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Ethnomedicinal treesutilized by the khasitribal communities inhabiting villages in close proximity to the Indo-Bangla border (Raddcliffe line) in the Khasi Hills of Meghalaya: An overview with special reference to gastrointestinal ailments

MW anlambok Sanglyne[1], Donald H Nongkynrih[2*], Carefulness M Dirborne[1]
[1] Department of Botany, North Eastern Hill University, Shillong, Meghalaya, India
[2] Independent Researcher, North Eastern Hill University, Shillong, Meghalaya, India

Abstract
The Indo-Bangla border especially those running along the north eastern states of India are inhabited mainly by the tribal communities which belongs to different ethnic groups possessing immense knowledge on the use of plant resources surrounding them for the treatment of ailments and diseases of various kinds. The present study aim to investigate such knowledge with special reference to those involved in the treatment of gastrointestinal ailments possessed by the Khasi tribal communities along the Indian side of the Indo-Bangla border particularly in the border's plain of the Khasi Hills in the state of Meghalaya. During this investigation a total of 78 tree species belonging 41 families had been reported. The mode of usage as well as the importance of each tree species had been described in details. Two indices *viz*., Cultural Value Index (CV_e) and Practical Value Index (PV_e) of individual species belonging to families (*viz*., Fabaceae, Euphorbiaceae, Moraceae, Lauraceae, Rutaceae, Rosaceae and Anacardiaceae) with most number of ethno-species recorded was also carried out to ascertain their importance in the studied communities.

Keywords: ethnomedicinal trees, Indo-Bangla Border, cultural value index, practical value index

Introduction
Meghalaya, meaning "the abode of clouds" is one of the northeastern states of India. Meghalaya has a total covering area of 22,429 sq. KM and lies between the coordinates of 25°05' N and 26°10' N latitudes and 89°47' E and 92°47' E longitudes respectively. Meghalaya is regarded as one of the famous hill stations in India. The State is well known for its scenic beauty, steep terrains, water falls, rich biodiversity, rivers and countless tourist spots which attract thousands of nature's lovers throughout the year. In addition, the State also harbours different ethnic groups belonging to numerous tribal communities possessing immense knowledge of the used of medicinal plants surrounding them [1]. Owing to its rich diversity of floras, the state has the potential to commercialize traditionally used and scientifically proven medicinal plants which could be highly beneficial to the tribal farmers of the region [1, 2]. Meghalaya is mainly inhabited by the Khasis, Jaintias and the Garos tribal communities although other tribal groups like the Hajong, Rabha, Bodo, Miri, Koch etc. werealso present [3, 4]. The Khasis one of the dominant tribal communities of the state belongs to the Austro-Asiatic language groups which practiced and lived in matrilineal societies. In the South, Meghalaya is bordered by the country Bangladesh and shares a border line of approximately 443 KM which constitute part of the Radcliffe Line (Indo-Bangla border line)[5]. The border plains of the Khasi Hills Districts (i.e. East Khasi Hills District and South West Khasi Hills District) of Meghalaya is mainly inhabited by the Khasis tribal communities called the War (War-Khasis). These communities even though belonging to the same language group, speak different dialects. There are numerous dialects among the Khasi tribes, it has been found during this study that the inhabitants of all the study sites even though belonging to the same tribal communities, speaks different dialects and have different accent when communicated with the widely used Khasi language (ktien Sohra). Agriculture which sometimes includes 'slash and burn' methods of cultivation is the main occupation of majority of the tribal inhabitants of these villages close to the Indo-Bangla Border.

Ethno-medicine is the traditional knowledge practised by different tribal communities belonging to different ethnic groups of countless remote societies in the world using easily available naturally occurring products (eg. flora or fauna) to cure various ailments and diseases. There had been numerous concerns over the years on the survival of these ethno based knowledge throughout the world owing to modernization, modern improved medicines and technologies and improved social life style [6,7]. From a scientific stand point, plants possessed rich source of useful biologically active constituents with numerous healing and medicinal properties *viz*., antimicrobial, antidepressant, antidiabetic, anticancer etc. [8,9]. Today, more that 50% of the world's modern reliable drugs came from plants or are products with plant origin [10]. Earlier studies had reported that in India, around 65% of the total population are still dependent on traditional medicines and on local healers for their primary health care [11].

Therefore, owing to their susceptibility to modernization and the possibility that they could forever be lost with time, it became necessary to document and study indigenous knowledge possessed by tribal communities in India. In addition, these knowledge of medicinal plants possessed by ethnic groups belonging to different tribal communities could also very much serve as a source of future life-saving

drugs, cancer curing drugs, genetic diseases drugs etc. [12, 13]. Keeping this in mind, the present study was conducted with a sole objective to document knowledge of medicinal plants possessed by traditional healers and tribal inhabitants of villages closed to the Indo-Bangla border which in a sense have a different kind of life style compared to villages that are more ahead in terms of development or those that were closed to the state's capital city Shillong.

Materials and Methods

Study Sites

The study was carried out in 7 villages mainly inhabited by the Khasi tribal communities on the Indian side along the Indo-Bangla border situated in the state of Meghalaya *viz*., Mustoh, Shella, Nongtrai, Lawbah, Sohbar, Balat and Ranikor respectively (Fig 1).

The people residing in these villages are mostly of the Khasitribal communities called "War" (War-Khasis) which are matrilineal societies, belonging to the Austro-Asiatic language group. Agriculture is the main source of income for people inhabiting these villages whereby it has been found that almost 80% of their annual income came from agro-based businesses and the trading of economically important agricultural crops grown in the mountainous terrains in the foothills of the East Khasi Hills and the South West Khasi Hills District of Meghalaya.

