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Research Paper

Indigenous uses of medicinal plants in Tarikhet block of Kumaun Himalaya, India

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ABSTRACT

Over 80% of the world population relies on vegetation for health care; more than 30% of the entire plant species are used for medicinal purposes. India displays large topography and various climatic conditions which accommodates more than 45,000 species. Uttarakhand state known as the 'natural reservoir of India' is in north-western Himalaya; it has 8000 vascular plants species, over 1748 of these are known for their therapeutic properties. In hilly areas of Uttarakhand, local communities still use the ethno-medicinal plants to cure various diseases and ailments. Although several researchers have conducted surveys across different areas of the Himalayan region, and to our knowledge, ethno-medicinal plants' studies have not been conducted in Tarikhet block of Almora district, Uttarakhand. In this study, a total of 155 individuals of different age groups (20–93 years) with different socio-economic status (farmer, service man, ex-service man, businessman, housewives, students) participated. A total of 72 medicinal plant species were reported from which 31 were herbs, 20 trees, 15 shrubs and 6 were climbers belonging to 44 families used in the treatment of various ailments. Furthermore, we recorded that local people used various plant parts that is, leaves (35), fruit (15), root (10), whole plant (5), seed (6), bark (6) stem (4), rhizome (3) and others (4), to treat a wide range of health conditions. Thus, documenting the ethno-medicinal plants and for conservation is of the upmost important not only for cultural traditions and for biodiversity conservation. The study shows that locals have extensive ethnobotanical knowledge and are highly dependent on the forest for their livelihood. The valuable knowledge is anchored in cultural practices and orally transmitted from one generation to another; however, the loss is imminent as the new generation lacks the interest and the traditional ethnobotanical knowledge is unprotected.

Key words: Indigenous medicinal plants, traditional ethnobotanical knowledge, Uttarakhand, Himalaya, India.

INTRODUCTION

According to the World Health Organization (WHO), 80% of the world population use natural resources in healthcare mainly based on plants and plant extracts (Kapkoti et al., 2014; Kumar et al., 2018). As with ethno-medicine, traditional medical systems - Ayurveda, Traditional Chinese Medicine (TMC), Unani and biomedicine- includes thousands of medicines made from the secondary metabolites of different parts of plants (Alves and Rosa, 2007). In India, the production of Ayurvedic, Siddha, Unani medicinal systems uses more than 400 plants and traditional remedies which include approximately 25% of plants from temperate and 75% from tropical forests (Topwal and Uniyal, 2018). According to the floral statistics of India (BSI, Kolkata 2019), a total of 2, 68,600 flowering plants of which 18,666 (6.95% of earth) exist in India. India is one of the world's 12 biodiversity hotspots, classified into 11 different phyto-geographical zones which present over 45000 different plant species and traditional communities

only used 7000-7500 species for their medicinal values (Singh et al., 2019). In India, many communities use approximately 50% of plant species in ethno-medicine; tribal communities use more than 7500 species in primary health care and over 2000 species are used in the Indian traditional systems of medicine. Uttarakhand state is situated in the north-western Himalaya at the tri-junction of India, Nepal and Tibet. It covers dense vegetation (65%) and is a repository of 8000 species of vascular flora with a large number of medicinal plants; it is known as the 'Herbal State' (Bhat et al., 2013; Joshi et al., 2016; Pandey et al., 2016; Prasad and Tomar, 2020). The region is well known because of its diverse climatic conditions and a unique geographical location rich floristic and faunistic wealth and an important storehouse of wealth of natural resources and medicinal plants (Kala, 2000; Dhami, 2007).

