



Indigenous knowledge of medicinal plants used by the Reang tribe of Tripura state of India



Sanjib Shil*, Manabendra Dutta Choudhury, Soumita Das

Department of Life Science, Assam University Silchar, Silchar-788011, Assam, India

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ABSTRACT

Ethnopharmacological relevance: Traditional remedies used for the treatment of various ailments are considered to be very important in the primary health care of Reang people living in Tripura state of Northeast India. Novel information gathered from the present investigation is important in preserving folk indigenous knowledge of Reang tribe.

Methods: Systematic and exhaustive field surveys were conducted during 2003 to 2004 in Reang inhabited areas of Tripura state of Northeast India covering all the seasons, to gather information on medicinal herbs used by them in the treatment of various ailments. Information was collected from 55 traditional herbalists of different age through structured questionnaires and personal observations made during the field visit. The data obtained was analyzed through informant consensus factor (F_{IC}) to determine the homogeneity of informant's knowledge on medicinal plants also the fidelity level (FL) to authenticate the uniqueness of a species to treat a particular ailment.

Results: In the present study a total of 125 medicinal plants species belonging to 116 genera and 59 families were presented, used for treating 42 different ailments. The major plant parts used are leaves and most of the remedies are suggested to take orally. The greatest parts of plants used for curing various ailments were found locally. The consensus analysis revealed that the fever and gastro-intestinal diseases have the highest informant consensus factor F_{IC} of 0.79 followed by the dermatological problems (F_{IC} 0.78). It is equal (F_{IC} 0.77) for both general health problems and inflammation and pain while urinogenital problems showed relatively low levels of consensus (F_{IC} 0.63). The level of informants' consent was high for most ailment categories indicating greater homogeneity among informants. In the present study we analyzed the disease categories to highlight some of the important plant species in terms of Fidelity level. Greater parts of the plant species achieve highest fidelity level, while only 4% acquire lower FL. The species with high citation and informant concurrence value are reasonably significant. *Cyathea*, a rare tree fern used for major cuts or wounds for immediate blood coagulation. Extensive local application may threaten the species if not judiciously managed.

Conclusion: The traditional pharmacopoeia of the Reang ethnic group incorporates a myriad of diverse flora available locally. Traditional knowledge of the remedies is passed down through oral traditions without any written document. This traditional knowledge is however, currently threatened mainly due to acculturation and deforestation. Therefore, documenting medicinal plants and associated indigenous knowledge can be used as a basis for developing management plans for conservation and sustainable use of medicinal plants of the study area. In addition, findings of this study can be used as an ethnopharmacological basis for selecting plants for future phytochemical and pharmaceutical studies.

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1. Introduction

Plants and human beings have intrinsic relationships since ancient times and were evolved along parallel lines for their existence, cooperating and depending upon each other. This intimate relationship had progressed over generations of experiences and practices.

Apart from their nutritional, ritual and magical value, plants have important contributions in the health care system of human being.

The traditional wisdom of folklore medicines that has been inherited rich in domestic recipes for common ailments. Traditional medicine encompasses protection and restoration of health over millennia. The World Health Organisation (WHO) has promoted a movement for "Saving Plants for Saving Lives"; this is because of the growing understanding of the pivotal role of medicinal plants in providing herbal remedies. According to WHO, herbal medicines serve the health needs of about 80% of

* Corresponding author. Tel.: +91 3822 2316 94; mob.: +91 940174 3630.
E-mail address: sanjib_shil@rediffmail.com (S. Shil).

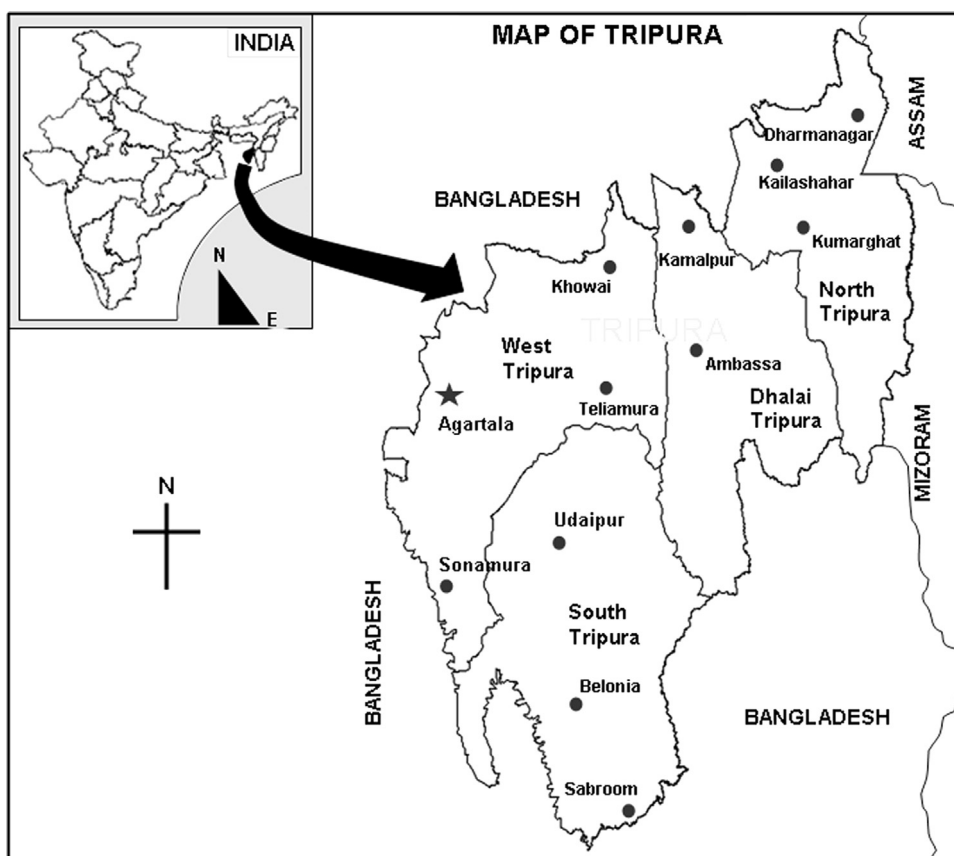


Fig. 1. Map of study area (Tripura).

the world's population, especially for millions of people in the rural areas of developing countries (WHO, 2001). The ethnobotanical studies have become increasingly valuable in the development of health care and conservation programs in different parts of the world.