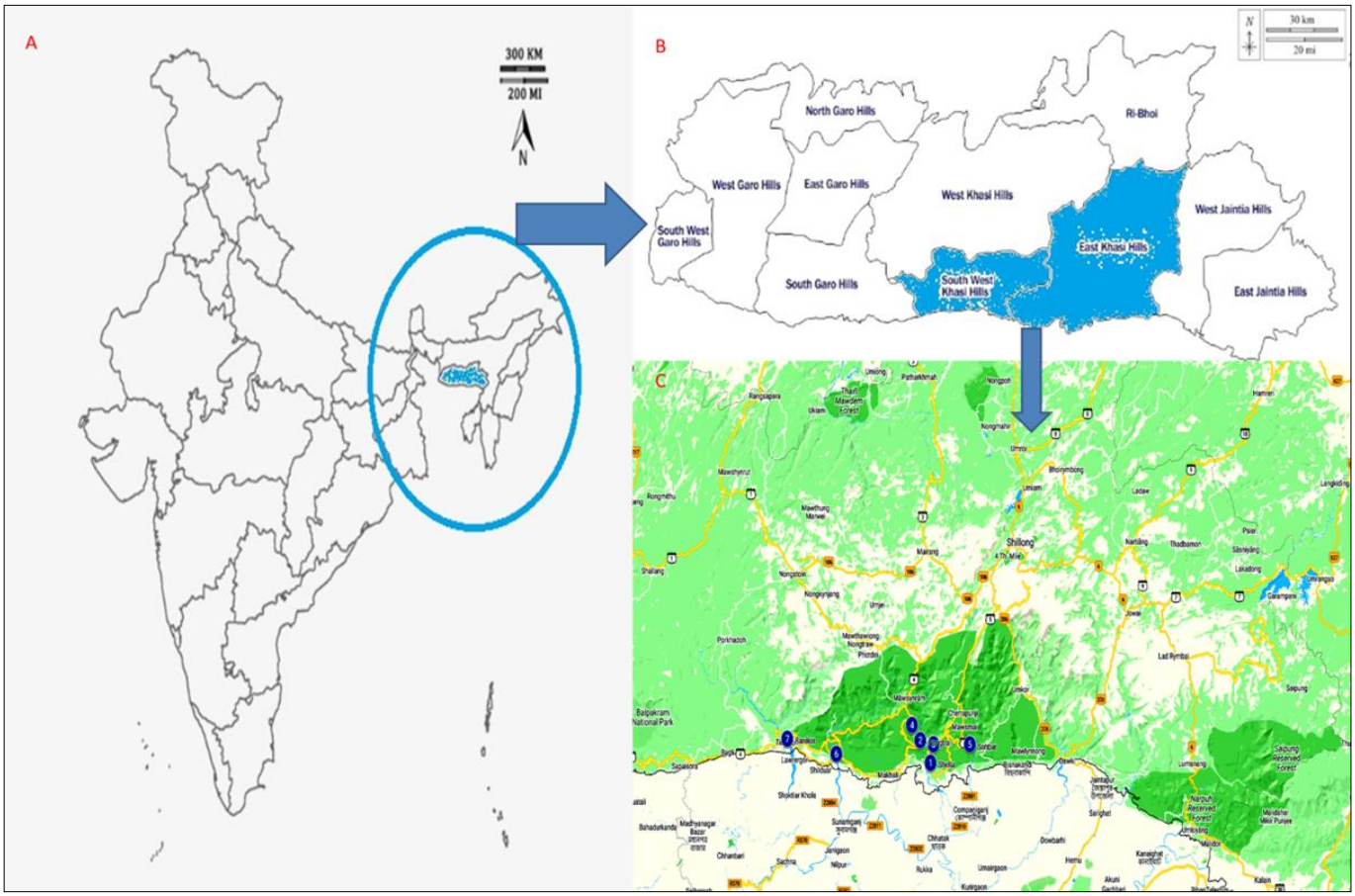

Fig 1: Geographical location of the study sites A: Map of India showing the state of Meghalaya in which the study was conducted B: Map of Meghalaya showing the two districts (i.e. East Khasi Hills and South West Khasi Hills District) in which the study was conducted C:Geographical location of the study sites (1:Shella; 2:Nongtrai;3:Mustoh;4:Lawbah;5:Sohbar;6:Balat;7:Ranikor;)

Collection of Data

Studies in these 7 villages were conducted during the month of July 2019 to March 2020. Through survey and interview with the local inhabitants who had traditional knowledge, the ethno-medicinal information about several plants was recorded. The inhabitants includes traditional medical healers, that mostly relies on local markets and forest products, aged people (>30 and 90+), and people who were willing to share their traditional knowledge, acquired by virtue of ancestral knowledge or past experiences all of which permanently resides in these study areas. A detailed list of tree species, their vernacular names, their family, parts used, illness/diseases associated, composition and dosage were also recorded. During the survey, photographs and recorded specimens were collected to ensure correct and proper identification of species. Identifications of correct scientific names was determined with the help of existing standard literature *viz*., Flora of Tripura, Flora of Assam, Forest Flora of Meghalaya and several other e-floras[14,15,16,17,18,19,20]. The resulting identification was later confirmed with BSI, Shillong, Meghalaya.

Statistical Analysis

The collected data were put systematically with information such as botanical name, local name, family, parts used and ethno medicinal uses attributed to each species in MS Excel spread sheets.

Ethnobotanical Indices

In order to find out the cultural and practical importance of recorded tree species belonging to families with most number of taxa used, and to assess the homogeneity in the

information gathered, two Indices were used and recorded data were calculated accordingly. The indices that were used in this study were given below [21]:

Cultural Index Value (CV_e)
Cultural value Index is given by the following formula:

$CV_e = Uc_e * Ic_e * \Sigma IUc_e$

Where,

$$UC_e = \frac{Number\ of\ uses\ reported\ for\ an\ ethnospecies}{\text{Total number of used categories}}$$

$$Ic_e = \frac{Number\ of\ participants\ who\ listed\ a\ species\ as\ important}{Total\ number\ of\ participants}$$

$$\Sigma IUc_e = \frac{Number\ of\ participants\ who\ mentioned\ each\ used\ (category)\ for\ the\ ethnospecies}{Total\ number\ of\ participants}$$

Practical Value Index (PV_e)
Practical Value Index is given by the following formula:

$PV_e = Up_e * Ip_e * DUp_e$

Where,

$$Up_e = \frac{Number\ of\ uses\ reported\ for\ an\ ethno\ species}{Total\ number\ of\ used\ categories}$$

$$Ip_e = \frac{Number\ of\ times\ an\ ethno\ species\ was\ brought\ to\ the\ house\ for\ used}{Total\ number\ of\ participants\ in\ scan\ observation}$$

DUpe = an assignment of duration of used for each items brought to the household

Where,
CV_e and $PV_e$is the Cultural Index Value, Practical Index Value of an ethno species respectively
(* = multiplication)
According to Reyes-García *et al.* [21], the Cultural Value Index and the Practical Value Index should have a minimum value of 0 and a maximum value not exceeding 20.3 and 25.2 respectively.