Local people living in the mountain region of Uttarakhand lead simple lives in adverse conditions. The local communities mainly depend on farming and forests for their livelihood and these communities have rich traditional ethnobotanical knowledge. In the region, medicinal plants have always been used to cure various diseases and ailments and been used for food, shelter, timber, fodder and other basic needs (Singh et al., 2017). The natural resources were previously inexpensive and used extensively as medicine because of the absence of side effects; the traditional knowledge transmission occurred from generation to generation and the local communities contributed to its conservation through traditions and devotion. The current study shows that studies of medicinal plants have been largely covered in this Himalayan part of India. Several scholars like Kumar et al. (2011); Kumari et al. (2012); Bhatt et al. (2013); Kapkoti et al. (2014); Joshi et al. (2016); Joshi and Juyal, (2017); Pandey et al. (2017) have already documented medicinal plants from the different regions of Uttarakhand. However, this study which identifies and documents the medicinal plants from the different regions of Tarikhet block, Uttarakhand state has not previously been documented. In this article, we describe the scientific names, families, vernacular names, medicinal uses and their mode of preparation for scientific validation and further investigation.

MATERIALS AND METHODS

Study area

Uttarakhand also known as Devbhoomi is a mountain region surrounded by Nepal and China with Himachal Pradesh in the northwest and Uttar Pradesh in the south. The State is a store house for biodiversity, medicinal plants and ethnobotanical knowledge (Prasad and Tomar, 2020). For the study, we investigated the region Tarikhet, a block situated in Almora district under the Kumaun Himalaya and situated in the rural regions of Uttarakhand state approximately between 79°24'-79°29'E Longitude, 29°36'-29°42'N Latitude, at an altitude of 1300 m (Pandey et al., 2016). The region of Uttarakhand surrounded by Dwarahat block to the North, Bhikiyasain block to the West, Betalghat block to the South and Hawalbag block to the East has a rich diversity of floral species. The rural settlement living in the area ranges from altitude 919 m to 1191 m. The forests in the region are mainly dominated by pine trees and banj oaks. The study mainly included eight villages, Papda, Kotali, Sangura, Naula, Obari, Chamdoli Baman, Pipeli, and Sagneti. All villages are in Tarikhet block of Almora district of Uttarakhand state (Figure 1). Most of the population speaks Kumauni and Hindi as the secondary main language. The local inhabitants depend mainly on agriculture for subsistence.

Climate

The altitude of the mountain regions of the entire block is varied which contributes to a large extent in the variation of climatic conditions. Three main seasons dominate-summer, rain and winter; summer (March to June); June is the hottest month with an average temperature of 19.2°C; however it usually varies between 17.5 and 20.9°C; heavy rainfall occurs during the monsoon season (from July to October) with a maximum rainfall in July; and January is the coldest winter month with an average temperature of 13.3°C. Temperatures however can drop below zero.

Soil

Soils vary from one place to another. The area includes different physiographical conditions such as hill side slopes, alluvial plain, narrow mountain valleys and river terraces. The texture of the soil ranges from sandy loam to clay loam and is directly related to abiotic and biotic factors prevailing in a particular area.

Data collection

The information related to the medicinal plants was collected from selected villages of Tarikhet block between March to October 2020. Interviews, questionnaires and group discussions were conducted. They sought to elucidate the local people's knowledge and their reliance on the forest for different products especially medicinal uses. Secondary sources of information (that is, Uttarakhand government websites, research papers, books and articles) were also used for reference. A total of 155 participants (age between 20 to 93 years) were selected randomly and interviewed about their socio-economic status (Table 1). Questionnaires were prepared to gather information on the local/vernacular names of medicinal plants, habitat,