The state Tripura, one of the seven sister states of North Eastern region of India, can be of very good prospects in this regard because of its unique ethnic culture and diverse vegetation. Tripura is located between 22°–56' to 24°–32' North latitude and between 90°–09' to 92°–20' East longitude. It is bounded on the North West, South and South East by Bangladesh, whereas in the East it has a common boundary with Assam and Mizoram (Fig. 1. Map of study area). Total geographical area of Tripura is 10,496 Sq. km. The forest of Tripura is divided into 2 major categories viz., evergreen forest and moist deciduous forest. Deb reported about 1600 vascular plant species from the state which constitutes almost 14% of total flora of India (Deb, 1981 and 1983).

The tribal people of Tripura have been in the practice of preserving a rich heritage of information on medicinal plants and their usage. These people have faith in their traditional system of healthcare and put it in practice. They have their own traditional physicians who use these plants as their materia medica. They have rich and outstanding traditional knowledge and wisdom regarding material for healing of commonly occurring ailments. They have both the know-how and do-how for preparing the medicine and its administration. Unfortunately, these information are not yet collected systematically and comprehensively. The tribal populations' economic power is limited but their biore-sources endowment is rich. Reang is the second most populous tribe of Tripura. Out of the 19 scheduled tribes, the Reangs mostly residing in inaccessible forest areas were recognized in the seventies by Government of India as the only Primitive Tribal Group (PTG) in Tripura. They are Austro-mongoloid in origin and

are primarily agriculturist tribe (Samanta, 1984). They mostly used to practice the Huk or Jhum cultivation. Total Reang population in the state is 165,103 and the literacy rate is 39.8% (Census of India 2001). They spoke a dialect closely related to the Austro-asiatic family of language and is locally called 'Kaubru'.

The North Eastern part of India has a sizeable tribal population; investigations on their Ethno-botanical aspects have been made so far by different research workers in the state of Assam (Sajem and Gosai, 2006), Meghalaya (Rao, 1981), Manipur (Yumnam et al., 2012), Mizoram (Lalfakzuala et al., 2007), Nagaland (Jamir et al., 2012) and Arunachal Pradesh (Khongsai et al., 2011). The present medico-botanical investigation of Tripura is found to be very insignificant in comparison to the number of tribes inhabiting the state due to inaccessibility in the dense forest area. Deb (1968) reported some medicinal plants of Tripura. Considerably very less attention has been paid by the ethno botanists for exploring the ethno-medicinal resources of the state. Some of the pioneering works conducted by a number of researchers in the state are 'Tribal drink of Tripura' by Devbarma (1976); 'medicinal plants of Tripuri tribes' by Singh et al. (1997) and 'useful weeds of Tripura' by Chakraborty (2003).

2. Materials and methods

Exhaustive field survey have been undertaken from 2003 to 2004 covering all the seasons for gathering information on each and every species useful in herbal medicine among the Reangs. Survey was conducted in different villages of North Tripura, Dhalai, West Tripura and South Tripura district of Tripura state. The information's were collected from 55 traditional practitioners (48 men and 7 women) in 29 different villages. Most of the interviewees (42) were more than 55 years old and belonging to

Table 1
Medicinal plants used by the Reang tribes of Tripura state against different ailments.