Result and Discussion
A total of 917 informants belonging to 7 villages of age groups from 30 to 90 and above were interviewed during the course of this study. Of these, 466 were male informants and 451 were females. The highest number of informants belongs to the 30-40 age groups with 244 contributions while only 15 informants participated from the 90 and above category (Table1). Coming to the educational status of these informants, out of 917, 611 of them were illiterate with no known educational qualifications or were dropped outs before reaching primary education, 129 had successfully finished their primary education, 95 informants finished secondary education, 69 finished higher secondary education and 13 informants possessed a College's degree (Table 2). During this investigation, a total of 9 diseases or ailments categories were recorded {(*viz*., Antidote, Oncological diseases, Cardiovascular diseases, Worm infestations, External injury and bleeding, Gastrointestinal ailments, Mucoloskeletal and bone fractures, Respiratory ailments and others (symptoms or diseases that could not be group under any known medical terms for diseases categories)}. Based on these categories of diseases/ailments, 673 informants reported the used of 55 taxa in the treatments of Gastrointestinal diseases/ailments which is the highest number of used reports by informants and the largest number of taxa employed, while only 11 informants, all of which reported the use of a single genus in the treatment of tumour/cancer which falls under the grouping of oncological diseases category (Table 3, Fig 2).
During the course of this investigation, a total of 78 tree species belonging to 41 families (*viz*., Abietaceaae, Acanthaceae, Anacardiaceae, Apocyanaceae, Arecaceae, Berberidiaceae, Betulaceae, Bignoniaceae, Bombacaceae, Boraginaceae, Burseraceae, Cesalpinaceae, Caprifoliaceae, Clusiaceae, Dilleniaceae, Dipterocarpaceae, Elaegnaceae, Ericaceae, Euphorbiaceae, Fabaceae, Fagaceae, Flacourtiaceae, Juglandaceae, Lauraceae, Lythraceae, Meliaceae, Mimosaceae, Moraceae, Myricaceae, Myrtaceae, Oleaceae, Papilionaceae, Plumbaginaceae, Rhamnaceae, Rosaceae, Rubiaceae, Rutaceae, Sapindaceae, Taxaceae, Theaceae and Verbenaceae) had been reported to be used in ethnomedicine for the treatments of various diseases and ailments which falls under the above mentioned categories. Of the above mentioned families, Rutaceae has the highest (8) number of taxa that are being used as ethnomedicines followed by Moraceae with 6 number of taxa, Euphorbiaceae with 5 numbers of taxa being used, Anacardiaceae and Lauraceae with 4 number of taxa, followed by Fabaceae and Rosaceae with 3 number of taxa and so on. Of these 78 tree species which belongs to 41 families, 44 are wild trees, 26 are both wild and cultivated and only 8 were cultivated tree species. Moreover out of the 78 tree species, 72 are Eudicots, 3 are Magnolids, 2 are Gymnosperm and only one taxa belongs to the Gymnosperm classification (Table 4, Fig 3).
Assessment of Cultural Value Index (CV_e) and Practical Value ((PV_e)) index of species belonging to the above 7 families with more number of species selected after data analysis revealed that, Cultural Value Index (CV_e) was maximum (20.045) for *Artocarpusheterophyllus* Lam. which belongs to the family Moraceaeindicationg that from a cultural stand point, the species is very important. Again, Cultural value Index (CV_e) was minimum (0.006) for *Antidesmabunius*(L.) Spreng which belongs to the family Euphorbiaceae suggesting that this species was not so important from a cultural point of view. On the other hands, Practical Value Index (PV_e) was maximum (22.349) for *Ficusbenghalensis*(L.) indicating that the species were more practically used compared to the rest of the species assessed. Similarly Practical Value Index (PV_e) was minimum (0.952) for *Cassia fistula* (L) belonging to the family Fabaceae suggesting that its practical used is lesser preferred (Table 5, Fig 4).
Traditional healers and knowledge of traditional medicines plays a very significant role in the primary health care of tribal communities inhabiting remote areas with no easy

accessibility to modern means of communication, treatments and medicines[22]. The same can be said to the tribal inhabitants of these border villages which possessed immense knowledge on the use of medicinal plants surrounding them. It has been found that this knowledge of medicinal plants that these tribal inhabitants possesses, enabled them to make crude extracts that can be used for the treatment of something as simple as a mild fever to something as complicated as a tumour. It has been found through this study that administration of these traditional extracts was most of the time accompanied with traditional belief prayers and rituals. The present study confirmed earlier reports that tribal communities, local practitioners, inhabitants and individual do possessed a substantial knowledge of the use of medicinal plants in the treatment of various diseases and ailments [23]. The high cultural value Index exhibited by *Artocarpusheterophyllus*Lam. could be due to the facts that the roots, barks, fruits, seeds and leaves of this tree species was used often in tribal rituals, incantations, believes and even eaten with the presumption that their local deities would remove sicknesses and provide lasting peace and prosperity.

Ficusbenghalensis (L) on the other hand, because of its usefulness in tribal belief to cure diarrhoea which is a common ailment in their communities has been used more often than others. This would explain its high Practical Index Value. Earlier studies had shown that younger generation of tribal villages/societies lacks or have only limited knowledge on the use of medicinal plants for the treatment of ailments and diseases which also holds true in this investigation [24].

This trend however, should not be encourage and younger folks should be made aware of the usefulness and effectiveness of these tribal remedies and should be train in this area so that knowledge of medicinal plants and the local art of curing diseases and ailments of various types using readily available natural resources can be preserve for future generation and the days to come.

Table 1: Age and gender distribution of 917 traditional Informants.

Age Group	Gender		Total respondents	Percentage (%)
	Male	Female		
30-40	125	119	244	26.61
41-50	114	109	223	24.32
51-60	105	101	206	22.47
61-70	64	56	120	13.09
71-80	42	31	73	7.96
81-90	11	25	36	3.92
90>	5	10	15	1.63
Total	466	451	917	100 %

Table 2: Educational levels of the 917 traditional informants.

Educational levels	Number of individuals	Percentage (%)
Illiterate	611	66.63
Primary	129	14.07
Secondary	95	10.36
Higher secondary	69	7.52
College	13	1.42
University	-	-
Total	917	100%

Table 3: Recorded diseases/ailments categories, number of used reports for each category and the number of taxa recorded to have been used for each of the category.

