

## RESEARCH ARTICLE

# Ethnomedicinal plants used by traditional healers of Bodo community in Udalguri district of BTAD, Assam for treatment of Jaundice

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## Abstract

Bodo community of Assam has been using plants as medicine since an unknown past. The traditional Bodo-healers, 'Ojha' are reported to have good knowledge in preparation of herbal medicines for curing several ailments of man and domesticated animals. Ethnomedicobotanical study in 40 villages of Udalguri district of Bodoland Territorial Area District (BTAD) of Assam during 2021 – 2022 and interaction with Ojhas and other knowledgeable people recorded 44 species of plants from 30 families and five formulations they use to treat Jaundice. The herbal formulations used to treat jaundice were found innovative and unique but the practitioners decline to share their detailed protocols to others. However, majority of the recorded plant species they use are commonly growing in the study area.

**Keywords:** Bodo-tribe; Jaundice; Herbal medicine; Traditional healers; Udalguri; BTAD; Assam

## 1. Introduction

The North Eastern Region (NER) of India, consisting of eight member-states namely Arunachal Pradesh, Assam, Meghalaya, Mizoram, Manipur, Nagaland, Sikkim, and Tripura, covering a total area of 2,62,230 km<sup>2</sup> (Wouters and Subba, 2022; Borthakur, 1980). It is situated between 24.5°N to 28°N latitudes and 88.25° E to 96.0° E longitudes of Eastern Himalaya including Patkai and Naga Hills regions (Das, 2003). Assam, the 'land of red-river and blue hills', is the gateway to Northeast India and is the abode of numerous indigenous tribal communities living in close association with nature since time immemorial. The population of Assam is an admixture of different races which includes Mongolian, Indo-Burmese, Indo-Iranian and Aryan origin (Borthakur, 1980). Mainly 13 tribal communities live in Assam, they are *Bodo*, *Rabha*, *Karbi*, *Mishing*, *Sonowal Kacharis*, *Deori*, *Dimasa*, *Tiwas*, *Tai-Phake*, *Singpho*, *Kuki*, *Kelma*, and *Tea Tribe*. People of all these communities are rich in traditional knowledge related to utilization and conservation of medicinal plants (Borthakur, 1980). Bodo and Mishing communities are Tibeto-Burmese in origin and represent the largest tribal population in Assam (Anonymous 2014; Borthakur, 1980). Bodo people are the early settlers of Assam and are mainly settled in the Bodoland Territorial Area Districts (BTAD) region in the North-western part of Assam (Endle, 1911; CDPS, 2004). There are four districts under BTAD, namely Kokrajhar, Chirang, Baksa, and Udalguri, administered by the Bodoland Territorial Council (BTC). Bodo, Rabha, and Rajbonghis represent the major tribal communities living in Bodoland area. BTAD is situated on the north bank of the river Brahmaputra and foothills of the Great Himalayas, is endowed with rich flora and fauna of ecological, economic and cultural significance (Borthakur et al., 2018).

Like most other traditional communities in any part of the world, the tribal communities of BTAD also rich in traditional knowledge that includes knowledge of using plants as medicine. However, the knowledge on ethnomedicine differs from community to community. Different communities have different ways and means of practicing and preserving their own tradition of medical practices (Kotoky and

Das 2008; Shankar et al., 2012). Such medical practices are closely related to the local flora and the type of diseases they suffer in an area.

Among different diseases, jaundice is the most common ailment affecting the citizens throughout the world. In *Rig-Veda* (8000 BCE) Jaundice has been referred as *Hariman* disease. Jaundice was recognized by Charaka in 700 BCE when it was referred as *Kamala* and herbal treatments were prescribed to treat it (Vidyalankar, 1994). Hippocratic School in 200 BCE first reported Hepatitis (Nene, 2007). Throughout the world Jaundice is one of the most widespread and life-threatening diseases. It occurs mostly in the underdeveloped countries. Elevated concentration of bilirubin in serum causes Jaundice (Ullah et al., 2016). The term 'jaundice' has been derived from the French word *jaune*, which literally means yellow (Constantin, 2011). Jaundice may be caused by an obstruction of bile ducts which normally discharge bile salts and pigments into the intestine. It is caused by bilirubin which comes from red blood cells. The colour of the skin and urine vary depending on the level of bilirubin (Drummod and Kappas, 2004). Only 20% of bilirubin comes from multiple sources like myoglobin, cytochromes etc. and about 80 % of it is derived from the heme-group of haemoglobin. This haemoglobin comes from the destruction of red blood cells in the reticuloendothelium of liver, spleen, and bone marrow. Jaundice is less common in adults and is mainly observed in infants but it creates serious condition when it affects the adults (Memon et al., 2016). Infact, the occurrence of jaundice (*Icterus neonatorum*) in newborns is observed for centuries (Juncker and Stahl, 1724).

People living in BTAD also, quite often suffer from jaundice and for its treatment they prefer to depend on their botanical origin traditional medicinal knowledge. Present ethnomedicobotanical study was undertaken to document the plants used by the bodo-people in Udalguri district of BTAD, Assam (India) (Figure 2) for the treatment of jaundice.

## 2. Materials and methods

### 2.1. Study area

BTAD is consisting of four districts in north-western region of Assam, namely Udalguri, Chirang, Baksa and Kokrajhar covering an area of 9612 sq km. Udalguri district covers 20.93% (2012 sq km) of the total area of BTAD and is located at 26°46' and 27°77' North Latitudes and 92°08' and 95°15' East Longitudes (Figure 1 and 2). This district comprises of 800 villages is bounded by Bhutan and West Kmeang district of Arunachal Pradesh in the North, Sonitpur District in the east, Darrang district in the South and Baksa district in the west (Anonymous, 2014).

### 2.2. Field Survey

#### 2.2.1. Sample size and participants

For the present ethnomedicobotanical survey, 40 villages of Udalguri district were visited randomly during February 2021 to April 2022 (Figure 2). With assistance of local informants, traditional medicine practitioners or 'Ojha' from all these villages were identified and established contact with them using local Bodo language (the first author, JB, herself is a Bodo). Then from each village two such practitioners were selected randomly for further investigation. In addition, some senior villagers were also interviewed considering their experiences. While Ojhas were asked for the medicines and associated methods of treatment, the senior people were interviewed for the frequency of the disease and their level of satisfaction after taking medicines from the practitioners.

Villages were selected randomly, however, villages with more than 100 households, like *Kapurpara*, *Bornogaon*, *Dwifhangkuti* and *Dogormakha* were visited first for the survey and smaller villages were surveyed later. Personal interviews were conducted using a pre-structured questionnaire format prepared following the methods suggested by Martin (1995), Phillips et al. (1994), Tag (2007) and Tag et al. (2012). Focused group discussions involved two person or solitary. Before the start of interview mandatory prior informed consent (PIC) were obtained from the potential informants.

Collected knowledge or data from the informants mainly included: (i) village details, (ii) Name, age, gender, and occupation of informant; (iii) vernacular name of medicinal plants; (iv) parts of plant harvested and used; and (v) method of preparation of medicine and its administration.

Taking assistance of the potential informants, plants were spotted and collected from the community forest area or from the kitchen gardens. For the collection and processing of plant specimens, leading to the preparation of mounted herbarium-sheets Jain and Rao (1976) and Das (2021) were followed. Digital photographs were taken for each species using a CANON 1500D camera. Collected plants were identified in the laboratory using different floras including *The Flora of British India* (Hooker 1872 – 1897), *Bengal Plants* (Prain, 1903), *Flora of Assam* (Kanjilal et al., 1934 – 1940), and *Flora of BTAD* (Borthakur et al., 2018). In some cases, expert taxonomists were consulted and were matched with images of specimens available online from different Herbaria. Accepted plant names were verified from POWO [<https://powo.science.kew.org/>], Royal Botanic Garden, Kew UK. A set of the voucher specimens has been deposited in the HAU-Herbarium of Department of Botany, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh for future reference.

