



Hepatoprotective plants used by hajong tribe of northeast India

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Abstract

The present study was conducted to document the process of exploration of hepatoprotective plants by Hajong tribe of Northeast India. Field studies were carried out from August 2017 to July 2019 covering all the states of Northeast India inhabited by the Hajong community. Systematic recording of data was done using a specially designed questionnaire and the data have been analyzed. The results obtained reveal that 39 species of medicinal plants belonging to 38 genera and 29 families are being used traditionally to cure and control jaundice by the tribe. Preliminary biochemical investigations on alkaloids were also carried out. All the plant species used by the tribe for the treatment of Jaundice tested positive for alkaloids.

Keywords: alkaloids, exploration, hajong tribe, jaundice, medicinal plants, northeast India

Introduction

The traditional knowledge system is embedded in the cultural traditions of regional, indigenous, or local communities (Sullivan, 2015) [17]. Traditional knowledge is gathered or accumulated by a community through years of experiences which reflects a community's interests and is deeply rooted in every community across the globe. Nearly 80% of the world population depends upon traditional system of health care (Rajadurai *et al.*, 2009) [12]. The importance of traditional knowledge has been realized chiefly in respect of varied economic uses of plants prevailing among the primitive human societies (Majumdar and Shyam, 2013) [10]. Traditional knowledge and ethnobotanical information play an important role in scientific research (Awadh *et al.*, 2004) [1].

The Hajongs are a small endogamous Bodo-Kachari tribe with a rich socio-cultural heritage. They form a unique tribal community having a trans-border international presence i.e. in the Northeast Indian states of Assam, Meghalaya, Arunachal Pradesh and Mizoram; in West Bengal and in Bangladesh (Kim *et al.* 2011) [8]. In Assam Hajong tribe is distributed in the districts of Goalpara, Dhubri, South Salmara-Mankachar, Kamrup (Metropolitan), Chirang, Bongaigaon, Baksa, Odalguri, Darrang, Sonitpur, Lakhimpur, Dhemaji, Nagaon, Tinsukia, Dima Hasao and karbi-Anglong with a population of 1,33,000 (Hajong, 2017) [6]. Jaundice is a common disease among the tribe and they have their own traditional therapy for prevention and treatment of the disease by using the plants available in their localities and nearby forest. Considering the uniqueness of their traditional therapy, a survey was conducted to document the old age traditional healing practice for prevention and treatment of jaundice by Hajong community of Northeast India.

Material and methods

Study site

The study was carried out in Arunachal Pradesh, Assam and Meghalaya states of Northeast India in the areas inhabited by the Hajong tribe. Field studies were undertaken in the

districts of Changlang and Tirap in Arunachal Pradesh; West Garo Hills, East Garo Hills, South Garo Hills, South West Garo Hills and North Garo Hills districts in Meghalaya and in the entire state of Assam (Fig. 1).

Data collection

During the survey, the information was collected by interactions with Kabiraj, Deodhani (traditional healers) who have been practicing traditional medicine since long time to cure jaundice. A very simple questionnaire was designed for the respondents in order to gather information that mainly focused on the local name of medicinal plants, knowledge about past and present use, mode of preparation, plant part used, methods of their formulation and administration, procurement method, place of collection of the medicinal plants and habitats, threats and conservation strategies, season of collection, etc. The data gathered was verified by repeated queries among local herbalists in order to authenticate the information (Cochran and Cornfield, 1951) [4]. Respondents were visited two to three times in order to confirm the reliability of the ethnobotanical information. Information provided by respondents that lack consistency were rejected and they were not included in the sample (Majumdar *et al.*, 2019) [9].

Specimen Identification

Collection of the medicinal plants and their digital photography was done during the field studies. The herbarium preparation of each collected species was done following Jain and Rao, (1977) [7]. Identification of medicinal plants was done with the help of literatures, monographs and herbarium like GUBH, ASSAM, etc The Scientific name and their family were confirmed in the websites 'The Plant List' (<http://www.theplantlist.org/>) and 'World Flora Online' (<http://www.worldfloraonline.org/>).

