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Traditional Usage of Ethnomedicinal Plants in Treating Liver Disorders at Manipur, North East India

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Authors' contributions

This work was carried out in collaboration between all authors. Authors Anita Devi Thokchom, Anupam Das Talukdar, SSN and MDC designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors Anita Devi Thokchom and BSC managed the analyses of the study. Authors Anupam Das Talukdar and SSN managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

History ensures that, plants with its medicinal usage are always being the topic of attraction for the researchers. Medicinal plants can be used for the various purposes, for example healing pain, treating ailments or any other health issues. Gastrointestinal diseases more specifically liver disorders are treated with the help of these medicinal plants. Manipur is considered to be the place where liver disorders are primarily treated with the help of these medicinal plants by local health care providers, which emphasize the attributes of these plants in health care system. Following this aspect the study was carried out at three different districts namely Bishnupur, Kakching and Thoubal, that includes Ethnobotanical field surveys conducted from 2012-14, by

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covering traditional healers of Meitei community. Collected information from the surveys was analyzed and the target plants were identified. Disease Consensus Index was calculated on the basis of collected information to determine most significant plants. A total of 52 plant species of 34 distinct families are used as hepatoprotective medicinal plants amongst which the highest Disease Consensus Index (DCI) value was found in the species named *Engelhardtia spicata* Lechen; ex Blume. From these ethno pharmacological data plants with highest hepatoprotective values are identified.

Keywords: Hepatoprotective; disease consensus index (DCI); gastrointestinal disease; ethno medicinal plants; Manipur.

1. INTRODUCTION

From ancient times, medicinal plants have played very important roles in the human health care system. It has been estimated that 80 percent of the world's population still believe the concept of curing disease with the help of medicinal plants [1]. Human beings of Paleolithic age (60,000 years ago) started using plants as medicinal resource to recover from wounds [2]. Even now, medicinal plants still remain as one of the major sources of drugs delivery system and considered as leading compounds for various ailments. Out of these ailments, many liver diseases namely cirrhosis of liver, hepatitis and liver induced loss of appetite [3] are major diseases that are treated with various plant derived medicines [4].

Liver is the largest and one of the most important organs of the human body having multifarious role such as regulating metabolism, storage, secretion, detoxification and synthesis of useful substances [5-7]. Considering its importance in human physiology, liver disease has a serious implication in human health. At present, various liver diseases emerge as a major threat to the world [8]. Existing drugs are inefficient to cope up with the upcoming emerging challenges of the world which make researchers keen to show their prime interest for the research in delivering alternative medicine resources with the help of these medicinal plants.

The state of Manipur located in the north eastern part of India is endowed with rich flora and fauna. The state falls under Indo—Burma biodiversity hotspot region with various endemic species. State is inhabited by various communities belonging to Mongoloids and Indo-Aryans origin. Out of the various communities, Meitei (also called Manipuri) is a major community inhabiting the valley districts of the state. Meitei community has a rich traditional medicine knowledge, which is the amalgamation of folk medicine, Indian Ayurveda and Burmese medicine. Some of the Meitei traditional healers in Manipur are also reknowned in using various medicinal plants for hepatoprotective treatments [9].

With the introduction of western medicine system and urbanization process, this traditional knowledge is slowly getting eroded from the common practices. Documentation and validation of these herbal therapies explore some newer dimensions for hepato-protective treatments. Considering these aspects, an ethnobotanical field investigation was conducted in three districts of Manipur viz: Thoubal, Kakching and Bishnupur. The aim of the study was to explore and record the traditional knowledge of medicinal plants which are used by the local healers in treating the liver disorders of three valley districts of Manipur.

2. MATERIALS AND METHODS

2.1 Site of Study for Ethno-pharmacological Survey

The investigations were carried out in the three district valleys of Manipur viz: Thoubal, Kakching and Bishnupur covering 13 villages in all. These districts are chosen as the place of work because many of the health care providers of these places are still practicing the traditional method of treatments with the help of those medicinal plants which are used to grow over there.

Traditional healers present in these villages were selected by using snowball technique. Traditional healers with grass root level of knowledge are called Heirok (Thoubal District). The survey covered only those traditional healers and informants of Meitei communities who were born and brought up in these thirteen [10] villages (Table 1).

