

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 administered 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), Uprety *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 Terai) 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).

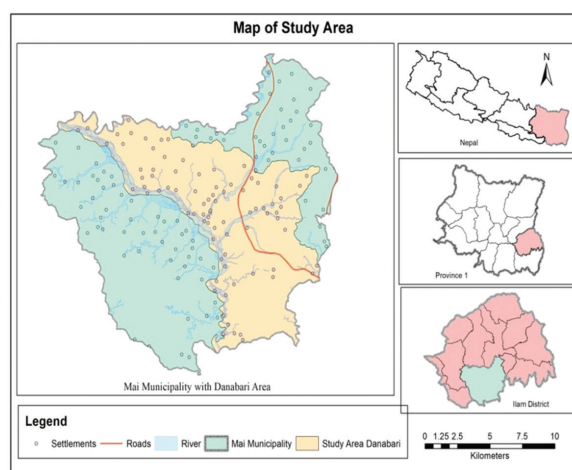


Fig. 1: Map showing the location of the study area

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).

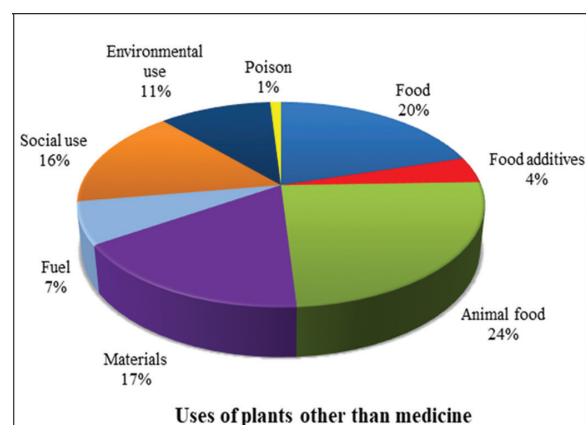


Fig. 2: Uses of medicinal plants in the study area

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	<i>Aloe vera</i> , <i>Justicia adhatoda</i> , <i>Moringa oleifera</i> , <i>Nyctanthes arbor-tristis</i> , <i>Rauvolfia serpentina</i> , <i>Sida rhombifolia</i>	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	<i>Achyranthes aspera</i> , <i>Aegle marmelos</i> , <i>Aloe vera</i> , <i>Acorus calamus</i> , <i>Bauhinia vahlii</i> , <i>Bombax ceiba</i> , <i>Brucea javanica</i> , <i>Cassia fistula</i> , <i>Centella asiatica</i> , <i>Cinnamomum tamala</i> , <i>Citrus aurantifolia</i> , <i>Curcuma aromatica</i> , <i>Curcuma longa</i> , <i>Cuscuta reflexa</i> , <i>Elaeocarpus serratus</i> , <i>Euphorbia royleana</i> , <i>Gladiolus sp.</i> , <i>Hibiscus sabdariffa</i> , <i>Lasia spinosa</i> , <i>Maesa macrophylla</i> , <i>Mallotus philippensis</i> , <i>Mangifera indica</i> , <i>Melastoma melabathricum</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocotea lancifolia</i> , <i>Phyllanthus emblica</i> , <i>Piper longum</i> , <i>Piper mullesua</i> , <i>Pogostemon benghalensis</i> , <i>Polygonum molle</i> , <i>Premna barbata</i> , <i>Psidium guajava</i> , <i>Rauvolfia serpentina</i> , <i>Scoparia dulcis</i> , <i>Shorea robusta</i> , <i>Sida acuta</i> , <i>Sida rhombifolia</i> , <i>Smilax ovalifolia</i> , <i>Spondias pinnata</i> , <i>Stephania glandulifera</i> , <i>Stephania japonica</i> , <i>Syzygium cumini</i> , <i>Tamarindus indica</i> , <i>Tectaria sp.</i> , <i>Terminalia bellirica</i> , <i>Terminalia chebula</i> , <i>Terminalia tomentosa</i> , <i>Tinospora sinensis</i> , <i>Trichosanthes cucumerina</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i> , <i>Wrightia arborea</i> , <i>Zingiber montanum</i>	54
Endocrine System Disorders	Diabetes	<i>Aegle marmelos</i> , <i>Aloe vera</i> , <i>Moringa oleifera</i> , <i>Scoparia dulcis</i> , <i>Stephania glandulifera</i> , <i>Syzygium cumini</i> , <i>Ziziphus jujuba</i>	7
Genitourinary System Disorders	Burning urination, dysuria, female sterility, hematuria, kidney problems, m e n o r r h a g i a , menstrual disorder	<i>Alstonia scholaris</i> , <i>Cassia fistula</i> , <i>Centella asiatica</i> , <i>Colebrookea oppositifolia</i> , <i>Eclipta prostrata</i> , <i>Mangifera indica</i> , <i>Mentha spicata</i> , <i>Mimosa pudica</i> , <i>Molineria crassifolia</i> , <i>Morus alba</i> , <i>Nephrolepis cordifolia</i> , <i>Ocotea lancifolia</i> , <i>Scoparia dulcis</i> , <i>Solanum torvum</i> , <i>Stephania glandulifera</i> , <i>Tinospora sinensis</i>	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”), gonorrhoea, lice repellent, malaria, measles, scabies, sore throat, hyperthermia (heat illness)	<i>Achyranthes aspera, Aegle marmelos, Alstonia scholaris, Artemisia indica, Azadirachta indica, Callicarpa macrophylla, Centella asiatica, Cheilocostus speciosus, Colebrookea oppositifolia, Curcuma aromatica, Curcuma longa, Dioscorea deltoidea, Etlingera linguiformis, Euphorbia royleana, Justicia adhatoda, Lasiaspinosa, Lobelanicotianifolia, Mimosa pudica, Murraya koenigii, Molineria crassifolia, Mussaenda macrophylla, Ocimum tenuiflorum, Ocotea lancifolia, Pogostemon benghalensis, Rauvolfia serpentina, Scoparia dulcis, Sida acuta, Tetrastigma bracteolatum, Woodfordia fruticosa, Zingiber montanum, Ziziphus jujuba</i>	31
