# Ethnobotanical survey of Medicinal Plants used as Hepatoprotective in Imphal east and west district of Manipur, India.

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***Abstract-*** There is a long tradition of use of medicinal plants for treatment of liver disorders. Documentation and evaluation of hepatoprotective medicinal plants could provide an important role in development of novel drugs for treatment of various hepatic disorders. The present study was aimed to document and perform quantitative evaluation on the medicinal plants used for the treatment of liver disorders by the local traditional healers of two district of Manipur. Ethnopharmacological field studies were conducted by using semi-structured questionnaires during 2012-2014 among the Meitei community in Imphal East and West districts of Manipur. Disease Consensus Indices (DCI) were calculated on the compiled data. A total of 40 plant species belonging to 22 families are used as hepatoprotective medicinal plants by the traditional healers of some certain area of Imphal east and imphal west district of Manipur, India. The highest DCI value was found in *Andrographis paniculata* (Burm.f.) Nees. The study could document various medicinal plants used in the treatment of liver disorders and for support of liver functions. Application of quantitative methods could highlight the consensus information on the use of therapeutic application of different medicinal plants.

***Index Terms-*** Hepatoprotective; Manipur; Traditional knowledge; Disease Consensus Index; Liver

## I. INTRODUCTION

From time immemorial, traditional medicine has been practiced by various communities throughout the world for treating various ailments. Still today, about 80% of the world's population are relying on traditional medicines as their primary health care (Akerele, 1993). Large number of rural people in the developing countries are still depending on these medicine system as their first line of defense in health care practices (Goleniowski *et al*., 2006).Knowledge of plant-derived drugs that form significant part in traditional healthcare treatments is also significant in bioprospecting programmes for production of novel drug entity. Focus on medicinal plants in drug discovery programmes has seen a resurgence with the appearance of disease-resistant pathogens and rapid increase of nonsocomial infection particularly from Eskape pathogens (*Enterococcus faecium, Staphylococcus aureus, Klebsiella apneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa* and *Enterobacter* species)(Mitchell, 2011). In the last few years many scientists and research institutes are giving focus on plant-based natural products or their synthetic analogues as novel drug leads for treating various ailments (Heinrich *et al*., 2012).

The liver is an important gland in human body responsible for various metabolism, such as regulation of glycogen storage, decomposition of red blood cells, plasma protein synthesis, hormone production and detoxification (Rouiller, 2013).Disorders in this gland create many serious health problems and constitute major cause of morbidity and mortality in many parts of the world (Mokdad *et al*., 2014). Liver diseases has multiple origins ranging from those caused by toxic chemicals, excessive consumption of alcohol, infections and autoimmune diseases (Gutierrez and Navarro, 2010).Though various modern medicines are available, challenges still exist in production of effective and reliable drugs that can stimulate liver function, provide protection to the liver from damage and help in hepatic cell regeneration (Chattopadhyay, 2003; Subramoniam and Pushpangadan, 1999). As such, there is need to search for the alternative drugs for the treatment of liver diseases to replace currently used drugs of doubtful efficacy and safety (Madrigal-Santillán *et al*., 2014). In such scenario, medicinal plants has seen as an important source of novel drugs apart from synthetic origin. It is because there is a long tradition of using medicinal plants for the treatment of liver diseases in India and China (Schuppan *et al*., 1999).

The North East India, endowed with two biodiversity hotspots – Indo-Burma and Himalayan, has a rich tradition of using medicinal plant for healthcare practices. The region is the melting pot of various traditional medicine systems ranging from Indian Ayurveda, Traditional Chinese Medicine, Burmese Medicine and indigenous folk medicine. In spite of the availability of modern healthcare facilities, there is still relevancy of traditional medicine for treating various ailments in some areas of Manipur, one of the states of North Eat India (Ningthoujam *et al*., 2013). Many people irrespective of ethnicity and religions are consulting traditional healers for the treatment of renal calculi, gynecological problems, bone fractures, psychological problems and hepatic disorders. Treatment of hepatic disorders, particularly those expressed as jaundice, has seen a wide diversity among the healers with each of them has their own specialized formulations. Some of these medications

are used as food, while other are prescribed as therapeutics in the form of decoction, infusion, extract powder or paste depending upon the assigned symptoms. Though there is long tradition of using dependency on medicinal plants for hepatic treatments, scientific validation of these practices in the state is fundamentally lacking. Therefore, an attempt has been made to document the existing knowledge of the hepatoprotective plants used by the Meitei community in Manipur for the treatment of liver disorder. It is anticipated that scientific validation of traditional practices could provide important information for drug development in bioprospecting programmes as well as providing standards of safety and efficacy in the herbal practices.