Ailments/ Diseases categories	Number of used reports (out of 917 participants)	Number of taxa
Antidote	24	1
Oncological diseases	11	1
Cardiovascular diseases	16	2
Worm infestation	5	1
External injury and bleeding	82	2
Gastrointestinal	673	55
Mucoloskeletal and bone fracture	318	7
Respiratory ailments	19	2
Others	454	13

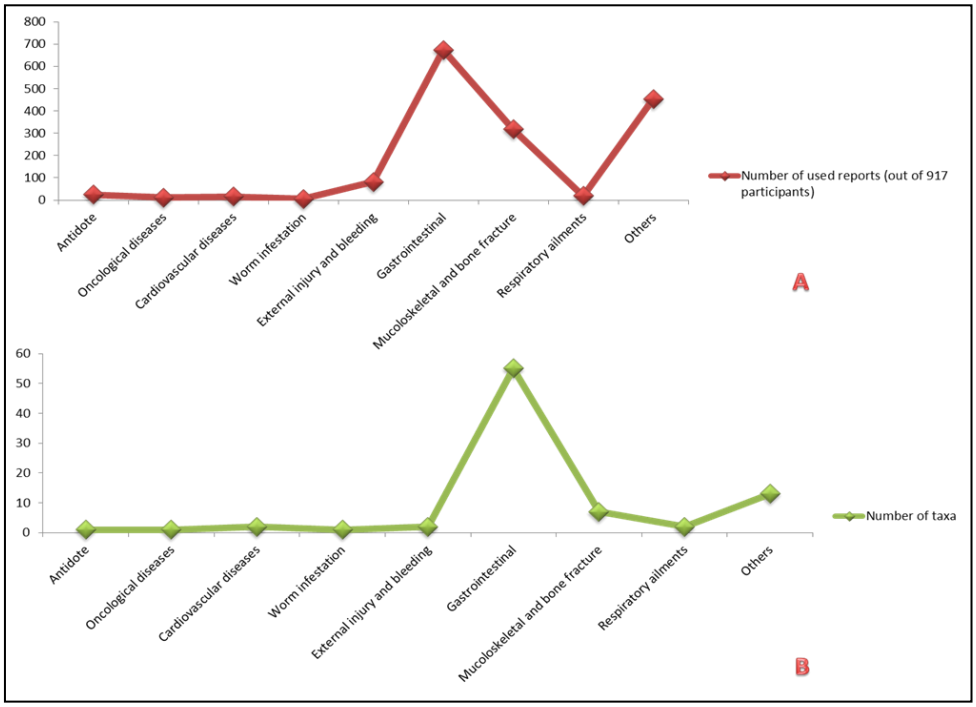

Fig 2: Graphical representation showing (A): ranges of number of used reports (out of 917 informants) across 9 ailments/diseases categories (B): ranges of number of taxa used across each of the category.

Table 4: Medicinal tree species used by the Khasi and War tribal communities along the Indo-Bangla border in the Khasi Hills of Meghalaya.

Sl. No.	Scientific name	Local name	Family	Cultivation status	Classification	Parts used	Mode of utilisation & Diseases Associated
1.	*Adenantherapavonina*(L)	Dieng Thing	Fabaceae	Wild	Eudicots	Bark, stem, heartwood	Bark, Stem, Heartwood is use in dysentery
2.	*Aeglemarmelos* (L.) Correa	Diengsohbel	Rutaceae	Wild and cultivated	Eudicots	Bark	Bark is use in gastric problem and dysentery
3	*Aesculusassamica*Griff.	DiengDula	Sapindaceae	Wild	Eudicots	Roots, Leaves, Bark	Roots, Leaves, Bark is use in dysentery
4	*Agapetesvariegata*(Roxb) D. Don ex G. Don	Diengsohhalamut, Diengsohjalamut	Ericaceae	Wild	Eudicots	Flowers	Eaten raw, help relief stress and abdominal constipation
5	*Albiziachinensis*(Osb)	Diengphallut	Mimosaceae	Wild	Eudicots	Bark, roots, leaves	Bark,roots,leaves areuse for decoction for dysentry and diarrheaoea.
6	*Alnusnepalensis*D.Don	Diengsam	Betulaceae	Wild and cultivated	Eudicots	Bark	Paste applied to areas of bone fractured
7	*Alstoniascholaris* (L)R.Br.	Diengryteng	Apocynaceae	Wild	Eudicots	Bark	Juice obtained from bark is use to relieve dysentery and gastrointestinal problems
8	*Antidesmabunius*(L.) Spreng	Sohsyllai	Euphorbiaceae	Wild and cultivated	Eudicots	Leaves	Boiled and applied to areas of pains in the joints
9	*Areca catechu* L.	Kwai	Arecaceae	Wild and cultivated	Monocots	Nut	Used with *Piper beetle* leaves and lime then applied to cuts
10	*Artocarpusheterophyllus*Lam.	SohPhan	Moraceae	Wild and cultivated	Eudicots	Seeds	Boiled crushed and eaten in case of fever
11	*Azadirachtaindica* (A.Juss)	Diengnim	Meliaceaae	Wild and Cultivated	Eudicots	Leaves	Extracts of boiled leaves are used for diarrhoea and dysentery.
12	*Baccaurearamiflora*Lour.	Sohmyndong	Euphorbiaceae	Wild and cultivated	Eudicots	Fruits	Eaten raw known to ease stomach discomfort
13	*Bauhinia variegata*(L.)	Dieng Tharlong	Caesalpiniaceae	Wild	Eudicots	Flowers	Flowers are boiled and eaten for piles for dysentery.
14	*Berberiswallichiana* (DC)	Diengniangmat	Berberidaceae	Wild	Eudicots	Young twigs and leaves	Decoction of young twigs mixed with leaf juice for fever.
15	*Betulaalnoides* (Buch Ham)	Dienglieng	Betulaceae	Wild	Eudicots	Root	Root extract is given for indigestion and flatulence.
16	*Bombaxceiba*(L)	Diengkymphad	Bombacaceae	Wild	Eudicots	Leaves	Leaves is use for diarrheae
17	*Callicarpaarborea* (Roxb)	Dienglakhiot	Verbenaceae	Wild	Eudicots	Leaf, bark and stem	Leaf, stem and bark and leaf juice use in gastric
18	*Cassia fistula* (L)	Diengmaroi	Fabaceae	Wild and cultivated	Eudicots	Bark	Bark is use for stomach pain
19	*Castanopsisindica* (Roxb. ex Lindl.) A.DC.	Soh-otrit/diengsohstap	Fagaceae	Wild	Eudicots	Nuts	Eaten raw or crushed with honey for stomach ache
20	*Cinnamomum pauciflorum*(Nees)	Diengtarthia	Lauraceae	Wild and cultivated	Magnolids	Shoots	Extract of bark and young shoots, is use for dysentry and diarrheaoea
21	*Cinnamomumtamala.* (Nees&Eberm.)	DiengLatyrpad	Lauraceae	Wild and cultivated	Magnolids	Leaves	Leaf extract which is aromatic in odor is used to treat diarrhea.
22	*Citrus assamensis*R.M. Dutta& Bhattacharya	Sohsying	Rutaceae	Wild and cultivated	Eudicots	Fruits and leaves	Juice used for fever, boiled water with leaves used for bath during fever