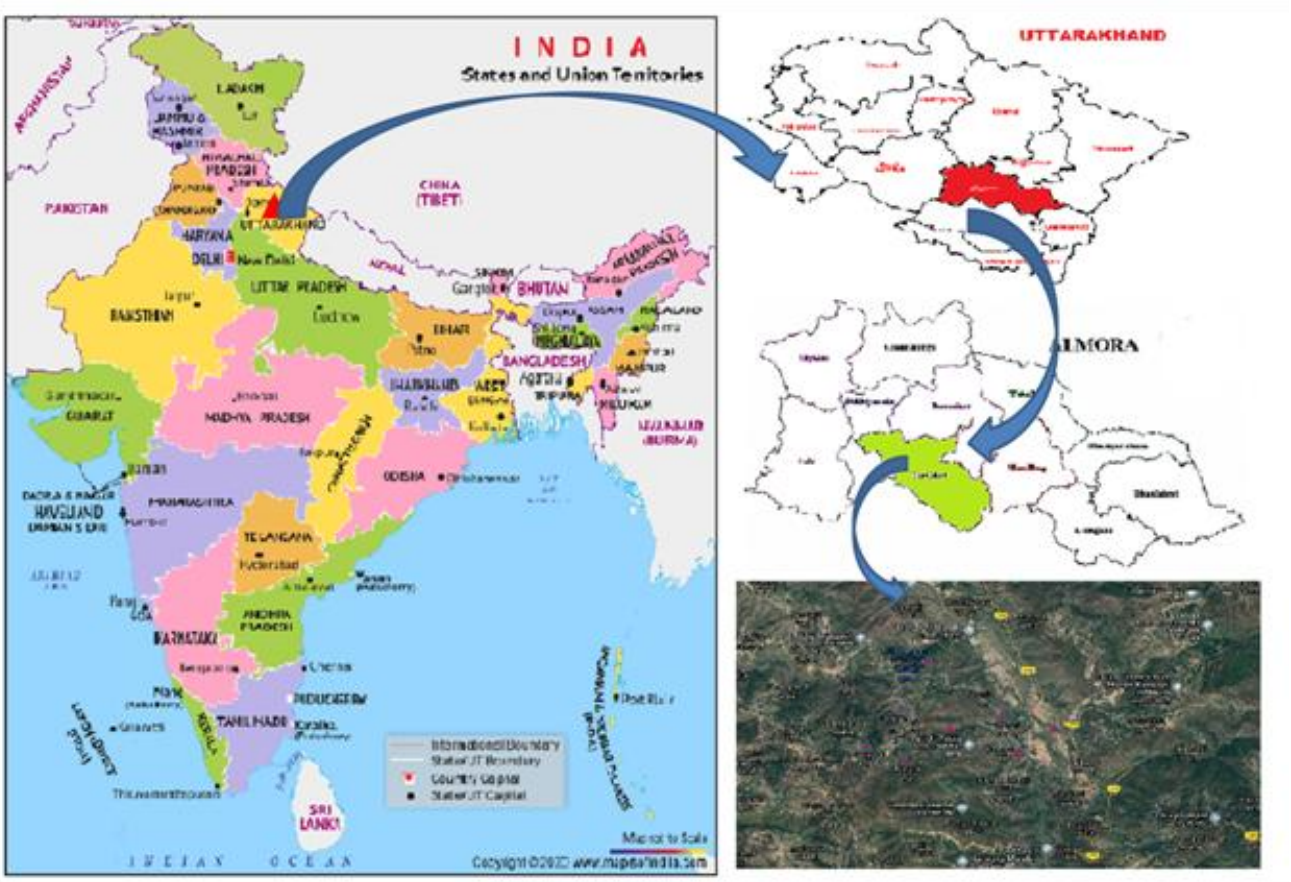

Figure 1: Map of the study area.

Table 1: Age and gender characteristics of participant in Tarikhet block, Uttarakhand, India.

Gender	Age-Group			Total
	20-40	41-60	61 and above	
Female	31	38	21	90
Male	22	23	20	65
Total	**53**	**61**	**41**	155

medicinal uses, mode of preparation, plant parts used and treated ailments. The plants were photographed in their natural habitats and further identified through their vernacular name, with the information that the local people provided and from the literature review from the consulted websites (Table 2).

Phytochemical constituents

The literature review reveals that research has already been conducted on the phytochemical constituents of medicinal plants. Guimarães et al. (2020) reported the presence of ar-turmerone, α –turmerone, β-turmerone, α -phellandrene, β -sesquiphellandrene, ar-curcumene and the monoterpenes β-pinene and paracymene in the rhizome of *Curcuma longa* L which posses antioxidant, anti-inflammatory and antiseptic activity. Grauso et al. (2020) investigate the occurrence of 3-β-Sitosterol, Sitosterol- β -D-glucoside, scopoletin, sitosterol, All-trans-lutein, Acetic acid, Lauric acid, Inositol, Palmitic acid, cis-9,12-Linoleic acid, a-Linolenic acid, Epicatechin, Quercetin-3-O-rutinoside and volatil compound viz.,Carvone, Carvacrol, Naphtalene and (E)-Anethol in *Urtica dioica* L showed antimicrobial, antiulcer, anti-inflammatory, cytotoxic and antioxidant properties. Assaf et al., (2020) recorded that, *Boehmeria rugulosa* Wedd. showed cytotoxicity, antimicrobial, anti-inflammatory and antidiabetic activity

Table 2: Medicinal plants species with their botanical and local names and parts traditionally used in the study.