Family	Botanical name and voucher specimen no.	Local name (in Reang)	Parts used	Use/ailments treated	Preparation and application	Citation
Acanthaceae	<i>Andrographis paniculata</i> (Burm. f.) Wall. ex Nees. (AUH 1777)	Kairata	Whole plant	Small worms and stomach troubles	Decoction (I)	8
Acanthaceae	<i>Justicia adhatoda</i> L. (AUH 1680)	Asuamfang	Root and leaf	Pneumonia and cough	Decoction (I) Juice (I)	7 9
Acanthaceae	<i>Phlogacanthus thyrsoiflorus</i> (Roxb.) Ness. (AUH 1540)	Ficong	Leaf	Ear pain	Extract (E)	5
Amaranthaceae	<i>Achyranthes bidentata</i> Blume (AUH 1595)	Ultalingra	Leaf	Water born foot disease	Paste (E)	5
Amaranthaceae	<i>Amaranthus gracilis</i> Desf. (AUH 1757)	Khentamaira	Whole plant	Allergetic swelling	Paste (E)	5
Amaranthaceae	<i>Celosia argentea</i> L. (AUH 1738)	Khumcha-korma	Leaf	Fever	Decoction (I)	4
Amaranthaceae	<i>Alternanthera paronychioides</i> A. St.-Hil. (AUH 1608)	Khurmurmu	Leaf	Cut and wounds	Extract (E)	5
Annonaceae	<i>Desmos longiflorus</i> (Roxb.) Safford (AUH 1721)	Khorjun	Bark	Toothache	Gargling (E)	3
Annonaceae	<i>Goniothalamus sesquipedalis</i> (Wall.) Hook. f. and Thomson (AUH 1755)	Damnagra	Root	Leucorrhoea	Decoction (I)	2
Apocynaceae	<i>Alstonia scholaris</i> (L.) R. Br. (AUH 1559)	Chaithuang	Leaf	Stomach disorder	Extract (I)	11
Apocynaceae	<i>Chonemorpha fragrans</i> (Moon) Alston (AUH 1747)	Yiangma	Leaf	Blood coagulation	Paste (E)	4
Apocynaceae	<i>Holarrhena pubescens</i> (Buch. Ham.) Wall ex G. Don. (AUH 1685)	Kuchiamma	Bark	Dog bite	Pills (I)	7
Apocynaceae	<i>Plumeria alba</i> L. (AUH 1594)	Sichu	Bark	Stomachache	Decoction (I)	6
Apocynaceae	<i>Tabernaemontana divaricata</i> (L.) R. Br. (AUH 1788)	Khuntautai	Root bark	Toothache	Extract (E)	6
Araceae	<i>Homalomena aromatica</i> (Spreng.) Schott. (AUH 1546)	Kamaitru	Rhizome	Against white spot in eye	Decoction (I)	7
Araceae	<i>Scindapsus officinalis</i> (Roxb.) Schott. (AUH 1779)	Duleiro	Leaf	Leprosy	Extract (E)	2
Asclepiadaceae	<i>Asclepias curassavica</i> L. (AUH 1596)	Parija	Root	Blood coagulation	Paste (E)	3
Asparagaceae	<i>Cordyline fruticosa</i> (L.) A. Chev. (AUH 1588)	Chanthi	Root	Malarial fever	Pills (I)	7
Asteraceae	<i>Ageratum conyzoides</i> L. (AUH 1537)	Samnama	Leaf	Stomach disorder	Juice (I)	4
Asteraceae	<i>Blumea lanceolaria</i> (Roxb.) Druce (AUH 1618)	Musingha	Leaf	Vaginal protrusion	Curry (I)	2
Asteraceae	<i>Eclipta prostrata</i> (L.) L. Mant. (AUH 1760)	Profit	Leaf	Cut and wounds	Paste (E)	3
Asteraceae	<i>Mikania cordata</i> (Burm. f.) Robinson. (AUH 1703)	Deshmara	Leaf	Blood coagulation	Paste (E)	17
Asteraceae	<i>Sonchus brachyotus</i> DC. (AUH 1741)	Blonghamchen	Leaf	Rheumatism	Extract (I)	3
Begoniaceae	<i>Begonia thomsonii</i> A. DC. (AUH 1730)	Thaichengmokoi	Root	Diarrhoea	Decoction (I)	2
Bignoniaceae	<i>Oroxylum indicum</i> (Linn.) Vent. (AUH 1652)	Thaukharung	Bark	Eczema	Extract (E)	3
Bixaceae	<i>Cochlospermum religiosum</i> (L.) Alst. (AUH 1759)	Kenkechi	Root	Urinary infection	Decoction (I)	2
Blechnaceae	<i>Blechnum orientale</i> L. (AUH 1693)	Sikiomamoidu	Pinnae	Abscess	Decoction (E)	5
Boraginaceae	<i>Ehretia acuminata</i> R. Br. (AUH 1692)	Dusukchaoma	Leaf	Bones fracture	Paste (E)	7
Combretaceae	<i>Combretum decandrum</i> Roxb. (AUH 1605)	Kechi	Root	Malarial fever	Decoction (I)	4
Commelinaceae	<i>Amischotolype hookeri</i> (Hassk.) Hara (AUH 1739)	Msautotra	Leaf	Naval pain	Decoction (I)	3