Muscular-Skeletal System Disorders	Fracture, joint pain, muscular pain, body pain, sprain	<i>Acacia pennata, Asparagus racemosus, Butea monosperma, Callicarpa macrophylla, Calotropis gigantea, Curcuma aromatica, Desmodium multiflorum, Eclipta prostrata, Gonostegia hirta, Lagerstroemia parviflora, Lepidium sativum, Lygodium flexuosum, Neolamarckia cadamba, Oroxyllum indicum, Poranopsis paniculata, Pterospermum acerifolium, Shorea robusta, Smilax ovalifolia, Solanum torvum, Spatholobus parviflorus, Terminalia chebula, Terminalia tomentosa, Uncaria sessilifructus, Zingiber montanum</i>	24
Neoplasm	Cancer	<i>Asparagus racemosus, Butea monosperma</i>	2
Nervous System Disorders	Nervous problems	<i>Zingiber montanum</i>	1
Nutritional Disorders	Tonic	<i>Alstonia scholaris, Asparagus racemosus, Bauhinia vahlii, Calamus erectus, Centella asiatica, Mangifera indica, Morus alba, Murraya koenigii, Musa paradisiaca, Phyllanthus emblica, Tinospora sinensis</i>	11
Poisonings	Caterpillar sting, insect bite, snake bite	<i>Caryota urens, Cassia fistula, Centella asiatica, Clerodendrum viscosum, Polygonum molle, Rauvolfia serpentina, Sida rhombifolia</i>	7
Pregnancy /Birth/ Puerperium Disorders	Abortifacient, breast engorgement, delay expulsion of placenta, lactation stimulant, prevent miscarriage	<i>Asparagus racemosus, Achyranthes aspera, Butea monosperma, Mentha spicata, Sida rhombifolia,</i>	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	<i>Achyranthes aspera</i> , <i>Acorus calamus</i> , <i>Aegle marmelos</i> , <i>Bauhinia vahlii</i> , <i>Centella asiatica</i> , <i>Cinnamomum tamala</i> , <i>Cissus repanda</i> , <i>Colebrookea oppositifolia</i> , <i>Curcuma longa</i> , <i>Drymaria cordata</i> , <i>Etlingera linguiformis</i> , <i>Mimosa pudica</i> , <i>Myrica esculenta</i> , <i>Ocimum tenuiflorum</i> , <i>Ocotea lancifolia</i> , <i>Oroxylum indicum</i> , <i>Phyllanthus emblica</i> , <i>Piper longum</i> , <i>Piper mullesua</i> , <i>Piper nigrum</i> , <i>Pogostemon benghalensis</i> , <i>Spondias pinnata</i> , <i>Stephania japonica</i> , <i>Syzygium kurzii</i> , <i>Terminalia bellirica</i> , <i>Terminalia chebula</i> , <i>Vitex negundo</i>	27
Sensory System Disorders	Conjunctivitis, corneal opacity	<i>Euphorbia royleana</i> , <i>Piper nigrum</i>	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 <i>Clocosia</i> , vitiligo ("seto dubi")	<i>Achyranthes aspera</i> , <i>Aerva sanguinolenta</i> , <i>Ageratina adenophora</i> , <i>Aloe vera</i> , <i>Alstonia scholaris</i> , <i>Antidesma acidum</i> , <i>Artocarpus lakoocha</i> , <i>Azadirachta indica</i> , <i>Caryota urens</i> , <i>Centella asiatica</i> , <i>Curcuma longa</i> , <i>Eclipta prostrata</i> , <i>Euphorbia heterophylla</i> , <i>Ficus racemosa</i> , <i>Justicia adhatoda</i> , <i>Lygodium flexuosum</i> , <i>Magnolia champaca</i> , <i>Mimosa pudica</i> , <i>Molineria crassifolia</i> , <i>Moringa oleifera</i> , <i>Mucuna macrocarpa</i> , <i>Mussaenda macrophylla</i> , <i>Ocimum tenuiflorum</i> , <i>Oroxylum indicum</i> , <i>Pogostemon benghalensis</i> , <i>Poranopsis paniculata</i> , <i>Premna barbata</i> , <i>Sapindus mukorossi</i> , <i>Scoparia dulcis</i> , <i>Senna sophera</i> , <i>Sida rhombifolia</i> , <i>Spatholobus parviflorus</i> , <i>Thunbergia coccinea</i> , <i>Thysanolaena maxima</i>	34
Unspecified	Chest pain, dizziness, headache, internal wound, nasal bleeding	<i>Drymaria cordata</i> , <i>Sida rhombifolia</i> , <i>Syzygium cumini</i> , <i>Vitex negundo</i> , <i>Zingiber montanum</i>	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 parts of 4 spp. were reported to be used (Figure 3).