## II. MATERIALS AND METHOLOGY

**Study site and ethnomedicinal survey**

The study was conducted in the Imphal East and Imphal West district where there are pockets of traditional healers. Ethnopharmacological field studies were conducted in four villages of Imphal East district, viz., Bamon kampu, Wangkhei, Kongba and Naharup and four villages of Imphal West district, viz., Tera, Lamphel, Langol and Takyel The study was confined to Meitei communities born and raised in the respective villages.

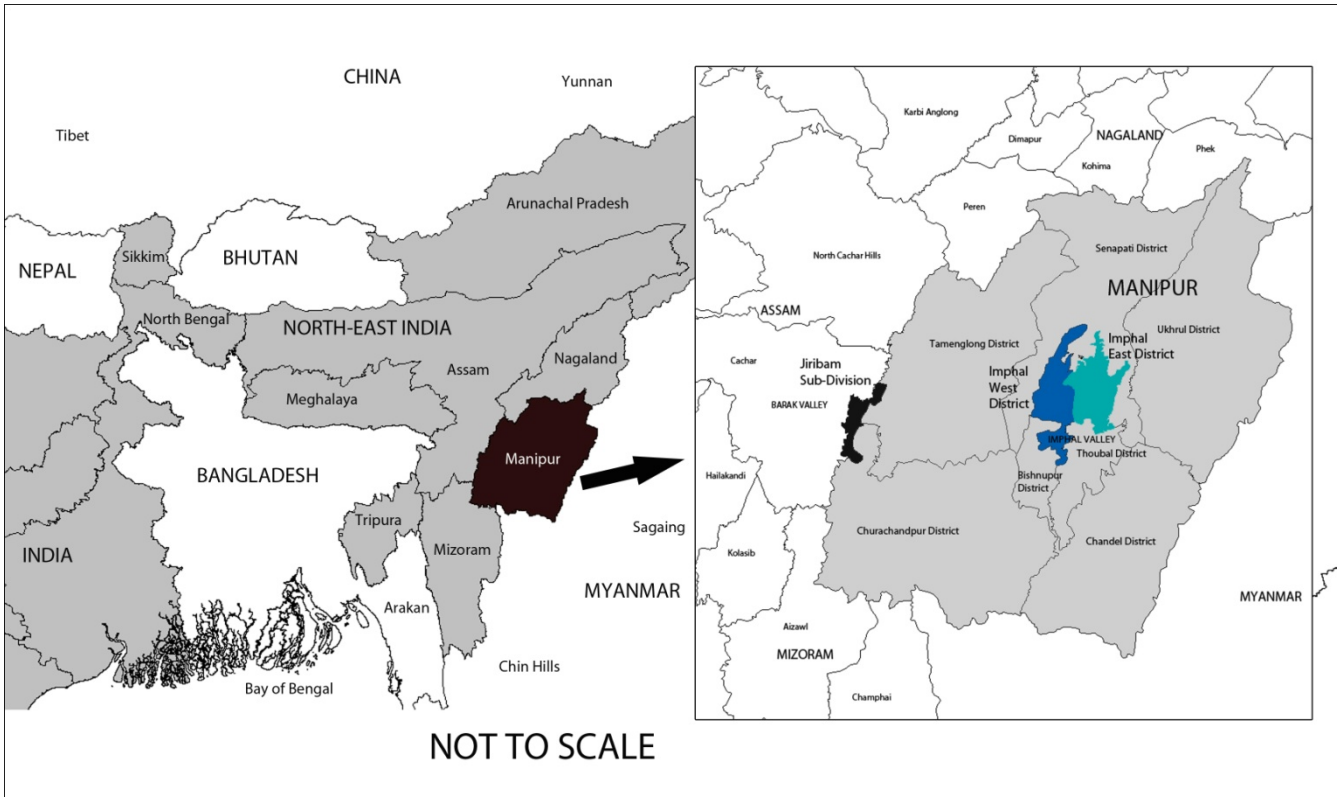


**Fig-I : Study site (Imphal east and west district of Manipur)**

**Data collection**

Field survey has been undertaken from 2012-2014, through interaction with 28 traditional practitioners (20 men and 8 women) belonging to Meitei community. The semi structured questionnaire containing 25 questions were used in the survey. Out of these questions, 15 were based on the personal perception of the disease, personal profiles including gender, age, address, educational level and mother tongue which are not directly related to DCI. The remaining 10 questions were used for calculating the Disease Consensus Index (DCI) and consists of (1) plant name in Manipuri, (2) general plant description, (3) mode of preparation, (4) way of administration during the treatment, (5) "organoleptic" characteristics, like flavor, odour, texture, (6)main symptoms after the plant consumption, (7) how often must the species be administered, (8) did the person feel better after consuming the species, (9) general knowledge about the region of gathering or information about how to grow the species, (10) whether the patient has recommended the species to other members of the community (Andrade-Cetto *et al*., 2006). Based on the information collected from the informants, 38 plants has been collected from the nearby forests, agricultural fields and home gardens of the healers. Collected plants were photographed in their fruiting and/or flowering stages. Plants were initially identified at the Department of Life Science and Bioinformatics, Assam University by consulting with Flora of Manipur (Singh *et al*., 2000), Flora of Assam (Kanjilal, 