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An ethnomedicinal study focusing the genus Costus in Assam with emphasis on traditional medicine

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Abstract
The objective of the study was to get an overview of different species belonging to the genus Costus that are available in Assam with special emphasis on the use of the plants in traditional medicine. To attain the objective an ethnomedicinal study was conducted in several geographically distinct zones, encompassing seven administrative districts spread across Assam *viz.* Nagakhelia village and Jokai area, Dibrugarh; Naojan and Borghoria area, Golaghat; Laipuli, Tinsukia; Majarbari village and Sissiborgaon, Dhemaji; Kathkatia village, Karbi Anglong; Dhupdhora, Goalpara and Dotma, Kokrajhar. Three species belonging to the genus Costus namely *Costus speciosus*, *Costus pictus* and *Costus scaber* were found to be mainly prevalent in traditional medicine in the different surveyed areas of Assam, particularly in the upper Assam. *Costus speciosus* is found to be mainly used in the treatment of jaundice. *Costus pictus* was found to be used traditionally in the upper Assam region bordering Nagaland for treating diabetes and associated conditions and *Costus scaber* is being used in the area bordering Arunachal Pradesh for treating people with jaundice, snake bite etc.

Keywords: Costus, Assam, traditional medicine, ethnomedicinal study, *Costus speciosus*, *Costus pictus*, *Costus scaber*

Introduction
The family Costaceae has seven different genus viz. Costus, Chamaecostus, Cheilocostus, Paracostus, Monocostus, Dimerocostus and Tapeinochilos. Costus being the largest genus with over 100 species, mostly indigenous to the neo-tropical region of South America, Mexico and West Indies and about 20 species are also found in Asia and Africa. Chamaecostus, having seven species is localized in the South American region. The genus Paracostus and Dimerocostus having two species each is distributed in Africa and Central & South America respectively. Tapeinochilos and Cheilocostus are mostly indigenous to Australia and Asia and have sixteen and four species respectively. Lastly, the genus Monocostus found only in Peru is reported to contain only single specie [1, 2]. The plants belonging to the family Costaceae are used in different traditional systems of medicine for febrile conditions, coughs, skin conditions, retention of the placenta, post-partum bleeding, threatening abortion, insufficient uterine contractility and snake bites [2]. It is well known that traditional medical knowledge is experiencing increased attention worldwide in light of global health care demand and the significant role of traditional medicine in meeting the public health needs of developing countries.

The State of Assam is a constituent unit of the Eastern Himalayan Biodiversity Region; one of the two biodiversity "Hot Spots" in the country. The climatic condition and wide variety in physical features witnessed in Assam have resulted in a diversity of ecological habitats such as forests, grasslands, wetlands, which harbor and sustain wide ranging floral and faunal species [3]. The climatic conditions cause prevalence of hot and highly humid weather in this part of the country and coupled with heterogenic demography make possible luxuriant growth of a number of plant communities imparting Assam a distinct identity. Phyto-geographically, many a species are endemic to this region and it is also the centre of origin for commercially important plants including banana, citrus, mango, zizyphus and tea. The array of floristic richness has prompted many a scholars to describe Assam as the "Biological Gateway" of North East [4].

Assam also falls in one of the great migration routes of mankind of different groups of people who over the centuries have come and settled down. The routes of migrations are: Bangladesh, the northern passes of Bhutan, Tibet and Nepal, Assam-Burma routes on the eastern side, the valleys of the western side formed by the Brahmaputra- Gangetic plains and the sea route, by Bay of Bengal via Bengal and Burma [5]. Over times, these different groups living side by side are causing both physical and cultural fusion of traits resulting in the growth and development of a composite culture which is unique to Assam. Contemporary Assam is now home to more than 100 ethnic groups belonging to different tribes, castes, language and religion [6]. In Assam around forty languages are spoken by different communities belonging to major language families like Austro-Asiatics, Sino-Tibetan and Indo European. On both side of the Brahmaputra, Assamese language is spoken by the majority of people [7]. The food and dietary culture of every community is unique and symbolic of its socio-cultural ethnicity. Every community has its own traditional rituals, customs and herbal remedies which have been molded by the geographical location and the environmental factors where they reside. The abundant natural resources in encompassing location form the basis for the characteristic food habits and related medicinal practices of each community. By their experience, the knowledge of herbal remedies was transferred to generation as folk medicine. However, the folkloric use of crude drugs is often empirical and is based on observation from clinical trials without experimental support [8, 9].

In Assam three species of Costus, *Costus speciosus*, *Costus pictus* and *Costus scaber* are mainly used in the traditional system of medicine. *Costus speciosus* is mainly used in treatment of jaundice and diabetes. *Costus pictus* is used specifically in upper Assam for treating diabetes and *Costus scaber* is used in the area bordering Arunachal Pradesh for treating jaundice and snake bite [10-13].

As traditional medicines already comprise a multibillion dollar international industry, and the biomedical sector is increasingly investigating the potential of genetic resources and traditional knowledge. Documenting and protecting these medicines is becoming a greater priority. Documentation based upon ethnomedicinal survey along with interaction with local healers practicing traditional system of medicine can be said to be the basis for establishing a systematic protocol for validating traditional medical knowledge.

Materials and Methods

Selection of study area

Assam was selected as the targeted study area due to the rich diversity in flora, fauna and above all due to the presence of diverse ethnic groups with a wide array of traditional practices. Several geographically distinct zones, encompassing seven administrative districts spread across Assam were considered for the study (Figure 1).

