



## Diversity, distribution and uses of threatened ethno-medicinal plants of Manipur

Hirom Dolendro Singh<sup>\*1</sup>, D S Ningombam<sup>2</sup>, Limasena<sup>1</sup>

<sup>1</sup>*Department of Botany, Nagaland University, Lumami, India*

<sup>2</sup>*Department of Botany, Jadonang Memorial College, Noney, Manipur, India*

Article published on September 30, 2020

**Key words:** Threatened, Diversity, Ethno-medicinal, Ethno-botanical, Conservation status, Habitat destruction

### Abstract

Survey and documentation of threatened ethno-medicinal plants used by the different communities residing in Manipur was carried out for their diversity, distribution, threats and conservation status in Manipur. A total of 52 taxa belonging to 33 families were collected represents by Herbs 18 species, Tree 14 species, Climber and Shrubs 7 species each, Orchid by 4 species and Creeper by 2 species. Information on ethno-medicinal and ethno-botanical uses was collected from the informants at various studied sites and also by personal observations. Leaf represents the most used plant part with 9 species and 17 different modes of preparation in which the maximum was found in the decoction by 25 species. It was also recorded that 7 medicinal plants were used by majority of the communities where as others species were used only by some particular communities. The different primary health ailments used are respiratory, gastrointestinal complaints, orthopaedic problems, diabetes, dermatological problems, urology problems, snake and dog bites. The maximum species occurrence of the species was found in the elevation below 1200 metres above sea level. The major threats are over-exploitation and habitat destruction. Regarding the conservation status it was assessed that Vulnerable species (VU) is represented by 21 species, followed by Near threatened (NT) species with 20 species, Endangered (EN) by 9 species, Least Concern (LC) and Critically Endangered (CR) represented by 1 species each. The present study findings shows that immediate awareness programme is needed for all stakeholders which are directly associated with the threatened ethno-medicinal plants of Manipur.

**\*Corresponding Author:** Hirom Dolendro Singh ✉ [dolendrohirom14@gmail.com](mailto:dolendrohirom14@gmail.com)

## Introduction

The state of Manipur lies in the north-easternmost part of the Indian sub-continent which falls under the Indo-Burma Region (IBR), one of the biodiversity hot spots of the globe (Myers *et al.*, 2000). It stretches between 92°2′E to 93°6′E Longitudes and 23°50′N to 25°41′N Latitudes with a total geographical area of 22,327km<sup>2</sup> at an elevation from 390m to 2994m above sea level. It is bounded, on the east by Myanmar, west by Cachar hills of Assam, north by Nagaland and south by Chin Hills of Myanmar and Mizoram.

The rich diversity of plants of the state originates from the variations in the climatic, altitudes and edaphic factors. The flora of the state is blessed with nearly 4000 angiospermic plant species and with richest repositories of medicinal and aromatic plants which have a long age intrinsic relationship between the various ethnic communities residing in Manipur.

The communities in the state used these medicinal plants for the treatment of various primary health care ailments. There have been many published reports in Manipur by several authors as Sinha, 1996 reported medicinal plants used by the communities in Manipur; Singh *et al.*, 2003 also reported medicinal plants used by the different communities in Manipur; Singh & Sundriyal, 2003 about the traditional medicinal system of ethnic groups of Manipur; Singh & Singh 2003 about ethno-medico plants of Meitei community; Khumbongmayum *et al.*, 2005 about the ethno-medicinal plants in sacred grooves of Manipur; Ahmed & Singh, 2007 about traditional medicinal knowledge of Muslim community; Singh 2009 about the medicinal plants used in Manipur; Salam *et al.*, 2009 about medicinal plants of Tangkhul Naga tribe of Ukhrul district; Pfoze *et al.*, 2011 about the wild edible plants of Senapati district; Salam *et al.*, 2011 about ethno-medicinal plants of Tangkhul Naga tribe; Kongsam & Choudhury 2012, about ethno-medicinal plants used by Kuki tribes; Lokho A. 2012, about the folk medicinal plants of Mao Naga tribe; Ningombam *et al.*, 2014 of about the ethno-medicinal plants of Meitei community; Devi *et al.*, 2015 about the wild medicinal plants of hill districts of Manipur; Devi *et al.*, 2016 about the plants

used by the Mongsang tribe; Singson *et al.* (2016) about the home remedial plants used by Thadou Kuki tribe and Yuhlung & Bhattacharyya 2016, about the indigenous medicinal plants used by Maring tribe of Manipur.

The Indo-Myanmar hotspot is one of the most threatened hotspots globally. It ranks among the eight hotspots likely to lose most plants and vertebrates as a result of forest loss continuing at its current rate (Brooks *et al.*, 2002). The Eastern Himalaya, which includes Manipur, has a high plant endemism. Habitat degradation, forest fires, unsustainable harvesting and over-exploitation led to the decline of the medicinal plant species.

Regarding, the threatened ethno-medicinal plants Singh & Singh, 2009 reported 14 endangered species of medicinal importance available in Northeast India from Manipur. Nayar & Sastry 1987-88 reported 15 species in the Checklist of threatened plants of Manipur. Mao & Gogoi, 2016 also reported 333 species belonging to 236 genera and 119 families from Dzukou valley which includes several threatened plants. The present authors (Singh *et al.*, 2017) also reported 18 ethno-medicinal plants belonging to 16 families and 16 genera in the sub alpine areas of Shirui and Dzukou valley of Ukhrul district and Senapati districts of Manipur. Mao & Deori in 2018 reported 407 species under 95 genera of orchids from Manipur which also includes threatened species. Ved *et al.*, 2018 including (present authors) conducted the Conservation assessment and management prioritization for medicinal plants of Manipur (CAMP), which studied 43 species in which 3 were Critically Endangered, 17 were Endangered, 11 species were Vulnerable, 7 were Near Threatened, 1 was Least Concern and 4 were Data Deficient was assessed.

The pressure on the wild population of the medicinal plants has increased manifold due to habitat destruction, forest fires and shifting cultivation along with the overexploitation from wild for causes various threats. The conservation and management of threatened species have become an important issue for the state.

Till now there no complete comprehensive reports about the threatened ethno-medicinal regarding their distribution, status, habitat, ecology, appropriate conservation measures and its uses by the different communities residing in Manipur.

Considering the above aspects, the present study is an attempt to evaluate the diversity, habitat, distribution pattern, conservation status of the threatened ethno-medicinal plants. Secondly, it also aims at documenting ethno-medicinal uses of the species by the different communities, part use, mode of administration, types of primary ailments and its ethno botanical uses. Moreover, the environmental factors like soil, elevation, temperature, humidity, rainfall and forest types of each individual plant were recorded to provide an base line data for policy makers, stakeholders and concerned authorities to take up necessary conservation measures.

## Materials and methods

### *Study Area*

The study area is based on its structure, topography, geomorphic process and socio-economic development can be divided into two physiographic divisions. The Manipur hills and mountains, which surrounded the valley occupies about 20,089km<sup>2</sup> consisting about 90% of the total land area of the state and the Manipur valley occupies 2,238km<sup>2</sup> consisting about 10% of the total area of the state. Out of this about 550km<sup>2</sup> is covered by lakes or wetlands and isolated hillocks. Among the 16 districts of the state, 10 are hill districts and 6 are valley districts. The climate of the state is of four types Winter season (December to February), Summer season (march – May), Rainy season (June to September) and Retreating monsoon (October to November). The monthly mean temperature ranges from 3°C to 34°C, with an average rainfall of 1mm to 365.7mm. The relative humidity of the state ranges from 41.5% to 93.9%. Geologically, the soils are of laterite red soil, non-laterite soil, old alluvial soils and new alluvial soil types.

### *Demographic structure*

Based on their traditions, customs, language, religions and cultural landscape the Manipur ethnic groups can be grouped into four major communities Meitei, Meitei

pangals (Muslims), Nagas tribes (Zeliangrong, Rongmei, Kabui, Liangmei, Zemei, Tangkhul, Mao, Maram, Maring and Tarao. Anal, Kom and Thangal etc). and Kuki or Chins group tribes (Gangte, Hmar, Paite, Thadou, Vaiphei, Zou, Aimol, Chiru, Koireng, Kom, Anal, Chothe, Lamgang, Koirao, Thangal, Moyon and Monsang, Paite, Zou, and Vaiphei etc). The Scheduled caste consists of Yaithibi, Lois, Dhobi, Muchi or Robidas, Namsudra, Patni and Sutradhar residing in few pockets of the state. The valley districts is inhabited mainly by Meitei's, Manipuri Muslims and scheduled tribes which constitutes about 53.71% whereas the hilly districts is inhibited by the tribal's communities which constitutes about 8.32% of the total population of the state.

### *Survey, sampling and documentation of traditional knowledge*

Extensive and intensive surveys were conducted from 2016 to 2019 throughout the whole state of Manipur for the occurrence of the threatened ethno-medicinal plants species based on literature-guided and earlier reports. Field site data on geographical coordinates, soils, habitat, elevation, humidity, temperature, ecological peculiarities, forest types and threats were also recorded. Regarding plant data information reading habitat, distribution pattern, population, community association and others aspects will be recorded as per (Simpson 2006).

Ethno-medicinal documentation was conducted by visiting the herbal practitioners, traditional healers, birth attendant and elders using semi structured questionnaires at the field site or species occurrence area. Information regarding informant identity, plant diversity, local name, parts use, mode of administration, primary health ailments and ethno-botanical uses were collected. Moreover, information regarding the mode of collection methods, threats, conservation aspects was also recorded. For authentication of the data the authors along with traditional healers visited the area for details study.

### *Conservation status of ethno-medicinal plants*

The collected information regarding plant data and field data of the threatened ethno-medicinal plants

were used for analysis. Others information including global distribution, population reduction, extent of occurrence, area of occupancy, threats (forest fires, habitat destruction, deforestation, overexploitation etc.) were considered. Based on the above data, 33 species out of the 52 species collected were categorized into Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) and Least Concern (LC) following IUCN Red List Categories and Criteria (IUCN, 2012) Version 3.1. of were assessed.