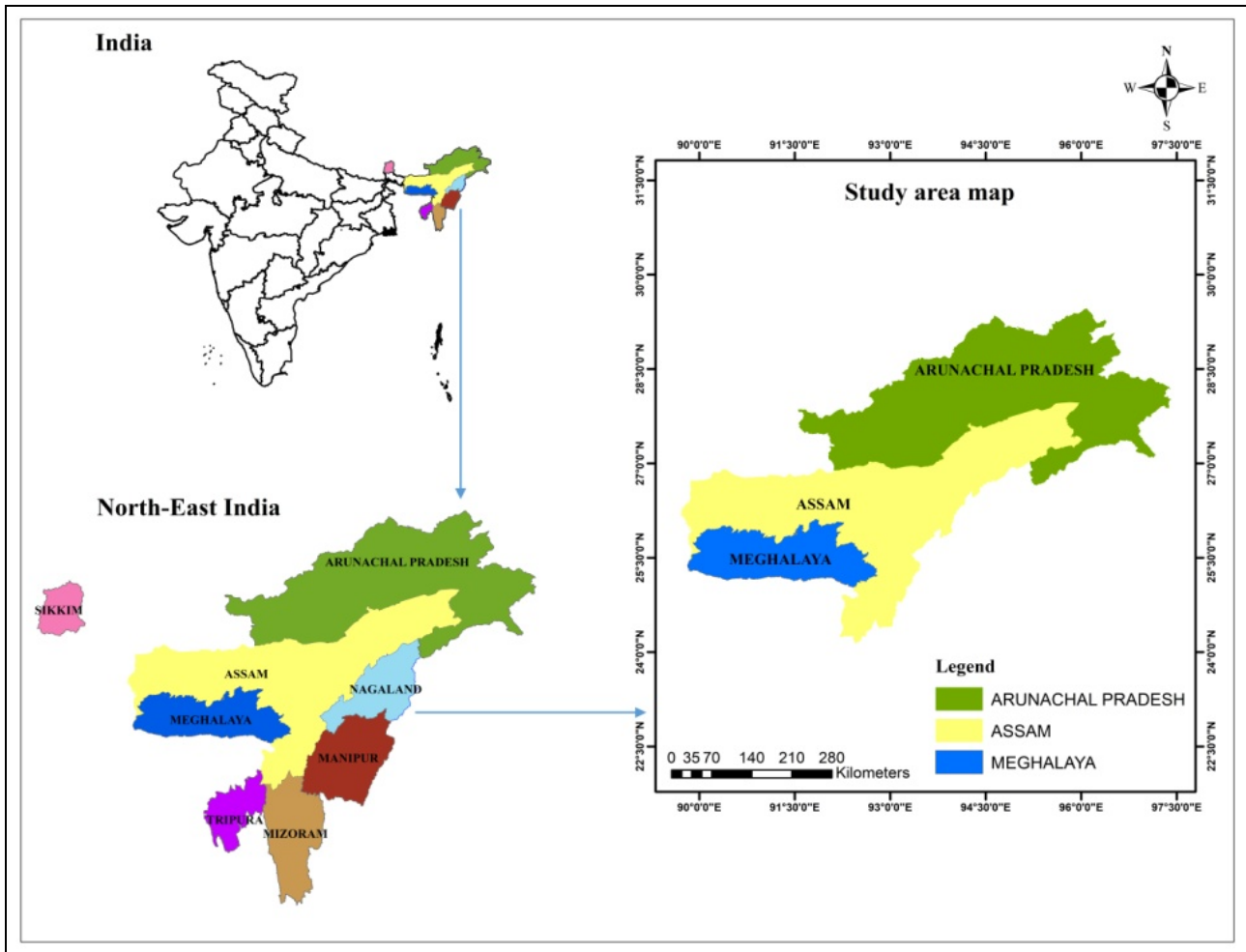


Fig 1: Map showing the study areas of Northeast India

Phytochemical analysis

The plant samples were air dried and powdered, which was moistened with distilled water and then mixed with ammonia solution. Thereafter, petroleum ether was added to the mixture and shaken. The extract was concentrated and shaken with equal amount of dilute Sulphuric acid (H_2SO_4) and the mixture was separated into two layers with a separating funnel. The collected acidic solution was made alkaline by adding Sodium carbonate (Na_2CO_3) and the precipitate was extracted in ethanol. The presence or absence of alkaloids of plant samples were tested by Meyer's reagent, Dragendroff's reagent and Wegner's reagent (Buzarbarua, 2000) [3].