The selected areas in which the ethnomedicinal survey was done are as follows:

- Nagakhelia village and Jokai area, Dibrugarh
- Naojan and Borghoria area, Golaghat
- Laipuli, Tinsukia
- Majarbari village and Sissiborgaon, Dhemaji
- Kathkatia village, Karbi Anglong
- Dhupdhora, Goalpara
- Dotma, Kokrajhar

Results and Discussion

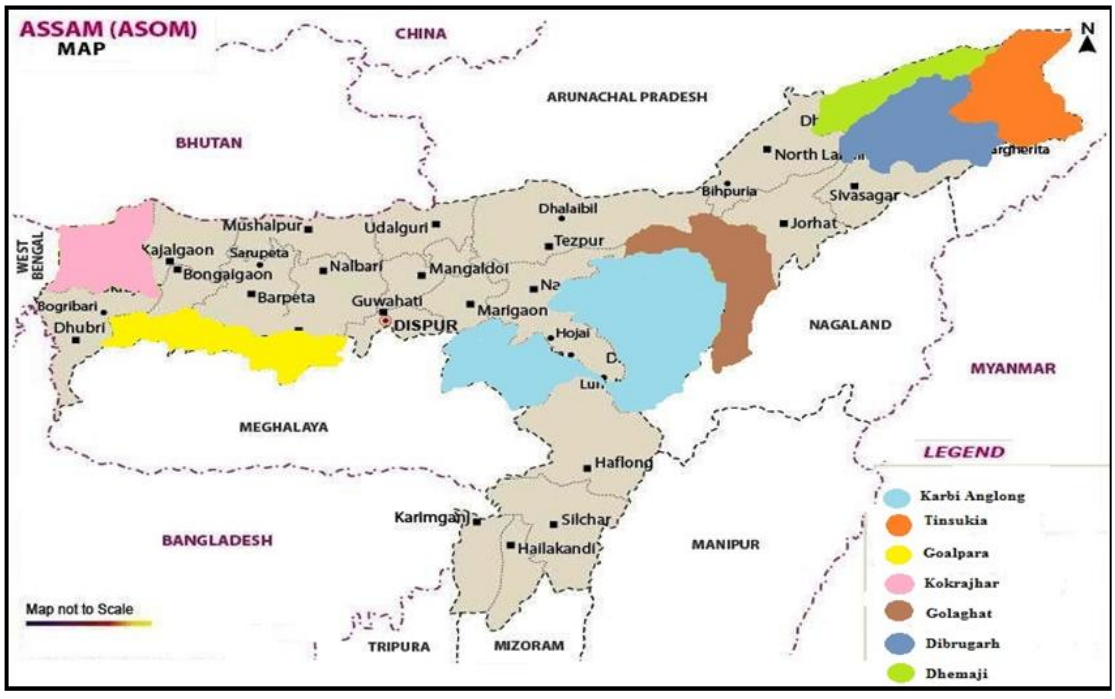

Fig 1: Map of Assam showing different districts where ethnomedicinal survey was conducted.

Dibrugarh

Two places in Dibrugarh district were selected for ethnomedicinal survey viz. Nagakhelia and Jokai (Figure 2). Nagakhelia is a small village, consisting of around hundred households under Barbaruah block of Dibrugarh district lays about 6 km from Dibrugarh University [14]. The village is located on the banks of river Brahmaputra and the area boasts of thick vegetation which serves as a prime source of medicinal plant materials for the local healers of the area practicing traditional medicine.

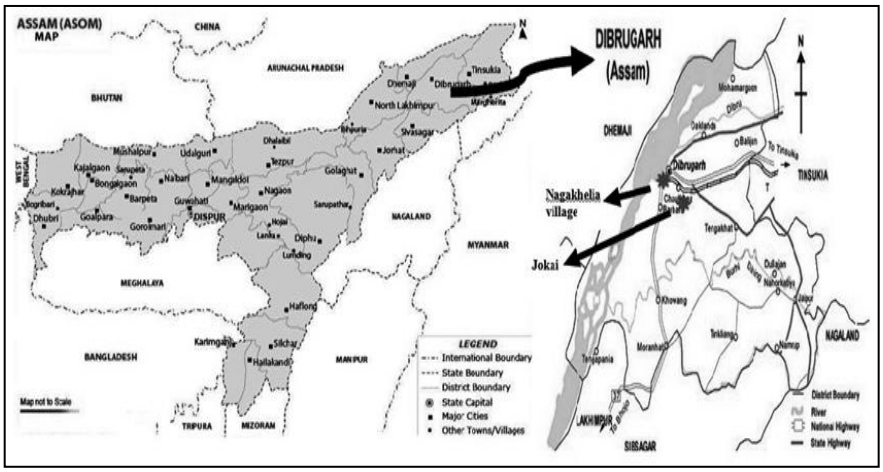

Fig 2: Location of area surveyed in Dibrugarh district of Assam.

Jokai comes under Barbaruah block in Dibrugarh district. It is located about 10 km south from Dibrugarh University. It is also home to the over twelve hectare Jokai reserve forest within which Jokai Botanical Garden cum Germplasm Centre is located. The reserve forest is endowed with different flora species of medicinal, oil bearing and aromatic plants. It also has diverse fauna species like flying squirrel, black panther and leopard including various species of butterflies and fishes. The villages surrounding the forest areas in Jokai has a rich heritage of prescribing traditional medicine, mostly from plants for many types of ailments like jaundice, diabetes, malaria, fever, skin infection etc.

Plants surveyed in this region were documented on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders (Table 1).

Table 1: Some of the Medicinal Plants used in Dibrugarh District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	**Local Name**		
Dibrugarh	*Asparagus racemosus*	Sotmul	Root	Kidney stone
	Averrhoa carambola	Kordoi	Leaves, Fruit	Jaundice
	Bonnaya brachiata	Horu Kasidoria	Leaves	Wound healing
	Cassia fistula	Sonaru	Bark	Fever, Deworming
	Caesalpinia bonducella	Letaguti	Seed	Wound healing
	Cassia tora	Bilokhoni	Leaves	Skin infection, Snake bite, Joint pain
	Centella asiatica	Barmanimuni	Whole plant	Wound healing, Well being
	Cleodendrum viscosum	Dhapat tita	Leaves, Root	Malaria, Diabetes, Jaundice, Skin infection
	Costus speciosus	Jomlakhuti	Rhizome	Jaundice
	Coscorus olitorius	Meetha Pat	Leaves	Body pain, dysentery, piles, fever
	Cucumis sativus	Tiyanh	Leaves, Fruit	Bleeding nose, Diabetes
	Dillenia indica	Ow tenga	Fruit	Constipation, Stomach trouble
	Drymaria cordata	Laijabori	Aerial part	Fever, stomach ache
	Eupatorium cannabinum	Tongloti	Root	Tooth ache
	Euphorbia nerifolia	Hiju	Latex	Asthma
	Hiptage benghalensis	Madhoi maloti	Root	Asthma
	Houttuynia cordata	Mosonduri	Leaves	Constipation
	Leucas apsera	Durum bon	Aerial parts	Cough, Fever
	Mangifera indica	Aam	Bark	Diabetes
	Momordica dioica	Bhat kerela	Root	Urinary problems
	Murrya koenigii	Narashinha	Leaves, Tender aerial parts	Stomachic
	Naravelia zylenica	Gorob choi	Aerial parts	Tooth ache, Skin infection
	Paederia foetida	Bhedai lota	Aerial parts	Stomach problem, Constipation, Joint pain
	Perilla ocimoides	Hukloti	Leaves, Root	Jaundice, Body pain, Fever, Mouth ulcer
	Physalis peruviana	Kopalphoota	Aerial parts	Jaundice
	Polygonum chinense	Modhuhuleng	Aerial parts	Stomach trouble, Dysentery
	Rhynchostylis retusa	Kopou	Leaves	Fever
	Rosa centifolia,	Tezi gulap	Flower	Eye infection
	Sapindus mukorossi	Monisal	Fruit	Tonsillitis
	Sarcochlamys pulcherrima	Mesaki	Leaves	Infection, Diarrhoea, Dysentery
	Spondias pinnata	Omora	Fruit	Acidity, Stomach trouble
	Stereospermum chelonoides	Paroli	Leaves	Skin infection
	Stephania hernandifolia	Tubuki lota	Leaves	Wound healing
	Syzygium jambolanum	Kola jamuk	Seed	Diabetes, Stomach trouble
	Sida rhombifolia	Hunbarial	Leaves	Body pain, Joint pain
	Terminalia chebula	Hilikha	Fruit	Stomach trouble, Dysentry
	Vitex negundo	Pochotia	Leaves	Fever, Cough