As the author's had already assessed the remaining 19 species viz. *Aconitum elwesii* Stapf., *Aconitum nagarum* Stapf., *Canarium strictum* Roxb., *Curcuma caesia* Roxb., *Dendrobium denudans* D. Don, *Dendrobium nobile* Lindl., *Garcinia pedunculata* Roxb., *Hedychium spicatum* Sm., *Hippochaete debilis* (Roxb. ex Vaucher) Ching, *Homalomena aromatic* (Spreng.) Schott., *Litsea cubeba* (Lour) Pers. *Homalomena aromatic*, *Oroxylum indicum* (L.) Kurz., *Panax pseudo-ginseng* Wall., *Paris polyphylla* Sm., *Quercus lamellosa* Sm., *Rubia cordifolia* L., *Smilax ovalifolia* Roxb. ex D. Don, *Taxus wallichiana* Zucc and *Zanthoxylum rhetsa* (Roxb.) DC. In the (CAMP) workshop of Conservation assessment and management prioritization for medicinal plants of Manipur (Ved *et al.*, 2018), these species were excluded and assigned the same conservation status category.

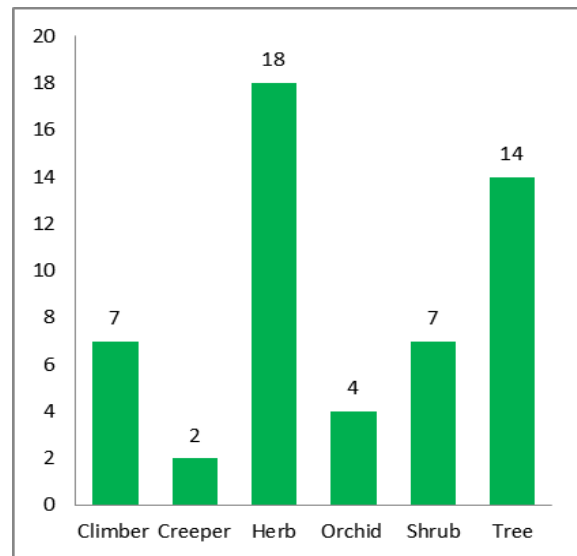
Identification and authenticating of the taxa were made referring published literatures of Deb (1961 a,b), Singh *et al.*, 2003, Mao & Gogoi 2016 and Mao & Deori 2018. The botanical names were updated using [www.theplantlist.org](http://www.theplantlist.org). The collected voucher specimens are prepared and deposited for inclusion in the herbaria of Department of Botany, Nagaland University, Lumami, India.

**Result**

*Species diversity*

A total of 52 species of threatened ethno-medicinal plants were recorded from Manipur. The maximum ethno-medicinal species was recorded in Herbs (18

sps) follows by Tree (14 spp.), Climber and Shrubs (7spp. each), Orchid (4 spp.), and Creeper (2spp.).



**Fig. 1.** Fig. showing the habit of the threatened ethno-medicinal plants of Manipur.

A total of 33 plant families were recorded in which the maximum of 4 species was recorded in the Orchidaceae and Araliaceae, followed by 3 species in Ranunculaceae, Rutaceae, Zingiberaceae and Lauraceae, 2 species each was recorded from Begoniaceae, Leguminosae, Phyllanthaceae, Piperaceae and Rubiaceae. The remaining 22 species was represented by each family namely: Araceae, Berberidaceae, Burseraceae, Clusiaceae, Compositae, Equisetaceae, Ericaceae, Fagaceae, Gentianaceae, Hydrangeaceae, Iridaceae, Lamiaceae, Liliaceae, Melantheriaceae, Meliaceae, Myrtaceae, Pentaphragaceae, Plantaginaceae, Salicaceae, Smilacaceae, Taxaceae and Vitaceae.

*Utilization pattern*

Regarding the part used of the ethno-medicinal plants collected from Manipur, it was recorded that the maximum recorded in leaf by 9 species, follows by whole plant represented by 8 species, root with 6 species, rhizome 6 species, fruit by 5 species, tuber by 3 species, bark by 2 species, pseudo bulb, resin, seed and young shoots are represented by one species each. The multiple parts used were represented by 7 species were also recorded which is depicted in the table given below.

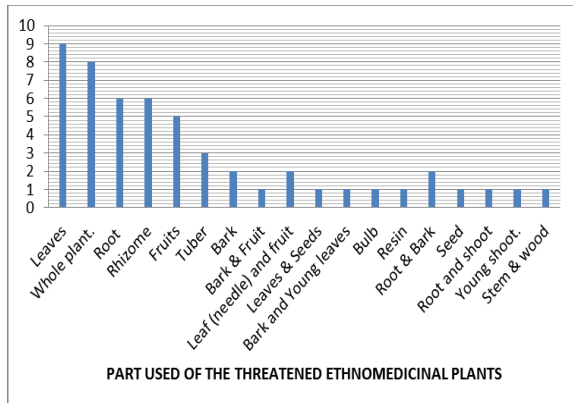
**Table 1.** Table showing the Ethno-medicinal and Ethno-botanical uses of Manipur.

| SL | Species  | Family/Local name                                     | Ethno medicinal uses |                            |  | Ethno-botanical uses   | Community   |
|----|--|---|----------------------|----------------------------|--|--|---|
|    |  |   | Part Use             | Mode of administration     | Ailment  |  |   |
| 1  | <i>Aconitum elwesii</i> Stapf.                             | Ranunculaceae/ Nuishiwon (Tangkhul)                   | Root                 | Pounded and paste          | Abdominal pain and febrifuge                                   | Naga tribe used the root paste for poisoning arrow head.                                       | Tangkhul, Mao, Maram                                |
| 2  | <i>Aconitum nagarum</i> Stapf.                             | Ranunculaceae/ Khawari (Tangkhul)                     | Root                 | Pounded and paste          | Arthritis.   | Naga tribe used the root paste for poisoning arrow head.                                       | Tangkhul, Mao-Maram, Maring, Poumai, Angami, Hmar   |
| 3  | <i>Albizia myriophylla</i> Benth                           | Leguminosae /Yanglee (Chakpa, Meitei)                 | Root and Bark        | Pounded and mixed in water | Dermatological problems.                                       | Dried stem bark is powdered and used as starrer in the preparation of traditional beverages    | Chakpa, Meitei, Tangkhul, Rongmei, Monsang, Vaiphei |
| 4  | <i>Amoora rohituka</i> (Roxb.) Wight and Am.               | Meliaceae / Heirangoi (Meitei)                        | Fruits               | Juice and decoction        | Skin to reduce bleeding and minor abrasions and Liver problems | The fruit is generally eaten and it is also a culturally important plant for Meitei community. | Meitei, Rongmei, Tangkhul, Anal, Mao                |
| 5  | <i>Begonia adscendens</i> C.B. Clarke                      | Begoniaceae / Banhang (Rongmei)                       | Whole plant          | Decoction                  | Stomach pain and dysentery                                     | Nil  | Rongmei, Tangkhul, Poumai, Thangal, Maram           |
| 6  | <i>Brassaiopsis bodinieri</i> (H. Leveille) J. Wen & Lowry | Araliaceae / Chom (Meitei)                            | Leaves               | Decoction                  | Diabetes   | Used in making traditional harvesting tools for paddy harvesting of Meitei community           | Meitei , Liangmei, Tangkhul                         |
| 7  | <i>Bulbophyllum cylindraceum</i> Lindley                   | Orchidaceae / Leishiwon (Tangkhul)                    | Bulb                 | Paste                      | Cuts and wounds  | Used as wild ornamental plant  | Paite, Tangkhul, Mao, Maring                        |
| 8  | <i>Canarium strictum</i> Roxb.                             | Burseraceae / Mekruk beraw (Meitei)                   | Resin                | Resin is lukewarm          | Rheumatism.  | The dried gum powdered is used as agarbati by the Meitei community.                            | Common  |
| 9  | <i>Cinnamomum verum</i> J. Presl.                          | Lauraceae / Usingsha (Meitei)                         | Bark                 | Decoction                  | Respiratory problems   | The bark is used as spices   | Common  |
| 10 | <i>Cissus javana</i> DC.                                   | Vitaceae / Kongouyenlaba (Meitei)                     | Leaves               | Decoction                  | Urinary bladder and kidney stones as home remedy               | Used as wild edible plant by different communities   | Commonly  |
| 11 | <i>Citrus macroptera</i> Mont.                             | Rutaceae / Heiribob (Meitei); Heiripok (Tangkhul)     | Fruits               | Infusion                   | Urinary bladder and kidney stones                              | The peel is used as condiment for fish and meat culinary items                                 | Meitei, Rongmei, Mizo, Tangkhul                     |
| 12 | <i>Curcuma amada</i> (Roxb)                                | Zingiberaceae / Yai Heinouman (Meitei)                | Rhizome              | Infusion                   | Diabetes   | Rhizomes are used as spices and condiment and also used as flavouring for pickles.             | Commonly  |
| 13 | <i>Curcuma caesia</i> Roxb.                                | Zingiberaceae / Yaimu (Meitei)                        | Rhizome              | Decoction                  | Bronchitis, cough and bruises.                                 | Used as culturally important plant for Meitei community.                                       | Meitei, Kabui, Zee ranglong, Maring                 |
| 14 | <i>Dendrobium aphyllum</i> (Roxb.) C.E.C.Fisch.            | Orchidaceae / Iyonglei (Meitei); Saheikungal (Thadou) | Rhizome              | Extract                    | Cuts and wounds  | Used as wild ornamental plant  | Tangkhul, Paite, Thadou, Monsang, Kabuitribes       |
| 15 | <i>Dendrobium denudans</i> D. Don                          | Orchidaceae / Shailengwon (Tangkhul)                  | Whole plant          | Decoction                  | Stomach ulcers.  | Used as wild ornamental plant  | Tangkhul, Poumai, Vaiphei                           |
| 16 | <i>Dendrobium nobile</i> Lindl.                            | Orchidaceae / Yerumlei (Meitei)                       | Whole plant          | Decoction and Juice        | Cough and bronchial disorders and general debility             | Used as wild ornamental plant  | Monsang, Tangkhul, Mao, Meitei, Chiru               |
| 17 | <i>Dichroa febrifuga</i> Lour.                             | Hydrangeaceae / Barak (Meitei); Khawsik-damdai (Mizo) | Root and shoot       | Extract                    | Malaria and High fever   | Used as cultural important plant of Liangmei   | Mizo, Monsang, Tangkhul, Rongmei , Liangmei         |
| 18 | <i>Eleutherococcus trifoliatus</i> (L.) S.Y.Hu             | Araliaceae / Rangsongthei (Tangkhul)                  | Fresh leaves         | Decoction                  | Jaundice   | Nil  | Tangkhul, Rongmei                                   |