23	*Citrus latipes*(Swingle)Yu. Tanaka	Sohmongor, sohkymphor	Rutaceae	Wild and cultivated	Eudicots	Fruits and leaves	Juice used for fever, boiled water with leaves used for bath during fever
24	*Citrus macroptera* (Montrouz)	Sohkwid	Rutaceae	Wild and cultivated	Eudicots	Fruits, leaves	Juice used for fever, boiled water with leaves used for bath during fever
25	*Citrus medica* L.	Sohmad	Rutaceae	Wild and cultivated	Eudicots	Fruits and leaves	Juice used for fever, boiled water with leaves used for bath during fever
26	*Citrus reticulata*Blanco (*Citrus reticulata*cv. Khasi Mandarin)	Soh-niamtra, Sohumkdait, Soh-syiem	Rutaceae	Wild and cultivated	Eudicots	Fruits and leaves	Juice used for fever, boiled water with leaves used for bath during fever
27	*Citrus sinensis* (L.) Osbeck	Sohnairiang, sohmosambi	Rutaceae	Wild and cultivated	Eudicots	Fruits and leaves	Juice used for fever, boiled water with leaves used for bath during fever
28	*Cordiadichotoma* (G.Forst)	Dieng Mong	Boraginaceae,	Wild	Eudicots	Bark, fruits and leaves	Bark, Leaves, Fruit is use in dysentry
29	*Dilleniaindica*(Linn)	Dieng-soh-karbam	Dilleniaceae	Wild	Eudicots	Bark and leaves	Bark, leaves is use in dysentery and diarrheoea
30	*Dilleniapentagyna* (Roxb)	DiengSohbar	Boraginaceae	Wild	Eudicots	Fruits and leaves	Fruits, Leaves is use in dysentry
31	*Docyniaindica* (Wallich)	Diengsohphohbtet	Rosaceae	Wild	Eudicots	Leaves	Leaves are use in dysentery and diarrhoea
32	*Elaeagnuscaudata*Schltdl. Ex Momiy	Sohshang	Elaeagnaceae	Cultivated	Eudicots	Fruits	Eaten raw or squeezed into juice, used during common cold
33	*Emblicaofficinalis* L.	Sohmylleng	Euphorbiaceae	Wild and cultivated	Eudicots	Fruits	Juice is prepare and consume directly, blood pressure and constipation
34	*Engelhardtiaspicata* (Lesch.ex.Blume)	DiengIyba	Juglandaceae	Wild	Eudicots	Inflorescence and young leaves	A fine paste made from inflorescence and young leaves is use on dysentery and diarrheoea
35	*Erythrinaarborescens*(Roxb)	Dieng-song	Papilionaceae	Wild and cultivated	Eudicots	Leaves	The leaves are made into paste and use for gastric problem.
36	*Eucalyptus citriodora*(Hook.) K.D. Hill &L.A.S.Johnson	KynbatTyrphin	Myrtaceae	Wild	Eudicots	Leaves	Made into paste, Food poisoning
37	*Ficusbenghalensis* (L)	Diengjri	Moraceae	Wild	Eudicots	Leaves	Powdered leaves mixed with curd and used for treatment of diarrhea.
38	*Ficuselastica*Roxb ex. Hornem	Dieng-jri	Moraceae	Wild	Eudicots	Leaves	Fried with oil, Ointment is apply for the treatment of body pain, paralysis.
39	*Ficushispida*(L.f.)	Dienglapong	Moraceae	Wild	Eudicots	Roots	Root is use in dysentery
40	*Garciniacowa* (Roxb)	Diengsohlongksan	Clusiaceae	Wild and cultivated	Eudicots	Fruits	Acidic fruits are use to cure dysentery and stomach troubles
41	*Garciniapedunculata*Roxb. exBuch.-Ham.		Clusiaceae	Wild and cultivated	Eudicots	Fruits and leaves	Eaten raw and made into a paste, Gastric, Rheumatism
42	*Garugapinnata*(Roxb)	Diengkhiang	Burseraceae	Wild	Eudicots	Fruits	Fruit juice,stem juice is given for indigestion,
43	*Gynocardiaodorata*R.Br.	Sohliang, Soh ling	Flacourtiaceae	Wild and cultivated	Eudicots	seeds	Made into a paste and applied for Leprosy, Rheumatism
44	*Holharhennaantidysenterica* (L.) Wall. Ex A. DC.	DiengJamew	Apocynaceae	Wild	Eudicots	Bark	Bark is use in dysentery and diarrhoea

