

Technical Report

**Documentation of Some Indigenous Traditional Knowledge (TK)
and their Prioritization for Intellectual Property Rights (IPRs) issues
in Tripura**



Tripura Biodiversity Board

AranyaBhwan, Pt. Nehru Complex
Gurkhabasti, Agartala- 799 006

The following Traditional Knowledge Report was prepared to support the local BMCs (Biodiversity Management Committee) for protection of their indigenous knowledge and IPR issues related to the bio-resources surrounding the villages.

The traditional knowledge was gathered and recorded through a process of community interviews and meetings with BMC members. At the preliminary stage, our Traditional Knowledge team conducted several interviews throughout the state especially with the elders, middle aged and the young members of Tribal community under the BMC.

This document was prepared for:

Tripura Biodiversity Board, AranyaBhwan, Pt. Nehru Complex, Gurkhabasti, Agartala- 799 006

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Cover page: Traditionally skilled Tripuri Women selling NTFPs in village market

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BACKGROUND OF THE STUDY

Traditional Knowledge (TK) refers to any knowledge of indigenous communities which is either already in the documented form or remained undocumented. Traditional Knowledge (TK) is essentially culturally oriented, and it is integral to the cultural identity of the social group in which it operates and is preserved. The definition of traditional knowledge used by the World Intellectual Property Office (WIPO) includes indigenous knowledge relating to categories such as agricultural knowledge, medicinal knowledge, biodiversity related knowledge, and expressions of folklore in the form of music, dance, song, handicraft, designs, stories and artwork (Jain, 1986; Jain, 1995).

TK is generally associated with biological resources and is invariably an intangible component of such a biological resource. It has the potential of being translated into commercial benefits by providing *leads/ clues* for development of useful practices and processes for the benefits of mankind. The valuable *leads/clues* provided by TK save time, money and investment of modern biotech and other industries into any research and product development. Logically, therefore, a share of such benefits should accrue to the creators and/or holders of such traditional knowledge. Some countries have specific legislation protecting this kind of knowledge while some other countries feel their existing Intellectual Property Right (IPR) regime protect such knowledge (Utkarsh et al. 1999). Proper documentation of suchThe importance of traditional knowledge of the indigenous communities is now known to the World. With this realised importance comes the need to protect this knowledge and to prevent its misappropriation. But the question is how?

In the past few years, ample amount of discussions and debates on the subject of protecting traditional knowledge as intellectual property, have been occurring at the WTO, Conference of Parties at the Convention on Biodiversity, etc. A few national governments in these discussions have embraced the view that traditional knowledge needs to be secured legitimately, and they have condemned the formal IPR framework in its available structure for not just neglecting to give satisfactory protection to traditional knowledge additionally for legitimizing its misappropriation (Singh et al. 1994).

India has taken an initiative through TKDL, a collaborative project of Council of Scientific and Industrial Research (CSIR) and Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy (AYUSH), which helps the examiners of Patent Offices to search for any information regarding substance or practice while granting patents and they can dismiss the grant of patent, if the substance or practice is already there in the TKDL list as Indian traditional knowledge. With the rise in need to protect Traditional Knowledge and to prevent its misappropriation the main question that has to be answered is: Can IP protect Traditional Knowledge? However, the main criticism of protecting traditional knowledge with IPR is that IPR leads to the commodification of knowledge; it treats knowledge as a commodity with economic value, which is far way different from the perspective of Indigenous People, who treat their knowledge as pious and sacred (Sharma et al. 1971; Khan et al. 2004).

Tripura is India's third smallest state, located in the North-eastern part of the country. It is bordered on the North, West and South by Bangladesh, on the East by the state Mizoram and on the North-East by the state Assam. Tripura state lies between 22°56' to 24°32' North latitude and between 90°09' to 92°20' East longitudes covering an area of 10,491sq. km. According to the census report 2000-2001 the total population of the state was 31,91,168 of which more than 83% are the rural population. The climate is usually hot and humid; temperature ranges from 10-35°C. The maximum humidity is about 88% while the minimum is 40%. State receives an average of 247.9 cm rains within a year. About 63% of the annual rainfall is caused by the South-West monsoon. The soil is laterite in the hills and alluvial in the plains. The forests in the state are mainly tropical semi evergreen and moist deciduous and cover 77.18% of total geographical area. Apart from the unique natural diversity, this state also a classic example of 'unity in diversity'. A large number of indigenous and immigrant ethnic and tribal groups are inhabit in this region with bewildering physical and cultural features. Ethnic communities have always generated, refined and passed on traditional knowledge from generation to generation. This knowledge is based on their needs, instinct, observation, trial and error and long experience. Such knowledge is often an important part of their cultural identities. Traditional knowledge has played, and still plays, a vital role in the daily lives of those people. Traditional knowledge is essential to the food security, shelter, ritual and healthcare system. A large number of ethnic people are still live

on remote forests and hills. Agriculture through 'Jhum' or 'Shifting' cultivations is the main occupations of the people. They are highly dependent on natural resources including forests (Majumdar et al., 2006).

THE TRIBAL COMMUNITIES

Tripura accounts 31% of tribal population of its state's total population. In Tripura, 19 scheduled tribes are found to dwell, viz. Tripuri, Mog, Riang, Shantal, Koki, Noatia, Lusai, Halam, Jamatia, Chakma and others. Among all the tribal communities, the Tripuri is the largest in size, concentrated in interior forests and remote areas of West and South districts of Tripura. Tripuris have their own dialects, beliefs, customs, tradition and cultural heritage. They build their house by bamboo and wood in hill tracts and cultivate cereals, pulses, fruits, etc. in Jhum fields. They also collect various plants from nearby forest for food, fodder, fuel, furniture and handicraft and for the treatment of different ailments; still they depend on local medical practitioners, popularly known as Ochai. The Ochai possess very rich experiences about the diagnosis and treatment of several serious to minor diseases; they are generally specialist in the art of traditional folk medicine among their community. But sometimes they perform various magical rites and worships for the treatment of several diseases by using flower, fruit, stem, leaf, bud or root of plants, sacrifices pigeon, hen, pig and goats, etc. and enchanting mantras. Their knowledge is passed on from generation to generation through oral tradition. However, much of the traditional knowledge has remained secret with Ochai (Majumdar et al. 2007).

IMPORTANCE OF TRADITIONAL KNOWLEDGE

There is a mounting focus on the importance of medicinal plants and traditional health systems in solving the health care problems of the world. North east India represents an extremely unique eco-system rich in biodiversity wealth associated with their everyday life issues. Among the natural resources many species of medicinal plants in Tripura are extensively used in villages as Ayurvedic or Kabiraj systems of medicine (Dhar, 2000). Those medicinal plants play an important role in supporting rural healthcare system in this region. According to the World Health Organization (WHO), 80% of the rural population in developing Asian and African countries utilizes locally available medicinal plants for their

primary healthcare needs. Traditional medical practice is an integral part of culture of people of North East India (Ramakrishnan, 1984; Jain, 1986). In spite of this condition traditional health care systems suffered a setback during modern civilization, industrialization and lost patronage particularly in urban areas. Herbal products are gaining global owing in this modern, busy and polluted environment. Traditional herbal medicine, supplements and cosmetics are better than synthetic components; as they are cost-effective, easily available, better compatible with physiological flora, and most importantly have negligible side effects (Jain, 1995; Haridashan 2001). Therefore the need of the hour is to harness this natural resource sustainably for the socio-economic development of the local and indigenous people while protecting the biodiversity at the same time. The strategies like cultivation of medicinal plants combined with sustainable collection practices from the wild would be useful in achieving this goal. In the 21st century, conservation, sustainable use of medicinal plants of North East India will contribute to self-reliance of millions for India's own health needs and has global relevance (Mao et al. 2009; Chakraborty et al. 2012).

STUDY AREAS

Present study was conducted in Tripura, which is a small hilly state belonging to the north eastern part of India. The state is surrounded by Bangladesh on three sides and only northeast part of the state is connected through Assam and Mizoram with the country, accounting for barely 0.342% of the total area of the country. In terms of area, it is the third smallest state in the country, after Goa and Sikkim. The geographical area of the state is only 10,492 km² and has 8 districts. The state is located in bio-geographic zone of 9B-North-East hills, endowed with rich and diverse forest resources. About 59.98% of the geographical area of the state is under the forest. The forests are mainly semi-evergreen, moist deciduous, mixed sal, and dry deciduous forests. The present study sites located between 23°57'55" and 24°05'34" north latitude and 91°17'18" and 91°29'22" east longitude. The area is bordered by Bangladesh on northwest side and located in extreme northwest part of state. The study area falls under low physiographic zone: slope is < 40° and the altitude is < 100m (ranging from 18.59 to 90.22mamsl). The climate of the area is characterized by highly humid atmosphere and temperatures range from 10°C to 35°C. The monsoon season

is mainly from June to September with an annual average rainfall around 240cm mostly due to southwest monsoon.

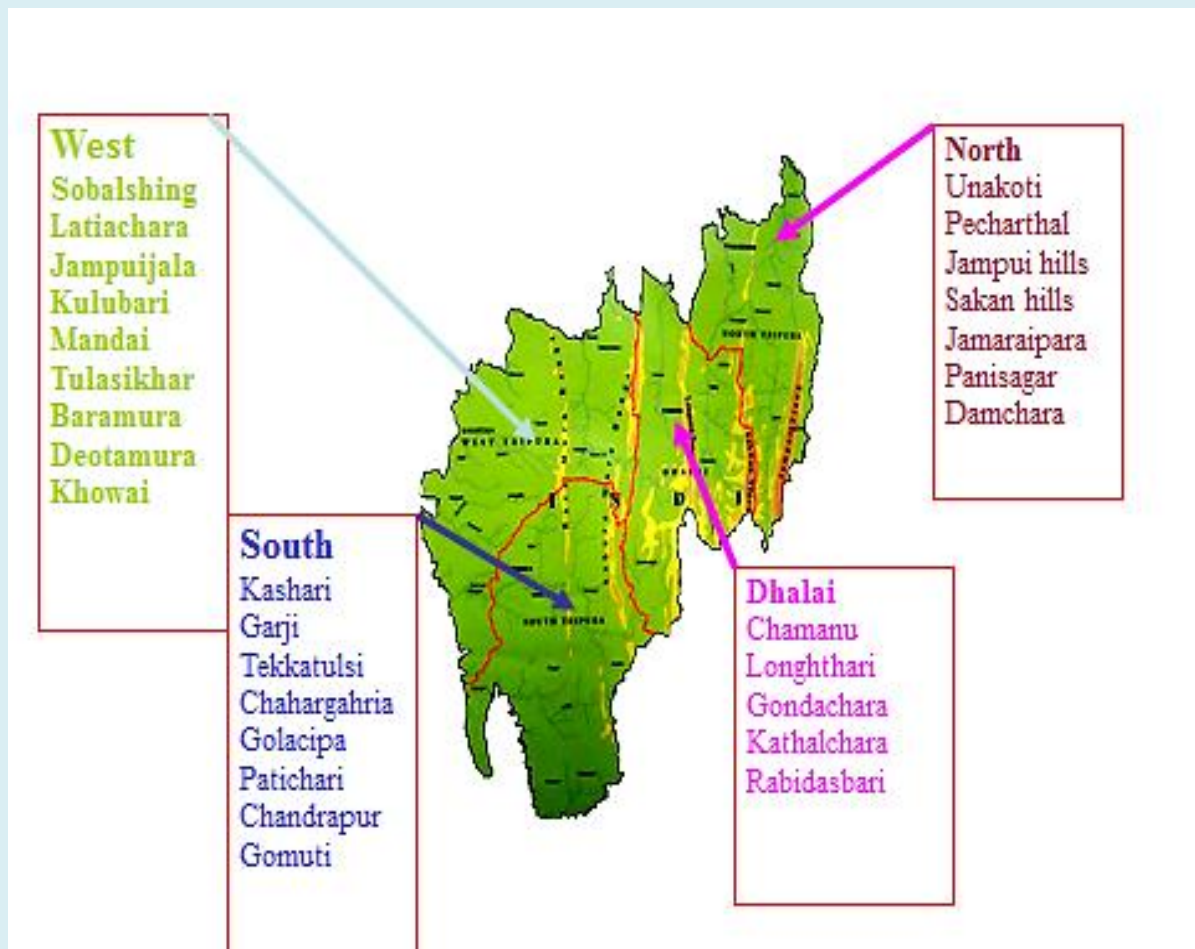


Figure 1: Showing the study area and prioritized locations for indigenous Traditional knowledge in Tripura

METHODOLOGY

The documentation of the traditional knowledge about medicinal plant used by the traditional healers in Tripura region is limited compared to the extent of the variety of cultures and the diversity of plants of the region. Most of the studies are focused on interviewing traditional healers locally called 'Ochai' or 'Kabiraj' and listing the plants for food and medicinal use with detailed ethnobotanical study on the medicinal plant in the region. Traditional knowledge and practice within any culture vary by geographical origin,

residence, ethnicity religion, age, and gender. The biographic characteristics of the respondents include: gender, age of respondents when first starting to practice traditional healing; occupational status and sources of income. This study mainly focused on the use of indigenous medicinal plants by traditional healers. Questionnaires designed to the respondents (traditional healers) about medicinal plants knowledge were mainly focused on common local name, knowledge about past and present use, mode of preparation, parts of the plants used, the methods of their preparation and administration, procurement method, place of collection and habitats, threats and conservation status, date/season of collection and types of treated diseases with these medicinal plants. Surveys were organized structurally adjacent to forest area to better understand of plants. It helped the informants to identify the plants by their local names and quality specimens of the plant used traditionally by the people were available for the herbarium purpose. Information on traditional phyto-therapy to cure various ailments was collected through oral discussions and documented on well-structured questionnaires Following Jain (1986), Jain (1995), Jain and Mudgal (1999) .Data were verified in different villages among the interviewers showing the same plant sample, and even with the same informants on different occasions. The information regarding the traditional knowledge on the local uses of plants, their local names, part(s) used, ailments cured and mode of preparation and administration have been given in the results. Besides, plant family and scientific name with voucher specimen number of each plant used in traditional phyto-therapy have also been provided.