Convolvulaceae	<i>Cuscuta reflexa</i> Roxb. (AUH 1576)	Bana1ata	Whole plant	Jaundice	Extract (I)	3
Convolvulaceae	<i>Argyrea nervosa</i> (Burm. f.) Bojer. (AUH 1743)	Konglabli	Root	Sprain	Paste (E)	5
Convolvulaceae	<i>Ipomoea aquatica</i> Forsk. (AUH 1566)	Banialochi	Stem	Fever and body ache	Juice (I)	8
Convolvulaceae	<i>Merremia umbellata</i> (Linn.) Hall. f. (AUH 1768)	Goiramrang	Leaf	Dysentery	Decoction (I)	5
Crassulaceae	<i>Kalanchoe pinnata</i> (Lam.) Pers. (AUH 1545)	Zihor	Leaf	Gall bladder stone	Juice (I)	1
Cucurbitaceae	<i>Cucumis melo</i> L. (AUH 1614)	Buthaibutlai	Seed	Fever	Paste (I)	2
Cucurbitaceae	<i>Lagenaria siceraria</i> (Molina) Standl. (AUH 1662)	Muilao	Root	Fever	Pills (I)	1
Cucurbitaceae	<i>Melothria heterophylla</i> (Lour.) Cogn. (AUH 1737)	Dupoitha	Root	Urinary troubles	Decoction (I)	4
Cucurbitaceae	<i>Momordica dioica</i> Roxb. ex Willd. (AUH 1773)	Rajakangla	Root	Fever	Paste (E)	5
Cyatheaceae	<i>Cyathea contaminans</i> (Wall. ex Hook.) Copel. (AUH 1550)	Bongreng	Young apex of the caudex	Antiseptic	Paste (E)	2
Dioscoreaceae	<i>Dioscorea bulbifera</i> L. (AUH 1603)	Rangrang	Tuber	Health tonic	Extract (I)	2
Euphorbiaceae	<i>Euphorbia hirta</i> L. (AUH 1689)	Khemychu	Leaf	Throat pain	Gargling (E)	3
Euphorbiaceae	<i>Gelonium multiflorum</i> A. Juss. (AUH 1669)	Thairungtu	Bark	Gastritis	Pills (I)	5
Euphorbiaceae	<i>Jatropha gossypifolia</i> L. (AUH 1629)	Keron	Stem	Tooth ache	Extract (E)	2
Euphorbiaceae	<i>Mallotus philippensis</i> (Lamk.) Muell. Arg. (AUH 1723)	Boltauhtu	Leaf bud	Leucorrhoea	Curry (I)	3
Flacourtiaceae	<i>Flacourtia indica</i> (Burm. f.) Merr. (AUH 1581)	Lukluki	Leaf	Carbuncle	Paste (E)	5
Gleicheniaceae	<i>Dicranopteris linearis</i> (Burm. f.) Underwood. (AUH 1597)	Muikandochla	Fronds	Throat pain	Decoction (I)	2
Hypoxidaceae	<i>Curculigo capitulata</i> (Lour.) O. Kuntze (AUH 1536)	Lairdam	Leaf bud	Cut and wounds	Paste (E)	5
Lamiaceae	<i>Prunella vulgaris</i> L. (AUH 1754)	Lamaku	Bark	Toothache	Decoction (E)	4
Lamiaceae	<i>Eusteralis stellata</i> (Lour.) Panig. (AUH 1753)	Mulomandar	Leaf	Night blindness	Paste (E)	1
Lamiaceae	<i>Mentha arvensis</i> L. (AUH 1728)	Khumbawbaw	Leaf	Asthma	Decoction (I)	3
Lamiaceae	<i>Ocimum basilicum</i> L. (AUH 1585)	Tulasisom	Leaf	Cough	Decoction (I)	9
Lamiaceae	<i>Ocimum tenuiflorum</i> L. (AUH 1574)	Tulasi	Leaf	Cough	Decoction (I)	8
Lamiaceae	<i>Callicarpa arborea</i> Roxb. (AUH 1671)	Chamathuichla	Root and bark	Leucorrhoea and gastritis	Pills (I)	2
Lamiaceae	<i>Clerodendrum paniculatum</i> L. (AUH 1539)	Boiec	Root	Typhoid	Decoction (I)	3
Lamiaceae	<i>Clerodendrum viscosum</i> Vent. (AUH 1592)	Chukraima	Leaf	Dysentery	Pills (I)	3
Lamiaceae	<i>Vitex heterophylla</i> Roxb. (AUH 1631)	Prung	Leaf	Bone fracture	Paste (E)	6
Lauraceae	<i>Cinnamomum camphora</i> (Linn.) Sieb. (AUH 1624)	Ducaphur	Bark	Cardiac problem	Decoction (I)	2
Lauraceae	<i>Litsea glutinosa</i> (Lour.) C. B. Rob. (AUH 1690)	Musafaoma	Leaf	Gonorrhoea	Paste (I)	2
Leguminosae	<i>Bauhinia variegata</i> Linn. (AUH 1627)	Blongsitakaya	Leaf	Bone fracture	Paste (E)	7
Leguminosae	<i>Caesalpinia pulcherrima</i> (L.) Sw. (AUH 1646)	Krishnochura	Root	Malarial fever	Pills (I)	3
Leguminosae	<i>Cassia fistula</i> L. (AUH 1698)	Skthuri	Fruit	Tapeworm	Decoction (I)	6
Leguminosae	<i>Crotalaria pallida</i> Ait. (AUH 1668)	Karamakakho	Leaf	Ringworm	Paste (E)	8

