# STUDY OF MEDICINAL PLANTS IN EASTERN HIMALAYAN MONTANE FORESTS OF MIZORAM

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**TANHRIL, AIZAWL**

**2013**

# STUDY OF MEDICINAL PLANTS IN EASTERN HIMALAYAN MONTANE FORESTS OF MIZORAM

**A THESIS**
**SUBMITTED TO**
**THE MIZORAM UNIVERSITY**
**IN FULFILLMENT OF**
**THE DEGREE OF DOCTOR OF PHILOSOPHY**
**IN**
**FORESTRY**

**BY**
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**2013**

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# Certificate

*This is to certify that a Ph. D thesis entitled, "Study of Medicinal Plants in Eastern Himalayan Montane Forests of Mizoram" submitted by Mr. R. Lalrinkima, Research Scholar in the Department of Forestry, Mizoram University Aizawl, embodied the record of original investigation under my supervision. I further certified that the thesis and the outcome of the research work is the first of its kind ever carried out in Mizoram. The content of the thesis and the part or parts thereof have not been borrowed from any other thesis nor does it submitted for the award of any degree in this or any other University or Institute.*

*He is allowed to submit the Thesis for examination for the Award of the Degree of Doctor of Philosophy in Forestry.*

Dated Aizawl,
the 17th June 2013

(DR. LALNUNDANGA)
Professor & Supervisor
Department of Forestry

# Declaration

*I, R. Lalrinkima, do hereby declare that the thesis entitled "Study of Medicinal Plants in Eastern Himalayan Montane Forests of Mizoram" is a record of work done by me under the supervision and guidance of Dr. Lalnundanga, Professor, Department of Forestry, Mizoram University. The Thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the Thesis has not been submitted by me for any research degree in any other University/Institute.*

*This is being submitted to the Mizoram University for the Degree of Doctor of Philosophy in Forestry.*

(R. LALRINKIMA)
Candidate

# ACKNOWLEDGEMENT

It gives me a great pleasure to express my deepest gratitude and honor to my supervisor Dr. Lalnundanga, Professor, Department of Forestry, Mizoram University, Aizawl, Mizoram for rendering constant guidance, valuable suggestions, immense knowledge and encouragements during the course of study to produce this thesis. I would also like to thank to Dr. B. Gopichand, Professor and Head, Department of Forestry for his help to produce this thesis.

I acknowledge my heartfelt thanks to Mr. Samuel Lalenkawla, Mr. Jimmy Zairemmawia, Mr. David Lalrinawma, Mr. H. Lalhmunsiama, Mr. R. Lalhminghlua (L) and Mr. V.L. Rinpuia for their help and assistance during the field work.

I am very grateful to my friends Mr. R.K. Lalrinpuia, Mr. Vanlalnghaka Fanai and Mrs. Biakthanpuii for their help in computer works.

Kind help in identification and consultation of herbarium by the scientists of Botanical Survey of India, Eastern Circle, Shillong, is greatly acknowledged.

I am immensely thankful to Damteii, Becki, Marovi, OP-a and Maruata, Department of Forestry, Mizoram University for their support.

I gratefully acknowledged the contributions, help and support of my colleagues and friends Dr. Alfred Malsawmsanga, Dr. Lalchawimawii, Dr. Lalchhuanawma, Mr. Vanlalfela, Mr. Lalhmachhuana and Mr. F. Lalbiakmawia without whom the completion of this study would not have been possible.

I would also like to express my sincere thanks to Ms. Lalbiaksangi Chawngthu, Associate Professor, Department of English, Pachhunga University College for her valuable help in completing my thesis.

I would also like to express my deepest thanks to my parents Mr. Solfathanga and Mrs. F. Sungkawii, my sisters Helen Lalrinsangi, Lalrintluangi Ralte and R. Lalrinpuii and all other members of my family for their encouragement, moral support and prayers.

I am deeply grateful to my beloved wife Mrs. Laldinpuii Chawngthu, my daughters R. Lalnuntluangi, R. Lalrinawmi, R. Lalnunkimi and my son R. Lalrinchhana for their moral support, inspiration and prayer during my work.

I also like to thank all those whose names have not mentioned but have helped directly or indirectly during the course of my study.

Financial support received from the University Grants Commission, Government of India, in the form of Rajiv Gandhi National Fellowship is greatly acknowledged.

Above all, I thank the Almighty God for His blessings in each and every day of my life.

17th June, 2013 . (R. LALRINKIMA)

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## LIST OF ABBREVIATIONS USED

| | | |
|---|---|---|
| AC | - | Alternating Current |
| Anon. | - | Anonymous |
| AICRPE | - | All India Co-ordinated Research Project on Ethnobiology |
| BC | - | Before Christ |
| cm | - | centimetre |
| conc. | - | concentrated |
| c.,ca | - | confer: compare circa, circiter: above |
| diam. | - | diameter |
| DTL | - | Digestion Tube Large |
| E | - | East |
| etc. | - | *et ceteri or cetera* ; or any other |
| *et al.,* | - | *et alii;* and others |
| FI | - | Flora of India |
| Fl. | - | Floret; flower |

| | | |
|---|---|---|
| FRLHT | - | Foundation for Revitalisation of Local Health Traditions |
| Ft | - | Feet |
| g/gms | - | gram(s) |
| ha | - | hectare |
| IBK | - | Indigeneous Botanical Knowledge |
| inch. | - | inches |
| IPNI | - | International Plant Names Index |
| ITK | - | Indigeneous Traditional Knowledge |
| IUCN | - | International Union for Conservation of Nature and Natural resources |
| i.e. | - | *id est*: that is |
| Kg | - | Kilogram |
| L | - | Litre |
| M | - | Mole |
| m | - | metrum : metre |
| ml | - | millilitre |
| mm | - | millimetrum : millimetre |
| mμ | - | milimicron |
| m.asl | - | metre above sea- level |
| N | - | Normality |
| N | - | North |
| NMPB | - | National Medicinal Plants Board |
| No. | - | Number |
| Photo | - | Photographs |
| Pl. | - | Plate |

| | | |
|---|---|---|
| ppm | - | Parts Per Million |
| p., pp. | - | *pegina :* page or pages |
| sec. | - | second |
| Sp;spp | - | Species (singular) Species (Plural) |
| sq.km | - | square kilometre |
| TKS | - | Traditional Knowledge System |
| UNDP | - | United Nations Development Programme |
| UNESCO | - | United Nation Educational Scientific and Cultural Organization |
| US | - | United States |
| USA | - | United States of America |
| viz. | - | *videlicet:* namely |
| vol. | - | volume |
| WHO | - | World Health Organisation |
| Wt. | - | Weight |
| $^0$F | - | Degree Fahrenheit |
| $^0$C | - | Degree Celcius |
| µg | - | Microgram |

# CHAPTER - 1

# INTRODUCTION

Plants have always been a major component of traditional system of healing in developing countries, which have also been an integral part of their history and culture. Medicinal plants offer alternative remedies with tremendous opportunities. Many traditional healing herbs and plant parts have been shown to have medicinal value especially in the rural areas and that these can be used to prevent and cure several human diseases. Even to day, majority of the world population depends on herbal healthcare practice. The strategic importance of reviving indigenous medical practices to provide safe and affordable primary healthcare to the people of the world is now recognized. During the last two decades or so, WHO's health Assembly has passed a number of resolutions in response to this resurgence of interest in the study and use of traditional medicines and in recognition of the importance of medicinal plants to health care of people in many developing countries (Subramoniam, 2001).

Traditional systems of medicine, whether they are of Indian, Chinese, Tibetan, Thai, Vietnamese and other origins, have evolved over several hundreds or thousands of years through transfer of knowledge, usage, and practices from generation to generation. These systems utilize the resources of plant and animal kingdom. Plants are the major source among them, as they are a treasure house of potential drugs.

The indigenous traditional knowledge of medicinal plants of various ethnic communities, which were transmitted orally from generation to generation for many centuries, is fast disappearing from the face of the earth due to the advent of modern technology and transformation of the traditional culture. For this purpose ethnobiologists have great responsibilities, they need not only inventories these medicinal plants but help conserve and revitalize the traditional culture and beliefs and also safeguard this knowledge from being misused by the modern societies.

## 1.1 HISTORICAL BACKGROUNDOF MEDICINAL PLANTS

Records of early civilizations of the world reveal that a considerable number of drugs used in modern medicine were in use even in ancient times. The use of plants for curing various diseases figured in manuscripts such as The Bible, The Rig-Vedas, The Iliad and The Odyssey and the History of Herodotus (Kochar, 1998). The ancient Chinese used medicinal plants 6000 years ago. The Babylonians, Egyptians, Greeks, Romans and Sumerians, all developed their respective characteristic *Materia Medica*. On the other side of the world, the Aztecs, Mayans and Incas had developed primitive medicines. The oldest and most comprehensive Chinese work about herbal drugs the "Yellow Emperor's Internal Classic" was dated 300 B.C. Ancient Egyptian textbooks 'Papyri' (such as Edwin Smith Papyrus and the Ebers Papyrus), written as early as 1600 B.C., indicate that the Egyptians had an amazingly complex *Materia Medica.* These textbooks contained names of medicinal plants then known and prescriptions for several diseases (Samuel, 2004).

Initially, the plants were part of folk – medicine practiced by ancient man in different parts of the world, which include India, China, the Middle East, Africa and South America. The same herbs, trees and shrubs employed by ancient people have continued to be valued through the ages – by Egyptians, Greeks, Romans and Indians. In the long struggle to achieve mastery over powerful forces of nature, man has always turned to plants for help. When pain, injury or disease struck early man, he had little choice but to come to plants.

Around 90 percent of the medicines were of plant origin until 1930 (Swain, 1972). The period of chemotherapy began in the 1930s, with the synthesis of sulphonamides. The era of antibiotics began in the following decade, when the Second World War ended. From the 1960s, over 75 percent of all standard medicines are of synthetic origin, lowering medicines of plant origin to a secondary role (Rao, 2000).

With the advancement of western medicine, the indigenous systems were overshadowed, although it survived the test of time and competition from vastly popular allopathic system. With the emergence of environment concept and popularization of environment friendly activities, the herbal medicare system also revived with the result that a sudden herbal drug boom emerged during last three decades (Pushpangandhan and Nair, 1997; Rao, 2000). The western society now recognized the great potential of the herbals in healing many present day ailments. This has now resulted in high-level market demand for such herbs and herbal derived products (Hazel *et. al*., 1999; Dhar *et. a1*., 2002).

## 1.2 ETHNOBOTANY : ORIGIN AND DEFINITION

The present day ethnobotanic study begun in 1873 with the work of Stephan Power who used the term "Aboriginal botany", which elucidated the total aboriginal dependence on plants for food and medicine. The term ethnobotany was first introduced by Harshberger (1895) as "The study of plants used by primitive and aboriginal people". Before the introduction of the term "Ethnobotany", the study of traditional botanical knowledge was focused almost entirely on the applications and economic potential of plants by native people. At this time the subject included mere identification and catalogue of plants used by the primitive people. In 1916, Robins Harrington and Feiro Marreco promulgated the broad definition of ethnobotany and considered it as a study and evaluation of the knowledge of all phases of plant life amongst primitive societies, and of the effects of vegetal environment upon the life, customs, beliefs and history of the people of such societies. Later in middle of the $20^{th}$ century anthropological and ecological aspects were also included with it. Ethno-botanical study escalated during 1980's and the subject became multidisciplinary (Cotton, 1996). Since time immemorial man has used various parts of plants in the treatment and prevention of many ailments. (Chah *et. al.,* 2006).

Ethnobotany is the science simply defined as “the existing interrelationship between plant-animal, animal-human and plant-human”. In last few decades ethnobotany has become an important thrust area of research for the documentation and preservation of historical traditional knowledge at tribal level as well as to develop resource management, conservation of biological diversity at genus, species, ecosystem, forest type and regional level. On other hand Ethnobotanical knowledge has been described so far as variety of terms that can be each interpreted in slightly different ways. Indigenous Traditional Knowledge (ITK) and Indigenous Botanical knowledge (IBK) are some of the terms used recently for the description of the information with reference to ethnobotanical importance.

With the advancement of ethnobotany, many definitions have been given for the term, from time to time. Some of the popular definitions are:

a. Aboriginal botany: The study of all forms of vegetation which aborigines use for commodities such as medicine food, textile and ornaments (Power, 1873).

b. Ethnobotany: The study of plants used by the primitive and aboriginal people (Harshberger, 1895).

c. Not just a record of plant use but the traditional impressions of the total environment has revealed through custom and ritual. (Robins *et. al.*, 1916).

d. The study of the relations which exist between humans and their ambient vegetation. (Schultes, 1941).

e. The Study of interrelations of primitive man and plants (Jones, 1941).

f. The Study of direct relationship of humans and plants (Ford, 1978).

g. All studies (concerning plants) which describe local people's interaction with the natural environment. (Martin, 1995).

h. Total natural and direct interrelationship between man and plants and his domesticated animals (Jain, 2002).

Ethnobotany deals with the direct relationship of plants with man. The term has often been considered synonymous with either economic botany or with traditional medicine. Early origins of traditional medicine must have had their roots in ethnobotanical folklore, but today traditional medicine incorporates several well organized, distinct systems of diagnosis and cure. In India alone, three traditional systems of medicine namely Ayurveda, Siddha and Unani are distinguished. Further, ethnobotany includes study of foods, fibers, dyes, and tans, other useful and harmful plants, taboos, avoidances and even magico-religious beliefs about plants (Jain, 1967; Ford, 1978).

The first book published titled “aboriginal botany” (Power, 1873) describe the botanical investigation of native plant use, a term which was readily accepted by the academic community over the next 25 years. However, as the nineteenth century drew to a close, interest in aboriginal botany began to broaden, particularly during preparations for the 1893 World's Fair which involved both anthropologists and archaeologists in the collection of traditionally useful plant products (Ford, 1978). Significantly, this exhibition included the hazard collection, a range of preserved plant products used by the ancestors of the Pueblo Indians in Mancos Canon in Colorado, and which was later sent to the University of Pennsylvania for analysis. There, a botanist, John Harshberger examined the collection, and in December 1895 he finally delivered a lecture in which he described items of food, dress, household utensils and agricultural tools of plant origin preserved in the hazard collection; it was during this lecture the term ‘ethnobotany’ was first used (Harshberger, 1896).

In the decades which followed, the study of ethnobotany entered a phase of rapid expansion and change. Only a year after his historical lecture, anthropologist Walter Fewkes introduced Harshberger`s term to the anthropological literature, where he emphasized Hopi Indian plant names and their etymology; in 1900 the first doctoral dissertation in ethnobotany, “The ethno-botany of the Coahuilla Indians of Southern California” was

awarded to David Barrows by the University of Chicago. In 1916 “ethnobotany” had expanded to include not only how plants were used by indigenous peoples, but also how they were perceived and understood within deferent cultures (Robbins cited in Castetter, 1944). This last point was later expanded by American ethnologist Melvin Gilmore who argued both the need to interpret ethnobotanical data within its cultural context, and the important role of linguistics in ethnobotanical study.

The present century has witnessed the emergence of Ethnobotany as a distinct academic branch of the natural science. All over the world, these has been an increasing interest in the scientific study of man-plant interaction in the natural environment which is clearly visible among various indigenous people commonly designated as Aboriginal, Natives, Autochthonous, Adivasi, Vanyajati, Forest dwellers, Adimjati, Janjati, Tribals etc. Ethnomedicine is a component of Ethno botany which refers to the use of plants by humans as medicine.

Recent development of Ethnobotany in India has been strongly oriented towards the promotion of documentation of traditional knowledge, traditional herbal medicine, traditional famine foods, traditional resource utilization, traditional sustainable use and management of natural resources, traditional conservation practices of natural biological resources etc. with applied approaches in the field.

## 1.3 CURRENT STATUS OF MEDICINAL PLANTS IN THE WORLD

The importance of Traditional System of Medicine has now been recognized all over the world. This has lead the WHO experts to define the traditional medicine as “ the sum total of all knowledge and practices whether explicable or not used in diagnosis, prevention, and elimination of physical, mental and social imbalance and relying exclusively on practical experience and observation handed down from generation to generation whether verbally or

in writing. The traditional system of medicine might also be considered as a solid amalgamation of dynamic medical source, how an ancient experience". This is the foundation stone of Ayurveda in utilizing the plant material available in India from times immemorial. The term "herbal drug" determines the part/parts of a plant (leaves, flowers, seeds, roots, barks, stems, etc.) used for preparing medicines. Furthermore, WHO (2001) defines medicinal plant as herbal preparations produced by subjecting plant materials to extraction, fractionation, purification, concentration or other physical or biological processes which may be produced for immediate consumption or as a basis for herbal products.

Despite the increasing utilisation of modern medicine with consequent reduction in morbidity and mortality, traditional medical systems still persist and exert significant influence on the state of health, medical decisions, and outcomes in developing societies. Modern medicine generally has been established in these societies not so much by displacing indigenous medicine but by increasing the medical options available to the people. In these pluralistic medical situations, one medical system may be influencing the other. Modern medicine can more effectively serve populations in developing areas by utilising the resources of indigenous medical systems. Knowledge of the reasons for these choices would be of practical value to improve local, regional and world health and also can contribute to a general understanding of human behavior in relation to culture changes.

Ackerchnecht (1942) said that medicine is no where independent and follows its own motivations. Its character and dynamism depend on the place it takes in every cultural pattern. They do not of course cover the whole range of misfortune a society may face and they can reflect its member's view of misfortune in a general sense (Maclean, 1966).

Plants have been used as source of medicine by man from ancient times, and it is accepted that plants are useful in their crude or advanced forms as drugs. Medicinal plants are plants containing inherent active ingredients used to cure disease or relieve pain (Okigbo

*et. al.,* 2008). The use of traditional medicines and medicinal plants in most developing countries as therapeutic agents for the maintenance of good health has been widely observed (UNESCO, 1996). The total number of prescription dispensed in public pharmacies in U.S.A had consistently contained about 25% of plant derived drugs. In Africa, 80% of the prescription depends mainly on herbal medicine and this situation is likely to continue (Bickmann, 1984).

According to an estimate of the World Health Organization (WHO), approximately 80% of the people in developing countries rely chiefly on traditional medicine for primary health care needs. It is assumed that 20,000 – 30,000 species of higher plants are used as medicines in various culture of the world. In India the contributions made during the last one hundred years have meticulously brought into focus much of the diverse information on a large number of medicinal plants. In recent times, the interest in the use of herbal products and the focus on plant research has grown dramatically in the western world as well as developing countries (Loya *et. al*., 2009; Mythilypriya *et. al.,* 2007; Sparreboom *et. al.*, 2004; Vaidya, 1997). Medicinal herbs as potential source of therapeutic aid has attained a significant role today in health system all over the world, not only in the diseased condition but also as potential material for maintaining proper health. The size of the worldwide market of herbal medicines is estimated to be around US $80 billion to US $100 billion and this market is expected to reach US $2500 billion in near future (Mathur, 2003; Agrawal and Raju, 2006). In the west, the demand for herbal drugs has reached a new high in recent years. Since 1999, the global market for herbal supplements exceeded US $15 billion, with a US $7 billion market in Europe, US $2.4 billion in Japan, US $2.7 in the rest of Asia and US $3 billion in North America (Wakdikar, 2004). The results of a nationwide survey in USA indicated a marked increase in the number of individuals using alternative therapies between 1990 and 1997 estimating total out-of-pocket expenditures for alternative therapies at $27

billion (Eisenberg *et. al.*, 1998). According to a recent estimate in a study, 70-80% of the world populations especially in developing countries rely on traditional medicine, mostly plant drugs for their primary healthcare need s (Agrawal and Raju, 2006). About one third of the adults in developed countries and more than 60% Asians use herb as an alternative medicines (Zhou, 2007).

As the use of herbal medicines is steadily growing, public, academic and government interest in traditional medicines is growing exponentially due to the increased incidence of the adverse drug reactions and economic burden of the modern system of medicine (Charrois *et. al.,* 2007). The total turnover of the herbal drug industry is estimated to be around US $500 millions. The global market for herbal medicines is 150000 crores of rupees, as estimated by a United Nations Development Programme (UNDP) study. It is expected to grow to ten times in the near future (Karki, 2000). There are estimated to be over 5000 plant-based medicine-manufacturing units in India with an annual turnover of over Rs. 2000 crores per year (Anonymous, 2000). The herbal cosmetic industry also uses these plants. The annual turnover of the Indian Herbal Industry is estimated to be around Rs. 2300 crores per year (FRLHT, 1999).

Modernization is posing serious threats to medicinal plants and associated systems. Public are attracted to the modern system of medicine, which provides quick relief, at lower cost. But, in recent times, there has been an increasing awareness about the significance of medicinal plants and their use. There has been revival of interest in knowing about many medicinal plants and their by - products which are inherently safer and more efficacious than the modern, potent synthetic drugs which very often produce undesirable side effects in man. This prompted the people to return to the ancient and traditional system of phyto-medicines or herbal medicines. With the result, the use of natural medicines or herbal

drugs has gained momentum and the demand for herbal raw drugs and other products is increasing many fold.

It is noteworthy that some of the most important drugs of the last 50 years for some serious diseases, which did not have suitable remedies in the modern system have been developed from plants (Trivedi, 2004). Thus medicinal plants constitute a group of industrially important crops which bring appreciable income to the country by way of export. Apart from health care this enterprise provides means of livelihood to scores of people.

## 1.4 SCENARIO OF MEDICINAL PLANTS IN INDIA

Western Scientists were attracted by the richness of lndian medicinal plant wealth long time ago, the first one being Garcia de Orta (1563), a reputed pharmacist, who adopted over a dozen of the Indian species into his personal *Materia Medica*. The Dutch Governor to Malabar Henderik Adriaan Van Rheed, during the period 1678 to 1693, published Hortus Malabaricus in 12 volumes. It contains the description of 791 species, illustrations of 742 species and information on medicinal and other uses of these plants of the Malabar region, and the book is a landmark in lndian botany and medicinal plants.

'Doctrine of signatures' advocated by an eccentric genius Paracelsus (1493-1541) suggested that plants possessed certain signs given by God, which indicated their usefulness in treating diseases of similarly shaped organs in the human body. Plants, for example, with heart shaped leaves were used for heart diseases. The lanecolate leaves of *Sansevieria roxburghiana* with transverse striations have some likeness to the striated body surface of vipers and the plant has been used by the Kani tribes of Kerala as a remedy for snake poison (Jawahar, 1996).

A survey conducted by the All India Co-ordinated Research Project on Ethnobiology (AICRPE) during the last decade recorded over 8000 species of wild plants used by the tribal

and other traditional communities in India for treating various health problems. The recorded plant species include trees (33%), herbs (32%), shrubs (20%), climbers (12%) and epiphytes, grasses, lichens, ferns and algae put together (3%). Among 2,000 drugs being used in curing human ailments in India, only 200 are of animal origin, 300 of mineral origin and the rest 1500 drugs are extracted from various plants (Aggarwal and Ghosh, 1985).

The world trade now is estimated to be over US $ 60 billion per year. The World Health Organization's (WHO) forecast is that the global market for herbal products is expected to be US $ 5 trillion by 2050 (NMPB, 2002). India is rich in all the three levels of medicinal biodiversity such as species diversity, genetic diversity and habitat diversity. All known types of agro climatic, ecological and edaphically conditions are met within India. Schultes (1962) explained about the Indian ethnobotanical emporia in his words: India with her many living groups of people, having diversified ethnic culture, history of rituals and performances, who are more or less isolated from modern world, and are closely associated with their ambient vegetation is the emporia of enthnobotanical research".

The tribal people or the indigenous people (as they are acknowledged by the environmental agencies and United Nations) living closest to nature are influenced more by socio-cultural and environmental dimension in their healing practices. India with its sizeable tribal population (12% of the total population) consisting of 162 major tribes and 270 minor tribal communities has much more to contribute to the traditional health care and healing systems (Mahanti, 1994).

## 1.5 PROSPECTS FOR THE DEVELOPMENT OF MEDICINAL PLANTS

The opening up of global markets is bringing in expanding opportunities and demand for new resources, materials and products. Increasing awareness regarding the protection of the interests of the disadvantaged people and bio-diversity conservation is also

leading to renewed interest in medicinal plants. Search for new medicines for the prevention and cure of deadly diseases also provides prospects for developing medicinal plants. Medicinal plants are among the few developing country natural resources that sell at premium prices. Thus global c1amor for more herbal ingredients creates possibilities for the local cultivation of medicinal plants as well as for the regulated and sustainable harvest of wild stands. Such endeavors could help in raising rural employment in the developing countries, boost commerce around the world, and perhaps contribute to the health of many people.

The use of plant-based medicines is expanding rapidly worldwide and any economic activity relating to the growing of medicinal· plants for commercial purpose is bound to be a viable enterprise. The entire scheme is low-cost and provides an effective way of treating illness without consuming costly medicines (FRLHT, 1999). As a large amount of private sector investment is possible in this sector, medicinal plants can be developed as a mean for sustainable economic development, safe and affordable health care and conservation of biodiversity.

## 1.6 DOMESTICATION OF MEDICINAL PLANTS

Domestication of medicinal plants involves their manipulation and cultivation for specific uses. During the domestication process, wild plants are first brought to some form of management. In a later stage of the process, wild plants are actively cultivated. In the final phase, the process involves the selection and breeding of selected genotypes resulting in rather uniform plant populations with a narrow genetic base (Wiersum, 1995). Broadly speaking, it is the process of increasing human-plant interactions. Domestication has several advantages: a consistent, predictable supply; an opportunity to select for desirable genetic traits; and protection of diminishing wild resources.

The first stage of domestication of medicinal plants, viz. gathering wild plants and managing them is already under way in many countries. The second stage, namely cultivation of medicinal plants has not gained momentum. Systematic cultivation of these plants could be initiated only if there is a continuous demand for the raw materials. It is therefore necessary to establish processing facilities in the vicinity of cultivation in order to create a demand and assure the farmers of the sale of raw materials (Silva, 1995).

If developed properly, the domestication of medicinal plants has the features of providing the poor with a route out of poverty, saving a heritage of human knowledge and putting it to global use, revitalizing the economies of many developing countries, saving natural bio-diversity and improving the output from natural forests and tree plantations.

## 1.7 SCOPE OF THE STUDY

About 35000 to 70000 plant species have at one time or other been used in some culture or other for medicinal purposes. They are used in both traditional and modern systems of medicine. At least 25 per cent of the drugs in the modem pharmacopoeia are derived from plants. Around 75 percent of the global population and more than 80 per cent of the people in South Asia rely on medicinal plants for their primary health care needs **(**Nickel and Sennhauser, 2003**).** 75 to 80 per cent of people in the developing world depend on traditional medicines derived from plants, insects and animal produces with an estimated value of about US $ 35 to 40 billion (Chandrashekharan, 2000). The total value of the traditional medicinal products worldwide is estimated to be as large as that of modern medicines-about US $ 80-90 billion (Karki, 2000).

Over 7500 species of plants are estimated to be used by 4365 ethnic communities for human and veterinary health care in lndia (Rajasekharan and Ganeshan, 2002). The World Health Organization (WHO) has listed over 21,000 plant species used around the

world for medicinal purposes. In India, about 2,500 plant species belonging to more than 1000 genera are being used in indigenous systems of medicine. India is tenth among the plant rich countries of the world and fourth among the Asian countries. The Eastern Ghats and Western Ghats harbours about 5.332 endemic species of higher plants (Lokesha and Vasudeva, 1997). Twenty-five global hot spots have been identified so far, of which the Western Ghats and Eastern Himalayas are located in India are of significance (Myers *et. al.,* 2000).

Macro analysis of the distribution shows that medicinal plants are distributed in diverse habitats, with around 70 % of the resource are found in the Indian subcontinent spread over Western and eastern Ghats, the Vindhyas, Chotta Nagpur plateau, Aravallis, the Terai region in the foothills of the Himalayas and the northeast. Less than 30% of the medicinal plants are found in the temperate forest and higher altitudes (Balasingh *et. al.,* 2000; Rajasekharan and Ganeshan, 2002). Micro-ecological studies show that larger percentages of medicinal plants are occurring in dry and moist deciduous forest as compared to the evergreen or temperate forests (Balasingh *et. al.,* 2000; Rajasekharan and Ganeshan, 2002).

Even in this day of increasing spread of allopathic medicines, there are hundreds of millions of people in India who are dependent on biodiversity for their health needs. It is a tradition that is of remarkable contemporary relevance for ensuring health security to the teeming millions. The Indian system of medicine has identified 1,500 medicinal plants of which 500 are commonly used (Agrawal and Raju, 2006). It is estimated that there are over 7800 medicinal drug-manufacturing units in India, which consume about 2000 tones of herbs annually (Ramakrishnappa, 2003).

There are estimated to be around 25,000 effective plant-based formulations, used in folk medicine and known to rural communities in India. In spite of widespread use of herbal

remedies, scientific data about their safety and efficacy are lacking in most cases plus reporting of adverse drug events is currently limited. To worsen the scenario, in the Indian systems of medicine, most practitioners formulate and dispense their own recipes which are available without prescriptions. The same require proper documentation and research. The lack of available clinical data for many herbal products serves as a barrier for post marketing safety assessment of herbal products (Chavez *et. al*., 2006).

The northeastern region is one of the richest biodiversity zone in the Indian sub-continent with high endemism. It is a rich region of ethnobiocultures. The actual forest cover is also high despite the on going practice of ethnoagriculture. The unique richness of ethnoculturo-biodiversity is a great challenge to the scientist to explore the region (Lalramnghinglova, 2000).

The state of Mizoram receives little attention so far as the survey of medicinal plant is concerned. The ethno medicinal knowledge of the tribes of Mizoram has descended through generations since time immemorial; Lalramnghinglova and Jha (1997), Lalramnghinglova (1996), Lalramnghinglova and Jha (1999) and Lalnundanga (2000) have conducted ethno botanical survey of Mizoram. Nevertheless, no effort has been made on the survey of medicinal plants of Eastern Himalayan Montane forest of Mizoram and there is no proper documentation with regards to judicious utilization and management. There is, therefore, a need for documentation of the valuable traditional knowledge about medicinal plants and domestication of economically important medicinal plants of Eastern Himalayan Montane Forest of Mizoram for the purpose of decreasing pressure over natural resources, conservation, education and research in the development of new drugs.

The present study is carried out with the following objectives:

- To survey and documents the Traditional Knowledge System (TKS).
- Collection and identification of indigenous medicinal plants and preservation of voucher specimens in the herbarium for future reference.
- Screening of economically important medicinal plant species.
- To determine ecological status by measuring various micro-climatic variability around important medicinal plants.

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# CHAPTER - 2

# REVIEW OF LITERATURE

## 2.1 AN OVERVIEW

Since the beginning of human civilization, medicinal plants have been used by mankind for its therapeutic value. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Many of these isolations were based on the uses of the agents in traditional medicine. The plant-based, traditional medicine systems continues to play an essential role in health care, with about 80% of the world's inhabitants relying mainly on traditional medicines for their primary health care (Owolabi *et. al*, 2007).

Medicinal plants are plants containing inherent active ingredients used to cure disease or relieve pain (Okigbo *et. al*, 2008). The use of traditional medicines and medicinal plants in most developing countries as therapeutic agents for the maintenance of good health has been widely observed (Anon., 1996). Modern pharmacopoeia still contains at least 25% drugs derived from plants and many others, which are synthetic analogues, built on prototype compounds isolated from plants. Interest in medicinal plants as a re-emerging health aid has been fuelled by the rising costs of prescription drugs in the maintenance of personal health and well being and the bio-prospecting of new plant-derived drugs (Lucy and Edgar, 1999).

Long before the earliest record available today, it seems many different people cultures discovered that some plants are not only good to eat, but many plants have healing properties. As civilization grew from 3000 BC onwards, that is, in Egypt, India, China and the Middle East, the use of herbs became more sophisticated and gradually the first written account of plants of medicinal value were made. Nearly half or more of all medicines currently prescribed are derived from members of the plant kingdom. Ancient Egypt was not

alone in recording the healing power of plants and gave the world the famous *Eberus papyrus* of *Circa 1500 BC*.

The instant rising demand of plant-based drugs is unfortunately creating heavy pressure on some selected high-value medicinal plant populations in the wild due to over-harvesting. Several of these medicinal plant species have slow growth rates, low population densities, and narrow geographic ranges (Nautiyal *et. al*., 2002), therefore, they are more prone to extinction (Jablonski, 2004). Conversely, because information on the use of plant species for therapeutic purpose has been passed from one generation to the next through oral tradition, this knowledge of therapeutic plants has started to decline and become obsolete through the lack of recognition by younger generations as a result of a shift in attitude and ongoing socio-economic changes (Kala, 2000). Furthermore, the indigenous knowledge on the use of lesser-known medicinal plants is also rapidly declining. Continuous erosion in the traditional knowledge of many valuable plants for medicine in the past and the current renewal interest, the need to review the valuable knowledge with the expectation of developing the medicinal plants sector arises. (Kala *et. al*, 2006).

The ethnobotanists have been trying to preserve the use of medicinal plants by various ethnic groups so that the information could be passed on to the modern world and be applied by the modern man in treating different diseases in a more modernized way in the form of medicines and others.

The diverse ethnic communities with their traditional cultures are often exploited, making them gradually lose their knowledge and information about their own traditional cultures in the modern world. Because of this, they are unable to use many of their forest resources. And so before these people completely lose their knowledge of plants having medicinal properties, there is an urgent need to record as much information about them and to

study their properties and implications (Lalnundanga, 2000). The studies on folk medicines through ethnobotanical survey are gaining importance. In discussing the role of ethno botany in our search for new drug, we must constantly bear in mind the widespread exaggeration of the usefulness of ethnobotanical data. Nevertheless, we cannot afford to pre-judge reports of aboriginal uses of plants simply because they seem to fall beyond our limits of credence. Since primitive society possesses nothing more than a very limited intuition about the properties of plants. It therefore, behoves us to push forward, along with ethnobotanical investigation, studies on the flora in general (Schultes, 1962; Lalramnghinglova and Jha, 1999).

Systematic study about the knowledge gained by various ethnic group from their ancestors in regard to plants, used as foods, medicine, clothing, or religious rituals, are covered under ethno botany. The work so far undertaken in the field of medicinal plants under ethnobotanical researches by different workers to acquaint the modern world as well as local communities in an attempt to preserve and document vanishing knowledge and to introduce the use of medicinal plants abroad and in India are reviewed here.

## 2.2 ABROAD

There have been several ethnobotanists who have undertaken ethnobotanical investigations abroad. Some of the significant contributions in the field of Ethnobotany are mentioned below.

The foremost centre of ethnobotany is the Botanical Museum of Harvard University in Massachusetts and the evolution of the modern approach to the science of ethnobotany started in the United States. The best studied area for these purposes is the South-West of the United States of America (Ford, 1985).

The well known ethno botanists of the world, Dr. Richard Evan Schultes conducted ethno botanical exploration in Oklahama, Oaxala, Amazon, Mexico and in other regions. He had spent almost 12 years among the tribals and worked on hallucinogens, medicinal and toxic plants (Schultes, 1938, 1954, 1956, 1962).

Anderson (1985) documented the medicinal uses of 121 species which grow in the Akha tribes' zone of Thailand. El Rayah (1993) documented a brief account of herbal medicines prescribe for various ailments in Sudan. Cunninghum (1993) studied African medicinal plants with emphasis on conservation and primary health care.

Abbas *et. al.* (1992) reported ethnobotanical information on 52 medicinal plants used in traditional medicine of Bahrain. Ethnobotanic information on 52 plants species of Sengkurong and 29 plants species of Bukit Udal of Darrussalam were given by Haji Mohiddin *et. al.* (1991) and Holdsworth (1991) respectively. 100 anti-leucodermic traditional herbal medicines consisting of 80 medicinal plant species being employed by Caucasians in the Mediterranean area were reported by Capitanio *et. al.* (1989).

Barrett (1994) has investigated 152 plants used by the people of Nicaraguasis, Atlantic Coast for the treatment of various diseases. The diversity and prevalence of medicinal plant used for this region has been reported for the first time.

Youngken *et. al.* (1970) documented plants for antimalarial activity. Ethnobotanical studies from Central Nigeria includes 52 plant species having ethnobotanical importance (Bhat *et. al.*, 1990).

Huyin *et. al.* (1998) have reported that *Baphicacanthus cusia* plays a very important role in the traditional life of the Hani and other ethnic groups in Jinpin country, Yunnan province. Indigo obtained from aerial parts is used to dye their traditional clothes, and the roots and leaves are used as medicine.

George (1995) has reported pharmacopoeia of 108 medicinal species from 52 families. Fifty percent of the pharmacopoeia is composed of species indigenous to Tonga, 30 percent of the species introduced by Polynesian settlers, and 20 percent are species of post – European introduction. The traditional and modern uses of 48 native plants which grow in the First Yukon region, Alaska, have been documented and the medicinal and edible material used by the Guich in Athabaskan and Caucasian residents have been identified. The present and past values of these plants in Guich's culture are discussed (Holloway and Alexander, 1990).

Halbarstein and Saunders (1978) have reported traditional medicinal practices and medicinal plant usage on a Bahamian Island. Weniger *et. al.* (1986) have documented popular medicinal plants of the Central Plateau of Haiti. The ethnomedicinal plants from Garifuna of Eastern Nicaragua is reported by Coce and Anderson (1996). The folk herbal medicine used by Fiji Indians is documented by Singh (1986).

Caceres *et. al.* (1990) have screened 84 plants which is used to cure gastrointestinal disorders caused by Enterobacteria in Guatemala. Giron *et. al.* (1991) have reported medicinal flora used by the Caribs of Guatemala. The 16-ethnomedicinal plants used by the people of Guatemala against Gram-Positive Bacteria, (causing agent of respiratory diseases) were evaluated by Caceres *et. al.* (1993).

Joshi and Edington (1990) reported medicinal plants of central Nepal. Ethnobotanical observation on 71 plant species from Tharu tribe of Chitwan District, and 86 plant species from Makawanpur District of Nepal were reported by Dangol and Gurung (1991) and Bhattarai (1990), respectively.

Bhattarai (1990) has reported medico botanical information on 51 empirically accepted prescriptions involving 36 plant species belonging to 36 genera and 27 families, collected from the rural inhabitants of Kabhrepalanchock District of Central Nepal.

Quisenberry (1960) lists more than eight hundred known medicinal plants in the Philippines alone, including flora efficacious in the treatment of a number of maladies such as asthma, diarrhoea, dysentery, malaria, diabetes etc.

Raskoti and Ale (2009) reported *Nervilia makinnoni* Duthie. and *Nervilia plicata* (Andrews) Schltr. (Orchidaceae) as a new records for flora of Nepal.

Chung *et. al.* (2008) documented the occurrence of five species of Acamella in Taiwan, of which two were not reported for the flora of this island before, namely: *A. brachyglossa* and *A. ciliata.*

Kunwar *et. al.* (2010) reported 48 Nepalese medicinal plants used in the Far-west Nepal and validated the ethnomedicinal uses by comparative assessment with the common uses of the Ayurveda.

Analgesic and Anti- inflammatory Effect of *Clausena suffruticosa* root extract in animal model has been studied by Chakma *et. al.* (2011), and revealed the presence of alkaloids, flavonoids, tannin and sterols. Evaluation of antioxidant, antibacterial, antifungal and cytotoxic effects of *Clausena suffruticosa* ethanolic root extract was done by Rahman *et. al.* (2011).

Okere and Adegeye (2011) studied the In vitro propagation of an endangered medicinal timber species *Khaya grandifoliola* C. Dc. to prevent the species from extinction.