From each sampling site, the voucher specimens of plant species were collected and identified with the help of local floras (Deb, 1981; 1983). Specimens collected during the surveys were processed in the herbarium laboratory following Jain and Rao (1976). These were pressed, dried in blotting sheets and poisoning with formaldehyde or mercuric chloride solution (0.5%) was done to protect against insect and fungal attack before mounting on the herbarium sheets. The plant specimens having unique voucher number were deposited in the herbarium of the Department of Botany, Tripura University for future reference. A comprehensive List of traditionally used medicinal plants of Tripura was given in the **Table 2** with detailed ethno-medicinal information (Majumdar et al. 2006, Majumdar and Datta 2007, Das et al., 2009; Majumdar et al. 2009, Majumdar and Datta 2013).

CHAPTER II

Documentation of Traditional Knowledge related to the traditional medicinal formulation of Tripura:


Following are the samples of data format used to document the details the traditional healers and prescribed traditional medicinal formulations:

A. Formulation for bone healing

Background of the Knowledge Holder			
Name of the Knowledge Holder	Gangacharan Debbarma		
Father's Name	Kulachandar Debbarma		
Community belongs to	Tripuri		
Age	102 years		
Gender	Male		
Education	Primary		
Language Proficiency	Kokborak, Bengali		
Occupation	Agricluture, HH income		
Complete Address for communication			
House	Halong Matia		
Village	Hazari Para		
Locality	Rajnagar		
District	Khowai		
Post Office	Rajnagar		
Pin	799201		
State	Tripura		
Land Mark	Halong Matai Temple		
Contact Number (if any)			
GPS Data	North 23°59'52.2" Latitude	East 91°39'25.1" Longitude	
Traditional Skill and Expertise Area			
Skill	Herbal Practitioner		
Acquired from	Father		
Specialization	Bone healing		
Name of the ailment/disease	Bone fracture		
Symptoms / Identification Tech.	Bone fracture, swelling the fractured part, extreme pain		
Form of Medicine	Poultice of plant mixture		
Number of Plant/article used	5 (Five)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Harzora	<i>Cissus quadrangularis</i>	Whole Plant	3
Phagraechera	<i>Clerodendron viscosum</i>	Bark	1
Borsrap	<i>Litsea glutinosa</i>	Bark	1


Dhuttra	<i>Datura stramonium</i>	Leaf	1
Cissri	<i>Monochorea hastata</i>	Whole Plant	1
Other Ingredients/composition	Nil		
Details of Mode of Preparation			
Mix the fresh plant parts with above mentioned ratio, crushed it and made into paste, warmed up then applied on the fractured area of the body and covered with a clean cloth and keep the bandaged for three days.			
Details of Dosage			
After three days bandaged should be remove and repeat the treatment with the above mentioned formulation for three times or more, if pains continue.			
Precautions, if any	Nil		
Number of Patients Treated	More Than 100		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			

B. Formulation for Snakebite

Background of the Knowledge Holder		
Name of the Knowledge Holder	Santi Kumar Debbarma	
Father's Name	Rajendra Debbarma	
Community belongs to	Tripuri	
Age	36 years	
Gender	Male	
Education	6 th Passed	
Language Proficiency	Kokborak, Bengali	
Occupation	Agriculuture,	
Complete Address for communication		
House	Halong Matia	
Village	Hazari Para	
Locality	Rajnagar	
District	Khowai	
Post Office	Rajnagar	
Pin	799201	
State	Tripura	
Land Mark	Halong Matai Temple	
Contact Number (if any)		
GPS Data	North 23°59'52.2" Latitude	East 91°39'25.1" Longitude
Traditional Skill and Expertise Area		
Skill	Herbal Practitioner	
Acquired from	Dream about 12 years ago	
Specialization	Snakebite	
Name of the ailment/disease	Snakebite	
Symptoms / Identification Tech.	Spot of teeth, bleeding the bite area, extreme pain	
Form of Medicine	Poultice of plant mixture	
Number of Plant/article used	3 (three)	


Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Tukkma	<i>Hyptis seovelence</i>	Leaf	1
Osundi	<i>Spilanthus paniculata</i>	Leaf	1
Daski	<i>Ageratum conyzoides</i>	Leaf	1
Other Ingredients/composition	Nil		
Details of Mode of Preparation			
Mix the fresh plant parts with above mentioned ratio, crushed it and made into paste, then applied on the bite area of the body and covered with a clean cloth and keep the bandaged for three days.			
Details of Dosage			
After three days bandaged should be remove and repeat the treatment.			
Precautions, if any	Nil		
Number of Patients Treated	More Than 50		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			

C. Formulation for Skin Disease

Background of the Knowledge Holder		
Name of the Knowledge Holder	Narendra Debbarma	
Father's Name	Bichat Ranjan Debbarma	
Community belongs to	Tripuri	
Age	80 years	
Gender	Male	
Education	3 rd Passes	
Language Proficiency	Kokborak, Bengali	
Occupation	Agriculuture,	
Complete Address for communication		
House	Jackchera	
Village	Jackchera	
Locality	East Rajnagar	
District	Khowai	
Post Office	Rajnagar	
Pin	799201	
State	Tripura	
Land Mark	Kabiraj Bari	
Contact Number (if any)	8974650943 (Sanjit Debbarma)	
GPS Data	North 24°00'38.1" Latitude	East 91°42'51.7" Longitude
Traditional Skill and Expertise Area		
Skill	Herbal Practitioner	
Acquired from	Father	
Specialization	Skin Disease, Gynaecological ailments, Mental disorder	
Name of the ailment/disease	Skin disease	


Symptoms / Identification Tech.	Infection, swelling,		
Form of Medicine	Poultice of plant mixture		
Number of Plant/article used	5 (Five)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Mukhri	<i>Eupatorium odoratum</i>	Leaf	1
Kuchama	<i>Clerodendrum viscosum</i>	Bark	1
Khamkha	<i>Solanum torvum</i>	Leaf	1
SadaPata	<i>Diospyros montana</i>	Leaf	1
Other Ingredients/composition	CaCO ₃	Lime	1/4
Details of Mode of Preparation			
Mix the fresh plant parts with above mentioned ratio crushed it and made into paste, apply it on the affected area of the body for two times in a days.			
Details of Dosage			
Continue the process with fresh poultice for ten days			
Precautions, if any	<ol style="list-style-type: none"> 1. Pork, Duck, Egg are Banana should be avoid during this time 2. Plant should be collect only Tuesday or Saturday 		
Number of Patients Treated	10-12 patients per year		
Patients History, if any			
Name and Address of Documenter			
Remark, if any	Mr. Uttam Kumar Debbarma is learning the healing practices form Narandra Debbarma for last 10 years, i.e. the healer giving his knowledge to next generation.		

D. Formulation for bone healing

Background of the Knowledge Holder		
Name of the Knowledge Holder	Manidwal Rupini	
Father's Name		
Community belongs to	Rupini	
Age	75	
Gender	Male	
Education	Primary	
Language Proficiency	Kokborak, Bengali	
Occupation	Agriculuture, House hold income	
Complete Address for communication		
House		
Village	Tuichakma	
Locality	Hadrai panchayet	
District	Khowai	
Post Office	Tuichakma	
Pin	799205	
State	Tripura	
Land Mark	Near Bangali Colony Anganwari Centre, Tuichakma, Teliamura.	

Contact Number (if any)	9863214426		
GPS Data	North 23°49'09.0" Latitude	East 91°35'38.6" Longitude	
Traditional Skill and Expertise Area			
Skill	Herbal Practitioner		
Acquired from	Father		
Specialization	Bone healing		
Name of the ailment/disease	Bone fracture		
Symptoms / Identification Tech.	Bone fracture, swelling the fractured part, extreme pain		
Form of Medicine	Poultice of plant mixture		
Number of Plant/article used	7 (Seven)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Bithisrama	<i>Allophylus cobbe</i>	Leaf	1
Rawth	<i>Stephania japonica</i>	Leaf & stem	1
Rawth(Small)	<i>Cissampelos pareira</i>	Leaf & stem	1
Sinsrama	<i>Mussanda incanna</i>	Leaf	1
<i>Chuan pata</i>	<i>Alophyllus racemosus</i>	Leaf	1
<i>Maicha pata</i>	<i>Hibiscus schizopetalus</i>	Young leaf	1
<i>Maikrikabang</i>	<i>Grewia hirsuta</i>	Leaf	1
Other Ingredients/composition	Nil		
Details of Mode of Preparation			
Mix the fresh plant parts with above mentioned ratio, crushed it and made into paste, warmed up then applied on the fractured area of the body and covered with a clean cloth and keep the bandaged for 7 days.			
Details of Dosage			
After 7 days bandaged should be remove and repeat the treatment with the above mentioned formulation for three times or more, if pains continue.			
Precautions, if any	Nil		
Number of Patients Treated	More Than 50		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			

E. Formulation for Gallbladder Stone etc.

Background of the Knowledge Holder		
Name of the Knowledge Holder	Ranabhadur Debbarma	
Father's Name	Late Ramcharan Debbarma	
Community belongs to	Debbarma	
Age	77	
Gender	Male	
Education	Class seven passed	
Language Proficiency	Kokborak, Bengali	
Occupation	Agricluture,	
Complete Address for communication		
House		


Village	Kamalsingh para		
Locality	Purba Rajnagar		
District	Khowai		
Post Office	Tulashikhar		
Pin	799201		
State	Tripura		
Land Mark	Near kamal Singh More		
Contact Number (if any)	8729844798.		
GPS Data	North 23°57'39.4" Latitude	East 91°57'51.7" Longitude	
Traditional Skill and Expertise Area			
Skill	Herbal Practitioner		
Acquired from	Acquired from father		
Specialization	Gall bladder stone, Malaria, Jaundice, Pneumonia, Leucorrhoea		
Treatment No:1			
Name of the ailment/disease	Gall bladder stone		
Symptoms / Identification Tech.	Extreme pain at the right side of the bailey.		
Form of Medicine	Decoction of plant extract		
Number of Plant/article used	2 (Two)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Musaihenta	<i>Bryophyllum pinnatum</i>	Leaf	1
Berella	<i>Sida cordifolia</i>	Leaf	1
Other Ingredients/composition	Nil		
Details of Mode of Preparation			
Mix the fresh leaves with above mentioned ratio, crushed it with water and decoction is made, then the decoction is given to the patient orally.			
Details of Dosage			
15 ml of decoction is given to patient orally 2 times a day for 15 days.			
Precautions, if any			
Number of Patients Treated	More Than 10		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			
Treatment No: 2			
Name of the ailment/disease	Diarrhoea		
Symptoms / Identification Tech.			
Form of Medicine	Decoction of plant extract		
Number of Plant/article used	7 (Seven)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Shephalika	<i>Nyctanthes arbor-tristis</i>	Bark	1
Ula lengra	<i>Achyranthes aspera</i>	Root, Leaf	1
Kalo tulsi	<i>Ocimum tenuiflorum</i>	Leaf	1

Bishalya karani	<i>Alternanthera brasiliana</i>	Leaf	1
Durba	<i>Cynodon dactylon</i>	Leaf	1
Maicha pata	<i>Chromolaena odorata</i>	Leaf	1
Krishnachura	<i>Caesalpinia pulcherrima</i>	Leaf	1
Other Ingredients/composition	Water		
Details of Mode of Preparation			
Mix the fresh plant parts with above mentioned ratio and make it 20-25 gm and crushed with 100 ml of water and filtered, then the juice is given to the patient orally.			
Details of Dosage			
The juice is given to patient orally 2 times a day for 2 -3 days.			
Precautions, if any	Not to take Spicy and oily rich food.		
Number of Patients Treated	More Than 50		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			
Treatment No: 3			
Name of the ailment/disease	Jaundice		
Symptoms / Identification Tech.			
Form of Medicine	Decoction of plant extract		
Number of Plant/article used	5 (Five)		
Administration			
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Musaihentha	<i>Bryophyllum pinnatum</i>	Leaf	1
	<i>Urena lobata</i>	Leaf	1
Muimasingh	<i>Cajanus cajan</i>	Leaf	1
Neem	<i>Azadirachta indica</i>	Leaf	1
Gahula	<i>Pavetta indica</i>	Leaf	1
Other Ingredients/composition	Water		
Details of Mode of Preparation			
Mix the fresh leaves with equal ratio, crushed it with water and heat the juice to make 1/3 rd of the original mixture then the mixture is given to the patient orally.			
Details of Dosage			
10 ml of mixture is given to patient orally 2 times a day for 3-5 days.			
Precautions, if any	Not to consume Turmeric and spicy food.		
Number of Patients Treated	More Than 50		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			
Treatment No: 4			
Name of the ailment/disease	Leucorrhoea		
Symptoms / Identification Tech.	Whitish Discharge from female genital, Weakness etc		
Form of Medicine	Decoction of plant extract		
Number of Plant/article used	2 (Two)		

Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Sadhalicum	<i>Catharanthus roseus</i>	Leaf	1
Gahula	<i>Pavetta indica</i>	Leaf	
Ukpala	<i>Hibiscus rosa-sinensis</i>	Flower bud	
Ractanjan	<i>Adenantha pavonina</i>	Bark	
Agar	<i>Aquilaria malaccensis</i>	Bark	
Other Ingredients/composition	Water		
Details of Mode of Preparation			
Mix the fresh leaves with equal proportion crushed it with water then the paste is added with 300 ml of water and filtered. The mixture is given to the patient orally.			
Details of Dosage			
The mixture is given to patient orally 2 times a day in empty stomach for 15 days.			
Precautions, if any			
Number of Patients Treated	More Than 50		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			
Treatment No: 5			
Name of the ailment/disease	Syphilis		
Symptoms / Identification Tech.			
Form of Medicine	Poultice of plant mixture		
Number of Plant/article used	3 (Three)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio
Durba	<i>Cynodon dactylon</i>	Whole plant	1
Gudhubi	<i>Rhynchospora colorata</i>	Inflorescence	1
Basaki	<i>Adhatoda vasica</i>	Leaves	1
Other Ingredients/composition	Nil		
Details of Mode of Preparation			
5 gm of each plant parts are taken and make it into paste, and then the paste is applied topically into the affected area. two times a day for one week.			
Details of Dosage			
Prepared paste is applied two times a day for seven days.			
Precautions, if any			
Number of Patients Treated	More Than 20		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			
Treatment No: 6			
Name of the ailment/disease	Gonorrhea		
Symptoms / Identification Tech.			
Form of Medicine	Poultice of plant mixture		
Number of Plant/article used	4 (Four)		
Administration	External		
Name of the Plant/article			
Vernacular Name	Scientific Name	Part(s) Used	Ratio

Fysu	<i>Mangifera indica</i>	Dry mango pulp	1
Fypol	<i>Dillenia indica</i>	Fruit	1
Demfol	<i>Hydnocarpus kurzii</i>	Seed	1
Tentruiply	<i>Tamarindus indica</i>	Leaf	1
Other Ingredients/composition	Nil		
Details of Mode of Preparation			
Equal proportion of each plant parts is taken and a paste is prepared then the paste is heated in low temperature for 2 to 3 minutes and paste is applied topically on the affected area.			
Details of Dosage			
The paste is applied topically into the affected area for 2 times a day for 3 to 4 days.			
Precautions, if any			
Number of Patients Treated	More Than 10		
Patients History, if any			
Name and Address of Documenter			
Remark, if any			

F. Formulation for Gynaecological Ailments

Background of the Knowledge Holder		
Name of the Knowledge Holder	Ganesh Chandra reang	
Father's Name	Areha Reang	
Community belongs to	Reang	
Age	75	
Gender	Male	
Education	Class VI Passed	
Language Proficiency	Kokborak, Bengali	
Occupation	Agricluture, Traditional healer	
Complete Address for communication		
House		
Village	Kathal chara	
Locality	Birchandra Manu	
District	South Tripura	
Post Office	Birchandra Manu	
Pin	799125	
State	Tripura	
Land Mark		
Contact Number (if any)		
GPS Data	North 23°21'56.07" Latitude	East 91°34'03.6" Longitude
Traditional Skill and Expertise Area		
Skill	Herbal Practitioner	
Acquired from	Father	
Specialization	Gall stone, Gynaecological ailments, Energy drink, Eye disease etc	

A comprehensive List of traditionally used medicinal plants of Tripura with detailed ethno medicinal information

1.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Amomum ligniforme</i> (Roxb.) Benth. Zingiberaceae Bon Alach (B) Rare Wild Rhizome Muscular rheumatism. Dried rhizome is powdered and half teaspoonful powder is mixed with equal amount of honey and taken once a day for about one month in case of muscular rheumatism.
2.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Aquilaria malaccensis</i> Lamk. Thymeleaceae Agar (B) Rare Planted Bark Leucoderma & rheumatism Poultice of bark are given to cure rheumatic pain, decoction of bark are rubbed on the spotted areas before bath till cure.
3.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Asparagus racemosus</i> Willd. Liliaceae Satamuli (B) Rare Wild Tuberos roots. Epilepsy Half cup tuberous root's decoction dilute with equal amount of milk and taken ones a day for three month as a remedy against in epilepsy.
4.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Atylosia scarabaeoides</i> (L.) Benth. Papilionaceae Ban kalai (B) Common Wild Leaves & Seed. Skin disease Crushed leaves and seed are applied externally on body in any kind of skin disease of children.
5.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Barleria prionitis</i> L. Acanthaceae Ziodi (R) Common Wild Leaves Pruritis, Rubefacient and blotch. Equal amount of leaves of this mix with the ashes of Terminalia chebula fruit and sulphur-di-oxide (Gandhak) are crushed and made into pills (500 mg) and then dried. About 1-2 pills are mixed with 100 ml of coconut oil and massaged everyday all over the body.
6.	Name of the Plants: Name of Family:	<i>Barringtonia acutangula</i> (L.) Gaertn. Lecythidaceae

	Vernacular Name: Hijol (B) Availability status: Occasional Source of Collection: Wild Part(s) Used: Bark & tender leaves Name of the Ailments: Worm infection, boils Mode of Administration: Decoction of bark about 5ml, is used twice a day for 2-3 days in worm infection, juice of tender leaves is applied in boils to promote suppuration.
7.	Name of the Plants: <i>Brassaiopsis glomerulata (Bl.) Regel.</i> Name of Family: Araliaceae Vernacular Name: Chapok (K) Availability status: Occasional Source of Collection: Wild Part(s) Used: Flower bud Name of the Ailments: Gastritis, ulcer, Jaundice Mode of Administration: Immature flower is cooked with common vegetable and taken with rice during sever gastritis and ulcer, juice extract from both mature and immature flower and prescribe 2 cup in a day during jaundice.
8.	Name of the Plants: <i>Brassaiopsis griffithii C. B. Clarke.</i> Name of Family: Araliaceae Vernacular Name: Chapok (K) Availability status: Occasional Source of Collection: Wild Part(s) Used: Flower & fruit Name of the Ailments: Gastritis, ulcer, Jaundice Mode of Administration: Immature flower is cooked with common vegetable and taken with rice during sever gastritis and ulcer, juice extract from both mature and immature flower and prescribe 2 cup in a day during jaundice.
9.	Name of the Plants: <i>Canavalia gladiata (Jacq.) DC.</i> Name of Family: Papilionaceae Vernacular Name: Makhan sim (K) Availability status: Occasional Source of Collection: Wild Part(s) Used: Pod Name of the Ailments: Jaundice Mode of Administration: Soup of the tender pod is given to the patients suffering from jaundice.
10.	Name of the Plants: <i>Careya arborea Roxb.</i> Name of Family: Lecythidaceae Vernacular Name: Kumbhira (B), Kumbhi(K) Availability status: Common Source of Collection: Wild Part(s) Used: Flower & bark Name of the Ailments: Cough, mouth and throat infection Mode of Administration: Equal amount of crushed fresh flower and bark are soaked overnight in one glass of water, patients are prescribe to gargling with the filtrate solution thrice daily.
11.	Name of the Plants: <i>Ceiba pentendra (L.) Gaertn.</i> Name of Family: Bombacaceae Vernacular Name: Sweta Shimul (B) Availability status: Common Source of Collection: Planted Part(s) Used: Root & bark Name of the Ailments: Fever & Diabetes Mode of Administration: Decoction of root is prescribed as a tonic during fever, bark decoction sometimes taken in empty stomach to cure diabetes.

12.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Chenopodium ambrosioides L.</i> Chenopodiaceae Bara Bathu sag (B), Bara Bathua (K), Batto (R) Common Wild Leaves & stem Scabies Leaves and stems are boiled in water, strained, cooled and then sponged all over the body.
13.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Cissus adnata Roxb.</i> Vitaceae Shiltedoi (K) Common Wild Tender leaves Jaundice Boiled leaves are prescribed to take one glass in a day in empty stomach to cure jaundice.
14.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Croton oblongifolius Roxb.</i> Euphorbiaceae Chucka (B) Common Wild Fruit Fever Dry fruits are powdered and mixed with little honey are given during fever.
15.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Debregeasia longifolia (Burm. f.) Weed.</i> Urticaceae Thepan (K), Nicchia (B) Common Wild Tender Leaves Dysentery, arthritis Tender leaves are taken as vegetable during dysentery, crushed leaves paste is applied as poultice in case of arthritis.
16.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Eriocaulon cinereum R. Br.</i> Eriocaulaceae Acchoni (K) Frequent Wild Whole plant Hair tonic & ringworms Paste is applied externally on hair before bath. Small pills prepare from paste are also taken in empty stomach to check ringworms.
17.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Erioglossum rubiginosum (Roxb.) Bl.</i> Sapindaceae Muli (K), Aboian (B). Occasional Wild Bark Blood dysentery, malarial fever Dry bark powder is taken with milk during malarial fever, raw bark are given to chew in case of blood dysentery.
18.	Name of the Plants: Name of Family:	<i>Euphorbia hirta L.</i> Euphorbiaceae

	Vernacular Name: Dudhi (B) Availability status: Frequent Source of Collection: Wild Part(s) Used: Whole plant Name of the Ailments: Gonorrhoea & to increase lactation Mode of Administration: About 4 - 5 teaspoonful of plant juice and one teaspoonful sugar dilute in one cup of warm milk and taken once daily for 7-8 weeks as a remedy for gonorrhoea and lactation.
19.	Name of the Plants: <i>Glycosmis arborea (Roxb.) DC.</i> Name of Family: Rutaceae Vernacular Name: Phatikhira (B); Availability status: Occasional Source of Collection: Wild Part(s) Used: Whole plant Name of the Ailments: Jaundice, anaemia, worms and vomiting Mode of Administration: Fresh barks are pounded with half cup of bark decoction and given to take orally in every morning and evening for about three weeks in case jaundice and anaemia. About 15-20 g of fresh leaf and 10 g of root pounded and half cup of juice administered twice a day in case of vomiting or intestinal worms.
20.	Name of the Plants: <i>Gmelina arborea Roxb.</i> Name of Family: Verbenaceae Vernacular Name: Gamair (B) Availability status: Common Source of Collection: Planted Part(s) Used: Fruit Name of the Ailments: Wounds Mode of Administration: Decoction of fruits is applied in case of serious wounds.
21.	Name of the Plants: <i>Grewia sapida Roxb.</i> Name of Family: Tiliaceae Vernacular Name: Amang (B) Availability status: Common Source of Collection: Wild Part(s) Used: Young Leaves Name of the Ailments: Bone fracture Mode of Administration: Paste of young leaves is applied on bone fracture.
22.	Name of the Plants: <i>Hymenodictyon excelsum (Roxb.) Wall.</i> Name of Family: Rubiaceae Vernacular Name: Chepkowa (K) Availability status: Occasional Source of Collection: Wild Part(s) Used: Flower bud Name of the Ailments: Jaundice, fever Mode of Administration: Spatial type of vegetable is cooked by flower bud and prescribes to the patients suffering from jaundice and fever.
23.	Name of the Plants: <i>Kaempferia galanga L.</i> Name of Family: Zingiberaceae Vernacular Name: Homola (K) Availability status: Rare Source of Collection: Wild Part(s) Used: Rhizome Name of the Ailments: Asthma Mode of Administration: Decoction of rhizome prescribes in asthma.
24.	Name of the Plants: <i>Laportea interrupta (L.) Chew.</i> Name of Family: Urticaceae Vernacular Name: Phereijang (K)

	Availability status: Wild, frequent Source of Collection: Wild Part(s) Used: Roots Name of the Ailments: Paralysis Mode of Administration: Fresh roots of this plant are crushed with leaves of <i>Eriocaulon cinereum</i> R. Br. and <i>Holarrhena antidysenterica</i> Flem. in a 2:1:1 ratio. The extract is massage on the affected area and sometimes poultice also prescribe.
25.	Name of the Plants: <i>Ludwigia adscendens (L.) Hara.</i> Name of Family: Onagraceae Vernacular Name: Lhum phool (K) Availability status: Wild, frequent Source of Collection: Wild Part(s) Used: Root Name of the Ailments: Dental pain Mode of Administration: Fresh root are prescribe to crushed with salt to cure sever dental pain.
26.	Name of the Plants: <i>Meyna spinosa Roxb.</i> Name of Family: Rubiaceae Vernacular Name: Monkata (B) Availability status: Common Source of Collection: Wild Part(s) Used: Tender Leaves Name of the Ailments: Skin irritation Mode of Administration: About 40 – 50 g of leaves crushed with little amount of zinger, the paste is rubbed on the infected areas.
27.	Name of the Plants: <i>Mussaenda roxburghii Hook. f.</i> Name of Family: Rubiaceae Vernacular Name: Mussaenda (B); Kuthoikhum (K) Availability status: Common Source of Collection: Wild Part(s) Used: Leaves Name of the Ailments: Bone fracture Mode of Administration: Approx. 100 g matured fresh leaves are crushed and one egg (Hen's) mixed with it and made into paste, warmed up then applied on the fractured area of the body and covered with a young banana leaf and bandaged with some hard materials (bamboo stick). After seven days bandaged should be open and repeat the treatment with the above formulation at least three times or more.
28.	Name of the Plants: <i>Pancratium verecundum Ait.</i> Name of Family: Amaryllidaceae Vernacular Name: Hodorotthang (K) Availability status: Common Source of Collection: Wild Part(s) Used: Leavess & roots Name of the Ailments: Chicken pox Mode of Administration: Paste prepared from crushed leaves and root of this plant are applied on the body in a thin layer to cure.
29.	Name of the Plants: <i>Parkia javanica (Lamk.) Merr.</i> Name of Family: Mimosaceae Vernacular Name: Yaikhrail (K), kukitetoi (B) Availability status: Occasional Source of Collection: Planted Part(s) Used: Tender fruit Name of the Ailments: Gastritis, ulcer Mode of Administration: Tender fruits are cocked to make a special dish called 'Ironba' to cure stomach ulcer and gastric disorders.
30.	Name of the Plants: <i>Passiflora foetida L.</i>