| SL Species   | Family/Local name  | Ethno medicinal uses  |                           |  | Ethno-botanical uses   | Community  |
|--|--|-----------------------|---------------------------|--|--|--|
|  |  | Part Use              | Mode of administration    | Ailment  |  |  |
| 19 <i>Eupatorium cannabinum</i> L.                     | Compositae / Langthrei (Meitei)                                  | Leaves                | Decoction                 | Stomach ulcers   | Used as an important plants in rituals of Meitei local deities   | Monsang, Tarou, Kabui, Meitei.                         |
| 20 <i>Eurya acuminata</i> DC.                          | Pentaphragaceae / Sizou (Thadou); Moriisii (Maram)               | Leaves                | Decoction                 | Respiratory problems                                     | Leaves are used as condiment, eaten as raw or cooked especially with fish or chicken                               | Mao, Hmar, Kuki, Thadou, Vaiphei, Paite                |
| 21 <i>Sisyrinchium palmifolium</i> L.                  | Iridaceae / Hoojam (Meitei)                                      | Root                  | Juice                     | Red onion juice is applied at the site of the Snake bite | As a wild ornamental plants  | Thadou, Tarao, Monsang                                 |
| 22 <i>Flacourtia jangomas</i> (Lour) Raeusch.          | Salicaceae / Heitroi (Meitei)                                    | Bark and fruits.      | Infusion and paste        | Sore throat, bleeding gum, and astringent                | Used in cultural rituals of Meitei community.  | Meitei, Tangkhul, Hmar, Thadou                         |
| 23 <i>Garcinia pedunculata</i> Roxb.                   | Clusiaceae / Heibung (Meitei); Vawm- Va-Pui (Mizo),              | Fruits                | Decoction                 | Urinary problems, gout and paralysis                     | Fruit juices are offered during social gathering of the Meitei community   | Tangkhul, Mizo, Rongmei, Meitei                        |
| 24 <i>Glochidion coccineum</i> (Buch.-Ham) Mull.Arg.   | Phyllanthaceae / Ningthourembi (Meitei)                          | Bark and Young leaves | Fresh leaves              | Aphrodisiac  | Cultural important plant of Meitei community   | Meitei   |
| 25 <i>Hedychium spicatum</i> Sm.                       | Zingiberaceae / Takhellei (Meitei); Tontairui (Tangkhul)         | Rhizome               | Decoction and extract     | Blood purification and gastrointestinal complaints       | Rhizome used in preparation of traditional culinary item called Iromba by Meitei community.                        | Thadou, Paite, Mizo, Meitei, Tangkhul                  |
| 26 <i>Hippochaete debilis</i> (Roxb. ex Vaucher) Ching | Equisetaceae / Lai Utong (Meitei); Chagacheng (Liangmei)         | Whole plant           | Extract and Decoction     | Backache arms and joins pains and gonorrhoea.            | Used in cultural rituals of Meitei community   | Meitei, Anal, Monsang, Liangmei, Thadou, Paite         |
| 27 <i>Homalomena aromatica</i> (Spreng.) Schott        | Araceae / Hongoo Kakla Maanbi (Meitei); An-Chi-Ri (Mizo)         | Rhizome               | Juice                     | Joint-pain and inflammation                              | Used as wild ornamental  | Monsang, Thadou, Hmar, Mizo, Meitei                    |
| 28 <i>Lilium mackliniae</i> Sealy.                     | Liliaceae / Shirui Timrawon (Tangkhul)                           | Rhizome               | Decoction                 | Stomach troubles   | State flower of Manipur  | Tangkhul   |
| 29 <i>Litsea cubeba</i> (Lour) Pers.                   | Lauraceae / Ngairong (Meitei); Chongathe (Tangkhul)              | Fruits                | Infusion and Juice        | Respiratory problems and insects bites                   | Fruits is eaten as spices  | Meitei, Maram, Liangmei, Tangkhul, Maring              |
| 30 <i>Litsea glutinosa</i> (Lour.) C.B.Rob.            | Lauraceae / Chingjai (Meitei); Dapthak (Thadou)                  | Leaf                  | Juice                     | Poultice applied on cuts and skin diseases               | Nil  | Tangkhul, Mao, Paite, Thadou                           |
| 31 <i>Mahonia napaulensis</i> D C.                     | Berberidaceae/ U-Naapu (Meitei); Yaiganmachurong (Tangkhul)      | Stem and wood         | Decoction                 | Diuretic and anti-dysenteric.                            | Tender shoots are eaten cooked with dry meat or fish. The Anal community used it in coronation of the village king | Monsang, Poumai, Anal, Tangkhul, Mao                   |
| 32 <i>Milletia pachycarpa</i> Benth.                   | Leguminosae / Ngamu Yai (Meitei); Tiupum (Liangmei)              | Root and Bark         | Extract                   | Dermatological problems                                  | Stem are pounded and put into water body or streams as a traditional fishing method.                               | Monsang, Chothe, Liangmei, Hmar, Maring.               |
| 33 <i>Nanorrhinum ramosissimum</i> (Wall.) Betsche.    | Plantaginaceae/ Nunggai Peruk (Meitei); Tankuangmalngai (Thadou) | Whole plant.          | Decoction                 | Urinary stone cases                                      | Tender shoots are used as wild edible food by the Anal community   | Meitei, Thadou, Poumai, Mizo, Tangkhul.                |
| 34 <i>Oroxylum indicum</i> (L.) Kurz                   | Bignoniaceae / Shamba (Meitei); Hlongthing (Hmar)                | Whole plant.          | Paste and concoction      | Piles & Viral fever                                      | Unripe fruits are cooked with pork. The Meitei used it as cultural important plant.                                | Meitei, Hmar, Mongsang, Tangkhul, Kabui, Tarou, Chakpa |
| 35 <i>Paederia foetida</i> L.                          | Rubiaceae / Oinam (Meitei); Veihnam-khau (Paite)                 | Whole plant           | Fresh leaves and poultice | Piles, dysentery and bone fracture                       | Tender leaves are eaten as vegetable or fried items.   | Meitei, Mao, Poumai, Hmar, Paite                       |
| 36 <i>Panax assamicus</i> R.N.Banerjee.                | Araliaceae / Ginseng (Meitei)                                    | Tuber                 | Decoction                 | Recuperative power to body.                              | Nil  | Tangkhul, Mao maram                                    |
| <i>Panax pseudo-</i>                                   | Araliaceae / Pan- Manbi  | Tuber                 | Decoction                 | Relieve pain,  | Nil  | Tangkhul,  |

| SL Species   | Family/Local name   | Ethno medicinal uses |                        |   | Ethno-botanical uses  | Community                                   |
|--|---|----------------------|------------------------|---|---|---|
|  |   | Part Use             | Mode of administration | Ailment   |   |   |
| 37 <i>ginseng</i> Wall.                              | (Meitei); Ramhui (Maring)   |                      |                        | swelling, cholesterol & blood purifier and recuperative power to body. Bronchitis and respiratory problems and recuperative power to body. Leucoderma and irregular menses. It is also used cough, bronchitis and asthma. |   | Poumai, Maring, Liangmai                    |
| 38 <i>Paris polyphylla</i> Sm.                       | Melanthiaceae/ Kazeapai (Tangkhul); Mariubi, kajuibon (Liangmai)          | Tuber                | Decoction              | Gastrointestinal problems. Gastrointestinal and respiratory problems  | Nil   | Tangkhul, Mao, Liangmai, Monsang, Vaiphei   |
| 39 <i>Phyllanthus urinaria</i> L.                    | Phyllanthaceae. / Chakpa Heikru (Meitei); Suaklulem (Paite)               | Whole plant          | Decoction              | Gastrointestinal problems. Gastrointestinal and respiratory problems  | Tender leaves and twigs are eaten cooked as vegetable with fish or meat                   | Common in valley                            |
| 40 <i>Piper griffithii</i> C. DC.                    | Piperaceae / Chingmarik (Meitei)  | Seeds                | Decoction              | Gastrointestinal problems. Gastrointestinal and respiratory problems  | Nil   | Rongmei, Liangmai, Maring                   |
| 41 <i>Piper peepuloides</i> Wall.                    | Piperaceae / Uchithi (Meitei)   | Leaves and Seeds     | Decoction              | Astringent  | Nil   | Meitei, Tangkhul, Kabui, Thadou             |
| 42 <i>Quercus lamellosa</i> Sm.                      | Fagaceae / Uyung (Meitei)   | Bark                 | Decoction              | Easy delivery of child birth, diarrhoea and dysentery.  | Stem bark is used as dyeing purposes  | Tangkhul, Meitei, Mao,                      |
| 43 <i>Rhododendron arboreum</i> Sm.                  | Ericaceae / Kharam Leishok (Meitei); Kokluiwon (Tangkhul)                 | Young shoot.         | Decoction              | Rheumatism and anti-inflammatory and antimicrobial  | Fleshy petals are eaten raw with chilly chutney and cooked as vegetable suited with fish. | Tangkhul, Poumai, Paite, Maram, Zou, Kom    |
| 44 <i>Rubia cordifolia</i> L.                        | Rubiaceae / Moiyum (Meitei); Mayong (Tangkhul)                            | Root                 | Juice                  | White discharge, Poisonous bites, control high hypertension   | The root is used as dyeing purposes   | Meitei, Tangkhul, Mao, Monsang              |
| 45 <i>Scutellaria discolor</i> Colebr.               | Lamiaceae / Yenakhat (Meitei); Rakipro (Poumai)                           | Leaf                 | Extract & Decoction    | Skin diseases, muscular sprain, stomach pain and rheumatic problems   | Leaves are eaten as vegetable.  | Meitei, Paite, Kabui, Tangkhul, Mao- Poumai |
| 46 <i>Smilax ovalifolia</i> Roxb. ex D. Don          | Smilacaceae / Kwa-Maanbi (Meitei); Khekhra (Mao)                          | Root                 | Juice                  | Abdominal parts and Irregular menstrual problem   | Nil   | Tangkhul, Mao, Lamkang, Paite, Chothe       |
| 47 <i>Swertia angustifolia</i> Buch.- Ham. ex D. Don | Gentianaceae / Khabi Chisak (Meitei); Changla (Tangkhul)                  | Leaves               | Steam and Concoction   | Gall bladder or kidney stone case.  | Nil   | Meitei, Kabui, Tarou, Tangkhul, Monsang     |
| 48 <i>Syzygium jambos</i> (L.) Alston                | Myrtaceae / Gulamjat / Nungpambi (Meitei); Lenmui (Paite)                 | Leaves               | Decoction              | Cold, cough & fever and Hypertension & dizziness  | Nil   | Meitei, Thadou, Anal.                       |
| 49 <i>Taxus wallichiana</i> Zucc.                    | Taxaceae / Uchan Manbi (Meitei); Thing kang (Thadou); Khawreng-far (Mizo) | Leaf and fruits      | Decoction              | Scabies, diuretic and astringent  | Nil   | Tangkhul                                    |
| 50 <i>Thalictrum foliolosum</i> DC.                  | Ranunculaceae/ Umang Peruk (Meitei); Kharuri (Tangkhul)                   | Root                 | Decoction              | Gastric problems, tonsil, and skin diseases   | Leaves and fruit are used as spices for different types of culinary items.                | Tangkhul, Poumai, Maram, Rongmei            |
| 51 <i>Zanthoxylum acanthopodium</i> DC.              | Rutaceae / Mukthrubi Tingkhang panbi (Meitei); Mangnangthei (Tangkhul)    | Leaf and fruits      | Decoction & extract    | Asthma, bronchitis and rheumatism   | Fruit is used as spices for culinary items  | Common                                      |
| 52 <i>Zanthoxylum rhetsa</i> (Roxb.) DC.             | Rutaceae / Ngang (Meitei); Gan Macheng (Rongmei)                          | Fruits               | Decoction              |   |   | Common                                      |



