Ethnobotanical survey on plants used in Mai Municipality of Ilam district, eastern Nepal

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This study was aimed to document medicinal plant species, their utilization and methods to treat common ailments by traditional healers in Churiya region of Ilam district, eastern Nepal. This study would contribute positively to the field of biodiversity conservation, phytochemistry and ethnopharmacology. Ethnobotanical information were collected in 2016 based on semi-structured questionnaire with key informant interview. Data were evaluated and expressed in terms of number and percentage. A total of 116 medicinal plants belonging to 61 families were reported to treat 76 different ailments categorized into 18 groups. The highest numbers of plants were used to treat digestive system disorders. The most medicines were prepared as the form of paste from leaves or tender shoots and administrated orally. Of the documented plants, 5 species were reported with novel uses and 7 were newly reported as ethnomedicinal plants in Nepal. Besides medicine, 111 species were utilized additionally for food, fodder, socio-cultural events and environmental use. People of the area less frequently use traditional herbal therapies. Due to lack of proper collection, conservation and cultivation practices, some plant species are at risk of extinction. Thus, sustainable harvesting and access to benefit sharing help to improve livelihood and conserve biodiversity.

Key words: Ailment, Churiya, ethnobotany, livelihood, medicinal plant

The continuous war against disease and illness has been fought by man from the beginning of human civilization to present date. For the victory of the war and maintenance of health, various plant-based medicines have been used since the early days (Ghani, 2013). From time immemorial, many medicinal plants are used as folk medicine for the treatment of various ailments in Nepal and rest of the world. Globally, about 30,000 to 70,000 plant species are used medicinally, and in developing world, 70-80% of the population depend upon plants for their primary health care (WHO, 2002). Similarly, at least 7,000 medical compounds in the modern pharmacopoeia are derived through ethnobotanical surveys from the plants mainly based on the folk medicine of native people (Coe & Anderson, 1996).

Nepal is rich in its biological and cultural diversity. The documentation of ethnobotanical knowledge helps in the preservation of indigenous culture and contribute to the conservation and management of plant diversity that benefits the local communities (Luitel et al., 2014). Over 2,500 plant species are medicinal in Nepal (Ghimire, 2008; Bhatt & Kunwar, 2020) which are used in the traditional systems of medicine. The uses are associated with diverse ethnic groups of the country residing in diverse geographical ranges, and the knowledge is transferred orally through generations (Adhikari et al., 2019). However, the new generation does not seem willing to continue their local healing tradition since it neither generates sustainable income nor offer any career development scheme. In addition to documenting the traditional knowledge related to medicinal plants, scientific validation of the healing systems is required for protecting the intellectual property rights of the particular community (Aryal et al., 2016).

In Nepal, ethnobotanical research started from eastern Nepal with the publication of a paper on medicinal and food plants by Banerji in 1955. Since then, many scientists have covered different

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communities in different geographical area. A number of studies such as Oli et al. (2005), Acharya & Pokhrel (2006), Gachhadar (2006), Maden et al. (2008), Poudel (2009), Gautam (2011), Limbu & Rai (2013), Bhattarai & Khadka (2016), Shrestha et al. (2016), Upety et al. (2016), Bhattarai (2017), Parajuli (2017), Bhattarai (2018), Chaudhary et al. (2020) and Pradhan et al. (2020) have documented ethnobotanical information from eastern Nepal based on different communities. However, many communities in different parts of the nation are still either unexplored or little explored.

Most of the ethnomedicinal studies conducted in the recent years in Nepal have only documented whether the community people have knowledge about the use of plant or not, but have not mentioned about the recent practices of the use of these plants as medicines. Though they have knowledge about the traditional medicine, they may prefer modern medicine. More recent data suggest that the use of traditional medicine in some Asian and African countries is substantially lower and is declining (Oyebode et al., 2016).

I hypothesized that the people in Danabari of Mai municipality, Ilam have specialized knowledge on the utilization of medicinal plants, because the settlement area is rich in plant diversity with diverse ethnic communities. I also expected that the knowledge on ethnomedicine is declining in young generation as the community is affected by urbanization and cultural transformation. The present study, therefore, aims to enlist the ethnomedicinal plants and the methods/technique to manage common ailments by the traditional healers among the Magar-dominated community in Ilam district. Besides, emphasis had been also given for the multiple utilization of medicinal plants and evaluation of ethno medicinal knowledge status in young generations.

Materials and methods

Study area

Extending over an area of 1,703 sq km, Ilam is a hilly district situated about 600 Km east from Kathmandu, in Province No. 1 of Nepal (Figure 1). It is located between 26°40' – 27°08’N latitudes and 87°40’ – 88°10’ E longitudes. The district stretches from the lower belt of Terai (flat land stretching all along the southern border with India) and Chure (a stretch of Siwalik hill extending from east to west on the north, next to the upper hilly belt of the Himalayan region with the altitude ranging from 150 m to 3636 m above the mean sea level (amsl). The average annual temperature is 20°C, and the average annual rainfall is 2500 mm with more than 90% of relative humidity during January–October (Sharma, 2000). The tropical to alpine vegetation is found in the district with forest coverage of about 55% (DFRS, 2015).

Fig. 1: Map showing the location of the study area

The study was conducted in Danabari area within Mai municipality situated in the southern part of Ilam district (Figure 1). The municipality is surrounded by Deumai and Ilam municipalities on the north, Suryodaya municipality on the north-east, Jhapa district on the south-east and Mangsebung and Chulachuli rural municipalities on the west. The total area of the municipality is 264 sq km with 33,210 population. Danabari stretches towards north from the east of Kankai Mai River at an average altitude of 200 m to 400 m amsl in the Churiya region. The area is inhabited by diverse group of people like Chhetri, Brahmin, Magar, Limbu, immigrants from different places of Ilam and other districts as well as indigenous people like Meche, Dhimal, Danuhar, Rajbanshi, Tharu, Jhangad, Darai, etc. (DDC, 2015); Magar being the dominant ones. The forest resources in this area are under great threat due to rapid population growth, deforestation, habitat encroachment, over grazing and over exploitation, but still the eastern Churiya has been regarded as a rich place in terms of vegetation and floristic diversity (Oli et al., 2005).
Data collection and analysis

This study was conducted among the key informants between Feb–July, 2016 by using semi-structured questionnaire. Prior to documentation of ethnomedicinal information, a number of open discussions and interactions were organized among the pre-informed people of Danabari in order to acquire knowledge about the medicinal plants found in the locality and also to document the ethnomedicinal information. After that, field survey was carried out with the help of the local people to collect information on the available medicinal plants and their conservation status. The informants were selected randomly to document the knowledge about the medicinal plants in detail. The collected plant specimens were photographed, and some of them were collected and preserved as herbarium specimens. The reported use of the medicinal plants and ailments treated were grouped into major categories following Cook (1995), and compared with the national and international literature. The data were entered in the Microsoft Office Excel 2016 Software to analyze the information regarding plant families, their habit, habitat, parts used, preparation type, mode of application, ethnomedicinal uses and other uses; data were expressed in terms of number and percentage. The plants were first identified following the nomenclature of APG III (The Plant List, 2013), and the reported uses were verified by using the available literature of Nepal (Manandhar, 2002; Baral & Kurmi, 2006; Kunwar et al., 2010; Malla et al., 2015; Upreti et al., 2016; Adhikari et al., 2019; Ambu et al., 2020). The voucher specimens were deposited at the herbarium of Plant Research Centre, Ilam.