Table 1. List of the villages where ethnopharmacological surveys were conducted

District	Villages
Thoubal	Heirok
	Wangjing
	Thoubal
	Khangabok
Kakching	KakchingKhullen
Bishnupur	Bishnupur [Lamangdong]
	Naranseina
	Ningthoukhong
	Toubul
	Phubala
	Moirang
	Kumbi

2.2 Collection of Data

The systematic field survey was carried out during 2012 to 2014 to collect information on the hepatoprotective plants used by the healers in these 3 districts of Manipur viz: Thoubal, Kakching and Bishnupur. Informations were collected using the semi structured questionnaire which contains 25 questions. Out of these 25 questions, 15 were based on the perception regarding disease and personal knowledge that include queries about gender, age, address, educational level and type of local language spoken by them which are not directly related to Disease Consensus Index (DCI). The remaining 10 questions were used to calculate DCI which include

(a) Vernacular name of the plant [in Manipuri language]
(b) General description of the plant,
(c) Mode of medicine preparation,
(d) Route of administration during the treatment,
(e) "Organoleptic" characteristics like flavor, odor, texture etc,
(f) main symptoms depicted by the patient after the consumption of the plant derived medicine,
(g) Frequency of dose administration,
(h) Patients' feedback after taking the medicine,
(i) Knowledge about the collection site or information about how the species grow and
(j) Whether the patients will be recommended the same medicinal species of plants to other members of the community or not. [11].

Based on the collected information from several informants, 38 plants were collected from the home gardens and nearby forests and agricultural fields. Photographs of all the collected ethnomedicinal plants were captured during the time of flowering and fruiting days. Collected plant samples were identified at the Department of Life Science and Bioinformatics, Assam University by comparing with Flora of Manipur [12], Flora of Assam [13] and Flora of British India [10]. Voucher specimens were deposited at the Department of Life Science and Bioinformatics, Assam University, Silchar. Identified plants were then crosschecked by the Botanical Survey of India (BSI), Eastern Regional Centre, Shillong. Then the name of all plants were standardized through the Plant List from website (www.theplantlist.org). All the plants were also classified accordingly by APG III [14].

2.3 Data Analysis

2.3.1 Determination of one plant value

Disease Consensus Index calculations value for one plant were determined with binary evaluation i.e., (1) for "yes", which represents the knowledge or (0) for "no", which indicates the lack of such knowledge. In each case, mathematical analyses were done to obtain the results. The maximum potential of one plant value (OP) for one informant is always 1 (one). This calculation depended on 10 questions in the questionnaire.

2.3.2 Disease consensus index

The Diseases Consensus index was based on the equation proposed by Andrade-Cetto et al.in Mexico (Andrade-Cetto et al. 2006) The DCI is a comparison based index which depends on the mathematical aspects (limit theory).The equation is as follows:

$$DCI = \left(\frac{\sum_{i=1}^{\infty} V_{xi}}{Cc} mVx \right) Pm^{-0.1}$$

Cc symbolizes the ideal answers of informant reports and Vx symbolizes the ideal answers for each species.

In this equation, the *x* represents one species, (∑V*xi*) the sum of the individual values obtained for one species within the community; (mVx) the statistical mean of the individual values, for one plant; Cc the Correlation coefficient, defined as the maximal number of informants whom the plant is referred; Pm-0.1 is the compensation factor, and analyses the dispersion for one plant, considering the mode of preparation and parts used.

3. RESULTS AND DISCUSSION

In this survey, hepatoprotective medicinal plants were collected with the help of ethnic Meitei community group and medicines are prepared by considering the type of syndrome, its' symptoms, strength, route of infection etc. Doses are also selected accordingly. Disease Consensus Index (DCI) was calculated on the collected medicinal plants. In the present ethno-pharmacological survey, a total of 52 plant species of 34 different families were reported by traditional healers of 13 different villages for treating several hepatic diseases in Manipur. Collected plants were tabulated by their botanical names as well as vernacular names. Their parts which are used in medication, type of diseases treated by it, mode of usage and Disease Consensus Index (DCI) were also mentioned (Table 2).