## 3. Results

This study recorded 44 species of medicinal plants clubbed within 40 genera from 30 different families used for treatment of jaundice among the traditional healers of Bodo community in BTAD, Assam. Fruits were reported highest among the plant part harvested and used followed by bark and whole plants (Figure 3). The survey elucidated the use of five unique herbal formulations for treatment of jaundice, all plant based, and are in use by different traditional medicine practitioners. All the five formulations used plants but, in some cases, little non-plant materials are also used.

### 3.1. Herbal formulations and methods of threatment

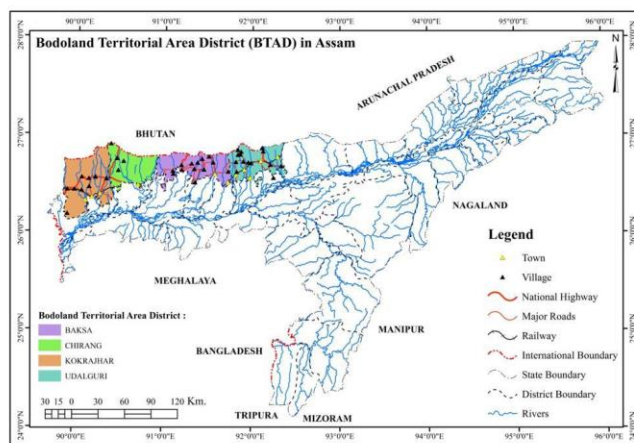


Figure 1. Drainage system of Assam and human settlement area of Bodoland Territorial Area Districts (BTAD).

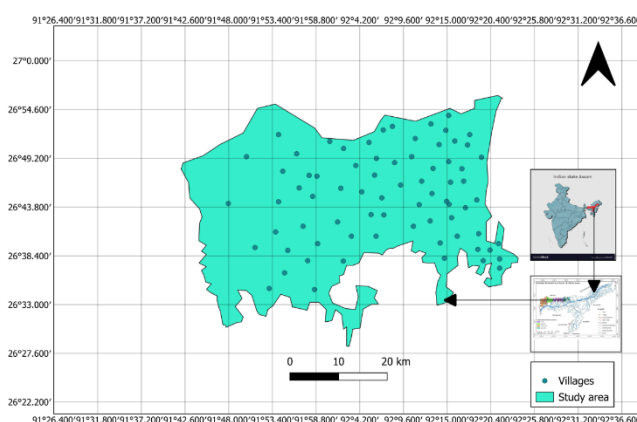


Figure 2. Location map of the villages surveyed in Udalguri district of BTAD, Assam.

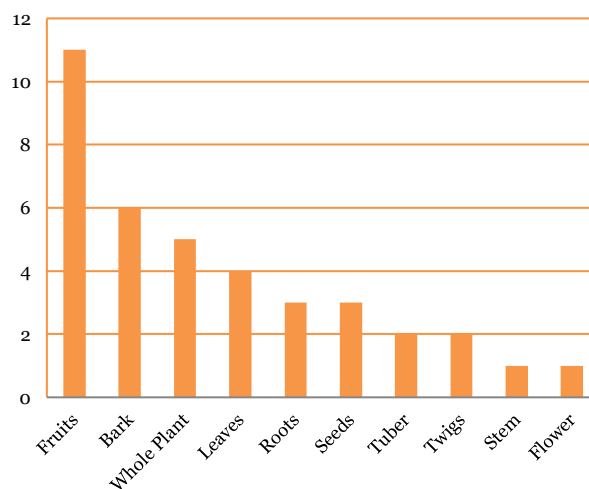


Figure 3. Graph showing number of plant parts used by the Bodo community of Udalguri district of BTAD, Assam for treatment of jaundice.

#### 3.1.1. Formulation 1

Plants used: *Amomum subulatum*, *Areca catechu*, *Artocarpus heterophyllus*, *Capsicum annum*, *Cuscuta reflexa*, *Cassia fistula*, *Cocos nucifera*, *Centella asiatica*, *Cinnamomum verum*, *Curcuma longa*, *Cyclea peltata*, *Drymaria cordata*, *Elettaria cardamomum*,

*Euphorbia royleana*, *Flueggea leucopyrus*, *Hellenia speciosa*, *Hydrocotyle sibthorpioides*, *Impatiens balsamina*, *Lawsonia inermis*, *Leucas aspera*, *Marselia quadrifolia*, *Mangifera indica*, *Morinda angustifolia*, *Myristica fragrans*, *Oroxylum indicum*, *Persicaria strigosa*, *Phyllanthus emblica*, *Plumbago zeylanica*, *Piper nigrum*, *Senna occidentalis*, *Stephania rotunda*, *Terminalia arjuna*, *Terminalia bellirica*, *Terminalia chebula*, *Syzygium aromaticum* and *Zanthoxylum oxyphyllum* [36 species of plants]

In this formulation, as much as 36 species of plants are used and nine of the responded *Ojhas* used this method.

**Processing:** Plant materials were washed properly, kept in air for some time to remove the surface water and then made into a paste. Small globules of c. 0.5 cm in diameter were prepared from the paste, dried properly under the sun, and stored for use.

**Administration:** 2 globules are to be taken twice a day until the patient is cured.

### 3.1.2. Formulation 2

**Plant used:** *Averrhoa carambola*

One informant used this method

**Processing:** Fruits are to be eaten raw when mild symptoms are recognized.

**Administration:** To be consumed only when mild symptoms are seen. 1 or 2 ripe fruits are to be eaten in the mid-day, sprinkled with a pinch of salt.

### 3.1.3. Formulation 3

**Plants used:** *Morus alba*, *Tinospora cordifolia*, *Morinda angustifolia*, *Musa x balbisiana*, *Stephania rotunda* and an empty cocoon of silk-moth. Five of the responded *Ojhas* were using this method.

**Processing:** Plant parts are cut into very small pieces and the cocoon is turned inside out. The empty cocoon is now filled with the small pieces of plant materials and tied with a long thread to use as a loket.

**Administration:** The cocoon-garland is needed to wear for 3 – 4 days or till the symptoms of recovery from the disease appears.

### 3.1.4. Formulation 4

**Plants used:** *Lawsonia inermis*, *Morus alba*, *Hydrocotyle sibthorpioides*, *Stephania rotunda*, *Artocarpus heterophyllus* and *Cuscuta reflexa*. In addition, water used for washing rice-grains is also used.

Five of the responding *Ojhas* practice this method using six species of plants.

**Processing:** Plant parts are grinded properly and boiled using rice-water and the strained extract is to drink.

**Administration:** One cup of extract is to drink twice a day, in the morning and in the night after a meal. The medicine is to be used till the disease is cured.

### 3.1.5. Formulation 5

**Plant used:** *Achyrenthes aspera*

One *Ojha* use this formula

**Processing:** Stems and roots are cut into 2 – 4 cm long pieces and make a bracelet with the help of white thread and wear it on the wrist.