Golaghat

Borghoria and Naojan (Figure 3) were the areas selected for ethnomedicinal survey in Golaghat district. Borghoria village and Naojan is located about 30 km and 60 km from Golaghat town and about 2.5 km and nearly 70 km from Numaligarh Refinary township, respectively Naojan, due to its close proximity to Barpathar, an.

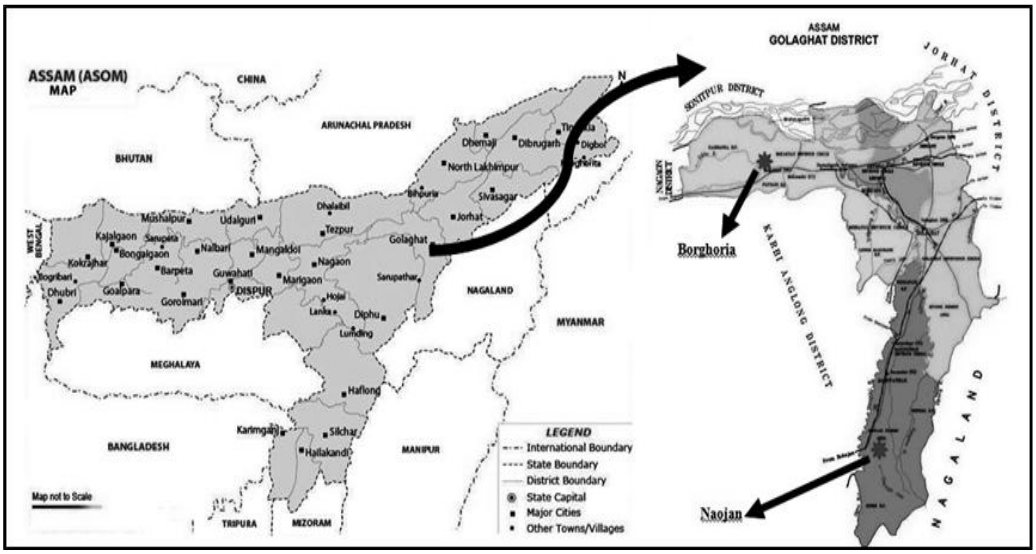

Fig 3: Location of area surveyed in Golaghat district of Assam

archeological site where the remains of an 8th century temple made of square bricks and a stone inscription of Brahmi characters belonging to the 5th century were excavated along with the hot water springs and Garampani Wildlife Sanctuary of Garampani, has a very rich abundance of diverse flora and fauna. This may serve as a strong reason for the development of traditional medicine in and around the area. Borghoria situated in the vicinity of Dhansiri river has an exposure to vast and varied natural resources. Traditional healers around the area are mainly engaged in agricultural activities and prescriptions of traditional medicine by these healers are done on philanthropic basis [15].

Plants were subjected to documentation on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders. Some of the plants are listed in Table 2

Table 2: Some of the Medicinal Plants used in Golaghat District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	**Local Name**		
Golaghat	*Achasma loroglossum*	Kor Phool	Rhizome	Tooth ache
	Aegle mermelos	Bel	Leaves, Fruit	Kidney problem, Dysentery
	Adiantum capillus	Chuli dhekia	Aerial part	Wounds, Infection, Tooth ache
	Averrhoa carambola	Kordoi	Fruit	Jaundice, Diarrhoea, Dysentery
	Ageratum conyzoides	Gandhalibon	Leaves	Cuts and wound
	Alpinia allughos	Tora	Rhizome	Stomach trouble, Joint pain
	Alternanthera sessilis	Mati Kanduri	Aerial part	Constipation
	Baccuarea sapida	Leteku	Fruit	Stomach problem
	Borreria hispda	Dolicha Bon	Leaves	Tooth ache, Gum swelling
	Bryophyllum calycinum	Dupor tenga	Leaves	Kidney stone
	Cissus repens	Bogi tenga	Leaves	Menstrual discomfort
	Clenogyne dichotoma	Patidoi	Stem	Support in fracture
	Costus speciosus	Jomlakhuti	Rhizome	Jaundice, Diabetes
	Costus pictus	Leteki	Aerial parts	Diabetes
	Cinnamomum bejalghota	Patihunda	Leaves	Asthma, Cough
	Clitoria ternatea	Aparijita	Root, Flower	Fever, Snake bite, Infection of skin
	Croton bonplandianum	Bonoria jaifal	Seed	Laxative
	Cissampelos pareira	Tubuki lota	Leaves	Diabetes
	Cleodendrum viscosum	Dhapat tita	Leaves, Root	Diabetes, Jaundice
	Cyathea spinulosa	Goch Dhekia	Rhizomes	Snake bite
	Drymoglossum heterophyllum	Rupchakalia	Aerial part	Wound healing
	Eclipta alba	Kehraj sesu	Leaves	Blood clotting
	Heydichium coronarium	Pakhila phool	Rhizome	Joint pain
	Hydrocotyl sibthropioides	Horu manimuni	Whole plant	Fever, Stomach problem
	Justicia adhatoda	Bahak	Aerial parts	Asthma, Cough
	Leucas aspera	Durun Bon	Leaves	Snake bite, Sinusitis
	Litsea salicifolia	Dighloti	Leaves	Insect repellent
	Marsilea minuta	Pani tengechi	Whole plant	Jaundice, Sinusitis
	Phyllanthus niririi	Bon Amlokhi	Shoot	Stomach trouble, Urinary problem
	Polygonum chinense	Madhu huleng	Aerial parts	Diarrhoea
	Psidium guajava	Modhuri	Leaves	Tooth pain, Diarrhoea