S/N	Voucher No and Locality	Botanical Name	Family	Plant name (English)	Vernacular Name	Habit	Plant Part Used	Medicinal uses	References
1	LU-Bot-2020901 Silor Mahadev	*Achyranthus bidentata* Blume.	Amaranthaceae	Prickly chaff flower	Apamarga	Herb	Root, Seed	10-30 ml decoction of roots and seed is given for fever and dengue.	(Pandey et al., 2017)
2	LU-Bot-2020902 Silor Mahadev	*Acorus calamus* L.	Araceae	Sweet flag or Calamus	Bach/ Vach (Boj)	Herb	Root	Reports claim potential cure for epilepsy, insomnia, and gastric trouble. 1 gm root powder is mixed with honey or ghee taken orally for epilepsy for 2-3 days.	(Pandey et al., 2016)
3	LU-Bot-2020903 Kotali	*Adhatoda vasica* Nees.	Acanthaceae	Malabar nut	Basa (Vasa)/ Adoosa	Shrub	Leaves	Decoction of fresh leaves is used for gargling for toothache and gum bleeding. Decoction of leaves is effective in cough and mucous.	(Pandey et al., 2017)
4	LU-Bot-2020904 Obery	*Aegle marmelos* (L.) Corrêa	Rutaceae	Bael fruit	Bel	Tree	Fruit, Leaves	Grounded fresh leaves to paste with 5-7 *Piper nigrum* and taken orally with water on an empty stomach in the morning for diabetes. Fruit juice is taken orally for gas, constipation and indigestion.	(Dwivedi et al., 2019)
5	LU-Bot-2020905 Obery	*Agave americana* L	Agavaceae	Century Plant	Rambans/Ramans	Shrub	Leaves	Burned leaves ashes are taken against whooping cough- 1-2 teaspoon daily with lukewarm water.	(Pandey et al., 2017)
6	LU-Bot-2020906 Sangura	*Ageratum conyzoides* L.	Asteraceae	Goatweed	Bhuinya	Herb	Leaves	Crushed fresh leaves in a paste and applied over the cut and wounds.	(Dwivedi et al., 2019)

Table 2: Continued

7	LU-Bot-2020907 Silor Mahadev	*Ajuga bracteosa* Wall.ex Benth.	Lamiaceae	Bugleweed	Ratpatiya	Herb	Leaves	3 or 4 fresh bitter leaves are chewed, and the juice is swallowed for diabetes.	(Gulzar et al., 2017; Pandey et al., 2017)
8	LU-Bot-2020908 Papda	*Aloe vera* Linn.	Asphodelaceae	Aloe Vera	Aloe Vera/ Patquar	Herb	Leaves	Crushed leaves paste is applied and bandage for knee pains. 15-20 ml leaves juice also taken orally with 200 ml of water for indigestion; also used in beauty products for removing acne.	(Topwal and Uniyal, 2018)
9	LU-Bot-2020909 Sangura	*Artemisia nilagirica* (C.B.Clarke) Pamp.	Asteraceae	Indian wormwood	Paati	Shrub	Leaves, Root	Juice extracted from the crushed leaves or roots (1-2 teaspoon) is used for intestinal worm problems. Juice extracted from the crushed leaves dropped (1-2 drops) in ear provides relief for ear pain.	(Pala et al., 2010; Bhat et al., 2013)
10	LU-Bot-2020910 Sangura	*Berberis aristata* DC.	Berberiadaceae	Indian barberry	Kilmora	Shrub	Root	Juice extracted from the crushed roots- 1/3 cup (80ml) is drunk for diabetes. The root is boiled in water and decoction (1/3 cup 80ml) is taken for diarrhea. Juice extracted from the crushed roots or bark dropped (1-2 drops) into the eye. Root infusion used for fever.	(Bhat et al., 2013; Dwivedi et al., 2019; Kumari et al., 2012; Pala et al., 2010)
11	LU-Bot-2020911 Silor Mahadev	*Bidens pilosa* L.	Asteraceae	Black jack	Katari Kumbhar	Herb	Leaves	Fresh leaves are crushed into a paste and applied over cuts and wounds.	(Pala et al., 2010)