Results

Plant diversity and uses

Among the documented 116 medicinal plant species belonging to 61 families and 106 genera, 97 were dicots, 16 were monocots and 3 were pteridophytes. These were represented by highest number of trees (n=42) followed by herbs (n=31), shrubs (n=23), climbers (n=15) and lianas (n=5). Out of the 61 families, Leguminosae (10 spp.) and Lamiaceae (8 spp.) were dominant followed by Malvaceae (5 spp.), Euphorbiaceae, Myrtaceae and Zingiberaceae (4 spp. each). Rest of the 55 families had less than 4 species each (Annex 1). The study showed that different parts of the same plants were used for different purpose (food, food-additives, fodder, fuel, different materials, socio-cultural use, environmental use and poison) and for the treatment of different ailments. Among the total medicinal plant species, 5 species were used only as medicine whereas 111 species were used for different other purposes besides medicine. Of the total plants with other uses, 40 species (20%) were used as food (fruits, curries and pickles); 8 species (4%) as food additives (condiments, souring agent and flavours); 48 species (24%) as fodder and forage; and 33 species (17%) as materials (furniture, agricultural tools, household containers, musical instruments, rope, ink, etc.); and 13 species (7%) as fuel. Similarly, 31 species (16%) were used either as sacred plants or used in various socio-cultural events; 21 species (11%) as hedge, ornamental use and also for erosion control; and the rest 2 species (1%) as poison to control pests of plants and livestock (Figure 2).

Fig. 2: Uses of medicinal plants in the study area

The people in the study area used the documented medicinal plants for the treatment of 76 different ailments categorized into 18 groups. The highest number of plants (54 spp.) were reported to be used for digestive system disorders, followed by 34 spp. for skin/subcutaneous, 31 spp. for infections/infestations, 27 spp. for respiratory disorders, 24 spp. for muscular-skeletal disorders, 16 spp. for genito-urinary disorders, 12 spp. for metabolic disorders, 11 spp. for nutritional disorders, 8 spp. for mental disorders, and 7 spp. for endocrine disorders. Similarly, 6 spp. were reported to be used for circulatory disorders, 6 spp. for the treatment of inflammation and 7 spp. for poisoning. Likewise, 5 spp. were reported to be used for the treatment of pregnancy/birth/
puerperium disorders, 2 spp. for neoplasm, 2 spp. for sensory disorders, and 1 sp. for nervous disorders, and the use of 5 spp. were unspecified (Table 1).

**Table 1: List of plant species used for specific ailment categories**

| Ailment categories | Name of ailments | Name of plant species in each category | No. of plant spp. |
|--------------------|------------------|---------------------------------------|------------------|
| **Circulatory System Disorders** | High blood pressure | Aloe vera, Justicia adhatoda, Moringa oleifera, Nyctanthes arbor-tristis, Rauvolfia serpentina, Sida rhombifolia | 6 |
| **Digestive System Disorders** | Bad breath, constipation, dental problems /toothache, diarrhoea, dysentery, gastritis, ulcer, green diarrhoea ("Saruwa"), indigestion jaundice and liver disorder, mild laxative, piles, pyorrhoea, stomach disorder, vomiting | Achyranthes aspera, Aegle marmelos, Aloe vera, Acorus calamus, Bauhinia vahlili, Bombax ceiba, Brucea javanica, Cassia fistula, Centella asiatica, Cinnamomum tamala, Citrus aurantifolia, Curcuma aromatica, Curcuma longa, Cuscuta reflexa, Elaeocarpus serratus, Euphorbia royleana, Gladiolus sp, Hibiscus sabdariffa, Lasia spinosa, Maesa macrophylla, Mallotus philippensis, Mangifera indica, Melastoma melabathricum, Mimus pudica, Musa paradisica, Ocotea lancifolia, Phyllanthus emblica, Piper longum, Piper mulesua, Pogostemon benghalensis, Polygonum molle, Premna barbata, Psidium guajava, Rauvolfia serpentina, Scoparia dulcis, Shorea robusta, Sida acuta, Sida rhombifolia, Smilax ovalifolia, Spondias pinnata, Stephania glandulifera, Stephania japonica, Syzygium cumini, Tamarindus indica, Tectaria sp., Terminalia bellirica, Terminalia chebula, Terminalia tomentosa, Tinospora sinensis, Trichosanthes cucumerina, Vitex negundo, Woodfordia fruticosa, Wrightia arborea, Zingiber montanum | 54 |
| **Endocrine System Disorders** | Diabetes | Aegle marmelos, Aloe vera, Moringa oleifera, Scoparia dulcis, Stephania glandulifera, Syzygium cumini, Ziziphus jujuba | 7 |
| **Genitourinary System Disorders** | Burning urination, dysuria, female sterility, hematuria, kidney problems, menstruation, mothers, menstrual disorder | Alstonia scholaris, Cassia fistula, Centella asiatica, Colebrookea oppositifolia, Eclipta prostrata, Mangifera indica, Mentha spicata, Mimoso pudica, Molineria crassifolia, Morus alba, Nepthelepis cordifolia, Ocotea lancifolia, Scoparia dulcis, Solanum torvum, Stephania glandulifera, Tinospora sinensis | 16 |
| Ailment categories         | Name of ailments                                                                 | Name of plant species in each category                                                                 | No. of plant spp. |
|---------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------|
| **Infections/Infestations** | Anthelmintic, diphtheria, fever, food poisoning ("naskapat"), gonorrhea, lice,   | Achyranthes aspera, Aegle marmelos, Alstonia scholaris, Artemisia indica, Azadirachta indica, Callicarpa | 31                |
|                           | repellent, malaria, measles, scabies, sore throat, hyperthermia (heat illness)    | macrophylla, Centella asiatica, Cheilocostus speciosus, Colebrookea oppositifolia, Curcuma aromatica, |                   |
|                           |                                                                                  | Curcuma longa, Dioscorea deltoidea, Etingera linguiformis, Euphorbia royleana, Justicia adhatoda,      |                   |
|                           |                                                                                  | Lasia spinosa, Lobelianicocytianifolia, Mimos paudica, Murraya koenigii, Molineria crassifolia,          |                   |
|                           |                                                                                  | Mussaenda macrophylla, Ocimum tenuiflorum, Ocotea lancefolia, Pogostemon benghalensis, Rauvolfia       |                   |
|                           |                                                                                  | serpentina, Scoparia dulcis, Sida acuta, Tetrastigma bracteolatum, Woodfordia fruticosa, Zingiber      |                   |
|                           |                                                                                  | montanum, Ziziphus jujuba                                                                                          |                   |
| **Muscular-Skeletal System Disorders** | Fracture, joint pain, muscular pain, body pain, sprain | Acacia pennata, Asparagus racemosus, Butea monosperma, Callicarpa macrophylla, Calotropis gigantea, | 24                |
|                           |                                                                                  | Curcuma aromatica, Desmodium multiflorum, Eclipta prostrata, Gonostegia hirta, Lagerstroemia parviflora, |                   |
|                           |                                                                                  | Lepidium sativum, Lygodium flexuosum, Neolamarckia cadamba, Oroxylum indicum, Poranopsis paniculata,    |                   |
|                           |                                                                                  | Pterospermum acerifolium, Shorea robusta, Smilax ovalifolia, Solanum torvum, Spatholobus parviflorus,   |                   |
|                           |                                                                                  | Terminalia chebula, Terminalia tomentosa, Uncaria sessilifrutus, Zingiber montanum                     |                   |
| **Neoplasm**              | Cancer                                                                           | Asparagus racemosus, Butea monosperma                                                                        | 2                 |
| **Nervous System Disorders** | Nervous problems                                                                  | Zingiber montanum                                                                                           | 1                 |
| **Nutritional Disorders**  | Tonic                                                                            | Alstonia scholaris, Asparagus racemosus, Bauhinia vahlia, Calamus erectus, Centella asiatica, Mangifera | 11                |
|                           |                                                                                  | indica, Morus alba, Murraya koenigii, Musa paradisica, Phyllanthus emblica, Tinospora sinensis         |                   |
| **Poisonings**            | Caterpillar sting, insect bite, snake bite                                        | Caryota urens, Cassia fistula, Centella asiatica, Clerodendrum viscosum, Polygonum molle, Rauvolfia  | 7                 |
|                           |                                                                                  | serpentina, Sida rhombifolia                                                                               |                   |
| **Pregnancy/Birth/Puerperium Disorders** | Abortifacient, breast engorgement, delay expulsion of placenta, lactation stimulant, prevent miscarriage | Asparagus racemosus, Achyranthes aspera, Butea monosperma, Mentha spicata, Sida rhombifolia         | 5                 |
| Ailment categories                  | Name of ailments                                                                 | Name of plant species in each category                                                                                                                                                                                                 | No. of plant spp. |
|-----------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Respiratory System Disorders      | Asthma, cough, cough-cold, sore throat, deepening of voice, pneumonia, respiratory problems, sinusitis | *Achyrantes aspera, Acorus calamus, Aegle marmelos, Bauhinia vahlii, Centella asiatica, Cinnamomum tamala, Cissus repanda, Colebrookea oppositifolia, Curcuma longa, Drymaria cordata, Etlingera linguiformis, Mimosos pudica, Myrica esculenta, Ocimum tenuiflorum, Ocotea lancifolia, Oroxylum indicum, Phyllanthus emblica, Piper longum, Piper mulesua, Piper nigrum, Pogostemon benghalensis, Spondias pinnata, Stephan dia japonica, Syzygium kurzii, Terminalia bellirica, Terminalia chebula, Vitex negundo*                                                                 | 27               |
| Sensory System Disorders          | Conjunctivitis, corneal opacity                                                  | *Euphorbia royleana, Piper nigrum*                                                                                                                                                                                                     | 2                |
| Skin/Subcutaneous Cellular Tissue Disorders | Boils, burn and scalds, cracks and sores, cut and wound, dandruff, rashes on tongue/mouth, skin diseases/lesions, stinging irritation of *Clocosia*, vitiligo ("seto dubi") | *Achyrantes aspera, Aerva sanguinolenta, Ageratina adenophora, Aloe vera, Alstonia scholaris, Antidesma acidum, Artocarpus lakoocha, Azadirachta indica, Caryota urens, Centella asiatica, Curcuma longa, Eclipta prostrata, Euphorbia heterophylla, Ficus racemosa, Justicia adhatoda, Lygodium flexuosum, Magnolia champaca, Mimosos pudica, Molineria crassifolia, Moringa oleifera, Mucuna macrocarpa, Mussaenda macrophylla, Ocimum tenuiflorum, Oroxylum indicum, Pogostemon benghalensis, Poranopsis paniculata, Premna barbata, Sapindus mukorossi, Scoparia dulcis, Senna sophera, Sida rhombifolia, Spatholobus parviflorus, Thunbergia coccinea, Thysanolaena maxima* | 34               |
| Unspecified                       | Chest pain, dizziness, headache, internal wound, nasal bleeding                  | *Drymaria cordata, Sida rhombifolia, Syzygium cumini, Vitex negundo, Zingiber montanum*                                                                                                                                                   | 5                |