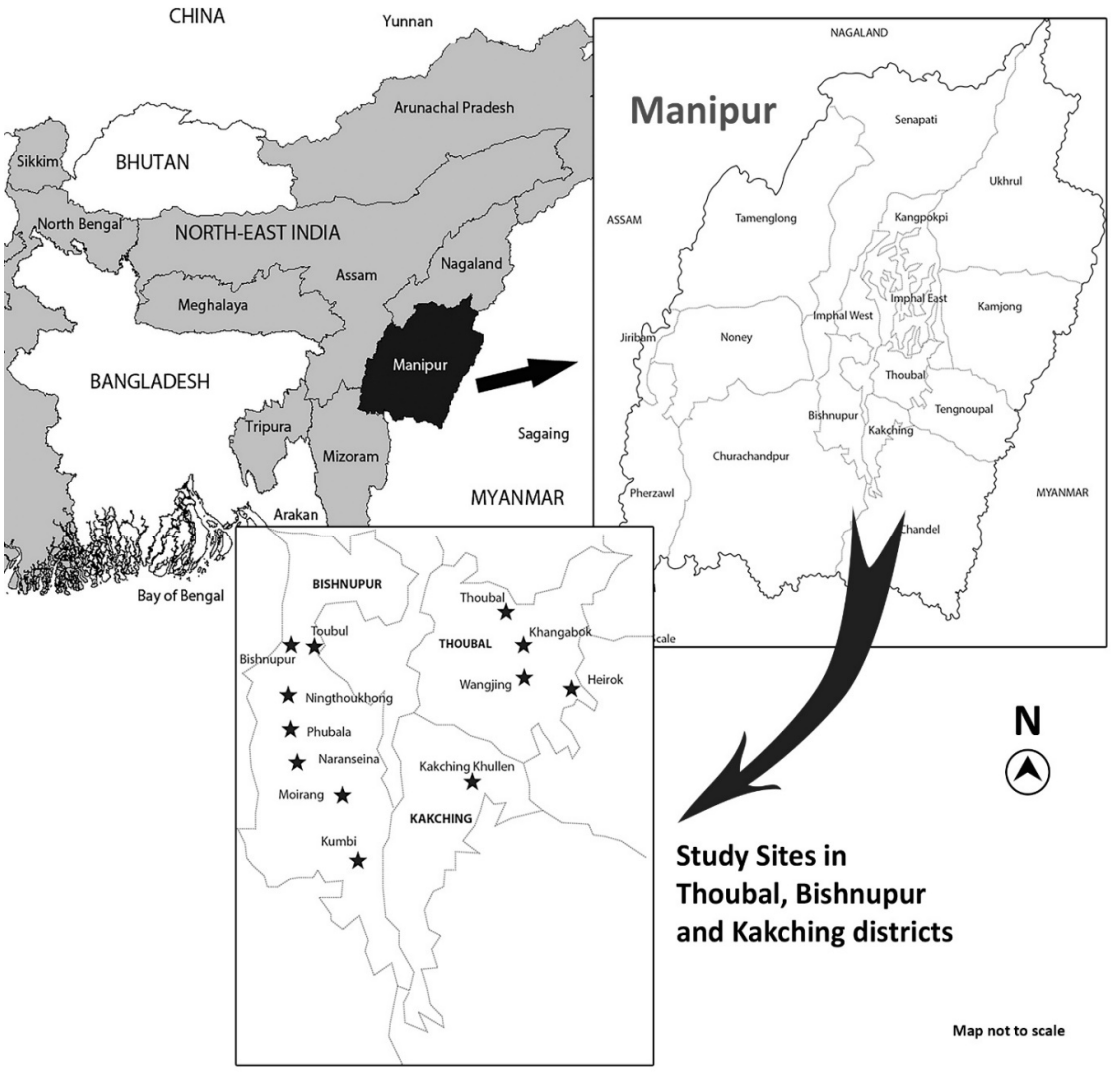

Fig. 1. Map of Thoubal, Kakching and Bishnupur showing the villages

In the survey, highest number of plants were reported in Leguminosae family (5 plants) followed by Compositae and Rutaceae which contains 3 plants of each. Among the plants, *Engelhardtia spicata* Lechen ex Blume (0.23) is found to possess the most dominant and highest DCI level followed by *Saccharum officinarum* L (0.22), *Averrhoa carambola* L. (0.21) and *Andrographis paniculata* (Burm.f.) Nees (0.19) and so on. It was observed that the dose preparation of the herbal medicine and their recipes solely depends upon several factors of the patients, for e.g. age, sex and degree of ailments. Doses varied from person to person so as from a child to an adult. Higher doses were given to the adult and lower doses to the children accordingly.