	Ranunculus scleratus	Pani narzi	Leaves	Skin disease, Acidity
	Roydsia suaveolen	Madhoimaloti	Flower, Fruit	Piles, Appatite stimulant
	Sarochlamys pulcherrima	Mesaki	Aerial parts	Tapeworm infection
	Sida rhombifolia	Hunbariol	Root	Helps in child birth for pregnant women
	Smilax perfoliata	Tikoni barua	Leaves, Root	Wound healing
	Styrex serulatum	Lota madhuri	Shoot	Anti infective
	Triumfetta rhomboidea	Bon Agora	Aerial parts	Insect repellent
	Xanthozylum nitidum	Tejmuri	Stem	Fractured bone

Tinsukia

Tinsukia district falls in the far east of North-East region of Assam (India), it is a part of global bio-diversity hot spot and has great biodiversity significance [16, 17]. The high biological diversity found in the district is often related to its forest cover, which is categorized into tropical wet evergreen forests. The important sanctuary located in the district is Dibru-Chaikhowa Sanctuary. It has an area of 640 sq km and is famous for rare, endangered animals and birds such as white-winged wood duck, elephant, tiger, sambar buffalo, aquatic avifauna and wild white horse.

Ethnomedicinal survey in Tinsukia districted was conducted in Laipuli area (Figure 4). Laipuli is located at a distance of around 6 km from Tinsukia town [15].

Plants were then documented on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders (Table 3).

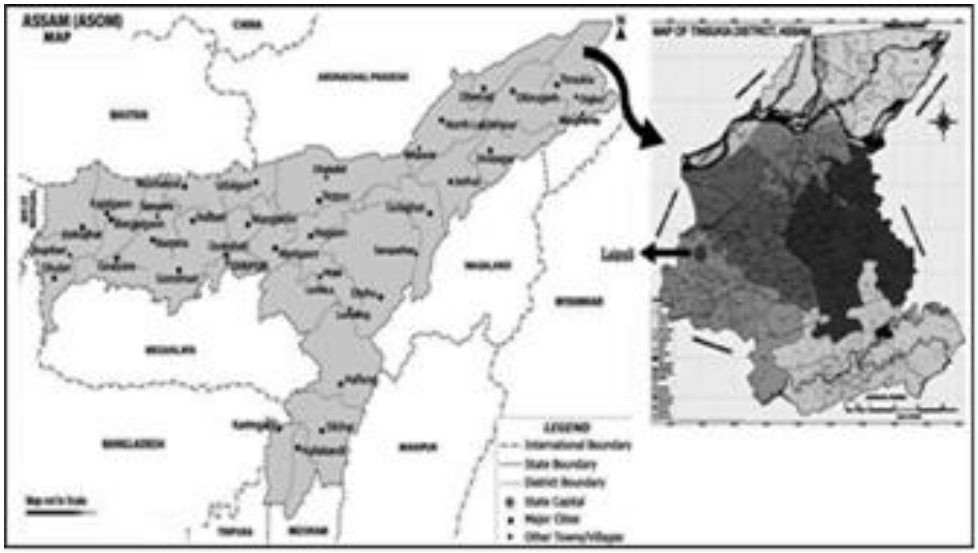

Fig 4: Location of area surveyed in Tinsukia district of Assam

Table 3: Some of the Medicinal Plants used in Tinsukia District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	**Local Name**		
Tinsukia	*Abroma augusta*	Gorokhia korai	Root	Urinary disorders
	Abrus precatorius	Latumoni	Root	Urinary disorders
	Achyranthes aspera	Bionihakuta	Leaves, Root	Wound, Sore throat, Cough and Cold
	Acorus calamus	Bosh	Rhizome	Acidity
	Amaranthus spinosus	Hatikhutura	Root, Aerial parts	Diarrhoea, Increases milk output in lactating mother
	Amaranthus tricolor	Bishalya karani	Leaves	Wound healing
	Alternanthera sessilis	Mati kanduri	Aerial parts	Dysentry, Stomach trouble
	Alpinia nigra	Tora	Rhizome	Asthma, Bronchitis
	Alstonia scholaris	Sotiona	Bark, Latex	Skin infection, Dysentry, Fever
	Artocarpus heterophyllus	Kothal	Latex, Leaves	Deworming
	Baccaurea ramiflora	Leteku	Aerial parts, Fruit	Constipation, Stomach problems
	Caesalpinia bonduc	Letaguti	Seed	Fever, Body pain
	Caryota urens	Sewa	Root	Increases milk output in lactating mother
	Carissa carandus	Korja tenga	Leaves, Fruit, Bark	Stomach trouble, Heart burn
	Calotropis procera	Akon	Leaves, Latex	Joint pain, Heart burn
	Cascabela thevetia	Karabi phool	Seed, Bark, Latex	Anti-infective, Diabetes, Fever
	Celtis tetrandra	Hukuta	Tender Aerial parts	Relieves pain after child birth
	Centalla asiatica	Bormanimuni	Whole plant	Health tonic, Memory enhancer
	Cinnamomum bejolghata	Patihonda	Leaves	Diabetes
	Ipomoea aquatic	Kolmou	Leaves	Diabetes
	Cissus quadriangularis	Harjura lota	Stem, Tendrils	Wound, Fracture
	Citrus grandis	Robab tenga	Fruit	Jaundice, Deworming
	Clerodendron colebrookianum	Nephafu	Leaves	Hypertension
	Clerodendron serrartum	Nangalbhanga	Leaves, Root	Wound healing, Stomach upset