Conclusion

The present ethnobotanical survey revealed widespread popularity of traditional systems of medicine among the Hajong tribe of Northeast India. The ethnobotanical information gathered from the study sites of Northeast India is the first of its kind practiced by the traditional healers. All the recorded plant species are locally available in the forests of Northeast India and several species are commonly cultivated in the household yards. These plants have entered into their traditional systems of medicine. The study provides ethnobotanical information about 39 plant species belonging to 29 families are used by the Hajong community of Northeast India for hepatoprotection. Among this 39 plant species; 28 species (72%) belongs to dicotyledonous,

10 species (26%) belongs to monocotyledonous and only 1 species (2%) belongs to Pteridophytes (Fig. 2). The majority of the plant species are herbs (20 species) followed by trees (11 species), shrubs (6 species) and creeper (2 species) (Fig. 3). Among the different plant parts prescribed for hepatoprotection, roots/rhizome are the most frequently used plant part (10 species) followed by leaves (9 species); fruits (8 species); stems (6 species); whole plant (3 species); flowers (1 species); both stem and root (1 species) and leaf, stem and flowers all together (1 species) (Fig. 4). The alkaloids test of the all plant parts have tested positive. The information about the ethnomedicinal uses, scientific name and local name of the plants, plant parts used, preparation and mode of administration, dose regimen and duration, and presence of alkaloids are described in the Table 1. The data in Table 1 reveals 33 medications that are used for the treatment of jaundice. These 33 medication are prepared by using normal water or hot water as a medium and administered by different modes like taken orally by making tablet from paste, cooking plant parts, external application of paste, tied some plant parts with thread in the body, inhale the plant parts, juice preparation, making garland of the plant parts and direct smearing on the body externally.. The herbal remedies are applied to the patients on the basis of patients' conditions, generally the preparation were used daily two times once in the early morning and once in the evening for one week or till the jaundice is cured.

Table 1: List of medicinal plants used for treatment of jaundice by Hajong tribe of Northeast India