	Name of Family: Passifloraceae Vernacular Name: Ban kamala (B), Availability status: Common Source of Collection: Wild Part(s) Used: Leaves & Fruit Name of the Ailments: Blood purifier, burns and scabies. Mode of Administration: Ash of the leaves mixed with ghee and applied in burns and scabies, to heal the wounds and immediate relief from pain. Ripe fruits are prescribed to take raw as a blood purifier.
31.	Name of the Plants: <i>Pentapetes phoenicea L.</i> Name of Family: Sterculiaceae Vernacular Name: Dibbucchi (K) Availability status: Occasional Source of Collection: Wild Part(s) Used: Tender Name of the Ailments: Nephritic disorder Mode of Administration: Tender shoots are cooked specially for the patients suffering from nephritic disease.
32.	Name of the Plants: <i>Phajus flavus (Bl.) Lindl.</i> Name of Family: Orchidaceae Vernacular Name: Maittehandori (K) Availability status: Rare Source of Collection: Wild Part(s) Used: Capsule Name of the Ailments: Earache Mode of Administration: Fresh fruit of this plant are mixed with the leaves of <i>Vernonia cinerea</i> 2:1 ration. Decoction of this mixture is applied as ear drop.
33.	Name of the Plants: <i>Pothos cathcartii Schott.</i> Name of Family: Arecaceae Vernacular Name: Thinara (K) Availability status: Common Source of Collection: Wild Part(s) Used: Leaves & Name of the Ailments: Asthma & snake bite. Mode of Administration: Decoction of Leaves is given to cure asthma; dried pieces of stem are prescribed to tie up on arms to prevent snakebite.
34.	Name of the Plants: <i>Psidium guineense Swartz.</i> Name of Family: Myrtaceae Vernacular Name: Bangayam (B), Availability status: Rare Source of Collection: Wild Part(s) Used: Leaves & twigs Name of the Ailments: Scurvy & dentrites Mode of Administration: About 100-200 g of fresh Leaves and twigs are boild with two glasses of water and reduced to one glass, given as mouth wash to the patient suffering from scurvy.
35.	Name of the Plants: <i>Rorippa indica (L.)</i> Name of Family: Brassicaceae Vernacular Name: Ban sarisha (B) Availability status: Common Source of Collection: Wild Part(s) Used: Leaves Name of the Ailments: Urinary & nephritic disease Mode of Administration: Decoction of Leaves is given in empty stomach during suffering from urinary and nephritic disease.
36.	Name of the Plants: <i>Semecarpus anacardium L. f.</i>

	<p>Name of Family: Anacardiaceae Vernacular Name: Vela (B), (K) Availability status: Common Source of Collection: Wild Part(s) Used: Fruits, Seeds Name of the Ailments: Hair tonic Mode of Administration: Decoction of seed is applied externally on the scalp before one hour of bath to prevent hair baldness or excessive falling of hair.</p>
37.	<p>Name of the Plants: <i>Solanum stramonifolium Jacq.</i> Name of Family: Solanaceae Vernacular Name: Ram begun (K), Tide Begal (R) Availability status: Occasional Source of Collection: Wild Part(s) Used: Whole plant Name of the Ailments: Chest pain & asthma Mode of Administration: About 250 g of whole plant are boiled in one liter of water till it reduces into paste. About 1-2 teaspoonful of this paste taken with little honey twice a day for one week.</p>
38.	<p>Name of the Plants: <i>Solanum xanthocarpum Schr.</i> Name of Family: Solanaceae Vernacular Name: Kantikari (B) Availability status: Common Source of Collection: Wild Part(s) Used: Whole plant Name of the Ailments: Asthma Mode of Administration: About 250 g stem juice is boiled in 2 liters of water, reduced to half liter, which is further evaporated into a thick viscous liquid. Equal amount of honey is added for preserved it. About 1-2 spoonfuls are taken 4-5 times a day as a remedy against asthma.</p>
39.	<p>Name of the Plants: <i>Typhonium trilobatum (L.) Schott.</i> Name of Family: Araceae Vernacular Name: Kharkan (K) , (B) Availability status: Occasional Source of Collection: Wild Part(s) Used: Leaves, tubers Name of the Ailments: Bleeding piles, rheumatism. Mode of Administration: Leaves and tubers are cooked as vegetable and prescribe to the patient suffering from piles and rheumatism.</p>
40.	<p>Name of the Plants: <i>Zanthoxylum limonella (Dennst.) Alston.</i> Name of Family: Rutaceae Vernacular Name: Bajna (B); Bajrong (K) Availability status: Occasional Source of Collection: Wild Part(s) Used: Bark, Fruits Name of the Ailments: constipation, Dysuria. Mode of Administration: About half cup root decoction is mixed with 4-5 drops of honey and given twice a day for about one week to relieve lower abdominal pain and dysuria. Fruits are also prescribed for sexual stimulant.</p>
41.	<p>Name of the Plants: <i>Tinospora cordifolia (Willd.) Miers</i> Name of Family: Menispermaceae Vernacular Name: Gulancha Availability status: Occasional Source of Collection: Wild Part(s) Used: Stem Name of the Ailments: Leucorea Mode of Administration: Paste prepared from crushed Stem then make it to Juice and take it a</p>

		douse for once daily during douses need to Avoid Arrum, lemon, fish, leddis finger, kaddu
42.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Andrographis paniculata</i> (Burn.f.)Wall.ex Acanthaceae Kalomegh Planted Leaf Fever Juice prepared from crushed leaf and take it half cup twince daily after food
43.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Averrhoa carambola L.</i> Averrhoaceae Kapranga Occasional Planted Fruit Dysentery Crushed fruit and prepared juice and take it half cup thrice per day after food
44.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Hemidesmus indicus (L.) R.Br.</i> Asclepiadaceae Anantamul Occasional Wild Root Piles Fresh root juice are prescribed in empty stomach
45.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Cuscuta reflexa L.</i> Convolvulaceae Sornalati Common Wild Root Gall bladder stone Paste prepared from churched root and make tablets and take it thrice per day after food
46.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Aloe vera L.</i> Aloaceae Ghritakanchan Occasional Planted Leaf Kidney stone Juice prepared from crushed leaf and take it one cup daily after food
47.	Name of the Plants: Name of Family: Vernacular Name: Availability status: Source of Collection: Part(s) Used: Name of the Ailments: Mode of Administration:	<i>Cissus quadrangularis L.</i> Vitaceae Harjora Rare Planted Leaf Bone fracture Pated leaf are used a bandage on the fractured area
48.	Name of the Plants: Name of Family: Vernacular Name:	<i>Microcos paniculata L.</i> Tiliaceae Pislata

	Availability status: Common Source of Collection: Wild Part(s) Used: Leaf Name of the Ailments: Urine infection Mode of Administration: Juice prepared from crushed leaf and make tablets and take it thrice per day after food
49.	Name of the Plants: <i>Musa paradisiaca L.</i> Name of Family: Muaceae Vernacular Name: Kola Availability status: Common Source of Collection: Planted Part(s) Used: Leaf Name of the Ailments: Leucorea Mode of Administration: Juice prepared from crushed leaf and take it one cup daily after food
50.	Name of the Plants: <i>Oroxylum indicum</i> Roxb. Name of Family: Bignoniaceae Vernacular Name: Kannai-dinga Availability status: Occasional Source of Collection: Planted Part(s) Used: Inflorescence Name of the Ailments: High blood pressure Mode of Administration: Taken as a juice once glass per day



Figure 2: Showing some dried / preserved traditional medicinal plant parts for use in different formulations



Figure 3: Some important traditional medicinal plants of Tripura. 1: *Asparagus racemosus* Wild, F., 2: *Rauwolfia serpentina* (L.) Benth. ex Kurz. , 3: *Spilanthes paniculata* Wall. ex DC., 4: *Homalomena aromatica* Schott.



Figure 4: Some important traditional medicinal plants of Tripura. 1: *Amomum ligniforme* (Roxb.) Benth, 2: *Brassaiopsis glomerulata* (Bl.) Regel., 3: *Tinospora cordifolia* (Willd.) Miers, 4: *Mussaenda roxburghii* Hook. f.



Figure 5: Other important traditional medicinal plants of Tripura. 1: *Abrus precatorius* L., 2: *Ardesia solanacea* L., 3: *Oroxylum indicum* Roxb.

Discussion and Conclusion:

Since there is a common belief among the indigenous people that if any secret regarding therapeutic value is revealed to anyone outside their own clan, the efficacy of plant will vanish, in order to win their confidence, close contacts were developed with local people particularly traditional healers and elders before gathering information on traditional medicinal uses of plants. In the context of how research has been conducted and the issue of compliance with legal norms, this study aims to analyze how the results of documentation of local traditional knowledge research are shared with communities and how prior and informed consent and authorization of BMC have been considered. In addition, we aim to know how these medicinal formulations are still effective in those rural

areas, their formulations, administrations, cost, resources availability and their acceptance to rest other villagers of the community. Our objective is to faster documentation and promotion of traditional healers, their knowledge with the interaction among research, government, and social spheres in relation to legal aspects (IPR) and involving access to benefit shearing of resources associated with traditional knowledge of the BMC.



Figure 6: Traditional Knowledge holders and processes of data documentations

References:

1. Chakraborty, R., De, B., Devanna, N., & Sen, S. (2012). North-East India an ethnic storehouse of unexplored medicinal plants. *Journal of Natural Product and Plant Resources*, 2(1): 143-152.
2. Dhar, U., Rawal, R. S. & Upreti, J. (2000). Setting priorities for conservation of medicinal plants—a case study in the Indian Himalaya. *J Biol Conserv*, 95 : 57.
3. Haridasan, K. (2001)., *Ethnobotanical studies in Arunachal Pradesh- A status report*, Proc National Seminar Traditional knowledge base on herbal medicines and plant resources of North-east India: Protection, utilization and conservation. (National Institute of Science Communication and Information Resources, New Delhi), 154-167.
4. Jain, S. K. (1986). *Ethnobotany. Interdisciplinary Science Reviews*, 11(3):285-292.
5. Jain, S. K. (1995). *A manual of ethnobotany. A manual of ethnobotany.*, (Ed. 2).
6. Jain, S. K. & Mudgal, V. (1999). *A Hand Book of Ethnobotany*, (Bishan Singh Mahendra Pal Singh, Dehra Dun,), 309.
7. Khan, Z.S., Khuroo, A.A. & Dar, G.H. (2004). *Ethnomedicinal survey of Uri, Kashmir Himalaya*, *Indian J Traditional Knowledge*, 3 (4) :351.
8. Majumdar, K., Saha, R., Datta, B. K., & Bhakta, T. (2006). Medicinal plants prescribed by different tribal and non-tribal medicine men of Tripura state. *Indian Journal of Traditional Knowledge*, 5(4), 559-562.
9. Majumdar, K., & Datta, B. K. (2007). A study on ethnomedicinal usage of plants among the folklore herbalists and Tripuri medical practitioners: Part-II. *Natural Product Radiance*, 6(1), 66-73.
10. Das, H. B., Majumdar, K., Datta, B. K., & Ray, D. (2009). Ethnobotanical uses of some plants by Tripuri and Reang tribes of Tripura. *Natural Product Radiance*, 8(2), 172-180.
11. Majumdar, K., & Datta, B. (2013). Practice Pattern of Traditional Pharmaceutical Formulations by the Tribes of Tripura, Northeast India. *Global Journal of Pharmacology*, 7(4), 442-447.
12. Mao, A. A., Hynniewta, T. M., & Sanjappa, M. (2009). Plant wealth of Northeast India with reference to ethnobotany. *Indian journal of traditional knowledge*, 8(1), 96-103.
13. Ramakrishnan, P.S. (1984). Problems and prospects of conservation of north-eastern hill region of India, In: *Conservation of plant resources by Jain SK & Mehra KL*, (Botanical Survey of India, Howrah)pp. 172-180.

14. Sharma, J.R., Mudgal ,V. & Hajra, P.K. (1971). Floristic Diversity- Review, Scope and Perspectives, In: Floristic Diversity and Conservation Strategies in India, (BSI, Calcutta), (1997) 1-45.
15. Singh, J.S., Raghubanshi, A. S. & Vashney, C. K. (1994). Integrated biodiversity research in India, Current Science, 66 (2) :109.
16. Utkarsh, G. M., Gadgil, M. & Rao, P.R.S. (1999). Intellectual property rights on biological resources: Benefiting from biodiversity and peoples knowledge, Current Science, 77(11): 1418.

Chapter: III

Traditional uses of Wild Plant Sap for Energy drink by the tribes of Tripura

INTRODUCTION

Plant sap has as its principal function the long-distance transport of nutrients, especially photosynthate, around the plant (Fisher, 2000), and the diversion of these nutrients to animals is not in the plant's selective interests., the relationships of plants with nectar and fruit feeders are generally mutualistic and those with phloem-feeders are generally antagonistic (Douglas, 2006). Many comparatively insignificant plants, are represented in the tropics by trees whose juice and sap give to the human race many important products, contributions to mechanics, the arts, medicine, creating commerce and extending trade. From plant juices our wines and cider are made. Many very harmful drinks are thus obtained. Absinthe, the favourite drink of the French (they consume millions of gallons in a single year), is made from a Composite, *Artemisia absinthium* , compounded with roots of *Archangelica officinalis*, sweet flag, dittany and anise. Adulterations of tumeric, indigo and blue vitriol make the inferior qualities. It is a greenish liqueur, and was introduced by French soldiers who served in the Algerian war (1844-47). Many intoxicating drinks are made from the juices of palm trees. Palm wine is obtained from several species of palm - *Phoenix sylvestris*, *Borassus flabelliformis* and others. A man climbs the tree to its top, cuts the flowering spadix before it expands, and hangs a vessel underneath to catch the juice. Every morning he climbs the tree, empties the vessel and leaves it again to be filled. A palm in Borneo will yield one gallon a day for two months. By boiling this wine a good sugar is obtained (Creevey, 1899; Douglas, 2006).

