> and Externaludate of <i>Cinnamomumcamphora</i> , ash is mixed with camphor and coconut oil and applied locally (Devi et al., 2018; Das, 2017).	
82	<i>Picrorhiza scrophulariiflora</i> Pennell	Scrophulariaceae		SK	Perennial herb	Rhizome	Decoction of powder of rhizome is taken Orally 2-3 times daily (Pradhan and Badola, 2008.).	Cucurbitacin glycoside, Picoside, Iridoid glycoside, Phenolic glycoside etc.; healing, antioxidant and antiulcer activity (Pradhan & Badola, 2008).
83	<i>Plantago erosa</i> L.	Plantaginaceae	Krah shit (MG)	MG	Herb		Whole plant is used (Singh et al., 2016).	Tannins, diterpenes, triterpenes and steroids; anti-inflammatory, astringent, antimicrobial, demulcent (Barua et al., 2011; Singh et al., 2016).

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84	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Boga agyachit (AS), Ceylon leadwort (NG)	AS, NG	Herb	Root, seed	Roots and seeds are used for the treatment of piles. Paste of dried root powder mixed with vinegar and applied externalternally (Zhasa et al., 2015; Devi et al., 2018).	Naphthoquinones flavonoids, alkaloids, glycosides, saponins, steroids, tannins, triterpenoids, coumarins, carbohydrates, phenolic compounds, fixed oils, fats and proteins; antimicrobial, hepatoprotective, antiulcer, antifungal and wound healing. (Zhasa et al., 2015; Devi et al., 2018; Shukla et al., 2021.).
85	<i>Psidium guajava</i> L.	Myrtaceae	Guyam (TR)	TR	Tree	Leaves	Tender shoots are taken directly either by chewing or paste in digestive disorders (Debberma et al., 2017).	Flavonoids, mainly quercetin derivatives; analgesic, anti-inflammatory, antimicrobial, hepatoprotective, anti-diarrheic (Debberma et al. 2017; Metwally, 2010).
86	<i>Punica granatum</i> L.	Punicaceae	Dalim (AS)	AP	Tree	Root	Root is used (Doley et al., 2014).	Phenols, flavonoids, Rutin, luteolin, gallic acid, and ellagic acid; antibacterial (Doley et al., 2014; Trabelsi et al., 2020).

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87	<i>Raphanus sativus</i> Linn.	Brassica ceae	Mula (AS)	AS	Herb	Root	The paste of root is applied topically at night and the slice of root is applied topically in the morning (Chopra, 2002; Acharyya et al., 2004).	Anthocyanin, isothiocyanates, Flavonoids, polyphenols , terpenes and derivatives , fat and fatty related compounds , glucosinolates and breakdown products , and hydrocarbons; antimicrobial and antioxidant (Chopra, 2002; Acharyya et al., 2004; Gamba et al., 2021).
88	<i>Rheum nobile</i> Hook. f. & Thomson	Polygona ceae	Tchuka (Lepcha) (SK)	SK	Herb	Rhizome	Rhizomes are used (Mandal et al., 2013).	Anthraquinone, anthrone, chromone, flavonoids, quercetin, lignan, phenol, sterol, stilbenes; antimicrobial, anti inflammatory, astringent, carminative, depurative, purgative, tonic (Mandal et al., 2013; Gupta et al., 2017).
89	<i>Ricinus communis</i> L.	Euphorbiaceae	Miggim (AP), Kege (MN)	AP, MN	Shrub	Whole plant, seed,	350 g of the leaf boiled in 2 litres of water in a closed vessel and the steam liberated was externalposed to anus (Goswami et al. 2009; 19, Perme et al., 2015; Thokchom et al. 2015; Perme et al. 2015.)	Flavonoids, glycosides, alkaloids, steroids, terpenoids; anti-inflammatory, central analgesic, antitumor, antiasthmatic activity (Singh, 2015).

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90	<i>Sida rhombifolia</i> L.	Malvaceae	Arrow-leaf sida (NG)	NG	Herb		Whole plant used (Zhasa et al., 2015).	Alkaloids and flavonoids; antioxidant, antimicrobial, anti-inflammatory, hepatoprotective (Sundaraganapathy et al. 2013; Zhasa et al., 2015).
91	<i>Solanum khasianum</i> C.B. Clarke	Solanaceae	Akholongkok (NG)	NG	Shrub	Fruit	Juice of ripped and peeled fruits is taken (Zhasa et al., 2015).	-
92	<i>Solanum nigrum</i> L.	Solanaceae	Pokmou (AS), Anhling (MZ)	AS, MZ	Herb	Fruit, whole plant	Fruits boiled in water taken internally. 30 ml of plant juice for adults and 15ml for children is prescribed to take preferably in empty stomach. This is given once in the morning and once minimum half an hour before meal (Lalramnghinglova, 2016; Devi et al., 2018.)	Alkaloids, flavonoids, Phenolic, diterpenes and saponin; laxative, improve appetite used to cure chronic enlargement of liver, piles, dysentery and fever (Pandey & Arnold, 2017).
93	<i>Solanum tarvum</i> Sw.	Solanaceae	Bhetkuri (AS)	AS	Shrub	Stem	Taken orally with other ingredients (Das, 2017).	Steroids, steroid saponins, steroid alkaloids, and phenols; antimicrobial, anti-tumour, anti-bacterial, anti-inflammatory, anti-ulcerogenic, anti-platelet aggregation, antioxidant, analgesic, anti-inflammatory, (Yousafa et al., 2013; Das,

								2017).
94	<i>Stereospermum personatum</i> (Hassk.) De. Chatt.	Bignoniaceae	Zihngghal (MZ)	MZ	Tree	Leaves, bark, root, flower	Decoction of the leaves, bark, roots and flowers are taken (Laldinsanga et al. 2018).	Steroids, carbohydrates, triterpenoids, coumarins, phenolic compounds, flavonoids, saponins, anthroquinones, proteins and lipid; anti-inflammatory, antitumor, antibacterial (Kumar & Sanshi, 2016; Laldinsanga et al., 2018).
95	<i>Swertia chirayita</i> (Roxb. Ex. Fleming) Karst.	Gentianaceae	Chirata (AS), Chiretta (MN)	AS, MN	Herb	Stem, root and leaves	Stem, root and leaves are used as different moods of administrations (Hazarika et al. 2012).	Xanthenes and their derivatives, lignans, alkaloids, flavonoids, terpenoids, iridoids, secoiridoids, chitin, ophelic acid, palmitic acid, oleic acid, and stearic acid; anti inflammation, digestive, anthelmintic, hepatoprotective, antimicrobial, anti-inflammatory, antidiarrheal (Hazarika et al. 2012; Kumar & Van Staden, 2016).
96	<i>Terminalia chebula</i> Retz.	Combretaceae	Manahi (MN)	MN	Large deciduous tree	Fruits	The fruit is crushed with the rhizomes of <i>Zingiber officinale</i> Rosc.; bark of <i>Albizia myriophylla</i> Benth. (Local name-Yangli) and leaves of <i>Mentha arvensis</i> Linn. (Local name-	Gallic acid, ellagic acid, tannic acid, ethyl gallate, chebulic acid, chebulagic acid, corilagin, mannitol, ascorbic acid; antioxidant, laxative (Singh et al., 2014; Chang &

							Nungshihidak) using a little water. Sugar or honey is added to the extract and is prescribed for 4 to 6 days, one yaum (equivalent to 5 or 6 teaspoonful) in piles (Singh et al., 2014).	Lin, 2012).
97	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Bhoira/Bhomora (AS), Thingva ndawt/ Tuikuk-reraw/ char-vantai (MZ)	AS, MZ	Tree	Fruit	Leaf Extract of <i>Desmodium triquetrum</i> is mixed with fruit powder of <i>Emblica officinalis</i> and <i>Terminalia bellirica</i> with 50ml of honey or jaggery and to be taken after meal. Decoction of plum of fruit taken internally (Devi et al., 2018; Laldinsanga et al. 2018)	Alkaloid, flavanoid, glycoside, phenol, steroid, terpenoid, lignan, tannin; antioxidant, antidiarrheal, anti-helminthic antimicrobial activity (Devi et al., 2018; Laldinsanga et al. 2018; Hazra, 2019).
98	<i>Tinospora sinensis</i> (Lour.) Merr.	Menispermaceae	Lengkot budu (MG)	MG	Climber	Tuber	Decoction (Roy et al. 2018).	Tinosinoides, Tinocordifolioside, steroids, glycosides, carbohydrates, mucilage and oxalic acids, glycosides, saponins, tannins and phenols, flavonoids and alkaloids; antioxidant, anti-inflammatory, antimicrobial, anthelmintic, anti ulcer (Hegde & Jayaraj, 2016; Roy

								et al., 2018).
99	<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	Gilloi/Amarlata (AS)	AS	Climber	Stem	Fruit of <i>Piper nigrum</i> is burnt along with rhizome of <i>Allium sepa</i> , stem of <i>Tinosporacordifolia</i> and externaludate of <i>Cinnamomum camphora</i> , ash is mixed with camphor and coconut oil and applied locally (Das, 2017).	Phenols, flavanoids, alkaloids, saponins, cardiac glycosides, steroids, carbohydrate and proteins; antispasmodic, anti-inflammatory, anti-spasmodic, anti-inflammatory, anti-oxidant, antipyretic, hepatoprotective (Pradhan et al. 2013; Das, 2017).
100	<i>Vitex trifolia</i> L.	Lamiaceae	Urikshibi (MN)	MN	Shrub	Leaves	The boiled extract of the leaves mixed with honey and taken orally (Singh et al., 2014).	Alkaloids, flavonoids, phenol, saponin, steroids and tannins; antimicrobial, anti-inflammation (Parkhe & Bharti, 2019).
101	<i>Xylosma longifolia</i> Clos	Flacourtiaceae	Nongleishang (MN)	MN	Tall tree	Leaves	The decoction of the leaves alone or mixed with the leaves of <i>Azadirachta indica</i> A. Juss. and taken (Singh et al., 2014).	Alkaloids, flavonoids, phenols, tannins, terpenoids and saponins; antispasmodic, anti-oxidant, antifungal (Bhattacharyya et al., 2020).
102	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Ada (AS)	AS	Perennial herb	Rhizome	Root decoction of Glory lily is mixed with 10 gm of ginger and to be given three tea spoonful three times in a day (Devi et al., 2018).	Monoterpenoids, sesquiterpenoids, gingerols, gingerols, shogaols, 3-dihydroshogaols, paradols, dihydroparadols; anti-tumorigenic, anti-

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								inflammatory (Ali et al. 2008; Devi et al., 2018).
103	<i>Zingiber purpureum</i> Rosc.	Zingiberaceae	Tekhaoy aikhu (MN)	MN	Herb	Rhizomes	The soup obtained by boiling the rhizome along with crab is prescribed in bleeding piles. (Singh et al., 2014)	Terpenoids, flavonoids, alkaloids, steroids, benzenoids, Sabinene and terpinen-4-ol; Antimicrobial activity, anti-inflammatory activity (Singh et al., 2015).

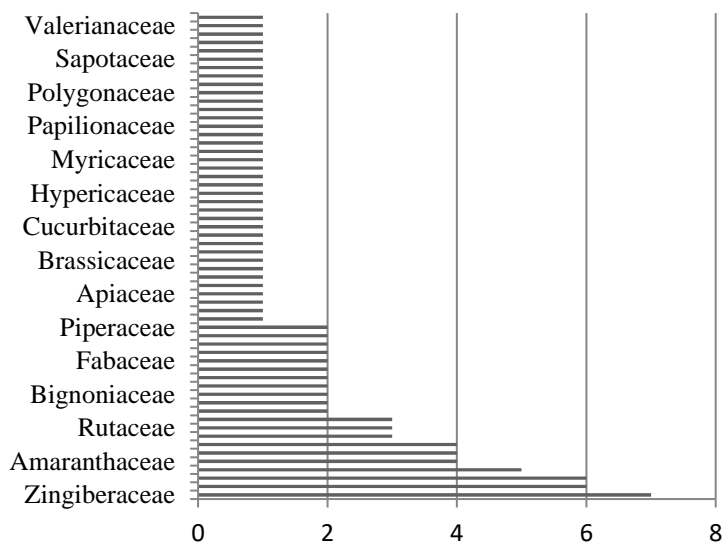


Fig 6.1. Distribution of different families of plants used in the traditional medicine of hemorrhoids in NE India.

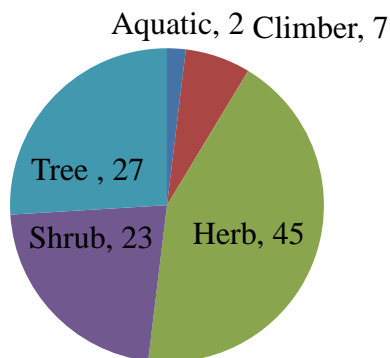
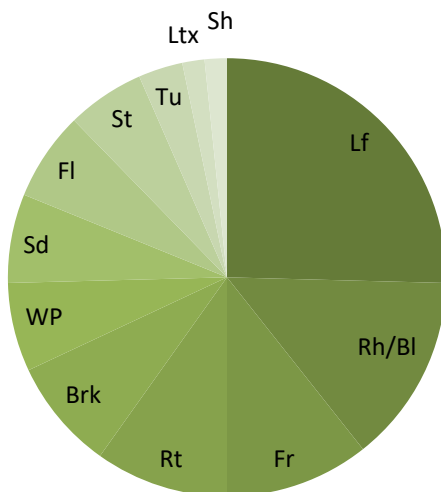


Fig 6.2. Different plants habits used in the traditional medicine of hemorrhoids in NE India.

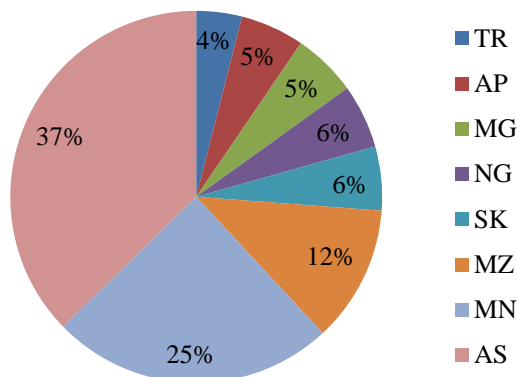


(Tu-Tuber, Ltx-Latex, Sh-Shoot, Lf-Leaf, Rh/Bl- Rhizome/Bulb, Fr-Fruit, Rt-Root, Brk-Bark, Wp-Whole plant, Sd-Seed, Fl- Flower, St- Stem)

Fig 6.3. Different plant parts used in the treatment of hemorrhoids by traditional healer.

Plant's parts, mode of preparation, and route of administration:

Out of various plant parts used as medicine (Fig.6.3), usage of leaf has shown highest percentage of 25% followed by rhizome and bulb (14%), fruit (11%), root (10%), bark (8%). Flower (7%), whole plant (6%), seed (6%), stem (6%), tuber (3%), latex (2%) and shoot (2%).



(AS-Assam, AP- Arunachal Pradesh, MN-Manipur, MZ- Mizoram, MG- Meghalaya, NG-Nagaland, TR-Tripura, SK-Sikkim)

Fig 6.4. Use of herbal medicines for piles in different states of North East India.

Among the eight states of north east India, comparatively more plant based herbal treatments are reported and documented from Assam (37%), Manipur (25%) and Mizoram (12%) (Fig. 6.4). There might be wide use of herbal treatment for piles among native people in other states also, but more scientific documentation needs to be reported. Among the plants used in the treatment for piles *Acaryanthus aspera*, *Mimosa pudica* and *Oroxylum indicum* are the most popular and extensively used in most of the states viz. Assam, Arunachal Pradesh, Mizoram, Meghalay, Manipur, Nagaland and Sikkim. *Aegle marmelos*, *Asparagus racemosus*, *Averrhoa carambola*, *Bauhinia variegata*, *Cynodon dactylon*, *Jatropha curcus*, *Lasia spinosa*, *Mangifera indica*, *Pedilanthus tithymaloides*, *Piper longum*, *Plumbago zeylanica*, *Ricinus communis*, *Solanum nigrum*, *Swertia chirayita* and *Terminalia bellirica* are the other popular medicinal plants used in the treatment of piles in north east Indian states.

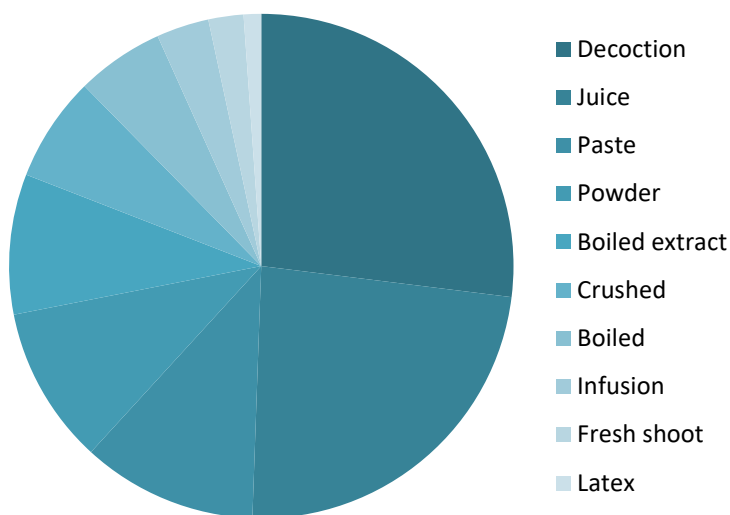


Fig 6.5: Different types of mode of preparation of the herbal medicine for the treatment of hemorrhoids.

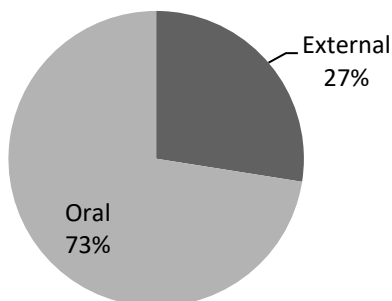


Fig 6.6: Different modes of administration of the herbal dose in the treatment of hemorrhoids.

The mostly used forms of preparation of medicine are decoction (27%), which is followed by juice (24%), paste (11%), powder (10%) and boiled (9%)

(Fig.6.5). The herbal medicines are either applied externally (27%) or taken orally (73%) (Fig. 6.6). Oral administration is more frequent than the external application. Oral applications are taken in the form of juice, decoction, boiled or boiled plant part, paste or infusion. Plants parts are made paste and used externally. Sometimes plant parts are burnt together with other ingredients and applied the ash locally on anus. Also plant parts are crushed, roasted and smoke is allowed to apply locally. Steam of boiled plant parts are also exposed to anus in the treatment of hemorrhoids.

Phytochemicals and pharmacognostic evidence value of the common plants used in the treatment of hemorrhoid:

Hemorrhoid mostly occurs due to long standing complaint of digestion, constipation and irregular food habit. Therefore, most of the ingredients used in the oral medicine are having remedial properties for gastrointestinal problems like *Hydrocotyle rotundifolia*, *Piper nigrum*, *Piper longum*, *Allium sepa* (Borah et al., 2006). *Hedyotis diffusa*, *Tinospora cordifolia*, *Clerodendrum infortunatum* have anticancer, antiinflammatory, hepatoprotective, digestive properties and used in the treatment of Jaundice, skin disease, anaemia, worms, chronic diarrhea, dysentery, bone fracture, pain, asthma, skin disease etc. (Niu et al., 2013; Mishra et al., 1969; Das, 2017). *Tinospora cordifolia*, *Mimosops elangi*, *Ricinus communis*, *Hypericum perforatum*, *Centella asiatica* exhibits wound healing properties (Das, 2017; Süntar et al. 2010; Rufe et al., 2015; Sribandit, 2008). *Physallis minima* and *Aegele marmelos* exhibits antibacterial antiinflammatory, antipyretic and analgesic properties (Arul et al., 2005; Süntar et al., 2010). Some plant species are used singly and certain species are used in combination with others plants or animals or substances. The root of *Acarynthus aspera* contains triterpenoid saponins and has the properties of astringent, diuretic and antispasmodic (Nguyen & Doan, 1989). The juice of the plant is used in the treatment of boils, diarrhoea, dysentery, haemorrhoids, rheumatic pains, itches and skin eruptions (Manandhar, 2002). *Mimosa pudica* exhibits antibacterial, antivenom, antifertility, anticonvulsant, antidepressant, aphrodisiac, and various other pharmacognostic activities and has been traditionally used for ages in the treatment of urogenital disorders, piles, dysentery, sinus, and also applied on wounds (Ahmed et al., 2012). The plant is reported to contain alkaloids, non-protein amino acid (mimosine), flavonoids C-glycosides, sterols, terpenoids, tannins, and fatty acids (Genest et al., 2008). *Oroxylum indicum* possesses anti-inflammatory, anthelmintic, antihepatotoxic, anticancer, immunomodulator, gastroprotective properties and is an

active ingredient of several Ayurvedic formulations like Chyawanprash and Dashmoolarisht etc. (Lawania et al., 2010).

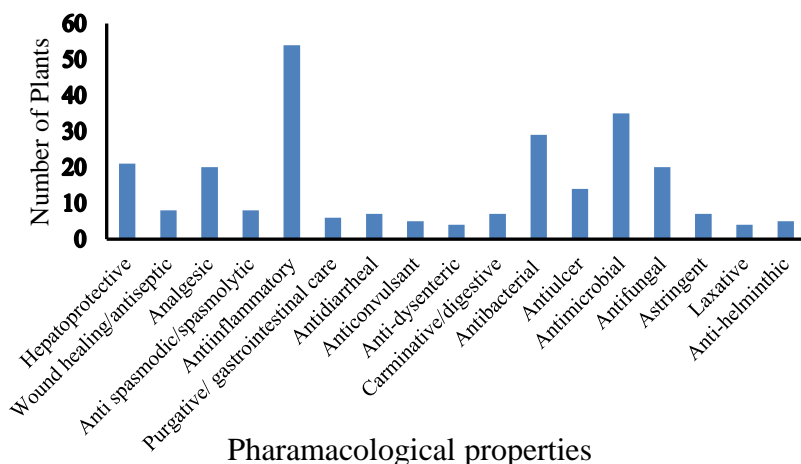


Fig 6.7. Common pharmacological properties present in the plants used as traditional medicine for hemorrhoids.

It is evident that almost all of the plants used in traditionally in the treatment of hemorrhoids have some common particular pharmacological properties such as Hepatoprotective, Wound healing/antiseptic, Analgesic, Anti spasmodic/spasmolytic, Antiinflammatory, Purgative/ gastrointestinal care, Antidiarrheal, Anticonvulsant, Anti-dysenteric, Carminative/digestive, Antibacterial, Antiulcer, Antimicrobial, Antifungal, Astringent, Laxative and Antihelminthic or larvicidal (Fig. 6.7). These medicinal properties provide considerable cure and healing of the patient suffering from hemorrhoids by reducing the pain, making the fecal motion comfortable, improving digestion and protecting from any infection or ulcer. Though, the folk healers are not aware of proper quantitative or qualitative phytochemical analysis of the plant material, but the selection of the effective herbal cure for the disease hereby implies that the traditional knowledge system of curing any ailment must have a strong understanding of both the disease and the remedies.

Presence of abundant potent Antimicrobial, Antioxidant, anti inflammatory, hepatoprotective, blood clot promoting phyto chemicals such as alkaloid, flavanoid, terpenoids, tannin and steroids also justifies the use of investigated plant species are effective remedies for treatment of piles (Chung et al., 1998; Cör et al., 2018; Sharmin & Syeda, 2018; Panya & Gadhavi, 2015). Presence of a wide range of potent medicinally effective phytochemical molecules in the plants used by the folk healers also supports the rich heritage of traditional knowledge in medicine used by different communities of North East India.

Conclusion:

Medicinal and aromatic plants have been extensively used by the native people of north east India for the treatment of piles or hemorrhoids. Local rural people are strongly dependent on the locally available plants for preparing herbal preparations to be used in the treatment. But indigenous traditional knowledge of medicinal plants, their uses and herbal prescriptions are transmitted orally for centuries from generation after generation. Eventually, due to the lack of proper documentation, the part of information is becoming extinct. To save the indigenous knowledge of medicinal plants of north east India there is a need of increasing awareness among the people. Plant parts of herbs, shrubs and trees belonging to Zingiberaceae, Euphorbiaceae, Lamiaceae and Liliaceae are most commonly used in every state of north eastern states of India for the treatment of piles or hemorrhoids. Traditional healers mostly used rhizomes, roots, fruits and leaves of various plants for preparation of herbal drugs. *Acarynthus aspera*, *Mimosa pudica* and *Oroxylum indicum* are found to be the most commonly used medicinal plants for curing hemorrhoids. It has also been noticed that most of the plants used in the treatments of hemorrhoid has anti spasmodic, antimicrobial, laxative, astringent, gastroprotective, anti inflammatory and wound healing properties. They are rich in alkaloid, flavanoid and their derivatives, terpenoids, tannin, glycosides, essential oil, saponins, phenolic compounds and steroid content. Unfortunately, still there is no any particular medicine for the complete cure of this ailment. Although, several medicinal treatment methods including Ayurveda, Homeopathy or Allopathic treatments claims it, but reoccurrence of the ailment after a considerable period of treatment is very common. Therefore, more emphasis on further pharmacognostic study, phytochemical investigation and other advanced medicinal studies of the common plants used in the treatment of piles in traditional system of healing has a great scope. It would help in formulating the

best medicine for the complete cure and less pathetic treatment of hemorrhoid in future.

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Chapter 7

Ethnodermatological practices among the ethnic groups in North East India: a review

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Abstract

Skin diseases are one of the key problems through out the world. There are more than a thousand conditions that may affect the skin but most skin diseases are highly dominated by bacterial and superficial fungal infections; however, the pattern of skin diseases varies from place to another and influenced by various factors like environment, economy, literacy, racial and social customs. Throughout the present study we have recorded a total of 102 species used for the treatment of skin diseses including their pharmacological activests and chemical constituents.

Keywords: Skin diseases, tradtional Practices, Northeast region

Introduction

North East India comprising the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. The northeastern part of India is well-known to be the world's most culturally diverse region; the region

covers an area of ca. 262060 sq. km and steadily inhabited by more than 200 tribes. Some of the most popular tribes are the Adi tribe, Nishi Tribe, Bhutia tribe, Garo tribe, Kuki tribe etc. Nevertheless, the Northeast region is home to many ethnic community, it signifies a unique social and environmental context for Ethnobotanical studies, merely because of their rich cultural/ethnic/religious existences, the area is as well recognized as hotspot of biodiversity and the region shares the international border with Myanmar, Bangladesh, Bhutan, Nepal, South Tibet and China. From the immemorial period these ethnic tribe use the plants and animals in their daily livelihood in their different sociocultural aspect. Each ethnic community of the region has different and very specific knowledge in their Traditional medicine practices, their food habitat and in different sociocultural features. Geographical boundary and the different vegetation type of the region is also a certain effect of forming of varied culture diversity between the ethnic tribes. Assam is situated in the center and all hill states (except Sikkim) are situated around it. The literature survey reveals a number of documentation and Ethnobotanical studies viz. edible plants, floral diversity, medicinal plant use for skin diseases, respiratory diseases, jaundice, on different tribes of northeast India. Though there is no systematic review on dermatological study in northeast India, the present study was taken to fill up the on ethno pharmacological researches.

Skin disorders:

Skin diseases are one of the major problems through out the world. It is the study of both normal and abnormal skin and associated structures such as hair, nails, and oral and genital mucous membranes (Chiang & Verbov, 2009). These diseases are highly dominated by bacterial and superficial fungal infections. There are more than a thousand conditions that may affect the skin but most skin diseases are highly dominated by bacterial and superficial fungal infections, nevertheless the pattern of skin diseases varies from place to another and influenced by various factors like environment, economy, literacy, racial and social customs. The common type of skin diseases can be categorized into nine types viz., Rashes, Viral infections, Bacterial infections, Fungal infections, Parasitic infections, Pigmentation disorders, Tumors and cancers and Trauma (Tabassum & Hamdani, 2014).

Methods

Ethnopharmacological data sources and collection

Systematic literature searches relevant to the field of ethnobotany were carried out and the available information on various plants traditionally used for oral and dental health care was collected from different bibliographical databases via electronic search (using Pubmed, SciFinder, Scopus, Scirus, ScienceDirect, Google Scholar and Web of Science) and a library search for articles published in peer-reviewed journals and also locally available books. The phytochemicals and pharmacological activities, which are considered as helpful for the treatment of oral

and dental health care are reported in this review include: Antioxidant, Anti-bacterial, Anti-inflammatory and antimicrobial activity.

Systematization of plant names and chemical structures

For the systematization of plant names and to check the status of plants gathered in this review, the database: The Plant list (<http://www.theplantlist.org/2020>) was used. Only the accepted names and family of plant species highlighted in this database were retained to be listed in this review.

Results and Discussion

The present study recorded a total of 102 species under 58 families and 104 genera, under this families 57 families with 119 species belongs to Angiosperm and 1 family with one species belongs to Pteridophyte. The habit of the species comprises about 17 species herbs, 57 species shrubs, 31 species trees, 6 species climbers and 8 species were vine. Through the secondary information the presented study noted total 15 parts of plants were used for the medicine preparation or direct use for the treatment of skin diseases, between them 42% of leaves parts were used for the treatment of dermatological diseases and also recorded a total -29 types of skin diseases along with their treatment and medicinal preparation through traditional method (Table 7.1, Fig. 7.1, 7.2). During present study the authors furthermore go away through the literature survey to appraisal scientifically and chronicled the Pharmacological activities and phytochemical constituent of each 102 species. Certain Pharmacological activities of the species were viz, antimicrobial, anti viral, antifungal activities and including their Phytochemical Constituent viz, alkaloids, phenols, volatiles etc.,

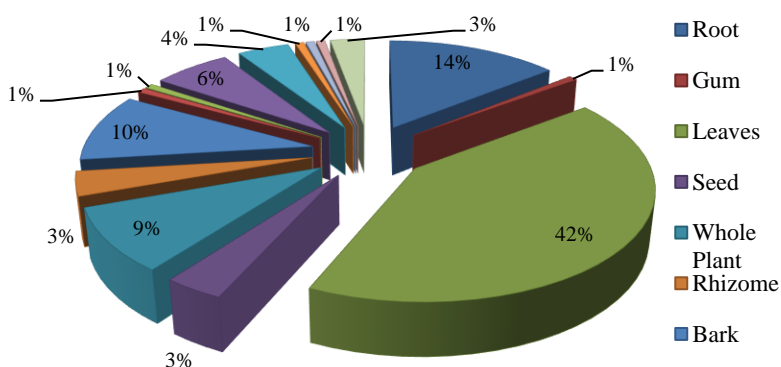


Fig. 7.1. Different parts of plants used for the treatment of skin diseases.

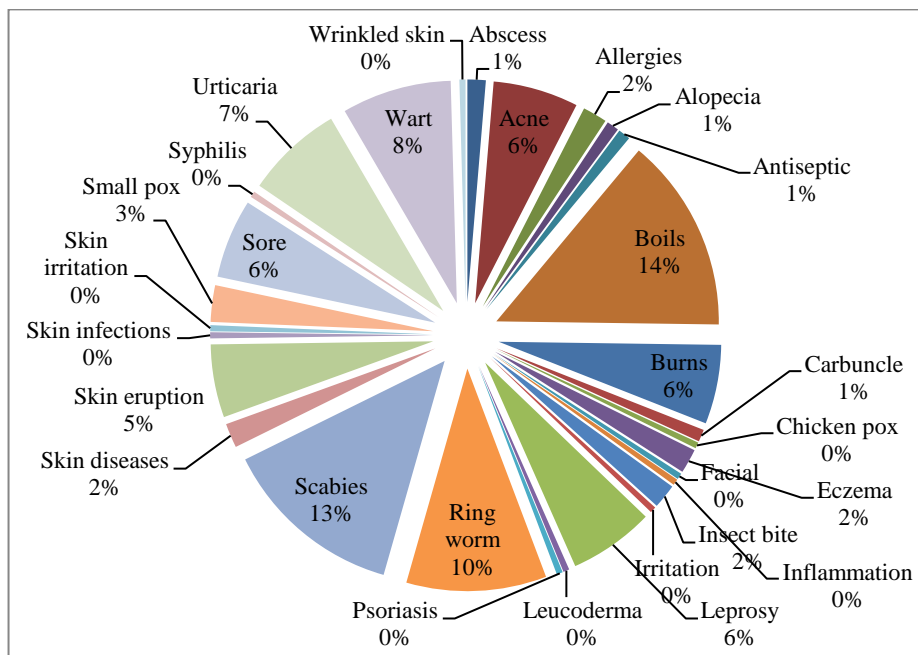


Fig. 7.2. Different types of Plants species used for the treatment of ethnodermatology.

Table 7.1. Diversity of medicinal plants traditionally used in ethnodermatological practices among the ethnic groups in North East India with pharmacological effect/Phytochemical constituent with reference.

Sl No	Species with family	Part use	Disease	Mode of uses with reference	Pharmacological effect/ Phytochemical Constituent with reference
1.	<i>Abrus precatorius</i> L. (Leguminosae)	Roots	Leucoderma	Root paste is smeared to the affected part in the form of thick paste. (Buragohain & Konwar,	Alkaloids, Flavonoids, Steroids, Tannins, Terpenoids (Nassir et al., 2017). Anti-viral effect (Premanand & Ganesh, 2010)

				2007)	Antioxidant activity (Nassir et al., 2017).
2.	<i>Acacia farnesiana</i> (L.) Willd (Mimosaceae)	Gum	Skin burns	The extracted gum is added with egg and then smeared (Saikia et al., 2006)	Albumin, gallic acid, glutelins, kaempferol, quercetin, methyl gallate, myricetin, diosmetin, ellagic acid, β -sitosterol, ferulic and caffeic acids. (Puga et al., 2018) Antioxidant, Antimicrobial and Cytotoxicity Activities. (Ramli et al., 2011)
3.	<i>Acalypha indica</i> Linn (Euphorbiaceae)	Leaf	Scabies, ringworm, urticaria	Extraction of Leaf juice is applied on the infected portion. (Devi, 2017)	Anthraquinones, Alkaloids, Catechols, Flavonoids, Phenolic compounds, Saponins, Steroids, Tannins, Triterpenoids. (Saha & Ahmed, 2011) Analgesic Activity, Anti-inflammatory Activity, Antihelmintic Activity, Antibacterial, Antifungal activity, Antitubercular Activity, Antioxidant Activity, Neuro-protective and Neuro-Therapy Activity and Anti-venom Activity. (Saha & Ahmed, 2011)
4.	<i>Achyranthus aspera</i> L. (Amaranthaceae)	Seed & leaf	Carbuncle, Boils,	Seed paste is added with little amount	Tannins, phlobatannins, terpenoids,

			skin eruption, acne, insect bite, ringworm, scabies	of salt and paste to the affected part. (Buragohain and Konwar, 2007) Decoction or infusion of leafs is applied against infection surface (Devi, 2017)	flavonoids, cardiac glycosides, phenols and alkaloids. (Baraiketal., 2014) Anti-oxidant Activity (Priya et al., 2010; Antiparasitic Activity (A. A. Zahir et al. 2009) Anti-allergic Activity (Datir et al. 2009)
5.	<i>Aconitum nagarum</i> Stapf (Ranunculaceae)	Whole plant	Ringworm	Extraction of entire plant is applied. (Devi, 2017)	Alkaloids, antibacterial activity (Sinam et al., 2012)
6.	<i>Acorus calamus</i> Linn. (Araceae)	Rhizome	Skin diseases	Rhizome paste is applied for the treatments of skin diseases. (Pradhan & Badola, 2008)	Alkaloids, flavonoids, gums, lectins, mucilage, phenols, quinone, saponins, sugars, tannins, and triterpenes (steroids). (Ahmad & Aqil, 2006; Aqil et al., 2006; Bains et al., 2005; Parab & Mengi, 2002; Chitetal., 2001) Anti-inflammatory and immunomodulatory activity (Varde et al., 1988; Vohra et al. 1989) Antibacterial activity (Bhuvaneswari et al., 2006) Antioxidative/protective effect (Palani et al., 2010)
7.	<i>Acronychia pedunculata</i> (L.) Miq. (Rutacea)	Root	Scabies	Extraction of roots and bark is	Robinetin, chalcone, butin and flavanol ampelopsin,

				applied against the infected area. (Devi, 2017)	stigmasterol glucosides, oleanolic acid, echinocystic acid, and sapogenins. (Adedapo et al., 2009; Shaiq et al., 2009; Enuo & Shishan., 2007; Mesbah et al., 2002; Yeoh et al., 1984; Chandra & Saxena. 1982; Yadev et al., 1967) Anti-inflammatory, analgesic, antioxidant, cytotoxic, anti-diarrheal, acute toxicity, antibacterial, antifungal, and blood pressure-reducing activities. (Ara et al., 2013; Ara et al., 2010a, 2010b; Adedapo et al., 2009; Mayuren et al., 2009; Rodrigo et al., 2007; Jayasinghe et al., 2006; Olajide et al., 2004)
8.	<i>Aegle marmelos</i> Correa ex Roxb. (Rutacea)	Leaves	Abscess	Crushed leaves is add with black pepper and made paste is smeared on the boils (Saikia et al., 2006)	Chlorogenic acid, coumaric acids, flavonoids, phenolic compounds and phenolic acids; Anti-inflammatory activity, antioxidant' (Mujeeb et al., 2017)
9.	<i>Ageratum conyzoides</i> Linn. (Asteraceae)	Leaves	Ringworm	Extract leaves is applied against the infected area.	Alkaloids, flavonoid, tannins, saponins, glycosides, resins, phenols,

				(Devi, 2017)	asphytochemicals with ileproteins, carbohydrate (Amadi et al., 2012) Anti-inflammatory, anti-bacterial and anti-fungal properties. (Okwu et al., 2003; Sofowora, 1982)
10.	<i>Ageratum houstonianum</i> Mill. (Asteraceae)	Leaves	Scabies	Extract leaves is applied against the infected area. (Devi, 2017)	Flavonoids, triterpenoids, steroids, pyrrolizidine alkaloids and benzofuran derivatives (Quijano etal., 1987) Antimicrobial, cytotoxicity. (Doaa et al., 2019)
11.	<i>Albizia odoratissima</i> · (L.f.) Benth. (Mimosaceae)	Bark	Leprosy	Extract bark and leaf is applied against the infected surface. (Devi, 2017)	Glycosides flavonoids Tannins, Phenolic compound, Phyto steroids Saponins (Jayasiri et al., 2015) Antioxidant and antimicrobial activities (Banothu et al., 2017)
12.	<i>Allium sativum</i> L. (Amaryllidaceae)	Bulb	Ringworm, Scabies , Abscesses	Bulb are crushed and applied directly on the infected skin (Saikia et al., 2006)	Alkaloids (7.2 %), tannin (4.8 %), saponin (4.3 %) and flavonoids (2.18 %). (Ali & Ibrahim, 2019) Antimicrobial, antifungal, antiparasitic, antiviral, anti- allergenic, antispasmodic, antihyperglycemic, anti-inflammatory and immunomodulatory

					properties (Rabi & Bishayee, 2009)
13.	<i>Aloe barbadensis</i> Mill. (Aloaceae)	Leaves	Skin burns	Leaves are crushed and pasted on the burnt places (Saikia et al., 2006)	Phenols, flavonoids, flavonols, proanthocyanidins, tannins, alkaloids and saponins; antioxidant activities (Wintola & Afolayan, 2011)
14.	<i>Alpinia galanga</i> Willd. (Zingiberaceae)	Rhizome	Ringworm, scabies	Powder made from rhizomes applied against on the infected skin (Devi, 2017)	Flavonoids, terpenoids, saponins, phenolic acids and essential oils (Chudiwal, et al., 2010) Antimicrobial activity, antioxidant activity. (Tang et al., 2018)
15.	<i>Amaranthus spinosus</i> Linn (Amaranthaceae)	Shoot leaf	Boils, burn	Crushed shoot leaf is pasted on the infected skin (Devi, 2017)	Flavonoids, Tannins, Saponins, alkaloids, proteins, and glycosides; Antioxidant, Antimicrobial activity (Amabye, 2015)
16.	<i>Anotis foetida</i> Dalz. (Rubiaceae)	Root	Boils	Root is made paste and applied on the affected skin. (Devi, 2017)	Not reported
17.	<i>Aquilaria agallocha</i> Roxb (Thymelaceae)	Wood oil	Skin diseases, Leprosy	Extracted oil from wood is used in skin infection (Konwar et al., 2020, Saikia et al., 2006)	furanoid monoterpenoids, methyl esters of higher fatty acids, fatty acids, ketones, aldehydes and alcohols (Talukdar, 2014) Antioxidant, antidiabetic, analgesic, antipyretic, anti-inflammatory,

					antihistaminic, laxative, anticancerous (Alam et al., 2015)
18.	<i>Argemone mexicana</i> Linn. (Papaveraceae)	Latex	Scabies	Latex is applied in skin infection area. (Devi, 2017)	Alkaloids & Terpenoids; Cytotoxic (Chang et al., 2003); Phenolics and aromatic acids (Bhardwaj et al., 2012) Anti-stress and antiallergic (Bhalke et al., 2009) Anti-inflammatory (Sukumar et al., 1984)
19.	<i>Argyreia nervosa</i> (Burm.f.) Boj. (Convolvulaceae)	Leaves	Boils, acne	Crushed leaves are Poultice on the infected skin. (Devi, 2017)	Alkaloids, Oil, fats, glycosides, flavonoids, tannins and phenolic (Jeet et al., 2012); Antimicrobial activity, Antiviral activity, Antiulcer activity (Rao et al., 2003)
20.	<i>Artemisia nilagirica</i> (Clarke) Pamp. (Asteraceae)	Leaves	Scabies	Extract of leaves are applied against infection portion. (Devi, 2017)	Alkaloids, Flavonoids, Tannins, Terpenoids (Santilna et al., 2014) Antioxidant activity (Santilna et al., 2014), Antibacterial activity (Rao et al., 2006)
21.	<i>Artemisia parviflora</i> Roxb. (Asteraceae)	Leaves	Scabies	Extract of leaves are applied against infection portion. (Devi, 2017)	Sesquiterpene lactones, coumarins, flavones and acetylenes (Silva, 2004) Antifungal activity (Mehrotra et al., 1993), antiprotozoal activity, antihelminthic activity, anti-viral,

					respiratory effects, cardiovascular effects (Dhar et al., 1973)
22.	<i>Artocarpus lakoocha</i> Roxb. (Moraceae)	Bark/fruit/latex	Acne, skin eruption, boils, antiseptic boils	The powdery substances made from bark, fruit and latex is applied against skin infection surfaces. (Devi, 2017)	Phenols, flavonoids, tannins; Antioxidant, antimicrobial, antioxidative activities, fungicidal activity (Bhattacharya et al., 2019)
23.	<i>Azadirachta indica</i> A. Juss (Meliaceae)	Leaves	Boils, small-pox Ringworm, acne, urticaria	Leaves are made paste and Poultice on the infected skin. Decoction of leaves are applied against affected surfaces. (Devi, 2017)	Phenolic compounds, terpenoids, alkaloids and glycosides, antioxidant capacity. (Mohammad et al., 2013) Antiviral, antibacterial, antifungal, anti-inflammatory, antipyretic, antiseptic and antiparasitic uses (Britto & Sheeba, 2011)
24.	<i>Bambusa arundinacea</i> (Retz.) Willd.	Shoot	Ringworm, alopecia	Decoction of bamboo shoots are applied against affected surfaces. (Devi, 2017)	Flavone glycosides, phenolic acids, coumarin lactones, anthraquinones and amino acids. (Nayak and Rout, 2005) Anti-inflammatory and antiulcer activity, Antibacterial activity, Protective effects, antifertility activity, Insecticidal activity. (Soni et al., 2013)
25.	<i>Barleria cristata</i> L. (Alba) (Acanthaceae)	Aerial Parts	Skin infections	Aerial parts of plant is crushed and boiled in	Carbohydrates, amino acids, steroids, saponins, flavonoids, proteins,

				water and the decoction is used against skin infections. (Sajem & Gosai, 2006)	tannins, terpenoids and phenolic compounds (Narmadha & Devaki, 2012) Anti-bacterial activity, anti-diabetic activity, anti-inflammatory activity (Belmaghraoui et al., 2018; Singh et al., 2012; Chander et al., 2010)
26.	<i>Barringtonia acutangula</i> · (L.) Gaertn (Lecythidaceae)	Stem bark	Syphilis, leprosy	Stem bark is used for the cures (Konwar et al., 2020)	Carbohydrates, saponins, amino acids, flavanoids, phenols, tannins steroids, triterpenoids (Charles et al., 2001). Anti-oxidant and anti-inflammatory activity (Inampudi et al., 2014)
27.	<i>Basella alba</i> Linn. (Basellaceae)	Leaf	Boils/ Burn	Leaf extract is applied against boils and burning skin. (Devi, 2017)	Vitamins- A, C, thiamine, riboflavin, niacin, and betacyanin, oxalic acid, flavonoid like acacetin, 4,7-dihydroxy kempferol and 4'-methoxyisovitexin and also phenolic acids (Daniel, 2006; Eliana et al., 2007) Anti-proliferative and anti-angiogenic activity (Kumar et al., 2018)
28.	<i>Basella rubra</i> L. (Basellaceae)	Leaves	Skin burns	Crushed leaves are mixed with cheese and then applied	Anti-proliferative and anti-angiogenic activity (Kumar et al., 2018) Anti-bacterial, anti-

				(Saikia et al., 2006)	hyperglycemic, anti-inflammatory, cytotoxic and anti-proliferative activity (Priya et al. 2015).
29.	<i>Bauhinia acuminata</i> Linn. (Caesalpiniaceae)	Bark and leaves	Leprosy	Paste of bark and leaves are applied against skin infections area. (Devi, 2017).	Phenolic compounds, saponins, flavonoids, oils, and fats, alkaloids, anthocyanoside, steroids, anthraquinone, terpenoids. (Krishna et al., 2015). Anti oxidant activity, Antidiabetic activity, Antibacterial activity (Ray et al., 2017; Phansri et al., 2011)
30.	<i>Bauhinia purpurea</i> Linn. (Caesalpiniaceae)	Bark	Leprosy	Extract of barks are applied against affected area. (Devi, 2017)	Phenolic compounds, tannins, flavonoids, phytosterols saponins, glycosides (Pahwa et al., 2010) Antinociceptive and anti-inflammatory (Zakaria et al., 2009)
31.	<i>Bauhinia variegata</i> Linn. (Caesalpiniaceae)	Bark and root	Leprosy	Extract of bark and roots are applied against affected area. (Devi, 2017)	Flavones, flavanol glycosides and tannin, chemoprotective antitumor activity, anti-inflammatory, anti-diabetic, antioxidant. (Sudheerkumar et al., 2015)
32.	<i>Blumea hieracifolia</i> (D. Don) DC (Asteraceae)	Leaves	Scabies	Decoction of leaves is used against affected skin.	Not reported

				(Devi, 2017)	
33.	<i>Brassica juncea</i> (L.) Czern. (Brassicaceae)	Seed oil	Scabies	The extracted oil is mixed with liquor of <i>Cynodondactylon</i> , <i>Curcuma longa</i> and then by adding water the mixture is heated and applied on the infected portion. (Saikia et al., 2006)	Tannin, terpenoid, saponin, flavonoid, alkaloid, phenols and cardiac glycoside. (Ogidi et al., 2019) Antioxidant, anti-diabetic, hyperglycemic, hypoglycemic (Dubie et al., 2013)
34.	<i>Buddleja asiatica</i> Lour (Buddlejaceae)	Leaves	Scabies, wart, acne	Extract of leaves are applied against affected area. (Devi, 2017)	Flavonoids (Fathy et al., 2006), steroids, iridoid glucosides, phenylpropanoids, triterpene, Saponin, flavonoids, Mannitol, sucrose. (El-Domiaty et al., 2009) Antibacterial, antifungal, antispasmodic (Ali et al., 2011)
35.	<i>Buddleja paniculata</i> Wall. (Buddlejaceae)	Root	Skin eruption, sore	Extract of roots are applied against affected area. (Devi, 2017)	Not reported
36.	<i>Calotropis procera</i> (Willd.) R.Br. (Asclepiadaceae)	Root & Latex	Ringworm Leprosy	Juice Extract from root and latex is applied against infected skin. (Devi, 2017)	Terpenoids, flavonoids, saponins, steroids and cardiac glycosides; antibacterial, antioxidant and analgesic effect (Uddin et al., 2012)
37.	<i>Canarium bengalense</i>	Resin	Urticaria	Extract resin	Phenols,

	<i>eRoxb</i> (Burseraceae)		ia	is used against Urticaria. (Devi, 2017)	flavone glycosides, cytotoxicproperty (Le et al. 2012).
38.	<i>Capparis tenera</i> Dalz. (Capparidaceae)	Leaves	Acne, scabies	Decoction of leaf is applied against Acne and Scabies. (Devi, 2017)	Not reported
39.	<i>Cassia fistula</i> Linn. (Caesalpiniaceae)	Root & Bark	Ringw orm	Decoction of root and bark is used against infected portion of skin. (Devi, 2017)	Tannins, flavonoids and glycosides (Verma, 2016) Antimicrobial activity, Anti- Fungal Activity, Antioxidant activity, anti-inflammatory, Anti-fertility, Antipyretic activity (Sivanesan&Kuppan nanGobianand, 2010; Duraipandiyan&Ign acimuthu, 2007; Ilavarasan et al., 2005; Yadav & Jain, 1999; Bhakta et.al., 1998)
40.	<i>Celastrus paniculatus</i> Willd. (Celastraceae)	Seed	Skin irritatio n, allergy.	Seed paste is applied for the treatment of Skin irritation, allergy. (Pradhan & Badola,20 08)	Alkaloids, sterols, celapanine, celapanigine, celapagine, celastrine stearic acid (Debnath et al.,2012) Anti-fungal activity, anti-arthritis activity, Anti- malaria activity (Vonshak et al., 2003)
41.	<i>Cinnamomum tamala</i> (Buch. - Ham.) Nees. &Eberm. (Lauraceae)	Leaves	Scabies	Leaves are rubbed on the body surface of the scabies affected	Polyphenoles, flavonoids, tannins, alkaloids and saponins (Dandapat et al., 2014) Antimicrobial

				surface. (Pradhan & Badola, 20 08)	Activity (Hassan et al., 2016),
42.	<i>Commelinabenghal ensis</i> Linn (Commelinaceae)	Entire Plants	Lepros y, boils, burn	Decoction of entire plants is used against infected area of skin. (Devi, 2017)	Oils and fats, alkaloids, lactones, coumarins, triterpenoids, steroids, resins, reducing agents, phenols and tannins, amino acids, quinones, flavonoids, astringents, saponins. (Cuellar et al., 2010) Anti-Inflammatory Activity, Analgesic Activity (Hossain et al., 2014), Anti- microbial Properties (Kunle & Egharevba, 2009)
43.	<i>Coriandrum sativum</i> Linn. (Apiacea)	Leaves	Acne	Crushed of leaves made paste and then applied on the infected skin. (Devi, 2017)	Essential oil, tannins, and terpenoids, reducing sugars, alkaloids, phenolics, flavonoids, fatty acids, sterols and glycosides. (Chauhan et al., 2012; Sreelatha&Inbavalli, 2012; Pandey et al., 2011) Antidepressant effect, Antibacterial, antifungal, anthelmintic and insecticidal effects, Anxiolytic effect. (Sudha et al., 2011; Oudah and Ali, 2010; Harsha SN and Anilakumar, 1539)

44.	<i>Croton caudatus</i> Geisel. (Euphorbiaceae)	Leaves	Skin eruptio n	Extract of leaves and roots are used against skin eruption. (Devi, 2017)	Alkaloids, terpenoids, steroids and their glycosides, cardiac glycosides, phenols, coumarins, flavonoids. (Farnsworth, 1996; Kokate, 1994) Antinociceptive, anti-inflammatory and antipyretic effect. (Neeharika et al., 2012)
45.	<i>Curculigo orchioides</i> Gaertn. (Amaryllidaceae)	Rhizom e	Acne, urticari a	The powdery substances made from rhizome are applied on infected skin. (Devi, 2017).	Antioxidant properties (Venukumar & Latha nm, 2002; Wu et al., 2005), anti- inflammatory and hepatoprotective activities (Rao & Mishra, 1996a, 1996b). Tricortane, linoleic, linolenic, arachidic, oleic, and palmitic acids, curculigol, cycloartenol, sitosterol and stigmasterol (Chatterjee & Pakrashi, 2001)
46.	<i>Curcuma longa</i> L. (Zingiberaceae)	Rhizom e	Small pox, chicken pox, scabies , facial, boils	Rhizome paste is applied on the infected skin. (Devi, 2017).	Phenolic diketone, curcumin (Ravindran et al., 2007) Antimicrobial Effects, Hepatoprotective Effects, Antioxidant Effects (Dujic et al., 2009; Park et al., 2000; Bernard et al., 1982).
47.	<i>Curcuma zedoaria</i> Roxb. (Zingiberaceae)	Rhizom e	Skin disease s	Fresh rhizome paste is applied to	Epicurzerene, curdione, and 5- isopropylidene-3, 8- dimethyl-1(5H)-

				cure skin disorders. (Pradhan & Badola, 2008).	azulenone (9.2%) (Lai et al., 2004) Anti-inflammatory activity, Antimicrobial and antifungal activity, Anticancer, Antiallergic activity, Antiulcer activity. (Wilson et al., 2005; Seo et al., 2005).
48.	<i>Datura metel</i> Linn. (Solanaceae)	Leaf	Ringworm, boils, wart	Decoction of Leaf is applied against the infected portion. (Devi, 2017).	Alkaloids, tannins, phlorotannins, cardiac glycosides, carbohydrates, flavonoids, amino acids, and phenolic compounds (Ratan et al., 2011). Antibacterial, Antifungal, Hypoglycemic, Anti-hyper glyceemic (Okwu and Igara, 2009).
49.	<i>Datura stramonium</i> Linn. (Solanaceae)	Leaf	Boils	Leaf paste is applied against boils. (Devi, 2017)	Glycosides, saponins, flavonoids, alkaloids, phenol, phlobatanins, Hyoscine and hyoscyamine. (Afsha et al. 2016; Sundarmoorthy et al., 2014) Anticancer, Antimicrobial, Antioxidant, Antifungal Effect. (Afsha et al., 2016)
50.	<i>Emblica officinalis</i> Gaertn (Euphorbiaceae)	Fruit	Scabies, Wrinkled skin	The extracted juice is mixed with sugar and then taken orally The paste	Alkaloids phyllantine, amllic acid, chebulagic acid, chebulic acid, linolenic acidtannin (Khan, 2009). Hypolipidemic activity,

				made from fruit is applied on the skin (Saikia et al., 2006)	antibacterial activity, antioxidant activity & antifungal activity. (Santoshkumar et al., 2013; Hossain et al., 2012).
51.	<i>Entada pursaetha</i> subsp. <i>sinohimalensis</i> Grierson & D. G. Long, (Mimosaceae)	Bark	Skin diseases	Paste of crushed bark or Juice is smeared to cure skin diseases. (Pradhan & Badola, 2008)	Not Reported
52.	<i>Eryngium foetidum</i> Linn. (Apiaceae)	Whole plants	Ringworm	Crushed of whole plant is used against ringworm. (Devi, 2017)	Volatile oils, aliphatic and aromatic compound (et al., 2017) Anti-oxidant, Antimicrobial, anti-proliferative activities (Chandrika et al., 2016)
53.	<i>Eupatorium birmanicum</i> DC (Asteraceae)	Leaf	Acne, burn	Leaf paste is used for the treatment of acne and burn. (Devi, 2017)	Coumarin, β -sitosterol, β -sitosterol-D-glucoside, Antifungal activity. (Devi et al., 2007)
54.	<i>Eupatorium odoratum</i> Linn. (Asteraceae)	Leaf	Wart and sore	Leaf juice is used for the treatment of wart and sore. (Devi, 2017)	Steroids, triterpenes, alkaloids, flavonoids, tannins, diterpenes, saponins, glycosides Lactones, diterpenes (Patel et al., 2011) Antioxidant Properties, Anti-Oxidant Activity, Anti-Inflammatory Activity, Hemostatic Activity (Afolabi et al., 2007).
55.	<i>Euphorbia</i>	Leaf	Wart	Leaf latex is	Diterpenes,

	<i>antiquorum</i> Linn. (Euphorbiaceae)		Boils	applied to reduce Skin eruption. (Devi, 2017)	Triterpenes, Flavonoids (Noemi et al., 2004).
56.	<i>Euphorbia neriifolia</i> Linn. (Euphorbiaceae)	Latex	Skin eruption	Latex juice is applied to reduce Skin eruption. (Devi, 2017)	Alkaloids, flavonoids, glycosides, phenols, saponins, tannins, terpenoids. (Bigoniya & Rana, 2010; Sharma & Pracheta, 2013; Bigoniya & Rana, 2017) Antioxidant, Antimicrobial, Anti- inflammatory/anti- thrombotic, Cytotoxicity. (Bigoniya & Rana, 2017; Bigoniya & Rana, 2010; Bigoniya & Rana, 2009).
57.	<i>Euphorbia thymifolia</i> Linn. (Euphorbiaceae)	Leaf	ringworm	Crushed of leaf is used for the treatment of Urticaria and ringworm. (Devi, 2017)	Alkaloids, Cinnamic acid derivatives, Phenolics (Khare, 2007) (Lee et al., 1990) Antibacterial, Anti- inflammatory, Antioxidant, Antimicrobial, Antifungal (Nagaraju et al., 2012; Prasad & Bisht, 2011; Mon et al., 2008; Khare, 2007).
58.	<i>Ficus glomerata</i> Roxb. (Moraceae)	Latex	Boils, skin eruption, leprosy	Paste of latex is used to cure boils and decoction of Fruit/ root/ bark is applied against Skin	Alkaloids, anthraquinone, cardiac glycoside, Coumarin, flavonoids, steroids, phenol, saponin, tannins; antidiuretic, hypolipidemic, anticholinesterase

				eruption, leprosy.(Devi 2017)	and anthelmintic. (Deep et al., 2020)
59.	<i>Ficus hispida</i> Linn. (Moraceae)	Leaf & bark	Ringworm	Decoction of Leaf and bark is applied against ringworm. (Devi, 2017)	Alkaloids, sterols, phenols, flavonoids, glycosides, saponins, terpenes, lupeol acetate, β -amyrine acetate, β -sitosterol. (Ghosh et al., 2004) Anti-inflammatory, antipyretic, antidiarrheal activity. (Sivaraman & Muralidharan, 2010).
60.	<i>Ficus palmata</i> Forks. (Moraceae)	Latex	Boils	Latex juice is applied to reduce Boils. (Devi, 2017)	Furanocoumarin derivatives, vanillic acid and psoralenoside methyl ether; Antiulcer activity, Antioxidant activity (Alqasoumi et al., 2014).
61.	<i>Ficus religiosa</i> Linn. (Moraceae)	Bark	Boils, scabies	Decoction of bark is applied against infected skin portion. (Devi, 2017)	Flavonoid, linoleic acid, phenolic, Phytosterols, tannins (Swami & Bisht, 1996) Antibacterial activity, Antioxidant activity, hypoglycemic activity (Bushra & Muhraf, 2009; Valsaraj et al., 1997; Ambike & Rao, 1967).
62.	<i>Ficus semicordata</i> F. Ham (Moraceae)	Latex	Boils	Latex is applied to reduce boils. (Devi, 2017; Pradhan & Badola, 2008).	Alkaloids Flavonoids Tannin, Glycoside Phenolic compound, Steroid, Saponin (Shashi et al., 2019); Antioxidant, antibacterial activity. (Rao et al., 2011,

					2012).
63.	<i>Foeniculum vulgare</i> Mill. (Apiaceae)	Whole plant	Scabies	The plant is crushed along with <i>Coriandrum sativum</i> and mixed with ghee and sugar and orally taken. (Saikia et al., 2006).	Cardiac glycosides, flavonoids sterols, Saponins, triterpenes, coumarins and volatile oils (WHO, 2001; Tanira et al., 1996). Gastrointestinal effects, Antimicrobial effect, Antiinflammatory and analgesic effects (Tognolini et al., 2007, Elizabeth et al., 2014, Salami et al., 2016).
64.	<i>Fumaria vaillantii</i> Loisel. (Papaveraceae)	Whole plant	Boils	Paste of whole plant is used to reduce boils. (Devi, 2017)	Anthelmintic, antipyretic, antidiarrhoeal (Hordgen et al., 2003; Gilani et al., 2005; Khattak et al., 1985) Alkaloids, flavone, biculline, cryptopine, fumariline, fumaritine, perfumine, paprarine, fumaric acid (Kurma & Mishra, 1997)
65.	<i>Garuga pinnata</i> Roxb. (Burseraceae)	Leaves	Ringw orm	Leaves are crushed and directly applied on the skin (Saikia et al., 2006)	Alkaloids, Terpenoids, saponin, tannin, glycosides, phenolic compounds; Anti microbial activity (Ramaraju & Emmanuel, 2013)
66.	<i>Glycosmis pentaphylla</i> (Retz.) Correa (Rutaceae)	Leaves	Urticar ia, scabies	Extract of leaves are applied on the affected	Alkaloids, coumarins, flavonoids & terpenoids.

				skin. (Devi,2017)	(Rahmani et al., 1998; Chakravarty et al., 1996; Ono et al., 1995; Tian et al., 1995) Antibacterial activity, Antifungal activity, Antioxidant activity, Hepatoprotective activity (Abbas et al., 2011; Amran et al., 2011; Nayak et al., 2011; Jeeshna et al., 2009).
67.	<i>Gmelina arborea</i> Roxb. (Verbenaceae)	Leaves	Boils	Extract of leaves are applied to cure Boils (Devi, 2017)	Flavonoids, saponins, terpenoids and cardiac glycosides (Chugh et al., 2012). Antioxidant Anti-diabetic activity, Anti-bacterial activity (Ghareeb et al., 2014).
68.	<i>Goniothalamus sesquipedalis</i> Hook.f & Thorn. (Annonaceae)	Leaves	Ringworm, scabies, wart, boils	Extract of leaves are applied against affected skin. (Devi, 2017)	Flavonoids, phenol and tannins; Antibacterial activity (Konsam et al., 2015)
69.	<i>Gossypium arboreum</i> Linn. (Malvaceae)	Flower & Seed	Scabies, sore	Paste of Flower/ seed are applied against Scabies, sore. (Devi, 2017).	Sinapic, ferulic, p-hydroxybenzoic acids, quercetin, and rutin; Antioxidant activity (Kazeem et al., 2013)
70.	<i>Gynocardia odorata</i> R.Br (Flacourtiaceae)	Fruit	Scabies, wart, urticaria	Decoctions of fruits are applied on the affected skin. (Devi, 2017)	Flavonoids, alkaloids, and steroids; Anti-inflammatory, analgesic and antipyretic effects Flavonoids, quercetin. (Rupeshkumar et al., 2014; Khan et al.,

					2013, Shrish et al, 2014).
71.	<i>Hedychium spicatum</i> Ham. (Zingiberaceae)	Root	Small pox, burn	Crush of root stock is used for the treatment of Small pox and burn. (Devi, 2017)	Saponins, Labdane diterpenes; Nootropic effects, memory restorative activity, Anti-inflammatory activity, Anticancer, cytotoxic properties (Shete & Bodhankar, 2010; Reddy et al., 2009, 2009; Srimal et al., 1984)
72.	<i>Heliotropium indicum</i> Linn. (Boraginaceae)	Leaves	Boils, insect bite	Leaf paste is applied on the affected skin to reduce Boils and insect bite. (Devi, 2017)	Volatile oil, Indicine-N-oxide, esters, terpenes; antitumor and antileukemic activities (Machan et al., 2006; Yasukawa et al., 2002; Kupchan et al., 1976).
73.	<i>Hemidesmus indicus</i> (L) R. Br. (Asclepiadaceae)	Root & Leaves	Skin eruption, Sore	Decoction of root Stalk leaf is used for the treatment of Skin eruption Sore. (Devi,2017)	Alkaloids, steroids, terpenoids, flavonoids, saponins, phenolic compounds, lignin; antiinflammatory, antipyretic, antinociceptive, antioxidant, antithrombotic, (Saravanan & Nalini, 2007a)
74.	<i>Hiptagebenghalensis</i> Linn. (Kurz)(Malpighiaceae)	Leaves	Sore, acne, urticaria, scabies.	Leaf paste is applied against affected skin to reduce Sore, acne, urticaria and scabies.	Triterpenes and steroid compounds; Anti-inflammatory effects (Hsu et al., 2015)
75.	<i>Hodgsoniamacrocarpa</i> (Blume) Cogn. (Cucurbitaceae)	Flower/ fruit /Leaf	Eczema, acne, sore	Decoction/Paste of Flower/fruit	Saponin & cytotoxicity. (Rizwana et al.,

			Wart	/Leaf is used for the treatment of Eczema, acne, sore and wart. (Devi, 2017)	2010)
76.	<i>Impatiens balsamina</i> Linn. (Balsaminacea)	Leaves	Ringworm	Leaf juice is applied against ringworm. (Devi, 2017)	Alkaloids, tannins, phlobatannins, saponins, carbohydrates, sterols and terpenoids, antioxidant activity (Kumaresan et al., 2019), Antibacterial and antifungal. (John et al., 2013).
77.	<i>Jasminum multiflorum</i> . (Burm. f.) Andrews. (Oleacea)	Leaves	Sore	Paste of leaf is used to reduce sore. (Devi, 2017)	Alkaloids, coumarins, flavonoids, tannins, terpenoids, glycosides, anthocyanins, phlobatinins, essential oil and saponins. (Dubey et al., 2016; Patil et al., 2012) Antioxidant effect, Insecticidal effect, antimicrobial effect. (Dubey et al., 2016; Raveen et al., 2015; Rama & Ampati, 2013)
78.	<i>Jasminum nervosum</i> Lour. (Oleaceae)	Root	Ringworm	Extract of root is applied to reduce ringworm. (Devi, 2017)	Caffeoyl phenylpropanoid glycosides, monoterpenoid glycoside, poliumoside; Antioxidant activities, cytotoxic activities (Guo et al., 2014); Anti-inflammatory activity, Anti-tumor

					activity (Calixto et al., 2003).
79.	<i>Jasminum subhumile</i> W.W.Sm. (Oleaceae)	Root	Ringworm	Extract of root is applied to reduce ringworm. (Devi, 2017)	Not Reported
80.	<i>Jatropha curcas</i> Linn.(Euphorbiaceae)	Latex & Seed	Sore and wart	Juice extract from Latex and Seed is used for the treatment of Sore and wart. (Devi,2017)	Terpenes, cyclic peptides alkaloids, lignans & flavonoids (Devappa et al., 2010a; Khafagy et al. 1977) Antioxidant activity, Antidiarrhoeal activity, Anti-inflammatory activity (Igbiosa et al., 2011; El Diwani et al., 2009).
81.	<i>Justicia adhatoda</i> L. (Acanthaceae)	Leaf	Abscesses Scabies, wart, urticaria	Leaf paste mixed with sugar and paste to the affected area.(Buragohain and Konwar, 2007) Leaf power is applied to the affected area. (Devi, 2017)	Alkaloids, cardiac glycosides, tannins, steroids saponins; anti-microbial, antifungal, antioxidant and hemolytic activity (Aziz et al., 2017)
82.	<i>Lagenaria siceraria</i> (Mol.) Standl. (Cucurbitaceae)	Leaf	Acne, alopecia	Juice of leaf and is applied to cure Acne and alopecia. (Devi, 2017)	Flavonoids, Volatile, Triterpenes. (Chatterjee et al., 2009; Chen et al., 2008) Antimicrobial activity, antistress property (Lakshmi & Sudhakar, 2009; Goji et al., 2006)