**Administration:** Bracelet is to wear for 3 – 4 days. The bracelet will dry in 3 – 4 days which indicates that the formula/ medicine is working and this can be seen in just 3 – 4 days

## 3.2. Enumeration of medicinal plants used in herbal formulations for jaundice treatment

1. ***Amomum subulatum*** Roxb. [Zingiberaceae]. Bodo name: *Bor-Elashi*

Perennial rhizomatous herb; pseudostem clustered, upto 1.5 m high; lamina oblong-lanceolate; Inflorescence cum infructescence basal, globose; epicarp irregular; seeds arillate, aromatic.

**Specimen cited:** Badagami, Udalguri; *JB & HT-021* (HAU), dated 25.02.2022. **Flowers & fruits:** May to August.

**Native distribution:** Wet tropical and subtropical areas of India, Nepal to China (cultivated in NE India)

**Plant part used:** Seed (Formulation 1).

2. ***Achyrenthes aspera*** L. [Amaramtheceae]. Bodo name:

*Sampher-ultha*

Annual, erect, oppositely branched herb; lamina broadly obovate, entire, acute hairy; spike long, densely flowered; flowers bractate; utricle oblong.

**Specimen cited:** No 1 Bhalukmari, Udalguri; *JB & HT-016* (HAU); dated 21.02.2022. **Flowers & fruits:** September to April.

**Native Distribution:** Old-world species, throughout tropical and subtropical areas.

**Plant Part used:** Root and stem (Formulation 5)

3. ***Areca catechu*** L. [Arecaceae]. Bodo name: *Goi*

Monopodial erect tree to 20 m high; lamina lanceolate; inflorescence compact, much branched; epicarp regular, mesocarp fibrous; nutmore or less spherical, embryonic end slightly compressed.

**Specimen cited:** Badagami, Udalguri; *JB & HT-026* (HAU), dated 01.03.2022. **Flowers & fruits:** November to March

**Native distribution:** Philippines (wet tropical areas) (widely cultivated in warmer and moist areas)

**Plant part used:** Fruit-peel (pericarp) (Formulation 1).

4. ***Artocarpus heterophyllus*** Lam. [Moraceae]. Bodo name: *Khantal*

Evergreen tree, 9 to 21 m high; latex milky; lamina coriaceous; multiple fruit (infructescence) huge covered with spine-like persistent styles.

**Specimen cited:** Lising-pakribari, Badagami, Udalguri; *JB & HT-028* (HAU), dated 02.03.22. **Flowers & fruits:** March to July.

**Native distribution:** Tropical India (naturalized over wide areas; also planted)

**Plant part used:** Stem/ bark (Formulation 1) and leaf (Formulation 4).

5. ***Averrhoa carambola*** L. [Oxalidaceae]. Bodo name: *Khurdwi, Khambrenga*

Evergreen tree 5 – 12 m high; leaves compound, leaflets ovate or ovate-oblong, entire, acuminate; cymose clusters on old stem; fruits oblong with 5 fleshy wings (star-shaped in cross section).

**Specimen cited:** Dwifhangkuti, Balisia Gwdanari, Badagami, Udalguri; *JB & HT-029* (HAU), dated 02.03.2022. **Flowers & fruits:** Round the year.

**Native distribution:** Central & E. Jawa to Maluku (commonly planted in warmer areas)

**Plant part used:** Ripe fruit (Formulation 2)

6. ***Capsicum annuum*** L. [Solanaceae]. Bodo name:

*Phanlubuddwn*

Annual erect herb, up to 1.2 m tall; lamina ovate, entire, acute; berries of variable shapes; seeds flattened-discoid.

**Specimen cited:** Badagami, Udalguri; *JB & HT-010* (HAU), dated 07.02.2022. **Flowers & fruits:** Round the year.

**Native distribution:** Southern U.S.A. to Brazil, Caribbean islands; (cultivated widely)

**Plant part used:** Fruit (Formulation 1).

7. ***Cassia fistula*** L. [Fabaceae]. Bodo name: *Sonari*

Medium-sized tree, 10–20 m tall; leaves unipennate; racemes long, pendulous; pods terete, long, pendulous.

**Specimen cited:** Sorunogaon, Udalguri; *JB & HT-024* (HAU), dated 26.02.2022. **Flowers & fruits:** March to July

**Native distribution:** Tropical areas of Indian Subcontinent to Myanmar (also planted)

**Plant part used:** Fruit and bark (Formulation 1).

8. ***Centella asiatica*** (L.) Urb. [Apiaceae]. Bodo name: *Mana-muni-gidir*

Branches slender, runners; lamina reniform, crenate; runners long with slender stem; umbels axillary, small, few flowered; fruits closely reticulate.

**Specimen cited:** Bhithwrsnai, Udalguri; *JB & HT-038* (HAU), dated 09.03.2022. **Flowers & fruits:** September to December

**Native distribution:** Caucasus, Tropical & Subtropical Old World to E. Australia and W. Pacific

**Plant part used:** Whole plant (Formulation 1)

9. **Cinnamomum verum** J.Presl. [Lauraceae]. Bodo name:

*Dalchini*

Trees, 10–15 m high; lamina ovate-oblong, 3-veined from base; panicles terminal; drupes 1-seeded.

*Specimen cited:* No.1 Bhalukmari, Udalguri; *JB & HT-30* (HAU), dated 02.03.2022. *Flowers & fruits:* May to August

*Native distribution:* Sri Lanka (cultivated in moist tropical areas)

*Plant part used:* Bark (Formulation 1).

10. **Cocos nucifera** L. [Arecaceae]. Bodo name: *Naringkhol*

Monopodial tree to 30 m high, stem with large leaf-scars; leaves pinnately dissected; female and male flowers on same spadix; fibrous-drupes

*Specimen cited:* Badagami, Udalguri; *JB & HT-022* (HAU), dated 26.02.2022. *Flowers & fruits:* round the year

*Native distribution:* Central Malesia to SW. Pacific (wildly cultivated)

*Plant parts used:* Peel from pericarp (Formulation 1).

11. **Curcuma longa** L. [Zingiberaceae]. Bodo name: *Haldui*

Herb with annual pseudostem; rhizome deep-yellow inside; leaves distichous; lamina broadly oblong-lanceolate; spike basal with coloured bracts, emerge before appearance of pseudostem.

*Specimen cited:* Pakribari, Udalguri; *JB & HT-012* (HAU), dated 10.02.2022. *Flowers & fruits:* May to June

*Native distribution:* SW India (wildly cultivated for its rhizome)

*Plant part used:* Rhizome (Formulation 1).

12. **Curcuma caesia** Roxb. [Zingiberaceae]. Bodo name:

*Haldwigwsum.*

Herb with annual pseudostem; rhizome deep-blue inside; leaves distichous; lamina broadly oblong-lanceolate; spike basal with coloured bracts, emerge before appearance of pseudostem.

*Specimen cited:* Pakribari, Udalguri; *JB & HT-020* (HAU), dated 25.02.2022. *Flowers & fruits:* May to June

*Native distribution:* Bangladesh, India

*Plant part used:* Rhizome (Formulation 1).

13. **Cuscuta reflexa** Roxb. [Convulvaceae]. Bodo name:

*Gumw bendwng*

Total stem-parasite; stem slender, yellow; leafless; flowers in small clusters; corolla bell shaped, white.

*Specimen cited:* Pakribari, Udalguri; *JB & HT-038* (HAU), dated 09.03.2022. *Flowers & fruits:* November to March

*Native distribution:* Afghanistan to Indo-China, Jawa.

*Plant part used:* Whole plant (Formulation 1 & 4)

14. **Cyclea peltata** (Burm.f.) Hook.f. & Thomson

[Menispermaceae]. Bodo name: *Phennel-Khuga*

Shrubby twinner; lamina peltate, ovate; flowers dioecious; the fruits are white, spherical or oval drupes.