**Fig. 2.** Fig. showing the part used of the threatened ethno-medicinal plant.

The mode of preparation of the plant part used for medicinal or treatment of primary health ailments are given below. Altogether there 17 different modes of preparation in which the maximum was found in the decoction which is represented by 25 species follows by juice represent by 5 species and the third was recorded in decoction and extract.

The ethno-medicinal plants were used by different communities residing in the state. It was recorded

that 8 medicinal plants were used by majority of the communities where as others species were used only by some particular communities. The different primary health ailments treated are abdominal pain, diarrhoea, dysentery, gastrointestinal complaints, piles, febrifuge, asthma, astringent, bronchitis, rheumatism, joint pains, diabetes, hypertension, blood purifier, bone fracture, gynaecological problems, aphrodisiac, diuretic, dermatological problems, scabies, gall bladder or kidney stone case, respiratory problems, snake and dog bites.

In terms of altitudinal distribution the maximum occurrence of 31 species was found in the elevation below 1200 metres above sea level. It was followed by 14 species occurrence in altitude between 1200-1800 msl. The least number of 7 species was recorded in the altitude above 1800 msl. The details of the environmental factors which include physical properties of soil, temperature, annual rainfall & humidity and forest types of each and every species were shown in the recorded 52 ethno-medicinal plants details which includes habitat, distribution in Manipur, threats were shown in the Table 3.

**Table 2.** Table showing the environmental factors and forest types of the threatened ethno-medicinal plants of Manipur.

| SL | Species  | Physical properties of Soil                | Elevation Metres above sea level | Temperature | Annual Rainfall | Humidity (%) Range | Forest type  |
|----|--|--|----------------------------------|-------------|-----------------|--------------------|--|
| 1  | <i>Aconitum elwesii</i> Stapf.                             | Clay soil, Sandy clay soil, Clay loam soil | 1500 to 2600 m                   | 3°C to 27°C | 1000 to 1700mm  | 88.5-95.0%         | Wet temperate forest, Pine forest, Bamboo brakes.  |
| 2  | <i>Aconitum nagarum</i> Stapf.                             | Clay loam soil, Clay soil, Sandy clay soil | 1400 to 2690 m                   | 3°C to 27°C | 1000 to 1900mm  | 86.4-93.8%         | Wet hill forest, Semi-evergreen forest, Grass brakes.  |
| 3  | <i>Albizia myriophylla</i> Benth                           | Clay soil, Silt soil, Sandy clay soil      | 600 to 950m                      | 5°C to 36°C | 1100 to 2200mm  | 34.6-91.4%         | Temperate forest, Pine forest, Wet hill forest, Tropical moist deciduous.                            |
| 4  | <i>Amoora rohituka</i> (Roxb.) Wight & Am.                 | Clay loam soil, Silt soil, Sandy loam soil | 700 to 960m                      | 7°C to 35°C | 1100 to 2100mm. | 85.1-93.4%         | Pine forest, Semi evergreen forest, Bamboo brakes.   |
| 5  | <i>Begonia adscendens</i> C.B. Clarke                      | Clay soil, Silt soil, Sandy loam soil      | 1300 to 2000 m                   | 5°C to 26°C | 1100 to 1900mm. | 88.6-93.9%         | Temperate forest, Wet hill forest, Pine forest.  |
| 6  | <i>Brassaiopsis bodinieri</i> (H. Leveille) J. Wen & Lowry | Sandy soil, Clay soil                      | 540 to 950m                      | 7°C to 36°C | Above 1600 mm   | 47.8-93.3%         | Sub tropical pine forest, Wet hill forest, Buk Oak forest  |
| 7  | <i>Bulbophyllum cylindraceum</i> Lindley                   | Clay soil, Silt soil, Sandy loam soil      | 950 to 1750 m                    | 8°C to 25°C | 1200 to 2100mm  | 89.0-93.5%         | Pine forest, Wet hill forest, tropical to alpine humid forest with heavy rainfall and high humidity. |
| 8  | <i>Canarium strictum</i> Roxb.                             | Sandy loam soil, Clay soil, Silt loam soil | 650 to 975m                      | 8°C to 28°C | 1200 to 1800mm. | 87.3-93.0%         | Sub tropical pine forest, Semi evergreen forest.   |
| 9  | <i>Cinnamomum</i>  | Loamy soil, Clay                           | 700 to                           | 3°C to 31°C | 1200 to         | 86.2-              | Wet hill forest, Pine forest,  |