83.	<i>Lawsoniainermis</i> L (Lythraceae)	Leaf	Wrinkl ed skin	The extracted leaves is applied directly on the skin (Saikia et al., 2006)	Napthoquinone, isoplumbagin, triterpenoids, Hennadiol, aliphatics (3-methyl nonacosan-1- ol) (Dev, 2006) Antiviral Activity, anticancer Activity (Chaib et al., 2015; Hussain, 2010)
84.	<i>Leucas aspera</i> Spreng. (Lamiaceae)	Leaf	Skin eruptio ns, insect- bites, scabies , eczema , psorias is	Leaf Juice is applied to reduce Skin eruptions/ insect- bites/scabies/ eczema/ psoriasis. (Devi, 2017)	Oleanolic acid, ursolic acid and 3- sitosterol (Chaudhury & Ghosh, 1969) Antinociceptive, antioxidant and cytotoxic activities (Rahman et al., 2007)
85.	<i>Lindernia crustacea</i> (L.) F. Muell. (Scrophulariaceae)	Whole plants	Boils, urticari a, ringwo rm, sore	Whole plants is made Poultice and applied against Boils/ urticaria/ring worm/sore.(Devi, 2017)	Diterpene, anthraquinones, phenylpropanoid glycosides, flavonoids, lignan glycoside, cinnamic acid derivatives, anti-EBV activity. (Tsai et al., 2020)
86.	<i>Ludwigia clavelliana</i> Gomez de la Maza & Molinet (Euphorbiaceae)	Whole plants	Burn, urticari a	Whole plant made is Poultice and applied to cure skin burn/urticaria (Devi, 2017)	Not Reported
87.	<i>Lycopodium cernuum</i> Linn. (Lycopodiaceae)	Whole plants	Skin eruptio n	Whole plant made is Poultice and applied to cure skin eruption. (Devi, 2017)	Not Reported
88.	<i>Lycopodium clavatum</i> Linn.	Whole plants	Skin eruptio	Whole plant made is	Anti-inflammatory, antioxidant, and

	(Lycopodiaceae)		n	Poultice and applied to cure skin eruption. (Devi, 2017)	antimicrobial actions (Orhan et al., 2007) Alkaloids and triterpenoids (Wang et al., 2012)
89.	<i>Lyonia ovalifolia</i> (Wall.) Drude. (Ericaceae)	Young leaf/ bud/ flower	Skin allergy	Juice made from Young leaf/ bud/ flower is used to reduce skin allergy. (Devi, 2017)	Phenols, flavonoids, glycosides, tannins, xanthoprotein, quinone, emodin, saponins and resin (Karki et al., 2021) Antibacterial activity (Negi et al., 2012)
90.	<i>Mallotus philippinensis</i> Muell.-Arg. (Euphorbiaceae)	Fruit & Leaf	Scabies, ringworm and Boils	Powdery substances made from Fruit and Leaf is used for the treatment of Scabies, ringworm and Boils. (Devi, 2017)	Flavonoids, steroids, terpenoids, tannins and saponins (Moorthy et al., 2007) Antioxidative potentiality and antibacterial activity (Sharma et al., 2017)
91.	<i>Manihot esculenta</i> Crantz. (Euphorbiaceae)	Leafs	Wart, sore, eczema, scabies	Extract of leafs is applied against Wart, sore, eczema, scabies. (Devi, 2017)	Alkaloids, flavonoids, tannins, steroids, triterpenoids; antioxidant and cytotoxicity (Chinnadurai et al., 2019)
92.	<i>Melanorrhoea usitata</i> Wall. (Anacardiaceae)	Bark	Skin allergy, leprosy	Extract of Bark is used to cure Skin allergy/leprosy. (Devi, 2017)	Not reported.
93.	<i>Melastomamalabathricum</i> Linn. (Melastomaceae)	Bark/leaf/ root	Skin eruption, antiseptic	Extract of Bark/leaf/ root is used for the treatment of Skin eruption/anti	Kaempferol-3-O- β -D-xyloside, quercetin-3-O- α -L-rhamnosyl-(1 \rightarrow 2)- β -D-galactoside, flavan-3-ol, 4'-methylpeonidin-7-

				septic. (Devi, 2017).	<i>O</i> - β -D-glucoside, anthocyanins, and tannins (Lin, 2005) Antioxidant Activity; antiviral Activity (Susanti et al., 2007)
94.	<i>Melia azedarach</i> L. (Meliaceae)	Leaves	Carbuncle	The leaves boiled water is used to wash the infected place and then crushed leaves is mixed with ghee and then applied on the infected skin (Saikia et al., 2006)	Flavonoids, terpenoids, steroids, acids and anthraquinones, and melianol meliacin, meliacarpin, meliartenin vanillin (Sen & Batra, 2015) Antimalarial activity, antiulcer activity, antiprotozoal activity (Lee et al., 2007; Moursi et al., 1984)
95.	<i>Melothria heterophylla</i> (Lour.) Cogn. (Cucurbitaceae)	Leaf	Burn, acne, wart	Extract of leaf is used for the treatment of Burn, acne and wart. (Devi, 2017)	Antitumor and Antioxidant Activity (Mondal et al., 2013)
96.	<i>Meyna spinosa</i> Roxb. (Rubiaceae)	Fruit	boils	Extract of fruit is used to reduce boils. (Devi, 2017).	Carbohydrates, amino acids and peptides phytosterols carotenoids, polyphenols alkaloids; Antibacterial activity (Bhaumik et al., 2015).
97.	<i>Microcos paniculata</i> Linn. (Tiliaceae)	Bark, Leaf & fruit	Small pox, eczema, urticaria	Extract of Bark, leaf and fruit is used for the treatment of Small pox, eczema and urticaria. (Devi, 2017)	Flavonoids, Saponins, Triterpenoids, antinociceptive and antidiarrheal Activities (Moushome et al., 2016)

98.	<i>Mikania micrantha</i> Kunth. (Asteraceae)	Leaf	Ringworm, boils, wart	Leaf paste is applied against Ringworm, boils, and wart. (Devi, 2017)	Coumarins and derivatives, sesquiterpenes, sesquiterpenes lactones, diterpenes, phytosterols/terpenoids and flavonoids. (Gasparetto et al., 2010). Antimicrobial activity, and cytotoxic activity (Saikia et al., 2020)
99.	<i>Millettia pachycarpa</i> Benth. (Fabaceae)	Root	Scabies, urticaria	Decoction of root is used for the treatment of Scabies, urticaria. (Devi, 2017)	Isoflavonoids, triterpenoid, Flavonoids (JH et al., 1999, Singhal et al., 1980, Hui et al., 1973) Anticholinesterase activities, Antiestrogenic activity (Huang et al., 2012; Okamoto et al., 2006)
100.	<i>Mimosa pudica</i> Linn. (Mimosaceae)	Root	boils	Root paste is smeared externally to cure boils. (Pradhan & Badola, 2008)	Terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins, and coumarins (Gandhiraja et al., 2009) Antifungal activity, Antivenom activity, Antihepatotoxic and antioxidant potential (Nazeema & Brindha, 2009; Mahanta & Mukherjee, 2001)
101.	<i>Mirabilis jalapa</i> Linn. (Nyctaginaceae)	Leaf	Boils	Leaf paste is applied for the treatment of boils. (Devi, 2017).	Triterpenes and flavonoids (Siddiqui et al, 1990); Antimicrobial activity, anti-oxidant activity (Oladunmoye 2012; Dimayuja et al

					1998)
102.	<i>Murdania nudiflora</i> (Linn.) Brenan (Commelinaceae)	Whole Plant	Burn, urticaria, sore	Extract of whole plants to cure skin burns, urticaria, and sore. (Devi, 2017).	Alkaloides, Flavanoides, Tannins, Saponins, analgesic activity (Patwari et al., 2014)
103.	<i>Mussaenda frondosa</i> Linn. (Rubiaceae)	Root	Leprosy	Extract of root is applied against Leprosy disease. (Devi, 2017)	Alkaloids, tannins and phenolic compound, carbohydrate, steroids, and flavonoids; Diuretic activity (Sreelakshmi et al., 2015)
104.	<i>Nerium oleander</i> Linn. (Apocynaceae)	Root	Boils Wart, insect-bites Wart	Root paste is applied to reduce boils and extract of leaf and root bark is used for the treatment of wart. (Devi, 2017)	Glycosides, neriin and, alkaloid (Jayabalan & Rjaranthinam, 1995) Anticancer activity, Anti-inflammatory activity (Nagourne et al., 2001; Judith et al., 2001).
105.	<i>Nicotiana tabaeccum</i> Viv. Vaihlo. (Solanaceae)	Whole	skin infections	Entire plant is crushed and applied to the infected area 3 times a day. (Sajem & Gosai, 2006).	Not reported
106.	<i>Ocimum sanctum</i> L. (Lamiaceae)		Urticaria Ringworm	The extracted juice is mixed with <i>Curcuma longa</i> and orally taken. The paste made from <i>Ocimum sanctum</i> and <i>Curcuma</i>	Flavonoids, phenolic compounds, volatile oil (Yanpallewar et al., 2004; Gupta et al., 2002; Shah & Qadry, 1988) Antimicrobial activity, Antioxidant activity (Madhuri et al., 2010; Geeta et al., 2001)

				<i>longa</i> is added with Salt and rubbed on the infected skin. (Saikia et al., 2006).	
107.	<i>Opuntia dillenii</i> (Ker Gawl) Haw Cactaceae		Boils, burn	Poultice of Phylloclade is applied against boils and burns. (Devi, 2017)	Inflammatory, antifungal, anticancer (Katanic et al., 2019; Kumaar et al., 2013; Park et al. 2001)
108.	<i>Pandanus odoratissimus</i> Linn. (Pandaceae)		Leprosy, small pox, scabies	Leaf paste is used to cure Leprosy/ small pox/scabies. (Devi, 2017)	Alkaloids, flavanoids, glycosides, , steroids, terpenoids, saponins and tannins; Anti-inflammatory, anti-convulsant (Adkar et al., 2014; Panda et al., 2008).
109.	<i>Parkia roxburghii</i> G. Don. (Mimosaceae)		Wart	Extract of Bark/ leaf is used for the treatment of wart. (Devi, 2017)	Diabetes, α -Glucosidase, α -Amylase, Anti-hyperglycemic (Sheikh et al., 2016)
110.	<i>Pavetta indica</i> Linn. (Rubiaceae)		Boils	Leaf/root Poultice is used against to reduce boils. (Devi, 2017)	Anti-malarial activity, antimicrobial activity (Gupta et al., 2013; Sandra et al., 2009)
111.	<i>Phlogacanthus thyrsoiflorus</i> Nees (Acanthaceae)		Small pox, scabies	Inflorescence Paste is used to reduce Small pox/ scabies. (Devi, 2017)	Analgesic, anti-inflammatory, and anti-oxidant activities (Das et al., 2015)
112.	<i>Phyla nodiflora</i> (Linn.) Greene (Verbenaceae)		Boils	Leaf Poultice is applied to reduce boils. (Devi, 2017)	Anti-inflammatory, analgesic, antipyretic, antiatherosclerotic, antidandruff, antibacterial, hepatoprotective,

					antiurolithiatic, antimicrobial, and antioxidant abilities (Janki et al., 2011; Dodoala et al., 2010)
113.	<i>Phyllanthus urinaria</i> Linn. (Euphorbiaceae)		Leprosy, burn	Leaf juice is applied against Leprosy/ burn. (Devi, 2017)	Polyphenols, phenylpropanoid Anti-oxidative activities, anti-diabetic effects (Gunawan-Puteri et al., 2012; HY et al., 2011; Chularojmontri et al., 2005)
114.	<i>Pieris ovalifolia</i> (Wall.) D. Don (Ericaceae)		Inflammation, irritation and allergies.	Leaves crushed or mixed with water and then rubbed on the body to reduce. (Pradhan & Badola, 2008)	Not reported
115.	<i>Plantagoerosa</i> Wall ex Roxb. (Plantaginaceae)		Boils	Roast of seed and leaves are used for the treatment of boils. (Devi, 2017)	Antiviral and Immunoenhancing effect, Antitumoral effect (Oto et al., 2011, Ozaslan et al., 2007)
116.	<i>Plumbago indica</i> Linn. (Plumbaginaceae)		Wart, leprosy	Paste of root is applied against wart and leprosy. (Devi, 2017)	Alkaloids, flavonoids, steroids; Antimicrobial activity, antibiotics (Bisignano et al., 1996)
117.	<i>Plumbago zeylanica</i> Linn. (Plumbaginaceae)		Wart, boils	Decoction of root is used to reduce wart and boils. (Devi, 2017)	Alkaloids, phenols and flavonoids; Antidiarrheal activities; antiallergic, insecticidal, antidiabetic, hepatoprotective, hypolipidaemic (Aquil et al., 2006;

					Dai et al., 2004; Olagunju et al., 1999; Kubo et al., 1983).
118.	<i>Plumeria acuminata</i> W. T. Aiton (Apocynaceae)	Root bark/latex	Sore, Urticaria.	Decoction of Juice of root bark/latex is applied against sore and Urticaria. (Devi, 2017)	Anti-inflammatory activity (Thirumagal & Geetha, 2019)
119.	<i>Polygonum chinense</i> Linn. (Polygonaceae)	Leaf	Acne, wart	Leaf paste is applied against Acne and wart. (Devi, 2017)	Terpenoids, alkaloids, flavonoids, tannins, steroids and glycosides; Antimicrobial, antioxidant and cytotoxic activities in vitro (Ezhilan et al., 2012; Srividya et al., 2012; Thuan et al., 2012; Tsai et al., 1998)
120.	<i>Polygonum hydropiper</i> Linn. (Polygonaceae)	Leaves & Root	Boils, sore	Extract of leaf/root is applied against Boils/sore. (Devi, 2017)	Flavonoids, superoxide anion, & xanthine oxidase; Antifungal Activity, antioxidant Activity (Haraguchi et al., 1992)

Conclusion: The information of medicinal plants by the people of northeast India signifies a well diverse with its culture and tradition. In the present study we have recorded a total of 102 species under 58 families used by the people of Northeast India for the treatment of dermatological disorders and cosmetics. Some of the plants were found to have more than twice used in different skin diseases. However, additional extensive ethnobotanical documentation and ethnopharmacological study is needed to study within the region which may lead to the discovery of plants and compounds for skin diseases.

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Chapter 8

Diversity of hepatoprotective medicinal plants traditionally used in folk healing practices among the ethnic groups in North East India: a review

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Abstract

Ethnomedicinal plants and traditional healing practices have a significant role among the ethnic groups in the healthcare management in the North East Region. Traditional healer used to treat various diseases by using many herbal plant species. Among the other ailments, Jaundice is one of the common diseases among the peoples of this region, which is also treating traditionally. Present review describes the different ethno-medicinal plants used for healing jaundice by the ethnic groups in the region. The study reveals 153 medicinal plant species belonging to 67 different families. Among the reported 153 plant species, 65 species are used in combination with other plant species in the treatment of Jaundice. Among the total species reported in this

review, 69 species are herbs, 35 species are trees, 28 species are shrubs and 21 species are climber. Asteraceae (10), Leguminoaceae (9) and Phyllanthaceae (9) are the most dominant family followed by Cucurbitaceae (8), Amaranthaceae (6), Rubiaceae (6),

Acanthaceae (5), Poaceae (5), Rosaceae (5), Zingiberaceae (5), etc. The remaining families represented by one to four plant species (e.g., Rutaceae, Moraceae) or just a single one (e.g., Verbenaceae, Meliaceae, etc.). Some of the plant extracts have already been explored for their phytochemical and pharmacological significance and proved their potential in the preparation of new medicines or drugs against the treatment of jaundice. This review is an attempt to highlight the indigenous knowledge of medicinal plants, which are specifically used for the treatment of jaundice. The data mentioned in the present review is compiled from various sources like existing literature, books, Google Scholar, and Scopus publications. Among all the observed plant parts, the leaves are the most used parts for the treatment of jaundice by the ethnic groups of North east India with a percentage of 27%, followed by the roots (22%), fruits (13%), whole plant (12%), bark (9%), rhizome (5%), stem (5%), seed (5%), flower (3%), aerial part (2%), Bulb (1%), Tuber (1%), foliage (1%), inflorescence (1%) and young shoot (1%). Plants that are mostly utilized for the treatment of jaundice need to be scientifically validated by pharmacological investigation, which may yield new information in terms of drug discovery for jaundice treatment.

Keywords: Ethno-medicinal plant, Jaundice, Traditional Healing, North East India

Introduction

North East (NE) India consists of the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura is one of the richest repositories of medicinal and aromatic plants in the World. This region is also well-known for diverse culture and traditional knowledge of human races and home of large number of ethnic tribal people of India. Out of 450 tribal communities in India, the region alone provides the dwelling place of about 200 ethnic communities (Mao et al., 2009). The region can be considered as center of ethnic groups where peoples have strong cultural linkages with dependence on nature for their survival forests on a daily basis is very high. Most of the ethnic groups in this region live in the remote areas with close harmony to the adjacent forest areas. The socio-economic condition of the residents of forested areas is miserable and the ethnic communities cannot afford the expensive modern medical facilities. It is believed that they have developed their own traditional knowledge of herbal medicine through their aged long trial and error method and passed on orally from generation to generation. The practice of ritualistic healing and folk remedies has been an integral part of different ethnic

communities in the region. The continuation of these practices can be attributed to the traditional healing usage and their promising activity over due course of time. Among the different ailment Jaundice is one of common problems, which is generally treated by traditional healers with their traditional knowledge. Many authors (Raghuvanshi et al., 2021; Janghel et al., 2019), carried out ethnobotanical survey of plant traditionally used to treat jaundice disease in other parts of the nation, but there is lack of specific research on use of ethno-medicine on particularly Jaundice diseases. The objective of this paper is to collate as much as possible, available information about medicinal plants traditionally used for the management of Jaundice in North East India.

Methods

Ethnopharmacological data sources and collection

Systematic literature searches relevant to the field of ethnobotany were carried out and the available information on various plants traditionally used for jaundice disorders was collected from different bibliographical databases via electronic search (using Pubmed, Sci Finder, Scopus, Scirus, Science Direct, Google Scholar and Web of Science) and a library search for articles published in peer-reviewed journals and also locally available books. The phytochemicals and pharmacological activities, which are considered as helpful for the treatment of jaundice disorder are reported in this review include: Antioxidant, Anti-bacterial, Anti-inflammatory and antimicrobial activity.

Systematization of plant names and chemical structures

For the systematization of plant names and to check the status of plants gathered in this review, reliable online databases such as the International Plant Names Index (IPNI), Tropicos and The Plant List Version 1.1 (2013) were consulted. Only the accepted names and family of plants species highlighted in this database were listed in this review.

Results and Discussion

Ethnobotanical data of medicinal plants used for Jaundice treatment North East India

It was observed that approximately 153 ethnomedicinal plants belong to 67 families are used by the tribal and rural communities of North East India for curing jaundice. This information is described in Table 8.1 & 8.2, where plant families are arranged in

alphabetical order and include scientific name, family, habit, part used, mode of use and scientific evidence of hepatoprotective activity are reported. Among the reported 153 plant species, 65 species are used in combination with other plant species in the treatment of Jaundice (Table 8.1). Among the total species reported in this review, 69 species are herbs, 35 species are trees, 28 species are shrubs and 21 species are climber. Asteraceae (10), Leguminoaceae (9) and Phyllanthaceae (9) are the most dominant family followed by Cucurbitaceae (8), Amaranthaceae (6), Rubiaceae (6),

Acanthaceae (5), Poaceae (5), Rosaceae (5), Zingiberaceae (5), etc. The remaining families represented by one to four plant species (e.g., Rutaceae, Moraceae) or just a single one (e.g., Verbenaceae, Meliaceae, etc.). This result is similar with the findings of Raghuvanshi *et al.*, (2020), who also reported that maximum plants belong to major families, i.e., Asteraceae, Fabaceae, Euphorbiaceae species which are traditionally used to treat jaundice.

Plant's parts, Use and mode of preparation and Pharmacological evaluation

The leaves are the most used parts for the treatment of jaundice by the ethnic groups of North east India with a percentage of 27%, followed by the roots (22%), fruits (13%), whole plant (12%), bark (9%), rhizome (5%), stem (5%), seed (5%), flower (3%), aerial part (2%), Bulb (1%), Tuber (1%), foliage (1%), inflorescence (1%) and young shoot (1%) (Fig. 8.1). This shows that in most cases, the leaves of medicinal plants have more significance than any other plant part. Hence, it can be concluded that leaves are highly effective for curing jaundice, which may be due to more phytochemical accumulation in the plant leaves. However, roots are the second most used to treat jaundice; fruit belongs to the third position for treating jaundice. The result of this present review is also similar with the study of Raghuvanshi *et al.* (2020).

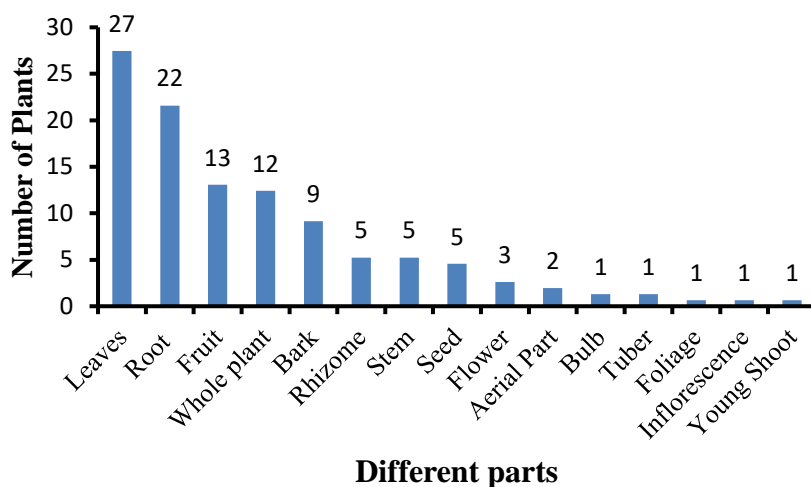


Fig. 8.1. Plant parts used as medicine.

3.3. Pharmacological evaluation

The medicinal property or activity of a plant species is mainly depended on the presents of various phytochemicals that occur naturally in the plants, which is used to cure Jaundice and various other diseases. An attempt has been made to review the pharmacological activity of the medicinal plants recorded based literature review to confirm their traditional use against jaundice. Total 119 plants out of 153 plant species have been found on which pharmacological studies were conducted to evaluate their antioxidant, anti-bacterial, anti-inflammatory and antimicrobial activity which are useful for the healing of jaundice. Remaining 34 species highlighted in the table yet to be evaluated pharmacologically in order to confirm their folkloric claim (Table 8.1 & 8.2). In vivo experimental studies with these plants (Table 8.1&8.2) have shown effective results in the treatment of jaundice and confer scientific evidence regarding plant use in the folk healing practices.

Table 8. 1. Combinations of Medicinal plants traditionally used for Jaundice.

Sl. No.	Species name	Family	Habit	Part used	Mode of use in jaundice	Hepatoprotective activity
Treatment I	<i>Mangifera indica</i> L.	Anacardiaceae	Tree	Bark	The juice of all plants are extracted and mixed well and one spoon is taken twice a day for one week. (Das et al., 2019).	<ul style="list-style-type: none"> • Leaf and Stem bark extract of <i>M. indica</i> contains effective antioxidants which are useful against liver injury (Karuppanan et al., 2014). • Methanol and aqueous extract of leaves of <i>A. heterophyllum</i> showing hepatoprotective activity (Prakash et al., 2016). • Methanol extract of
	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Tree	Bark		
	<i>Oroxylum indicum</i> (L.) Kurz	Bignoniaceae	Tree	Bark		
	<i>Passiflora nepalensis</i> Walp.	Passifloraceae	Climber	Whole plant		
	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Herb	Whole plant		
	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Climber	Whole plant		

						<p>whole plant of <i>P. nepalensis</i> record hepatoprotective activity (Khare et al., 2015).</p> <ul style="list-style-type: none"> • Ethanolic extract of whole plant of <i>C. dactylon</i> showing hepatoprotective activity (Surendra et al., 2008). • Alcoholic and aqueous extract of <i>C. reflexa</i> have showing hepatoprotective activity (Katiyar et al., 2015).
Treatment II	<i>Carica papaya</i> L.	Caricaceae	Shrub	Fruit	Intake of syarane and	<ul style="list-style-type: none"> • Aqueous leaf

	<i>Saccharum officinarum</i> L.	Poaceae	Herb	Stem	papaya are increased and the rhizome of curcuma zedonia is cut into pieces and chewed for 10-25 days. (Das et al., 2019).	extract of <i>C. papaya</i> record hepatoprotective activity (Mohammed et al., 2011).
	<i>Curcuma zedoaria</i> (Christm.) Roscoe	Zingiberaceae	Herb	Rhizome		<ul style="list-style-type: none"> Juice of <i>S. officinarum</i> the protects against hepatotoxicity presumably via antioxidant action (Patel et al., 2010). The phytochemicals present in <i>C. zedoraia</i> report hepatoprotective activity (Sumarheni et al., 2019).
Treatment III	<i>Bridelia retusa</i> (L.) A.Juss.	Phyllanthaceae	Tree	Bark	The bark of <i>B. retusa</i> and roots of <i>C. benghalensis</i>	<ul style="list-style-type: none"> The aqueous ethanolic extracts of <i>B. retusa</i> are
	<i>Commelina benghalensis</i>	Commelinaceae	Herb	Root		

	L.				are grounds and made into one spoon juice and taken twice a day. (Das et al., 2019).	<p>showing hepatoprotective activity (Raja & Srilakshmi, 2010).</p> <ul style="list-style-type: none"> • Aqueous and alcoholic root extract of <i>C. benghalensis</i> record hepatoprotective activity (Sambrekar et al., 2011).
Treatment IV	<i>Sapindus mukorossi</i> Gaertn.	Sapindaceae	Tree	Seed	The seeds of all the plants burned into fire till it chars, ground into paste, mixed with water and two spoon of which is taken a day for two days. The paste	<ul style="list-style-type: none"> • Extracts of fruit pericarp of <i>S. mukorossi</i> (Ibrahim et al., 2008). • Antioxidant activity of <i>R. succedanea</i> record hepatoprotect
	<i>Rhus succedanea</i> L.	Anacardiaceae	Tree	Seed		
	<i>Entada scandens</i> (L.) Benth.	Fabaceae	Climber	Seed		

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					is applied externally on the whole body in the evening and bath is taken in the next morning. (Das et al., 2019).	<div>ive activity (Shah et al., 2010).</div> <ul style="list-style-type: none"> Seed extracts of <i>Entada scandens</i> showing antimicrobial activity (Prabakaran et al., 2016).
Treatment V	<i>Edgeworthia</i> spp.	Thymelacaceae	Shrub	Root	The root is cut into very small pieces and is to be chewed once every seven days for three weeks. (Das et al., 2019)	
Treatment VI	<i>Artemisia vulgaris</i> L.	Asteraceae	Shrubs	Young Shoot	The young shoot tip of <i>A. vulgaris</i> and <i>R. calycinus</i> and made into paste. One spoon paste	<ul style="list-style-type: none"> The crude extract of the aerial parts report hepatoprotective activity
	<i>Rubus calycinus</i> Wall. Ex D.	Rosaceae	Climber	Root		

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	Don				is mixed with ½ glass of water and taken once a day for 10-15 days. (Das et al., 2019)	(Gilani et al., 2005)
Treatment VII	<i>Musa balbisiana</i> Colla	Musaceae	Herb	Inflorescence	Inflorescence is boiled with four to six crabs in water and decoction is given orally once daily for 7-10 days in the treatment of Jaundice. (Borborah et al., 2016).	
Treatment VIII	<i>Emblica officinalis</i> Gaertn.	Phyllanthaceae	Tree	Fruit	Dried fruits are taken against the treatment of Jaundice. (Khongsai et al., 2011)	<ul style="list-style-type: none"> • Fruit of <i>Emblica officinalis</i> showing hepatoprotective property (Jose & Kuttan, 2000)

Treatment IX	<i>Andrographis paniculata</i> (Burm.f.) Nees	Acanthaceae	Herbs	Whole plant	The plant extract is taken for the treatment of Jaundice (Das et al., 2019)	<ul style="list-style-type: none"> The extract of whole plant is reported for hepatoprotective activity (Nagalekshami et al., 2011).
Treatment X	<i>Phyllanthus amarus</i> Schumach. & Thonn.	Phyllanthaceae	Herbs	Fruits & leaves	Dried leaf and fruit powder is eaten twice a day for two weeks to cure Jaundice (Das et al., 2019).	<ul style="list-style-type: none"> Aqueous extract of whole plant of <i>P. amarus</i> recorded hepatoprotective activity (Pramyothinet al., 2007).
Treatment XI	<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	Shrubs	Leaf	Leaf extract is given in Jaundice (Das et al., 2019).	
	<i>Piper caninum</i> Blume	Piperaceae	Climber	Leaf		
Treatment XII	<i>Melothria perpusilla</i> (Blume) Cogn.	Cucurbitaceae	Climber	Whole plant	<i>M. perpusilla</i> plant is boiled in water along with	<ul style="list-style-type: none"> Aqueous extract of <i>M. perpusilla</i>

	<i>Mimosa pudica</i> L.	Leguminosae	Herb	Leaf	the plants of <i>M. pudica</i> and the soup is taken in against Jaundice (Das et al., 2019).	record hepatoprotective activity (Yengkhom et al., 2017). • Ethanol extract of leaves of <i>M. pudica</i> showing hepatoprotective activity (Purkayastha et al., 2016).
Treatment XIII	<i>Solanum nigrum</i> L.	Solanaceae	Herb	Whole plant	Freshly prepared extract of the plant is used in treatment of liver cirrhosis (Das et al., 2019).	• <i>S. nigrum</i> recorded hepatoprotective activity (Lin et al., 2008)
Treatment XIV	<i>Punica granatum</i> L.	Punicaceae	Shrubs	Fruits & Seeds	Dried seed powder mixed in water is taken for one treatment of Jaundice. Dried	• Fruit juice and seed extracts recorded hepatoprotective activity (Niknahad et

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					powder is mixed in sugar solution for the treatment of Jaundice, hepatitis and other disorders (Das et al., 2019)	al., 2012).
Treatment XV	<i>Justicia adhatoda</i> L.	Acanthaceae	Shrub	Root	Decoction of its roots is taken for a month in the treatment of Jaundice (Das et al., 2019)	<ul style="list-style-type: none"> Leaves and flowers extract of <i>J. adhatoda</i> showed hepatoprotective activity (Afzal et al., 2013).
Treatment XVI	<i>Cleistanthus monoicus</i> (Lour.) Müll. Arg.	Phyllanthaceae	Shrub	Root	The roots of these plants are grounded and the paste is collected in a cup of water. The mixture is boiled and taken orally (Das et	<ul style="list-style-type: none"> No report from <i>C. monoicus</i>. Roots of <i>S. ovalifolia</i> recorded hepatoprotective activity (Noor et al.,
	<i>Smilax ovalifolia</i> Roxb. ex D. Don	Smilacaceae		Root		

	<i>Ardisia paniculata</i> Roxb.	Primulaceae		Root	al., 2019).	2013). • Roots of <i>A. paniculata</i> recorded hepatoprotective activity (Noor et al., 2013).
Treatment XVII	<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	Climber	Stem	Fresh stem juice is taken orally twice a day for 7 days. Das et al., 2019	• Extract of all the parts reported hepatoprotective effect (Kavitha et al., 2011).
Treatment XVIII	<i>Lawsonia inermis</i> L.	Lythraceae	Shrub	Bark	The bark are crushed into paste and boiled with ½ liter of water. One pinch of salt is also added in this mixture. Half (½) cup of this liquid preparation is	• Leaf extract of this plant recorded hepatoprotective activity (Hossain et al., 2011).

					prescribed twice daily continuously for seven days. In case of children the amount of medicine is 3 tablespoon only twice daily (Deka and Nath, 2015).	
Treatment XIX	<i>Ficus lepidosa</i> Wall. ex Kurz	Moraceae	Tree	Leaf	Nine (9) number leaves of <i>F. lepidosa</i> and nine (9) number of petals of <i>T. divaricate</i> is paste with the help of mortar and is mixed carefully 100 ml fruit juice of <i>A. carambola</i> . 100 ml milk of goat is also added in this mixture. ½	<ul style="list-style-type: none"> The extract of whole plant of <i>T. divanicata</i> recorded hepatoprotective activity (Kannappan <i>et al.</i>, 2014). Fruit extract of <i>A. carambola</i> recorded hepatoprotective activity (Azeem <i>et al.</i>,
	<i>Tabernaemontana divaricata</i> (L.) R. Br. ex Roem. & Schult.	Apocynaceae	Shrub	Flower		
	<i>Averrhoa carambola</i> L.	Oxalidaceae	Tree	Fruit		

					cup of this mixture is prescribed thrice daily for 4 to 7 days after food. For children or adolescence boys/girls the herbal medicine is two table spoonful's twice daily. The patients are advice not to take spicy food items, meat, fishes during the period (Deka and Nath, 2015).	2010).
Treatment XX	<i>Justicia adhatoda</i> L.	Acanthaceae	Shrub	Leaf	Fifty (50) gm. fresh leaves of all the three plants namely, <i>J. adhatoda</i> , <i>C. cajan</i> and <i>P. fraternus</i> (with	<ul style="list-style-type: none"> Leaves extract of <i>J. adhatoda</i> record hepatoprotective activity (Afzal et al., 2013).
	<i>Cajanus cajan</i> (L.) Millsp.	Leguminosae	Shrub	Leaf		
	<i>Phyllanthus fraternus</i> G.L.	Phyllanthaceae	Herb	Leaf		

	Webster				<p>tender stem) are grinded and prepared tablets which are sun dried. These tablets are given to the patients for the treatment of jaundice. One tablet three times daily for continuously three days is prescribed. For children $\frac{1}{2}$ tablets is prescribed two times daily for 5-7 days. The patients are strictly prohibited to take fish, chillies, spicy food and advised to take</p>	<ul style="list-style-type: none"> • The seed of <i>C. cajan</i> record hepatoprotective activity (Rizket <i>al.</i>, 2016).
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					rest (Deka and Nath, 2015).	
Treatment XXI	<i>Phyllanthus fraternus</i> G. L. Webster	Phyllanthaceae	Herb	Leaf, Stem	Leaves of all the plant ingredients are crushed and the extract is boiled with ½ liter of water, a pinch of salt is also added in this preparation. After cooling the liquid extract is allowed to take internally at the rate of 3 tablespoon thrice daily before food for 5-8 days continuously. In case of children or adolescence boys or girls the	<ul style="list-style-type: none"> • The Saponin compound of <i>H. sibthorpioides</i> contains an anti-HBV compound (Huang et al., 2013). • The plant extract of <i>C. asiatica</i> record hepatoprotective activity (Antony et al., 2006). • Aqueous extract of <i>L. aspera</i> reported for its hepatoprotective and antioxidant activity (Banu et al., 2012). • The
	<i>Hydrocotyle sibthorpioides</i> Lam.	Apiaceae	Herb	Leaf		
	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Herb	Leaf		
	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Herb	Leaf		
	<i>Drymaria cordata</i> (L.) Willd. ex Schult.	Caryophyllaceae	Herb	Leaf		
	<i>Centipeda minima</i> (L.) A. Braun & Asch.	Asteraceae	Herb			

					dosage 1-2 tablespoonful. The patient is advised to drink hot water after taking the medicine. The patients are strictly prohibited to take curd, spicy food, fish, meat, turmeric. Consumption of boiled food is advised (Deka and Nath, 2015)	hepatoprotective activity of <i>D. cordata</i> is yet to be investigated. • The phytochemical groups present in <i>C. minima</i> also possessed various biological results including hepatoprotective activity (Linh et al., 2021).
Treatment XXII	<i>Swertia chirayita</i> (Roxb.) Buch.-Ham. ex C.B.Clarke	Gentianaceae	Herb	Stem/Leaf	Hundred (100) gm stem of both <i>J. adhatoda</i> and <i>A. indica</i> , 50 gm stem of <i>P. acuminata</i> and 100 gm stem/leaf of <i>S. chirayita</i> are	• The ethanol extract of <i>S. chirayita</i> recorded hepatoprotective activity (Verma et al., 2013).
	<i>Plumeria rubra</i> L.	Apocynaceae	Tree	Stem		
	<i>Justicia</i>	Acanthaceae	Shrub	Stem		• <i>Hydromethan</i>

	<i>adhatoda</i> L.				crushed and boiled and stored in a bottle. Two tablespoonful of this medicine is take daily after food for two times for five days. In case of children the prescribe dose is (½) tablespoon (Deka & Nath, 2015)	<p><i>olic and aqueous extracts of leaves of P. rubra recorded for hepatoprotective activity (Engineer et al., 2017).</i></p> <ul style="list-style-type: none"> • Leaf extract of <i>A. indica</i> reported for hepatoprotective activity (Chattopadhyay et al., 1992).
	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Tree	Stem		
Treatment XXIII	<i>Inula cappa</i> (Buch.-Ham. ex D. Don) DC.	Asteraceae	Herb	Leaves	Juice of crushed leaves taken orally in Jaundice (Lalramnghingl ova, 2016)	<ul style="list-style-type: none"> • Aqueous extract of whole plant of <i>I. cappa</i> significantly showed hepatoprotective activity
	<i>Lobelia angulata</i> G. Forst.	Campanulaceae	Herb	Leaves		

	<i>Plantago major</i> L.	Plantaginaceae	Herb	Leaves		<p>(Kaur et al., 2017).</p> <ul style="list-style-type: none"> Hepatoprotective activity of <i>Lobelia angulata</i> G. Forst. yet to be reported. <i>P. major</i> has hepatoprotective activity (Turel et al., 2009).
Treatment XXIV	<i>Smilax ovalifolia</i> Roxb. ex D. Don	Smilacaceae	Climber	Root	Clean roots boiled in water is used for taking bath and drunk in the treatment of Jaundice (Lalramnghingl ova, 2016)	<ul style="list-style-type: none"> Roots of <i>S. ovalifolia</i> recorded hepatoprotective activity (Noor et al., 2013).
	<i>Bridelia tomentosa</i> Blume	Phyllanthaceae	Shrub	Root		<ul style="list-style-type: none"> Hepatoprotective activity of <i>B. tomentosayet</i> to be reported.

Treatment XXV	<i>Ardisia paniculata</i> Roxb.	Primulaceae	Tree	Root	Crushed roots in combination with <i>S. ovalifolia</i> and <i>B. tomentosa</i> is boiled with water (Rai & Lalramnghingl ova, 2010).	<ul style="list-style-type: none"> • Roots of <i>A. paniculata</i> recorded hepatoprotective activity (Noor et al., 2013). • Roots of <i>S. ovalifolia</i> recorded hepatoprotective activity (Noor et al., 2013). • Hepatoprotective activity of <i>B. tomentosa</i> yet to be reported.
	<i>Smilax ovalifolia</i> Roxb. ex D. Don	Smilacaceae	Climber	Root		
	<i>Bridelia tomentosa</i> Blume	Phyllanthaceae	Shrub	Root		

Table 8.2. Medicinal plant traditionally used to treat Jaundice by the traditional healers in North Eastern Region.

Species name	Family	Habit	Part used	Mode of use in jaundice	Hepatoprotective activity
<i>Ipomoea aquatic</i> Forssk.	Convolvulaceae)	Aquatic herb	Whole plant	Extract of whole plant is used as medicine for jaundice.	<i>I. aquatic</i> showing the hepatoprotective activity (Alkiyumi et al., 2012).
<i>Achyranthes aspera</i> L.	Amaranthaceae	Herb	Stem & Leaf	Stem and leaf juice is used in the treatment of Jaundice (Das et al., 2008).	Root and Bark extract are reported for hepatoprotective activity (Fahim and Sathi, 2018).
<i>Ageratum conyzoides</i> (L.) L.	Asteraceae	Herb	Whole plant	Plant juice is taken orally once daily in jaundice (Das et al., 2008; Sarkar and Devi, 2017).	The extract of whole plant is reported for hepatoprotective property (Verma et al., 2013).
<i>Andrographis paniculata</i> (Burm. f.) Nees	Acanthaceae	Herb	Whole plant	The whole plants extract is taken for jaundice	The ethanol extract of <i>A. paniculata</i>

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				(Khongsai et al., 2011).	recorded hepatoprotective activity (Verma et al., 2013).
<i>Erythrina arborescens</i> Roxb.	Leguminosae	Tree	Seeds, barks	Decoction of seeds and barks taken orally to treat cholera and jaundice like disorders (Tsering et al., 2017).	Yet to be studied the hepatoprotective effect.
<i>Rosa sericea</i> Wall. ex Lindl.	Rosaceae	Shrub	Fruits	Infusion of fruits used to treat jaundice (Tsering et al., 2017).	Yet to be studied the hepatoprotective effect.
<i>Terminalia chebula</i> Retz.	Combretaceae	Tree	Fruit	Dried fruits chewed during severe fever and jaundice (Tsering et al., 2017).	Water extract of fruit of <i>T. chebula</i> recorded for hepatoprotective effect (Choi et al., 2015).
<i>Rheum nobile</i> Hook. f. & Thomson	Polygonaceae	Herb	Root	Decoction of root consumed	Not reported.

				during Jaundice (Tsering et al., 2017).	
<i>Neopicrorhiza scrophulariiflora</i> (Pennell) D. Y. Hong	Plantaginaceae	Herb	Root	Decoction of rhizome consumed to treat Jaundice (Tsering et al., 2017).	Root extract of this plant recorded for hepatoprotective activity (Wang et al., 2006).
<i>Ligularia amplexicaulis</i> DC.	Asteraceae	Herb	Root	Infusion of roots consumed to treat jaundice (Tsering et al., 2017).	Not reported.
<i>Berberis aristata</i> DC.	Berberidaceae	Shrub		Root used in the treatment of Jaundice (Shankar and Rawat, 2013)	Root extract of this plant recorded for hepatoprotective activity (Dehar et al., 2013).
<i>Coptis teeta</i> Wall.	Ranunculaceae	Herb	Root	Root tonic used in the treatment of jaundice (Shankar and	Not reported.

				Rawat, 2013).	
<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Tree	Fruit	Fresh fruit are used as liver tonic. The dried fruit are chewed in the treatment of Jaundice (Khongsai et al., 2011).	Dried leaves and stems extract of this plant recorded for hepatoprotective activity (Srirama et al., 2012).
<i>Oldenlandia Corymbosa</i> L.	Rubiaceae	Herb	Whole plant	Used in the treatment of Jaundice (Sailo et al., 2017).	Methanolic extract of the whole plant of this plant recorded for hepatoprotective activity (Sadasivan et al., 2006).
<i>Phyllanthus niruri</i> L.	Phyllanthaceae	Herb	Root	The root juice in combination with milk is used in Jaundice (Sailo et al., 2017).	Methanolic and aqueous extract of leaves and fruits of <i>P. niruri</i> recorded for hepatoprotective activity (Harish

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					& Shivanandappa, 2006).
<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Amaranthaceae	Herb	Leaves	Leaves are used (Gogoi et al., 2019)	Methanolic extract of the whole plant of <i>A. sessilis</i> is recorded for hepatoprotective activity (Bhuyan et al., 2018).
<i>Alseodaphne petiolaris</i> Hook .f.	Lauraceae	Tree	Bark	Paste of about 50 gm of dried bark and a type of an insect is given once daily (fresh preparation each day) for 1 week (Rout et al., 2012)	The hepatoprotective activity of this species is yet to be reported.

<i>Oxalis corymbosa</i> DC.	Oxalidaceae	Herb	Whole	Entire plant is crushed and the extract is taken thrice daily to counteract jaundice (Sajem & Gosai, 2006)	The hepatoprotective activity of this species is yet to be reported.
<i>Plantago major</i> L.	Plantaginaceae	Herb	Leaves	An equal proportion of crushed leaves and raw milk (w/v) is mixed and taken in an empty stomach for almost a week to cure jaundice (Sajem & Gosai, 2006).	Plant extract of <i>P. major</i> is recorded for hepatoprotective activity (Turel et al., 2009).
<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Herb	Rhizome	Dry ginger powder mixed with equal amount of honey is given in the treatment of Jaundice (riary et al., 2019).	Hepatoprotective effect is recorded for <i>Z. officinale</i> (Atta et al., 2010).

<i>Spinacia oleracea</i> L.	Amaranthaceae	Herb	Leaves	Leaves curry is used to treat Jaundice (Swargiary et al., 2019).	Methanol extract of <i>S. oleracea</i> is recorded for hepatoprotective activity (Maximas et al., 2014).
<i>Allium cepa</i> L.	Amaryllidaceae	Herb	Bulb	Finely chopped onion mixed with lemon juice is given to treat jaundice (Swargiary et al., 2019).	Bulb extract of this species is reported for hepatoprotective effect (Shaik et al., 2012).
<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Parasitic climber	Stem	Stem cut into small pieces and crushed. The paste so obtained is then diluted to double its content and filtered through cotton cloth. The filtrate (about 5 ml) is then taken internally in	Alcoholic and aqueous extract of <i>C. reflexa</i> have showing hepatoprotective activity (Katiyar et al., 2015).

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				empty stomach for 7 days in mornings during jaundice. (Choudhury, 1999).	
<i>Dipteris wallichii</i> (R.Br.) Moore.	Dipteridaceae	Shrub	Rhizome	Fresh rhizome cut into pieces pounded and made a paste. The paste is then diluted. The decoction is taken internally ½ cup about 20 ml) a day in empty stomach for the treatment of jaundice. This process is continued till recovery (Choudhury, 1999).	Not reported
<i>Eclipta prostrata</i> (L.) L. Mant.	Asteraceae	Herbs	Leaves	The juice of leaves given in	Hepatoprotective effect of <i>E.</i>

				jaundice (Choudhury, 1999).	<i>prostrata</i> is recorded (Dheeba et al., 2012).
<i>Flacourtia indica</i> (Burm. f.) Merr.	Salicaceae	Tree	Fruit	Fruits are used in jaundice (Choudhury, 1999).	Extracts of the aerial parts of <i>F. indica</i> (Burm. f.) Merr., were evaluated for hepato- protective effect (Nazneen et al., 2009).
<i>Magnolia champaca</i> (L.) Baill. ex Pierre	Magnoliaceae	Tree	Seed	About 10 gm. of seed powder is dissolved in a cup (about 40 ml) of cold water and taken in empty stomach in the treatment of jaundice. The disease is cured if it is taken regularly for 7	Flower extract of <i>M. champaca</i> possess promising hepatoprotective effect (Ananthi & Anuradha, 2015).

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				days (Choudhury, 1999).	
<i>Archidendron clypearia</i> (Jack) I. C. Nielsen	Leguminaceae	Tree	Leaves	Leaves boiled, the decoction is cold and used to give bath once a day during jaundice (Choudhury, 1999).	Not reported.
<i>Argemone mexicana</i> L.	Papaveraceae	Herb	Leaf	The boiled leaf is used in liver (Nonibala, 2010). Decoction of the leaves is used in jaundice (Sinha, 1996).	Extract of areal part of <i>A.</i> <i>mexicana</i> is recorded for hepatoprotective activity (Adam et al., 2011).
<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Climber	Fruit	The boiled fruit is used in jaundice and stomach ulcer and liver complaints (Nonibala,	Not reported.

				2010).	
<i>Potentilla indica</i> (Andr.) Wolf	Rosaceae	Herb	Whole plant	The plant is boiled and extract obtained is used in the treatment of jaundice (Nonibala, 2010).	Not reported.
<i>Oldenlandia Auricularia</i> (L.) K. Schum.	Rubiaceae	Herb	Whole plant	The boiled extract of the plant is used in liver problem (Nonibala, 2010).	Not reported.
<i>Oldenlandia diffusa</i> (Willd.) Roxb.	Rubiaceae	Herb	Leaf	Decoction of the plant is used in jaundice (Nonibala, 2010)	<i>O. diffusa</i> is recorded for hepatoprotective property (Sunwoo et al., 2015).
<i>Lygodium flexuosum</i> (L.) SW.	Lygodiaceae	Herb	Whole Plant	The boiled extract of the plant is used in the treatment of	<i>L. flexuosum</i> is recorded for hepatoprotective property (Wills

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				jaundice (Nonibala, 2010).	& Asha, 2006).
<i>Mimosa pudica</i> L.	Leguminosae	Herb	Whole plant	The boil of whole plant along with crystal sugar is used in jaundice (Nonibala, 2010).	Ethanol extract of leaves of <i>M. pudica</i> showing hepatoprotective activity (Purkayastha et al., 2016).
<i>Zehneria scabra</i> Sond.	Cucurbitaceae	Climber	Leaf	The boiled extract of the leaves along with sugar molasses is given in jaundice (Nonibala, 2010).	Not reported.
<i>Bixa orellana</i> L.	Bixaceae	Shrub	Leaf & Seed	Leaf & Seed extract is used in jaundice (Nonibala, 2010).	Seed extract is recorded for hepatoprotective activity (Singh et al., 2018).
<i>Mussaenda glabra</i> Vahl	Rubiaceae	Shrub	Leaf	Leaf extract is used in jaundice	Not reported.

				(Devi, 2013).	
<i>Amaranthus viridis</i> L.	Amaranthaceae	Herb	Root	Few granules of mishri (rock sugar) added to crushed root soaked in water for about 1 hour taken orally twice a day before food (Kom et al., 2018).	Plant extracts of this plant is recorded for hepatoprotective activity (Sundarrajan et al., 2017).
<i>Artocarpus lacucha</i> Buch.-Ham.	Moraceae	Tree	Root	Few granules of mishri (rock sugar) added to crushed root soaked in water for about 1 hour taken orally twice a day before food (Kom et al., 2018).	Fruit extract is recorded for hepatoprotective activity (Saleem et al., 2018).
<i>Melothria perpusilla</i> (Blume) Cogn.	Cucurbitaceae	Creeper	Whole plant	The decoction of the whole plant	Aqueous extract of <i>M. perpusilla</i>

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				mixed with mishri (rock sugar) is administered orally (Kom et al., 2018).	is recorded for hepatoprotective activity (Yengkhom et al., 2017)
<i>Pavetta indica</i> L.	Rubiaceae	Shrub	Leaves	10-15 leaves are boiled in about 300 ml water with or without salt. The decoction (one tea cup) is given both in the morning and evening before food for 6 months in the treatment of Jaundice & liver cirrhosis (Kom et al., 2018).	Ethanol extract of <i>P. indica</i> ” exhibited significant hepatoprotective activity.
<i>Mukia maderaspatana</i> (L.) M. Roem.	Cucurbitaceae	Climber	Whole plant	Decoction is taken orally to treat Jaundice (Ningombam et	Not reported.

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				al., 2014).	
<i>Zanthoxylum rhetsa</i> (Roxb.) DC.	Rutaceae	Tree	Leaves	Decoction is taken orally to treat jaundice (Ningombam et al., 2014).	Not reported.
<i>Sonchus brachyotus</i> DC.	Asteraceae	Herb	Root	Root extract is given in Jaundice (Singh, 1990).	Not reported.
<i>Hygrophila salicifolia</i> (Vahl) Nees	Acanthaceae	Herb	Leaves	The plant extract is used for stomach complaints and jaundice (Singh, 1990).	The plant extract is recorded for hepatoprotective activity (Feng et al., 2005).
<i>Gymnopetalum chinense</i> (Lour.) Merr.	Cucurbitaceae	Climber	Whole aerial part	Whole aerial parts of the plant are boiled and drink as a prescription against jaundice (Pofze, 2012).	Not reported
<i>Lantana camara</i> L.	Verbenaceae	Shrub	Flower	Boiled extract of flowers is given	Extract of this species is

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				as remedy for jaundice (Pofze, 2012).	reported for hepatoprotective activity (Asija et al., 2015).
<i>Mahonia napaulensis</i> DC.	Berberidaceae	Shrub	Stem Bark & Root	Decoction of stem bark or root is prescribed against fevers and jaundice (Pofze, 2012).	Not reported.
<i>Nymphoides indica</i> (L.) Kuntze	Menyanthaceae	Aquatic Herb	Whole Plant	Decoction of plant used against fever and jaundice (Rajkumari et al., 2013).	Whole plant extract of <i>N.hydrophylla</i> is recorded for hepatoprotective activity (Bharathi et al., 2014).
<i>Celtis australis</i> L.	Cannabaceae	Tree	Fruit	The juice obtained by crushing the fresh fruit is mixed with water and honey and prescribed	Not reported.

				in Jaundice and dysentery (Salam, 2013).	
<i>Garcinia pedunculata</i> Roxb. ex Buch.-Ham.	Clusiaceae	Tree	Fruit	Immature fruit are eaten raw for jaundice (Salam, 2013).	Fruit extract is reported for hepatoprotective activity (Mundugaru et al., 2014).
<i>Oroxylum indicum</i> (L.) Kurz	Bignoniaceae	Tree	Bark	Boiled extract of the bark mixed with the leaf juice of <i>Mussaenda roxburghii</i> is taken orally to cure jaundice (Salam, 2013).	Extract of the stem bark <i>O. indicum</i> is recorded for hepatoprotective property (Mohapatra et al., 2018).
<i>Boerhaavia diffusa</i> L.	Nyctaginaceae	Herb	Leaves	Leaf juice (15 ml) is taken orally 2 times to treat jaundice (Dolui et al., 2004).	Alcoholic extract of whole plant of <i>B. diffusa</i> is recorded for hepatoprotective property (Chandan et al., 1991).

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<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	Herb	Root	Root juice is used for jaundice (Kayang et al., 2005).	Extract of <i>E. indica</i> is recorded for hepatoprotective activity (Iqbal & Gnanaraj, 2012).
<i>Thalictrum foliolosum</i> DC.	Ranunculaceae	Herb	Root	The decoction of the roots is used to treat jaundice (Neogi et al., 1989).	Root ethanolic extract of <i>T. foliolosum</i> is recorded for hepatoprotective property (Marlin & Prakash, 2020).
<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	Climber	Leaves	Crushed juice of the leaves taken internally for jaundice (Khangte & Lalramnghinglova, 2017).	Dried seeds of <i>B. hispida</i> are recorded for hepatoprotective property (Patel et al., 2012).
<i>Curcuma longa</i> L.	Zingiberaceae	Herb	Rhizome	Decoction of root stock taken for jaundice	Rhizome extract is recorded for hepatoprotective property

				(Khiangte & Lalramnghinglo va, 2017).	(Karamalakova et al., 2019).
<i>Dendrocnide sinuata</i> (Blume) Chew	Urticaceae	Shrub	Root	Decoction of roots taken internally for jaundice (Khiangte & Lalramnghinglo va, 2017).	Aqueous extract of <i>D. sinuata</i> root bark is recorded for hepatoprotective effect (Angom et al., 2018).
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Shrub	Flower	Raw flower is taken for curing Jaundice (Lalfakzuala et al., 2007).	Flower extract of <i>H. rosa-sinensis</i> is recorded for hepatoprotective effect (Biswas et al., 2014).
<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	Tree	Root	Root decoction is taken in Jaundice (Lalfakzuala et al., 2007).	Bark extract of <i>L. speciosa</i> is recorded for hepatoprotective activity (Pal et al., 2020).
<i>Chonemorpha fragrans</i> (Moon) Alston	Apocynaceae	Climber	Fruit, root and leaf	Fruit, root and leaf were taken raw or boiled with water and	Ethanollic extract of <i>C. fragrans</i> root is recorded for

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				taken for jaundice (Lalmuanpuii, 2013)	hepatoprotective activity (Duraishankar et al., 2015).
<i>Vitex peduncularis</i> Wall. ex Schauer	Lamiaceae	Tree	Stem Bark	Stem bark was boiled with water and drink in the treatment of jaundice (Lalmuanpuii, 2013).	Not reported.
<i>Phyllanthus fraternus</i> G.L.Webster	Phyllanthaceae	Herb	Stem Bark	Raw or hot water decoction of stem bark and leaves were taken for treating diabetes and jaundice (Lalmuanpuii, 2013).	Aqueous extract of this species is recorded for hepatoprotective activity (Lata et al., 2014).
<i>Baccaurea ramiflora</i> Lour.	Phyllanthaceae	Tree	Stem bark	Hot or cold- water decoction of the stem bark used in the treatment of jaundice	Not reported.

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				(Lalmuanpuii, 2013).	
<i>Anodendron paniculatum</i> A. DC.	Apocynaceae	Shrub	Leaves & Fruit	Raw leaves and fruits were eaten for jaundice (Lalmuanpuii, 2013).	Not reported.
<i>Inula cappa</i> (Buch.-Ham. ex D. Don) DC.	Asteraceae	Herb	Leaves	Leaves juice is used for treating jaundice (Lalmuanpuii, 2013).	Not reported.
<i>Clerodendrum serratum</i> (L.) Moon	Lamiaceae	Shrub	Leaves	Leaf decoction of 4 -5 leaves used in jaundice twice a day and improves high blood pressure (Rama Shankar et al., 2012)	Ethanol extract of <i>C. serratum</i> roots is recorded for hepatoprotective property (Vidya et al., 2007).
<i>Thunbergia grandiflora</i> (Roxb. ex Rottl.) Roxb.	Acanthaceae	Climber	Root	Root powder or paste (1 gm.) is taken twice a day in the treatment of jaundice (Rama	Aqueous methanol extract of leaves of <i>T. grandiflora</i> is recorded for hepatoprotective

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				Shankar et al., 2012).	effect (Ibrahim et al., 2017).
<i>Acacia concinna</i> (Willd.) DC.	Leguminaceae	Tree	Leaves	A mixture of infusion of leaves, black pepper and tamarind is taken orally in the treatment of jaundice (Sharma et al., 2001).	Not reported.
<i>Amomum subulatum</i> Roxb.	Zingiberaceae	Herb	Rhizome	Decoction of the rhizome (5 ml, 4 times daily) is taken orally in jaundice (Sharma et al., 2001).	Methanolic extract of <i>A. subulatum</i> seeds is reported for hepatoprotective property (Parmar et al., 2009).
<i>Curcuma caesia</i> Roxb.	Zingiberaceae	Herb	Rhizome	The infusion of fresh rhizome is taken for jaundice (Jamir et al., 2012)	Rhizome extract of <i>C. caesia</i> is recorded for hepatoprotective property (Baghel et al., 2013).

<i>Brassica oleracea</i> L.	Brassicaceae	Herb	Foliage	The fresh juice of the foliage is consumed to treat jaundice (Kichu et al., 2015).	Inflorescence extract of <i>B. oleracea</i> is recorded for hepatoprotective property (Hashem et al., 2013).
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Herb	Fruit	About 50 ml juice of fresh fully ripened fruit is mixed with 100gm of sugar and taken 10 ml twice in a day after food for a week in the treatment of Jaundice (Singh et al., 2015).	Pineapple juice exhibited hepatoprotective activity (Yantih et al., 2017).
<i>Asparagus racemosus</i> Willd.	Asparagaceae	Climber	Root	Root pounded into paste and taken orally in jaundice (Rama Shankar & Devalla, 2012).	Aqueous extract of <i>Asparagus racemosus</i> root is recorded for hepatoprotective activity

					(Rahiman et al., 2011).
<i>Cassia fistula</i> L.	Leguminosae	Tree	Fruit	Fruit pulp used in the treatment of jaundice and liver diseases (Rama Shankar & Devalla, 2012).	Fruit extract were recorded for hepatoprotective activity (Ahirwar et al., 2010).
<i>Rumex nepalensis</i> Spreng.	Polygonaceae	Herb	Root	Infusion of root is used in the treatment of hepatitis and taken as liver tonic (Chhetri, 2005).	Not reported.
<i>Oxalis corniculata</i> L.	Oxalidaceae	Herb	Whole plant	The whole plant juice is taken as a liver tonic (Chhetri, 2005).	Plant extract were recorded for hepatoprotective activity (Sreejith et al., 2013).
<i>Corydalis govaniana</i> Wall.	Papaveraceae	Herb	Root	Decoction of root is used as a liver tonic (Chhetri, 2005).	The phytochemical govaniadine isolated from the

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					plant extract of <i>C. govanianais</i> recorded for hepatoprotective activity (Jahan et al., 2021).
<i>Cinnamomum bejolghota</i> (Buch.-Ham.) Sweet	Lauraceae	Tree	Bark	Decoction of bark is used as liver tonic (Chhetri, 2005)	Not reported.
<i>Abrus precatorius</i> L.	Fabaceae	Climber	Root	Root used against jaundice (Dahal, 2019)	Seed extract is recorded for hepatoprotective property (Battu & Kumar, 2009).
<i>Aphanamixis polystachya</i> (W all.) R. Parker	Meliaceae	Tree	Bark	Bark used to cure liver disorder & jaundice (Dahal, 2019)	Not reported.
<i>Bacopa monnieri</i> (L.) Wettst.	Plantaginaceae	Herb	Whole plant	Plant juice is used to treat Jaundice (Dahal, 2019)	Plant extract is recorded for hepatoprotective property (Gudipati et al., 2012).

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<i>Betula utilis</i> D. Don	Betulaceae	Tree	Stem Bark	Decoction of stem bark is used in the treatment of Jaundice (Dahal, 2019).	Not reported.
<i>Citrus aurantiifolia</i> (Christm.) Swingle	Rutaceae	Tree	Leaf	Leaves juice taken on empty stomach to cure jaundice (Dahal, 2019)	Peels extracts is recorded for hepatoprotective property (Oyinloye et al., 2020).
<i>Citrus maxima</i> (Burman) Merrill	Rutaceae	Tree	Fruit	Fruit juice taken against jaundice (Dahal, 2019).	Leaves extract is recorded for hepatoprotective activity (Feksa et al., 2018).
<i>Citrus medica</i> L.	Rutaceae	Tree	Root	Decoction of root used to cure jaundice (Dahal, 2019).	Not reported.
<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Climber	Fruit	Fruits useful in the treatment of jaundice (Dahal, 2019).	Leaves extract is recorded for hepatoprotective activity (Kundu et al., 2012).

<i>Cucumis sativus</i> L.	Cucurbitaceae	Climber	Fruit	Fruits is used in the treatment of Jaundice (Dahal, 2019)	Ethanollic extract of the fruits of <i>C. sativus</i> is recorded for hepatoprotective activity (Gopalakrishnan & Kalaiarasi, 2013).
<i>Curculigo orchioides</i> Gaertn.	Hypoxidaceae,	Herb	Tuber	Pounded tuber given in jaundice and liver complaints (Dahal, 2019).	Rhizomes extract of <i>C. orchioides</i> recorded for hepatoprotective activity (Babu <i>et al.</i> , 2013)
<i>Desmostachya bipinnata</i> (L.) Stapf.	Poaceae	Herb	Whole plant	Root used to cure jaundice (Dahal, 2019)	Root extract of this species is recorded for hepatoprotective activity (Rahate & Rajasekaran, 2015).
<i>Gossypium arboretum</i> L.	Malvaceae	Shrub	Flower	Decoction of flowers used to cure Jaundice	Not reported.

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				(Dahal, 2019)	
<i>Imperata cylindrica</i> (L.) Raeusch.	Poaceae	Herb	Rhizome	Rhizome juice taken against jaundice (Dahal, 2019)	Rhizome extract is recorded for hepatoprotective property (Ma <i>et al.</i> , 2018).
<i>Jatropha curcas</i> L.	Euphorbiaceae	Shrub	Leaves	Decoction of leaves used against jaundice (Dahal, 2019).	Leaf extract is recorded hepatoprotective activity (Adejumobi <i>et al.</i> , 2012).
<i>Nardostachys jatamansi</i> (D. Don) DC.	Caprifoliaceae	Herb	Rhizome	Infusion of rhizomes taken to cure Jaundice (Dahal, 2019)	Ethanollic extract of the rhizomes is recorded for hepatoprotective property (Ali <i>et al.</i> , 2000).
<i>Phlogacanthus thyrsiflorus</i> Nees.	Acanthaceae	Shrub	Leaves	Leaf juice taken to cure jaundice (Dahal, 2019).	Leaves extract is recorded for hepatoprotective property (Saikia <i>et al.</i> , 2019).
<i>Portulaca oleracea</i> L.	Portulacaceae	Herb	Aerial Part	Aerial parts used in	Aqueous extract of <i>P. oleracea</i> is

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				Jaundice (Dahal, 2019)	recorded for hepatoprotective property (Anusha et al., 2011).
<i>Potentilla lineata</i> Trevir.	Rosaceae	Herb	Root	Root juice used to cure jaundice (Dahal, 2019)	Not reported.
<i>Pterocephalus hookeri</i> (C.B. Clarke) E. Pritz.	Caprifoliaceae	Herb	Aerial part	Infusion of aerial part taken to cure jaundice (Dahal, 2019)	Not reported.
<i>Rubia cordifolia</i> L.	Rubiaceae	Climber	Root	Root juice taken on empty stomach to cure jaundice (Dahal, 2019)	Extracts of roots of <i>R. cordifolia</i> is recorded for hepatoprotective property (Babita et al., 2007).
<i>Rubus ellipticus</i> Sm.	Rosaceae	Shrub	Root	Decoction of root taken to cure jaundice (Dahal, 2019)	Not reported.
<i>Sarcococca hookeriana</i> Baill.	Bischofiaceae	Shrub	Root	Root juice taken in treatment of jaundice (Dahal, 2019).	Not reported.