The black birch (*Betulanigra*) contains sugar in its sap, which flows freely in the spring and which is used to make a pleasant birch wine. As winter wanes and spring approaches, wild foodists all across North America tap into the time-honored tradition of sugar production – mainly, the transformation of maple tree sap into maple syrup and sugar. This process, passed on from the Native Americans to the early settlers, is still quite popular today, and is responsible for one of the few wild foods that can be purchased commercially in most supermarkets. Several species of *Acer*, the sugar maple yields the highest volume and

concentration of sap, making it a superior candidate for tapping. Its sugar content is approximately 2.0%. Several species of *Juglans*, the butternut produces a sap that yields roughly 2% sugar – similar to sugar maples. The timing and total volume of sap are also comparable to sugar maples. Several species of Birch (*Betula* species) has a lower sugar content than sugar maple (less than 1%), but is the sweetest of the birch trees. The yellow birch tree has been found to have a higher mineral composition, lower sugar content, and a higher ORAC value (measure of antioxidant capacity) than sugar maple (Schultz et al. 1982; Douglas 2006).

The cow-tree of Para, *Mimusopselata*, growing too feet high, gives out a milky juice, thick, tasting like rich cream. After being exposed to the air it hardens and forms serviceable glue. The *Excoecaria agallochum*, a native of India of this family, exudes a very acrid juice, said to cure leprosy. The sap from maple, birch, or walnut trees is comprised mostly of water with 2% or less sugar and loaded with minerals, nutrients, enzymes, antioxidants, and more an incredible, all-natural beverage. The Sugarmaker's Companion by Michael Farrell, documents the untapped potential of American forests and shows how sugaring can turn a substantial profit for farmers while providing tremendous enjoyment and satisfaction (Creevey 1899; Douglas 2006).

In some respects, plant sap is an excellent diet for animals. For most plants, it approximates to a 'predigested' food with high concentrations of sugars providing an abundant source of carbon and energy, and nitrogen predominantly in the form of free amino acids. It is also generally free of toxins and feeding deterrents, a consequence of its being a highly specialized cytoplasm (plant secondary compounds tend to be localized in the apoplast and cell vacuole, and not the cytoplasmic compartment (Thompson and Schulz, 1999; Brudenell et al., 1999). Although, despite of these exceptions, many wild plant sap remains poorly studied and their potentially was not evaluated as nutrient-rich food source for human and animals that can access it. According to Douglas (2006), plant sap is the most valuable product that can get out of a tree. Especially, which could have potential as substitute of energy drink in forest and remote areas. The purpose of this article is to give an overview of the traditional use of plant saps in Tripura. Relying on ethnobotanical fieldworks, we investigate the source, means of collection, purposes and non-food use of saps as traditional

energy drink of three species, *Ampelocissus barbata* (a woody climber), *Saraca asoca* (a threatened medicinal Plant) and

Ampelocissus barbata (Wallich) Planchon in DC., Monogr. Phan. 5: 372. 1887.
Vitis barbata Wallich in Roxb., Fl. Ind. 2: 478. 1824; M. Lawson in Fl. Brit. India 1: 651. 1875.

Botany: Large climbers; branches stout, terete, striate, hollow, pubescent to tomentose and with ca 1-2.5 mm long, stiff brown or blackish, glandular-capitate hairs. Leaves simple, broad-ovate, 12-30 x 10-20 cm, acute to acuminate at apex, sometimes 3-lobed, deep-cordate at base, irregularly sinuate-dentate at margins, membranous, glabrous above, rufous hairy or tomentose beneath; petioles 6-12 cm long, glandular-hairy. Inflorescences paniculate; peduncles 5-12 cm long; tendrils branched; primary branch of inflorescence ca 2 cm long; panicles ca 10 cm long. Flowers ca 1.75 mm long; pedicels ca 0.5 mm long, pubescent. Calyx cupular, 5-notched. Petals oblong, incurved at apex, ca 1.7 x 0.8 mm. Stamens ca 1 mm long; anthers ovoid. Disc almost covering the ovary, thick, 5-furrowed. Ovary ca 1 mm across, glabrous; stigma sessile. Berries globose, 7-10 mm across, fleshy, 1-2-seeded. Seeds elliptic-obovate in outline, ca 6.5 x 4.5 mm, laterally compressed; adaxial surface with a longitudinal ridge; abaxial surface with an elliptic chalazal knot from which very fine, sometimes indistinct fissures radiate towards margin.

Flowering and Fruiting: March - September

Distribution in World: Bhutan, Bangladesh, Myanmar, Thailand, Laos and Vietnam.

Distribution in India: Tropical and subtropical forests, up to 1500 m. Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Mizoram, Tripura, Meghalaya and Andaman & Nicobar Islands.

Use of Sap: Forest dwellers, especially, during scarcity of water search for this climber in the forest. After identification the appropriate species, they used to cut the climber and have gathered and suck the juice /sap of this plant, usually adults have drunk it and chosen by the climber's thickness or high DBH. The sap has been used as a fresh drink and according to them it was a kind of sweet taste.



Figure 7: showing traditional use of plant sap (*Ampelocissus barbata*) as energy drink by the tribe of Tripura

Saracaasoca (Roxb.)De Wilde, Blumea 15 (1968).*S. indica* (non L.)Beddome, Fl. Sylv. x (1869) 57, t. 57; Baker, Fl. Br. Ind. 2 (1879) 271; Prain, J. As. Soc. Beng. 66, ii (1897) 213, 489, incl. var. *puberula* et var. *latifolia*; Krishnamurti, J. Ind. Bot. Soc. 10 (1932) 159; Blatter & Millard, J. Bomb. Nat. Hist. Soc. 36 (1933) 353, t. 19—20; Corner, Ways. Trees Mai. (1940) 402; Randhawa, J. Bomb. Nat. Hist. Soc. 45 (1945) 558; Blatter & Millard, Some Beautiful Indian Trees ed. 2 (1954) 130, t. 27.

Botany: Leaves jugate, (sub)coriaceous, subsessile, c. 7—30 cm long, when dry never dark, blackish brown, apex of rachis rarely ending in a small, subulate, free appendage; leaflets oblong to lanceolate, base cuneate, rounded, or rarely (in the basal leaflets) cordate, apex acute or up to c. 2 cm acuminate, 3 —25 by 1—9 cm, uppermost ones generally not the largest; petiolules c. 5 mm, basal glands apparently absent. Corymbs generally tufted, compact, small, c. 15—20 cm, branches mostly glabrous; bracts small, usually smaller than

bracteoles, persistent or fugacious, ovate to obovate, blunt, 1–6 by 1–3 mm; bracteoles during anthesis persistent, erect, embracing the pedicel, never spreading more than 45° from the pedicel, oval to obovate, blunt or acutish, 2–7 mm. Calyx tube by 1–2 mm; lobes 7–10 by 5–9 mm, oval to obovate, apex rounded. Stamens (5 – 8; filaments c. 17–25 mm; anthers 1–2 mm long. Stipe of ovary 2–4 mm; ovary 4–5 mm long; style 15–20 mm. Pods oval to oblong, 4.5–15 by 2– 4.5cm, flat to mostly swollen, up to 1.5–2 cm thick, when flat (and young) with thickened margin, apex shortly beaked; base rounded or cuneate; only up to 1–2 fruits developing from an inflorescence.

Flowering and Fruiting: According to Roxburgh (1799) flowering occurs here in the beginning of the hot season, fruiting during the rains. The flowers are fragrant during the night.

Distribution in World: Ceylon, India, E. Pakistan, Burma west of the Irrawaddy River

Ecology: From sea-level up to c. 500 m altitude, but there are several records from Khasia.

Use of Sap: The use of sap of *Saracaasokais* less common in Tripura and people do not know very well about the use of this medicinal plant, where this tree is considered as “precious medicinal plant”. However, there are records that some tribal/ traditional healer used to tap the sap and it is believe that its sap is sweeter. However, it is also believed that the tree growing on a hill have sweeter sap. Usually, sap is suck from branches; sometimes roots also cutor drilled a hole on the trunk. A collecting bamboo container sometime placed under the dropping and wait for fill up.



Figure 8: showing traditional use of plant sap (*Saracaasoca*) as energy drink by the tribe of Tripura

DISCUSSION AND CONCLUSIONS

There are also a few reports on the use of other plant species for tapping sap. Recent field work in Tripura have gathered information that earlier taxon is probably more widely used than the rest others, since this climber is widespread in Sal forest and degraded moist deciduous vegetation in Tripura. The presented data shows that plant saps have been used in in Tripura by several tribes. It can be assumed that, historically plant saps were most widely used where there was water scarcity on the top of hill forest; especially for NTFPs collectors, other forest dwellers, traditional etc. Two main uses of tree saps apply to most countries. The plant sap is nutritional and the sugar content made plant saps a valuable nutritional resource or sometime supplement for water. This is utilizing mainly in

the form of fresh. Plant saps are believed to contain some vital substances, hence, for example their use to restore the energy. However, much less is known about the chemical composition of the sap of those plant species. Immediate studies are required to know the sugar content of the sap, including other ingredients present in the sap of those plant species, as well as their secondary products to promote its commercial use and popularity like tree sap of birches, hornbeams and maples in European conditions (Wilmot and Brett, 1995). This may have immense potential to be an important Non-Timber Forest Product, particularly in the hilly and remote areas of Tripura.

REFERENCES

1. Brudenell, A. J. P., Griffiths, H., Rossiter, J. T., & Baker, A. D. (1999). The phloem mobility of glucosinolates. *Journal of Experimental Botany*, 50(335), 745-756.
2. Creevey C. A. 1899. Plant juices and their commercial values. *The Plant World*, 2(11): 187-189.
3. Douglas, A. E. (2006). Phloem-sap feeding by animals: problems and solutions. *Journal of Experimental Botany*, 57(4), 747-754.
4. Essiamah S. 1980. Spring sap of trees, *Ber. Deut. Bot. Ges.*, 1980, 93, 257–267.
5. Kallio H., Ahtonen S. 1987. Seasonal variations of the sugars in birch sap, *Food Chem.*, 25(4), 293–304.
6. Schultz, J. C., Nothnagle, P. J., & Baldwin, I. T. (1982). Seasonal and individual variation in leaf quality of two northern hardwoods tree species. *American Journal of Botany*, 753-759.
7. Taghiltsev Y.G., Kolesnikova R.D. 2000. Sap utilization directions of Russian Far East birch trees, In: Anonymous (Ed.), *Tree sap II. Proceedings of the 2nd Intern. Symp. on Sap Utilization (ISSU) in Bifuka, Hokkaido, April 21–23, 2000*, Hokkaido University Press, Sapporo.
8. Thompson, G. A., & Schulz, A. (1999). Macromolecular trafficking in the phloem. *Trends in plant science*, 4(9), 354-360.
9. Wilmot T.R., Brett P.W. 1995. Vigor and nutrition vs. sap sugar concentration in sugar maples. *Northern Journal of Applied Forestry*, 12(4), 156–162.

CHAPTER: IV

Traditional knowledge on the preparation of Rice-Based Fermented Beverage by the tribes of Tripura

INTRODUCTION

Traditional fermented foods are prepared from most common types of cereals such as rice, corn, wheat, millet, and sorghum . Fermented foods are prepared by the action of microorganism(s), either naturally fermented or by adding starter culture(s), which modify the substrates biochemically and organoleptically into edible products, and are thus generally palatable, safe, and nutritious (Simango 1997, Steinkraus 1983). During the course of fermentation, a group of metabolites such as lactic acid, alcohol, enzymes, antimicrobial substances, aromatic compounds, and organic acids are produced, which enrich the quality of products in respect to availability of nutrients and therapeutic potentials (Steinkraus 1983).

Rice is a good source of carbohydrates (77–89%) and energy (1460–1560 KJ) (FAO 1993). It also provides a moderate amount of protein (6.3–7.1%), though it is devoid of lysine (Steinkraus 2002). There are many popular rice fermentation procedures used to make it more nutritious (i.e., enrichment with essential amino acids and removal of phytic acid, a major anti-nutrient in rice), easily digestible (as microbial enzymes predigest it), and acquire therapeutic properties (antimicrobial peptides, antioxidants, etc.) and synbiotic properties (lactic acid bacteria and bifidobacteria can easily grow in it; occurrence of both oligosaccharide and probiotic make it a synbiotic food) (Steinkraus 2002).

Rice beer is a nutritious and energy-enriching fermented beverage recognized worldwide though mostly found in a few tropical areas of Asian countries. Some fermented beverages of Northeast India contain 83.7-86.9% carbohydrate on dry weight basis and 4.8-5.9% alcohol (Tamang et al. 2012). Rice-Based Fermented Beverage or '*Desi Mod*' or '*Bangla*' (in Bengali) or '*Langi*' or (in Kokborak) is very cheap local beverage prepared from low grade rice (*Atop Chal*) and consumed as a staple food by both tribal and non-tribal people in Tripura. It is integral part of the traditional culture of several tribes of Tripura and widely

consumes especially during any festival, ceremonious occasion, rituals, social feast, marriage feast, birth and death feast, etc. This Rice-Based Fermented Beverage also prescribed to cure several ailments and as energy-enriching drink in the remote interior areas of Tripura. We hypothesized that every tribes has its own unique tradition and culture in Tripura, the method of preparation of this ethnic beverage may differ from each other in terms of its mode of preparation, plants composition of Muli, its chemical and biological components, preservation and taste. This study revealed that the traditional methods of preparation of tribal beverages in Tripura are unique in nature, which need to further evaluate in terms of physio-chemical and biological characteristics, and there is a wide scope for documentation of its IPR issues.