| SL | Species   | Physical properties of Soil                             | Elevation Metres above sea level | Temperature  | Annual Rainfall | Humidity (%) Range | Forest type  |
|----|---|---|----------------------------------|--------------|-----------------|--------------------|--|
|    | <i>verum</i> J. Presl.                              | soil.   | 1500 m                           |              | 2200mm.         | 83.8%              | Bamboo brakes.   |
| 10 | <i>Cissus javana</i> DC.                            | Loamy soil, Silt soil, Sandy clay loam                  | 500 to 850m                      | 8°C to 32°C  | 1250 to 2100mm  | 49.3-93.2%         | Pine forest, Wet temperate forest, Semi evergreen forest.                |
| 11 | <i>Citrus macroptera</i> Mont.                      | Sandy loam soil, Sandy clay loam soil                   | 450 to 850m                      | 5°C to 34°C  | 1400 to 2100mm  | 41.5- 89.7%        | Buk Oak forest, Sub tropical pine forest, Wet hill forest.               |
| 12 | <i>Curcuma amada</i> (Roxb)                         | Sandy loam soil, Clay soil, Silt loam                   | 600 to 960 m                     | 10°C to 33°C | 1500 to 2500mm  | 34.6- 91.1%        | Tropical semi evergreen forest, Tropical moist deciduous forest.         |
| 13 | <i>Curcuma caesia</i> Roxb.                         | Sandy loam soil, Clay soil, Sandy clay loam soil        | 400 to 980m                      | 7°C to 33°C  | 1600 to 2300mm. | 85.2- 92.7%        | Wet hill forest, Pine forest, Semi evergreen forest.                     |
| 14 | <i>Dendrobium aphyllum</i> (Roxb.) C.E.C.Fisch.     | Sandy loam soil, Loamy soil, Silt soil.                 | 900 to 1350 m                    | 3°C to 28°C  | 1600 to 2000mm  | 79.5- 91.6%        | Moist Bamboo brakes, Pine forest, Wet temperate forest.                  |
| 15 | <i>Dendrobium denudans</i> D. Don                   | Silt soil, Clay soil, Sandy clay loam                   | 950 to 1450 m                    | 3°C to 28°C  | 1650 to 2100mm  | 90.0 – 93.6%       | Wet hill forest, Grass brakes, Pine forest.                              |
| 16 | <i>Dendrobium nobile</i> Lindl.                     | Silt soil, sandy soil, Clay soil                        | 800 to 1700 m                    | 3°C to 33°C  | 650 to 1550 mm  | 85.0 – 89.9%       | Semi evergreen forest, Pine forest, Bamboo brakes.                       |
| 17 | <i>Dichroa febrifuga</i> Lour.                      | Loam soil, Sandy soil, Silt soil                        | 900 to 1500 m                    | 7°C to 26°C  | 650 to 1500 mm  | 55.6- 93.5%        | Wet hill forest, Pine forest, Bamboo brakes, Moist deciduous forest.     |
| 18 | <i>Eleutherococcus trifoliatius</i> (L.) S.Y.Hu     | Clay soil with rich humus                               | 1100 to 1450 m                   | 4°C to 32°C  | 650 to 1600mm.  | 88.6- 93.4%        | Sub tropical pine forest, Semi evergreen forest, Grass brakes.           |
| 19 | <i>Eupatorium cannabinum</i> L.                     | Silt soil, Loam soil, Sandy loam soil                   | 600 to 970m                      | 3°C to 35°C  | 670 to 1754 mm  | 85.0- 93.8%        | Wet temperate forest, Pine forest, Semi evergreen forest.                |
| 20 | <i>Eurya acuminata</i> DC.                          | Clay soil, Loam soil, Silt soil,                        | 500 to 900m                      | 5°C to 36°C  | 671 to 1500 mm  | 37.5- 88.9%        | Semi -evergreen forest, Wet hill forest, Moist deciduous forest.         |
| 21 | <i>Sisyrinchium palmifolium</i> L.                  | Clay soil, Silty soil, Sandy soil.                      | 450 to 950m                      | 4°C to 31°C  | 671 to 1654 mm  | 82.8- 91.9%        | Pine forest, Temperate forest, Wet hill forest.                          |
| 22 | <i>Flacourtia jangomas</i> (Lour)Raeusch.           | Clay soil, sandy loam soil and Silt soil                | 600 to 900m                      | 6°C to 34°C  | 671 to 1540 mm  | 85.0- 92.7%        | Bamboo brakes, pine forest, Wet hill forest.                             |
| 23 | <i>Garcinia pedunculata</i> Roxb.                   | Sandy loam soil Silt soil, Clay soil                    | 700 to 970m                      | 6°C to 34°C  | 679 to 1454 mm  | 82.8- 93.0%        | Tropical semi evergreen forest, Pine forest, Wet temperate forest.       |
| 24 | <i>Glochidion coccineum</i> (Buch.-Ham) Mull.Arg.   | Clay loam soil with humus                               | 650 to 950m                      | 4°C to 31°C  | 679 to 1454 mm  | 88.6- 93.6%        | Moist deciduous forest, Pine forest, Grass brakes.                       |
| 25 | <i>Hedychium spicatum</i> Sm.                       | Sandy loam soil with rich humus                         | 500 to 850m                      | 6°C to 34°C  | 700 to 1400 mm  | 85.3- 83.8%        | Sub tropical pine forest, Bamboo brakes , Wet hill forest.               |
| 26 | <i>Hippochaete debilis</i> (Roxb. ex Vaucher) Ching | Sandy clay loam soil with small pebbles.                | 600 to 940m                      | 4°C to 33°C  | 700 to 1500 mm  | 41.7 – 89.9%       | Wet hill forest, semi evergreen forest, pine forest.                     |
| 27 | <i>Homalomena aromatica</i> (Spreng.) Schott        | Sandy loam soil with small rock pebbles                 | 500 to 970m                      | 3°C to 33°C  | 700 to 2300 mm  | 51.7 – 90.9%       | Tropical semi evergreen forest, Moist deciduous forest, pine forest      |
| 28 | <i>Lilium mackliniae</i> Sealy.                     | Sandy clay loam soil, Loam soil, Silt soil              | 1300 to 2200 m                   | 3°C to 33°C  | 730 to 1700 mm  | 85.1 – 92.6%       | Wet hill forest, Pine forest, Bamboo brakes forest.                      |
| 29 | <i>Litsea cubeba</i> (Lour) Pers.                   | Sandy soil, Clay soil, Loam soil.                       | 600 to 960m                      | 6°C to 29°C  | 750 to 1300mm.  | 85.3 – 91.2%       | Tropical semi evergreen forest, Wet hill forest,                         |
| 30 | <i>Litsea glutinosa</i> (Lour.) C.B.Rob.            | Silt soil, Loam soil, Clay soil                         | 540 to 950m                      | 2°C to 36°C  | Above 2100 mm   | 81.1- 91.8%        | Sub tropical pine forest, Wet hill forest, Buk Oak forest                |
| 31 | <i>Mahonia napaulensis</i> D C.                     | Sandy loam soil, Loam soil, Silt soil.                  | 600 to 900m                      | 4°C to 30°C  | 750 to 2400mm.  | 86.3 – 91.2%       | Tropical semi evergreen forest, Moist deciduous forest, Wet hill forest. |
| 32 | <i>Millettia pachycarpa</i> Benth.                  | Sandy clay loam soil, Loamy soil, Clay soil, Silt soil. | 500 to 950m                      | 9°C to 32°C  | 750 to 1800 mm. | 82.8– 92.8%        | Pine forest, Bamboo brakes forest, Wet temperate forest.                 |
| 33 | <i>Nanorrhinum</i>                                  | Silt loam soil,   | 700 to                           | 9°C to 29°C  | 751 to 1300     | 61.3 –             | Tropical semi evergreen forest,  |

| SL | Species   | Physical properties of Soil                 | Elevation Metres above sea level | Temperature | Annual Rainfall | Humidity (%) Range | Forest type  |
|----|---|---|----------------------------------|-------------|-----------------|--------------------|--|
|    | <i>ramosissimum</i> (Wall.) Betsche.              | Loamy soil, Clay soil.                      | 1200 m                           |             | mm.             | 81.6%              | Moist deciduous forest.  |
| 34 | <i>Oroxylum indicum</i> (L.) Kurz                 | Clay loam soil, Loamy soil, Sandy soil.     | 600 to 950m                      | 6°C to 32°C | 800 to 1300 mm  | 85.8 – 92.8%       | Sub tropical pine forest, Wet hill forest, Bamboo brakes.                |
| 35 | <i>Paederia foetida</i> L. Mant.                  | Silt soil, Sandy loam soil, Silty clay soil | 500 to 960m                      | 3°C to 31°C | 800 to 1500mm.  | 83.8 – 92.3%       | Tropical semi evergreen forest, Pine forest.                             |
| 36 | <i>Panax assamicus</i> R. N. Banerjee.            | Clay loam soil, Sandy Loam soil.            | 900 to 1450 m                    | 3°C to 29°C | 800 to 1600mm.  | 62.8 – 97.3%       | Wet hill forest, Pine forest, Semi evergreen forest.                     |
| 37 | <i>Panax pseudo-ginseng</i> Wall.                 | Sandy loam soil, Clay loam, Silty clay loam | 760 to 1500 m                    | 3°C to 28°C | 800 to 1750 mm  | 88.6 – 93.7%       | Buk Oak forest, Subtropical wet hill forest, Sub tropical pine forest.   |
| 38 | <i>Paris polyphylla</i> Sm.                       | Clay soil, Sandy clay soil                  | 800 to 1450 m                    | 3°C to 27°C | 800 to 1900mm.  | 85.8 – 90.1%       | Sub tropical pine forest, Wet temperate forest, Bamboo brakes            |
| 39 | <i>Phyllanthus urinaria</i> L.                    | Mostly sandy loamy with small pebbles       | 600 to 900m                      | 7°C to 28°C | 800 to 2100 mm  | 89.4 – 93.7%       | Pine forest, Wet hill forest, semi evergreen forest.                     |
| 40 | <i>Piper griffithii</i> C. DC.                    | Sand soil, Loamy soil, Silty clay loam      | 550 to 950m                      | 4°C to 31°C | 800 to 2100 mm  | 87.1 – 96.4%       | Tropical semi evergreen forest, Moist deciduous forest,                  |
| 41 | <i>Piper peepuloides</i> Wall.                    | Sandy clay loam soil, Sandy loam            | 600 to 945m                      | 5°C to 29°C | 800 to 1500mm.  | 74.6 – 89.4%       | Wet hill forest, Semi evergreen forest, Bamboo brakes forest.            |
| 42 | <i>Quercus lamellosa</i> Sm.                      | Red sandy loams soil, Clay soil, Silt soil. | 900 to 1500 m                    | 4°C to 30°C | 900 to 1900 mm  | 65.8 – 90.0%       | Sub tropical pine forest, Buk Oak forest.                                |
| 43 | <i>Rhododendron arboreum</i> Sm.                  | Red sandy soil with small pebbles           | 900 to 2100 m                    | 3°C to 24°C | 900 to 2100 mm  | 86.6 - 97.5%       | Buk Oak forest, Sub tropical pine forest, Semi evergreen forest.         |
| 44 | <i>Rubia cordifolia</i> L.                        | Sandy loam soil, Clay soil, Silt soil       | 800 to 1500 m                    | 3°C to 33°C | 900 to 1600mm.  | 84.0 – 92.4%       | Wet hill forest, Sub tropical pine forest, Moist mixed deciduous forest. |
| 45 | <i>Scutellaria discolor</i> Colebr.               | Sandy loam soil, Clay loam soil, Silt soil. | 550 to 900m                      | 4°C to 32°C | 900 to 1900 mm  | 74.7 – 89.5%       | Semi evergreen forest, Bamboo brakes forest, Pine forest.                |
| 46 | <i>Smilax ovalifolia</i> Roxb. ex D. Don          | Sandy loam soil, Clay soil, Silt soil       | 500 to 950 m                     | 3°C to 34°C | 900 to 2500mm.  | 77.7 – 90.5%       | Sub tropical pine forest, wet temperate forest, Grass brakes forest.     |
| 47 | <i>Swertia angustifolia</i> Buch.- Ham. ex D. Don | Sandy loam soil, Clay loam soil, Silt soil  | 1000 to 1450 m                   | 3°C to 22°C | Above 1000 mm   | 92.0 – 93.2%       | Tropical semi evergreen forest, Pine forest, Buk Oak forest.             |
| 48 | <i>Syzygium jambos</i> (L.) Alston                | Sandy soil, Clay soil, Silt soil.           | 500 to 850m                      | 5°C to 28°C | Above 1200 mm   | 75.0 – 89.2%       | Sub tropical Wet hill forests, Buk Oak forest, Pine forest.              |
| 49 | <i>Taxus wallichiana</i> Zucc                     | Sandy loam soil, Loamy soil, Silt soil      | 1100 to 1900 m                   | 3°C to 29°C | Above 1450 mm   | 76.1- 92.5%        | Semi evergreen forest, Buk Oak forest, Wet hill forest.                  |
| 50 | <i>Thalictrum foliolosum</i> DC.                  | Sandy loam soil, Silt loam soil, Clay soil  | 1000 to 1850 m                   | 3°C to 23°C | Above 1500mm.   | 83.1- 92.8%        | Wet hill forest, Pine forest, Moist deciduous forest                     |
| 51 | <i>Zanthoxylum acanthopodium</i> DC.              | Sandy soil, Silt soil, Clay soil            | 600 to 1000 m                    | 3°C to 30°C | Above 1500mm.   | 88.1- 93.6%        | Sub tropical pine forest, Wet hill forest, Buk Oak forest                |
| 52 | <i>Zanthoxylum rhetsa</i> (Roxb.) DC.             | Sandy clay soil, Silt soil, Clay soil.      | 500 to 950m                      | 3°C to 34°C | Above 1500mm.   | 82.1- 94.6%        | Sub tropical pine forest, Wet hill forest, Buk Oak forest                |