**Plant parts used, their preparation and administration**

Different parts of these plants were reported to be used for ethno medicinal purpose. The most commonly used parts of the plants were found to be the leaves and tender shoots (48 spp.), followed by root/rhizome (41 spp.), fruit/pulp (35 spp.), bark (25 spp.), stem (17 spp.), flowers (13 spp.), seeds (11 spp.), gel/latex/sap (6 spp.) while the whole part sof 4 spp. were reported to be used (Figure 3).

![Fig. 3: Usability and frequency of the plant parts used](image-url)
The study revealed that the plant parts were mostly used as paste (63 spp.), followed by raw/chewable (45 spp.), juice (34 spp.), decoction (14 spp.) and powder (10 spp.). The young shoot and fruits of some species like Lasia spinosa, Moringa oleifera, Piper longum and Smilax ovalifolia were even used as curry and some other species were used as tea, infusion, ash, fume/scent/vapour, chew stick, fomentation and adhesive (Figure 4). Internal consumption as well as external applications are involved in administration of medicines. It was found that the most common method of administration was oral (66%, 128 spp.) followed by external or topical application (32%, 62 spp.), and inhalation (2%, 3 spp.). In the study area, 95 plant species were collected from wild while the remaining 21 species were domesticated in kitchen garden or cultivated in farm-land.

Fig. 4: No. of plant species in different modes of drug preparation

Discussion
Ethnobotanical uses of medicinal plants

The frequent use of tree species as source of medicine is a common phenomenon in the low-altitudinal regions like the present study site, which indicates the better abundance and year-round availability of such resources. The studies conducted by Singh (2017) in Parsa district and other tropical region (Raj et al., 2018) also reported the similar trend. The families 'Leguminosae' and 'Lamiaceae' have accounted for highest number of medicinal plants, which could be due to their species richness. Other studies (Bhattarai & Acharya, 2015; Singh et al., 2018; Pradhan et al., 2020) carried out in different parts of the country also revealed the similar trends. Most of the people in study area were farmers, and so they had to depend upon the forest resources for food, fodder/forage, agricultural tools, pesticides, fermenting agent and construction materials along with different religious and environmental activities.

The scenario of using the highest number of plants for digestive system disorders showed that there is high frequency of occurrence of this group of ailments, and better exchange of information among the informants for their treatment (Heinrich et al., 1998). Local people had to use sharp tools and work with mud during farming, leading to frequent problem of skin diseases, cuts/wounds, boils/infections, and so on. These problems were tried to be solved by the recognized healer of their own community by using the plants found in their surroundings, and so, they had cultural belief in folk medicine. Though the indigenous population is less as compared to the immigrants, the existing knowledge on ethnomedicine is rich, which may be due to the social interaction among the communities (Gaoue et al., 2017), resulting in accumulation and sharing of knowledge among themselves (Medeiros et al., 2012). The similarities in the uses of plants with the findings of the previous researchers (Oli et al. 2005; Poudel, 2009; Subba et al., 2016; Bhattarai, 2017; Bhattarai, 2018) from the same region indicates the highly reliable pharmacological effectiveness of the reported plants.

In the case of herbaceous plants, the whole parts were used for preparation of remedies. Fresh parts were preferred if remedies contain essential oils, the concentration of which could be lost on drying (Giday et al., 2009). The plant parts were dried and stored for future need as well. The common use of young leaves and tender shoots could be due to the relative ease of collection, simplicity of preparation, and are more likely to have alkaloids with more medicinal value than older ones (Coley et al., 2003). The leaves of the herbaceous plants were shown to be the most commonly utilized parts in other studies (Malla et al., 2015; Bhattarai & Khadka, 2016) as well. On the contrary, some studies carried out in the highland areas of western Nepal (Rokaya et al., 2010; Budha-Magar et al., 2020), central Nepal (Shrestha et al., 2014; Tamang et al., 2017) and eastern Nepal (Limbu & Rai, 2013; Shrestha et al., 2016) reported that roots were the most widely used parts, and this might be related to the culture and environmental condition of the area. Moreover, collecting leaf parts for medicinal
Threat to medicinal plants and their conservation

Different people have different perception regarding the available plants. Some perceive them as nothing, just natural objects to earn money, whereas others take them as resources for their socio-cultural and other use value in their life (Poudel, 2009). In the present study area, medicinal plants used by the community were found to be unsustainable. Only 18% of the plants were either domesticated in kitchen garden or cultivated in farm land. The plants with additional use value in terms of timber, fodder and firewood were found to be the most threatened. In addition to this, logging, grazing, forest encroachment, illegal collection, and forest fire were accelerating the threatened rate of all the plant species. The loss of resources and habitat has disrupted the social and ecological context within which the communities have made use of their traditional knowledge (Venkataraman & Latha, 2008). The knowledge of medicinal plant species for their correct identification and treating various ailments was found low among the young generations as in the previous studies conducted by Luintel et al. (2014), Bhattarai (2018) and Pradhan et al. (2020) in Nepal. The knowledge of medicinal plants use was largely associated with common ailments in the area. However, the plants for the treatment of nervous problems, genito-urinary system disorders, pregnancy/birth related problems, cancer, etc. were rare, and were familiar only to the traditional healers and a few local community members. This indicates the issue of knowledge erosion due to modern medicine and other reasons including socio-cultural issues and over exploitation as indicated by Wanjohi et al. (2020) in Kenya. In the study area, the local government should ensure adequate income to the community healers and support in cultivation of medicinal plants for effective conservation of biodiversity and traditional knowledge.