1997, 2012; Kanjilal and Das, 1938), Flora of Mizoram (Singh *et al*., 2002) and Flora of British India (Hooker, 1879). Herbarium specimens were deposited at the Department of Life Science and Bioinformatics, Assam University, Assam. Identified plants were crosschecked with the Botanical Survey of India, Eastern Regional Centre, Shillong. The plants names were standardized by cross-checking the scientific names through

(www.theplantlist.org) website. Plants were classified according to APG III.

**Analysis of Data**

**Determination of One Plant Value**

For calculation of Disease Consensus Index, value for one plant was determined. It begins with binary evaluation i.e., (1) or "yes", which represents the knowledge or (0) or "no", which represents lack of such knowledge. In each case, this refers to a single question, allowing a mathematical analysis of the results. The potential maximum value for one informant (about one plant, OP) is always 1. This calculation was based on 10 questions present in the questionnaire.

***Disease Consensus Index***

The index was based on the equation proposed on selection of potential medicinal plants in Mexico (Andrade-Cetto *et al.*, 2006). The DCI is a comparison based on the mathematical aspects (limit theory), the ideal answers of informant reports (Cc) and the ideal answers for each species (Vx).It is calculated as follows:

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

where (x) is an species, (∑Vxi) 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 refer a plant; Pm-0.1 is the compensation factor, and analyses the dispersion for one plant, considering the mode of preparation and parts used.

## III. RESULTS AND DISCUSSION

In the present survey, a total of 38 plant species belonging to 21 families were reported by traditional healers for treating various hepatic disorders in Manipur. Associated recipes are tabulated with scientific name, vernacular name, type of ailments, plant parts used, mode of uses, similar usage reports and Disease Consensus Index (DCI) (Table 1).Highest number of plants was reported in Leguminosae (5 plants) followed by Compositae and Rutaceae with 3 plants each.