**Table 3.** Table showing the habitat, threats, distribution in Manipur, status and conservation aspects.

| SL Species | Habitat  | Threats   | Distribution in Manipur   | Status  | Conservation Aspects |  |
|------------|--|---|---|---|----------------------|--|
| 1          | <i>Aconitum elwesii</i> Stapf.                             | It is found growing only in small pockets on a particular microhabitat at an altitude 1500 m above sea level.         | Scattered and disjunct population & forest fires.   | Shiruichingkha, Lunghar, Dzukou valley, Mao-Maram,          | EN                   | Local NGOs started <i>in-situ</i> conservation measures.   |
| 2          | <i>Aconitum nagarum</i> Stapf.                             | It is found growing in the grassy hill slopes along with Bamboo species at an altitude around 1500 m above sea level. | Restricted fragmented distribution, forest fires & jhumming cultivation.                              | Shirui & adjacent hill, Mao-Maram & adjacent hills          | EN                   | Some local youth started conservation in their natural habitat.  |
| 3          | <i>Albizia myriophylla</i> Benth                           | It grows in forest margins, riverine, disturbed habitat at an altitude about 600 m above sea level.                   | The main threats are edaphic factors, harvest for food, medicine and parts of the plant.              | Andro, Phayeng, Chandel, Tengnoupal & Churachandpur.        | VU                   | Need awareness programme for proper collection of root and bark for medicine.                              |
| 4          | <i>Amoora rohituka</i> (Roxb.).                            | It is found growing very scarcely at forest margin at an elevation of below 1000 m above sea level                    | Unsustainable collection, forest clearance and encroachment.  | Tangjeng, Phayeng, Bishnupur, Thoubal & Senapati,           | NT                   | Avoid forest fire, improper collection and human interference.   |
| 5          | <i>Begonia adscendens</i> C.B. Clarke                      | It is found growing in forest floor and in rock crevices at an elevation of 900–1800m above sea level                 | Population declined due to habitat loss and forest fires.   | Shirui hill, Lunghar, Tungjoi, Dzukou hill (Esii hill).     | NT                   | Immediate awareness should be given to avoid habitat destruction and forest fire.                          |
| 6          | <i>Brassaiopsis bodinieri</i> (H. Leveille) J. Wen & Lowry | It is found growing in open forest at an elevation of below 1000m above sea level                                     | Over-exploitation from wild   | Phayeng, Moirangpural, Churachandpur, Andro                 | VU                   | To conduct regular training camps for the farmers for cultivation, harvesting and sustainable utilization. |
| 7          | <i>Bulbophyllum cylindraceum</i> Lindley                   | Tree trunks or rocks in forest, up to 1800 m above sea level  | The wild population is affected by harvest for medicine and others.                                   | Ukhrul, Dzukou hill, Mao-Maram, Laimatonching & Tengnoupal  | NT                   | Some local NGOs started both <i>in-situ</i> and <i>ex-situ</i> conservative measures.                      |
| 8          | <i>Canarium strictum</i> Roxb.                             | Moist Evergreen and Semi-evergreen forests at an altitude of 800 -1000 m above sea level                              | The species is declining due to harvest for medicine, habitat loss and trade for parts of the plants. | Moreh, Chakpikarong, Dilong, Ukhrul                         | VU                   | The species is traded locally and nationally. So, planted in reserved forest by forest dept.               |
| 9          | <i>Cinnamomum verum</i> J. Presl.                          | Found sparsely at an altitude about 750 – 1500 m above sea level  | The wild population is adversely affected by habitat destruction, trade and over exploitation.        | Dzukou hill, Tamenglong, Ukhrul, Chandel, Puilong, Senapati | VU                   | Awareness on habitat destruction, trade, human interference and encouraging <i>in-situ</i> conservation.   |
| 10         | <i>Cissus javana</i> DC.                                   | Found as climbers in open forest at an elevation of 700- 1200m above sea  | The species is declined due to low seed germination   | Thoubal, Kakching, Laimatonching,                           | NT                   | Encouraging <i>in-situ</i> conservation measure in wild population.  |

| SL Species                               | Habitat   | Threats  | Distribution in Manipur   | Status | Conservation Aspects  |
|--|---|--|---|--------|---|
|  | level   | and habitat destruction.   | Heingang reserve forest.  |        |   |
| 11 <i>Citrus macroptera</i> Mont.        | Found growing in forest at an elevation of 700-1000 m above sea level   | The wild population is declined due to human interference, edaphic factors and disease                   | Tamenglong, Chandel, Kangpokpi, Churachandpur                         | VU     | Need immediate awareness programme for proper collection methods and commercial cultivation.          |
| 12 <i>Curcuma amada</i> (Roxb)           | It is found growing in the wet or shady areas of forest floor and plain areas at an elevation upto 950 m above sea level  | Population decline due to low regeneration and harvest for medicine.                                     | Thoubal-Haokha, Imphal East, Phayeng, Tangjeng, Churachandpur         | VU     | Scattered in hills of Manipur. It needs awareness for proper collection methods for sustainable uses. |
| 13 <i>Curcuma caesia</i> Roxb.           | It is found growing in the wet or shady areas of forest floor and plain areas at an elevation upto 1000 m above sea level | The wild population is declining due to harvest for medicine and parts of the plant                      | Nongmaiching, Langol-hill, Tamenglong, Chandel                        | VU     | Mass awareness programme for proper collection methods and to start up commercial cultivation.        |
| 14 <i>Dendrobium aphyllum</i> (Roxb.)    | Found as epiphytes on tree trunks at an elevation of 800-1500 m above sea level   | The wild population of the species are largely affected by various natural and anthropogenic activities. | Lunghar, Kangpokpi, Chandel (Near United College), Kamjong            | LC     | Need awareness to stop rampant forest fires and illegal trade   |
| 15 <i>Dendrobium denudans</i> D. Don     | Found as epiphytes on tree trunks at an elevation of 800-1600 m above sea level   | Wild population has declined due to habitat destruction, forest fire and low regeneration.               | Senapati (Mao), Chandel, Khayangbung, Tengnaupal                      | EN     | Avoid habitat destruction and illegal trade of the whole plants.                                      |
| 16 <i>Dendrobium nobile</i> Lindl.       | Found as epiphytes on tree trunks at an elevation of 800-1800 m above sea level   | Human interference, loss of habitat, unsustainable collection methods are the main threats.              | Khayangbung, Lambui, Mao-Maram, Kangpokpi, Tamenglong.                | EN     | Need awareness for proper collection and its medicinal importance.                                    |
| 17 <i>Dichroa febrifuga</i> Lour.        | Found grows mainly in forest margin at an altitude of 900 to 1500 m above sea level                                       | The species is decreasing due to improper collection, harvest for medicine and encroachment..            | Ukhrul, Chandel, Tamenglong (Puilong & Dilong)                        | NT     | Local NGOs started <i>in situ</i> conservation in their natural habitat.                              |
| 18 <i>Eleutherococcus trifolius</i> (L.) | It is found on the edges of forests and thickets at an altitude of 900 to 1500 m above sea level.                         | Over- exploitation of roots and harvest for medicine are the main threats.                               | Senapati, Kangpokpi, Ukhrul (Shirui & adjacent hills)                 | VU     | Both <i>in situ</i> and <i>ex situ</i> conservation measures are necessary.                           |
| 19 <i>Eupatorium cannabinum</i> L.       | Found near swamps, marshes and stream banks at an altitude of 600- 1000 m above sea level.                                | Loss of habitat, improper collection method and forest fire.   | Heingang-ching, Langol-hill, Kakching, Noney, Moirang, Churachandpur. | NT     | Improper collection leading to death of the plants. Need the importance of medicinal value.           |
| 20 <i>Eurya acuminata</i> DC.            | Found in forests at an altitude of 600 to 1000 m  | Harvest for food and medicine.   | Senapati ( Mao- Maram) Kangpokpi (Saikul),                            | NT     | <i>In- situ</i> conservation are importance within the  |

| SL Species | Habitat   | Threats   | Distribution in Manipur  | Status  | Conservation Aspects |  |
|------------|---|---|--|---|----------------------|--|
| 21         | <i>Sisyrrinchium palmifolium</i> L.                 | Found in open areas at an altitude up to 1000 m above the sea level   | Declined due to forest fires and medicine  | Tamenglong, Kamjong Chandel (Komlathabi), Tengnoupal (Laimaton-Ching), Bishnupur. | NT                   | habitat. Awareness for proper collection methods and importance of plants.                                 |
| 22         | <i>Flacourtia jangomas</i> (Lour)                   | Found near swamp forest margins at an altitude around 600 to 1000 m above sea level                           | Declined due to habitat destruction and over exploitation.                       | Langol hill, Phayeng, Chandel, Ukhrul, Jiribam                                    | VU                   | Both <i>In situ</i> and <i>ex situ</i> conservation are encouraged   |
| 23         | <i>Garcinia pedunculata</i> Roxb.                   | Found in evergreen and mixed forest at an altitude upto 920 m above sea level.                                | Declined due to over- exploitation and forest clearance                          | Ukhrul, Senapati, Tamenglong, Phayeng, Noney, Churachandpur.                      | NT                   | Forest clearance and forest fires leads to loss of microhabitat.   |
| 24         | <i>Glochidion coccineum</i> (Buch.-Ham)             | Found in open areas at an altitude of 700 to 1600 m above the sea level.                                      | The population is decreasing due to forest clearance & harvest for medicine.     | Nongmaiching, Chaning-Lairembi Nambol, Heingang reserve forest, Kangpokpi, Sekmai | NT                   | Awareness programme to stop rampant forest fires and habitat destruction                                   |
| 25         | <i>Hedychium spicatum</i> Smith.                    | Found in swampy and shady areas at an elevation upto 1000 m above the sea level                               | Habitat destruction, harvest for medicine & ornamental purpose.                  | Moirang, Chandel, Maram, Khonghampat, Tamenglong                                  | VU                   | Need to check forest fires and habitat destruction   |
| 26         | <i>Hippochaete debilis</i> (Roxb. ex Vaucher) Ching | Found in moist shady exposed areas near waterfalls and streams at an elevation of 400- 1000 m above sea level | Low population and restricted fragmented distribution.                           | Nungba, Leimaram, Andro, Modi village Chandel, Lamlai.                            | NT                   | Need <i>in-situ</i> conservation in their natural habitat  |
| 27         | <i>Homalomena aromatica</i> (Spreng.) Schott.       | Found in Moist shady forest floor at an elevation of 800-1200 m above sea level                               | Population decline due to low regeneration and harvest for medicine.             | Tamenglong, Senapati, Saikul , Chandel  | EN                   | Need immediate awareness for proper collection methods and importance of plants.                           |
| 28         | <i>Lilium mackliniae</i> Sealy.                     | Found grows along with grassy hill slope at an altitude up to 2200 m above sea level.                         | Habitat destruction and forest fires.  | Shirui, Khayangbung , Ukhrul  | EN                   | Need to check forest fires and overgrowth of <i>Yushania rolloana</i> (Gamble) T.P.Yi                      |
| 29         | <i>Litsea cubeba</i> (Lour.) Pers.                  | Found in wet hill forest and moist mixed deciduous forest   | Improper collection methods and harvest for medicine.                            | Moirang purel, Noney, Phayeng, Nongdam Tangkhul Kamjong,                          | VU                   | Encouraging <i>in-situ</i> conservation measures in wild population  |
| 30         | <i>Litsea glutinosa</i> (Lour.) C.B.Rob.            | It is found in open forest area at an altitude of 600-1000 m above sea level.                                 | Over-exploitation from wild  | Kamjong, Andro, Maram, Kakching Khunou, Ningthoukhong.                            | VU                   | To conduct regular training camps for the farmers for cultivation, harvesting and sustainable utilization. |
| 31         | <i>Mahonia napaulensis</i> D C.                     | Found in open area in forest at an elevation of 700-900 m above sea level                                     | Population is adversely affected by habitat destruction and harvest for medicine | Komlathabi Chandel, Dailong, Chingai, Senapati                                    | VU                   | Awareness on proper collection of bark and young shoots leading to death of the plants.                    |