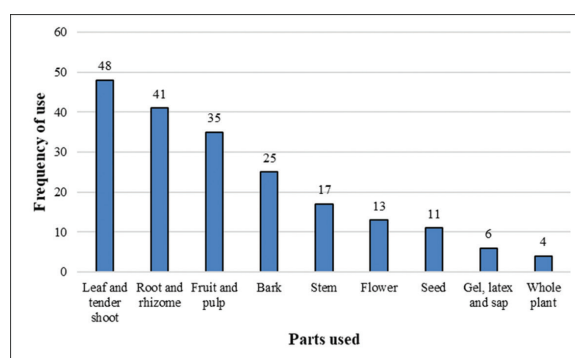


Fig. 3: Usability and frequency of the plant parts used

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.

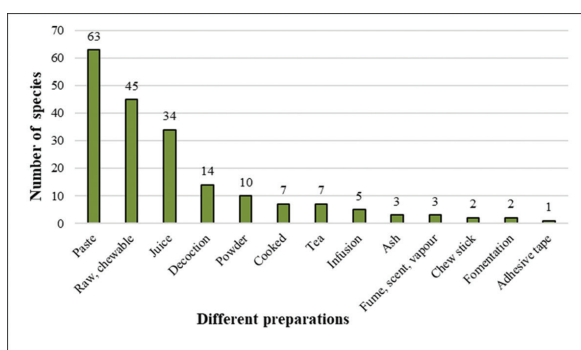


Fig. 4: No. of plant species in different modes of drug preparation

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

purpose is usually not a threat to the survival of plants as compared to the use of whole parts, roots, and stem barks (Giday *et al.*, 2003; Bekalo *et al.*, 2009). In the study area, the removal of under ground parts was one of the major causes of declination and rare occurrence of the population of *Asparagus racemosus*, *Etlingera linguiformis* and *Rauvolfia serpentina*.

In this study, paste was the most common form of preparation followed by raw/chewable, juice, decoction, powder, cooked, tea, infusion, ash, fume/scent/vapour, chew stick, fomentation and adhesive tape. All these preparations resemble the findings of the previous studies (Rokaya *et al.*, 2010; Bhattarai, 2018; Adhikari *et al.*, 2019; Khadka *et al.*, 2020) carried out in Nepal. Such a diverse preparation may contain single or multiple plant species. Meragiaw *et al.* (2016) reported that combined use of several plant species to treat specific ailments was considered important to increase the strength and effectiveness of the remedies. It was also found that one species might be used to treat a single ailment or a number of ailments. In general, one ailment can be cured by using several plant species. The idea that several species can be used for the same purpose are predicted to experience less impact as the use pressure is diffused across a greater number of species (Albuquerque & de Oliveira, 2007). The use of individual medicinal plants to cure a single disease was less in number. Limbu & Rai (2013) reported that oral and topical modes of administrations were easiest and most effective in delivering bioactive compounds into the body. In this study, medications for fracture were reported to be applied by multiple modes (oral and topical) for betterment and fast recovery.

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 lancifolia*, *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 sessilifrutus* 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. These 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	<i>Acacia pennata</i> (L.) Willd.; Leguminosae; Arari Kanda	D; Sh	Root-bark	Paste	Topical	Sprain, fracture	Barrier, hedge; fodder
2	<i>Achyranthes aspera</i> 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"
				Raw	Topical (tied on outer end of placenta)	To accelerate the expulsion of placenta after birth (Cattle), abortifacient (root inserted in uterus)	
			Stem	Chew-stick	Topical (As tooth brush)	Relieve from dental problems and pyorrhoea	
3	<i>Acorus calamus</i> L.; Acoraceae; Bojho	Mo; H	Rhizome	Raw (chewable)	Oral	Cough, Deepening of voice, stomach disorder (diarrhoea and dysentery)	Plant pest control
4	<i>Aegle marmelos</i> (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
			Root, leaf	Paste	Oral	Pneumonia and fever of children	
			Fruit	Juice, raw	Oral	Diabetes; gastritis, diarrhoea	
5	<i>Aerva sanguinolenta</i> (L.) Blume; Amaranthaceae; Iteen jhar	D; H	Leaf	Juice	Topical	Cut-wound	Ornamental
6	<i>Ageratina adenophora</i> (Spreng.) R.M.King & H.Rob.; Compositae; Kali jhar/Ilame jhar	D; H	Leaf	Juice	Topical	Cut-wound	Forage
7	<i>Aloe vera</i> * (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
					Oral	Gastritis, high blood pressure, diabetes, piles, constipation, jundice, ulcer	