*Specimen cited:* No.1 Bhalukmari, Udalguri, *JB & HT-027* (HAU), dated 01.04.2022. *Flowers & fruits:* April-June /November-January.

*Native Distribution:* Indian Subcontinent to Indo-China

*Plant Parts used:* Leaf (Formulation 1)

15. **Drymaria cordata** (L.) Willd. ex Schult. [Caryophyllaceae].

Bodo name: *San-mijingkri.*

Prostrate annual herb, branches dichotomous; lamina ovate-rounded, thick, entire, base slightly cordate, 3 – 7 veined from base; petiole c. 1 cm; panicle terminal.

*Specimen cited:* Bithwrsnai, Badagami, Udalguri; *JB & HT-031* (HAU), dated 02.03.2022. *Flowers & fruits:* March to July.

*Native distribution:* Mexico to S. Tropical America, Tropical Asia, S. Africa

*Plant part used:* Whole plant (Formulation 1).

16. **Euphorbia royleana** Boiss. [Euphorbiaceae]. Bodo name:

*Sijou*

Prickly succulent shrub up to 4 m tall, stem 5-ridged, much branched; leaves narrowly obovate nodes with a pair of prickles and leaf-scar; capsule 3-lobed.

*Specimen cited:* Badagami, Udalguri; *JB & HT-034* (HAU), dated 05.03.2022. *Flowers & fruits:* February to June.

*Native distribution:* Iran to Myanmar (religious plant; often planted)

*Plant part used:* Leaf (Formulation 1).

17. **Elettaria cardamomum** (L.) Maton [Zingiberaceae]. Bodo

name: *Choto-elashi*

Plant not seen. But small-cardamon is a common spice and is available in markets.

*Specimen cited:* Badagami, Udalguri; *JB & HT-035* (HAU), dated 05.03.2022. *Flowers & fruits:* Fruits procured from local markets.

*Native distribution:* SW India (not cultivated in the study area)

*Plant part used:* Seed (Formulation 1).

18. **Flueggea leucopyrus** Willd. [Phyllanthaceae]. Bodo name:

*Huken*

Dioecious shrub, bushy with angular branches; lamina small, obovate, obcordate; flowers in axillary clusters from small bracts; drupes globose, white.

*Specimen cited:* Badagami, Udalguri; *JB & HT -019* (HAU), date 22.02.2022. *Flowers and fruits:* April – May.

*Native Distribution:* Indian subcontinent, China South-Central, Ethiopia, Myanmar, Saudi Arabia, Socotra, Somalia, Sri Lanka.

*Plant Parts Used:* Leaf (Formulation 1)

19. **Hellenia speciosa** (J.Koenig) S.R.Dutta [Costaceae]. Bodo

name: *Buri-thokon.*

Stem tall to 2 m; leaves spirally arranged; spike compact, terminal; corolla white; reproduce mainly by rhizome.

*Specimen cited:* Ambagaon, Udalguri; *JB & HT-023* (HAU), dated 26.03.2022. *Flowers & fruits:* May to July.

*Native distribution:* Tropical & Subtropical Asia to Australia (often grown for rhizome)

*Plant part used:* Rhizome (Formulation 1).

20. **Hydrocotyle sibthorpioides** Lam. [Araliaceae]. Bodo name:

*Mana-muni-pisa*

Annual in moist habitat, runners slender; lamina reniform, 0.5 to 1.5 cm in diameter, crenate; peduncle very small; umbels small globose; flowers sessile; fruits flat, thinly ridged.

*Specimen cited:* Bithwrsnai, Udalguri; *JB & HT-039* (HAU), dated 09.03.2022. *Flowers & fruits:* September to December.

*Native distribution:* Old World, Tropical and temperate regions

*Plant part used:* Whole plant (Formulation 1)

21. **Impatiens balsamina** L. [Balsaminaceae]. Bodo name: *Gwthi-*

*khwra.*

Annual herb, 20–75 cm tall; leaves alternate; lamina ovate-lanceolate, deeply toothed, acute; corolla colour much variable; capsules dehiscent with force to disperse seeds.

*Specimen cited:* No. 1 Bhalukmari, Udalguri; *JB & HT-048* (HAU), dated 11.03.2022. *Flowers & fruits:* June – October.

*Native Distribution:* India, Sri Lanka (also grown as an ornamental)

*Plant part used:* Leaf (Formulation 1)

22. **Lawsonia inermis** L. [Lythraceae]. Bodo name: *Jenthoka*

Shrubs, 2 – 4 m tall; branches slender, rigid, spinescent; lamina oblanceolate, entire, acute; capsules globular.

*Specimen cited:* Serhang, Udalguri; *JB & HT-044* (HAU), dated 09.03.2022. *Flowers & fruits:* January to May.

*Native distribution:* Tropical Africa, Arabian Peninsula, S. Pakistan to India (sometimes cultivated)

*Plant part used:* Leaf (Formulation 1)

23. **Leucas aspera** (Willd.) Link [Lamiaceae]. Bodo name:

*Brahmaputra-Khansisa*

Annual herb, upto 60 cm high; lamina lanceolate, serrate, acute; verticillaster globose; corolla 2-lipped, white.

*Specimen cited:* Boramjuli, Udalguri; *JB & HT-049* (HAU), dated 19.03.2022. *Flowers & fruits:* September to February

*Native distribution:* Tropical and subtropical parts of Asia

*Plant part used:* Leaf (Formula 1) and root (Formulation 3)

24. **Mangifera indica** L. [Anacardiaceae]. Bodo name: *Thaijou*

Ever-green spreading tree, 15 – 30 m high; leaves alternate, simple; flowers polygamous in spreading panicle; drupes with fleshy mesocarp.

*Specimen cited:* Silputa, bithwrsnai, Badagami, Udalguri; *JB & HT-043* (HAU), dated 09.04.2022. *Flowers & fruits:* February to July.

*Native distribution:* Warmer areas of Indian subcontinent and China (cultivated in warmer areas)

*Parts used:* Bark of trunk, fruits and seed (Formulation 1)