Sl. No.	Scientific Name & Family	Vernacular Name in Hajong (H) & Assamese (A)	Plant Parts Used	Mode of Administration	Test for alkaloids
1	<i>Abrus precatorius</i> L. (Fabaceae)	Kwasmala gash (H) Latumoni (A)	Roots	The root is made into a ring and tied the ring in any finger or the root is made into garland and put on the neck or the root is tied in the waist till cure.	+ve
2	<i>Allium sativum</i> L. (Amaryllidaceae)	Ruhun (H) Naharu (A)	Cloves	4-5 cloves are crushed and mixed with half cup of hot water and taken orally.	+ve
3	<i>Alstonia scholaris</i> (L.) R. Br. (Apocynaceae)	Satihana/Suitan Gash (H) Chatiyana (A)	Bark	Bark paste mixed with little water and taken orally for three weeks.	+ve
4	<i>Ananas comosus</i> (L.) Merr. (Bromeliaceae)	Anarosh (H) Mati kothal/ Anarosh (A)	Roots	Root paste mixed with little water and taken orally till cure.	+ve
5	<i>Andrographis paniculata</i> (Burm.f.) Nees (Acanthaceae) <i>Azadirachta indica</i> A.Juss. (Meliaceae) <i>Ipomoea carnea</i> Jacq. (Convolvulaceae) <i>Cajanus cajan</i> (L.) Millsp. (Fabaceae)	Mati neem (H) Chiratatita (A) Khawa neem (H) Neem (A) Kumli gash (H) Panibhotara (A) Orol gash (H) Rahardail (A)	Leaves Leaves Roots Leaves	All plant parts are mixed together and made into a paste. The paste is made into tablets, which are dried and taken orally till cure..	+ve
6	<i>Argyrea nervosa</i> (Burm. f.) Bojer (Convolvulaceae)	Taklevututung Gash (H) Bisadharakalata (A)	Roots	Roots are crushed and the aroma inhaled thrice daily.	+ve
7	<i>Artocarpus heterophyllus</i> Lam. (Moraceae)	Kahol gash (H) Kothal (A)	Stem gall	Stem gall is made into paste; tablets are prepared and taken orally. Patients are advised to take vegetarian food during medication.	+ve
8	<i>Averrhoa carambola</i> L. (Oxalidaceae)	Kamerenga gash (H) Kardo (A)	Fruits	Fruit juice to be taken orally till cure.	+ve
9	<i>Azadirachta indica</i> A.Juss. (Meliaceae)	Khawa neem (H) Neem (A)	Leaves	Leaves are grounded and mixed with molasses and taken orally.	+ve
10	<i>Basella alba</i> L. (Basellaceae)	Puihak (H) Puixaak (A)	Whole plant	The plant is crushed with one crab, curry is prepared and taken with rice.	+ve
11	<i>Cajanus cajan</i> (L.) Millsp. (Fabaceae)	Orol gash (H) Rahardail (A)	Leaves	Young leaves are made to paste, pinch of salt is added and taken orally thrice daily.	+ve
12	<i>Cajanus cajan</i> (L.) Millsp. (Fabaceae) <i>Rauvolfia serpentina</i> (L.) Benth.ex Kurz (Apocynaceae) <i>Oroxylum indicum</i> (L.) Kurz (Bignoniaceae), <i>Centella asiatica</i> (L.) Urb. (Apiaceae)	Orol gash (H) Rahardail (A) Chandotitw (H) Sarpogandha (A) Naora gash (H) Bhatghila (A), Dangomanikong (H) Dangor Manimuni (A)	Leaves Leaves Leaves Leaves	All the leaves are together grounded with little amount of water and the juice is taken orally.	+ve
13	<i>Carica papaya</i> L. (Caricaceae)	Mudhu (H) Omita (A)	Fruits	The raw fruit is cooked and taken daily for a week.	+ve
14	<i>Citrus limon</i> (L.) Osbeck (Rutaceae)	Libu gash (H) Nemu (A)	Fruits	The juice of the fruit taken orally thrice daily for enhancing the power of other herbal medicine.	+ve
15	<i>Coccinia grandis</i> (L.) Voigt (Cucurbitaceae)	Kakolewa (H) Kundali (A)	Roots	Juice is taken out by grinding the roots and taken orally.	+ve
16	<i>Coix lacryma-jobi</i> L. (Poaceae)	Kwawa mala gash (H) Kauri moni (A)	Roots	Roots are pulled out and tied with three threads round the neck.	+ve
17	<i>Curcuma longa</i> L. (Zingiberaceae), <i>Oroxylum indicum</i> (L.) Kurz (Bignoniaceae)	Hildi gash (H) Halodhi (A), Naora gash (H) Bhat ghila (A)	Flowers Bark	Flowers and bark of the stem are grounded together and small balls are made. These are dried and taken daily after food.	+ve
18	<i>Cuscuta reflexa</i> Roxb. (Convolvulaceae)	Aakashilota (H) Aakashilota/ Sornolota (A)	Whole plant	The whole plant is rounded thrice on the neck of the patient and made into a garland.	+ve
19	<i>Drynaria quercifolia</i> (L.) J. Sm. (Polypodiaceae)	Gormohabir (H) Rajmukut (A)	Rhizome	Rhizome is grounded along with little sugar and taken orally.	+ve
20	<i>Eichhornia crassipes</i> (Mart.) Solms (Pontederiaceae)	Kushripanar (H) Mateka (A)	Roots	Roots are made into paste and pinch of salt is added The paste taken orally once daily.	+ve
21	<i>Euphorbia royleana</i> Boiss. (Euphorbiaceae)	Siju kata gash (H) Hiju gosh (A)	Spine	Spine is made into seven pieces. Garland is prepared with the seven pieces with three threads of different colours and worn as necklace until cure.	+ve
22	<i>Ipomoea carnea</i> Jacq. (Convolvulaceae)	Kumli gash (H) Panibhutara (A),	Roots	Small balls are prepared out of the paste made by mixing all the plant parts which are dried and taken	+ve