Some other significant contribution in the field of Ethnobotany was done by workers like Galeano (2000) investigated the forest use of Pacific Coast of Chococlombia. Huyin *et. al.* (2000) compared the ethno-botany of Lahu people of China & Thailand. Kambizi and Afolayan (2001) studied the use of plants in sexually transmitted disease in Zimbabwe. Hilaly *et. al.* (2003) worked on economic evaluation of medicinal plants in Northern Morocco. Chhetri and Devakota (2007) investigated the plants of ethnobotanical importance in Nepal. Tilahun and Mirutse (2010) studied the wild edible plants of Ethiopia. Yunheng *et. al.* (2000)

studied the traditional utilization of Chinese Chellera (*Stellera chamacjasme* L.) in North West Yunan, China.

## 2.3 INDIA

India has several traditional medical systems, such as *Ayurveda* and *Unani*, which has survived through more than 3000 years, mainly using plant-based drugs. The *materia medica* of these systems contains a rich heritage of indigenous herbal practices that have helped to sustain the health of most rural people of India. The ancient texts like *Rig Veda* (4500-1600 BC) and *Atharva Veda* mention the use of several plants as medicine. The books on ayurvedic medicine such as Charaka Samhita and Susruta Samhita refer to the use of more than 700 herbs (Jain, 1968).

The study on ethnobotany in India was initiated by the economic botany section of Botanical Survey of India since 1954. Dr. E.K. Janki Amal (1956) had published a paper on subsistence economy of India. In 1960, Dr. S. K. Jain started intensive field studies among the tribal of central India and published several paper on ethnobotany (Jain 1963 a-c; 1964 a-b; and 1965).

In India, written records of the use of plants for curing human or animal diseases can be traced back to the earliest (4500-1600 BC) scriptures of the Hindus, the *Rigveda* (Jain, 1994).

The Indian system of herbal medicine had caught the attention of the West since the beginning of the colonial days and some books on these have been published. The important contributions are : (a) Garcia da Orta (1563), the personal physician of the then Portuguese Governor in India published his '*Colloquies on the Simples & Drugs of India*`; (b) 12 volumes work on Kerela medicinal Plants (1678-1703) from Amsterdam, (c) *A catalogue of*

*Indian Medicinal Plants & Drugs* (Fleming, 1810) and (d) *Materia Medica of Hindoostan* (Ainslie, 1813).

R.R. Rao (1989) mentioned a considerable manual literature in 'Methods & Techniques in Ethnobotanical study & Research: some Basic Considerations'.

Ethnobotanical investigation has led to the documentation of a large number of wild plants used by the tribal for meeting their multifarious requirements (Anonymous, 1990).

Mudgal and Pal (1987) gave a synoptic treatment on ethnobotanical works in India. Binu *et. al.* (1992) compiled an outline of ethnobotanical research carried out in different states and union territories of India. The last two decades have seen different works carried on to record information on different medicinal plants from different regions of the country (Jain and Mitra, 1997). Prakash (1998) reviewed status of Indian medicinal plants.

Some of the important plants and other products used in indigenous medicine in Andhra Pradesh and in India are provided by Gambel (1967) and Watt (1981). Rao *et. al.* (1996) reported 27 plant species used to cure dental disorder at Tirumala Hills in Chittor district of Andhra Pradesh. Reddy *et. al.* (1989) investigated plant based crude drugs of Anantpur and Chitoor districts, Andhra Pradesh. They reported 64 plant drugs. Kumar and Nisteswar (1990) documented 188 medicinal plant species of Kakinada district. Hemadri *et. al.* (1987) recorded 211 species of the medicinal plants wealth of the state of Andhra Pradesh. The medicinal plants wealth of Karimnagar districts of Andhra Pradesh was documented by Hemadri (1990, 1991). The medicinal plants used for family planning and birth control is reported by Vedavathy *et. al.* (1991).

Santhals' taboos, medicines and folklore customs were documented by Boddings (1925, 1927). The medicinal plants used by Santhals, Mundas, Orans, Birhors, Bedia of Chotanagpur plateau are reported by Tarafder (1983 a-b, 1984 a-b). Tarafder (1983 c-e) documented ethnogyanaecolgy of different tribals in Bihar. The ethnomedicinal plants of

famous Saranda forest is documented by Jain (1989). Jha *et. al.* (1989) reviewed folk medicine of Mithila zone of Bihar.

The plant species having ethnomedicinal value, used by Bhils, Rabaries, Gharashias and Dubias tribes in Gujarat were documented by Shah and Gopal (1985). The ethnomedicinal informations along with other uses of 133 plant species used by tribals of Saurashtra are recorded by Shah *et. al.* (1981). Joshi (1988) provided information on 139 plants of medicinal value. The ethnomedicinal uses of plants in Sunderban recorded by Tribedi *et. al.* (1993).

Lal and Yadav (1983) recorded 69 species having medicinal importance and 66 prescriptions for therapeutic dose were also mentioned. Medicinal application of each species was presented. Jain (1984) documented 26 medicinal plant species of Morni and Kabasar hills in Ambala district of Haryana.

50 plant species having ethnomedicinal importance along with part of plants used and mode of administration of each species are reported by Kapahi (1990).The medicinal plants of Chamba Forest Division and Kangra Forest Division (Uhal valley) is recorded by Gupta (1964) and Uniyal and Chauhan (1971) respectively.

Ethnobotanical uses of plant species by the Gaddhis, Gujjars and Bakerwals inhibiting Bhadarwah hill in Jammu were reported by Kapur and Nanda (1992). A survey on the ethno botany of Kashmir Sind Valley was done in 1983 by Dar *et. al*. The medicinal plants used by Amchis of Ladakh has been recorded by Srivastva *et. al.* (1981).

The important contributions on medicinal plants from the state of Karnataka are medicobotany of Mysore (Rao, 1977) cited by Binu *et. al.* (1992); medicobotany of Tumkur district (Yoganarasimhan *et. al.,* 1982); folk medicine of Bangalore district (Pushpalata *et. al.,* 1990); ethno botany of Soligas in Biligiri Betta (Hosagaudar and Henry, 1996) and the ethno botany of Gowlis of Uttara Kannada district (Bhandary *et. al.,* 1996).

The ethnomedicinal investigations containing information about the medicinal plants are reported by Mooss (1952, 1976, 1978); Kolammal (1979); Manilal (1981); Ramachandran and Nair (1981), Nambiar *et. al.* (1986) and Sivarajan and Balachandran (1994) and Radhakrishnan *et. al.* (1996).

Folk medicine of Baiga tribes along with medicinal uses of 25 species are reported by Pandey *et. al*. (1991). The flowering plants (233 numbers) of high medicinal value of Madhya Pradesh are recorded by Oommachan and Masih (1991). The medicinal plants commonly used by 'Sahariya' tribe are recorded by Jain (1992).

Vartak (1981) reported Medicinal plants of Karnala tribal area of Kolaba district in Maharashtra. Ethnomedico-botany of some sacred plants of Western Maharashtra and ethnomedico-botany of genus *Mucuna* from Western Maharashtra are recorded by Upadhye *et. al.* (1997).

Saxena and Dutta (1975) have investigated 82 medicinal plants used for antifertility, fibre and food by the rural folk of Orissa. Saxena and Tripathi (1990) recorded 200 plant species having medicinal uses. A survey of medicinal plants used by tribals of Mayurbhanj was carried out by Mudgal and Pal (1980); Tribedi *et. al.* (1982); Saxena e*t. al.* (1981).

Ethnomedicinal plants suitable to cure venereal and gynaecological diseases are documented by Singh and Pandey (1996). Ethnomedicobotany of household remedies of Phagi Tehsil of Jaipur district is documented by Sen and Balra (1997). Khandelwal (1998) have reported ethnomedicine of Bhills in Rajasthan: plants used in diarrhea.

Raghunathan (1976) have documented medicinal flora of Nilgiri. Ethnomedicinal plants used by Malayali and Veduvar tribes of Salem district of Tamil Nadu were documented by Dwarkan and Ansari (1992).

Plant species used by Kols, Gondas, Lodhas and Gujars of Banda district, Uttar Pradesh against various infections were documented by Saxena and Vyas (1981). Other

notable works done in U.P are traditional uses of medicinal plants from Jaluan district (Khanna *et. al.,* 1996); medicinal plants used by the forest ethnic of Gorakhpur district (Singh and Siddiqui, 1997); native medicine of Jansari tribe (Singh, 1997); ethno-medico-botanical studies on the fungi of Kumaun Himalaya (Joshi *et. al.,* 1997) and native plant remedies for liver disorder among the tribals of Uttar Pradesh (Singh and Prakash, 1998).

The contributions in the field of ethnomedicobotany in West Bengal are plants of ethnobotanical importance used by Santhals, Bhumijs, Birhors and Kherias in Purulia (Jain and De, 1996; Sur *et. al.,* 1992); herbal medicines used by the tribals of Bhankura district (Namhata and Ghost, 1993); 36 plants used for rheumatic pain, chronic acidity and tuberculosis (Mishra *et. al.,* 1997) and ethnomedicine to modern medicine: An observation studies in some villages in West Bengal (Ghosh and Sarma, 1997).

Ethnobotanically, the flora of Andaman and Nicobar constitutes an interesting group as it consists of considerable percentage of Malaysian elements (Binu *et. al.,* 1992). Some of the interesting contributions in the field of ethnomedicobotany are ethnobotany of Shompens of Great Nicobar (Chakrabarty and Rao, 1988); ethnomedicobotany of Nicobarese (Dagar, 1989b; Dagar and Chakhtai, 1989) and folk medicines of Nicobarese (Dagar and Dagar, 1996).

Chawla *et. al.* (2012) studied the traditional, pharmacological and phytochemical properties of various bioactive compounds present in *Ficus carica* Linn.

Kala (2010) documented 37 plant species available in the agro-forestry system and used for curing various ailments by traditional healers in Tehri Garhwal, Uttarakhand.

Acute anti-inflammatory activity of *Pandanus fasicularis* Lam. was studied by Kumar *et. al.* (2011).

Raina *et. al.* (2010) studied reproductive biology of *Picrorhiza kurroa* – a critically endangered high value temperate medicinal plant and reported the chromosome number and reproductive behaviour for the first time.

Joshi *et. al.* (2012) studied the ecology and conservation of threatened plants in Tapkeshwari Hill ranges in the Kachchh Island, Gujarat, India. They assessed 13 plant species, of which 5 species are reported to be medicinally important.

Rout and Panda (2010) documented 77 plant species represented by 73 genera and 41 families used by the local people in traditional health care system in Mayurbhanj district of Orissa.

Kumar *et. al.* (2012) reviewed the hepatoprotective activity of 10 medicinal plants which are commonly used in the Indian traditional system of medicine.

Desai and Patel (2012) recorded 24 medicinal plants from Gadhvada (Dharoi Range) area, District Mehsana (North Gujarat), India.

Ethnobotanical work in India was also done by several other workers like Kumar and Jain (1998) who studied ethnobotany of Surguja district in Madhya Pradesh. India. Dagar (1989a, 2000) studied the ethnobotanical investigation on Onge tribe of Little Andaman. Yadav and Mishra (2001), Jhariya (2006) worked on the ethnobotaical study of some medicinal plants used traditionally by the tribes of Madhya Pradesh. Prakas and Singh (2000) did the observation on some high valued ethnomedicinal plants among the tribals of Uttar Pradesh. Singh and Pandey (1998) studied on Ethnobotany of Rajasthan. Subramani (2000) carried out the ethnobotanical studies among Paliyar tribals of Grizzled Squirrel Sanctuary, Southern Western Ghats, Tamil Nadu. Upadhyay and Chauhan (2000) did the ethnobotanical observations on Koya tribe of Gundaala mandal of Khammam district, Andhra Pradesh. Harsha *et. al.* (2003) investigate the ethnomedicobotany of Uttarkannada district in Karnatka, India. Islam (1999) studied the ethnobotany of asteraceous plant.

## 2.4 NORTH EASTERN STATES

Information and reports of the ethnobotanical investigations carried out in these regions by several etnobotanists are as follows.

Some of the notable contributions in the state of Assam are- Medical plants used by the Karbi Anglong of Mikir Hills (Borthakur, 1976); ethnomedicinal surveys of Miris (Hajra and Baishya, 1981); Medical plants from Tezpur district (Puri, 1987); Ethno botanical information on Plants associated with religio-cultural beliefs of the Tai Khamti race of the Assam and Arunachal Pradesh is reported by Gogoi and Borthakur (1991). Plant used to cure jaundice in Golaghat district is documented by Pandey *et. al.* (1996).The herbal remedy of the Nepalese of Assam is also reported by Borthakur *et. al.* (1996).

Joseph and Kharkongor (1981) surveyed the Khasi and Jaintia tribes and recorded 100 plants species of ethno botanical importance. Rao and Neogi (1980) studied Ethnobotany of Khasi and Garo tribes. Medicinal plants used by Garo tribes are also studied by Rao and Shampru, 1997; Rao, 1989). While ethno botanical uses of 33 plants employed by the Khasis, Jaintias and Garos for Ichthyotoxi purpose are documented by Chhetri *et. al*. (1992).

Folk medicines used to cure 25 diseases by the Manipuris are recorded by Sinha (1990); Devi (1989, 1990) contributed ethno biological studies of Manipur valley. Singh (1996) reported aphrodisiacal plants used by the Meitei community. Medico-botany of Meitei community in Manipur state is recorded by Singh and Huidrom (1997). Some other important contributions are: medicinal uses of 36 species used by Naga tribes in Ukhrul district (Elangbam *et. al.,* 1989). Ethnobotanical uses of 931 medicinal plants (Sinha, 1987).

Medicinal plants used by Zealang sub-tribes of Nagaland are recorded by Jamir and Rao (1990). Ethno botanical folk practices and beliefs of the Ao Nagas have been reported by Sapu and Yogendra (1996). In 1997, Jamir reported the medical herbs utilized by the Naga

tribes. Megoneitso and Rao (1983) have documented medicinal plant species used by the Angamis of Kohima district.

Some of the most relevant contributions in the state of Arunachal Pradesh are Medicinal plants of Arunachal Pradesh compiled by Hajra (1977); Ethnomedicinal Plants of Tirap district (Tiwari *et. al*., 1978); Ethnobotanical studies of plants used by Monpa tribes of Kameng District (Dam and Hajra,1981); Medicinal Plants of Lohit District (Bhuyan, 1989); Ethnobotany of wild edible plants (Haridasan *et. al*., 1990); Tiwari and Tiwari (1996) contributed some important medicinal plants of the tropical, sub-tropical and temperate regions of Siang, Subansiri and Tirap Districts. Ethnobiological records on 171 plant species of lower Subansiri district was done by Gangwar and Ramakrishnan (1990). Notes on the ethno botany of the Monpa tribe of Tawang district were recorded by Rawat *et. al.* (1997).

The contributions made by Hajra and Chakraborty (1982), Bennet (1983) and Uniyal (1980) in the field of ethnomedicinal plants in Sikkim are important.

Deb (1968) has recorded medicinal plants of Tripura. Ethno-medico-botanical studies in Tripura reported by Singh *et. al.* (1997).

Srivastava and Adi community (2009) studied Traditional knowledge of *Adi* tribe of Arunachal Pradesh on plants and reported 113 plant species used by the Adi tribe.

The ethnomedicinal information along with other uses of 214 species of plants used by the Nyishi (Daffla) tribe of Arunachal Pradesh is documented by Srivastava and Nyishi community (2010).

Mao *et. al.* (2009) reported 7 potential ethnomedicinal plants uses, 7 over collected medicinal plants and 25 threatened important medicinal plants of North East India.

Benniamin (2011) documented 51 medicinally important Pteridophyte species of North East India with special reference to Arunachal Pradesh.

Lepcha *et. al.* (2011) conducted a survey on medicinally important plants from the landslide prone areas of East Sikkim, India, and documented 25 species of plants.

Khumbongmayum *et. al*. (2005) documented 120 ethnomedicinal plants in the sacred groves of Manipur.

Kayang (2007) studied the Tribal knowledge on wild edible plants of Meghalaya, Northeast India and recorded 110 wild growing plants along with their ethnomedicinal uses and other uses.

Singh (2011) reported 28 commonly used anti-diabetic plants in the indigenous system of health care which are found in Manipur, North-East India.

Pfoze *et. al.* (2012) documented 120 medicinal plants used by the Nagas and Kukis tribes in Senapati district of Manipur. Rout *et. al.* (2010) studied traditional medicinal knowledge of the Zeme (Naga) tribe of North Cachar Hills District, Assam on the treatment of diarrhea and documented 8 plant species used for the treatment of diarrhoea.

Some of the notable works done in the field of ethnomedicine in the state of Mizoram are enlisted below:

In 1940, Lorrain mentioned a few traditional medicinal plant used by the Lushai (Mizo). Some diseases/ailments along with medicinal treatments from plants were mentioned by Irish (1975) and Thangchuanga (1979). A total of 228 cases of human diseases and 27 animal diseases along with herbal medicine used for their treatments were documented in 'Zoram Upa Pawl Thurawn Bu' by Anonymous (1984). Herbal medicine used for treatment of 97 diseases has been reported by Darlianthanga (1989). Saptawna (1990) reported 58 plants species used as medicines. Lallianthanga (1990) reported 128 plant species used as local medicine. Vailinga (1991) also documented 165 diseases and their ethnomedicine, Lalramnghinglova (1991) documents 437 plant species on the basis of secondary informations. Mekkalath (2000) documented 200 plants species used as medicine.

In 1997, Lalramnghinglova and Jha reported the ethno medicine including medical of plants & animals combined, used by ethnic communities of Mizoram. A detailed account of 236 plants species of ethno botanical importance have been documented by Lalramnghinglova (2003). Lalnundanga (2000) also has documented 68 plants species of ethnomedicinal importance. Some of the most notable contribution are made by Lalramnghinglova (1996); Lalramnghinglova and Jha (1996); Lalnundanga *et. al.* (1997); Lalramnghinglova and Jha (1997); Jha and Lalnundanga (1998); Lalnundanga and Jha (2000) and Sawmliana (2003).

Bhardwaj and Gakhar (2005) recorded 17 ethno-medicinal plants used by the tribal of Mizoram to cure cuts and wounds. Lalfakzuala *et. al.* (2007) reported 89 plant species used ethnobotanically in the western Mizoram.

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# CHAPTER - 3

## METHODOLOGY

In the study of medicinal plants, the following methods and techniques were adopted:

### 3.1 COLLECTION OF INFORMATION FROM LOCAL LITERATURE :

At first, information on the use of medicinal plants in Mizoram was collected from literatures which were available locally. This literature pertains to any kind of literature, printed or unprinted that can be found to give information on the traditional uses of medicinal plants. Through this literature, different plants and their medicinal uses are noted down. These are sorted out and arranged; then after careful scrutiny, they are again compiled in the field notebook which serves as an aid making it easy in the field investigation during the research.

The local literature which was collected and consulted for this particular work are as follows : *Dictionary of the Lushai language* (Lorrain, 1940), *Local Medicine Tualchher Damdawi* (Irish, 1975), *Mizo Damdawi leh Fanau Enkawl Dan* (Thangchuanga, 1979), *Zoram Upa Pawl Thurawn Bu* (Anonymous, 1984), *Fa Duhthlan Dan leh Mizo Damdawi* (Darliangthanga, 1989), *Medicinal Plants of Mizoram (*Lallianthanga, 1990), *Tualchhuak Damdawi Thlan Chhuah* (Saptawna, 1990), *Mizo pipute Sulhnu leh Mizo Damdawi* (Vailinga, 1991), *Mizo Damdawi leh An Hmannate* (Lianhnuna, 1991), *Medicinal and Aromatic Plants of Mizoram (Lalramnghinglova, 1991), Mizo Damdawi* (Sawithanga, 1993), *Mizo Damdawi* (Lunghnema, 1995), *Mizo Damdawi* (Rozika, 1995), *Tualchhuak Damdawi* (Chawngkunga, 1996) and *Mizo Damdawi Siam Dan leh Hmanna* (Anonymous, 1996). Medicinal Plants of Tropical semi evergreen and Montane sub-tropical Pine forest in Mizoram (Lalnundanga and Jha, 2000), Study of Medicinal Plants in Tropical and Sub-Tropical Semi-Evergreen Forest of Mizoram (Lalnundanga, 2000), *Mizorama Thing leh Hnim Damdawia Hman Theihte (*Mekkalath, 2000*), Ethnomedicinal Plants of Mizoram* (Lalramnghinglova, 2003), *The Book Of Mizoram Plants* (Sawmliana, 2003).

## 3.2 CONDUCTING PERSONAL OR GROUP INTERVIEWS:

At the time of actual field work, interviews were conducted at different places, occasions and according to convenience. Most of the information collected was from real practitioners, who use their knowledge of medicinal plants on their immediate families, friends and others. Besides this, others were also interviewed, mostly old men and some women who had some knowledge on the subjects handed down by their fathers and a few who were being treated with medicinal plants.

Every possible opportunity was seized to conduct these interviews. Some people were contacted at their homes, some at public meetings and conferences, social gatherings and there were some chance meetings too. Not all, but some of the informants were people who sort of specialized in a particular disease or diseases and so interviews were also sometimes focused on certain disease – states of special interest.

All the information gathered at these interviews was carefully recorded in a note book which was used to confirm the authenticity of the uses of medicinal plants. The information gathered especially from real practitioners proved very useful and advantageous when combined with direct field observation.

## 3.3 ETHNOBOTANICAL FIELD WORK

This is the most important method and it includes gathering of primary information from real practitioners or local medicine-men, authentification of voucher specimens and preservation of plant samples for proper identification.

The principle guidelines followed in plant collections and herbarium techniques were given by Jain and Rao (1977); Womersley (1981); Mehrotra (1989); Martin (1995).

### 3.3.1 Collection and Processing of Plant Samples:

The following equipments and chemicals were used during the collection and processing of plant samples:

(a) Field equipments :

(i) Field note book (22cm x 12cm), (ii) Wooden plant press (50cm x 34cm x 3cm), (iii) Portable plant press (48cm x 32cm x 1cm), (iv) Camera, (v) Rucksack, (vi) Knife, (vii) Scissor, (viii) Altimeter, (ix) Old newspaper, (x) Scale and pencils, (xi) Polythene bags, (xii) Small spade for collecting soil sample.

(b)Laboratory equipment and chemicals :

(i) Plastic or Enamel tray (40cm x 30cm x 3cm), (ii) Dissecting box, (iii) Cane forceps, (iv) Fevicol / Dendrite or quick fix, (v) Specimen jars, (vi) Ethyl alcohol (98%), (vii) Rectified spirit, (viii) Formaldehyde, (ix) Mercuric chloride, (x) Paraformaldehyde, (xi) Sodium carbonate,

(c) Herbarium equipments :

(i) Genus cover (48cm x 32cm), (ii) Species cover (42cm x 30cm), (iii) Mounting boards (42cm x 30cm), (iv) Absorbers or blotters (46cm x 30cm), (v) Cardboards (45cm x 30cm), (vi) Labels (11cm x 9cm), (vii) Straps and Needles, (viii) Napthalene balls, and (ix) Pigeon-hole herbarium cabinets (170cm x 62cm x 50c).

### 3.3.2 Pre-planned field trip programme:

This pre-planned programmed helps in enabling the work to cover as many areas as possible and also in speeding up the actual field work. Before starting the actual field work, a programme for a field trip was chalked out. By using local maps, important places where collection of samples are to be undertaken were demarcated on the basis of centre of biodiversity; all these areas were marked at random. Then the areas, routes and time to be covered were chalked out in order to be able to cover the important areas of collection such as the centres of biodiversity.

### 3.3.3 Actual field work:

Actual field collection was conducted throughout the study area. As the study area is very vast which covers about one-third of the total area of the state of Mizoram, some important areas were selected in such a way that these areas represent the entire study area. The study area extended from Khawkawn in the extreme north to Zawngling in the south and from Thingfal in the west to Hnahlan in the extreme east. A total of 78 villages has been visited and studied, in district wise the study area includes parts of Aizawl districts, Champhai districts, Serchhip districts, Lunglei districts, Lawngtlai districts and Saiha districts of Mizoram.

The villages visited during the actual field work usually have at least one or more medicine men who were 'Key informants'. It is important to have information about these people beforehand so that they could be easily located.

In some villages, the local medicine men sometimes were not easily available, and in their absence, village heads and sometimes even government personnel were very helpful. Besides these people, the locals were interviewed too so that the authenticity of the uses of particular plant or plants to cure diseases can be proved.

Although interviews with locals, village heads and others was not difficult, the medicinemen are sometimes very reluctant to share their knowledge; since most of the time their knowledge had been secretly handed down through generations only within their family and that too only from father to son. So, while interviewing the local medicinemen the trust of the medicinemen must be gained by applying various techniques depending upon the societal background of the people.

To gain the trust of the people, not words but deeds are very important. A field worker has to show through his actions, his genuine appreciation, empathy and respect of the culture, customs and traditions of the particular tribe or tribes he is in contact with. This means that he must adapt comfortably to the local environments, habit and taste of the people. If a local medicineman feels he is talking to a trustworthy person, he is very cooperative and does not hesitate to share his knowledge. But again, as mentioned earlier, the interviews have to be held in private as most of these medicinemen do not want to disclose their knowledge, especially in front of their own people. All in all, interviews with these local specialists went smoothly and the information gathered was most helpful in the actual field work.

After verification of the authenticity of the uses of particular medicinal plants, collection has been undertaken with the help of local people who knows better regarding the locality of the particular plant species. The habit & habitat, associates, growth behaviour, phenology, silviculture character etc. of the medicinal plants were recorded. The soil samples were collected to analyse the nutrient status of the site.

## 3.4 PRESERVATION

A herbarium is a store-house of plant specimens collected from far and wide, mounted on appropriate sheets, arranged according to some known system of classification, and kept

in pigeon-holes of steel or wooden cupboards, usually prepared for the purpose (Jain and Rao, 1977). The guidelines suggested by Jain and Rao (1977) and Womersley (1981) were adopted in collection and preparation of herbarium. The steps involved in Herbarium methods are as follows:

(a) **Plant collection:** The flowers or fruits of different plant species inside the study area were collected as far as possible and in some cases twigs and leaves were also collected. In case of grasses, sedges and other herbs, the whole plant including the underground parts were collected and were prepared in a herbarium for identification by following the works of Jain and Rao (1977) and Womersey (1981).

(b) **Field notes and field numbers**: An important part of the plant collection work is the record of field notes in the field note book. Field note books are specially prepared note books for labeling the plants and for recording notes about them in the field. The pages are serially numbered and there are six tags or tickets on each page having the same number; these are detachable on lines of perforation, and were tied to the specimens with the thread provided in the punched hole of each tag. Detailed notes like location, habit and growth form, flowers and fruits, architecture of shoot and root, bark character of trees, nodes and internodes for bamboos, arrangement of leaves, shape of stem, petiole base etc. were entered in the field note book at the time of collection in the field.

(c) **Preservation of plants before drying:** The specimens collected were poisoned immediately in the camp for longer storage. Poisoning kills the plant thereby the formation of abscission layer and decay was prevented. For poisoning the specimen, 30% para-formaldehyde solution (300g of para-formaldehyde dissolved in 3000ml luke warm water) was poured over the bundles of specimens collected, so that the

bundles get soaked thoroughly. The bundles were then put in a bag and then tied securely. No further change of folders is necessary till reaching the laboratory. On reaching the laboratory, the bundles were opened out; the specimens were exposed to the air to drive away the excess of paraformaldehyde fumes.

(d) **Pressing and drying plant specimens:** Pressing is the process of placing specimens between absorbents under heavy pressure. Specimens were pressed in a plant press, which consists of a wooden frame (for rigidity), corrugated cardboard ventilators (to allow air to flow through the press), blotter paper (to absorb moisture), and folded newspaper (to contain the plant material). In order to fit on a standard herbarium sheet, plant specimens were pressed flat to no more than 1 1 X 1 6 inches. If the specimen did not fit to those dimensions, it was folded or cut into sections. Large fruits or bulbs are cut in half lengthwise or in slices prior to pressing. Each specimen consists of a stem with attached leaves, flowers or fruits. The roots of herbaceous plants were also included. Plants specimens were carefully arranged while they are placed in the press to maximize preservation of diagnostic features. Leaves, flowers, and fruits were spread out so that they do not overlap and can be observed from different perspectives. The plant press was kept tight; this prevents shrinkage and wrinkling of the plant material and yields specimens that are easier to mount securely on herbarium paper. The objective of pressing plants is to flatten the plant and to extract moisture in the shortest period of time, while preserving the morphological integrity of the plant and to yield material that can be readily mounted on herbarium paper for long term storage.

The pressed plants were thoroughly dried by placing in the sun prior to storage and mounting. To obtain best results the plant press was kept in an oven and provides steady bottom heat between 95°F and 113°F. A low ambient humidity and good

airflow around and through the presses also insures rapid and thorough drying of plant material. As the specimens dry, straps on the press were further tighten to minimize shrinkage and wrinkling.

e) **Fumigation:** This was done for killing pests and fungal attack on the plant specimens. The properly dried plant materials were poisoned by dipping into a plastic tray or sprayed with *'Kew Mixture'* (115 gms. of Mercuric Chloride dissolved in 4.5 litres of Ethyl alcohol or Rectified Spirit). One should be very careful while using *'Kew Mixture'* as it is harmful to health. The dried specimens were then mounted on herbarium sheets for identification.

f) **Mounting and stitching:** After the specimen was pressed, dried and poisoned, it was affixed (along with a label) on a mounting sheet with the help of glue. The mounting sheets were made from heavy long-lasting white card sheet in uniform size of 28 x 42 cm (± 1 cm). The attachment or gluing of the specimen was done carefully in such a way to allow maximum observation of diagnostic (usually reproductive) features as well as the range of variation in vegetative structures, including both sides of the leaves. Plants are generally positioned in a lifelike arrangement (that is, with roots or lower stem toward the bottom of the sheet and flowers toward the top). The mounting sheets with specimens glued with fevicol on them were kept in press for one day for proper sticking and drying. Large or bulky items were sewn onto the sheet with a sturdy thread. The objective is to secure the specimen firmly to the mounting paper, while leaving some pieces of the plant loose enough to be removed if necessary.

g) **Labelling:** Mounting of the specimens was followed by pasting of herbarium labels. A plant specimen is incomplete without labeled data. Labeled data is a form of field data and must be accurate. After mounting the specimens on herbarium sheets, each sheet was labeled. A label was pasted on the lower right-hand corner. Herbarium labels are important parts of finished specimens. The standard size of the label is 4" X 2.5". The labels contained the following data.

(i) Collection No. and Date

(ii) Name of the family

(iii) Name of the genus and species

(iv) Locality of collection

(v) Phenology

(vi) Distribution

(vii) Notes

(viii) Collector's name and number.

## 3.5 IDENTIFICATION AND MATCHING OF THE SPECIMENS:

The plant specimens collected during the research work were identified with the help of various regional floras, including the books of "Flora of British India Vol. 1-7" (Hooker, 1872-1897), "Flora of Assam Vol 1-5 (Kanjilal *et. al.,* 1934-1940), Flora of Mizoram (Vol. 1) by Singh *et. al.* (2002), "A Handbook of Common Trees of Mizoram" (Lalramnghinglova, 1997), "Ethno- Medicinal Plants of Mizoram" (Lalramnghinglova, 2003) and "The book of Mizoram Plants" (Sawmliana, 2003). Taxonomic literature such as floras, manuals, journals, monograph, etc. were also used for identification of the specimen.

Besides these floras, in order to match the specimens for confirmation and to identify the unidentified species, plant specimens were taken to the Herbarium of Botanical Survey of

India, Eastern Circle, Shillong, Meghalaya. The local herbarium of parent Department and Environment & Forest Department, Mizoram, had also been consulted for confirmation and identification.

## 3.6 SCREENING OF ENDEMICS, RARE AND ENDANGERED SPECIES

Quantification of medicinal plant specimens was screened with the help of IUCN Red List Categories (1997) and Red Data Book of Indian Plants Vol. I, II & III (Nayer and Sastry, 1987, 1988, 1990); and IUCN Red List Web Site (www.iucnredlist.org).

## 3.7 DOCUMENTATION

The collected plant species were documented by the format as below:

3.7.1. Scientific name

3.7.2. Botanical Description

3.7.3. Habit

3.7.4. Habitat

3.7.5. Local Name

3.7.6. Family

3.7.7. Locality

3.7.8. Micro-climatic Status/Condition (Ambient temperature, Altitude, Humidity, Light intensity.)

3.7.9. Phenology

3.7.10. Growth behavior

3.7.11. Associates

3.7.12. Ecology/Silvicultural character

3.7.13. Soil (N, P, K, pH, OC)

3.7.14. Parts used

3.7.15. Uses

3.7.16. Mode of Preparation

3.7.17. Mode/Route of application

3.7.18. Threat status

## 3.8 ANALYSISNOF THE SOIL SAMPLE

### 3.8.1 Collection of Soil:

Soil samples were collected at the time of actual field work. Soils were dug with the help of dao or small spade to the depth of at least 10cms. and about 1kg. were collected and packed in a clean polythene bag. All the soil samples collected were marked with the help of marking pen at the sides of each polythene bag by giving the local name of the plants collected.

### 3.8.2 Processing:

The samples collected were air dried. Here care should be taken that there should not be any contamination. The air dried soil is passed through 2mm. sieve for analysis. Before sieving, the soil clods were crushed in pestle and mortar so as to pass it through sieves of finer mesh size (0.2-0.5mm) (Ghosh *et. al.*, 1983).

### 3.8.3 Determination of pH:

Soil pH was measured by mixing 10 gram of freshly collected soil sample and 50ml of distilled water and stirred for 20 minutes in a 100 ml beaker using magnetic

stirrer. The soil-water mixture was kept overnight and the reading is taken with the help of Digital pH meter -Systronics 335 (Maiti, 2003).

### 3.8.4 Estimation of organic carbon:

Soil organic carbon was determined by rapid dichromate oxidation technique or, Walkley and Black Method (1934). The organic matters in the soil were oxidized by chromic acid (Potassium dichromate plus cone. H2 SO4 utilizing the heat of dilution of $H_2$ $SO_4$. The unreacted dichromate was determined by back titration with ferrous sulphate (Maiti, 2003).

*Procedure*

The dried soil is ground completely and passed through 0.2 mm sieve (80-mesh) and 0.5g sample is placed at the bottom of dry 500ml conical flask. 10ml of 1N potassium dichromate was added in the conical flask and the flask was swirled gently to disperse the soil in the dichromate solution. The flask is kept on asbestos sheet. 20ml of conc. Sulphuric acid was carefully added from a measuring cylinder and was swirled 2 – 3 times. The flask was allowed to stand for 30 minutes. 200ml of distilled water and 10ml of ortho-phosphoric was added to get a sharper end point of titration. After the addition of 1ml diphenylamine indicator, the content was titrated with ferrous ammonium sulfate solution till the colour flashed from blue-violet to green. Simultaneously, a blank is run without soil.

The soil organic carbon content was calculated by the following formula,

$$\text{Organic carbon (\%)} = \frac{10\ (B\text{-}T)}{B} \times 0.003 \times \frac{100}{S}$$

Where, B = Volume of ferrous ammonium sulfate solution required for blank titration in ml.

T = Volume of ferrous ammonium sulfate solution required for soil sample in ml.

S = Wt. of soil in gram.

### 3.8.5 Determination of Total Nitrogen:

The total nitrogen was determined by Kjeldahl method which involves three steps which were done as follows:

*(i) Digestion*

5g of air dried soil sample was transfer to the digestion tube.10-15ml of conc. Sulphuric acid ($H_2SO_4$) was added and 5-7g of catalyst mixture of the sample. The digestion tubes were loaded in the Digester and the digestion block was heated to 410 $^oC$ till the sample colour turns colorless or light green colour.

*(ii) Distillation*

The main AC power and the Rear side Green colour of the distillation unit was switched on. The distilled water tap was kept in ON condition. The power was switched in control panel. The Digestion tube large (DTL) was taken with digested sample. After the addition of 10ml distilled water it was shaken well. The DTL was loaded in Distillation Unit using the slider mechanism. 25 ml of 40% Boric acid plus 3 drops of Methyl red and 3 drops of Bromocresol green was taken in a 250ml conical flask and kept in the receiver end. Then, 40ml of 40% NaOH was added by using the control panel.

The timer was set at 20 sec. on the upper button. After the process was over the boric acid turned colourless. After the READY signal was glowing, the tap water inlet was opened for condensation. The required process time was set at 6 minutes for distillation on the lower button. The run key was pressed at the lower button. After the process time was over, steam was automatically cut off and the condensation tap water inlet was closed. The conical flask containing boric acid was taken out from the receiver end and the sample was ready for titration.

*(iii) Titration.*

The solution of Boric acid was titrated against 0.1N HCl. Or 0.1N $H_2SO_4$ until the Boric acid turned pink. The burette reading was taken and the percentage of

Total Nitrogen was calculated with the help of the formula.

$$\text{Percentage of } N_2 = \frac{14 \text{ X Normality of acid X Titrant value X } 100}{\text{Sample weight X } 1000}$$

### 3.8.6 Estimation of available phosphorus:

Available phosphorus was determined after extracting soil phosphorus in 0.5 M sodium bicarbonate solution by Olsen's method (Olsen *et. al.,* 1954). The extract was prepared by adding 2.5 g of soil sample in the 250 ml conical flask containing 50 ml of extracting solution ($NaHCO_3$), shaken for 30 minutes and the suspension was filtered through a Whatman filter paper No. 40. Activated carbon (free of phosphorous) was added to obtain a clear filtrate. The flask was again shaken immediately before pouring the suspension into the funnel.

*(i) Colour development*

5 ml of the extract was taken into a 25 ml conical flask, to which 5 ml of Dickman and Bray's reagent was added drop by drop till the effervescence ceased. The content was diluted to 22 ml. adjusted the pH to 5.0 and added 1ml of diluted $SnCl_2$ (2.5g in 100 ml glycerol heat in water bath for mixture). The colour was stable for 24 hours and maximum intensity was obtained just after 10 minutes with the help of Systronics Spectrophotometer 119 at 660 *m*« (Dickman and Bray, 1940).

(ii) *Preparation of standard curve*.

For preparation of standard curve different concentration of phosphorus (1, 2, 3, 4, 5 and 10 ml of 2 ppm phosphorus solution) were taken in 25ml volumetric flask. The standard concentration of phosphorus was prepared in the range of 0.08ug/ml to 0.80ug/ml (Spectophotometer 660 *m*« ).

The curve was plotted taking the colorimeter reading on the vertical axis and the amount of phosphorus (in µg P/ml) in the horizontal axis.

Calculation:

Olsen's phosphorus (Kg/ha) = R X V/v X 1S x (2.24 X $10^6/10^6$)

= R X (50/5) X (1/2.5) X 2.24

= µg P X 8.96

Where, V = Total volume of extractant (50ml)

v = Volume of aliquot taken for analysis (5ml)

S = Wt. of soil (2.5g)

R = Wt. of the aliquot in ug (from standard)

### 3.8.7 Determination of available potassium:

Exchangeable potassium of soil was determined by using flame photometer after extracting with 1N ammonium acetate solution. 5 g of soil sample was shaken with 25 ml of 1N ammonium acetate solution for 5 minutes and filtered through Whatman No. 1. Then the potassium concentration was determined by flame photometer by using K-filter (Ghosh *et. al.,* 1983; Maiti, 2003). The first few ml of the filtrate was rejected. The potassium concentration in the extract was determined by flame photometer using K filter.

*Preparation of standard curve:*

Prepare 10 to 60 ppm K solutions was prepared from the stock solution by adding ammonium acetate solution. After attaching the appropriate filter, gas and air pressure in the flame photometer were also adjusted. The reading was adjusted to zero for the blank in flame photometer. The readings at the different conc. for K solution were noted. The readings were plotted against the concentrations.

Calculation:

i) Available potassium (mg of K/g of soil) = $\frac{A \times V}{W \times 100}$

ii) Available K (Kg/ha) $= R \times \frac{V}{W} \times 2.24 \times \frac{10^6}{10^6}$

$= \text{ppm of K} \times 11.2$

Where, A = K content of soil extract from standard curve, mg/L

V = Volume of the soil extract ml.

W = weight of air-dried sample taken for extraction in g. (5g)

R = ppm of K in the extractant.