Table 1 (continued)

Family	Botanical name and voucher specimen no.	Local name (in Reang)	Parts used	Use/ailments treated	Preparation and application	Citation
Leguminosae	<i>Crotalaria spectabilis</i> Roth. (AUH 1697)	Skamayomakakho	Root and leaf	Health tonic and ringworm	Decoction (I) Paste (E)	4 2
Leguminosae	<i>Crotalaria verrucosa</i> L. (AUH 1681)	Skemakakho	Root	Rheumatism	Paste (I)	3
Leguminosae	<i>Codariocalyx motorius</i> (Houtt.) H. Ohashi (AUH 1752)	Turkimondon	Leaf	Health tonic	Decoction (I)	4
Leguminosae	<i>Entada rheedii</i> Spreng. (AUH 1746)	Kung	Seed	Body pain	Paste (E)	2
Leguminosae	<i>Parkia biglandulosa</i> Wight. and Arn. (AUH 1613)	Yaekre	Bark and fruit	Gastritis and indigestion	Extract (I)	4
Leguminosae	<i>Senna alata</i> (L.) Roxb. (AUH 1633)	Khaspoi	Leaf	Ringworm	Paste (E)	4
Leguminosae	<i>Teramnus labialis</i> (L. f.) Spreng. (AUH 1675)	Kircha	Leaf	Health tonic	Juice (I)	5
Magnoliaceae	<i>Michelia champaca</i> L. (AUH 1740)	Champa	Seed	Jaundice	Decoction (I)	3
Malvaceae	<i>Ceiba pentandra</i> (L.) Gaertn. (AUH 1647)	Bachumuthui	Root	Carbuncle	Paste (E)	6
Malvaceae	<i>Sida rhombifolia</i> L. (AUH 1791)	Bonisuio	Leaf	Blood coagulation	Paste (E)	4
Malvaceae	<i>Urena lobata</i> L. (AUH 1612)	Santhai	Root	Fever	Decoction (I)	2
Malvaceae	<i>Grewia nervosa</i> (Lour.) Panigr. (AUH 1694)	Lamaku	Bark	Toothache	Extract (E)	3
Malvaceae	<i>Triumfetta rhomboidea</i> Lindl. (AUH 1664)	Dumso	Root	Carbuncle	Paste (E)	4
Menispermaceae	<i>Cissampelos pareira</i> L. (AUH 1659)	Tousabachoriaha	Leaf	Bone fracture	Paste (E)	7
Menispermaceae	<i>Stephania glandulifera</i> Miers. (AUH 1695)	Thandamanik	Corms	Gastritis	Decoction (I)	5
Menispermaceae	<i>Stephania japonica</i> (Thunb.) Miers. (AUH 1726)	Tousabachoiyama	Root	Rheumatism	Pills (I)	3
Moraceae	<i>Ficus hispida</i> L. (AUH 1767)	Thaichuwathia	Hypantho-dia	Cough	Paste (I)	3
Moraceae	<i>Ficus pumila</i> L. (AUH 1598)	Dusalua	Leaf	Anti lice	Extract (E)	1
Moraceae	<i>Streblus asper</i> Lour. (AUH 1801)	Salua	Leaf	Dysentery	Juice (I)	5
Moringaceae	<i>Moringa oleifera</i> (L.) Lamk. (AUH 1649)	Sadna	Bark	Cough and cold	Decoction (I)	7
Myrsinaceae	<i>Ardisia paniculata</i> Roxb. (AUH 1666)	Siphufu	Bark	Burns	Paste (E)	5
Nyctaginaceae	<i>Mirabilis jalapa</i> L. (AUH 1780)	Khonksorui	Whole plant	Sprain	Paste (E)	4
Oleaceae	<i>Anacolosia ilicoides</i> Mast. (AUH 1720)	Musafama	Leaf	Cut and wounds	Paste (E)	6
Oleaceae	<i>Jasminum laurifolium</i> Roxb. ex. Hornem. (AUH 1722)	Mali	Leaf	Vomiting	Decoction (I)	4
Orchidaceae	<i>Cymbidium aloifolium</i> (L.) Sw. (AUH 1714)	Khelang	Aerial roots	Bone fracture	Paste (E)	8
Orchidaceae	<i>Papilionanthes teres</i> (Roxb.) Schult. (AUH 1679)	Khelang	Aerial root	Bon fracture	Paste (E)	7
Orchidaceae	<i>Rhynchostylis retusa</i> (L.) Blume (AUH 1663)	Sibraimfyry	Leaf	Pyorrhea	Gargling (E)	2
Phyllanthaceae	<i>Baccaurea ramiflora</i> Lour. (AUH 1542)	Samai	Root	Insect sting	Paste (E)	2
Piperaceae	<i>Peperomia pellucida</i> (L.) H.B.K. (AUH 1792)	Charkouma	Leaf	Wounds	Paste (E)	8
Plumbaginaceae	<i>Plumbago zeylanica</i> L. (AUH 1600)	Agunsita	Leaf	Rheumatism	Curry (I)	2
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf. (AUH 1775)	Chaimandar	Leaf	Cough and cold	Decoction (I)	5
Poaceae	<i>Phragmites karka</i> (Retz.) Trin. ex Steud. (AUH 1796)	Nusui	Leaf bud	Sprain	Paste (E)	4
Poaceae	<i>Thysanolaena maxima</i> (Roxb.) Kuntz. (AUH 1552)	Nusui	Leaf	Blood coagulation	Paste (E)	2
Polygonaceae	<i>Polygonum orientale</i> L. (AUH 1798)	Biskatali	Leaf	Cough and asthma	Extract (I)	2
Polypodiaceae	<i>Drymoglossum heterophyllum</i> (L.) Trimen (AUH 1535)	Sikitang	Pinnae	Bones fracture	Paste (E)	6
Polypodiaceae	<i>Microsorium superficiale</i> (Bl.) Ching. (AUH 1762)	Huluwukto	Rhizome	Cough and cold	Paste (I)	1
Polypodiaceae	<i>Pyrrosia adnascens</i> (Sw.) Ching (AUH 1789)	Bormondi	Rhizome	Cough and cold	Decoction (I)	3
Pontederiaceae	<i>Monochoria hastata</i> (Linn.) Solms. (AUH 1751)	Chichiri	Petiole	Health tonic	Curry (I)	2
Portulacaceae	<i>Portulaca quadrifida</i> L. (AUH 1725)	Khumchowma	Leaf	Gastritis	Decoction (I)	4
Pteridaceae	<i>Cheilanthes tenuifolia</i> (Burm. f.) Sw. (AUH 1682)	Dalamkhundruj	Fronds	Abscess	Paste (E)	5
Pteridaceae	<i>Pteris semipinnata</i> L. (AUH 1706)	Skaiumamoidu	Fronds	Carbuncle	Paste (E)	2
Putranjivaceae	<i>Drypetes assamica</i> (Hook. f.) Pax and Hoffm. (AUH 1736)	Lamaku	Bark	Toothache	Decoction (E)	1
Rubiaceae	<i>Mussaenda roxburghii</i> Hook. f. (AUH 1724)	Khurmumu	Bark	Diarrhoea	Decoction (I)	3
Rutaceae	<i>Aegle marmelos</i> (L.) Corr. (AUH 1571)	Belbli	Leaf	Fever and body pain	Decoction (I)	7
Rutaceae	<i>Clausena heptaphylla</i> (Roxb.) Wt. and Arn. (AUH 1704)	Sataukura	Fruit	Cough and asthma	Juice (I)	5
Rutaceae	<i>Murraya koenigii</i> (L.) Spreng (AUH 1778)	Santauxhi	Root	Leucorrhoea	Pills (I)	2
Sapindaceae	<i>Lepisanthes senegalensis</i> (Poir) Leenh. (AUH 1628)	Khikrakhidang	Bark and root	Stomachache and dog bite	Decoction (I) Paste (I)	2 2
Saurauaceae	<i>Saurauia roxburghii</i> Wall. (AUH 1787)	Dubaikang	Root	Leucorrhoea	Decoction (I)	3
Schizaeaceae	<i>Lygodium flexuosum</i> (L.) Sw. (AUH 1733)	Duoreng	Whole plant	Headache	Paste (E)	1
Sterculiaceae	<i>Sterculia villosa</i> Roxb. ex Sm. (AUH 1717)	Fathi	Root	Health tonic	Decoction (I)	2
Thelypteridaceae	<i>Pronephrium nudatum</i> (Roxb.) P.Chandra (AUH 1650)	Uabamthu	Pinnae	Pyorrhea	Mouthwash (E)	3
Urticaceae	<i>Boehmeria macrophylla</i> D. Don (AUH 1710)	Muithlimsu	Root	Leucorrhoea	Decoction (I)	1
Verbenaceae	<i>Lantana camara</i> L. (AUH 1696)	Khangsiniha	Leaf	High blood pressure	Extract (I)	2
Vitaceae	<i>Ampelocissus divaricata</i> (Wall. ex Laws.) Planch. (AUH 1705)	Yosrem	Leaf	Cut and wounds	Paste (E)	4
Vitaceae	<i>Cissus adnata</i> Roxb. (AUH 1712)	Khumthaili	Tubers	Carbuncle	Paste (E)	3
Vitaceae	<i>Cissus assamica</i> (Laws.) Craib. (AUH 1619)	Dudebra	Root	Carbuncle	Paste (E)	5
Zingiberaceae	<i>Alpinia nigra</i> (Gaertn.) Burt. (AUH 1672)	Thri	Rhizome	Cut and wounds	Extract (E)	2
Zingiberaceae	<i>Curcuma caesia</i> Roxb. (AUH 1643)	Karmoksom	Rhizome	Malarial fever	Pills (I)	7
Zingiberaceae	<i>Globba multiflora</i> Wall. ex Baker (AUH 1731)	Hiching	Rhizome	Hoping cough	Decoction (I)	2
Zingiberaceae	<i>Kaempferia rotunda</i> L. (AUH 1699)	Khuntowia	Tuber	Chest pain	Paste (E)	2
Zingiberaceae	<i>Zingiber cassumunar</i> Roxb. (AUH 1735)	Hiching	Rhizome	Cough and cold	Decoction (I)	8
Zingiberaceae	<i>Zingiber rubens</i> Roxb. (AUH 1790)	Brintaukru	Rhizome	Urinary infection	Paste (E)	5