	<i>Andrographis paniculata</i> (Burm.f.) Nees (Acanthaceae) <i>Cajanus cajan</i> (L.) Millsp. (Fabaceae) <i>Stephania glabra</i> (Roxb.) Miers (Menispermaceae)	Mati neem (H) Chirata (A) Orol gash (H) Rahardail (A) Bhuikumrw gash (H) Tubuki-lota/ Goldua (A)	Leaves Leaves Roots	orally after meal.	
23	<i>Mangifera indica</i> L. (Anacardiaceae), <i>Achyranthes aspera</i> L. (Amaranthaceae) <i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Aam gash (H) Aam gosh (A), Ultwnengra gash (H) Hatisur (A) Dublw bon (H) Dubori bon (A)	Bark Roots Leaves	At first lime is applied on the legs below the knee. Then the plant parts are soaked in water in a container for 5 minutes and smeared on the legs for one week twice daily, once early morning and once at the time of sunset.	+ve
24	<i>Musa balbisiana</i> Colla (Musaceae) ` <i>Streblus asper</i> Lour. (Moraceae)	Aathyea kola (H) Bhimkol (A) Herow gash (H) Khorua (A)	Fruits Leaves	Nine leaves of <i>Streblus asper</i> are mixed with one fruit of <i>Musa balbisiana</i> and made into paste. Small balls are made, dried and taken thrice daily after food.	+ve
25	<i>Oroxylum indicum</i> (L.) Kurz (Bignoniaceae)	Naora gash (H) Bhatghila (A)	Bark and Flowers	Bark is soaked in water till turns red. The red bark taken orally for one week. Flowers are also fried only in mustard oil and taken orally till cure.	+ve
26	<i>Oroxylum indicum</i> (L.) Kurz (Bignoniaceae) <i>Ipomoea carnea</i> Jacq. (Convolvulaceae) <i>Citrus sinensis</i> (L.) Osbeck (Rutaceae)	Naora gash (H) Bhat ghila (A), Kumli gash (H) Panibhutura (A), Komla gash (H) Komola (A)	Bark Leaves Fruit's Skin (peel)	Plant parts are grounded together and small balls are made. These are dried and taken daily after food.	+ve
27	<i>Oxalis corniculata</i> L. (Oxalidaceae)	Hamolchukw (H) Tengeshitenga (A)	Whole plant	The whole plant is cooked with mustard oil and taken with rice.	+ve
28	<i>Plumbago zeylanica</i> L. (Plumbaginaceae)	Aaggyea gash (H) Boga-agechi (A)	Roots	Roots mixed with garlic are grounded to paste and applied on the forehead.	+ve
29	<i>Rhynchostylis retusa</i> (L.) Blume. (Orchidaceae)	Kopoful (H) Kopowful (A)	Bulbs	The bulb of the plant is cut into odd number of pieces, a garland is prepared and tied in the neck of the person.	+ve
30	<i>Ricinus communis</i> L. (Euphorbiaceae) <i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Vena/Anda gash (H) Ara gosh (A) Dublw bon (H) Dubori bon (A)	Leaves Leaves	Leaves of both the plants are grounded to a paste. The paste is diluted with water and taken orally 3 times daily.	+ve
31	<i>Saccharum officinarum</i> L. (Poaceae)	Kuher gash (H) Kuhiyar (A)	Stem	Juice of the stem is taken orally twice daily till cure.	+ve
32	<i>Terminalia chebula</i> Retz. (Combretaceae) <i>Phyllanthus emblica</i> L. (Phyllanthaceae) <i>Cardiospermum corindum</i> L. (Sapindaceae) <i>Andrographis paniculata</i> (Burm.f.) Nees (Acanthaceae)	Hortakki Gash (H) Hilikha (A) Bon angla (H) Aamlokhi (A) Sonapata (H) Kapalphuta (A) Mati neem (H) Chiratitita (A)	Fruit's epicarp Fruits Leaves Leaves	Decoction is prepared by mixing all the plant parts and taken orally after meal.	+ve
33	<i>Terminalia chebula</i> Retz. (Combretaceae)	Hortokki Gash (H) Hilikha (A)	Fruit's epicarp	Epicarp of the fruit is powdered and mixed with molasses and taken orally.	+ve