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<i>Senecio scandens</i> Buch.-Ham. ex D. Don	Asteraceae	Herb	Leaves	Leaves juice taken to cure jaundice (Dahal, 2019).	Not reported.
<i>Tamarindus indica</i> L.	Leguminosae	Tree	Leaf	Leaf juice taken in the treatment of jaundice (Dahal, 2019).	Leaves extract is recorded for hepatoprotective property (Rodriguez Amado et al., 2016).
<i>Taraxacum campylodes</i> G. E. Haglund	Asteraceae	Herb	Root	Roots juice taken against jaundice (Dahal, 2019).	Not reported.
<i>Urtica dioica</i> L.	Urticaceae	Herb	Leaves	Boiled leaves taken to cure jaundice (Dahal, 2019).	Whole plant extract is recorded for hepatoprotective property (Joshi et al., 2015).
<i>Xanthium strumarium</i> L.	Asteraceae	Herb	Leaves	Decoction of leaves and fruits taken to cure jaundice (Dahal, 2019).	Fruit extract is recorded for hepatoprotective property (Wang et al., 2011).

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<i>Zephyranthes carinata</i> Herb.	Amaryllidaceae	Herb	Bulb	Decoction of bulb taken against jaundice (Dahal, 2019)	Not reported.
<i>Dactylorhiza hatagirea</i> (D. Don) Soo	Orchidaceae	Herb	Tuber	The tuber is made into paste (1-2 gm per dose) and is prescribed twice daily in case of Jaundice and is taken till recovery (Maity et al., 2004).	Not reported.
<i>Cucurbita pepo</i> Linn.	Cucurbitaceae	Climber	Fruit	Ripen fruits cure jaundice (Pradhan & Badola, 2008).	Seed extract is recorded for hepatoprotective property (Elmeligy et al., 2019).
<i>Bryophyllum pinnatum</i> (Lam.) Oken	Crassulaceae	Herbs	Leaves	Juice is administered in jaundice (Das & Choudhury, 2012)	Leaves extract is recorded for hepatoprotective property (Yadav & Dixit, 2003).

Conclusions

In this review, we described the medicinal plants used to treat jaundice and liver disorders in North East India. Local people or traditional healers are using plants without any scientific base. There are large number of important plant resources in this region, practices and folk healing knowledge among the ethnic groups, which can address several problems in the health science. The details documentation of folk medicine and healing practices and their scientific validation is utmost important to preserve this precious knowledge and for wider use for health management and disease treatment. Phytochemical screening for progressive chemical constituents, clinical studies and biological activities is of global importance. Therefore, such popular plant species could be further analyzed for bioactive constituents, *in vivo/in vitro* biological activities, which may lead to new and potential drugs. This review provides a baseline data for initial screening of promising plants used in jaundice treatment and liver disorders in this north eastern region, India.

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Chapter 9

DIVERSITY OF MEDICINAL PLANTS TRADITIONALLY USED TO TREAT GASTROINTESTINAL AILMENTS AMONG THE ETHNIC GROUPS IN NORTH EAST INDIA: A REVIEW

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Abstract

The present documentation has gathered information from published literature on plant based traditional medicine used by the dependent communities along with their traditional way of treating different stomach related diseases/disorders recorded from different parts of North East India. We documented a total of 400 species belonging to 303 genera and 114 families used to treat gastrointestinal disorders in North Eastern part of India. Most of the reported medicinal plant species were Angiosperms (395 species), followed by gymnosperms (3 species) and pteridophytes (2 species). Asteraceae was the most dominant family reported to be used for the treatment of gastrointestinal tract. Among all the plant parts leaves are highly preferred in stomach disorder by the healers. Juice/extract (148 species) was the most popular form of treatment used. We focused the diversity and importance of

medicinal plants used to treat gastrointestinal disorders in the traditional health care system of North east region. As such disorders are still causing several deaths each year, it is of the utmost importance to conduct phytochemical and pharmacological studies on the most promising species. It is also crucial to increase access to traditional medicine, especially in rural areas. Threatened species need special attention for traditional herbal medicine to be exploited sustainably.

Keywords: North East India, Traditional medicine, Gastrointestinal disorder, Pharmacological activity

Introduction

Gastrointestinal Disorder

Gastrointestinal diseases affect the gastrointestinal (GI) tract from the mouth to the anus. It basically effects the functions of the digestive tract, i.e., food and liquid absorption, digestion, or excretion (Neamsuvan et al., 2012). Such disorders are caused by infections by various kinds of bacteria, viruses and parasitic organisms (Mathabeet al., 2006; Karki & Tiwari, 2007). In human being, the gastrointestinal (GI) tract is considered as the most important organ vulnerable to diverse diseases such as bloating, constipation, diarrhea, gastroenteritis, reflux and parasitic and other infectious ailments (Kasper et al., 2005). Diet dependent GI ailments are mainly due to disordered eating patterns in individual's body. These patterns describe irregular eating behaviors like skipping meals, restricted food types, fasting and binge eating (Grilo, 2006). These ailments slowly and steadily lead to mortality, particularly in developing countries where proper sanitation facilities are deficient (Pawlowski et al., 2009; Tuite et al., 2011). According to reported studies, diarrhea as infectious disease occurs in about 19-83 people out of every 100 people annually depending on regions (Porcelliet al., 2004). Outbreaks of diarrhea, dysentery, or cholera caused by contaminated drinking water have claimed millions of lives worldwide, mainly infants and children (Ryan, 2011). Diarrhoea itself responsible for killing around 52,5000 children every year all over world and it is the second leading cause of death in children under five years old (WHO, 2009). Infection is spread generally through contaminated food or drinking-water, or from person-to-person as a result of poor hygiene (WHO, 2017). Serious diarrhea/dysentery/cholera gastrointestinal outbreaks were reported in Ethiopia (Bartels et al., 2010), Haiti (Tuite et al., 2011), Vietnam (Anh et al., 2011), Zimbabwe (Fisher, 2009), Nepal (Bhandari et al., 2009) and India (Ramamurthy & Sharma, 2014) all with a high death toll. India has an estimated about 1.5 million patients affected by Gastrointestinal disorder every year due to eating indigestible, excessive or irregular foods, imbalanced and spicy diets, and adulteration of food and contamination of drinking water (Kedia & Ahuja, 2017).

Traditional herbal medicines in Ethnodermatological practices

Natural products (NPs) signify large and diverse secondary metabolites with a comprehensive choice of biological activities those have established with their numerous practices, particularly in human and veterinary. Pharmaceutical, insecticidal, and herbicidal importance have been driven from Natural products discovery and been taken a significant role after the discovery of penicillin more than 85 years ago. Since then, numerous NPs have been isolated and characterized. What mostly have fascinated NP scientists the phytochemical diversities and their complication to find out proper manifestation in treatment and management of diseases (Adhikari & Paul, 2018). However, throughout the ages, humans have relied on mother nature for the practice of herbal and phytonutrients treatment to fight against numerous diseases which are expanding across the world and about 80-85% or about 6 billion people worldwide trust herbal medication for the treatment of various diseases (WHO, 2004; Ekor, 2014).

Approximately 70-80% of global population of human depends on plants for medicine in prime healthcare (Singh et al., 2014). Indian traditional medicine, the foundation of age-old practice of medicine in the world, has played an essential role in human health care service and welfare from its inception. (WHO, 2008). Traditional medicine are much compatible with nature of human body and are reported to have little or no side effects (Rafieian-Kopaei, 2012; Nasri&Shirzad, 2013). Use of plant species as medicine is primary system of medication for the people residing in remote places of sub-urban or rural areas (Nandankunjdam, 2006). In India, 65% of the population in rural areas use Ayurveda and medicinal plants to help meet their primary health care needs. (WHO, 2003). The use of medicinal plants is widespread, not only because they are easily accessible and affordable, but also due to persistent cultural beliefs and practices, as well as the lack of access to modern health care systems in rural areas (Baral & Kurmi, 2006). Traditional, complementary and alternative medicines are commonly used to treat or prevent disease and chronic illness and to improve quality of life (WHO, 2003). Herbal medicines or botanicals are considered as the most effective candidate to cure various human and animal diseases including gastrointestinal ailments (Street & Prinsloo, 2013; Madikizela et al., 2012; Manandhar, 2002; Heinrich et al., 1992). Use of medicinal plants to treat various gastrointestinal disorders ranging from simple types such as vomiting to more complex problems like peptic ulcer were reported (Lama et al., 2001; Rajbhandari 2001)

The aim of the present study is to record the cross analysis of traditional knowledge about treatment of stomach disorder for all the states of North east India. Specifically, we collected information on the plants species used to treat for gastrointestinal disorders of North East India along with information on medicinal plants, part uses, recipes, mode of use and phytochemical constituent. The main purpose of the study was to conserve the Ethnomedicinal knowledge and to select candidate medicinal plants for further phytochemical and pharmacological investigation. The available literature shows that such studies can constitute the starting point for the development of new drugs. Our efforts are towards not only providing nutrition and health care to the people, but also recovering record and diffuse local botanical knowledge and traditional wisdom.

Methods

Ethnopharmacological data sources and collection

Systematic literature searches relevant to the field of ethnobotany were carried out and the available information on various plants traditionally used for gastrointestinal disorder was collected from different bibliographical databases via electronic search (using Pubmed, SciFinder, Scopus, Scirus, ScienceDirect, Google Scholar and Web of Science) and a library search for articles published in peer-reviewed journals, Ph.D thesis and also locally available books. For each species, we also searched the literature for information on conservation status, as well as for phytochemical and pharmacological studies in support of the ethnobotanical information. We used principal component analysis to explore the relation among disorders and plant families, plant life forms, plant parts and preparation modes. The phytochemicals and pharmacological activities, which are considered as helpful for the treatment of gastrointestinal disorder health care are reported in this review include: Antioxidant, Anti-bacterial, Anti-inflammatory and Antimicrobial activity.

Systematization of plant names and chemical structures

For the systematization of plant names and to check the status of plants gathered in this review, the database: The Plant list (<http://www.theplantlist.org/2020>) was used. Only the accepted names and family of plants species highlighted in this database were retained to be listed in this review.

Results and Discussion

Diversity, uses, preparation modes

A total of 400 species belonging to 303 genera and 114 families have been reported for the treatment of gastrointestinal disorders. Most of the reported medicinal plant species were Angiosperms (395 species), followed by gymnosperms (3 species) and pteridophytes (2 species). It was also found that wild species (70%) are most commonly used by the healers than that of domesticated (19%) or semiwild species (11%) (Fig 9.1). Herbaceous species are (annual and perennial) are dominating the list with as much as 53% species, followed by trees (22%), shrubs (16%) and climbers (9%)(Fig 9.2). For each species scientific name with family, parts used and method of drug preparation and dosage, and phytochemical constituent with reference are provide (Table 9.1). Well dominant Angiosperm families were Asteraceae (31), followed by Fabaceae (25 species), Lamiaceae (15), Zingiberaceae (15) and Poaceae (12). The family Polygonaceae, Moraceae, Rutaceae and Rubiaceae representing 11 species respectively. The poorly representing families (one species each) are Ebenaceae, Cycadaceae, Convulvulaceae, Iridaceae, Lycopodiaceae, Hypoxidaceae, Primulaceae, Nepenthaeae, Davalliaceae, Bignoniaceae, Moringaceae, Melanthiaceae, Passifloraceae, Sterculiaceae, Symplocaceae, Taxaceae, Plumbaginaceae, Orchidaceae, Portulacaceae, Onagraceae, Fagaceae, Loranthaceae, Dipterocarpaceae, Smilacaceae, Stemonaceae, Tiliaceae, Umbelliferae, Malpighiaceae, Lardizabalaceae, Saururaceae, Flacourtiaceae, Caryophyllacerae, Equisetaceae, Basellaceae, Elaeocarpaceae, Costaceae, Caricaceae, Lecythidaceae, Vitaceae, Nyctaginaceae, Cannabaceae, Bombaceae, Cornaceae, Woodsiaceae, Verbinaceae, Bromeliaceae, Araceae, Pinaceae, Pinaceae and Xanthorrhoeaceae. The dominant genus is Asteraceae represented by 27 species. The most significant plant for the use of gastrointestinal disorders by most of the herbal healers in this region includes *Acorus calamus*, *Aegle marmelos*, *Asparagus racemosus*, *Centella asiatica*, *Drymaria cordata*, *Garcinia* spp, *Houttuynia cordata*, *Mangifera indica*, *Oroxylum indicum*, *Oxalis corniculata*, *Paedaria foetida* and *Psidium guajava*. Different plant parts were used for the treatment of gastrointestinal disorders. Different therapies were reported for the disease. Some are taken as direct raw oral consumption of the plant while others after preparation of formulations either orally or externally.

All plant parts are used either singly or as mixture and in some cases whole plants are also used. In general, leaves are highly used in stomach disorder followed by fruits, roots, barks, whole plant, shoots, rhizomes, stem, seeds, tubers, flowers, bulbs, latex and petiole respectively (Fig 9.3). Dosage of recipe was found to be related with the age of the patient. Also, it was determined that gastrointestinal system ailments for which the folk medicinal plants are mostly used, are as follows: diarrhea, dysentery, constipation, gastritis and ulcer, intestinal winds and indigestion. It was also found that herbal drugs were most commonly prepared in the form of juice/extract (148 species), followed by decoction (105 species), Raw/chew

(37 species), Paste (33 species), Infusion (28 species), Powder (21 species), Roasted/vegetable (13 species) for gastrointestinal disorder (Fig 9.4).

Pharmacological evaluation

In our present investigation we found slightly more pharmacological studies than phytochemical studies on plant species used in gastrointestinal disorders in North East India. We found 31% species for antioxidant activities followed by Antimicrobial (27%) and Antibacterail (26%). Whereas 11% species were studied both for Antibacterial and Antioxidentactivities, 4% species for Antimicrobial and Antioxident, 1% species for Anti-inflammatory and Antioxident and only 0.5% species for Anti-inflammatory and antimicrobial (Fig 9.5). More pharmacological studies were *in-vivo* experiments than in-vitro experiments. Almost all *in-vivo* experiments were conducted for diarrhea, induced in wistar rats by castor oil and magnesium sulfate, *Escherichia coli* enterotoxin, charcoal meal and castor oil-arachidonic acid. The *in-vitro* experiments included antimicrobial tests for diarrhea or dysentery or for other diseases caused by bacteria such as *Escherichia coli*, *Shigella spp.*, *Salmonella typhii*, *Vibrio cholera* and *Pseudomonas aeruginosa*. It was also found that 50 species have not any report on pharmacological or phytochemical studies on gastrointestinal disorder.

Table 9.1. Plant species used for treating Gastrointestinal ailments along with part uses, mode of preparations and Pharmacological effects.

Sl No	Species with family	Part use	Disease	Mode of uses with reference	Pharmacological effect/ hytochemical Constituent with reference
1	<i>Abies densa</i> Griff. (Pinaceae)	Leaves	Diarrhoea, Dysentery	Infusion of fresh leaves once daily in empty stomach till cure. (Badola & Bharat, 2013; Mandal et al., 2013; Dahal, 2019).	Not reported
2	<i>Abroma augusta</i> (L.) L.f. (Malvaceae)	Stem	Dysentery	Stem bark decoction is take orally twice daily as antidyseric. (Murtem & Chaudhry, 2016; Kagyung et al., 2009; Sharma et al., 2014; Chetryet al., 2018; Gurung, 2002).	Antibacterial (Bisht & Bhattacharaya, 2013)
3	<i>Abrus precatorius</i> L. (Fabaceae)	Root, Seed	Diarrhoea, Dysentery	1 teaspoonful of juice of roots is given twice or thrice daily for 3 days. (Ahmed & Borthakur, 2005; Bora, 2016).	Antibacterial (Mistryet al., 2010)
4	<i>Acacia catechu</i> (L.)Willd (Arecaceae)	Fruit	Constipati on	Fruit eaten after food to cure indigestion. (Ranjana, et al., 2013; Sharma & Hazarika,	Antibacterial (Thangaveluet al., 2018)

				2018).	
5	<i>Acacia farnesiana</i> Willd. (Fabaceae)	Leaf	Dysentery, Stomach pain	Leaf of <i>Cajanuscajan</i> , <i>Acacia farnesiana</i> , <i>Desmodiumtriflorum</i> and <i>Hydrocotyle sibthorpioides</i> along with the rhizome of <i>Acorus calamus</i> are mixed gently to prepared pea motor sized teblets. One tablet is given orally in empty stomach for 3 days.(Bora, 2016; Bora, 2001).	Antimicrobial (Yallappaet al., 2013)
6	<i>Acacia pinnata</i> (L.) Wild. (Fabaceae)	Root	Indisetion	Root extract is given 2 tea-spoonful thrice a day for one week. (Badola& Pradhan, 2013; Das, 2003; Dahal, 2019).	Antioxidant (Chanwitheesuket al., 2005)
7	<i>Achyranthes aspera</i> L. (Amaranthaceae)	Whole plant	Diarrhoea, Dysentery	Decoction take orally twice daily till cure. (Rai et al., 2010; Borkataki, 2006; Devi, 2015; Sharma et al., 2014; Das et al., 2013; Majumdar et al., 2006; Debbarmaet al., 2017; Lalramnghinglova, 2003; Dahal, 2019).	Antioxidant (Husain & Kumar, 2015; Upadhyayet al., 2015)
8	<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	Flower	Diarrhoea, Dysentery	Flower heads are crushed and juice is extracted. One tatablespoon of dose mixed with	Antimicrobial (Mamidala & Prasad, 2013)

	(Asteraceae)			1/2 cup of water and take it twice daily for 3-7 days. (Majumdar & Dutta, 2007; Das, 2003; Kar & Borthakur, 2008; Hynniewta & Bora, 1997; Dahal, 2019).	
9	<i>Aconitum ferox</i> Wall. ex Seringe (Ranunculaceae)	Rhizome	Diarrhoea	After proper cleaning, dried rhizome chewed during diarrhea. (Badola & Pradhan, 2013)	Antimicrobial (Singhet al., 2019)
10	<i>Aconitum palmatum</i> D. Don (Ranunculaceae)	Leaf, Root	Diarrhoea	<ol style="list-style-type: none"> 1. The leaf is crushed and prescribe till cure. (Rai et al., 2010; Sharma & Sharma, 2010; Badola & Pradhan, 2013; Dahal, 2019; Chhetri et al., 1992; Das & Sharma, 2002; Zhasa et al., 2015). 2. The root is crushed and soaked overnight in water and 1 cup of these drunk as a tonic. (Sharma et al., 2014; Devi, et al., 2011; Komet al., 2018). 	Antimicrobial (Aslam & Ahmad, 2016)

11	<i>Acorus calamus</i> Linn. (Araceae)	Rhizom e, Leaf	Dysentery, Stomach pain, Indisation	1. Rhizome along with the leaf of <i>Cajanus cajan</i> , <i>Acacia farnesiana</i> , <i>Desmodium triflorum</i> and <i>Hydrocotyle sibthorpioides</i> are mixed gently to prepared tebllets. One tablet is given orally in empty stomach for 3 days. (Khongsai et al., 2011; Lalramnghinglova, 2003; Bora, 2016; Mandal et al., 2013; Changkija, 1999; Saikia, 2006; Kar & Borthakur, 2008; Dahal, 2019; Pfoze, 2012; Das et al., 2006; Monlai, 2013; Sharma & Pegu, 2011; Bora, 2001; Marak, 2018; Bhuyan, 1998; Samati, 2006; Chhetri et al.,	Antibacterial (Joshi, 2016)
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				<p>1992; Dutta, 2012; Teron, 2011; Shankar & Rawat, 2008; Chetryet al., 2018; Naldarine & Lalnundanga, 2017; Borkataki, 2006).</p> <p>2. Burnt ashes of the leaves is made into paste with coconut oil and applied over the belly in indigestion with colic pain. (Chhetri et al., 1992; Khatoon, 2014; Gogoi, 1997).</p>	
12	<i>Adiantum philippense</i> L. (Adiantaceae)	Shoot	Dysentery	Decoction of aerial part given orally once daily after food till cure. (Singh et al., 1989; Dahal, 2019)	Antimicrobial (Ramesha et al., 2020)
13	<i>Aegle marmelos</i> L. Corr (Rutaceae)	Fruit	Dysentery	The fruit juice is mixed with milk and is prescribed orally for about 7 days. (Bora, 2016, Talukdera & Gupta, 2014; Sarma & Devi, 2017; Talukdar & Gupta, 2014; Borkataki,	Antioxidant (Sudharameshwari & Radhika, 2007)

				<p>2006; Kom et al., 2018; Hazarika et al., 2012; Lalramnghinglova, 2003; Das, 2003; Shankar & Rawat, 2008; Gurung, 2002 Choudhury, 1999; Rout et al., 2012; Chhetri et al., 1992; Devi, 2015; Das et al., 2013; Rao & Jamir, 1982; Chhetri et al., 1992; Naldarine & Lalnundanga, 2017; Das & Dutta Choudhury, 2012; Zhasaet al., 2015;)</p> <p>Boiled Fruit pulp mixed with fruits of <i>Punica granatum</i> and leaves of <i>Psidium guajava</i>. The filtrate after mixing along with sugar and water is taken to get cure. (Ahmed, 2005; Das & Dutta Choudhury, 2010; Dahal, 2019)</p> <p>Solution from roasted unripe fruit (wrapped with mud) with a spoonful of sugar in water is given in dysentery and diarrhoea. (Khatoon, 2014)</p>	
14	<i>Agave americana</i> L.	Whole	Diarrhoea	Half cup of decoction of root	Antibacterial (Shigute

	(Asparagaceae)	plant		given orally once daily for 3-6 days (Srivastava et al., 1987; Dahal, 2019)	&Wasihun,2020)
15	<i>Ageratina adenophora</i> (Spr.) King & Robinson. (Asteraceae)	Shoot	Dysentery, Ddiarrhea	Tender shoots are grinded and the juice obtained by squeezing. 1/2 cup of juice take orally twice daily after food till cure. (Ahmed, 2005; Daur&Hajra, 1980; Hynniewta, 2010)	Antioxident (Subba& Kandel, 2012)
16	<i>Ageratum conyzoides</i> L. (Amaranthaceae)	Root, Leaf	Ddiarrhea, Stomach ulcer	The root is crushed with <i>Callicarpa arborea</i> (bark) and rhizome of <i>Curcuma longa</i> & the juice is drunk for the remedy of stomach cancer; stem and leaf as anti-diarrhoeal. (Hazarika et al., 2012; Rai et al., 2010; Das & Dutta Choudhury, 2010; Kagyung et al., 2009; Badola & Pradhan, 2013; Nath, 2001; Devi, 2013;Chetryet al., 2018; Daur & Hajra, 1980)	Antibacterial (Shirwaikaret al., 2003)
17	<i>Alternanthera sessilis</i> (Linn.) R. Br. ex DC. DC. (Amaranthaceae)	Shoot, Leaves	Chronic dysentery, Dysentery, Stomachic	Shoot and leaves boiled with 1 crab & juice is given orally for 3-5 days. (Srivastava et al., 1987; Das & Sharma, 2002; Sharma, et al., 2014; Bora,	Antioxident (Reddyet al., 2019)

				2016) Tender shoot and leaf boiled or roasted and given in dysentery. (Srivastava et al., 1987; Bora, 2016; Borah & Bora, 2020; Dahal, 2019; Bora, 2001; Bora, 2001; Dutta, 2012)	
18	<i>Alangium chinense</i> (Lour.) Harms (Cornaceae)	Leaves, Bark.	Dysentery	Decoction of leaves with ½ spoon sugar and little salt is given in dysentery. (Khatoon, 2014)	Antioxident (Kumari & Krishnan, 2016; Kotaet al., 2017)
19	<i>Albizia chinensis</i> (Osbeck) Merr. (Fabaceae)	Bark	Stomach pain	Powder with one glass of water once daily after food. (Chhetri, 2005; Myrchiang et al., 2020; Ahmed & Borthakur, 2005; Jamir & Tsurho, 2016)	Antioxident (Kumari et al., 2011)
20	<i>Allantodia aspera</i> (Blume) Ching. (Woodsiaceae)	Root	Diarrhoea, Dysentery	Half cup of decoction of root given orally once daily for 3-6 days. (Dahal, 2019)	Not reported
21	<i>Allium ascalonicum</i> L. (Amaryllidaceae)	Bulb	Diarrhoea, Dysentery, Stomach pain	Bulb crushed and mixed with lukewarm water and prescribe these dose once daily till cure. (Daur & Hajra, 1980; Das, 2003; Hazarika et al., 2012)	Antioxidant, Antimicrobial (Raeisiet al., 2016)

22	<i>Allium hookeri</i> L. (Amaryllidaceae)	Leaves	Stomach ulcers	10 ml leaf juice mixed with salt and is prescribed thrice a day in stomach ulcers. (Choudhury, 1999; Khan & Yadava, 2010; Khatoon, 2014; Guha et al., 2018; Singh et al., 2015; Salam et al., 2014)	Antioxidant (Singh & Singh, 2014)
23	<i>Allium sativum</i> Linn. (Amaryllidaceae)	Bulb	Indigestion	One bunch aerial parts of <i>Stellaria media</i> are boiled and mixed with 3-4 bulbs of garlic and kept overnight and then filtered. Orally one dose daily morning for 3-4 days or till relief of symptoms. (Hazarika et al., 2012; Bora, 2016; Kagyung et al., 2009)	Antioxidant (Lawrence & Lawrence, 2011)
24	<i>Allium wallichii</i> Kunth (Amaryllidaceae)	Whole plant	Indigestion	The plant is eaten cooked for gastritis, and is believed to aid in indigestion. (Daur & Hajra, 1980; Chase & Singh, 2013)	Antibacterial (Kishore et al., 2011)
25	<i>Alnus nepalensis</i> D. Don (Verbenaceae)	Root	Diarrhoea	A decoction (about 1 cup) of the root is drunk to treat diarrhea. (Changkija, 1999; Dahal, 2019; Gurung, 2002; Sangtam et al., 2012; Imchen and Jamir, 2011; Jamir et al., 2012)	Antibacterial (Ren, et al., 2017)

26	<i>Aloe vera</i> (L.) Burm.f. (Xanthorrhoeaceae)	Leaves	Constipation	Half cup of infusion taken orally for about 7 days. (Hazarika et al., 2012; Srivastava et al., 1987; Sharma and Hazarika, 2018; Debbarma et al., 2017; Chetry et al., 2018; Dahal, 2019)	Antioxidant (Miranda et al., 2009)
27	<i>Alpinia officinarum</i> Hance (Zingiberaceae)	Rhizome	stomach pain	Rhizome is carminative and is eaten in stomach pain. About one cup take orally till cure. (Chettri & Sharma, 2011; Khan, 2005; Khatoon, 2014)	Antioxidant, Anticholinergic (Köse et al., 2015)
28	<i>Alpinia allughas</i> Roscoe (Zingiberaceae)	Rhizome	Diarrhoea, Dysentery	Crush the roots (rhizome) and mix with gooseberry and little honey and take one tea spoonful as syrup after food whenever thirsty. (Majumdar & Dutta, 2007; Yuhlung & Bhattacharyya, 2016)	Antibacterial (Bhunia & Kumar, 2012)
29	<i>Alpinia galanga</i> Willd. (Zingiberaceae)	Rhizome	Diarrhoea, Dysentery	10 ml of rhizome juice with teaspoonful of spoon of honey is given twice daily for continuing up to ten days in stomach trouble. (Daur and Hajra, 1980; Khatoon, 2014)	Antimicrobial, Antioxidant (Tang, 2018)

30	<i>Alstoniascholaris</i> R. Br. (Apocynaceae)	Bark	Dysentery	<ol style="list-style-type: none"> 1. 100 ml of juice is mixed with 100 ml goat milk. The juice is given orally 4 spoonfuls for adults and 2 spoons for child twice daily till cure the disease. (Megoneitso & Rao, 1983; Bora, 2016) 2. 250 ml infusion of the bark of <i>Alstoniascholaris</i> and <i>Oroxylum indicum</i> is mixed and given orally at morning in empty stomach till cure. (Hazarika et al., 2012; Changkija, 1999; Borkataki, 2006; Bora, 2001; Choudhury, 1999; Das et al., 2008; Lalramnghinglova, 2003; Gogoi, 1997; Naldarine & Lalnundanga, 2017; 	Antimicrobial (et al., 2010)
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				Dahal, 2019; Teron, 2011)	
31	<i>Amaranthus spinosus</i> L. (Amaranthaceae)	Leaves, stems	Indigation	Tender leaves use as vegetable with rice during indigation. (Chetryet al., 2018; Das et al., 2008; Bora & Das, 2015; Gogoi et al., 2019)	Antioxident (Kumaret al., 2011)
32	<i>Amaranthus tricolour</i> L.(Amaranthaceae)	Leaves	Indigestion	Curry prepared from green leaves taken to cure indigestion. (Dahal, 2019; Rai & Sharma, 1994; Gurung, 2002; Chhetri et al., 1992)	Antibacterial (Fatimah & Afrid, 2019)
33	<i>Amaranthus viridis</i> L. (Amaranthaceae)	Root	Indisetion	Infusion of root take twice daiy till cure. (Dahal & Borthakur, 2017; Dahal, 2019)	Antioxident (Saravanan, et al., 2013)
34	<i>Amomum dealbatum</i> Roxb. (Zingiberaceae)	Stem	Diarrhoea, Dysentery	Fresh soft stems are eaten raw and can treat both diarrhoea and dysentery. (Gurumayum & Soram, 2014; Ahmed & Borthakur, 2005; Dahal, 2019)	Not repoeted
35	<i>Amomum subulatum</i> Roxb. (Zingiberaceae)	Seed	Gastric problem	Powdered seeds taken with warm water to cure cough, asthma and in gastritis. (Devi, et al., 2011; Majumdar & Dutta, 2007; Hynniewta & Bora, 1997;	Antimicrobial (Alam& Singh, 2021

				Dahal, 2019; Shankar & Rawat, 2008)	
36	<i>Ananascomosus</i> L. Merr. (Bromeliaceae)	Leaves, Fruit	Diarrhoea, Intestinal worms	Juice of tender leaves, about 10 ml once daily is given for 3 days. (Gogoi et al., 2019) Fruit is effective against intestinal worms when consumed. (Borah & Bora, 2020; Devi, 2015; Dahal, 2019)	Antioxidant (Beniteset al., 2019; Emekaaet al., 2014)
37	<i>Andrographis paniculata</i> (Burm.f.) Wall. Ex Nees. (Acanthaceae)	Leaf	Dysentery, Diarrhoea	Leaf extract taken in empty stomach in worm infection of the gastrointestinal tract of children. (Khongsai et al., 2011; Taluder & Gupta, 2014; Konwar et al., 2020; Lalramnghinglova, 2003; Konwaret al., 2020; Rethy et al., 2010; Devi, 2015; Zhasa et al., 2015; Shankar & Rawat, 2008; Achoudhury, 1999; Talukdar & Gupta, 2014; Das et al., 2008; Debbarma et al., 2017)	Antimicrobial (Akowuahet al.,2006)
38	<i>Angiopteris evecta</i> (G. Forst.) Hoffm. (Marattiaceae)	Rhizom e	Diarrhoea, Dysentery	Decoction of rhizome take orally twice daily till cure. (Chettri & Sharma, 2011; Kar &	Antibacterial (Khan&Omoloso, 2008)

				Borthakur, 2008; Ranjana, et al., 2013)	
39	<i>Antidesma acidum</i> Retz. (Phyllanthaceae)	Leaves	Diarrhoea, Dysentery	Leaves cooked with fish and eaten as curry to get relief from stomach problem. (Devi, 2015; Das, 2003; Khatoon, 2014)	Antibacterial, Antioxidant (Patil & Jadhav, 2014)
40	<i>Aporosa octandra</i> (Buch.- Ham. ex D.Don) Vickery (Phyllanthaceae)	Bark	Gastritis	Bark is boiled and administered orally after taking meal. (Lalruatfeliet al., 2019)	Antimicrobial (Panda et al., 2018)
41	<i>Arctium lappa</i> L. (Asteraceae)	Root	Gastric problem	Decoction of root (250 ml) is used twice a day to get relief from gastric problem. (Das & Sharma, 2002; Khatoon, 2014)	Antioxidant (Liu et al., 2014)
42	<i>Ardisia humilis</i> Vahl. (Myrsianaceae)	Bark, Leaves	Diarrhoea, Ulcer	About 10 ml juice of the bark is given once daily for 3 days. (Borah & Bora, 2020)	• Antibacterial (Khatun et al., 2013)
43	<i>Argemone maxicana</i> L. (Papaveraceae)	Seed	Dysentery	Pounded seed mixed with hot water and given for 3-5 days after food. (Ahmed & Borthakur, 2005; Dahal, 2019)	Antibacterial (Bhattacharjee et al., 2006)
44	<i>Artemisia vulgaris</i> L. (Asteraceae)	Leaf	Dysentery, Diarrhoea	Half cup of decoction of leaf prescribe after food for 2-4 days. (Dahal, 2019)	Antibacterial (Pandey et al., 2017)
45	<i>Artemisia nilagirica</i>	Root	Stomach ulcers	2 tea-spoonful root extract is given thrice a day for one week.	Antibacterial (Naiket al., 2014)

	(C.B.Clarke) Pamp. (Asteraceae)			(Devi, 2015; Salam et al., 2014.)	
46	<i>Artocarpus lacucha</i> Buch.-Ham. (Moraceae)	Bark, Fruit	Constipation	<ol style="list-style-type: none"> 1. Juice of bark, about 10 ml once daily is given for 3 days (Khan, 2005; Ranjana, et al., 2013; Sangtam et al., 2012; Gurung, 2002; Rao & Jamir, 1982; Dahal, 2019) 2. Fruit juice is prescribing orally once daily for 2-3 days. (Khan, 2005; Konwar et al., 2020; Lalramnghinglova, 2003; Konwar et al., 2020) 	Antioxidant (Kumaret al., 2010)
47	<i>Arundinaria maling</i> Gamble. (Poaceae)	Tender shoot	Stomach ulcers	Tender shoots are eaten cooked for stomach problems, especially stomach ulcers. (Sharma et al., 2014; Singh et al., 1989; Khan & Yadava, 2010; Chase & Singh, 2013)	Not reported
48	<i>Asparagus filicinus</i> Buch. Ham. (Liliaceae)	Root	Dysentery	2 teaspoon of root juice is mixed along with equal amount of honey and is taken to cure diarrhea. (Ahmed, 2005)	Antioxidant (Negiet al., 2010)

49	<i>Asparagus racemosus</i> Willd. (Liliaceae)	Root	Diarrhoea, Dysentery	<ol style="list-style-type: none"> 1. Root crushed along with root/stem of <i>Stemona tuberosa</i> and the juice is given orally to stop diarrhoea. (Dahal, 2019; Bora, 2016) 2. Mixture of ground <i>Asparagus racemosus</i> and <i>Byttneria pilosa</i> together with the boiled bark of <i>Myrica esculenta</i> and is given all together to cure dysentery. (Ahmed, 2005; Das & Sharma, 2002; Choudhury, 1999; Myrchiang, 2020) 3. Juice of fresh roots mixed with little honey is used in diarrhoea and dysentery. (Borah & Bora, 2020; Naldarine&Lalnundan ga, 2017; Chhetri et al., 	Antioxidant (Karunaet al., 2018;Dohareet al., 2011)
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				1992; Hazarika et al., 2012).	
50	<i>Astilbe rivularis</i> Buch.-Ham. ex D. Don (Saxifragaceae)	Rhizome	Dysentery, Diarrhoea	Pounded rhizome taken with honey to cure gastritis and constipation. (Sharma & Sharma, 2010; Myrchanget al., 2020)	Antioxidant (Mandalet al., 2009)
51	<i>Averrhoa carambola</i> L. (Oxalidaceae)	Fruit	Dysentery, Diarrhoea, Intestina worms	Raw fruits are taken once daily for about 1-2 days. (Samati, 2006; Srivastava et al., 1987; Borah & Bora, 2020; Hazarika et al., 2012)	Antibacterial, Antioxidant (Astiet al., 2018)
52	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	Leaf	Dysentery	½ cup of boiled leaf extracts prescribe orally for 2-3 days. (Dutta, 2012; Laloo & Hemalatha, 2011; Devi, 2015; Murtem & Chaudhry, 2016; Chetryet al., 2018; Gogoi, Kayang et al., 2005; 1997; Namsaet al., 2011; Dahal, 2019)	Antimicrobial (Thakurta et al., 2007)
53	<i>Bacopa monnieri</i> (L.) Wettst. (Plantaginaceae)	Whole plant	Indisention	Plant juice drunk twice daiy against constipation and stomach disorder. (Das et al., 2013; Shilet al., 2014; Ranjana, et al., 2013; Dahal, 2019).	Antioxidants (Mishra et al., 2006)

54	<i>Bambusa nutans</i> Wall. ex Munro (Poaceae)	Stem	Indisetion	Watery liquid of internodes taken against constipation. (Das, 2003; Das, 2003; Chettri & Sharma, 2011; Sharma, et al., 2014; Dahal, 2019)	Antioxidant (Tripathiet al., 2015)
55	<i>Basella alba</i> L. (Basellaceae)	Tender leaves	Diarrhoea, Dysenter y	Tender leaves are taken as vegetables. (Ranjana, et al., 2013; Gogoiet al., 2019)	Antibacterial (Ratheet al., 2010)
56	<i>Bauhinia purpurea</i> Linn. (Fabaceae)	Bark	Diarrhoea	Bark is crushed and the juice extract drunk to treat diarrhea. (Changkija, 1999; Pfoze, 2012; Dahal, 2019; Badola & Pradhan, 2013)	Antimicrobial (Zakariaet al., 2011)
57	<i>Bauhinia acuinata</i> Linn. (Fabaceae)	Flower	Dysentery	Flowers are boiled and ½ cup f decoction take orally for 6-7 days. (Rai & Sharma, 1994; Das and Dutta Choudhury, 2012; Laloo & Hemalatha, 2011; Dahal, 2019; Bhuyan, 1998; Zhasa et al., 2015; Jamir and Tsurho, 2016; Lalramnghinglova, 1998; Panda et al., 1991)	Antimicrobial (Panda, et al., 2015)
58	<i>Bauhinia vahlii</i> Wig ht & Arn. (Fabaceae)	Seeds	Dysentery	Roasted seeds are chewed and taken once dally for three days. (Dahal & Borthakur, 2017;	Antimicrobial (Samysowndhararajan & Chulkang, 2013)

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				Dahal, 2019; Kayang et al., 2005; Lalramnghinglova, 2003; Kar & Borthakur, 2008)	
59	<i>Begonia josephii</i> A. DC. (Begoniaceae)	Shoot, Leaves	Indisetion	Decoction of freshly collected shoot and leaves are prescribing 2-3 times after food. (Kagyung et al., 2009; Rao & Jamir, 1982; Singh et al., 1989; Teron, 2011)	Not repoeted.
60	<i>Begonia picta</i> Sm. (Begoniaceae)	Shoot	Colic and dysentery	Lukewarm juice prescribes orally till cure in colic and dysentery. (Gurung, 2002; Dahal, 2019)	Antioxidant, Antibacterial (Nisha et al., 2016).
61	<i>Begonia rubrovenia</i> Hook. (Begoniaceae)	Stem	Dysentery and diarrhea.	Leaf juice taken orally twice daily in empty stomach for one week. (Mao, 1993; Laloo & Hemalatha, 2011)	Not repoeted.
62	<i>Begonia roxburghii</i> A. DC (Begoniaceae)	Root	Diarrhoea, Bile dysentery	Root decoction (1/2 cup) take orally once daily for 2-3 days. (Hynniewta, 2008, 2010; Teron, 2011)	Antioxidant, Antibacterial Lalawmpuii & Tlau, 2021).
63	<i>Benincasa hispida</i> (Thunb) Cogn. (Cucurbitaceae)	Fruit	Dysentery, Diarrhoea	One glass of freshly prepared fruit juice is taken in the morning in empty stomach for 1 month. (Salam et al., 2014)	Antibacterial (Soliman et al., 2020).

64	<i>Betula alnoides</i> Buch.-Ham. ex D. Don (Betulaceae)	Leaf, Bark	Stomach ache, Diarrhoea, Indigestion	<ul style="list-style-type: none"> Decoction of leaf with one pinch of salt is given orally twice daily till cure. (Pfoze, 2012). The bark is aromatic, and chewed for digestion. (Ranjana et al., 2013). Decoction of bark (about half cup) used against stomach ache and diarrhoea. (Sharma et al., 2017; Das, 2003; Gurung, 2002; Dahal, 2019). 	Antibacterial (Sur et al., 2002).
65	<i>Betula utilis</i> D. Don (Betulaceae)	Bark	Dysentery	½ cup of decoction of stem bark used against dysentery. (Chhetri, 2005; Dahal, 2019)	Antimicrobial (Pandey et al., 2020).
66	<i>Berberis angulosa</i> Wall. (Berberidaceae)	Root	Dysentery	Root paste with half cup of water used to cure dysentery. (Mao, 1993; Singh et al., 1989; Dahal, 2019; Das, 2003)	Antioxidant and antibacterial activities of fruit extracts of <i>Berberis</i> species from Nepal Antimicrobial (Dhungel et al., 2016).
67	<i>Berberis aristata</i> DC. (Berberidaceae)	Stem, Bark	Diarrhoea, Gastritis	Decoction of stem and bark used against gastritis and diarrhoea. (Badola & Pradhan, 2013; Gurung, 2002; Dahal,	Antioxidant and antibacterial activities of fruit extracts of <i>Berberis</i>

				2019)	species from Nepa Antioxidant (Singh & Kakkar, 2009).
68	<i>Berberis wallichiana</i> DC (Begoniaceae)	Shoot	Dysentery	Decoction of young twigs mixed with leaf juice of <i>Oxalis richardiana</i> is given for dysentery. (Gurung, 2002; Laloo & Hemalatha, 2011; Chhetri et al., 1992).	Not reported
69	<i>Bergenia ciliata</i> (Haw.) Sternb. (Saxifragaceae)	Leafs, Root	Diarrhoea, Dysentery	Infusion of root is taken internally for diarrhoea and dysentery @ 1/2 cup (50 ml) twice daily. (Sharma, et al., 2014; Badola & Pradhan, 2013; Iramnghinglova, 1998) Infusion of leaves and root is taken orally twice daily till cure. (Khan & Yadava, 2010; Rai et al., 2010; Chase & Singh, 2013)	Antioxidant, Antimicrobial (Singh et al., 2017; Shahet al., 2020)
70	<i>Bidens pilosa</i> L. (Asteraceae)	Whole plant	Dysenter, Diarrhoea, Stomachache	1. The plant juices with salt or honey are prescribed in diarrhea and dysentery thrice daily for 3-7 days. (Rai & Sharma, 1994; Singh	Antioxidant, Antibacterial (Owoyemi & Oladunmoye, 2017; Deba et al., 2008)

				et al., 1989; Ahmed & Borthakur, 2005; Salam et al., 2014; Nonibala, 2015) 2. Decoction of leaves (about one cup) is taken in intestinal and stomach problem. (Shilet al., 2014; Khatoon, 2014)	
71	<i>Bischofia javanica</i> Blume (Phyllanthaceae)	Bark	Pain in the abdomen	Two teaspoon of powder with one glass of water once daiy after food till cure. (Dahal, 2019; Lalramnghinglova, 2003; Myrchiang et al., 2020)	Antibacterial (Chowdhury et al., 2020)
72	<i>Blumea balsamifera</i> D.C. (Asteraceae)	Tender shoots	Dysentery	½ cup of leaf decoction twice daily till cure. (Hazarika et al., 2012; Chhetri et al., 1992; Rao & Jamir, 1982)	Antioxidant, Antibacterial (Nessa et al., 2004)
73	<i>Blumea fistulosa</i> (Roxb.) Kurz (Asteraceae)	Leaf	Diarrhoea	Leaf paste or infusion with one cup of lukewarm water taken orally to cure diarrhoea. (Rai & Sharma, 1994; Dahal, 2019)	Not repoeted
74	<i>Blumea hieracifolia</i> Hayata (Asteraceae)	Leaves	Gastritis	The extract of the fresh leaves is orally administered after food till cure. (Chhetri et al., 1992;	Not repoeted

				Sharma et al., 2014; Majumdar & Dutta, 2007; Singh et al., 1989; Kom et al., 2018)	
75	<i>Blumea lanceolaria</i> (Roxb.) Druce (Asteraceae)	Leaves	Dysentery	Infusion (1 glass) of leaves is taken orally twice daily till cure. (Rai et al., 2010; Bora, 2001; Ngente, 2012)	Antimicrobial, Antioxidant (Mishra et al., 2015)
76	<i>Boerhaavia diffusa</i> L. (Nyctaginaceae)	Whole plant	Stomach ulcers	Whole plant is used as leafy vegetable in stomach ulcer. (Dutta, 2012; Das & Sharma, 2002; Chhetri et al., 1992; Borah & Bora, 2020)	Antibacterial (Kumar et al., 2014).
77	<i>Boehmeria macrophylla</i> Horn. (Urticaceae)	Stem, Leaf	Dysentery	A paste of the stem and leaf is taken twice daily to get cured from dysentery. (Sharma et al., 2014; Mao, 1993; Ahmed, 2005)	Antioxidant (Islam et al., 2016).
78	<i>Bombax ceiba</i> Linn. (Bombaceae)	Bmboo shoot	Blood dysentery	Aqueous extracts mixed along with curd is used to check blood dysentery. (Das et al., 2008; Laloo & Hemalatha, 2011; Das & Sharma, 2002)	Antibacterial, Antioxidant (Rehman et al., 2017)
79	<i>Borassus flabellifer</i> L. (Arecaceae)	Fruit	Indiseton	Fruit juice drunk twice daily till cure. (Das, 2003; Gurung, 2002; Ranjana, et al., 2013; Dahal, 2019)	Antioxidant (Athinarayanan et al., 2018)

80	<i>Bossenbergia rotunda</i> (L.) Mansf (Zingiberaceae)	Tuber	Indigestion	Boiled tuber (about one cup) is used in indigestion. (Konwar et al., 2020)	Antibacterial (Zainin et al., 2013).
81	<i>Brassaiopsis glomerulata</i> Bl. Regd. (Araliaceae)	Bark	Constipation	Juice extract of the bark is drunk for digestion and during constipation. (Majumdar & Dutta, 2007; Changkija, 1999)	Not reported
82	<i>Brassaiopsis mitis</i> Clarke (Araliaceae)	Fruit	Dysentery	Powdery form of dry fruits mixed with lukewarm water and prescribe twice daily after food till cure. (Singh et al., 1989; Chhetri et al., 1992; Dahal, 2019)	Not reported
83	<i>Brassica oleracea</i> L. (Brassicaceae)	Leaves	Stomach ulcer	Decoction of leaves takes twice daily till cure. (Das, 2003; Chhetri & Sharma, 2011; Sharma, et al., 2014; Dahal, 2019)	Antioxidant (Volden et al., 2008)
84	<i>Breonia chinensis</i> (Lam.) Capuron (Rubiaceae)	Fruit	Dysentery, Gastritis	Fruits paste with hot water used to treat gastritis and dysentery. (Gurung, 2002; Dahal & Borthakur, 2017; Dahal, 2019)	Not reported
85	<i>Brunella vulgaris</i> L. (Lamiaceae)	Leaves	Blood dysentery	Leaves taken raw for cure of blood dysentery. (Hynniewta, 2010; Singh et al., 1989; Das & Sharma, 2002)	Antioxidant (Mojab et al., 2003)

86	<i>Bryophyllum pinnatum</i> (Lam) Oken (Crassulaceae)	Leaves	Diarrhoea, Dysentery	<ol style="list-style-type: none"> 1. Paste of leaves with little salt used in dysentery, 20 ml once daily until cure. (Sharma, et al., 2014; Mao, 1993; Goswami et al., 2009; Borah & Bora, 2020) 2. Two to three leaves chewed raw with 1 teaspoon sugar. (Hynniewta & Bora, 1997; Das & Dutta Choudhury, 2010; Pfoze, 2012; Das et al., 2008) 	Antimicrobial, Antioxidant (Tatsimo et al., 2012)
87	<i>Caesalpinia bonducella</i> L. Flem. (Fabaceae)	Fruit, Shoot	Gastritis	Filtrate prepared from fruit and shoots along with 3 black pepper. 50ml of dosage thrice daily for 3 days. (Borah & Bora, 2020)	Antibacterial, Antidiarrhoeal (Billahet al., 2013)
88	<i>Cajanus cajan</i> (L.) Millsp. (Fabaceae)	Leaf	Dysentery, Stomach pain	Leaf of <i>Cajanus cajan</i> , <i>Acacia farnesiana</i> , <i>Desmodium triflorum</i> and <i>Hydrocotyle rotundifolia</i> along with the rhizome of <i>Acorus calamus</i> are	Antibacterial (Nagati et al., 2012)

				mixed gently to prepared tablets. One tablet is given orally in empty stomach for 3 days. (Rout et al., 2012; Bora, 2016; Das & Dutta Choudhury, 2010)	
89	<i>Callicarpa arborea</i> Roxb. (Verbenaceae)	Young shoot	Gastric problems	Juice extracted from the young twigs is drunk for the treatment of gastric problems. (Khongsai et al., 2011; Dahal & Borthakur, 2017, 2017a; Das & Sharma, 2002; Shankar & Rawat, 2008; Shankar & Rawat, 2008; Das et al., 2008; Dahal, 2019; Changkija, 1999)	Antibacterial (Roy et al., 2020)
90	<i>Calotropis gigantea</i> (L.) Dryand. (Apocynaceae)	Leaf	Dysentery	Leaf decoction (about half cup) use against dysentery. (Daur & Hajra, 1980; Shilet al., 2014; Marak, 2018; Naldarine & Lalnundanga, 2017; Dahal, 2019)	Antibacterial (Habib et al., 2010)
91	<i>Campylandra aurantiaca</i> Baker (Asparagaceae)	Rhizome	Dysentery, Diarrhoea	Rhizome decoction is administered 2-3 times daily as antidiarrhoeic. (Ranjana et al., 2013; Megoneitso & Rao, 1983; Rao & Jamir, 1982;	Antibacterial (Chakraborty et al., 2017)

				Kagyung et al., 2009; Chhetri, 2005; Devi et al., 2011; Das, 2003; Dahal, 2019).	
92	<i>Cannabis sativa</i> Linn. (Cannabaceae)	Leaf	Diarrhoea, Dysentery	Leaves are grinded with water and filter. The filtrate is prescribes orally till cure. (Ahmed, 2005; Myrchiang et al., 2020; Khongsai et al., 2011; Pfoze, 2012; Borkataki, 2006; Gogoi, 1997; Rai and Sharma, 1994; Badola and Pradhan, 2013; Chetry et al., 2018; Khan, 2005; Shankar and Rawat, 2008; Dahal, 2019; Zhasa et al., 2015; Dutta, 2012)	Antimicrobial (Cantele et al., 2020)
93	<i>Canscora diffusa</i> (Vahl) R.Br. ex Roem. & Schult. (Gentianaceae)	Whole plants	Diarrhoea, Dysentery	Decoction (about two cup) once daily till cure. (Myrchiang et al., 2020)	Antibacterial (Mahida & Mohan, 2006)
94	<i>Capsella bursa-pastoris</i> (L.) Medik. (Brassicaceae)	Leaf	Diarrhoea	Leaf juice (1 cup) twice daily till cure. (Singh et al., 1989; Mao, 1993; Dahal, 2019)	Antibacterial (Soleimanpour et al., 2013)
95	<i>Capsicum chinense</i>	Fruit	Diarrhoea	About 20 gm fruit taken orally	Antimicrobial,

	Jacq. (Solanaceae)			stops blood dysentery. (Hazarika et al., 2012; Das, 2003)	Antioxidant (Loizzo et al., 2015)
96	<i>Capsicum frutescens</i> Linn. (Solanaceae)	Seeds	Dysentery	Paste along with the aerial part of <i>Drymaria cordata</i> and leaves of <i>Ocimum sanctum</i> is given orally once daily till relief of symptoms. (Samati, 2006; Dahal, 2019; Teron, 2011; Bora, 2016).	Antimicrobial, Antioxidant (Gurnani et al., 2016)
97	<i>Capsicum minimum</i> Roxb. (Solanaceae)	Fruit	Blood dysentery	About 20 gm fruit taken orally stops blood dysentery. (Dutta, 2012; Chhetri et al., 1992; Hynniewta, 2010; Ved et al., 2017)	Not reported
98	<i>Cardamine hirsuta</i> L. (Brassicaceae)	Leaf	Stomach ulcer	Leaf juice with warm water taken against gastric ulcers. (Majumdar & Dutta, 2007; Singh et al., 1989; Dahal, 2019)	Antibacterial, Antithrombin (Medeiros et al., 2000)
99	<i>Careya arborea</i> Roxb. (Lecythidaceae)	Bark, Leaf	Stomachache, Dysentery	Bark is crushed and decoction (about 1 cup) taken orally till cure. (Lalruatfeli et al., 2019; Bhuyan, 1998) Leaf juice taken orally twice daily in empty stomach for about one week. (Teron, 2011;	Antioxidant (Natesan et al., 2007; Kumar et al., 2006)

				Laloo & Hemalatha, 2011)	
100	<i>Carica papaya</i> Linn. (Caricaceae)	Root	Cholera	Root crushed along with the seed of <i>Piper nigrum</i> and mixed with a cup of warm water and prescribe orally daily in empty stomach for 1-2 days. (Bora, 2016; Das & Dutta Choudhury, 2010; Borah et al., 2006; Kar & Borthakur, 2008; Hazarika et al., 2012; Choudhury, 1999; Das et al., 2008; Das & Dutta Choudhury, 2012; Chetry et al., 2018; Murtem & Chaudhry, 2016; Pfoze, 2012)	Antioxidant (Bapan et al., 2017).
101	<i>Carum carvi</i> L. (Apiaceae)	Seed	Gastritis, Ulcer, Indigestion	Seed paste with lukewarm water prescribe twice daily till cure. (Chettri & Sharma, 2011; Dahal, 2019)	Antioxidant, Antibacterial (Thippeswamy et al., 2013).
102	<i>Carum khasianum</i> C.B. Clarke (Apiaceae)	Seeds	Dysentery	Seeds are soaked in water overnight and that water can be drunk against the dysentery at the rate of 1 glass daily after food. (Ranjana, et al., 2013)	Antioxidant (Choudhury et al., 2020).
103	<i>Cascabela thevetia</i> (L.) Lippold (Apocynaceae)	Leaf, Root	Stomachache	Leaf is crushed and the juice is taken as an effective remedy for stomachache. (Rai et al., 2010)	Antioxidant, Antibacterial (Seetharaman et al.,

					2017).
104	<i>Cassia fistula</i> L. (Fabaceae)	Seeds	Diarrhoea	Seed powder with 10 ml hot water prescribe locally for two days. (Borah & Bora, 2020; Srivastava et al., 1987; Dutta, 2012; Sumitra, 2013; Bhuyan, 1998)	Antibacterial, Antioxident (Duraipandiyar & Ignacimuthu, 2007)
105	<i>Catharanthus roseus</i> (L.) G.Don (Apocynaceae)	Leaf, Root	Stomachache	Root and leaf juice extract is boiled and drunk to cure stomachache. (Khatoon, 2014; Dahal & Borthakur, 2017, 2017a; Changkija, 1999)	Antimicrobial (Jaleel et al., 2006)
106	<i>Centella asiatica</i> (Linn.) Urban. (Apiaceae)	Whole plant	Blood dysentery, Gastritis, Chronic dysentery, Stomachache	10-25 ml juice with cow milk is given orally daily at morning in empty stomach for 3 days. (Kar & Borthakur, 2008; Bora, 2001; Bora, 2016; Ahmed, 2005; Taluder & Gupta, 2014; Gogoi et al., 2019; Chase & Singh, 2013; Das & Dutta Choudhury, 2010; Lea & Limasenla, 2020; Nath, 2001; Khongsai et al., 2011; Kagyung et al., 2009; Bhuyan, 1998; Das et al., 2009; Das & Dutta Choudhury, 2012;	Antioxidant, Antibacterial (Puttaraket al., 2017; Ray et al., 2013; Oyediji & Afolayan, 2005)

				<p>Sharma & Pegu, 2011; Das et al., 2006; Naldarine & Lalnundanga, 2017; Murtem & Chaudhry, 2016; Teron, 2011; Marak, 2018; Nonibala, 2015; Borah & Bora, 2020; Lalramnghinglova, 2003; Das & Singh, 2017; Namsaet al., 2011; Salam et al., 2014)</p> <p>Juice in raw condition is preserved in airtight container and 2 teaspoons of dosage are taken orally thrice daily after food. (Gogoi, 1997; Dutta, 2012; Devi, 2013; Hynniewta, 2010)</p>	
107	<p><i>Cheilocostus speciosus</i> (J.König) C. Specht (Costaceae)</p>	Rhizome	Stomach inflammation	<p>Rhizome (about half cup) used to cure stomach inflammation. (Majumdar & Dutta, 2007; Dahal, 2019)</p>	Antioxidant (Balasubramanian et al., 2018)
108	<p><i>Chenopodium album</i> L. (Chenopodiaceae)</p>	Fruit, Leaf	Diarrhoea, Dysentery	<p>Fruit is bitter and acrid, and taken during stomach pain. Leaf juice with rice used in dysentery & diarrhea. (Hazarika et al., 2012)</p>	Antioxidant (Hafeezlaghari et al., 2011)

109	<i>Chromolaena odorata</i> (L.) Voigt. (Asteraceae)	Leaf	Dysentery, Diarrhoea	Two teaspoon leaf juice prescribe orally twice a day till cure. (Taluder & Gupta, 2014; Myrchiang et al., 2020; Pfoze, 2012; Talukdar & Gupta, 2014; Naldarine & Lalnundanga, 2017)	Antioxident (Thang et al., 2001)
110	<i>Chrysanthemum morifolium</i> Desmond (Asteraceae)	Leaves	Diarrhoea, Dysentery	Young leaves are chewed raw to treat diarrhoea and dysentery. (Chhetri, 2005; Badola & Pradhan, 2013; Singh et al., 1989; Dahal, 2019)	Antioxidant (Duh et al., 1999)
112	<i>Chukrasia tabularis</i> A. Juss. (Meliaceae)	Root, Seed	Stomach pain, Diarrhoea, Dysentery	Raw roots are taken for the remedy of stomach pain; infusion of seedcoat taken internally or a small portion is eaten raw for diarrhoea and dysentery. (Rai et al., 2010)	Antioxident (Kaur & arora, 2009)
113	<i>Ciccus repens</i> Lam. (Vitaceae)	Leaf	Diarrhoea, Dysentery	Tender leaves are taken as vegetables. (Konwar et al., 2020)	Antioxident (Chaveerach et al., 2017)
114	<i>Cinnamomum pauciflorum</i> Nees (Lauraceae)	Bark	Diarrhoea, Dysentery	2 teaspoons of powder mixed with half cup of hot water and taken orally till cure. (Laloo et al., 2006)	Antibacterial (Wanget al., 2009)
115	<i>Cinnamomum</i>	Leaf	Diarrhoea	Leaf extract which is aromatic in	Antibacterial (Goyalet

	<i>tamala</i> Fr. Nees (Lauraceae)			odor is used to treat diarrhea. (Badola& Pradhan, 2013; Lalooet al., 2006; Guha et al., 2018; Sharma & Pegu, 2011; Nath, 2001; Bora et al., 2016; Gogoiet al., 2019)	al., 2009)
116	<i>Cissampelos pareira</i> Linn. (Menispermaceae)	Stem	Dysentery	Paste is mixed with 1 gm salt & given orally in empty stomach daily at morning for 3 days. (Ahmed & Borthakur, 2005; Borkataki, 2006; Khan, 2005; Bora, 2016; Shankar & Rawat, 2008; Biswas, 1956)	Antibacterial (Shrestha & Gupta, 2019)
117	<i>Citrus aurantifolia</i> (Christm.) Swingle. (Rutaceae)	Fruit	Dysentery, Diarrhoea	1. Orally ½ tea spoonful of powder thrice daily before food for 5-7 days. (Ranjana, et al., 2013; Nath, 2006; Sharma, et al., 2014; Devi, et al., 2011). 2. One roasted fruit is kept overnight in dew and taken in morning empty stomach. (Bora, 2016)	Antioxident (Al-Aamriet al., 2017).
118	<i>Citrus hystrix</i> DC.	Fruit	Stomachac	Extract of the fruit with warm	Antioxident (Abirami

	(Rutaceae)		he	water is given in stomach disorder. (Ranjana, et al., 2013; Marak; 2018; Khatoon, 2014)	et al., 2014).
119	<i>Citrus limon</i> L. Burm (Rutaceae)	Leaves, Seed, Bark	Diarrhoea	Leaves, seed and bark crushed and mixed with little salt is given to control diarrhoea. (Gogoi, 1997; Dutta, 2012; Nath, 2006; Dahal, and Borthakur, 2017, 2017a; Borah and Bora, 2020; Chetry et al., 2018; Chhetri et al., 1992)	Antioxidant, Antibacterial (Saeb et al., 2016).
120	<i>Citrus medica</i> L. (Rutaceae)	Fruit	Dysentery	Fruit juice along with juice of sugarce mixed gently. 1-2 spoon of the mixture is given orally daily for 2-3 times. (Laloo & Hemalatha, 2011; Badola & Pradhan, 2013; Das & Sharma, 2002; Bora, 2016)	Antioxidant, Antibacterial (Wuaet al., 2013).
121	<i>Citrus paradisi</i> Macf (Rutaceae)	Fruit	Chronic dysentery	A ripe fruit is taken & create a small hole where petiole of <i>Piper betle</i> Linn. is placed inside the fruit. Then the fruit is placed inside the burning tuh (by product of rice- lemma). After totally cooked one fruit is given daily at morning in empty	Antioxidant, Antibacterial (Giamperi et al., 2004).

				stomach up to 10 days. (Singh et al., 1989; Bora, 2016).	
122	<i>Clerodendrum colebrookianum</i> Walp. (Lamiaceae)	Tender leaves	Diarrhoea, Dysentery	Decoction taken orally 2-3 times daily till cure. (Gogoi et al., 2019; Rao & Jamir, 1982; Namsa, et al., 2001)	Antimicrobial (Kar et al., 2019).
123	<i>Clerodendrum indicum</i> L. Kuntz. (Lamiaceae)	Leaves	Stomach ache	20 ml of decoction of leaves is given once daily for 3 days. (Borah & Bora, 2020; Das & Sharma, 2002; Murtem & Chaudhry, 2016; Chhetri et al., 1992; Yakang et al., 2013)	Antimicrobial (Pal et al., 2012).
124	<i>Clerodendrum infortunatum</i> L. (Lamiaceae)	Roots	Stomach problem	Root extract (about one cup) is administered to the patient till cure. (Lalramnghinglova, 1998; Das & Dutta Choudhury, 2010; Das et al., 2009; Das et al., 2008; Choudhury, 1999)	Antimicrobial (Sannigrahi et al., 2009)
125	<i>Codonopsis clematidea</i> (Schrenk) CL. (Campanulaceae)	Leaf	Diarrhoea	About half cup of leaf juice given to infant to cure diarrhoea. (Sharma, et al., 2014; Rao & Jamir, 1982; Dahal & Borthakur, 2017; Daur & Hajra, 1980; Ahmed & Borthakur, 2005; Gurung, 2002; Dahal, 2019)	Antioxidant, Antibacterial (Bhardwaj et al., 2020)

126	<i>Codonopsis foetens</i> Hook. f. et Thomson (Campanulaceae)	Leaf	Diarrhoea	About half cup of leaf juice given to infant to cure diarrhoea. (Mao, 1993; Dahal, 2019)	Antioxidant (Luan et al., 2019)
127	<i>Coffea benghalensis</i> B. Heyne ex Schult. (Rubiaceae)	Leaf	Diarrhoea, Stomachache	One cup of decoction is administered as antidiarrhoeic and stomachache. (Devi, et al., 2011; Kagyung et al., 2009)	Antioxidant (Patayet al., 2016)
128	<i>Coix lacryma-jobi</i> Linn (Poaceae)	Leaf	Dysentery	Leaf juice (about 1 cup) is taken orally till cure. (Hynniewta, 2008, 2010; Chase & Singh, 2013; Das & Sharma, 2002)	Antibacterial (Diningrat et al., 2020)
129	<i>Coptis teeta</i> Wall. (Ranunculaceae)	Rhizome	Dysentery	Infusion of dry rhizome soaked overnight in water is taken as antidysenteric. (Kagyung et al., 2009; Rethy et al., 2010; Gurung, 2002; Mao, 1993; Monlai, 2013)	Antibacterial (Payum, 2017)
130	<i>Corchorus capsularis</i> L. (Tiliaceae)	Leaves	Intestinal worms	Tender leaves use as vegetable with rice. (Das et al., 2013; Chhetri et al., 1992)	Antioxidant (Ademiluyi et al., 2015)
131	<i>Cordia dichotoma</i> G. Forst. (Boraginaceae)	Bark	Diarrhoea	Decoction of bark taken against fever and diarrhoea. (Das, 2003; Dahal, 2019; Lalramnghinglova, 2003; Singh et al., 1989)	Anti-inflammatory, Antioxidant (Hatware et al., 2018)

132	<i>Cordia fragrantissima</i> Kurz. (Boraginaceae)	Bark	Diarrhoea, dysentery	2 teaspoons of powder mixed with half cup of hot water and taken orally given till cure. (Ranjana, et al., 2013; Laloo et al., 2006)	Antioxidant (Ozaa & Kulkarni, 2017)
133	<i>Crassocephalum crepidioides</i> (Benth.) Moore (Asteraceae)	Whole plant	Gastriti, Indigestion , Stomach ache	About half cup freshly collected plant juice taken to cure diarrhoea. (Sharma et al., 2014; Chettri & Sharma, 2011; Das, 2003; Dahal, 2019; Pfoze, 2012; Chhetri et al., 1992; Salam et al., 2014; Das & Sharma, 2002; Devi, 2015)	Antioxidant, Anticholinesterases (Ayodele et al., 2019)
134	<i>Croton tiglium</i> L. (Euphorbiaceae)	Bark, Shoots	Amoebic dysentery, Constipation	1. Juice of about 50 gm bark with 50 ml water is given thrice daily for 3 days. 2. About ½ cup of juice of tender shoots with 1 teaspoonful of powdered pepper is mixed and prescribe it once daily for 3 days. (Borah & Bora, 2020; Srivastava et al., 1987; Shil et al., 2014; Borkataki, 2006; Gogoi, 1997)	Antifungal, Antibacterial (Shahid et al., 2008)
135	<i>Cucumis sativus</i> L. (Cucurbitaceae)	Fruit	Constipation	Fruit chewed and is reported to be very useful in stomach	Antioxidant (Zhu et al., 2004)

				disorder and constipation. (Chettri & Sharma, 2011; Wangpan et al., 2019; Das, 2003; Majumdar & Dutta, 2007; Samati, 2006; Khatoon, 2014)	
136	<i>Cucurbita maxima</i> Duch. (Cucurbitaceae)	Fruit, Seed	Stomach ache	Seeds and fruit are use to prepae curry. (Dahal & Borthakur, 2017; Gogoi, 1997; Dahal, 2019; Bora, 2001)	Antioxident (Amabirami et al., 2014)
137	<i>Curcuma aromatica</i> Salisb. (Zingiberaceae)	Rhizom e	Diarrhoea, Blood dysentery	<ol style="list-style-type: none"> 1. The rhizome of <i>Curcuma zedoria</i> made into paste. Added water into it and taken one cup of it three times only to cure strong diarrhea. (Singh et al., 1989; Devi, et al., 2011; Bhuyan, 1998) 2. Paste of two tablespoons of rhizome take thrice daily for three days after meals. (Daur & Hajra, 1980; Devi, 2015; Kar & 	Antioxident (Al-Reza et al., 2010)