Comparison of the reported uses and novelty of work

The comparison of uses with different existing studies showed that there are novel uses of some plants which were still not yet reported. By comparing the uses of 116 plants, 7 plants were newly reported as ethnomedicinal plants in Nepal, because these were not reported as medicinal plants in the previous available literatures so far. The documentation on ethnomedicinal use of Caryota urens, Cissus repanda, Etlingera linguiformis, Gladiolus sp., Ocotea lancefolia, Pterospermum acerifolium and Syzygium kurzii were newly reported in Nepal, but were already reported in other countries. However, Ghimeray et al. (2010) reported the food value of stem-pith and terminal leaf bud of Caryota urens from Ilam. Similarly, 5 plants have novel uses against ailments which were not reported elsewhere. The uses of Mussenda macrophylla in leucoderma, Tetrastigma bracteolatum in diphtheria, Pogostemon benghalensis in mental disorder, Premna barbata in jaundice and
Ziziphus jujuba in measles were not reported elsewhere, and so these need to be confirmed further. Out of the 116 plants, 104 plants have similar uses in different parts of Nepal with 13 plants having additional uses which were unreported in Nepal, but were already reported by a number of international literatures. The plant Achyranthes aspera was found additionally to be used against pneumonia which was reported by Hasan (2014). Similarly, Alstonia scholaris was used for female sterility (Choudhary et al., 2017) and against sores (Pankti et al., 2012). Asparagus racemosus was used against fracture (Bantawa & Rai, 2009) and in cancer (Mitra et al., 2012). Likewise, Butea monosperma against cancer, Cassia fistula against snake bite, Curcuma longa in sprain and fracture, Mimosa pudica against jaundice, Neolamarckia cadamba against inflammation, Nyctanthes arbor-tristis against high blood pressure, Oroxylum indicum against sore throat, Sapindus mukorossi against boils and skin lesions, Smilax ovalifolia against diarrhea/dysentery and Uncaria sessilifructus against arthritis and fracture were also reported and supported by international literatures.

**Traditional knowledge and intellectual property rights**

Traditional knowledge (TK) is a knowledge that consists of tradition-based innovations and creations that originate from indigenous and local communities, and are used within themselves. Because its generation, preservation and transmission are based on cultural traditions, it is integral to the cultural identity of the social group in which it operates and is preserved (Girsberger, 2004). TK is collective in nature, and is often considered as the property of the entire community and not belonging to any single individual within the community. It is transmitted orally through elders or specialists, and often to only a selected people within a community (Hansen & Van Fleet, 2003). Intellectual property rights (IPRs) are the legal protections given to protect TK. TK, its protection and its interrelationship with IPRs have been the subject of international debate for several years. This debate covers issues mainly in protection of the environment and conservation of biological diversity; access to genetic resources and fair & equitable sharing of the benefits arising from their use; and the rights of indigenous and local communities. IPRs should guarantee both an individual’s and a group’s right to protect and benefit from its own cultural discoveries, creations, and products. TK and natural resources are still under the threats of both unethical uses by outsiders as well as bio-piracy without sharing benefits and assuring rights of the knowledge and practices (Aryal et al., 2016). Therefore, there is an urgent need for registration and patenting of knowledge along with comprehensive studies for documentation and sustainable management of the existing resources. In this study, different types of formulations of 116 plant species with 5 spp. of novel uses, including 7 newly reported ones should be registered as community asset. These findings should be scientifically confirmed for protecting their IPRs.

**Conclusion**

Present study area is rich in medicinal plants where 7 species were newly reported in Nepal with medicinal potentials. Several plant species were threatened due to unsustainable harvesting, deforestation, habitat degradation, urbanization and cultural transformation. The uses of medicinal plants to cure ailments were found less frequent due to availability of modern medicine along with inappropriate government policies. Therefore, there is an urgent need to develop a database of medicinal plants, legal provisions for registration of TK, and creating intellectual property rights through scientific validation of TK. This provisions help for benefit sharing and conservation of ethnobotanical knowledge.

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### Annex 1: List of ethnomedicinal plant species documented in Mai Municipality, Ilam

| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|-------|------------------------------------|----------------------|------------|------------------|----------------------|---------------------|------------|
| 1     | *Acacia pennata* (L.) Wild.; Leguminosae; Arari Kanda | D; Sh | Root-bark | Paste | Topical | Sprain, fracture | Barrier, hedge; fodder |
| 2     | *Achyranthes aspera* L.; Amaranthaceae; Datiwon/apamarga | D; H | Root | Paste | Oral | Pneumonia; fever; typhoid; sore throat; to fasten the expulsion of placenta after birth | Forage; used in Hindu culture, “Teej” |
| 3     | *Acorus calamus* L.; Acoraceae; Bojho | Mo; H | Rhizome | Raw (chewable) | Oral | Cough, Deepening of voice, stomach disorder (diarrhoea and dysentery) | Plant pest control |
| 4     | *Aegle marmelos* (L.) Corrêa; Rutaceae; Bel/Sitalu | D; T | Leaf, tender shoot | Raw | Oral | Bad breath; anthelmintic, mild laxative | Wild fruit; fruit used as polisher to smoothen the “Nepali-kagaj” by rubbing because fruit contains latex., leaves offered to Shiva |
| 5     | *Aerva sanguinolenta* (L.) Blume; Amaranthaceae; Iteen jhar | D; H | Leaf | Juice | Topical | Cut-wound | Ornamental |
| 6     | *Ageratina adenophora* (Spreng.) R.M.King & H.Rob.; Compositae; Kali jhar/Ilame jhar | D; H | Leaf | Juice | Topical | Cut-wound | Forage |
| 7     | *Aloe vera* (L.) Burm. f.; Asphodelaceae; Ghyu Kumari | Mo; H | Gel | Raw | Topical | Burn and scalds, cut and wound | Gel is used as substitute of shaving cream |