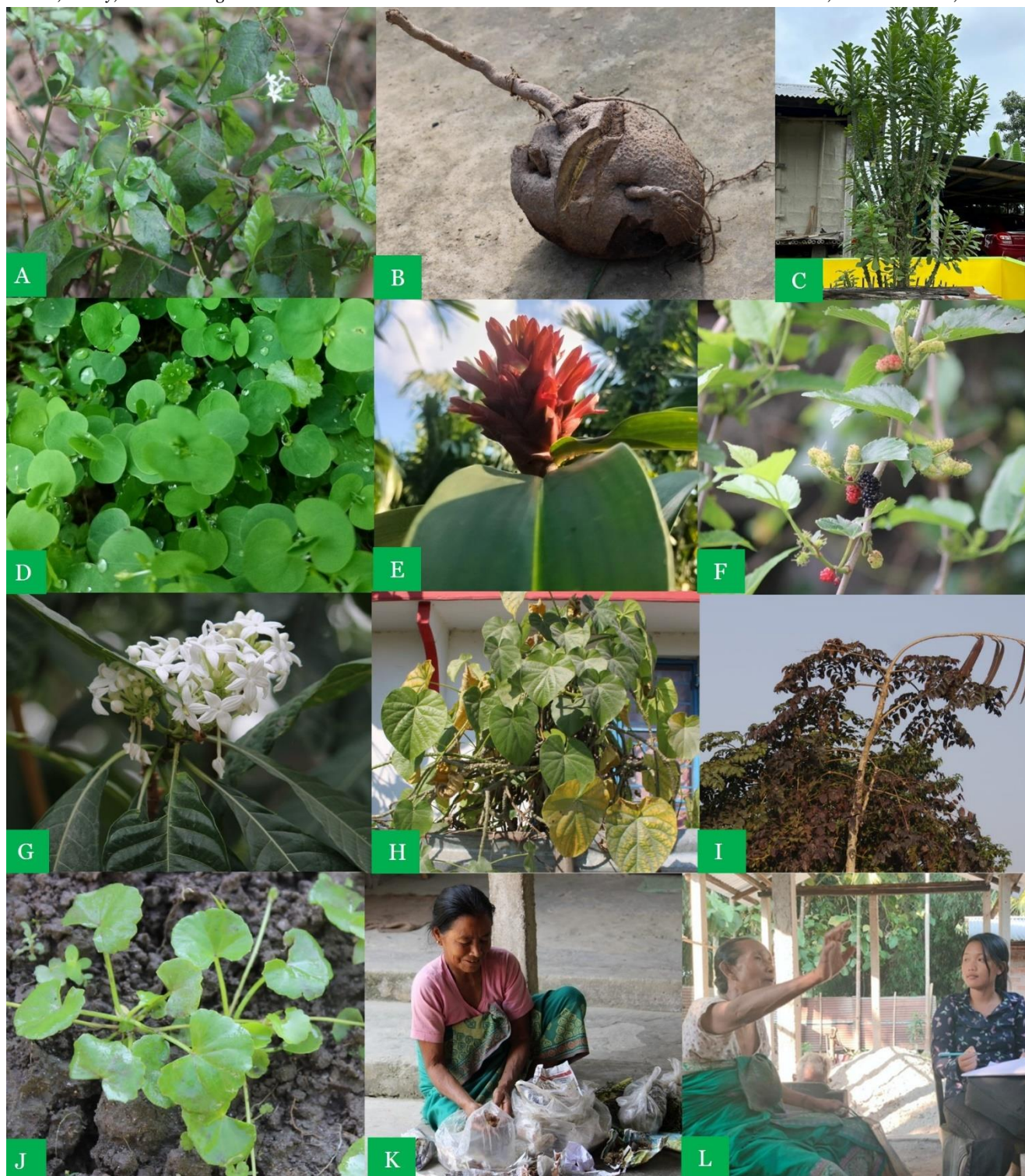
25. **Marsilea quadrifolia** L. [Marseliaceae]. Bodo name: *Dwini-singri*. Aquatic fern; runners slender; leaves alternate; petiole slender, upright; lamina of leaflets obdeltoid; ellipsoid; sporocarps few on short axillary stalk.  
*Specimen citation:* Dogormakha, Udalguri; *JB & HT-032*(HAU), dated 02.03.2022. *Sporulating:* December to February.  
*Native distribution:* Canary Islands, Europe to Japan and Iran  
*Plant part used:* Whole plant (Formulation 1)
26. **Morinda angustifolia** Roxb. [Rubiaceae]. Bodo name: *Asuka* Small evergreen shrub to tree; young stem quadrangular; lamina obovate-lanceolate; cyme on a terminal straight peduncle, crowded; drupes fused with each other.  
*Specimen cited:* Boramjuli, Dogormakha, Udalguri; *JB & HT-018* (HAU), dated 10.03.2022. *Flowers & fruits:* Round the year.  
*Native distribution:* Tropical Himalayas to China and Indo-cina.  
*Plant part used:* Roots (Formulation 1 & 3)
27. **Morus alba** L. [Moraceae]. Bodo name: *Thaikongsib, Jabgeng* Bushy shrub to a small tree; lamina ovate, lobed-serrate, acute; catkins axillary; young infructescence whitish, turns black on ripening.  
*Specimen cited:* Boramjuli, Kndarbil, Udalguri; *JB & HT-042* (HAU), dated 09.03.2022. *Flowers & fruits:* March to April  
*Native distribution:* Central China, growing throughout tropical and subtropical areas of world (often cultivated)  
*Plant part used:* Root (Formulation 3 & 4)
28. **Musa balbisiana** Colla [Musaceae]. Bodo name: *Thalir athia* Cultivated; pseudostem tall; lamina large, oblong, entire; spadix large, pendulous, drupes fleshy without seed.  
*Specimen cited:* Boramjuli, Udalguri; *JB & HT-036* (HAU), dated 08.04.2022; *Flowering and fruiting:* August–November.  
*Native distribution:* Indian subcontinent, China, E. Himalaya, Myanmar, Thailand, Vietnam.  
*Plant part used:* Root (Formulation 3)
29. **Myristica fragrans** Houtt. [Myristicaceae]. Bodo name: *Joi-phol, joitri*  
 The plant is not growing here but *Joitri* is available in the market as spice.  
*Specimen cited:* No 1 Bhalukmari, Udalguri; *JB & HT-037* (HAU), dated 08.04.2022; Procured from markets.  
*Native distribution:* Banda Island (Indonesia) (not planted in study area)  
*Plant part used:* Aril from seed (Formulation 1)
30. **Ocimum tenuiflorum** L. [Lamiaceae]. Bodo name: *Tulshi* Erect, undershrub, 30–60 cm; stem obscurely angled, hairy; lamina ovate, serrate; verticillasters small, closely placed; corolla white with purple tips.  
*Specimen cited:* Boramjuli, Udalguri; *JB & HT-045* (HAU), dated 09.03.2022. *Flowers & fruits:* May to July.  
*Native distribution:* Tropical & Subtropical Asia to W. Pacific (often cultivated)  
*Plant part used:* young twig, leaf (Formulation 1) and root (Formulation 3)
31. **Oroxylum indicum** (L.) Kurz [Bigoniaceae]. Bodo name: *Kharokhandai*  
 Small tree with few branches; leaves 2 – 3-pinnate; corolla trumpet shaped; night-blooming; pods to 1 m long; seeds thinly flat with papery wings.  
*Specimen cited:* Bada gami, Udalguri; *JB & HT-013* (HAU), dated 12.3.2023. *Flowers & fruits:* June to July.  
*Native distribution:* S. China to Tropical Asia  
*Plant part used:* Bark (Formulation 1)
32. **Persicaria strigosa** (R.Br.) H.Gross [Polygonaceae]; Bodo name: *Alari-gufur*. Annual, branches trailing and creeping, strongly retrorse-strigose; lamina hastate or sagittate, margin glabrous; inflorescence of 2–4 branches with small terminal subglobose flower clusters. Perianth pink or white; achenes lenticular or trigonous.  
*Specimen cited:* Ambagaon, Udalguri; *JB & HT-022* (HAU), dated 26.03.2022. *Flowers & fruits:* May to August