## 3.9 DELINATION ON MAP

The topo sheet (scale 1 : 250,000) which covers the site of collections are collected. The latitudes and longitudes are measured to delineate the place of collection of the plants.

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# CHAPTER - 4

# STUDY AREA

## 4.1 GEOGRAPHICAL LOCATION:

The study area falls under the major group Montane Sub-tropical Forest (Subramanian and Sasidharan, 1996) or Eastern Himalayan Montane Forests of Mizoram. The area covers about 24% of the total geographical area (i.e. 21, 081 sq.km) of the state; it expanse in the eastern fringes of Mizoram bordering Myanmar (Burma) on the east and Manipur on the north. It lies between $21^0$ 57` N to $24^0$ 15` N latitude and $93^0$ 11` E to $93^0$ 29` E longitude**.** The altitude varies approximately from 750 m asl on the western side and 2158 m asl on the eastern side. The study area includes parts of Aizawl district, Champhai district, Serchhip district, Lunglei district, Lawngtlai district and Saiha district of Mizoram. It forms parts of the Topographical Maps No. 83 H/4, 83 H/8, 84 A/14, 84 A/15, 84 B/13, 84 B/14, 84 B/15, 84 E/1, 84 E/2, 84 E/3, 84 E/4, 84 E/5, 84 E/6, 84 E/7, 84 E/8, 84 F/1, 84 F/2, 84 F/3 of Forest Survey of India

## 4.2 CLIMATE:

The area as a whole enjoys a pleasant and moderate climate. It is neither very cold nor very hot. It has a sub-temperate climate and the temperature varies from $9^0$C to $25^0$C (Lalramnghinglova, 2003). The places at higher altitude experiences very cold winter with higher temperature ranges while places at lower altitude experiences lower temperature ranges.

The entire state of Mizoram is under the influence of monsoon. The study area also receives heavy rain during May to September like other areas of the state with the average of 2063.83 mm per annum, Within the study area, Saiha district which is

in the southern most part of the state receives heaviest rainfall with an average of 3244.90mm per annum (Anonymous, 2010). Normally July and August are the rainiest months whereas December and January are the driest months (Pachuau, 1994).

## 4.3 SOIL:

The soils of Mizoram are classified by Sanker and Nandy (1976) into three orders of soil taxanomy : (i) Entisols, (ii) Inceptisols and (iii) Ultisols (USDA, 1988) followed by Anonymous (1988), Hrahsel (1988), Singh and Datta (1989), Pachuau (1994) and Saithantluanga (1997).

The soils of the study area also falls under the above three orders. They are generally young, immature and sandy. The surface soils are dark, highly leached and poor in bases, rich in iron and have low pH values ranging from 4.5-6.0 *i.e.* averagely acidic. They are well drained, rich in organic carbon, low in phosphate content and high in available potash. The surface soil textures are loam to clay loam with clay content increasing in depth. The pH and organic carbon content decreases with the increase in depth. They are capable of providing substancial oxygen supply for plant growth and have capability to retain moisture for sufficient supply of oxygen throughout the year. The percentages of clay, silt and sand within 50cms. of the surface is 15-30%, 35-45% and 25-45% respectively (Anonymous, 1999).

## 4.4 VEGETATION:

Out of the total geographical area (21, 081 sq.kms) of the state, 19,240 sq. kms. is covered by Forest which is about 91.27 % of the total area of the state (Anonymous, 2010). The vegetation of Mizoram can be simply divided into three

category: 1) Tropical Wet Evergreen Forest, 2) Tropical Semi Evergreen Forest and 3) Montane Sub-tropical Forest (Champion and Seth, 1964).

The study area also covers Montane Sub-tropical Forest and has abundant growth of vegetation. The common timber trees and some of the economically important plants species of the forest are as given below:

The forest are characterized by *Rhododendron arboreum* Sm.(Chhawkhlei); *Myrica esculenta* Buch. Ham. ex D. Don (Keifang); *Engelhardtia spicta* Leschn. ex Blume (Hnum); *Pinus kesiya* Royle ex Gordon. (Far); *Lithocarpus dealbata* (Miq.) Rehder. (Fah); *Quercus griffithii* Hk.f. & Th. ex DC (Sasawthing); *Quercus serrata* Thumb. (Sehawrdum) etc.

*Arundinaria callosa* Munro (Phar); *Chimonobambusa khasiana* (Munra) Nakai (Lik); *Dendrocalamus sikkimensis* Gamble (Rawmi); and *D. giganteus* Munro (Rawpui) are the characteristic bamboo species. *Melocalamus compactiflorus* Benth. (Sairil) are also present, whereas distribution of *Melocanna baccifera* (Roxb.) Kurz is restricted to the forests. *Trachycarpus martiana* H. Wendl. (Siallute) and few cycads are also present (Lalramnghinglova, 2003).

The forest is also the natural abode of epiphytic orchids like *Renanthera inschootiana* Rolfe (Senhri); *Vanda coerulae* Griff ex Linda (Lawhleng); *Mantisia saltoria* and *M. wengerii* Fischer (Ruala, 1985; Singh *et. al*., 1990). Since most of the villagers are practicing Shifting Cultivation, it leads to the degradation of forest and disturbed plant succession.

## 4.5 PROTECTED AREAS:

The study area also includes 2 (two) National Parks (Murlen National Park and Phawngpui National Park) and 2(two) Wildlife Sanctuaries

(Lengteng Wildlife Sanctuary and Tawi Wildlife Sanctuary). They are briefly described as below :

i) **Murlen National Park:** Situated in the eastern part of Mizoram (bordering Myanmar) it has an area of 150km$^2$ and the highest peak is 2175 m asl. Sub-tropical hill forests and tropical semi-evergreen forests prevail in the area. Pradhan (1995) has recorded 427 species of animals including 275 species of birds. The distance from Aizawl-via-Champhai is about 245 Km.

ii) **Phawngpui National park :** It is located in the eastern part of Lai Autonomous District Council in Chhimtuipui District of South Mizoram. The area is 50 km$^2$ and the park includes the highest peak in Mizoram, ***i.e.,*** **Phawngpui** or **Blue Mountain** (2157 m asl). The existence of a Sub-tropical hill forests is characterized by the natural growth of *Rhododendron arboretum* Sm. and is endowed with rich growth of epiphytic orchids. Robertson (1996) has reported birds, *viz., Falco peregrines, Garrulax virgstus, Ficidula superaciliaris,* etc. which were not seen anywhere in Mizoram.

iii) **Lengteng Wildlife Sanctuary :** Lengteng Wildlife Sanctuary is located in Champhai District of Mizoram. It lies at Lamzawl and is near to Murlen National Park. Some of the wild animals and birds found in this sanctuary are Tiger, Leopard, Sambar, Barking deer, Wild boar, Hoolock gibbon, Rhesus macaque, Ghoral, Serrow, Hume's Bartailed Pheasant, Kaleej Pheasant. Lengteng Wildlife Sanctuary is 250 km east of Aizawl. Lengteng wildlife sanctuary is very close to Indo-Myanmar and Indo-Bangladesh borders. It

covers about 110 sq. km of land and ranges in altitude from 400 m to about 2300 m asl. The second highest Peak in Mizoram can also be seen in this park.

iv) **Tawi Wildlife Sanctuary :** Tawi Wildlife Sanctuary in Aizawl District of Mizoram is one of the first sanctuaries in Mizoram. It is located in the central part of the state, about 115 km from the capital town of Aizawl. It covers an area of about 35.75 sq. km and ranges in altitude from 400m to 1300m from sea level. Notified in 1978, its vegetation includes tropical evergreen and semi evergreen forests, which are home to many species of flora like Canes and Bamboos, *Michelia champaca, Duabanga, Schima wallichi, Termunalia, Gmelina arborea*, etc. and fauna like Tiger, Leopard, Sambar, Barking deer, Jungle Cat, Serow, Hoolock gibbon, Rhesus macaque, Kallej pheasant, Jungle fowl, Common patridges, Hill myana, Dark rumped swift.

## 4.6 THE INHABITANTS:

In Mizoram, 16 Scheduled Castes, 14 Scheduled Tribes and 37 Sub-tribes have been recognized (Anonymous, 1991). Shakespeare (1912) divided the Lushai (Mizo) into a number of sub-tribes or clans and sub-clans. Dutta (1992) so far traced fifteen ethnic groups or population in Mizoram, such as *Lusei, Paihte, Hualngo, Tlau, Thado, Ralte, Hmar, Mara* (Lakher), *Pawi (Lai), Bawm, Pang, Chakma, Riang, Biate* and *Mog.*

Out of the above mentioned fifteen ethnic groups, 4 minority ethnic groups or communities form the **"inhabitants"** of the study area, such as (i) *Mizo* (Lusei) (ii) *Mara* (Lakher), (iii) *Lai* (Pawi), (iv) Paihte who are a very distinctive people rich in old-age traditions, cultures and customs, and continue to retain their respective

dialects and ethnic identity. (Lalramnghinglova, 2003). A brief account of the inhabitants of study area is presented below:

**MIZO** *(Lusei):* The Mizos are formerly known as *Lushais* and their language (i.e., *Lushai language or Duhlian)* has now became *"Mizo language"* (Phukan, 1992; Thanga, 1992). Their life and culture has been described under *"The People and Culture"* in Chapter 1. They are the dominant tribe in Aizawl, Champhai, Serchhip and Lunglei Districts of the study area.

**MARA :** The true name and the name by which they call themselves is *'Mara'* but by the surrounding tribes they are known as *"Lakhers"* (Lorrain, 1921). They are known as *'Shamtu'* in Myanmar, *'Shindu'* in Arakan and *'Lakher'* in Mizoram. They occupy the south-eastern corner of Mizoram. They came from Haka, the Chin Hills of Myanmar and they speak Mara language. They live in eastern hills and the valleys of *Kolodyne* river. The principal Lakher clans have been classified into royal, patrician and plebeian clans (Parry, 1932). They are extremely sensitive to their peculiar identity (Chatterjee, 1990). Agriculture is the main occupation. The rural people have acquired the knowledge of indigenous medicines form Mor or Rakhai. The Maras are expert cotton growers and women are good weavers.

**LAI :** Lai people are known as *Pawi* or *Chin*, because most of their settlements were in the Chin Hills of Burma (Singh, 1995). According to tradition, they came from Haka and Klangklang Sub-division of the Chin Hills of Myanmar (Anonymous, 1994). According to Hengmang (1992), Lai people came down from China in 200-100 B.C.

Lai People live around the Blue Mountain and in-between Kolodyne river and Chakma Autonomous District in Chhimtuipui District of South Mizoram. They speak their own language called, **'Lai Hawlh'** (Language of Lai). Their dialect belongs to the Tibeto-Burman type of Central-Chin Group along with Lushei, Lakher and Zahau tribes (Grieson, 1908).

There are over 160 clans and sub-clans among the Pawi tribe. The principal clans are *Hnialum, Chinzah, Hlawncheu, Hlawnchhing, Khenglawt* and *Fanai* (Anonymous, 1994). *Jhuming* agriculture is their main occupation.

**PAITE:** The Paites are one of the constituting tribes of the ZOMI/ZOs who inhabit India, Burma and Bangladesh. The word paite means "a group of people marching " (pai-march ;te - "plural maker"). The Paites are a recognised scheduled tribe in Manipur as well as in Mizoram. The Paites are concentrated in Manipur, a northeastern state of India. They are dominant in Lamka Town of Churachandpur of Manipur state with a population of 60 thousands (as per the population consensus, 2001). Almost all ethnic Paites follows Christianity. There is also a large Paite population in the Indian State of Mizoram. They are well integrated in the Mizo group which consist of many very similar tribes. They live around Lengteng hills in the Northern part of Mizoram in Champhai district.

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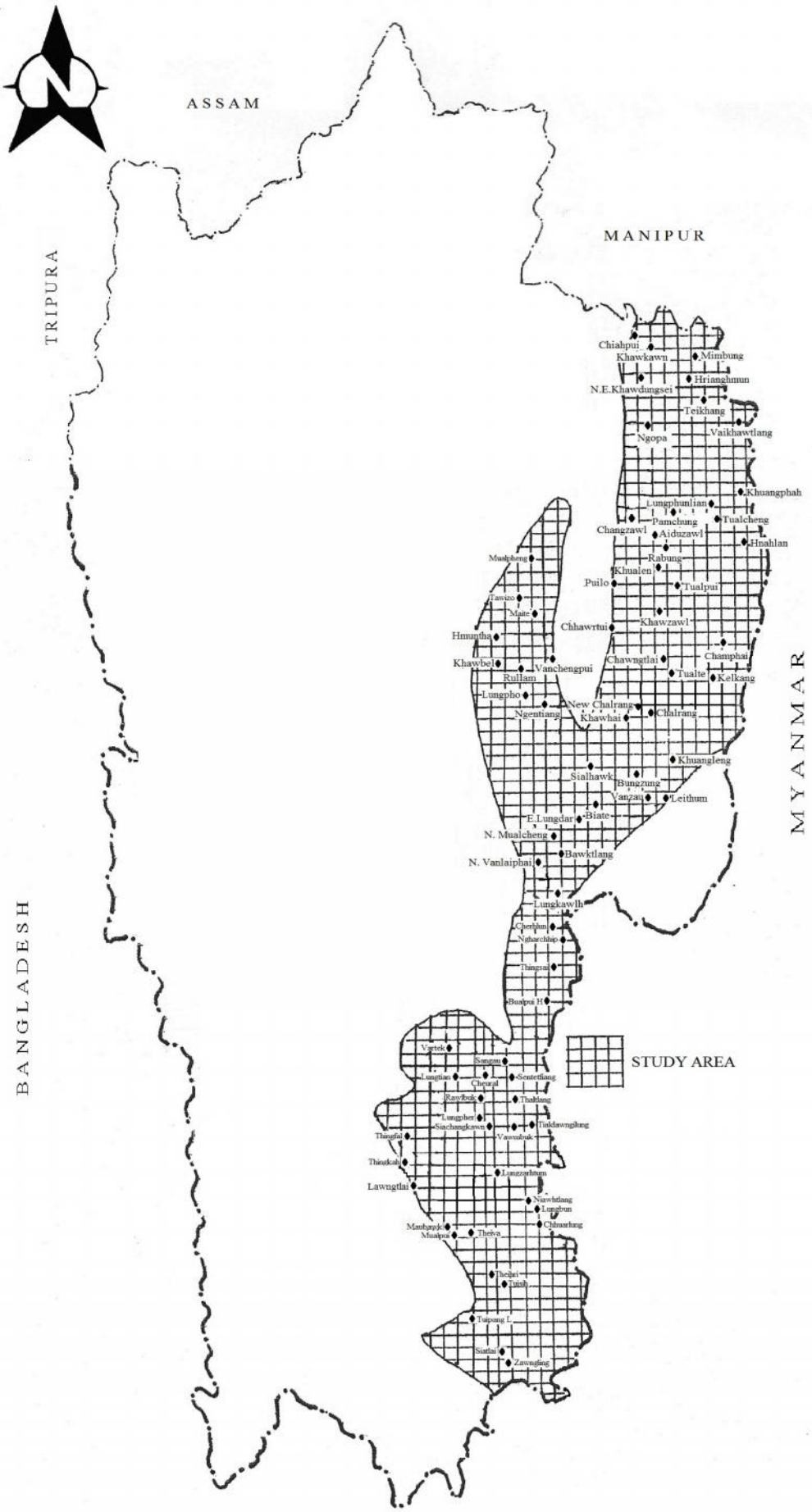
Map No. 1

**MIZORAM**




Map showing Study Area and Places of ethnomedicinal collections

# CHAPTER - 5

# RESULT

## 5.1 DESCRIPTION:

### 5.1.1 Presentation of data:

The plant species having ethnomedicinal importance are altogether one hundred and seven in numbers. Out of one hundred and seven plant species collected, ninety seven belongs to Dicotyledons, six comes under Monocotyledons and four are Ferns. The plant species represent sixty four families (Table No.1).

Scientific names of the plants are arranged alphabetically, where an effort has been made to give the latest botanical names with the help of IPNI (International Plant Names Index) web site: http://www.ipni.org. Description of the plant species are made in the sequence of : scientific name, local name, family, locality, botanical description, habit, habitat, micro-climatic status/condition (ambient temperature, altitude, humidity, light intensity) of the growing site of the plant species, phenology, associates, ecology/silvicultural character, analysis of soil (content of Nitrogen : N in percentage : %, content of Phosphorus : P in Kilograms per Hectres : kg/ha, content of Potassium : K in Kilograms per Hectres : kg/ha, Hydrogen potentials : pH and Organic compound : OC content in percentage : %) collected from the growing site of the plant species, parts used, uses, their mode of preparation, mode/route of application and threat status.

Among the 64 families, the families Euphorbiaceae and Asteraceae have the maximum number of 7 plant species each followed by Rubiaceae, Malvaceae and Fabaceae with 6, 5, 4 species respectively. (Table No.1).

Taxonomic description of plants follow successively.

### 5.1.2 Description of plants:

***Abelmoschus moschatus* (Pl. IV, Photo 10)**

| | | |
|---|---|---|
| Scientific name | : | *Abelmoschus moschatus* Medik. |
| Local Name | : | Uichhuhlo |
| Family | : | Malvaceae |
| Locality | : | Tualcheng |
| Botanical Description | : | A soft, herbaceous trailing plant to 2 m in length, with soft hairy stems. Leaves polymorphous, the lower ovate, acute or roundish-angled, the upper palmately 3-7 lobed, hairy on both surfaces. Flowers large, corolla bell-shaped, yellow with purple centre. Capsules fulvous-hairy, pyramidal-oblong, acute. |
| Habit | : | A soft, herbaceous trailing shrub with soft hairy stems. |
| Habitat | : | In open places, grasslands and open clearings, etc., at low and medium altitudes. |
| Micro-climatic Status/Condition: | | Ambient temperature : $24^{o}$C<br>Altitude : 1300 m<br>Humidity : 54%<br>Light intensity : 85170 lux |
| Phenology | : | Leaf shedding : Annual herb<br>Flowering : September - October<br>Place of flower : Axillary<br>Fruiting : October – December |
| Associates | : | *Ageratum conyzoides, Plantago major, Clerodendrum spp.* |
| Ecology/Silvicultural character: | | High light demander, heavy and continuous rain effects crops growth negatively, can be easily regenerate by natural and artificial methods. |
| Soil | : | N : 0.04 %<br>P : 14.2Kg/ha<br>K : 254.0 Kg/ha.<br>pH : 6.2<br>OC : 1.0% |
| Parts used | : | Leaves, roots and seeds. |

| | | |
|---|---|---|
| Uses | : | Sprain, inflammations and removal of thorn. |
| Mode of Preparation | : | Leaf and root paste as a poultice for sprain and inflammations. Leaf paste is also used as poultice for removing thorn stuck in the body. |
| Mode/Route of application | : | External application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Acer oblongum* (*Pl. IV, Photo* 11 & Fig. 5)**

| | | |
|---|---|---|
| Scientific name | : | *Acer oblongum* Wall.ex DC |
| Local Name | : | Thingphingphihlip |
| Family | : | Aceraceae |
| Locality | : | Tualcheng |
| Botanical Description | : | A small or medium-sized evergreen tree. Leaves broadly oblong to lancelike, long pointed, toothless, blue-green beneath, finely hairy when young. Inflorescence corymobose, pubescent on leafy terminal and lateral shoots, 5-15 cm long. Pedicels pubescent. Flowers 5-merous, 7-9 mm across, greenish-white. Sepals linear, 1-2 mm wide, acute, pubescent. Petals narrowly lanceolate, 1-2 mm wide. Stamens 8, inserted on disc. Ovary pubescent, styles free nearly to the base. Samaras glabrous, 2-3 cm long; wings veined, divergent, constricted at base; nutlets gibbous, locules white-pubescent inside. |
| Habit | : | A small or medium-sized evergreen tree. |
| Habitat | : | Rare in Mizoram. Found in lime-free soils in forests at higher altitude of Tualcheng, etc. |
| Micro-climatic Status/Condition: | Ambient temperature | : $19^{o}$C |
| | Altitude | : 1245 m |
| | Humidity | : 50 % |
| | Light intensity | : 18500 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Leaf shedding | : | April-May |
| | | New Leaf | : | June - July |
| | | Flowering | : | October - November |
| | | Place of flower | : | Terminal or lateral |
| | | Fruiting | : | January - March |
| Associates | : | *Castanopsis spp., Quercus spp., Bauhinia variegate, Schima wallichi, Lantana camara.* | | |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire, no problem in natural regeneration. | | |
| Soil | : | N | : | 0.22% |
| | | P | : | 2.19 kg/ha |
| | | K | : | 102 kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 2.17% |
| Parts used | : | Bark | | |
| Uses | : | Diarrhoea and dysentery | | |
| Mode of Preparation | : | Decoction of the bark is taken for diarrhea and dysentery. | | |
| Mode/Route of application | : | Oral | | |
| Status/Category | : | Endangered | | |

***Adiantum lunulatum*** **(Pl. IV, Photo 12)**

| | | |
|---|---|---|
| Scientific name | : | *Adiantum lunulatum* Burm. f. |
| Local Name | : | Lungsam |
| Family | : | Pteridaceae (Adiantaceae) |
| Locality | : | Ngopa |
| Botanical Description | : | Leafy fern. Fronds often elongated, rooting at apex, pinnate, pinnae sub-dimidate; sori borne in a continuous line along the edge. |
| Habit | : | Leafy fern. |

| | | | | |
|---|---|---|---|---|
| Habitat | : | Commonly found on rock and slopes of the lower hills as well as under shade near swamps. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 18 $^{o}$C |
| | | Altitude | : | 1200 m |
| | | Humidity | : | 61 % |
| | | Light intensity | : | 74150 lux |
| Phenology | : | Flowering | : | June - September. |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | October – March |
| Associates | : | Mosses and ferns | | |
| Ecology/Silvicultural character: | | Shade bearer, resistant to heavy rainfall, regenerate naturally. | | |
| Soil | : | N | : | 0.092 % |
| | | P | : | 1.98 kg/ha |
| | | K | : | 19 kg/ha |
| | | pH | : | 4.84 |
| | | OC | : | 0.76 % |
| Parts used | : | Stem and leaves | | |
| Uses | : | For removing gravel from gall bladder and heart disease | | |
| Mode of Preparation | : | Either decoction or raw eaten of the stem and leaves is used for removing gravel from gall bladder, it is also used for heart disease. | | |
| Mode/Route of application | : | Oral. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Adina cordifolia* (Pl. V, Photo 13)**

| | | |
|---|---|---|
| Scientific name | : | *Adina cordifolia* (Roxb.) Brandis. |
| Local Name | : | Lungkhup |
| Family | : | Rubiaceae. |
| Locality | : | Ngopa |

| | | | | |
|---|---|---|---|---|
| Botanical Description | : | A large deciduous tree, up to 40 m tall by 2.2 m in diameter. Leaf is big, heart shaped, 10-22 cm long, pubescent, simple stipulate, opposite cordate and ovate. Flower brown. However, yellow flower is reported elsewhere (Kirtikar & Basu, 1981). Inflorescence panicle. Fruits very numerous, in round heads. | | |
| Habit | : | A large deciduous tree. | | |
| Habitat | : | Common in deciduous and semi evergreen forest. Grown on sandy loam soil in tropical and semi evergreen forests. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 25 $^{o}$C |
| | | Altitude | : | 1300 m. |
| | | Humidity | : | 47 % |
| | | Light intensity | : | 14700 lux |
| Phenology | : | Leaf shedding | : | Evergreen. However, the species is deciduous elsewhere (Brandis,1990) |
| | | New Leaf | : | March - April |
| | | Flowering | : | June – July. It is also reported upto August (Chatterjee & Prakashi, 1997) |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | August – September. Fruiting in October – December is reported by Chatterjee & Prakashi (1997) |
| Associates | : | *Thea sinensis, Parkia roxburghii, Cinnamomum bejholghata.* | | |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire, no problem in natural and artificial regeneration. | | |
| Soil | : | N | : | 0.21% |
| | | P | : | 2.11 kg/ha |
| | | K | : | 102 kg/ha |
| | | pH | : | 6.0 |
| | | OC | : | 2.10 % |
| Parts used | : | Bark | | |
| Uses | : | Sprain, diarrhoea and stomach ulcer. | | |

| | | |
|---|---|---|
| Mode of Preparation | : | Decoction of the bark is used as lotion for sprain, it is also taken orally to cure diarrhoea and stomach ulcer. |
| Mode/Route of application | : | Externally and orally |
| Status/Category | : | Not assessed for the IUCN Red List |

***Aeschynanthus hookeri* (Pl. V, Photo 14)**

| | | |
|---|---|---|
| Scientific name | : | *Aeschynanthus hookeri* C.B.Clarke |
| Local Name | : | Pawhrual (zam chi) |
| Family | : | Gesneriaceae (Gloxinia family) |
| Locality | : | Aiduzawl |
| Botanical Description | : | Stems ca. 40 cm, glabrous. Leaves opposite; petiole 6-10 mm; leaf blade narrowly elliptic to oblong, 7-9 X 2.3-4 cm, thick leathery, glabrous, adaxially drying smooth or wrinkled, abaxially not punctate, base broadly cuneate, margin entire, apex acuminate; lateral veins indistinct. Cymes pseudoterminal, 4-10-flowered; peduncle absent; bracts persistent, green, triangular to lanceolate, 5-9 X 1.5-3 mm. Pedicel 1-1.5 cm, glabrous. Calyx red or purple, 1-1.3 cm, 5-lobed from above to near middle; tube 5-6 mm in diam. at mouth; lobes ovate to broadly triangular, 3-7 X 2.2-3.2 mm, outside glabrous. Capsule ca. 30 cm. Seeds with 2 hairlike appendages at hilar end, to 13 mm, opposite end with 1 hair like appendage to 7 mm. |
| Habit | : | Climber |
| Habitat | : | Rarely found in Mizoram in sandy rocky places in disturbed forets. |

| | | | |
|---|---|---|---|
| Micro-climatic Status/Condition: | Ambient temperature | : | 18 $^{o}$C |
| | Altitude | : | 1250 m |
| | Humidity | : | 56 % |
| | Light intensity | : | 82200 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Flowering | : | June - July. |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | August – September |
| Associates | : | *Securinega virosa, Osbekia rostrata, Mussaenda glabra.* | | |
| Ecology/Silvicultural character: | | Light demander, acceptable to jhum fire, natural regeneration. | | |
| Soil | : | N | : | 0.092 % |
| | | P | : | 12.0 kg/ha |
| | | K | : | 156 kg/ha |
| | | pH | : | 5.5 |
| | | OC | : | 1.66% |
| Parts used | : | Leaves | | |
| Uses | : | Sprain | | |
| Mode of Preparation | : | The leaves are crushed with a piece of lime to make paste and then applied to sprain particularly in the waist. | | |
| Mode/Route of application | : | External application. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Ageratum conyzoides* (Pl. V, Photo 15)**

| | | |
|---|---|---|
| Scientific name | : | *Ageratum conyzoides* L. |
| Local Name | : | Vailenhlo |
| Family | : | Asteraceae |
| Locality | : | Lungtian |
| Botanical Description | : | An erect, annual, foetid herb, 30-60 cm high. Leaves are opposite, pubescent with long petioles and include glandular trichomes. : Inflorescence a terminal corymb; flowers pale blue, in small head. The fruit is an achene with an aristate pappus and is easily dispersed by wind. |

| | | | | |
|---|---|---|---|---|
| Habit | : | An erect annual herb. | | |
| Habitat | : | Common in moist shady and waste places, road sides and gardens. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 20 $^{o}$C |
| | | Altitude | : | 1090 m |
| | | Humidity | : | 44% |
| | | Light intensity | : | 9815 lux |
| Phenology | : | Leaf shedding | : | Annual herb |
| | | Flowering | : | Throughout the year |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | Throughout the year |
| Associates | : | *Mikania micrantha, Cissus javanica, Chromolaena odorata, Ageretum adenomorpha.* | | |
| Ecology/Silvicultural character: | | Moderate light demander, acceptable to jhum fire, regenerate naturally. | | |
| Soil | : | N | : | 0.31 % |
| | | P | : | 11.2 kg/ha |
| | | K | : | 165.0 kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.0 % |
| Parts used | : | Leaves | | |
| Uses | : | Itches due to Lungphur (small caterpillar), tonsillitis. | | |
| Mode of Preparation | : | Juice of the crushed leaves is applied to itches caused by a small caterpillar called Lungphur(Mizo). Juice of the crushed leaf is applied externally around the throat to cure tonsillitis. | | |
| Mode/Route of application | : | External | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Alstonia scholaris* (Pl. VI, Photo 16)**

| | | |
|---|---|---|
| Scientific name | : | *Alstonia scholaris* (L.) R.Br. |
| Local Name | : | Thuamriat |
| Family | : | Apocynaceae |

| | | |
|---|---|---|
| Locality | : | Bualpui H |
| Botanical Description | : | A middle sized to large evergreen tree. Leaves 5-8, whorled, elliptic-lanceolate or elliptic oblong, bluntly acuminate, 3-5 x 8-20 cm. cuneate, narrowed into a petiole. Flowers greenish white, in terminal umbellate cymes. Fruits (follicle) often pendulous and paired, clustered, cylindric and linear up to 60 cm long; seeds with hair. |
| Habit | : | A middle sized to large evergreen tree. |
| Habitat | : | Very frequent in Mizoram in tropical evergreen and semi-evergreen forests. It thrives well on sandy loam soil in tropical and semi evergreen forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 25 $^{o}$C |
| | Altitude : | 1200 m |
| | Humidity : | 43% |
| | Light intensity : | 12800 lux |
| Phenology | : | |
| | Leaf shedding : | September - October |
| | New Leaf : | February - March |
| | Flowering : | February - March |
| | Place of flower : | Terminal |
| | Fruiting : | April – May |
| Associates | : | *Tetrameles nudiflora, Bauhinia variegate, Duranta rapens* |
| Ecology/Silvicultural character: | | Light demander, resistant to high rainfall, acceptable to jhum fire, artificial and natural regeneration is easy. |
| Soil | : | |
| | N : | 0.160 % |
| | P : | 12.76 kg/ha |
| | K : | 72 kg/ha |
| | pH : | 5.5 |
| | OC : | 1.6 % |
| Parts used | : | Roots, bark and latex. |
| Uses | : | Hypertension, malaria, dysentery, antiseptic, fever, stomachache. |
| Mode of Preparation | : | 1) A decoction of the bark is taken for hypertension at the rate of tablespoonful three times per day.<br>2) Infusion of crushed root bark is taken for Malaria. Decoction of root bark is taken against dysentery at the rate of one cup thrice daily. |

3) The milky juice or latex is applied on cuts and wounds. The latex is taken in small quantity for fever and stomachache.

Mode/Route of application : Oral administration, local application as an ointment.

Status/Category : Lower Risk

***Ampelocissus latifolia* (Pl. VI, Photo 17)**

Scientific name : *Ampelocissus latifolia* (Roxb.) Planch.

Local Name : Hruipawl

Family : Vitaceae

Locality : Tualpui

Botanical Description : A weak herbaceous climber, with a tuberous root stock. Leaves orbicular or broadly cordate 7-15 x 8-15 cm, 3-7 lobed, lobes acute, serrate-dentate, ± glabrous on both sides; petiole 3-5 cm long, stipules minute, deciduous. Inflorescence a compact thyrsoid cyme; peduncle 6 7 cm long, ending in a long bifurcate tendril. Flowers numerous, deep reddish. Clayx truncate or obscurely 5 toothed. Petals 5, oblong. Ovary 10-lobed at apex, sunken in the disc, style absent; stigma cup shaped. Berry globose, black, 6-7 mm, 2 seeded, rarely 3 seeded. Seeds elliptical, margin rugose, transversely with a linear tubercle on the back and bluntly ridged on the face.

Habit : An extensive climber.

Habitat : Common in Mizoram, in tropical dense forests and semi-evergreen forests. It is grown in moist shady places under primary and secondary forests.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 19 $^{o}$C |
| Altitude | : | 1200 m |
| Humidity | : | 42 % |
| Light intensity | : | 3640 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Leaf shedding | : | March - April |
| | | New Leaf | : | May - June |
| | | Flowering | : | July - August |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | August – October |
| Associates | : | *Mikania mikrantha, Eupatorium odoratum, Ficus spp.* | | |
| Ecology/Silvicultural character: | | Shade bearer, resistant to heavy rainfall, natural regeneration has no difficulty but artificial regeneration is ver difficult. | | |
| Soil | : | N | : | 0.173 % |
| | | P | : | 0.56 kg/ha |
| | | K | : | 88 kg/ha |
| | | pH | : | 5.7 |
| | | OC | : | 0.94 % |
| Parts used | : | Roots and leaves. | | |
| Uses | : | Tooth-ache, excess urination. | | |
| Mode of Preparation | : | 1) Juice of crushed roots is taken orally to stop excess urination mixed swith blood. The medicine is drunken 1 cup (100 ml) twice or thrice daily.<br>2) The leaves are chewed against teeth set on edge. | | |
| Mode/Route of application | : | Oral administration. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Aporusa octandra* (Pl. VI, Photo 18)**

| | | |
|---|---|---|
| Scientific name | : | *Aporusa octandra* (Buch.-Ham. ex D.Don.) Vick. |
| Local Name | : | Chhawntual |
| Family | : | Euphorbiaceae. |
| Locality | : | Rabung |
| Botanical Description | : | A small or middle sized evergreen tree. Leaves elliptic-oblong or oblong lanceolate, acuminate, 2.5-6 x 8-12 cm, obscurely crenate; nerves 5-7 pairs, slender; base cuneate or rounded. Flowers dense yellow, clustered on the axils and scars of fallen |

leaves on old branches, forming a yellow mat on the ground when fallen. Fruits ovoid-oblong, beaked, yellowish when ripe.

Habit : A small or middle sized evergreen tree.

Habitat : Common throughout Mizoram, particularly in tropical semi-evergreen forests and secondary mixed bamboo forests. It is grown on compact sandy-loam soil.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 20 $^{o}$C |
| Altitude | : | Upto 1500m |
| Humidity | : | 42 % |
| Light intensity | : | 14700 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| New Leaf | : | March - April |
| Flowering | : | November - January |
| Place of flower | : | Axillary |
| Fruiting | : | February – March |

Associates : *Schima wallichi, Sapium baccatum, Actinodaphne obovata, Clerodendrum viscosum*

Ecology/Silvicultural character: Moderate light demander, resistant to jhum fire and heavy rainfall, natural and artificial regeneration has no problem.

Soil :

| | | |
|---|---|---|
| N | : | 0.168 % |
| P | : | 13.0Kg/ha |
| K | : | 975Kg/ha |
| pH | : | 6.1 |
| OC | : | 2.0% |

Parts used : Bark and wood

Uses : Stomach-ache, Stomach ulcer, diarrhoea, dysentry, colic etc

Mode of Preparation : Decoction or Infusion of the inner bark is taken orally for colic and stomach-ache @ one cup twice or thrice daily for atleast three days. The bark is boiled in water and water is taken as a remedy for stomach ulcer, diarrhoea and dysentery.