- **S. N.**: Serial number
- **Botanical name; Family; Local name**: Scientific name of the plant, family to which it belongs, and local name
- **Plant category; Type**: Type of plant and its classification
- **Parts used**: Parts of the plant used
- **Preparation type**: Method of preparing the plant
- **Mode of application**: Way of applying the plant
- **Ethnomedicinal uses**: Uses of the plant for medical purposes
- **Other uses**: Additional uses of the plant
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|----------------------------------|---------------------|------------|------------------|---------------------|---------------------|-----------|
| 8    | **Alstonia scholaris** (L.) R. Br.; Apocynaceae; Chhatiwon | D; T | Tender shoot | Juice | Oral | Sore throat | Fodder; wood is used to make "madai", "dhol", and "theki" as it is light. Trunk is used as a feeding container for cattle. |
|      | Bark | Powder, raw | Oral | Tonic (promote weight gain in cattle); cause sterility effect on female cattle. |
|      | Paste | Topical | Healing cracks and sores, boils |
| 9    | **Antidesma acidum** Retz.; Phyllanthaceae; Archal | D; Sh | Tender shoot, leaf | Raw | Oral | Stinging irritation on tongue by eating *Clocosia* sp. | Fruit and tender shoot is eaten directly or used to make pickle because of its sour taste; fodder |
|      | Root | Paste | Topical | Skin lesions "khatira"; cut-wound |
| 10   | **Artemisia indica** Willd.; Compositae; Titepati | D; Sh | Leaf | Juice | Topical | Scabies, skin lesions (wounds) | Religious and incense; livestock pest control |
|      | Tender shoot | Raw | Oral | Fever |
| 11   | **Artocarpus lakoocha** Wall. ex Roxb.; Moraceae; Badhar | D; T | Latex | Adhesive tape with "Nepali paper". | Topical | Boils | Wild fruit; fodder; construction materials |
|      | Flower | Decoction with cow-urine | Oral | Cancer |
|      | Tender shoot | Cooked | Oral | Tonic, lactation stimulant |
|      | Tuberous root | Paste (along with stem of *P. paniculata*, root of *D. multiflorum*, *U. sessilifructus*, *A. pennata*, seed of *L. sativum*; slug and red soil) | Topical | In fracture |
| 12   | **Asparagus racemosus*** Wild.; Asperagaceae; Kurilo | Mo; H | Flower | Decoction with cow-urine | Oral | Cancer |
|      | Tender shoot | Cooked | Oral | Tonic, lactation stimulant |
|      | Tuberous root | Paste (along with stem of *P. paniculata*, root of *D. multiflorum*, *U. sessilifructus*, *A. pennata*, seed of *L. sativum*; slug and red soil) | Topical | In fracture |
| 13   | **Azadirachta indica** A. Juss.; Meliaceae; Neem | D; T | Leaf, bark | Decoction | Oral | Fever | Furniture, construction; plant pest control; ornamental |
|      | Paste, powder | Topical (for bathing) | Skin diseases and lesions |
|      | Seed | Roasted, baked | Oral | Dyentery, diarrhoea |
|      | Bark | Raw (chewable) | Oral | Pyorrhoea |
| 14   | **Bauhinia vahlii** Wight & Arn.; Leguminosae; Bhorla/ Gokarne | D; Lianas | Tender shoot | Juice | Oral | Dyentery, diarrhoea | Seed is roasted and eaten; fodder; stem used as rope, leaves used to make plate during religious work; also used to make special type of raincoat called "ghum"; in the past, the large pods were used as slippers. |
|      | Seed | Roasted, baked | Oral | Cough and cold, tonic |
|      | Bark | Raw (chewable) | Oral | Pyorrhoea |
| 15   | **Bombax ceiba** L.; Malvaceae; Simal | D; T | Flower | Paste | Oral | Dyentery, dysentery | Flowers are used as vegetable; timber, fibre |
| 16   | **Brucea javanica** (L.) Merr.; Simaroubaceae; Bhaki-amilo | D; T | Fruit | Powder | Oral | Dyentery | Fodder; fruit used as souring agent in pickle. |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|-----------------------------------|----------------------|------------|------------------|---------------------|---------------------|------------|
| 17   | Butea monosperma (Lam.) Taub.; Leguminosae; Palans | D; T | Bark, Flower, Leaf | Paste | Topical | Sprain, fracture | Flowers are used to offer Gods; stem is used as "samidha" (fire wood) or used to make "suro" (a spathula shaped tool) for religious works. Used as "bati" by pregnant women in the belief of prevention of miscarriage. |
| 18   | Calamus erectus Roxb.; Arecaceae; Phyakre | Mo; Sh. | Ripe fruits | Raw | Oral | Tonic | Wild fruit; used for making baskets and comb |
| 19   | Callicarpa macrophylla Vahl; Lamiaceae; Guyelo | D; T | Bark, Fruit | Paste, raw (chewable) | Oral | Muscular pain, body pain | Wild fruit; fodder; firewood |
| 20   | Calotropis gigantea (L.) Dryand.; Asclepiadaceae; Ank | D; Sh | Leaf | Fomentation (heated lightly on fire) | Topical | Muscular pain, inflammation and fracture | Social use; fibre and fur |
| 21   | Caryota urens L.; Arecaceae; Machha Jode/ Rangbang | Mo; T | Leaf, bark | Paste | Topical | Cut-wound, boils, snake bite | Ornamental |
| 22   | Cassia fistula L.; Leguminosae; Raj brichcha | D; T | Seed, Fruit pulp | Paste | Topical | Snake bite | Snare, kissing, and biting, poliomyelitis (DPV) |
| 23   | Centella asiatica (L.) Urb.; Apiaceae; Ghodtapre | D; H | Leaf | Juice, Paste | Topical | Cut and wound, used against caterpillar sting ("Dhokre" infection) | Curry; forage |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|----------------------------------|---------------------|-----------|-----------------|--------------------|---------------------|-----------|
| 24   | Cheilocostus speciosus (J.Koenig) C.D.Specht; Costaceae; Bet lauri | Mo; H | Stem  | Juice | Oral  | Sore throat, urinary problems | Stem is used during the ritual, "Kirati" use the stem during "Kul puja/Shiva puja". |
| 25   | Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm.; Lauraceae; Tejpat | D; T | Leaf, bark | Raw (chewable), tea | Oral  | Stomach disorders, cough-cold | Condiment |
| 26   | Cissus repanda (Wight & Am.) Vahl; Vitaceae; Pani lahara | D; Lianas | Sap  | Raw (drinkable) | Oral  | Pneumonia; Reduce heat illness (hyperthermia) | Fodder; stem used as rope |
| 27   | Citrus aurantifolia* (Christ.) Swingle; Rutaceae; Kagati | D; Sh | Fruit | Juice | Oral  | Indigestion, anorexia | Fruit, pickle; souring agent |
| 28   | Clerodendrum viscosum Vent.; Lamiaceae; Bhamti | D; Sh | Root  | Paste | Topical | Snake bite |
| 29   | Colebrookea oppositifolia Sm.; Lamiaceae; Dhusuro | D; T | Root | Juice | Oral  | Pneumonia, fever | Leaves and inflorescence used for ripening of banana. |
|      | Leaf | Juice | Topical | Cornal opacity in cattle |
|      | Flower | Decoction with newly delivered cow-urine | Oral | Menstrual disorder |
| 30   | Curcuma aromatica Salisb.; Zingiberaceae; Kalo haledo/ ban besar | Mo; H | Rhizome | Paste, raw (chewable) | Oral  | Sprain and fracture | Used in "buti" |
|      | Paste | Oral  | Food poisoning ("nas-kapat"), indigestion, heat illness (hyperthermia) |
| 31   | Curcuma longa* L.; Zingiberaceae; Besar | Mo; H | Rhizome | Powder, tea | Oral  | Fever, cough-cold, liver disorder (jaundice) | Condiment |
|      | Paste | Topical | Wound, inflammation |
| 32   | Cuscuta reflexa Roxb.; Convolvulaceae; Binajadi | D; Cl | Whole plant | Paste | Oral  | Jaundice |
| 33   | Desmodium multiflorum DC.; Leguminosae; Bhatamanse | D ; Sh | Root | Paste | Oral  | Muscular pain, body pain | Fodder |