45	*Jatrophacurcas* (L)	Dieng song dkhar	Euphorbiaceae	Wild	Eudicots	Leaves	Leaf juice is use in the treatment of diarrhoea and stem juice is use in the treatment of dysentery.
46	*Justiciagendarussa* Burm.f.	Diengnili	Acanthaceae	Wild	Eudicots	Leaves	It is use in dysentery when blood appear in stool.
47	*Lagerstroemia speciosa* (L. Pers)	Diengther	Lythraceae	Wild	Eudicots	Bark, Root	Bark, root is use in dysentry
48	*Ligustrumlucidum*D. Don		Oleaceae	Wild	Eudicots	Fruits and bark	Made into a paste for Bones injuries/bone fracture
49	*Litchi chinensis* (Sonn. T)	Diengsohmanir	Sapindaceae	Wild and cultivated	Eudicots	Bark, Root, Seeds	Bark, Root, Seed is use for dysentery and diarrhoea
50	*Litseakhasyana*(Meissn)	Diengmosu	Lauraceae	Wild	Eudicots	Roots	Powdered roots along with *Piper nigrum* and sugar candy is given for chronic dysentery
51	*Litseaglutinosa* (Lour)C.B.Rob	Diengja–lowan	Lauraceae	Wild	Magnolids	Bark and leaves	Decoction of bark and leaves is taken orally in the treatment of dysentery.
52	*Mangiferaindica* (L)	DiengSohpieng	Anacardiaceae	Cultivated	Eudicots	Bark	Bark is made into thin paste and use for stomach disorder
53	*Mallotusphilippensis* (Lam.)Muell.Arg	Dieng Chandan	Euphorbiaceae	Wild	Eudicots	Fruits	Powdered fruits with little sugar are given for tapeworm infestations.
54	*Meliaazedarach* (L)	Diengja Rasang	Meliaceae	Wild	Eudicots	Bark	Barks is used for dysentry and diarrhea
55	*Meynalaxiflora*Robyns	Sohmon, Sohmyren	Rubiaceae	Cultivated	Eudicots	Fruits	Eaten raw or after incubation in raw rice, Diarrhoea, gastric
56	*Morusnigra*(L)	Sohlangdkhur, Sohlyngdkhur	Moraceae	Wild	Eudicots	Fruits	Eaten raw, Lower body temperature
57	*Myricaesculenta* Buch.-Ham. ex D.Don	Diengsohphie	Myricaceae	Wild	Eudicots	Fruits	Stomach ache, Diarrhoea
58	*Myricanagi*Thunb.	Diengsohphienam, Diengsohphierit, Diengsohphei	Myricaceae	Wild	Eudicots	Fruits	Stomach ache, Diarrhoea
59	*Oroxylumindicum* (L.) Benth Ex Kurz	Diengtit-kong-ling	Bignoniaceae	Wild	Eudicots	Roots bark	Root bark juice is taken orally two to three times daily to control diarrhea and dysentery.
60	*Pinuskeysiya*Royle ex Gordon	DiengKysi, Diengkseh, Diengksehrit	Abietaceae	Wild	Gymnosperm	Young shoots	Made into a paste help Relieve cough in children
61	*Plumbagozeylanica (L)*	Diengshitu	Plumbaginaceae	Wild	Eudicots	Root Bark	Root bark decoction is taken orally 2-3 times daily to treatdiarrhea.
62	*Prunusnepaulensis* Ser.	DiengSohjong, Diengsohiong	Rosaceae	Cultivated	Eudicots	Fruits	Eaten raw, Blood pressure, Fever
63	*Psidiumguajava*L.	Sohpri-am, Sohpyram	Myrtaceae	Cultivated	Eudicots	Leaves	Made into paste for chronic dysentery
64	*Quercus semicarpifolia* (Sm)	DiengShahdngiem	Fagaceae	Wild	Eudicots	Bark	Bark is use in Chronic Diarrhoea and Dysentry
65	*Rhussemialata* (Murr)	Dieng Sohma,	Anacardiaceae	Wild and cultivated	Eudicots	Fruits	Ripe fruits are either boiled or eaten raw to relieve diarrhea and dysentery.
66	*Rhus succedanea* (L.) Kuntze	Dieng-Khlaw	Anacardiaceae	Wild and cultivated	Eudicots	Bark	Bark is used for the treatment of diarrhea
67	*Rosa indica*(L)	Diengtiewjainheh	Rosaceae	Cultivated	Eudicots	Seeds	Seed powder mix with water and is use in the treatment of dysentry
68	*Schimawallichii*(Choisy)	Diengngan	Theaceae	Wild	Eudicots	Young leaves	Young leaves are boiled; the solution is

							taken to cure dysentry.
69	*Shorearobusta*(Roth)	DiengBlei	Dipterocarpaceae	Wild and cultivated	Eudicots	Bark and Stem	Bark and stem is use for Dysentery
70	*Spondiaspinnata* (L.f.) Kurz	Diengsohpien	Anacardiaceae	Wild	Eudicots	Bark	Bark is used for the treatment of diarrhea and dysentry.
71	*Stereospermumchelenoides* DC.	Dieng sir	Bignoniaceae	Wild	Eudicots	Leaves	Leaves is use for the treatment of Cholera,
72	*Streblusasper* (Lour)	DiengSohKhyrdang	Moraceae	Wild	Eudicots	Bark	Bark is use for dysentry
73	*Tamarindusindica*L.	Diengsohkyntoi	Fabaceae	Cultivated	Eudicots	Leaves, flowers	Boiled and eaten for flatulence
74	*Taxusbaccata* Linn	DiengksehBlei, SohBlei	Taxaceae	Wild	Gymnosperm	Leaves	Made into paste for tumour and gastric
75	*Viburnum foetidum*Wall.	SohlangJa, Diengsohlang	Caprifoliaceae	Wild	Eudicots	Fruits	Eaten raw during high fever
76	*Viburnum odoratissimum*Ker Gawl.	Diengsohlangeitksew, sohlangkthang	Caprifoliaceae	Wild	Eudicots	Fruits	Made into a paste and applied to cuts and wounds, Eaten raw during high fever
77	*Zanthoxylumarmatum*DC	Jaiur	Rutaceae	Wild and cultivated	Eudicots	Leaves and seeds	Made into a paste or eaten raw for Stomach disorder and as insecticides
78	*Ziziphusjujuba* Mill.	Diengsohbroi	Rhamnaceae	Cultivated	Eudicots	Leaves	Leaf juice mix with a little salt is use in the treatment of dysentery.