				Borthakur, 2008)	
138	<i>Curcuma caesia</i> Roxb. (Zingiberaceae)	Rhizome	Indisagition, Stomachache	<ol style="list-style-type: none"> 1. Infusion twice daily till cure. (Mandal et al., 2013; Pfoze, 2012; Salam et al., 2014; Singh et al., 1989; Rao & Jamir, 1982; Dahal, 2019; Tushar et al., 2010) 2. Juice extract of rhizome taken orally to get releafe from stomachache. (Kagyung et al., 2009; Dahal & Borthakur, 2017, 2017a; Chhetri et al., 1992; Shil et al., 2014; Bora, 2001) 	Antioxident (Borahbet al., 2019; Krishnarajet al., 2008)
139	<i>Curcuma longa</i> Linn. (Zingiberaceae)	Rhizome	Diarrhoea, Blood dysentery	Juice of rhizome is mixed with sugar and given in empty stomach daily for 3 days. (Kagyung et al., 2009; Bora, 2016; Saikia, 2006; Bhuyan,	Antioxident (Ahmadet al., 2020; Danapur & Venugopal, 2019)

				1998; Hynniewta, 2010; Das et al., 2013; Chetryet al., 2018; Das & Sharma, 2002)	
140	<i>Cyanthillium cinereum</i> (L.) H. Rob. (Asteraceae)	Root	Stomachach, Diaarrhoea	2 tea-spoonful of root extract is given thrice a day for one week. (Dahal & Borthakur, 2017; Daur & Hajra, 1980; Chhetri, 2005; Dahal, 2019)	Antimicrobial (Tantengco et al., 2016)
141	<i>Cycas pectinata</i> Buch.-Ham. (Cycadaceae)	Leaves	Stomachach, Dysentery	Juice of tender leaves (about half cup, twice daily) used to cure dysentery and stomach complaints. (Singh et al., 1989; Deb, 1957; Majumdar & Dutta, 2007; Chhetri et al., 1992; Dahal, 2019)	Antibacterial (Tareq et al., 2020)
142	<i>Cymbopogon citratus</i> (DC) Stapf (Poaceae)	Leaf	Gastritis	Decoction of leaf prescribe orally to cure gastritis. (Das, 2003; Devi, 2013; Dahal, 2019)	Antibacterial (Nyamath & Karthikeyan, 2018)
143	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Whole plant	Dysentery, Diarrhoea	Decoction of plant prescribe twice daily till cure. (Das et al., 2008; Das & Dutta Choudhury, 2012; Nonibala, 2015; Dahal, 2019)	Antimicrobial (Pmelinda et al., 2010)
144	<i>Cyperus rotundus</i> Linn.	Tuber	Dysentery, Diarrhoea	About 1 glass of decoction of plant prescribe twice daily till	Antimicrobial (Kilani-Jaziri et al., 2011)

	(Cyperaceae)			cure. (Ahmed & Borthakur, 2005; Devi, 2013; Dahal, 2019)	
145	<i>Dactyloctenium aegyptium</i> (L.) Willd. (Poaceae)	Whole plant	Diarrhoea, Dysentery	The extract (about ½ cup) of the plant with honey is prescribed in stomach problem. (Mao, 1993; Deb, 1957; Kom et al., 2018)	Antimicrobial (Ali, 2017)
146	<i>Dactylicapnos scandens</i> (D. Don) Hutch. (Papaveraceae)	Tuber	Dysentery	½ cup of juice take twice daily after food till cure. (Pfoze, 2012; Singh et al., 1989; Khan, 2005; Srivastava et al., 1987)	Antimicrobial (Xu et al., 2006)
147	<i>Debregeasia longifolia</i> Wedd. (Urticaceae)	Fruit	Indigestion	One cup of decoction of fruit prescribe after food. (Leal & Limasenla, 2020)	Antioxidant, Antiproliferative (Sathak et al., 2014)
148	<i>Deeringia amaranthoides</i> (Lam.) Merr. (Amaranthaceae)	Leaf	Dysentery	Fresh leaf paste is prescribing orally for about 3-7 days. (Rai & Sharma, 1994; Laloo & Hemalatha, 2011)	Not reported
149	<i>Desmodium gangeticum</i> (Linn.) DC (Fabaceae)	Root	Dysentery	Root crushed and mixed with ginger and two teaspoon of dose prescribe orally for 3-5 days. (Dahal & Borthakur, 2017, 2017a)	Antibacterial (Thirunavoukkarasu et al., 2013)

150	<i>Desmodium triflorum</i> (L.) DC. (Fabaceae)	Leaf	Dysentery, Stomach pain	Leaf of <i>Cajanus cajan</i> , <i>Acacia farnesiana</i> , <i>Desmodium triflorum</i> and <i>Hydrocotyle sibthorpioides</i> along with the rhizome of <i>Acorus calamus</i> are mixed gently to prepared tebllets. One tablet is given orally in empty stomach for 3 days. (Das & Sharma, 2002; Rao & Jamir, 1982; Chhetri et al., 1992; Bora, 2016)	Antibacterial (Sharma et al., 2013)
151	<i>Desmostachya bipinnata</i> (L.) Stapf. (Poaceae)	Leaves	Dysentery, Diarrhoea	Decoction of leaf prescribe twice daily till cure. (Ranjana, et al., 2013; Gurung, 2002; Sharma, et al., 2014; Das, 2003; Dahal, 2019)	Antibacterial (Subramaniam et al., 2014)
152	<i>Dichrocephala integrifolia</i> (L.f.) Kuntze (Asteraceae)	Leaves	Diarrhoea	Leaves are crushed and the juice is taken orally. (Chhetri, 2005; Sharma & Sharma, 2010; Lalruatfeli et al., 2019; Shilet al., 2014)	Antioxidant (Nadègeaet al., 2017)
153	<i>Dillenia indica</i> Linn. (Dilleniaceae)	Fruit	Dysentery, Diarrhoea	The fruit is boiled & the water is taken for the remedy of diarrhoea & dysentery. (Bora, 2016; Hazarika et al., 2012;	Antioxident(Kumar et al., 2011)

				Khatoon, 2014; Sumitra, 2013; Dahal, 2019; Ray et al., 2010; Kagyunget al., 2009; Bora, 2001; Bora et al., 2016; Borkataki, 2006; Baidya et al., 2020; Naldarine & Lalnundanga, 2017; Majumdar et al., 2006; Chetry et al., 2018; Lalramnghinglova, 1998)	
154	<i>Dillenia pentagyna</i> Roxb. (Dilleniaceae)	Leaves, Bark	Diarrhoea, Indigestion	Decoction of the leaves or bark are used for curing gastric trouble and dysentery. (Das & Sharma, 2002; Sharma, et al., 2014; Ngente, 2012)	Antioxident (Yadav et al., 2017)
155	<i>Dioscorea alata</i> L. (Dioscoreaceae)	Tuber	Diarrhoea	Boiled tuber prescribe with lukewarm water for 2-4 days. (Mao, 1993; Dahal, 2019; Shilet al., 2014; Das, 2003)	Antimicrobial (Ochoaet al., 2020)
156	<i>Dioscorea bulbifera</i> L. (Dioscoreaceae)	Tuber	Dysentery	Boiled tuber taken to cure dysentery. (Rai & Sharma, 1994; Chettri & Sharma, 2011; Das, 2003; Singh et al., 1989; Dahal, 2019)	Antibacterial (Kuet et al., 2012)
157	<i>Dioscorea deltoidea</i> Wall. ex Griseb. (Dioscoreaceae)	Tuber	Indigestion	Juice of tuber used for treatment of constipation. (Dahal & Borthakur, 2017; Dahal, 2019)	Antimicrobial (Chandra et al., 2013)

158	<i>Diospyros pilosula</i> (DC.) Heim. (Ebenaceae)	Whole parts	Dysentery	Half cup of juice taken orally twice daily in empty stomach for one week. (Chhetri et al., 1992; Rai & Sharma, 1994; Srivastava et al., 1987; Hynniewta & Bora, 1997; Laloo & Hemalatha, 2011; Daur & Hajra, 1980; Laloo et al., 2006)	Not reported
159	<i>Dipsacus inermis</i> Wall. (Caprifoliaceae)	Rhizome	Diarrhoea, Dysentery	Four tablespoon of fresh juice of rhizome take orally once daily for three days. (Kar & Borthakur, 2008)	Not reported
160	<i>Dolichos lablab</i> Linn. (Fabaceae)	Fruit	Dysentery	Pod is boiled and 1 cup of decoction taken orally till cure. (Majumdar & Dutta, 2007; Chase & Singh, 2013)	Antimicrobial (Narendr et al., 2017)
161	<i>Dolomiaea macrocephala</i> DC. (Asteraceae)	Whole plant	Indigestion	Decoction of plant prescribe orally twice daily till cure. (Singh et al., 1989; Dahal, 2019)	Not reported
162	<i>Drymaria cordata</i> Willd (Caryophyllaceae)	Shoot	Dysentery and Diarrhoea, Gastritis	1. Paste along with the seed of <i>Capsicum frutescens</i> and leaves of <i>Ocimum sanctum</i> is given orally once daily	Antimicrobial (Ghimire et al., 2011)

				<p>till relief of symptoms. (Ahmed & Borthakur, 2005; Samati, 2006; Bora, 2016; Chetry et al., 2018; Devi, 2013)</p> <p>2. Whole plant is eaten as vegetable for stomach troubles. (Bora & Bora, 2020; Gogoi et al., 2019; Kagyung et al., 2009)</p>	
163	<i>Duabanga grandiflora</i> (Roxb. Ex DC.) walp. (Lythraceae)	Leaves	Diarrhoea	Decoction of tender leaves (one glass) used against diarrhoea. (Deb, 1957; Chhetri et al., 1992; Sharma et al., 2014; Dahal, 2019; Khan, 2005)	Antimicrobial (Othman et al., 2011)
164	<i>Dysoxylum procerum</i> Heirn. (Meliaceae)	Leaf, Root	Dysentery, Diarrhoea	<p>1. Half cup of decoction of the crushed leaves prescribes orally given till cure. (Laloo & Hemalatha, 2011)</p> <p>2. The decoction of the root is used twice daily after food for about 4 days. (Mao, 1993; Srivastava et al., 1987; Neogiet al., 1989)</p>	Antimicrobial (Arya et al., 2017)

165	<i>Eclipta prostrata</i> (L.) L. (Asteraceae)	Whole plant	Indigestion	Decoction of whole plant (about one lass) taken against constipation. (Ahmed & Borthakur, 2005; Sharma, et al., 2014; Das, 2003; Dahal, 2019; Bora, 2016; Khan, 2005; Khan & Yadava, 2010; Mao, 1993; Gogoi et al., 2019)	Antimicrobial (Kim et al., 2008; Pandey et al., 2011)
166	<i>Elaeagnus parvifolia</i> Wall. ex Royle (Elaeagnaceae)	Fruits	Diarrhoea	10-15 fruits are taken orally once daily for about one week. (Dahal & Borthakur, 2017a; Das, 2003)	Antioxidant (Spínola et al., 2019)
167	<i>Elaeocarpus floribundus</i> Blume (Elaeocarpaceae)	Fruits	Indigestion	Extract of leaves (100 ml) with one pinch of salt is given thrice daily in dysentery and diarrhoea till motion is controlled. (Pfoze, 2012; Khattoon, 2014)	Antioxidant (Umar et al., 2013)
168	<i>Elatostema platyphyllum</i> Wedd. (Urticaceae)	Stem	Gastric	Shoot consumed as vegetable in gastritis. (Devi et al., 2011; Badola & Pradhan, 2013; Dahal & Borthakur, 2017; Rai & Sharma, 1994; Dahal, 2019)	Antimicrobial (Medak & Singha, 2018)
169	<i>Eleusine coracana</i> (L.) Gaertn. (Poaceae)	Seed	Gastritis	Fermented seed with rice taken to cure gastritis. (Mao, 1993; Chettri & Sharma, 2011;	• Antimicrobial (Jayawardana et al., 2021)

				Majumdar & Dutta, 2007; Dahal, 2019)	
170	<i>Eleutherococcus cissifolius</i> (Griff. ex C.B. Clarke) Nakai (Araliaceae)	Leaves	Stomachache	Leaf extract mixed with hot water and prescribe orally twice daily till cure. (Daur & Hajra, 1980; Gurung, 2002; Gurumayum & Soram, 2014)	Not reported
171	<i>Elsholtzia blanda</i> (Benth.) Benth. (Lamiaceae)	Leaf	Diarrhoea	About half cup of decoction of leaf is used once daily till cure. (Majumdar & Dutta, 2007; Leal & Limasenla, 2020)	Not reported
172	<i>Elsholtzia ciliata</i> Thunb. (Lamiaceae)	Leaves	Dysentery, Stomachache	Fresh leaves extract is given to treat gas formation and quick relief. (Sharma, et al., 2014; Gurumayum & Soram, 2014; Das, 2003; Gurung, 2002; Devi, et al., 2011; Pfoze, 2012)	Antimicrobial (Pudziuelytea et al., 2017; Ishwori et al., 2014)
173	<i>Emilia sonchifolia</i> (L.) DC. Ex DC. (Asteraceae)	Whole plant	Diarrhoea, Dysentery	Root extract (1/2 cup) take orally once daily after food till cure. (Khaton, 2014; Dahal, 2019)	Antimicrobial (Ogundajo et al., 2021)
174	<i>Enhydra fluctuans</i> Lour (Asteraceae)	Leaf	Diarrhoea, Dysentery	Decoction of leaf is given orally twice daily after food till cure. (Das & Sharma, 2002; Megoneitso & Rao, 1983; Debbarma et al., 2017)	Antimicrobial (Ali et al., 2013)

175	<i>Equisetum diffusum</i> D. Don (Equisetaceae)	Root	Indigestion	2 tea-spoonful of root extract is given thrice a day for once a week. (Dahal & Borthakur, 2017; Daur & Hajra, 1980; Dahal, 2019)	Antibacterial (Thanh et al., 2019)
176	<i>Eriosema chinense</i> Baker (Fabaceae)	Bark	Dysentery	Decoction used in the treatment of dysentery. Dose take orally once daily after food. (Shilet al., 2014; Laloo & Hemalatha, 2011)	Antioxidant (Prasad et al., 2013)
177	<i>Eriosema himalaicum</i> Ohashi (Fabaceae)	Tuber	Dysentery	Raw tubers are chewed against dysentery. (Chhetri et al., 1992; Hynniewta, 2010; Sharma et al., 2014; Daur & Hajra, 1980)	Not reported
178	<i>Eryngium foetidum</i> L. (Apiaceae)	Whole plant	Diarrhoea, Dysentery	Paste with cold water (1/2 cup) take twice daily till cure. (Sumitra, 2013; Marak, 2018; Mandal et al., 2013; Dahal, 2019; Naldarine & Lalnundanga, 2017; Chetry et al., 2018)	Antioxidant (Lingaraju et al., 2016)
179	<i>Erythrina arborescens</i> Roxb. (Fabaceae)	Leaves	Diarrhoea, Dysentery	Fresh leaves are crushed and made into paste. Two talespoon of dose with lukewarm water take once dally for 7 days. (Kar & Borthakur, 2008; Pfoze,	Antibacterial (Kaushal et al., 2020)

				2012)	
180	<i>Eugenia jambolana</i> Lam. (Myrtaceae)	Bark, Fruits	Diarrhoea, Dysentery, Indigestion	A lime decoction of the bark is drunk to treat dysentery and diarrhea. (Ahmed & Borthakur, 2005; Changkija, 1999) Fruits are taken raw which help in digestion. (Chhetri et al., 1992; Bora & Bora, 2020)	Antioxidant (Bushra et al., 2007; Sultana et al., 2007)
181	<i>Euphorbia hirta</i> L. (Euphorbiaceae)	Whole plant	Dysentery	Decoction of plant takes twice daily after food till cure. (Bhuyan, 1989; Das, 2003; Ngente, 2012; Shankar & Rawat, 2008; Devi, 2015; Dahal, 2019; Baidya et al., 2020)	Antimicrobial (Arrabasma et al., 2011)
182	<i>Euphorbia stracheyi</i> Boissier (Euphorbiaceae)	Whole plant	Gastritis	Useful in bile related problems and in digestive problems. One cup of decoction of plant taken twice daily after food till cure. (Dahal & Borthakur, 2017; Singh et al., 1989; Shil et al., 2014; Chettri & Sharma, 2011; Dahal, 2019; Baidya et al., 2020; Chhetri et al., 1992)	Not repoeted

183	<i>Fagopyrum esculentum</i> Moench. (Polygonaceae)	Root	Stomach ulcer	Grain flour along with honey in lukewarm water taken in early morning to cure stomach ulcer. (Chettri & Sharma, 2011; Ahmed & Borthakur, 2005; Chetry et al., 2018; Rai & Sharma, 1994; Daur & Hajra, 1980; Deb, 1957; Dahal, 2019)	Antimicrobial (Zhao et al., 2018)
184	<i>Ficus auriculata</i> Lour. (Moraceae)	Fruits	Diarrhea, Dysentery	Bark juice (about ½ cup) taken twice daily against diarrhoea and dysentery. (Chhetri et al., 1992; Dahal, 2019)	Not reported
185	<i>Ficus benghalensis</i> Linn. (Moraceae)	Leaf	Diarrhoea, Dysentery	Powdered leaves mixed with curd and 50 ml of dosage prescribe orally thrice daily for 3 days. (Naldarine & Lalnundanga, 2017; Rao & Jamir, 1982; Vedet al., 2017; Jaiswal, 2010)	Antibacterial (Saxena et al., 2012)
186	<i>Ficus benjamina</i> L. (Moraceae)	Shoot	Dysentery	1/2 cup of decoction of tender shoot prescribe orally for 2-4 days after food. (Dahal, 2019)	Antioxidant (Jain et al., 2013)
187	<i>Ficus glomerata</i> Roxb. (Moraceae)	Bark	Dysentery, Diarrhoea	One cup of boiled extract of the bark is given twice daily till cure. (Nonibala, 2015)	Antioxidant (Irfan et al., 2011)
188	<i>Ficus hispida</i> Roxb.	Bark,	Diarrhoea	The boiled extract of fruit and	Antioxidant,

	ex Wall. (Moraceae)	Fruit		bark is prescribing once daily for two days. (Srivastava et al., 1987; Sumitra, 2013; Nonibala, 2015)	Antibacterial (Ramesh et al., 2018)
189	<i>Ficus palmata</i> Forss k.(Moraceae)	Leaves	Diarrhoea, Dysentery	Leaves cooked and taken as a remedy for carminative and stomach trouble. (Khatoon, 2014)	Antibacterial (Nasar et al., 2017)
190	<i>Ficus pumila</i> L. (Moraceae)	Fruit	Diarrhoea	The boiled extract of the fruit is given in diarrhea. (Sharma & Sharma, 2010; Nonibala, 2015; Sharma et al., 2014; Chetryet al., 2018)	Antibacterial (Maria et al., 2014)
191	<i>Ficus religiosa</i> L. (Moraceae)	Bark, Latex	Dysentery	Decoction taken orally 2-3 times daily till cure. (Sharma & Hazarika, 2018; Chhetri et al., 1992; Shankar & Rawat, 2008; Jamir et al., 2015; Gogoi et al., 2019; Das et al., 2008)	• Antibacterial (Prakashet al., 2017)
192	<i>Ficus squamosa</i> Rox b. (Moraceae)	Leaves	Indigestion	Decoction of young leaves (about 1/2 cup) given in indigestion. (Chhetri et al., 1992; Khatoon, 2014)	Antioxident (Saklani & Chandra, 2011)
193	<i>Flacourtia jangomas</i> (Lour.) Raeush. (Flacourtiaceae)	Fruit	Stomach ulcer	About once cup of decoction of fruit is given in stomach ulcer. (Sharma & Sharma, 2010;	Antioxident (Ahmad et al., 2020)

				Khatoon, 2014)	
194	<i>Foeniculum vulgare</i> Mill. (Apiaceae)	Fruit	Stomach ulcer	Two tablespoon of juice with halfcup of water is given in stomach ulcer. (Ved et al., 2017; Khatoon, 2014)	Antibacterial (Cantore et al., 2004)
195	<i>Fragaria nilgerrensis</i> Schltdl. ex J. Gay (Rosaceae)	Whole plant	Dysentery, Diarrhoea	One cup of decoction twice daily till cure. (Mao, 1993; Chhetri, 2005; Das, 2003)	Not reported
196	<i>Garcinia cowa</i> Roxb. ex DC. (Clusiaceae)	Bark, Fruits	Dysentery	<ol style="list-style-type: none"> 1. The fruit is finely powdered after sun dried and one or two teaspoon of power mixed with one glass of cold water and take it in empty stomach. (Laloo et al., 2006; Rao, 1981; Bora & Bora, 2020; Gogoi et al., 2019; Borkataki, 2006; Gogoi, 1997; Changkija, 1999) 2. Decoction (about ½ cup) of bark taken against hypertension and in stomach disorders. (Pfoze, 2012; Sharma & Sharma, 2010) 	Antioxident (Joseph et al., 2005)

197	<i>Garcinia kydia</i> Roxb. (Clusiaceae)	Fruit	Constipation, Dysentery	Fruits can be preserved sundried and during the off season dried fruits can be boiled with water and that juice can be taken orally twice a day after food. (Bora, 2001; Marak, 2018; Rao & Jamir, 1982)	Antioxidant (Dutta et al., 2018)
198	<i>Garcinia lancaefolia</i> Roxb. (Clusiaceae)	Fruit	Diarrhoea, Dysentery	Half cup of fruit juice is given twice daily till cured. (Samati, 2006; Rout et al., 2012; Teron, 2011; Rai et al., 2010)	Antioxidant (Policegoudra et al., 2012)
199	<i>Garcinia morella</i> (Gaertn.) Desv.(Clusiaceae)	Fruit	Dysentery	Dry fruit curry consumed in dysentery. (Taluder & Gupta, 2014; Talukdar & Gupta, 2014; Das et al., 2013; Megoneitso and Rao, 1983; Khatoon, 2014)	Antioxidant (Gogoi et al., 2017)
200	<i>Garcinia pedunculata</i> Roxb. (Clusiaceae)	Fruit	Constipation, Dysentery	1. Dry fruit is mixed with boiled rice water, salt and mustard oil. The mixture is given orally during trouble and given till cure. (Khatoon, 2014; Kar & Borthakur, 2008; Bora, 2016; Lalramnghinglova, 1998; Teron, 2011;	Antioxidant (Mudoi et al., 2012; Jayaprakash et al., 2006)

				<p>Rethy et al., 2010)</p> <p>2. ¼ part dried fruit of <i>Garcinia pedunculata</i> is soaked in half cup (15-20 ml) water for few hours then mixed with salt & pseudo-stem water of <i>Musa bulbisiana</i> is given to cure dysentery. (Srivastava et al., 1987; Bora, 2001; Bora, 2016; Sumitra, 2013).</p>	
201	<i>Garcinia xanthochymus</i> Hook. f (Clusiaceae)	Leaf	Chronic dysentery	Decoction of leaves boiled and take twice daily till cure. (Konwar et al., 2020)	Antioxident (Fu et al., 2012)
202	<i>Gaultheria fragrantissima</i> Wall. (Ericaceae)	Leaf	Dysentery	Powdered leaf mixed with water and 1 glass of these doges taken orally till cure. (Jaiswal, 2010)	Antioxidant, Antibacterial (Pandey et al., 2017)
203	<i>Globba clarkei</i> Baker (Zingiberaceae)	Rhizome	Stomachache	Rhizomes pounded and juice extract used for curing stomachache. (Samati, 2006; Ved et al., 2017)	Not reported
204	<i>Glochidion oblatum</i> J. D. Hooker	Stem, Root	Dysentery	Fresh stem and roots extracts are taken orally till cure. (Pfoze,	Not reported

	(Ranunculaceae)			2012; Gurumayum & Soram, 2014)	
205	<i>Gossypium arboreum</i> L. (Malvaceae)	Root, Leaf	Dysentery, Diarrhoea, Gastritis	Decoction of root and leaves useful in gastric irritation, dysentery and diarrhoea. (Rai & Sharma, 1994; Daur & Hajra, 1980; Gogoi, 1997; Dahal, 2019)	Antioxidant, Antibacterial (Annan & Houghton, 2008)
206	<i>Gynura bicolor</i> (Roxb. ex Willd.)DC. (Asteraceae)	Leaf	Gastritis, Diarrhoea	1. Leaves along with the young stems is boiled with or without rice and is taken for treating gastritis. (Megoneitso & Rao, 1983; Majumdar & Dutta, 2007; Gurumayum&Soram, 2014; Sharma et al., 2014; Ranjana, et al., 2013; Leal & Limasenla, 2020; Pfoze, 2012; Daur & Hajra, 1980; Chhetri, 2005; Ahmed & Borthakur, 2005; Das, 2003)	Antibacterial (Rozano et al., 2017; Rozano, et al., 2017; Lu et al., 2012)

207	<i>Hedychium coccineum</i> Buch.-Ham. ex Sm. (Zingiberaceae)	Rhizome	Gastritis	The shoots are eaten raw. (Kom et al., 2018)	Antioxidant (Ray et al., 2018)
208	<i>Hedychium flavescens</i> Carey ex Rosc (Zingiberaceae)	Rhizome	Gastritis	About one cup of boiled extract of the tuber is mixed with honey and administered orally. (Sharma et al., 2014; Komet al., 2018)	Antioxidant (Ray et al., 2018)
209	<i>Hedychium rubrum</i> A.S Rao & D.M. Verma (Zingiberaceae)	Rhizome	Diarrhoea, Dysentery	The boiled extract of rhizome (about 1 cup) is mixed with honey and administered orally. (Gurung, 2002; Kom et al., 2018)	Antioxidant (Hartatia et al., 2014)
210	<i>Hedychium spicatum</i> Sm. (Zingiberaceae)	Whole plant	Diarrhoea	Half cup of infusion is taken with warm water against diarrhoea till cure. (Kagyung et al., 2009; Mandal et al., 2013, Jamir et al., 20115; Dahal, 2019)	Antioxidant (Rawat et al., 2011)
211	<i>Hedyotisauricularia</i> L. (Rubiaceae)	Leaves	Diarrhoea, Dysentery	Decoction of leaves is used in diarrhoea and dysentery. (Megoneitso & Rao, 1983; Murtem & Chaudhry, 2016; Hynniewta, 2010; Kayang et al., 2005; Majumdar et al., 2006;	Antimicrobial (Ali et al., 1996)

				Khatoon, 2014)	
212	<i>Helianthus annus</i> L. (Asteraceae)	Seed	Stomachache	Seed mixed with hot water and take orally twice daily till cure. (Rai et al., 2010)	Antimicrobial (Adetunji et al., 2014)
213	<i>Heracleum wallichii</i> DC. (Umbelliferae)	Fruit	Diarrhoea, Dysentery	Fruits chewed against stomach disorders. (Daur & Hajra, 1980; Chhetri, 2005; Dahal, 2019)	Antioxidant, Antibacterial (Bahadori et al., 2016)
214	<i>Hibiscus cannabinus</i> L. (Malvaceae)	Leaf	Indigestion	Boiled extract of leaves is given once daily for a week in case of indigestion. (Sharma & Sharma, 2010; Khatoon, 2014)	Antioxidant (Mariod et al., 2012)
215	<i>Hibiscus sabdariffa</i> L. (Malvaceae)	Leaf	Dysentery	Leaf curry (about 1 glass) in dysentery. (Taluder & Gupta, 2014; Bora & Das, 2015; Gogoi, 1997; Gogoi et al., 2019; Talukdar & Gupta, 2014; Sumitra, 2013; Singh et al., 2015; Das & Singh, 2017; Teron, 2011; Zhasa et al., 2015)	Antibacterial (Abdallah, 2016)
216	<i>Himalaiella deltoidea</i> (DC.) Raab-Straube (Asteraceae)	Leaves	Gastritis, Stomachache	Boil decoction of the plant with salt is prescribed twice daily for about 1-3 days. (Pfoze, 2012; Das & Sharma, 2002; Chhetri et al., 1992)	Not reported

217	<i>Hiptage benghalensis</i> (L.) Kurz (Malpighiaceae)	Root	Diarrhoea, Dysentery, Stomachache	Decoction (about ½ cup) of the root is taken orally for stomachache; chewed in a raw form in diarrhoea and the powdered root bark mixed with water is use for dysentery. (Ngente, 2012; Ahmed & Borthakur, 2005)	Antibacterial (Murugan & Mohan, 2011)
218	<i>Hippophae salicifolia</i> D. Don (Elaeagnaceae)	Fruits	Constipation, Stomachache	Fruits juice used to treat constipation and stomachache. (Shil et al., 2014; Dahal, 2019)	Antioxidant, Antibacterial (Saikia & Handique, 2013)
219	<i>Holarrhena pubescens</i> Wall. ex G. Don (Apocynaceae)	Bark	Chronic dysentery	Bark crushed along with root of <i>Mimosa pudica</i> and mixed with a cup of warm water and decoction is given orally after breakfast till cure the disease. (Bora, 2016; Chhetri, 2007; Rai & Sharma, 1994; Debbarma et al., 2017; Changkija, 1999; Laloo & Hemalatha, 2011, Dahal, 2019; Dutta, 2012; Monlai, 2013; Ahmed & Borthakur, 2005; Naldarine & Lalnundanga, 2017; Das et al., 2009; Gogoi, 1997; Bhuyan,	Antibacterial (Chouhan. et al., 2017)

				1998; Teron, 2011; Choudhury, 1999)	
220	<i>Holboellia latifolia</i> Wall (Lardizabalaceae)	Fruit	Diarrhoea	Boiled fruit is eaten orally. (Devi, et al., 2011; Chase & Singh, 2013)	Antimicrobial (Malewska et al., 2018)
221	<i>Houttuynia cordata</i> Thunb (Saururaceae)	Leaf, Root	Dysentery, Stomach disorder, Colic and bilious pain	<ol style="list-style-type: none"> 1. Paste of young branch of <i>Mentha spicata</i> along with the leaf of <i>Houttuynia cordata</i> and <i>Psidium guajava</i> given orally in empty stomach till cure the disease. (Ahmed & Borthakur, 2005; Dahal, 2019; Bora, 2016; Kagyung et al., 2009; Singh et al., 2015; Das & Tag, 2005; Zhasa et al., 2015; Jamir & Tsurho, 2016; Baidya et al., 2020; Guha et al., 2018) 2. Roots and leaves are eaten raw to treat amoebic dysentery. (Ahmed, 2005; Changkija, 1999; Khongsai et al., 2011; Kar 	Antioxidant (Tianet al., 2011)

				& Borthakur, 2008; Borkataki, 2006; Hynniewta, 2010; Monlai, 2013; Khatoon, 2014; Bhuyan, 1998; Gogoi, 1997; Tsering, 2017; Namsa et al., 20011; Chetry et al., 2018; Bora, 2001; Rao & Jamir, 1982; Sangtam et al., 2012). 3. Three teaspoonfuls of leaf juice mixed with little black pepper and is prescribe twice daily in a day to cure colic and bilious pain. (Khan & Yadava, 2010; Chhetri et al., 1992; Ahmed & Borthakur, 2005; Bora & Bora, 2020)	
222	<i>Hydrocotyle javanica</i> Thunb. (Apiaceae)	Whole plant	Watery diarrhea	The whole plant is ground with water and the leaves of <i>Rubus hexogonus</i> and <i>Cymbopogon</i> species. This decoction taken for two days on empty stomach to cure watery diarrhea. (Ahmed,	Antimicrobial (Sivakumar et al., 2017)

				2005; Daur & Hajra, 1980)	
223	<i>Hydrocotyle sibthorpioides</i> Lam. (Apiaceae)	Whole plant	Dysentery, Stomach pain	<ol style="list-style-type: none"> 1. Leaf of <i>Cajanuscajan</i>, <i>Acacia farnesiana</i>, <i>Desmodiumtrifloruman</i> d <i>Hydrocotyle sibthorpioides</i> along with the rhizome of <i>Acorus calamus</i> are mixed gently to prepared teblets. One tablet is given orally in empty stomach for 3 days. (Kar & Borthakur, 2008; Bora, 2016) 2. 10-25 ml juice with cow milk is given orally daily at morning in empty stomach for 3 days. (Salam et al., 2014; Borah et al., 2006; Talukdar & Gupta, 2014; Bora, 	Antimicrobial (Hazarika et al., 2021; Mandal et al., 2016; Hazarika et al., 2019)

				2016; Lepchaet al., 2019)	
224	<i>Hygrophila ringens</i> (L.) R. Br. ex Spreng. (Acanthaceae)	Whole plant	Diarrhoea, Dysentery, Stomach ache	Once tea cupfull of fresh extract of whole plant taken orally for a week in treatment of stomach complaints. (Rai & Sharma, 1994; Singh et al., 1989; Khatoon, 2014)	Antimicrobial (Patra et al., 2009)
225	<i>Hyptis suaveolens</i> (L.) Poit. (Lamiaceae)	Root	Dysentery	A glassful of root decoction is given once daily for one week (Salam et al., 2014; Majumdar & Datta, 2006)	Antioxidant (Mishra et al., 2021; Gavani & Paarakh, 2008)
226	<i>Imperata cylindrica</i> Beauv. (Poaceae)	Rhizome	Diarrhoea, Dysentery	Rhizome is crushed and soaked in water overnight, then drunk to relieve dysentery and diarrhea. (Das, 2003; Gurung, 2002; Changkija, 1999)	Antibacterial (Parkavi et al., 2012)
227	<i>Inula obtusifolia</i> A. Kerner (Asteraceae)	Shoot	Diarrhoea, Dysentery	Plant antiseptic, diuretic, expectorant and useful in gastrointestinal problems. (Ahmed & Borthakur, 2005; Dahal, 219)	Antimicrobial (Amin et al., 2013)
228	<i>Ipomea uniflora</i> Roem. & Schult. (Convolvulaceae)	Leaf	Dysentery	1 tablespoon twice a day of the aqueous extract is consumed daily to treat dysentery. (Maikhuri, 1993; Sharma &	Not reported

				Sharma, 2010)	
229	<i>Iris domestica</i> (L.) Goldblatt et Mabb. (Iridaceae)	Rhizome	Chronic constipation	Decoction of rhizome used against chronic constipation. (Das, 2003; Rai & Sharma, 1994; Ahmed & Borthakur, 2005; Megoneitso & Rao, 1983; Rao & Jamir, 1982; Bhuyan, 1998; Dahal, 2019)	Antioxidant (Iwashina & Mizuno, 2020)
230	<i>Ixora coccinea</i> L. (Rubiaceae)	Root, Leaf	Dysentery	Leaf and root extract taken to cure dysentery. (Ahmed & Borthakur, 2005; Badola & Pradhan, 2013; Dahal, 2019)	Antioxidant, Antimicrobial (Muhammada et al., 2020)
231	<i>Ixora nigricans</i> R.Br.. (Rubiaceae)	Leaf	Dysentery, Colic problems	Infusion of the leaves is prescribed for dysentery & colic problems. (Devi et al., 2011; Rai et al., 2010)	Antioxidant, Antimicrobial (Annapurna et al., 2003)
232	<i>Jasminum nervosum</i> Lour. (Oleaceae)	Leaf	Stomachache	Juice of leaf with half cup of cold water prescribe twice daily till cure. (Shil et al., 2014; Rai et al., 2010)	Antimicrobial (Balkrishna et al., 2021)
233	<i>Jatropha curcas</i> Linn. (Euphorbiaceae)	Latex	Dysenter, Chronic dysentery	Latex is mixed with 125 ml goat milk and given orally in empty stomach for 3 days. (Bhuyan, 1998; Marak, 2018; Gogoi, 1997; Naldarine & Lalnundanga, 2017; Bora, 2016;	Antimicrobial (Rofida, 2015)

				Teron, 2011)	
234	<i>Justicia adhatoda</i> Linn. (Acanthaceae)	Leaves, Fruits	Indigestion	½ cup of decoction of fresh leaves, seeds and fruits is taken for indigestion till cure. (Hazarika et al., 2012; Gurumayum & Soram, 2014; Sumitra, 2013; Borah et al., 2006; Rao & Jamir, 1982; Das et al., 2009; Changkija, 1999; Bora, 2001)	Antibacterial (Sharma & Kumar, 2016)
235	<i>Kyllinga brevifolia</i> Rottb. (Cyperaceae)	Tubers	Blood dysentery	Fresh tubers are crushed and made into paste. Half teaspoon of dose takes orally once daily for 7 days. (Mao, 1993; Kar & Borthakur, 2008)	Not reported
236	<i>Lantana camara</i> L. (Verbinaceae)	Root	Diarrhoea, Dysentery	Root powder taken with water to cure stomach disorder. (Sharma et al., 2014; Sharma, et al., 2014; Dahal, 2019)	Antioxidant, Antibacterial (Patil & Kumbhar, 2017)
237	<i>Launaea aspleniifolia</i> Hook.f. (Asteraceae)	Root	Darrhoea.	Root juice taken orally in empty stomach once daily till cure. (Chhetri et al., 1992; Das & Sharma, 2002; Dahal, 2019)	Antibacterial (Cheriti et al., 2012)
238	<i>Lagerstroemia micr ocarpa</i> Wight (Lythraceae)	Bark	Stomachac he	Decoction of bark (about one cup) taken orally twice daily to get releafe from stomachache.	Not reported

				(Megoneitso & Rao, 1983)	
239	<i>Lagerstroemia speciosa</i> (Linn.) Pers. (Lythraceae)	Root, Bark	Diarrhoea, Dysentery	Infusion of bark (1/2 cup about) take orally twice daily till cure. (Sharma & Sharma, 2010; Rai et al., 2010)	Antibacterial (Ambujakshi et al., 2009)
240	<i>Leucas aspera</i> (Will d.) Link (Lamiaceae)	Leaf	Indigestion	10 ml of leaf juice per day given for five days in indigestion. (Taluder & Gupta, 2014; Debbarma et al., 2017; Das et al., 2008; Devi, 2013)	Antioxidant, Antibacterial (Chew et al., 2012)
241	<i>Ligularia amplexicaulis</i> DC. (Asteraceae)	Whole plant	Colic and bilious pain	Decoction used in the treatment of stomach ache and vomiting due to indigestion. Dose take orally after food. (Khan & Yadava, 2010; Chettri & Sharma, 2011; Tsering, 2017; Dahal, 2019)	Antibacterial (Joshi et al., 2018)
242	<i>Lindera neesiana</i> (Wall. ex Nees) Kurz (Lauraceae)	Fruit	Diarrhoea, Dysentery	½ cup of juice given in empty stomach daily for 3 days. (Chhetri, 2005; Devi, et al., 2011; Lepcha et al., 2019)	Antimicrobial, Antineuroinflammatory (Subedi et al., 2016)
243	<i>Litsea cubeba</i> (Lour.) Pers. (Lauraceae)	Stem, Leaves, Fruits	Diarrhoea, Dysentery	Pounded stem, leaves and fruits are eaten with 1 glass of water till cure against stomach disorder. (Kar & Borthakur, 2008; Namsa, et al., 20011;	Antibacterial (Li et al., 2014)

				Mandal et al., 2013; Pfoze, 2012)	
244	<i>Litsea salicifolia</i> (Roxb. Ex Nees) Hook. F (Lauraceae)	Tender leaves	Diarrhoea, Dysentery	Leaf paste is taken twice a day with lukewarm water to cure loose motion (Das et al., 2009; Singh et al., 1989; Naldarine and Lalnundanga, 2017; Gogoi et al., 2019)	Antibacterial (Uddin et al., 2016)
245	<i>Lonicera japonica</i> T humb. (Caprifoliaceae)	Bark, Leaves	Stomac ache, Diarrhea	Bark is cut into pieces and boiled with water. Decoction prescribe orally once daily till cure. (Singh et al., 1989; Lalruatfeli et al., 2019)	Antioxidant, Anti-inflammatory (Hsu et al., 2016; Hsu et al., 2016)
246	<i>Lonicera macrantha</i> (D.Don) Spreng. (Caprifoliaceae)	Leaves	Constipation	Infusion of leaves is taken internally as an effective remedy against diarrhoea. (Megoneitso & Rao, 1983; Das & Sharma, 2002; Lalramnghinglova, 1998)	Antioxidant, Anti-inflammatory (Thanzami et al., 2013)
247	<i>Lycopodium clavatum</i> Linn. (Lycopodiaceae)	Root	Dysentery	Decoction of root (about one cup) take orally after food. (Vedet al., 2017; Chhetri, 2007)	Antibacterial (González-Alva, 2018)
248	<i>Lysimachia parviflora</i> Baker (Primulaceae)	Whole plant	Constipation	Plant cooked and eaten as apitizer as it helps in digestion. (Chettri & Sharma, 2011; Chhetri et al., 1992; Shilet al.,	Antioxidant (Merecz-Sadowska et al., 2021)

				2014; Khatoon, 2014)	
249	<i>Mahonia napaulensis</i> DC. (Berberidaceae)	Bark	Diarrhoea, Dysentery	20 ml. of decoction of bark taken against diarrhoea and dysentery. (Das, 2003; Tsering, 2017; Dahal, 2019)	Antibacterial (He & Mu, 2015)
250	<i>Mangifera indica</i> Linn. (Anacardiaceae)	Bark, Seed, Fruit	Dysentery	<ol style="list-style-type: none"> 1. Decoction of bark take orally for 3-7 days after food. (Sharma & Hazarika, 2018; Gogoi et al., 2019; Gogoi, 1997; Kar & Borthakur, 2008; Nonibala, 2015; Marak, 2018; Myrchiang, 2020; Yuhlung & Bhattacharyya, 2016) 2. Ripe fruit useful in constipation and cardiac debility. (Choudhury, 1999; Naldarine & Lalnundanga, 2017; Das et al., 2008). 3. Powdered seed kernel used in chronic dysentery. (Ahmed & Borthakur, 2005; Borah et al., 2006; Teron, 2011; Nath, 2006; Dahal, 2019; Sangtam et al., 2012; Imchen & Jamir, 2011) 	Antibacterial, Antioxidant (Ribeiro et al., 2008)

251	<i>Melastoma malabathricum</i> L. (Melastomaceae)	Leaf	Constipation	About one cup of extract is drunk for stomach troubles and gastric problems. (Rethy et al., 2010; Dutta, 2012; Choudhury, 1999; Bora & Das, 2015; Nonibala, 2015; Kagyung et al., 2009)	Antioxident, Antibacterial (Susanti et al., 2007)
252	<i>Melodinus cochinchinensis</i> (Lour.) Merr. (Apocynaceae)	Leaves	Diarrhoea	Paste of leaves mixed with a cup of warm water and taken twice daily. (Majumdar & Dutta, 2007; Kar & Borthakur, 2008)	Antibacterial (Yang et al., 2021)
253	<i>Mentha arvensis</i> Linn. (Lamiaceae)	Young shoot, Leaves	Diarrhoea	Fresh shoot juice with a pinch of common salt or a spoon of honey is given to diarrhoea patient. (Gurumayum & Soram, 2014; Khongsai et al., 2011; Sumitra, 2013; Das & Sharma, 2002; Dutta, 2012; Bora & Das, 2015; Das et al., 2008; Bora, 2001; Singh et al., 2015; Bharali et al., 2017; Hazarika et al., 2012)	Antibacterial (Biswas et al., 2014)
254	<i>Mentha spicata</i> Linn. (Lamiaceae)	Shoot	Dysentery, Constipation	Paste of the leaf of <i>Houttuynia cordata</i> and <i>Psidium guajava</i> along with the young branch of	Antibacterial (Bellik & Ammar, 2017)

				<i>Mentha spicata</i> and a pinch of rice flour is given orally in empty stomach till cure the disease. (Devi, 2015; Nath, 2006; Nonibala, 2015; Jamir et al., 2012; Rao & Jamir, 1982; Dahal, 219; Bora, 2016)	
255	<i>Meyna laxiflora</i> Rob yns (Rubiaceae)	Dried fruits	Dysentery	Dry fruits are chewed to treat dysentery. (Gurumayum & Soram, 2014; Gurung, 2002)	Not reported
256	<i>Mikania micrantha</i> Kunth. (Asteraceae)	Leaf	Diarrhoea	Leaves are chewed and used to get relieved from diarrhea. (Kagyung et al., 2009; Ahmed, 2005; Dutta, 2012; Khatoon, 2014; Monlai, 2013; Changkija, 1999; Das et al., 2008; Rao & Jamir, 1982; Salam et al., 2014; Lalramnghinglova, 1998)	Antibacterial (Sahaet al., 2015)
257	<i>Mimosa pudica</i> Linn. (Fabaceae)	Root	Dysentery, Chronic dysentery	Root crushed along with bark of <i>Holarrhena pubescens</i> and mixed with a cup of warm water and decoction is given orally after breakfast till cure the disease. (Hazarika et al., 2012; Bora, 2016; Khongsai et al., 2011; Pfoze, 2012; Das et al.,	Antibacterial (Arokiyaraj et al., 2012)

				2008; Teron, 2011)	
258	<i>Molineria capitulata</i> (Lo ur.) Herb Herb. (Hypoxidaceae)	Leaf, Tuber	Diarrhoea, Dysentery	Fresh leaves and tuber ground to paste and mixed with 1 cup of cow urine and dose take orally to treat diarrhea and dysentery. (Deb, 1957; Maikhuri, 1993). Two teaspoon of paste of rhizome with lukewarm water taken orally till cure. (Gurung, 2002; Chase & Singh 2013).	Antimicrobial (Umaruet al., 2020)
259	<i>Momordica charantia</i> L. (Cucurbitaceae)	Fruits, Seed	Diarrhoea	Boiled fruit and seed take with rice as vegetabe. (Rai & Sharma, 1994; Tsering, 2017; Devi, 2015; Das, 2003; Deb, 1957; Murtem& Chaudhry, 2016)	Antioxidant (Wu & Ng, 2008)
260	<i>Moringa oleifera</i> L. (Moringaceae)	Fruit	Diarrhoea	Young fruit use as vegetable with rice. (Das, 2003; Monlai, 2013)	Antioxidant (Vongsak et al., 2013)
261	<i>Morus australis</i> Poir. (Moraceae)	Root	Diarrhoea, Dysentery	Root juice taken in hypertension and also useful in diarrhoea. (Khan & Yadava, 2010; Megoneitso & Rao, 1983; Chhetri et al., 1992; Dahal, 2019)	Antioxidant (Imran et al., 2010)
262	<i>Mucuna pruriens</i>	Root	Diarrhoea,	Decoction of root taken orally	Antioxidant (Yadav et

	(L.) Dc. (Fabaceae)		Dysentery	in empty stomach till cure. (Mao, 1993; Srivastava et al., 1987; Majumdar & Datta, 2006; Hynniewta & Bora, 1997; Dahal, 219)	al., 2017)
263	<i>Murraya koenigii</i> (L.) Spreng. (Rutaceae)	Root, Leaf	Gastritis, Constipation	<ol style="list-style-type: none"> 1. Decoction of root taken to cure gastritis and constipation. Leaf juice taken against indigestion and dysentery. (Bora, 2001; Sumitra, 2013; Bora & Das, 2015; Dahal, 2019; Sharma et al., 2014; Choudhury, 1999) 2. Raw or cooked leaf extract given in indigestion. (Chhetri et al., 1992; Shil et al., 2014; Taluder & Gupta, 2014) 	Antimicrobial (Arulselvan & Subramanian, 2007)
264	<i>Musa bulbisiana</i> Colla. (Musaceae)	Pseudo stem, Fruit	Constipation, Dysentery	<ol style="list-style-type: none"> 1. $\frac{1}{4}$ part dried fruit of <i>Garcinia pedunculata</i> is soaked in half cup (15-20 ml) water for 	Antioxidant (Uthpala & Raveesha, 2019)

				<p>few hours then mixed with salt & pseudo-stem water of <i>Musa bulbisiana</i> is given to cure dysentery. (Bora, 2016; Gogoi et al., 2019; Marak, 2018; Gogoi, 1997; Dutta, 2012; Bhuyan, 1998; Rao & Jamir, 1982; Chetry et al., 2018; Nath, 2006; Borkataki, 2006)</p> <p>2. Dried fruit powder taken with water in dysentery. (Bhuyan, 1998; Das, 2003; Dahal, 2019).</p>	
265	<i>Musa paradisiaca</i> Linn. (Musaceae)	Fruit	Diarrhoea	<p>1. Crushed raw fruit mixed with curd is taken orally 2-3 times daily till cure. (Jaiswal, 2010; Chase & Singh, 2013; Yuhlung & Bhattacharyya, 2016; Vedet al., 2017; Sharma</p>	Antioxidant (Shodehinde & Oboh, 2013)

				&Pegu, 2011; Choudhury, 1999; Khatoon, 2014) 2. Fruit with cold water and a pinch of black salt prescribe 2 times in a day. (Nonibala, 2015; Dahal, 2019; Laloo&Hemalatha, 2011; Singh et al., 2015; Chhetri et al., 1992; Sangtam et al., 2012; Das & Dutta Choudhury, 2012;Imchen & Jamir, 2011; Rout et al., 2012; Kagyung et al., 2009)	
266	<i>Musa velutina</i> Wendl. & Drude (Musaceae)	Stem	Blood dysentery	3-4 tablespoon of stem juice takes orally twice dily till cure. (Sharma et al., 2014; Ranjana et al., 2013; Kar & Borthakur, 2008)	Antioxidant (Jayakumari et al., 2018)
267	<i>Mussaenda glabrata</i> (Hook.f.) Hutch. ex Gamble (Rubiaceae)	Leaf	Diarrhoea	Tender leaves are cooked with fish and is prescribed in diarrhoea. (Chhetri et al., 1992; Khatoon, 2014)	Antibacterial (Manasa et al., 2021)

268	<i>Myrica esculenta</i> Buch-Ham ex D. Don (Myricaceae)	Bark	Diarrhoea, Dysentery	Fruit juice in raw condition is preserved in airtight container and 2 teaspoons of dosage are taken orally thrice daily after food. (Sharma et al., 2014; Rai & Sharma, 1994; Laloo et al., 2006; Zhasa et al., 2015; Yakang et al., 2013; Ahmed, 2005; Hynniewta, 2010)	Antioxidant (Kabra et al., 2019)
269	<i>Myrica nagi</i> Thunb. (Myricaceae)	Bark	Blood dysentery	Stem bark in powdered form is mixed with a glass of water and 1 drop of lemon juice added, the mixture is taken against blood dysentery. (Marak, 2018; Pfoze, 2012; Hynniewta, 2010)	Antioxidant (Prashar & Patel, 2020)
270	<i>Neonauclea purpurea</i> (Roxb.) Merr. (Rubiaceae)	Fruits	Stomachache	Fruits consumed during stomachache. (Mao, 1993; Badola & Pradhan, 2013)	Not reported
271	<i>Neopicrorhiza scropulariiflora</i> (Pennell) D.Y. Hong (Plantaginaceae)	Root	Diarrhoea, Dysentery	One teaspoon of dry root powder mixed in a tea cup of lukewarm water and is taken once daily for two days. (Kar & Borthakur, 2008)	Antimicrobial (Rokaya et al., 2020)
272	<i>Nepenthes khasiana</i> Hook. f. (Nepenthaceae).	Leaves	Stomach disorder	Juice (about ½ cup) from unopened pitcher is used for stomach disorder. (Samati, 2016)	Antimicrobial (Dhamecha et al., 2016)

				2006; Sharma & Sharma, 2010)	
273	<i>Nephrolepis auriculata</i> (L.) Trimen (Davalliaceae)	Tuber	Indigestion	Root extract is given 2 teaspoonful thrice a day for one week. (Gurung, 2002; Dahal, 2019; Chhetri et al., 1992)	Antimicrobial (Yi et al., 2019)
274	<i>Nyctanthes arborescens</i> L. (Oleaceae)	Leaf, Flower	Intestinal worms	One teaspoon of leaf or flower juice for three days is given to children in empty stomach to expel common worms. (Debbarma et al., 2017; Ranjana, et al., 2013; Talukdar & Gupta, 2014; Singh et al., 1989; Taluder & Gupta, 2014. Saikia et al., 2010)	Antimicrobial (Dasgupta & de, 2007)
275	<i>Ocimum americanum</i> L. (Lamiaceae)	Leaves	Constipation.	Extract of leaves mixed with honey are used in bleeding piles and constipation. (Srivastava et al., 1987; Majumdar & Datta, 2006; Khatoon, 2014)	Antimicrobial (Parida et al., 2014)
276	<i>Ocimum basilicum</i> Linn. (Lamiaceae)	Root and Leaf	Dysentery	Paste is given orally in empty stomach for 3 days. (Debbarma et al., 2017; Bora, 2016; Leal & Limasena, 2020; Marak, 2018; Naldarine & Lalnundanga, 2017; Devi, 2015; Khatoon, 2014; Naldarine &	Antimicrobial (Ahmed, et al., 2019; Bernstein et al., 2009; Kaurinovic et al., 2011)

				Lalnundanga, 2017; Jamir & Tsurho, 2016; Nonibala, 2015)	
277	<i>Ocimum sanctum</i> Linn. (Lamiaceae)	Leaves	Blood dysentery	Leaves crust along with the seed of <i>Capsicum frutescens</i> and aerial part of <i>Drymaria cordata</i> and dose is prescribe orally once daily till relief of symptoms. (Das & Dutta Choudhury, 2012; Namsa et al., 20011; Bora, 2016).	Antimicrobial (Hussain et al., 2001)
278	<i>Oenanthe javanica</i> (Bl.) DC ssp. <i>stolonifera</i> Wall (Apiaceae)	Whole plant	Gastritis	Extract of the plant with salt help in digestion. (Pfoze, 2012; Khatoon, 2014; Sharma & Sharma, 2010; Hynniewta, 2010)	Antioxidant (Bhaigyabati et al., 2017; Lu & Li, 2019)
279	<i>Oldenlandia corymbosa</i> L. (Rubiaceae)	Whole plant	Dysentery	Infusion taken orally 2-3 times daily. (Singh et al., 1989; Mao, 1993; Sharma & Hazarika, 2018; Sharma & Pegu, 2011)	Antimicrobial (Datta et al., 2019)
280	<i>Oroxylum indicum</i> Vent. (Bignoniaceae)	Bark, Root	Dysentery	250 ml infusion of the bark of <i>Oroxylum indicum</i> and <i>Alstonia scholaris</i> is given orally at morning in empty stomach for till cure. (Bora, 2016; Das & Dutta Choudhury, 2012; Shankar & Rawat, 2008; Pfoze,	Antimicrobial (Kumar et al., 2010)

				<p>2012; Salam et al., 2014; Singh et al., 2015; Murtem & Chaudhry, 2016)</p> <p>Root bark juice is taken orally two to three times daily. (Kar & Borthakur, 2008; Bora, 2001; Monlai, 2013; Bhuyan, 1989; Jaiswal, 2010; Gurumayum & Soram, 2014; Khongsai et al., 2011a; Lalramnghinglova, 1998; Marak, 2018; Baidya et al., 2020; Naldarine & Lalnundanga, 2018)</p>	
281	<p><i>Oryza sativa</i> Linn. Var. bora (Poaceae)</p>	Fruit	<p>Dysentery, Diarrhoea</p>	<p>Infusion of <i>Sida cordifolia</i> mixed with <i>Oryza sativa</i> Linn. var. bora and 250 ml of curd. orally once daily morning for 3 days. (Rao & Jamir, 1982; Megoneitso & Rao, 1983; Ahmed & Borthakur, 2005; Bora, 2016).</p> <p>Paste of the leaf of <i>Houttuynia cordata</i> and <i>Psidium guajava</i> along with the young branch of <i>Mentha spicata</i> and a pinch of rice flour is given orally in</p>	<p>Antioxident (Premakumara et al., 2013)</p>

				empty stomach till cure the disease. (Bora, 2016).	
282	<i>Osbeckia crinata</i> Benth. Ex Naudin (Melastomaceae)	Leaf	Diarrhea, Dysentery	2-6 teaspoon of leaf paste is used to treat diarrhea and dysentery. (Rai & Sharma, 1994; Yakang et al., 2013; Rao & Jamir, 1982; Devi, 2013; Kayang et al., 2005; Laloo & Hemalatha, 2011)	Antioxidant (Lawarence & Murugan, 2017)
283	<i>Osbeckia nepalensis</i> Hook. (Melastomaceae)	Leaves and Roots	Gastric	Plant juice taken in empty stomach to cure indigestion. (Dahal, 2019)	Antioxidant (Tiwary et al., 2017)
284	<i>Oxalis corniculata</i> Linn. (Oxalidaceae)	Whole plant	Dysentery	Whole plant is ground into paste together with <i>Drymaria cordata</i> and <i>Centella asiatica</i> ; juice extracted from the paste is given till cure. (Neogi, 1989; Das & Singh 2017; Das et al., 2013; Hynniewta, 2010; Ahmed, 2005; Kayanget al., 2005; Leal & Limasenla, 2020; Gogoi, 1997; Marak, 2018; Khatoon, 2014; Pfoze, 2012; Badola & Pradhan, 2013; Baidya et al., 2020; Das et al., 2008; Zhasaet al., 2015; Chhetri et al., 1992;	Antioxidant, Antimicrobial (Raghavendra et al., 2006)

				Chetryet al., 2018; Talukdar & Gupta, 2014; Devi, 2015; Borkataki, 2006; Naldarine & Lalnundanga, 2017; Yakang et al., 2013; Bharali et al., 2017; Imchen & Jamir, 2011).	
285	<i>Paedariafoetida</i> Linn. (Rubiaceae)	Leaf	Diarrhea, Dysentery	Half cup of juice of the leaf given orally to cure dysentery. (Laloo & Hemalatha, 2011; Myrchiang et al., 2020; Guha et al., 2018; Lea & Limasenla, 2020; Khongsai et al., 2011; Kagyung et al., 2009; Kar & Borthakur, 2008; Gurumayum & Soram, 2014; Hynniewta, 2010; Borah et al., 2006; Talukdar & Gupta, 2014; Sarma & Devi, 2017; Goswami et al., 2009; Monlai, 2013; Shankar & Rawat, 2008; Tsering, 2017; Pfoze, 2012; Gogoi, 1997; Bora, 2001; Marak, 2018; Das & Singh, 2017; Naldarine &	Antioxidant , Antimicrobial (Uddinet al., 2007)

				Lalnundanga, 2017; Kala, 2005; Chetry et al., 2018; Borkataki, 2006; Khatoon, 2014; Nath, 2006; Chhetri et al., 1992; Murtem & Chaudhry, 2016)	
286	<i>Paris polyphylla</i> Sm. (Melanthiaceae)	Rhizome	Stomach ulcers	Fresh rhizome is eaten raw for stomach ulcers. (Pfoze, 2012; Sumitra, 2013; Chhetri et al., 1992; Khan & Yadava, 2010; Sharma & Sharma, 2010; Salam, et al., 2014)	Antioxidant (Lepcha et al., 2019)
287	<i>Parkia javanica</i> (Lam.) Merr. (Fabaceae)	Fruits	Diarrhoea, Dysentery	Fruits consumed as curry with rice. (Singh et al., 2015; Singh et al., 1989; Rao & Jamir, 1982; Debbarma et al., 2017)	Antibacterial (Saha et al., 2018)
288	<i>Parkia timoriana</i> Merr. (Fabaceae)	Bark, Twig, Pods	Diarrhoea, Dysentery	Decoction of bark, pods & twigs is taken orally against diarrhoea & dysentery. (Lalramnghinglova, 1998; Sumitra, 2013; Rai et al., 2010; Devi, 2015; Zhasa et al., 2015; Sangtam et al., 2012; Rao & Jamir, 1982; Jamir et al., 2015; Sharma, et al., 2014; Pfoze, 2012)	Antioxidant (ReshmiSingha et al., 2021)

289	<i>Parochetus communis</i> D. Don (Fabaceae)	Whole plant	Diarrhoea	Juice is extracted and about one cup of its dose take orally till cure. (Ahmed & Borthakur, 2005; Myrchiang et al., 2020)	Not reported
290	<i>Passiflora edulis</i> Sims (Passifloraceae)	Fruit	Dysentery	Half cup of juice is given twice daily, till cured. (Ahmed, 2005; Sangtam et al., 2012; Zhasa et al., 2015; Rai & Sharma, 1994; Gurung, 2002; Singh et al., 2015; Chhetri et al., 1992; Hynniewta, 2010; Pfoze, 2012)	Antioxidant (Rudnicki et al., 2007)
291	<i>Pedicularis siphonantha</i> D. Don (Scrophulariaceae)	Whole plant	Dysentery, Stomach pain	Half cup of decoction once daily for 3-6 days in empty stomach. (Ranjana, et al., 2013; Dahal, 2019)	Antibacterial (Frezza et al., 2019)
292	<i>Pentapanax leschenaultii</i> (DC.) Seemann (Araliaceae)	Flowers	Dysentery	Infusion of flowers taken 2 time in a day for about one or two days. (Gurung, 2002; Shilet al., 2014; Dahal, 2019)	Antibacterial (Bandivdekar & Moodbidri, 2002)
293	<i>Perilla frutescens</i> (L.) Britton. (Lamiaceae)	Whole plant	Gastric problems	Extract (about ½ cup) take orally twice daily after food till cure. (Chettri & Sharma, 2011; Das, 2003; Rao & Jamir, 1982; Changkija, 1999)	Antioxidant (Lee et al., 2013)

294	<i>Persicaria capitata</i> (Buch.- Ham. ex D.Don) H. Gross (Polygonaceae)	Whole plant	Dysentery, Stomach pain	Infusion taken in empty stomach 2 time in a day for two days. (Srivastava et al., 1987; Singh et al., 1989; Dahal, 2019)	Antibacterial (Han et al., 2018)
295	<i>Persicaria vivipara</i> (L.) RonseDecr. (Polygonaceae)	Root	Dysentery	Root juice taken orally twice daily in empty stomach for one week. (Sharma & Sharma, 2010; Chhetri et al., 1992; Dahal, 2019)	Not reported
296	<i>Phlogacanthus thyrsiflorus</i> Nees (Acantheceae)	Leaf, Flower	Dysentery	Juice extract with one cup of lukewarm water is prescribe orally after food till cure. (Dahal, 2019; Gurumayum & Soram, 2014; Debbarma et al., 2017; Hynniewta, 2010; Das, 2003; Teron, 2011; Dutta, 2012; Khatoon, 2014).	Antimicrobial (Kumar et al., 2017)
297	<i>Phoenix sylvestris</i> (L.) Roxb. (Arecaceae)	Latex	Diarrhoea, Dysentery	The fresh gum with ½ cup of lukewarm water and one pinch of salt take orally till cure. (Khatoon, 2014).	Antioxidant (Jain et al., 2018)

298	<i>Phyllanthus emblica</i> L. (Phyllanthaceae)	Root	Diarrhoea, Dysentery	<ol style="list-style-type: none"> 1. Infusion (1/2 to 1 cup) of crushed root bark taken once daily for 2-4 days to cure diarrhoea and dysentery. (Nath, 2006; Monlai, 2013; Tsering, 2017; Lalramnghinglova, 1998; Bhuyan, 1998; Choudhury, 1999; Dahal, 2019; Jamir & Tsurho, 2016; Sangtam et al., 2012) 2. Two teaspoon fruit extract given twice daily for five days in indigestion. (Taluder & Gupta, 2014; Gogoi et al., 2019; Rao & Jamir, 1982; Sharma et al., 2014; Pfoze, 2012) 	Antioxidant (Liu et al., 2008).
299	<i>Phyllanthus fraternus</i> G.L. Webster (Phyllanthaceae)	Whole plant	Diarrhoea, Constipation	The root is boiled with milk and taken in digestive troubles. (Pfoze, 2012; Bora & Das, 2015; Jamir et al., 2012; Bora, 2001)	Antimicrobial (Sailaja & Setty, 2006)
300	<i>Phyllanthus parvifolius</i> Ham. (Phyllanthaceae)	Whole plant	Diarrhoea, Dysentery	Half cup of leaf juice is given twice daily, till cured. (Khan, 2005; Sharma et al., 2014;	Not reported

				Laloo et al., 2006)	
301	<i>Physalis minima</i> Linn. (Solanaceae)	Root	Dysentery	Root paste along with the fruit of <i>Piper nigrum</i> and mixed with water and given orally in empty stomach for 1-2 days. (Bora, 2016; Ahmed & Borthakur, 2005; Kagyung et al., 2009)	Antioxidant (Banothuet al., 2017; Singh & Prakash, 2014)
302	<i>Physalis peruviana</i> Linn. (Solanaceae)	Leaves	Stomachache, Dysentery	The leaves are taken raw or boiled and the decoction is taken as vegetable. (Ahmed and Borthakur, 2005; Gurumayum and Soram, . (Pfoze, 2012; Ranjana, et al., 2013; Srivastava et al., 1987)	Antioxidant (Wu et al., 2006; Cueva et al., 2017)
303	<i>Picrorhiza kurrooa</i> Royle ex Benth. (Scrophulariaceae)	Rhizome	Diarrhoea, Dysentery, Stomachache	Dried rhizome soaked overnight in water and one cup of dose taken during stomach ache, diarrhea and dysentery. (Gurung, 2002; Dahal & Borthakur, 2017a; Daur & Hajra, 1980; Murtem & Chaudhry, 2016)	Antioxidant (Krupashree et al., 2014)
304	<i>Pimpinella hastata</i> C.B. Clarke	Leaves	Gastric trouble	Leaves extract (about one cup) is taken to get relief from gastric trouble. (Mao, 1993; Khatoon, 2014).	Not reported