Figure 9: Preparation of traditional drink by the tribes of Tripura

MATERIALS AND METHODS

Field data collection on the preparation of traditional rice based beverage in Tripura. Study was conducted through household surveys and group discussions. Documentation on the preparation methods, its composition were based on data collected from different villages of West Tripura. A questionnaire was developed first to acquire data into the local languages (Bengali and Kokborak) among the local people who have sufficient knowledge on its preparation.

RESULTS

The preparation method of 'Muli' is differ among the tribes of Tripura. Plants which are mostly used for preparation of 'Muli' was listed in **Table 3**. There are several types of rice beer consumed in the state, but in this part only 'Chowarak' and 'Langi' were discussed. Detail methods for preparation of rice beer in Tripura are given in **Table 4 & Table 6**.

Table 3: List of Plants used for Making Muli

Sl. No.	Common name of the plant	Scientific name	Plant part use
1	Golmorich	<i>Piper nigrum</i>	Fruit
2	Anarash	<i>Achyranthes aspera</i>	Leaf
3	Kathal	<i>Artocarpus heterophyllus</i>	Leaf
4	Rasun	<i>Allium sativum</i>	Fruit
5	Menda	<i>Litsea monopetala</i>	Fresh Bark
6	Sarpagandha	<i>Rauwolfia serpentina</i>	Rhizome
7	Muli	<i>Erioglossum eduli</i>	Whole plant
8	Choanti	<i>Allophylus racemosus</i> OR <i>A. Serratus</i> OR <i>A. cobbe</i>	Whole plant
9	Choanly	<i>Markhamia stipulata</i>	Leaves
10	Kamala	<i>Citrus sinensis</i>	Peel

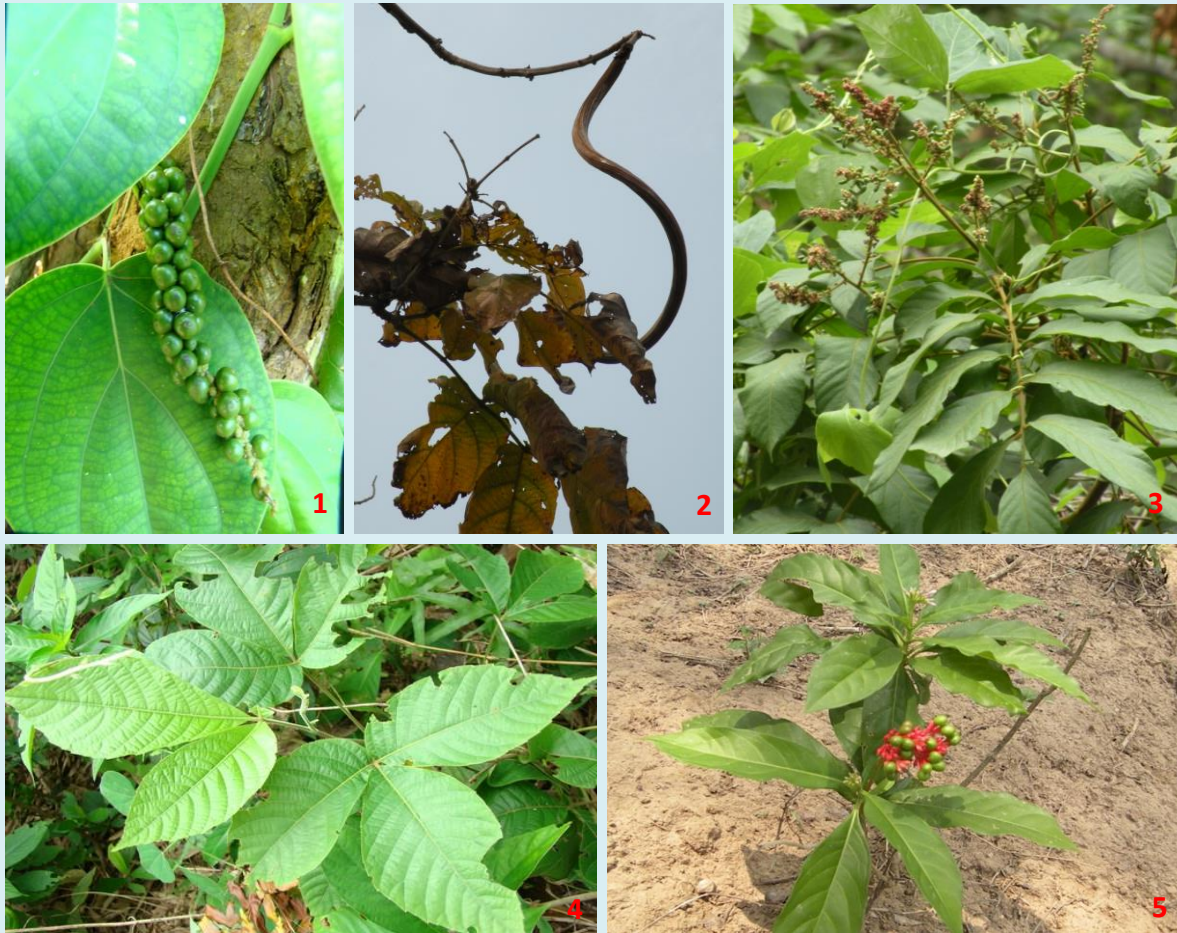





Figure 10: Some important plants used for preparation of 'Muli'. 1: *Piper Longum L.*, 2: *Markhamia stipulata (Wall.)* , 3: *Erioglossum rubiginosum (Roxb.)*, 4: *Allophylus serratus (Hiern) Kurz*, 5: *Rauwolfia serpentina (L.) Benth.*



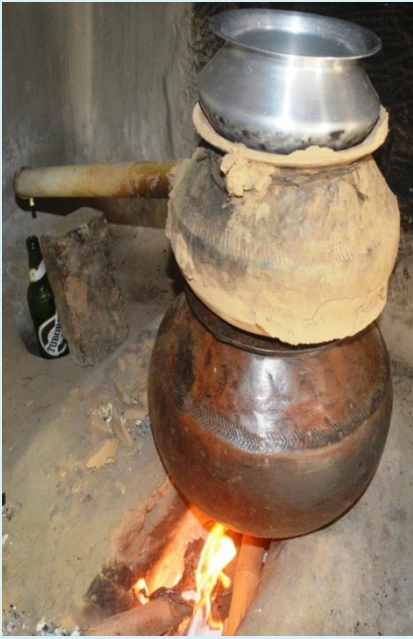


Figure 11: Product (*Muli*) which may be selected for promotion and value addition in Tripura

Table 4: An overview of the preparation of 'Muli' and traditional drink 'Chowarak' by the tribes of Tripura

<p>Step-1: Preparation of Rice Beer Cake (<i>Muli</i>) or starter culture</p>	 	<p>All the different plant parts needed for preparing 'Muli' is collected and cleaned. Then they are dried, sometime also can be used fresh. Soaked rice and the leaves are grinded separately in a wooden grinder and they are mixed together in a vessel with a little of water. For preparation of 'Muli' a clean, sterile earthen pot is used. Nowadays, due to unavailability of earthen pot, silver / plastic pot (Dek) is used. About 1kg rice soaked in normal water for 2 to 3 hr. Afterwards, the plant mixture in a particular ratio along with soaked rice grinded in traditional grinder for making into powdery paste to make some round biscuit shape cake. The cake is spread over a mat in open air let it to sundry for about 3-5 days to become hardened. Properly dried 'Muli' can be used for about 4-6</p>
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		<p>months. The microbial inoculums in Muli ultimately act on the rice grain for conversion of the starchy material to simple sugar and alcohol. The plant parts in Muli may increase the shelf-life of the microbes, acting as bio-preservatives. Apart from these, the plant parts contain many bioactive compounds.</p>
<p>Step-2: Boiling of Rice, mixing inoculums and fermentation</p>		<p>For preparation of beer, rice is first boiled, then spread and allowed to cool. '<i>Muli</i>' starter is added to this, and the mixture is then poured into the earthen pot and the lid closed. Normally in 5kg rice need 5-6 pieces of <i>Muli</i> is used. The mixture is incubated at room temperature for 2 to 3 days in a closed, dark room. The earthen/plastic/silver pots are kept in an upright and immobile condition. Any physical disturbance during fermentation is entirely prohibited. The texture of the rice grain changes notably during fermentation, losing its</p>

		<p>compactness, melting, and developing a glutinous appearance.</p> <p>After completion of fermentation, some amount of water is added to the fermented rice. It is also kept for 3-5 days durations for production of more alcohol.</p>
<p>Step-3: Boiling of fermented Rice mixture, Condensation of smoke</p>	 	<p>For filtration, a special type of arrangements of silver and earthen pots is placed like a funnel shaped structure. The fermented mass is first placed in the downward earthen pot. On the top of the earthen pot, a silver pot connected with a hollow bamboo made pipe. Another silver pot filled with cold water placed on the top of the structure. This is used to cool the smoke and to flow down the smoke through the bamboo pipe in a collector or glass bottle. Some time, flow of cold water is continued over the pipe or a wet cloth is used to cover the condenser (3rd pot) to condense the smoke into the desired collector or</p>







		<p>bottle. Sometime water is mixed to the filtrate. The quality and concentration of the final product depends on the quantity of water.</p>
<p>Step-4 : Storage of Beer</p>	 	<p>After make rice beer they store in plastic/ glass container or bottle ready for use.</p>

Table 5: Estimation of economy for preparation of traditional drink or rice beer in Tripura

Sl. No.	Item	Qty.	Rate	Total
1.	Rice Beer Cake (Muli)	6 nos	Rs. 2-5/- per cake	Rs.12-30/-
2.	Rice (Low quality)	5 kg	Rs. 10-15 /- per kg	Rs.50-75/-
3.	Fuel Wood	5 kg	Rs. 5-10/- per	Rs.25-50/-
4.	Manpower (processing is take 5 days, but considering a single day work load)	1	100-150/- per day (For unskilled labour in village)	Rs.100-150/-
Total cost for preparation of 8 litter			Rs.23-38/- litter	Rs.187-305/-
Total market price of 8 litter			Rs.60-70/- litter	Rs.480-560/-
Cost of waste product (Widely used to feed pig)			Rs.5-10per kg	Rs.15-30/-
Net Income			Rs. (495-187)=308/- to Rs. (590-305)=285/-	Rs. 285-308/-

Table 6: An overview on the preparation of traditional drink Langi in Tripura

Sl. No.	Description	Photos
1.	<p>Preparation of rice beer cake "mulii"</p> <p>Local tribble people of Debbarma community found in Village Halflong, North Tripura, generally make the Rice Bear Cake 'Mulli' they used 1 kg of normal rice soaking in normal water for 5hr, they start to soaking the rice in morning and after that they went to forest for collecting wild plants like Chwanlife(K) Chandrima (k) and others plant parts mix those plant parts(Rhizome, Bark, Leaf) along with soaking rice and crusade with grinder make jelly pest and lays on a bamboo made trey covered with banana leaf, stay it on home weather condition for 3 days, after that they dried in sunlight for 1-2 days, 1 kg rice produce 8 no of small mulii, those</p>	

		market prise Rs. 10/- per each, and 8 nos of big size muli those prise Rs. 20/- per each.	
2.	Preparation of Rice Beer "Langi"	Generally they used 2 kg of rice cooked it properly and make non sticky rice, after cooking those rice need to cooling. They used a bamboo made tray, after completely cooled the rice they crushed the muli and mix with rice carefully and kept it on a aluminium pot/container and covered with banana leaf or still disc, for 5 days. For fermentation, then the rice looks like yellow, After that the mix water 2lit/2kg of rice and prepared whitest juice	
3.	Filter and storage	They filtered the liquid by using of cotton, and the conserved the drink in to still pots. 2kg rice produce 3lt of langi, market prise Rs. 50/- per kg	
4.	Uses	They use this drink as a soft wine, and also use if for quick relief for gastric. Waste rice used for fish/pig feeding	

DISCUSSION AND CONCLUSION

Traditionally, this home-based beverage is prepared within an earthen pot by a large number of women using their indigenous knowledge. The traditional starter used for the home-based beverage preparation is called *Chuwanti*, *Chuwanly*, *Chuwan*, *Muli* (in Kokborak). *Muli* is mainly composed of rice dust and parts of different plants which makes itself a mixture of old ferments (containing microbial inoculums). The livelihood of many tribal women especially 'Tripuri', 'Mog', 'Jamatia' and 'Riang' communities solely depends upon the '*Muli*' and there are village based entrepreneur has develop as small-scale cottage industries for its preparation, storage and commercialization in rural markets in Tripura. There are several studies exists on the preparation of traditional rice based beverage in mainland India (Calpe 2006), Northeast region (Tamang & Thapa 2006; Das et al. 2012); but till to date no analytical research has been conducted to compare this traditional knowledge, its mode of preparation, plants compositions to establish it as a fermented product and to promote further study for evaluation the composition of micro-organism, its health benefit and effects etc.

The method of rice beer preparation by different tribal community in Tripura is not similar. There is difference in the ingredients of different plant and plants parts, process of inoculums (*Muli*) preparation, also the methods of fermentation, condensation and storage. Some of the plant species documented in this article have also been mentioned in different regions on their availability for the similar usage. There are several reports earlier by different authors like Saikia et al. (2007) about the Ahoms of Assam, Deori et al. (2007) about the Deoris of Assam, Teron (2006) about the Karbis of Assam, Tiwari and Mahanda (2007) about the Arunachalis of Arunachal Pradesh and Tanti et al.(2010) about the Misings of Assam, Uchoi et al (2015) about indigenous tribes of Tripura. There also significant variation of knowledge of the indigenous people in the use of the starter cultures as a source of yeast. It is very important to mention that the several microorganisms are reported which are responsible for fermentation the rice beverages in Northeast India, for example species like *Saccharomycopsis fibuligera*, *Saccharomycopsis cerevisiae*, *Lactobacillus bifermentans* etc (Tamang et al. 2015). The microbial starch-degrading enzyme systems play a major role in the process of rice gelatinization, which directly help in the

further growth and metabolism of microbes (Tamang & Thapa 2006). This is a cereal-based food fermentation processes; where lactic acid bacteria, mold, and yeast play principal roles (Tamang & Thapa 2006; Das et al. 2012).