Engelhardtia spicata Lechen ex Blume with highest value of DCI is used in various traditional medicines. The bark of the tree is used as piscidal and flower juice is used in abdominal pain [15], cough and cold [16]. Engelhardtione, oleanolic acid compound is extracted from this plant [17]. Three important compounds namely engelhardione, (-) -hydroxyl-4-methoxy-1-tetralone and 3-methoxycarbonyl-1,5-dihydroxyanthra-quinone were isolated from related species of *Engelhardtia roxburghiana*. It is to be noted that compounds of Engelhardtione, 3-methoxyjuglone and (-)-4-hydroxy-1-tetralone posses antitubercular activities [18].

Sugarcane, *Saccharum officinarum* L. with second highest DCI value is used to treat jaundice in various traditional medicines [19]. It is also reported that it possessed antioxidant activity [20] and anti-proliferative property [21]. Another plant mentioned in the survey namely, *Averrhoa carambola* L. is claimed to possess higher medicinal value for its fruit pulp in treating jaundice [22] and its roots and leaves are used for its laxative [23]. *Andrographis paniculata* L. is also used for diversified activities for e.g., hepatoprotection [24] anti-inflammatory, antioxidant, antidiabetic, hepatoprotective and antibacterial [25]. These plants with higher DCI values could be the target for future drug discovery programmes.

The study also revealed that different parts of plants are used in various hepatic disorders. Among the different parts, leaves are used mostly (26%) followed by whole plant (21%), fruit (13%), aerial parts and bark (10%), stem (8%), flower and rhizome (5%), shoot and inflorescence (1%) respectively (Fig. 2).

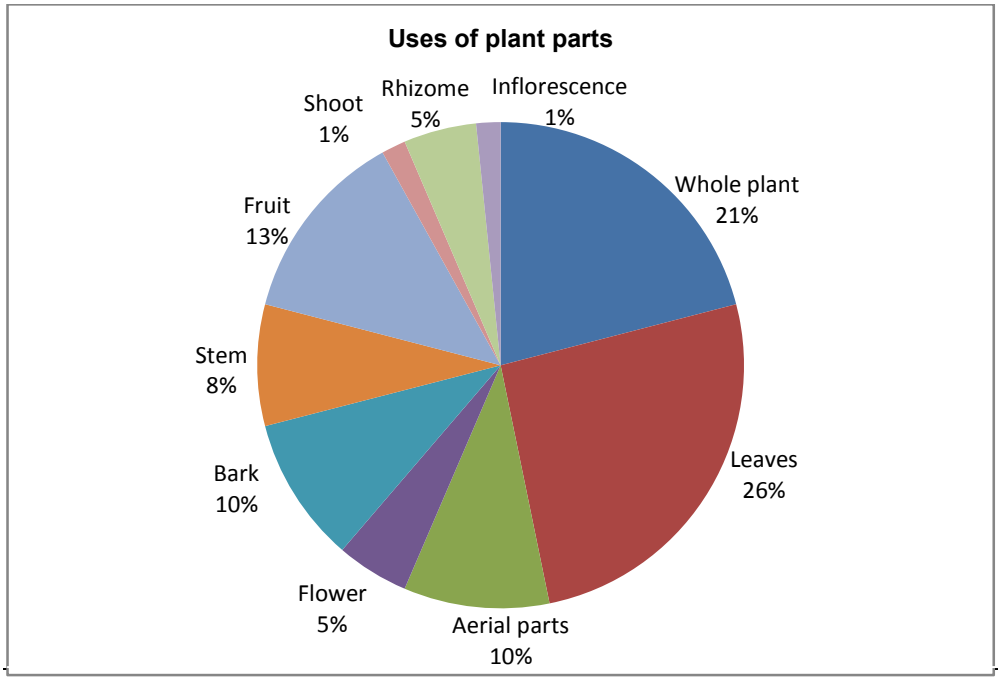

Fig. 2. Reported plant partsin percentage

The mode of herbal recipes of these medicinal plants administered by the local healers are available in different forms like decoction, infusion, powder, paste, fruit extract etc. As per this survey, it has been found that decoction form is used (29%) at highest level of percentage followed by two other forms of recipes like decoction or fruit extract preparation (4%) followed by only fruit consumption recipe (4%), used as decoction or powder or paste (3%) and the lowest combination was found to be the leaf extract (1%) (Fig. 3).