Mode/Route of application : Oral administration

Status/Category : Not assessed for the IUCN Red List

***Artemisia indica* (Pl. VII, Photo 19)**

| | | | | |
|---|---|---|---|---|
| Scientific name | : | *Artemisia indica* Willd. | | |
| Local Name | : | Sai | | |
| Family | : | Asteraceae | | |
| Locality | : | Vanchengpui | | |
| Botanical Description | : | Tall aromatic herb or undershrub, stem cylindrical, paniculately branched, solid and brown; leaf simple, alternate, lanceolate, agitate; white flower borne on panicled head, petal ligulate; fruit achene, minute, pappus absent. | | |
| Habit | : | Tall aromatic herb or undershrub. | | |
| Habitat | : | Not common in Mizoram, grows in an open fallow land. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 24 $^{o}$C |
| | | Altitude | : | 1400 m |
| | | Humidity | : | 42 % |
| | | Light intensity | : | 12800 lux |
| Phenology | : | Leaf shedding | : | June - November |
| | | New Leaf | : | February - March |
| | | Flowering | : | December – March. However, flowering in the month of August – November is reported by Chaterjee & Prakashi (1997) |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | April – May |
| Associates | : | *Schima wallichii, Ageretum conyzoides, Eupatorium odoratum.* | | |
| Ecology/Silvicultural character: | | Needs abundant light or moderate light demander, acceptable to jhum fire, moderately resistant to heavy rainfall, natural regeneration has no difficulties but artificial regeneration is difficult. | | |
| Soil | : | N | : | 0.138 % |
| | | P | : | 13.32 Kg/ha |
| | | K | : | 81 Kg/ ha |
| | | pH | : | 4.3 |
| | | OC | : | 0.88 % |

| | | |
|---|---|---|
| Parts used | : | Leaves |
| Uses | : | Malaria, nose bleeding, stomach ulcer, cancer. |
| Mode of Preparation | : | The leaf is boiled and the water is used for bathing to heal malaria. Juice of crushed leaves is used to stop bleeding from the nose. Decoction of leaves is used against stomach ulcer and cancer. |
| Mode/Route of application | : | External application |
| Status/Category | : | Not assessed for the IUCN Red List |

***Bauhinia variegata* (Pl. VII, Photo 20)**

| | | |
|---|---|---|
| Scientific name | : | *Bauhinia variegata* Linn. |
| Local Name | : | Vaube |
| Family | : | Leguminosae (Caesalpiniaceae). |
| Locality | : | Tualte |
| Botanical Description | : | A small to medium-sized tree. Leaves ovate, 14 x 10-15 cm, divided into 2 lobes, rigidly subcoriaceous, deeply cordate; nerves 11-15. Flowers variegated, white to pink or purple, axillary or terminal racemes. Fruits flat pods, dehiscent, slightly falcate, 2-3 x 15-13 cm; seeds 11-15. |
| Habit | : | A small to medium-sized tree. |
| Habitat | : | Very common throughout Mizoram, particularly in tropical semi-evergreen forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 21 $^{o}$C |
| | Altitude : | 1200 m. |
| | Humidity : | 41 % |
| | Light intensity : | 15780 lux |
| Phenology | : Leaf shedding : | March - April |
| | New Leaf : | May - June |
| | Flowering : | February - March |
| | Place of flower : | Axillary |
| | Fruiting : | April – May |

| | | |
|---|---|---|
| Associates | : | *Tetrameles nudiflora, Alstonia scholaris, Duranta rapens* |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire and heavy rainfall. Artificial and natural regeneration has no problem. |
| Soil | : | N : 0.157 %<br>P : 14.2Kg/ha<br>K : 254.0Kg/ha<br>pH : 6.2<br>OC : 1.0 % |
| Parts used | : | Bark and wood |
| Uses | : | Dyspepsia and flatulence, diarrhea. |
| Mode of Preparation | : | 1) Decoction of roots is given in dyspepsia and flatulence.<br>2) Decoction of bark is taken orally for diarrhoea @ ½ cup (50 ml) once or for twice daily. It is also taken to cure ulcers. |
| Mode/Route of application | : | Oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Begonia inflate*** **(Pl. VII, Photo 21)**

| | | |
|---|---|---|
| Scientific name | : | *Begonia inflata* Cl. |
| Local Name | : | Sekhupthur |
| Family | : | Begoniaceae |
| Locality | : | N.E.Khawdungsei |
| Botanical Description | : | A soft herb; stem sometimes streaked with red. Leaves oblong-lanceolate, acuminate; base obliquely cordate. sinuate-dentate c. 12 cm long; stipules subulate. Flowers axillary, dichotomous, pinkish white. Fruits trigonous, inflated; seeds ellipsoid or obvoid. |
| Habit | : | A soft herb. |

| | | |
|---|---|---|
| Habitat | : | Ocassional in Mizoram, in moist rocky habitat near streams and river in primary forests. It is grown on sandy rocky places and river banks under primary forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 20 $^{o}$C |
| | Altitude : | 1120 m |
| | Humidity : | 62 % |
| | Light intensity : | 90170 lux |
| Phenology | : Flowering : | April - May |
| | Place of flower : | Axillary |
| | Fruiting : | June – October |
| Associates | : | *Ageratum conyzoides*, *Mikania micrantha*, *Musa spp.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to heavy rainfall, natural regeneration is seen but artificial regeneration is very difficult. |
| Soil | : N : | 0.148 % |
| | P : | 11.2 Kg/ha |
| | K : | 165.0 Kg/ha |
| | pH : | 5.0 |
| | OC : | 1.0 % |
| Parts used | : | Whole plant. |
| Uses | : | Stomachache, food allergy, pile disorder, genito-urinary problems. |
| Mode of Preparation | : | The root is eaten raw against stomachache and food allergy. The stem is also eaten raw against pile disorder. The white roots are boiled in water and the water is taken as effective remedy against genito-urinary problems. |
| Mode/Route of application | : | Oral administration, Local application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Bergenia ciliate* (Pl. VIII, Photo 22)**

| | | |
|---|---|---|
| Scientific name | : | *Bergenia ciliata* (Haw.) Sternb. |
| Local Name | : | Khamdamdawi |
| Family | : | Saxifragaceae |
| Locality | : | Maite |
| Botanical Description | : | A creeping plant with big stout stem. Leaves broadly ovate or sub-orbicular, 5-35 cm long, coarsely hairy, dotted on lower surface; margin ciliated; base cordate, with large sheath. Flowers with pink, purple, corymbose on slender peduncles. Fruits sub-globose; seeds sub-pyramidal, smooth. |
| Habit | : | A perennial procumbent herb. |
| Habitat | : | Occasional in Mizoram, in sub-tropical hill forests above 100 m asl. It is grown on cliff and rocky places at higher altitudes. |
| Micro-climatic Status/Condition: | | Ambient temperature : 18 $^{o}$C<br>Altitude : 1200-1600 m<br>Humidity : 67 %<br>Light intensity : 17250 lux |
| Phenology | : | Leaf shedding : September - October<br>New Leaf : November<br>Flowering : May - June<br>Place of flower : Terminal<br>Fruiting : August – September |
| Associates | : | Setaria glauca, Eleucine indica, Cyprus rotundus. |
| Ecology/Silvicultural character: | | Shade bearer, resistant to high rainfall, but acceptable to jhum fire, natural and artificial regeneration has no problem. |
| Soil | : | N : 0.157 %<br>P : 12.21Kg/ha<br>K : 254Kg/ha<br>pH : 5.0<br>OC : 1.1% |
| Parts used | : | Stem |
| Uses | : | Diarrhoea, dysentery, sores, ulcers, burns |

| | | |
|---|---|---|
| Mode of Preparation | : | Infusion of stem is taken orally for diarrhoea and dysentery @ ½ cup (50 ml) twice daily. Sometimes, the root is chewed. Juice of stem is used for burns and sores by external application; it is also used in stomach ulcers. |
| Mode/Route of application | : | Oral administration, External application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Boehmeria rugulosa* (Pl. VIII, Photo 23)**

| | | |
|---|---|---|
| Scientific name | : | *Boehmeria rugulosa* Wedd. |
| Local Name | : | Lenlang |
| Family | : | Urticaceae |
| Locality | : | Cheural |
| Botanical Description | : | A small to medium-sized evergreen tree up to 30 ft tall. Leaves alternate, long pointed, with toothed margins and three prominent veins; lower surface white velvety. Flowers small, greenish- yellow, in thin pendulous spikes 5-15 cm long. Fruit is an achene, pointed at both ends. |
| Habit | : | A small to medium-sized evergreen tree up to 30 ft tall. |
| Habitat | : | Frequent in Mizoram, grown mostly in open forest. |
| Micro-climatic Status/Condition: | Ambient temperature : | 20 $^{o}$C |
| | Altitude : | 1450 m |
| | Humidity : | 43 % |
| | Light intensity : | 18500 lux |
| Phenology | : Leaf shedding : | Evergreen |
| | Flowering : | August-September |
| | Place of flower : | Axillary |
| | Fruiting : | October – November |
| Associates | : | *Callicarpa arborea, Anogeissus acuminate.* |

| | | |
|---|---|---|
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, regenerate naturally |
| Soil | : | N : 0.152 %<br>P : 12.21 Kg/ha<br>K : 254 Kg/ha<br>pH : 5.0<br>OC : 1.1% |
| Parts used | : | Barks |
| Uses | : | Cuts, burn and sore |
| Mode of Preparation | : | Juice of the bark is applied to treat fresh cuts and also helps in blood coagulation. Crushed bark is also applied to burns and sores. |
| Mode/Route of application | : | External |
| Status/Category | : | Not assessed for the IUCN Red List |

***Bryophyllum pinnatum*** **(Pl. VIII, photo 24)**

| | | |
|---|---|---|
| Scientific name | : | *Bryophyllum pinnatum* (Lamk.) Oken |
| Local Name | : | Ruhseh |
| Family | : | Crassulaceae |
| Locality | : | Chawngtlai |
| Botanical Description | : | A perennial herbs. Lower and uppermost leaves simple, the middle ones usually pinnately compound with 3-5 leaflets, opposite, blades flat, elliptic, 5-20 cm long, 2-10 cm wide, margins crenate, sometimes producing bulbils, petioles 2-10 cm long. Flowers in paniculate cymes 20-80 cm long, each one pendent on pedicels 1-2.5 cm long; sepals pale yellow, streaked with red, connate, cylindrical, inflated and papery, the tube 2.5-4.5 cm long, the lobes ca 1 cm long; corolla 3-6 cm long, the exserted part maroon, sparsely glandular pubescent. |
| Habit | : | A perennial herbs. |

| | | | | |
|---|---|---|---|---|
| Habitat | : | In open settled areas, thickets, dry second-growth forests, sometimes planted, and locally abundant. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 21 $^{o}$C |
| | | Altitude | : | 1170 m |
| | | Humidity | : | 42 % |
| | | Light intensity | : | 87540 lux |
| Phenology | : | Flowering | : | January - May |
| | | Place of flower | : | Terminal |
| | | Fruiting | : | June – July |
| Associates | : | Cultivated | | |
| Ecology/Silvicultural character: | | Moderate light demander, acceptable to heavy rainfall and jhum fire, regenerates naturally and artificially. | | |
| Soil | : | N | : | 0.162 % |
| | | P | : | 0.87 Kg/ha |
| | | K | : | 98 Kg/ha |
| | | pH | : | 5.67 |
| | | OC | : | 1.20 % |
| Parts used | : | Leave | | |
| Uses | : | Sprain, joint pain | | |
| Mode of Preparation | : | The leaf is warmed in a fire and then placed firmly over sprain or joint pain for pain relief. | | |
| Mode/Route of application | : | External | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Byttneria aspera* (Pl. IX, Photo 25)**

| | | |
|---|---|---|
| Scientific name | : | *Byttneria aspera* Colebr. ex Roxb. |
| Local Name | : | Zawngluang |
| Family | : | Sterculiaceae |
| Locality | : | N.E.Khawdungsei |

| | | |
|---|---|---|
| Botanical Description | : | Lianas, shrubs, or subshrubs. Leaves simple, stipulate, petiolate; leaf blade various shapes, but usually orbicular or ovate; foliar nectaries present. Sepals ovate, ca. 2 mm, puberulent, apex acute. Petals yellowish white, and purple-red adaxially, apex 2-lobed, with long ligulate appendix, nearly as long as sepals. Fruits globose or ovoid-globose, 3–4 cm in diam., spiny, spines short and robust, puberulent. Seeds oblong, ca. 12 mm, black when mature. Fl. spring and summer. |
| Habit | : | Lianas, shrubs, or subshrubs. |
| Habitat | : | Occasional in Mizoram, in open forests, valley stream sides. NE. Khawdungsei, Maite, etc. |
| Micro-climatic Status/Condition: | | Ambient temperature : 21 $^{o}$C<br>Altitude : 1145 m<br>Humidity : 42 %<br>Light intensity : 2670 lux |
| Phenology | : | Flowering : April - July<br>Place of flower : Axillary<br>Fruiting : October – December |
| Associates | : | *Bischofia javanica, Ficus spp., Entada, pursaetha.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to jhum fire, heavy rainfall and drought, regenerate naturally. |
| Soil | : | N : 0.373 %<br>P : 21.73 Kg/ ha<br>K : 127 Kg/ha<br>pH : 6.2<br>OC : 1.34 % |
| Parts used | : | Stem |
| Uses | : | Mouth and tongue ulcers. |
| Mode of Preparation | : | The main stem is cut to produce juice which is then collected and used as mouth wash in mouth and tongue ulcers. |
| Mode/Route of application | : | Orally. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Carica papaya* (Pl. IX, Photo 26)**

| | | |
|---|---|---|
| Scientific name | : | *Carica papaya* Linn. |
| Local Name | : | Thingfanghma |
| Family | : | Caricaceae. |
| Locality | : | Vartek |
| Botanical Description | : | A soft-wood tree. Leaves glabrous, palmatifid, 12-24 in. across, on long hollow petioles, forming a round tuft at the top of the stem, stipules. *Flowers* pale yellow, fragrant, in axillary panicles, generally dioceous, but occasionally a few female flowers on a male plant. *Fruit* indehiscent, fleshy, sulcate, seeds black, numerous, embedded in sweet pulp, the testa consisting of an inner hard and outer soft layer. Embryo straight, cotyledons flat, in oily albumen. |
| Habit | : | A soft-wood tree. |
| Habitat | : | Cultivated in Mizoram, in tropical evergreen and semi-evergreen forests. It is found both in dry compact and moist loamy soil in primary forests. |

| | | | |
|---|---|---|---|
| Micro-climatic Status/Condition: | Ambient temperature | : | 24 $^{o}$C |
| | Altitude | : | 1100 m. |
| | Humidity | : | 47 % |
| | Light intensity | : | 23010 lux |
| Phenology : | Leaf shedding | : | February - March |
| | New Leaf | : | March - April |
| | Flowering | : | Throughout the year |
| | Place of flower | : | Axillary |
| | Fruiting | : | Throughout the year |

| | | |
|---|---|---|
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire, heavy rainfall and drought, natural and artificial regeneration has no problems. |

| | | | |
|---|---|---|---|
| Soil | : | N | : 0.172 % |
| | | P | : 14.2 Kg/ha |
| | | K | : 254.0 Kg/ha |
| | | pH | : 1.0% |
| | | OC | : 6.2 |
| Parts used | : | Leaf, latex, fruit and seed. | |

| | | |
|---|---|---|
| Uses | : | Enlarged liver, enlarged spleen, dysentery, centipede bite, intestinal worm, scabies, burn, cancer etc |
| Mode of Preparation | : | The unripe fruit is steamed with chicken which is eaten to cure enlarged liver.<br>The ripen fruits is eaten against enlarged spleen and liver problems.<br>The green fruit is chopped and dried which is taken for treating dysentery.<br>The fluid extracted from the un-ripened fruit is applied against centipede bite.<br>Intestinal worm of a child is killed by eating seeds of the plants.<br>Scabies and other skin diseases are used to cure by applying the latex of the plants.<br>A leaf crushed with sugar into paste is applied to burns.<br>Decoction of half dried leaves is used to cure cancer. |
| Mode/Route of application | : | Oral administration, external application. |
| Status/Category | : | Rare in the wild; cultivated abundantly |

***Castanopsis echinocarpa*** **(Pl. IX, Photo 27)**

| | | |
|---|---|---|
| Scientific name | : | *Castanopsis echinocarpa* Miq. |
| Local Name | : | Thingsia |
| Family | : | Fagaceae |
| Locality | : | Ngopa |
| Botanical Description | : | Trees 5-10 m tall; young branchlets and young leaf blades abaxially pubescent and with glabrescent, rusty brown, waxy scalelike trichomes. Petiole 1-1.5 cm; leaf blade elliptic to ovate, 9-16 × 3.5-5 cm, abaxially reddish brown but may become gray to grayish brown with age, base acute to rounded, margin entire or rarely with 1 or 2 teeth, apex acute; midvein adaxially impressed; secondary veins 11-14 on each side of midvein, sometimes impressed. Infructescences ca. 25 cm; rachis slender. Cupules |

loosely arranged, globose to ellipsoid, 1.6-2.2 cm in diam., outside covered with brownish, small, lamellate, waxy scalelike trichomes, sometimes pubescent, wall to 1 mm thick; bracts spinelike, sparsely covering cupule, 3-5 mm, slender, free but a few in bundles. Nut 1 per cupule, broadly conical, 1.5-2 × 1-1.6 cm, glabrous; scar basal, 8-10 mm in diam.

Habit : Trees 5-10 m tall.

Habitat : Evergreen forests. Ngopa, NE. Khawdungsei, etc.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 23 $^{o}$C |
| Altitude | : | 1100 m |
| Humidity | : | 41 % |
| Light intensity | : | 78150 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| Flowering | : | April - May |
| Place of flower | : | Axillary |
| Fruiting | : | September – October of following year |

Associates : *Ficus* spp., *Aporusa octandra* , *Schima wallichii.*

Ecology/Silvicultural character: Light demander, resistant to jhum fire and heavy rainfall, regenerate naturally.

Soil :

| | | |
|---|---|---|
| N | : | 0.137 % |
| P | : | 3.92 Kg/ha |
| K | : | 220 Kg/ha |
| pH | : | 5.4 |
| OC | : | 1.4% |

Parts used : Stem

Uses : Mouth and tongue ulcer, pneumonia.

Mode of Preparation : Young stem is cut to produce juice which is used as mouth wash to cure mouth and tongue ulcer, it is also taken orally for pneumonia.

Mode/Route of application : Orally.

Status/Category : Not assessed for the IUCN Red List

***Catharanthus roseus* (Pl. X, Photo 28)**

| | | |
|---|---|---|
| Scientific name | : | *Catharanthus roseus* (Linn.) G.Don. |
| Local Name | : | Kumtluang (parvar) |
| Family | : | Apocynaceae. |
| Locality | : | N. Vanlaiphai |
| Botanical Description | : | A perennial under shrub. Leaves opposite, obovate or oblong, mucronate, glossy, 2-3 x 2.5-6 cm; base narrowed to a short petiole with 2-glands at the base. Flowers white or pink to deep rose-coloured in axillary cluster. Fruits 2, cylindrical follicles, many seeded. |
| Habit | : | A perennial under shrub. |
| Habitat | : | Introduced in Mizoram as an ornamental plant in gardens and grow in waste open places. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1040 m<br>Humidity : 51 %<br>Light intensity : 19050 lux |
| Phenology | : | Leaf shedding : Evergreen<br>Flowering : Throughout the year<br>Place of flower : Axillary<br>Fruiting : Throughout the year |
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Light demander, acceptable to heavy rainfall and drought, natural and artificial regeneration has no problem. |
| Soil | : | N : 0.172 %<br>P : 14.2 Kg/ha<br>K : 254.0 Kg/ha<br>pH : 1.0%<br>OC : 6.2 |
| Parts used | : | Leaves and flowers. |
| Uses | : | Hypertension, Diabetes. |
| Mode of Preparation | : | The leaves or flowers are boiled and the water is taken orally against hypertension and diabetes @ |

tablespoonful (10 ml) twice or thrice daily. Some people chew the flowers for hypertension. Juice of the crushed leves is also used for hypertension. White flowers are preferred to red ones.

Mode/Route of application : Orally.

Status/Category : Not assessed for the IUCN Red List

***Centella asiatica* (Pl. X, Photo 29)**

Scientific name : *Centella asiatica* (Linn.) Urban.

Local Name : Khawte/Lambak

Family : Apiaceae.

Locality : Thingsai

Botanical Description : A prostrate herb with long stolons. Leaves orbicular, crenate, 2-8 cm across, palmately nerved, deeply cordate, long petioled, up to 30 cm. Flowers pale pink, in clusters or umbels. Fruits ovoid, rugose, crowned by peristent petals; seeds compressed.

Habit : A prostrate herb with long stolons.

Habitat : Frequent but scattered at different localities throughout Mizoram. It is grown in moist and damp places.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1420 m |
| Humidity | : | 47 % |
| Light intensity | : | 12070 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Not periodical |
| Flowering | : | April - May |
| Place of flower | : | Axillary |
| Fruiting | : | May – June |

Associates : *Plantago major, Sonchus* spp., Grasses.

| | | |
|---|---|---|
| Ecology/Silvicultural character: | | Shade bearer, resistant to drought and heavy rainfall, natural and artificial regeneration has no difficulties. |
| Soil | : | N : 0.143 %<br>P : 6.2 Kg/ha<br>K : 194.0 Kg/ha<br>pH : 5.1<br>OC : 1.3% |
| Parts used | : | Whole plant |
| Uses | : | Liver disorder, jaundice, kidney problem, hypertension, water-brash or heartburn, itches, cuts, wounds, eyesore, gartroenteritis, cholera and children's cough and cold. |
| Mode of Preparation | : | Decoction of the leaves with *Phyllanthus fraternus* is taken orally for liver disorder. The aerial part is eaten raw for jaundice and kidney problem. Fresh leaves are chewed and swallowed daily for 7 days as an effective remedy against hypertension, water-brash or heartburn. The juice of crushed leaves is applied on itches, cuts and wounds and dropped into the eye (2-3 drops) for eyesore. Cold infusion of leaves is taken as tea for gartroenteritis, cholera and children's cough and cold. |
| Mode/Route of application | : | Oral administration, local application |
| Status/Category | : | Not assessed for the IUCN Red List |

***Chonemorpha fragrans* (Pl. X, Photo 30)**

| | | |
|---|---|---|
| Scientific name | : | *Chonemorpha fragrans* (Moon.) Alston |
| Local Name | : | Theikelkisuak |
| Family | : | Apocyanaceae |
| Locality | : | Cheural |
| Botanical Description | : | A large climber; Leaves broadly-ovate, bi-forked, shortly acute, 18 x 26 cm, dark-green above, pale beneath, pubescent; base shallowly cordate, |

fimbriate. Flowers white, fragrant, axillary peduncled cymes; follicles in pairs, up to 30 cm long; beak curved.

Habit : A large climber.

Habitat : Frequent in Mizoram, in tropical evergreen forests. It is grown on sandy-loam soil in primary forests of Sangau, Cheural, Dampui, etc.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 22 oC |
| Altitude | : | 1350 m |
| Humidity | : | 38 % |
| Light intensity | : | 11750 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| Flowering | : | March |
| Place of flower | : | Terminal |
| Fruiting | : | April – May |

Associates : *Quercus semiserrata, Leea bracteate, Laportea cresulata, Ficus sp.*

Ecology/Silvicultural character: Shade bearer resistant to jhum fire and heavy rainfall, natural and artificial regeneration has no difficulty.

Soil :

| | | |
|---|---|---|
| N | : | 0.197 % |
| P | : | 11.2 kg/ha |
| K | : | 165.0 kg/ha |
| pH | : | 5.0 |
| OC | : | 1.0 % |

Parts used : Latex and root bark.

Uses : Wounds, cuts, jaundice and placental disorder.

Mode of Preparation : The inner portion of the root bark is crushed and mixed with a small quantity of water, the water is then filtered and drinks against retained placenta at the dose of one cup twice daily; it is said that chicken should not be eaten while taking the medicine. The latex is applied to the wounds and cuts. Decoction of bark is used for treating placental disorder and jaundice by taking half cup twice a day

Mode/Route of application : Local application and orally.

Status/Category : Not assessed for the IUCN Red List

***Chromolaena odorata* (Pl. XI, Photo 31)**

| | | |
|---|---|---|
| Scientific name | : | *Chromolaena odorata (*L.) R.M.King & H.Rob. |
| Local Name | : | Tlangsam |
| Family | : | Asteraceae. |
| Locality | : | Ngharchhip |
| Botanical Description | : | A scandent shrub. Leaves ovate-lanceolate or triangular, acuminate, dentate-serrate, 3-nerved up to the apex, intramarginal, pubescent on nerves beneath; base oblique, cuneate; petiole to 4.5 cm long; stipules large, lanceolate. Flowers terminal and supra-axillary corymbose heads, white in colour; bracts lanceolate. Fruits minute, light and dispersed by wind. |
| Habit | : | A scandent shrub. |
| Habitat | : | Very common throughout Mizoram, in fallow lands, clearings, waste places and immediate surroundings of villages and towns. |

| Micro-climatic Status/Condition: | | | | |
|---|---|---|---|---|
| | Ambient temperature | : | 25 $^{o}$C |
| | Altitude | : | 1200 m |
| | Humidity | : | 48 % |
| | Light intensity | : | 72150 lux |

| Phenology | : | | | |
|---|---|---|---|---|
| | Leaf shedding | : | Partial shedding in January - February |
| | New Leaf | : | March - April |
| | Flowering | : | October - December |
| | Place of flower | : | Axillary |
| | Fruiting | : | December – January |

| | | |
|---|---|---|
| Associates | : | *Mikania micrantha, Ferns.* |
| Ecology/Silvicultural character: | | Light demander, acceptable to jhum fire but resistant to drought, natural regeneration is adequate. |

| Soil | : | | | |
|---|---|---|---|---|
| | N | : | 0.142 % |
| | P | : | 15.2 Kg/ha |
| | K | : | 187.0 Kg/ha |
| | pH | : | 5.0 |
| | OC | : | 1.0% |

| | | |
|---|---|---|
| Parts used | : | Leaves. |

| | | |
|---|---|---|
| Uses | : | Cuts and wounds, stomach ulcer and dysentery. |
| Mode of Preparation | : | The juice of crushed leaves is applied externally on fresh cuts and wounds as haemostatic. Decoction of leaves is taken for stomach ulcer and dysentery. |
| Mode/Route of application | : | External application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Chukrasia tabularis*** **(Pl. XI, Photo 32)**

| | | |
|---|---|---|
| Scientific name | : | *Chukrasia tabularis A.* Juss. |
| Local Name | : | Zawngtei |
| Family | : | Meliaceae |
| Locality | : | Tialdawnglung |
| Botanical Description | : | A lofty deciduous tree. Leaves pinnate, pubescent when young; leaflets 10-16, alternate, unequal-sided, ovate or elliptic-lanceolate, 3.5-6 x 5-12 cm, acuminate, pubescent or velvety; nerves 10 pairs; base oblique. Flowers greenish-white, large in terminal peduncle. Fruits ellipsoidal, *c.* 3.5 cm long, very hard, blackish, speckled with lenticels outside; valves usually 3; seeds flat, dark-brown, broadly winged. |
| Habit | : | A lofty deciduous tree |
| Habitat | : | Common in Mizoram, particularly in tropical wet evergreen forests |
| Micro-climatic Status/Condition: | Ambient temperature : | 18 $^{o}$C |
| | Altitude : | 1440 m |
| | Humidity : | 57 % |
| | Light intensity : | 8900 lux |
| Phenology | : Leaf shedding : | November- December |
| | New Leaf : | February - March |
| | Flowering : | April - May |
| | Place of flower : | Terminal panicles |
| | Fruiting : | December – March |

| | | |
|---|---|---|
| Associates | : | *Cinnamomum gladuliferum, Anogeisus acuminate.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, drought and heavy rainfall, naturally regenerate, but artificial regeneration is very difficult. |
| Soil | : | N : 0.143 %<br>P : 18.4 Kg/ha<br>K : 187.0 Kg/ha<br>pH : 5.0<br>OC : 1.1% |
| Parts used | : | Fruits, bark, seed-coat and wood. |
| Uses | : | Diarrhoea, Gastric problem and Flatulence. |
| Mode of Preparation | : | Infusion of crushed fruits is taken orally for diarrhoea. Infusion of bark is taken orally against gastric problem and flatulence. The medicine is taken @ teaspoonful (5 ml) twice daily.Decoction of seed-coat is taken orally for diarrhoea @ teaspoonful (5 ml) twice or thrice a day; the seed-coat is also eaten raw. |
| Mode/Route of application | : | Orally. |
| Status/Category | : | Lower risk |

***Cissus javanica* (Pl. XI, Photo 33)**

| | | |
|---|---|---|
| Scientific name | : | *Cissus javanica* DC**.** |
| Local Name | : | Hlosangharhmai |
| Family | : | Vitaceae. |
| Locality | : | Changzawl |
| Botanical Description | : | Slender climber with a hard base and subangular, glabrous, red branches. Leaves ovate-lanceolate, acute or acuminate. crenate-serrate, membranous, cordate or sub-truncate at the base, glabrous, with irregular translucent white blotches on the upper surface, purple beneath; tendril forked. Flowers tetramerous, in umbellate cymes, calyx fleshy, petals yellowish. Fruit reddish purple to black. |

| | | | | |
|---|---|---|---|---|
| Habit | : | Climber. | | |
| Habitat | : | Frequent in Mizoram. It is generally grown on the roadside and calm places. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 25 $^{o}$C |
| | | Altitude | : | 950 m. |
| | | Humidity | : | 49 % |
| | | Light intensity | : | 5850 lux |
| Phenology | : | Flowering | : | May - July |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | September- November |
| Associates | : | *Costus speciosus, Plantago major, Schima walichii.* | | |
| Ecology/Silvicultural character: | | Shade bearer, resistant to heavy rainfall and drought, regenerate naturally. | | |
| Soil | : | N | : | 0.147 % |
| | | P | : | 11.2 Kg/ha |
| | | K | : | 165.0 Kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.0% |
| Parts used | : | Whole plant. | | |
| Uses | : | Itches, stomachache, sore, boil and sprain. | | |
| Mode of Preparation | : | The whole plant is boiled with water and the water is used for bathing and a small quantity is drunk for itches. Decoction of the plant mixed with *Centella asiatica* is used for stomachache. The juice of crushed plant is applied externally on the wounded surface of sprain, boil and sore. | | |
| Mode/Route of application | : | External application | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Clausena suffructicosa*** **(Pl. XII, Photo 34)**

| | | |
|---|---|---|
| Scientific name | : | *Clausena suffructicosa* (Roxb.) Wight & Arn. |
| Local Name | : | Santawkhi (Bru) |
| Family | : | Rutaceae |

| | | |
|---|---|---|
| Locality | : | Lawngtlai |
| *Botanical Description* | : | *Shrubs or small trees, upto 5m tall, glabrous, young* parts tomentoes. Leaves 15-30cm long, 5-15 foliolate or sometimes more, imparipinnate; leaflets alternate, obliquely ovate-oblong or ovate lanceolate, 4-10 x 2-4cm, obtuse, caudateacuminate at apex, glandular crenulate along margins, membranous, young ones tomentoes, older ones glabrous; petiolules upto 5mm long. Racemes axillary in the upper portions of branchlets, tomentoes or glabrous; flowers whitish, fragrant; calyx ovate-deltate, glandular, glabrescent or ciliolate petals oblong, concave, glabrous. Berries globose, purplish-orange when ripe, pellucid; seeds solitary, ovoid, compressed. |
| Habit | : | Shrubs or small trees, upto 5m tall, glabrous, young parts tomentoes. |
| Habitat | : | Common in evergreen forests, grows on moist soil in shady areas, Lawngtlai, Saiha, etc. |
| Micro-climatic Status/Condition: | | Ambient temperature : 26 $^{o}$C<br>Altitude : 950 m<br>Humidity : 47 %<br>Light intensity : 4870 lux |
| Phenology | : | Flowering : March - June<br>Place of flower : Axillary<br>Fruiting : September- November |
| Associates | : | *Murraya koenigii, Phoebe lanceolata, Sterculia hamiltonii.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to jhum fire and heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.138 %<br>P : 10.10 Kg/ha<br>K : 149 Kg/ha<br>pH : 5.1<br>OC : 1.2 % |
| Parts used | : | Young stem and leave. |
| Uses | : | Headache, stiff and sore due to delivery. |
| Mode of Preparation | : | Decoction of young stem and leaves mixed with leaves of *Phoebe lanceolata* is taken orally @ 1 cup |

daily and then use for bathing to cure headache, stiff and sore due to delivery for three days. The prepared water should not be used more than three days.

Mode/Route of application : External and oral.

Status/Category : Not assessed for the IUCN Red List

***Costus speciosus* (Pl. XII, Photo 35)**

Scientific name : *Costus speciosus* (Koenig) Smith.

Local Name : Sumbul

Family : Costaceae.

Locality : Khawkawn

Botanical Description : A perennial herb. Leaves elliptic-oblong, spirally arranged; cuspidate acute, 3-5 x 10-22 cm, silky pubescent beneath. Flowers white, on terminal oblong spike, dense flowered; bracts ovate, reddish. Fruits globosely 3-gonous, red; seeds black or dark brown.

Habit : A perennial herb.

Habitat : Common throughout Mizoram, usually in clearings and damp places or river banks, in both tropical evergreen and semi-ever-green forests. It is grown on various types of soil from dry sandy to moist loamy soil. It is found in Ngopa, Khawzawl etc.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1070 m |
| Humidity | : | 42 % |
| Light intensity | : | 72100 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | June - October |
| Place of flower | : | Terminal |
| Fruiting | : | October – March. Flowering and fruiting During August - September is reported by Jain et. al, 1991. |

| | | |
|---|---|---|
| Associates | : | *Albizia procera, Clerodendrum bracteata, Mikania micrantha.* |
| Ecology/Silvicultural character: | | Shade bearer, can withstand heavy rainfall; natural and artificial regeneration has no difficulty. |
| Soil | : | N : 0.152 %<br>P : 1.83 Kg/ha<br>K : 82 Kg/ha<br>pH : 5.4<br>OC : 0.86 % |
| Parts used | : | Rhizome and seeds. |
| Uses | : | Opthalmia, Kidney problem, stomach-ache, stomatitis. |
| Mode of Preparation | : | Juice of the crushed leaves is drop directly to the eyes for ophthalmia. The juice is also taken orally for kidney problems.<br>Juice of the crushed roots is taken orally for stomach problems and kidney problems.<br>Cold infusion of the rhizome is taken orally for kidney trouble. The medicine is taken at the dose of one tablespoon thrice daily.<br>Juice of rootstock is taken for stomatitis. |
| Mode/Route of application | : | Orally and external. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Curanga amara* (Pl. XII, Photo 36)**

| | | |
|---|---|---|
| Scientific name | : | *Curanga amara* Juss. |
| Local Name | : | Khatual |
| Family | : | Scrophulariaceae |
| Locality | : | Biate |
| Botanical Description | : | A smooth, prostrate herb. Petioles 0.5 – 2 cm; leaf blade ovate to sometimes suborbicular, abaxially hispid on veins, adaxially short hispid, base cuneate, rounded or truncate, margin crenate-serrate, apex |

acute; lateral veins 4 or 5 on each side of mid-rib. Racemes 4 – 8 flowered. Pedicel to 1 cm. Calyx lobes oblong-ovate, to 1.4 x 1 cm in fruit, veins conspicuously reticulate; lower slobe smaller than upper; upper lobe often apically 2-lobed; 2 lateral lobes linear.Corolla white or red brown; tube ca 6.5 mm, constricted at middle; apically narrowly suboblong, emarginated. Capsule ovoid, 5-6 mm.

Habit : A smooth, prostrate herb.

Habitat : On forested slopes at low altitudes, ascending to 400 meters, rather rare and local.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 950 m |
| Humidity | : | 47% |
| Light intensity | : | 7900 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | July - September |
| Place of flower | : | Terminal |
| Fruiting | : | October - November |

Associates : Cultivated

Ecology/Silvicultural character: Shade bearer, resistant to heavy rainfall, natural and artificial regeneration has no difficulty.

Soil :

| | | |
|---|---|---|
| N | : | 0.164 % |
| P | : | 14.2 Kg/ha |
| K | : | 254.0 Kg/ha |
| pH | : | 6.2 |
| OC | : | 1.0% |

Parts used : Stem and leaves.

Uses : Hypertension

Mode of Preparation : Decoction of the stem and leaves is taken orally for hypertension. Dried leaves grounded to powder is also mixed in curry and eaten with food.

Mode/Route of application : Oral.

Status/Category : Least concern

***Curcuma caesia* (Pl. XIII, Photo 37)**

| | | |
|---|---|---|
| Scientific name | : | *Curcuma caesia* Roxb. |
| Local Name | : | Ailaidum |
| Family | : | Zingiberaceae |
| Locality | : | Puilo |
| Botanical Description | : | A rhizomatous herb to 1.2 m high; root-stock large, pale yellow or grey inside; leaves large, broadly lanceolate or oblong, with a broad purple brown cloud down the middled; flowers pale yellow, reddish at outer border, shorter than the bracts. |
| Habit | : | A perennial herb. |
| Habitat | : | Cultivated in Mizoram in kitchen garden as germplasm conservation. It is grown in tilted sandy loam soil in open or partial shaded areas. |
| Micro-climatic Status/Condition: | | Ambient temperature : 25 $^{o}$C<br>Altitude : 1100 m<br>Humidity : 48 %<br>Light intensity : 81935 lux |
| Phenology | : | Flowering : June – July (Spikes appear before and/or along with the leaves.)<br>Place of flower : Terminal |
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Cultivated in tilted sandy-loam soil in open or partial shaded areas. |
| Soil | : | N : 0.174 %<br>P : 14.2 Kg/ha<br>K : 254.0 Kg/ha<br>pH : 6.2<br>OC : 1.0% |
| Parts used | : | Rhizome. |
| Uses | : | Food poisoning, stomachache, bruises, sprain, rheumatic pain, piles disorder and skin problems. |
| Mode of Preparation | : | The rhizome is taken orally against food poisoning and stomachache. It is bitter and the paste is |

| | | |
|---|---|---|
| | | externally applied on bruises, sprains and rheumatic pains. Rhizome paste is also used in piles and leucoderma |
| Mode/Route of application | : | Oral and External application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Dendrocnide sinuate*** **(Pl. XIII, Photo 38)**

| | | |
|---|---|---|
| Scientific name | : | *Dendrocnide sinuata (*Blume) Chew |
| Local Name | : | Thakpui |
| Family | : | Urticaceae. |
| Locality | : | Rullam |
| Botanical Description | : | An evergreen shrub. Leaves broadly elliptic to ovate-oblong, acuminate, 7-15 x 15-30 cm, crenulate in the upper half; nerves 12-16 pairs; base rounded or cordate; petiole stout, up to 8 cm long; Flowers greenish white, in axillary panicled dichotomously branched. Fruit (achene) obliquely ovoid. |
| Habit | : | An evergreen shurb. |
| Habitat | : | Common in Mizoram as undergrowth in tropical wet evergreen forests, particularly on the bank of rivers and streams. |
| Micro-climatic Status/Condition: | Ambient temperature | : 24 $^{o}$C |
| | Altitude | : 1320 m. |
| | Humidity | : 52 % |
| | Light intensity | : 5650 lux |
| Phenology | : Leaf shedding | : Evergreen |
| | New Leaf | : March - April |
| | Flowering | : December - March |
| | Place of flower | : Axillary |
| | Fruiting | : May - June. |
| Associates | : | *Hydechium coccinium, Polygonum glabrum, Rubus birmanicus, etc.* |

| | | | | |
|---|---|---|---|---|
| Ecology/Silvicultural character: | | Shade bearer, natural regeneration has no problems, resistant to heavy rainfall. | | |
| Soil | : | N | : | 0.152 % |
| | | P | : | 13.4 Kg/ha |
| | | K | : | 115.0 Kg/ha |
| | | pH | : | 5.4 |
| | | OC | : | 12.4% |
| Parts used | : | Roots. | | |
| Uses | : | Diarrhoea, dysentry, liver problem, stomach ulcer, kidney problem, burns. | | |
| Mode of Preparation | : | The roots are crushed with crabs and mixed with water and the water is drunk against diarrhoea and dysentery at a dose of half cup thrice daily. It is also taken for kiney problem. The roots are crushed with live crabs and spadix of *Musa spp.* and then the water is taken orally for liver ailment and stomach ulcer. The root is crushed to make into paste and then applied on burns | | |
| Mode/Route of application | : | Oral and external. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Derris robusta* (Pl. XIII, Photo 39)**

| | | |
|---|---|---|
| Scientific name | : | *Derris robusta* Benth. |
| Local Name | : | Thingkha |
| Family | : | Fabaceae |
| Locality | : | Tialdawnglung |
| Botanical Description | : | A tree up to 20 m tall. Leaflets up to 20, elliptic – oblong, base narrowed and unęual, mucronulate at apex, puberulous on both surfaces when young but often glabrescent above. Inflorescence axillary, flowers white, fascillated; calyx golden hairy, campanulate; corolla white, standard without basal |

| | | |
|---|---|---|
| | | callosities. Fruit strap-shaped, with a wing along one side. |
| Habit | : | A tree up to 20 m tall. |
| Habitat | : | Occasional in Mizoram. . It is grown in sandy rocky slopes and in tropical forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 23 $^{o}$C<br>Altitude : 1447 m<br>Humidity : 49 %<br>Light intensity : 8900 lux |
| Phenology | : | Flowering : April - June<br>Place of flower : Axillary<br>Fruiting : July – October |
| Associates | : | Schima wallichii, Emblica officinalis, etc. |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire and heavy rainfall, artificial and natural regeneration has no difficulties. |
| Soil | : | N : 0.147 %<br>P : 17.8 Kg/ha<br>K : 118 Kg/ha<br>pH : 5.4<br>OC : 1.20 % |
| Parts used | : | Bark |
| Uses | : | Tooth-ache, diarrhea. |
| Mode of Preparation | : | The barks is crushed and apply to tooth-ache, juice of the crushed bark is taken for diarrhea. |
| Mode/Route of application | : | Oral. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Dillenia pentagyna* (Pl. XIV, Photo 40)**

| | | |
|---|---|---|
| Scientific name | : | *Dillenia pentagyna* Roxb. |
| Local Name | : | Kaihzawl |
| Family | : | Dilleniaceae |

| | | |
|---|---|---|
| Locality | : | Changzawl |
| Botanical Description | : | A large deciduous tree with a straight bole; bark greyish-white; leaves very large in young plant, up to 120 cm long, crowded at branchends, oblanceolate or obovate, acute, 1-20 x 20-60 cm, sharply dentate; base attenuate; flowers in fascicles of 5-8, bright yellow; fruits sub-globose *c.* 1.5 cm across; seeds ovoid. |
| Habit | : | A large deiciduous tree. |
| Habitat | : | Quite frequent in Mizoram, in tropical evergreen and semi-evergreen forests. It is found both in dry compact and moist loamy soil in primary forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 27 $^{o}$C<br>Altitude : 1050 m<br>Humidity : 41 %<br>Light intensity : 12300 lux |
| Phenology | : | Flowering : March - April<br>Place of flower : Terminal<br>Fruiting : May-June |
| Associates | : | *Helicia robusta*, *Aporusa octandra etc.* |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire and drought, natural regeneration is seen but artificial regeneration is difficult. |
| Soil | : | N : 0.143 %<br>P : 11.2 Kg/ha<br>K : 165.0 Kg/ha<br>C : 1.0%<br>pH : 5.0 |
| Parts used | : | Leaves, Bark and wood. |
| Uses | : | Diabetes, kidney problem, cancer, colic, stomach-ulcer, rheumatism. |
| Mode of Preparation | : | Decoction of the young leaves is taken orally for cancer, a person having lungs cancer is reported to be cured with this medicine during the field work.<br>Decoction of the bark is taken orally for diabetes, kidney problem and also given to cancer patients @ 2-4 tablespoonfuls twice daily. |

Infusion and decoction of the bark is taken as an effective cure for colic and stomach-ulcer at the dose of ¼ cup twice daily.

The paste made of bark is applied externally on rheumatic pains.

Mode/Route of application : Oral administration, external application.

Status/Category : Not assessed for the IUCN Red List

***Dinochloa compactiflora* (Pl. XIV, Photo 41)**

Scientific name : *Dinochloa compactiflora* Kurz.

Local Name : Sairil

Family : Poaceae.