	Coccinia grandis	Kunduli	Fruit, Leaves	Diabetes
	Costus pictus	Leteki	Leaves	Diabetes, Blood purification
	Costus speciosus	Jomlakhuti	Rhizome, Leaves	Jaundice, snake bite
	Croton joufra	Gochmahudi	Leaves	Menstrual discomfort
	Curanga amada	Bhui tita	Leaves	Fever, Malaria
	Curcuma amada	Aam ada	Rhizome	Diarrhoea, Dysentery
	Cuscuta reflexa	Akashi lota	Stem	Jaundice, Wound healing
	Dracena angustifolia	Hati kuhiar	Stem, Root	Jaundice
	Flemingia srobilifera	Makhioti	Root	Pain, Menstrual discomfort
	Garcinia cowa	Kuji thekera	Fruit	Diarrhoea, Dysentery
	Garcinia lancifolia	Rupahi thekera	Fruit	Gastric discomfort, Diarrhoea
	Hibiscus sabdarifolia	Tengamora	Aerial parts	Diarrhoea, Dysentery
	Houttuynia cordata	Mosondori	Leaves, Tender shoot	Flatulence, Diarrhoea, Dysentery
	Kaempferia galangal	Gathion	Rhizome	Cough and Cold, Improves skin lustre
	Lasia spinosa	Sengmora	Rhizome, Aerial parts	Menstrual discomfort
	Lindernia pursilla	Gakhiroti bon	Whole plant	Increases milk output in lactating mother
	Lygodium flexuosum	Kopou dhekia	Leaves	Fungal infection
	Malastoma malabathricum	Phutuki	Leaves	Wound healing
	Mussandra roxburghii	Hukloti	Aerial parts	Stomach problems
	Oxalis corniculata	Tengesi	Leaves	Stomach trouble
	Psidium guajava	Modhuri	Tender leaves	Diarrhoea, Dysentery
	Vetivera zizanoides	Birina	Root	Rheumatic pain and sprains

Dhemaji

Dhemaji district is one of the districts situated in the remote corner of North East India on the north bank of river Brahmaputra. The boundaries of the district are the hilly ranges of Arunachal Pradesh to the North and the East, Lakhimpur district in the West and the river Brahmaputra in the South. Dhemaji district area was originally inhabited by various indigenous tribes like Mishing, Sonowal Kachari, Bodo Kachari, Deori and Laloong. In addition, different other tribes such as Ahom, Rabha, Tai - Khamti, Konch, Keot, Koiborta, Brahman, Kayastha, Kalita migrated during different time periods in history [18].

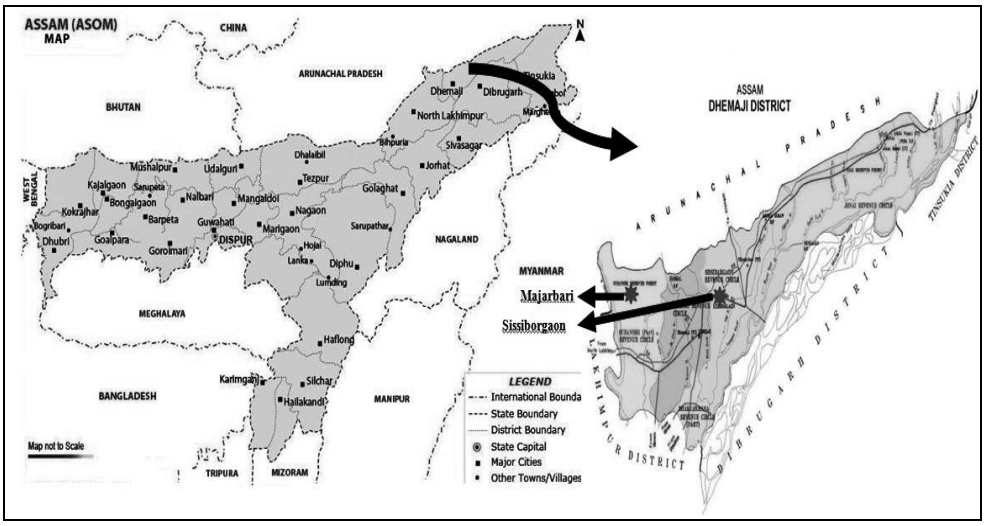

Fig 5: Location of area surveyed in Dhemaji district of Assam.

There are nine reserved forests namely, Jiadhal, Subansiri, Sissi, Simen, Archiac, Jamjing, Senga, Gali and Pova covering an area of 53,224.11 hectares which is about 16% of the total area of the district. Two places selected for the ethnomedicinal survey in Dhemaji district were Majarbari and Sissiborgaon (Figure 5).

Plants were documentated on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders (Table 4).

Table 4: Some of the Medicinal Plants used in Dhemaji District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	**Local Name**		
Dhemaji	*Abroma augusta*	Ui-sipak	Leaves	Cuts and wound healing
	Ageratum conyzoides	Namnyin/ Gunduabon	Aerial parts	Aids blood clotting, Wound healing
	Alternanthera sessilis	Patang oying	Aerial parts	Jaundice, Body ache
	Antidesma ghaesembilla	Somkong	Aerial parts	Menstrual discomfort
	Bacopa monnieri	Brahmi	Whole plant	Memory enhancer, Fever, Diabetes, Jaundice, Cold
	Bryophyllum pinnatum	Dupor tenga	Leaves	Wound healing, Improves bowel movement
	Bombax ceiba	Singgi	Leaves	Wound healing
	Catharanthus roseus	Sada Bahar	Leaves	Diabetes

	Calotropis gigantean	Akon	Leaves, Latex	Wound healing, Body ache
	Caesalpinia cucullatum	Tezmuri	Leaves	Tooth ache, Fever
	Chromolaena odorata	Jarmanibon	Leaves, Root	Snake bite, Anti infective
	Cissus quadrangularis	Gomset sori	Aerial parts, Tendrils	Joining of fractured bone
	Costus scaber	Keuri	Leaves	Snake bite, wounds
	Costus speciocus	Peki jigjig	Rhizome	Jaundice, UTI
	Cyclosorus extensus	Rukji	Leaves	Increases milk output in lactating mother
	Desmodium laxiforum	Bhuter chira	Aerial parts	Infection, Menstrual discomfort
	Dillenia indica	Sompa	Fruit	Diabetes, Stomach trouble
	Drymaria cordata	Laijabori	Aerial parts	Asthma, Allergy
	Eclipta prostrate	Keharaj	Aerial parts	Liver ailments, Urinary problems
	Eryngium foetidum	Bormang ori	Leaves	Appetizer, stomach problems
	Ficus hispida	Takpi	Fruit	Jaundice
	Garcinia lanceifolia	Rupohi tehekera	Fruit	Jaundice, Diarrhoea
	Hedyotis scandens	Bhebeli lota	Leaves	Wound healing
	Houttuynia cordata	Musondri	Leaves	Optimizes stomach function
	Ipomoea aquatic	Mou	Leaves	Jaundice, Diabetes
	Mentha arvensis	Takemare	Leaves	Stomach trouble
	Mimosa pudica	Yuptap	Root	Deworming
	Musa velutina	Doge kopak	Flower	Diarrhoea, Dysentry
	Murraya koenigii	Narasingha	Aerial parts	Stomach disorder, Liver tonic
	Oldenlandia diffusa	Bonjaluk	Leaves	Jaundice
	Litseacitr ata	Mezangkori	Bark	Asthma, Cough
	Solanum nigrum	Loshkosi	Leaves	Jaundice
	Tylophora asthamatica	Jangli pikran	Leaves, Roots	Purify blood, Stops white vaginal discharge
	Oxalis corniculata	Tengsi	Leaves	Hypertension, Diabetes, Stomach upset
	Zanthoxylum nitidum	Rikom	Aerial parts	Anti infective