- Native distribution:* W. Ethiopia to S. Africa, Madagascar, Tropical & Subtropical Asia to E. Australia  
*Plant part used:* Leaf (Formulation 1)
33. **Phyllanthus emblica** L. [Phyllanthaceae]. Bodo name: *Amblai* Trees to 8 m high; branches crowded, small determinate branchlets with subsessile leaves; flowers axillary, greenish-yellow, male and female mixed; drupes nearly spherical, greenish-yellow upto 26 mm in diameter.  
*Specimen cited:* Badagami, Udalguri; *JB & HT-046* (HAU), dated 09.03.2022. *Flowers & fruits:* March - August.  
*Native distribution:* Tropical and subtropical Asia (widely cultivated)  
*Plant part used:* Fruit (Formulation 1)
34. **Piper longum** L. [Piperaceae]. Bodo name: *Phatwi*. Shrubby root-climber, dioecious, reaching 10 m or more heights; lamina rounded-ovate, cordate; spikes slender, upright; infructescence narrowly elongated, compact, fruits 1-seeded.  
*Specimen cited:* Sorunogaon, Udalguri; *JB & HT-033* (HAU), dated 03.03.2022. *Flowers & fruits:* May to August  
*Native distribution:* India, Malaysia, Nepal, Sri Lanka, Vietnam (also cultivated)  
*Plant part used:* Fruit (Formulation 1)
35. **Piper nigrum** L. [Piperaceae]. Bodo name: *Gol-moris* Woody root-climber, reaching 10 m or more heights; lamina rounded-ovate, acuminate, cordate; spikes slender, pendulous; drupes distinct, spherical, turns orange, 1-seeded.  
*Specimen cited:* No.1 Bhalukmari, Udalguri; *JB & HT-028* (HAU), dated 02.03.2022. *Flowers & fruits:* May to August.  
*Native distribution:* SW India (warmer areas); (commonly cultivated as secondary crop)  
*Plant part used:* Fruit (Formulation 1)
36. **Plumbago zeylinica** L. [Plumbaginaceae]. Bodo name: *Agwi-ashi*. Small bushy shrub; stem finely ridged; lamina oblanceolate; flowers in terminal raceme; calyx green with glandular-hairy; corolla white; pistil heterostylous.  
*Specimen cited:* Bornogaon, Kndarbil, Udalguri; *JB & HT-017* (HAU), dated 21.03.2022. *Flowers & fruits:* September to December.  
*Native distribution:* Widely distributed in tropical and subtropical areas (often grown as an ornamental)  
*Plant part used:* Root (Formulation 1 & 3)
37. **Senna occidentalis** (L.) Link [Fabaceae]. Bodo name: *Soleng* Foetid undershrub, 1 – 2 m high, stem softly-hairy; leaves impeipinnate; branched corymbs terminal; corolla yellow; fruits terete, slightly curved.  
*Specimen cited:* Kusubil, Udalguri, *JB & HT-011* (HAU), dated 10.02.2022, *Flowers & fruits:* August to November.  
*Native distribution:* Native of mainly to S. American region but now pantropical.  
*Plant part used:* Leaf (Formulation 1)
38. **Stephania rotunda** Lour. [Menispermaceae]. Bodo name: *Swima-Kuntutri, Dumaolu-bedor*  
 Root-stock robust, nearly spherical; arial shoots annual, climbing on bushes. Stem obscurely ridged; leaves alternet; lamina peltate, rounded, obscurely lobed, apex rounded to acute; cypes stalked, spreading like umbels.  
*Specimen cited:* Kusubil, Balisiagwdanari, Udalguri, *JB & HT-015* (HAU), dated 21.05.2022. *Flowers & fruits:* March to June  
*Native distribution:* Indian Subcontinent to S. Tibet and Indo-China  
*Plant part used:* Tuber (Formulation 1 & 3)
39. **Syzygium aromaticum** (L.) Mer. & L.M. Perry [Myrtaceae]. Bodo name: *Long*  
 Plant not seen. But clove is a common spice and is always available in the market.  
*Specimen cited:* No, 1 Bhalukmari, Bada gami, Udalguri; *JB & HT-014* (HAU), dated 20.04.2022 (collected from market)  
*Native distribution:* Maluku (Indonesia) (not grown in the study area)  
*Plant part used:* Flower-bud (Formulation 1)
40. **Terminalia arjuna** (Roxb. ex DC.) Wight & Arn. [Combretaceae]. Bodo name: *Arjun*

Tropical evergreen tree 20 – 25 m; trunk usually buttressed; lamina oblong, entire, acute, glabrous; racemes with new leaves; fruits fibrous, woody, with five wings.

41. ***Terminalia bellirica*** (Gaertn.) Roxb. [Combretaceae]. Bodo name: *Bhaora*

Tall deciduous trees with buttress, bark fissured; branches



**Figure 3.** Medicinal plants used by Bodo community of Udalguri district of BTAD, Assam for treatment of Jaundice. **A.** *Plumbago zeylinica* L.; **B.** *Stephania rotunda* Lour.; **C.** *Euphorbia nerifolia* L.; **D.** *Drymaria cordata* (L.) Wild.ex.Schult.; **E.** *Cheilcostus speciosus* (J.Koning) C.Specht; **F.** *Morus alba* L.; **G.** *Morinda angustifolia* Roxb.; **H.** *Tinospora cordifolia* (Thunb) Miers.; **I.** *Oroxylum indicum* (L.) Kurz; **J.** *Centella asiatica* (L) Urban; **K.** Traditional herbalist of Bodo; **L.** Interview schedule with herbalist specialized in traditional treatment of jaundice.

*Specimen cited:* Borigaon, Udalguri; *JB & HT-025* (HAU), dated 01.03.2022. *Flowers & fruits:* May to August.

*Native distribution:* Indian Subcontinent (wild and planted)

*Plant part used:* Bark (Formulation 1)

symodial; lamina c.15 cm long, obovate, entire, acute to acuminate; spikes axillary, rachis slender; fruits obovoid, scarcely 5-ridged.

*Specimen cited:* Badagami, Udalguri; *JB & HT-029* (HAU), dated 02.03.2022. *Flowers & fruits:* May to August

**Native distribution:** Indian Subcontinent to China (S. Yunnan) and Malesia (wild and planted)

**Plant part used:** Fruit (Formulation 1)

42. ***Terminalia chebula*** Retz. [Combretaceae]. Bodo name: *Selekha*.

Deciduous tree 30 m high, profusely branched, bark opening as scales; lamina ovate-oblong, entire, acute; spikes terminal; drupes obovoid, obscurely 5-angled, endocarp woody.

**Specimen cited:** Badagami, Udalguri; JB & HT-046 (HAU), dated 09.04.2022. **Flowers & fruits:** May to August

**Native distribution:** Indian Subcontinent to China (W. Yunnan) and Indo-China (wild and planted)

**Plant part used:** Fruit (Formulation 1)

43. ***Tinospora cordifolia*** (Willd.) Hook.f. & Thomson [Menispermaceae]. Bodo name: *Amar lota*.

Deciduous, climbing vine; leaves simple, alternate; lamina broadly ovate or ovate cordate; flowers in dense pendulous spikes, axillary; fruits in elongated clusters.

**Specimen cited:** Badagami, Udalguri; JB & HT-040 (HAU), dated 09.03.2022. **Flowers & fruits:** May to July.

**Native distribution:** Indian Subcontinent to Indo-China

**Plant part used:** Stem (Formulation 3)

44. ***Zanthoxylum oxyphyllum*** Edgew. [Rutaceae]. Bodo name: *Jabrang*.

Scrambling liana, prickles hooked, enlarges with secondary growth; leaves 15 – 40 cm long, prickly beneath; leaflet-lamina lanceolate to ovate; cymes corymbose c. 30-flowered; petals purple

**Specimen cited:** Badagami, Udalguri; JB & HT-041 (HAU), dated 09.04.2022. **Flowers & fruits:** Dry fruits procured from markets

**Native distribution:** Nepal to China (W. Yunnan), Myanmar

**Plant part used:** Fruit (Formulation 1).

## 4. Discussion

The present study recorded the use of 44 species of medicinal plants representing 40 genera from 30 different families. Among the families Zingiberaceae is represented by highest number of 4 species. It is followed by Memispermaceae and Combretaceae with three species each. Six families (Arecaceae, Moraceae, Fbaceae, Lamiaceae, Phyllanthaceae and Piperaceae) have two species each and the rest 22 families are represented each by single species. Among 43 plants 35 are dicots and remaining 9 are monocots.