Locality : Maite

Botanical Description : A tufted straggling evergreen bamboo, arching over tall trees; nodes thickened; internodes up to 60 cm long; culm sheaths 7 x 15 cm, truncate at throat, dilated at the base, covered with ad-pressed hairs; leaves oblong or lanceolate, acuminate, scabrous, 2.5-5 x 15-25 cm; base rounded; flowers small, dense heads on large panicles; fruits (caryopsis) ovoid, 2-3.5 cm across.

Habit : A straggling evergreen bamboo

Habitat : Frequent in Mizoram, in tropical wet evergreen forests and sub-tropical dense forests. It is generally found in moist dense forests.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 21 $^{o}$C |
| Altitude | : | 7450 m |
| Humidity | : | 67% |
| Light intensity | : | 1870 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | Not seen |
| Fruiting | : | Not seen |

Associates : *Trachycarpus martiana, Calamus erectus, Engelhardtia spicata.*

| | | | | |
|---|---|---|---|---|
| Ecology/Silvicultural character: | | Shade bearer, resistant to drought and heavy rainfall, natural and artificial regeneration has no difficulties. | | |
| Soil | : | N | : | 0.178 % |
| | | P | : | 27.08 Kg/ha |
| | | K | : | 174 Kg/ha |
| | | pH | : | 6.2 |
| | | OC | : | 1.7 % |
| Parts used | : | Stem. | | |
| Uses | : | Cuts, influenza, cough, chest complaints and Dandruff. | | |
| Mode of Preparation | : | (1) The outer skin is scraped off and applied externally on cuts and bandaged to stop bleeding. (2) The sap oozing out of the cut-stem is given to children for influenza, cough and chest complaints. It is also applied to scalp as anti-dandruff. | | |
| Mode/Route of application | : | Oral administration, external application. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Elsholtzia blanda* (Pl. XIV, photo 42)**

| | | |
|---|---|---|
| Scientific name | : | *Elsholtzia blanda* Benth. |
| Local Name | : | Nauhri |
| Family | : | Lamiaceae |
| Locality | : | Siatlai |
| Botanical Description | : | An aromatic under shrub, gregarious; branches quadrangular, greenish; leaves opposite, peltate, elliptic lanceolate, serrate, acuminate, 1 – 3 x 3 – 10 cm; base narrowed to the petiole; flowers greenish white, in axillary-terminal spikes up to 8 cm long; fruits ellipsoid. |
| Habit | : | An under shrub. |

| | | | | |
|---|---|---|---|---|
| Habitat | : | Not common in Mizoram, restricted to high altitude in sub-tropical hill forests. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 20 $^{o}$C |
| | | Altitude | : | 1450 m |
| | | Humidity | : | 52% |
| | | Light intensity | : | 61450 lux |
| Phenology | : | Flowering | : | September - October |
| | | Place of flower | : | Axillary & Terminal |
| | | Fruiting | : | October – January |
| Associates | : | Phlogacanthus tubiflorus, Piper sp., Clerodendrum sp., Quercus sp. | | |
| Ecology/Silvicultural character: | | Moderate light demander. It is grown as undergrowth near streamlets in primary forests. | | |
| Soil | : | N | : | 0.143 % |
| | | P | : | 12.21 Kg/ha |
| | | K | : | 254 Kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.1% |
| Parts used | : | Aerial parts. | | |
| Uses | : | Children‘s disease called ‘Nauhri’ a combination of fever, cholera, skin disease and inflammation. | | |
| Mode of Preparation | : | (1) Infusion of aerial part of the plants is used for children’s disease called ‘Nauhri’ a combination of fever, cholera, skin disease and inflammation. The medicine is taken at the dose of 10ml twice daily. | | |
| Mode/Route of application | : | Orally and external application. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Emblica officinalis* (Pl. XV, Photo 43)**

| | | |
|---|---|---|
| Scientific name | : | *Emblica officinalis* Gaertn. |
| Local Name | : | Sunhlu |
| Family | : | Euphorbiaceae |
| Locality | : | Chhawrtui |

| | | |
|---|---|---|
| Botanical Description | : | A small tree. Leaves feathery, sub-sessile, linear-oblong, acute; base rounded. Flowers greenish-yellow, axillary fascicled on branchlets. Fruits depressed globose; obscurely 6-lobed, 1.5-2 cm across, 3-celled; seeds 6, trigonous. |
| Habit | : | A small tree |
| Habitat | : | Fairly common throughout Mizoram; less common in tropical evergreen forests, most common in tropical semi-evergreen forests. It is found in sandy-rocky places in secondary mixed deciduous forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 21 $^{o}$C<br>Altitude : 1300 m<br>Humidity : 46 %<br>Light intensity : 72100 lux |
| Phenology | : | Flowering : March-May<br>Place of flower : Axillary<br>Fruiting : September-November. |
| Associates | : | *Schima wallichii, Aporusa octandra, Engelhardtia spicata, G*rasses. |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire and drought, natural and artificial regeneration has no difficulty. |
| Soil | : | N : 0.138 %<br>P : 2.22 Kg/ha<br>K : 23.1 Kg/ha<br>pH : 4.9<br>OC : 0.72% |
| Parts used | : | Bark, leaves, fruits, seeds. |
| Uses | : | Diarrhoea, dysentry, stomatitis, gum-bleeding, nose bleeding, ringworm, cuts, wounds, eye-sore,liver problem, cough, hiccup with fever, cutaneous diseases |
| Mode of Preparation | : | 1) The bark is crushed and the juice is taken against diarrhoea and dysentry. The medicine is taken @ 1/2 cup (50 ml) twice daily.<br>(2) Decoction of leaves is used as gargle for stomatitis and gum bleeding.<br>(3) Fresh or dry fruits are crushed and the juice is mixed with the juice of *Citrus lemon* and taken as stomachic, in dysentry, nose bleeding and gum-bleeding @ tablespoonful (10 ml) 2 times per day. |

(4) Juice of bark is used for washing eye-sore.
(5) The above mixture is also applied on cuts and wounds, ringworm and cutaneous diseases.
(6) Decoction of the seeds is used for eye-washing with the help of clean cotton or soft cloth to remove particles that causes eye-itch.
(7) The fruits are crushed and the juice is strained through cloth and taken for cirrhosis of liver @ tablespoonful (5 ml) thrice daily.
(8) A combination of the pulp of *Emblica officinalis, Terminalia bellirica* and *Terminalia chebula* in the form of powder (*Triphala*) is very useful in cough and hiccup associated with fever.

Mode/Route of application : Oral administration, external application.

Status/Category : Not assessed for the IUCN Red List

***Engelhardtia spicata* (Pl. XV, photo 44)**

Scientific name : *Engelhardtia spicata* Lechen ex Blume.

Local Name : Hnum

Family : Junglandaceae

Locality : Hmuntha

Botanical Description : A large deciduous tree. Leaf pinnately compound, leaflet oblong – lanceolate, entire, pubescent. Flower yellow, where female flower pendulous while male flower slender spike.

Habit : Large deciduous tree.

Habitat : Occasional in Mizoram. It grows in an open area of virgin forest.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1060 m |
| Humidity | : | 57 % |
| Light intensity | : | 4750 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | October - December |
| New Leaf | : | January - March |

| | | | | |
|---|---|---|---|---|
| | | Flowering | : | March - April |
| | | Place of flower | : | Terminal |
| | | Fruiting | : | May – June |
| Associates | : | *Terminalia myrcocaipa, Myristica longiflora, Schima wallichii.* | | |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to heavy rainfall, regeneration difficult. | | |
| Soil | : | N | : | 0.142 % |
| | | P | : | 5.17 kg/ha |
| | | K | : | 99 kg/ha. |
| | | pH | : | 5.0 |
| | | OC | : | 0.62%. |
| Parts used | : | Bark | | |
| Uses | : | Diarrhoea and dysentery. | | |
| Mode of Preparation | : | Decoction of bark is used for diarrhoea and Dysentry. | | |
| Mode/Route of application | : | Orally | | |
| Status/Category | : | Lower Risk | | |

***Entada pursaetha* (Pl. XV, Photo 45 & Fig. 6)**

| | | |
|---|---|---|
| Scientific name | : | *Entada pursaetha DC.* |
| Local Name | : | Kawi |
| Family | : | Mimosaceae |
| Locality | : | Maite |
| Botanical Description | : | Large woody climber; stem gnarled; branches terete; bark grayish-brown; leaves bipinnate; main rachis grooved; leaflets 4-6 pairs, oblong-obtuse or acute, 2-3 x 4-6 cm, shinning above; flowers creamy-white to pale yellow, fragrant, in axillary or terminal panicled spikes; pods woody, up to 130 cm long (largest fruit in India), falcate or curved, constricted between the seeds; seeds compressed, discoidal, |

shinning on edge, brownish-orange, powder on the center, very fragrant.

Habit : Large woody climber.

Habitat : Common throughout Mizoram, particularly in tropical semi-evergreen forests.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 19 $^{o}$C |
| Altitude | : | 1400 m |
| Humidity | : | 52 % |
| Light intensity | : | 8560 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | March - April. |
| Place of flower | : | Axillary or terminal panicled spike |
| Fruiting | : | March - May |

Associates : *Duabanga grandiflora, Ficus sp., Toona ciliate, Chisocheton paniculata,* etc.

Ecology/Silvicultural character: Moderate light demander, acceptable to jhum fire, natural regeneration.

Soil :

| | | |
|---|---|---|
| N | : | 0.147 % |
| P | : | 3.92 Kg/ha |
| K | : | 220 Kg/ha |
| pH | : | 5.4 |
| OC | : | 1.4% |

Parts used : Seeds, twigs.

Uses : Fever, delirium, mumps, convulsion, leech.

Mode of Preparation :

The seed is burned to produce smoke and the smoke is then inhaled for 15 minutes to cure fever and delirium especially for children

The seeds are grounded into a paste and mixed with un-cooked egg very mildly and then applied externally in mumps.

The seeds are soaked in water and the water is dropped into the nostril against water leech.

The young shoots and leaves are boiled and the water is used for bathing against convulsions.

Mode/Route of application : Oral administration, bathing.

Status/Category : Rare

***Erythrina stricta* (Pl. XVI, Photo 46)**

| | | |
|---|---|---|
| Scientific name | : | *Erythrina stricta* Roxb |
| Local Name | : | Fartuah |
| Family | : | Fabaceae. |
| Locality | : | Bualpui H |
| Botanical Description | : | A medium-sized to large deciduous tree with conical prickles; bark yellow, corky, deeply furrowed; leave large; leaflets 3-nate, deltoid, broader than long, 7-20 x 5-18 cm; base rhomboid-oblique, cuneate; flowers scarlet-red, seconded, crowded at branchends; fruits spindle-shaped pods, narrowed at both ends; seeds 2-3, reniform. |
| Habit | : | A medium-sized to large deciduous tree with conical prickles |
| Habitat | : | Common throughout Mizoram, most frequent in tropical semi-evergreen forests and less frequent in tropical evergreen forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1200 m.<br>Humidity : 48 %<br>Light intensity : 82100 lux |
| Phenology | : | Flowering : February - March<br>Place of flower : Terminal<br>Fruiting : March – May |
| Associates | : | *Ficus semi-sordata,Bauhinia indica,Sterculia colorata.* |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire, heavy rainfall and drought, artificial regeneration is easy but natural regeneration is difficult. |
| Soil | : | N : 0. 148 %<br>P : 6.2 Kg/ha<br>K : 194.0 Kg/ha<br>pH : 5.1<br>OC : 1.3% |
| Parts used | : | Bark and stem. |
| Uses | : | Diarrhoea, dysentery and stomach ulcer. |

| | | |
|---|---|---|
| Mode of Preparation | : | Decoction of inner bark with the bark of *Emblica officinalis* is taken orally for diarrhea and dysentery. A young stem is cut to produce juice which is taken orally for stomach ulcer. |
| Mode/Route of application | : | Orally. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Eupatorium odoratum* (Pl. XVI, Photo 47)**

| | | |
|---|---|---|
| Scientific name | : | *Eupatorium odoratum* L. |
| Local Name | : | Bengal hlo/ Midum hlo |
| Family | : | Asteraceae |
| Locality | : | Teikhang |
| Botanical Description | : | Erect or straggling, aromatic undershrubs, 1.5-3 m tall; stems repeatedly branched, villose-pubescent, with angulate branches. Leaves opposite, petioled, triangulate-ovate, deltoid, or ovate-lanceolate, 3.5-12 x 2 – 6 cm, acute-long acuminate, cuneate at base, margins irregularly dentate-serrate or sometimes entire, pubescent beneath. Heads more or less cylindrical, up to 1.5 cm long, 20-30 flowered, in terminal, usually trichotomous corymbs. Involucral bracts multi-seriate, ovate-lanceolate, acute or obtuse. Florets whitish purple, odorous. Achenes small, narrow-oblong, 5-angled, blackish; pappus stiff, white. |
| Habit | : | Errect or strangling shrub. |
| Habitat | : | Common in open places, along road sides and forest fringe. |
| Micro-climatic Status/Condition: | Ambient temperature : | 25 $^{o}$C |
| | Altitude : | 1442 m |
| | Humidity : | 57 % |
| | Light intensity : | 12100 lux |
| Phenology | : Flowering : | September- November |
| | Place of flower : | Terminal |
| | Fruiting : | January – March |

| | | |
|---|---|---|
| Associates | : | *Ageratum conyzoides, Chromolaena odorata, Polygonum barbatum.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, heavy rainfall and drought, regenerate naturally. |
| Soil | : | N : 0.142 %<br>P : 15.2 Kg/ha<br>K : 187.0 Kg/ha<br>pH : 5.0<br>OC : 1.0% |
| Parts used | : | Leaves |
| Uses | : | Cuts and wounds, kidney problems. |
| Mode of Preparation | : | The juice of crushed leaves is applied externally on fresh cuts and wounds as haemostatic and antiseptic. Decoction of leaves is taken orally for kidney problems. |
| Mode/Route of application | : | External Uses & oral. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Euphorbia hirta*** **(Pl. XVI, Photo 48)**

| | | |
|---|---|---|
| Scientific name | : | *Euphorbia hirta* L. |
| Local Name | : | Sazubeng |
| Family | : | Euphorbiaceae |
| Locality | : | Bawktlang |
| Botanical Description | : | Terrestrial, annual, erect herb, up to 60 cm tall. Leaves simple, not lobed or divided, opposite, sessile or stalked, elliptic, less than 2 cm long/wide, hairy on both sides, denser pilosity along the veins in the lower face, more scattered on the upper side; leaf base asymmetric, margin finely dentate, apex acute, base acute, 3-veined not to the top. Flowers unisexual, solitary or grouped together in an axillary cyme, stalked, petals absent. Fruit a capsule opening with 3 valves. |

| | | | | |
|---|---|---|---|---|
| Habit | : | Terrestrial, annual, erect herb, up to 60 cm tall. | | |
| Habitat | : | It is frequent in Mizoram, scattered in open forests above 900 m. Grown in roadside and moist shady places. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 27 $^{o}$C |
| | | Altitude | : | 1250 m |
| | | Humidity | : | 79 % |
| | | Light intensity | : | 49000 lux |
| Phenology | : | Leaf shedding | : | Annual herb |
| | | Flowering | : | June - July |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | August – September |
| Associates | : | *Plantago major, Lindernia ruelloides*, etc. | | |
| Ecology/Silvicultural character: | | Moderate light demander, acceptable to jhum fire, resistant to heavy rainfall, regenerate. | | |
| Soil | : | N | : | 0.143 % |
| | | P | : | 0.56 Kg/ha |
| | | K | : | 62 Kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 0.62 % |
| Parts used | : | Stem and leaves | | |
| Uses | : | Kidney problems, and dysentery | | |
| Mode of Preparation | : | Decoction of the stem with leaves is taken orally for kidney problems and dysentery. | | |
| Mode/Route of application | : | Oral | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Ficus auriculata* (Pl. XVII, Photo 49)**

| | | |
|---|---|---|
| Scientific name | : | *Ficus auriculata* Lour. |
| Local Name | : | Theibal/Theibate |
| Family | : | Moraceae |

| | | |
|---|---|---|
| Locality | : | Chawngtlai |
| Botanical Description | : | A small tree, evergreen tree, 3-10 m tall, with wide spreading crown. Bark warty, pale-grey or, young twigs pubescent, hollow. Leaves are alternately arranged, carried on 4-6 cm long stalks. They are obovate-elliptic to elliptic, papery, densely small tuberculate on the underside, hairless above, base shallowly heart-shaped to broadly wedge-shaped, margin irregularly toothed. Male flowers: sessile, ostiolar, in several whorls; large, inflated, imbricate; stamens 2 (-3), filaments much longer than anothers. Gall flowers in lower part of male hypanthodium, with 2-3-lobed calyx. Female flowers: subsessile to pedicellate; sepals united, 2-3-lobed; ovary with subterminal long hairy style, stigma dilated-cylindric. Figs are clustered on short branchlets of old stems, dark red when mature, pear-shaped to spherical, with 4-6 longitudinal ridges and small tubercles. |
| Habit | : | A tree of 5-10 m tall with a wide crown. |
| Habitat | : | It usually occurs in windbreaks of the forest, in forest clearings, or at the edge of rain forests |

| Micro-climatic Status/Condition: | | | |
|---|---|---|---|
| | Ambient temperature | : | 24 $^{o}$C |
| | Altitude | : | 1120 m |
| | Humidity | : | 41 % |
| | Light intensity | : | 12150 lux |

| Phenology | | | |
|---|---|---|---|
| | Leaf shedding | : | Evergreen |
| | Flowering | : | August - September |
| | Place of flower | : | Axillary |
| | Fruiting | : | October – November |

| | | |
|---|---|---|
| Associates | : | *Erythryna stricta, Prunus cerasoides, Aporusa octandra.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, heavy rainfall and drought, regenerate naturally. |

| Soil | | | |
|---|---|---|---|
| | N | : | 0.157 % |
| | P | : | 1.70 Kg/ha |
| | K | : | 124 Kg/ha |
| | pH | : | 5.6 |
| | OC | : | 1.40 % |

| | | |
|---|---|---|
| Parts used | : | Leaves, Bark |

| | | |
|---|---|---|
| Uses | : | Cuts, Wounds, Diarrhoea |
| Mode of Preparation | : | The leaves are crushed and the paste is applied on cuts and wounds. Juice of the crushed bark is also effective for cuts, wounds and diarrhoea. |
| Mode/Route of application | : | External and Oral. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Ficus semicordata*** **(Pl. XVII-Photo No. 50)**

| | | |
|---|---|---|
| Scientific name | : | *Ficus semicordata* Buch.-Ham. ex Smith |
| Local Name | : | Theitit |
| Family | : | Moraceae. |
| Locality | : | Ngopa |
| Botanical Description | : | A small tree; twigs hirsute; bark red brown; leaves elliptic to oblong-lanceolate, 4-8 x 12-30 cm, acuminate, repand-serrate, scabrid above, less pubescent beneath; base very unequal, semi-cordate or semi-sagittate, with a broad round lobe on one side with 3-4 nerved; lateral nerves 8-15 pairs; male sepals 3; female sepals 4; receptacles (fruits) globose or pyriform, hispid, in pairs or clusters; fruiting branches running on the ground or arising from the trunk and main branches, often ripening underground, dark-red when ripe. |
| Habit | : | A small tree |
| Habitat | : | Frequent in Mizoram, in tropical evergreen and semi-evergreen forests. It is grown in dry and slopy localities on sandy-rocky soils. |
| Micro-climatic Status/Condition: | Ambient temperature | : 23 $^{o}$C |
| | Altitude | : 1070 m |
| | Humidity | : 48 % |
| | Light intensity | : 12300 lux |
| Phenology | : Leaf shedding | : Evergreen |
| | Flowering | : Not seen |

| | | | |
|---|---|---|---|
| | Place of flower | : | Not seen |
| | Fruiting | : | Most of the year (Ripening in May – September) |

| | | |
|---|---|---|
| Associates | : | *Hibiscus macrophyllus, Hedychium spp., Mikania micrantha.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire and heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.10 %<br>P : 3.92 Kg/ha<br>K : 220 Kg/ha<br>pH : 5.4<br>OC : 1.4% |
| Parts used | : | Root-bark. |
| Uses | : | Ophthalmia, snake-bite. |
| Mode of Preparation | : | Seven leaves are put together in such a way that one over the other and rolled in a cone shape; it is then filled with warm ashes to produce water from below. The water is then dropped directly to the eyes to cure ophthalmia. The latex is applied to snake-bite. |
| Mode/Route of application | : | Orally |
| Status/Category | : | Not assessed for the IUCN Red List |

***Gelsemium elegans* (Pl. XVII, Photo 51)**

| | | |
|---|---|---|
| Scientific name | : | *Gelsemium elegans* Benth. |
| Local Name | : | Hnamtur |
| Family | : | Lo-ganiaceae. |
| Locality | : | Ngopa |
| Botanical Description | : | An evergreen scandent shrub.; bark thick, warty and green; wood vessels numerous, fibrous; leaves opposite, ovate-acuminate, 4-8 x 9-12 cm, thin, |

membranous; lateral nerves 5-6, distant; base rounded or oblique; Flowers golden yellow, in axillary trichotomous cymes; fruits inflated, 2 celled; seeds oblong, numerous.

Habit : An evergreen scandent shrub.

Habitat : Frequent in Mizoram at higher altitudes above 1000 m in sub-tropical hill forests.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1150 m. |
| Humidity | : | 42 % |
| Light intensity | : | 72300 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| Flowering | : | April - May |
| Place of flower | : | Axillary |
| Fruiting | : | June - August |

Associates : *Quercus sp., Eurya serasifolia, Measa indica.*

Ecology/Silvicultural character: Moderate light demander, acceptable to jhum fire, grown on sandy loam soil under shady forests as an undergrowth.

Soil :

| | | |
|---|---|---|
| N | : | 0.10 % |
| P | : | 3.92 Kg/ha |
| K | : | 220 Kg/ha |
| pH | : | 5.4 |
| OC | : | 1.4% |

Parts used : Leaves, Root-bark.

Uses : Asthma, diarrhoea, stomach-ache.

Mode of Preparation : The leaf is processed like tobacco leaf for smoking, which is then smoke like cigarette to cure asthma. Decoction of leaf is taken orally against diarrhoea and stomach-ache at the dose of not more than half cup per day. It can be deadly poisonous to human beings if taken too much. Incidence of death was reported during field work in Ngopa village due to eating of the fruits.

Mode/Route of application : Orally and External.

Status/Category : Not assessed for the IUCN Red List

***Hedyotis diffusa* (Pl. XVIII, Photo 52)**

| | | |
|---|---|---|
| Scientific name | : | *Hedyotis diffusa* Willd. |
| Local Name | : | Kairem |
| Family | : | Rubiaceae |
| Locality | : | Rabung |
| Botanical Description | : | An annual diffuse flaccid weed, stems numerous, prostrate, often rooting at the nodes. Leaves subsessile, 2-3.2 cm long, linear or linear-lanceolate, acute. Flowers very small, white, usually solitary, sessile or on very short pedicels. Capsules broader than long, very truncate and flat on the top. |
| Habit | : | A slender annual herbs. |
| Habitat | : | Not common in Mizoram. Found on road sides and humid open fields. |
| Micro-climatic Status/Condition: | | Ambient temperature : 23 $^{o}$C<br>Altitude : 1250 m<br>Humidity : 45 %<br>Light intensity : 15900 lux |
| Phenology | : | Leaf shedding : Annual herb<br>Flowering : May - July<br>Place of flower : Axillary<br>Fruiting : August – October |
| Associates | : | *Adiantum lunulatum, Ageretum conyzoides,* Ferns. |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to drought and heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.187 %<br>P : 13.0 Kg/ha<br>K : 575 Kg/ha<br>pH : 6.1<br>OC : 2.0 % |
| Parts used | : | Aerial parts |
| Uses | : | Sprain and sciatica |
| Mode of Preparation | : | The aerial parts of the plant are boiled with *Lindenia ruelloids* in water and the water is used as lotion to massage sprain and sciatica. |

| | | |
|---|---|---|
| Mode/Route of application | : | External application |
| Status/Category | : | Least Concern |

***Hedyotis scandens* (Pl. XVIII, Photo 53)**

| | | |
|---|---|---|
| Scientific name | : | *Hedyotis scandens* Roxb. |
| Local Name | : | Kelhnamtur |
| Family | : | Rubiaceae |
| Locality | : | Ngopa |
| Botanical Description | : | A slender woody much-branched climbing shrub; leaves elliptic-oblong or laceolate, caudate or acuminate, rather thick, nerves obscure; base narrowed to channelled petiole; flowers white or creamy white, in axillary and terminal panicled corymbose cymes; pedicels horizontal, slender; fruits obovoid or globose; seeds minute, numerous. |
| Habit | : | A slender soft wooded climber. |
| Habitat | : | It is common throughout Mizoram, particularly in waste places in tropical secondary forests. Grown in moist shady areas and waste place. |
| Micro-climatic Status/Condition: | Ambient temperature | : 24 $^{o}$C |
| | Altitude | : 1070 m |
| | Humidity | : 40 % |
| | Light intensity | : 12070 lux |
| Phenology | : Leaf shedding | : Partial shedding in winter |
| | Flowering | : May to June. However, flowering in cold weather reported by Biswas & Chopra (1982). |
| | Place of flower | : Axillary |
| | Fruiting | : July - August |

| | | |
|---|---|---|
| Associates | : | *Thea sinensis, Maesa indica, Schima wallichii, Artocarpus gomezianus.* |
| Ecology/Silvicultural character: | | Low light demander; tolerate shade in early stage, resistant to heavy rainfall, natural regeneration satisfactory, artificial regeneration through stem cuttings. |
| Soil | : | N : 0.145 %<br>P : 11.2 Kg/ha<br>K : 165.0 Kg/ha<br>pH : 5.0<br>OC : 1.0% |
| Parts used | : | Roots, leaves. |
| Uses | : | Toothache, malaria fever, jaundice, kidney trouble, dysuria. |
| Mode of Preparation | : | The leaf is chewed and the water is retained in the mouth for toothache. Infusion of the roots and leaves is taken as an effective remedy against malarial fever. The medicine is taken @ tablespoon (10 ml) twice daily.The leaves in combination with the leaves of *Passiflora nepalensis* wall. in equal proportion is boiled and the water is taken orally against fever @ tablespoonful (10 ml) twice daily. Infusion of the leaves is commonly employed to cure jaundice, kidney trouble and removal of stones in the kidney/gall-bladder.The juice of crushed leaves is taken for dysuria. |
| Mode/Route of application | : | Oral administration |
| Status/Category | : | Not assessed for the IUCN Red List |

***Helicia robusta* (Pl. XVIII, Photo 54)**

| | | |
|---|---|---|
| Scientific name | : | *Helicia robusta* Roxb. |
| Local Name | : | Pasaltakaza |
| Family | : | Proteaceae |
| Locality | : | Rabung |

| | | |
|---|---|---|
| Botanical Description | : | A middled sized evergreen tree; bark thick whitish brown; leaves dark green paler below, opposite, oblong lanceolate, hard and stiff, smooth surface, taper at apex; flower and fruit not seen. |
| Habit | : | A middled sized evergreen tree. |
| Habitat | : | Rare in Mizoram, in tropical evergreen and semi-evergreen forest. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1100 m<br>Humidity : 42 %<br>Light intensity : 3850 lux |
| Phenology | : | Leaf shedding : Evergreen<br>Flowering : Not seen<br>Fruiting : Not seen |
| Associates | : | *Schima wallichi, Terminalia citrine, Aporosa octandra.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, natural regeneration has no problem but artificial regeneration is difficult. |
| Soil | : | N : 0.149 %<br>P : 41.2 Kg/ha<br>K : 161 Kg/ha<br>pH : 4.5<br>OC : 1.0% |
| Parts used | : | Rootstock, leaves and flowers. |
| Uses | : | Placental problems, Kidney problems, problem in stomach, intestinal and pile problems. |
| Mode of Preparation | : | Decoction of the bark and root bark is taken orally to cure placental problems, kidney problems and stomach sore.<br>The crushed bark is boiled with 250g of fruits of *Emblica officinalis* and 125g of sugar to produce about one litre of the water; the water is taken orally for stomach problems, intestinal and pile problems. |
| Mode/Route of application | : | Oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Hibiscus rosa-sinensis*** **(Pl. XIX, Photo 55)**

| | | |
|---|---|---|
| Scientific name | : | *Hibiscus rosa-sinensis L.* |
| Local Name | : | Laifual/Midum pangpar |
| Family | : | Malvaceae |
| Locality | : | Vanchengpui |
| Botanical Description | : | An ornamental shrub or small tree. Leaves ovate-lanceolate, more or less acuminate, irregularly and coarsely serrate towards the top. Flowers large, axillary solitary; corolla 7.5 cm diam., tubular below, red. |
| Habit | : | An ornamental shrub or small tree. |
| Habitat | : | Commonly cultivated as a garden ornamental shrub. |
| Micro-climatic Status/Condition: | | Ambient temperature : 21 $^{o}$C<br>Altitude : 1400 m<br>Humidity : 44 %<br>Light intensity : 72000 lux |
| Phenology | : | Leaf shedding : Evergreen<br>Flowering : Almost throughout the year.<br>Place of flower : Axillary<br>Fruiting : Almost throughout the year |
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Light demander, acceptable to heavy rainfall, natural and artificial regeneration is done easily. |
| Soil | : | N : 0.152 %<br>P : 25 Kg/ha<br>K : 123 Kg/ha<br>pH : 5.6<br>OC : 1.22 % |
| Parts used | : | Leaves and Flowers. |
| Uses | : | Cancerous swellings, mumps, fever and jaundice. |
| Mode of Preparation | : | The leaves and flowers are beaten into a paste and poultice onto cancerous swellings and mumps. A decoction is used as a lotion in the treatment of |

fevers. The flower is put onto a fire for a second and eaten directly to cure jaundice.

Mode/Route of application : External application.

Status/Category : Not assessed for the IUCN Red List

***Hiptage benghalensis* (Pl. XIX, Photo 56)**

Scientific name : *Hiptage benghalensis* (L.) Kurz

Local Name : Raisentur

Family : Ebenaceae.

Locality : Ngharchhip

Botanical Description : A large, woody, evergreen, straggling or climbing shrub with young branches being grey tomentose it belongs to the family Malpighiaceae. The opposite and entire leaves are oblong to ovate-lanceolate, 9-21 cm long and 4-9 cm wide, acute or acuminate, glabrous, and have petioles of *c*. 1 cm length. White and fragrant flowers of 2-3 cm diameter are borne in erect, pubescent racemes of 10-20 cm length, the pedicels being 15-20 mm long. Flowers have a yellow centre and orbicular to elliptic petals that are hairy outside. Fruits are samaras with three wings each, the middle wing being 4-6 cm long and the lateral wings 2-3 cm long

Habit : A large, woody, evergreen, straggling or climbing shrub

Habitat : Habitat variable. Prefers climates ranging from warm temperate to tropical. Dry and moist areas from sea level to 1000m.

| | | | |
|---|---|---|---|
| Micro-climatic Status/Condition: | Ambient temperature | : | 24 $^{o}$C |
| | Altitude | : | 1060 m |
| | Humidity | : | 48 % |
| | Light intensity | : | 12850 lux |
| Phenology : | Leaf shedding | : | September - October |
| | New Leaf | : | February - March |
| | Flowering | : | September–December |

| | | | | |
|---|---|---|---|---|
| | | Place of flower | : | Axillary |
| | | Fruiting | : | January – March |
| Associates | : | *Acer laevigatum, Eupatorium odoratum, Rubus* spp. | | |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, regenerates naturally. | | |
| Soil | : | N | : | 0.154 % |
| | | P | : | 3.33 Kg/ha |
| | | K | : | 150 Kg/ha |
| | | pH | : | 5.2 |
| | | OC | : | 0.92 % |
| Parts used | : | Root bark. | | |
| Uses | : | Diarrhoea, dysentery and stomach ulcer. | | |
| Mode of Preparation | : | Decoction of crushed root bark is taken orally for dysentery at the dose of which as much as one can drink. Root bark is air dried and powdered, mixed with water. One pinch of the powder is enough for one cup of water. Used against severe diarrhoea, dysentery and stomach ulcer by taking one cup thrice daily. | | |
| Mode/Route of application | : | Orally | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Houttuynia cordata*** **(Pl. XIX, Photo 57)**

| | | |
|---|---|---|
| Scientific name | : | *Houttuynia cordata* Thunb. |
| Local Name | : | Uithinthang |
| Family | : | Saururaceae |
| Locality | : | Vanchengpui |
| Botanical Description | : | A creeping herb with fleshy stems and a scent that has been described as lemon, sandalwood, coriander or raw fish. The leaves are alternate, broadly heart-shaped, 4–9 cm long and 3–8 cm broad. The lower parts of the leaf stalks form a sheath round the stem. |

The leaves are usually heart-shaped, 4–10 cm long and 2.5–6.0 cm wide, and purple underneath. The flowers are small, crowded into a short spike around 2 cm long, with four white, petal-like bracts at the base. The fruits are apomictic, i.e. they develop seeds without being fertilized.

Habit : A creeping herb with fleshy stems.

Habitat : Shrubberies and damp places to 1300 m in Mizoram. Often found as a weed in wet fields. Stream edges, wet woodlands, damp grassy places, paddy field margins, roadsides.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 22 $^{o}$C |
| Altitude | : | 1380 m |
| Humidity | : | 48 % |
| Light intensity | : | 3210 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Annual herb |
| Flowering | : | April - September |
| Place of flower | : | Terminal |
| Fruiting | : | June – October |

Associates : Cultivated

Ecology/Silvicultural character: Shade bearer, resistant to drought, natural and artificial regeneration has no difficulties.

Soil :

| | | |
|---|---|---|
| N | : | 0.152 % |
| P | : | 25 Kg/ha |
| K | : | 123 Kg/ha |
| pH | : | 5.6 |
| OC | : | 1.22 % |

Parts used : Whole plant

Uses : Sinus

Mode of Preparation : Smelling of the plant is done to cure sinus.

Mode/Route of application : Smelling

Status/Category : Not assessed for the IUCN Red List

***Imperata cylindrical* (Pl. XX, Photo 58)**

| | | |
|---|---|---|
| Scientific name | : | *Imperata cylindrical* Linn. |
| Local Name | : | Di |
| Family | : | Poaceae. |
| Locality | : | Khawbel |
| Botanical Description | : | A perennial herb; rootstock creeping, stoloniferous; culms solid; leaves flat, linear-lanceolate, acuminate, up to 2m long, margins scabrid; base narrowed; petiole channeled; flowers silvery-white, speciform, panicles to 45 cm long, very dense; panicles purplish when young; fruits (caryopsis) small, elliptic-oblong, brown, light and loose. |
| Habit | : | A perennial herb |
| Habitat | : | Very common or abundant throughout Mizoram. It is grown on loamy clay soil in open areas, particularly in fallow lands, newly burnt jhums and old jhum lands. |
| Micro-climatic Status/Condition: | | Ambient temperature : 23 $^{o}$C<br>Altitude : 1070 m<br>Humidity : 39 %<br>Light intensity : 78210 lux |
| Phenology | : | Flowering : March - April<br>Place of flower : Panicled<br>Fruiting : April – May |
| Associates | : | *Wendlandia grandis, Schima wallichii, Eurya acuminate, Sterculia colorata.* |
| Ecology/Silvicultural character: | | Light demander, non resistant to jhum fire, resistant to drought and heavy rainfall, natural regeneration is adequate. |
| Soil | : | N : 0.151 %<br>P : 8.3 Kg/ha<br>K : 210 Kg/ha<br>pH : 5.1<br>OC : 0.8% |
| Parts used | : | Roots and Aerial parts. |
| Uses | : | Round-worms and pin-worms, urinary problem. |

| | | |
|---|---|---|
| Mode of Preparation | : | The roots are washed and crushed and the juice is taken orally against round-worm and pin-worm. Juice of crushed aerial parts mixed with sugar is taken orally for urinary problems. |
| Mode/Route of application | : | Oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Jasminum nervosum* (Pl. XX, Photo 59)**

| | | |
|---|---|---|
| Scientific name | : | *Jasminum nervosum* Lour |
| Local Name | : | Hruikhawng/Mau-fim |
| Family | : | Oleaceae |
| Locality | : | Tualpui |
| Botanical Description | : | A scandent shrub, glabrous, stem green and smooth; leaves ovate lanceolate, acuminate, chartaceous, glossy above, 3-nerved; 2-4 x 3.5-12 cm, a pair of basal nerves extending up to the apex and anastonosing with secondary nerves; base rounded or sub-cordate; flowers white, in axillary 2-5 flowered cymes; lobes 7-10; fruit ellipsoid, small. |
| Habit | : | A scandent shrub. |
| Habitat | : | Common in Mizoram, found in open places as well as under shade. |
| Micro-climatic Status/Condition: | Ambient temperature : | 23 $^{o}$C |
| | Altitude : | 1250 m |
| | Humidity : | 37 % |
| | Light intensity : | 5750 lux |
| Phenology | : Leaf shedding : | Evergreen |
| | Flowering : | January - March |
| | Place of flower : | Axillary |
| | Fruiting : | March – May |
| Associates | : | *Wendlandia grandis, Quercus incana, Embelia nutans, Globa sp., Psychotria sp.* |

| | | |
|---|---|---|
| Ecology/Silvicultural character: | | Shade bearer, acceptable to jhum fire, resistant to heavy rainfall, natural regeneration satisfactory. |
| Soil | : | N : 0.146 %<br>P : 10.1 Kg/ha<br>K : 149 Kg/ha<br>pH : 5.1<br>OC : 1.2% |
| Parts used | : | Leaves. |
| Uses | : | Dysentery, diarrhea and toothache. |
| Mode of Preparation | : | Leaves are chewed for dysentery, diarrhea and toothache. It is also used by infusing the crushed leaves. |
| Mode/Route of application | : | Orally |
| Status/Category | : | Not assessed for the IUCN Red List |

***Justicia zeylanica* (Pl. XX, Photo 60)**

| | | |
|---|---|---|
| Scientific name | : | *Justicia zeylanica* Medicus. |
| Local Name | : | Kawldai |
| Family | : | Acanthaceae |
| Locality | : | Lungkawlh |
| Botanical Description | : | An evergreen, perennial shrub; bark grey; leaves ovate-lanceolate, acuminate, attenuate; flowers pure white,with pink dots, clustered towards the ends of branchlets in axillary spikes; bracts large, ovate, mucronate; fruit clavate, c. 2 cm long, pubescent, channeled; seeds-4, orbicular, tubercled. |
| Habit | : | An evergreen, perennial shrub. |
| Habitat | : | Frequent in Mizoram, usually planted as hedge plants throughout Mizoram. |
| Micro-climatic Status/Condition: | | Ambient temperature : 29 $^{o}$C<br>Altitude : 1410 m.<br>Humidity : 66 %<br>Light intensity : 12100 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Leaf shedding | : | Evergreen |
| | | New Leaf | : | February - April |
| | | Flowering | : | February - April |
| | | Place of flower | : | Terminal |
| | | Fruiting | : | February – May |
| Associates | : | *Terminalia bellirica, Globa sp., Morinda sp.* | | |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to heavy rainfall, natural and artificial regeneration is not easy because of which they are now become under endangered species. | | |
| Soil | : | N | : | 0. 109 % |
| | | P | : | 2.22 Kg/ha |
| | | K | : | 231 Kg/ha |
| | | pH | : | 4.9 |
| | | OC | : | 1.1% |
| Parts used | : | Leaves. | | |
| Uses | : | Burns, cuts, wounds, chronic fever/malarial fever, whooping cough. | | |
| Mode of Preparation | : | Crushed leaf is applied to burns externally. Juice of crushed leaves is applied externally on cuts and wounds as haemostatics.The leaves are boiled and the water is used for bathing and the leaf paste is applied on the whole body as an effective cure for chronic fever/malarial fever. The water is also taken orally @ tablespoonful (10 ml) twice daily for 3 days. This routine is followed for 3 consecutive days. Juice of young leaves mixed with honey is taken for whooping cough. | | |
| Mode/Route of application | : | Orally and external. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Kalanchoe integra* (Pl. XXI, Photo 61)**

| | | |
|---|---|---|
| Scientific name | : | *Kalanchoe integra* (Medik.) O. Kuntze |
| Local Name | : | Kangdamdawi |
| Family | : | Crassulaceae |

| | | |
|---|---|---|
| Locality | : | Tawizo |
| Botanical Description | : | A perennial glabrous fleshy herbs; stems fistular, 0.3-1.2 m tall. Leaves simple, spathulate-oblong or obovate, lanceolate, 7-20 x 2-5 cm, base cuneate, crenate-serrate along margins, glabrous, upper leaves trifoliate; petioles 2-5 cm long. Cymes subcorymbose, flattish, elongate; bracts few, scattered, linear, 0.6-1.2 cm long. Flowers erect, light yellow-pink, fragrant; sepals ca 7 mm long; lobes elongate triangular, united at base; corolla tube glabrous, ca 1.5cm long, constricted at middle. |
| Habit | : | A perennial glabrous fleshy herb with pale pink flowers. |
| Habitat | : | Rare in Mizoram, in Sub-tropical hill forests. Grows in Tawizo. |
| Micro-climatic Status/Condition: | Ambient temperature : | 22 $^{o}$C |
| | Altitude : | 1500 m |
| | Humidity : | 48 % |
| | Light intensity : | 87200 lux |
| Phenology | : Flowering : | December – February |
| | Place of flower : | Axillary |
| | Fruiting : | March - April |
| Associates | : | *Chromolaena odorata, Urena lobata,* Grasses. |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire and heavy rainfall, natural regeneration is satisfactory but artificial regeneration is difficult. |
| Soil | : N : | 0. 162 % |
| | P : | 6.2 Kg/ha |
| | K : | 194.0 Kg/ha |
| | pH : | 5.1 |
| | OC : | 1.3% |
| Parts used | : | Leaves |
| Uses | : | Burns |
| Mode of Preparation | : | Juice of crushed leaves alongwith the paste is applied on burns. |
| Mode/Route of application | : | External application |
| Status/Category | : | Not assessed for the IUCN Red List |