	(Apiaceae)				
305	<i>Piper betle</i> Linn. (Piperaceae)	Petiole, Leaf	Chronic dysentery	<ol style="list-style-type: none"> 1. Ripe fruit of <i>Citrus paradisi</i> Macf. is taken & create a small hole where petiole is placed inside the fruit and fruit is placed inside the burning tuh. After totally cooked one fruit is given daily at morning in empty stomach up to 10 days. (Bora, 2016). 2. Leaves are eaten raw which help in digestion. (Dutta, 2012; Bora & Bora, 2020; Hynniewta & Bora, 1997; Das & Dutta Choudhury, 2010). 	Antioxidant, Antimicrobial (Dasgupta & De, 2004)
306	<i>Piper longum</i> Linn. (Piperaceae)	Fruit	Stomach ache	Powdered dried roots taken with water serve as vermifuge in children, relieves from stomach ache. (Bora & Das, 2015; Badola & Pradhan, 2013; Jamir & Tsurho, 2016; Nath, 2006; Dahal, 2019; Kar & Borthakur, 2008)	Antioxidant, Antimicrobial (Aziz et al., 2018)
307	<i>Piper nigrum</i> Linn.	Fruit	Dysentery	1. Root paste of <i>Physalis</i>	Antioxidant,

	(Piperaceae)			<p><i>minima</i> along with the fruit, mixed with water and given orally in empty stomach for 1-2 days. (Bora, 2016; Borah et al., 2006; Hynniewta & Bora, 1997).</p> <p>2. Fruits of <i>Piper nigrum</i> crushed gently with root of <i>Polygonum barbatum</i>. Paste is mixed with hot water 150 ml and filtered. Filtrate is given orally once daily till cure. (Sharma & Sharma, 2010; Das, 2003; Sharma et al., 2014; Dahal, 2019; Bora, 2016).</p>	Antimicrobial (Zarai et al., 2013)
308	<i>Plantago asiatica</i> subsp. <i>erosa</i> (Wall.) Z.Yu Li (Plantaginaceae)	Tender shoots	Constipation	Tender shoots is cooked and taken as a remedy for carminative and stomach trouble. (Kala, 2005; Khan, 2005)	Antioxidant (Ahna et al., 2018)
309	<i>Plantago erosa</i> Wall. (Plantaginaceae)	Root	Indigestion	One cup of root juice taken to cure indigestion. (Srivastava et al., 1987; Devi, 2015; Salam, et al., 2014; Dahal, 2019)	Antioxidant (Beara et al., 2009)

310	<i>Plumbago zeylanica</i> Linn. (Plumbaginaceae)	Root, Bark		Root and bark decoction is taken orally 2-3 times daily to treat diarrhea. (Choudhury, 1999; Nonibala, 2015; Zhasa et al., 2015; Maikhuri, 1993)	Antimicrobial (Rajakrishnan et al., 2017)
311	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze (Lamiaceae)	Leaf	Diarrhoea	One tea cup of fresh leaf juice take orally thrice daily for 7 days. (Deb, 1957; Sharma, et al., 2014; Kar & Borthakur, 2008)	Antimicrobial (Thoppil et al., 2014)
312	<i>Potentilla fulgens</i> Wall. (Rosaceae)	Root	Dysentery	Decoction of root taken orally once daily till cure. (Mao, 1993; Das, 2003; Das & Sharma, 2002; Khan, 2005; Chase & Singh, 2013)	Antioxidant (Jaitak et al., 2010)
313	<i>Polycarpon prostratum</i> (Forrsk.) Asch. & Schweinf. Ex Asch (Caryophyllaceae)	Whole plant	Diarrhoea	Half cup of juice takes orally twice daily for about 7 days. (Dahal & Borthakur, 2017; Chhetri, 2005; Ahmed & Borthakur, 2005; Debbarma et al., 2017)	Antimicrobial (Chandra & Rawat, 2015)
314	<i>Polygonum barbatum</i> Linn. (Polygonaceae)	Root	Diarrhoea	Root of <i>Polygonum barbatum</i> and fruits of <i>Piper nigrum</i> crushed gently. Paste is mixed with hot water 150 ml and filtered. Filtrate is given orally	Antioxidant (Shen et al., 2018)

				once daily till cure. (Ranjana, et al., 2013; Bora, 2016)	
315	<i>Polygonum molle</i> D. Don (Polygonaceae)	Leaves	Diarrhoea	The leaf is crushed and ½ cup of dose prescribe till cure. (Majumdar & Dutta, 2007; Ranjana et al., 2013; Lepcha et al., 2019)	Not reported
316	<i>Polygonum orientale</i> Linn. (Polygonaceae)	Leaves	Diarrhoea, Dysentery	Fresh leaves are boiled with or without rice and serve the patient for quick relief. (Chhetri, 2005; Gurumayum & Soram, 2014; Singh et al., 1989; Gurumayum&Soram, 2014).	Antimicrobial (Chiu et al., 2018; Wei et al., 2009)
317	<i>Polygonum perfoliatum</i> Linn. (Polygonaceae)	Leaf, Root	Dysentery	Crushed leaves and roots mixed with water and taken for about one week. (Khan & Yadava, 2010; Mao, 1993)	Antimicrobial (Lei et al., 2013)
318	<i>Polygonum posumbu</i> Buch.-Ham. ex D. Don (Polygonaceae)	Leaves	Diarrhoea	The leaves cooked with the fish <i>Puntius phutunio</i> is prescribed to cure diarrhoea due to malnutrition and menstrual disorder (Ranjana, et al., 2013; Ahmed & Borthakur, 2005; Khatoon, 2014).	Antimicrobial (Ishwori et al., 2014)

319	<i>Ponerorchischusua</i> (D. Don) Soo (Orchidaceae)	Tuber	Diarrhoea, Dysentery	Boiled decoction take orally twice daily for 1-4 days. (Dahal, 2019)	Not reported
320	<i>Portulaca oleracea</i> L. (Portulacaceae)	Stem and Leaves	Stomachac he	Stem and leaves are taken as vegetable with boied rice. (Rai & Sharma, 1994; Deb, 1957; Kagyunget al., 2009)	Antioxidant (Erkan, 2012)
321	<i>Prunus armeniaca</i> L. (Rosaceae)	Fruits	Stomach disorders	Water extract of the crushed fruit with salt is given in colic and stomach disorders. (Khatoon, 2014; Sharma et al., 2014; Bora, 2001).	Antimicrobial (Jaya &Lamba, 2012)
322	<i>Psidium guajava</i> Linn. (Myrtaceae)	Leaf	Dysentery, Stomach disorder, Blood dysentery	Paste of the leaf of <i>Houttuynia cordata</i> and <i>Psidium guajava</i> along with the young branch of <i>Mentha spicata</i> and a pinch of rice flour is given orally in empty stomach till cure the disease. (Kayang et al., 2005; Das & Dutta Choudhury, 2012; Bora, 2016; Bora & Bora, 2020; Debbarmaet al., 2017; Yuhlung& Bhattacharyya, 2016; Sharma & Pegu, 2011; Kar &Borthakur, 2008; Sumitra, 2013; Borah et al., 2006; Gogoi,	Antimicrobial, Antioxident (Bose& Chatterjee, 2016)

			<p>1997; Jamir et al., 2012; Majumdar et al., 2006; Nath, 2006; Khatoon, 2014; Teron, 2011; Marak, 2018; Das et al., 2008; Dutta, 2012; Sumitra, 2013; Choudhury, 1999; Rethy et al., 2010; Sarma & Devi, 2017; Imchen & Jamir, 2011; Jamir et al., 2012)</p> <p>Young twigs of <i>Viscum album</i> and <i>Psidium guajava</i> crushed gently with bark of <i>Spondias pinnata</i>. Filtered juice prescribed with water in empty stomach daily at morning for 3 days. (Chhetri et al., 1992; Chhetri et al., 1992; Hynniewta, 2010; Bora, 2016; Lea & Limasenla, 2020; Kagyung et al., 2009; Sharma & Sharma, 2010)</p> <p>Leaves are ground with the peels of raw mango and bark of <i>Rubus ellipticus</i> or with the leaves of <i>Passiflora edulis</i> and rhizome of <i>Curcuma longa</i> and</p>	
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				the juice obtained from these mixtures are given twice daily after food till cured. (Ahmed, 2005; Gurumayum & Soram, 2014; Ahmed & Borthakur, 2005; Myrchiang et al., 2020; Pfoze, 2012)	
323	<i>Pterocephalus hookeri</i> (C.B. Clarke) Diels (Caprifoliaceae)	Shoot	Diarrhoea, Dysentery	Infusion of aerial part taken to cure diarrhoea and dysentery. (Shilet al., 2014; Dahal, 2019)	Antimicrobial (Yanget al., 2020)
324	<i>Punicagranalum</i> Lin n. (Onagraceae)	Fruit, Leaf	Dysentery, Indigestion	Decoction of leaf is given orally twice daily after food till cure. Fruit juice take orally after food. (Yuhlung & Bhattacharyya, 2016; Das et al., 2008; Nonibala, 2015; Khatoon, 2014; Naldarine & Lalnundanga, 2017; Gogoi, 1997; Das et al., 2013; Sumitra, 2013; Marak, 2018; Nath, 2006; Borkataki, 2006; Das, 2003; Pfoze, 2012)	Antimicrobial, Antioxident (Celik et al., 2009)
325	<i>Quercus serrata</i> Thunb. (Fagaceae)	Fruit	Diarrhoea, Dysentery	Ripe fruit are chewed and used to get relieved from diarrhea and dysentery. (foze, 2012)	Antimicrobial (Taib et al., 2020)

326	<i>Raphanus sativus</i> L. (Brassicaceae)	Root	Diarrhoea	Soup (about one cup) prepared from fermented radish is useful against diarrhoea. (Srivastava et al., 1987; Samati, 2006; Dahal, 2019)	Antioxidant (Goyeneche et al., 2015)
327	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz (Apocynaceae)	Root	Dysentery	1 inch of root of <i>Rauvolfia serpentina</i> grind into powder. Added little amount of water in it and taken 2 teaspoonsful thrice daily for 2 days will recover from dysentery. (Mao, 1993; Marak, 2018; Naldarine & Lalnundanga, 2017; Bhuyan, 1998)	Antimicrobial (Divyanair et al., 2013)
328	<i>Rheum nobile</i> Hook. f. (Polygonaceae)	Rizome	Dysentery	Decoction (about one cup) of rhizome taken against dysentery. (Ved et al., 2017; Dahal, 2019)	Antimicrobial (Gupta et al., 2017)
329	<i>Rhododendron arboreum</i> Sm. (Ericaceae)	Bark, Flowers	Diarrhoea, Dysentery	Once cup of decoction of flower take orally after food till cure. (Marak, 2018; Lepcha et al., 2019; Dutta, 2012; Tsering, 2017; Badola & Pradhan, 2013; Dahal, 2019; Sumitra, 2013; Naldarine & Lalnundanga, 2017; Zhasa et al., 2015;	Antibacterial (Chauhan et al., 2016)

				Samati, 2006)	
330	<i>Rhus semialata</i> Murr. (Anacardiaceae)	Fruit	Diarrhea, Dysentery	Ripe fruits are either boiled or eaten raw to relieve from diarrhea and dysentery. (Ahmed, 2005; Gurumayum & Soram, 2014; Leal & Limasenla, 2020; Kagyung et al., 2009; Gurumayum & Soram, 2014; Pfoze, 2012)	Antimicrobial, Antioxidant (Bose & Maity, 2010)
331	<i>Rhus succedanea</i> Gamble (Anacardiaceae)	Fruit	Dysentery	A cup of fruit juice is given twice daily, till cured. (Laloo et al., 2006; Singh et al., 1989; Gurumayum & Soram, 2014)	Antimicrobial, Antioxidant (Surveswaran et al., 2007)
332	<i>Rohdea nepalensis</i> (Raf.) N.Tanaka (Asparagaceae)	Flower	Diarrhoea, Dysentery	Fresh inflorescence is directly consumed once daily for three days. (Rao & Jamir, 1982; Daur & Hajra, 1980; Kar & Borthakur, 2008)	Not reported
333	<i>Rubus moluccanus</i> auct non Linn. (Rosaceae)	Root	Pectic ulcer, Chronic dysentery	Juice given orally with cow milk in empty stomach for 4-5 days. (Sharma et al., 2014; Ahmed & Borthakur, 2005; Sharma & Sharma, 2010; Bora, 2016)	Antioxidant (Lee et al., 2012)

334	<i>Rubia manjith</i> Roxb. ex Fleming (Rubiaceae)	Roots	Diarrhoea	Root juice is taken twice a day with lukewarm water. (Samati, 2006; Yakanget al., 2013; Dutta, 2012; Gogoiet al., 2019)	Not reported
335	<i>Rubus ellipticus</i> Sm. (Rosaceae)	Fruit, Root, Stem	Diarrhoea, Dysentery	Half a cup of juice taken for two days on empty stomach. (Samati, 2006; Ahmed, 2005; Lea1 & Limasenla, 2020; Pfoze, 2012; Tsering, 2017; Sumitra, 2013; Rout et al., 2012)	Antioxident (Sharma & Kumar, 2011)
336	<i>Rubus niveus</i> Thunb. (Rosaceae)	Fruit	Diarrhoea, Dysentery	Ripe fruit are chewed and used to get relieved from diarrhea. (Chetryet al., 2018; Pfoze, 2012; Dahal & Borthakur, 2017, 2017a)	Antioxident (Muniyandiet al., 2019)
337	<i>Rumex acetosella</i> L. (Polygonaceae)	Leaves	Diarrhoea, Dysentery	Two teaspoon of fresh juice of leaves take orally twice daily for 7 days. (Dahal & Borthakur, 2017a; Singh et al., 1989; Kar & Borthakur, 2008)	Antimicrobial (Wegiera et al., 2011)
338	<i>Rumex vesicarius</i> L. (Polygonaceae)	Shoots	Dysentery	Half a cup of juice taken for two days on empty stomach. (Sharma et al., 2014)	Antimicrobial (El-Bakry et al., 2013)
339	<i>Saccharum officinarum</i> Linn. (Poaceae)	Stem	Dysentery	1-2 teaspoon of the mixture of the juice of sugarcane and <i>Citrus medica</i> is prescribed orally for 2-	Antioxident (Duarte-Almeida et al., 2011)

				3 times daily. (Megoneitso & Rao, 1983)	
340	<i>Sapindus mukorossi</i> Gaertn. (Sapindaceae)	Fruit	Constipation	Half cup of decoction of one fruit take orally for 2-4 days in empty stomach. (Pfoze, 2012; Dahal & Borthakur, 2017, 2017a; Gurung, 2002; Das & Sharma, 2002)	Antibacterial (Dinda et al., 2017)
341	<i>Sarcochlamy spulcherrima</i> (Roxb.) Gaud. (Urticaceae)	Leaves	Diarrhoea, Dysentery	Curry of young leaves is believed to cure diarrhea, dysentery and also used as digestive. (Sharma et al., 2014)	Antioxident (Paul et al., 2010)
342	<i>Saussurea gossypiphora</i> D.D. (Asteraceae)	Flower	Diarrhoea, Dysentery	One cup of decoction of flower taken twice daily after food against stomach disorders. (Vedet al., 2017)	Not reported
343	<i>Scoparia dulcis</i> Linn. (Scrophulariaceae)	Shoot	Stomach disorders	The decoction of the plant is used as an anthelmintic for infants of age 6 months to 1 year. (Ngente, 2012; Shilet al., 2014; Das & Choudhury, 2010; Dahal, 2019)	Antibacterial (Nahannu et al., 2018)
344	<i>Senna alata</i> (L.) Roxb. (Fabaceae)	Leaf	Diarrhoea, Dysentery	About ½ cup of leaf decoction twice daily till cure. (Hazarika et al., 2012)	Antibacterial (Sundaramsugumar et al., 2016)

345	<i>Senna obtusifolia</i> (L.) H.S. Irwin & Barneby (Fabaceae)	Fruit	Diarrhoea, Dysentery	Half cup of decoction of fruit take orally once daily after food for three days. (Majumdar & Dutta, 2007; Chhetri et al., 1992; Kar & Borthakur, 2008)	Antibacterial (Maoet al., 2019)
346	<i>Shorea robusta</i> Gaertn. (Dipterocarpaceae)	Leaves	Dysentery	About one cup of juice of tender leaf taken against dysentery. (Dahal, 2019)	Antimicrobial (Mukherjee et al., 2013)
347	<i>Sida cordifolia</i> Linn. (Malvaceae)	Roots	Dysentery	Infusion of <i>Sida cordifolia</i> mixed with <i>Oryza sativa</i> Linn. var. bora and 250 ml of curd. Take this mixture orally once daily morning for 3 days. (Megoneitso & Rao, 1983; Bora, 2016)	Antimicrobial (Dhalwal et al., 2005)
348	<i>Siegesbeckia orientalis</i> L. (Asteraceae)	Root	Indigestion	Root paste with one cup of lukewarm water taken against indigestion. (Das, 2003; Dahal, 2019)	Antimicrobial (Sasikumar et al., 2007)
349	<i>Silene nigrescens</i> (Edgew.) Majumdar (Caryophyllaceae)	Flower, Root	Indigestion	Decoction of leaf is given orally twice daily after food till cure. (Gurung, 2002; Dahal & Borthakur, 2017)	Not reported
350	<i>Sinopodophyllum hexandrum</i> (Royle) T.S.Ying	Root	Diarrhoea, Dysentery	About ½ to 1 cup of decoction of root take orally after food. (Pandey et al., 1991; Deb, 1957;	Antimicrobial (Wanga et al., 2018)

	(Berberidaceae)			Singh et al., 1989; Mandal et al., 2013)	
351	<i>Smilax aspera</i> L. (Smilacaceae)	Whole plant	Dysenter y	20 ml juice take orally twice daily for about 3 days. (Samati, 2006; Ahmed & Borthakur, 2005; Majumdar et al., 2006; Lepcha et al., 2019; Dahal, 2019)	Not repoeted
352	<i>Solanum anguivi</i> Lam. (Solanaceae)	Fruits	Diarrhoea, Dysentery	Fruit is cook as dish and consumed for dysentery and diarrhea. (Debbarma et al., 2017)	Antioxident (Elekofehinti et al., 2013)
353	<i>Solanum spirale</i> Roxb. (Solanaceae)	Fruit	Gastric	Warm decoction of fruit is used in stomach troubles and gastric problems. (Daur & Hajra, 1980; Kagyung et al., 2009)	Antioxident (Keawsaard et al., 2012)
354	<i>Solanum torvum</i> SW. (Solanaceae)	Leaf	Indisetion	Decoction of leaf is prescribing for indisetion after food till cure. (Dutta, 2012; Das & Tag, 2006; Khongsai et al., 2011)	Antioxident (Gandhi et al., 2011)
355	<i>Sonchus asper</i> (L.) Hill (Asteraceae)	Shoot	Stomachache, Gastritis	Decoction take orally once daily for 2-4 days in empty stomach. (Sinha, 1996; Pfoze, 2012; Sharma & Sharma, 2010)	Antimicrobial (Ali et al., 2010)
356	<i>Sonchus wightianus</i>	Roots	Diarrhoea	Root extract is given 2 teaspoonful thrice a day for one	Antimicrobial (Bolleddu et al., 2018)

	DC. (Asteraceae)			week. (Shilet al., 2014; Gurung, 2002; Kar & Borthakur, 2008)	
357	<i>Spilanthes paniculate</i> Wallich ex. DC. (Asteraceae)	Leaves	Diarrhea, Dysentery	Decoction of leaf is given orally twice daily till cure. (Das & Dutta Choudhury, 2010; Sharma et al., 2014; Choudhury, 1999; Sharma & Pegu, 2011; Das & Dutta Choudhury, 2012; Majumdar & Dutta, 2007; Pfoze, 2012)	Antimicrobial (Dias et al., 2012)
358	<i>Spinacia oleracea</i> L. (Lauraceae)	Tender leaves	Indigation	Tender leaves use as vegetable with rice during indigation. (Gogoi et al., 2019)	Antioxidant (Hussain et al., 2016)
359	<i>Spondias pinnata</i> (Linn.f.) Kurz. (Sapindaceae)	Bark	Dysentery	Bark along with the young twigs of <i>Viscum album</i> and <i>Psidium guajava</i> is crushed gently. Filtered juice given with water in empty stomach daily at morning for 3 days. (Laloo et al., 2006; Lalramnghinglova, 1998; Ahmed & Borthakur, 2005; Dahal, 2019; Bora, 2001; Chhetri et al., 1992; Bora, 2016; Sharma & Sharma, 2010)	Antibacterial, Antioxidant (Jain & Hossain, 2014; Hazra et al., 2009)
360	<i>Stellaria media</i> (L.) Villars	Shoot	Constipation,	Boiled aerial parts of <i>Stellaria media</i> are mixed with 3-4 bulbs	Antibacterial, Antioxidant (Solomon

	(Caryophyllaceae)		Dysentery	of garlic and kept overnight. Filtered dose prescribes daily morning for 3-4 days or till relief of symptoms. (Singh et al., 1989; Bora, 2016)	& Oyebamiji, 2020)
361	<i>Stemona tuberosa</i> Lour. (Stemonaceae)	Root, Stem	Gastric trouble	Root/stem of <i>Stemona tuberosa</i> crushed along with the root of <i>Asparagus racemosus</i> and juice is prescribing orally to stop diarrhoea. (Ahmed & Borthakur, 2005; Rao & Jamir, 1982; Hynniewta & Bora, 1997; Srivastava et al., 1987; Bora, 2016)	Antibacterial (Chung et al., 2003)
362	<i>Stephania glabra</i> (Roxb.) Miers (Menispermaceae)	Tuber	Diarrhoea, Dysentery	Pounded tuber taken with water to cure diarrhoea and dysentery. (Das, 2003; Rai & Sharma, 1994; Chhetri et al., 1992; Nonibala, 2015; Srivastava et al., 1987; Dahal, 2019; Zhasa et al., 2015)	Antimicrobial (Semwal et al., 2010)
363	<i>Sterculia villosa</i> Roxb.ex Sm. (Sterculiaceae)	Root Bark	Stomach disorders	Juice of root bark taken to cure blood dysentery and also useful in stomach disorders. (Sharma & Sharma, 2010; Das et al., 2008; Ranjana, et al., 2013;	Antioxidant (Haque et al., 2014)

				Deb, 1957; Hynniewta, 2010; Majumdar & Datta, 2006)	
364	<i>Swertia bimaculate</i> Hook.f. & Thomson ex C.B. Clarke (Gentianaceae)	Stem, Leaf	Gastritis	Aerial part of the plant is boiled in water and taken for gastritis. (Dahal & Borthakur, 2017, 2017a; Das, 2003; Daur & Hajra, 1980; Leal & Limasenla, 2020)	Antimicrobial (Das et al., 2013)
365	<i>Swertia chirayita</i> H. Karsten (Gentianaceae)	Whole plant	Dysentery, Stomachache	Infusion of plant drunk once daily till cure against stomach disorders. (Dahal & Borthakur, 2017; Salam et al., 2014; Dahal, 2019) The whole plant is crushed and soaked in water overnight and then used as a tonic. (Badola & Pradhan, 2013; Changkija, 1999)	Antimicrobial (Awasthi et al., 2006; Dutta Gupta & Karmakar, 2017)
366	<i>Swertia hookeri</i> C.B. Clarke (Gentianaceae)	Root	Diarrhoea, Dysentery	Two tablespoon of fresh juice of roots take orally once daily for five days. (Das, 2003; Singh et al., 1989; Majumdar & Dutta, 2007; Kar & Borthakur, 2008)	Antimicrobial (Pant et al., 2000)
367	<i>Swertia multicaulis</i> D. Don (Gentianaceae)	Whole plant	Diarrhoea, Dysentery	Infusion of whole plant taken against diarrhoea and dysentery. (Das, 2003; Ahmed &	Not reported

				Borthakur, 2005; Dahal, 2019; Chhetri et al., 1992)	
368	<i>Symplocos racemose</i> Roxb. (Symplocaceae)	Bark	Diarrhoea	Half a cup of juice taken for two days on empty stomach. (Laloo et al., 2006)	Antimicrobial (Wakchaure et al., 2011)
369	<i>Syzygium cumini</i> (L.) Skeels. (Myrtaceae)	Bark, Seed	Dysentery	Powdered form is take along with half cup of hot water in empty stomach till cured. (Bhuyan, 1998; Gogoi, 1997; Sumitra, 2013; Choudhury, 1999; Borah et al., 2006; Chhetri et al., 1992; Nath, 2006;Srivastava et al., 1987; Khongsai et al., 2011; Das et al., 2008; Rao & Jamir, 1982; Megoneitso & Rao, 1983; Jamir et al., 2012)	Antimicrobial, Antioxident (Sari et al., 2012)
370	<i>Tacca integrifolia</i> K er Gawl. (Dioscoreaceae)	Root	Diarrhoea, Dysentery	Fresh root decoction along with salt is used for dysentery and diarrhea. (Kagyung et al., 2009).	Antimicrobial (Ahmed et al., 2019)
371	<i>Taxus wallichiana</i> Zucc (Taxaceae)	Young shoot	Diarrhoea	Decoction (one cup) prescribe orally for about one week. (Ranjana, et al., 2013; Shilet al., 2014; Pandey et al., 1991)	Antimicrobial (Adhikari & Pandey, 2019)
372	<i>Terminalia arjuna</i> (Roxb.) W t.et Arn.	Bark	Diarrhoea, Dysentery	Decoction is used in diarrhoea and dysentery (about 5 ml thrice	Antioxidant (Sultana et al., 2007)

	(Combretaceae)			daily till cure). (Sumitra, 2013; Choudhury, 1999; Gogoi, 1997)	
373	<i>Terminalia bellirica</i> (Gaertn.) Rox. (Combretaceae)	Fruits	Diarrhoea, Dysentery	The fruits are chewed in stomach upsets and stomach dysfunction. (Lalramnghinglova, 1998; Dutta, 2012; Monlai, 2013; Sarma & Devi, 2017; Borah et al., 2006; Zhasa et al., 2015; Ahmed & Borthakur, 2005; Tsering, 2017; Chhetri, 2007)	Antioxidant, Anti-inflammatory (Gupta et al., 2021)
374	<i>Terminalia chebula</i> Retz. (Combretaceae)	Fruit	Constipation	Decoction of fruit with one table spoon of juice of rhizome of turmeric take twice daily after food till cured. (Lalramnghinglova, 1998; Khongsai et al., 2011; jeeva et al., 2006; Dutta, 2012; Das & Tag, 2005; Taluder & Gupta, 2014; Megoneitso & Rao, 1983; Tsering, 2017; Borah et al., 2006; Das & Dutta Choudhury, 2012; Naldarine & Lalnundanga, 2017; Rethy et al., 2010)	Antioxidant (Naik et al., 2004)

375	<i>Terminalia citrina</i> Roxb. ex Flem. (Combretaceae)	Fruit	Stomach ache, Dysentery	Decoction of fruit with one table spoon of juice of rhizome of turmeric take twice daily after food till cured. (Das & Dutta Choudhury, 2012; Dutta, 2012)	Antioxidant, Antimicrobial (Narhari et al., 2016)
376	<i>Tetracera sarmentosa</i> (L.) Vahl (Dilleniaceae)	Bark	Stomachach h	Decoction of bark taken orally for stomachach. (Megoneitso & Rao, 1983; Rai et al., 2010)	Antimicrobial (Lima et al., 2014)
377	<i>Tetradium fraxinifolium</i> (Hook. f.) T.G. Hartley (Ranunculaceae)	Fruits	Dysentery, Gastritis	Fruits powder along with lukewarm water is given to cure dysentery and gastritis. (Megoneitso & Rao, 1983; Mao, 1993; Lepcha et al., 2019)	Not reported
378	<i>Thalictrum foliolosum</i> DC. (Ranunculaceae)	Whole plant	Chronic acidity, Diarrhoea, Dysentery	The whole plant is boiled or eaten raw for chronic acidity, diarrhoea and dysentery. (Majumdar & Dutta, 2007; Pfoze, 2012; Megoneitso & Rao, 1983; Ranjana, et al., 2013; Kar & Borthakur, 2008)	Antibacterial (Pandey et al., 2018; Joshi & Sati, 2014)
379	<i>Thysanolaena latifolia</i> (Roxb. ex Hornem.) Honda (Poaceae)	Roots	Gastro-intestinal worms	One cup of decoction once daily for 3-5 days. (Pfoze, 2012; Sharma & Sharma, 2010; Khan & Yadava, 2010)	Antioxidant, Antibacterial (Hoque et al., 2016)

380	<i>Tinospora cordifolia</i> (Willd.) Hook. f. & Thoms. (Menispermaceae)	Leaf, Bark, Root	Diarrhoea, Dysentery	Decoction of leaves, bark and root bark in equal amounts is taken orally thrice daily. (Bora, 2001; Monlai, 2013; Sumitra, 2013; Choudhury, 1999; Jaiswal, 2010; Murtem & Chaudhry, 2016).	Antimicrobial (Prince & Menon, 1999)
381	<i>Toxicodendron hookeri</i> (K.C. Sahni & Bahadur) C.Y. Wu & T.L. Ming (Anacardiaceae)	Fruits	Dysentery	Two glass of infusion of fruits take orally twice daily for three days. (Kar & Borthakur, 2008; Sharma et al., 2014)	Not reported
382	<i>Trichosanthes dioica</i> Roxb. (Cucurbitaceae)	Root	Diarrhoea, Dysentery	Root extract is given 2 tea-spoonful thrice a day for one week. (Kagyung et al., 2009).	Antimicrobial (Bhattacharya & Kantihaldar, 2012)
383	<i>Trigonella foenum-graceum</i> L. (Fabaceae)	Seed	Stomach pain, Constipation	Powdered seeds is given during night for 2 days for stomach pain & constipation. (Gurung, 2002; Khatoon, 2014; Hynniewta & Bora, 1997; Chhetri et al., 1992)	Antioxidant (Radini et al., 2018)
384	<i>Tupistra nutans</i> Wall. ex Lind. (Asparagaceae)	Flower	Dysentery	Inflorescence eaten as vegetable. (Ranjana, et al., 2013; Dahal, 2019)	Antimicrobial (Chettri et al., 2020)

385	<i>Urena lobata</i> L. (Malvaceae)	Leaves	Dysentery, Gastritis	Infusion of leaves taken against dysentery and gastritis till cure. (Chettri & Sharma, 2011; Zhasaet al., 2015; Sharma, et al., 2014; Dahal, 2019)	Antimicrobial (Purnomo et al., 2018)
386	<i>Urtica dioica</i> Linn. (Urticaceae)	Whole plant	Diarrhoea, Dysentery	½ cup of juice of plant is prescribing after food. (Devi, et al., 2011; Gurung, 2002; Pandey et al., 1991)	Antioxidant, Antimicrobial, Antiulcer (Gülçin et al., 2004)
387	<i>Verbena officinalis</i> L. (Verbenaceae)	Leaves	Stomachache	10-20 ml juice is given orally at morning in empty stomach for 3 days. (Das, 2003; Pfoze, 2012)	Antibacterial (Casanova et al., 2008; Mengiste et al., 2014)
388	<i>Veratrum baillonii</i> Franchet (Gentianaceae)	Root	Diarrhoea, Dysentery	Roots ground with water and filter. The filtrate is prescribes orally given till cure. (Majumdar & Dutta, 2007; Singh et al., 1989; Dahal, 2019)	Antibacterial (He et al., 2020)
389	<i>Vigna unguiculata</i> (L.) Walp. (Fabaceae)	Leaves	Stomach pain	Boiled leaves (1 cup) are eaten to destroy worms in the stomach. (Mao, 1993; Khatoon, 2014)	Antibacterial (Garcia et al., 1986)
390	<i>Viscum album</i> Linn. (Loranthaceae)	Shoot	Dysentery	Young twigs of <i>Viscum album</i> and <i>Psidium guajava</i> crushed gently with bark of <i>Spondia spinnata</i> . Filtered juice prescribed with water in empty	Antimicrobial (Hussain et al., 2011)

				stomach daily at morning for 3 days. (Sharma et al., 2014; Mao, 1993; Bora, 2016)	
391	<i>Vitex trifolia</i> L. (Verbenaceae)	Leaves	Constipation	The decoction of leaves with honey is given against constipation. (Konwaret al., 2020; Khatoon, 2014)	Antimicrobial (Mary & Banu, 2015)
392	<i>Woodfordia fruticosa</i> (L.) Kurz (Lythraceae)	Fresh flowers	Blood dysentery	Decoction of fresh flowers are taken once daily till cure. (Kar & Borthakur, 2008; Chettri & Sharma, 2011; Sharma et al., 2014; Ahmed & Borthakur, 2005; Dahal, 2019)	Antimicrobial (Arya et al., 2015)
393	<i>Wrightia antidysenterica</i> (L.) R.Br. (Apocynaceae)	Bark	Dysentery	½ kg of bark is to be boiled in 1 litre of water till the solution becomes brownish, cooled it down and filtered it with fine and clean cloth. The extracted juice can be taken orally at 1 teaspoonful daily after food. (Das & Sharma, 2002; Nath, 2001; Marak, 2018)	Antioxidant, Antimicrobial (Ramalakshmi et al., 2012; Nirmali et al., 2015)
394	<i>Zanthoxylum acanthopodium</i> DC. (Rutaceae)	Fruits	Dysentery	Powder along with 1 cup of water take orally for 3 days. (Dahal, 2019; Das, 2003; Tsering, 2017; Devi, 2015;	Antimicrobial (Ranawat et al., 2010)

				Lepcha et al., 2019; Jamir et al., 2015; Das & Tag, 2005).	
395	<i>Zanthoxylum armatum</i> DC (Rutaceae)	Fruits	Gastric, Dysentery	Three to five seed's fleshy covers are chewed and taken for stomached, stomach disorder and expulsion of gas from the stomach. (Kar & Borthakur, 2008; Guha et al., 2018; Singh et al., 1989; Gurumayum & Soram, 2014). Infusion of seed along with <i>Allium sativum</i> prescribe orally twice daily till cure. (Singh et al., 1989; Majumdar & Dutta, 2007; Kagyung et al., 2009)	Antimicrobial (Negi et al., 2012)
396	<i>Zanthoxylum oxyphyllum</i> Edgew. (Rutaceae)	Fruit, Leaves	Diarrhoea, Dysentery	Decoction (about two cup) once daily till cured. (Myrchiang et al., 2020; Mao, 1993; Gurung, 2002; Singh et al., 1989; Chhetri et al., 1992; Majumdar & Dutta, 2007)	Antimicrobial (Wang et al., 2021)
397	<i>Zanthoxylum nitidum</i> (Roxb.) DC (Rutaceae)	Leaves, stem, bark	Stomach infection	Infusion taken in empty stomach in worm infection of the gastrointes-tinal tract of children.(Sharma & Sharma, 2010; Sharma & Pegu, 2011;	Antimicrobial (Chakthong et al.,2019)

				Gogoi et al., 2019)	
398	<i>Zephyranthes carinata</i> Herb. (Amaryllidaceae)	Bulb	Stomach ulcers	Decoction of bulb taken orally twice daily after food against stomach disorder. (Dahal, 2019)	Antibacterial (Manoj et al., 2013)
399	<i>Zingiber officinale</i> Rosc. (Zingiberaceae)	Rhizome	Stomachache	Freshly collected rhizome decoction is given to get relief from stomachache. About one cup of dose twice daily till cure. (Namsa et al., 2011; Das, 2003; Kagyung et al., 2009; Sangtam et al., 2012).	Antimicrobial (Zancan et al., 2002)
400	<i>Zingiber purpureum</i> Rosc. (Zingiberaceae)	Rhizome	Stomachache, Diarrhoea	Chakma tribe use rhizome (about one cup) to cure stomachache & diarrhoea. (Daur & Hajra, 1980; Chhetri, 2005; Rai et al., 2010)	Antimicrobial (Basu & Tripura, 2021)

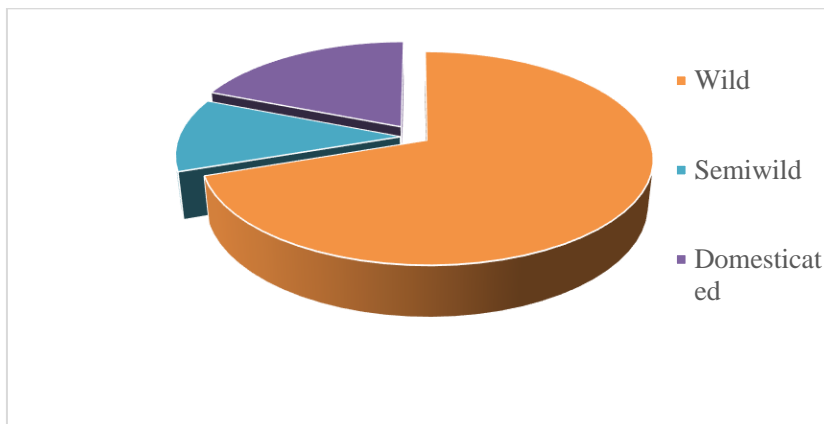


Fig. 9.1. Representing the percentage of habit of plant species.

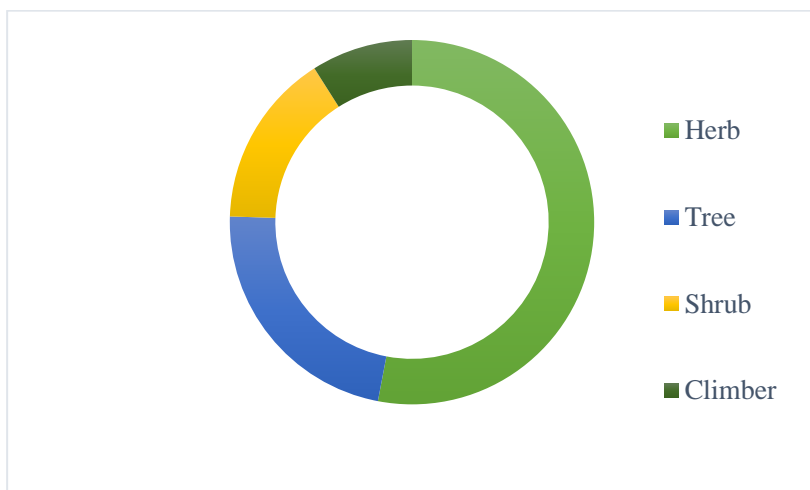


Fig. 9.2. Representing the numbers most and least parts used.

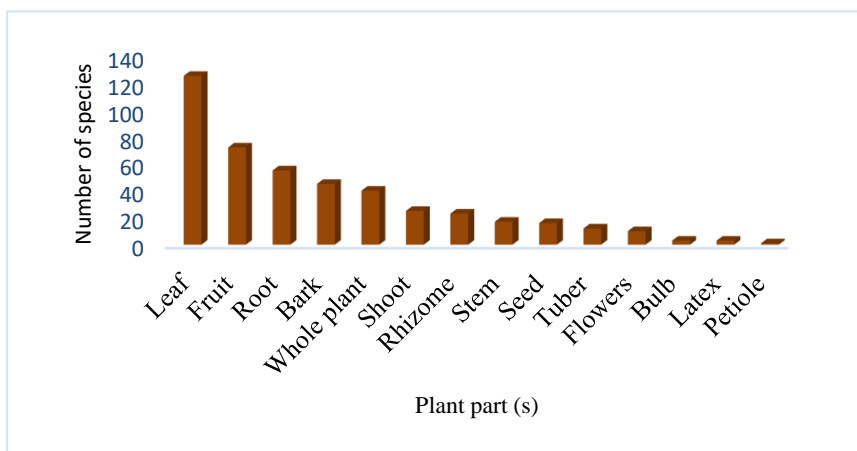


Fig. 9.3. Use frequency (number of species) of different plant parts.

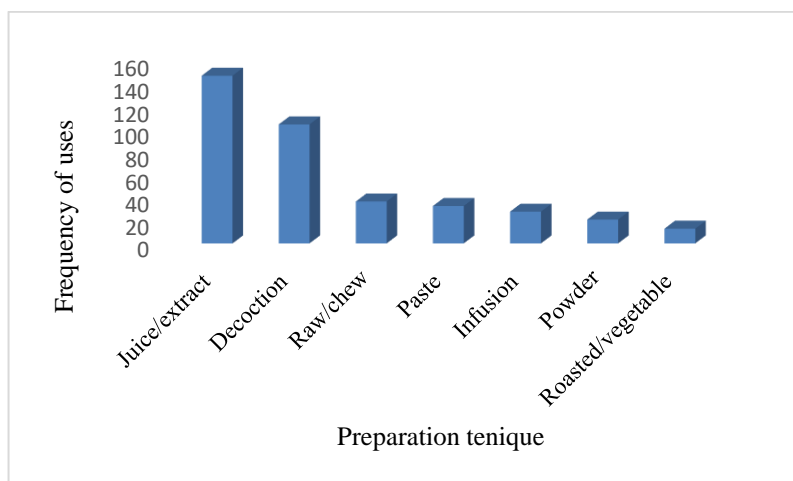


Fig. 9.4. Use frequency of remedy preparation techniques.

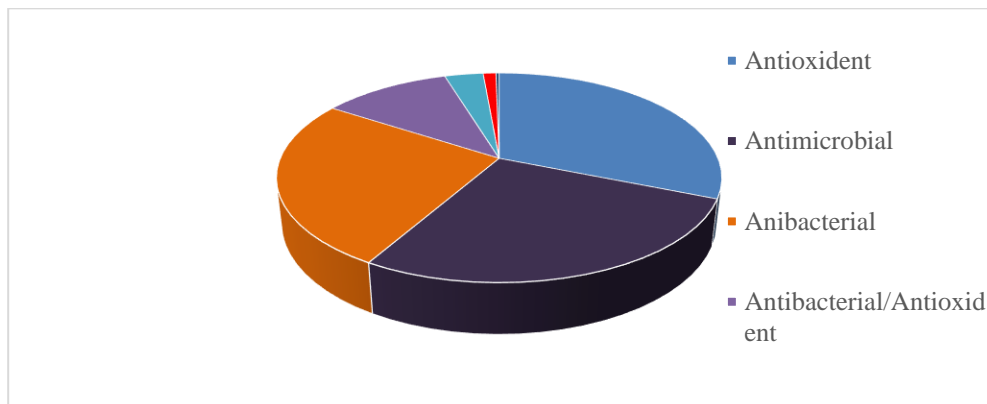


Fig. 9.5. Phytochemical Constituent of medicinal plants use in gastrointestinal disorders.

Discussion

Herbal medicines are important in primary health care systems in India and thus have been widely studied. However, studies on specific disease types are still lacking except for a few on anthelmintic (Jain, 2013), diarrhea and dysentery (Vineeta et al., 2018) and gastrointestinal disorders (Thakur et al., 2020). Here, we reviewed the literature and documented plant species used in North east India to treat different disorders related to the digestive system. We focused on gastrointestinal disorders because many people die each year in India due to gastrointestinal related diseases such as diarrhea, dysentery and cholera (Siddalinga & Vidyasagar, 2013). Similar documentations on use of plant parts for gastrointestinal disorders reported from other regions also (Jalal & Garkoti 2013; Sharma et al., 2010; Korkmaz et al., 2016). The most frequently utilized plant parts are leaves, bark, roots, branches, stem, fruits and seeds (Shukla & Chakravarty 2012; Alagesaboopathi 2014; Mondal & Samanta 2014). Additionally, some plant species have medicinal value in their flowers, rhizomes, tubers and heart-wood. In some cases, the whole plant including the roots was utilized (Shukla & Chakravarty 2012). Most of the ethnobotanical studies confirmed that the leaves are the major portion of the plant used in the treatment of diseases (Ignacimuthu et al., 2008; Choudhury et al., 2012). The prevalence of these gastrointestinal ailments is likely due to malnutrition, poor hygiene, and lack of clean

drinking water, as is the case in India (Dey & De, 2012). Notwithstanding the importance of addressing the public health issues at the root of gastrointestinal disorders, it is as crucial to improve our understanding of how these ailments can be treated. Medicinal plants are part of the solution.

Conclusion

Gastrointestinal infections are causing great health loss in almost all developing countries. Due to low income status and lack of modern health facilities people of North East region still using medicinal plants for stomach related disorders. This review on herbal medicines for stomach disorders indicates that till today traditional practitioners play an important role in health care system among traditional communities of North East India and these communities possess a good knowledge of herbal drugs. This compilation on ethnomedicinal information on stomach disorders ended up with enlisting 400 species of plants which were used to treat stomach diseases/disorders in different states of North East India. Majority of the plants included in this study occur in the wild habitat of foothills of Himalaya, while few of them are cultivated or planted (eg: *Allium sativum*, *Ananas comosus*, *Mangifera indica*, *Hibiscus sabdariffa*, *Curcuma longa*, *Zingiber officinale*, *Benincasa hispida*, *Cucumis sativus*, *Cucurbita maxima*, *Trichosanthes dioica*, *Garcinia* spp., *Ocimum* spp., *Mentha* spp., *Piper* spp., *Musa* spp.) in home-gardens for daily use and for economic-benefits. The local people use some of these plants judiciously by way of sun drying and use them by preparing decoctions or infusions as per need throughout the year. From this research, it can be concluded *Acorus calamus*, *Aegle marmelos*, *Asparagus racemosus*, *Centella asiatica*, *Drymaria cordata*, *Garcinia* spp, *Houttuynia cordata*, *Mangifera indica*, *Oroxylum indicum*, *Oxalis corniculata*, *Paedaria foetida* and *Psidium guajava* recorded to possess high Use Values and Fidelity levels and thus are more important plants as per curing various GI disorders. The family Asteraceae is of great importance for GI ailments, followed by Fabaceae, Lamiaceae, Zingiberaceae and Poaceae. There is more need of research data to authenticate homogeneity of traditional knowledge regarding the use of particular plant species to treat a particular GI ailment. Leaves and fruits are always the most important parts along with bark and roots for preparation of drugs. Although some species are commonly used but may not be still clinically proven. It was also found that pharmacological and phytochemical constituent of some species use in

gastrointestinal disorder in North east region still not reported. So there will be a great chances to find out the active compounds of these herbal medicine and develop new drugs. Medicinal plants play an important role in providing knowledge to the researchers in the field of ethnopharmacology. This compilation of herbal medicine of Gastrointestinal disorder might help the researchers for further critical exploration of medicinal plants present in North East India and development of novel drugs.

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Chapter 10

Ethnozoological Studies in Northeast India: A Review

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Abstract

Human-animal relationships have existed since the dawn of mankind. Across time, cultures all over the world have developed distinct ways of human interaction with local and regional fauna. Human communities have accumulated a vast bank of indigenous and traditional knowledge about animals through the centuries that is usually passed from generation to generation, largely through discipleship. The present study is the systematic literature review of topics of research conducted on ethnozoology in Northeast India. From this study, 41 peer-reviewed articles were

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identified, of which (80.49%) were published after 2000, indicating that this topic has mainly received regional attention in the past ten years. The extensive use of animals suggests that the tribes of Northeastern India rely heavily on forest faunal resources. The study emphasizes on the importance of traditional knowledge in conservation strategies and management of faunistic resources in Northeast India as a fundamental component to conservation efforts.

Key words: Zootherapy, Ethnozoology, Biodiversity

Introduction

Human civilization has evolved with the environment and extremely close relationship have existed between human and animals since primitive times. Hunting is one of the earliest known human arts, and animals have been hunted for both utilitarian and defensive reasons (Alves, 2012). The products derived from animals are used for various purpose, including food, clothing, and tools, as well as medical and magical uses (Alves & Souto, 2015). Human have consumed a wide variety of vertebrate and invertebrate species from last thousand years or more (Jorgenson, 1998; Emery, 2007). The variety of interactions between human and animals is an interesting domain of study and the knowledge and experience gained from natural sources by the native population of any region can lead us to not only vast range of opportunities, but it also gives the opportunity to cross check scientific hypothesis (Alves & Nishida, 2002). Zoo-therapy refers to treatment of human disease using animals and animal derived entities (Costa-Neto, 1999).

World Health Organization reported that all over the world, around 80% of the rural population practices traditional medicines for health care (WHO, 1993). Traditional medicines rely upon wild animals and products obtained from it which plays a significant role in healing processes. According to reports of World Health Organization, out of 252 essential chemicals, animal products contribute 8.7% (Marques, 1997) and the animal-based medicines are generally obtained from its body parts, metabolic products (such as excreta) or from the items produced like egg, nests, etc. (Costa-Neto, 2005). Global trade of animal based medicinal products accounts for billion-dollar business per year (Kunin & Lawton, 1996) and ethnobiology guides for new pharmaceutical searches (Blakeney, 1999). In India, almost 20% of biotherapeutic medicines are animal origin (Unnikrishnan, 1998). North-Eastern states of India are one of the bio-geographically distinctive hotspots in the world rich in biodiversity (Myers et. al., 2000) and a hub of traditionally, culturally, and anthropogenically different mass of population. Remedies using animal products have traditionally played a vital role in indigenous people's healing methods (Mihsill & Keshan, 2017). North east India is the home for more than 166 tribes and are largely

associated with the Indo-Mongolians, Tibeto-Burmese, and Proto-Australians populations. Arunachal Pradesh consists of around 25 types of tribes. Nagaland has more than 16 tribes. However, among all the tribes, Garo, Khasia, Jaintia, Adi, Galo, Niyishi, Bhutia, Kuki, Angami, Bodo, Deori are some of the major tribes. They have scattered throughout the region and have distinctive cultural, occupational, and peculiar food habits. Zootherapeutic is an indigenous knowledge system, passed down by people from generation to generation, people are in close contact with nature. People use traditional medicines of animal origin in local environments, so is specially tailored and conditions for the local population. These methods have not died off but have been able to withstand the tests of time even with the advent of western medicine. Therefore, it is vital that we understand and record the irreplaceable indigenous knowledge of the traditional culture and practices which may get extinct with the demise of the bearer. This review paper aims to compile all the relevant information related to the ethnozoological studies practiced by different tribes of Northeast India with special reference to different knowledge systems prevails in the region.

Materials and methods

Study Area:

North-east India forms a significant portion of both the Himalaya and Indo-Burma biodiversity hotspots (Mittermeier et al., 2004). The north covering nearly 2,62,379 km² area and the biogeographic zone comprises of states of Arunachal Pradesh, Assam, Nagaland, Manipur, Meghalaya, Mizoram and Tripura. The region lies between 22°N and 29°5N latitude, 88°E and 97°30'E longitude. Northeast India shares international border with China, Bangladesh, Myanmar and Bhutan. At the confluence of Indo- Malayan, Indo Chinese and Indian biogeographical realms, this part of India is a mosaic of unique habitats, home to rich floral and faunal diversity. Out of the total 450 tribes in the country, the region is also abode to 225 tribes. The culture and customs of different tribes have an important role in understanding biodiversity conservation and management issues (Chatterjee et al., 2006).

Literature review was conducted on the previous work regarding ethnozoological studies in northeast India, in order to evaluate the potential use of faunal diversity for valued service of humankind. Standardised search terms with three online databases were searched *viz.* Web of Science, Scopus and Science Direct. The words “ethnozoology”, “northeast” “tribe” “zootherapy” were searched in title, keywords and abstract (except in Web of Science, where the search was in Topic). Only peer-reviewed papers including were selected for the study.

Results and Discussion

The search returned a total of 41 papers, most of which (80.49%) were published after 2000. People of North-East have long practiced the traditional medicines in day-to-day life (Mao et. al., 2009). Arunachal Pradesh, the largest among all the North-Eastern states has a mixed demography of which indigenous communities like Nyishi, Apatani and Monpa use almost hundred fauna for ethnomedicinal purpose (Solanki & Chutia, 2009). Of their use, 48% are mammals, 28% are birds and 24% are amphibian and reptiles. Wide use of insect as ethnomedicine was documented in Galo community. A total of 12 edible and 4 unidentified insect species were documented in this regard by Dagyom & Gopi, 2009. According to Chakravorty et. al., 2011a Nyishi and Galo communities of Arunachal Pradesh uses vertebrate (36 species) and insect (81 species) for ethnozoological purpose.

Gangwar and Ramakrishnan in 2016 reported the use of variety of animals for treating common ailments by Nyishi community. Roasted liver of Apes (*Presbytis spp.*) is used against diarrhoea, dysentery, and malaria; dried liver of Bear (*Melursus ursinus*) is used to cure body and stomach-aches, dysentery, and malaria; Cockroach (*Periplaneta americana*) consumed with liquor to reduce intoxication; ash of feathers of Crow (*Corvus splendens*) used for healing dysentery and fever; ash of feathers of Eagle (*Aquila spp.*) is applied on wounds for healing; Earthworm (*Oligochaeta*) used against dysentery; fat of Hornbill (*Bucerotidae*) is massaged onto skin to set dislocated bones; Crab (Crustacea) is used as a food item and is a preventive against general ailments; Dried meat of the head and tail portions of Python is used against snake bite and dysentery. Other than these, some of the insects like dragonfly (Odonata) grasshopper (Orthoptera) and larva of Wasp (Hymenoptera) are also consumed as food item for nutritional value.

Moreover, reports were found on the use of animals among Adi (39 aquatic and terrestrial species) (Chinlampa et. al., 2013), Wancho and Tangsa (20 and 55 animal species respectively; Jugli et. al., 2019) etc. However, use of animals and animal products differs among different tribal communities. Tangsa people apply body fat of hornbill to sprain, strain and burns (Jugli et. al., 2020). They also reported that body fat of python and members of cat family (such as *Panthera pardus*, *P. tigris*, *Neofelis nebulosa*) is used to treat burns and wounds. Reports are found that Wancho community consumes meat of bat to treat cough and cold (Jugli et. al., 2020). Bile and gall bladder of bear is used as painkiller against headache, toothache, stomach-ache and body pain by Tangsa community whereas it has been reported that pregnant women of Wancho community uses this to reduce labour pain during child birth (Betlu, 2013). Use of Bile and gall bladder of bear in treatment of malaria and

diabetes is also found in Monpa (Solanki & Chutia, 2004) and Galo and Nyishi community (Chakravorty et. al, 2011b). Another tribe known as Adi uses 39 animal species as traditional medicine and insects specially larva of ant, locally known as *run-kung* and *tari* insect are collected by their woman which is used in malarial treatment.

Assam, the second largest state of the region practices ethnobiology from time immemorial. Bora and Prasad in 2017 had done extensive studies in this regard and concluded that 44 animal species are used for many ethno-zoological purposes by different indigenous communities of Assam like Ahom, Tea tribes, Koch-Rajbanshi, Chutia and Kalita. In their report, insects were found to be used mostly (30.9%) followed by mammals (23.8%), fish (16.7%), reptiles (11.9%), amphibians (7.1%) and gastropod and annelids (4.8% each). Insects such as *Vespa affinis* (Linnaeus, 1764), *Tetraponera rufonigera* (Jordan, 1851), *Acheta domestica* (Linnaeus, 1758) were reported by them to be eaten orally and as a whole against disease like cancer, body arch and low eye sight respectively but only alimentary canal is used from *Scapteriscus borellii* (Giglio-Tos, 1894) for treating the intestinal worm. Horn of mammals such as *Bubalis bubalis* (Linnaeus, 1758) are taken orally to treat pre-menstrual pain and in some cases horn of animals such as *Rucervus duvaucelii* are applied topically against piles. Some fish species such as *Amphipnouscuchia* (Hamilton, 1822), *Chacca chacca* (Hamilton, 1822) etc. are taken totally for treating anaemia and asthma. Mostly the whole animal in many cases were found to be used against diseases rather than specific body parts. Moreover, excretory product like human urine was found to be used against skin diseases by the Karbi people. However, Hussain and Tynsong, 2021 reported that among the animals used for ethnozoological purpose in Assam, mammals are highest in number followed by fish, insect, bird and reptiles. Karbi people have been found to use 14 species of Ichthyofauna (Teronpi et. al., 2012) and 48 species of various species including leeches were used against diseases like cancer, piles and tuberculosis (Verma et. al., 2014). It was also reported about the use of gall bladder against hookworm infection and to reduce labour pain by the Biate tribe (Betlu, 2013).

Manipur is another integral part of Northeast where this type of practices is very old. Mostly and interestingly different fish species are used there as ethnomedicine which is not common in other North-eastern states. Meitei community of this state use almost 21 fish species for this purpose (Chanu et. al., 2016). Fish is generally a very good source of protein and raw, fried or cooked fishes found to be in use for traditional medicine through decades. Moreover, specific body parts such as bile, liver, barbells of different fish species such as *Anguilla bengalensis*, *Hilsa ilisha*, *Channa striatus*, etc. are found to be in ethnomedicinal use (Chanu et. al., 2016). Devi et. al., 2015 reported that 33 total species including both invertebrate and vertebrate

species are used here against a total of 35 ailments. Rongmei community is found to use a total of 26 fauna (Ngaomei & Singh, 2016) but interestingly no fish species were mentioned in their findings. Singh (2014) identified 11 insect species with medicinal values from Manipur.

Khasi, Garo and Jaintia primarily constitute the demographic constituent of Meghalaya. Khasi people traditionally use certain spider species for boil and wound by crushing it (Mihsill & Keshan, 2017). They also documented that the Khasis traditionally treat malaria by consuming hill mole or cow bile. Milk of tigress in combination with mud for burns, sun dried deer fetus for the breastfeeding mother are some of the common prices among them. Fish (*Channa striatus*) and leeches are also traditionally used there. Different ailments such as anemia, diarrhea, cold and fever are found to be treated by almost 13 animal-based medicines in the state where mammals are used mostly followed by insects.

Ethnozoological findings revealed that Mizo, Chamka and Bru communities of Mizoram use mammals (approx. 9 species), bird (1 species) and reptiles (3 species) traditionally over ages (Solanki et. al., 2016). Different body parts such as bone, liver, gall bladder etc. were used in this purpose. Zomi-Paite community were reported to use 48 animal species for such purposes (Chinlapianga et. al., 2013). Solanki et. al., in 2016 reported that 22 animal species (including mammals, birds and reptiles) were recorded in Mizo, Bru, and Chakma communities against diseases like dysentery, cholera, epilepsy, asthma, diabetes, pneumonia, etc. They further reported that almost every body part such as bone, quill, scale, tooth, etc. are in use for this purpose. Hussain and Tynsong, 2021 reported that vertebrate species of different phylum are basically used for ethnomedicinal purposes in this state along with some invertebrate species in small quantities.

Nagaland is the state of 14 distinct major aboriginal Naga tribes which are unique in their culture and have many sub tribes. A total of 26 animal species are used for zootherapeutic purpose in Nagaland (Jamir and Lal, 2005). Different species such as Earthworm (*Pheritima* spp.) and Python (*Python reticulates*) are used as antidote against snake and spider bites. Crush of earthworm (*Pheretima posthuma*), is applied in eye for red eye by Chakhesang Tribe of Nagaland, Kakati & Dulo (2002). Other than this, Apple snail (*Pila globosa*) for stomach disorder, crab (*Cancer pararus*) for Jaundice, *Lymnionectes limnorcharis* for rheumatic-joints, *Canis familiaris* for pre and post-partum health care etc. are commonly as their ethnozoological tradition. Ao community is found to use body parts such as teeth, intestine, meat, skin, etc. of 25 fauna in different formulations for such purposes (Kakati et. al., 2006). Roasted animal (*Passer domestica*) is used for paralysis and flesh is used for stammering by

Aotribes (Kakati et al., 2006). Along with vertebrates, invertebrates also contribute hugely in the ethnomedical practices in Nagaland.

Tripura is inhabited by 19 different ethnic tribal communities of which Reang, Tripuri and Jamatia are found to use 25 faunal species in total or different parts of it such as antler, testis, meat, etc. for ethnomedicine against diseases like arthritis, rickets, pneumonia, male impotency, constipation, paralysis, joint pain, ulcer, etc. (Das, 2015). Among the invertebrates they used Annelida, Arthropoda and Mollusca and among vertebrates, Aves and mammals top the chart followed by Pisces, Amphibian and Reptiles. Among all the animals used as ethnomedicine 16% of the total is included in IUCN Red data book (Das, 2015). *Metaphire posthuma*, *Pila globosa*, *Palaemon* sp., *Apisindica*, *Cracinus* sp., *Cryllus* sp., *Rana tigrina*, *Najanaja*, *Gallus gallus* L. *Felis domesticus* are among the list of animals and insects used for ethnobiological purpose in Tripura

In Sikkim, Bhutia, Lepcha and Nepali community people use and practice traditional knowledge for different diseases like heart disease, diabetes, piles, urinary tract infection, malaria, nose bleed asthma etc. (Dhakal et.al., 2019). Whole body or body parts of animals especially mammals, birds and insects were used in this purpose.

However, among invertebrates, use of honey bee venom toxin and melittin has been proved to have anticancer activity and found to inhibit the JAKk/STAT 3 pathway (Jo et.al., 2012). Evolution brings out changes that too in unique defense mechanism against different diseases that makes the animals a vital source of study. The bile is a rich source of chemicals (Wang & Carey, 2014) that has anti-inflammatory, anti-pyretic, anti-diabetic and anti-spasmodic effects. Moreover, biles of different animal are also found to be effective against specific disease.

Table 10.1. Animal species used for different ailments in Northeast India. (Following after Hussain & Tynsong, 2021).

Disease	Total species used
Malaria	37
Tuberculosis	21
Wounds	33
Cough and cold	31
Burns	30
Dysentery	32
Jaundice	24
Stomach ailment	29

Rheumatism	33
Asthma	37
Liver ailment	14
Joint pain	13
Fever	21
Weakness	27
Female health problems	23
Fracture	11
Animal/ Insect bite	14
Anemia	6
Male impotency	15
Diabetes	17

Traditional medicine has taken a backseat with the entry of the modern medicine. Cross cultural connections likely to play important role in use of certain animals throughout the whole region, but the tribes also maintain their heritage through traditional and secrete knowledge among them. The most commonly used fauna for ethnozoological purposes in Northeast India includes 21 species of animals under vulnerable category, 9 species as endangered, 7 species as near threatened and 3 species are critically endangered according to IUCN report 2020.

Conclusion

The study of literature reveals that most of the work on ethnobiological studies were done only after the year 2000. Considering the importance of animals in contribution to the quality of life and their valuing services to the society, ethnozoology can be viewed as a fundamental scientific area that examines the historical, economic, sociological and environmental aspects of the relationships between humans and animals. This review illustrates the persistence of ethnozoological practices in North-eastern states of India covering mostly the vertebrate fauna. However, the extensive survey on the of use of invertebrates specially insect fauna by different tribes for various purposes are yet to be done. The application of indigenous knowledge by tribal communities for health care for healing diseases also provide a cheaper and accessible alternative to the high-cost pharmaceutical remedies. Thus, knowledge about the regional fauna can offer the possibility of significant savings in comparison to the costs involved with conventional methodologies. However, the use of such practices brings out information that carries medical importance. Hence, new arena of drug discovery may be possible by intervening the knowledge of the traditional practices that can lead to a more sustainable future. Despite the lack of sufficient scientific evidence to support

these treatment methods, the rich treasures of the traditional treatment methods using animals or their products practiced by the traditional healers of different tribes of North east India is promising. Therefore, more such scientific research is needed to validate traditional treatment methods and discover their role in healing disease. The activity of continuous slaughtering of numerous animals without proper scientific verification may otherwise lead to adverse effect of resource extinction. Moreover, the users and sellers should also be aware of legal and ecological status of the species they use before reaping the benefits. Further research on understanding of the relationship among human and environment is important to enhance and preserve the traditional indigenous knowledge on the use of resources. Use of traditional knowledge in valuing service of mankind still lacks documentation in many parts of Northeast India. Hence, further researches on updating the inventory of ethnozoological studies is encouraged which will lead to have more effective strategies towards conservation of habitats for the protection of species. Thus, the connection between ethnozoology and the social and human sciences can act as a bridge the gap in the development of conservation plans.

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Author's Contribution:

The review is conceptualised by KS and KB. The review part is done by DJS and DT and prepared the draft of the manuscript. Finally, DT and KS prepared the manuscript.

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Chapter 11

Phytochemical screening of ornamental orchid *Rhynchostylis retusa* (Kopou Phul)

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Abstract

Rhynchostylis retusa is a common orchid found in Assam. This orchid is commonly used as ornamental and medicinal purpose. It is commonly known as *Kopou Phul*, flower is ornamentally used in the spring festival of Bihu. Leaf juice used externally on skin, in the diseases of nervous system, also remedy for secondary syphilis, scorpion staining, rheumatism etc. Its roots are used against bronchitis and fever. The purpose of this study was to determine photochemical constitutes and antibacterial activity of *Rhynchostylis retusa*. The qualitative analysis for the present phytochemicals was performed using methanol, acetone and chloroform extracts of leaves *Rhynchostylis* plant by various standard techniques available. Phytochemical analysis revealed the presence of alkaloids, flavonoids, terpenoids, glycosides and phenols in all the extracts varying quantities. Since the plant contains high quantities of these bioactive potential compounds, it is reliable to possess large number of pharmacological values like antioxidants, antifungal, antibacterial, anti-inflammatory activities and are being employed for the treatment of different ailments in the indigenous system of medicine.

Keyword: *Rhynchostylis retusa*, ornamental, medicinal, phytochemical screening, Assam

Introduction

The medicinal plants are useful for healing as well as for curing of human diseases because of the presence of phyto-components. Phytochemicals are naturally occurring in the medicinal plants leaves, stem bark, fruits and roots that have defence mechanism and protect from various diseases. Natural products from plants called secondary metabolites are the end products of primary metabolites such as carbohydrates, amino acid, and chlorophyll lipid so on. They are synthesis large variety of chemical substances known as secondary metabolites which include alkaloids, steroids, flavonoids, terpenoids, glycoside, saponin, tannins, phenolic compounds etc.

Orchids have been used in traditional medicine in an effort to treat many diseases and ailments. They have been used as a source of herbal remedies in China 2800BC (Zhang et al., 2007 & Zhang et al., 2008). In India the earliest reference on orchids dates back to the Vedic period. The people of ancient India were well aware of the medicinal properties of orchids. The Indian ancient literature and Indian system of medicines used several orchids, both terrestrial like ‘Ridhi’, ‘Vridhi’, ‘Jeevak’ and epiphytic like ‘Vandak’ ‘Jeewanti’ etc. In India, there are legends wound around the beautiful inflorescence *Rhynchostylis retusa* ‘Seeta Pushpa’ (Rao, 1998). Orchids are associated with the culture of the Assamese people from the past. There is a tradition of using orchids by different tribes of Assam. Assamese people profusely used *Rhynchostylis retusa* (kopou phul), in the spring festival of Bihu. They are popular among the young folks who use them as a symbol of love and affection. During the spring festival, youths present the inflorescence to their hair. The spike is also used for decorating the head gear of bride in marriage ceremony.