Karbi Anglong

Karbi Anglong district is situated in the central part of Assam. It is bounded by Golaghat district in the east, Meghalaya and Morigaon district in the west, Nagaon and Golaghat district in the north and N.C. Hills district and Nagaland in the south. The district which is covered with dense tropical forest hills and flat plains is situated between 25º 33' N to 26º35' N Latitude and 92º10' E to 93º50' E Longitude. It is to be noted that a new district, West Karbi Anglong was curved out from erstwhile Karbi Anglong district on 15th of August, 2015 [15, 19]. About 85 percent of the district is covered by hills

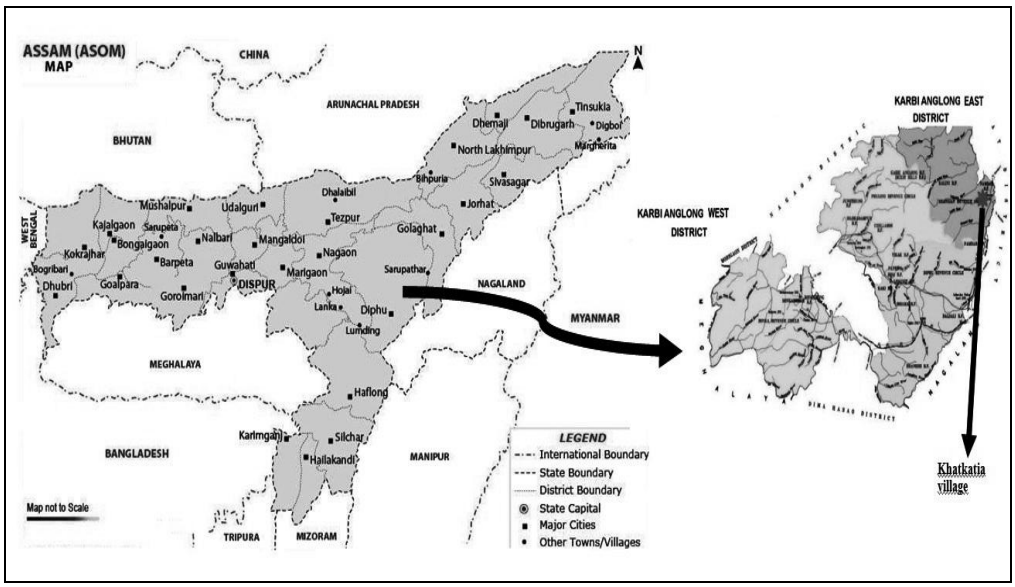

Fig 6: Location of area surveyed in Karbi Anglong district of Assam

The area located between the northern and southern hills in Diphu sub-division is characterised by undulating plains. The landscape and ecological studies of forests of Karbi Anglong indicate a high amount of heterogeneity promoting greater bio-diversity. These forest areas are natural museums of living giant trees, a treasure house of rare, endemic and endangered species, a dispensary of medicinal plants, a garden for Botanists, a gene bank for economically important organisms, a paradise for nature lovers and a laboratory for environmentalists.

Kathkatia village (Figure 6) located in Silonijan of Karbi Anglong district was selected for the ethnomedicinal survey [19].

Documentation of plants was then done on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders (Table 5).

Table 5: Some of the Medicinal Plants used in Karbi Anglong District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	Local Name		
Karbi Anglong	*Acmella paniculata*	Bapchuki	Leaves, Flower	Stomach ache, Acidity
	Abelmoschus moschatus	Arnam hanserong	Leaves, Fruit	Snake bite
	Abrus precatorius	Chuselok	Leaves	Fever, Asthma, Joint pain
	Abutilon indicum	Mir-at	Leaves, Flower	Snake bite, Insect bite
	Acacia pennata	Themra/Khemra	Leaves, Bark	Snake bite
	Alpinia galangal	Phrikan gnek	Leaves, Rhizome	Stomach ache, Improves digestion
	Alternanthera sessilis	Raeaba	Aerial parts	Fever, Infection
	Amorphophalus bulbifer	Hen salku	Leaves, Flower	Piles, Irregular bowel movement
	Arisaema tortuosum	Chamua	Leaves, Tuber	Piles, Irregular bowel movement
	Calamus rotang	Pri	Aerial parts	Snake bite
	Cassia tora	Bapduli	Leaves, Flower	Joint pain, Improves bowel movement
	Costus pictus	Tui	Leaves	Diabetes, Jaundice
	Costus speciosus	Ai-upo	Leaves, Rhizome	Jaundice, Snake bite
	Cycas pectinata	Or-oh	Aerial parts	Acidity, Heart burn
	Croton joufra	Mahudi	Whole plant	Jaundice, Ulcer
	Dioscorea pentaphylla	Ruipheng/Phurui	Underground parts	Spider bite, Fever
	Drymaria cordata	Kur-vengso	Leaves, Flower	Cough and cold, sinusitis
	Houttuynia cordata	Maisundri	Leaves	Body ache, Diarrhoea
	Lasia spinosa	Chusot	Aerial parts	Piles, Irregular bowel movement
	Laportea cremulata	Bap kangsam	Fruit, Flower	Scorpion bite
	Murraya koenigii	Thengsakso	Leaves	Acidity, Fever
	Olax acuminate	Hanboka	Leaves	Wound healing
	Oroxylum indicum	Nopak ban	Leaves, Flower	Intestinal worm, Stomach ache
	Paederia foetida	Rekang nemthu	Leaves	Acidity
	Physalis peruviana	Thebongkang	Leaves, Fruit	Stomach ache, Deworming
	Phlogocanthus thyriflorus	Titaful	Flower	Fever, Jaundice
	Solanum torvum	Bhekuri tita	Leaves, Fruit	Anti infective
	Spondias pinnata	Siming	Leaves, Flower	Acidity, Diarrhoea
	Tagetes erecta	Mir kadomphui	Leaves, Flower	Anti infective, Wound healing, Improves digestion
	Vitex negundo	Vorke abap	Leaves, Flower	Fever, Ache, Malaria