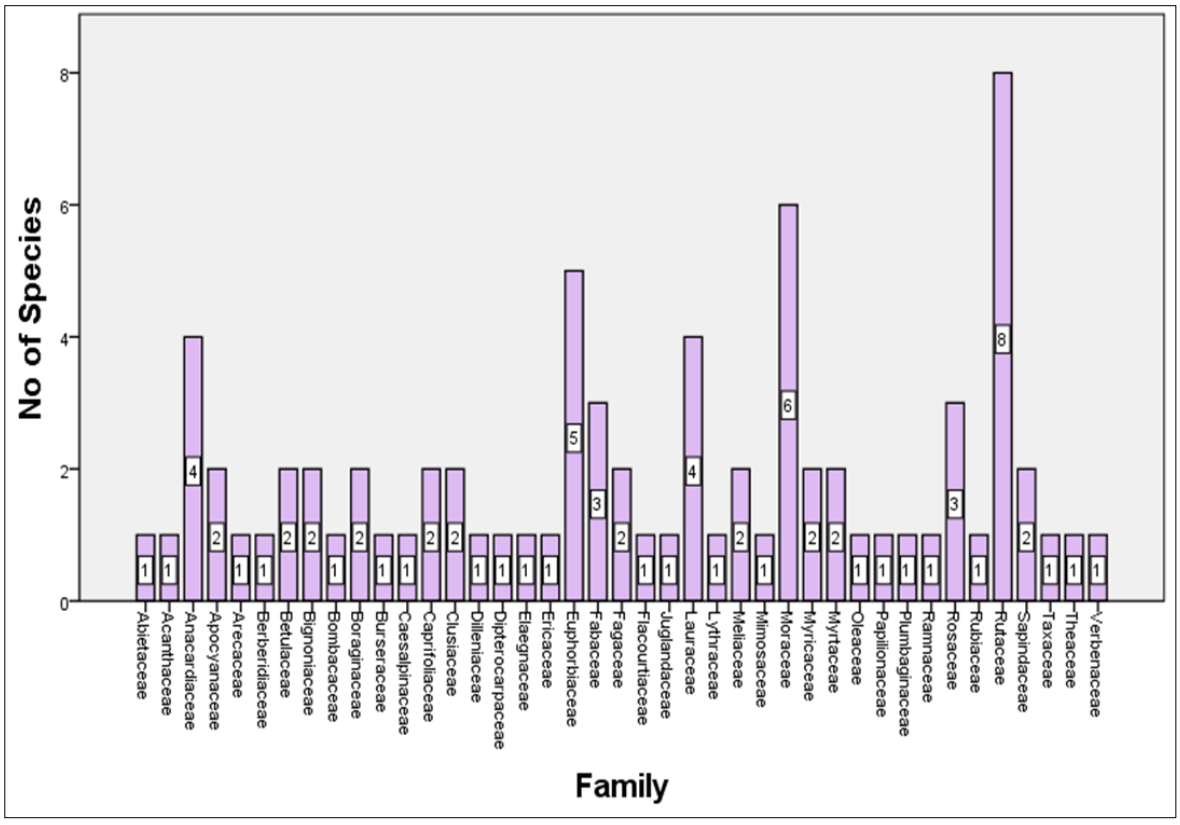

Fig 3: Graphical representation of the number of species in each of the 41 recorded families.

Table 5: Cultural Value Index (CV_e), Practical Value Index (PV_e), Economic Value Index (EV_e) and Total Value Index (V_e) of the ethnomedicinal tree species belonging to 7 selected families.

Family	Ethnomedicinal tree species	Cultural value Index (CV_e) *(CV_e= Uc_e * Ic_e * ΣIUc_e)*				Practical Value Index (PV_e) *(PV_e= Up_e* Ip_c* DU_p)*			
		Uc_e	Ic_e	ΣIUc_e	CV_e	Up_e	Ip_c	DU_p	PV_e
Fabaceae									
1	*Adenantherapavonina*(L)	10.777	0.035	0.106	0.040	10.777	0.017	7	1.282
2	*Cassia fistula* (L)	8	0.045	0.079	0.028	8	0.017	7	0.952
3	*Tamarindusindica*L.	19.778	0.122	0.194	0.468	19.778	0.081	1	1.602

Euphorbiaceae									
1	*Antidesmabunius*(L.) Spreng	5.222	0.023	0.051	0.006	5.222	0.041	7	1.499
2	*Baccaurearamiflora*Lour.	24.556	0.184	0.241	1.089	24.556	0.139	1	3.413
3	*Emblicaofficinalis* L.	35.222	0.299	0.375	3.949	35.222	0.186	1	6.551
4	*Jatrophacurcas* (L)	10.777	0.256	0.383	1.057	10.777	0.023	7	1.735
5	*Mallotusphilippensis* (Lam.)Muell.Arg	10.777	0.059	0.106	0.067	10.777	0.047	7	3.545
Moraceae									
1	*Artocarpusheterophyllus*Lam.	61.333	0.542	0.603	20.045	61.333	0.238	1	14.597
2	*Ficusbenghalensis* (L)	49.888	0.437	0.489	10.661	49.888	0.064	7	22.349
3	*Ficuselastica*Roxb ex. Hornem	46.666	0.422	0.487	9.591	46.666	0.041	7	13.393
4	*Ficushispida*(L.f.)	43.444	0.373	0.426	6.903	43.444	0.041	7	12.468
5	*Morusnigra*(L)	11.444	0.088	0.112	0.113	11.444	0.174	1	1.991
6	*Streblusasper* (Lour)	30.222	0.244	0.297	2.190	30.222	0.052	7	11
Lauraceae									
1	*Cinnamomum pauciflorum*(Nees)	10.777	0.088	0.106	0.101	10.777	0.233	1	2.511
2	*Cinnamomumtamala.* (Nees&Eberm.)	8	0.069	0.079	0.044	8	0.314	1	2.512
3	*Litseakhasyana* (Meissn)	21.888	0.198	0.215	0.932	21.888	0.041	7	6.282
4	*Litseaglutinosa* (Lour)C.B.Rob	17.888	0.153	0.176	0.482	17.888	0.069	7	8.639
Rutaceae									
1	*Aeglemarmelos* (L.) Correa	46.777	0.435	0.459	9.33	46.777	0.157	1	7.344
2	*Citrus assamensis*R.M. Dutta& Bhattacharya	39	0.353	0.383	5.273	39	0.349	1	13.611
3	*Citrus latipes*(Swingle)Yu. Tanaka	37	0.350	0.363	4.700	37	0.355	1	13.135
4	*Citrus macroptera* (Montrouz)	27.555	0.249	0.270	1.853	27.555	0.233	1	6.420
5	*Citrus medica* L.	43.777	0.411	0.429	7.719	43.777	0.198	1	8.668
6	*Citrus reticulata*Blanco (*Citrus reticulata*cv. Khasi Mandarin)	39	0.369	0.383	5.512	39	0.430	1	16.770
7	*Citrus sinensis* (L.) Osbeck	24.555	0.220	0.241	1.302	24.555	0.395	1	9.699
8	*Zanthoxylumarmatum*DC	36.888	0.339	0.386	4.827	36.888	0.523	1	19.292
Rosaceae									
1	*Docyniaindica* (Wallich)	49	0.468	0.481	11.030	49	0.285	1	13.965
2	*Prunusnepaulensis* Ser.	17.444	0.133	0.186	0.432	17.444	0.180	1	3.139
3	*Rosa indica*(L)	24.555	0.219	0.241	1.296	24.555	0.233	1	5.721
Anacardiaceae									
1	*Mangiferaindica* (L)	12	0.099	0.118	0.140	12	0.395	1	4.740
2	*Rhussemialata* (Murr)	14.111	0.121	0.138	0.236	14.111	0.023	7	2.271
3	*Rhus succedanea* (L.) Kuntze	16.444	0.149	0.161	0.394	16.444	0.052	7	5.986
4	*Spondiaspinnata* (L.f.) Kurz	14.555	0.128	0.143	0.266	14.555	0.098	7	9.985