Mode of application of medicine: E=External, I=Internal and AUH=Assam University Herbarium.

the families that have a strong connection with traditional agriculture (Jhum/Shifting cultivation) for supporting their daily needs. The data were collected through direct interviews with the medicine men. The interviews were registered on the note book immediately.

Methodologies as suggested by Schultes (1960, 1962); Jain (1964, 1967, 1987, and 1989; Jain and Rao (1977) and Ford (1978) have been followed during collection of information on medico-botanical aspects. Information on medicinal plants has mainly been collected from medicine men and village chief of age group 40 to 85 years. Queries have been made repeatedly, occasionally taking the help of local informant for confirmation of data on each medicinal plant.

All the plants cited by the herbalist were cross verified for authentication approaching other traditional practitioner. Therefore, the citation per species refers to the individual plant species cited by the total number of traditional practitioners undertaken in this study and is denoted by 'n'.

Plants have been collected in their flowering and fruiting stages as far as possible, from the natural habitat and serially tagged with collection numbers. Thorough observations have been made on the spot of collection of the individual plant species and recorded field data as regards location, natural habitat, distribution pattern, nature of roots or tubers, rhizomes, bulbs etc. The characteristic features of the collected plants, which cannot be observed after drying the specimen, such as colour and odour of flowers and fruits etc. were recorded on the spot.

A number of Floras and Monographs were consulted specially, Flora of British India Vol. 1–7 (Hooker, 1872–1897), Flora of Assam, Vol. 1–4 (Kanjilal et al., 1934, 1938, 1939 and 1940) and Vol. 5 (Bor, 1940), Flora of Tripura State, Vol. 1 and 2 (Deb, 1981 and 1983) along with neighbouring floras viz., Flora of Jowai, Vol. 1 and 2 (Balakrishnan, 1981 and 1983), Flora of Nongpoh (Joseph, 1982) etc. Collected specimens were identified and finally confirmed by consulting herbaria viz., Assam University Herbarium, Botanical Survey of India (Shillong). Voucher plant specimens have been deposited to Assam University Herbarium for future references.

Calculation of a consensus factor (F_{IC}) for testing homogeneity on the informant's knowledge was followed by the method provided by Trotter and Logan (1986). A consensus factor (F_{IC}) is thus calculated by the following formula

$$F_{IC} = (N_{ur} - N_t) / (N_{ur} - 1)$$

The factor provides a range of 0 to 1, where a high value acts as a good indicator for a high rate of informant consensus. N_{ur} is the number of use-reports of informants for particular illness usage, where a use-report is a single record for use of a plant mentioned by an individual, and N_t refers to the number of species used for a particular illness category for all informants. The use of "general categories" is adopted here as recommended by other ethnobotanical researchers (Heinrich, 2000; Cook, 1995). These 42 illnesses were clustered into 6 usages (dermatological diseases, fever, inflammation and pain, gastrointestinal problems, urinogenital diseases and general health problems) categories.

The fidelity level (FL), which is the ratio between the number of informants who independently suggested the use of a species for the same major purpose and the total number of informants who mentioned the plant for any use also evaluated. Fidelity level is calculated by the following formula-

$$FL(\%) = (N_p / N) \times 100$$

where N_p is the number of informants that claimed a use of a plant species to treat a particular disease and N is the number of informants that used the plants as a medicine to treat any given disease (Friedman et al., 1986).

3. Results and discussion

The present ethnobotanical survey carried out from 2003 to 2004 in four different districts of Tripura state of North East India. A total of 125 plant species has been reported by 55 Reang medicine men having potential to cure about 42 different diseases. Data of 125 medicinal plants are tabulated with the family name first in alphabetical order followed by scientific name of plants and voucher specimen number, local name, plant part(s) used, ailments treated, preparation and administration and citation/use report (Table 1).