Goalpara

The district of Goalpara is situated on the south bank of River Brahmaputra, and it covers an area of 1,824 square kilometres and is bounded by West and East Garo Hills districts of Meghalaya on the South, Kamrup district on the East, Dhubri district on the West and, River Brahmaputra all along the North. The geographical location of the district is between 25º 53' N to 26º30' N latitude and 90º07' E to 91º5' E longitude [6,7]. Among the 15 agro-climatic regions of the country, categorized/identified on the basis of homogeneity in agro-characteristics, Goalpara falls in the Lower Brahmaputra Valley zone. The topography of the district is characterized by an almost flat plain except for few low forested Hills that break the monotony of the terrain. A significance of the district is the existence of a large number of Char (riverine tracts and sandy river Island) in the River Brahmaputra.

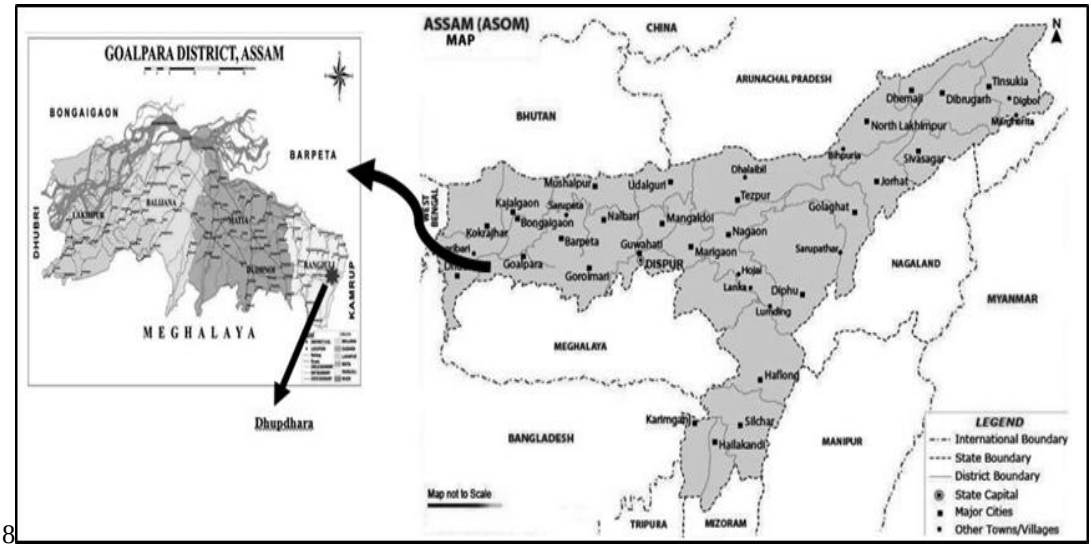

Fig 7: Location of area surveyed in Goalpara district of Assam

Dhupdhara (Figure 7) selected for the ethnomedicinal survey, is a village in Rongjuli circle in Goalpara district of Assam. It is located about 58 km east of district headquarter Goalpara and 13 km from Rangjuli [9, 15].

Documentation of plants was then initiated on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders (Table 6).

Table 6: Some of the Medicinal Plants used in Goalpara District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	Local Name		
Goalpara	*Abroma augusta*	Dadhubedang	Leaves	Stomach ache, Ringworm infestation
	Acalypha indica	Muktaborcha	Leaves	Asthma, Bronchitis
	Azadirachta indica	Neem gakha	Fruit, Leaves	Fever, Deworming
	Bryophyllum pinnatum	Pategaja	Leaves	Diarrhoea, Dysentry
	Calamus rotang	Batbelai	Leaves	Eye infection
	Catharanthus roseus	Pangkha	Flower, Leaves	Wounds, Fever
	Chrysanthemum morifolium	Chandra molika	Aerial part	Body pain, Wound
	Clerodendrum bracteatum	Vate gakha	Leaves	Memory tonic
	Citrus aurantifolia	Kazi lebu	Leaves, Fruit	Prevent vomiting, Helps in digestion
	Citrus limon	Gol lebu	Leaves, Fruit	Wound healing, Diarrhoea, Jaundice
	Calotropis gigantia	Aakon	Leaves, Bark	Snake bite, Asthma
	Deeringia amaranthoides	Matak tuka	Leaves	Wound, Sore
	Euphorbia hirta	Dudh bon	Shoot, Latex	Infection
	Ficus hispida	Domuru	Leaves	Jaundice
	Murraya koenigii	Narasinghabelai	Leaves, Tender aerial parts	Fever, Stomach upset
	Nelumbo nucifera	Podum	Rhizome	Menstrual discomfort
	Ocimum sanctum	Dhulungshi	Leaves	Cough, Fever
	Paederia foetida	Bhadalilewa	Leaves	Diarrhoea, Dysentry
	Polyalthia longifolia	Debdaru	Bark	Menstrual discomfort
	Solanum integrifolium	Tita Bhekri	Fruit	Malaria, Fever, Jaundice, Diabetes
	Terminalia tomentosa	Amra	Fruit	Diabetes, Stomach upset
	Vitex negundo	Pasatia	Leaves	Body pain, Wound, Fever

Kokrajhar

Kokrajhar district can be described as the gateway to the north eastern region of India. It has a total area of 3,169.22 sq. km. and lies roughly between 89º46' E to 90º38' E longitudes and 26º19" N to 26º54" N latitudes. The district is bounded on the north by the Himalayan kingdom of Bhutan, by Dhubri district on the south, Bongaigaon district on the east and the state of West Bengal on the west [15]. The district is situated in a humid sub-tropical climate, which is the characteristic of the lower Brahmaputra Valley of Assam. The district also has one of the largest concentrations of forest in the state. About 55% of the total geographical area of the district is under reserved forest.