While most of the recorded species are either growing wild or are under cultivation in the community forest area, the useful plant-parts of other three species (*Elettaria cardamomum*, *Myristica fragrans* and *Syzygium aromaticum*) are collected from local markets. Though *Zanthoxylum oxyphyllum* is available in the wild, but its dry and dehiscent fruits are generally procured from the market. Out of the recorded 43 species, 18 are trees and remaining 14 are herbs, 5 are climbers and 6 are shrubs. The highest used plant part is fruit of 11 species. It is then followed by bark (6 spp.), whole-plant (5 spp.), leaf (4 spp.), root (3 spp.), seed (3 spp.), stem (3 spp.) and rhizome (3 spp.). Other plant parts like, young shoot, flower-bud, root-tuber and aril are used from one species each each.

Most of the parts of the plants like *Achyranthes aspera*, *Stephania rotunda*, *Impatiens balsamina*, *Plumbago zeylinica*, etc. were collected from the wild sources as mentioned by some practitioners. While some plants *Zanthoxylum oxyphyllum*, *Myristica fragrans*, *Cinnamomum verum*, *Amomum subulatum*, *Elettaria cardamomum* etc. were generally bought from markets. Some plant-parts like of *Musa balbisiana*, *Curcuma longum*, *Mangifera indica* were collected from the kitchen garden.

Mode of application was oral for the three formulations i.e. Formulation 1, 2 & 5. A patient must consume the herbal medicine for at least one week for recovery and generally until cured. For Formulation 3, a cocoon is filled with medicine was reported wear around the neck as a locket of necklace for at least 3 – 4 days with the help of white thread and for Formulation 5 the prepared ring was to wear on wrist as a bracelet. Of the 45 species some are used as spices (*Myristica fragrans*, *Amomum subulatum*, *Cinnamomum verum*, *Elettaria cardamomum*, *Piper nigrum*, *Syzygium aromaticum*, and *Zanthoxylum oxyphyllum*) to improve the taste and aroma of the

prepared drug. So, these may not be treated as medicinal plants for these formulations.

Large number of 36 species of plants are used in 'Formulation 1'. However, apart from some core-plants (*Plumbago zeylinica*, *Stephania rotunda*, *Oroxylum indicum*, *Centella asiatica*, *Cuscuta reflexa*, *Morus alba*, and *Morinda angustifolia*), use of other plants varies from one *Ojha* to the other. However, most of these plants are generally accepted to have some medicinal properties. However, in most cases these folk-medicines worked positively.

Literature study shows that *Centella asiatica* is one magical herb and reported to be in use against numerous ailments like blood purifier, appetizer, and also to treat diarrhea, leprosy, tuberculosis, amoebiasis, etc. (Kirtikar and Basu, 1935; Yakang et al., 2013; Chandrika and Kumarab, 2015; Ünlü, 2022). Leaves or entire plant of *C. asiatica* was observed to be in use for most of the formulations. Roots of *Plumbago zeylinica* has been reported to use for birth control and for permanent sterilization (Tiwari et al., 1982). *P. zeylinica* also has been reported to have anticancer, antimicrobial, antioxidant, anti-inflammatory, and anticonvulsant activities (Vijver, 1971; Vishnukanta, 2010; Jain et al., 2014; Aleem, 2020). *Cuscuta reflexa* is a non-chlorophyllous total stem parasite which has been reported to use in digestive system disorders (Prakash et al., 2015). However, it is also reported to be used as antihypertensive, antidiabetic, antioxidant, hair growth promoting, antimicrobial, spasmolytic, antitumor, anti-arthritis, nephroprotective, antiviral, anti-inflammatory, antipyretic agents in ayurveda as well as in homoeopathy (Lalchand et al., 2017; Khan and Widunbiliu, 2022). *Stephania rotunda* generally produce a large root-tuber which is known to have medicinal properties and has been reported to use against malaria and cancer (Desgrouas et al., 2014). Camille (2014) reviewed the ethnobotany, phytochemistry and pharmacology of *S. rotunda* which indicated the high medicinal properties and recognized the presence of several important phytochemical compounds in it. Phytochemicals present in the species have been reported as potent antimalarial agent (Chea et al., 2007; Desgrouas et al., 2014). *Morinda angustifolia* has been reported to use in the treatment of hepatic injury, and in different types of hepatitis (Chen et al., 2020) and more recently, Oladeji et al. (2022) reviewed the ethnopharmacology, phytochemistry, pharmacology and industrial applications of the species and realized the extremely high medicinal importance of the plant. So, it is now clear that most of the species used as core plants are important medicinal plants of high conservation significance and a combination of these plants could be considered as a very strong and useful combination to treat many human ailments including jaundice.

## 5. Conclusion

The use of plant-based medicines to treat hepatitis or jaundice is widespread and are under use, probably, since pre-historic period. The present survey recognized five formulations from the Udalguri district of BTAD, Assam (India) and exposed that the core-plants used in such medicines are mostly well-studied important medicinal plants. However, so far, no scientific attempt was taken to study the medicinal values of these formulations and their real efficacy against jaundice. At the same time the common people in remote areas of the district expressed their high level of satisfaction after the use of such formulations, specially for the Formulation-1.

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### Authors' contributions

The first author (JB) generated the field data and prepared the draft manuscript. The second and the third authors (APD and HT) are Ph.D. supervisors and mentors who formulated the research design and contributed for intellectual approach, and critically reviewed and finalized the draft manuscript.

**Conflict of interests**

The author declares no conflict of interest.