Table 2: Continued

12	LU-Bot-2020912 Obery	*Boehmeria rugulosa Wedd.*	Urticaceae	Boehmeria	Gheti/ Githa/ Gethi	Tree	Bark	Bark is crushed and paste is applied on bone fracture and sprain.	(Pandey et al., 2017)
13	LU-Bot-2020913 Silor Mahadev	*Boerhaavia diffusa* var. hirsuta Kuntze	Nyctaginaceae	Red spiderling	Punarnava	Herb	Root	Grounded root mixed with milk or honey and applied on the eyes, to cure itching.	(Bhat et al., 2013; Dwivedi et al., 2019)
14	LU-Bot-2020914 Silor Mahadev	*Callicarpa macrophylla* Vahl.	Verbenaceae	Beautyberry	Daiya/Daya	Shrub	Seed	Raw seeds are chewed for treating stomach-ache. Crushed seed paste is applied on mouth ulcers.	(Pandey et al., 2017; Dwivedi et al., 2019)
15	LU-Bot-2020915 Papda	*Cannabis sativa* L	Cannabaceae	Indian hemp	Bhaang	Herb	Leaves	Juice extracted from crushed leaves applied over the cut, wound and bleeding.	(Monika et al., 2020)
16	LU-Bot-2020916 Obery	*Carica papaya* L.	Caricaceae	Papaya	Papita	Tree	Leaves, Fruit	Grounded leaves in water, filtered and mixed with goat milk, 1-2 teaspoon daily 3 times daily; effectively used against dengue.	(Pandey et al., 2016)
17	LU-Bot-2020917 Papda	*Catharanthus roseus* (L.) G.Don.	Apocynaceae	Periwinkle	Sadabahar/ Baramasi	Herb	Leaves	3 to 4 fresh leaves are eaten raw on an empty stomach in the morning for diabetes.	(Das & Sharangi, 2017; Shoba, 2017)
18	LU-Bot-2020918 Chiliyanaula	*Cedrus deodara* (Roxb.) G.Don	Pinaceae	Himalayan cedar	Devdar/ Devadaru	Tree	Bark, Wood oil	Bark or wood is ground and applied on forehead to reduce headache.	(Chaudhary et al., 2011; Monika et al., 2020; Pala et al., 2010; Saab et al., 2017)
19	LU-Bot-2020919 Sangura	*Celtis australis* L.	Ulmaceae	Hackberry	Khadik	Tree	Root	Root is grinded with the root of *Rumex hastatus* in water and paste is applied over boils, once daily until the boils have healed.	(Tiwari et al., 2010)