***Knema linifolia* (Pl. XXI, Photo 62)**

| | | |
|---|---|---|
| Scientific name | : | *Knema linifolia* (Roxb.) Warb. |
| Local Name | : | Thingthi |
| Family | : | Myristicaceae |
| Locality | : | Maite |
| Botanical Description | : | Trees to 20 m tall, 25–35 cm d.b.h.; bark rough, grayish brown; branches slightly drooping, arising at top, with dense rusty pubescence; leaf blade obovate-lanceolate, (15–)24–40 × 7–13 cm, petiolate, widened at middle, papery or subleathery, finely hairy, glabrescent on both surfaces, base rounded, apex acuminate or long acuminate; lateral veins 20–25 pairs, prominent on both surfaces; male inflorescences 0.8–1 cm. Male flowers 2–5-fascicled on short peduncle; buds ovoid or obovoid, 7–10 × 5–6 mm, with dense brown pubescence; pedicel 1.2–1.5 cm; bracteole inserted at about middle or in lower part of pedicel; perianth lobes 3; staminate disk concave; anthers 13–18, sessile. Female flowers 2–4-fascicled, ca. 6 mm; ovary broadly ovoid, pubescent; stigma bifid, each lobe again shallowly 2-lobulate. Infructescences short, often with 1 fruit; Fruit nearly sessile, ellipsoid or ovoid, 2.5–4 × 2.2–2.5 cm, with rusty hairs 0.5–1 mm; pericarp 2–3 mm thick. Aril red, laciniate at apex. |
| Habit | : | Trees to 20 m tall. |
| Habitat | : | Low hilly forests, moist mountain slopes. Maite, Mualpheng etc. |
| Micro-climatic Status/Condition: | | Ambient temperature : 22 $^{o}$C<br>Altitude : 1450 m<br>Humidity : 47 %<br>Light intensity : 13850 lux |
| Phenology | : | Flowering : August - September<br>Place of flower : Axillary<br>Fruiting : October – November |
| Associates | : | *Schima wallichii, Engelhardtia roxburghiana, Thunbergia coccinea.* |

| | | |
|---|---|---|
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.167 %<br>P : 21 Kg/ha<br>K : 128 Kg/ha<br>pH : 5.7<br>OC : 1.1 % |
| Parts used | : | Latex |
| Uses | : | Stomachache and ulcer. |
| Mode of Preparation | : | The latex is mixed with honey and warm water which is taken orally to cure stomachache and ulcers. |
| Mode/Route of application | : | Orally |
| Status/Category | : | Not assessed for the IUCN Red List |

***Lindenia ruelloids* (Pl. XXI, Photo 63)**

| | | |
|---|---|---|
| Scientific name | : | *Lindenia ruelloids* (Colsm) Pennel. |
| Local Name | : | Thasuih |
| Family | : | Scrophulariaceae. |
| Locality | : | Chiahpui |
| Botanical Description | : | A trailing herb; rooting at the nodes; leaves obovate-oblong, serrate, obtuse, 1-2.5 x 204 cm, reddish; flowers bluish, subtended by green calyx, in axillary-terminal cymes; fruits capsule, small, slender, up to 2.5 cm long; seeds yellow. |
| Habit | : | A trailing herb |
| Habitat | : | It is frequent in Mizoram, scatterded in open forests above 900m. Grown in moist shady places. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1100 m<br>Humidity : 42 %<br>Light intensity : 57100 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Leaf shedding | : | Annual herb |
| | | Flowering | : | May - June |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | July – August |
| Associates | : | *Plantago major, Eleusine sp.* | | |
| Ecology/Silvicultural character: | | Low light demander, acceptable to jhum fire, resistant to heavy rainfall, regenerate naturally. | | |
| Soil | : | N | : | 0.132 % |
| | | P | : | 11.2 Kg/ha |
| | | K | : | 165.0 Kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.0% |
| Parts used | : | Whole plant. | | |
| Uses | : | Joint pain, sprain, swelling, spasmodic | | |
| Mode of Preparation | : | The aerial part is boiled in water and a piece of cloth is dip in the warm water which is used for fomentation in joint paint and sprain. Infusion of the plant is used as a lotion for local swelling, sprains and as antispasmodic | | |
| Mode/Route of application | : | Local application. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

**Lithocarpus dealbata (Pl. XXII, Photo 64)**

| | | |
|---|---|---|
| Scientific name | : | Lithocarpus dealbata (Hook. f. & Thoms.) Rehd. |
| Local Name | : | Fah |
| Family | : | Fagaceae |
| Locality | : | Thaltlang |
| Botanical Description | : | Trees rarely to 20 m tall; bud scales, branchlets, petioles, leaf blades abaxially, rachis of inflorescences, and scales of cupule tawny tomentose with short hairs. Petiole 1-2 cm; leaf blade ovate, ovate-elliptic, or lanceolate, 7-14 × 2-5 cm, thickly papery to leathery, concolorous or |

abaxially grayish and with waxy scale, base cuneate, margin entire or rarely apically shallowly undulate, apex acuminate to acute; midvein adaxially slightly raised and usually sparsely pubescent; secondary veins (8-)10-13 on each side of midvein; tertiary veins abaxially conspicuous, ± parallel. Male inflorescences clustered at apex of branches, rarely to 15 cm. Female inflorescences sometimes androgynous, rarely to 20 cm; cupules in clusters of 3(-5). Infructescences usually 5-8 cm. Cupule cupular, 0.8-1.4 × 1-1.8 cm, enclosing 1/2 to most of nut; bracts imbricate, triangular, appressed or a few spreading. Nut depressed globose to subglobose, slightly smaller than cupule, apex rounded, ± flat, or rarely convex, wall ca. 1 mm thick; scar covering ca. 1/3 (-1/2) of nut, convex.

Habit : Evergreen tree up to 20 m high.

Habitat : Not common in Mizoram, on humus sandy loam soil in primary forest mostly at higher altitude.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 21 $^{o}$C |
| Altitude | : | 1350 m |
| Humidity | : | 41 % |
| Light intensity | : | 9200 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| Flowering | : | September - December |
| Place of flower | : | Terminal axillary |

Fruiting : April – November of the following year.

Associates : Castanopsis spp., Vitex peduncularis, Callicarpa arborea

Ecology/Silvicultural character: Moderate light demander, resistant to jhum fire and heavy rainfall, regenerate naturally.

Soil :

| | | |
|---|---|---|
| N | : | 0. 214 % |
| P | : | 26.10 Kg/ha |
| K | : | 110 Kg/ha |
| pH | : | 5.1 |
| OC | : | 2.4 % |

Parts used : Wood

Uses : Ringworm and vitiligo.

| | | |
|---|---|---|
| Mode of Preparation | : | Half dried wood when put on fire produce froth from the other end, which is used as lotion to remove ringworm and vitiligo. |
| Mode/Route of application | : | External |
| Status/Category | : | Not assessed for the IUCN Red List |

***Lobelia angulata*** **(Pl. XXII, Photo 65)**

| | | |
|---|---|---|
| Scientific name | : | *Lobelia angulata* Forst. |
| Local Name | : | Choakthi |
| Family | : | Lobeliaceae. |
| Locality | : | Ngopa |
| Botanical Description | : | A small creeping herb, pubescent, rooting on lower stem; leaves cordate-ovate, repand or slightly notches; 1 x 2 cm, denticulate; flowers greenish-pink; berries ellipsoid with persistent style on tip, pinkish -black. |
| Habit | : | A creeping herbs with mauve-colored, berries. |
| Habitat | : | Scattered in Mizoram, on waysides and clearings in tropical secondary forests. It is grown on walls of road in damp places and open spaces. |
| Micro-climatic Status/Condition: | | Ambient temperature : 22 $^{o}$C<br>Altitude : 1100 m<br>Humidity : 42 %<br>Light intensity : 81950 lux |
| Phenology | : | Leaf shedding : Annual herb<br>New Leaf : After germination<br>Flowering : April - May<br>Place of flower : Axillary<br>Fruiting : June – August |
| Associates | : | *Plantago major, Polygonum sp.* |
| Ecology/Silvicultural character: | | Shade bearer, acceptable to jhum fire, natural and artificial regeneration has no problems. |

| | | | | |
|---|---|---|---|---|
| Soil | : | N | : | 0.112 % |
| | | P | : | 1.35 Kg/ha |
| | | K | : | 76 Kg/ha |
| | | pH | : | 5.6 |
| | | OC | : | 0.92 % |
| Parts used | : | Fruits | | |
| Uses | : | Tonsillitis, pneumonia, asthma and lungs trouble. | | |
| Mode of Preparation | : | The fruit together with *Centella asiatica* made into paste is taken orally to cure tonsillitis, pneumonia, asthma and lungs trouble at the dose of one teaspoon thrice daily. Two or three fresh fruits are also eaten against tonsillitis. | | |
| Mode/Route of application | : | Oral administration | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Lobelia nicotianifolia* (Pl. XXII, photo 66)**

| | | |
|---|---|---|
| Scientific name | : | *Lobelia nicotianifolia* Roth ex Schult. |
| Local Name | : | Berawchal |
| Family | : | Campanulacea |
| Locality | : | Khawzawl |
| Botanical Description | : | A hairy annual shrub that reaches a height of three meters; leaves very large, up to 45 cm long in lower part of stem, smaller upwards, margins not entire; the main nerve of the leaves whitish; Flowers large white, in very large terminal bunches; fruit 8 mm, roundish. Seeds many, small, yellowish, and brown. |
| Habit | : | A hairy annual shrub that reaches a height of 3 meters. |
| Habitat | : | It is common throughout Mizoram. It is usually grown on the edge of home garden. |

| | | | | |
|---|---|---|---|---|
| Micro-climatic Status/Condition: | | Ambient temperature | : | 21 $^{o}$C |
| | | Altitude | : | 1250 m |
| | | Humidity | : | 48 % |
| | | Light intensity | : | 71900 lux |
| Phenology | : | Leaf shedding | : | Annual shrub |
| | | Flowering | : | November-December |
| | | Place of flower | : | Terminal |
| | | Fruiting | : | January – February |
| Associates | : | *Eupatorium odoratum, Justicia zeylanica, Scoparia dulcis.* | | |
| Ecology/Silvicultural character: | | Light demander, resistant to drought and heavy rainfall, regenerate naturally. | | |
| Soil | : | N | : | 0.104 % |
| | | P | : | 22.5 Kg/ha |
| | | K | : | 250 Kg/ha |
| | | pH | : | 6.1 |
| | | OC | : | 1.20 % |
| Parts used | : | Lac | | |
| Uses | : | Snake bite, ringworm. | | |
| Mode of Preparation | : | The lac is applied to snake bite and ringworm. | | |
| Mode/Route of application | : | External | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Lonicera macrantha* (Pl. XXIII, Photo 67)**

| | | |
|---|---|---|
| Scientific name | : | *Lonicera macrantha* DC. |
| Local Name | : | Leihruisen |
| Family | : | Caprifoliaceae. |
| Locality | : | N.E.Khawdungsei |
| Botanical Description | : | A large climber; stem rigid and dark red; leaves ovate or oblong-ovate, caudate-acuminate, 1-4 x 9-10 cm, rugose above, villous beneath; base cordate; |

| | | |
|---|---|---|
| | | flowers white fading to yellow in short compact terminal panicles; berries fleshy ovoid, ellipsoid, narrowed at tip. |
| Habit | : | A large climber. |
| Habitat | : | Very frequent throughout Mizoram, in tropical evergreen and semi-evergreen forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 22 $^{o}$C<br>Altitude : 1022 m<br>Humidity : 53 %<br>Light intensity : 15850 lux |
| Phenology | : | Flowering : April - June<br>Place of flower : Terminal<br>Fruiting : July – October |
| Associates | : | *Albizia chinensis, Wendlandia grandis, Schima wallichii, Erianthus longisetosus.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire and heavy rainfall, natural regeneration has no difficulty but artificial regeneration is difficult. |
| Soil | : | N : 0.244 %<br>P : 22 Kg/ha<br>K : 143 Kg/ha<br>pH : 5.6<br>OC : 1.23 % |
| Parts used | : | Leave, root. |
| Uses | : | Cuts, wound, diarrhoea, cancer |
| Mode of Preparation | : | Juice of the crushed leaf and paste is applied to cuts and wounds; it acts as antiseptic and blood coagulant. Infusion leaves is taken orally as an effectively remedy against diarrhoea. The medicine is taken @ 1/2 (50 ml) twice daily. Decoction of the root is reported to be used for cancer. |
| Mode/Route of application | : | External and Oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Lygodium flexuosum* (Pl. XXIII, Photo 68)**

| | | |
|---|---|---|
| Scientific name | : | *Lygodium flexuosum (L) SW* |
| Local Name | : | Hnungzangzum |
| Family | : | Lygodiaceae |
| Locality | : | Lawngtlai |
| Botanical Description | : | A climbing fern; rachis twining; pinnae digitately lobed; pinnules ternate, bearing fertile and infertile parts; veins forked; spores marginal in biseriate spike, numerous. |
| Habit | : | A climbing fern. |
| Habitat | : | Common throughout Mizoram, in waste places and in primary forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 750 m<br>Humidity : 45 %<br>Light intensity : 72100 lux |
| Phenology | : | Spores : January - September |
| Associates | : | *Ammomum dealbatum, Dillenia indica, Baccaurea ramniflora, etc.* |
| Ecology/Silvicultural character: | | Moderate light demander, natural regeneration is seen, but artificial regeneration is difficult. |
| Soil | : | N : 0.157 %<br>P : 15 Kg/ha<br>K : 125 Kg/ha<br>pH : 5.6<br>OC : 1.54 % |
| Parts used | : | Stem, roots and leaves. |
| Uses | : | Excessive menses, antihelmenthic, wounds and scabies. |
| Mode of Preparation | : | Three stems are tie together around shin to stop excessive menses. The roots are ground to a paste and made into pills. Three pills are taken 3 times a day as antihelmenthic. Leaves are made into poultice and applied to wounds and scabies twice daily. |

| | | |
|---|---|---|
| Mode/Route of application | : | Orally and externally. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Malvaviscus arboreus* (Pl. XXIII, Photo 69)**

| | | |
|---|---|---|
| Scientific name | : | *Malvaviscus arboreus* Cav. |
| Local Name | : | Saparngeng |
| Family | : | Malvaceae (Mallow family) |
| Locality | : | Vartek |
| Botanical Description | : | It is a spreading shrub to 2-3 m high. Stems densely clothed in stellate hairs; leaves are densely clothed in velvety to tough hairs, ovate to nearly circular, heart-shaped, not lobed or shallowly 3-lobed. Leaf margin is crenate-serrate. Leaves are 5-15 cm long with stalks 2-12 cm long; flowers are borne solitary or few in fascicles, in leaf axils. Petals are scarlet. There also exists a pink cultivar called 'Rosea'. Flowers are pendulous, 2-3 inches long. |
| Habit | : | It is a spreading shrub to 2-3 m high. |
| Habitat | : | Very common throughout Mizoram. It is also cultivated as ornamental plants. Best in full sun but will tolerate light shade. |
| Micro-climatic Status/Condition: | Ambient temperature : | 24 $^{o}$C |
| | Altitude : | 980 m |
| | Humidity : | 42 % |
| | Light intensity : | 82250 lux |
| Phenology | : Leaf shedding : | Evergreen |
| | Flowering : | Throughout the year |
| | Place of flower : | Axillary |
| | Fruiting : | Throughout the year |
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Light demander, resistant to heavy rainfall and drought, artificial regeneration is easy but natural regeneration is difficult. |

| | | | | |
|---|---|---|---|---|
| Soil | : | N | : | 0.127 % |
| | | P | : | 39.9 Kg/ha |
| | | K | : | 130 Kg/ha |
| | | pH | : | 4.9 |
| | | OC | : | 1.0 % |
| Parts used | : | Flower | | |
| Uses | : | Sore | | |
| Mode of Preparation | : | The flower is crushed and made into paste, which is applied on sores. | | |
| Mode/Route of application | : | External | | |
| Status/Category | : | Endangered in the wild; cultivated abundantly | | |

***Mallotus philippensis* (Pl. XXIV, Photo 70)**

| | | | | |
|---|---|---|---|---|
| Scientific name | : | *Mallotus philippensis* Muell | | |
| Local Name | : | Thingkhei | | |
| Family | : | Euphorbiaceae | | |
| Locality | : | Lungpho | | |
| Botanical Description | : | A small to medium-sized evergreen to semi-deciduous tree; branchlets, young leaves and inflorescence rusty tomentose. Leaves variable, 7.5-15 cm long, ovate or ovate-lanceolate, acuminate, entire or slightly toothed. Flowers dioecious, small; the males clustered in erect, long, terminal spikes; the females in short spikes. Capsules 8-13 mm diam., 3-lobed, brick-red. | | |
| Habit | : | Evergreen tree up to 12 m tall. | | |
| Habitat | : | Common under storey trees in evergreen to semi-evergreen forests up to 1500 m. Lungpho, E. Lungdar, etc. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 22 $^{o}$C |
| | | Altitude | : | 1310 m |
| | | Humidity | : | 46 % |
| | | Light intensity | : | 19080 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Leaf shedding | : | Evergreen |
| | | Flowering | : | September- November |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | February – May |
| Associates | : | *Garcinia paniculata, Callicarpa arborea, Prunus cerosoides, etc.* | | |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, drought and heavy rainfall, regenerate naturally and artificially. | | |
| Soil | : | N | : | 0.186 % |
| | | P | : | 13.40 Kg/ha |
| | | K | : | 132 Kg/ha |
| | | pH | : | 5.5 |
| | | OC | : | 0.66 % |
| Parts used | : | Bark | | |
| Uses | : | Diarrhoea and dysentery | | |
| Mode of Preparation | : | Decoction of the bark is taken orally against diarrhea and dysentery at the dose of one cup thrice daily. | | |
| Mode/Route of application | : | Oral administration. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Mallotus roxburghianus* (Pl. XXIV, Photo 71)**

| | | |
|---|---|---|
| Scientific name | : | *Mallotus roxburghianus* Muell. Arg. |
| Local Name | : | Zawngtenawhlung |
| Family | : | Euphorbiaceae. |
| Locality | : | Ngentiang |
| Botanical Description | : | A shrub or an evergreen small tree; young parts softly pubescent; bark grey and rough; leaf big, rough, green, paler beneath. Leaves alternate, caudate-acuminate, distantly serature, 6-15 x 10-15 cm; base rounded; nerves 5 at the base, |

| | | |
|---|---|---|
| | | intramarginal; tertiaries scariform; veinlets reticulate; petiole up to 15 cm long; Flowers recemes, terminal, as long as leaves. Fruits 3-lobed, sub globose. |
| Habit | : | A shrub or small tree. |
| Habitat | : | Not common in Mizoram, particularly in tropical evergreen forests and mixed bamboo forests. It is grown in moist shady areas. |
| Micro-climatic Status/Condition: | | Ambient temperature : 19 $^0$C<br>Altitude : 1140 m<br>Humidity : 37 %<br>Light intensity : 41700 lux |
| Phenology | : | Leaf shedding : October - December<br>New Leaf : December<br>Flowering : May - June<br>Place of flower : Terminal<br>Fruiting : August – September |
| Associates | : | *Garcinia paniculata, Callicarpa arborea, Murraya hoenigii, Prunus cerosoides.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, drought and heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.140 %<br>P : 14.43 Kg/ha<br>K : 220 Kg/ha<br>pH : 5.1<br>OC : 1.6% |
| Parts used | : | Bark and leaves. |
| Uses | : | Diabetes, hypertension. |
| Mode of Preparation | : | Decoction of leaves is taken orally to cure diabetes by taking one cup twice daily, it is also taken for diarrhoea; decoction of bark is good to control hypertension by taking one cup twice daily. |
| Mode/Route of application | : | Oral administration |
| Status/Category | : | Not assessed for the IUCN Red List |

***Millettia pachycarpa* (Pl. XXIV, Photo 72)**

| | | |
|---|---|---|
| Scientific name | : | *Millettia pachycarpa* Benth. |
| Local Name | : | Ru-lei |
| Family | : | Fabaceae |
| Locality | : | Aiduzawl |
| Botanical Description | : | A large scandent shrub or climber; stem dark grey rough; young parts and inflorescence rusty brown tomentose; leaves 6-10 pairs imparpinate; leaflets oblanceolate or lanceolate, 2.5–5 x 2-22 cm, abruptly acuminate or causpidate, villous beneath; nerves 9-13; base rounded; petiole short; flowers violet or pinkish, *c.* 2.5 cm long, in axillary recemes or terminal panicles; pedicels stout'; podsrugose, 2.5 x 8.5 cm indented between seeds; seeds 1-3. |
| Habit | : | A large scandent shrub or climber. |
| Habitat | : | Common throughout Mizoram, in secondary and primary forests. It is grown on sandy loamy soil in shady places. In Mizoram it is found in the forest of Aiduzawl, Tualpui, etc. |
| Micro-climatic Status/Condition: | | Ambient temperature : 22 $^{o}$C<br>Altitude : 1400 m<br>Humidity : 40 %<br>Light intensity : 11800 lux |
| Phenology | : | Flowering : March - April<br>Place of flower : Axillary<br>Fruiting : June – November |
| Associates | : | *Macaranga denticulate, Desmos chinensis, Litsea glutinosa.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to jhum fire, heavyrainfall and drought, regenerate naturally. |
| Soil | : | N : 0.184 %<br>P : 26.10 Kg/ha<br>K : 110 Kg/ha<br>pH : 5.1<br>OC : 2.4% |
| Parts used | : | Bark and root bark. |

| | | |
|---|---|---|
| Uses | : | Diarrhoea, liver enlargement. |
| Mode of Preparation | : | Decoction of the bark and root bark is taken orally to cure diarrhea and liver enlargement. |
| Mode/Route of application | : | Oral. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Mirabilis jalapa* (Pl. XXV, Photo 73)**

| | | |
|---|---|---|
| Scientific name | : | *Mirabilis jalapa* Linn. |
| Local Name | : | Ara-tukkhuan |
| Family | : | Nyctaginaceae |
| Locality | : | Chawngtlai |
| Botanical Description | : | Herbs annual, to 1 m tall. Roots tuberous, black or black-brown. Stems erect, much branched, cylindric, glabrous or slightly pubescent, inflated on nodes. Petiole 1-4 cm; leaf blade ovate or ovate-triangular, 3-15 × 2-9 cm, base truncate or cordate, margin entire, apex acuminate. Flowers usually several clustered at apex of branches, fragrant; pedicel 1-2 mm. Invo- lucre campanulate, ca. 1 cm, 5-lobed, lobes triangular-ovate, acuminate, glabrous, persistent. Perianth purple, red, yellow, white, or variegated; tube 2-6 cm; limb 2.5-3 cm in diam., opening in late afternoon, closing next morning. Stamens 5; filaments slender, exserted; anther globose. Fruit black, globose, 5-8 mm in diam., coriaceous, ribbed and plicate. Endosperm white mealy. |
| Habit | : | Annual herb. |
| Habitat | : | Frequent in Mizoram, usually in waysides and clearings in tropical semi-evergreen forests and secondary forests. It is found on sandy dry soil and sandy loam soils in waste places. |
| Micro-climatic Status/Condition: | Ambient temperature | : 22 $^{o}$C |
| | Altitude | : 1100 m |
| | Humidity | : 35 % |
| | Light intensity | : 82250 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Leaf shedding | : | Annual herb |
| | | Flowering | : | June - October |
| | | Place of flower | : | Stem |
| | | Fruiting | : | August – November |
| Associates | : | Cultivated | | |
| Ecology/Silvicultural character: | | Light demander, resistant to heavy rainfall and drought, artificial regeneration is not difficult but natural regeneration is difficult. | | |
| Soil | : | N | : | 0.124 % |
| | | P | : | 2.22 Kg/ha |
| | | K | : | 23.1 Kg/ha |
| | | pH | : | 4.9 |
| | | OC | : | 1.1 % |
| Parts used | : | Root, leaf. | | |
| Uses | : | Malaria, typhoid, retained placenta, itches, anti-inflammatory. | | |
| Mode of Preparation | : | Decoction of the crushed root is taken orally with honey to cure Malaria and typhoid. Juice of the crushed roots is used to remove retained placenta. Infusion of leaves is used for itching by applying externally. Sprain and bone fractures are treated with this plant by bandaging over the injured area with the leaves. | | |
| Mode/Route of application | : | Oral and external application. | | |
| Status/Category | : | Not yet assessed for the IUCN Red List | | |

***Morinda angustifolia* (Pl. XXV, Photo 74)**

| | | |
|---|---|---|
| Scientific name | : | *Morinda angustifolia* Roxb. |
| Local Name | : | Lum |
| Family | : | Rubiaceae. |
| Locality | : | Lawngtlai |

| | | |
|---|---|---|
| Botanical Description | : | Erect shrub or small tree, ca. 6 m tall; branches quadrangular, glabrous. Leaves opposite, 6-9 x 15-26 cm, oblanceolate, acute, glossy above, pale beneath; nerves 10-18 pairs; base attenuate; petiole channeled. Flowers white, *c.* 3 cm across; corolla-tube 3 cm long; stamens 5, yellow; pistil short. Fruits obovoid-globose, turbinate. |
| Habit | : | Erect shrub or small tree. |
| Habitat | : | Frequent throughout Mizoram, in tropical evergreen and semi-evergreen forests. It is grown on sandy loam soil in open places. |
| Micro-climatic Status/Condition: | Ambient temperature : | 25 $^{o}$C |
| | Altitude : | 940 m. |
| | Humidity : | 42 % |
| | Light intensity : | 92100 lux |
| Phenology | : Leaf shedding : | April - May |
| | New Leaf : | August |
| | Flowering : | February - March |
| | Place of flower : | Terminal |
| | Fruiting : | April – May. However, flowering and fruiting during February – October is reported by Jain et al. (1991). |
| Associates | : | *Morus alba, Adina cordifolia, Rhus javanica.* |
| Ecology/Silvicultural character: | | Moderate light demander, non resistant to jhum fire, resistant to heavy rainfall, natural regeneration is simple and artificial regeneration is also very easy through the stem. |
| Soil | : N : | 0.104 % |
| | P : | 14.40 Kg/ha |
| | K : | 73 Kg/ha |
| | pH : | 4.5 |
| | OC : | 0.88 % |
| Parts used | : | Root. |
| Uses | : | Liver enlargement and jaundice |
| Mode of Preparation | : | Decoction of the chopped root is taken orally by diluting it with a small quantity of water at the dose |

| | | |
|---|---|---|
| | | of one cup twice daily for three days to cure liver enlargement and jaundice. |
| Mode/Route of application | : | Orally |
| Status/Category | : | Not assessed for the IUCN Red List |

***Mussaenda roxburghii* (Pl. XXV, Photo 75)**

| | | |
|---|---|---|
| Scientific name | : | *Mussaenda roxburghii Hk.* f. |
| Local Name | : | Vakep |
| Family | : | Rubiaceae |
| Locality | : | Tualpui |
| Botanical Description | : | Large shrub with strong quadrangular stem, young stem pubescent and fleshy. Leaf simple, pubescent, opposite, stipulate, entire, acuminate. Flower small, red, panicle, pentamerous, one of the sepal is modified into leaf-like form but white and hairy; fruit small green siliqua. |
| Habit | : | A large shrub. |
| Habitat | : | Thickets or forests on mountains; sea level to 1150m. |
| Micro-climatic Status/Condition: | Ambient temperature : | 23 $^{o}$C |
| | Altitude : | 1150 m |
| | Humidity : | 40 % |
| | Light intensity : | 71950 lux |
| Phenology | : Leaf shedding : | November- December |
| | New Leaf : | February - March |
| | Flowering : | July - August |
| | Place of flower : | Axillary |
| | Fruiting : | October – November |
| Associates | : | *Lantana camara, Albizzia chinensis, Schima wallichii.* |

| | | |
|---|---|---|
| Ecology/Silvicultural character: | | Shade bearer, acceptable to jhum fire, natural regeneration is difficult but artificial regeneration can be done easily by stem cutting. |
| Soil | : | N : 0.174 %<br>P : 14.2 Kg/ha<br>K : 254.0 Kg/ha<br>pH : 6.2<br>OC : 1.0% |
| Parts used | : | Leaves and Bark |
| Uses | : | Cuts and wounds, Snake bite. |
| Mode of Preparation | : | The leaves or bark is crushed to make paste and applied on fresh cuts, wounds and snake bite. Leaves chewed raw to make paste and applied externally to snake bite. |
| Mode/Route of application | : | External application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Nervelia plicata* (Pl. XXVI, Photo 76)**

| | | |
|---|---|---|
| Scientific name | : | *Nervelia plicata* (Andr.) Schltr. |
| Local Name | : | Hnahkhat |
| Family | : | Lamiaceae |
| Locality | : | Ngopa |
| Botanical Description | : | Single leaf appearing after inflorescence bearing scape, prostrate, dark green, mottled with purplish-brown, purplish underside, shortly petioled; petioles up to 1-2(3) cm long; blade reniform or orbicular with cordate base, 7-12 cm in diam., margin entire or very inconspicuously wavy, remotely ciliate, nerves fan-like, scattered ciliate. Scape 8-15 cm tall, with 3-4 tubular sheaths and 1-3 flowers. Bracts very small, ovate, shorter or equalling the pedical of ovary. Sepals and petals subequal, spreading, |

narrowly lanceolate, green. Labellum ovate when spread out, lower part whitish or rose-coloured, embracing the column, with thickened yellow midrib, apex pale violet, minutely emarginate. Column narrowed in lower half. Ovary and pedicel ridged.

Habit : Single leaf herb

Habitat : Not common in Mizoram, in shaded and damp places at lower altitude. Phainuam, Ngopa, etc.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1020 m |
| Humidity | : | 56 % |
| Light intensity | : | 7800 lux |

Phenology :

| | | |
|---|---|---|
| New Leaf | : | August - October |
| Flowering | : | April - May |
| Place of flower | : | Main stem just above ground |
| Fruiting | : | Not seen |

Associates : *Mangifera indica, Curcuma sp., Curculigo capitulata.*

Ecology/Silvicultural character: Shade demander, resistant to heavy rainfall, regenerate naturally.

Soil :

| | | |
|---|---|---|
| N | : | 0.241 % |
| P | : | 10.2 Kg/ha |
| K | : | 104 Kg/ha |
| pH | : | 4.2 |
| OC | : | 1.2 % |

Parts used : Root and leaves

Uses : Stomachache, diarrhea and dysentery.

Mode of Preparation : Root and leaf paste is taken orally for stomachache, diarrhea and dysentery.

Mode/Route of application : Orally

Status/Category : Not assessed for the IUCN Red List

***Onychium siliculosum* (Pl. XXVI, Photo 77)**

| | | |
|---|---|---|
| Scientific name | : | *Onychium siliculosum* (Desv.) C. Chr. |
| Local Name | : | Kangdamdawi |
| Family | : | Adiantaceae |
| Locality | : | Lawngtlai |
| Botanical Description | : | The fronds are 15 to 40 cm longm, finely 3- to 4-pinnately divided. Pinnules are small, narrow, and numerous; sterile ones usually spatulate, less than 5 mm long, often toothed at the apex; the fertile ones are pod like, linear, entire, acuminate, 5 to 20 cm long and 1 to 2 mm wide. The indusium and sori are of a rich golden-yellow color. |
| Habit | : | A small fern. |
| Habitat | : | Common throughout Mizoram, found on moist shaded places and on the road sides. |
| Micro-climatic Status/Condition: | | Ambient temperature : 25 $^{o}$C<br>Altitude : 854 m.<br>Humidity : 42 %<br>Light intensity : 12100 lux |
| Phenology | : | Leaf shedding : Annual herbs<br>Flowering : Not seen<br>Fruiting : Not seen |
| Associates | : | *Ageretum conyzoides*, *Passiflora nepalensis*, Ferns. |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to heavy rainfall and drought, regenerate naturally. |
| Soil | : | N : 0.104 %<br>P : 14.40 Kg/ha<br>K : 73 Kg/ha<br>pH : 4.5<br>OC : 0.88 % |
| Parts used | : | Leaves |
| Uses | : | Burns |
| Mode of Preparation | : | Leaf paste is applied on burns. |
| Mode/Route of application | : | External |
| Status/Category | : | Not assessed for the IUCN Red List |

***Oroxylum indicum* (Pl. XXVI, Photo 78)**

| | | |
|---|---|---|
| Scientific name | : | *Oroxylum indicum* (Linn.) Vent. |
| Local Name | : | Archangkawm |
| Family | : | Bignoniaceae |
| Locality | : | Hnahlan |
| Botanical Description | : | A small deciduous tree to 10 m tall, branched at the top; bark brownish-grey; leaves 2-pinnate; rachis cylindric, warty; leaflets 2-4 pairs, elliptic-ovate, acuminate, 4-10 x 6-12.5 cm; base rounded or sub-cordate; flowers large, erect, purplish, in terminal lax racemes upto 60 cmlong, foetid; fruits flat, sword shaped, pods on stout peduncle 30-60 cm, semi-woody; seeds flat, with silvery wings. |
| Habit | : | A small tree. |
| Habitat | : | Common in Mizoram, grows in a damp and shady locality. |

| Micro-climatic Status/Condition: | | | | |
|---|---|---|---|---|
| | Ambient temperature | : | $22^{o}$C |
| | Altitude | : | 1250 m |
| | Humidity | : | 48 % |
| | Light intensity | : | 62100 lux |

| Phenology | : | | | |
|---|---|---|---|---|
| | Leaf shedding | : | September - October |
| | New Leaf | : | December |
| | Flowering | : | March |
| | Place of flower | : | Terminal |
| | Fruiting | : | May – June |

| | | |
|---|---|---|
| Associates | : | *Quercus semiserrata, Leea bracteate, Laportea cresulata.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to heavy rainfall, natural regeneration is difficult, propagated by artificial method. |

| Soil | : | | | |
|---|---|---|---|---|
| | N | : | 0.137 % |
| | P | : | 2.22 kg/ha |
| | K | : | 23.1 kg/ha |
| | pH | : | 4.9 |
| | OC | : | 1.1 % |

| | | |
|---|---|---|
| Parts used | : | Rooted-bark, bark and fruits. |

| | | |
|---|---|---|
| Uses | : | Cancer, enlarged liver, placental problems, hypertension and fever. |
| Mode of Preparation | : | Decoction of the young fruits is taken orally to cure cancer. Decoction of the bark is taken orally against liver enlargement. Decoction of the root with the bark is used to cure placental problems. Decoction of the young leaves and the fruit are taken orally for hypertension and fever. |
| Mode/Route of application | : | Oral administration, local application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Osbeckia sikkimensis* (Pl. XXVII, Photo 79)**

| | | | | |
|---|---|---|---|---|
| Scientific name | : | *Osbeckia sikkimensis* Craib. | | |
| Local Name | : | Builukhampa | | |
| Family | : | Melastomataceae | | |
| Locality | : | Ngopa | | |
| Botanical Description | : | Erect shrub; stem quadrangular with hairs; leaf lanceolate, acuminate, 2.5-5 x 7-12 cm, margins ciliate, tomentose above, slightly strigose beneath; basal nerves 5, running up to the apex; tertiaries sclariform; stipules folioceous; flowers pink or purple, in pyramidal terminal and axillary spikes; fruit ovoid-oblong or cylindric with a narrowed neck, covered with scattered stellate hairs, truncate. | | |
| Habit | : | Shrub, attains upto 1.5 m. | | |
| Habitat | : | Frequent in Mizoram, in sub-tropical hill forests. It grows on sandy loose soils in secondary open forest. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 23 $^{o}$C |
| | | Altitude | : | 1070 m |
| | | Humidity | : | 46 % |
| | | Light intensity | : | 72100 lux |
| Phenology | : | Leaf shedding | : | December - February |
| | | New Leaf | : | March - April |

| | | | | |
|---|---|---|---|---|
| | | Flowering | : | August - September |
| | | Place of flower | : | Terminal |
| | | Fruiting | : | October – December |
| Associates | : | *Mussaenda roxburghii, Schima wallichii, Maesa Indica.* | | |
| Ecology/Silvicultural character: | | Shade bearer, non resistant to jhum fire, can be easily regenerate by natural and artificial methods. | | |
| Soil | : | N | : | 0.187 % |
| | | P | : | 17.0 Kg/ha |
| | | K | : | 99.0 Kg/ha |
| | | pH | : | 5.5 |
| | | OC | : | 1.22 % |
| Parts used | : | Roots, leaf | | |
| Uses | : | Kidney problem, genito-urinal problem, toothache, stomachic, pile trouble. | | |
| Mode of Preparation | : | Juice of the crushed roots is taken orally for kidney trouble; the root is also eaten raw. Decoction of the root is taken orally to cure genito-urinal problem and as stomachic. The dried leaf is used in toothache. A crushed root is put together with some chicken in small pot without water. The small pot is then put in a bigger pot filled with water and then boiled. The extracted solution is taken orally for pile trouble. | | |
| Mode/Route of application | : | Oral administration. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Pandanus fascicularis* (Pl. XXVII, Photo 80)**

| | | |
|---|---|---|
| Scientific name | : | *Pandanus fascicularis* Lam. |
| Local Name | : | Ramlakhuih |
| Family | : | Pandanaceae |
| Locality | : | Niawhtlang |

| | | |
|---|---|---|
| Botanical Description | : | Much branched shrubs or small trees with numerous, thick prop roots. Leaves ensiform, up to 250 x 8 cm, caudate-acuminate, prickly on the margins and midrib, glossy green. Male inflorescence spicate, pedunculate, fragrant. Bracts linear-lanceolate or lanceolate, yellowish, lower ones flagelliferous. Spikes 5-11, up to 10 cm long. Stamens many, racemose on stamenophores; anthers cuspidate. Female inflorescence solitary, terminal, pedunculate, globose or ellipsoid. Bracts whitish yellow, lower ones leaf-like. Carpels confluent in groups (phalanges) of 5-15; stigma U- or V- shaped. Fruit a syncarp, up to 25 cm long, orange or reddish; phalanges turbinate, up to 8 x 4.5 cm. |
| Habit | : | A shrub or a small tree with many aerial roots. |
| Habitat | : | Frequent in Mizoram, in hilly rocky slopes of tropical evergreen forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 22 $^{o}$C<br>Altitude : 1400 m<br>Humidity : 52 %<br>Light intensity : 17800 lux |
| Phenology | : | Flowering : August - September<br>Place of flower : Terminal<br>Fruiting : Otober – November |
| Associates | : | *Schima wallichii, Rhus semialata, Macaranga indica.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire and heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.194 %<br>P : 12.21 Kg/ha<br>K : 254 Kg/ha<br>pH : 5.0<br>OC : 1.1 % |
| Parts used | : | Root and leaves. |
| Uses | : | Kidney trouble and stomach ulcer. |
| Mode of Preparation | : | Decoction of the chopped root mixed with the chopped root of *Ananas comosus* is taken orally to cure kidney trouble and to remove stone from the kidney at the dose of one cup thrice daily. It is also used with *Osbeckia sikkimensis* in some place. |

| | | |
|---|---|---|
| | | Decoction of the root is taken for stomach ulcer. Decoction of the leaves is also used for kidney trouble. |
| Mode/Route of application | : | Oral |
| Status/Category | : | Not assessed for the IUCN Red List |

***Passiflora nepalensis* (Pl. XXVII, Photo 81)**

| | | |
|---|---|---|
| Scientific name | : | *Passiflora nepalensis* Wallich. |
| Local Name | : | Nauawimu |
| Family | : | Passifloraceae |
| Locality | : | Thaltlang |
| Botanical Description | : | Glabrous, slender, tendril climbers with angular stems, up to 2.5 m tall. Leaves alternate, ovate to lanceolate, 5-10 x 2 x 4.5 cm., base rounded or subcordate, acute to acuminate at apex, ±entire along margins, glabrous on both surfaces, basal nerves 3-5; lateral nerves 3-5 pairs; petioles 2-5 cm long with two glands. Flowers in axillary cymes, 0.8-1.2 cm across, whitish, cup-shaped; sepals 0.7-0.8 cm long, not horned; petals 0.6-0.7 cm long; corona filiform; stamens 5. Fruits subglobose to globose, 1-1.2 cm across, glabrous, purplish; seeds 10-15, ± 0.2 cm across, obovoid. |
| Habit | : | Climber |
| Habitat | : | Frequent in Mizoram. Generally found in abandoned jhumland and disturbed forests. |
| Micro-climatic Status/Condition: | Ambient temperature | : 22 $^{o}$C |
| | Altitude | : 1330 m |
| | Humidity | : 42 % |
| | Light intensity | : 52100 lux |
| Phenology | : Flowering | : June - July |
| | Place of flower | : Axillary |
| | Fruiting | : August – September |

| | | |
|---|---|---|
| Associates | : | *Mikania micrantha, Artemesia sp., Thysanchaena maxima.* |
| Ecology/Silvicultural character: | | Moderate light demander, non resistance to jhum fire, but resistance to heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.178 %<br>P : 11.2 kg/ha<br>K : 165.0 kg/ha<br>pH : 5.0<br>OC : 1.0 % |
| Parts used | : | Roots and stem. |
| Uses | : | Malarial fever and cold fever. |
| Mode of Preparation | : | Juice of the crushed root is taken orally for the treatment of malarial fever and cold fever thrice a day @ three tablespoonfuls. |
| Mode/Route of application | : | Oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Persea minutiflora* (Pl. XXVIII, Photo 82)**

| | | |
|---|---|---|
| Scientific name | : | *Persea minutiflora* Kosterm. |
| Local Name | : | Nghalenglutar |
| Family | : | Lauraceae |
| Locality | : | Vanchengpui |
| Botanical Description | : | Shrubs to medium-sized trees, evergreen. Bark reddish brown, thin, fissured. Leaves alternate, aromatic. Leaf blade pinnately veined; surfaces pubescent, especially abaxially, becoming glabrescent with age; domatia absent. Inflorescence appearing when mature leaves are present, axillary, flowers in pedunculate, compound cymes. Flowers bisexual ; tepals persistent , yellowish, pubescent, outer tepals slightly shorter than inner; stamens 9, |

anthers 4-locular, 4-valved, anthers of outer 6 stamens introrse , anthers of inner 3 latrorse ; staminodes 3, sagittate ; ovary nearly globose . Drupe dark blue to black, nearly globose, borne on pedicel with tepals persistent at base; cupule absent.