**References**

- Aleem M. 2020. Anti-Inflammatory and Anti-Microbial Potential of *Plumbago zeylanica* L.: A Review. *Journal of Drug Delivery and Therapeutics* 10 (5): 229 – 235.
- Anonymous. 2014. *Census of India 2011. Series 19, Part XIIA. District Census Handbook, Udalguri*. Director of Census Operations, Assam.
- Assam state website: Udalguri district <https://www.census2011.co.in/census/district/167-udalguri.html>.
- Borthakur SK.1980. *Medicinal flora of Karbi-Anglong (Mikir-hills), Assam with reference to Ethnobotany*. Ph.D. Thesis, Guahati University, Guwahati, Assam.
- Borthakur SK, Baro D, Bawri A and Boro A. 2018. *Flora of BTAD (Bodoland Territorial Districts, Assam)*, Vol. 1-4. EBH Publishers, India.
- Camille D. 2014. Ethnobotany, phytochemistry and pharmacology of *Stephania rotunda* Lour. *Natural Products Chemistry Research*, 2: 5. [2<sup>nd</sup> International Conference and Exhibition on Pharmacognosy, Phytochemistry & Natural Products, August 25 – 27, 2014. DoubleTree by Hilton Beijing, China].
- CDPS. 2004. [https://en.wikipedia.org/wiki/Bodoland\\_Territorial\\_Region](https://en.wikipedia.org/wiki/Bodoland_Territorial_Region)
- Chandrika UG and Kumarab PAASP. 2015. Gotu Kola (*Centella asiatica*): Nutritional Properties and Plausible Health Benefits. In: *Advances in Food and Nutrition Research*, Volume 76, chapter 4. ISSN 1043-4526. Elsevier Inc. <http://dx.doi.org/10.1016/bs.afnr.2015.08.001>.
- Constantin T. 2011. Jaundice obstructive syndrome. *Current Health Science Journal* 37: 96–100.
- Chea A, Hout S, Bun S-S, Tabatadze N, Gasquet M, Azas N, Elias R and Balansard G. 2007. Antimalarial activity of alkaloids isolated from *Stephania rotunda*. *Journal of Ethnopharmacology* 112: 132–137.
- Chen R-r.,1 Juan L, Zhe C, Wen-jun C, Xiu-fen L and Chuan-li L. 2020. Anthraquinones Extract from *Morinda angustifolia* Roxb. Root Alleviates Hepatic Injury Induced by Carbon Tetrachloride through Inhibition of Hepatic Oxidative Stress. *Hindawi*. 9.
- Das AP. 2021. Herbarium Techniques. In: J.B. Bhandari & Cyria Gurung (eds.), *Instrumentation Manual*. Narosa Publishing House, New Delhi. Pp. 78 – 94.
- Das KK. 2003. Pattern of dermatological diseases in Gauhati medical college and hospital Guwahati. *Indian Journal of Dermatology, Venereology and Leprology* 69: 16–18.
- Desgrouasa C, Taudon N, Bunb S-S, Baghdikianb B, Sothavireak Boryd S, Daniel Parzya D and Ollivier E. 2014. Ethnobotany, phytochemistry and pharmacology of *Stephania rotunda* Lour. *Journal of Ethnopharmacology*, <http://dx.doi.org/10.1016/j.jep.2014.04.024>
- Drummond GS and Kappas A. 2004. Chemoprevention of severe neonatal hyperbilirubinemia. *Semin Perinatology* 28: 365-368.
- Endle RS. 1911. *The Kacharis*. Akansha Publishing House, New Delhi, India.
- Hooker JD. 1872-1897. *The Flora of British India*, Vols. 1-7. L. Reeve & Co Ltd, Ashford, Kent. London. <https://powo.science.kew.org/>
- Jain SK and Rao RR. 1976. *A Handbook of Field and Herbarium Methods*. Today & Tomorrow's Printers and Publishers, New Delhi.
- Jain P, Sharma HP, Basri F, Baraik B, Kumari S and Pathak C. 2014. Pharmacological Profiles of Ethno-Medicinal Plant: *Plumbago zeylanica* L.- A Review. *International Journal of Pharmaceutical Sciences Review and Research* 24 (1): 157 – 163.
- Juncker J and Stahl GE. 1724. *Conspectus Medicinæ theoretico-Practicæ, e Tabulis 137 Omnes Primarios Morbos Methodo Stahliaana Tractandos Exhibens: Secunda Vice Editus et Auctus Cum... Præfatione... Stahlia, etc. MS. Notes. Germany: Impensis Orphanotrophei Waisenhaus; Halle an der Saale.*
- Khan WA and Widunbilu. 2022. *Cuscuta reflexa*: A critical review on the medicinal plant used in homeopathy. *International Journal of Research in Agronomy* 5 (1): 36 – 39.
- Kanjilal UN, Das A, Kanjilal PC, Purkaystha C, De RN and Bor NL. 1934 – 1940. *Flora of Assam* (Vols. I – V). Government of Assam, Shillong [Printed by: Prabasi Press, Calcutta].
- Kirtikar RB and Basu BD.1935. *Indian Medicinal Plants*, Vols. I - IV. Lalit Mohan Basu, Allahabad.
- Kotoky J and Das PN. 2008. Medicinal plants used for liver diseases in some parts of Kamrup district of Assam, a North-Eastern State of India. *Pitoterapia* 79: 384 – 387.
- Lalchand Sahu R, Gupta R and Rout OP. 2017. *Cuscuta reflexa* (Dodder Plant): A critical review on the medicinal plant used in ayurveda. *International Journal of Research in Ayurveda and Pharmacy* 8 (6): 38 – 42. <http://dx.doi.org/10.7897/2277-4343.086288>
- Martin GJ. 1995. *Ethnobotany: A Methods Manual*. 1st ed. New York, Chapman & Hall, London. Pp. 1–64.
- Memon N, Weinberger BI, Hegyi T and Aleksunes LM. 2016. Inherited disorders of bilirubin clearance. *Pediatric Research* 79: 378–386.
- Nene YL. 2007. *Glimpses of the Agricultural Heritage of India*. AsianAgri-History Foundation, Secunderabad 500009, India. P.902.
- Oladeji OS, Oluoyori AP and Dada AO. 2022. Genus *Morinda*: An insight to its ethnopharmacology, phytochemistry, pharmacology and Industrial Applications. *Arabian Journal of Chemistry* 15: 104024. <https://doi.org/10.1016/j.arabjc.2022.104024>.
- Phillips O, Gentry AH, Reynel C, Wilkin P and Galvez-Durand BC. 1994. Quantitative ethnobotany and amazonian conservation etnobotánica cuantitativa y la conservación de la amazonia. *Conservation Biology* 8: 225–248.
- POWO. 2023. Plants of the World Online. Royal Botanic Garden, Kew. <https://powo.science.kew.org/>
- Prain D. 1903. *Bengal Plants*. Vols. I & II. West, Newman & Co., London.
- Prakash RC, Manabendra DC, Sanjoy SN, Abhijit M, Deepa N and Anupam DT. 2015. Plant utilization against digestive system disorder in Southern Assam, India. *Journal of Ethnopharmacology* (15) 30143-30144
- Shankar R, Lavekar GS, Deb S and Sharma, BK. 2012. Traditional healing practice and folk medicines used by Mishing community of North East India. *Journal of Ayurveda and Integrative Medicine* 3: 124 – 129.
- Tag H. 2007. *A systematic study of plants of ethnomedicinal importance used by the Khamti tribe of Arunachal Pradesh*. Submitted to Rajiv Gandhi University for Degree of Doctor of Philosophy in Botany (unpublished).
- Tag H, Kalita P, Dwivedi P, Das AK, Nima DN. 2012. Herbal medicines used in the treatment of diabetes mellitus in Arunachal Himalaya, northeast, India. *Journal of Ethnopharmacology* 141 (3): 786 – 795.
- Tiwari KC, Majumdar R and Bhattacharjee S. 1982. Folklore Information from Assam for Family Planning and Birth Control. *International Journal of Crude Drug Research* 20 (3): 133-137.
- Ullah S, Rahman K and Hedayati M. 2016. Hyperbilirubinemia in neonates: types, causes, clinical examinations, preventive measures and treatments: a narrative review article. *Iranian Journal of Public Health* 45: 558.
- Ünlü B. 2022. 15 - Herbal medicine and common dermatologic diseases. In: Maryam Sarwat and Hifzur Siddique (eds.), *Herbal Medicines: A Boon for Healthy Human Life*. Academic Press. <https://doi.org/10.1016/B978-0-323-90572-5.00019-6>.
- Vidyalankar J.1994. *Charak Samhita*. Part I. Motilal Banarsidass, New Delhi 110 007, India.
- Vijver LM. 1971. Antibacterial Activity in Roots of *Plumbago zeylanica*. *Planta Medica* 20: 8 – 13.
- Vishnukanta and Rana AC. 2010. Evaluation of anticonvulsant activity of *Plumbago zeylanica* Linn. leaf extract. *Asian Journal of Pharmaceutical and Clinical Research* 3(1): 76 – 78.
- Wouters JJP and Subba TB. 2022. *History of North East India*. Routledge Publisher, New York.
- Yakang B, Gajurel PR, Potsangbam S and Bhuyan LR. 2013. Account of common and traditional non-timber forest products used by Apatani tribe of Arunachal Pradesh, India. *Pleione* 7 (2): 514 - 529.