S. N.	Botanical name; Family; Local name	Plant category; Type	Parts used	Preparation type	Mode of application	Ethnomedicinal uses	Other uses
8	<i>Alstonia scholaris</i> (L.) R. Br.; Apocynaceae; Chhatiwon	D; T	Tender shoot	Juice	Oral	Sore throat	Fodder; wood is used to make "madal", "dhol", and "theke" as it is light. Trunk is used as 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	<i>Antidesma acidum</i> Retz.; Phyllanthaceae; Archal	D; Sh	Tender shoot, leaf	Raw	Oral	Stinging irritation on tongue by eating <i>Clocosia</i> 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	<i>Artemisiaindica</i> Willd.; Compositae; Titepati	D; Sh	Leaf	Juice	Topical	Scabies, skin lesions (wounds),	Religious and incense; livestock pest control
			Tender shoot	Raw	Oral	Fever	
11	<i>Artocarpus lakoocha</i> Wall. ex Roxb.; Moraceae; Badhar	D; T	Latex	Adhesive tape with "Nepali paper".	Topical	Boils	Wild fruit; fodder; construction materials
12	<i>Asparagus racemosus</i> * Willd.; Asperagaceae; Kurilo	Mo; H	Flower	Decoction with cow-urine	Oral	Cancer	Tender shoot used as vegetable; used in rituals
			Tender shoot	Cooked	Oral	Tonic, lactation stimulant	
			Tuberous root	Paste (along with stem of <i>P. paniculata</i> , root of <i>D. multiflorum</i> , <i>U. sessilifructus</i> , <i>A. pennata</i> , seed of <i>L. sativum</i> ; slug and red soil)	Topical	In fracture	
13	<i>Azadirachta indica</i> 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	
14	<i>Bauhinia vahlii</i> Wight & Arn.; Leguminosae; Bhorla/ Gokarne	D; Lianas	Tender shoot	Juice	Oral	Dysentery, 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 rain-coat 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	<i>Bombax ceiba</i> L.; Malvaceae; Simal	D; T	Flower	Paste	Oral	Diarrhoea, dysentery	Flowers are used as vegetable; timber, fibre
16	<i>Brucea javanica</i> (L.) Merr.; Simaroubaceae; Bhaki-amilo	D; T	Fruit	Powder	Oral	Dysentery	Fodder; fruit used as souring agent in pickle.

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17	<i>Butea monosperma</i> (Lam.) Taub.; Leguminosae; Palans	D; T	Bark	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 "buti" by pregnant women in the belief of prevention of miscarriage).
				Juice	Oral	Cancer	
			Flower, Leaf	Paste	Topical	Burn	
18	<i>Calamus erectus</i> Roxb.; Arecaceae; Phyakre	Mo; Sh.	Ripe fruits	Raw	Oral	Tonic	Wild fruit; used for making baskets and comb
19	<i>Callicarpa macrophylla</i> Vahl; Lamiaceae; Guyelo	D; T	Bark	Paste, raw (chewable)	Oral	Muscular pain, body pain	Wild fruit; fodder; fierwood
			Fruit	Raw	Oral	Fever	
20	<i>Calotropis gigantea</i> (L.) Dryand.; Asclepiadaceae; Ank	D; Sh	Leaf	Fomentation (heated lightly on fire)	Topical	Muscular pain, inflammation and fracture	Social use; fibre and fur
21	<i>Caryota urens</i> L.; Arecaceae; Machha Jode/ Rangbang	Mo; T	Leaf, bark	Paste	Topical	Cut-wound, boils, snake bite	Ornamental
22	<i>Cassia fistula</i> L.; Leguminosae; Raj brikchha	D; T	Seed, Fruit pulp	Paste	Topical	Snake bite	Fodder; furniture, construction materials; leaf is used to ripen banana and jack fruit; Ornamental
			Fruit-bark	Ash	Topical (as tooth powder)	Dental problems	
			Fruit pulp	Raw	Oral	Diarrhoea, vomiting (in diarrhoea pulp from basal portion of fruit is eaten whereas in vomiting, pulp from apical portion is eaten)	
			Seed, Fruit pulp	Infusion	Oral	Painful urination (dysuria), hematuria; constipation	
23	<i>Centella asiatica</i> (L.) Urb.; Apiaceae; Ghodtapre	D; H	Leaf	Juice, Paste	Topical	Cut and wound, used against caterpillar sting ("Dhokre" infection)	Curry; forage
				Raw	Oral	Heat illness (burning urination), gastritis, pneumonia, fever, jaundice, tonic, urinary problems	