**Table1 : List of Plant used for the treatment of hepatic disorders among Meitei community in Manipur**

| Family | Botanical 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 | 14.2 | 0.5 | 0.25 |
| | *Justiciaadhatoda L.* | Nongmakhaangouba | Leaves | One form: decoction | 10 | 0.58 | 0.21 |
| Amaranthaceae | *Achyranthes aspera L.* | Khujumpere | Aerial parts | One form: infusion | 11.1 | 0.46 | 0.18 |
| | *Chenopodium album L.* | Monsaobi | Aerial parts | two form: decoction, leaf extract | 11.4 | 0.43 | 0.17 |
| Apiaceae | *Eryngium foetidum L.* | Awa Phadigom | Whole plant | Two form: decoction, paste | 11.1 | 0.55 | 0.22 |
| Bignoniaceae | *Oroxylum indicum (L.) Kurz* | Shamba | Stem, bark | One form: decoction | 3.2 | 0.4 | 0.04 |
| Caryophyllaceae | *Drymaria cordata (L.) Willd. exSchult.* | Tandanpambi | Aerial parts | One form: decoction | 10.4 | 0.41 | 0.15 |
| Clusiaceae | *Garcinia xanthochymusHook.f.ex T. Anderson* | Heirangkhoi | Fruit | Two form: decoction, fruit | 9 | 0.39 | 0.12 |
| | *Garcinia pedunculataRoxb. ex Buch.-Ham* | Heibung | Fruit | One form: Fruit extract | 6.2 | 0.41 | 0.09 |
| Combretaceae | *Terminalia arjuna (Rox. Ex DC.) Wight &Arn.* | Mayokpha | Bark | Three form: decoction, powder, paste | 7.2 | 0.37 | 0.09 |
| Combretaceae | *Terminalia chebula Retz.* | Manahi | Fruit | Three form: decoction, powder, fruit | 5.5 | 0.36 | 0.07 |
| Compositae | *Elephantopus scaber L.* | Shamunapi | Whole plant | One form: decoction | 7.9 | 0.41 | 0.11 |
| | *Eclipta prostrata (L.) L.* | Uchisumban | Aerial parts | One form: decoction | 7.1 | 0.41 | 0.1 |

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|---|---|---|---|---|---|---|---|
| | *Carthamus tinctorius L.* | Kushum lei | Inflorescence | One form: infusion | 2.9 | 0.41 | 0.04 |
| Convolvulaceae | *Cuscuta reflexaRoxb.* | Uri Sanamachu | Whole plant | Two form: decoction, infusion | 12.9 | 0.46 | 0.19 |
| Cucurbitaeae | *Benincasa hispida (Thunb.) Cogn.* | Torbot | Fruit | Two form: decoction, fruit | 11.6 | 0.46 | 0.19 |
| | *Mukia maderaspatana (L.) M.Roem.* | Lamthabi | Whole plant | One form: decoction | 6.6 | 0.388 | 0.09 |
| Juglandaceae | *Engelhardtia spicata blume* | Limpop | Bark | One form:decoction,bark | 2.5 | 0.125 | 0.01 |
| Lamiaceae | *Vitex negundo L.* | Urikshibi | Flowers | One form: decoction | 10 | 0.38 | 0.13 |
| Leguminosae | *Bauhinia purpurea L.* | Chingthraoangangba | Leaves | One form: decoction | 10.4 | 0.47 | 0.17 |
| | *Cajanus cajan (L.) Millsp.* | Mairongbi | Leaves | One form: decoction | 8.6 | 0.43 | 0.12 |
| | *Mimosa pudica L.* | Kangphanikaithabi | Whole plant | One form: decoction | 6.2 | 0.41 | 0.09 |
| | *Cassia fistula L.* | Chaohui | Leaves, fruit | Two form: decoction, fruit | 5.2 | 0.44 | 0.07 |
| | *Sesbania sesban (L.) Merr* | Chuchuramei | Leaves, fruit | Two form: decoction, fruit | 4.2 | 0.38 | 0.05 |
| Menispermaceae | *Tinospora sinensis (Lour.) Merr.* | Ningthoukhongli | Stem | One form: decoction | 10 | 0.4 | 0.13 |
| Moringaceae | *Moringa oleifera Lam.* | Sajana | Bark | One form: decoction | 10.6 | 0.4 | 0.15 |
| Oxalidaceae | *Averrhoa carambola L.* | Heinoujom | Fruit | One form: Fruit extract | 11.8 | 0.47 | 0.19 |
| Phyllanthaceae | *Phyllanthus urinaria L.* | Chingheikhru | Whole plant | One form: decoction | 9.2 | 0.38 | 0.12 |
| Poaceae | *Saccharum officinarum L* | Chu | Stem | One form: Fresh juice | 11.6 | 0.41 | 0.17 |
| | *Coix lacryma-jobi L.* | Chaning | Fruit | One form: decoction | 7.5 | 0.46 | 0.12 |
| Rubiaceae | *Spermacoce hispida L.* | Langbankoukha | Whole plant | One form: decoction | 9.5 | 0.33 | 0.11 |
| | *Pavetta indica L.* | Nongmakhaasinba | Leaves | One form: decoction | 7.9 | 0.41 | 0.1 |
| Rutaceae | *Aegle marmelos (L.) Correa* | Harikhagok | Leaves, fruit | Two form: decoction, fruit | 11.6 | 0.42 | 0.17 |
| | *Glycosmis pentaphylla (Retz.) DC.* | Yong komla | Leaves | One form: Leaves extract | 8.7 | 0.51 | 0.14 |
| | *Zanthoxylum armatum DC.* | Mukthrubi | Leaves | Two form: decoction, paste | 5.7 | 0.43 | 0.08 |
| Saururaceae | *Houttuynia cordataThunb.* | Toningkok | Whole plant | One form: decoction | 6.7 | 0.51 | 0.12 |
| Zingiberaceae | *Curcuma longa L.* | Yaingang | Rhizome | Three form: decoction, powder, paste | 9.2 | 0.48 | 0.15 |
| | *Curcuma caesiaRoxb.* | Yaimuachouba | Rhizome | Three form: decoction, powder, paste | 6.5 | 0.5 | 0.11 |
| | *Curcuma leucorrhizaRoxb.* | Yaingangangouba | Rhizome | Three form: decoction, powder, paste | 6.8 | 0.48 | 0.11 |