At this context it can be said that plants belong to the family of Compositae, Curcubitaceae and Rubiaceae, are the most potent healer of several liver disorders as well as other pathological issues (Fig. 4).

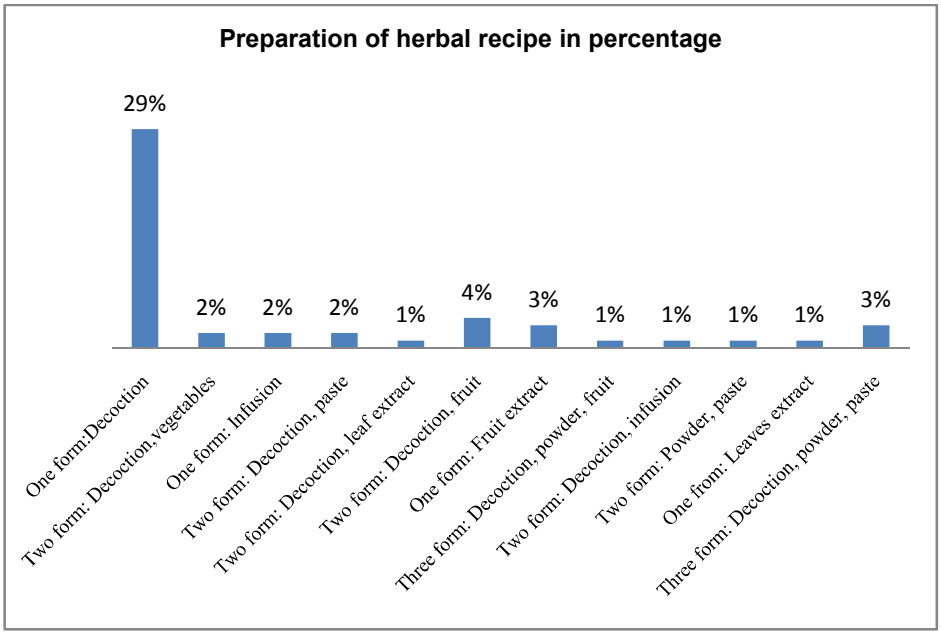

Fig. 3. Preparation of herbal recipe in percentage in the survey

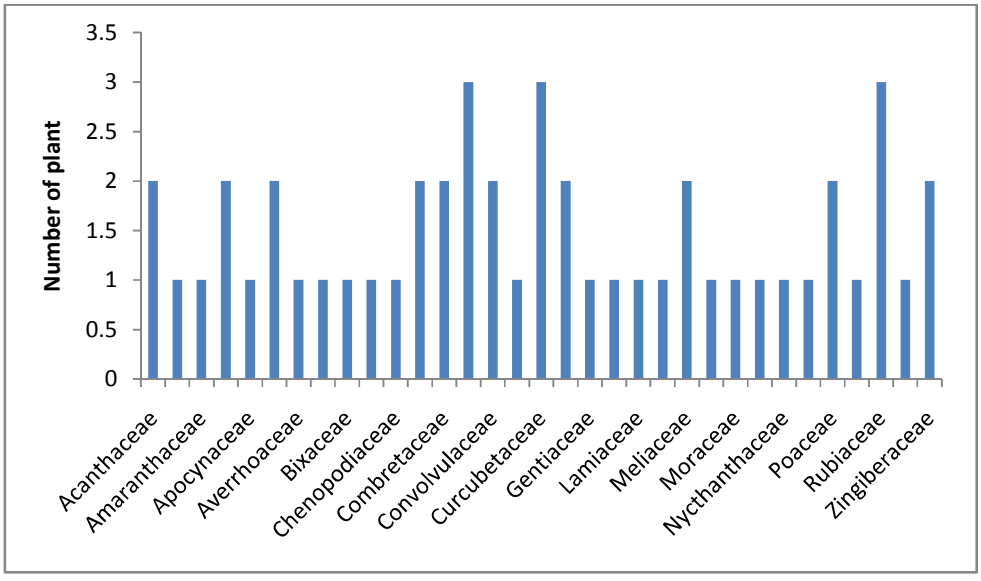

Fig. 4. Reported families of the collected plants in the survey

Table 2. List of Plants used for the treatment of hepatic diseases amongst Meitei communities in Kakching, Bishnupur and Thoubal District, Manipur