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24	<i>Cheilocostus speciosus</i> (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	<i>Cinnamomum tamala</i> * (Buch.-Ham.) T.Nees & Eberm.; Lauraceae; Tejpat	D; T	Leaf, bark	Raw (chewable), tea	Oral	Stomach disorders, cough-cold	Condiment
26	<i>Cissus repanda</i> (Wight & Arn.) Vahl; Vitaceae; Pani lahara	D; Lianas	Sap	Raw (drinkable)	Oral	Pneumonia; Reduce heat illness (hyperthermia)	Fodder; stem used as rope
27	<i>Citrus aurantifolia</i> * (Christ.) Swingle; Rutaceae; Kagati	D; Sh	Fruit	Juice	Oral	Indigestion, anorexia	Fruit, pickle; souring agent
28	<i>Clerodendrum viscosum</i> Vent.; Lamiaceae; Bhanti	D; Sh	Root	Paste	Topical	Snake bite	
29	<i>Colebrookea oppositifolia</i> Sm.; Lamiaceae; Dhusuro	D; T	Root	Juice	Oral	Pneumonia, fever	Leaves and inflorescence used for ripening of banana.
			Leaf	Juice	Topical	Corneal opacity in cattle	
			Flower	Decoction with newly delivered cow-urine	Oral	Menstrual disorder	
30	<i>Curcuma aromatica</i> Salisb.; Zingiberaceae; Kalo haledo/ ban besar	Mo; H	Rhizome	Paste, raw (chewable)	Topical	Sprain and fracture	Used in "buti"
					Oral	Food poisoning ("nas-kapat"), indigestion, heat illness (hyperthermia)	
31	<i>Curcuma longa</i> * L.; Zingiberaceae; Besar	Mo; H	Rhizome	Powder, tea	Oral	Fever, cough-cold, liver disorder (jaundice)	Condiment
				Paste	Topical	Wound, inflammation	
32	<i>Cuscuta reflexa</i> Roxb.; Convolvulaceae; Binajadi	D; Cl	Whole plant	Paste	Oral	Jaundice	
33	<i>Desmodium multiflorum</i> DC.; Leguminosae; Bhatamanse	D ; Sh	Root	Paste	Oral	Muscular pain, body pain	Fodder
34	<i>Dioscorea deltoidea</i> Wall. Ex Griseb.; Dioscoreaceae; Vyakur	D; Cl	Root/ Tuber	Paste	Oral	Diphtheria (in cattle)	Vegetable
35	<i>Drymaria cordata</i> (L.) Willd. Ex Roem. & Schult.; Caryophyllaceae; Abijalo	D; H	Leaf, stem	Fume/scent, warm- juice	Dropped in nostril or scent inhaled	Nasal bleeding, sinusitis	Forage
				Juice	Oral	Pneumonia	

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36	<i>Eclipta prostrata</i> (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.
				Juice	Oral	Heat illness (hyperthermia), urinary problems (burning urination)	
37	<i>Elaeocarpus serratus</i> * L.; Elaeocarpaceae;	D; T	Bark	Juice	Oral	Jaundice	Sacred plant
			Seed	Paste	Oral	Pneumonia, ulcer	
38	<i>Rudrakshya Etilingera linguiformis</i> (Roxb.) R.M.Sm.; Zingiberaceae; Madhu	Mo; H	Fresh Rhizome	Raw	Oral	Cough-cold, sore throat, tonsillitis, burning sensation in stomach	Rhizome used as flavouring agent in alcohol preparation due to its pleasant smell; fodder
			Dried rhizome	Raw	Oral	Deepening of voice	
39	<i>Euphorbia heterophylla</i> L.; Euphorbiaceae; Dudhe	D; H	Latex	Raw	Topical	Cut-wound	Forage
40	<i>Euphorbia royleana</i> * Boiss.; Euphorbiaceae; Siudi	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
				Baked (mix latex or stem pulp with rice grain, cover in leaf and baked on hot ash.)	Oral	Anorexia, stomach disorder, food poisoning ("Nas-kapat")	
41	<i>Ficus racemosa</i> L.; Moraceae; Dumri	D; T	Latex	Raw	Topical	Skin lesions, boils	Ripe fruits are eaten; fodder
42	<i>Gladiolus</i> sp.; Iridaceae; Tarbare phool	Mo; H	Stem-bulb	Paste	Oral	Diarrhoea and dysentery	Ornamental
43	<i>Gonostegia hirta</i> (Blume ex Hassk.) Miq.; Urticaceae; Chiple	D; H	Root	Paste	Topical	Fracture, inflammation	Vegetable; forage
44	<i>Hibiscus sabdariffa</i> * 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	<i>Justicia adhatoda</i> L.; Acanthaceae; Asuro	D; Sh	Flower	Tea	Oral	High blood pressure	Hedge plant, leaves used as compost
			Leaf	Decoction	Oral	Fever	
				Paste	Topical (for bathing)	Skin lesions	
46	<i>Lagerstroemia parviflora</i> Roxb.; Lythraceae; Bot dhairo	D; T	Bark	Paste	Oral	Fracture	Fodder; fire wood
47	<i>Lasia spinosa</i> (L.) Thwaites; Araceae; Morange sag	Mo; H	Leaf	Cooked as curry	Oral	Piles, used as anthelmintic	Vegetable