| 34   | Dioscorea deltoidea Wall. Ex Griseb.; Dioscoreaceae; Vyakur | D; Cl | Root/ Tuber | Paste | Oral  | Diphtheria (in cattle) | Vegetable |
| 35   | Drymaria cordata (L.) Wild. Ex Roem. & Schult.; Caryophyllaceae; Abijalo | D; H | Leaf, stem | Fume/scent, warm-juice | Oral  | Dropped in nostril or scent inhaled | Nasal bleeding, sinusitis |
|      | Juice | Oral  | Pneumonia | Forage |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|----------------------------------|---------------------|------------|------------------|---------------------|---------------------|------------|
| 36   | *Eclipta prostrata* (L.) L.; Compositae; Bhringa raj/Bhumi raj | D; H | Root, stem, leaf | Juice, paste | Topical, oral | Cut and wound; fracture | Use as dye for making ink and colouring hair. |
| 37   | *Elaeocarpus serratus* *L.*; Elaeocarpaceae; | D; T | Bark | Juice | Oral | Jaundice | Sacred plant |
| 38   | *Rudrakshya Ehingera linguiformis* (Roxb.) R.M.Sm.; Zingiberaceae; Madhu | Mo; H | Fresh Rhizome | Raw | Oral | Cough-cold, sore throat, tonsilitis, burning sensation in stomach | Rhizome used as flavouring agent in alcohol preparation due to its pleasant smell; fodder |
| 39   | *Euphorbia heterophylla* L.; Euphorbiaceae; Dudhe | D; H | Latex | Raw | Topical | Cut-wound | Forage |
| 40   | *Euphorbia royleana* *Boiss.*; Euphorbiaceae; Studi | D; T | Latex, stem-Pulp. | Raw | Topical | Conjunctivitis or cloudiness of eye (latex is applied carefully on temper of opposite side of infected eye) | Protect house from thunder and lightning; bio-fence |
| 41   | *Ficus racemosa* L.; Moraceae; Dumri | D; T | Latex | Raw | Topical | Skin lesions, boils | Ripe fruits are eaten; fodder |
| 42   | *Gladiolus* sp.; Iridaceae; Tarbare phool | Mo; H | Stem-bulb | Paste | Oral | Diarrhoea and dysentery | Ornamental |
| 43   | *Genostegia hirta* (Blume ex Hassk.) Miq.; Urticaceae; Chiple | D; H | Root | Paste | Topical | Fracture, inflammation | Vegetable; forage |
| 44   | *Hibiscus sabdariffa* *L.*; Malvaceae; Lalchan/Belchan | D; H | Fruit | Infusion | Oral | Diarrhoea and dysentery (of both man and cattle) | Seeds are roasted to make pickle; fibre |
| 45   | *Justicia adhatoda* L.; Acanthaceae; Asuro | D; Sh | Flower | Tea | Oral | High blood pressure | Hedge plant, leaves used as compost |
| 46   | *Lagerstroemia parviflora* Roxb.; Lythraceae; Bot dhairo | D; T | Bark | Paste | Oral | Fracture | Fodder, fire wood |
| 47   | *Lasia spinosa* (L.) Thwaites; Araceae; Morange sag | Mo; H | Leaf | Cooked as curry | Oral | Piles, used as anthelmintic | Vegetable |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|-----------------------------------|----------------------|------------|------------------|---------------------|---------------------|-----------|
| 48   | *Lepidium sativum* L.; Brassicaceae; Chamsur | D; H | Seed | Cooked with milk | Oral | Fracture, body ache | Vegetable |
| 49   | Lobelia nicotianfolia Roth ex Schult.; Campanulaceae; Eklebhir | D; H | Root | Paste | Oral | Food poisoning ("Nas-kapat") for adults, not for children. | |
| 50   | *Lygodium flexuosum* (L.) Sw.; Lygodiaceae; Lahare unu, Janai laharo | Pt; Cl | Whole plant | Paste | Topical | Sprain and fracture, cut and wound | |
| 51   | Maesa macrophylla Wall. ex Roxb.; Primulaceae; Bhogate | D; Sh | Tender shoot | Paste | Oral | Dysentery | |
| 52   | Magnolia champaca (L.) Baille. ex Pierre; Magnoliaceae; Champ | D; T | Bark | Paste | Topical | Cut-wound | Furniture, construction; ornamental |
| 53   | Mallotus philippensis (Lam.) Müll.Arg.; Euphorbiaceae; Sindure | D; T | Stem-bark | Decoction | Oral | Gastric problems, diarrhoea, used against heat illness (hyperthermia) | Fodder; fuel-wood. |
| 54   | *Mangifera indica* L.; Anacardiaceae; Aanp | D; T | Bark | Paste | Oral | Urinary problems (hematuria) | Fruits and pickle; fodder; fuel wood; religious. |
| 55   | Melastoma melabathricum L.; Melastomataceae; Kaali angeri | D; Sh | Ripe Fruit | Raw | Oral | Dysentery | Ripe fruits are eaten raw. |
| 56   | Mentha spicata* L.; Lamiaceae; Pudina | D; H | Leaf | Paste | Oral | Heat illness (burning urination), anorexia, breast engorgement of lactating women. | Leaves are used as pickle. |
| 57   | Mimosa pudica L.; Leguminosae; Lajawati/Lajime | D; H | Root | Paste | Oral | Fever; Pneumonia; menstrual problems | |
|      |                                   |                     |            |                  | Topical             | Wounds, sores; dental caries. | |
|      |                                   |                     |            |                  | Juice (along with stem-juice of Cuscuta) | Oral | Jaundice |
| 58   | *Mirabilis jalapa* L. Nyctaginaceae; Lankasaani | D; H | Root | Juice | Oral | Urinary problems | Ornamental |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|------------------------------------|----------------------|------------|-----------------|-------------------|--------------------|-----------|
| 59   | *Molineria crassifolia* Baker; Hypoxidaceae; Dhotisaro | Mo; H | Root | Paste | Oral | Urinary problems (hematuria); gonorrhoea | Ornamental |
|      |                                                    |                      |            | Raw (chewable) | Oral | High blood pressure; diabetes |                  |
| 60   | *Moringa oleifera*; Lam.; Moringaceae; Sajiwon | D; T | Flower, leaf | Juice | Topical | Healing of wound of cattle (as alternative of *Prunus* leaf) | Fruit and tender shoot used as vegetable; fodder. |
|      |                                                    |                      | Root       | Cooked as curry | Oral | Relieve from heat illness (hyperthermia) |                 |
| 61   | *Morus alba* L.; Moraceae; Kimbu | D; T | Root | Paste | Oral | Menstrual disorder | Ripe fruits are edible; shade giving plant. |
|      |                                                    |                      | Fruit | Raw | Oral | Tonic |                    |
| 62   | *Mucuna macrocarpa* Wall.; Leguminosae; Pangra | D; Lianas | seed | Paste | Topical | Skin diseases, cure dandruff | Fodder |
| 63   | *Murraya koenigii* (L.) Spreng.; Rutaceae; Mitha neem | D; Sh | Leaf | Juice | Topical/spray | Lice repellent to control bugs and fleas. | Leaves are used as condiments; fodder for goat; bedding material for cattle; soil erosion control. |
| 64   | *Musa paradisica*; L.; Musaceae; Kola/ Kera | Mo; H | Unripe fruit | Raw | Oral | Diarrhoea | Ripe fruits are edible, flowers and unripe fruits are used as vegetable; social use. |
|      |                                                    |                      | Ripe fruit | Raw | Oral | Tonic, constipation |                   |
| 65   | *Mussaenda macrophylla* Wall.; Rubiaceae; Dhibini phool | D; Sh | Root | Juice | Oral | Sore throat of infant | Fodder, ornamental |
|      |                                                    |                      | Stem | Prepare paste with "Seto dubo" (*Phalaris arundinacea*) and mix with buffalo's curd | Topical | In leucoderma/vitiligo ("seto dubi") |                  |
| 66   | *Myrica esculenta* Buch.-Ham. ex D. Don; Myricaceae; Kaphal | D; T | Bark | Fume (burn on fire) | Inhale | Sinusitis | Wild fruit; fodder; material for furniture and construction. |