Apart from imparting colour, flavour and sweetness to the beer, the various plants used in the starter culture are also said to have many medicinal properties (Ghosh et al. 2014). The Karbi Tribe of Assam use rice beer for treatment of dysentery, cholera and pharyngitis (Teron, 2006). Manupuri also use traditionally prepared rice beer for several women disease (Singh and Singh, 2006). In Sikkim local rice beer also use by women for beauty care (Singh et al, 1999; Das et al. 2012). Also some of the plant extracts may also provide certain secondary compounds and also nutrients for the survival of the micro-flora present in the starter cakes may add its therapeutic benefit. The quality of the starter cultures said to be dependent on the variety of plant parts used and also on the maintenance of proper sanitary conditions. Moreover, excessive alcohol is injurious to health, but as these are using traditionally and part of our century old cultures which need to be assessed scientifically. Further studies on the plants used and the final product may reveal some other important properties and beneficial effects of this traditional beverage. Furthermore, the preparation and local marketing of this product serves a source of income and livelihood to many of the families living in the rural regions.

Reference:

1. Bhuyan, D. J., Barooah, M. S., Bora, S. S., & Singaravadiel, K. (2014). Biochemical and nutritional analysis of rice beer of North East India. *Indian journal of traditional knowledge*, 13(1), 142-148.
2. Calpe, C. (2006). Rice international commodity profile. Rome: Food and Agricultural Organization of the United Nations.
3. Das, A. J., Deka, S. C., & Miyaji, T. (2012). Methodology of rice beer preparation and various plant materials used in starter culture preparation by some tribal communities of North-East India: A survey. *International Food Research Journal*, 19(1).
4. Deori, C., Begum, S. S., & Mao, A. A. (2007). Ethnobotany of Sujen-A local rice beer of Deori tribe of Assam. *Indian Journal of Traditional Knowledge*, 6(1), 121-125.
5. Deka, D., & Sarma, G. C. (2010). Traditionally used herbs in the preparation of rice-beer by the Rabha tribe of Goalpara district, Assam. *Indian Journal of Traditional Knowledge*, 9(3), 459-462.
6. Ghosh, K., Maity, C., Adak, A., Halder, S. K., Jana, A., Das, A. et al. . (2014). Ethnic preparation of Haria, a rice-based fermented beverage, in the province of lateritic West Bengal, India. *Ethnobotany Research and Applications*, 12, 039-049.

7. Palaniveloo, K., & Vairappan, C. S. (2013). Biochemical properties of rice wine produced from three different starter cultures. *Journal of Tropical Biological and conservation*, 10, 31-41.
8. Saikia, B., Tag, H., & Das, A. K. (2007). Ethnobotany of foods and beverages among the rural farmers of Tai Ahom of North Lakhimpur district, Asom. *Indian J Tradit Knowl*, 6(1), 126-132.
9. Simango, C. (1997). Potential use of traditional fermented foods for weaning in Zimbabwe. *Social Science & Medicine*, 44(7), 1065-1068.
10. Singh, P. K., & Singh, K. I. (2006). Traditional alcoholic beverage, Yu of Meitei communities of Manipur. *Indian Journal of Traditional Knowledge*, 5(2), 184-190.
11. Steinkraus, K. H. (1983). Lactic acid fermentation in the production of foods from vegetables, cereals and legumes. *Antonie van Leeuwenhoek*, 49(3), 337-348.
12. Tamang, J. P., Sarkar, P. K., & Hesseltine, C. W. (1988). Traditional fermented foods and beverages of Darjeeling and Sikkim—a review. *Journal of the Science of Food and Agriculture*, 44(4), 375-385.
13. Tamang, J. P. & Thapa, S. (2006). Fermentation dynamics during production of bhaati jaanr, a traditional fermented rice beverage of the Eastern Himalayas. *Food Biotechnology*, 20(3), 251-261.
14. Tamang, J. P., Tamang, N., Thapa, S., Dewan, S., Tamang, B., Yonzan, H., et al. (2012). Microorganisms and nutritional value of ethnic fermented foods and alcoholic beverages of North East India. *Indian Journal of Traditional Knowledge*, 11(1), 7-25.
15. Tanti, B., Gurung, L., Sarma, H. K., & Buragohain, A. K. (2010). Ethnobotany of starter cultures used in alcohol fermentation by a few ethnic tribes of Northeast India. *Indian Journal of Traditional Knowledge*, 9(3), 463-466.
16. Teron, R. (2006). Hor, the traditional alcoholic beverage of the Karbi tribe of Assam. *Natural Product Radiance*, 5(5), 377-381.
17. Uchoi, D., Roy, D., Majumdar, R. K., & Debbarma, P. (2015). Diversified traditional cured food products of certain indigenous tribes of Tripura, India. *Indian Journal of Traditional Knowledge*, 14(3), 440-446.

CHAPTER: V

Traditional use of some wild edible plants by the tribes of Tripura

Introduction:

Plants are the natural industries which provide high quality food and raw materials for pharmaceutical, cosmetic and perfumery industries. On the other hand, increasing awareness of the side effects of synthetic drugs and fast food has necessitated exploration of the efficacy of pure natural products. This has led to the revival of the herbal treatments for a large number of diseases. Of all the medicine in clinical uses there are about 30% drugs derived from plants and about 80% people in the developing countries rely on traditional plant based medicine. Since, the population of the world is increasing at an alarming rate, so there is an urgent demand for food and medicines. The cope with the increasing demands for food and medicine steps are being taken to explore and populate important economic plant with established food and medicinal efficacies (Mughal et al 2000). The above mentioned plant is one of such tremendous potential plant as valuable sources of food and medicines. Despite having been in use since long, information on this plant is still scanty and fragmentary. World over, tribal population still stores a vast knowledge on the utilization of local plants as food material and other specific uses (Sundriyal et al. 1998). Documentation of knowledge on utility pattern of various natural resources by the tribal community is of immense importance for sustainable utilization, conservation and management of biodiversity. Traditionally, local communities worldwide are extremely knowledgeable about the local plant resources on which they are so intimately and immediately dependent. Unfortunately much of this knowledge is lost today, as traditional cultures are getting eroded (Hamilton 1995). Among the strategies used by the rural people to overcome food shortage is tend to depend on wild food, including wild fruits. These edible plants may greatly contribute to the diet of rural people by providing rare nutrients and facilitating survival in time of famine (Guy-Alain & Francois 2001). Such wild edible plants not only supplement the food quantity but also make significant contribution to the population's nutrition throughout the year (Ogle Britta et al. 2003). Use of large number of wild species by the tribal to meet their diverse requirements is largely due to the prevalence of diversity of vegetation in an area (Katewa 2003).

There are about 19 ethnic groups predominantly living in and around the dense forest of this state with cooperating nature, have their own language, culture, food habit and socio-religious traditions. The sustainable utilization of wild plant in daily life for food, medicine, fodder, house building, craft and agriculture is an integral part of rich tribal culture and tradition. Collection of wild plant parts for livelihood by the forest dwellers is not to sustain only their socio-economic and cultural life, but these types of minor products play a vital role to supplement the daily diet rather than generating small income by selling these in village markets.

Particularly the availability of some seasonal wild plants in the forest around their habitation not only to enhance their annual food storage or capital gain, but it is a traditional practice of seasonal gathering of nutrition and medicine. Considering this fact, an attempt has been made to document the wild edible plant resources especially which are consumed. Several works have been done on wild edible plants used by different communities in India such as Dietary uses of wild plant resources Sikkim, Himalaya. (Sundriyal et. al., 2004) ; Karbi Anglong of Assam (Kar. and Borthakur, 2007); Annamalais of Coimbatore district (Ramachandran, 2007); Meghalaya, NorthEast India (Kayang, 2007); Majuli Island and Darrang district, Assam (Baruah et. al., 2007); Traditional edible bio-resources Imphal, Manipur (Sunnanda et. al., 2010); Melghat Forest, Maharashtra (Bhogaonkar et. al. 2010); Nokrek Biosphere Reserve, Meghalaya (Bikarma et. al., 2011); Ethnobotany of western Mizoram (Lalfakzuala et. al. 2007). However, Majumdar and Datta (2009) and Deb *et al.* (2013) also documented some wild edible plants of Tripura. The present work is an attempt to document the wild edible plants consumed by the tribes of Tripura.

Table 7: Checklist of wild edible vegetable traditionally used by the tribes of Tripura

Sl. No.	Name of the plant	Family	Vernacular Name	Part(S) Used
1.	<i>Amorphophallus bulbifer</i> (Roxb) Bl.	Araceae	Dangadonga	Stem, Rhizome
2.	<i>Alpinia allughas</i> (Retz.) Roscoe	Zingiberaceae	Tara	Stem
3.	<i>Amaranthus spinosus</i> L.	Amarentaceae	Katamairah	Tender shoot
4.	<i>Brassaiopsis griffithii</i> C.B. Clarke	Araliaceae	Chapok	Flower
5.	<i>Bambusa tulda</i> Roxb.	Poaceae	Mritinga	Shoot
6.	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Talakachu	Leaf
7.	<i>Colocasia esculenta</i> (L.) Schott	Araceae	Kacu	Whole plant
8.	<i>Canavalia gladiata</i> (Jacq.) DC	Papilionaceae	Makhan Sim	Pod
9.	<i>Dendrocalamus longispathus</i> Kurz	Poaceae	Rupai	Shoot
10	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Thaborchok	Tuber
11	<i>Dioscorea hamiltonii</i> H.K	Dioscoreaceae	Thanara	Tuber
12	<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	Dhekisag	Shoots
13	<i>Euryle ferox</i> Salisb.	Nymphaeaceae	Makhna	Fruit
14	<i>Homalomena aromatica</i> Schott.	Araceae	Gandhuri	Leaf, rhizome
15	<i>Hodgsonia macrocarpa</i> (Bl). Cogn	Cucurbitaceae	Bonkomar	seed
16	<i>Ipomoea aquatica</i> Forsk.	Convolvulaceae	Kamli Sag	Leafy stem
17	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Dron	Leafy stem
18	<i>Lasia spinosa</i> (L.) Thw.	Araceae	Kaitaish	Stem
19	<i>Musa acuminata</i> Colla	Musaceae	Bonkala	Inflorescence, Xylem
20	<i>Melocana baccifera</i> Trin.	Poaceae	Muli	Shoot
21	<i>Monochoria hastate</i> (L.) Solms	Pontederiaceae	Chichiri	Whole plant
22	<i>Momordica cochinchinensis</i> (Lour.) Spreng.	Cucurbitaceae	Bonkakrol	Fruit
23	<i>Nymphaea nouchali</i> Burm. f.	Nymphaeaceae	Sefla	Stem with flower
24	<i>Neptunia prostrata</i> (Lamk.) Baill.	Fabaceae	Khorai	Whole plant
25	<i>Ocimum americanum</i> L.	Lamiaceae	Banta	Leaf
26	<i>Oroxylum indicum</i> Vent.	Bignoniaceae	Thana	Pod
27	<i>Polycarpon prostratum</i> (Forssk.) Ashers and Schweinf.	Caryophyllaceae	Gima	Whole plant
28	<i>Solanum torvum</i> Sw.	Solanaceae	Titbegun	Fruits
29	<i>Solanum surattense</i> Burm	Solanaceae	Khamka	Fruits
30	<i>Zanthoxylum limonella</i> (Dennst.)Alston	Rutaceae	Zarai	Leaves



Figure 12: Wild edible vegetables of Tripura . 1. *Diplazium esculentum* L., 2. *Hygrophila spinosa* T. Anders., 3. *Neptunia prostrata* (Lam.) Baill., 4. *Lasia spinosa* L.. 5. *Leucas aspera* (Willd.) Linn., 6. *Monochoria hastate* L., 7. *Solanum torvum* L., 8. *Dioscorea hamiltonii* Hook.f., 9. *Centella asiatica* L., 10. *Polycarpon prostratum* (Forssk.)Asch., 11. *Solanum surattense* Burm., 12. *Enhydra fluctuans* Lour.