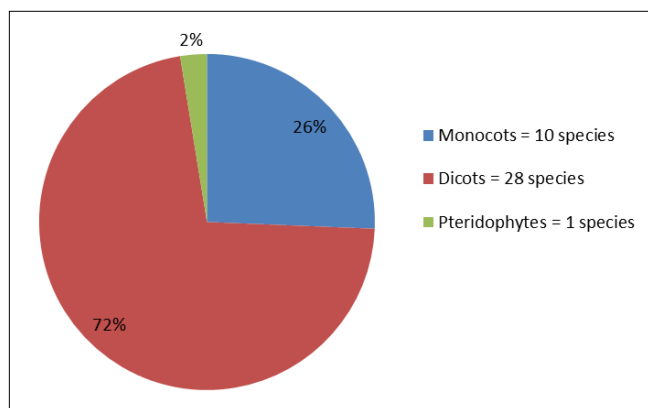


Fig 2: Pie chart showing types of plants

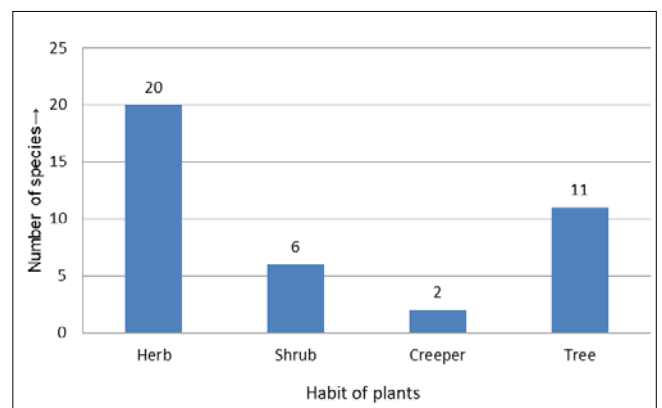


Fig 3: Total number of plants and their habit types.