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48	<i>Lepidium sativum</i> * L.; Brassicaceae; Chamsur	D; H	Seed	Cooked with milk	Oral	Fracture, body ache	Vegetable
49	<i>Lobelia nicotianifolia</i> Roth ex Schult.; Campanulaceae; Eklebir	D; H	Root	Paste	Oral	Food poisoning ("Nas-kapat") for adults, not for children.	
50	<i>Lygodium flexuosum</i> (L.) Sw.; Lygodiaceae; Lahare unu, Janai laharo	Pt; Cl	Whole plant	Paste	Topical	Sprain and fracture, cut and wound	Tender shoot used as vegetable; fodder; used as bedding materials of cattle; used in "buti" for children.
51	<i>Maesa macrophylla</i> Wall. ex Roxb.; Primulaceae; Bhagate	D; Sh	Tender shoot	Paste	Oral	Dysentery	Seeds are used as substitute of millet for preparation of local alcoholic beverage; root is used as fermenting agent.
52	<i>Magnolia champaca</i> (L.) Baill. ex Pierre; Magnoliaceae; Chanp	D; T	Bark	Paste	Topical	Cut-wound	Furniture, construction; ornamental
53	<i>Mallotus philippensis</i> (Lam.) Müll.Arg.; Euphorbiaceae; Sindure	D; T	Stem-bark	Decoction	Oral	Gastric problems, diarrhoea, used against heat illness (hyperthermia)	Fodder; fuel-wood.
54	<i>Mangifera indica</i> * L.; Anacardiaceae; Aanp	D; T	Bark	Paste	Oral	Urinary problems (hematuria)	Fruits and pickle; fodder; fuel wood; religious.
			Unripe Fruit	Paste	Oral	Anorexia	
			Ripe Fruit	Paste	Oral	Tonic, piles	
55	<i>Melastoma melabathricum</i> L.; Melastomataceae; Kaali angeri	D; Sh	Ripe Fruit	Raw	Oral	Dysentery	Ripe fruits are eaten raw.
56	<i>Menthaspicata</i> * L.; Lamiaceae; Pudina	D; H	Leaf	Paste	Oral	Heat illness (burning urination), anorexia, breast engorgement of lactating women.	Leaves are used as pickle.
57	<i>Mimosa pudica</i> L.; Leguminosae; Lajawati/Lajime	D; H	Root	Paste	Oral	Fever; Pneumonia; menstrual problems	
					Topical	Wounds, sores; dental caries.	
					Oral	Jaundice	
58	<i>Mirabilis jalapa</i> L. Nyctaginaceae; Lankasaani	D; H	Root	Juice	Oral	Urinary problems	Ornamental

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59	<i>Molineria crassifolia</i> Baker; Hypoxidaceae; Dhotisaro	Mo; H	Root	Paste	Oral	Urinary problems (hematuria); gonorrhoea	Ornamental
					Topical	Boils ("Baghe khatira")	
60	<i>Moringa oleifera</i> * Lam.; Moringaceae; Sajiwon	D; T	Flower, leaf	Raw (chewable)	Oral	High blood pressure; diabetes	Fruit and tender shoot used as vegetable; fodder.
			Root	Juice	Topical	Healing of wound of cattle (as alternative of <i>Prunus</i> leaf)	
			Fruit	Cooked as curry	Oral	Relieve from heat illness (hyperthermia)	
61	<i>Morus alba</i> L.; Moraceae; Kimbu	D; T	Root	Paste	Oral	Menstrual disorder	Ripe fruits are edible; shade giving plant.
			Fruit	Raw	Oral	Tonic	
62	<i>Mucuna macrocarpa</i> Wall.; Leguminosae; Pangra	D; Lianas	seed	Paste	Topical	Skin diseases, cure dandruff	Fodder
63	<i>Murraya koenigii</i> (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.
				Cooked (condiment)	Oral	Tonic	
64	<i>Musa paradisiaca</i> * L.; Musaceae; Kola/ Kera	Mo; H	Unripe fruit	Raw	Oral	Diarrhoea	Ripe fruits are edible, flowers and unripen fruits are used as vegetable; social use.
			Ripe fruit	Raw	Oral	Tonic, constipation	
65	<i>Mussaenda macrophylla</i> Wall.; Rubiaceae; Dhobini phool	D; Sh	Root	Juice	Oral	Sore throat of infant	Fodder; ornamental
			Stem	Prepare paste with "Seto dubo" (<i>Phalaris arundinacea</i>) and mix with buffalo's curd	Topical	In leucoderma/vitiligo ("seto dubi")	
66	<i>Myrica esculenta</i> 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	<i>Neolamarckia cadamba</i> (Roxb.) Bosser; Rubiaceae; Karam/Kadam	D; T	Bark	Paste	Oral	Inflammation, fracture	Construction material, social use (religious plant)
68	<i>Nephrolepis cordifolia</i> (L.) C. Presl; Nephrolepidaceae; Pani amala	Pt; H	Root/ Tuber	Raw	Oral	Menorrhagia (over bleeding in menstruation); heat illness (hyperthermia), urinary problems	Ornamental
69	<i>Nyctanthes arbor-tristis</i> * L.; Oleaceae; Parijat	D; T	Flower	Raw	Oral	High blood pressure	Flowers are used as curry; religious plant.
70	<i>Ocimum tenuiflorum</i> * L.; Lamiaceae; Tulsi	D; H	Leaf, flower, whole plant	Decoction	Oral	Fever; pneumonia; rashes on tongue or mouth.	Religious plant