The study also revealed the diversity among plant parts used for medicine against hepatic disorders. Whole plant (21%) are found to be the most dominant plant parts followed by leaves and fruit (16%), aerial parts (13%), rhizome and leaves, fruit (8%), stem and bark (5%), inflorescence and stem, bark (3%) and flowers (2%) (Figure II).

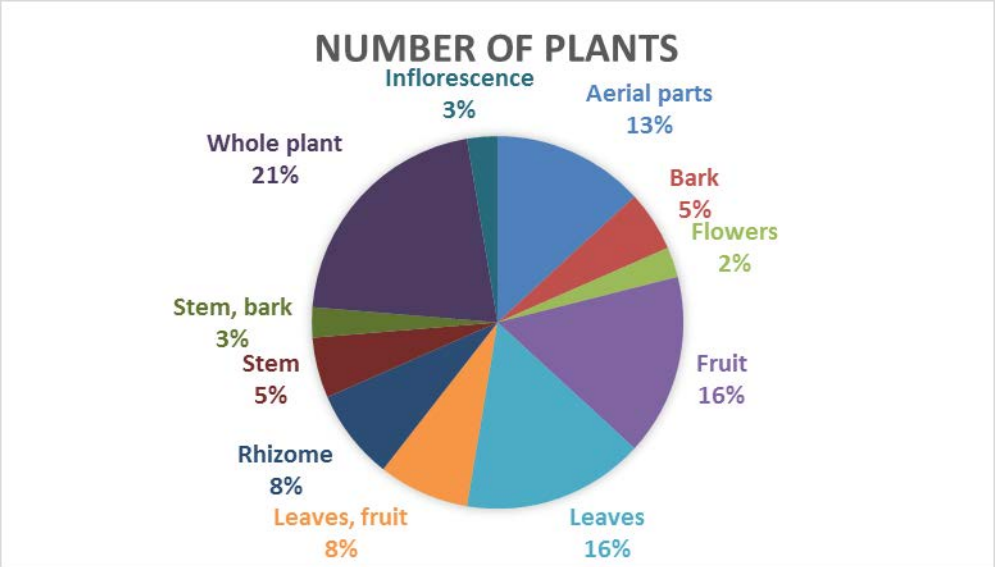


**Figure II: Percentage of plant parts reported in the study**

These medicinal plants are administered by the local healers in various combination of recipes. Highest form of recipes was observed in use as decoction (47%) followed by use as decoction or fruit (13%). Lowest combination was observed in plants used as leaf extract or fresh extract or whole plant (3%) (Figure III).