Family	Family with plant name	Vernacular name in Manipuri	Parts used	Mode of preparation and use [Pm]	∑Vx	mVx	DCI
Acanthaceae	*Andrographis paniculata* (Burm.f.) Nees	Bhubati, Chirota	Aerial parts	One form: decoction	12.7	0.4	0.19
	*Justicia adhatoda*L.	Nongmakha angouba	Leaves	One form: decoction	10	0.52	0.17
Alliaceae	*Allium tuberosum Roxb.*	Maroi- nakuppi	Whole plant	Two form: Decoction, vegetable	11.6	0.48	0.18
Amaranthaceae	*Achyranthes aspera L.*	Khujumpere	Aerial parts	One form: infusion	10.8	0.41	0.14
Apiaceae	*Eryngium foetidum* L.	Awa Phadigom	Whole plant	Two form: decoction, paste	9.9	0.45	0.14
	Centella asiatica (L.) Urb	Peruk	Whole plant	One form:Decoction	6	0.42	0.08
Apocynaceae	*Catharanthes roseus* (L.) G. Don	Shaheb lei	Leaves, flower	One form: Infusion	7.2	0.42	0.09
Averrhoaceae	*Averrhoa carambola L.*	Heinoujom	Whole plant	One form: decoction	13.8	0.47	0.21
Bignoniaceae	*Oroxylum indicum* (L.) Kurz	Shamba	Stem, bark	One form: decoction	6.3	0.37	0.07
Bixaceae	*Bixa orellana Linn*	Ureirom	Leaves	One form: decoction	5.7	0.35	0.06
Caryophyllaceae	*Drymaria cordata* (L.) Willd. Ex Schult.	Tandanpambi	Aerial parts	One form: decoction	10.4	0.41	0.15
Chenopodiaceae	*Chenopodium album L.*	Monsaobi	Aerial parts	Two form: Decoction, Leaves extract	12.1	0.44	0.18
Clusiaceae	*Garcinia xanthochymus* Hook.f.ex T. Anderson	Heirangkhoi	Fruit	Two form: decoction, fruit	9.3	0.38	0.12
	Garcinia pedunculata Roxb. ex Buch.-Ham	Heibung	Fruit	One form: Fruit extract	8.3	0.43	0.12
Combretaceae	*Terminalia arjuna* (Rox. Ex DC.) Wight & Arn.	Mayokpha	Bark	Three form: decoction, powder, paste	8.1	0.36	0.09
	Terminalia chebula Retz.	Manahi	Fruit	Three form: decoction, powder, fruit	6.2	0.36	0.07
Compositae	*Elephantopus scaber L.*	Shamunapi	Whole plant	One form: decoction	8.7	0.41	0.11
	Eclipta prostrata (L.) L.	Uchisumban	Aerial parts	One form: decoction	11.4	0.45	0.17
	Carthamus tinctorius L.	Kushum lei	Inflorescence	One form: infusion	6	0.37	0.07
Convolvulaceae	*Cuscuta reflexa*Roxb.	Uri Sanamachu	Whole plant	Two form: decoction, infusion	9.2	0.48	0.13
	Ipomoea aquatic Forssk. Fl.	Kolamni	Shoots and leaves	Two form: Decoction, vegatables	9.4	0.4	0.11
Costaceae	*Costus specious* (J.Koen.) Sm.	Okchakhombi	Stem and rhizome	One form: Decoction	5.9	0.34	0.06
Cucurbitaceae	*Bauhinia purpurea L.*	Chingthrao angangba	Leaves and flowers	One form:	10.4	0.43	0.15
	Benincas ahispida (Thunb.) Cogn.	Torbot	Fruit	Two form: decoction, fruit Decoction	11.6	0.46	0.19
	Mukia maderaspatana (L.) M.Roem.	Lamthabi	Whole plant	One form: decoction	6.6	0.38	0.09
Fabaceae	*Cajanus cajan* (L.) Millsp.	Mairongbi	Leaves	One form: Decoction	9.5	0.41	0.12
	Sesbania sesban (L.) Merr	Chuchuramei	Leaves and fruit	Two form: Decoction, fruit	6.1	0.35	0.07
Gentianaceae	*Swertia augustigolia* Buch. – Ham ex D, Don	Sabal- marinkla	Aerial parts	One form: Decoction	9.4	0.39	0.12
Juglandaceae	*Engelhardtia spicata* Lechen ex Blume	Lilbob	Bark	One form: decoction	14.4	0.48	0.23
Lamiaceae	*Vitex negundo L.*	Urikshibi	Flowers	One form: decoction	10.5	0.37	0.13
Mimosaceae	*Mimosa pudica L.*	Kangphan ikaithabi	Whole plant	One form: decoction	6.2	0.38	0.08