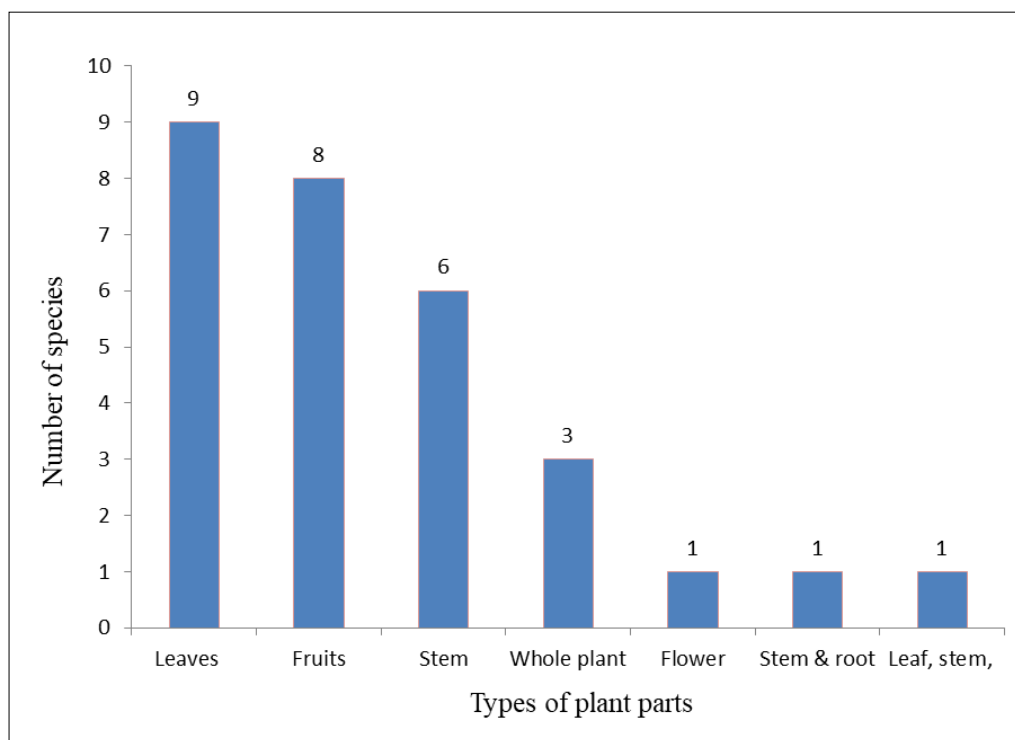


Fig 4: Medicinal plants parts used for treatment of jaundice.

The survey result exhibits that 39 plants are used by the people of Hajong community of Northeast India. *Averrhoa carambola* L. used by the people of Hajong community of Northeast India is also used by the Halam and Chakma community of Tripura for prevention or treatment of jaundice (Sarma and Datta, 2021) [14] and Gujjar community of Sub-Himalayan region of Uttarakhand uses the plant for same purpose (Sharma *et al.* 2012) [15]. *Cuscuta reflexa* Roxb. is used by the Hajong tribe for jaundice treatment. The whole plant is rounded thrice on the neck of the patient and made into a garland. The Halam, Reang and Tripuri community of Tripura uses the whole plant decoction ingredients with coconut water twice for a fortnight (Sarma and Datta, 2021) [14]. Literature reports the same formulation used by different ethnic communities of Tripura (Deb *et al.* 2016, Shil *et al.* 2014) [5, 16]. The plant is used for the same treatment in different parts of India (Sharma *et al.* 2012) [15]. *Musa balbisiana* Colla. is predominately used by Hajong tribe. Leaves of *Streblus asper* are mixed with the fruits of *Musa balbisiana* and made into paste. Small balls are made and dried and taken thrice daily after food. to prevent and cure jaundice. Traditionally, the inflorescences and pseudo stem is also consumed as vegetable in their diet. The raw fruit of *Carica papaya* L. is cooked and eaten by the people for treatment of jaundice. The raw fruits are also used by Bengalee, Halam, Chakma, and Tripuri community of Tripura to prevent jaundice (Sarma and Datta, 2021) [14]. *Cajanus cajan* (L.) Millsp. is significant in jaundice treatment for the Hajong tribe. Small balls are prepared out of the paste made by grinding the leaves which are dried and taken orally after meal. The Tripuri, Halam, Bangalee, and Reang community of Tripura takes leaf juice mixed with honey. *Cajanus cajan* leaves are used for jaundice therapy

in different regions of India (Sharma *et al.* 2012, Nath and Choudhury 2010) [15, 11]. *Cynodon dactylon* (L.) Pers. is used by the ethnic community for the treatment of jaundice. The people of the community orally take the rhizome juice or sometimes chewing the rhizome for jaundice remedies. The plant is used for treatment of various diseases in India (Tushar *et al.*, 2010, Ayyanar and Ignacimuthu 2011) [18, 2]. In our present survey, another plant *Terminalia chebula* Retz. is also reported to be used by the Hajongs of the region. The fruit epicarp is taken after meal as a herbal medicine for jaundice treatment. Bhil community uses the same formulation for jaundices treatment (Samvatsar and Diwanji 2000) [13]. Additionally, in our study numerous widely used plants for jaundice treatment by the Hajong tribe in Northeast India has highlighted the potentiality of these plants, which refers the future priority to the young researchers, pharmaceutical industries for scientific validation, clinical studies and introduce a new bioactive molecule for presentation and treatment of jaundice.