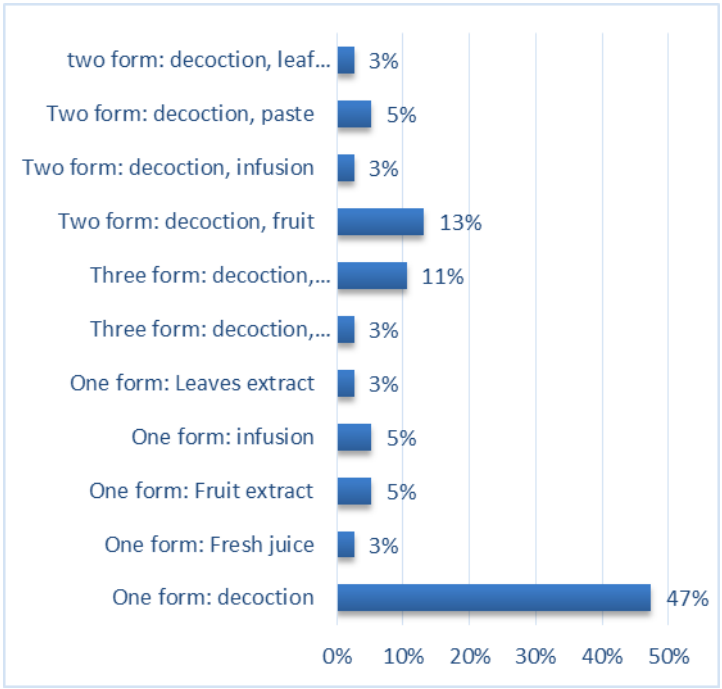


**Figure III: percentage of preparation of herbal recipe in the survey**

Mode of preparation and dosage of the recipes were found to be dependent on the patient's age, sex and health. Adult were prescribed with higher dose as compared to children.DCI are reported for the calculation of the medicinal plant species used by the informants. DCI values are found to be the highest in *Andrographis paniculata* (Burm.f.) Nees (0.25) followed by *Eryngium foetidum* L(0.22), and *Justicia adhatoda* L. (0.21).

At the present condition, traditional knowledge of medicinal plants are slowly eroding among the Meitei community in Manipur. Practices of the traditional medicines are still observed in some rural areas of Manipur. In the survey,

concepts of ailments and symptoms of traditional medicine were observed to be different from modern scientific viewpoints. According to traditional Meitei medicine system, jaundice is considered as disease. However, in modern medicine concept, jaundice can be seen as set of symptoms expressed as yellow pigmentation of the skin, conjunctivitis membranes of the sclera and other mucous membranous caused by high level of bilirubin level in the blood (Click *et al*., 2013; Roche and Kobos, 2004).The International Classification of Diseases Version 10 of WHO categorized jaundice into that of digestive system and abdomen or neonatal jaundice. Traditional healers provide medicinal recipes only to the jaundice related to digestive system disorders. They considered such disorders was caused by improper dietary habits that affect liver. With regard to neonatal jaundice, they did not provide medicinal recipes rather provide incantations or non-herbal treatments.

Some of the medicinal plants reported in the study have similar usage reports in other countries. For instance, use of *Cuscuta reflexa* is also reported in other parts of India and China (Patel *et al*.,2012). There have been some reports of scientific validation of traditional uses. Methanolic extract of *Cuscuta reflexa* were observed to improve the liver function by decreasing the serum ALT, AST and ALP levels in hepatotoxic rats (Balakrishnan *et al*., 2010). Use of sugarcane juice in the treatment of jaundice are also observed in other parts of the world such as Equatorial Guinea (Akendengué, 1992). This juice has been reported in other countries as dietary regimen possessing hepatoprotective properties (Ri-ming, 2011).