Fig 11.1(a): *Rhynchostylis retusa* (complete plant); (b): Inflorescence of *R. retusa*

Orchids are well known for their beauty and its medicinal use. *Rhynchosstylis retusa* is a monopodial epiphytic orchid that grows in almost every part of Assam. It is an epiphytic herbaceous orchid. It can tolerate a wide range of temperature from 3°C -34°C. Leaf juice and aerial roots were also used externally on skin, in the diseases of nervous system, ear pain and cleaning, also remedy for secondary syphilis, scorpion staining, rheumatism etc. Its roots are used against bronchitis and fever. It also used as emollient, throat inflammation. *Rhynchosstylis retusa* roots were used to cure malarial fever. The whole plant preparations were used to cure blood dysentery, Tuberculosis, epilepsy, menstrual disorders, fever, gout, Asthma etc. (Hossain, 2011). Hence the present study focused on the phytochemistry of *Rhynchosstylis retusa*.

Material and Method

Collection and identification of plant sample: Fresh plant sample of *Rhynchosstylis retusa* was collected from Doomdooma, Tinsukia district. All plant samples were dried under shade and then ground into fine powder form (80 mesh sieve size) by electrical grinder. Powdered sample of all parts stored in clean paper bags and preserved at 4°C for further analysis (Harborne, 1986).

Preparation of plant extracts: Organic extracts of leaves of plant were prepared by using three different solvents (Methanol, acetone and chloroform with decreasing polarity). Dried plant powder weighed carefully and used for extract preparation through Soxhlet apparatus at respective temperature (Oyaizu, 1986 & Ordon et al., 2006). The extract obtained was filtered and concentrated in rotary evaporator. The concentrated plant extracts (semi-solid mass) were lyophilized and then store the dried extracts in airtight bottles.

Qualitative phytochemical screening: The different qualitative chemical tests were performed for establishing phytochemical profile of methanol, acetone and chloroform extracts obtained from cold extractions. The tests for alkaloids, Saponins, Phytosterols, phenols, Tannins, glycosides, flavonoids were performed on all the extracts to detect various phytoconstituents present in them.

Estimation of total phenols: The extracts were dissolved in 5mL of distilled water and were estimated for total phenols by Folin-Ciocalteu reagent method (Gutteridge, 1995) with absorbance measured at 650nm with catechol (50 µg mL⁻¹) as the standard.

Estimation of total flavonoid: The extracts were dissolved in DMSO and were estimated for total flavonoid content by aluminium chloride method (Harborne,

1998 & Ghasemi et al., 2014) with absorbance measured at 510 nm with quercetin (100 μ g mL⁻¹) as the standard.

Statistical analysis

All the experiments were carried out in triplicate and the results are expressed as mean \pm standard error (SE).

Results

Qualitative phytochemical screening: The different qualitative chemical tests were performed for establishing phytochemical profile of three extracts obtained from cold extraction. Phytochemical screening was performed for three extracts which revealed the presence of alkaloids, saponins, phytosterols, flavonoids, phenols, glycosides in different extracts (**Table 11.1**).

Qualitative estimation of phytochemicals: The quantitative estimation of phytochemicals, which were detected in phytochemical screening of *Rhynchosytilis retusa* revealed the presence of high phenol content (129.020 μ g/mL) was recorded in the methanol extract (**Table 11.2**). High content of flavonoids (108.34 μ g/mL) was recorded in the methanol extract (**Table 11.2**).

Table 11.1: Phytochemical screening of four extracts of *Rhynchosytilis retusa*.

Phytochemical Screening	M	A	C
Alkaloids			
Mayer's	+	+	+
Wagners	+	+	+
Hager's	+	+	-
Dragendroff's	+	+	-
Saponins			
Foam Test	+	+	+
Phytosterols			
Liebemann-Burchards	+	-	-
Phenols			
Ferric chloride	+	+	+
FC reagent	+	+	-
Flavonoids	+	+	+
Glycosides	-	-	-

Note: M: Methanol, A: Acetone, C: Chloroform

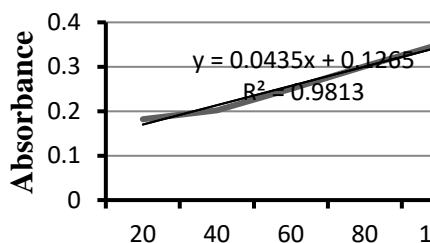
Table 11.2: Quantitative estimation of phytochemicals.

Extracts	Phenols ($\mu\text{g/ml}$) $\bar{X} \pm \text{SE}$	Flavonoid ($\mu\text{g/ml}$) $\bar{X} \pm \text{SE}$
M	129.020 \pm 0.864	108.34 \pm 1.145
A	112.65 \pm 0.045	96.21 \pm 0.028
C	47.00 \pm 0.017	29.87 \pm 0.014

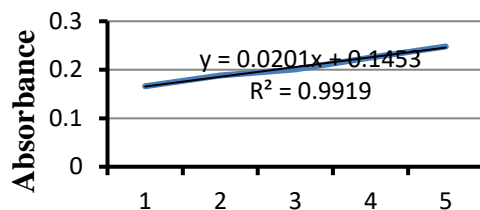
Note: * - Mean of 3 replications, **SE**- Standard Error.

Estimation of total Phenols and flavonoids content

From the standard curve equation of catechin; $y = 0.043x + 0.126$, $R^2 = 0.981$ (Fig. 11.2) and gallic acid; $y = 0.020x + 0.145$, $R^2 = 0.991$ (Fig. 11.3).



Concentration of catechin



Concentration of gallic acid

Fig 11.2. Calibration curve of catechin.

Fig 11.3: Calibration curve of gallic acid.

Discussion:

Nature is the source of medicinal agent and there are number of modern drugs have been isolated from natural sources (Gutteridge, 1995). Herbal medicines are free from side effects, adverse effects and they are economical and easily available will be beneficial for the mankind over the centuries (Kahl & Kappus, 1993; Kalita et al., 2012). *Rhynchosyilis retusa* is well known for its ornamental as well as medicinal value. Phytochemical analysis revealed the presence of alkaloids, flavonoids, saponins, glycosides and phenols in all the extracts (**Table 11.1**). Present study of *Rhynchosyilis retusa* revealed the presence of high phenol content (129.020 $\mu\text{g/mL}$) was recorded in the methanol extract

(**Table 11.2**). High content of flavonoids (108.34 µg/mL) was also recorded in the methanol extract (**Table 11.2**).

Since the plant contains high quantities of these bioactive potential compounds, it is reliable to possess large number of pharmacological values like antioxidants, antifungal, antibacterial, anti-inflammatory activities and are being employed for the treatment of different ailments in the indigenous system of medicine (Kumar et al., 2013; Mahmoud, 2014). The findings of the present study suggest that *Rhynchosyilis retusa* could be a potential source of natural antioxidant that could have great importance as therapeutic agents in preventing or slowing the oxidative damage of tissues and biomolecules, eventually leading to disease conditions, like degenerative diseases. Flavonoids are the major bioactive compounds useful against free radical derived oxidative stress (Gutteridge, 1995). A detailed study on the role of different phytoconstituents which influences the antioxidant activities are further required to be investigated.

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Chapter 12

Ethnobotanical survey of Ritual plants used by Boro tribe of Udalguri district, Assam

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Abstract

The Boro tribe of Udalguri district performs different religious and ritual activities during different seasons of a year. Many plants are associated in such tribal festivals. Therefore, an ethnobotanical survey was conducted to document such ritual plants utilized by the tribe in different festivals in the district. In present study, a total of 23 ritual plants were recorded from the study area having different utilities in different festivals of the tribe. Among these ritual plants 8 species were found to have medicinal values and 5 other species having diverse utilities. Maximum species were found to be conserved in the gardens by the tribe. Only 8 species of these ritual plants were recorded from the wild.

Key words: Ritual plants, Boro tribe, Udalguri district, Ethnic uses, Conservation.

Introduction

In tribal societies plants play major role in their livelihood. Plants are used as foods, medicines, shelter, etc. by the tribal people. Plants are also worship as gods and goddesses for the protection and betterment of their life. They have their tradition to worship different trees in different occasion. Many tribal communities preserve this tradition through folklore and worship their deities right from the occasion of birth to mourning death. They perform specific worship with pressie offerings. Various plant parts like bark, twigs, leaves flowers, fruits and seeds are offered to gods and goddesses. They generally grown such ritual plants in gardens or in religious institutions which they regard as sacred plants.

Boro tribe of Assam is also very rich in traditional knowledge. They are belonging to Mongoloid group. Their culture is rich in magico-religious beliefs and taboos. They are known as animist and believe the five natural powers such as sun, air, earth, fire and space as gods and deities. They believe that these powers reside in some plants especially in *Euphorbia neriifolia*. The plant is worship as a symbol of the supreme deity Bathou Borai. So this plant have specific place in north-east corner of the courtyard of every household known as Bathou alter. Along with Bathou Borai, Bathou Buri (Mainao Buri) is also worship. Any Rice varieties are regarded as Bathou Buri (Mainao Buri) by the tribe. They worship these plants along with other associated plants in different religious and ritual activities.

Boro tribe of Udalguri district performed five religious and ritual festivals in different season of a year. Bwisagu, the first festival of Boro tribe is celebrated during mid of April month for seven days beginning from the day of Sankranti of Chaitra. On the first day of this festival, a ritual activity was performed by the tribe for the cattle which includes the decoration and ritual bathing. Cattles were bathed early in the morning into a river then worship by offering some plant parts. The second festival performed is Amthisuwa (June), third Katigosasaonai (October), Mainaofwrwbw (November) and last Domasifwrwbw (Mid-January). All these festivals of the tribe were observed associated with various plants part(s) utilizations. Some of these plants were conserved in their home garden for other uses. So present study was conducted to document the various utilizations aspects of these ritual plants, utilization of plant part(s), their distribution and availability in the Udalguri district.

Materials and Methods

1. Location and physiography of study area

Udalguri district is located in the central part of the state Assam on the northern bank of Brahmaputra River along the foothills of Himalaya. Udalguri was declared as a separate district on 30 October 2003 with Govt. Notification No. GAG (B)-137/2002/Pt/117. It is situated in between the Latitudes between 26°30'N and 27° 0'N and Longitudes between 91°08'E and 92°20' E. The district occupies an area of

1852.16 km². It is bounded by Bhutan and West Kameng district of Arunachal Pradesh state in the north, Sonitpur district in the east and Darrang district in the south and Baksa district in the west. The major tributaries of the river Brahmaputra viz., Nonoi, Suklai, Nallanadi, Barnadi, Pachnoi, Noa, Kulsi, Borno, Golandi and Dhansiri which originate from the foothills of the himalayan range flow through the district. The district is inhabited by multi-lingual and multi-cultural groups of people. The Bodo-Kacharis and Rabhas are the local inhabitant tribe of the district. Topographically the district is almost flat with small patches of hills along the Indo-Bhutan border. Physiographically the district can be divided into two parts-plain region and foothill region. The most part of the district adjoining the northern border of foothills of Indo-Bhutan border form the plain belt of the district.

2. Collection of data

The present ethnobotanical study of ritual plants used by Boro tribe in Udalguri District was based on households survey made during 2014-2016. The Boro tribe dominated villages were selected during field survey. Primary data on different types of uses of Ritual plants was collected through direct interviews with people of different age groups of both sexes with semi-structured questionnaire. For confirmation, the plants were collected from surroundings of households and also from wild habitat followed by head of family. Collected plant specimens were processed following standard Herbarium techniques (Jain & Rao, 1977). Identification was confirmed by matching with pre-identified specimens in the Herbarium of the Department of Botany, Gauhati University, Guwahati and counter checked with authentic published literatures like Flora of Assam (Kanjilal et al., 1934-40), *Flora of British India* (Hooker 1872-1897), *Flora of BTAD, Assam* (Borthakur et al., 2018), etc. The specimens are deposited in the Department of Botany, Tangla college, Tangla. Nomenclatures have been checked with the help of online websites like www.theplantlist.org and www.ipni.org.

Presentation of data

Systematic enumeration of the plants is arranged alphabetically. The families, Vernacular name (Boro name), habit, description of specimen, use of the plants in religious and ritual practices etc. are mentioned.

Results

1. *Aegle marmelos* (L.) Corr. (Rutaceae)

Vernacular name: Bel (Bodo)

Description: Tree, deciduous, 10-25 m tall; leaves trifoliate, alternate. Flowers in axillary panicles, greenish-white, fragrant

Parts used: Leaf and fruit.

Ritual virtue: Leaves are used in ritual activities especially in wedding ceremony. Trifoliate leaves are tie with thread along with leaves of *Mangifera indica* and some flowers keep hanging in the main entrance of wedding ceremony.

Medicinal use: Ripe fruits are eaten raw or making juices for various stomach problems such as gastric ulcer, gas problem, pain, etc.

Distribution: INDIA (Throughout India), SRI LANKA, TROPICAL AMERICA, MALAYSIA.

Local status: Wild as well as planted in the district.

2. *Allium sativa* L. (Alliaceae)

Vernacular name: Sambram (Bodo)

Description: Herb, bulb solitary; leaves flat, scape slender.

Parts used: Bulb.

Ritual virtue: The bulb along with chilly are used to eliminate bad evil.

Medicinal use: The paste is also applied on nostril and naval region to get relief of cough.

Distribution: INDIA (Throughout India), MALYSIA, SRI LANKA, NEPAL, BHUTAN, CENTARL ASIA, CANADA, UNITED STATES.

Local status: Cultivated in the district.

3. *Alpinia nigra* (Gaertn.) B. L. Bertt. (Zingiberaceae)

Vernacular name: Tharai (Bodo)

Description: Herb, erect with tuberous rootstocks, leafy stem 1-2 m high; Leaves oblong lanceolate. Flowers in panicles, pink.

Parts used: Leafy stem.

Ritual virtue: Leafy stem are used in Bwisagu festival along with *Phragmites karka*, *Clerodendrum viscosum*, and *Melastoma malabathricum* where cattles are worship by the tribe during mid of April month.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya), MALYSIA, SRI LANKA, NEPAL, BHUTAN.

Local status: Wild.

4. *Areca catechu* L. (Arecaceae)

Vernacular name: Goy (Bodo)

Description: Palm about 12-30 m tall; Leaves in a terminal crown.

Parts used: Fruit.

Ritual virtue: The Boro tribe use Areca catechu along with *Piper betle* in all religious and ritual activities like worshipping god, wedding ceremonies, welcoming guests, exchange of gifts, and even as a signal for a visitor to depart.

Other uses: The nut with leaf of *Piper betle* is used as masticatory.

Distribution: INDIA (Arunachal Pradesh, Assam, Manipur, Meghalaya, Sikkim), AUSTRALIA, MYANMAR, SRI LANKA.

Local status: Cultivated.

5. ***Bambusa tulda*** Roxb. (Poaceae)

Vernacular name: Jathiowa (Bodo)

Description: Tufted bamboo reaching 20-45 meters in height. Leaves alternate, linear-lanceolate.

Parts used: Culm.

Ritual virtue: The whole plant parts are used in all religious practices. Bamboo sticks are used in and around the sacred plant *Euphorbia nerifolia* as a main altar of worshipping.

Other use: Besides all the customary handicrafts were made of this plant. It also used in making fence, pillar of hut, ladder, etc.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya, West Bengal), BANGLADESH, MYANMAR.

Local status: Cultivated in the district.

6. ***Clerodendrum viscosum*** Vent. (Verbenaceae)

Vernacular name: Mwkhnabifang (Bodo).

Description: Shrub, 0.5-2.5 m high; leaves simple, opposite. Flowers in panicles of corymbose, white tinged with pink in terminal panicles of cymes.

Parts used: Leafy twig.

Ritual virtue: Leafy twig are used along with *Alpinia nigra*, *Melastoma malabathricum* and *Phragmites karka* in Bwisagu festival where cattles are worship by the tribe during mid of April month.

Medicinal use: Root extract is used for stomach ache.

Distribution: INDIA (Throughout India), SRI LANKA, VIETNAM, CHINA, BHUTAN.

Local status: Wild in the district.

7. ***Cynodon dactylon*** (L.) Pers. (Poaceae)

Vernacular name: Dubliha (Bodo).

Description: Perennial stoloniferous grass, about 0.5 m long. Leaves linear, lanceolate.

Parts used: Whole plant.

Ritual virtue: Twigs are used in every religious festival.

Distribution: INDIA (Throughout India), CHINA, MALAYSIA, MYANMAR.

Local status: Wild in the district.

8. ***Delinia indica*** L. (Dilleniaceae)

Vernacular name: Thaigir (Bodo).

Description: A big tree, 10-30 m tall; leaves simple, oblanceolate. Flowers solitary, white.

Parts used: Fruit.

Ritual virtue: The sepals are used as Diya or oil lamp in various festivals especially in Katifwrbw.

Medicinal use: Mucilaginous seeds are used for hair problems.

Distribution: INDIA (Assam, Arunachal Pradesh, Tripura, Mizoram, Tamil Nadu, Kerala, Odisha, West Bengal, Uttar Pradesh), MALAYSIA, SRI LANKA, THAILAND, VIETNAM.

Local status: Wild as well as planted in the district.

9. *Euphorbia neriifolia* L. (Euphorbiaceae).

Vernacular name: Sijou (Bodo).

Description: Shrub, 1-6 m tall; leaves alternate, simple. Cyathia in cymes.

Parts used: Whole plant.

Ritual virtue: The plant is worship by the tribe and planted as symbol of Bathou religion. Boro tribe regard this plant as the most sacred plant.

Medicinal use: Paste of leaves is used in different acne of bodies for quick relieve.

Distribution: INDIA (Throughout India), MALAYSIA, MYANMAR.

Local status: Planted in the district.

10. *Flemingia strobilifera* (L.) Ait. (Papilionaceae).

Vernacular name: Makhiotalaifang (Bodo).

Description: Shrub, 0.5-3 m tall; leaves simple, trifoliate. Flowers in long axillary racemes.

Parts used: Leafy twig.

Ritual virtue: Leafy twig is used in ritual activity performed during Bwisagu festival.

Distribution: INDIA (Throughout India), NEPAL BHUTAN, MYANMAR, CHINA, PAKISTAN, BANGLADESH.

Local status: Wild in the district.

11. *Jatropha curcas* L. (Euphorbiaceae).

Vernacular name: Enda (Bodo).

Description: Shrub; leaves palmatifid. Flowers in axillary and terminal cymes.

Parts used: Whole plant.

Ritual virtue: Plant is used in dead ritual by the tribe.

Medicinal use: Paste Twigs are advised to brush in pyorrhea problem.

Distribution: INDIA (Throughout India), TROPICAL AMERICA.

Local status: Wild as well as planted in the district.

12. *Justicia gendarussa* Burm. f. (Acanthaceae)

Vernacular name: Jatrashi (Bodo).

Description: Shrub, 1-2 m tall; leaves simple, linear. Flowers terminal, narrow spikes, white.

Parts used: Leafy twig.

Ritual virtue: Twigs along with *Cynadondactylon* and *Ocimumtenuiflorum* tie together with white thread for purifying home in each and every religious ceremonies and ritual activities.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura), TROPICAL ASIA, AFRICA, SRI LANKA, PHILIPPINES.

Local status: Planted in the district.

13. *Litsea salicifolia* (Roxb. ex Nees) Hook. f. (Lauraceae)

Vernacular name: Digloti (Bodo).

Description: Shrub, 2-5 m tall; leaves simple, lanceolate. Flowers in umbels, purple.

Parts used: Leafy twig.

Ritual virtue: Leafy twig are used in bwisagu festival.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Tripura, Sikkim, West Bengal, Uttar Pradesh), MYANMAR.

Local status: Wild as well as planted in the district.

14. *Mangifera indica* L. (Anacardiaceae).

Vernacular name: Thaijou (Bodo).

Description: A big tree about 10-30m tall; leaves simple alternate. Flowers in terminal panicles.

Parts used: Leaves.

Ritual virtue: Leaves are used for ritual purposes mostly related to wedding ceremony.

Distribution: INDIA (Throughout India), BHUTAN, NEPAL, SRI LANKA, MALAYSIA.

Local status: Planted in the district.

15. *Melastoma malabathricum* L. (Melastomaceae)

Vernacular name: Furkha (Bodo).

Description: Shrub, 1-3 m tall; leaves simple, hairy on both sides. Flowers in clusters, purple.

Parts used: Leafy twig.

Ritual virtue: Leafy twig are used along with *Alpinia nigra*, *Clerodendrum viscosum* and *Phragmites karka* in Bwisagu festival where cattles are worships by the tribe during mid of April month.

Other uses: Ripe fruits are eaten raw as seasonal fruit.

Distribution: INDIA (Throughout India), MALAYSIA, SRI LANKA, THAILAND, VIETNAM MYANMAR.

Local status: Wild in the district.

16. *Musa ssp.* (Musaceae)

Vernacular name: Thair (Bodo).

Description: Fleshy herb about 1-6 m tall, pseudostem robust; leaves oblong.

Parts used: Leaf apex, shoot, root.

Ritual virtue: Leaf apex, fruit and fleshy petiole are heavily used by Boro people in every religious activities. The plant is also erected on both side of the main entry of any festival premises.

Medicinal uses: Root paste is used for tooth ache.

Other uses: The young shoots are used as vegetable and dried shoots and rhizomes are used in preparation of *khar* (Alkaline).

Distribution: INDIA (Throughout India), SRI LANKA, BHUTAN, NEPAL, BANGLADESH.

Local status: Planted in the district.

17. *Ocimum tenuiflorum* L. (Lamiaceae).

Vernacular name: Thuluni (Bodo).

Description: Shrub, 0.3-2-1 m tall; leaves simple, pubescent. Flowers in pedicelled racemes, reddish pink.

Parts used: Leafy twig.

Ritual virtue: The plant also considered as sacred by the tribe. Twigs are used for purifying home and various ritual activities.

Medicinal uses: Leaves extract mixed with honey is used for respiratory problems.

Distribution: INDIA (Throughout India), SRI LANKA, AUSTRALIA, WEST ASIA.

Local status: Planted in the district.

18. *Oryza sativa* L. (Poaceae).

Vernacular name: Mairong (Bodo).

Description: Annual cereal, 0.5-1.5 m tall.

Parts used: Cereal.

Ritual virtue: The Rice is indispensable item in every festival of Boro tribe. Rice is regarded as deity and kept inside north-east corner of a kitchen in a full of a pitcher.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya, Tripura, Sikkim, West Bengal, Madhya Pradesh, Punjab, Andhra Pradesh, Bihar, Uttar Pradesh), SRI LANKA, JAPAN, BRAZIL, CHINA, INDONESIA, BANGLADESH, THAILAND, MYANMAR, PHILIPPINEA.

Local status: Cultivated in the district.

19. *Phragmites karka* (Retz.) Trin. ex Steud. (Poaceae)

Vernacular name: Nwlwhagra (Bodo).

Description: Perennial grass with creeping rhizome, about 4 m high. Panicles decompounds, hairy.

Parts used: whole plant.

Ritual virtue: Stem are used along with *Alpinia nigra* and *Clerodendrum viscosum* in Bwisagu festival where cattles are worship by the tribe during mid of April month.

Other uses: The culms are used for making temporary wall of a hut.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya, Tripura), SRI LANKA, JAPAN, S.E. ASIA, MYANMAR, AUSTRALIA, AFRICA.

Local status: Wild in the district.

20. *Piper betle* L. (Piperaceae)

Vernacular name: Fathwi (Bodo).

Description: Lianas; leaves simple, cordate, glabrous.

Parts used: Leaves.

Ritual virtue: A pair of leaves is always used along with *Areca catechu* in all traditional religious and ritual activities like worshipping god, wedding ceremonies, welcoming guests, exchange of gifts, and even as a signal for a visitor to depart.

Distribution: INDIA (Throughout India), MALAYSIA, SRI LANKA.

Local status: Planted in the district.

21. *Saccharum spontaneum* L. (Poaceae)

Vernacular name: Khasi hagra (Bodo).

Description: Perennial grass, erect culms, 2-5 m tall. Panicle densely silky hairy.

Parts used: Whole plant.

Ritual virtue: The plant is mostly used in all religious festivals of the tribe.

Distribution: INDIA (Assam, Arunachal Pradesh, Meghalaya, Tripura), AFRICA, AUSTRALIA, SRI LANKA.

Local status: Wild in the district.

22. *Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult. (Apocynaceae).

Vernacular name: Daodibibar (Bodo).

Description: Shrub about 1-4m tall; leaves simple, alternate. Flowers in cymes, fragrant, white.

Parts used: Flower.

Ritual virtue: Flowers are used for worshipping various deities.

Distribution: INDIA (Throughout India), ASIA.

Local status: Wild as well as planted in the district.

23. *Trichosanthes bracteata*(Lam.)Voigt. (Cucurbitaceae)

Vernacular name: Dawkhakhamflai (Bodo).

Description: Lianas; leaves cordate, simple, alternate. Flowers dioecious.

Parts used: Root.

Ritual virtue: Rhizome is used during ritual activity performed in Bwisagu festival.

Distribution: INDIA (Assam, Arunachal Pradesh, Manipur, Mizoram, Tripura), MYANMAR.

Local status: Wild in the district.

Discussion and Conclusion

Boro tribe of Udalguri district collect the ritual plants from their surroundings habitat. They collect these plants in the previous day of each festival. In present study, a total of 23 ritual plants species were recorded. These plants belong to 23 different genera under 18 families. Out of which 14 species belong to 14 different genera under 13 Dicotyledons families and 9 species belong to 9 different genera under 5 Monocot families. The species *Flemingia strobilifera* and *Litsea salicifolia* were reported as most difficult to collect from the nearby surroundings habitat and collected far from the forest areas. The informants stated that it is difficult to domesticate the species *Flemingia strobilifera* because of unknown facts. Due to present rate of habitat loss in the district the number of this species decreasing day by day.

Some species of these ritual plants claimed to have medicinal value for common ailments such as gastric problems, cough, tooth ache, etc. In present study 8 ritual plants species were reported to have medicinal value. Among other species like *Phragmites karka* and *Bambusa tulda* were collected for other uses like fencing, temporary wall of house, pillar, etc. *Musa ssp.* were found to be most utilized species among these ritual plants. All the parts of the plant such as leaf, fruits, fleshy petiole and roots were found to have different utility. So any species of genus *Musa* were found in each and every household of the tribe in the district. Some species like *Euphorbia neriifolia* were not reported in wild habitat in the district. Habitats of these ritual plants are decreasing so fast due to development of Small Tea Growers (STG) in the district. Therefore, proper documentation of such plants especially having medicinal value in the district is very important before extinction.

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Chapter 13

UTILIZATION PATTERN OF MEDICINAL PLANTS BY ZEME TRIBE OF MANIPUR, NORTHEAST INDIA

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Abstract

The state Manipur of North East India is located in the Indo Myanmar Biodiversity Hot spot and found rich in floristic diversity. The hilly areas of the state are inhabited by various tribal communities who are mostly forest dwellers. The *Zeme* is one of the tribes inhabiting in the Tamenglong district of the state and have been adopting traditional ways of resources utilization to fulfil their day-to-day needs. They are fulfilling their nutritional requirements and treating the various health ailments using mostly the wild species. To document the traditional knowledge systems and diversity of plants used an ethnobotanical incentivization was made. As a part of the study the present paper aims to document and understand the utilization pattern of medicinal plant by the Zeme tribe of Manipur. Altogether 84 Angiospermic plants were recorded within 47 families and 78 genera. These plants were used to treat 28 types of health ailments where gastro-intestinal disorders were found to be the most prevalent ailment category. *Croton joufra*, *Gynura bicolor* and *Oroxylum indicum* are the most

commonly used species preferred for more than 3 ailments. Majority of medicinal plant recorded exist in the wild without any particular conservation effort. The results of this study also showed that the local community still depend on medicinal plants, and indigenous knowledge are the main systems to maintain health care in Tamenglong District. Further phytochemical investigations may be helpful to validate the presence of bioactive chemicals following the ethnomedicinal knowledge of the tribes.

Key words: Ethnomedicinal plants, Zeme tribe, Manipur, Tamenglong, ethnobotany, healing practices.

Introduction

Documentation of traditional medicinal plants play a vital role for biodiversity conservation, bioactive chemical extractions and retention of indigenous knowledge. consequently, ethnobotanical survey was found to be one of the reliable approaches to drug discovery (Fabricant & Farnsworth, 2001). For a state like Manipur, inhabited by variant ethnic communities have an ample scope of ethnobotanical exploration. The state Manipur exhibits a rich and unique diversity of flora and fauna and the richness of the plant diversity is also evident from the uses of large number of plants species by the indigenous communities of the state (Panmei et al., 2019). The '*Meitei*' is the major ethnic group of the state mostly residing in the valley region. There are 32 different tribes recognized by the government inhabiting mostly in the hill districts of the state (Rongmei & Kapoor, 2005). Ethnically and linguistically *Zeme* tribes belong to the mongoloid group of races and speak *Zeme*, a Tibeto-Burman language under the Naga Bodo section family (Grierson, 1903; Kabui, 1991). In Manipur they are dominantly inhabited in Tousem division of Tamenglong district. Being forest dwellers, the *Zeme* tribe of Manipur have been adopting traditional way of harvesting these rich ethnobotanical resources to fulfil their healthcare and other day to day needs. The study aims to gather the ethnomedicinal plant species and their associated knowledge of the Zeme Naga tribe.

Materials and methods

The study was conducted during 2017- 2018 in Tamenglong district of Manipur (Fig. 13.1). The district lies between 24°30'N and 25°27'N Lat. and of 93°10'E and 94°54'E Lon., with an altitude of 1,260 m a.s.l. Integrated approach for botanical collections, group discussions and interviews with semi structured questionnaires were followed (Jain, 1987; Martin, 1995). Total eight local healers were selected from 4 villages (Aben, Mandu, Tousem Khunou and Khullen) adopting purposive sampling techniques (Tongo, 2007). Collection of plant samples were made as per standard taxonomic procedure (Jain & Rao, 1977). Collected plants were

identified with the help of Herbarium of BSI, Shillong and relevant taxonomic literatures.

Informant consensus factor (ICF) was calculated to determine the effectiveness of medicinal plants in each ailment category (Trotter & Logan, 1986). It was calculated as $ICF = \frac{Nur - Nt}{Nur - 1}$; Where *Nur* is the number of use reports for a particular ailment category and *Nt* is the number of species used for the particular ailment category by all informants. All the ailments treated in the study area are grouped into 11 major/broad categories following Tumoro and Maryo (2016), Chekole (2017)

Fidelity level (FL) was calculated to determine the most frequently used plant species for treating a particular ailment. It was calculated for the most frequently reported diseases or ailments by the formula $FL \% = \frac{Np}{N} \times 100$; where *Np* is the number of use reports cited for a particular ailment and *N* refers to the total number of use reports cited for any given plant species (Alexiades, 1996).

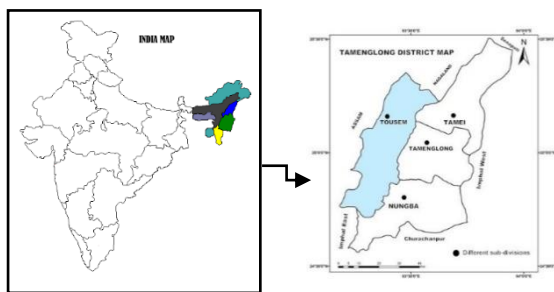


Fig. 13.1. Map showing Study site.

Results & Discussion

Diversity of Medicinal Plants used

The study revealed that the Zeme tribe of Manipur rely on the different plants found in their surroundings in management of their health and health ailments. A total of 84 species were recorded under 78 genera and 47 families that are used as ethnomedicinal plants. All the species recorded are Angiosperm which consist of 84% dicotyledons and 16 % monocotyledon. Among the different families of Angiospermic plants, Asteraceae with 9 species, Fabaceae 9, Euphorbiaceae with 5 and Zingiberaceae with 4 species were the most used sources for the medicinal purposes. Among the medicinal plants, shrubs were the most dominant habit form with maximum representation (36 spp), followed by herbs (20 spp), trees (19 spp) and climbers (9 spp). Details of the recorded species along with their botanical identity, part(s) used, disease treated and mode of treatment is presented in **Table 13.1**. Many of the reported species in the present study are also enumerated in earlier workers from the state (Sinha, 1996; Singh et al., 2000; Rajkumari et al., 2013; Panmei et al., 2018) and found important components of the floristic diversity of the state.

Plant part(s) used, mode of preparation and application

The selection of species and its parts are mostly depends on the nature of the disease treated and availability of the species. The healers of the Zeme tribe applied different plant parts in preparation of the crude drug for treatment of different diseases. Among the various plant parts employed, the leaves (52%) were mostly used, followed by the bark (16%), roots (12%), rhizomes (9%) and the flowers (1%) were found least used in preparation of different remedies (**Fig. 13.2**). Although crushed paste (34%) followed by water decoction (20%) were the most common form of the crude drug, the uses of juice, extracts, raw chewing, poultice, vapour, etc. were also followed (**Fig. 13. 2**). Majority of the reported remedies were drawn from mixture or multiple plants (55%). It is believed that multiple remedies contain a range of pharmacologically active compounds and the poly-herbal treatment has more healing power than the single medicinal plant treatment since each medicinal plant used in the mixture is a remedy (Teklehaymanot et al. 2007). Species like *Solanum spirale*, *Oroxylum indicum*, *Croton joufra* and *Gynura bicolor* are used for treating 2 or more different ailments. Such plant with multi medicinal uses may have more degradation liability. Therefore, proper conservation intervention is required for sustainable utilization.

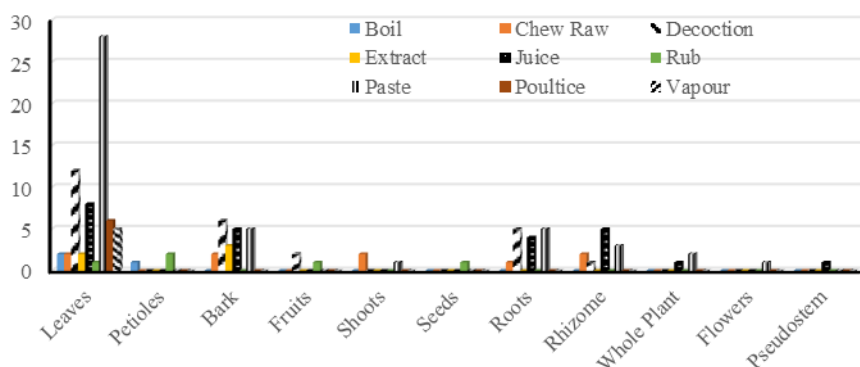


Fig. 13.2. Proportional contributions of plant parts and crude drug preparations.

The various health ailments treated in the study area are grouped into 11 broad disease categories (Table. 13.1). Among the major ailment categories, digestive system disorder was dominated with 33 use-reports followed by dermatological disorder 24 use- reports. Around 28 spp were found used to treat Digestive System Disorder followed by Dermatological disorder, Cultural related/ Undefined illness, Musculoskeletal & Nervous system, Pain/ Analgesic and antipyretic (21 spp, 17 spp, 12 spp, 10 spp and 2 spp respectively).

Table 13.1. List of ethnomedicinal plants.

Sl. No.	Botanical name [Family]	Local name (Zeme)	Habit	Part(s) and preparation mode	Broad Ailment category
1.	<i>Acorus calamus</i> L. [Acoraceae]	Nammechak	Herb	<p>Leaves/ rhizome + <i>Oroxylum indicum</i> (bark)+ <i>Plantago erosa</i> (leaves) crushed paste are applied to releif headache.</p> <p><i>Acorus calamus</i> (leaves/rhizome) + <i>Oroxylum indicum</i> (bark) crushed juice mixed with water is taken after food for jaundice.</p> <p><i>Acorus calamus</i>+ Ocimum basilicum (leaves) + <i>Lasianthus cyanocarpus</i> (leaves) +<i>Cymbopogon citratus</i> decoction is taken for stomachic and gastritis.</p> <p>Crushed paste of leaves of <i>Lasianthus</i> sp. + <i>Schefflera elliptica</i> + <i>Mussaenda glabra</i> + <i>Piper sylvaticum</i>+ <i>Acorus calamus</i> (rhizome)</p>	<p>Analgesic</p> <p>Digestive system disorder</p> <p>Digestive system disorder</p> <p>Undefined illness.</p> <p>Undefined illness</p>

				is applied to relief stomach pain. <i>Mimosa pudica</i> (leaves) + <i>Kaempferia galanga</i> (rhizome) + <i>Acorus calamus</i> (leaves/rhizome) crushed juice is taken (2-3 cup) for 1 week to relief sudden body pain.	
2.	<i>Ageratum conizoides</i> L. [Asteraceae]	Nakamkiheu	Herb	Crushed leaves paste applied on cuts and wounds	Dermatological
3.	<i>Aloe vera</i> (L.) Burm [Agavaceae]	Aloe vera	Herb	Leaves applied in burnt and blister	Dermatological
4.	<i>Artemisia</i> sp. [Asteraceae]	Takaibua	Shrub	Leaves decoction against stomachic. Crushed leaves juice also applied for sinusitis	Digestive system disorder. Respiratory system disorders
5.	<i>Azadirachta indica</i> A. Juss Mém. [Meliaceae]	Neem	Tree	Boiled leaves vaporish used in massage to relief fever	Antipyretic
6.	<i>Bambusa</i> sp. [Poaceae]	Kepai, Kechuipuak	Tree	Scraped bark paste applied in cuts and wounds	Dermatological
7.	<i>Blumeopsis flava</i> (DC.) Gagnep. [Asteraceae]	Tingmandibae	Shrub	Leaves + <i>Houttuynia cordata</i> + <i>Tagetes erecta</i> (leaves) crushed juice mixed with few drops of kerosene is used in	Undefined illness

				massaging to relief body pain.	
8.	<i>Brachystemma calycinum</i> D. Don Caryophyllaceae	Ngakpinchin	Climber	Crushed leaves paste applied to heal wounds.	Dermatological
9.	<i>Brassica sp.</i> [Brassicaceae]	N'jeikambe	Herb	Leaves poultice against headache	Pain analgesic
10.	<i>Cajanus cajan</i> (L.) Millsp. [Fabaceae]	Chiaupi	Shrub	Leaves + <i>Cannabis sativa</i> (leaves) decoction is taken for dysentery. <i>Cajanus cajan</i> (leaves) + <i>Oroxylum indicum</i> (bark) crushed paste mixed with water is taken against jaundice.	Digestive system disorder Digestive system disorder
11.	<i>Callicarpa arborea</i> Roxb. [Lamiaceae]	N'kong	Shrub	Crushed bark paste applied in cuts and wounds. <i>Callicarpa arborea</i> leaves + <i>Tabernaemontana divaricata</i> (leaves) crushed paste are applied to control bleeding in cuts and wounds.	Dermatological Dermatological Dermatological
12.	<i>Cannabis sativa</i> L. [Malvaceae]	Ganja	Shrub	Leaves + <i>Cajanus cajan</i> (leaves) decoction taken for dysentery.	Digestive system disorder
13.	<i>Capsicum chinese</i> Jacq. [Solanaceae]	Tasu	Shrub	Berries directly applied on spider/millipede sting.	Insect and snake bite

14.	<i>Carica papaya</i> L. [Caricaceae]	Chingaina	Tree	Leaves + <i>Cajanus cajan</i> (leaves) decoction taken for dysentery.	Digestive system disorder
15.	<i>Caesalpinia sappan</i> L. [Fabaceae]	Patikungam	Tree	Bark decoction taken as tea, as health tonic.	General metabolism
16.	<i>Centella asiatica</i> (L.) Urb.[Apiaceae]	Khareine	Herb	2-3 drops of crushed leaves juice of <i>Centella asiatica</i> + <i>Phlogacanthus thysiflorus</i> + <i>Momocordia</i> sp. are applied for 3 days before bed for conjunctivitis.	Eyes ailment
17.	<i>Clerodendrum glandulosum</i> Lindl. [Lamiaceae]	N'ringkun	Shrub	Boiled leaves eaten against hypertension.	Circulatory system disorder
18.	<i>Colocasia esculenta</i> (L) Schott [Araceae]	Kebeitikpe	Shrub	Boiled petiole eaten for dysentery	Digestive system disorder
19.	<i>Cordia trichotoma</i> (Vell.) Arráb. ex Steud. [Boraginaceae]	Temau bang	Tree	Shoots are chewed and applied to relief itching caused by cut and wounds.	Dermatological
20.	<i>Cheilocostus speciosus</i> (J. Koenig) C.D. [Costaceae]	Ruangpuitiu	Shrub	Decoction of <i>Cheilocostus speciosus</i> (rhizome) + <i>Schefflera elliptica</i> (bark) + <i>Mussaenda glabra</i> (bark) + <i>Phyllanthus urinaria</i> (leaves) is taken	Nervous system disorder

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				against paralysis	
21.	<i>Croton caudatus</i> Geiseler [Euphorbiaceae]	Sipuiniaria	Shrub	<i>Croton caudatus</i> (roots) + <i>Pericampylus incanus</i> (roots) + <i>Xanthium</i> <i>strumarium</i> (roots) juice/decoction is taken to relief labor pain	Urinogenital system disorder
22.	<i>Croton joufra</i> Roxb. [Euphorbiaceae]	Haobum	Tree	Decoction of root is taken for dysentery/ diarrhea. Root paste is applied to cure ringworm. Bark decoction for burp and chest pain.	Digestive system disorder Dermatological Digestive system disorder
23.	<i>Curcuma xanthorrhiza</i> Roxb. [Zingiberaceae]	Gah	Shrub	Rhizome + <i>Erythrina</i> <i>stricta</i> (bark) crushed juice drink in stomach pain	Digestive system disorder
24.	<i>Cucurbita maxima</i> Duch. ex Lamk. [Cucurbitaceae]	Maa-na	Shrub	Crushed leaves juice applied for blood clotting during injury.	Dermatological
25.	<i>Curcuma caesia</i> Roxb. [Zingiberaceae]	Hegeingmeiga	Herb	Rhizome + <i>Erythrina</i> sp (bark) crushed juice is applied to alleviate sudden body swelling. Juice of fresh rhizome is also taken to relief stomachic.	Undefined illness Digestive system disorder Digestive system disorder

				Fresh rhizome eaten to relief stomachic.	
26.	<i>Cymbopogon citratus</i> (DC.) Stapf [Poaceae]	M'bauliangtu	Shrub	Leaves decoction of <i>Cymbopogon citratus</i> + <i>Ocimum basilum</i> + <i>Acorus calamus</i> + <i>Lasianthus cyanocarpus</i> is taken for stomachic and gastritis.	Digestive system disorder
27.	<i>Datura stramonium</i> L. [Solanaceae]	Kepeu	Shrub	Poultice of leaves applied to relief body pain.	Undefined illness
28.	<i>Drymaria cordata</i> (L.) Willd. ex Schult. [Caryophyllaceae]	Phitpanew	Herb	Fresh leaves applied to cure abscesses (boil)	Dermatological
29.	<i>Erythrina stricta</i> Roxb. [Papilionaceae]	Tabang	Tree	Raw bark + <i>Curcuma caesia</i> (rhizome) crushed juice is applied to lessen sudden body swelling (evil spirit) Bark + <i>Curcuma caesia</i> (rhizome) crushed juice is taken to relief stomach pain.	Undefined illness Undefined illness
30.	<i>Euphorbia</i> sp. [Euphorbiaceae]	Heduiheu	Shrub	Juice of crushed whole plants applied in skin irritation (scabies)	Dermatological
31.	<i>Gmelina arborea</i> Roxb.	Bae	Tree	<i>Gmelina arborea</i> (fresh	Musculoskeletal

	[Verbenaceae]			bark) + <i>Tabernamontana divaricata</i> (leaves) + <i>Solanum spirale</i> (leaves/ roots) + <i>Paedaria foetida</i> (whole plant) + <i>Rhaphidophora decursiva</i> are crushed and paste are used as poultice for settling bones for 3 days.	disorder
32.	<i>Gnaphalium purpureum</i> L. [Asteraceae]	Kuliheuchiambe	Herb	Crushed leaves paste applied on cuts and wounds.	Dermatological
33.	<i>Gossypium arboreum</i> L.[Malvaceae]	Kalang	Shrub	Leaves of <i>Impatiens balsamina</i> + <i>Tagetes erecta</i> + <i>Gossypium arboreum</i> + Marengpa are crushed together and the paste are applied in cut and wound and cover with <i>Phrynium pubinerve</i> leaves which are poultice.	Dermatological
34.	<i>Gynura bicolor</i> (Roxb. ex Willd.) DC. [Asteraceae]	N'pungi	Shrub	Boiled leaves eaten in stomachic and ulcer.	Digestive system disorder
35.	<i>Gynura cusimbua</i> (D.Don) S.Moore [Asteraceae]	Khamadijei	Shrub	Flowers and leaves paste used for clotting blood during injury.	Dermatological

36.	<i>Hedyotis scandens</i> Roxb. [Rubiaceae]	N'rim	Shrub	Leaves decoction taken in urinary problem.	Urinogenital system disorder
37.	<i>Houttuynia cordata</i> Thunb. [Saururaceae]	Samma/ Nsenmah	Herb	Leaves of <i>Houttuynia cordata</i> + <i>Tagetes erecta</i> + <i>Sonchus</i> sp. are crushed together in hand with some kerosene and used for massage in body pain (Puan); care should be taken while massaging, e.g. in hand it should be massage downward while in neck it be done circularly.	Undefined illness
38.	<i>Hydrocotyle japonica</i> Makino [Apiaceae]	Heriepeikhuak	Herb	Vapour of boiled leaves of <i>Hydrocotyle japonica</i> + <i>Persicaria barbata</i> + <i>Ipomoea batatas</i> are used for massage in body pain	Analgesic
39.	<i>Impatiens balsamina</i> L. [Balsaminaceae]	BAHEU	Shrub	Leaves of <i>Impatiens balsamina</i> + <i>Tagetes erecta</i> + <i>Gossypium arboreum</i> + Marengpa are crushed together and the paste are applied in cut and wound and cover with <i>Phrynium</i>	Dermatological

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				<i>pubinerve</i> leaves which are poultice.	
40.	<i>Imperata cylindrica</i> (L.) Raeusch. [Poaceae]	Ngaina	Shrub	<i>Imperata cylindrica</i> (roots) + <i>Euphorbia</i> sp. (leaves) + <i>Solanum spirale</i> (roots) are crushed and paste applied in bone settle, sprain and cramp.	Musculoskeletal disorder
41.	<i>Ipomoea batatas</i> (L.) Lam. [Convolvulaceae]	Hereukumbe	Herb	Boiled leaves vapour of <i>Ipomoea batatas</i> + <i>Persicaria barbata</i> + <i>Hydrocotyle japonica</i> are massage to relief body pain.	Undefined illness
42.	<i>Kaempferia galanga</i> L. [Zingerberaceae]	Hekeuga	Herb	Leaves of <i>Kaempferia galanga</i> + <i>Tagetes erecta</i> + <i>Impatiens balsamina</i> leaves crushed paste are applied in cut and wound and cover with <i>Phrynium pubinerve</i> .	Dermatological

43.	<i>Lagenaria siceraria</i> (Molina) Standl. [Cucurbitaceae]	N'rau	Climber	Leaves applied to remove bee sting.	Snake and insect bites
44.	<i>Lasianthus cyanocarpus</i> Jack [Rubiaceae]	Chingbanam	Shrub	Vapour of boiled leaves used for massage in body pain. Leaves decoction of <i>Lasianthus cyanocarpus</i> + <i>Ocimum basilum</i> + <i>Acorus</i> <i>calamus</i> + <i>Cymbopogon</i> <i>citratus</i> is taken for stomachic and gastritis. Crushed leaves paste of + <i>Lasianthus cyanocarpus</i> + <i>Schefflera elliptica</i> + <i>Mussaenda glabra</i> + <i>Piper</i> <i>sylvaticum</i> + <i>Acorus</i> <i>calamus</i> (rhizome) applied for <i>puansumei</i> .	Undefined illness Digestive system disorder Undefined illness
45.	<i>Lindernia</i> sp [Scrophulariaceae]	Agakpu	Herb	Crushed leaves paste of <i>Lindernia</i> sp. + <i>Tabernaemontana</i> <i>divericata</i> + <i>Piper</i> <i>sylvaticum</i> are used in sprain and bone settle.	Musculoskeletal disorder
46.	<i>Lobelia nummularia</i> Lam. [Campanulaceae]	Buiseipewteu	Herb	Crushed plant applied in cut and wound	Dermatological

47.	<i>Mallotus pallidus</i> (Airy Shaw) Airy Shaw [Euphorbiaceae]	N'Nim bang	Tree	Fresh roots are tasted to diagnose evil spirit possession (Bitter taste).	Undefined illness
48.	<i>Mangifera indica</i> L. [Anacardiaceae]	Bachi	Tree	Crushed bark (inner part) mixed with ashes are wipe over the body of jaundice patient, it is believed that mucus is discharged from the body, disease is cured after there are no mucus.	Digestive system disorder
49.	<i>Meyna spinosa</i> Roxb. ex Link [Rubiaceae]	Tuding	Tree	Barks are crushed and the juice extract is taken for headache and back pain.	Analgesic
50.	<i>Mimosa pudica</i> L. [Leguminosae]	Kangamheu	Herb	<i>Mimosa pudica</i> (leaves) + <i>Kaempferia galanga</i> (rhizome) + <i>Acorus calamus</i> (leaves/rhizome) crushed juice of 2-3 cup is taken for a week against body pain.	Undefined illness/ cultural related
51.	<i>Molineria capitulata</i> (Lour.) Herb. [Hypoxidaceae]	M'pak	Shrub	Fresh crushed rhizome paste applied in cut and wound as coagulant	Dermatological
52.	<i>Musa paradisiaca</i> L. [Musaceae]	Nnungpui	Herb	Crushed pseudostem juice drank in snake bite to neutralize the venom.	Insect and snake bites

				Petiole applied in snake bite to remove venom.	
53.	<i>Mussaenda glabra</i> Vahl [Rubiaceae]	M'Phingpa	Shrub	<i>Mussaenda glabra</i> (bark) + <i>Cheilocostus speciosa</i> (rhizome) + <i>Schefflera elliptica</i> (bark) + <i>Phyllanthus urinaria</i> (leaves) the decoction is taken for paralysis. Crushed leaves paste of <i>Lasianthus cyanocarpus</i> + <i>Schefflera elliptica</i> + <i>Mussaenda glabra</i> + <i>Piper sylvaticum</i> + <i>Acorus calamus</i> (rhizome) applied for body pain	Nervous system disorder Undefined illness
54.	<i>Oroxylum indicum</i> (L.) Kurz [Bignoniaceae]	Ngumpi	Tree	<i>Oroxylum indicum</i> (bark) + <i>Phaseolus lunatus</i> (leaves) + <i>Plantago erosa</i> (leaves) + <i>Acorus calamus</i> (leaves/rhizome) are crushed and applied for headache . <i>Oroxylum indicum</i> (bark) + <i>Acorus calamus</i> (leaves/rhizome) crushed	Undefined illness Digestive system disorder Digestive system disorder Digestive system disorder

				juice mixed with water t is taken after food for jaundice . <i>Oroxylum indicum</i> (bark)+ <i>Zehmeria scabra</i> (roots) crushed juice and decoction is taken for jaundice . <i>Cajanuscajan</i> (leaves) + <i>Oroxylum indicum</i> (bark) crushed paste mixed with water is taken against jaundice .	
55.	<i>Paederia foetida</i> L. [Rubiaceae]	Banam	Climber	<i>Gmelina arborea</i> (fresh bark) + <i>Tabernamontana divaricata</i> (leaves) + <i>Solanum spirale</i> (leaves/ roots) + <i>Paedaria foetida</i> (whole plant) + <i>Rhaphidophora decursiva</i> are crushed and paste are used as poultice for settling bones for 3 days. Leaves/whole plant is crushed and bandage for sprain and bone settle. Poultice of leaves also used	Musculoskeletal disorder Musculoskeletal disorder

				for the same purpose.	
56.	<i>Parkia timoriana</i> (DC.) Merr. [Mimosaceae]	Kampi	Tree	Bark juice for dysentery. Juice extract from crushed barks of <i>Parkia timoriana</i> + <i>Psidium guajava</i> + <i>Phyllanthus emblica</i> are taken for dysentery and diarrhea.	Digestive system disorder
57.	<i>Pericampylus glaucus</i> (Lam.) Merr. [Menispermaceae]	N'giekukak	Climber	Crushed root juice/ decoction of <i>Pericampylus glaucus</i> + <i>Urena lobata</i> are taken against trouble after child birth.	Urinogenital system disorder
58.	<i>Persicaria barbata</i> (L.) H.Hara [Polygonaceae]	Heubin	Herb	Boiled leaves vapour of <i>Ipomoea batatas</i> + <i>Persicaria barbata</i> + <i>Hydrocotyle japonica</i> are used for massage in body pain.	Analgesic
59.	<i>Polygonum posumbu</i> Buch.-Ham. ex D. Don [Polygonaceae]	Kokfei	Shrub	Leaves paste applied for pile.	Digestive system disorder
60.	<i>Phaseolus lunatus</i> L. [Fabaceae]	Teipingei	Climber	<i>Oroxylum indicum</i> (bark) + <i>Phaseolus lunatus</i> (leaves) + <i>Plantago erosa</i> (leaves) + Rarouga (leaves/rhizome)	Analgesic

				are crushed and applied for headache.	
61.	<i>Phlogacanthus thyrsiflorus</i> Nees. [Acanthaceae]	Nongmangkha	Shrub	2-3 drops of crushed leaves juice of <i>Centella asiatica</i> + <i>Phlogacanthus thyrsiflorus</i> + <i>Momocordia</i> sp. are applied for 3 days before bed for conjunctivitis. Leaves decoction also taken against cold and fever	Eyes disorder antipyretic
62.	<i>Phrynium pubinerve</i> Blume [Marantaceae]	Kena	Shrub	Leaves of <i>Impatiens balsamina</i> + <i>Tagetes erecta</i> + <i>Gossypium arboreum</i> are crushed together and the paste are applied in cut and wound and cover with <i>Phrynium pubinerve</i> leaves which are poultice.	Dermatological
63.	<i>Phyllanthus emblica</i> L. [Phyllanthaceae]	Rampholochi	Tree	Juice extract from crushed barks of <i>Parkiatimoriana</i> + <i>Psidium guajava</i> + <i>Phyllanthus emblica</i> are taken for dysentery and diarrhea.	Digestive system disorder
64.	<i>Phyllanthus urinaria</i> L. [Euphorbiaceae]	Sibaina	Herb	<i>Schefflera elliptica</i> (bark) + <i>Costus speciosa</i> (rhizome)	Nervous system disorder

				+ <i>Mussaenda glabra</i> (bark) + <i>Phyllanthus urinaria</i> (leaves) the decoction is taken for paralysis.	
65.	<i>Piper sylvaticum</i> Roxb. [Piperaceae]		Climber	Crushed leaves paste of <i>Lindernia</i> sp. + <i>Tabernaemontana divericata</i> + <i>Piper sylvaticum</i> are used in sprain and bone settle. Crushed leave paste of <i>Lasianthus cyanocarpus</i> + <i>Schefflera elliptica</i> + <i>Mussaenda glabra</i> + <i>Piper sylvaticum</i> + <i>Acorus calamus</i> (rhizome) against body pain	Musculoskeletal disorder Undefined illness
66.	<i>Plantago erosa</i> Wall. [Plantaginaceae]	Khamadigei	Herb	<i>Oroxylum indicum</i> (bark) + <i>Phaseolus lunatus</i> (leaves) + <i>Plantago erosa</i> (leaves) + <i>Acorus calamus</i> (leaves/rhizome) are crushed and applied for headache.	Undefined
67.	<i>Psidium guajava</i> L.	Chikarichi	Tree	Juice extract from crushed	Digestive system

	[Myrtaceae]			barks of <i>Parkia timoriana</i> + <i>Psidium guajava</i> + <i>Phyllanthus emblica</i> are taken for dysentery and diarrhea.	disorder
68.	<i>Quercus serrata</i> Murray [Fagaceae]	M'phu	Tree	Inner bark eaten for dysentery.	Digestive system disorder
69.	<i>Rhaphidophora decursiva</i> (Roxb.) Schott [Araceae]	Henuaheu	Climber	Poultice of leaves in sprain and muscle cramp. Poultice of leaves applied to remove blood clot.	Musculoskeletal disorder Dermatological
70.	<i>Sambucus javanica</i> Blume [Adoxaceae]	Mbeuchimbe	Shrub	Leaves decoction for gastritis.	Digestive system disorder
71.	<i>Schefflera elliptica</i> (Blume) Harms [Araliaceae]	Talang	Climber	<i>Schefflera elliptica</i> (bark) + <i>Costus speciosa</i> (rhizome) + <i>Mussaenda glabra</i> (bark) + <i>Phyllanthus urinaria</i> (leaves) the decoction is taken for paralysis. Crushed leaves paste of + <i>Lasianthus cyanocarpus</i> + <i>Schefflera elliptica</i> + <i>Mussaenda glabra</i> + <i>Piper sylvaticum</i> + <i>Acorus calamus</i> (rhizome) applied	Nervous system disorder Undefined illness

				for body pain	
72.	<i>Schima wallichii</i> Choisy [Theaceae]	N'kia	Tree	2-3 fresh tender leaves eaten to relieve nausea; leaves facing toward east are preferred.	Digestive system disorder
73.	<i>Senna alata</i> (L.) Roxb. [Fabaceae]	Ghajangnew	Shrub	2/3 leaves /shoot eaten raw with water against burp (foul breath)	Digestive system disorder
74.	<i>Solanum spirale</i> Roxb. [Solanaceae]	N'Kabua, Mangmangrachi	Shrub	<i>Gmelina arborea</i> (fresh bark/root/stem) + <i>Tabernamontana divaricata</i> (leaves) + <i>Solanum spirale</i> (leaves/ roots) + <i>Paedaria foetida</i> (whole plant) + <i>Rhaphidophora decursiva</i> are crushed and paste are used as poultice for settling bones for 3 days. Poultice of leaves used to cure blood clot in the body. Grounded roots mixed with raw egg yolk are applied to heal wounds. <i>Imperata cylindrica</i> (roots) <i>Euphorbia</i> sp. (leaves) + <i>Solanum spirale</i> (roots) are crushed and paste applied	Musculoskeletal disorder Dermatological Dermatological Musculoskeletal disorder

				in bone settle, sprain and cramp.	
75.	<i>Spondias pinnata</i> (L. f.) Kurz [Anacardiaceae]	Majingchi	Tree	Bark eaten for dysentery.	Digestive system disorder
76.	<i>Stixis suaveolens</i> (Roxburgh) Pierre [Capparaceae]	Jourachi	Shrub	<i>Stixis suaveolens</i> (roots) + <i>Zingiber zerumbet</i> (rhizome) crushed and the juice is taken to relieve body pain.	Analgesic
77.	<i>Tabernaemontana divaricata</i> (L.) R.Br. ex Roem. &Schult. [Apocyanaceae]	Jampu, Hingbangheu	Shrub	<i>Gmelina arborea</i> (fresh bark) + <i>Tabernamontana divaricata</i> (leaves) + <i>Solanum spirale</i> (leaves/ roots) + <i>Paedaria foetida</i> (whole plant) + <i>Rhaphidophora decursiva</i> are crushed and paste are used as poultice for settling bones for 3 days.	Musculoskeletal and nervous system
78.	<i>Tagetes erecta</i> L. [Asteraceae]	Marengpatikpa	Shrub	Leaves of <i>Houttuynia cordata</i> + <i>Tagetes erecta</i> + <i>Sonchus</i> sp. are crushed together in hand with some kerosene and used for massage in body pain	Undefined illness Dermatological Analgesic Analgesic

				(Puan); Leaves of <i>Impatiens balsamina</i> + <i>Tagetes erecta</i> . + <i>Gossypium arboreum</i> crushed paste are applied in cut and wound and cover with <i>Phrynium pubinerve</i> . Crushed leaves paste also applied to relief headache.	
79.	<i>Tamarindus indica</i> L. [Fabaceae]	Kemeupi	Tree	Half seed (endosperm) is applied to remove bee sting.	Snake and insect bites
80.	<i>Urena lobata</i> L. [Malvaceae]	Raujia	Shrub	Crushed root juice/ decoction of <i>Pericampylus glaucus</i> + <i>Urena lobata</i> are taken against trouble after child birth.	Urinogenital system disorder
81.	<i>Xanthium strumarium</i> L. [Asteraceae]	Tingie	Shrub	Crushed leaves applied to heal wound.	Dermatological
82.	<i>Zehneria scabra</i> Sond. [Cucurbitaceae]	Siammgaiame	Climber	<i>Oroxylum indicum</i> (bark)+ <i>Zehneria scabra</i> (roots) crushed juice and decoction is taken for jaundice. Raw fruits or leaves decoction are taken twice a day (morning and before bed)	Digestive system disorder Digestive system disorder

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				for jaundice. Raw fruits; leaves decoction is also taken for stomachache.	
83.	<i>Zingiber</i> sp. [Zingiberaceae]	Gahtikpae	Herb	Fresh rhizome juice taken for stomachic.	Digestive system disorder
84.	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm. [Zingiberaceae]	Gakhuang	Shrub	<i>Stixis suaveolens</i> (roots) + <i>Zingiber zerumbet</i> (rhizome) crushed and the juice is taken to relieve body pain. Rhizome juice taken for jaundice, crushed paste also applied on the entire body.	Analgesic Digestive system disorder Analgesic

The ICF values were calculated and the value ranges from 0 (Respiratory system disorder) to 0.5 (Urinogenital system disorder and eye ailment (**Table 13.2**). This indicates the homogeneity of information provided by the different informants. It is found that the ICF values is inversely proportional to the use of mixture of multiple species among the healers for a particular ailment. The study found that digestive system disorder and dermatological disorder like cut & wound, ringworm, abscesses, eczema, skin irritation to be the most prevalent ailments among the community, where maximum number of plants and use reports are recorded. The major cause of digestive system disorder may be due to poor domestic hygiene condition, frequent consumption of chilly, alcohol and dietary routine, while the prevalence of dermatological disorder could be associated with the laborious lifestyle and poor hygienic condition.

Fidelity level (FL) was calculated for the most cited medicinal plants with 3 and above use-reports. This indicates the most preferred species mentioned by the informants to treat a particular ailment. *Clerodendrum glandulosum* and *Callicarpa arborea* has the highest FL values with 100 % for Dermatological disorder and least *Acorus calamus* with 40 % for Digestive system disorder (**Table 13.3**). This is due to the fact that the two species are being preferably used only for treatment of single type of ailment and the knowledge are homogenous among the informants.

Table 13.2. Disease category and their ICF values.

Broad categories	Ailments/ Diseases	No. of species used (Nt)	No. of Use reports (Nur)	ICF Values
<i>Antipyretic</i>	Fever	2	2	0.00
<i>Circulatory system disorder</i>	Hypertension, Health tonic	2	2	0.00
<i>Cultural related/ Undefined illness</i>	Hysteria, evil spirit, stomach pain, body pain	17	18	0.05
<i>Dermatological disorder</i>	Cut & wound, ringworm, abscesses, eczema, skin irritation	21	24	0.13
<i>Digestive system Disorder</i>	Jaundice, Stomachic, Gastritis, Dysentry, Diarrhea, ulcer, haemorrhoids, nausea	28	33	0.15
<i>Eye ailment</i>	Conjunctivitis	2	3	0.50

<i>Musculoskeletal & Nervous system</i>	Bone fracture, muscle cramp, sprain, paralysis	12	13	0.08
<i>Pain/ Analgesic</i>	Headache and Bodyache	10	12	0.18
<i>Poisoning</i>	Spider sting, snake bite, millipede sting	3	4	0.33
<i>Respiratory system disorder</i>	Sinusitis, cold	2	2	0.00
<i>Urinogenital system disorder</i>	Urinary trouble	2	3	0.50

Table 13.3. Fidelity Level of most common used plants.

Botanical name [Family]	Broad Ailment category	NP	N	FL % = $\frac{NP}{N} \times 100$
<i>Clerodendrum glandulosum</i> Lindl.	Circulatory system disorder	6	6	100.00
<i>Callicarpa arborea</i> Roxb. [Lamiaceae]	Dermatological	3	3	100.00
<i>Oroxylum indicum</i> (L.) Kurz [Bignoniaceae]	Digestive system disorder	3	4	75.00
<i>Croton joufra</i> Roxb. [Euphorbiaceae]	Digestive system disorder	2	3	66.66
<i>Lasianthus cyanocarpus</i> Jack [Rubiaceae]	Undefined illness	2	3	66.66
<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm. [Zingiberaceae]	Analgesic	2	3	66.66
<i>Solanum spirale</i> Roxb. [Solanaceae]	Musculoskeletal disorder	2	4	50.00
<i>Acorus calamus</i> L. [Acoraceae]	Digestive system disorder	2	5	40.00

Conclusion

The study showed that the *Zeme* tribe of Manipur still depends on medicinal plants adopting the indigenous knowledge systems for health management and treatments of

various diseases. The herbal practices adopted by the local healers are well accepted by the local mass. Phytochemical investigations particularly of the species with higher use report may be helpful to find out the bioactive chemicals of the ethnomedicinal plants and validate their application. The finding of the present study may contribute in undertaking in depth study of the ethnomedicinal and ethnopharmacological practices of the tribe for human welfare and also in biodiversity conservation.