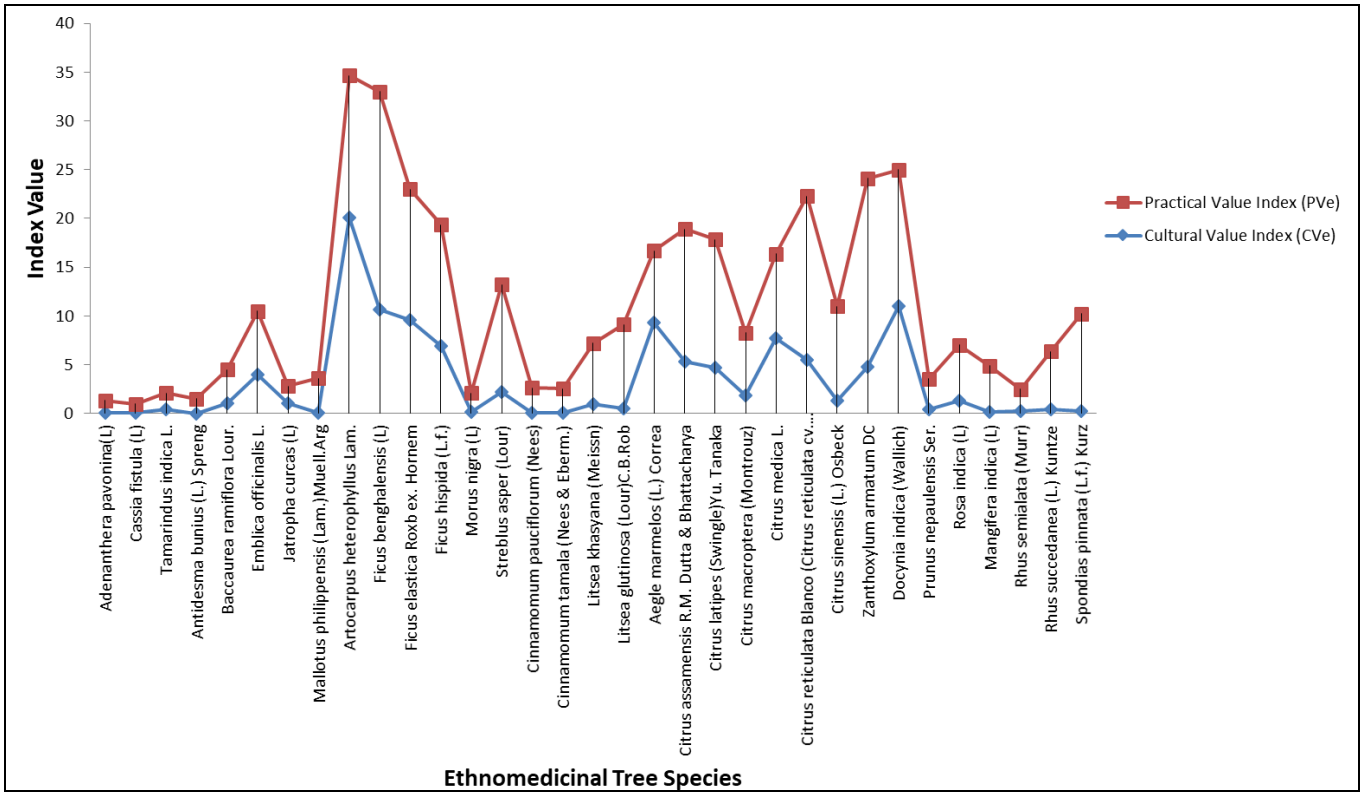

Fig 4: Graphical representation of the ranges of Cultural Index Value and Practical Index Value across 33 tree species belonging to 7 families with 3> numbers of recorded species.

Fig 5: Some of the parts of few ethno-species recorded from the study sites: a: unopened flower and leaves of *Citrus medica*L.; b: *Citrus medica*L. immature fruit; c: Riped fruits, leaves and branches of *Ligustrumlucidum*D. Don; d: Riped fruits of *Ligustrumlucidum*D.Don; e: Natural stands of *Areca catechu* L.; f: *Citrus macroptera*(Montrouz.) whole tree; g: Leaves of *Citrus macroptera*(Montrouz.); h: Fruits of *Citrus sinensis*(L.) Osbeck (upper)and *Citrus macroptera (*Montrouz.) (lower); i: Freshly plucked fruits of *Citrus macroptera*(Montrouz.); j: Fruits of *Citrus assamensis* R.M Dutta& Bhattacharyabeing sold in the market; k: Open/mature flower of *Citrus medica*L.; l: *Citrus reticulata*Blanco. (*Citrus reticulata*cv. Khasi Mandarin) sold in border hats; m: A *Citrus* tree with ripe fruits from the study sites.

Conclusion

It may be concluded from this investigative study that the tribal people inhabiting villages closed to the Indo-Bangla border do possessed the ethno-medicinal knowledge of using trees and their parts to cure various ailments and diseases. However, even though this knowledge exist, the used of trees and their parts in ethno medicines is very rare and is limited only to those informants with generations of practices. Hence, this knowledge should be made aware and documentation of such knowledge is of utmost importance.

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