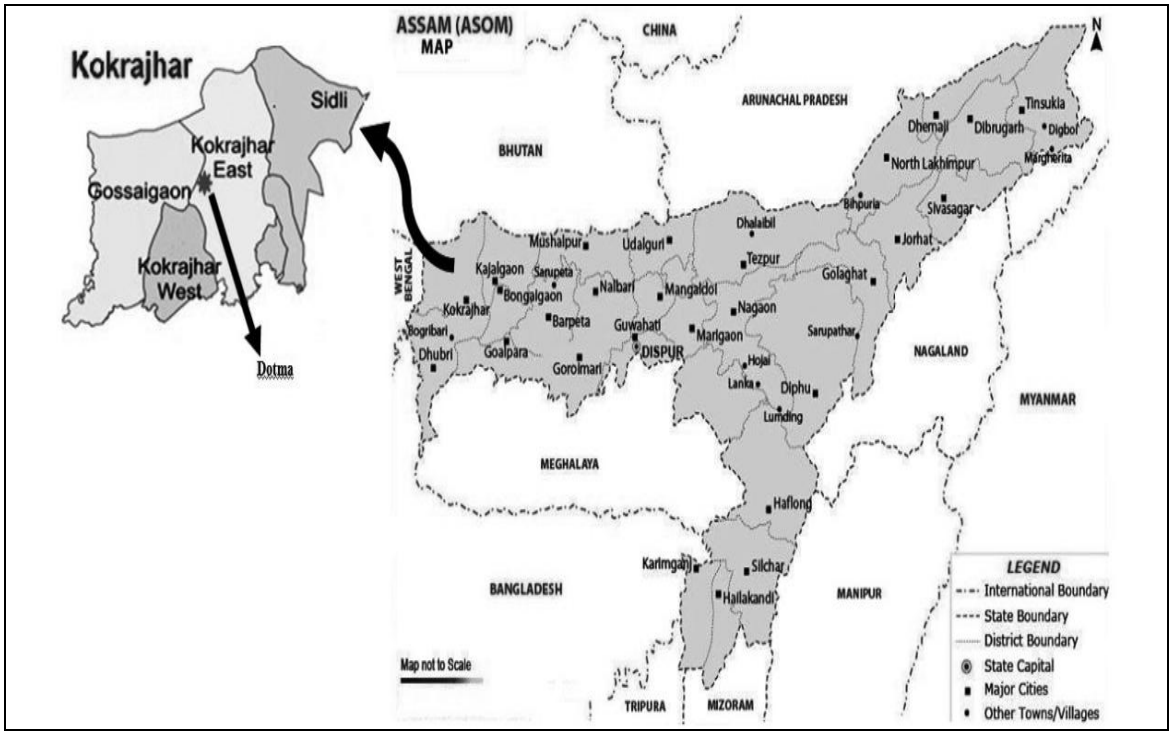

Fig 8: Location of area surveyed in Kokrajhar district of Assam.

Dotma (Figure 8) village in Kokrajhar district of Assam was selected for the survey for ethnomedicinal documentation. It is located about 17 km towards North from District head quarters Kokrajhar [20].

Plants were then documented on the basis of interview and questionnaire with the traditional healers with emphasis on the part of the plants and their applications in treating different diseases and disorders (Table 7).

Table 7: Some of the Medicinal Plants used in Kokrajhar District and their Allied Application

District	Plant Name		Part Used	Use/Application
	Botanical Name	**Local Name**		
Kokrajhar	*Benincasa hispida*	Kumbra	Fruit, Leaves	Diabetes, Acidity
	Canarium bengalensis	Dhuna	Leaves, Bark	Joint pain
	Chromolaena odorata	Bangrilewa	Leaves	Stomache ache, dysentery
	Chrystella parasitica	Sal Daokhumwi	Young aerial part	Wound healing
	Clerodendum infortunatum	Lwkwna	Leaves	Jaundice, Wound healing
	Clitonia ternatea	Nilkantha	Leaves	Fever, antiseptic
	Costus speciosus	Buritokon	Rhizomes, Leaves	Jaundice, Snake bite
	Corchorus capsularis	Patw	Leaves, Root	Fever, Diarrhoea
	Cynodon dactylon	Dubri hagra	Leaves	Diabetes, Well being
	Datura stramonium	Datura	Leaves, Fruits	Tooth ache, Heartburn, Asthma
	Emblica officinalis	Amla	Fruit	Tonic, Stomachic
	Euphorbia neriifolia	Sejou	Leaves, Latex	Cough relief, Body ache
	Laportea crenulata	Koma	Leaves, Root	Heartburn, Fever, Cuts and Wound
	Leucas plukenetii	Khangsinsa	Leaves	Sinusitis, Pain
	Musa paradisiacal	Tailir	Flower, Fruit	Diabetes, Dysentry
	Nyctanthes arbortristis	Sephali	Leaves, Flower	Antihelmintic
	Ocimum sanctum	Tulsi	Leaves	Cough relief, Asthma
	Paederia foetida	Bhedalilewa	Leaves	Diarrhoea, Constipation
	Ricinus communis	Indi bipang	Seed, leaves, Root	Constipation, Intestinal Worm, Jaundice
	Scoparia dulcis	Bongpang rakeb	Whole plant	Kidney stone, Diarrhoea, Fever
	Xanthium strumarium	Agara	Root, Leaves	Fever, Joint pain

Conclusion

The ethnomedicinal survey was basically aimed at documenting different traditional medicines and practices employed by different ethnic groups residing in several ecological areas in Assam. The study conducted intermittently since the year 2004 up till 2015 resulted in documentation of numerous plants of medicinal usage and different practices associated with treatment modalities. Among the plethora of information regarding different plant species, plants belonging to the genus Costus were given particular importance owing to their non-indigenous nature and wide popularity as ornamental plants. The study revealed usage of plants belonging to the genus Costus in treating jaundice, diabetes particularly in the upper Assam region. Interview conducted with the traditional healers endorsed proven anti diabetic efficacy of *Costus pictus* and high degree of affectivity of *Costus speciosus* in the treatment of jaundice. Positive patients feedback were also received for *Costus scaber* along with *Costus speciosus* and *Costus pictus* in alleviating conditions arising from jaundice and diabetes during the course of the entire ethnomedicinal survey.

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