Family	Family with plant name	Vernacular name in Manipuri	Parts used	Mode of preparation and use [Pm]	∑Vx	mVx	DCI
Meliaceae	*Aphanmixis polystachya* (Wall.) R.N.Parker.	Heirangkhoi	Bark	Two form: Powder, paste	8.6	0.37	0.1
	Azadirachta indica Adr. Jess.	Neem	Bark and leaves	One form: Decoction	9.1	0.47	0.13
Menispermaceae	*Tinospora sinensis* (Lour.) Merr.	Ningthou khongli	Stem	One form: decoction	10	0.4	0.13
Moraceae	*Ficus hispida L.*	Ashi-heibong	Fruit	One form:' Unripe fruit	5.4	0.33	0.06
Moringaceae	*Moringa oleifera* Lam.	Sajana	Bark	One form: decoction	10.5	0.37	0.13
Nyctanthaceae	*Nyctanthes arbor- tristis* L.	Singarei	Leaves	One form: Decoction	9.9	0.39	0.13
Phyllanthaceae	*Phyllanthus urinaria L.*	Ching heikhru	Whole plant	One form: decoction	9.6	0.38	0.12
Poaceae	*Saccharum officinarum L*	Chu	Stem	One form: Fresh juice	13.8	0.49	0.22
	Coix lacryma-jobi L.	Chaning	Fruit	One form: decoction	6.8	0.35	0.08
Portulacaceae	*Portulaca oleraceae L.*	Leibak kundo	Leaves and stem	One form: Decoction	10.4	0.43	0.14
Rubiaceae	*Spermacocehispida L.*	Langban koukha	Whole plant	One form: decoction	7.7	0.36	0.09
	Pavetta indica L.	Nongmakha asinba	Leaves	One form: decoction	9.1	0.45	0.12
	*Hedyotis auricularia*L.		Leaves	One form: Decoction	5.1	0.34	0.05
Rutaceae	*Aegle marmelos* (L.) Correa	Harikhagok	Leaves, fruit	Two form: decoction, fruit	9.1	0.45	0.12
	Glycosmis pentaphylla (Retz.) DC.	Yong komla	Leaves	One form: Leaves extract	8.3	0.39	0.1
	Zanthoxylum armatum DC.	Mukthrubi	Leaves	Two form: decoction, paste	7.1	0.39	0.09
Saururaceae	*Houttuynia cordata* Thunb.	Toningkok	Whole plant	One form: decoction	6.7	0.51	0.12
Zingiberaceae	*Curcuma caesia* Roxb.	Yaimuachouba	Rhizome	Three form: decoction, powder, paste	7	0.43	0.1
	*Curcuma leucorrhiza*Roxb.	Yaingangangouba	Rhizome	Three form: decoction, powder, paste	6.8	0.45	0.1

4. CONCLUSION

On the basis of the Disease Consensus Index (DCI) values, *Engelhardtia spicata* Lechen ex Blume, *Saccharum officinarum* L, *Averrhoa carambola* L, *Andrographis paniculata* (Burm.f.) Nees, *Benincasa hispida* (Thunb.) Cogn, *Chenopodium album* L, *Allium tuberosum* Roxb, *Dymaria cordata* (L.) Willd. Ex Schult, *Eclipta prostrate* (L.) L, *Justica adhatoda* L. and C*uscuta reflexa* Roxb. can be shortlisted against the liver diseases. However, it is very much necessary to validate the medicinal impact of these plants, so that their remedial aspects may bring up newer frontiers of research for liver diseases. Similarly these plants can be used to develop drugs for treating several unavoidable challenges which are growing day by day in the patho-physiological domain of the world.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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