Table 8: List of wild edible fruits traditionally used by the tribes of Tripura

Sl.No.	Name of the plant	Family	Mod eof use
1.	<i>Antidesma acidum Retzius</i>	Euphorbiaceae	The small ripe fruit is eaten as raw, acidic in taste.
2.	<i>Antidesma ghaesembilla Gaertner</i>	Euphorbiaceae	Ripe fruits eaten.
3.	<i>Artocarpus chaplasha Roxburg</i>	Moreaceae	Ripe fruits edible, pulp sweet to sour; dry seed eaten after roasting
4.	<i>Atrocarpus lakoocha Roxb.</i>	Moreaceae	Fruits are mostly eaten by children, sour in taste.
5.	<i>Baccaurea ramiflora Lour</i>	Euphorbiaceae	Fruits are edible, when ripe turns into deep brown color and sweetish in taste.
6.	<i>Bridelia retusa (L.) Juss.</i>	Euphorbiaceae	Pulp are edible, astringent
7.	<i>Bridelia stipularis (L.) Blume</i>	Euphorbiaceae	Pulp are edible, slightly sweetish to astringent
8.	<i>Calamus erectus Roxb.</i>	Arecaceae	Mesocarp of ripe fruits is eaten, sour to astringent in taste.
9.	<i>Calamus viminalis Willd</i>	Arecaceae	Ripe fruit is eaten with salts and chilly, sour in taste.
10.	<i>Crataeva religiosa Forster f.</i>	Capparaceae	Tender and mature fruits are cooked; sometimes ripe fruit is eaten raw.
11.	<i>Diospyros peregrina Guerke</i>	Ebenaceae	Ripe fruit is eaten sweet to astringent.
12.	<i>Elaeocarpus prunifolia Wallich ex Masters</i>	Elaeocarpaceae	Fruit is eaten raw, sour in taste.
13.	<i>Embllica officinalis Gaertner</i>	Euphorbiaceae	Both tender and mature frits are eaten and acidic in taste.
14.	<i>Eryoglossum rubiginosum (Roxburgh) Blume</i>	Sapindaceae	Ripe brown to black fruit is eaten, sweet in taste
15.	<i>Euryale ferox Salisbury</i>	Nymphaeaceae	Seeds are eaten raw or roasted, sometimes fruits used as vegetable
16.	<i>Ficus hispida L.f.</i>	Moreaceae	Yellow receptacle sweet to astringent
17.	<i>Ficus racemosa L.</i>	Moreaceae	Red receptacle sweet to astringent
18.	<i>Fissistigma verrucosum (Hooker f. & Thomson) Merrill</i>	Annonaceae	Only ripe fruit is eaten.
19.	<i>Flacouria indica (Burman f.) Merrill</i>	Flacourtiaceae	Ripe fruits are sweet when ripe.
20.	<i>Garcinia cowa Roxburgh</i>	Clusiaceae	Ripe yellow fruit is eaten and pulp sour in taste.
21.	<i>Garcinia lanceaefolia Roxburgh</i>	Clusiaceae	Pulp of yellow ripe fruit is eaten, acidic to sweetish in taste.
22.	<i>Garcinia paniculata Roxburgh</i>	Clusiaceae	Pulp of yellow ripe fruit is eaten, acidic to and sweet in taste.
23.	<i>Garcinia xanthochymos Hooker</i>	Clusiaceae	Pulp eaten and very sour in taste.
24.	<i>Gardenia resinifera Roth</i>	Rubiaceae	Ripe fruits are eaten raw.
25.	<i>Grewia hirsuta Vahl</i>	Tiliaceae	Ripe radish brown fruits are mostly eaten

		by children
26. <i>Grewia sapida</i> Roxburgh	Tiliaceae	Ripe fruit is eaten and astringent in taste.
27. <i>Haemotocarpus thomsonii</i> Miers	Menispermaceae	Blood red like small fruit is sweetish and eaten as raw
28. <i>Hodgsonia macrocarpa</i> (Blume) Cogniaux	Cucurbitaceae	Fresh fruit is eaten raw rarely, mostly seeds eaten after roasting, slightly sweet in taste.
29. <i>Mangifera sylvatica</i> Roxburgh	Anacardiaceae	Ripe yellow fruit are eaten raw and sour in taste
30. <i>Melastoma malabthricum</i> L.	Melastomaceae	Ripe fruit is eaten by children and sweet to astringent taste.
31. <i>Memecylon umbellatum</i> Burman f.	Melastomaceae	Seeds of ripe fruit are eaten by children.
32. <i>Meyna spinosa</i> Roxburgh	Rubiaceae	Yellow fleshy ripe fruit is eaten, slightly sweetish
33. <i>Microcos paniculata</i> L.	Tiliaceae	Small black ripe fruits are chewed by children, sweet in taste
34. <i>Micromelum integerrimum</i> (Buchanon-Hamilton ex DC.) Wright & Arnott	Rutaceae	Small orange colour ripe fruit is eaten
35. <i>Musa acuminata</i> Colla	Musaceae	Ripe fruit is eaten raw.
36. <i>Passiflora foetida</i> L.	Passifloraceae	Orange colour ripe fruit is eaten, slightly sour to sweetish.
37. <i>Parkia javanica</i> (Lamarck) Merrill	Mimosaceae	Tender fruits are rarely eaten raw, mostly used as vegetable
38. <i>Phoenix humilis</i> Royle	Arecaceae	Yellow ripe fruit is eaten raw and slightly sweetish in taste.
39. <i>Psidium guineense</i> Swartz	Myrtaceae	A mature fruit is eaten and sweetish in taste
40. <i>Sapium baccatum</i> Roxburgh	Euphorbiaceae	The pulp of black ripe fruit is eaten raw and sweetish to astringent
41. <i>Semicarpus anacardium</i> L.f.	Anacardiaceae	Roasted nuts are eaten and sweet in taste.
42. <i>Spondias pinnata</i> (L.f.) Kurz.	Anacardiaceae	Both ripe and unripe fruit is eaten raw and very sour in taste
43. <i>Sterculia indica</i> Merril	Sterculiaceae	Commonly roasted fruit is eaten, sometimes raw.
44. <i>Streblus asper</i> Loureiro	Moraceae	Yellow ripe fruit is eaten and sweetish in taste
45. <i>Syzygium cerasoides</i> (Roxburgh) Chatterjee	Myrtaceae	Ripe berry is eaten raw, sweet to astringent in taste.
46. <i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Ripe brown to black berry sweetish in taste.
47. <i>Syzygium fruticosum</i> DC.	Myrtaceae	Small berry is eaten.
48. <i>Syzygium jambos</i> (L.) Alston	Myrtaceae	Yellow ripe fruit is eaten and sweetish in taste
49. <i>Syzygium syzygioides</i> (Miqel) Merrill & Perry	Myrtaceae	Ripe globuse fruit is eaten, sweetish in taste.
50. <i>Tamarindus indica</i> L.	Caesalpiniaceae	Pericarp is eaten of both ripe and unripe fruit; dried fruit are preserved for prickles

51. <i>Terminalia bellirica</i> Gaertner	Combretaceae	Drupe is eaten raw or dried and bitter in roasted, tasteless, sometimes the inner cotyledon is eaten raw or
52. <i>Terminalia chebula</i> Retzius	Combretaceae	Both raw and dried fruit is taken and preserved, bitter in taste.
53. <i>Trapa natans</i> var. <i>bispinosa</i> (Roxburgh) Makino	Trapaceae	Seed of spiny fruit are eaten, sweetish in taste.
54. <i>Willughbeia edulis</i> Roxburgh	Apocynaceae	Flashy ripe fruit is eaten raw, sweetish in taste
55. <i>Xantolis assamica</i> (C.B. Clarke) P. Royen	Sapotaceae	Flashy ripe fruit is eaten raw
56. <i>Xeromphis spinosa</i> (Thunbergh) Keay	Rubiaceae	Fleshy berry is eaten.
57. <i>Zizyphus funiculosa</i> Buchanon-Hamilton ex Wallich	Rhamnaceae	Yellow ripe drupe is eaten, slightly sour to sweet.
58. <i>Zizyphus oenoplia</i> (L.) Miller	Rhamnaceae	Black ripe berry is sweetish in taste.
59. <i>Zizyphus rogusa</i> Lamarck	Rhamnaceae	Ripe berry is sweetish in taste.
60. <i>Zizyphus zylopyra</i> Willdenow	Rhamnaceae	Ripe fruit is eaten, sour to tasteless.

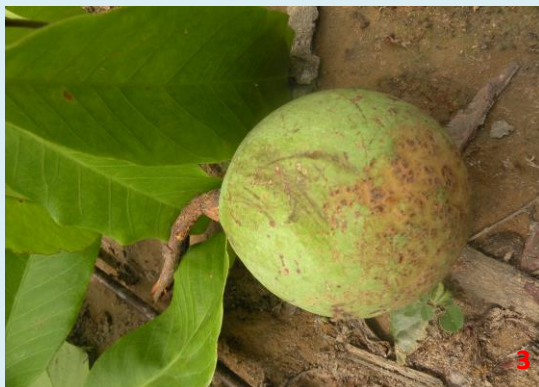


Figure 13: Some important wild edible fruit traditionally used by the forest dwellers of Tripura. 1: *Hodgsonia macrocarpa* (Blume) Cogn., 2: *Flacourtia jangomas* (Lour.) Raeusch., 3: *Willughbeia edulis* Roxb., 4: *Baccaurea sapida* (Roxb.) Müll.Arg.



Figure 14: Some wild edible fruits of Tripura. 1. *Mesua ferrea* Linn., 2. *Bridelia stipularis* (L.) Blume., 3. *Artocarpus chaplasha* Roxb., 4. *Calamus viminalis* Willd., 5. *Ziziphus funiculosa* Buch.-Ham. ex M.A.Lawson., 6. *Erioglossum edule* Blume., 7. *Terminalia chebula* Retz., 8. *Ficus roxburghii* Wall., 9. *Xantolis assamica* (C.B.Clarke) P.Royen, 10. *Garcinia cowa* Roxb.

Discursion and Conclusion:

There are 40- 100,000 plant species have been regularly used for food, fibres, shelter, industrial, cultural and medicinal purposes. However, only a small number of plants are widely used. The remaining plant diversity is underutilized in most of the tropical countries. Underutilized plants contribute immensely to family food security and serve as means of survival during times of drought, famine, shocks and risks. Wild edible fruit yielding plant are known to supplement nutritional requirements due to their better nutritional value. With alarming increase in human population and depletion of natural resources, it has been felt necessary to explore the possibility of use of new plant resources having potential for food. Many neglected and underutilized Wild edible fruit yielding plant species are nutritionally rich and till not adapted or domesticated like other food plant

in many region. While they are using by several tribe as part of their rich traditions. These species have immense nutritional value and a good option for food security in rural tribal villages. Their promotion for cultivation and enhanced use can bring better hidden nutrition and food security to the increasing population in rural area. For example, many underutilized fruits contain more vitamin C and pro-vitamin A than widely available commercial species and varieties. Moreover, these specie play a role in keeping rich ecosystem diversity associated with wildlife habits, ethnobotany, religious and social significance. Focusing attention on those species willprove an effective way to manageforest diversity and local healthy diet with rich micronutrient particularly among the rural people in developing countries.

In Tripura, diverse wild edible fruits are consumed by several tribes either raw or used to make jams and liqueurs. People in most of the remote areas sole depends on those wild vegetables and fruits. Some wild species are the most important , because those are used both as vegetable and either eaten raw. Maximum of them are grows inside the deep forest and they are very rarely cultivated. Many wild edible plants are regarded as famine food and are no longer gathered. In rural The modern rural people in Tripura may loosing this traditional knowledge especially relating to the identification, utilization and and management of those wild edible plants resources. This rich traditional knowledge are eroding slowly. Promotion of those species can play a crucial role in boosting the social importance of such resources. Moreover, the way local people perceive and use their resources plays an important role in their conservation. It is found that the collections of wild edible plants fromdeep forest were mostly done by the female members of the family. Theforest products having high demandmay be promoted for commercial production and domestication; maximum species are over exploited and may need to monitor their population trend. Present study also revealed that this traditional knowledge on wildedible plants is now mostly confined into the remote villages and they are replacing by the modern high yielding varieties. These edible plants are also part of their several cultural diets. They belief that these wild plants are not only rich innutrients but also have certain curative properties against manydiseases and disorders.

CHAPTER: VI

Concerns of the Traditional Knowledge Holders:

Listed below are the concerns as identified by the Traditional Knowledge interview process.

- Most of the traditional knowledge holder concerned about the decreasing trend of bio-resources in the area
- Short and long term effects on local bio-resources for increasing trend of rubber mono plantation.
- They are also concern about the traditional lifestyles, skill and harvesting of bio-resources from adjacent forest.
- There is no form of documentation of their traditional skill / knowledge for their future generations.
- They need financial support for plantation / small scale business/ skill development programme for promotion and upgradation of their TK
- There are also need to provide registered certification for unique TK holders /practitioners/ skilled persons for future IPR issues.
- All the success stories especially retalted to TK and conservation of bio-resoues by the tribes of our country should need to promote for greater acechivement.
- The BMC member may help in their respective region for providing both technical and financial assistance for the TK holders / villagers

Recommendations:

1. We consider that access authorization is regarded as authorization granted through the process of submitting projects, which involves providing access to genetic resources and associated traditional knowledge to governmental bodies
2. Returning and sharing information can involve participatory research and educational approaches that may require a wide approach toward acknowledging traditional knowledge and culture.
3. Now the time to recognize local IPR issues that although established, but regulations related to access to associated local traditional knowledge and biodiversity and for creating norms with certain flexibility based on local conditions.
4. The whole processes will need to function always in a homogenous manner for heterogeneous aspects of traditional knowledge in Tripura.
5. Solutions must be considered in a manner that legislation could fit both economic and social nuances for documentation, preservation, promotion and value addition.
6. It is fundamental to highlight the importance of understanding the matters related to TK and IPR issues from an ethical and moral perspective as a researcher and not only as a bureaucrats or legal administrator and obligations; because there is a demand for professionals engaged with scientific ethics and concerned with safeguarding knowledge and rights for local communities in Tripura.
7. Ensure employment and training opportunities for Old Ochai/ Kabiraj/TK holders, by which people could carry on for future careers.
8. Future BMC projects must share, in the revenues and royalties with land and resource development for the villagers.
9. Mapping of TK holders in each BMC.
10. Subsidies for constructing traditional homes gardens, botanical plot, medicinal plant growing, harvesting and marketing
11. Arrange monthly remuneration / funding to the oldest (>70 yrs) TK holders in each BMC.
12. Funding to revitalize and protect traditional secrets, knowledge/ heritage in Tripura
13. Constitute and recruit district / village /BMC level expert on Traditional Knowledge component and promotion it also in school activities.