Table 2: Continued

20	LU-Bot-2020920 Silor Mahadev	*Cinnamomum tamala* Bach.Ham. Nees & Ebermaeir	Lauraceae	Indian Bay Leaf	Tejpat	Tree	Leaves, Bark	Leaves and bark are ground to powder. Half to one teaspoon of the powder is mixed with water and drunk to control blood pressure.	(Kumari et al., 2011; Pandey et al., 2016)
21	LU-Bot-2020921 Kotali	*Cissampelos pareira* L.	Menispermaceae	Abuta/ Ice vine	Laghu Patha/ Pani bel	Climber	Leaves, Root	Juice extracted from the crushed leaves; 1 to 2 drops dropped in eye to provide itching relief. Juice extracted from the crushed root; ½ to 1 teaspoon to cure diarrhea in infants.	(Kumari et al., 2011)
22	LU-Bot-2020922 Chamdoli Baman	*Citrus limon* (L.) Burm. f	Rutaceae	Lemon	Niboo	Tree	Fruit	Paste of crushed fruit peel is applied on forehead to relieve migraine. Fruits are rich in vitamin C.	(Kapkoti et al., 2014)
23	LU-Bot-2020923 Silor Mahadev	*Curcuma longa L.*	Zingiberaceae	Turmeric	Haldi	Herb	Rhizome	Crushed rhizome paste is applied on cut and wound. Half to one teaspoon rhizome powder is mixed with honey, drunk for cough relief. One teaspoon rhizome powder is mixed with milk to relieve body pain.	(Kapkoti et al., 2014)
24	LU-Bot-2020924 Naula	*Cynodon dactylon* L.	Poaceae	Couch grass	Doob	Herb	Whole Plant	Crushed whole plant is pasted to relieve burning sensation and bleeding.	(Kumari et al., 2011; Monika et al., 2020)
25	LU-Bot-2020925 Tipola	*Datura metel* L	Solanaceae	Thorn apple	Dhatura	Herb	Seed	125-250 mg of seeds are burned to ashes and drunk in small amount for jaundice.	Sayyed and Shah, 2014; Lim et al., 2020)

Table 2: Continued

26	LU-Bot-2020926 Sagneti	*Dicliptera bupleuroides* Nees.	Acanthaceae	Thorowax	Kawgadi	Herb	Leaves	Juice or paste extracted from crushed leaves applied on wounds and bleeding; also mends broken bones.	(Kumari et al., 2011; Pandey et al., 2017)
27	LU-Bot-2020927 Sagura	*Dioscorea bulbifera* L.	Dioscoreaceae	Potato Yam	Gethi	Herb	Root, Fruit	Roasted fruits are eaten with salt for colds and coughs.	(Bhat et al., 2013; Pandey et al., 2017; Monika et al., 2020)
28	LU-Bot-2020928 Naula	*Eleusine coracana* Gaertn.	Poaceae	Finger millet	Maduwa, Raagi	Herb	Seed	Bread, soup, pudding mixed with finger millet flour and wheat flour is beneficial for preventing diabetes, anemia, stomach gas, constipation, migraine, and osteoporosis.	(Pandey et al., 2016)
29	LU-Bot-2020929 Papda	*Emblica officinalis* Gaertn.	Euphorbiaceae	Indian gooseberry	Amla/Aanwla	Tree	Fruit	Grounded seeds; ½-1 teaspoon powder mixed with 1 cup (240 ml) of water drunk for acidity.	(Dwivedi et al., 2019; Kumari et al., 2011)
30	LU-Bot-2020930 Tipola	*Eupatorium adenophorum* Sprengel	Asteraceae	Crofton weed	Basya	Herb	Leaves	Juice from crushed leaves applied on cuts and wounds.	(Monika et al., 2020)
31	LU-Bot-2020931 Kotali	*Euphorbia hirta* L.	Euphorbiaceae	Asthma plant	Badi Dudhi	Herb	Latex	The milky latex is smeared over pimples to eliminate pimple from the root. Crushed whole plant and paste is applied on pricking thorn.	(Monika et al., 2020; Pandey et al., 2017)
32	LU-Bot-2020932 Chamdoli Baman	*Ficus palmata* Forssk.	Moraceae	Wild fig	Bedu	Tree	Latex	Milky latex is applied on boils, cuts and wounds healing. Fruits are rich source of minerals, phosphorus and Vitamin C.	(Bhat et al., 2013; Dwivedi et al., 2019; Monika et al., 2020; Pala et al., 2010)