| 67   | *Neolamarckia cadamba* (Roxb.) Bosser; Rubiaceae; Karam/Kadam | D; T | Bark | Paste | Oral | Inflammation, fracture | Construction material, social use (religious plant) |
| 68   | *Neprolepis cordifolia* (L.) C. Presl; Neprolepidaceae; Pani amala | Pt; H | Root/Tuber | Raw | Oral | Menorrhagia (over bleeding in menstruation); heat illness (hyperthermia), urinary problems | Ornamental |
| 69   | *Nyctanthes arbor-tristis* L.; Oleaceae; Parijat | D; T | Flower | Raw | Oral | High blood pressure | Flowers are used as curry; religious plant. |
| 70   | *Ocimum tenuiflorum* L.; Lamiaceae; Tulsi | D; H | Leaf, flower, whole plant | Decoction | Oral | Fever; pneumonia; rashes on tongue or mouth. | Religious plant |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|-------|-----------------------------------|----------------------|------------|------------------|---------------------|---------------------|-----------|
| 71    | Ocotea lancifolia (Schott) Mez; Lauraceae; Jhankri syauli | D; T                | Leaf, tender shoot, bark | Juice           | Oral               | Sore throat, constipation, piles, Painful urination (dysuria), respiratory problems | Fodder; agricultural tools; faith healing |
| 72    | Oroxylum indicum* (L.) Kurz; Bignoniaceae; Tatelo/totala | D; T                | Stem-bark | Paste            | Topical            | Burn, wound, fracture | Social use |
|       |                                                                  |                      |            | Ash              | Topical            | Fast healing of burnt wound |          |
|       |                                                                  |                      |            | Flower Ash       | Oral               | Pneumonia, sore throat |          |
| 73    | Phyllanthus acidus* (L.) Skeels; Euphorbiaceae; Kansi amala/ Madhise amala | D; T                | Fruit      | Raw              | Oral               | Heat illness (hyperthermia) | Fruits are eaten fresh or pickled. |
| 74    | Phyllanthus emblica L.; Phyllanthaceae; Amala | D; T                | Fruit      | Raw              | Oral               | Cough-cold; tonic, tonic to teeth. | Fruits are eaten fresh or pickled; twigs used as fire wood ("samidha") during fire ritual i.e. "Yagya/horn/hawan". |
|       |                                                                  |                      | Fruit/Bark | Juice            | Oral               | Gastritis |          |
| 75    | Piper longum L. Piperaceae; Pipla | D; Cl               | Stem       | Paste            | Oral               | Gastritis | Condiment |
|       |                                                                  |                      | Fruit      | Cooked (in milk) | Oral               | Cough |          |
| 76    | Piper mullesua Buch.-Ham. ex D. Don; Piperaceae; Chabo | D; Cl               | Stem, fruit | Powder           | Oral               | Asthma, cough | Fodder |
|       |                                                                  |                      | Stem       | Chew stick       | Topical (brush)    | Toothache, bad breath | Leaves eaten or used as betel; fodder |
| 77    | Piper nigrum* L.; Piperaceae; Marich | D; Cl               | Seed       | Powder, tea      | Oral               | Cough-cold | Condiment |
|       |                                                                  |                      |            | Chew to make powder in mouth | Topical (breathe out scented warm air) | Corneal opacity |          |
| 78    | Pogostemon benghalensis (Burm. f.) Kuntze; Lamiaceae; Rudhilo | D; H                | Root       | Juice            | Oral               | Mental disorder | Fodder; manure. |
|       |                                                                  |                      | Leaf, stem | Tea              | Oral               | Stomach disorders; cough-cold and pneumonia |          |
|       |                                                                  |                      | Leaf       | Juice            | Topical            | Cut-wound, lice/ fleas repellant |          |
| 79    | Polygonum molle D. Don; Polygonaceae; Thotne | D; Sh               | Stem       | Juice            | Topical            | Insect bite | Tender shoot used as vegetable; fodder |
|       |                                                                  |                      | Paste      | Oral             | Diarrhoea |          |
| 80    | Poranopsis paniculata (Roxb.) Roberty; Convolvulaceae; Sikari laharo | D; Lianas           | Stem       | Paste            | Topical, Oral  | Sprain, fracture, body pain, inflammation due to accident. | Fodder |
|       |                                                                  |                      |            |                  | Topical            | Cut-wound |          |
| 81    | Premna barbata Wall. ex Schauer; Lamiaceae; Gineri | D; Sh               | Leaf       | Juice            | Topical            | Skin diseases, leaf juice is sprayed on fowl, cattle to remove fleas ("Sulsule"). | Fodder; bedding material for cattle. |
|       |                                                                  |                      | Root       | Juice            | Oral               | Jaundice |          |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|----------------------------------|---------------------|------------|------------------|--------------------|---------------------|-----------|
| 82   | *Psidium guajava* L.; Myrtaceae; Amba/Ambak | D; T | Bark | Paste | Oral | Diarrhoea and dysentery | Fruit plant |
| 83   | *Pterospermum acerifolium* (L.) Wild.; Malvaceae; Hatti paila | D; T | Root | Decoction prepared by cooking along with stem of *U. sessilifructus* and *P. paniculata*; bark of *O. indicum*, *T. chebula*, *S. robusta*, *L. parviflora*, *N. cadamba* and *T. tomentosa* is eaten for 1-2 months. | Oral | Fracture, inflammation | Fodder, fuel-wood; furniture, rope, leaf plate. |
| 84   | *Rauvolfia serpentina* (L.) Benth. ex Kurz; Apocynaceae; Chand marauwa/Sarpa gandha | D; Sh | Root | Raw (chewable) | Oral | Fever, malaria, jaundice, high blood pressure, mental disorder | Ornamental |
| 85   | *Sapindus mukorossi* Gaertn.; Sapindaceae; Ritha | D; T | Seed | Paste of kernel | Topical | Sores, pimpls, skin diseases | Fruits used as soap substitute, timber |
| 86   | *Scoparia dulcis* L.; Plantaginaceae; Chini jhar/Ambake jhar/Khareto jhar | D; H | Leaf, root | Paste, raw | Oral | Sore throat, tonsillitis, green diarrhoea of infant (“sarula”), diabetes, burning urination, heat illness (hyperthermia) | Used to prepare fermenting cake, "marcha" |
| 87   | *Senna sophora* (L.) Roxb; Leguminosae; Tapre | D; Sh | Root, Leaf | Paste | Topical | Cut-wound and lesions | |
| 88   | *Shorea robusta* Gaertn.; Dipterocarpaceae; Saal/Sakhuwa | D; T | Bark | Paste | Oral | Diarrhoea, dysentery; fracture | Fodder; timber plant; fuel-wood; leaves used to make plates. |
| 89   | *Sida acuta* Burm.f.; Malvaceae; Kuchi jhar/Satamuli | D; Sh | Root | Juice | Oral | Sore throat, fever | Fodder; used as fermenting agent; used as “buti” in the sickness of cattle. |