Habit : Shrub to medium-sized tree, evergreen.

Habitat : Not common in Mizoram, grows in open forest.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 22 $^{o}$C |
| Altitude | : | 1400 m |
| Humidity | : | 46 % |
| Light intensity | : | 62150 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| Flowering | : | April - May |
| Place of flower | : | Axillary |
| Fruiting | : | September – October |

Associates : *Schima wallichii, Callicarpa arborea, Albizia chinensis.*

Ecology/Silvicultural character: Light demander, resistant to jhum fire,drought and heavy rainfall, regenerate naturally.

Soil :

| | | |
|---|---|---|
| N | : | 0.157 % |
| P | : | 14.43 Kg/ha |
| K | : | 220 Kg/ha |
| pH | : | 5.1 |
| OC | : | 1.6 |

Parts used : Leaves.

Uses : Removal of poisonous hair of caterpillars.

Mode of Preparation : The leaf is boiled with water and the water is used for the removal of poisonous hair of certain caterpillars from the hand or off the body.

Mode/Route of application : External

Status/Category : Not assessed for the IUCN Red List

***Phoebe lanceolata* (Pl. XXVIII, Photo 83 & Fig. 7)**

| | | |
|---|---|---|
| Scientific name | : | *Phoebe lanceolata* (Nees) Nees |
| Local Name | : | Nuhbanthi |
| Family | : | Lauraceae |
| Locality | : | Lawngtlai |
| Botanical Description | : | Trees, 4-15(-20) m tall. Bark gray-white. Branchlets slender, older ones gray-brown or brown, young ones glabrous or yellowish brown puberulent and soon caducous. Buds densely yellowish gray tomentose. Petiole 1-2.5 cm, glabrous; leaf blade usually purplish red on both surfaces when young, lanceolate or elliptic-lanceolate, 13-22(-25) × 3-5.5(-6.5) cm, thickly papery, abaxially pubescent when young, glabrous on both surfaces when old, midrib thick, elevated adaxially, lateral veins 9-13(-15) pairs, slender but conspicuous, veinlets invisible on both surfaces or slightly conspicuous abaxially, base attenuate and decurrent, apex acuminate or long acuminate, summit usually falcate. Panicles variable in length, usually 12-15 cm, longer one to 20 cm, shorter one 4-5 cm, branched near top of peduncle; peduncle and pedicel glabrous. Pedicel as long as perianth, usually glaucous. Flowers pale green or yellowish green, 3-4 mm. Perianth lobes subequal, ovate, 2.5-3 mm, glabrous outside, gray-white pubescent inside. Filaments gray-white pubescent at base, those of 3rd series with sessile glands at base. Ovary glabrous. Fruit ovoid, 9-12 × 6-7 mm, usually with short rostrum at apex; fruiting pedicel slightly thickened; persistent perianth lobes straw-yellow, leathery, clasping base of fruit or lax. |
| Habit | : | Tree, 4-15(-20) m tall. |
| Habitat | : | Rare under storey trees in evergreen forests, grows on moist shady places. |
| Micro-climatic Status/Condition: | | Ambient temperature : 26 $^{o}$C<br>Altitude : 950 m<br>Humidity : 47 %<br>Light intensity : 6870 lux |
| Phenology | : | Flowering : April – May<br>Place of flower : Terminal<br>Fruiting : July – September |

| | | |
|---|---|---|
| Associates | : | *Sterculia hamiltonii, Murraya koenigii, Clausena suffructicosa.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to drought and heavy rainfall, regenerate naturally. |
| Soil | : | N : 0.138 %<br>P : 10.10 Kg/ha<br>K : 149 Kg/ha<br>pH : 5.1<br>OC : 1.2 % |
| Parts used | : | Leaves |
| Uses | : | Headache, stiff and sore due to delivery. |
| Mode of Preparation | : | The leaves mixed with young stem and leaves of *Clausena suffructicosa is* boiled with water in a pot using some big leaves as its lid, one cup of the water is drunk and then use for bathing to cure headache, stiff and sore due to delivery daily for three days. The prepared water should not be used more than three days. |
| Mode/Route of application | : | External |
| Status/Category | : | Critically Endangered |

***Plantago erosa* (Pl. XXVIII, Photo 84)**

| | | |
|---|---|---|
| Scientific name | : | *Plantago erosa* Wall. |
| Local Name | : | Kelbaan |
| Family | : | Plantaginaceae |
| Locality | : | Rabung |
| Botanical Description | : | A stemless perennial herb with stout rootstock; leaves radical, oblong ovate, 2.5-8 x 6-13 cm, irregularly toothed, sub-acute, 3-7 veined; base tapering, cuneate; petiole long, up to 5 cm long; flowers small, on slender scape or spike, up to 5 cm long, bracteate; fruits ovoid; seeds very minute, black, angled. |

| | | |
|---|---|---|
| Habit | : | An herb. |
| Habitat | : | Frequent in Mizoram usually in wayside and clearings in tropical semi-evergreen forests and secondary forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 24 $^{o}$C |
| | Altitude : | 1100 m |
| | Humidity : | 47 % |
| | Light intensity : | 11750 lux. |
| Phenology | : Flowering : | March-April. |
| | Place of flower : | Axillary |
| | Fruiting : | April-May. |
| Associates | : | *Murraya koenigii, Clausena suffruticosa, Sterculia hamiltonii.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to drought and heavy rainfall, regenerate naturally. |
| Soil | : N : | 0.152 % |
| | P : | 12.21 kg/ha |
| | K : | 254 kg/ha |
| | pH : | 5.0 |
| | OC : | 1.1 % |
| Parts used | : | Whole plant. |
| Uses | : | Bone fracture and dislocation, diarrhoea, fever, inflammation, burns. |
| Mode of Preparation | : | 100g of the plant (with roots) is mixed with one teaspoon of lime and then crushed to make into paste. The paste is then applied to bone fracture and dislocation, by placing the leaf of *Musa paradisiaca* upon the paste; it is then bandaged with cloth. Infusion of the plant is taken orally for fever, inflammation and diarrhoea. The medicine is taken @ tablespoonful (10 ml) twice or thrice daily.The pressed juice of leaves is applied on burns and bruishes. |
| Mode/Route of application | : | Oral administration, external application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Pramanthes scandens*** **(Pl. XXIX, Photo 85)**

| | | |
|---|---|---|
| Scientific name | : | *Pramanthes scandens Lour*. |
| Local Name | : | Kawlhlo/Pandamdawi |
| Family | : | Asteraceae. |
| Locality | : | Lawngtlai |
| Botanical Description | : | A slender climber without tendrils; stem green; branches in any direction from thenode; young part slightly pubescent, leaf lanceolate, serrate, short petiole, spirally alternate, simple; flower white panicle with lots of pappus; fruit achene. |
| Habit | : | A slender climber without tendrils. |
| Habitat | : | Moderate light demander, non resistant to jhum fire, natural regeneration has no problem. Lawngtlai, Saiha, etc. |
| Micro-climatic Status/Condition: | | Ambient temperature : 27 $^{o}$C<br>Altitude : 985-1340 m.<br>Humidity : 58 %<br>Light intensity : 82100 lux |
| Phenology | : | Flowering : April - June<br>Place of flower : Terminal<br>Fruiting : July – August |
| Associates | : | *Securinegavirosa, Rubus spp., Cinnamomum bejolghota, Schima wallichii.* |
| Ecology/Silvicultural character: | | Moderate light demander, non resistant to jhum fire, natural regeneration has no problem. |
| Soil | : | N : 0.152 %<br>P : 9.28 Kg/ha<br>K : 201 Kg/ha<br>pH : 5.1<br>OC : 0.87 % |
| Parts used | : | Leave. |
| Uses | : | Scabies. |
| Mode of Preparation | : | Juice of the crushed leaves is applied to sores due to scabbies; it gives a bit of heating sensation. |

| | | |
|---|---|---|
| Mode/Route of application | : | External application |
| Status/Category | : | Not assessed for the IUCN Red List |

***Prunus jenkinsii* (Pl. XXIX, Photo 86)**

| | | |
|---|---|---|
| Scientific name | : | *Prunus jenkinsii* Hook. f. & Thomson |
| Local Name | : | Keipui |
| Family | : | Rosaceae |
| Locality | : | Vanchengpui |
| Botanical Description | : | Deciduous shrub or small tree. Leaves are smooth, simple, broad, ovate or broad-eliptic or lanceolate, unlobed and toothed along the margin. Color is medium green. Inflorescences apparently axillary, solitary or to 3-flowered in a fascicle; bracts small, soon caducous. Flowers opening before or at same time as leaves. Hypanthium campanulate . Sepals 5, imbricate. Petals 5, white, sometimes purple-veined, rarely greenish, inserted on rim of hypanthium, imbricate. Fruit a drupe, glabrous, often glaucous, usually with a longitudinal groove. |
| Habit | : | Deciduous shrub or small tree. |
| Habitat | : | Not common in Mizoram, found mostly in mountain regions, ravines above 1000m. Vanchengpui, Thaltlang, etc. |

| | | | | |
|---|---|---|---|---|
| Micro-climatic Status/Condition: | | Ambient temperature | : | 22 $^{o}$C |
| | | Altitude | : | 1400 m |
| | | Humidity | : | 37 % |
| | | Light intensity | : | 82100 lux |
| Phenology | : | Flowering | : | October - November |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | January – March |
| Associates | : | Cultivated | | |

| | | | | |
|---|---|---|---|---|
| Ecology/Silvicultural character: | | Light demander, resistant to drought and heavy rainfall, natural and artificial regeneration has no difficulties. | | |
| Soil | : | N | : | 0.157 % |
| | | P | : | 14.43 Kg/ha |
| | | K | : | 220 Kg/ha |
| | | pH | : | 5.1 |
| | | OC | : | 1.6 |
| Parts used | : | Leaves | | |
| Uses | : | Kidney trouble | | |
| Mode of Preparation | : | Infusion of the crushed leaves is taken orally against kidney trouble. | | |
| Mode/Route of application | : | Oral | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Pseudodrynaria coronans* (Pl. XXIX, Photo 87)**

| | | | | |
|---|---|---|---|---|
| Scientific name | : | *Pseudodrynaria coronans* Wall. | | |
| Local Name | : | Awmvel | | |
| Family | : | Polypodiaceae | | |
| Locality | : | Chawngtlai | | |
| Botanical Description | : | A large epiphytic plant white paw like rhizome covered with thick brown hairs, encircling the host tree; fronds sessile, pinnatisect, lower ones gradually shorter; veins conspicuous, anastomising; sori oval, confluent in one row between each pair of lateral veins; spores bilateral. | | |
| Habit | : | An epiphytic fern | | |
| Habitat | : | Common throughout Mizoram, in tropical evergreen and semi evergreen forests. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 23 $^{o}$C |
| | | Altitude | : | 1200 m |

| | | | | |
|---|---|---|---|---|
| | | Humidity | : | 38 % |
| | | Light intensity | : | 5940 lux |
| Phenology | : | Spores | : | May – November |
| Associates | : | Epiphytic mosses and some orchids on tree trunk. | | |
| Ecology/Silvicultural character: | | Resistant to heavy rain, drought, regenerate naturally, artificial regeneration is easy by stem cutting and knot on the tree trunk. | | |
| Soil | : | Epiphyte, do not grow on soil. | | |
| Parts used | : | Rhizomes. | | |
| Uses | : | Herpes, irregular heart beat. | | |
| Mode of Preparation | : | Juice of the crushed rhizome is applied to herpes zoaster. About 50g of the stem is boiled in 750 ml of water; the water is then taken orally for irregular heart beat at the dose of teaspoonful twice daily, it is better if taken with honey. | | |
| Mode/Route of application | : | External application and oral. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Pueraria lobata* (Pl. XXX, Photo 88)**

| | | |
|---|---|---|
| Scientific name | : | *Pueraria lobata* (Willd.) Ohwi |
| Local Name | : | Hruiduk |
| Family | : | Fabaceae |
| Locality | : | Mualcheng |
| Botanical Description | : | Perennial climber. Stem twining, setose. Stipules 10-12 mm long, free lateral, setose. Leaf pinnately trifoliolate, petiole 5-30 cm long, pilose. Stipels 8 mm long, setose, petiolule 5-8 mm long, pilose, lamina 7.5-21 cm long, 7.5-20.0 cm broad, broadly ovate to trilobed, tip acute, pubescent on both sides. Inflorescence an axillary, peduncled raceme, 15-32 cm long, velutinous, peduncle 2-3 cm long. Bracts c. |

3 mm long, pilose to setose. Pedicel c. 7 mm long, pilose. Calyx 10-14 mm long, setose, teeth unequal, longest 7-12 mm long. Corolla purple with yellow spot at the base of the standard. Vexillum c. 15-18 cm long. Fruit c. 2.5-6.0 cm long, 7-8 mm broad, hispid, hairs brown.

| | | |
|---|---|---|
| Habit | : | Perennial herb |
| Habitat | : | Common in jhum lands and along the roadside ridges. |
| Micro-climatic Status/Condition: | Ambient temperature : | 26 $^{o}$C |
| | Altitude : | 1000 m |
| | Humidity : | 75% |
| | Light intensity : | 51800 lux |
| Phenology | : Flowering : | August - September |
| | Place of flower : | Axillary |
| | Fruiting : | October – November |
| Associates | : | *Thunbergia grandiflora, MIkania micrantha, Chromalaena odorata.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to heavy rainfall and drought, natural regeneration is adequate. |
| Soil | : N : | 0.184 % |
| | P : | 7.2 Kg/ /ha |
| | K : | 299 Kg/ /ha |
| | pH : | 4.9 |
| | OC : | 0.8 % |
| Parts used | : | Leaves, stem. |
| Uses | : | Antiseptic, kidney trouble |
| Mode of Preparation | : | Leaves and stems are crushed into paste and then applied to cuts, wounds. The stem is cut and blows from one side to produce the juice which is applied to cuts and wounds. Decoction of the crushed stem and leaves is taken orally for kidney trouble. |
| Mode/Route of application | : | External application and oral. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Punica granatum* (Pl. XXX, Photo 89)**

| | | |
|---|---|---|
| Scientific name | : | *Punica granatum L.* |
| Local Name | : | Theibuhfai |
| Family | : | Lythraceae |
| Locality | : | Bawktlang |
| Botanical Description | : | Tree or large shrub, up to 5 m tall, branches near the base and often provided with spines. Leaves opposite or cluster, oblong or obovate, 1-5 x 0.5-2 cm, base narrower, apex obtuse or narrower, entire along margins, surface shiny, glabrous on both surfaces. Flowers at the top of the branchlets, orange red, calyx tube funnel shaped, 2-3 cm long, coriaceous, red or pale yellow; lobes 5-7, 8-12 mm long, erecto- patent or patent with rounded apex. Berries subglobose, 3-12 cm in diam., red-pink or yellowish-white, crowned by calyx segments; seeds numerous, juicy. |
| Habit | : | Tree or large shrub. |
| Habitat | : | Cultivated in the garden or in residential compounds. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1250 m<br>Humidity : 57 %<br>Light intensity : 91950 lux |
| Phenology | : | Flowering : February - May<br>Place of flower : Terminal<br>Fruiting : May – June |
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Light demander, acceptable to jhum fire, resistant to heavy rainfall, natural and artificial regeneration has no difficulty. |
| Soil | : | N : 0.157 %<br>P : 23.3 Kg/ha<br>K : 189 Kg/ha<br>pH : 5.0<br>OC : 1.2 % |
| Parts used | : | Leaves, fruits, bark. |

| | | |
|---|---|---|
| Uses | : | Diarrhoea, cholera, genito-urinary problem, typhoid, malaria and kidney trouble. |
| Mode of Preparation | : | Fresh leaf is directly eaten for diarrhea. Juice of the crushed leaves or fruit peel is taken for cholera. Juice of the crushed fruit is also taken orally for genito-urinary problem at the dose of 1 cup twice daily. Decoction of the bark is taken for typhoid, malaria and kidney trouble. |
| Mode/Route of application | : | Oral |
| Status/Category | : | Least Concern |

***Quercus serrata* (Pl. XXX, Photo 90)**

| | | |
|---|---|---|
| Scientific name | : | *Quercus serrata* Murray |
| Local Name | : | Sasua |
| Family | : | Fagaceae |
| Locality | : | Tualcheng |
| Botanical Description | : | Trees to 25 m tall, deciduous. Leaves subsessile to petiolate; petiole to 3 cm, glabrous or glabrescent; leaf blade narrowly elliptic-ovate, ovate-lanceolate, or obovate, (5-)7-17 × (1.5-)3-9 cm, thinly leathery, with adherent single hairs when young, abaxially glabrous or occasionally stellate tomentose, base cuneate to nearly rounded, margin glandular serrate, apex acuminate to acute; secondary veins 7-12 on each side of midvein. Female inflorescences 1.5-3 cm. Cupule cupular, 5-8 mm × 1-1.2 cm, enclosing 1/4-1/3 of nut; bracts triangular, adherent, margin pilose. |
| Habit | : | Trees to 25 m tall. |
| Habitat | : | Rare in Mizoram, grows on moist fertile soil mostly in Champhai district. |
| Micro-climatic Status/Condition: | Ambient temperature | : 19 $^{o}$C |
| | Altitude | : 1300 m |
| | Humidity | : 47 % |
| | Light intensity | : 75200 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Flowering | : | March - April |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | September – October |
| Associates | : | *Aporusa octandra, Acer oblongum, Schima wallichii, Rhododendron arboreum.* | | |
| Ecology/Silvicultural character: | | Light demander, resistant to jhum fire, drought and heavy rainfall, natural regeneration has no difficulty but artificial regeneration is not easy. | | |
| Soil | : | N | : | 0.22% |
| | | P | : | 2.19 kg/ha |
| | | K | : | 102 kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 2.17% |
| Parts used | : | Bark | | |
| Uses | : | Stomach ulcer | | |
| Mode of Preparation | : | Decoction of the dried inner bark is taken orally for stomach ulcer. | | |
| Mode/Route of application | : | Oral | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Ricinus communis* (Pl. XXXI, Photo 91)**

| | | |
|---|---|---|
| Scientific name | : | *Ricinus communis* Linn. |
| Local Name | : | Mutih |
| Family | : | Euphorbiaceae. |
| Locality | : | Puilo |
| Botanical Description | : | Herbs erect, often single-stemmed but sometimes bushlike or treelike, 2-5 m tall; younger parts glaucous, whole plant often reddish or purplish. Stipules connate, 2-3 cm; petiole 20-40 cm; leaf blade palmately 7-11-lobed, 30-50(-100) × 30-50(-100) cm, margin serrate. Inflorescence to 30 cm. Male flowers: pedicels 5-17 mm; calyx lobes 5-8 × 3-5 mm; stamens 7-8 mm. Female flowers: pedicels |

5-10 mm; sepals ca. 5 mm; styles 2-5 mm. Fruiting pedicel to 45 mm; capsule ellipsoid or ovoid, 1.5-2.5 cm, echinate, spines to ca. 5 mm, sometimes smooth. Seed 7-12 mm, grayish, silvery, or beige with darker markings; caruncle depressed-conical, 2-3 mm wide.

Habit : Herb or big shrubs.

Habitat : Common throughout Mizoram, usually in waysides distributed areas and waste land near human settlement. It strives well in moderate climate.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1100 m |
| Humidity | : | 48 % |
| Light intensity | : | 62100 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | June - September. |
| Place of flower | : | Terminal |
| Fruiting | : | August - December. |

Associates : Cultivated

Ecology/Silvicultural character: Moderate light demander, resistant to drough and heavy rainfall, natural and artificial regeneration has no difficulties.

Soil :

| | | |
|---|---|---|
| N | : | 0. 187 % |
| P | : | 22.5 Kg/ha |
| K | : | 500 Kg/ha |
| pH | : | 6.1 |
| OC | : | 1.2 % |

Parts used : Leaves

Uses : Liver enlargement, Asthma

Mode of Preparation : Juice of the crushed leaves mixed with pepper is taken orally by diluting it with a small quantity of water for liver enlargement. The leaf is warmed in a fire and paste on the waist to cure asthma.

Mode/Route of application : External application, oral administration.

Status/Category : Not assessed for the IUCN Red List

***Saraca asoca* (Pl. XXXI, Photo 92 & Fig. 8)**

| | | |
|---|---|---|
| Scientific name | : | *Saraca asoca* Roxb. |
| Local Name | : | Mualhawih. |
| Family | : | Caesalpiniaceae |
| Locality | : | Khawkawn |
| Botanical Description | : | Small tree. Leaves peripinnate, 15-25 cm long, leaflets 4-6 pairs, oblong-lanceolate, acute, 3-5 x 10-20 cm drooping when young, dark-green above; base slightly oblique. Flowers orange-scarlet,fragrant, in dense axillary corymbs appearing with the leaves. Fruits oblong2.5-3.5 x 10-16 cm, veined, compressed, acute at both the ends; seed 4-8, oblong, compressed. |
| Habit | : | Small tree. |
| Habitat | : | Found in tropical evergreen forests. It is suitably grown on humas loamy soil on evergreen forest. |

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1200 m |
| Humidity | : | 38 % |
| Light intensity | : | 42180 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Evergreen |
| New Leaf | : | March |
| Flowering | : | April - May |
| Place of flower | : | Axillary |
| Fruiting | : | June – July |

Associates : *Ficus glomerata, Cyathocalyx mortabaniens, Holigarna longifolia.*

Ecology/Silvicultural character: Non resistant to jhum fire, resistant to heavy rainfall, natural regeneration has problem whereas artificial regeneration can be done without much problem.

Soil :

| | | |
|---|---|---|
| N | : | 0.167 % |
| P | : | 22 Kg/ha |
| K | : | 54 Kg/ha |
| pH | : | 5.0 |
| OC | : | 0.66 % |

Parts used : Bark and root bark

| | | |
|---|---|---|
| Uses | : | Stomach ulcer. |
| Mode of Preparation | : | Infusion of the crushed bark is taken orally for stomachache. Decoction of the bark is taken for stomach problems and it enhances White blood corpuscles (WBC). |
| Mode/Route of application | : | Oral administration, local application. |
| Status/Category | : | Vulnerable |

***Schima wallichii* (Pl. XXXI, Photo 93)**

| | | |
|---|---|---|
| Scientific name | : | *Schima wallichii* (DC) Korthals |
| Local Name | : | Khiang |
| Family | : | Theaceae |
| Locality | : | Cherhlun |
| Botanical Description | : | A tree; Leaves oblong-lanceolate or obovate, 2-5 x 5-13 cm, acute or acuminate, shinning above, pubescent along nerves beneath; base cuneate; flowers white, fragrant, solitary, axillary, on lenticellate pedicels; staments yellow, appearing with the leaves; Fruits *c.*2 cm across, sub-globose, a loculicidal capsule, 5-celled, silky while young, warty when mature. |
| Habit | : | Evergreen tree. |
| Habitat | : | Common throughout Mizoram, from tropical evergreen to sub-tropical hill forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 23 $^{o}$C |
| | Altitude : | 1250 m. |
| | Humidity : | 47 % |
| | Light intensity : | 82700 lux |
| Phenology | : Leaf shedding : | Evergreen |
| | New Leaf : | March - April |
| | Flowering : | April - May |
| | Place of flower : | Axillary |
| | Fruiting : | November – February |

| | | |
|---|---|---|
| Associates | : | *Aporusa octandra, Ilex umbellulata, Wendlandia grandis.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, natural regeneration is possible but artificial regeneration is difficult. |
| Soil | : | N : 0.174 %<br>P : 1.22 Kg/ha<br>K : 121 Kg/ha<br>pH : 5.5<br>OC : 1.35 % |
| Parts used | : | Bark, fruit. |
| Uses | : | Cuts and wounds, snake bite. |
| Mode of Preparation | : | Inner layer of the bark is crushed and the juice is applied on cuts and wounds. Dry fruit is grounded to powder and applied to snake bite externally. |
| Mode/Route of application | : | External application. |
| Status/Category | : | Not assessed for the IUCN Red |

***Scoparia dulcis* (Pl. XXII, Photo 94)**

| | | |
|---|---|---|
| Scientific name | : | *Scoparia dulcis* Medic. |
| Local Name | : | Perhpawngchaw |
| Family | : | Scrophulariaceae. |
| Locality | : | Ngopa |
| Botanical Description | : | Erect, much branched herb, glandular; stem angled; leaves-3- alternately rhomboid or whorled, elliptic, tapering at the base into a short petiole, coarsely serrate on the upper half, glossy-above, dull beneath; flowers white, small, axillary, numerous, on slender pedicels; fruit globose or sub-globose, valves ultimately bifid; seeds obovoid, angled. |
| Habit | : | A herb. |

| | | | | |
|---|---|---|---|---|
| Habitat | : | Very common throughout Mizoram near human settlement area. It is grown on varied type of soil, in open spaces and waste places. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 22 $^{o}$C |
| | | Altitude | : | 1200 m |
| | | Humidity | : | 42 % |
| | | Light intensity | : | 82300 lux |
| Phenology | : | Leaf shedding | : | Partial leaf shedding in the month of February – March. |
| | | New Leaf | : | March - April |
| | | Flowering | : | March - May |
| | | Place of flower | : | Axillary |
| | | Fruiting | : | May – December |
| Associates | : | Eupatoriium odoratum, Erigeron spp., Sonchus spp. | | |
| Ecology/Silvicultural character: | | Moderate light demander, acceptable to jhum fire, resistant to heavy rainfall and drought, natural regeneration has no difficulty but artificial regeneration is difficult. | | |
| Soil | : | N | : | 0.148 % |
| | | P | : | 11.2 kg/ha |
| | | K | : | 165.0 kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.0 % |
| Parts used | : | Whole plants. | | |
| Uses | : | Diarrhoea, dysentry, stomachache, kidney trouble, cuts, wounds, jaundice and genito-urinary trouble. | | |
| Mode of Preparation | : | Juice of the crushed aerial parts is taken for diarrhoea, dysentry, stomachache, kidney trouble and also applied on cuts and wounds. Infusion of the crushed aerial parts is taken for jaundice and genito-urinary trouble. Decoction of the whole plant including the roots is taken for kidney trouble. | | |
| Mode/Route of application | : | Oral administration, external application. | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Securinega virosa* (Pl. XXXII, Photo 95)**

| | | |
|---|---|---|
| Scientific name | : | *Securinega virosa* (Roxb. ex Willd.) Baill. |
| Local Name | : | Saisiak |
| Family | : | Euphorbiaceae |
| Locality | : | Lungpho |
| Botanical Description | : | A straggling shrub, stem often with spiny at the base; bark reddish-brown, peeled off in thin strips; leaves obovate or sub-orbicular, acute, 1.5 - 4 x 2-6 cm; petiole short; flowers greenish-yellow, scanted, in axillary clusters; fruits globose, berries, white, fleshy or pulpy, 0.5 cm across; seeds 3-6, punctuate. |
| Habit | : | A shrub, dioecious. |
| Habitat | : | Mostly found in the vicinity of towns/villages, in sandy rocky places in disturbed forets. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1310 m<br>Humidity : 47 %<br>Light intensity : 12100 lux |
| Phenology | : | Leaf shedding : November- December<br>New Leaf : March - April<br>Flowering : May - August<br>Place of flower : Axillary<br>Fruiting : July – September |
| Associates | : | *Osbekia rostrata, Mussaenda glabra, Musa spp.* |
| Ecology/Silvicultural character: | | Light demander, acceptable to jhum fire, natural regeneration is seen but artificial regeneration is difficult. |
| Soil | : | N : 0.174 %<br>P : 12.0 Kg/ha<br>K : 156 Kg/ha<br>pH : 5.5<br>OC : 1.66 % |
| Parts used | : | Leaves |
| Uses | : | Small pox, measles, scabies, malaria. |

| | | |
|---|---|---|
| Mode of Preparation | : | The leaves are boiled for about 15-30 mins and then cooled, which is used for bathing children having small pox, measles, scabies, malaria. |
| Mode/Route of application | : | External (Bathing) |
| Status/Category | : | Not assessed for the IUCN Red List |

***Senecio scandens* (Pl. XXXII, Photo 96)**

| | | |
|---|---|---|
| Scientific name | : | *Senecio scandens* Buch.-Ham. ex D.Don. |
| Local Name | : | Saiekhlo |
| Family | : | Asteraceae. |
| Locality | : | Rabung |
| Botanical Description | : | A slender climber; stem greenish, ribbed, terete; branches zig zag, grooved or ribbed; young parts slightly pubescent; leaves hastate while young, ovate lanceolate when old, acuminate, 1-2.5 x 5-12 cm, crenate or distantly denticulate, coarsely hairy; midrib channelled above, raised beneath; nerves arcuate, anastomosing; base acute; petiole auricled; flowers heads yellow, on lax divaricate terminal corymbs; involucre bracts 10-15, linear-oblong, retrose; achenes ribbed or 4-angled, recurved or retrose; pappus white, *c.* 1 cm long. |
| Habit | : | A perennial climber. |
| Habitat | : | Rare in Mizoram but seen here and there in tropical hill forests and secondary forests. It is grown on dark brown sandy loose soil in open forests. |
| Micro-climatic Status/Condition: | Ambient temperature | : 24 $^{o}$C |
| | Altitude | : 1350 m |
| | Humidity | : 48 % |
| | Light intensity | : 72500 lux |
| Phenology | : Flowering | : February - April |
| | Place of flower | : Terminal |
| | Fruiting | : April – May |

| | | |
|---|---|---|
| Associates | : | *Measa indica, Engelhardtia indica, Smilax sp., Paliosanthes violaceae.* |
| Ecology/Silvicultural character: | | Low light demander, non resistant to jhum fire, natural and artificial regeneration is possible |
| Soil | : | N : 0.187 %<br>P : 13.0 Kg/ha<br>K : 575 Kg/ha<br>pH : 6.1<br>OC : 2.0 % |
| Parts used | : | Leaves and aerial parts. |
| Uses | : | Cancer, diabetes, pain relief, sprain, ulcerated cancer/ulcers. |
| Mode of Preparation | : | Decoction of the leaves is taken against cancer and diabetes and as pain relief. The leaves is crushed with lime to make paste and applied to sprain especially on waist. The leaves or aerial parts of plant are boiled in small quantity of water for 2-3 minutes. The water is strained through a clean cloth in a container and the solution is used for treatment of ulcerated cancer/ulcers at the dose of 4 cups daily. |
| Mode/Route of application | : | Oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Sida rhombifolia* (Pl. XXXIII, Photo 97)**

| | | |
|---|---|---|
| Scientific name | : | *Sida rhombifolia L.* |
| Local Name | : | Khingkhih |
| Family | : | Malvaceae |
| Locality | : | Pamchung |
| Botanical Description | : | Subshrubs erect or prostrate, many branched, to ca. 1 m tall. Branchlets stellate. Stipules spinelike, 3-5 mm; petiole 2-5(-8) mm, stellate puberulent; leaf blade rhombic to oblong-lanceolate or obovate, |

rarely linear-lanceolate, 1-4.5 × 0.6-2 cm, abaxially gray-white stellate pilose, adaxially sparsely stellate pilose to subglabrous, base broadly cuneate, margin dentate, apex obtuse to acute. Flowers solitary, axillary. Pedicel 1-2.5 cm, densely stellate tomentose, articulate above middle. Calyx cup-shaped, 4-5 mm, abaxially stellate pubescent, lobes triangular, apices acute. Corolla ca. 1 cm in diam.; petals yellow, obovate, ca. 8 mm, base attenuate, apex rounded. Filament tube 4-5 mm, glabrous. Style branches 8-10. Fruit semiglobose to broadly turbinate, 6-7 mm in diam.; mericarps 7-10, 2.5-3 mm excluding awn, shallowly grooved to near base, eventually dehiscent, side walls usually thin, not veined, stellate puberulent, apex usually (1 or)2-awned, awns to 1.5 mm. Seeds reniform, ca. 2 mm, blackish.

Habit : Terrestrial, perennial, erect, shrub, up to 200 cm tall.

Habitat : Common in Mizoram, mostly found close to settlements, along roads and paths, and in forest edges and clearings.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 25 $^{o}$C |
| Altitude | : | 1075 m |
| Humidity | : | 47 % |
| Light intensity | : | 92270 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | July - November |
| Place of flower | : | Axillary |
| Fruiting | : | Not seen |

Associates : *Ageretum conyzoides*, *Bidens biternata*, etc.

Ecology/Silvicultural character: Light demander,acceptable to jhum fire, resistant against drought and heavy rainfall, naturally regenerated.

Soil :

| | | |
|---|---|---|
| N | : | 0.152 % |
| P | : | 10.5 Kg/ha |
| K | : | 111 Kg/ha |
| pH | : | 5.8 |
| OC | : | 1.4% |

Parts used : Root

Uses : Genito-urinary problem

| | | |
|---|---|---|
| Mode of Preparation | : | Decoction of the root mixed with the root of *Dendrocnide sinuate* is taken orally for the treatment of genito-urinary problems. |
| Mode/Route of application | : | Oral |
| Status/Category | : | Not assessed for the IUCN Red List |

***Smilax glalbra* (Pl. XXXIII, Photo 98)**

| | | |
|---|---|---|
| Scientific name | : | *Smilax glalbra* Roxb. |
| Local Name | : | Tluangngil |
| Family | : | Smilacaceae |
| Locality | : | N.E.Khawdungsei |
| Botanical Description | : | A slender climber with nodose or knotty roots; stem unarmed; leaves alternate, distant, elliptic-lanceolate, 3.5-4.5 x 5-18 cm, acuminate or subcaudate, glucous beneath, 3-costate; base rounded or cuneate; petiole and sheath up to 1.8 cm long; cirrhi very slender and coiled; flowers inn axillary umbels, many-flowered, white, minute; Berries dark blue. |
| Habit | : | A slender climber. |
| Habitat | : | Not common in Mizoram, grows on sandy soil in the shady places. |
| Micro-climatic Status/Condition: | Ambient temperature | : 24 $^{o}$C |
| | Altitude | : 1022 m |
| | Humidity | : 41 % |
| | Light intensity | : 51850 lux |
| Phenology | : Flowering | : June - July |
| | Place of flower | : Axillary |
| | Fruiting | : November – January |
| Associates | : | *Schima wallichii, Litsea salicifolia, Globba sp.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to drought and heavy rainfall, naturally regenerated. |

| | | | | |
|---|---|---|---|---|
| Soil | : | N | : | 0.452 % |
| | | P | : | 4.0 kg/ha |
| | | K | : | 135.0 kg/ha |
| | | pH | : | 4.3 |
| | | OC | : | 1.2 % |

Parts used : Tuber.

Uses : Sciatica, gynaecological problems, stomachache, kidney trouble and hypertension.

Mode of Preparation : The tuber is sliced and then crushed, which is mixed with local beer (Zu-fang) and taken orally for sciatica. Decoction of the root/tuber is taken against gynaecological problems at the dose of half cup thrice daily. It is also taken to cure stomachache, kidney trouble and hypertension

Mode/Route of application : Oral administration.

Status/Category : Not assessed for the IUCN Red List

***Solanum anguivi*** **(Pl. XXXIII, Photo 99)**

Scientific name : *Solanum anguivi* Lam.

Local Name : Tawkte

Family : Solanaceae.