The most prevalent ailments are fever, cough and cold, bone fracture, cut and wounds, leucorrhoea, gastritis, rheumatism, asthma, ringworm, toothache, urinary infection, dog bite, jaundice, cardiac problem, dysentery etc. Maximum number of plants reported to be used against fever (13) followed by cough and cold (12), cut and wounds (8), bone fracture (7), toothache (6), leucorrhoea (6) and gastritis (5). They have very strong knowledge of traditional therapeutics about different types of fever (pneumonia, malaria and typhoid) and severe injuries.

Out of these 59 families, the most predominant are Leguminosae (11 spp.), Lamiaceae (9 spp.), Zingiberaceae (6 spp.), Apocynaceae (5 spp.), Asteraceae (5 spp.), and Malvaceae (5 spp.) in terms of number of species used. Based on the informant consensus most frequently cited plants are *Mikania cordata* (17), *Alstonia scholaris* (11), *Justicia adhatoda* (9), *Ocimum basilicum* (9), *Andrographis paniculata* (8), *Crotalaria pallida* (8), *Cymbidium aloifolium* (8), *Ipomoea aquatica* (8), *Ocimum tenuiflorum* (8), *Peperomia pellucida* (8), *Zingiber cassumunar* (8).

In terms of percentage of plant parts used, the percentages are as follows, leaf 47.2%, root 24%, bark 12%, rhizome 6.4%, whole plant 4%, fruit 3.2%, stem 2.4%, tuber 2.4%, seed 2.4%. The modes of application of medicine are either taken internally (I) or applied externally (E), as prescribed by the herbalist.

The preparation of medicine from the raw plant materials is one of the most important processes in herbal therapies. The healers used 6 different preparative methods viz., paste (pounding), decoction (adding water and filtering with cloth), pills (making small balls of paste followed by drying), extract (extraction of liquids by maceration and adding water), juice (squeezing the juicy part), curry (cooking) and mouth wash (adding water with juicy extract). The most prevalent forms of administration of medicine are paste (37.6%), which is followed by decoctions (32.8%), extract (12.8), pills (8%), juice (5.6%), curry (4%) and gargling/mouthwash (3.2%).

It has been noted that several species of different genera are known under the same vernacular name possibly due to their same medicinal uses or similar habitat and appearance. For example, orchidaceous plant *Papilionanthes teres* and *Cymbidium aloifolium* both are known as 'Khelang' and are used in the treatment of bone fracture and bone dislocation. Reang has given a common name 'Lamaku' for *Prunella vulgaris*, *Grewia nervosa* and *Drypetes assamica* and all these three are employed in the treatment of toothache. *Phragmites karka* and *Thysanolaena maxima* are called 'Nusui' may be because of their same habitat and both the plants belonging to poaceae family. Both *Globba multiflora* and *Zingiber cassumunar* are called by Reang as 'Hiching' and are employed in the treatment of cough.

The present study indicates a high level of consensus within the Reang ethnic community. In this current work, the informant consensus of medicinal plant usage by the Reang group resulted in F_{IC} factors ranging from 0.63 to 0.79 per illness category (Table 2). The level of informants' agreement was high for most ailment categories ($F_{IC} > 0.75$) indicating greater homogeneity among informants. The consensus analysis revealed that the category fever and gastro-intestinal diseases have the highest informant

Table 2

Ethnobotanical consensus index for traditional medicinal plant use categories.

Illness category (disease and disorders)	Number of taxa (N_t)	Number of use reports (N_{ur})	Informants consensus index factor (F_{IC})
Dermatological diseases (Abscess/Carbuncle, Antiseptic/Cut and Wounds, Allergic swelling, Burns, Eczema, Leprosy, Ringworm and Water born foot disease)	24	104	0.78
Fever (including Pneumonia, Malaria and Typhoid)	13	58	0.79
Inflammation and Pain (Bone fracture, Tooth ache, Pyorrhea, Body pain, Sprain, Throat pain, Ear pain, Headache, Rheumatism and Naval pain)	30	127	0.77
Gastrointestinal problems (Gastritis and indigestion, Stomach disorder, Diarrhoea, Jaundice, Dysentery, Small worms/Tapeworm and Gall bladder stone)	20	91	0.79
Urinogenital diseases (Leucorrhoea, Gonorrhoea, Urinary infection and Vaginal protrusion)	11	28	0.63
General health problems (Cough and Cold, Health tonic, Cardiac problem, High blood pressure, Blood coagulation, Asthma, Dog bite, Anti lice, Eye disease, Insect sting, Night blindness and Vomiting)	36	151	0.77

Table 3

Fidelity Level (FL) of some interesting medicinal plants of the study area.

Sl	Botanical name	Ailments treated	Fidelity Level (FL %)
1	<i>Achyranthes bidentata</i>	Water born foot disease	100
2	<i>Aegle marmelos</i>	Fever and body pain	100
3	<i>Andrographis paniculata</i>	Stomach troubles	100
4	<i>Bauhinia variegata</i>	Bone fracture	100
5	<i>Callicarpa arborea</i>	Leucorrhoea	40
6	<i>Crotalaria spectabilis</i>	Ringworm	33.33
7	<i>Curcuma caesia</i>	Malarial fever	100
8	<i>Cuscuta reflexa</i>	Jaundice	100
9	<i>Cyathea contaminans</i>	Antiseptic	100
10	<i>Eclipta prostrata</i>	Cut and wounds	100
11	<i>Justicia adhatoda</i>	Pneumonia	43.75
12	<i>Lepisanthes senegalensis</i>	Dog bite	50
13	<i>Mikania cordata</i>	Blood coagulation	100
14	<i>Moringa oleifera</i>	Cough and cold	100
15	<i>Parkia biglandulosa</i>	Gastritis	50
16	<i>Zingiber rubens</i>	Urinary infection	100

consensus factor (F_{IC}) of 0.79 followed by the dermatological problems (F_{IC} 0.78). It is equal (F_{IC} 0.77) for both general health problems and inflammation and pain while urinogenital problems showed relatively low levels of consensus (F_{IC} 0.63). High F_{IC} value for fever and gastro-intestinal disease categories could be related to the high occurrence of such problems, in-depth knowledge management and also on the availability of plant species in the study area. The species having high citation frequency and informant agreement value are economically significant. Such species have potential to serve mankind in the future.