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71	<i>Ocotea lancifolia</i> (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	<i>Oroxylum indicum*</i> (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	<i>Phyllanthus acidus*</i> (L.) Skeels; Euphorbiaceae; Kanshi amala/ Madhise amala	D; T	Fruit	Raw	Oral	Heat illness (hyperthermia)	Fruits are eaten fresh or pickled.
74	<i>Phyllanthus emblica</i> 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/hom / hawan".
			Fruit/Bark	Juice	Oral	Gastritis	
75	<i>Piper longum</i> L. Piperaceae; Pipla	D; Cl	Stem	Paste	Oral	Gastritis	Condiment
			Fruit	Cooked (in milk)	Oral	Cough	
76	<i>Piper mullesua</i> 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	<i>Piper nigrum*</i> 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	<i>Pogostemon benghalensis</i> (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 repellent	
79	<i>Polygonum molle</i> D. Don; Polygonaceae; Thotne	D; Sh	Stem	Juice	Topical	Insect bite	Tender shoot used as vegetable; fodder
				Paste	Oral	Diarrhoea	
80	<i>Poranopsis paniculata</i> (Roxb.) Roberty; Convolvulaceae; Sikari laharo	D; Lianas	Stem	Paste	Topical, Oral	Sprain, fracture, body pain, inflammation due to accident.	Fodder
					Topical	Cut-wound	
81	<i>Premna barbata</i> 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	

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82	<i>Psidium guajava</i> L.*; Myrtaceae; Amba/ Ambak	D; T	Bark	Paste	Oral	Diarrhoea and dysentery	Fruit plant
83	<i>Pterospermum acerifolium</i> (L.) Willd.; Malvaceae; Hatti paila	D; T	Root	Decoction prepared by cooking along with stem of <i>U. sessilifructus</i> and <i>P. paniculata</i> ; bark of <i>O. indicum</i> , <i>T. chebula</i> , <i>S. robusta</i> , <i>L. parviflora</i> , <i>N. cadamba</i> and <i>T. tomentosa</i> is eaten for 1-2 months.	Oral	Fracture, inflammation	Fodder; fuel-wood; furniture, rope, leaf plate.
84	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz; Apocynaceae; Chand marauwa/ Sarpa gandha	D; Sh	Root	Raw (chewable)	Oral	Fever, malaria, jaundice, high blood pressure, mental disorder	Ornamental
				Paste	Topical	Snake bite	
85	<i>Sapindus mukorossi</i> Gaertn.; Sapindaceae; Ritha	D; T	Seed	Paste of kernel	Topical	Boils, pimples, skin diseases	Fruits used as soap substitute, timber
86	<i>Scoparia dulcis</i> L.; Plantaginaceae; Chini jhar/Ambake jhar/Khareto jhar	D; H	Leaf, root	Paste, raw	Oral	Sore throat, tonsillitis, green diarrhoea of infant ("saruwa"), diabetes, burning urination, heat illness (hyperthermia)	Used to prepare fermenting cake, "marcha"
				Paste	Topical	Cut-wound and lesions	
87	<i>Senna sophora</i> (L.) Roxb; Leguminosae; Tapre	D; Sh	Root, Leaf	Paste	Topical	Cut-wound, skin diseases	
88	<i>Shorea robusta</i> Gaertn.; Dipterocarpaceae; Saal/Sakhuwa	D; T	Bark	Paste	Oral	Diarrhoea, dysentery; fracture	Fodder; timber plant; fuel-wood; leaves used to make plates.
					Topical	Fracture	
89	<i>Sida acuta</i> 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.
				Raw (chewable)	Oral	anorexia, stomach disorders, food poisoning ("Nas-kapat")	

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90	<i>Sida rhombifolia</i> 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	<i>Smilax ovalifolia</i> Roxb. ex D. Don.; Smilacaceae; Kukur daino	M; Cl	Leaf	Fomentation (heated on fire)	Topical	Sprain and fracture	Tender shoot used as vegetable; used during the ritual in Shrawan 1st ("Luto phalne"), stem is hanged on ceiling in the belief of prevent from evil eyes ("ched-bhed").
			Tender shoot	Cooked as curry or decoction	Oral	Diarrhoea and dysentery	
92	<i>Solanum torvum</i> Sw.; Solanaceae; Ban bihi	D; H	Whole plant	Decoction	Oral	Urinary problems (hematuria)	Fruit edible.
				Paste	Topical	Joint pain	
93	<i>Solena amplexicaulis</i> (Lam.) Gandhi; Cucurbitaceae; Gol kankri	D; Cl.	Fruit	Raw	Oral	Reduce heat illness (hyperthermia)	Ripe fruits are eaten fresh; fodder.
94	<i>Spatholobus parviflorus</i> (DC.) Kuntze; Leguminosae; Debre lahara	D; Lianas	Stem and leaf	Decoction	Topical	Cut and wound; fracture	Fodder; fibre.
95	<i>Spondias pinnata</i> (L.f.) Kurz; Anacardiaceae; Amaru	D; T	Fruit	Raw	Oral	Pneumonia; dysentery	Wild fruit
96	<i>Stephania glandulifera</i> 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	<i>Stephania japonica</i> (Thunb.) Miers; Menispermaceae; Batulpate	D; Cl	Leaf	Powder	Oral	Cough	Fodder
			Root/ Tuber	Paste	Oral	Gastritis	
98	<i>Syzygium cumini</i> (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	<i>Syzygium kurzii</i> (Duthie) N.P. Balakr.; Myrtaceae; Amaru/ ambake	D; T	Fruit	Raw	Oral	Pneumonia	Fruit plant