In the study *Andrographis paniculata* has the highest DCI value indicating its high consensus among the traditional healers. This plant contained two important compounds andrographolide and neoandrographolide, both possessing hepatoprotective functions (Trivedi *et al*., 2007). Second highest DCI value is observed in *Eryngium foetidum* having many medicinal properties (Paul *et al*., 2011). However, information on its usage for hepatoprotective activities in other parts of the world is very limited. *Justicia adhatoda* also have similar usage report in hepatic disorders (Maurya and Singh, 2010; Scientific et al., 1992). The combined extracts of leaves and fruits of *Averrhoa carambola L* is used by the Tai-Khamyangs, Dimasa and Hmar tribe for the treatment of jaundice and gastric problems (Das *et al*.,2008;Nath and Choudhury, 2010). *Cuscuta reflexa* Roxb. contain a number of α-glucosidase inhibiroty compounds (Anis *et al*., 2002);2-(3-hydroxy-4-methoxyphenol)-3,5-dihydroxy-7-*O*-β-D-glucopyranoside-4*H*-1-benzoprane-4-one (Chemesova, 1990);3-(4-O-β-D-glucopyranoside-3,5-dimethoxyphenyl)-2-propen-1-ol (Kelley *et al*., 1976)7'-(4-hydroxy, 3'-methoxyphenyl)-N-[(4-butylphenyl)ethyl]propenamide(Kelker et al., 1984) have been isolated from *Cuscuta reflexa* along with five known compounds, 6,7-dimethoxy-2*H*-1-benzopyran-2-one (Cooke, 1908). *Benincasa hispida (Thunb.) Cogn* used as a laxative, diuretic, tonic,aphrodisiac, cardiotonic, urinary calculi,blood disease, insanity, epilepsy, jaundice, dyspepsia, fever and menstrual disorders (Rachchh and Jain, 2008). Phytochemical review indicates the presence of triterpenes: alnusenol, multiflorenol, iso-multiflorenol,flavones, iso-vitexin, sterols, lupeol, lupeol acetate and beta-sitosterol (Yoshizumi *et al*., 1998). *Achyranthes aspera L.*is used for skin eruption by decoction of leaf (Munuswamy et al.,2013).This plant is reported to be used as immunostimulant, antioxidant, diuretic, antipyretic, hepatoprotective, antiproliferative, anticancerous, cytotoxic and anti-inflammatory agent and also used for treatment of renal dropsy and ulcers (Edwin *et al*., 2008; Vasudeva *et al*., 2002). *Bahunia purpurea L* has been reported for antioxidant and hepatoprotective effects (Chaturvedi *et al*., 2011). Recently the hepatoprotective activity has been reported in *Chenopodium album Linn* (Nigam and Paarakh, 2011).Aegle marmelos(L.) Correa fruit contains volatile compounds like hexanal, isomyl acetate, limonene, β-phellandrene, p-cymene, acetoin, (E)-2-octenal, (E,E)-2, 4-heptadienal, dehydro-p-cymene, linalool; 3,5-octadience-2-one, α-cubebene, trans-p-metha-2,8-dienol, citronellal, cineole, p-cymene, citronella, citral, cuminaldehyde, β-cubebene, carvone, carvyl acetate, dihydro-β-ionone, (E)-6,10-dimethyl-5, 9-undecadien-2-one,β-ionone, caryophyllene oxide, humulene oxide and hexadacanoic acid (Charoensiddhi and Anprung, 2008). *Saccharum officinarum L* leaves contains leteolin-8-*C*-(rhamnosylglucoside) as major compound with radical scavenging activity (Vila *et al*., 2008).These are some of the plants species having highest DCI values. These plants are used as the highest degree in hepatoprotective activity used by the people of Manipur.

## IV. CONCLUSION

On the basis of the study, 11 plants viz., *Andrographis paniculata (Burm.f.) Nees, Eryngium foetidum L., Justicia adhadoda L., Cuscuta reflexa Roxb., Benincasa hispida (Thunb.) Cogn., Averrhoa carambola L., Achyranthes aspera L., Chenopodium album L., Bauhinia purpurea L., Saccharum officinarum L, Aegle marmelos (L.). Correa*have been observed to possess high DCI values among the Meitei community in Manipur. These plants can be shortlisted for future phytochemical programmes for hepatoprotective activities. Though some of these plants have known bioactive components, though phytochemical investigations on these plants are yet to be performed. Information on traditional hepatoprotective medicines, retaining among the traditional communities of Manipur may be a valuable input in the scientific investigation.

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