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Chapter 14

Resurgence of Wild Edible Plants of North East India as a source of nutrients

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Abstract

The Himalayan hill ranges are inhabited by a large number of different ethnic communities. The chapter enumerated the utility of wild edible plants among the ethnic life, mainly the northeastern states of India. In Assam, the Assamese community people prepare a very special dish using 101 vegetables during Bohag Bihu, in the month of April. According to their traditional belief, the intake of this dish on this particular day boosts their immunity. In the past, many scientific researchers have reported about the importance of green leafy vegetables. The indigenous people usually use the traditional green leafy vegetables (TGLVs) as their local diet which in turn prevents the risk of hidden hunger, since TGLVs are major source of micronutrients and mineral sources, thus enhancing the health as well as the food security. Different plant parts like, leaf, root, tuber, stem, bark, corm, rhizome, flower and inflorescence are the major consumable parts in the traditional food habits of the indigenous people of the state. There are over 170 species of wild edible plants,

mostly consumed by the local people of NE region. The region is also rich in the diversity of tree ferns which can be use as famine food including few species from family Arecaceae, eg. *Arenga*, *Wallichia* (Tashe/ Tashi).Tashi/tasheisa substitute of staple food locally known in the tribal communities of Arunachal Pradesh. They have a very unique technique to prepare their indigenous food from the trunks of tree *Wallichia* sp. The group of indigenous people from different communities has channelized the utilities and the economic pursuits through the traditional green leafy vegetables (TGLVs) as well as the underutilized fruits. In this article, some selected plant species are mentioned as wild edible plants along with their used pattern, usable parts and ethno medicinal properties. It is not only essential to conserve this wealth of information but also, the plant species used in the traditional wisdom. It would also be helpful in the modern biochemical and agricultural techniques to determine the utility and adaptability of the most effective one.

Key words: TGLVs, famine food, ethno medicine, northeast India.

Introduction

The use of plants and plant-based products had probably started with the advent of the origin of agriculture in the hoary past which forced the nomadic people to start settled life. With the growing awareness for food and food security, there is an ever-growing need of scientific assessment of all kinds of food known to mankind. As food is a commodity which cannot be artificially created; therefore, it is imperative to screen out available plant-based food from the nature with nutritional properties. In general, nutraceutical foods are those which provide major nutritional component and also contain compounds that promotes health quality.

Modern agriculture is basically monoculture and hence, when there is a sudden failure of an established crop, there will be no instant remedy. But in most rural societies there are traditional practice of falling back on what is called 'scarcity food' or 'famine food' whenever there is an unexpected food crisis. Research on the utilization of the underutilized herbs is renewed to promote the traditional knowledge in the developing countries. The TGLVs are beneficial in terms of the micronutrients as compared to the cultivated vegetables. The indigenous people often use the underutilized herbs as local diets which prevents the burden 'hidden hunger', thus enhancing the health as well as the food security. Due to the migration of the rural people to the towns, TGLVs tend to disappear from the diets. Furthermore, due to the unavailability and poor knowledge on the nutritional benefits of herbal plants among the young generations, remains unexplored.

Since 1970, the National Bureau of Plant Genetic Resources (NBPGR), has been actively engaged in the plant exploration along with other research institutes of NE India, for the documentation and validation of the underutilized food plants. The

indigenous people, especially the tribal people have their own traditions and domestication practices of the wild resources in their day-to-day life.

In terms of biodiversity richness among the phytogeographic locations, Western Ghats of India and North-east India are rich with 234 and 222 plant species respectively (Arora and Pandey, 1996). However, for North-East India the figure appears to be conservative since, the remote and inaccessible hilly areas are yet to be explored. The northeast India is known to be inhabited by almost 175 ethnic groups, of which most of them are tribal groups. So, apart from the floristic biodiversity north-east India is also famous for ethnic and cultural biodiversity. Therefore, North-east India is considered to be one of the mega diversity hotspots in the world. Ethnic knowledge about various wild edible plants is enormous which is more or less unexplored. Nutritional profile of many wild edible plants had been found comparable and sometime better than cultivated varieties (Handique, 2003; Handique & Handique, 2005; Gupta & Prakash, 2009).

The natural resources specially the plants and plant products are traditionally used by the people in their day-to-day life. An overall survey of the uses of wild plants in Indian subcontinent has revealed that nearly one-third of about 15,000 higher plants are used by the indigenous people and these plant products meet most of the requirement, from food to medicine, for man and domesticated animals, birds and poultry. These underutilized plant resources used in various purposes, mainly the wild edible plants as medicines; barks of the trees for clothing, vegetables fat as a cooking medium. Wild plants are also used to poison arrows and darts, as spices and condiments; few as antidotes to snake, scorpion and dog bite; as a natural dye, perfumes, insecticidal agents etc. In this chapter, we are trying to highlight the traditional uses of the plant resources available in NE India along with their used pattern as food and as traditional medicine.

Methodology

The research has been carried out during last one year (2019-2020) in Assam. During this survey, the information was gathered by the interactions with local aged people of Assam, who have been practicing traditional medicines since long time. Information on local name, use of plant parts etc. were documented. The collection of the plant specimens and their digital pictures were taken from those localities. The herbarium preparation of collected 101 plant species were done by following Jain & Rao, (1977). The herbaria were identified by BSI experts of Sikkim, Flora of Assam, Flora of Arun and deposited to the herbarium of CSIR-NEIST. Scientific name and their family were confirmed from the website International Plant Names Index (IPNI) (<https://www.ipni.org/>) and Plants of the World Online (POWO) (<http://www.plantsoftheworldonline.org/>). The information about the indigenous

Famine food, locally known as Tashi/Tashe (*Wallichia oblong folia*) was gathered by the interactions with local aged people of Kurung Kumey district of Arunachal Pradesh during 2017-2018. Other than the 101 vegetables, the information on Wild edible plants and their ethno-medicinal importance were collected from available secondary sources like literatures, different websites etc. and discussed in this paper.

Plants used as green leafy vegetables

The uses of these Traditional Green Leafy Vegetables (TGLVs) are not new among the human population. It is well proved that all the wild leafy green vegetables have immune boosting properties which may have some nutritional as well as antioxidants properties. During this COVID-19 pandemic situation, the scientific community and the ministry of AYUSH has also recommended some herbal formulation as an immune booster. There are no special diets, or particular food, that will directly boost your immune system. Eating a diet as fresh or whole food in reasonable amount is the best way to get the daily dose of vitamins, including the healthy antioxidants found in fruits and vegetables. The leafy vegetables are rich in the vitamins and nutrients which may act as the immune booster. The TGLVs are generally boiled before the consumption and sometimes washed extensively to remove the bitter and toxic plant materials. There is a need of nutrient rich diets, for strong immunity which includes the Fe, Zn, K, selenium and antioxidants. Among the minerals, Zn and Selenium plays a vital role in boosting the immunity. Zinc appears to slow down the immune response and control inflammation in human body. Selenium seems to have a powerful effect on the immune system, including the potentiality in lowering down the body's over-active responses to certain aggressive forms of cancer.

The Indian segment of the Eastern Himalaya is often referred to as “Paradise of Botanists” comprises more than 250 major tribes along with their own traditional knowledge. Among all the ethnic knowledge, the use of 101 wild leafy plants during the *Goru bihu* in Assam, in the month of April is one of the very interesting traditional practices among the community of Assamese people. They cook a mixture of the 101 nos. of known TGLVs in the very beginning day of the Assamese New Year calendar and there is a belief that this recipe can boost the immunity of the human for the entire year. Among those wild edible leafy vegetables, more than about 30% are toxic to the human health if it's consumed directly. Generally, those are not eaten in the normal days, but only on that very special day. They prepare a special dish using those 101 TGLVs, commonly known as *Ekho Eta Sak*. There are around 130 different wild leafy vegetables (**Table14.1**), out of which 101 different vegetables are used by the Assamese community on that special day. Few communities of Assam also use 15 different vegetables on that special day (**Table14. 2**).

There are around 50 species of wild leafy vegetables which generally use by the ethnic people in their regular diets in the form of raw or cooked. Among the most widely used species, *Alocasia macrorrhiza*, *Colocasia esculanta*, *Enhydra fluctuans*, *Houttuynia cordata*, *Diplozium esculentum*, *Leucas aspera*, *Paederia foetida*, *Centella asiatica*, *Hydrocotyle sibthorpioides*, *Amaranthus viridis*, *Amaranthus angeticus* linn, *Alternanthea sessilis* etc. are available in the agricultural fields and mostly of hygrophytic habitats, often abundant in waterlogged areas along the road side also.

There is a long list of wild edible leafy vegetables to a number of angiosperm families like *Asteraceae*, *Rubiaceae*, *Myrsinaceae*, *Urticaceae*, *Acanthaceae*, *Solanaceae*, *Polygonaceae*, *Anacardiaceae*, *Piperaceae*, *Brassicaceae*, *Lamiaceae*, *Euphorbiaceae*, *Araliaceae*, *Verbanaceae*, *Tiliaceae*, *Caesalpiniaceae*, *Balsaminaceae*, *Amaranthaceae*, *Poaceae* etc. Many of these species are grow wildly in agricultural fields including jhum fields, and others are found in primary and secondary forests.

Plants with edible flowers

The indigenous people have knowledge on the utilizing pattern of the plant products by trial-and-error method. They use different parts of plants as vegetables including the young unopened flowers. Scientifically it is proved that the flowers and flower buds are rich in the nutrients and antioxidants. Flowers and inflorescence of few plants having the spadix and with overlapping bracts at the end of large and long peduncles of wild and cultivated plants are delicacy for almost all the people of NE India. The young flowers of *Bauhinia purpurea* and *B. variegata* are cooked and used as vegetables by the Assamese community. The inflorescences of different *Musa* species e.g., *M. balbisiana*, *M. cheesmani*, *M. itinerans*, *M. acuminate* etc. are very common among the communities of Assam which are again a very good source of iron, with wound healing properties. Flowers of *Alpinia galangal*, *Polygonum runcinatum*, *Ensete superb*, *Indigofera dosua*, *Nelumbo*, *Ardisia griffithii*, *Vaccinium serratum*, *Carica papaya*, *Nyctanthes arbor-tristis*, *Phlogocanthus thyrsiflorus*, *Cucurbita maxima*, *Eichhornia crassipes*, *Monochoria hastaefolia*, *Jasmine* etc. are cooked and used as vegetables by different tribes of NE India (**Table 14.3**). These flowers are also available in the local markets in the different region of hilly areas, which are the potential source of nutrients and others required nutrients.

Table 14.1. List of traditional green leafy vegetables and their ethnomedicinal uses.

Sl. No.	Scientific Name	Family	Assamese Name	Ethnomedicinal Uses
1	<i>Adhatoda vasica</i> Nees.	Lamiaceae	<i>Titabahak</i>	Leaf and root decoction are used to treat cough & cold.
2	<i>Allium cepa</i> L.	Liliaceae	<i>Piyaz</i>	Juice from the bulb is use to cure Stone disease.
3	<i>A. sativum</i> L.	Liliaceae	<i>Nohoru</i>	Used to treat ailments such as arthritis, parasites, leprosy, and heart diseases.
4	<i>Aloe vera</i> (L.) Burm. f.	Liliaceae	<i>Sal kuwari</i>	The sap of leaf is applied to the infected area of skin.
5	<i>Alpinia nigra</i> (Gaertn.) Burt	Zingiberaceae	<i>Tora</i>	Rhizome paste is used to treat bronchitis, gastric disease. Shoot extract is used to treat helminthic disease.
6	<i>Alternanthera sessilis</i> (L.) R. Br. ex. DC.	Amaranthaceae	<i>Mati kaduri</i>	The plant is grinded to make paste and then the paste is applied to the wound area.
7	<i>A. philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	<i>Pani khutura</i>	-
8	<i>Amaranthus spinosus</i> L.	Amaranthaceae	<i>Hati khutura</i>	-
9	<i>Amaranthus hybridus</i> L.	Amaranthaceae	<i>Morichasak</i>	Taking as vegetable which improve eyesight.
10	<i>A. viridis</i> L.	Amaranthaceae	<i>Khutura</i>	Taking as vegetable which improve eyesight.
11	<i>Andrographis paniculata</i> (Burm. f.) Wall. ex Nees	Acanthaceae	<i>Kalmegh</i>	Traditionally used for the treatment of array of diseases such as cancer, diabetes, high blood pressure, ulcer, leprosy, bronchitis, skin diseases, flatulence, colic and influenza.
12	<i>Artocarpus heterophyllus</i> Lamk.	Moraceae	<i>Kothal</i>	-
13	<i>Azadirachta indica</i> A. Juss.	Meliaceae	<i>Moha neem</i>	Leaf paste is used to treat Small pox, Skin problems.
14	<i>Bacopa monnieri</i> (L.) Pennell.	Scrophulariaceae	<i>Brahmi</i>	Eaten as vegetable, is said to prevent epilepsy,

				anxiety and depression.
15	<i>Bambusa balcooa</i> Roxb.	Poaceae	<i>Bholuka banh</i>	The outer green layer is scrapped off, powdered and then can applied on fresh wound for quick healing.
16	<i>Basella alba</i> L.	Basellaceae	<i>Puroi sak</i>	Leaf, stem and fruit are largely used as Vegetable, considered good for anaemia patient.
17	<i>Benincasa hispida</i> (Thunb.) Cog	Cucurbitaceae	<i>Kumura</i>	The seed has anti-helminthic, anti-inflammatory, demulcent, diuretic, expectorant, febrifuge, laxative and tonic properties. A decoction of seed is used internally in the treatment of vaginal discharges and coughs.
18	<i>Beta vulgaris</i> L.	Chenopodiaceae	<i>Pirali paleng</i>	The decoction prepared from the leaf is use as purgative and in burns.
19	<i>B. juncea</i> (L.) Czern.	Chenopodiaceae	<i>Lai sak</i>	Used for the treatment of arthritis, foot ache, lumbago and rheumatism.
20	<i>Brassica nigra</i> (L.) Koch.	Brassicaceae	<i>Soriyah</i>	Mustard oil is said to help in reducing inflammation and pain to enhancing hair and skin health.
21	<i>Calamus erectus</i> Roxb.	Arecaceae	<i>Bet gaz</i>	Taking as vegetable is said to purify blood, also used as an anti-diabetic agent.
22	<i>Cannabis sativa</i> L.	Cannabaceae	<i>Bhang</i>	-
23	<i>Centella asiatica</i> (L.) Urban.	Apiaceae	<i>Bor mani muni</i>	The whole plant is chewed for blood purifier. The paste of the whole plant is applied on the infected areas of skin diseases and also used in the stomach problems.
24	<i>Chenopodium album</i> L.	Chenopodiaceae	<i>Bali bhotora/Jil mil</i>	The juice of the stem is applied to freckles and sunburn. The juice of the root is used for the treatment of bloody

				dysentery.
25	<i>Chrysanthemum coronarium</i> L.	Asteraceae	<i>Babori</i>	-
26	<i>Cinnamomum bejolghota</i> (Buch. –Ham.) Sweet.	Lauraceae	<i>Pati hunda</i>	Traditionally used for flavouring food. The leaf and bark are used against various ailments astringent, warming stimulant, carminative, blood purifier, digestive, antiseptic, antifungal, antiviral, antibacterial, antioxidant, anti-inflammatory and immune- modulatory properties.
27	<i>C. tamala</i> Fr.	Lauraceae	<i>Tezpat</i>	Traditionally used for flavouring food. The leaf and bark are used against various ailments astringent, warming stimulant, carminative, blood purifier, digestive, antiseptic, antifungal, antiviral, antibacterial, antioxidant, anti-inflammatory and immune- modulatory properties.
28	<i>Clerodendrum colebrookianum</i> Walp.	Verbenaceae	<i>Nephaphu</i>	Decoction of tender leaf is drink to cure hypertension.
29	<i>C. serratum</i> (L.) Moon	Verbenaceae	<i>Nangal bhanga</i>	Root decoction is use to cure dysentery.
30	<i>C. viscosum</i> Vent.	Verbenaceae	<i>Dhopat tita</i>	Leaf is use to cure malaria.
31	<i>Colocasia esculenta</i> (L.) Schott	Araceae	<i>Kochu</i>	The leaf and rhizomes are used for the treatment of various ailments such as asthma, arthritis, diarrhea, internal hemorrhage, neurological disorders, and skin diseases.
32	<i>Commelina benghalensis</i> L.	Commelinaceae	<i>Kona himolu</i>	Traditionally used for the treatment of many different diseases such as burns, leprosy, sore throat,

				pain and inflammations. And also used as an emollient, demulcent and laxative.
33	<i>Corchorus capsularis</i> L.	Tiliaceae	<i>Tita mora/ Mora pat</i>	Taking as vegetable is said to improve eyesight.
34	<i>Croton caudatus</i> Geisel.	Euphorbiaceae	<i>Mahudi</i>	Leaf decoction is taken in kidney troubles.
35	<i>Cucurbita maxima</i> Duch. Ex Lamk.	Cucurbitaceae	<i>Ronga lau</i>	Pumpkin has a cooling effect on human body. It is therefore used in hemorrhagic conditions such as uterine bleeding and rectal bleeding.
36	<i>Cma longa</i> L.	Zingiberaceae	<i>Halodhi</i>	Used as a traditional medicine for various diseases including cough, diabetes, dermatological conditions, respiratory problems, cardiovascular, hepatobiliary diseases, arthritis, irritable bowel disease (IBS), peptic ulcers, psoriasis, and atherosclerosis.
37	<i>Dendrocnide sinuata</i> (Bl.) Chew	Urticaceae	<i>Surat gas</i>	Used as a traditional medicine and used for various diseases including a cough, diabetes, dermatological conditions, respiratory problems, cardiovascular and hepatobiliary diseases, arthritis, irritable bowel disease (IBS), peptic ulcers, psoriasis, and atherosclerosis.
38	<i>Dillenia indica</i> L.	Dilleniaceae	<i>Ou tenga</i>	Fleshy calyx eaten raw or cooked which has anti-diabetic agent.
39	<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	<i>Dhekia</i>	Aerial parts are used to treat hemoptysis and coughs; rhizome is used for diarrhea, dysentery and coughs; leaf used to treat fever, dermatitis, measles, coughs, and as

				postpartum tonic; root is used for fever, dermatitis and as hair tonic.
40	<i>Drymaria diandra</i> Bl	Caryophyllaceae	<i>Lai jabori</i>	Whole plant is used as sinusitis, asthma, cough and cold, fever, head ache and pneumonia. And also used for burn, ring worm and skin diseases.
41	<i>Duchesnea indica</i> (Andr.) Focke	Rosaceae	<i>Goru khis</i>	Eaten fresh to cure dysentery.
42	<i>Eclipta prostrata</i> L.	Asteraceae	<i>Keha raj</i>	Leaf juice is taken in jaundice and root extract is applied to cut & wound area.
43	<i>Enhydra fluctuans</i> Lour.	Asteraceae	<i>Heloshi</i>	Leaves are pressed and applied to the skin as a cure for certain herpetic eruptions.
44	<i>Eryngium foetidum</i> L.	Apiaceae	<i>Man dhoniya</i>	-
45	<i>Euphorbia hirta</i> L.	Euphorbiaceae	<i>Gakhiroti/Dhudh bon</i>	Used traditionally for female disorders, respiratory ailments such as cough, coryza, bronchitis, and asthma.
46	<i>Fagopyrum esculentum</i> Moench.	Polygonaceae	<i>Sutiya lofa</i>	Aerial parts of the plant and its extract are used in traditional medicine and herbal remedies for the treatment of hemorrhagic complaints and hypotensive patients.
47	<i>Flemingia strobilifera</i> (L.) R. Br. ex Ait.	Fabaceae	<i>Makhioti</i>	Root paste is applied externally to body swellings.
48	<i>Garcinia acuminata</i> Planch. & Triana	Clusiaceae	<i>Mahi thekera</i>	-
49	<i>G. kydia</i> Roxb.	Clusiaceae	<i>Kujitheker a</i>	-
50	<i>G. pedunculata</i> Roxb.	Clusiaceae	<i>Bor thekera</i>	Fruit is used for various stomach problems.
51	<i>Hedyotis corymbosa</i> (L.) Lamk.	Rubiaceae	<i>Bon jaluk</i>	-

52	<i>Hibiscus sabdariffa</i> L.	Malvaceae	<i>Tenga mora</i>	Roselle has been used for relief of sour throat and healing wounds.
53	<i>Houttuynia cordata</i> Thunb.	Saururaceae	<i>Moshundari</i>	Leaf is used to treat the measles, dysentery and gonorrhoea.
54	<i>Hydrocotyle sibthorpioides</i> Lamk.	Apiaceae	<i>Horu mani muni</i>	Leaf is used for Dysentery, indigestion and fever.
55	<i>Ipomoea aquatica</i> Forsk.	Convolvulaceae	<i>Kolmou sak</i>	Oral administration of leaf leads to cure ailments such as jaundice and nervous debility.
56	<i>Kalanchoe pinnata</i> (Lamk.) Pers	Crassulaceae	<i>Dupor tenga/ Pate goja</i>	Chewed raw with sugar to control dysentery and diarrhea. Juice is drink to cure jaundice. Leaf paste is applied on skin infections and pimples.
57	<i>Lagenaria siceraria</i> (Molina) Stadley	Cucurbitaceae	<i>Jati lau</i>	The fruits, leaves, oil, and seeds are edible and used by local people as folk medicines in the treatment of jaundice, diabetes, ulcer, piles, colitis, insanity, hypertension, congestive cardiac failure, and skin diseases. The fruit pulp is used as an emetic, sedative, purgative, cooling, diuretic, antibilious, and pectoral.
58	<i>Lasia spinosa</i> (L.) Thw.	Areceae	<i>Seng mora</i>	-
59	<i>Lawsonia inermis</i> L.	Lythraceae	<i>Jetuka</i>	Decoction of stem bark is taken orally to cure Jaundice.
60	<i>Leucas plukenetii</i> (Roth.) Spreng.	Lamiaceae	<i>Durun</i>	Leaf is use in sinusitis. 2-3 drops of leaf juice is use to stop nasal haemorrhoe.
61	<i>Lindernia ruellioides</i> (Colsm.) Pen	Scrophulariaceae	<i>Kasi doriya</i>	-
62	<i>Litsea salicifolia</i> (Roxb. ex Wall.) Hk. f.	Lauraceae	<i>Digh loti</i>	-
63	<i>Luffa acutangula</i>	Cucurbitaceae	<i>Jika</i>	Fruit is use for diabetes

	(L.) Roxb	e		treatment.
64	<i>L. cylindrica</i> (L.) M. Roemer	Cucurbitaceae	<i>Bhol</i>	-
65	<i>Lygodium flexuosum</i> (L.) Sw.	Lygodiaceae	<i>Kopou dhekia</i>	Frond is boiled and used as local application carbuncles, rheumatism, sprains, scabies, ulcers, cut and wounds. Stem and rhizome are taken orally for curing sexually diseases gonorrhoea and spermatorrhoea. Paste of leaf is applied for piles. The infusion of plant is used in menorrhoea. Spore is used to cure high fever.
66	<i>Mangifera indica</i> L.	Anacardiaceae	<i>Am</i>	It is traditionally known for the treatment of different ailments like urinary tract infections, diuretic, throat disease, Malaria, Skin infection, dysentery, diarrhea, burns and scalds etc.
67	<i>Melastoma malabathricum</i> L.	Melastomataceae	<i>Phutkola</i>	Decotion of root is used to cure diarrhea.
68	<i>Melothria heterophylla</i> (Lour.) Cogn	Cucurbitaceae	<i>Beli poka</i>	-
69	<i>Mentha spicata</i> L.	Lamiaceae	<i>Podina</i>	-
70	<i>Momordica charantia</i> L.	Cucurbitaceae	<i>Tita kerela</i>	Juice is used for the treatment of conjunctivitis.
71	<i>M. cochinchinensis</i> (Lour.) Spreng.	Cucurbitaceae	<i>Bhat kerela</i>	-
72	<i>Monochoria hastata</i> (L.) Solms	Pontederiaceae	<i>Haru meteka</i>	Leaf juice is applied on boils.
73	<i>Morinda angustifolia</i> Roxb.	Rubiaceae	<i>Anshu gas</i>	-
74	<i>Moringa oleifera</i> Lamk.	Moringaceae	<i>Sojina</i>	Leaf is used to cure Diarrhoea, dysentery, colitis, sores, skin

				infection, anemia, cuts, scrapes, rashes and sign of aging. Gum is used for the treatment of Fevers, dysentery, asthma and dental decay. Flower is used to cure tumour, inflammation, hysteria, enlargement of spleen, muscle diseases and aphrodisiac substances.
75	<i>Morus indica</i> L.	Moraceae	<i>Nuni</i>	-
76	<i>Murraya koenigii</i> (L.) Spreng	Rutaceae	<i>Norosingha</i>	Used as Datun for cleaning, strengthen gums and teeth.
77	<i>Musa balbisiana</i> Colla	Musaceae	<i>Kol gas</i>	-
78	<i>Mussaenda roxburghii</i> Hk. f.	Rubiaceae	<i>Sukloti</i>	-
79	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	<i>Podum</i>	Decoction of flower petal is used as cardio tonic, liver tonic, anti-vomiting and diarrhea. Leaf paste with lime used as plaster on fracture bone. Young seed paste is externally used as a cooling agent for skin diseases. Root and rhizome paste is taken against ring worm. Root powder with lemon juice is taken for treatment of piles. The fruiting torus is edible and the rhizome is used as vegetable.
80	<i>Nyctanthes arbor-tristis</i> L.	Nyctaginaceae	<i>Sewali</i>	Leaf infusion is taken for malaria; fried flower is taken with meal for intestinal worm, diabetes and cough.
81	<i>Nymphaea nouchali</i> Burm. f.	Nymphaeaceae	<i>Bhet phul</i>	Rhizome is used to treat diarrhea, dysentery, dyspepsia, goiter, burn wounds and also to stop excessive menstrual flow. Flower and leaf are soaked in water overnight then the decanted water is

				taken for cardiac problems. Leaf paste is applied to cure scabies. Root juice is used to increase breast milk.
82	<i>Ocimum basilicum</i> L.	Lamiaceae	<i>Bon tului</i>	Leaf paste is applied on the infected area of skin diseases.
83	<i>Oxalis corniculata</i> L.	Oxalidaceae	<i>Horu tengeshi</i>	Leaf extract (20-30ml) is applied regularly once a day in pyorrhoea till the end of problem.
84	<i>O. debilis</i> H. B. K. var. <i>corymbosa</i> (DC.) Lour	Oxalidaceae	<i>Bor tengeshi</i>	-
85	<i>Paederia foetida</i> L.	Rubiaceae	<i>Bhedai lota</i>	Leaf juice is used to treat diarrhoea, dysentery and burns or scalding.
86	<i>Phlogacanthus thyrsiflorus</i> (Roxb.) Nees	Acanthaceae	<i>Tita phul</i>	-
87	<i>P. tubiflorus</i> Nees	Acanthaceae	<i>Tita phul</i>	-
88	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	<i>Amlokhi</i>	The exudation from the incisions on the fruit is used as an external application in inflammation of eye. Juice of the fresh bark with honey and turmeric is used to cure gonorrhea. Decoction of the roots has given in myalgia following upon some febrile condition.
89	<i>Piper longum</i> L.	Piperaceae	<i>Pipolee</i>	The decoction of dried fruit and root are used in the treatment of acute and chronic bronchitis.
90	<i>P. hamiltonii</i> DC.	Piperaceae	<i>Arani pan</i>	-
91	<i>Plantago erosa</i> Wall.	Plantaginaceae	<i>Singa pat</i>	-
92	<i>Pogostemon benghalense</i> (Burm. f.) Kuntz.	Lamiaceae	<i>Hukloti</i>	Decoction of fresh newly sprouted leaves is taken orally to cure dyspepsia, cold and cough.

93	<i>Polygonum plebeium</i> R. Br.	Polygonaceae	<i>Bon jaluk</i>	-
94	<i>P. scandens</i> Meissn.	Polygonaceae	<i>Modhu huleng</i>	-
95	<i>Portulaca oleracea</i> L.	Portulacaceae	<i>Hanh thengia/M albbug khutura</i>	The leaves are infused in linseed oil as a liniment for stiff neck. The mixture of plant juice with honey is used for cough.
96	<i>Prunus jenkinsii</i> Hk. f. & Th.	Rosaceae	<i>Thereju tenga</i>	-
97	<i>Psidium guajava</i> L.	Myrtaceae	<i>Modhuri</i>	Fruit particularly the raw ones or decoctions made from tender immature leaves are quite helpful in cold and cough.
98	<i>Rubus ellipticus</i> Smith.	Rosaceae	<i>Jetuli poka</i>	-
99	<i>Sarcochlamys pulcherrima</i> Gaud.	Urticaceae	<i>Meshangi</i>	Fresh leaf extract is applied as eye drop to stop itching.
100	<i>Sesamum indicum</i> L.	Pedaliaceae	<i>Til</i>	-
101	<i>Smilax perfoliata</i> Lour.	Smilacaceae	<i>Tikoni Barua</i>	-
102	<i>Solanum indicum</i> L.	Soalanaceae	<i>Tita bhekuri</i>	Eaten as curry to treat dysentery.
103	<i>S. melongena</i> L.	Soalanaceae	<i>Bengana</i>	-
104	<i>S. nigrum</i> L.	Soalanaceae	<i>Pok mou/Lach koshi</i>	Juice from roots is used to treat asthma and whooping cough. Leaves are pounded and applied topically to cure ringworm.
105	<i>S. torvum</i> Sw.	Soalanaceae	<i>Hati bhekuri</i>	-
106	<i>S. tuberosum</i> L.	Soalanaceae	<i>Alu</i>	Raw potato juice is used to treat gastritis, colitis, gastric and intestinal ulcers. The juice is also used as a remedy for rheumatism.
107	<i>Stephania japonica</i> (Thunb.) Miers	Menispermaceae	<i>Tubuki lota</i>	Decoction of leaves is used as antidiabetic and antioxidant.
108	<i>Tetrastigma thomsonianum</i> Planch	Vitaceae	<i>Nol tenga</i>	-

109	<i>Urena lobata</i> L.	Malvaceae	<i>Agora</i>	-
110	<i>Vitex negundo</i> L.	Verbenaceae	<i>Poshotiya</i>	Root decoction and leaf juice are used in treatment of cough and respiratory disorders.
111	<i>Zanthoxylum nitidum</i> (Roxb.) DC	Rutaceae	<i>Tez moi</i>	Root juice is used to treat pneumonia.
112	<i>Zingiber officinale</i> Rosc.	Zingiberaceae	<i>Ada</i>	Rhizome is eaten in both raw and cooked form, used to cure cardiovascular diseases.

Table 14.2. List of plants of which stems and barks are used as food and their ethno-medicinal properties.

S N	Scientific Name	Family	Uses (as local diet)	Ethno medicinal Properties	References
1	<i>Amomum</i> sp.	Zingiberaceae	Soft core of the shoot is taken in both raw and cooked form.	-	-
2	<i>Ampelocissus barbata</i> (Wall.) Planch.	Vitaceae	Young stem is chewed which is slightly sour in taste.	Used in the treatment for Bone fracture, Skin diseases.	Singh & Kumar, 2017.
3	<i>Arenga pinnata</i> (Wurmb) Merr.	Arecaceae	Trunk is used as a source of farinaceous food.	-	-
4	<i>Baccaurea ramiflora</i> Lour.	Phyllanthaceae	Bark of the stem, slightly sweetish in taste, is chewed.	Anti-phlogistic and anodyne against rheumatoid Arthritis, Cellulitis, Constipation, Indigestion, Jaundice.	Kalita et al., 2014; Lin et al., 2003; Rahim et al., 2012; Saha

					et al., 2017.
5	<i>Bambusa tulda</i> Roxb.	Poaceae	Soft core of the young sprouts is used in making curries and pickles.	Uterine prolapse, Poisonous insects bite.	Biswas et al., 2011; Gam, 2013.
6	<i>Begonia roxburghii</i> (Miq.) A.DC.	Begoniaceae	Fleshy sour petioles are chewed and also used in making chutney.	Skin problem, Piles (haemorrhoids), Bee stink, Stomachache, Diarrhea, Bile dysentery, Stomach ulcer, Tongue abnormalities, Jaundices, Diabetes.	Rahman, 1996; Sawmliana, 2013; Tag et al., 2012; Tangjanget al., 2011.
7	<i>Begonia silletensis</i> (A.DC.) C.B.Clarke	Begoniaceae	Sour petioles are chewed.	Various ailments.	Taram et al., 2020.
8	<i>Callicarpa arborea</i> Roxb.	Lamiaceae	Bark of the plant is chewed with betel nut.	Astringent, Demulcent, Antipyretic, Antipruritic, Cough, Cold, Eruptive fevers, Smallpox, Snake bite, Digestion promoter, Colic and loose motions, Ulcers, Jaundice, Asthma, Dental disease.	Ambar dar&Aeri, 2013.
9	<i>Caryota urens</i> L.	Arecaceae	Soft core portion of seedlings	Loss of appetite, to get relieved from	Reddy et al., 2008;

			shoot is taken in both raw and cooked form.	the effect caused due to intake of this plant in case of pregnant women.	Smita et al., 2012.
10	<i>Cinnamomum tamala</i> (Buch.-Ham.) T. Nees & C. H. Eberm.	Lauraceae	Bark of the plant is used as condiment.	Colic, Diarrhea, Nausea, Vomiting, Gastic problems, alleviate pain and inflammation in patients those who suffer from arthritic rheumatism.	Kunwar et al., 2009; Upadhyay, 2017.
11	<i>Maesa indica</i> (Roxb.) Sweet	Primulaceae	Young stem is chewed.	Antidiabetic.	Chakraborty et al., 2021.
12	<i>Mucuna monosperma</i> Roxb. ex Wight	Fabaceae	Slightly sweetish young stem is chewed.	Cough, Asthma, Expectorant, Glaucoma, Eczema and Scabies.	Bapuji & Ratnam, 2009; Kar, 2019; Singh & Kumar, 2017.
13	<i>Pegia nitida</i> Colebr.	Anacardiaceae	Bark of the young stem is chewed.	-	-
14	<i>Pseudodissochaeta assamica</i> (C.B. Clarke) Nayar	Melastomataceae	Young stems are chewed which is slightly sweetish in taste.	-	-
15	<i>Spondias</i>	Anacardiaceae	Slightly	Anti-thirst	Bora

	<i>pinnata</i> (L.f.) Kurz	e	sour leaf- bases are chewed.	remedy, Diabetes, Refrigerant, Tonic, Antiseptic, Astringent, Anti- dysenteric, Anti-diarrhoeal and Anti- emetic, Regulating menstruation, Anti- tubercular, Aphrodisiac.	et al., 2014; Sujarw o et al., 2019.
16	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combretacea e	Bark juice is taken out by crushing and taken orally.	Cure sores, Heart disease, Leucorrhoea.	Anony mous, 1984; Goswa mi & Dutta, 1983; Stewar t, 1869.
17	<i>Terminalia myriocarpa</i> Van Heurck & Müll.Arg.	Combretacea e	Bark of the stem is used as masticatory.	Urinary disorder, Heart problem.	De, 2016.

Table 14.3. List of edible flowers/buds/inflorescences and their ethno medicinal properties.

Sl. No	Scientific Name	Family	Uses (as local diet)	Ethno medicinal Properties	References
1	<i>Alpinia galanga</i> (L.) Willd.	Zingiberaceae	Flowers are eaten raw or cooked as vegetable	Stomach pain, Back pain, Rheumatism, Asthma, Diabetes, Heart disease, disorders of the liver, kidney disease, and to increase the appetite, antibiotics,	Chopra et al., 2006; Rajpal & Kohli, 2009; Ram & Rastogi, 2006; The Review of

				Disinfectants, Food seasonings, Gastric therapy, Cardiotonic lesions, Diuretic, Antiplatelet, Antifungal, Anti-tumor activities, Fever, Dyspepsia, Bronchitis, Irritations.	Natural Product, 2002.
2	<i>Ardisia griffithii</i> C.B. Clarke	Primulaceae	Flowers are eaten cooked.	-	-
3	<i>Bambusa bambos</i> (L.) Voss	Poaceae	Young buds are cooked as vegetables.	Ulcers, Pain, Cure ear infection.	Pattanayak et al., 2012; Tomar, 2019.
4	<i>Bauhinia purpurea</i> L.	Fabaceae	Flower buds are cooked as vegetables.	Diarrhoea, Dysentery, Tumour in stomach, Laxative.	Balami, 2004; Vanila et al., 2008.
5	<i>Bombax ceiba</i> L.	Malvaceae	Flower-buds and fleshy calyx are eaten raw.	Diabetes mellitus, Sexual problems, Debility, Urolithiasis, Acne, Hepatic disorder, Abortifacient, Aphrodisiac, Birth control, Sexual diseases, Tonic, Anti-inflammatory activity, Impotency, Asthma, Small-pox boils, Muscular Injury, Wounds, Anti-diarrheal, Leprosy, Pimples, Skin disease, Anthelmintics.	Chaudhary & Khadabadi, 2012; Jain & Verma, 2014.

6	<i>Dillenia indica</i> L.	Dilleniaceae	Flowers are boiled and taken orally.	Anti-diabetic, Fever, Aphrodisiac, promotes virility, Cures food poisoning, Applied externally in sprains.	Mehta, 2013; Talukdar et al., 2012.
7	<i>Dioscorea pentaphylla</i> L.	Dioscoreaceae	Flower buds are cooked as vegetables.	Stomach Ache, Constipation, Indigestion, Abdominal pain, Dysentery, Cough, Cold, Asthma, Tuberculosis, Skin wounds, Boils, Sunburn, Cuts and injury.	Dutta, 2015.
8	<i>Ensete superbum</i> (Roxb.) Cheesman	Musaceae	Flowers are cooked as vegetables.	Dog bite, to dissolve and eliminate kidney stone, enhance semen production, Leucorrhoea, Stomachache, Immune resistance to the baby, Debility, Hip pain, Fever with body pains, Scabies, Diabetes, Urolithiasis, Prevent pregnancy, Convulsions, Pneumonia, Cholera, Chickenpox, Measles.	Sethiya et al., 2019.
9	<i>Indigofera dosua</i> Buch. - Ham. ex D. Don	Fabaceae	Flowers are cooked as vegetables.	-	-
10	<i>Musa acuminata</i> Colla	Musaceae	Inflorescence and the flowers are good source of iron and	Blood pressure, Diabetes, Hypertension, Anemia, Allergies, Infections, Bronchitis, Fever, Coughs,	Mathew & Negi, 2017.

			vitamins, used as vegetable .	Tuberculosis, Dysentery.	
11	<i>Musa balbisiana</i> Colla	Musaceae	Inflorescence and the flowers are taken as vegetable, are good source of iron and vitamins.	Pineworm infection, Infertility in women, Jaundice, Gout, Gastritis, Health tonic, Cough, Dysentery.	Borborah et al., 2016.
12	<i>Musa cheesmanii</i> N.W. Simmonds	Musaceae	Inflorescence and the flowers are good source of iron and vitamins, used as vegetable .	-	-
13	<i>Musa itinerans</i> Cheesman	Musaceae	Inflorescence and the flowers are good source of iron and vitamins, used as vegetable .	-	-

14	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Flower buds are cooked as vegetables.	Diarrhea, High fever, Hemorrhoids, Leprosy, Lipolytic, Anti-obesity, Cardiovascular activity, Hypocholesterolaemic, Analgesic activity, Anthelmintic activities, Antiobesity, Hypolipidemic, Haematopoietic, Anti-diabetic, Uterine Bleeding, Cough, Consolidation of kidney function, Male sexual disorders and female leucorrhea.	Sheikh, 2014.
15	<i>Palaquium polyanthum</i> (Wall. ex G.Don) Baill.	Sapotaceae	Flowers taken as vegetables.	-	-
16	<i>Persicaria runcinata</i> (Buch. - Ham. ex D.Don) H.Gross	Polygonaceae	Flowers and inflorescence are taken as vegetables.	Tonic, Cardiac problems.	Malla, 2015.
17	<i>Pontederia hastata</i> L.	Pontederiaceae	Inflorescence is cooked as vegetables.	-	-
18	<i>Syzygium formosum</i>	Myrtaceae	Calyx is cooked as vegetables.	-	-

	(Wall.) Mason		s.		
19	<i>Vaccinium vacciniaceum</i> (Roxb.) Sleumer	Ericaceae	Flowers are used to make curry.	-	-

Table 14.4. List of underground edible parts (tuber/rhizome) and their ethnomedicinal properties.

Sl. No.	Scientific Name	Family	Uses (as local diet)	Ethnomedicinal Properties	References
1	<i>Alocasia macrorrhizos</i> (L.) G.Don	Araceae	Corms are boiled and eaten as a vegetable.	Pus in ears, Decreased eyesight.	Rahmatullah et al., 2009.
2	<i>Alpinia galanga</i> (L.) Willd.	Zingiberaceae	Rhizomes are boiled and taken as soup.	Stomach pain, Back pain, Rheumatism, Asthma, Diabetes, Heart disease, disorders of the liver, kidney disease, and to increase the appetite, antibiotics, Disinfectants, Food seasonings, Gastric therapy, Cardiotonic lesions, Diuretic, Antiplatelet, Antifungal, Anti-tumor activities, Fever, Dyspepsia, Bronchitis,	Chopra et al., 2006; Rajpal & Kohli, 2009; Ram & Rastogi, 2006; The Review of Natural Product, 2002.

				Irritations.	
3	<i>Alpinia speciosa</i> (Blume) D.Dietr.	Zingiberaceae	Rhizomes are boiled and taken soup.	-	-
4	<i>Amorphophalus</i> sp.	Araceae	Rhizomatous stems and leafy stalks are boiled and eaten.	-	-
5	<i>Asparagus racemosus</i> Willd.	Asparagaceae	Juice is taken out by boiling the roots and then it's taken orally.	Gastric, Ulcers, Dyspepsia, Diarrhea, Dysentery, Indigestion, Jaundice,	Hasan et al., 2016.
6	<i>Bistorta officinalis</i> Delarbre	Polygonaceae	Tubers are used as vegetable.	-	-
7	<i>Colocasia esculenta</i> (L.) Schott	Araceae	Rhizomatous stems and leafy stalks are boiled and eaten.	-	-
8	<i>Curcuma zedoaria</i> (Christm.) Roscoe	Zingiberaceae	Rhizomes are boiled and taken as soup.	Stomachic, Emmenagogic, Vomiting, Menstrual haematometra, Treatment of leucorrhoeal discharge, Treatment of worms in children, Antiallergant, Treatment of dropsy, Treatment of leprosy, As	Lobo et al., 2009.

				plasters in lymphangitis, Furunculosis.	
9	<i>Dioscorea alata</i> L.	Dioscoreaceae	Underground swollen roots are baked, boiled or grinded into flour.	Cancerous wounds, Leprosy, Gonorrhoea, Blood pressure, Skin diseases, Treatment of piles, Reduce weakness, Wormicide for stomach worms.	Dutta, 2015; Mustafa et al., 2018.
10	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Underground swollen roots are baked, boiled or ground into flour.	Skin related infections, Contraceptive disease, Struma, Throat infection, Tuberculosis, Cough, Asthma, Abdominal pains, Piles, Sexual vigour, Dysentery, Ulcers, Diabetics, Leprosy, and Syphilis.	Kundu et al., 2020.
11	<i>Dioscorea esculenta</i> (Lour.) Burkill	Dioscoreaceae	Underground swollen roots are baked, boiled or ground into flour.	To increase low weight, Analgesic for chest pain, Anti-inflammatory, Treat boils, Dysentery, Swellings.	Dutta, 2015; Mustafa et al., 2018.
12	<i>Dioscorea hamiltonii</i> Hook.f.	Dioscoreaceae	Underground swollen roots are baked, boiled or ground.	Dysentery, Piles, Burnt.	Dutta, 2015; Kumar et al., 2013.

13	<i>Dioscorea oppositifolia</i> L.	Dioscoreaceae	Underground swollen roots are baked, boiled or ground into flour.	Post pregnancy nutrition tonic, taken with honey to increase sperm, Antiseptic, used to treat scorpion bite, used with leaves of clematis to treat seizures or convulsions.	Mustafa et al., 2018.
14	<i>Dioscorea pentaphylla</i> L.	Dioscoreaceae	Underground swollen roots are baked, boiled or ground into flour.	Reduce swelling of joints and improve immunity, Analgesic for stomach pain, Tonic and Spasmodic, Inflorescence is used as vegetables for body weakness, Constipation, Indigestion, Abdominal pain, Dysentery, Cough, Cold, Asthma, Tuberculosis, Skin wounds, Boils, Sunburn, Cuts, Injury.	Dutta, 2015; Mustafa et al., 2018.
15	<i>Dioscorea versicolor</i> Buch. -Ham. ex Wall.	Dioscoreaceae	Underground swollen roots are baked, boiled or ground.	-	-
16	<i>Eleocharis dulcis</i> (Burm.f.) Trin. ex Hensch.	Cyperaceae	Tubers are cut into pieces and eaten raw as salad.	-	-
17	<i>Eulophia campestris</i>	Orchidaceae	Tubers are eaten raw or	-	-

	Wall.		boiled.		
18	<i>Flemingia vestita</i> Benth. ex Baker f.	Fabaceae	The tubers are used as vegetables.	-	-
19	<i>Hellenia speciosa</i> (J.Koenig) S.R.Dutta	Costaceae	Rhizomes are boiled and the juice is taken orally.	-	-
20	<i>Houttuynia cordata</i> Thunb.	Saururaceae	The tubers are eaten and mainly used as salad.	-	-
21	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	The rhizomes are boiled to prepare a soup and curry.	Diarrhea, High fever, Hemorrhoids, Leprosy, Lipolytic, Anti-obesity, Cardiovascular activity, Hypocholesterolaemic, Analgesic activity, Anthelmintic activities, Antiobesity, Hypolipidemic, Haematopoietic, Anti-diabetic, Uterine Bleeding, Cough, Consolidation of kidney function, Male sexual disorders and female leucorrhea.	Sheikh, 2014.
22	<i>Polygonum multiflorum</i> Gueldenst.	Polygonaceae	Tuber are cooked and taken as vegetable and curry.	Hair-blackening, Liver and kidney-tonifying, Anti-aging effects.	Lin et al., 2015.

23	<i>Polygonum verticillatum</i> Biroli ex Colla	Polygonaceae	Tubers are cooked and taken as a curry and sometime as a vegetable.	-	-
24	<i>Sagittaria sagittifolia</i> L.	Alismataceae	Tuberous roots are boiled and eaten as vegetable.	-	-
25	<i>Vigna vexillata</i> (L.) A.Rich.	Fabaceae	Tubers are eaten as raw and boiled.	-	-
26	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	Zingiberaceae	Leaf is used to add flavor in soup.	Inflammation, Fever, Toothache, Indigestion, Constipation, Diarrhea, Severe sprains, to relieve pain, Antispasmodic, Antirheumatic, Diuretic agents, Edema, Stomach ache, Sores, Loss of appetite	Yob et al., 2011.

Table 14.5. List of edible fruit plants and their ethnomedicinal properties.

Sl. No.	Scientific Name	Family	Uses (as local diet)	Ethnomedicinal Properties	References
1	<i>Alpinia malaccensis</i> (Burm.f.) Roscoe	Zingiberaceae	Ripen fruits are eaten.	-	-

2	<i>Amomum dealbatum</i> Roxb.	Zingiberaceae	The fleshy aerial parts are boiled and taken soup.	Throat trouble, Congestion of lungs, Inflammation of eyelids, Digestive disorders, Pulmonary tuberculosis, Flatulence, Loss of appetite, Gastric troubles, Congestion, Liver complaints, Headache, Stomatitis.	Jafri et al., 2001; Shukla et al., 2010; Verma et al., 2010.
3	<i>Ardisia rhynchophylla</i> C.B.Clarke	Primulaceae	Ripen fruits are eaten.	-	-
4	<i>Ardisia thomsonii</i> Mez	Primulaceae	Ripen fruits are eaten.	-	-
5	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Bracts and perianths of ripe fruits are eaten.	Fever, Boils, Wounds, Skin diseases, Brain tonic, Convulsions, Dysopia, Ophthalmic disorders, Pharyngitis, Antibacterial agents, Ulcers, Asthma, Diarrhoea, inflammation.	Vazhacharickal et al., 2015.
6	<i>Baccaurea ramiflora</i> Lour.	Phyllanthaceae	Arils of fruits are eaten which is very sweet or acidic in taste.	Anti-phlogistic and anodyne against rheumatoid arthritis, Cellulitis, Constipation,	Kalita et al., 2014; Lin et al., 2003; Rahim et al., 2012; Saha et

				Indigestion, Jaundice	al., 2017.
7	<i>Balakata baccata</i> (Roxb.) Esser	Euphorbiaceae	Ripen fruits are eaten.	-	-
8	<i>Berberis napaulensis</i> (DC.) Spreng.	Berberidaceae	Pulp of fruits are eaten which is sour in taste.	-	-
9	<i>Bischofia javanica</i> Blume	Phyllanthaceae	Ripen fruits are eaten.	-	-
10	<i>Broussonetia papyrifera</i> (L.) L'Hér. ex Vent.	Moraceae	Fruits are eaten which is fleshy, sweet.	-	-
11	<i>Calamus floribundus</i> Griff.	Arecaceae	Fruits are eaten.	-	-
12	<i>Canarium bengalense</i> Roxb.	Burseraceae	Fruits are eaten.	-	-
13	<i>Canarium resiniferum</i> Bruce ex King	Burseraceae	Fruits are taken.	-	-
14	<i>Choerospondias axillaris</i> (Roxb.) B.L.Burt & A.W.Hill	Anacardiaceae	Ripen fruits are taken.	-	-
15	<i>Citrus</i> sp.	Rutaceae	Fruit juice is taken.	-	-
16	<i>Dillenia indica</i> L.	Dilleniaceae	Thick, fleshy, acidic sepals are used as vegetables or in making chutney.	Anti-diabetic, Fever, Aphrodisiac, promotes virility, Cures food poisoning, Applied externally in sprains.	Mehta, 2013; Talukdar et al., 2012.

17	<i>Dimocarpus longan</i> Lour.	Sapindaceae	Fleshy aril of fruit is eaten which is sour in taste.	-	-
18	<i>Elaeocarpus floribundus</i> Blume	Elaeocarpaceae	Fruits are eaten raw which is sour in taste.	Diabetes, Hypertension, Dysentery, Rheumatism.	Mahomodally & Sookhy, 2018.
19	<i>Ficus auriculata</i> Lour.	Moraceae	Receptacle is eaten.	-	-
20	<i>Ficus benghalensis</i> L.	Moraceae	Fleshy receptacle is eaten raw.	-	-
21	<i>Ficus semicordata</i> Buch. -Ham. ex Sm.	Moraceae	Receptacle are eaten which is sweet in taste.	Leprosy, Wound, Boil, Liver disorders, Gynecological disorders.	Gupta, 2018.
22	<i>Garcinia lanceifolia</i> Roxb.	Clusiaceae	Ripen fruits are eaten which is very delicious.	Dysentery, Fever, Jaundice, Urinary troubles.	Baruah, 2021.
23	<i>Garcinia pedunculata</i> Roxb. ex Buch. -Ham.	Clusiaceae	Pulp of fruits is eaten raw or sometimes by cooked.	Dysentery, Jaundice, Diarrhea, Digestive, Cooling.	Baruah, 2021; Sarma & Devi, 2015.
24	<i>Garcinia xanthochymus</i> Hook.f. ex T.Anderson	Clusiaceae	Pulp of fruits is eaten raw.	Wound, Skin diseases, Dysentery.	Baruah, 2021.
25	<i>Grewia eriocarpa</i> Juss.	Malvaceae	Ripe fruits are eaten.	-	-
26	<i>Haematocarpu s validus</i> (Miers) Bakh.f. ex	Menispermaceae	Pulps of fruits are eaten which is	Jaundice, Anemia, Iching.	Rahim et al., 2015.

	Forman		very juicy.		
27	<i>Horsfieldia amygdalina</i> (Wall.) Warb.	Myristicaceae	Fruit arils are eaten raw which is very sweet.	-	-
28	<i>Hovenia dulcis</i> Thunb.	Rhamnaceae	Succulent peduncles, inflorescences are eaten and its taste is like pear.	-	-
29	<i>Huberantha jenkinsii</i> (Hook.f. & Thomson) Chaowasku	Annonaceae	Ripen fruits are eaten.	-	-
30	<i>Leea asiatica</i> (L.) Ridsdale	Vitaceae	Inspid fruits are eaten raw.	-	-
31	<i>Litsea glutinosa</i> (Lour.) C.B.Rob.	Lauraceae	Inspid fruits are eaten raw.	Fractured limbs, Tablet formulations, in making incense sticks.	Ramana & Raju, 2017.
32	<i>Macluracochi nchinensis</i> (Lour.) Corner	Moraceae	Ripen fruits are eaten.	-	-
33	<i>Maesa indica</i> (Roxb.) Sweet	Primulaceae	Ripen fruits are eaten.	Antidiabetic.	Chakraborty et al., 2021.
34	<i>Mangifera sylvatica</i> Roxb.	Anacardiaceae	Pulp of fruits is eaten raw as well as by making pickle.	-	-
35	<i>Medinilla rubicunda</i> (Jack) Blume	Melastomataceae	Inspid fruits are eaten raw.	-	-
36	<i>Melastoma malabathricum</i> L.	Melastomataceae	Fruits are eaten which is inspid	Diarrhoea, Dysentery, Leucorrhoea, Hemorrhoids,	Joffry et al., 2012.

			and taste is like a black berry.	Cuts and Wounds, Infection during confinement, Toothache, Stomachache, Flatulence, Sore legs, Thrush, Jaundice.	
37	<i>Morus alba</i> L.	Moraceae	Ripen fruits are eaten which is slightly sour in taste.	Coughs, Fever, Inflamed eyes, Sore throats, Headaches, Dizziness, Vertigo, Used as a gargle and mouthwash, Toothache, Retention, Joint pain.	Bagachi et al., 2013.
38	<i>Myrica esculenta</i> Buch. -Ham. ex D.Don	Myricaceae	Fruits are eaten raw and also, made into a drink.	Chronic cough, Asthma, Ulcers, Headache, Rheumatoid arthritis, Diarrhoea, Dysentery, Menorrhagia, Menstrual disorders.	Sood & Shri, 2018.
39	<i>Myrsine capitellata</i> Wall.	Primulaceae	Ripen insipid fruits are eaten raw.	-	-
40	<i>Parabaena sagittata</i> Miers ex Hook.f. & Thomson	Menispermaceae	Ripen fruits are eaten.	-	-
41	<i>Parthenocissus semicordata</i> (Wall.) Planch.	Vitaceae	Pulp of the fruits is eaten raw which is slightly sour in taste.	-	-

42	<i>Pegia nitida</i> Colebr.	Anacardiaceae	Pulp of the fruits is eaten raw which is slightly sour in taste.	-	-
43	<i>Persicaria chinensis</i> (L.) H.Gross	Polygonaceae	Ripen fruits are eaten.	Diuretic, Emmenagogue, regulate menstrual irregularities, Diarrhea, Dyspepsia, Itching skin, Excessive menstrual bleeding, Hemorrhoids, Cancer, Astringent, Cicatrizing, Gastric, Pulmonary problems, Uterine hemorrhages, For termination of pregnancy, Uterine disorders, Colic pain.	Huq et al., 2014.
44	<i>Phoenix dactylifera</i> L.	Arecaceae	Fleshy pulp of fruit is eaten which is sweet in taste.	Infertility problems.	Selmani et al., 2017.
45	<i>Pinanga gracilis</i> Blume	Arecaceae	Small nuts are chewed with betel leaf.	-	-

46	<i>Potentilla indica</i> (Andrews) Th. Wolf	Rosaceae	Ripen fruits are eaten.	-	-
47	<i>Rubus burkillii</i> Rolfe	Rosaceae	Ripen fruits are eaten.	-	-
48	<i>Rubus ellipticus</i> Sm.	Rosaceae	Fruits are eaten raw which is slightly sour in taste.	-	-
49	<i>Rubus lucens</i> Focke	Rosaceae	Ripen fruits are eaten.	-	-
50	<i>Rubus moluccanus</i> L.	Rosaceae	Ripen fruits are eaten.	-	-
51	<i>Rubus rosifolius</i> Sm.	Rosaceae	Fruits are taken which is sour in taste.	-	-
52	<i>Saurauia cerea</i> Griff. ex Dyer	Actinidiaceae	Fruits are eaten.	-	-
53	<i>Saurauia cerea</i> Griff. ex Dyer	Actinidiaceae	Fruits are cooked as vegetables.	-	-
54	<i>Saurauia punduana</i> Wall.	Actinidiaceae	Fruits are cooked as vegetables.	-	-
55	<i>Saurauia roxburghii</i> Wall.	Actinidiaceae	Ripen fruits are eaten which is very delicious.	Indigestion, Boils, Fever, Gout, Piles, Eczema, Asthma, Ulcers, Bronchitis, Epilepsy, Hepatitis B.	Nahrin et al., 2020.
56	<i>Saurauiana paulensis</i> DC.	Actinidiaceae	Fruits are cooked as	-	-

			vegetables .		
57	<i>Solanum spirale</i> Roxb.	Solanaceae	Fruits are cooked as vegetables .	-	-
58	<i>Solanum torvum</i> Sw.	Solanaceae	Fruits are cooked as vegetables .	Malaria, Common cold, Cough, Ringworm, Sinuses.	Asiedu-Darko, 2010.
59	<i>Solanum violaceum</i> Ortega	Solanaceae	Fruits are cooked as vegetables .	-	-
60	<i>Solena heterophylla</i> Lour.	Cucurbitaceae	Ripen fruits are eaten.	-	-
61	<i>Stauntonia latifolia</i> (Wall.) R.Br. ex Wall.	Lardizabaleae	Pulps of fruits are eaten.	-	-
62	<i>Syzygium aborense</i> (Dunn) Rathakr. & N. C. Nair	Myrtaceae	Ripen fruits are eaten.	-	-
63	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Ripen fruits are eaten.	Dysentery, Diabetes, Cough, Inflammation, Ringworm, Blisters in mouth, Cancer, Colic, Diarrhea, Digestive complaints, Dysentery, Piles, Pimples, Stomachache.	Shrikant Baslingappa et al., 2012.
64	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Raw fruits are eaten and also can be stored	-	-

			after drying.		
65	<i>Terminalia citrina</i> (Gaertn.) Roxb.	Combretaceae	Fruits are eaten which is sour in taste.	-	-
66	<i>Tetrastigma leucostaphylum</i> (Dennst.) Alston	Vitaceae	Ripen fruits are eaten.	-	-
67	<i>Trivalvaria argentea</i> (Hook.f. & Thomson) J.Sinclair	Annonaceae	Ripen fruits are eaten.	-	-
68	<i>Zanthoxylum nitidum</i> (Roxb.) DC.	Rutaceae	Fruits are eaten which is slightly pungent.	Relieve pain, Stomach ache, Toothache, Rheumatic arthralgia, Traumatic injury, Venomous snake Bites, Burn, Scald, Chronic lumbar muscle strain, Snake bites.	Lu et al., 2020.
69	<i>Zehneria scabra</i> (L.f.) Sond.	Cucurbitaceae	Fruits are eaten raw.	Skin diseases, Syphilis, Gonorrhea, Malaria, Worm, Diarrhoea, Malaise, Mumps, Fever, Taeniasis, Constipation, Conjunctivitis, Swelling, Headache, Snakebites, Eye infection, Evil eye, Michi, Internal mitch.	Bayu et al., 2018.

70	<i>Ziziphus apetala</i> Hook.f.	Rhamnaceae	Pulp of fruits is eaten.	-	-
71	<i>Ziziphus funiculosa</i> Buch. -Ham. ex M.A.Lawson	Rhamnaceae	Pulp of fruits is eaten.	-	-
72	<i>Ziziphus incurve</i> Roxb.	Rhamnaceae	Pulp of fruits is eaten.	-	-

Plants with edible stems and barks

Barks of some plants are chewed for its taste or as a masticatory in the day-to-day life of the forest dwellers. Bark of *Baccaurea sapida* stem is slightly sweetish in taste and is often chewed by the local people when they come across such trees in the jungle or during the cultivation period in the *jhum* land. The soft pith of some plants basically belonging to the Zingiberaceae, Poaceae and Arecaceae are also taken as a raw food and used as a famine food. The secondary metabolites deposition is mainly taking place in the bark and stem; therefore, these parts also have potential medicinal properties and used as a traditional medicine in the treatment of different diseases. A list of the plants whose stems and barks are used is given below (Table14.2).

Plants with underground edible parts (tubers/rhizome)

The North Eastern states are rich in the cultivation and domestication of the edible tuber/rhizome yielding crops native to the region. A number of plants belonging to the families Araceae and Dioscoreaceae come under the categories of food plants. However, these plants include both the cultivated and wild one. They are eaten in the form of raw or boiled. The people of this region cultivate different types of yam and taro in their agricultural fields along with other primary crops such as sweet potato. The family Araceae is represented by the species of *Colacasia*, *Alocasia*, *Amorpholus* and *Lasia* with a number of local varieties, as it is evident from the occurrence of long list of local names of *Colacasia antiquum*. Different yams like *Dioscorea esculenta*, *D. bulbifera* are cultivated in *jhum* fields and some other species are grown in wild (Table14.4). The edible tubers are found deep under the soil surface and after digging out, these are baked or boiled and served.

Fruit bearing plants

Over 170 different underutilized fruit bearing plants are recorded in different parts of NE India which are consumed by the indigenous group of people. Tropical and subtropical forests abound in a large variety of fruit plants. Some of the fruits are also used as vegetables in the raw or cooked form, one such prominent fruit is jackfruit (*Artocarpus heterophyllus*) which is popularly used all over the states of NE in both raw and cooked form and also as ripen fruit. Wild mangoes (*Mangifera sylvatica*) are also found in the primary forest of NE India. It has been reported that there are two different wild mango varieties, these wild species are smaller and inferior than the cultivated ones (*M. indica*). There are more than 60 different local cultivated mango varieties, reported from Assam which indicates the origin of these specific fruits. Fruits of wild and cultivated species of *Solanum* of the family Solanaceae are usually used as vegetables along with the other fruits of the family Cucurbitaceae. The family Moraceae is well represented by plants like *Morus indica* and several edible species of *Ficus* like *F. auriculata*, *F. cunia*, *F. roxburghii*, *F. racemosa* etc. The detailed list of the underutilized edible fruits is listed in the (Table 14.5).

Wild edible seeds

Besides the long list of the wild edible fruits, a few of the edible seed yielding plants come under the families such as Sterculiaceae, Clusiaceae, Cyperaceae, Euphorbiaceae, Lamiaceae, Fagaceae, Cucurbitaceae, Moraceae, Elaeocarpaceae etc. The most popular way of the utilization of the seeds are to roast the seeds and eat as it is or mixed with salt and considered as salad. Large seeds of *Hodgsonia macrocarpa* of the family Cucurbitaceae which is a good source of oil/protein. The hard and bitter taste of the seed is carefully removed and the kernel is taken. These seeds are commonly used by the Mizo tribe of Mizoram (Arora and Hardas, 1977). A detailed list of the plants along with their families having edible seeds is given below.

Bamboo based food

The young succulent bamboo shoots are used as food by the indigenous people of entire North East India. The tender shoots of the bamboo are collected at the advent of monsoon season from both cultivated and wild bamboo species. When the tips of the young shoots are about to come out from the soil heaps, they are then cut near the base attached to the parent rhizome. The tender shoots are generally used in the form of raw or cooked or fermented. Young sprouts are collected from the wild and cultivated species of bamboo like *Dendrocalamus hookeri* (cultivated and wild), *D. hamiltonii* (cultivated and wild), *Bambusa tulda* (cultivated), *B. arundinacea* (cultivated and wild), *Arundinaria* sp. (Wild) etc.

Traditional famine food plants in the realm of food security

In course of time various small communities, particularly in the tropical countries; they developed unique indigenous techniques for efficient utilization of resources and bio-resources around them. In other words, they have learnt to survive fulfilling their day-to-day requirements which led to a strong bond between Man and Biosphere relationship developed in complete harmony with nature. Whatever primitive Sweden or slash and burn methods of agriculture used by those communities were not adequate enough to fulfill their need for food for the whole year. During the lean period, they had to search for wild edibles to get over the period of crisis. Another emergent situation was that there were often crop failure due to various reasons viz. destruction of the crops by wild animals, natural calamities etc. As a result, those communities had to face famine like situation. In the verge of such a situation, the ethnic communities had developed some unique techniques to extract food from unconventional wild plant species to meet their hunger and nutritional needs. The interesting aspect is that many indigenous ethnic groups residing amidst the biodiversity rich tropical parts of the world are still following these techniques.

The indigenous people of NE India are basically agrarian society and rely on traditional *jhum* cultivation, the return from which is a meager and the local communities had to depend on wild food and animals as food supplement. Such conditions forced the people to depend on *famine* food to tide over the lean period. In the past such food were used as a source of starchy supplement and developed their indigenous techniques for processing and utilization. Increase in population in developing countries like India is the major problem leading to food scarcity. So, there is a basic need for alternative food material of traditional cereal crops viz., rice millets and pulses.

Earlier people used the plant products as food substances during the famine like situation in Arunachal Pradesh. *Wallichia oblongifolia* (Locally known as *Tashe*) is an important famine food plant which is traditionally used by the local people even today as food supplement (**Fig. 14.1**). After biochemical investigation and the nutritional profiling of this plant, it was proved that the trunk of *Wallichia oblongifolia* is a good source of carbohydrate as well as other minerals (Bharali *et al.*, 2014). Therefore, this plant can be used as an alternative food of rice and millets; hence, there is a need for technology input for manufacturing different food products, which can solve the problems related to food scarcity. One interesting aspect is that the local communities have plantation of this potential food plant in the vicinity of their habitat.

Although the young trunks are used as feed for the pigs, the mould or the poultry, and a formulated powder from the same can be used as a feed for fishes.



Fig. 14.1. The plant *Wallichia oblongifolia* (Locally known as Tashe) is used for various purposes by the tribal community of Arunachal Pradesh.

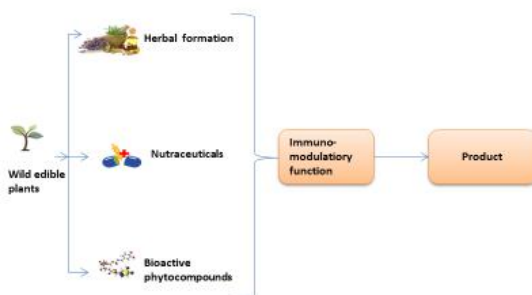


Fig. 14.2. The wild edible plants are used in herbal formulation, nutraceutical and phytochemical screening.

The black stiff hairs like vascular strands of the plant leaf is used in decorating and in making of the traditional raincoat and the head gear, by the local youths go for hunting. The midribs of the leaf are used as traditional broom which sustains the household economy in a small way. Due to the strength of the vascular strand, it is used as a trapping material for killing birds and also use in making carpets. There are other tree ferns like *Alsophila andersoni* J. Scott ex Bedd: (Tashe/Tashi Hiram in Galo), *Cyathea brunoniana* (Wall. ex Hook.) Clarke & Baker: (Saoe/Pangi), *Angiopteris evecta* (Forst.) Hoff. (Taba/Bakum) and their trunk are processed by indigenous techniques and to produce ethnic food, commonly known as Tashe/Tashi.