Fidelity level (FL) of each species also evaluated from the available information. It indicates the informants choice for each ailments and potential of the species related to the ailments as well. The fidelity value (FL) of plant species for a specific disease in the present study area varied between 30 and 100%. The majority of plant species (96%) attain highest fidelity level (i.e., FL-100%) and remaining 4% achieve lower FL. Some of the interesting species (Table 3) in the present study attain maximum fidelity level expressed by *Achyranthes bidentata*, *Aegle marmelos*, *Andrographis paniculata*, *Bauhinia variegata*, *Curcuma caesia*, *Cuscuta reflexa*, *Cyathea contaminans*, *Eclipta prostrata*, *Mikania cordata*, *Moringa oleifera* and *Zingiber rubens* indicated the absolute choice of most traditional plant practitioners for treating different types of ailments. On the other hand *Callicarpa arborea*, *Crotalaria spectabilis*, *Justicia adhatoda*, *Lepisanthes senegalensis* and *Parkia biglandulosa* attain lowest level of confidence. Along with informants claim,

increasing values of FL for a species authenticate its uniqueness to treat a particular illness.

Leaf juice of *Ageratum conyzoides* is taken orally to get cured from stomach disorder by Reangs. Whereas villagers of Sudanese community in west Java, Indonesia used to take the decoction leaf of same plant internally against lack of appetite (Roosita et al., 2008) and leaf extract used against intestinal problems by the Lepcha tribe of Sikkim, India (Pradhan and Badola, 2008). Leaf decoction of *Alstonia scholaris* and bark of *Callicarpa arborea* is taken internally to treat stomach and gastric disorders by Nagas in India (Changkija, 1999) which is also used for the same purpose by the Reangs of Tripura. Leaf paste of *Crotalaria pallida* is applied externally in skin disease by the tribals Tirunelveli hills, Tamil Nadu, India (Ayyanar and Ignacimuthu, 2004) which is also reported by Reangs for same purpose in the present work which validate the information of the present study. Leaf paste of *Achyranthes aspera* is applied externally in water born foot disease by the Reangs on the other hand decoction of leaf is taken internally by the Didayi tribe of Orissa in fever (Pattanaik et al., 2008). Leaf of *Bauhinia variegata* is applied externally in bone fracture by the Reangs whereas the Gond tribe of Madhya Pradesh uses the same in chest pain (Tiwari and Yadav, 2003). Leaf paste of *Eclipta prostrata* is used externally by the Reang people in treatment of cut and wounds while the same is used for dandruff control by different ethnic communities in Central Western Ghats of India (Bhat et al., 2013).

The paste of the caudex of *Cyathea* is applied locally on major cuts or wounds for immediate clotting of blood. To confirm Reang's claim experimental tests and chemical screening should be done immediately as all the species of *Cyathea* are in the endangered list. Wide local application may threaten the species.

4. Conclusion

The present study showed that traditional medicine, mainly involving the use of medicinal plants playing a significant role in meeting the primary healthcare needs of the Reang tribe of Tripura. Acceptance of traditional medicine as an integral part of their culture, limited access to modern health care facilities and the exuberant wealth of natural resources could be considered as the main factors for the continuation of the practice. There was no written document of traditional healing knowledge and transmission to the future generation takes place only through oral communication. The immediate and serious threat to the local medical practice in the study area seems to have come from the increasing influence of modernization, deforestation due to anthropogenic activities and migration of the younger generations to urban areas leaving a gap in the cultural beliefs and practices of

indigenous society signaling the need for serious efforts to create public awareness so that the appropriate measures are taken to conserve the suitable environments required to protect the medicinal plants in the natural ecosystems.

The prominent used parts are leaves and most of the remedies are taken orally. The majority of plants used for curing various ailments were herbs which could be attributed to their local abundance. Fresh plant materials are mostly used in the preparation of remedies indicating little practice by people to dry and store medicines for future uses. The dosage depends on the age and physical appearance of the individual whilst children's were given less than adults. Treatment was supposed to be continued for a particular time period or until recovery depending on the type of ailments treated. When patients did not show any sign of improvement after the completion of the treatment with herbal remedies, they were taken to a nearby modern health centers for further treatment by the physician.

The present study showed a high degree of agreement among interviewees especially in the categories of different types of fever, gastrointestinal problems and dermatological problems. Majority of the plant species revealed highest level of fidelity with a reasonable part as lower FL. Reason for this, possibly due to enormous importance of these groups of illness and plant species in their culture. The other reason could be the more frequent exchange of information by the herbalists on such usage categories or may be due to the abundance of species in particular.

Traditional medicinal plants were harvested mostly from natural vegetation/wild habitat followed by home gardens. It is, therefore, recommended that community need to be encouraged to cultivate medicinal plants in their home gardens through training or education. More detailed investigations need to be conducted in this area particularly in regard to conservation strategies and sustainable use of medicinal plants. Furthermore, the information generated will also be enlightened future validation through phytochemical and pharmacognostic studies, so as increasing the acceptability of plant-based remedies in human health care systems both nationally and internationally.

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