| SL Species  | Habitat  | Threats  | Distribution in Manipur  | Status | Conservation Aspects  |
|---|--|--|--|--------|---|
| 32 <i>Millettia pachycarpa</i> Benth.               | It is found in river bank, forest edges, at elevations of 600 to 1000 m above sea level. | The species is collected from wild in an indiscriminate way and population is decreasing continuously. | Chakpikarong, Laimaton-Ching, Tamei, Paomata                     | NT     | Mass awareness programme for proper collection methods, harvest for medicine and encouraging <i>in-situ</i> conservation. |
| 33 <i>Nanorrhinum ramosissimum</i> (Wall.) Betsche. | The species occurs in rock crevices at an altitude of 900 to 1500 m above sea level.     | Population decline due to low regeneration and harvest for medicine.                                   | Langol-hill, Jiribam, Kakching, Yaralpat.                        | NT     | Need immediate awareness for proper collection methods and importance of plants.  |
| 34 <i>Oroxylum indicum</i> (L.) Kurz                | Tropical and subtropical low altitude open forest at an elevation upto 1000 m            | The wild population is affected by habitat destruction, over exploitation and forest fires             | Heingang reserve forest, Kwatha, Lamphelpat, Jiribam, Lango-hill | VU     | Awareness should be given to localities for sustainable use of medicinal plants.  |
| 35 <i>Paederia foetida</i> L. Mant.                 | Moist soil of forest margin at an elevation upto 1100 m above sea level                  | Loss of habitat, improper collection method and forest fire.   | Phayeng, Nongdam Tangkhul Kamjong, Machi, Purul                  | NT     | Need awareness for proper collection and its medicinal importance.  |
| 36 <i>Panax assamicus</i> R.N. Banerjee             | Found wild in shady forest floor at an elevation upto 1500 m above sea level             | Uprooting of rhizome leads to death of the plants.   | Tamenglong, Shirui & Adjacent hill, Mao-Maram                    | VU     | Awareness for proper collection and its medicinal value.  |
| 37 <i>Panax pseudoginseng</i> Wall.                 | Found in forest floor and shrubberies at an altitude of 1000 to 1500 m above sea level   | Population reduction due to forest fire, habitat destruction and harvest for medicine.                 | Shirui- Chingkha, Dailong, Chandel, Ukhrol                       | VU     | Awareness should be given to localities for sustainable use of medicinal plants.  |
| 38 <i>Paris polyphylla</i> Sm.                      | Found moist shady areas at an elevation of 800-1500 m above sea level                    | Declined due to over-exploitation, uprooting of rhizome leads to death of the whole plants.            | Puilong, Shirui hill & adjacent, Mapithel,                       | EN     | Need awareness for proper collection and its medicinal importance to localities.  |
| 39 <i>Phyllanthus urinaria</i> L.                   | Found in wild mainly forest margins at elevation of 500 to 900 m above sea level         | Population reduction due to harvest for medicine, forest fire and pesticides.                          | Kanto Imphal West, Andro, Phayeng, Nachau                        | NT     | Awareness should be given to localities for sustainable use of medicinal plants.  |
| 40 <i>Piper griffithii</i> C. DC.                   | Found as undergrowths of forest at an elevation of 750-1100 m above sea level            | Loss of habitat, forest fires, and harvest for medicine are the main threats.                          | Noney, Tipaimuk, Paomata, Ukhrol                                 | NT     | Awareness on sustainable utilization should be encourage  |
| 41 <i>Piper peepuloides</i> Wall.                   | Found as undergrowths of forest at an elevation of 750-1100 m above sea level            | Declined due to forest fires, improper collection method and harvest                                   | Tengnoupal, Phungyar, Modi village Chandel                       | VU     | <i>In situ</i> conservation by establishment of natural reserves or biosphere resources.                                  |

| SL Species  | Habitat   | Threats  | Distribution in Manipur                                     | Status | Conservation Aspects   |
|---|---|--|---|--------|--|
|   |   | for medicine   |   |        |  |
| 42 <i>Quercus lamellosa</i> Sm.                     | Found growing in temperate forest at an elevation of 900- 1500 m above sea level.             | Population declined due to improper collection of bark and leaves.   | Ukhrul, Mao- Maram, Dzukou hill, Nungba                     | VU     | It needs to check forest clearance & proper collection methods.                                    |
| 43 <i>Rhododendron arboreum</i> Sm.                 | It is commonly found in the lower hill slopes at an elevation of 1200- 2200 m above sea level | Improper collection, harvest for medicine, forest fire are the main threats.   | Dzukou hill, Shirui hill, Churachandpur, Dailong Tamenglong | NT     | Awareness to stop rampant forest fires and habitat destruction                                     |
| 44 <i>Rubia cordifolia</i> Linn.                    | It is commonly found in moist areas as undergrowths up to 1500 m above sea level              | Population decline due to low seed germination, habitat loss and improper collection method.                         | Ukhrul (Tolloi), Noney , Tamei, Kangpokpi                   | EN     | Need awareness for proper collection methods and its medicinal importance.                         |
| 45 <i>Scutellaria discolor</i> Colebr.              | Found in forest margin at an altitude of 700 to 1000 m above sea level                        | Harvest for medicine, forest fire, improper collection methods are the main threats.                                 | Kamjong, Phayeng, Thoubal, Kakching, Pallel                 | VU     | To conduct training camps for the farmers for cultivation, harvesting and sustainable utilization. |
| 46 <i>Smilax ovalifolia</i> Roxb. ex D.Don          | Fairly common in jhum land and forest floor between 600- 1000 m above sea level               | Population is reducing due to over exploitation, forest fire and loss of habitat.                                    | Langol hill, Akampat, Lokchao, Mapithel, Saikul             | NT     | Awareness should be given to localities for sustainable use of medicinal plants.                   |
| 47 <i>Swertia angustifolia</i> Buch.- Ham. ex D.Don | Fairly common in jhum land and forest floor between 900- 1500 m above sea level               | The major threats to the wild population of this plant species are loss of habitat and harvest for medicinal uses.   | Khayangbung, Dzukou, Komlathabi, Tipaimuk                   | VU     | Both <i>In-situ and Ex- situ</i> conservation measures are necessary for sustainable uses.         |
| 48 <i>Syzygium jambos</i> (L.) Alston               | It is found in open areas at an elevation of 600 to 1000 m above sea level                    | Population is adversely affected by Laimaton Ching, habitat destruction, harvest for medicine and over exploitation. | Khudengthabi, Tamei, Churachandpur, Nachau Bishnupur.       | NT     | Some local NGOs started <i>in situ</i> conservation measures for sustainable uses.                 |
| 49 <i>Taxus wallichiana</i> Zucc                    | Common in the upper temperate forest at an altitude around 1400- 2200m above sea level        | Population decline due to low regeneration and harvest for medicine.   | Shirui hill, Khayangbung and adjacent hills                 | CR     | Awareness should be given to localities for sustainable use of medicinal plants.                   |
| 50 <i>Thalictrum foliolosum</i> DC.                 | Found in forest margin at an elevation of 1100-2000 m above sea level                         | Population is declined due to improper collection method, harvest for medicine and loss of habitat                   | Shirui Chingkha, Dzukou hill, Mao- Maram                    | EN     | Awareness should be given for proper collection, harvest for medicine to the farmers.              |
| 51 <i>Zanthoxylum</i>                               | Found growing upland  | Loss of habitat,   | Heingang Reserve forest,                                    | NT     | Some local NGOs started  |

| SL Species                               | Habitat  | Threats   | Distribution in Manipur                    | Status Conservation Aspects  |
|--|--|---|--|--|
| <i>acanthopodium</i> DC.                 | open forests and thickets up to 1000 m above sea level           | forest fires, edaphic factors, and harvest for medicine are the main threats.     | Langol hill, Thoubal, Bishnupur, Moreh     | <i>in situ</i> conservation measures for sustainable uses.   |
| <i>Zanthoxylum 52 rhetsa</i> (Roxb.) DC. | Found in open forest at an altitude of 600-1000m above sea level | Population is reducing due to over exploitation, forest fire and loss of habitat. | Bishnupur, Makhan, Ukhrul, Nambol, Phayeng | VU<br>To conduct regular training camps for the farmers for cultivation, harvesting and sustainable utilization. |

The recorded species were assessed for its status. In the present study it was recorded that Vulnerable species (VU) is represented by 21 species, followed by Near. Threatened (NT) species is represented by 20 species, Endangered (EN) by 9, Least Concern (LC) and Critically Endangered (CR) represented by 1 species each.