Rauvolfia serpentina (L.) Benth. ex Kurz; Apocynaceae; Chand marauwa/Sarpa gandha; Decoction prepared by cooking along with stem of *U. sessilifructus* and *P. paniculata*; bark of *O. indicum*, *T. chebula*, *S. robusta*, *L. parviflora*, *N. cadamba* and *T. tomentosa* is eaten for 1-2 months.

*Psidium guajava* L.; Myrtaceae; Amba/Ambak; Decoction prepared by cooking along with stem of *U. sessilifructus* and *P. paniculata*; bark of *O. indicum*, *T. chebula*, *S. robusta*, *L. parviflora*, *N. cadamba* and *T. tomentosa* is eaten for 1-2 months.

*Sapindus mukorossi* Gaertn.; Sapindaceae; Ritha; Paste of kernel | Topical | Sores, pimpls, skin diseases | Fruits used as soap substitute, timber |

*Scoparia dulcis* L.; Plantaginaceae; Chini jhar/Ambake jhar/Khareto jhar; Paste, raw | Oral | Sore throat, tonsillitis, green diarrhoea of infant (“sarula”), diabetes, burning urination, heat illness (hyperthermia) | Used to prepare fermenting cake, "marcha" |

*Senna sophora* (L.) Roxb; Leguminosae; Tapre; Paste | Topical | Cut-wound, skin diseases | |

*Shorea robusta* Gaertn.; Dipterocarpaceae; Saal/Sakhuwa; Paste | Oral | Diarrhoea, dysentery; fracture | Fodder; timber plant; fuel-wood; leaves used to make plates. |

*Sida acuta* Burm.f.; Malvaceae; Kuchi jhar/Satamuli; Juice | Oral | Sore throat, fever | Fodder; used as fermenting agent; used as “buti” in the sickness of cattle. |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|-----------------------------------|---------------------|------------|-----------------|---------------------|---------------------|------------|
| 90   | *Sida rhombifolia* L.; Malvaceae; Sano Khareto jhar | D; Sh | Leaf | Paste | Topical | Wounds, boils, skin lesions, breast engorgement in cattle and women, Infection of caterpillar hairs. | Used as broom |
|      |                                   |                     |           | Juice, tea | Oral | Headache, high blood pressure, deepening of voice, to cure internal wounds. |           |
|      |                                   |                     |           | Root | Juice | Oral | Diarrhoea |           |
| 91   | *Smilax ovalifolia* Roxb. ex D.Don.; Smilacaceae; Kukur daino | M; Cl | Leaf | Fomentation (heated on fire) | Topical | Sprain and fracture |           |
|      |                                   |                     |           | Tender shoot | Cooked as curry or decoction | Oral | Diarrhoea and dysentery |           |
| 92   | *Solanum torvum* Sw.; Solanaceae; Ban bibi | D; H | Whole plant | Decoction | Oral | Urinary problems (hematuria) | Fruit edible. |
|      |                                   |                     |           | Paste | Topical | Joint pain |           |
| 93   | *Solanum anglicaus* (Lam.) Gandhi; Cucurbitaceae; Gol kankri | D; Cl | Fruit Raw | Oral | Reduce heat illness (hyperthermia) | Ripe fruits are eaten fresh; fodder. |
| 94   | *Spatholobus parviflorus* (DC.) Kuntze; Leguminosae; Debre lahara | D; Lianas | Stem and leaf | Decoction | Topical | Cut and wound; fracture | Fodder; fibre. |
| 95   | *Spondias pinnata* (L. f.) Kurz; Anacardiaceae; Amaru | D; T | Fruit | Raw | Oral | Pneumonia; dysentery | Wild fruit |
| 96   | *Stephania glandulifera* Miers; Menispermaceae; Gujar gano/Tamarke | D; Cl | Root bulb | Paste | Oral | Diabetes, kidney problems; stomach disorders | Fodder; root bulb is used as feeding container for cattle; veterinary medicine |
| 97   | *Stephania japonica* (Thunb.) Miers; Menispermaceae; Batulpate | D; Cl | Leaf | Powder | Oral | Cough | Fodder |
|      |                                   |                     |           | Root/ Tuber | Paste | Oral | Gastritis |           |
| 98   | *Syzygium cumini* (L.) Skeels; Myrtaceae; Jamun | D; T | Fruit | Powder, ripe fruits-raw | Oral (eaten with honey) | Gastritis, diarrhoea | Fruits edible; fodder; firewood; construction materials. |
|      |                                   |                     |           | Bark | Paste | Oral | Chest pain |           |
|      |                                   |                     |           | Leaf | Decoction | Topical (massage) | Body ache |           |
|      |                                   |                     |           | Seed | Infusion | Oral | Diabetes |           |
| 99   | *Syzygium kurzii* (Duthie) N.P.Balakr.; Myrtaceae; Amaru/ ambake | D; T | Fruit | Raw | Oral | Pneumonia | Fruit plant |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|-------|-----------------------------------|----------------------|------------|------------------|---------------------|---------------------|------------|
| 100   | Syzygium jambos (L.) Alston; Myrtaceae; Gulab jamun/Fandir | D; T | Fruit | Raw (ripe fruits) | Oral | Relieve from heat illness (hyperthermia) | Fruit plant; fodder; fuel-wood. |
| 101   | Tamarindus indica L.; Leguminosae; Imali/Titri | D; T | Fruit | Raw | Oral | Indigestion, anorexia | Ripe fruits are pickled; construction materials |
| 102   | Tectaria sp.; Tectariaceae; kali niguro | Pt; H | Root | Paste | Oral | Diarrhoea and dysentery | Young frond used as vegetable. |
| 103   | Terminalia bellirica (Gaertn.) Roxb.; Combretaceae; Barro | D; T | Fruit | Powder/raw | Oral | Gastritis; cough | Fodder, timber; fire-wood. |
| 104   | Terminalia chebula Retz.; Combretaceae; Han | D; T | Fruit | Powder/raw | Oral | Cough; gastritis and constipation. | Timber, fire-wood. |
| 105   | Terminalia tomentosa Wight & Arn.; Combretaceae; Saj/ asna | D; T | Bark | Paste | Oral | Fracture; diarrhoea | Fodder, timber; fire-wood. |
| 106   | Tetrastigma bracteolatum (Wall.) Planch.; Vitaceae; Charchare lahara | D; Cl | Stem | Paste | Oral | Diphtheria | Fodder |
| 107   | Thunbergia coccinea Wall. ; Acanthaceae; Kanase | D; Cl | Leaf, tender shoot | Paste | Topical | Cut and wound | Ornamental |
| 108   | Thysanolaena maxima* (Roxb.) Kuntze; Poaceae; Amilso | Mo; Sh | Root | Paste | Topical | Boils | Fodder; common broom grass and used in rituals; used in bio-engineering to control landslide. |
| 109   | Tinospora sinensis (Lour.) Merr.; Menispermaceae; Gurjo | D; Cl | Stem | Decoction | Oral | Gastritis, urinary problems, tonic to cattle and human | Fodder |
| 110   | Trichosanthes cucumerina L.; Cucurbitaceae; Ban ghiraula | D; Cl | Fruit pulp, Leaf | Infusion of pulp (fibre), juice | Oral | Jaundice | Fodder for goat; root is used as one of the 7 kinds of spiny plant material to prepare "buti" for young children to cure "moch/runche lageko". |
| 111   | Uncaria sessilifructus Roxb.; Rubiaceae; Bhainse kando | D; Cl | Root, stem, bark | Paste | Topical | Arthritis, sprain and fracture | Fodder for goat; root is used as one of the 7 kinds of spiny plant material to prepare "buti" for young children to cure "moch/runche lageko". |
| 112   | Vitex negundo L.; Lamiaceae; Simali | D; Sh | Leaf | Rubbed; paste heated on fire | Inhalе scent; Inhalе vapour | Headache; sinusitis | Fuel-wood; used as support for twiner and climber crops; hedge plant, landslide control. |
| S. N. | Botanical name; Family; Local name | Plant category; Type | Parts used | Preparation type | Mode of application | Ethnomedicinal uses | Other uses |
|------|-----------------------------------|----------------------|------------|------------------|---------------------|---------------------|------------|
| 113  | Woodfordia fruticosa (L.) Kurz.; Lythraceae; Dhayero | D; Sh Flower | Juice, powder, raw | Oral | Dyentery; sore throat | Fuel-wood; soil stability in steep land. |
| 114  | Wrightia arborea (Dennst.) Mabb.; Apocynaceae; Rani Khirro | D; T Bark | Decoction | Oral | Piles | Timber, agricultural tools. |
| 115  | Zingiber montanum* (J.Koenig) Link ex A.Dietr.; Zingiberaceae; Phachhayang | Mo; H Rhizome | Raw (chewable) | Oral | Diarrhoea, food poisoning ("Naskapat") | Protect from evil spirit ("Bhut pret lageko, bachha Jhaskane, sato jane bhaya ma rhizome ko buti badhne; dewa lageko ma nihar ra sarir ma ghasne"). |
| 116  | Ziziphus jujuba Mill.; Rhamnaceae; Bayar | D; Sh Root | Decoction | Oral | Fever | Wild fruit; used as bio-fence. |
|      |                                    |          | Leaf | Tea | Oral | Diabetes |
|      |                                    |          | Seed | Paste | Oral | Measles |

Note: Cl = Climber; D = Dicotyledon; H = Herb; Mo = Monocotyledon; Pt = Pteridophyte; Sh = Shrub; T= Tree; * = Domesticated plant (in kitchen-garden or farm-land).