Our survey and published literatures clearly suggest that medical plants used in traditional medicine are rich sources of bio-active constituents. Some of the purified phytochemicals isolated from these plants have also been shown to possess potent hepatoprotective activity. Further investigation into the lead molecules that may produce better, safe, and effective therapeutic effects is warranted to overcome the pharmaceutical imbalance between remedies that protect the liver and drugs that induce hepatotoxicity. Moreover, quality control of herbal drugs and randomized controlled clinical trials will further validate the evidence based herbal therapy for the treatment of liver diseases.



Fig 5: Photographs of some medicinal plants in the study areas

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References

1. Awadh AN, Ali R, Lendequist UK. Some medicinal plants used in Yemeni herbal medicine to treat Malaria. *African Journal of Traditional, Complementary and Alternative Medicine*,2004:1:72-76.
2. Ayyanar M, Ignacimuthu S. Herbal medicines for wound healing among tribal people in Southern India: Ethnobotanical and Scientific evidences. *Inter. Journal of Appl Res in Natural Products*,2009:2:29-42.
3. Buzarbaruah A. *A Text Book of Practical Plant Chemistry*. S. Chand and Company Ltd., New Delhi,2000:10- 13.
4. Cochran WC, Cornfield J. Modern methods in sampling of human population. *Amer. J. Public Health*,1951:45:647- 661.
5. Deb D, Datta BK, Debbarma J, Deb S. Ethno-medicinal plants used for herbal medication of jaundice by the indigenous community of Tripura. India. *Biodiversitas*,2016:17:256-259.
6. Hajong KR. *Hajong Janajati*. Secretary, Hajong Sahitya Sabha, Dhamar, Goalpara (RHAC) Assam,2017:1-27.
7. Jain SK, Rao RR. *A Handbook for field and herbarium methods*. Today & Tomorrow's Publishers, New Delhi,1977:1- 157.
8. Kim A, Ahmad S, Kim S, Sangma M. The Hajong of Bangladesh: A sociolinguistic survey. *SIL Electronic Survey Report* 2011-042.
9. Majumdar HC, Shyam J, Chowdhury U, Koch D, Roy N. Traditional hepatoprotective herbal medicine of Koch tribe in the South-West Garo hills district, Meghalaya. *Indian Journal of Traditional Knowledge*,2019:18(2):312-317.
10. Majumdar HC, Shyam J. Studies on Indigenous Herbal Remedies for Jaundice in Nalbari District of Assam. *Plant Archive*,2013:13(2):823-825.
11. Nath M, Choudhury MD. Ethnomedico-botanical aspects of Hmar tribe of Cachar district, Assam (Part I). *Indian Journal of Traditional Knowledge*,2010:9:760–764.
12. Rajadurai M, Vidhya VG, Ramya M, Bhaskar A. Ethno-medicinal Plants used by the Traditional Healers of Pachmalai Hills, Tamilnadu, India. *Ethno-Med*,2009:3(1):39-41.
13. Samvatsar S, Diwanji VB. Plant sources for the treatment of jaundice in the tribals of Western Madhya Pradesh of India. *Journal of Ethnopharmacology*,2000:73:313–316.

14. Sarma D, Datta BK. Plants used for jaundice among the ethnic people of north tripura district (Tripura), Northeast India. *J. Indian bot. Soc.*,2021:101(1):82-89.
15. Sharma J, Gairola S, Gaur RD, Painuli RM. The treatment of jaundice with medicinal plants in indigenous communities of the SubHimalayan region of Uttarakhand, India. *J Ethnopharmacol*,2012:143:262–291.
16. Shil S, Choudhury MD, Das S. Indigenous knowledge of medicinal plants used by the Reang tribe of Tripura state of India. *Journal of Ethnopharmacology*,2014. 152(1):135-41.
17. Sullivan AM. Cultural Heritage & New Media: A Future for the Past. *J. Marshall Rev. Intell. Prop. L.*,2015:15:604.
18. Tushar, Basak S, Sarma GC, Rangan L. Ethnomedical uses of Zingiberaceous plants of Northeast India. *Journal of Ethnopharmacology*,2010:132(1):286–296.