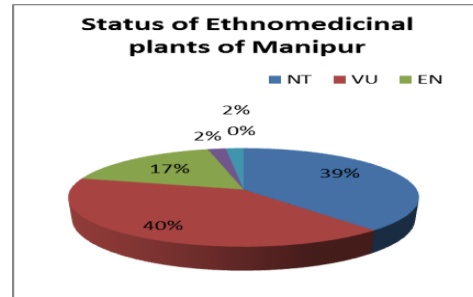


Fig. 3. Figure showing the status of ethno-medicinal plants.



*Aconitum elwesii* Stapf



*Brassaiopsis bodinieri*  
(H. Leveille)



*Dichroa febrifuga* Lour.  
J. Wen & Lowry



*Bulbophyllum cylindraceum* L.



*Glochidion coccineum*



Survey work at Tengnoupal





*Paris polyphylla* Sm.



*Scutellaria discolor* Colebr.



*Sisyrinchium palmifolium* L

### Discussion

The state of Manipur in Northeast India has rich repositories of ethno-medicinal plant diversity. The present survey and documentation works reveals these species are closely associated with the treatment of primary health ailments of several communities residing in the state since time immemorial. Interestingly, the medicinal uses were more in far flung areas because of its easy accessibility, substantial herbal knowledge and also derived of medicinal facilities. Although, some of the medicinal uses are in public domain or home remedies other are left hidden in the knowledgeable traditional healers. The rich traditional knowledge is fading day by day as it is orally transmitted from generation to generations along with some religious restrictions and in near future will soon be lost in time to come if not properly documented.

The occurrence of threatened ethno-medicinal plants was mostly found in the hilly districts of Manipur which constitutes about 90% of the state area. Moreover, the variations in altitudes, landscapes, climatic factors create micro habitats which favours for growth of many rare and endemic medicinal plants. It was also recorded that *Canarium strictum* Roxb., *Cissus javana* DC., *Curcuma amada* (Roxb), *Quercus lamellose* Sm, *Rubia cordifolia* L., *Zanthoxylum rhetsa* (Roxb.) DC., *Zanthoxylum acanthopodium* DC., and *Cinnamomum verum* J. Presl., were used by majority of the communities whereas *Glochidion coccineum* (Buch.-Ham) Mull.

Arg., *Lilium mackliniae* Sealy., *Taxus wallichiana* Zucc., were used only by a single particular community only.

The degree of threats to natural population of medicinal plants leading to population decline was due extreme anthropogenic pressures like habitat destruction, forest fires, jhum cultivation and overexploitation for wild. Moreover, increase in demand coupled with improper collection methods threatened the survival of many of them ethno medicinal plants. Regarding the conservation status majority of the species falls under the Vulnerable species (VU) and Near threatened (NT) which can be concluded that there is a severe threat in their habitats. The species *Taxus wallichiana* Zucc. was under assessed as Critical Endangered (CR) as its threat was due to habitat destruction and low seed germination. The only species which was assessed at Least Concern (LC) was *Dendrobium aphyllum* Roxb. As it was observed to cultivate by the locals in their houses as recreation or ornamental value.

The major primary health ailments treated are gastrointestinal complaints, orthopaedic problems, dermatological problems, urology problems, snake and dog bite. Regarding, mode of preparation the maximum was recorded in decoction which is can be considered as safe method for oral consumption. The indigenous knowledge could be exploited for strengthening health care systems for future options.

Considering environmental parameters and different attributes analysis, the present finding will give a base line data or area specific data of a particular species towards future conservation efforts for *in-situ* conservation. Additionally, mass reproduction, cultivation of commercially viable species, mass awareness for proper collection methods and conservation status are suggested. Moreover, there should be strict and priority measures from Forest department and concerned authorities for their effective conservation. Such efforts will help in sustainable utilization ethno medicinal plants and also develop state's economy.

### Conclusion

The rich diversity of medicinal plants plays a significant role in treatment of primary health ailments in the state of Manipur. The ethno-medicinal plants and traditional knowledge needs to be properly documented and their scientific validations for effective utilization should be done. Habitat destruction, overexploitation and other threats has made ethno-medicinal plants to become threatened status. Therefore, it is high time to come up with conservation strategies and measures for sustainable utilization at the earliest.

### Acknowledgement

The authors are thankful to department of botany, Nagaland University for their support and lab facilities. We are also thankful to the head of centre of advanced studies in Life Sciences Manipur University.

### References

**Ahmedmm, Singh PK.** 2007. Traditional knowledge system of the Muslim community in Manipur. *Indian Journal of Traditional Knowledge* **6(2)**, 383-389.

**Brooks TM, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Rylands AB, Konstant WR, Flick P, Pilgrim J, Oldfield S, Magin G, Taylor CH.** 2002. Habitat loss and Extinction in the Hotspots of Biodiversity. *Conservation Biology* **16(4)**, 909-923.

**Champion HG, Seth SK.** 1968. A revised survey of Forest types of India: The Manager of publications, New Delhi.

**Deb DB.** 1961a. Dicotyledonous plants of Manipur territory **3**, *Bulletin of Botanical Survey of India, Eastern Circle, Shillong*.

**Deb DB.** 1961b. Monocotyledonous plants of Manipur territory **3**, *Bulletin of Botanical Survey of India*.

**Devi MR, Dutta BK, Salam S, Singh PK.** 2016. Plants of Monsang Tribe of Manipur, Kha Manipur College, Kakching: Printed at Times Offset Printers, Kakching, Manipur.

**Devi TI, Devi KU, Singh EJ.** 2015. Wild medicinal plants in the hill of Manipur, India: A traditional therapeutic potential. *International Journal of Scientific and Research Publications* **5(6)**, 1-9.

**IUCN.** 2012. IUCN Red List Categories and Criteria: Version 3.1. Second Edition. Gland, Switzerland and Cambridge, UK: IUCN. iv + 32pp

**Khumbongmayum AD, Khan ML, Tripathi RS.** 2005. Ethnomedicinal plants in the scared grooves of Manipur. *Indian Journal of Traditional Knowledge* **4(1)**, 21-32.

**Konsam N, Choudhury MD.** 2012. Ethnomedicinal plants used by of Kukis of Senapati district of Manipur. *Journal of Econ. Bot* **36(4)**, 886-892.

**Lokho A.** 2012. The Folk Medicinal Plants of the Mao Naga in Manipur, North East India. *International Journal of Scientific and Research Publication* **2(6)**, 1-8.

**Mao AA, Deori C.** 2018. Checklist of Orchids of Manipur – A Pictorial Handbook: Forest Department, Government of Manipur and Botanical Survey of India, Government of India.



- Mao AA, Gogoi R.** 2010. Floristic Study of Dzukou Valley and Surrounding Hills, Manipur and Nagaland, India.
- Meyers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J.** 2000. Biodiversity hotspots for conservation priorities. *Nature* **403**, 853-858.
- Nayar MP, Sastry ARK.** 1987-1990. Red Data Book of Indian Plants, Vol. I-III, Botanical Survey of India, Calcutta. Pullaiah.
- Ningombam DS, Devi SP, Singh PK, Pinokiyo A, Thongam B.** 2014. Documentation and Assessment on Knowledge of Ethno-Medicinal Practitioners: A Case Study on Local Meetei Healers of Manipur **9**, 53-70.
- Pfoze NL, Kumar Y, Myrboh B.** 2011. Survey and assessment of floral diversity on wild edible plants from Senapati district of Manipur, Northeast India. *Journal of Biodiversity and Environmental Sciences* **1(6)**, 50-62.
- Salam S, Jamir JS, Singh PK.** 2009. Traditional uses of medicinal plants by the Tangkhul-Naga tribe in Manipur, India. *Pleione* **3(2)**, 157-162.
- Salam S, Jamir JS, Singh PK.** 2011. Ethnomedicinal studies on Tangkhul-Naga tribe in Ukhrul District, Manipur. *Ethnobotany* **23**, 129-134.
- Simpson MG.** 2006. *Plant Systematics*: Elsevier Academic press, London.
- Singh HB, Singh RS, Sandhu JS.** 2003. *Herbal Medicine of Manipur*: Daya Publishing House, Delhi, 110035.
- Singh HB, Sundriyal RC.** 2003. Common spices and their use in traditional medicinal system of ethnic groups of Manipur state, North eastern India. *Indian Journal of Traditional Knowledge* **2(2)**, 148-158.
- Singh HT.** 2009. *A manual on the medicinal plants of Manipur*: Published by Institute of Bioresources and Sustainable Development, Dept. of Biotechnology, Govt. of India: Printed at Sangai offset Printers, Imphal, Manipur. India.
- Singh NP, Chauhan AS, Mondal MS.** 2000. *Flora of Manipur (Ranunculaceae-Asteraceae) 1*, Botanical Survey of India: Printed at Roman Printers Pvt. Ltd. Calcutta.
- Singh NR, Singh MS.** 2009. Wild medicinal plants of Manipur included in the Red list. *Asian Agri-History* **13(3)**, 221-225.
- Singh PK, Singh KI.** 2003. First Aid Remedies: An ethno Medico Botanical study of Meitei Community of Manipur. *Journal of Economic and Taxonomic Botany* **27(2)**, 457-472.
- Singson N, Deshworjit SN, Nanda Y, Rao A.** 2016. Home remedial plants used by the Thadou Kuki tribe of Manipur, India: A case study. *International Journal of Scientific Research* **4(6)**, 389-391.
- Sinha SC.** 1996. *Medicinal plants of Manipur*: Manipur Association for Science & Society (MASS): Manasi Press, Calcutta.
- Ved DK, Anu V, Kareem MA, Jawahar CR, Ningombam DS.** 2018. *Conservation Assessment and Management Prioritization for the Medicinal Plants of Manipur*: Published by The University of Trans-Disciplinary Health Sciences and technology (TDU) Bengaluru, Karnataka-560064.
- Yuhlung CC, Bhattacharya M.** 2016. Indigenous Medicinal plants used by the Maring tribe of Manipur, North east India. *Journal of Ayurvedic and Herbal Medicine* **2(4)**, 146-153.