Ferns and Fern allies used as food

In contrast to the vast number of edible angiosperm plants, the number of edible ferns and fern-allies are very few. Certain tree ferns are used as source of

farinaceous food. In the remote past, the early food gatherers, when they had yet to learn the technique of agriculture, had tried different wild plants as sources of food.

Conclusion

The description presented above in the article confirmed and showed the prospects of the underutilized plant resources to the livelihood in a sustainable way. There is an urgent need of proper awareness and training among the indigenous people about the importance and sustainable use of those prominent species. The traditional green leafy vegetables (TGLVs) are rich in nutrients, carotenoids (vitamins), iron, calcium, ascorbic acid, riboflavin, folic acid and appreciable amounts of other minerals and so, the scientific evidence for the use of 101 leafy plants used in making a special dish by the people of Assamese community is extremely important on this regard. This needs scientific evaluation of the minerals and the proximate composition of the traditional green leafy vegetables along with other edible plant parts. This may lead to the establishment of the medicinal properties of indigenous plant resources from NE India. The extensive exploration and documentation are also required to find out the unreported specimen from NE India for the scientific validation. In addition, there is a need for survey and scientific documentation in the form of database which will be implementing AI and ML is required for easy availability of traditional knowledge globally. It will be more beneficial if the government institute provide training, awareness and other skill development activities among the rural people of the region for the formulation of food products and expand it to the local market within the state and beyond. This will definitely increase the local livelihood and rural economy among the indigenous people of NE India.

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Chapter 15

Ethnomedicinal knowledge of Mishing community for management of skin diseases in Dhemaji district, Assam, NE India

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Abstract:

Medicinal plants play an active role in herbal medicine and cost-effective way to treat disease. The ethnic groups are largely dependent on wild plant resources for their food, medicines and livelihood. The region is rich in wild medicinal plants resources. The indigenous people of this area depend on medicinal plants for their primary health care. This people have natural knowledge about medicinal plants and its uses. But no study has been carried out in Dhemaji district to report the therapeutic plants used to treat skin diseases. So the present study was aimed to

document the medicinal plants traditionally used by Mishing ethnic group. Structural questionnaires complemented by free interviews, group discussion, field interview and informal conversation were followed to accomplish the aim and objectives of the research. Informants were asked about etiology, health care system and herbal prescription for management of human skin disease problems. Medicinal plants were collected from natural habitats (home gardens, agricultural fields, wetlands, forests and roadside) with the help of local guidance and informants. The investigation includes names and parts used, ailments cured, preparation and administration. Total 38 species of 35 genera and 32 families of medicinal plants are collected. Plants parts such as leaves, tubers, shoot, young twigs, roots, bark, flower buds, fruits, seeds etc are used for medicine by tribal peoples. The study will be helpful in developing a comprehensive data base on wild medicinal plant resources, strengthening the health security and in conserving the traditional knowledge for prosperity of the remote areas. Exploration and documentation of ethnomedicinal practices among indigenous people can help in preservation of traditional knowledge and identification of new medicinal plant resources. Such local healing practices need to be validated for its promotion and development. Since the medicinal plants are non-toxic and easily affordable so they play a vital role for pharmacological research, drug development and direct used as therapeutic agent.

Key Words: Traditional medicine, Ethnobotany, medicinal plants, skin disease.

Introduction

Traditional medicine

Ethnobotany is the scientific study that deals with indigenous people and plants. Ethnomedicinal plants play an important role in the ethnic group of people. Ethnic people have deep belief in the traditional system of medicine for remedies and rely exclusively on their own herbal cures. There are enormous Ethnomedicinal plants which are useful as antimicrobial, antifungal, antiviral and antioxidant. Traditional medicine (also known as alternative, complimentary, indigenous or folk medicine). The World Health Organization (WHO) defines traditional medicine as “the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, use in maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. It has estimated that 80% of the world population is dependent on traditional medicine for their primary health’s needs.

Ethnomedicine and skin diseases

Herbalists and indigenous healers have used botanical medicines traditionally for the prevention and treatment of different skin disorders. Traditional knowledge that is developed through the combined experience of many generations and still practiced in many tribal and rural societies develops their own medical practices by trial-and-error method. Some medicinal plants are nontoxic easily affordable and they play an important role in pharmacological research and drug development. Scientists and medical professionals have found that the herbs themselves, which possess unique combinations of chemical components, are more effective than the chemical derivatives. Medicinal plants are the best source to obtain a variety of newer herbal drugs. This project will help to know skin problems to screen out the efficient or to find out the new approach in reported plants and to find out for related other plants which may be a step ahead in the drug discovery process.

Material and methods

Study sites

The study was carried out in some of the places in Dhemaji district, Assam. This state is located in the Northeastern region of India, lies between 24°10' - 27°56'N latitude and 89°40' - 95°42'E longitudes. There are about 100 tribes and sub tribes reported (Borthakur & Goswami, 1995) from the state. The state is situated in the north east corner of India surrounded by Bhutan and Arunachal Pradesh on north, Arunachal Pradesh, Nagaland and Manipur in the east, Meghalaya and Mizoram in the south of Bangladesh, Tripura and West Bengal in the west.

The study was carried out in Mishing rural communities of Dhemaji district, Assam. The Dhemaji district located within latitude 27°48' N and longitude 94°58' E. The climate is tropical and the vegetation is lowland rainforest with a mean annual rainfall of 2600 mm to 3200mm. The field survey was conducted in the tribal village areas to collect information about ethno medicinal plants used by tribal to heal skin disease. The actual application of plants parts to treat skin disease was also observed the field work. The majority of the traditional medicines were prepared using water as medium. In addition to pure herbal preparation, in some cases the drug was administered with ghee, honey, milk, coconut oil and curd etc.

Methods

Field survey and data collection:

The field work was conducted during the month of June 2018 to March 2019. The field work consisted of interviewing the local elder people of the villages and documenting local knowledge about the medicinal plants and their uses in skin disease. The medicinal plants were collected from the jungles, home gardens, agricultural fields, wetlands, roadside as well as from the villages and local markets with the help of local guidance and informants. During the interview question like the names, uses, how often it is used and whether it is used for the same purpose by other communities in the district are asked. Plants are identified with the help of floras. The herbarium was prepared for available specimens. Processed herbarium specimens are deposited in the department of Life Science and Bioinformatics, Assam University Diphu Campus.

Result and Discussion

The present study recorded ethnomedicinal knowledge of 39 medicinal plants belonging to 35 genera and 32 families used for management of skin disorders of human viz. Ringworm, scabies, abscesses, skin burn, skin dry, septic ulcer, carbuncles, leprosy (Table 15.1). The Zingiberaceae has highest representation with (4) species which followed by Fabaceae (3) and Lamiaceae, Euphorbiaceae (2) while rest of the botanical families has one species each.

Table 15.1. Enumeration of the Medicinal plants used by Mishing community for curing skin diseases.

Sl No	Species name & Family	Local Name	Habit	Part Used	Mode of used	Disease
1	<i>Azadirachta indica</i> A Juss. [Meliaceae]	Neem	Tree	Leaves, shoot, root	The extract directly applied on skin	Ringworm
2	<i>Achyranthus aspera</i> L. [Amaranthaceae]	Bionihakuta	Herb	Seed	Seed grind and paste with little salt is applied on carbuncles	Carbuncles

3	<i>Adhatoda zeylanica</i> Medik. [Acanthaceae]	Bahoktita	shrub	Leaf	The leaves crushed and paste with little sugar is applied on abscesses.	Abscesses
4	<i>Aloe vera</i> (L.) Burm.f. Mill. [Aloaceae]	Saalkuwo ri	Herb	Leaves	The leaves crushed and placed on burn region	Skin burn
5	<i>Areca catechu</i> L. [Arecaceae]	Tamul	Tree	Nut	The nuts are dried in the sun and crushed into powder, which is applied on septic ulcer for quick healing	Septic ulcer
6	<i>Allium sativum</i> L. [Liliaceae]	Nohoru	Herb	Bulb	The bulb is crushed and applied on skin	Ringworm , Allergy
7	<i>Allium cepa</i> L. [Liliaceae]	Piyaj	Herb	Bulb	The bulb crushed and directly applied on skin	Leprosy, Ringworm
8	<i>Aquilaria agallocha</i> Roxb. [Thymelaeaceae]	Agaru	Tree	Leaves	The leaves crushed and directly applied on skin	Leprosy
9	<i>Bryophyllum pinnatum</i> (Lam.) Oken. [Crassulaceae]	Duporten ga	Herb	Leaves	The leaves crushed and applied on skin	Skin burn
10	<i>Basella alba</i> L. [Basellaceae]	Puroi		Leaf	Leaves paste is applied on allergy for	Allergy

					quick relief.	
11	<i>Bischofia javanica</i> Blume. [Uphorbiaceae]	Urium	Tree	Bark	he bark is crushed and applied on insect bites	Insect bites
12	<i>Butea monosporma</i> (Lam.) Taub. [Fabaceae]	Polash	Tree	Latex	Extract the latex and directly applied on skin	Ringworm
13	<i>Carica papaya</i> L. [Caricaceae]	Amita	Tree	Latex	Extract fresh latex is applied on skin	Ringworm
14	<i>Cassia alata</i> L. [Caesalpiniaeae]	Khorpat	Shrub	Leaf	Crushed the leaf and applied on skin	Ringworm , scabies
15	<i>Centalla asiatica</i> L. [Apiaceae]	Bormanimuni	Herb	Leaf	Grind the leaves and paste directly on skin	Abscess and carbuncles for quick healing
16	<i>Cinnamomum tamala</i> (Buch.-Hum.) T.Nees & Eberm. [Lauraceae]	Tezpat	Tree	Leaf	Fresh leaf crushed and paste is applied on skin	Allergy
17	<i>Curcuma aromatic</i> Salisb. [Zingiberaceae]	Bon-halodhi	Herb	Rhizome	Rhizome is crushed and paste is applied on the skin	Ringworm and scabies
18	<i>Curcuma longa</i> L. [Zingiberaceae]	Halodhi	Herb	Rhizome	Dry rhizome along with a little lime is applied to remove warts	Ringworm
19	<i>Curcuma zedoaria</i>	Yumrng Rom	Herb	Rhizome	Rhizome crushed	Ringworm and quick

	Roxb. [Zingiberaceae]				and directly paste on skin	healing
20	<i>Ficus religiosa</i> L. [Moraceae]	Ahotgoch	Tree	Bark, latex	Barks are crushed and mixed with little milk and applied on scabies. Latex is applied on cracked heels for quick healing	Scabies and quick healing
21	<i>Flemingia strobilifera</i> (L.) W.T. Aiton. [Fabaceae]	Makhioti	Shrub	Root	Pounded roots are applied on ringworm	Ringworm
22	<i>Lawsonia inermis</i> L. [Lythraceae]	Jetuka	Shrub	Leaf	Leaf paste is applied on abscesses and septic ulcer for quick healing.	Abscesses
23	<i>Moringa oleifera</i> Lam. [Moringaceae]	Sajina	Tree	Bark	Juice of the bark is applied on abscesses.	Abscesses
24	<i>Morus alba</i> L. [Moraceae]	Nuni	Tree	Bark of its trunk and roots, matured fruits, leaves	Leaves, bark crushed and applied on skin	Itch
25	<i>Musa acuminata</i> Colla. [Musaceae]	Jatikol	Herb	Fruit peel	The crushed peel grind with <i>Curcuma longa</i> and	Skin burn

					applied on infected skin	
26	<i>Ocimum canum</i> Sims. [Lamiaceae]	Kola tulosi	Shrub	Leaf	Crushed leaves are mixed with a pinch of salt and applied on the infected region	Ringworm
27	<i>Oxalis corniculata</i> L. [Oxalidaceae]	Tengeshi	Herb	Leaf	Leaf juice is applied to cure scabies and root paste is applied on eczema	Scabies and eczema
28	<i>Paederia scandens</i> (Lour.) Merr. [Rubiaceae]	Bhedai-lota	Shrub	Leaf	Leaf juice is applied on allergy. Leaf juice with garlic is eaten to relieve from allergy.	Allergy
29	<i>Polyalthia longifolia</i> (Sonn.) Thwaites. [Annonaceae]	Debodaru	Tree	Bark	Crushed barks are made into paste and applied on skin	Scabies
30	<i>Piper nigrum</i> L. [Piperaceae]	Jaluk	Herb	Fruit	The crushed directly applied on infected skin	Scabies
31	<i>Pterocarpus santalinus</i> L.f. [Leguminosae]	Chandan	Tree	Wood	The crushed is directly applied on skin	During skin smooth
32	<i>Ricinus communis</i> L.	Erapat	Shrub	Leaf	Leaves crushed	Carbuncles

	[Euphorbiaceae]				and directly applied on skin	
33	<i>Solanum myriacanthum</i> Dunal. [Solanaceae]	Kotahibengana	Shrub	Fruit	Fruits are crushed and made into a paste and applied on abscesses	Abscesses
34	<i>Stephania japonica</i> (Thunb.) Miers. [Menispermaceae]	Tubukilota	Shrub	Leaf	Leaf paste is applied on septic ulcer for quick healing	Septic ulcer
35	<i>Typhonium trilobatum</i> (L.) Schott. [Araceae]	Chomakachu	Herb	Latex	Latex is applied on abscesses and pimples	Itch
36	<i>Vigna mungo</i> (L.) Hepper. [Fabaceae]	Matimah	Herb	Seed	The crushed directly applied on skin	Scabies
37	<i>Vitex negundo</i> L. [Verbenaceae]	Posotiya	Shrub	Leaf	Crushes the leafs and directly paste on skin	Allergy and abscesses
38	<i>Zingiber officinale</i> Roscoe. [Zingiberaceae]	Moranada	Herb	Rhizome	The juice of the rhizome with little amount of molasses is eaten to get relieve from allergy.	Allergy, ringworm

From the study it has been found that medicinal plants are used by people in many ways in their daily livelihood either as food, medicines, cosmetics etc. Use parts of

medicinal plants include shoot (1), bark (5) fruit (2), leaf (16), root (1), rhizome (4), fruit (2), seed (2) nut (1), bulb (2), peel (1), wood (1) (Fig. 15.1).

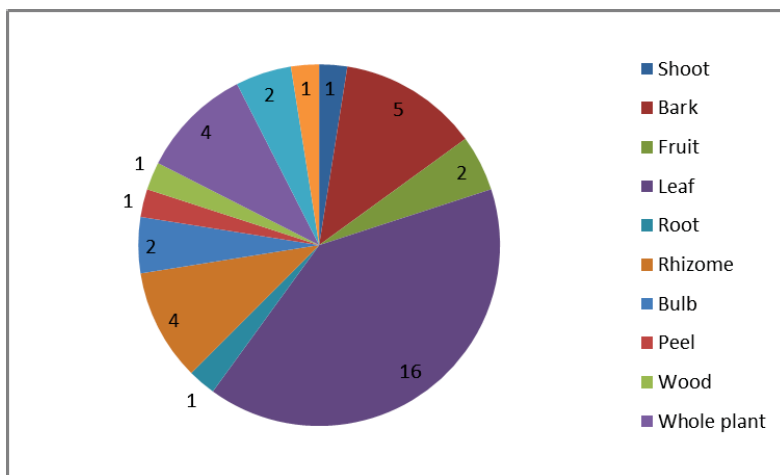


Fig. 15.1. Number of plants parts used in skin disease.

Conclusion

The Mishing community are depend on ethnomedicine for primary healthcare. Maintenance of sound skin disease in human is an important concern of the society. The present study documented the unique traditional healthcare of the Mishing tribes etiology, symptoms and management with homemade herbal with disease remedies. This can help for ethnomedicinal knowledge among the Mishing tribes is transmitted through word of mouth form one generation to another. But, their ehnomedicinal knowledge based is gradually declining with education and access to modern medicines, socio-economic changes and acculturation. Documentation ethnomedicinal practices with rituals, avoidance can help in preservation of traditional knowledge. Beside this study also documented about culture, belief, habitat, occupation as well as religion of the Mishing Community of the study area.

Non experimental validation of the collection ethnomedicinal plants was one of the objectives of the present study while isolated chemical compounds were recorded by reviewing previous phytochemical and pharmacological literatures. This can help to establish the potential efficacy and toxicities of ethnomedicines for their validation.

Acknowledgement

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Chapter 16

At the Cultural Crossroads: A Portrait of a Galo Shaman

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Abstract

The Galo shamans belong to the fast disappearing traditional healers of the Eastern Himalayas. In an ideal traditional setting, the shaman is the performer of rites and rituals as also of social memory. Some shamans exhibit knowledge of herbal healing, an art not specialised by all the shamans and often practised by people other than shamans. Indigenous healing systems or folk medicine today faces a different scenario: coming of Western Biomedicine; neo-faith healing; re-organised indigenous faith, etc. This article is a short sketch of a performing shaman (*Nyibu*) through whose experiences a brief exposition on the contemporary condition of the shamans would be made. It also raises the question about the place and future of the shaman in the context of the reformed indigenous religions.

Keywords: Shaman, Eastern Himalaya, Folk Medicine, Indigenous Faith, Arunachal Pradesh.

Introduction

The art of curing ailments and diseases through indigenous methods is a very old tradition. Among the early societies, diseases were linked to 'possession by evil spirits' and spells and drugs were accordingly formulated (Childe, 1957). The term 'shaman' is variously used along with 'native healer,' 'medicine man' or 'medicine woman' depending on the cultural perspective of the writer. A performing Native American shaman and writer prefer the term 'native healer' since it represents the cultural perspective of the tradition the shaman is part of (Lake, 2007). Mircea Eliade, the noted Romanian historian of religion, defined Shamanism as 'an ancient technique of ecstasy, often considered a kind of mysticism or magic but in very broad terms also a religion' (Nishimura, 1987). Writing about Shamanism among the Tungus of eastern Siberia in S.M. Shirokogoroff described a shaman as 'persons of both sexes who have mastered spirits, who at their will can introduce these spirits into themselves and use their power over the spirits in their own interests, particularly helping other people, who suffer from the spirits' (Nishimura, 1987). These definitions were broadly summarized by Kokan Sasaki in *Shamanizumu no jinruigaku* (The Anthropology of Shamanism) as: 'shamanism is a form of religion which centers on a magico-religious specialist who has a special ability to enter into a trancelike state at will and in the abnormal psychological state can make direct contact with the supernatural being' (Nishimura 1987:59). Thus, a shaman was the link between the material and the spiritual world of the people- a function fulfilled by a Galo shaman also. It is argued by Mercea Eliade that '...because the properties and conditions of the soul are within his domain of knowledge, the shaman is a curer and healer of disease' (Jones, 1968).

These definitions of shaman and shamanism can be inferred to describe the shamans of various communities of Arunachal Pradesh also. The shamans are the bedrock of indigenous healing system. Forster and Anderson defined ethnomedicine as: 'Comprising those beliefs and practices relating to disease which are the products of indigenous cultural development and are not explicitly derived from the conceptual framework of modern medicine' (Anquandah, 1997). The ethno-medical practice or folk medicine of the people of Arunachal Pradesh is rooted in religious beliefs and shaped by the local ecology, physical environment and customs. In a sense, it is agreeable that the concept of illness is basically rooted in supernatural cosmology as argued by a noted anthropologist who studied the Arunachal tribes (Elwin, 1999). The idea of disease/ailments, accidents, epidemics, and famine is construed as occurring as a result of 'breach' of the balance with natural and supernatural forces ('malevolent spirits') among the shamanistic communities of Arunachal Pradesh. For example, when a person meets with an accident the shaman negotiates (through rituals) with the spirits to safely 'retrieve' the *Yalo* (soul?) of the affected person from the offended spirits.

Objectives

From the 1950s Arunachal Pradesh was opened up for new impactful changes: expansion of government administrative machinery, roadways, introduction of Western Biomedicine (henceforth WBM), education, increasing population contact and powerful cultural influences. The degree of this process was described by Verrier Elwin as “creating the puzzle of the impact of the atomic age on a Stone Age” (Guha, 2000). Naturally, these influences were bound to have important, fundamental impacts. It has been a good seven decades since Elwin’s time and this paper aims to discuss the nature of such impacts on the career of a shaman. The two immediate references for making this assessment are changing environment and the renewed interpretation and projection of indigenous religion itself.

Material and Methods

This quick essay is ethno-historical in orientation. A brief profile of a practicing shaman is being presented. The data has been collected through oral interview. The rites and ritual performances of the shaman are not being discussed. *Emic* perspective is inherent since the author is born and bred in the same cultural milieu as the shaman- reason why I have not provided any transcript of the interview with the shaman. For the same reason, survey of existing literature on Galo shamans has not been done. No special field-study was conducted on the reformed indigenous religion as family members of the author are directly involved in its practice and propagation.

Results and Discussion

Roughly equidistant from Tibet in the north, the Assam plains in the south, Siang River in the east and Subansiri River in the west lay Bipi village of Liromoba in the central West Siang District of Arunachal Pradesh. Born in c.1940, TamaMindoRomin is a *Nyibu* (shaman) and a propagator of the Donyi Polo faith (reformed indigenous religion) who no longer lives at his ancestral village Bipi. As is common for would-be *Nyibu*’s, young Tama was ‘kidnapped’ by the *Yapom* (forest spirits believed to be of feminine gender) while asleep to be recovered by village folks from the nearby rivulet later on. Attracted to entrepreneurship and thus not interested in becoming a *Nyibo*, Tama left his ancestral village and started doing petty government contract works- a formative period of spiritual journey to shaman-hood later in life. In 1969, he adopted the Christian faith after coming into contact with Catholic Missionaries at Gandhigram in Vijaynagarin the Patkai Hills. Un-affected by his conversion, the *Yapoms*¹ again ventured to ‘kidnap’ Tama; this time the *Yapoms*

¹ The *Yapom* is colloquially referred to in plural. The ‘s’ here is a loose Anglicization. One of the earliest *etic* record of *Yapom* ‘kidnapping’ can be found in Elwin 1959:266. Such incidents are regularly reported till today.

were persistent. Circa, 1974, Tama was on a regular visit to the Shiva Mandir at Raneghat in Pasighat town. The temple premise hosted a huge banyan tree (locally called *sirek/ hirek*), a locally believed to be the favourite abode of the Yapoms. In the ‘custody’ of the relentless Yapoms, Tama had ecstatic experience of running across rivers and jumping over the mountains that divide the foothill town from hinterland Along (Aalo) headquarters - a distance the Yapoms helped him cover within a couple of hours in superman-style, literally. As expected, the Yapoms finally had the upper hand and a new poet stepped-in to a mystic world where the chosen few conversed with the spirits- as the plenipotentiary of the mortal beings. A shaman is born.

Tama specialises in what might be called ‘prosperity’ and ‘cure’ rituals (*GuminUyi*) as distinct from the types of rituals related to disputes, death, murder, etc. (*Yalu-YachuUyi*). Based on such specialisation, as well as the occult reputation, Galo shamans are viewed in loose hierarchical order at the pinnacle of which Tama considers himself to belong to. He is thus a *Gumin Nyibo* (indicating the type of rituals he performs) as well as a *Nyib-Buut* (suggestive of his position and reputation). As to whether his standing was equal to or above the *Tago-Nyigre* Nyibu, a shaman who can take the form of wild beasts, notably the tiger, like Kachi Yomcha (Riba, 2004) Tama avoided any comparison with the renowned late shaman who lived a generation before him in his home district.

Tama’s long and ongoing career is dotted by many feats: curing a dysenteric (*Takw*) and a Yapom-infested patient each who would not get relief from medical treatment, for example. In the latter case, a Sikh engineer employed under the state government had incurred the wrath of the Yapoms while supervising jungle-clearing for a road project eventually found cure for his medically unexplained recurring vertigo after Tama checked the omen and negotiated a deal with the offended Yapoms.

At personal front, our shaman claims that he is a teetotaler since childhood and is quick to issue the disclaimer that he does not eat cattle-meat because of allergy. In 1987, he helped in organizing the Abotani Shaman Association as its first General Secretary. At the time of my interview, Tama headed the ecclesiastical wing of the Indigenous Faith and Cultural Society of Arunachal Pradesh (IFCSAP) as its president. The IFCSAP currently leads the indigenous faith movement in Arunachal Pradesh; the process has been described as ‘reformist’ in the ‘contested domains of religious transformation...’ (Chaudhari 2013:259-277). Under the aegis of the IFCSAP and other sister organisations, Tama occasionally attends training workshops in different places where he gets to meet shamans from other regions and cultures from across the diverse country.

When enquired about the future of the shamans and shamanistic rites and rituals, the enthusiasm in the room quickly dissipated and Tama responded with a disheartened tone citing factors for a bleak future of the shamans as well as reasons

why religious reform was necessary: coming of new ways of life; non-observance of indigenous ways of life and taboos; change in food habits; negligence of indigenous religion and its methods of healing; and adoption of new religious faiths. Food avoidance (of certain types, not only before and after performing rituals), according to Tama, was one of the strict discipline a shaman was supposed to keep thereby highlighting some universals shamans across cultures share: ‘many abstentions may be interpreted as a type of primitive preventive medicine...Not only the individual, but also the whole community may derive psychological benefits from the avoidance of certain foods’ (Ferro-Luzzi, 1975).

Conclusion

Tama’s stress during the course of our extended interview was on two things: cure of many patients, who did not get relief from modern medical treatment, through the shaman’s intervention and; the future of the shamans. The first case reinforces the idea and relevance of medical pluralism. The second aspect throws some light on the decline in the number of shamans and the changing role of shaman within the structure of the reformed indigenous religions. Until his generation, a Galo shaman like Tama was alien to the idea of a place of worship and congregation. Being a shaman and thus a key stakeholder of the indigenous religious life, Tama contributed to the efforts for re-organising the indigenous religions where the mode of worship² was different from the propitiatory rituals of the original shaman-hood. For example, *Ganggi* is a prayer hall where reformed indigenous faith believers meet weekly, offer prayers and seek cure from ailments and diseases also.

It can be visualised that within the confines of the *Ganggi*, shamans like Tama would be not be able to perform the shamanistic rituals. An irony stems from the genuine apprehensions and works of shaman cum religious reform workers like Tama: one of the results of religious reform is to uniquely put a shaman in a devotional-congregational environment where the shamanistic chants and rituals are no longer to be found. Unlike Tama and his colleagues in the indigenous religious reform movement, there are many shamans and people who do not attend the *Ganggi* considering the reformed practices to be equally ‘alien’. This underlines the complexity and multi-positional nature of the religious reform movement in Arunachal Pradesh of which Tama is a part of.

Acknowledgement

The interview of the shaman was done as part of my recently awarded (2017) Ph.D. work titled “Development of Healthcare System in Arunachal Pradesh, 1826-1987”. A related paper named “A Priests’ Chant: Healing Traditions amongst

²For details on the types and nature of indigenous faith movements in Arunachal Pradesh see Chaudhury 2013.

the Galo tribe, Arunachal Pradesh, India” appears in the *Saudi Journal of Humanities and Social Science*, 2:11, Nov 2017: 1058-1061. While the data and methods remain same the organisation, focus and analysis of this article is different from the preceding two works. I received travel grants from the Indian Council of Historical Research (ICHR) for field-works during PhD study.

Note on Indigenous Terms

The vernaculars appearing in this article is in Galo language- a branch of Tani language cluster. The Tani languages (belonging to the Tibeto-Burman family), which share common roots and basic vocabulary, are spoken in central Arunachal and parts of upper Assam. There is no study on the archaic and shamanistic vocabulary of the Tani languages.

Interviews

Information about Tama Mindo was gathered through personal interview with the shaman at his residence at A-Sector, Naharlagun, Arunachal Pradesh on January 6, 2017.

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Chapter 17

Antiviral activity of traditional herbal medicine of North East India

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Abstract

Viral infections play a major role in human diseases, and recent outbreaks in the advent of globalization and ease of travel have underscored their prevention as a critical issue in safeguarding public health. Despite the progress made in immunization and drug development, many viruses lack preventive vaccines and efficient antiviral therapies, which are often beset by the generation of viral escape mutants. Thus, identifying novel antiviral drugs is of critical importance and natural products are an excellent source for such discoveries. A variety of phyto-constituents derived from medicinal herbs have been extensively studied for antiviral activity in different areas of the world. In this review, we summarize the antiviral effects reported for several medicinal plants available in North-East India. Herbal plants, plant preparations and phyto-constituents have proved useful in attenuating infectious conditions and were the only remedies available, till the advent of antibiotics (many being of plant origin themselves). Several studies reveal that herbal sources provide enormous scope to explore and bring out viable alternatives against viral diseases, considering non-availability of suitable drug and increasing resistance to existing drug molecules for many emerging and re-emerging viral diseases.

Keywords: Antiviral, Herbal plants, Drug, Natural product.

Introduction

Viruses are responsible for a number of human diseases which spreads either fecal-oral route via contaminated food or water supplies and person to person contact. Viral transmission also involves mosquitoes, wild birds with mammals including humans, being incidental end-stage hosts (Naides, 2012). Moreover, due to increased global travel and rapid urbanization, epidemic outbreaks caused by emerging and re-emerging viruses represent a critical threat to public health, particularly when preventive vaccines and antiviral therapies are unavailable. Examples include the recent emergence of Middle East respiratory syndrome coronavirus (MERS-CoV), Ebola viruses, Avian influenza A (H797) virus, dengue virus, influenza virus, measles virus, severe acute respiratory syndrome (SARS) virus, and West Nile virus outbreaks (Bertal et al., 2011). Complementary and alternative medicine offers a wide variety of herbal plants, which may serve as key to unlock the many mysteries behind human pathologies. According to a World Health Organization (WHO) report, 80 % of the population in developing countries depends on traditional plants for health requirements. Among several infectious diseases, viral infections in particular, caused by a range of new and old infectious viruses, challenge the survival of mankind on this planet (Babar et al., 2013). In a timeline that reaches the present day, an epidemic of cases with unexplained low respiratory infections detected in Wuhan, the largest metropolitan area in China's Hubei province, was first reported to the WHO Country Office in China, on December 31, 2019. This new virus seems to be very contagious and has quickly spread globally. An additional landmark occurred on February 26, 2020, as the first case of the disease, not imported from China, was recorded in the United States. To date, however, many viruses remain without effective immunization and only few antiviral drugs are licensed for clinical practice. The situation is further exacerbated by the potential development of drug-resistant mutants, especially when using viral enzyme-specific inhibitors, which significantly hampers drug efficacy (Chen et al., 2006) Hence, there is an urgent need to discover novel antivirals that are highly efficacious and cost-effective for the management and control of viral infections when vaccines and standard therapies are lacking.

Herbal medicines and purified natural products provide a rich resource for novel antiviral drug development. Identification of the antiviral mechanisms from these natural agents has shed light on where they interact with the viral life cycle, such as viral entry, replication, assembly, and release, as well as on the targeting of virus–host-specific interactions. In this brief report, we have summarized about some potential medicinal plants which have impressive antiviral activity and also readily available in North East India.

Objective of the study

Since ancient times, herbs have been used as natural treatments for various illnesses, including viral infections due to their concentration of potent plant compounds. At the same time, the benefits of some herbs are only supported by limited human research. Objectives of this review are to gather and highlight the information on the antiviral activities from several natural products as well as herbal medicines available in North-east India against some notable viral pathogens.

Materials and Methods

The present study was limited to researches available in Google scholar, Science direct, Traditional knowledge digital library(TKDL), Delphion, Patentscope, Patestate, Patent Information Centre (PIC) ASTEC, Asian patent information, E-Gateways, United States Patent & Trademark Office (USPTO) patent database, European Patent Office (EPO), World Intellectual Property Organization (WIPO), Scirus with primary search words used were “antiviral”, “herbs”, “herbal medicine”, “herbal formulations”, “medicinal plants”, “traditional medicine”, etc. Searches were also done using the single name of the plant with known possible antiviral property. Bibliographies of included studies were also searched for additional references. Non patent prior art, i.e., journal publications, proceedings of conferences, etc. have been incorporated wherever possible to best extent of their availability and access.

Results and discussion

Considering the diversity and vastness of the plant kingdom in North-East India the area of antiviral plants explored so far is a mere trailer, leaving researchers with a huge scope to screen extensively and exhaustively several other plant species hailing from the same or different genus and families studied till date. Our attempt has been to enlist as many plants as possible with reported antiviral activity and their mechanisms elucidated thereof. We have also tried to retrieve information about the active molecules responsible for the said antiviral action after in-depth and exhaustive literature search.

Antiviral effects of several natural products as well as herbal medicines of North-East India against specific viruses:

1. *Origanum vulgare* L. (*Oregano/ Ban tulsi*):

Oregano is a popular herbal medicine having plant compound carvacrol which offer antiviral properties. It was found that both oregano oil and isolated carvacrol reduced the activity of Murine norovirus (MNV) within 10-20 minutes of exposure. MNV is highly contagious and the primary cause of stomach flu in humans. It is very similar to human norovirus and used in scientific studies because human

norovirus is notoriously difficult to grow in laboratory settings(Gilling et al.,2014).Oregano oil and carvacrol have also been shown to exhibit antiviral activity against herpes simplex virus type-1 (HSV-1);rotavirus, a common cause of diarrhea in infants and children; and respiratory syncytial virus(RSV),which causes respiratory infections(Pilau et al.,2011).

2. *Ocimum basilicum* L. (Basil/Ram Tulsi):

Basil may fight against certain viral infections. Study reveals that extracts of this plant has active compounds like apigenin and ursolic acid, exhibited potent effects against herpes viruses, hepatitis B, and enterovirus (Chiang et al.,2005).It has been shown to increase immunity, which may help fight viral infections by increasing the level of helper T cells and natural killer cells and thus help to protect and defend your body from viral infections (Mondal et al.,2011).

3. *Foeniculum vulgare* Mill. (Fennel/Guwamorisaa):

Fennel is a licorice-flavored plant that may fight certain viruses. It was found that extract of this plant exhibited strong antiviral effects against herpes viruses and parainfluenza type-3 (PI-3),which causes respiratory infections in cattle (Shamkant et al.,2008).The main component of fennel essential oil, has demonstrated powerful antiviral effects against herpes viruses (Astani et al., 2014).According to animal research, fennel may also boost your immune system and decrease inflammation, which may help to combat viral infections (Lee et al.,2015).

4.*Allium sativum* L. (Garlic/ Noharu):

Garlic is a popular natural remedy for a wide array of conditions, including viral infections. In a study in 23 adults with warts caused by human papillomavirus (HPV), applying garlic extract to affected areas twice daily eliminated the warts in all of them after 1–2 weeks. Additionally, studies reveals that garlic may have antiviral activity against influenza A and B, HIV, HSV-1, viral pneumonia, and rhinovirus, which causes the common cold(Bayan et al.,2014).Animal and test-tube studies also indicate that garlic enhances immune system response by stimulating protective immune cells, which may safeguard against viral infections (Arreola et al., 2015).

5. *Houttuynia cordata* Thunb. (Fish Mint/ Masunduri):

In northeastern India, it is commonly used in salads or cooked with other vegetables along with fish as fish curry and tender roots can also be ground into chutneys along with dry fish, chilies, and tamarind. *Houttuynia cordata* was used in traditional Chinese medicine, including by Chinese scientists in an attempt to treat SARS(Lau et al.,2010)and various other disorders, although there is no high-quality clinical research to confirm such uses are safe or effective. Sometimes it is

found that *H. cordata* can cause severe allergic reactions. Chemical compounds that contribute to the aroma of *H. cordata* include β -myrcene and 2-undecanone (Lu et al.,2010;Chu et al,2007.).

6. *Glycyrrhiza glabra* L. (*Jesthamadhu*):

Properties of glycyrrhizin are under preliminary research, such as for hepatitis C or topical treatment of psoriasis, but the low quality of studies as of 2017 prevents conclusions about efficacy and safety (Yu et al.,2017). The United States Food and Drug Administration believes that foods containing liquorice and its derivatives (including glycyrrhizin) are safe if not consumed excessively and should not be used during pregnancy. Other studies suggested that more than 100 mg to 200 mg of glycyrrhizin shouldn't be consumed per day which is equivalent of about 70 to 150 g (2.5 to 5.3 oz) of liquorice confectionery (Cinatl et al.,2007).

7. *Zingiber officinale* Roscoe (*Ginger/Adrak*):

Ginger has been shown to have impressive antiviral activity. Test-tube research demonstrates that ginger extract has antiviral effects against avian influenza, RSV, and feline calicivirus (FCV), which is comparable to human norovirus (Rasool et al.,2017). Additionally, specific compounds in ginger, such as gingerols and zingerone, have been found to inhibit viral replication and prevent viruses from entering host cells (Chang et al.,2008; Arora et al., 2011).

8. *Pyrrosia lingua* (Thunb.) Farw.:

There is a future expect of using *Pyrrosia lingua* against HSV1 but more and more studies will be needed to clarify it. Clinically, among the 78 cases of herpetic keratitis due to HSV1 treated by *Pyrrosia lingua* eye drops, a cure was affected in 38 and an improvement in 37, with 3 being of no benefit (Zheng et al., 1990)

As many viruses remain without preventive vaccines and effective antiviral treatments, eradicating these viral diseases appears difficult. Natural products serve as an excellent source of biodiversity for discovering novel antivirals, revealing new structure–activity relationships, and developing effective therapeutic strategies against viral infections. Many natural products and herbal ingredients are observed to possess robust antiviral activity and their discoveries can further help develop derivatives and therapeutic leads. A substantial number of plant extracts and phytochemicals have been explored for antiviral property. Herbal preparations owing to their holistic approach strengthen the body's immune system, which in turn may help the body fight against invading infectious viruses.

Conclusion:

Herbal antiviral compounds, which are accessible and do not require laborious pharmaceutical synthesis are emerging as interesting alternatives in present trends of growing resistance to antiviral drug therapy. There are lots of promising herbal treatments exist for viral diseases with adequate evidences of their efficacy and safety in advanced clinical trials. But, more studies are needed to determine optimal treatments, doses, and formula for those herbal preparations. Although herbal plant preparations are widely used in several parts of the world traditionally, individually or in combination, data about the interactions of these medicinal plants in the living system is non-existent. Therefore, the traditional medicine practice should be clubbed with scientific research facilitating modern drug discovery from phytochemicals. Scientific data pertaining to detailed pharmacokinetic and pharmacodynamics of medicinal plants and their preparations should be made available to researchers and policy makers so that larger randomized multicenter clinical trials may be designed and conducted. By adopting such approaches, the idea of incorporating and implementing a particular herbal formulation in routine therapy may be transformed into reality. As many studies in this line are only preliminary, further exploration in characterizing the bioactive ingredients, defining the underlying mechanisms, as well as assessing the efficacy and potential application *in vivo* is encouraged in order to help develop effective antiviral treatments. Furthermore, additional studies should also examine the possibility of combination therapies with other natural agents or with standard therapeutics, as a multi-target therapy may help reduce the risk of generating drug-resistant viruses. We believe that natural products will continue to play an important role and contribute to antiviral drug development.

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Chapter 18

Review on the drug *Makkaya Kshara*

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Abstract

In Ayurvedic system of medicine there are various natural product which are possessed and used as medicine. It has been classified into different categories of dosage form in Ayurvedic pharmaceutical. *Kshara Kalpana* is one of them. It has been considered to be the best among *Anushastra*. *Kshara* are the substances derived from the ashes of medicinal plants. It is a product, which contains many alkaline substances, prepared by evaporating method, which may be used as single or compound or in a mixture form. *Makkaya* (corn silk) is an herbal remedy made from stigmas, the yellowish thread-like strands found inside the husk. *Kshara* has been used for the treatment of various diseases like *Mutrashmari*, *Bhagandara Vidradhi* etc. This article reviewed the details effects of *Makkaya Paneeya Kshara* in different disorders. Thus, *Kshara Karma* can be taken as the substitute for some surgical procedures, because they can be used safely on the patients who are scared of surgery.

Key words: *Kshara Kalpana, Makkaya Paneeya Kshara, Kshara karma.*

Introduction

Herbs, metals, minerals and animal products are among the health resources which has always been on topmost priority for human beings since the ancient times. Ayurveda has shown various paths to use these resources in medical treatment. In Rasa Shastra the pharmaceutical branch of Ayurveda has described the use of these resources in a very descriptive way by formulating various medicines to treat human diseases (Shastri, 1989). *Kshara* (alkaline substances) is one among them. *Kshara* is a medicament obtained from ash of one or more plants, animal and mineral products (Murthy, 2010). The method of preparation of *Kshara* includes the extraction of 'alkalies' from ash of dried plants. It is said that the disease which are difficult to treat can be cured by *Kshara* therapy (alkaline therapy) (Murthy, 2010). *Kshara* therapy not only minimizes the complications but also reduced the recurrences of diseases. *Kshara* can reduce the chances of post-surgical infections due to its alkaline (Sharma, 2010). *Kshara* can be used both internally and externally. The characteristics features of *Kshara* i.e. alkalinity, not only responsible for the conversion of one metal/ mineral into medicine through the process of *Shodana* (Sharma, 2008) (purification), *Sattvapatan* (Mishra, 2011) (metal extracting), *Marana* (incineration) and also contradict the ill effects of poisonous drugs as antidote (Jha, 2011).

Acharya Susruta has explained *Kshara* in scope of *Shayla Tantra* (Surgical branch) due to its action like *Chedana* (excision), *Bhedana* (incision), *Lekhana* (scrapping) etc (Murthy, 2008). *Acharya Charaka* has mentioned two types of *Kshara* preparations i.e.

- 1) *Bahya Parimarjaniya* (external use e.g. *Kshara Jala* – alkaline water).
- 2) *Antah- Parimarjaniya* (which is prepared from burned drugs by *Antahdhuma method*) (Sharma, 2011).

Classification of Kshara:

On the basis of their mode of application:

- 1) *Pratisaraniya Kshara* (external use).
- 2) *Paneeya Kshara* (internal use).

On the basis of Origin:

- 1) *Vanaspatijanya*: Obtained from the plant sources e.g. *Apamarga Kshara*, *YavaKshara*.
- 2) *Pranijaya*: Obtained from the animal sources e.g. *Shankha*, *Kapardika*, *Pravala* etc.
- 3) *Khanijajanya*: Obtained from the mineral origin e.g. *Tankan* (Borax), *SarjiKshara*, *Surya Kshara* etc.

On the basis of Season of preparation:

- 1) *Uttama*(best): Prepared in *Greeshma* (summer season).
- 2) *Madhyama* (medium): Prepared in *Sharad* (autumn season).
- 3) *Adhama* (bad): Prepared in *Varsha* (rainy season).

Properties of Kshara:

Table 18.1. Different Ayurvedic literature described the properties of *Kshara* (Sharma, 2007):

Sl. No	Charaka Samhita (Sutra Sthana 27/366)	Susruta Samhita (Sutra Sthana 11/16)	Astanga Hridaya (Sutra Sthana 24)	Rasa Tarangini (14/ 62-63)
1	<i>Tikshna</i> (sharp penetrating action)	<i>Nati- Tikshna</i> (not excessively sharp)	<i>Nati- Tikshna</i> (not excessively sharp)	<i>Tikshna</i> (sharp penetrating action)
2	<i>Ushna</i> (hot)	<i>Natimridu</i> (not excessively soft)	<i>Natimridu</i> (not excessively soft)	<i>Atyanta Ushna</i> (very hot tempearture)
3	<i>Laghu</i> (light)	<i>Sighrakari</i> (having rapid action)	<i>Sita</i> (cold)	
4	<i>Ruksha</i> (dry)	<i>Slakshna</i> (smooth texture)	<i>Natiruksha</i> (less dry)	<i>Krimighna</i> (wormicidal)
5	<i>Kledi</i> (oozing)	<i>Picchila</i> (sticky)	<i>Picchila</i>	<i>Pachaka</i> (digestive)
6	<i>Dahana</i> (cauterization of bleeders)	<i>Abhisyandi</i> (obstructive)	<i>Sukhanirvapy</i> (quenching)	<i>Dahaka</i> (corrosive)
7	<i>Darana</i> (bursting)	<i>Sita</i>	<i>Sighragani</i> (having rapid digestive fire)	<i>Shodhana</i> (purification)
8	<i>Lekhana</i> (scratching)	<i>Shikhari</i> (do not move when placed)	<i>Slakshna</i> (slimy)	<i>Mutrala</i> (Diuretic)
9	<i>Dipana</i> (digestive)	-	<i>Avisyandi</i> (immobile)	<i>Ropana</i> (Healing)
10	<i>Chedana</i> (cutting or excision)	-	-	-

Corn silk (*Zea mays*) is an herbal remedy made from stigmas, the yellowish thread-like strands found inside the husks of corn. These stigmas are usually the waste materials from corn cultivation. The drug which possessed diuretic, anti-hyperlipidaemic as well as anti-inflammatory properties. Corn silk is mainly used to treat urinary tract infections and kidney stones in adults. Corn silk also serve as a remedy for heart trouble, jaundice, malaria and obesity. Corn silk is rich in Vitamin K, making it useful in controlling of bleeding during child birth (Karmakar, 2013).

Dose of *Kshara*:

Table 18.2. Doses of *Kshara*.

Sl. No	Types	Quantity
1	<i>UttamaMatra</i>	1 <i>pala</i> (48 ml)
2	<i>MadhyamaMatra</i>	3 <i>karsha</i> (36 ml)
3	<i>HeenaMatra</i>	½ <i>pala</i> (24 ml)

Indications of *PaneeyaKshara* (Sharma, 2007):

It is indicated in *GaraVisha* (artificial poison), *Arochaka* (tastelessness), *Krimi*, *Gulma* (tumors), *Anaha* (constipation), *Visha*, *Udararoga* (GIT disorders), *Arsha*, *Agnimandya* (loss of appetite), *Ashmari* (renal calculi), *Ajirna* (indigestion), *Arsha*, *Bhagandara*, *Ashmari*, *Gulma* and *Udararoga*.

Makkaya which has been prepared in the form of *Paneeya Kshara* was prepared and hence to evaluate its management in different disorder will be reviewed in this article.

Method of Preparation:

Method: Open method

Drug Required: 150kg of dried *Makkaya Roma* (Silk hairs of *Zea mays*).

Preparation of the Drug at Pharmacy:

150kg of dried *Makkayaroma* was spread in an open field. Small quantity of dried hairs was initially burned using fire and subsequently the remaining quantity was added slowly into the fire to ensure complete burning. Drug gets burned quickly and converts into white ash. The maximum temperature during burning was approximately 75-100°C. Totally it took a whole day for entire burning. After that the resultant ash was kept undisturbed for *Swangashita* (Self cooling).

Preparation of *Kshara Jala*:

Ksharajala was prepared by using 6 parts of water for dissolution of alkaline material from ash into the water. The content was rubbed along with water and allowed to settle overnight. The *Ksharajala* was taken after filtration by using three folded white cloth.

Preparation of *Makkaya Paneeyakshara*:

MakkayaPaneeyakshara was obtained by *Nirjali Karana* [evaporating the water content from the filtrate] in open vessel.

Phytochemical analysis of compound drug:

Phytochemical Analysis of *Kshara: Makkaya Paneeyakshara* was analysed at Vasu Research Centre 2018, Vadodara-31960.

Results**Table. 18.3. Showing the Organoleptic characters of *Makkaya PaneeyaKshara*.**

Sl. No	Properties	Characteristics
1	Colour	Greyish white
2	Appearance	Course powder
3	Touch	Smooth
4	Taste	Alkaline
5	Odour	characteristic odour

Phytochemical parameters:

Makkaya Paneeyakshara was evaluated for various physio-chemical analyses like loss on drying, total ash, Acid insoluble ash, Water soluble extract, Alcohol soluble extract, pH. The results were shown in table No. 18.3.

Table 18.4. Showing the Phytochemical parameters of *Makkaya Paneeya Kshara*.

In-house ID: AD/17/113

Sl.No	Parameters	Result
1	pH (1% solution)	10.88
2	Loss on drying	2.34%
3	Total ash	84.43%
4	Acid insoluble ash	80.11%
5	Water soluble extractive	94.12%
6	Alcohol soluble extractive	30.55%

Preservation:

Prepared *Kshara* should be stored in airtight glass container in order to prevent from the moisture content.

Shelf life:

It has infinite shelf life but it has to be stored in airtight containers for preventing it from exposure to the atmospheric conditions.

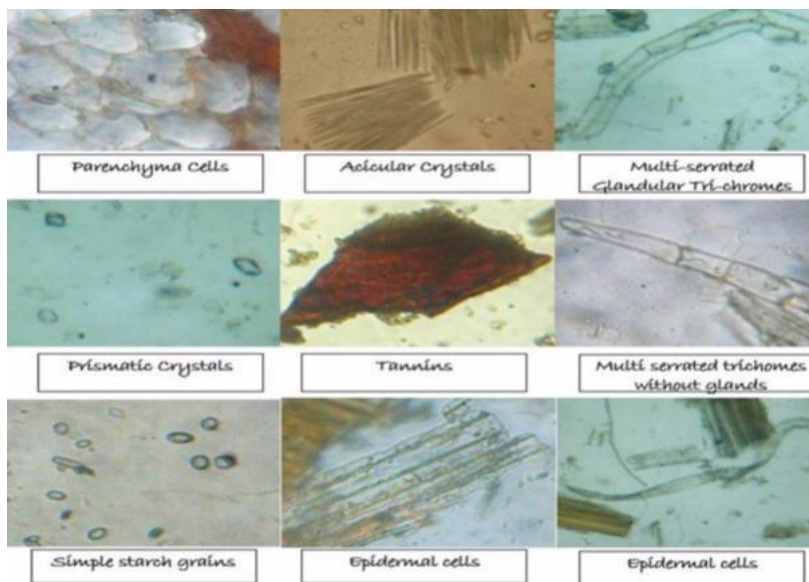
Pharmacognostical study:

The Pharmacognostical study of the Ingredients of trial drug – Makkaya Paneeyakshara was carried out in the Pharmacognosy laboratory, Parul Institute of Ayurved, Parul University, Vadodara. *Paneeya Kshara* of the trial drug was used for macroscopic, microscopic studies were carried out. Standards mentioned in API (Hasanudin, 2012), Quality Standards of Indian Medicinal Plants (Sharma, 2013), Database on Medicinal Plants used in Ayurveda (Jayaraman et al., 2018) are taken as reference for authentication.

Pharmacognosy of *Makkaya Paneeyakshara*:

Organoleptic characteristics Greyish white in colour, alkaline taste with Characteristic odour. **Microscopic features of whole Plant:**

Acicular crystals, Prismatic crystals, Parenchyma cells, Epidermal cells, Simple fibres, Multi serrated Trichomes with and without glands, Simple starch grains, Tannins.



Discussion

Corn (*Zea mays*) and corn silk (*Stigma maydis*) have not been mentioned anywhere in Ayurvedic classics. But in later period, there is an evidence of the word *Makkaya* (Hasanudin, 2012) (Indian corn) but no detailed description can be found. *Makkaya* has been used for various medical purpose for therapeutic used like diuretics, anti-inflammatory, anti-hyperlipidaemia effects etc. (Sharma, 2013). In

South India, this corn silk has been used by folklore practitioners with drastic effects in gall stones as well as bladder stone.

This prepared *Makkaya Kshara* does not have any explanation regarding its properties and its probable mode of action in our classics but can be considered along with predictable properties of any Kshara. The Kshara having the properties of “*Ksharanat*” (corrosive effect) might have probably acted mechanically on the calculi on the calculi to disintegrate its molecules thereby resulting into lithotriptic action (Jayaraman, 2018). *Acharya Susruta* said that *Asamshoditasheelata* (uncorrected system) and *Mithyahara Vihara* (incompatible food and activities) which causes of increase of *Kaphadosha* by *Srotovaigunya* (derangement of channels) leads to *Ashmari*(Calculi). It is mainly due to the obstruction of *Kapha-Vatadosha* (Jayaraman, 2018). So, *Makkaya* was (corn silk) was formulated into *Kshara* (Caustic alkali) dosage form. *Kshara* is considered as the *pradhanatam* (Superior) and *Sreshtha* (best) in *Shastra* (Surgical procedures) and *Anushastra* (Para- Surgical procedure) due to its *Chedhana* (cuts), *Bhedana* (splits), *Lekhana* (scraps), *Mutrala* (Diuretics) and *Tridoshaghna* (pacifies morbid *doshas*) properties. The *Makkaya Kshara* possess the properties as of *Makkaya* hairs but with more potency because of preparatory methods. *Makkaya Kshara* breaks the *Kapha-vatadosha* obstruction which can be achieved by *Ksharana* property and *Doshapratyanika Chikitsa* (antagonistic to the humour) due to its *Tikta rasa* (Bitter taste), *Laghu Rukshaguna* (Light-dry property), *Ushna Veerya* (Hot potency) and *Katu Vipaka* (pungent post digestive effect). The *Pachana* (owing of digestive capability) and *Daranagunas* (Breaking) of the drugs helps in breaking the *Sanghata* (obstruction) of *Ashmari* (Renal calculi) and helps in dissolution and disintegration of stone, i.e., urolithiatic property. The purificatory and diuretic properties help to expel out the stones from urinary tract and reduce the burning micturition, i.e., diuretic property. The *Ropana* (Healing) property of drugs helps in reducing the haematuria by healing property.

According to Ayurveda, all the three *Doshas* viz. *Vata*, *Pitta* and *Kapha* play a major role in formation of gallstone. Excessive increase of *Pitta* (caused by hot, spicy food, alcohol etc) creates the basis for stone formation, *Kapha* increased by fatty, heavy sticky mixture. The *Vata* dries this mixture and moulds it into shape of a stone. Cholelithiasis has been compared with *Pittashayashmari* in Ayurvedic system. The *Makkaya Kshara* by its *Ksharana* property exerting the *Pitta* and pacifying the *Kapha* due to its *Tikta Rasa*, *Laghu Rukshaguna*, *Ushnaveerya* and *Katuvipaka* property. The motility of gall bladder is improved due to the *Vata Anulomana* property of *Kshara* and due its *Prabhava* thus the stone gets dissolving and correcting the metabolic causes to prevent the further formation of *Pitta Ashmari*. *Tikta Rasa* by its *Pittasamana* property helps to reduces the chemical irritation of the inflamed gall bladder to reduce the *Shoola* (pain). *Agni Mandya* is caused due to *Adhmana* along with *Annadvasha*. *Makkaya Paneeya Kshara* acts by causing *Vata Anulomana* and

correction in *Dravyatah Vriddhi* and improvement in the *Guna and Karma* of *Pachaka Pitta*¹⁹.

Based of action based on modern science:

Corn silk has been used for the treatment of cystitis, oedema, kidney stones, diuretics, prostrate disorder and urinary infections as well as bedwetting and obesity. It soothes and relaxes the lining of the bladder and urinary tubules, hence reducing irritation and increasing urine secretion. Other beneficial treatments of Corn silk include anti- fatigue activity, anti- depressant activity and kaliuretic. In addition, it also possessed excellent anti- oxidant capacity and demonstrated protected effects in radiation and nephrotoxicity. Corn silk is rich in phenolic compounds particularly flavonoids (Reips&Funke,2008) which shows significantly lowering effects on the level of TC, TG, LDL and increasing the level of HDL, thereby it helps in liquefaction of stones formed due to cholesterol.

Conclusion

Kshara is one of the important dosage forms mentioned in *Ayurveda*. The alkaline nature of *Kshara* can be helpful to neutralized the hypertonicity as well as acidity of urine itself. So, *Makkaya Paneeya Kshara*, by its *Ksharanat* property helps in reducing the stone size in different disorder like *Pittasaya Ashmari* as well as *Ashmari* etc.

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Chapter 19

Understanding of Diabetes mellitus diet – An integrative approach

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Abstract

The entire human race is facing the engulfing problem of Diabetes Mellitus (DM) with new formulations and treatment modules developing. Along with therapeutics, diet plays a very pivotal role in managing DM. The modern dietetics throw a lot of inputs in designing the diet pattern for DM. In this present review study, an input in drawing awareness in the available diet pattern along with how Ayurveda can help in re-modelling the dietary pattern for DM in an integrated approach is discussed.

Keywords: Diet, Diabetes Mellitus, Integrated approach.

Introduction

Food and health have always been connected. Throughout history our ancestors survived on a variety of diet. What pre-historic humans ate in any particular geographic area depended in large part on the climate in which they lived, their hunting and gathering skills, their processing technology and available foods. Today many diseases are known to be linked to lifestyle behaviours such as smoking, lack of adequate physical activity and poor nutritional habits. The association of Diabetes mellitus with Diet as the etiology for Diabetes mellitus has been studied (Evert et al., 2014). The ancient Indian system of medicine Ayurveda while describing about the etiopathogenesis of Diabetes Mellitus which can be understood under the concept of *Prameha* has elaborately described the role of Diet in causing the disease (Campbell, 2017). Apart from being the causative factor diet has been considered as a part of treatment module in *Ayurveda*. In the modern science too, there is a trajectory towards the diet responses for maintaining Diabetes Mellitus for example, Low calorie diet and other popular diet like carbohydrate and ketogenic diet, vegan diet and Mediterranean diet etc. But what role do they play in Indian phenotype constitution seeks answers. It has been observed that low carbohydrate diet even though it is effective in reducing body weight and in patients with Type 2 it helps in maintaining glycemic control, but, the risk of cardiovascular diseases cannot be ignored (Ley et al., 2014). In this review paper we will discuss the role of Diets in managing Diabetes mellitus through an integrative approach. Integrative and functional medical nutrition therapy is a term used to identify an application of medical nutrition therapy that incorporates both integrative and functional medicine principles and conventional (mainstream/Western) nutrition practices.

Materials and Methods

Scrutiny of literature

Systematic literature searches with the keywords “Diabetes Diet and Ayurveda relevant to the field of Medical Science were carried out from different bibliographical databases via electronic search (using Pubmed, SciFinder, Scopus, Scirus, Science Direct, Google Scholar and Web of Science) and a library search for articles published in peer-reviewed journals and also locally available books. The classical textbooks of Ayurveda like Charak Samhita, Chakradatta, Bhavaprakash etc.

Result & Discussion

Following the consort guidelines, around 30 articles were reviewed and out of which only 10 (Jamy et al., 2004; Sharma & Chandola, 2011; Evert et al., 2014; Ley et al., 2014; Campbell, 2017; Neuenschwander et al., 2019; Chester et al., 2019;

Bolla et al., 2019; Noland & Raj, 2019) were considered for the study based on the relevance to the study title. For the Ayurveda part, classical textbooks were studied thoroughly and the pathya (Diet) have been highlighted in the charts.

Diets for Diabetes Mellitus as per Modern nutrition:

Dietary guidelines for the management of diabetes have evolved from a focus on a low-fat diet to the recognition that more important considerations are macronutrient quality (that is, the type versus the quantity of macronutrient), avoidance of processed foods (particularly processed starches and sugars), and overall dietary patterns. These guidelines exist (in many settings there are none or they are adapted from those in developed countries and therefore may not be applicable to the local situation), they vary substantially in whether they are evidence based or opinion pieces, and updated in line with scientific progress or outdated. Their accessibility—both physical availability (e.g., through a website or clinic) and comprehensibility—for patients and healthcare professionals varies. They vary also in scope, content, detail, and emphasis on the importance of individualised dietary advice, areas of controversy, and further research needs. The ADA also recognizes the integral role of nutrition therapy in overall diabetes management and has historically recommended that each person with diabetes be actively engaged in self-management, education, and treatment planning with his or her health care provider, which includes the collaborative development of an individualized eating plan. A thorough look into the available resources on the dietary plan are as follow-

DIET	BENEFITS	Drawback-
The DASH Diet	Curative: The DASH (Dietary Approaches to Stop Hypertension) eating plan is an acceptable eating pattern for people who have diabetes. Preventive: The DASH eating plan or DASH-like eating plans have also led to improvements in insulin sensitivity, further demonstrating that this type of eating plan may be helpful for individuals with prediabetes or who are at risk for type 2 diabetes	55% carbohydrate is included in the diet.
The Mediterranean Diet	As a result, the term “Mediterranean-style diet” is currently used in the literature in order to describe not a specific diet, but rather a collection of dietary habits traditionally followed by the populations of countries bordering the Mediterranean Sea. Preventive: In addition to its beneficial effect on body weight, the unique combination of foods and nutrients found in the MD has been proposed to be beneficial for T2DM prevention and treatment. In particular, the high consumption of fruits, vegetables, legumes, nuts, whole-grain cereals and olive oil encouraged in the MD, leads to	

	a high ratio of monounsaturated to saturated fatty acids, a low intake of trans fatty acids and a high intake of dietary fiber and antioxidants	
Mark Bittman's VB6 Diet	The VB6 Diet focuses on being a vegan about 75% of the time. Research shows a well-planned vegan diet can be good for health and weight, so it's likely that being vegan most of the time has the same benefits.	Although the recipes aren't necessarily low fat, they include healthy fat sources, and salt can be easily controlled during cooking. If you have diabetes, you can continue to count carbs to control blood sugar.
The Volumetrics Diet	The primary focus is filling up on foods that are naturally low in calories and high in fiber or water—think fruits, veggies, and soups. “Since carbohydrates and proteins both provide four calories per gram, and fat provides nine calories per gram, you can eat more [carbs and protein] without the excess calories.	
The Biggest Loser Diet	The Biggest Loser eating plan promotes weight loss by restricting calories (1,200–1,500 calories per day) and encouraging a diet comprising nutrient-dense, whole foods.	It can curb your calorie intake excessively — and it can be difficult to maintain.
American Diabetes Association Carbhydrate Counting	Carb counting at its most basic level involves counting the number of grams of carbohydrate in a meal and matching that to your dose of insulin.	
Ornish Diet/The Spectrum	calories are unrestricted unless you're trying to lose weight. Small frequent meals spread throughout the day will help you to avoid hunger and keep your energy levels constant. Portion control will assist you in reaching and maintaining a healthy body weight and controlling blood sugar levels. Non-fat dairy foods (no more than 2 servings/day) and egg whites are included.	

Weight Watchers	<p>Weight Watchers does not forbid specific foods or tell people what to eat.</p> <p>Weight Watchers offers two diet plans: -</p> <ol style="list-style-type: none"> The points plan: In the points plan, foods are assigned a certain number of points based on the food's calorie, total fat, and dietary fiber content. The core plan: The core plan is based on the consumption of wholesome foods from all the food groups, including fruits and vegetables, grains and starches, lean meats and poultry, and eggs and dairy products. 	
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Diet as per Ayurvedic concept

Along with this modern diet plan, Ayurveda emphasises on dietary behaviour along with dietary do's and don'ts for diseases targeting the preventive aspect as well as the therapeutic aspect. Understanding the etio-pathogenesis of DM from Ayurveda perspective, we can develop a diet module based on the following parameters:



Fig.19.1. Diet module.

Traditionally, the following chart-1 shows the variety of food combination in Diabetes mellitus from Ayurveda aspect-

Chart-1

Diabetes mellitus Diet according to different scholars-	Pathya	Gurvadiguna/nutritional value
CharakChikitsa-sthana	<ol style="list-style-type: none"> 1) Laghu food 2) Meat of viskir and pratud 3) Danti (<i>Baliospermum montanum</i>) 4) Ingudi (<i>Balanites aegyptiaca</i>) 5) Atasi (flax seed) 6) Sarsapa(mustard) 7) Shati rice 8) Trina dhanya(Millet) 9) Sattu(Powder of yava) 10) Jambu seeds 	<ol style="list-style-type: none"> 1)Laghu 2) Laghu/ 3) Guru/ 4)Laghu/fruits are antihyperglycaemic. 5)Guru/ decrease insulin resistance in pre-diabetics 6) laghu/ Flavonoid antioxidants protect from Type-2 7) Laghu/Low GI 8)Laghu/ High fibre content 9) Less Glycaemic index than Rice. 10) Guru/jamboline and jambosine that slow down the rate of sugar released into the blood and also increase the insulin levels in the body.
Chakradatta	<ol style="list-style-type: none"> 1) Syhamaka (millets) 2) Kodruva (Kodo millet) 3) Goudhuma (wheat) 4) Chanaka (Bengal gram) 5) Arhar dal (Pigeon dal) 6) Amla 7) Honey 	<ol style="list-style-type: none"> 1.Katu, Ushna /Magnesium content helps to balance the blood sugar 2)Laghu/Rich source of dietary fibre, anti-oxidants and iron. 3)Guru / Whole wheat and whole grains are lower on the glycemic index. 4) laghu/ low glycemic index and high fibre. Laghu/Good source of complex carbohydrates, low Glycemic index. Guru/Helps insulin resistance and balances blood glucose. Laghu/Fructose has a lower glycemic index of 19.

	8) Haldi(Turmeric) 9) Lodhra (<i>Symplocos</i> tree) 10) Parval(Pointed gourd) 11) Nimba 12) Sotha (Saussurealappa) 13) Maricha 14) Pippali	Laghu/Haridra halts the progression of Pre-diabetes to diabetes. Laghu/ Laghu/ It helps in prevention of Diabetes mellitus. Laghu/It helps in reducing and balancing Blood glucose. Laghu Laghu/ Laghu/ hypoglycaemia
Yogaratanakar	1) Bhuiamalakhi 2) Vanakoda 3) Shali(Red rice) 4) Mudga(Green gram) 5) Kulatha(Horse gram) 6) Yava(Barley) 7) Bitter vegetables 8) Jangalamamsa 9) Saindaiva salt	1. Laghu, kaphapittasamaka/ Hypoglycaemic 2)Laghu 3)Laghu/nutraceutical 4) Laghu/ improved glucose tolerance and increased insulin immunoreactive level 5) Laghu/ reduce post-prandial hyperglycemia 6)Guru/Less Glycaemic index than Rice 7)Laghu/Hypoglycaemia 8) Laghu 9) Dipana/ Low sodium level

Conclusion

The review paper on integration of Dietary Pattern is the need of hour. The global incidence of Diabetes mellitus is pushing the young generation to vulnerable health group. Management of Diabetes Mellitus through oral glycaemic and insulin is showing results but prevention of a disease should be the prime focus for the new generation. Modern nutrition has many dietary patterns, and Ayurveda has also described pathya (Wholesome food) for every disease. So, merging the concepts of modern diet and Ayurveda, a complete diet pattern may be the solution of preventing and managing the burden of Diabetes mellitus.

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The Book

The book is a collection of 19 articles on folk medicine, ethnobotany, ethnozoology, ayurveda and other aspects of botanical research in North Eastern India authored by different experts in their respective fields. The book is a noble attempt to compile the research articles on folk medicine, medicinal plant diversity and ethnobotany to identify gaps of research works in the field of traditional medicine and ethnobotany in North Eastern India.

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