Locality : Lungkawlh

Botanical Description : A shrub up to 10 ft high; branches herbaceous. *Bark* smooth, pale brown or greenish grey, warty, armed; blaze greenish; often with curved prickles; young parts and inflorescence thickly stellate-tomentose. *Leaves* 2-5 by 1-3.5 in. ovate or oblong, serrate or obtusely lobed; lobes often sub-acute or acute, thinly herbaceous, stellate-tomentose, green above, grey or dirty tomentose beneath; prominently on the nerves and midrib beneath; lateral nerves 3-5 on either half; base usually truncate, unequal; petiole up to 1.5 in. long. *Flowers* bluish purple, 0.5-0.75 in. across, in extra-axillary or sub-terminal racemose cymes; pedicels and peduncle often prickly; pedicels 0.8 in. long, thickened above. *Calyx* stellate, pubescent outside, usually prickly. *Corolla*

tomentose outside; lobes reflexed. *Fruits* globose, smooth, 1-1.25 in. in diameter, yellow.

| | | |
|---|---|---|
| Habit | : | A shrub. |
| Habitat | : | Very common in Mizoram, and widely cultivated also. |
| Micro-climatic Status/Condition: | Ambient temperature : | 21 $^{o}$C |
| | Altitude : | 1410 m. |
| | Humidity : | 48 % |
| | Light intensity : | 12700 lux |
| Phenology | : Flowering : | June - October |
| | Place of flower : | Axillary |
| | Fruiting : | November - January |
| Associates | : | Cultivated. |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to heavy rainfall, natural and artificial regeneration has no problem. |
| Soil | : N : | 0.163 % |
| | P : | 22.2 kg/ha |
| | K : | 231 kg/ha |
| | pH : | 4.9 |
| | OC : | 1.1 % |
| Parts used | : | Root, leaf, stem, flower and fruit. |
| Uses | : | Hypertension, herpes, enlarging scar. |
| Mode of Preparation | : | A boiled or raw fruit is eaten against hypertension. A crushed fruit is applied to herpes. It is also applied to enlarging scar to stop its enlargement. |
| Mode/Route of application | : | Oral administration and external application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Solanum khasianum* (Pl. XXXIV, Photo 100)**

| | | |
|---|---|---|
| Scientific name | : | *Solanum khasianum* Cl. |
| Local Name | : | Rulpuk/At-hlo |
| Family | : | Solanaceae. |

| | | |
|---|---|---|
| Locality | : | Chawngtlai |
| Botanical Description | : | A spionous undershrub to 1m tall, whole part covered with straight and curved pickles. Leaves ovate or deltoid-acute, lobed; lobes triangular, hirsute and prickly on both surfaces, 5-12 x 6-18 cm; base sub-cordate; petiole to 4 cm long. Flowers white or pale-yellow in few flowered axillary racemes. Fruits globose, greenish spotted while young, yellowish when ripe, *c.* 2.5 cm across; seeds many, compressed, smooth and brown. |
| Habit | : | A spionous undershrub |
| Habitat | : | Rare in Mizoram, but seen at different places in roadside, forest edges and waste places above 700m. |
| Micro-climatic Status/Condition: | | Ambient temperature : 23 $^{o}$C<br>Altitude : 1250 m<br>Humidity : 36 %<br>Light intensity : 82100 lux |
| Phenology | : | Leaf shedding : February - March<br>New Leaf : April<br>Flowering : July - August<br>Place of flower : Axillary<br>Fruiting : November – February |
| Associates | : | *Mikania micrantha, Ageretum conyzoides, Centella asiatica.* |
| Ecology/Silvicultural character: | | Light demand is high, resistant to heavy rainfall, regeneration by natural and artificial methods without problem. |
| Soil | : | N : 0.157 %<br>P : 12.21 kg/ha<br>K : 254 kg/ha<br>pH : 5.0<br>OC : 1.1 % |
| Parts used | : | Fruit/seeds. |
| Uses | : | Tooth ache/Tooth-worm. |
| Mode of Preparation | : | The smoke of burnt fruit/seed sucked through a pipe (bamboo or leafstalk of papaya) and retained in the mouth is said to expel tooth-worms from the mouth. |
| Mode/Route of application | : | Smoke |
| Status/Category | : | Not assessed for the IUCN Red List |

***Sonerila maculate* (Pl. XXXIV, Photo 101)**

| | | |
|---|---|---|
| Scientific name | : | *Sonerila maculata* Roxb. |
| Local Name | : | Thaksenhlo |
| Family | : | Melastomataceae |
| Locality | : | N.E.Khawdungsei |
| Botanical Description | : | Small herbs, 10-20 cm tall; stem with spreading hairs. Leaves opposite, ovate to lanceolate, 3.0-10 x 2.0-5.0 cm, base unequal to rounded, acute to attenuate at apex, serrulate and ciliate along margins, both surfaces with spreading hairs, under surface sometimes purple; lateral nerves 4-6 pairs; petioles 2.0-5.0 cm long, hairy. Flowers 3-merous, 10-12 mm across, purple, present in condensed, axillary, scorpioid cymes; calyx tube 3-5 mm long, campanulate, glabrous; petals ± 7 mm long, elliptic. Capsules 5-7 x 2-4 mm, glabrous, oblong, funnel shaped. |
| Habit | : | Small herbs, 10-20 cm tall. |
| Habitat | : | Common, on ground in moist places inside forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 24 $^{o}$C<br>Altitude : 1050 m<br>Humidity : 57 %<br>Light intensity : 9850 lux |
| Phenology | : | Flowering : September- November<br>Place of flower : Axillary<br>Fruiting : December – February |
| Associates | : | *Lonicera macrantha*, *Begonia inflata*, *Mikania micrantha.* |
| Ecology/Silvicultural character: | | Shade bearer, resistant to heavy rainfall and drought, regenerates naturally. |
| Soil | : | N : 0.452 %<br>P : 4.0 kg/ha<br>K : 135.0 kg/ha<br>pH : 4.3<br>OC : 1.2 % |
| Parts used | : | Leaves |

| | | |
|---|---|---|
| Uses | : | Itching sore. |
| Mode of Preparation | : | Juice of the crushed leaves is applied to itching sore. |
| Mode/Route of application | : | External |
| Status/Category | : | Not assessed for the IUCN Red List |

***Spilanthes oleracea* (Pl. XXXIV, Photo 102)**

| | | |
|---|---|---|
| Scientific name | : | *Spilanthes acmella* L. |
| Local Name | : | Ankasate |
| Family | : | Asteraceae |
| Locality | : | Tawizo |
| Botanical Description | : | Annual herb with erect stems, sometimes decumbent. Leaves opposite, simple; petiole 2–6.5 cm long; blade broadly ovate to deltate, 5–11 cm × 4–8 cm, base truncate to shortly attenuate, apex acute to shortly acuminate, margin dentate. Inflorescence a discoid head up to 2.5 cm × 1.5 cm; involucral bracts 15–18, 3-seriate, up to 8 mm × 1 mm, apex acute; receptacular bracts straw-coloured, often tinged purple-red, up to 6 mm × 1 mm. Disk flowers 400–620, corolla 5-merous, yellow, up to 3.5 mm long. Fruit an achene 2–2.5 mm × 1 mm; pappus consisting of 2 bristles. |
| Habit | : | Annual herb with erect stems, sometimes decumbent. |
| Habitat | : | Very common throughout Mizoram, in open and moist places inside forest. |
| Micro-climatic Status/Condition: | Ambient temperature : | 22 $^{o}$C |
| | Altitude : | 1550 m |
| | Humidity : | 48 % |
| | Light intensity : | 74500 lux |
| Phenology | : Leaf shedding : | Annual herb |
| | Flowering : | February - July |
| | Place of flower : | Axillary |
| | Fruiting : | August – October |

| | | |
|---|---|---|
| Associates | : | *Eupatorium odoratum*, Grasses, *Centella asiatica.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to drought and heavy rainfall, artificial and natural regeneration has no difficulties. |
| Soil | : | N : 0. 162 %<br>P : 6.2 Kg/ha<br>K : 194.0 Kg/ha<br>pH : 5.1<br>OC : 1.3% |
| Parts used | : | Flowers |
| Uses | : | Dental caries. |
| Mode of Preparation | : | The flower is directly applied to dental caries. |
| Mode/Route of application | : | Oral |
| Status/Category | : | Not assessed for the IUCN Red List |

***Stellaria media* (Pl. XXXV, Photo 103)**

| | | |
|---|---|---|
| Scientific name | : | *Stellaria media* (L.) Vill. |
| Local Name | : | Changkalrit |
| Family | : | Caryophyllaceae |
| Locality | : | Khawzawl |
| Botanical Description | : | Annual or biennial herbs with slender branched stems, prostrate or ascending. Leaves opposite, ovate (sometimes truncate at base), short-mucronate, petiolate. Blades to +2cm wide, +2cm long, glabrous, green above, lighter green below, entire. Petiole to +2cm long, sometimes winged, pubescent. Single flowers from leaf axils. Also terminal cymes of +3 flowers. Peduncles 1-3cm long, pubescent. Corolla white, rotate, 5-6mm broad. Petals 5, deeply notched and appearing as 10, glabrous, to 2mm long, free. Petal lobes oblong. Stamens typically 3-5, attached at base of ovary, alternating with petals. Styles 3, spreading. Sepals 5, free, to 5mm long, pubescent with glandular-tipped hairs, ovate-lanceolate, green. Capsules to +6mm |

long, 4mm wide, glabrous, with +/-15 seeds. Seeds 1mm in diameter, tuberculate, rotund.

Habit : Annual or biennial herbs.

Habitat : Very common throughout Mizoram, grows on moist soil in partial shady areas.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1070 m |
| Humidity | : | 42 % |
| Light intensity | : | 14800 lux |

Phenology :

| | | |
|---|---|---|
| Leaf shedding | : | Annual herbs |
| Flowering | : | Throughout the year |
| Place of flower | : | Axillary |
| Fruiting | : | Throughout the year |

Associates : *Centella asiatica, Ageretum conyzoides*, Ferns.

Ecology/Silvicultural character: Moderate light demander, resistant to drought and heavy rainfall, natural regeneration is adeṭuate.

Soil :

| | | |
|---|---|---|
| N | : | 0.185 % |
| P | : | 22.5 Kg/ha |
| K | : | 500 Kg/ha |
| pH | : | 6.1 |
| OC | : | 1.2 % |

Parts used : Aerial parts

Uses : Diarrhoea, herpes zoster, kidney trouble, common cold.

Mode of Preparation : The aerial part is crushed and taken against diarrhoea. Juice of the crushed leaves is applied to herpes zoster. Decoction of the aerial part mixed with bark of *Mangifera indica or* the roots of *Osbeckia sikkimensis* is taken for kidney trouble. The aerial part is boiled and the steam is inhaled as an effective remedy for common cold.

Mode/Route of application : External and oral administration.

Status/Category : Not assessed for the IUCN Red List

***Stemona tuberose*** **(Pl. XXXV, Photo 104)**

| | | |
|---|---|---|
| Scientific name | : | *Stemona tuberosa* Lour. |
| Local Name | : | Sang |
| Family | : | Stemonaceae. |
| Locality | : | Tualpui |
| Botanical Description | : | Twiner or scandent with fasciculated roots; stem dark-green, smooth, nodes present; leaves ovate-cordate, 2-3 whorled or opposite, 7.5-11 x 15-20 cm long, acuminate, coriaceous; base 9-12, costate; petiole 7-10 cm long; bracts lanceolate; flowers 2-3, usually 2, often opposite, companulate, 6.5 cm long; capsule ovoid-oblong, 4-5 cm long; seeds 5-8. |
| Habit | : | Twiner or scandent with fasciculated roots. |
| Habitat | : | Rare in Mizoram, on sandy loam soil in shady forest. |
| Micro-climatic Status/Condition: | | Ambient temperature : 22 $^{o}$C<br>Altitude : 1300 m<br>Humidity : 37 %<br>Light intensity : 7750 lux |
| Phenology | : | Flowering : March - April<br>Place of flower : Axillary<br>Fruiting : June – July |
| Associates | : | *Aporusa octandra, Emblica officinalis, Tabernaemontana divericata, Globa* sp. |
| Ecology/Silvicultural character: | | Shade bearer, resistant to drought and heavy rainfall, regenerated naturally. |
| Soil | : | N : 0.186 %<br>P : 15.5 kg/ha<br>K : 221.0 kg/ha<br>pH : 4.8<br>OC : 1.4 % |
| Parts used | : | Tuber |
| Uses | : | Stomachache and cancer, tuberculosis. |

| | | |
|---|---|---|
| Mode of Preparation | : | The tuber is taken directly for stomachache and cancer. Decoction of the tuber is taken against tuberculosis. |
| Mode/Route of application | : | Orally. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Stephania japonica* (Pl. XXXV, Photo 105)**

| | | |
|---|---|---|
| Scientific name | : | *Stephania japonica* (Thunb.) Miers. |
| Local Name | : | Hnahbial |
| Family | : | Menispermaceae. |
| Locality | : | N.E.Khawdungsei |
| Botanical Description | : | A slender climber without tendrils; whole plant pubescent, branches striate or ribbed; stem green, cylindrical; leaves triangular-ovate, broader than long, peltate, pubescent under surface, apex blunt or sub-acute; nerves 9-11 at the base; flowers yellow, umbellate on very slender axillary pedicels; fruits globose, red when ripe. |
| Habit | : | A slender climber. |
| Habitat | : | Rare in Mizoram, grows on sandy soil in damp waste places. |
| Micro-climatic Status/Condition: | Ambient temperature : | 24 $^{o}$C |
| | Altitude : | 1052 m |
| | Humidity : | 37 % |
| | Light intensity : | 42080 lux |
| Phenology | : Leaf shedding : | Partial shedding in November. |
| | New Leaf : | March - April |
| | Flowering : | March - April |
| | Place of flower : | Axillary |
| | Fruiting : | May – June |
| Associates | : | *Eupatorium odoratum, Callicarpa arborea, Bidens pilosa, Quercus spp.* |

| | | |
|---|---|---|
| Ecology/Silvicultural character: | | Shade bearer, acceptable to jhum fire, resistant to heavy rainfall, natural regeneration has no difficulty but artificial regeneration is very difficult. |
| Soil | : | N : 0.152 %<br>P : 4.0 kg/ha<br>K : 135.0 kg/ha<br>pH : 4.3<br>OC : 1.2 % |
| Parts used | : | Root-stock. |
| Uses | : | Diarrhoea, stomach trouble. |
| Mode of Preparation | : | Decoction of the root-stock is taken orally against diarrhea associated with stomachache. Infusion or Juice of the crushed root is also taken for diarrhea and stomach trouble. |
| Mode/Route of application | : | Orally. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Sterculia hamiltonii* (Pl. XXXVI, Photo 106)**

| | | |
|---|---|---|
| Scientific name | : | *Sterculia hamiltonii* (Kuntze) Adelb. |
| Local Name | : | Tlingi leh Ngama inchhawlthuaina |
| Family | : | Malvaceae |
| Locality | : | Lawngtlai |
| Botanical Description | : | Large shrub or small tree, 5-10 m tall. Leaves oblanceolate or oblong elliptic, 12-26 x 5-10 cm, tapering at base, abruptly short acuminate at apex, entire along margins, coriaceous, glabrous above, sparsely stellately hairy beneath; lateral nerves 10-12 paired; petioles 2-5 cm long. Flowers in axillary rarely supra axillary, in 10-25 cm long, drooping panicles, 1.5-2 cm across, pinkish-red, velvety outside; calyx 5, tubular; lobes narrow, 8-12 mm long, patently white hairy outside; calyx 5, tubular; lobes narrow, 8-12 mm long, patently white hairy outside. Male flowers: staminal column short, |

curved, glabrous, 4-5 mm long; Female flowers: ovary hairy with sterile anthers at base, ca 2 mm long. Follicles 2-5, oblong-lanceolate, 6-10 x 1-2 cm, drooping, beaked, spreading, crimson red inside, velvety outside, compressed; seeds 4-8, 1-1.5 x ca 0.8 cm, black, ovoid, smooth.

Habit : Large shrub or small tree.

Habitat : Common in evergreen forests, grows on moist soil in shady areas, along the road side in Lawngtlai, etc.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 26 $^{o}$C |
| Altitude | : | 950 m |
| Humidity | : | 47 % |
| Light intensity | : | 7870 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | April - August |
| Place of flower | : | Axillary |
| Fruiting | : | September – October |

Associates : *Murraya koenigii, Phoebe lanceolata, Clausena suffructicosa.*

Ecology/Silvicultural character: Shade bearer, resistant to jhum fire and heavy rainfall, regenerate naturally.

Soil :

| | | |
|---|---|---|
| N | : | 0.138 % |
| P | : | 10.10 Kg/ha |
| K | : | 149 Kg/ha |
| pH | : | 5.1 |
| OC | : | 1.2 % |

Parts used : Root

Uses : Ophthalmia

Mode of Preparation : The root is rub against stone and then dip in a clen and cold water for several times. The water is then filtered with a clean cloth and then dropped to the eyes to cure ophthalmia.

Mode/Route of application : External (eye drop).

Status/Category : Not assessed for the IUCN Red List

***Stereosparmum collais* (Pl. XXXVI, Photo 107)**

| | | |
|---|---|---|
| Scientific name | : | *Stereosparmum collais* (Buch.-Ham.ex Dillwyn)Mabb. |
| Local Name | : | Zihnghal |
| Family | : | Bignoniaceae. |
| Locality | : | Ngopa |
| Botanical Description | : | A large deciduous tree; branches and leaves pubescent; bark grey, thick, rough; leaf imparipinate, up to 40 cm long; leaflets 4-6 pairs; ovate or elliptic, caudate-acuminate; nerves 8-9; base-oblique; petiole up to 4 cm long, channelled, lenticellate; flowers yellow, tinged with pale red in large drooping panicles; fruits slender up to 60 cm long, spirally twisted, curved sub-quadrangular or 4-angled. |
| Habit | : | A large deciduous tree. |
| Habitat | : | Frequent in Mizoram, in tropical evergreen and semi-evergreen forests. It is grown on sandy-rocky places and loamy soil in the forests. |

| | | | |
|---|---|---|---|
| Micro-climatic Status/Condition: | Ambient temperature | : | 23 $^{o}$C |
| | Altitude | : | 1080 m |
| | Humidity | : | 47 % |
| | Light intensity | : | 5900 lux |
| Phenology : | Leaf shedding | : | October - January |
| | New Leaf | : | March - April |
| | Flowering | : | April - May |
| | Place of flower | : | Terminal |
| | Fruiting | : | November – February |

| | | |
|---|---|---|
| Associates | : | *Cordia dichotoma, Callicarpa arborea, Schima wallichii.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, natural and artificial regeneration has difficulty. |

| | | | |
|---|---|---|---|
| Soil | : | N | : 0.168 % |
| | | P | : 10.2 Kg/ha |
| | | K | : 201.0 Kg/ha |
| | | pH | : 5.5 |
| | | OC | : 0.86 % |
| Parts used | : | Bark, young leaves and shoots. | |

| | | |
|---|---|---|
| Uses | : | Malarial fever, stomach problems, fungal/bacterial infection. |
| Mode of Preparation | : | Decoction of the bark is drunk and used for bathing against malaria. The young shoots are chewed and swallowed once every day for a week as stomachic. Juice of the crushed young shoot is applied to fungal/bacterial infection between fingers. |
| Mode/Route of application | : | Oral administration and external application. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Syzygium cumini* (Pl. XXXVI, Photo 108)**

| | | |
|---|---|---|
| Scientific name | : | *Syzygium cumini* (L.) Skeels |
| Local Name | : | Lenhmui |
| Family | : | Myrtaceae. |
| Locality | : | Ngharchhip |
| Botanical Description | : | A moderate sized evergreen tree to 30 m tall; bark dark-grey; leaves elliptic-oblong or ovate, sub-obtuse, narrowed at the base, glabrouse; nerves close, fine forming a submarginal vein; petiole channeled. Flowers greenish white, sessile, in compound trichotomous panicles; fruits ellipsoid, up to 3 cm long, reddish pink while ripening, purplish black when fully ripe, juicy and edible. |
| Habit | : | Trees. |
| Habitat | : | Frequent in Mizoram, grows on sandy loam, well drained soil along streams in damp forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 24 $^{o}$C |
| | Altitude : | 1040 m. |
| | Humidity : | 38 % |
| | Light intensity : | 7920 lux |
| Phenology | : Flowering : | March - May |
| | Place of flower : | Axillary |
| | Fruiting : | June – September |

| | | |
|---|---|---|
| Associates | : | *Callicarpa arborea, Lagerstroemia parviflora, Cinnamomum* spp. |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, heavy rainfall and drought, regenerated naturally. |
| Soil | : | N : 0.185 %<br>P : 21.22 kg/ha<br>K : 235.1 kg/ha<br>pH : 4.9<br>OC : 1.1 % |
| Parts used | : | Young shoots, fruits. |
| Uses | : | Headache, heart trouble, enlarged spleen, dysentery, stomach-ache. |
| Mode of Preparation | : | The young shoot is crushed and smelled for headache; it is good for patient who is in bed for a long time.The medicine is also given to person having heart trouble. The ripen fruit is taken raw for the treatment of enlarged spleen, dysentery, stomach-ache. |
| Mode/Route of application | : | External application, oral administration. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Terminalia citrina* (Pl. XXXVII, Photo 109)**

| | | |
|---|---|---|
| Scientific name | : | *Terminalia citrina* (Gaertner) Flem. |
| Local Name | : | Kharuan |
| Family | : | Combretaceae |
| Locality | : | Rabung |
| Botanical Description | : | Small to large deciduous tree, often with buttressed stems towards base; bark brown, more or less vertically fissured. Leaves opposite-subopposite, broadly ovate, lanceolate, elliptic or oblong, 4-12 x 1.5-6.5 cm. acuminate or acute at apex, glabrous at maturity, pubescent on nerves beneath, base narrowed into petiole. Flowers dull white; calyx |

teeth glabrous outside, villous within. Drupes oblong-ellipsoid, slightly clavate, 2.5-4 x 1.5-2 cm, glabrous, obscurely 5-angled.

Habit : Small to large deciduous tree.

Habitat : Scarce in Mizoram in evergreen forest of Rabung.

Micro-climatic Status/Condition:

| | | |
|---|---|---|
| Ambient temperature | : | 24 $^{o}$C |
| Altitude | : | 1240 m |
| Humidity | : | 38 % |
| Light intensity | : | 15950 lux |

Phenology :

| | | |
|---|---|---|
| Flowering | : | June - August |
| Place of flower | : | Terminal |
| Fruiting | : | September- December |

Associates : *Helicia robusta, Albizia chinensis, Schima wallichii.*

Ecology/Silvicultural character: Light demander, resistant to jhum fire and heavy rainfall, regenerate naturally.

Soil :

| | | |
|---|---|---|
| N | : | 0.183 % |
| P | : | 13.0 Kg/ha |
| K | : | 475 Kg/ha |
| pH | : | 6.1 |
| OC | : | 2.0 % |

Parts used : Fruits

Uses : Stomach-ache

Mode of Preparation : Juice of the crushed fruit is taken orally in small quantity for stomach-ache.

Mode/Route of application : Oral

Status/Category : Not assessed for the IUCN Red List

***Thunbergia coccinea* (Pl. XXXVII, Photo 110)**

Scientific name : *Thunbergia coccinea* Wall.

Local Name : Fahrah-hrui

Family : Acanthaceae.

| | | |
|---|---|---|
| Locality | : | Mualpheng |
| Botanical Description | : | An extrorse profusely branched climber with long pendent branches. *Leaves* 3-7 by 1-3.5 inch., lanceolate, elliptic or ovate lanceolate, acuminate, entire, serrate or remotely toothed, rather membranous, glabrous, 3-5 nerved; base rounded or shallow cordate; petiole 0.05-2 inch long. *Flowers*, usually fascicled at the nodes of lax elongated pendent racemes; bracteoles about 1 inch long, reddish. *Calyx* a minute rim. *Corolla* orange red; lobes reflexed. *Capsule* about 2 in. long. |
| Habit | : | Climber. |
| Habitat | : | Frequent in Mizoram. It is also cultivated as horticultural plant. |
| Micro-climatic Status/Condition: | Ambient temperature : | 24 $^{o}$C |
| | Altitude : | 1400 m |
| | Humidity : | 38 % |
| | Light intensity : | 8100 lux |
| Phenology | : Flowering : | September-November. |
| | Place of flower : | Terminal |
| | Fruiting : | December - February. |
| Associates | : | Cultivated |
| Ecology/Silvicultural character: | | Moderate light demander, acceptable to jhum fire, regenerate naturally and artificially. |
| Soil | : N : | 0.143 % |
| | P : | 4.0 kg/ha |
| | K : | 135.0 kg/ha |
| | pH : | 4.3 |
| | OC : | 1.2 % |
| Parts used | : | Stem and leaves. |
| Uses | : | Sore |
| Mode of Preparation | : | The whole plant is crushed to make into a paste which is applied on sore. Juice of the crushed stem and leaves is also used for sore. |
| Mode/Route of application | : | Externally |
| Status/Category | : | Not assessed for the IUCN Red List |

***Thunbergia grandiflora* (Pl. XXXVII, Photo 111)**

| | | |
|---|---|---|
| Scientific name | : | *Thunbergia grandiflora* Roxb. |
| Local Name | : | Vako |
| Family | : | Acanthaceae |
| Locality | : | Mualcheng |
| Botanical Description | : | A large climber; stem hairy and terete; leaves ovate, angulary lobed, 8-18 x 12-24 cm,scabrid above, pubescent beneath; nerves5-7; base deeply chordate;petiole curve, upto 7cm long; flowers large, light blue or bluish in auxilary receme, fascilled; fruits upto 5cm long, curve upwards with quetrous beak, pubescents; seeds flat, sub trigonous. |
| Habit | : | Climber |
| Habitat | : | It is fairly common throughout Mizoram, particularly in tropical secondary forests as weeds.It is also grown on brown loamy and sandy soils in open forests. |
| Micro-climatic Status/Condition: | | Ambient temperature : 26 $^{o}$C<br>Altitude : 1000 m<br>Humidity : 75%<br>Light intensity : 51800 lux |
| Phenology | : | Flowering : April - May<br>Place of flower : Axillary<br>Fruiting : September- November |
| Associates | : | *Anogeisus acuminate, Dalbergia stipulaceae, Aporusa octandra.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to heavy rainfall and drought, natural regeneration is adequate. |
| Soil | : | N : 0.184 %<br>P : 7.2 Kg/ /ha<br>K : 299 Kg/ /ha<br>pH : 4.9<br>OC : 0.8 % |
| Parts used | : | Leaves, fruit. |
| Uses | : | Cuts and wounds, bee sting and snake bite. |

| | | |
|---|---|---|
| Mode of Preparation | : | Juice of the crushed leaves is applied to fresh cuts and wounds as antiseptic and blood coagulant. The fruit is broken in the middle and put on the sting/biting point to sucked the poison in bee sting or snake bite. |
| Mode/Route of application | : | External application. |
| Status/Category | : | Not assessed for the IUCN Red List |

**Trevesia palmate (Pl. XXXVIII, Photo 112)**

| | | |
|---|---|---|
| Scientific name | : | *Trevesia palmata* (Roxb.) |
| Local Name | : | Kawhtebel |
| Family | : | Araliaceae |
| Locality | : | Lungpho |
| Botanical Description | : | Unbranched small evergreen tree, armed with recurve prickles; young shoots rusty pubescent and prickly; leaves croeded at the apex, obicular in outline, deeply palmately lobeb; lobes acuminate, serrate, 5-9 nerved from base; petiole up to 60 cm long, often prickly; flowers umbels, rusty tomentum while young; fruits ovoid, crowned by the style. |
| Habit | : | A small evergreen tree. |
| Habitat | : | Common throughout Mizoram, on banks of rivelets and shady rocky places in tropical evergreen and semi evergreen forests. Cultivated in garden. |
| Micro-climatic Status/Condition: | Ambient temperature : | 22 $^{o}$C |
| | Altitude : | 1310 m |
| | Humidity : | 38 % |
| | Light intensity : | 17900 lux |
| Phenology | : Leaf shedding : | Evergreen |
| | Flowering : | November- December |
| | Place of flower : | Axillary |
| | Fruiting : | January – March |
| Associates | : | Cultivated. |

| | | | | |
|---|---|---|---|---|
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, heavy rainfall and drought, natural and artificial regeneration have no difficulties. | | |
| Soil | : | N | : | 0.184 % |
| | | P | : | 14.2 Kg/ha |
| | | K | : | 254.0 Kg/ha |
| | | pH | : | 6.2 |
| | | OC | : | 1.0% |
| Parts used | : | Fruits and petiole | | |
| Uses | : | Opthalmia, stomachache and colic. | | |
| Mode of Preparation | : | The boiled fruits taken as vegetables are good for eye sight. Infusion of the basal portion of the petiole (stalk) is taken orally against stomachache and colic. | | |
| Mode/Route of application | : | Orally | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Uncaria sessilifructus* (Pl. XXXVIII, Photo 113)**

| | | | | |
|---|---|---|---|---|
| Scientific name | : | *Uncaria sessilifructus* Roxb. | | |
| Local Name | : | Ralsamkuai/Galsamkuai (Hmar) | | |
| Family | : | Rubiaceae. | | |
| Locality | : | Mimbung | | |
| Botanical Description | : | Climbing shrubs. Leaves elliptic-lanceolate, glabrous on both surfaces; lateral nerves 5-6 pairs; stipules bifid. Flowers in axillary or terminal peduncles; bracts obtuse; calyx slightly lobed; corolla glabrous. Capsules sessile. | | |
| Habit | : | An extensive woody climber. | | |
| Habitat | : | Frequent in Mizoram, grows on moist fertile soil in open forests. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 22 $^{o}$C |
| | | Altitude | : | 1335 m |
| | | Humidity | : | 40 % |
| | | Light intensity | : | 41930 lux |

| | | | | |
|---|---|---|---|---|
| Phenology | : | Flowering | : | October - November |
| | | Place of flower | : | Axillary or terminal |
| | | Fruiting | : | January – February |
| Associates | : | *Eupatorium odoratum, Lantana camara.* | | |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire and drought, naturally regenerated. | | |
| Soil | : | N | : | 0.174 % |
| | | P | : | 17.5 Kg/ha |
| | | K | : | 185 Kg/ha |
| | | pH | : | 5.1 |
| | | OC | : | 1.4 % |
| Parts used | : | Young shoots, coiled tendril. | | |
| Uses | : | Tonsilitis and throat pain | | |
| Mode of Preparation | : | The coiled tendril is plug and squized to produce juice, which is directly dropped to the throat or tonsils. Young shoots are also eaten for tonsillitis. | | |
| Mode/Route of application | : | Orally | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Verbena officinalis* (Pl. XXXVIII, Photo 114)**

| | | |
|---|---|---|
| Scientific name | : | *Verbena officinalis* Linn. |
| Local Name | : | Sicharuh (Mara) |
| Family | : | Verbenaceae |
| Locality | : | Tuipang L |
| Botanical Description | : | Herbs, annual or weakly perennial. Leaves narrowed into a petiole 0.3-4 cm; leaf blade ovate, obovate, or oblong, 2-8 X 1-5 cm, papery, hirsute especially on abaxial veins, margin coarsely dentate or cut to sometimes deeply pinnatifid or lobed. Spikes long, slender; bracts as long as calyx. Calyx 1-4 mm, pubescent, glandular. Corolla blue to pink, (2-)4-8 mm, pubescent. Ovary glabrous. Nutlets oblong, ca. 2 mm. |

| | | | | |
|---|---|---|---|---|
| Habit | : | Herbs, annual or weakly perennial. | | |
| Habitat | : | Not common in Mizoram, grows on well drained fertile soil. It requires moist soil but in sunny position. | | |
| Micro-climatic Status/Condition: | | Ambient temperature | : | 24 $^{o}$C |
| | | Altitude | : | 1350 m |
| | | Humidity | : | 42 % |
| | | Light intensity | : | 75310 lux |
| Phenology | : | Flowering | : | June - August |
| | | Place of flower | : | Terminal |
| | | Fruiting | : | September – October |
| Associates | : | *Stellaria media, Bidens biternata, Euphorbia hirta.* | | |
| Ecology/Silvicultural character: | | Light demander, acceptable to jhum fire, moderately resistant to heavy rainfall, naturally regenerated. | | |
| Soil | : | N | : | 0.157 % |
| | | P | : | 12.21 Kg/ha |
| | | K | : | 254 Kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.1 % |
| Parts used | : | Leaves | | |
| Uses | : | Convulsion and Nau-hri (Children`s disease) | | |
| Mode of Preparation | : | Crushed leaves is applied to armpit, head, sole and neck of children against convulsion and Nauhri (Children`s disease) a combination of fever, cholera, skin disease and inflammation. | | |
| Mode/Route of application | : | External | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

***Vitex peduncularis*** **(Pl. XXXIX, Photo 115)**

| | | |
|---|---|---|
| Scientific name | : | *Vitex peduncularis* Wall. |
| Local Name | : | Thingkhawilu |
| Family | : | Verbenaceae |

| | | |
|---|---|---|
| Locality | : | Vawmbuk |
| Botanical Description | : | A medium-sized to large semi-deciduous tree. |
| Habit | : | A medium-sized to large semi-deciduous tree. Leaves 3-foliate; leaflets lanceolate, 2-5 x 6-16 cm; base acute. Flowers yellowish-white or green-white, in axilary lax peduncles. Fruits obovoid *c.* 1 cm across. |
| Habitat | : | Scattered in Mizoram, in tropical evergreen and semi-evergreen forests.It is grown on sandy-loam soil in mixed with bamboo forests. |
| Micro-climatic Status/Condition: | Ambient temperature : | 24 $^{o}$C |
| | Altitude : | 1200 m |
| | Humidity : | 37 % |
| | Light intensity : | 31970 lux |
| Phenology | : Leaf shedding : | October - January |
| | New Leaf : | March - April |
| | Flowering : | April - May |
| | Place of flower : | Axillary |
| | Fruiting : | July – September |
| Associates | : | *Castonopsis tribuloides, Ostodes paniculata, Polygonum glabrum.* |
| Ecology/Silvicultural character: | | Moderate light demander, resistant to jhum fire, natural and artificial regeneration has no problem. |
| Soil | : N : | 0.184 % |
| | P : | 14.2 kg/ha |
| | K : | 254.0 kg/ha |
| | pH : | 6.2 |
| | OC : | 1.0 % |
| Parts used | : | Bark. |
| Uses | : | Placental problems, hepatitis, malarial fever, sprain and joint dislocation. |
| Mode of Preparation | : | Decoction of the bark is taken for placental problems and hepatitis. The leaves are boiled with water and the water is used for bathing against malarial fever. Decoction of the bark and with leaves is taken orally agaist malaria with jaundice; the solution should be drunk as much as one can but without any other medicine. The crushed bark is used in sprain and dislocation of joints by bandaging it with a piece of cloth. |

| | | |
|---|---|---|
| Mode/Route of application | : | Oral administration, External application and bath. |
| Status/Category | : | Not assessed for the IUCN Red List |

***Woodfordia fructicosa* (Pl. XXXIX, Photo 116)**

| | | |
|---|---|---|
| Scientific name | : | *Woodfordia fructicosa* Kurz. |
| Local Name | : | Ainawn |
| Family | : | Lythraceae |
| Locality | : | Lungphunlian |
| Botanical Description | : | A large spreading deciduous or evergreen shrub; bark reddish-brown; young parts hairy; branches spreading, drooping; leaves opposite or in whorls of 3, sessile, ovate-lanceolate or oblong lanceolate, acuminate, puberulous above, white with black dots beneath; flowers numerous, brilliant-red in dense axillary clusters from the old wood, often completely covering the branches; fruits ellipsoid, irregularly dehiscent; seeds brown, obovoid, smooth, small. |
| Habit | : | A large spreading deciduous or evergreen shrub with bright brick red flowers. |
| Habitat | : | Rare in Mizoram, in dry tropical secondary forests in southern part of Mizoram. It is grown on rocky places and dry areas in secondary forests. |
| Micro-climatic Status/Condition: | Ambient temperature | : 23 $^{o}$C |
| | Altitude | : 1200m |
| | Humidity | : 36 % |
| | Light intensity | : 78540 lux |
| Phenology | : Flowering | : March - April |
| | Place of flower | : Axillary |
| | Fruiting | : April – May |
| Associates | : | *Tetrameles nudiflora, Milletia pachycarpa, Macaranga paniculata, Phyllanthus* spp. |
| Ecology/Silvicultural character: | | Light demander, acceptable to jhum fire, resistant to drought, regenerate naturally. |

| | | | | |
|---|---|---|---|---|
| Soil | : | N | : | 0.152 % |
| | | P | : | 12.21 Kg/ha |
| | | K | : | 254 Kg/ha |
| | | pH | : | 5.0 |
| | | OC | : | 1.1 % |
| Parts used | : | Flowers. | | |
| Uses | : | Dysentery | | |
| Mode of Preparation | : | The flowers are crushed and a small quantity of water is added; it is then filtered using a clean cloth. The filtrate is taken orally against dysentery. | | |
| Mode/Route of application | : | Oral administration | | |
| Status/Category | : | Not assessed for the IUCN Red List | | |

## 5.2 SOCIO-ECONOMIC CODITION OF THE STUDY AREA

Data on the socio-economic status of the 78 villages of the study area were collected during the year 2007 to 2009 by conducting group and or personal interview in each village. This shows that the economic status varies from place to place and from individual to individual, but it can be summarized that in general people are poor. The results of the present investigation give following inference about the inhabitants of the villages. Of the 78 villages, the total population is 95366 persons belonging to 19358 families. Among the villages, Sangau village has the highest population with 4800 inhabitants and Vartek village has the lowest population with 187 inhabitants. Majority of the population depends on traditional jhuming for their livelihoods (68.75%) while the rest engaged in Govt. services, small business and cottage industries. Out of 19217 houses of the study area only 3.55% of the houses are R.C.C. building, 94.16% are of tin roof and 2.28% are of local materials or thatched roofs (Table No. 6). These clearly indicates that their dependencies upon forest products is still very large.

Though the literacy rate of the state is high, only 352 persons of the study area completed master degree, 1699 graduated, 2819 passed higher secondary level and 6327 of them are matriculate. There are 59 High School, 101 Middle School, 143 Primary School and 187 Anganwadi within the 78 villages visited (Table No. 6 ).

Their standard of living is medium. Of all the houses in the study area, 98.11% were electrified, 56.94% with LPG connection and 94.49% houses with Telephone/Mobilephone connections (Table No. 6). Since the numbers of families with LPG connections are less, it shows that the use of firewood is still common in the study area. It was also noted that even among the families with LPG connections, the use of firewood is still unavoidable as the supply of gas cylinder is very difficult due to poor condition of the roads. Most of the villages were having good water supply system by

making several public water points in their villages. There are 71 community health centers available in the study area (Table No. 6). But as the supply of medicines to these health centers is insufficient, it results in traditional healing practices, thereby, collecting valuable medicinal plants from the forests. Though their dependency on the forest and its products are high, they are not aware of the sustainable utilization and habitat destruction of wild species which could lead to biodiversity loss and extinction of valuable species of plants. Therefore, steps should be taken in these regards.

Most of the families were having pig and poultry as a livestock, 47.54% of the families have poultry and 36.34% have pigs. Cows, Pony/Horse, Goat, Dog and Buffalo were also domesticated by 3.13%, 0.36%, 0.94%, 11.11% and 0.57% of the families respectively (Table No. 6).

### 5.3 DELINEATION OF MAP:

After collection of the plant samples, the forest beat was surveyed thoroughly to check the distribution patterns of plants. The adjacent forest beats were also covered to ascertain the range of distribution and degree of abundance of the plant species. The range of distribution was recorded. The topo sheets covering that particular area were collected, latitude and longitude were measured to delineate on the map to show the place of availability of the plants. In course of study the following topo sheets numbers were used: 83 H/4, 83 H/8, 84 A/14, 84 A/15, 84 B/13, 84 B/14, 84 B/15, 84 E/1, 84 E/2, 84 E/3, 84 E/4, 84 E/5, 84 E/6, 84 E/7, 84 E/8, 84 F/1, 84 F/2, 84 F/3.