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100	<i>Syzygium jambos</i> (L.) Alston; Myrtaceae; Gulab jamun/Fandir	D; T	Fruit	Raw (ripe fruits)	Oral	Relieve from heat illness (hyperthermia)	Fruit plant; fodder; fuel-wood.
101	<i>Tamarindus indica</i> L.; Leguminosae; Imali/Titri	D; T	Fruit	Raw	Oral	Indigestion, anorexia	Ripe fruits are pickled; construction materials
			Seed	Powder	Oral	Diarrhoea and dysentery	
102	<i>Tectaria</i> sp.; Tectariaceae; kali niguro	Pt; H	Root	Paste	Oral	Diarrhoea and dysentery	Young frond used as vegetable.
103	<i>Terminalia bellirica</i> (Gaertn.) Roxb.; Combretaceae; Barro	D; T	Fruit	Powder/raw	Oral	Gastritis; cough	Fodder; timber; fire-wood.
104	<i>Terminalia chebula</i> Retz.; Combretaceae; Harro	D; T	Fruit	Powder/raw	Oral	Cough; gastritis and constipation.	Timber; fire-wood.
			Bark	Paste	Topical	Fracture	
105	<i>Terminalia tomentosa</i> Wight & Arn.; Combretaceae; Saj/asna	D; T	Bark	Paste	Oral	Fracture; diarrhoea	Fodder, timber, fire-wood.
106	<i>Tetrastigma bracteolatum</i> (Wall.) Planch.; Vitaceae; Charchare lahara	D; Cl	Stem	Paste	Oral	Diphtheria	Fodder
107	<i>Thunbergia coccinea</i> Wall. ; Acanthaceae; Kanase	D; Cl	Leaf, tender shoot	Paste	Topical	Cut and wound	Ornamental
108	<i>Thysanolaena maxima</i> * (Roxb.) Kuntze; Poaceae; Amliso	Mo; Sh	Root	Paste	Topical	Boils	Fodder; common broom grass and used in rituals; used in bio-engineering to control landslide.
109	<i>Tinospora sinensis</i> (Lour.) Merr.; Menispermaceae; Gurjo	D; Cl	Stem	Decoction	Oral	Gastritis, urinary problems, tonic to cattle and human	Fodder
110	<i>Trichosanthes cucumerina</i> L.; Cucurbitaceae; Ban ghiraula	D; Cl	Fruit pulp, Leaf	Infusion of pulp (fibre), juice	Oral	Jaundice	
111	<i>Uncaria sessilifructus</i> 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	<i>Vitex negundo</i> L.; Lamiaceae; Simali	D; Sh	Leaf	Rubbed; paste heated on fire	Inhale scent; Inhale vapour	Headache; sinusitis	Fuel-wood; used as support for twiner and climber crops; hedge plant, landslide control.
				Decoction	Oral	Jaundice	
				Infusion	Oral	Gout (joint problems due to uric acid)	

S. N.	Botanical name; Family; Local name	Plant category; Type	Parts used	Preparation type	Mode of application	Ethnomedicinal uses	Other uses
113	<i>Woodfordia fruticosa</i> (L.) Kurz.; Lythraceae; Dhayero	D; Sh	Flower	Juice, powder, raw	Oral	Dysentery; sore throat	Fuel-wood; soil stability in steep land.
114	<i>Wrightia arborea</i> (Dennst.) Mabb.; Apocynaceae; Rani Khirro	D; T	Bark	Decoction	Oral	Piles	Timber, agricultural tools.
115	<i>Zingiber montanum</i> * (J.Koenig) Link ex A.Dietr.; Zingiberaceae; Phachhayang	Mo; H	Rhizome	Raw (chewable)	Oral	Diarrhoea, food poisoning ("Nas-kapat")	Protect from evil spirit ("Bhut pret lageko, bachha Jhaskane, sato jane bhaya ma rhizome ko buti badhne; dewa lageko ma nidhar ra sarir ma ghasne").
				Raw	Oral, topical	Headache; nervous problems (contraction and nodule formation of nerves); joint pain; dizziness; fracture	
116	<i>Ziziphus jujuba</i> 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).