Table 2: Continued

33	LU-Bot-2020933 Tipola	*Grevillea robusta* A. Cunn. ex R. Br.	Proteaceae	Silver oak/ Silk Oak	Silver Oak	Tree	Leaves	Burnt leaves to ashes are mixed with coconut oil and applied onto burned skin.	(Dwivedi et al., 2019)
34	LU-Bot-2020934 Pipeli	*Hedychium spicatum* Ham. ex Sm.	Zingiberaceae	Spiked ginger lily	Ban Haldi	Herb	Rhizome	Half to one teaspoon of powdered rhizome Mixed with 1 cup (240 ml) of lukewarm water drunk for stomachache. Paste of crushed rhizome is applied on boils.	(Kumari et al., 2011; Pandey et al., 2017)
35	LU-Bot-2020935 Kotali	*Hibiscus rosa-sinensis* L.	Malvaceae	Hibiscus	Gudhal	Shrub	Flower	One teaspoon of powdered flowers and with 1 cup (240 ml) of water is drunk at night after an hour after meal for kidney stones.	(Kumari et al., 2011)
36	LU-Bot-2020936 Chamdoli Baman	*Juglans regia* L.	Juglandaceae	Walnut	Akhrot	Tree	Bark, Leaves, Fruit	Chew bark for teeth clean and strong teeth; 40-60 ml of leaf decoction drunk for intestinal worm. Eating 25 to 50 g of walnut kernel daily strengthens the brain.	(Monika et al., 2020; Pala et al., 2010; Pandey et al., 2017)
37	LU-Bot-2020937 Obari	*Kalanchoe pinnata* (Lam.) Pers.	Crassulaceae	Kalanchoe Pinnata	Patharchatta	Herb	Leaves	Fresh leaves are eaten with rock sugar on an empty stomach in the morning for kidney stone.	(Dwivedi et al., 2019)
38	LU-Bot-2020938 Tipola	*Lantana camara L.*	Verbenaceae	Lantana	Kuri/Lantana	Shrub	Leaves	Paste extracted from the crushed leaves applied on wound and pus.	(Kalita et al., 2012; Parihaar et al., 2014)
39	LU-Bot-2020939 Obari	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Sponge gourd	Torai/Turai	Climber	Fruit	Burning the Ripe fruit is burnt and powdered 1-2 tablespoon mixed with 1 cup (240 m) of ginger water for vomiting.	(Pandey et al., 2016; Sharma & Mishra, 2009)

Table 2: Continued

40	LU-Bot-2020940 Papda	*Melia azedarach* L.	Meliaceae	Pride of India	Bitan	Tree	Bark, Leaves, Seeds	Half to one teaspoon of juice extracted from the crushed bark and seed drunk for parasitic roundworms. Bark and leaf decoction of for hernia.	(Pandey et al., 2017)
41	LU-Bot-2020941 Silor Mahadev	*Mentha piperita* L.	Lamiaceae	Mint	Pudina	Herb	Leaves	Juice extracted from the crushed leaves and 1-2 teaspoon with *Tamarindus indica* juice drunk to stop vomiting.	(Kumari et al., 2011)
42	LU-Bot-2020942 Obari	*Momardica charantia L*	Cucurbitaceae	Bitter gourd	Karela	Climber	Fruit	One cup (240 ml) fruit juice drunk for diabetes.	(Pandey et al., 2016)
43	LU-Bot-2020943 Silor Mahadev	*Morus nigra L.*	Moraceae	Mulberriy	Shahtoot	Tree	Leaves, Fruit	Paste extracted from the crushed leaves applied onto wounds and boils. Highly nutritious fruit.	(Rodrigues et al., 2019)
44	LU-Bot-2020944 Obari	*Murraya koenigii* (L.) Spr.	Rutaceae	Sweet neem	Karipatta	Shrub	Leaf	Juice extracted from the crushed fresh leaves applied on the eyes for cataract. Gargle with leaf-decoction twice daily for mouth ulcers; until completely cured.	(Monika et al., 2020)
45	LU-Bot-2020945 Chiliyanaula	*Myrica esculenta* Buch. Ham. ex D. Don	Myricaceae	Bayberry	Kafal	Tree	Bark	Gargle with bark-decoction twice daily for toothache, is taken, until completely cured.	(Dwivedi et al., 2019; Kumari et al., 2011; Pala et al., 2010)
46	LU-Bot-2020946 Pipeli	*Nyctanthes arbor-tristis* L.	Oleaceae	Night Jasmine/ Queen of night	Harsingar/ Parijat	Shrub	Leaves	Decoction of 3-4 leaves for back knee pains. 1/2 cups (120 ml) twice daily.	(Kumari et al., 2011)

Table 2: Continued

47	LU-Bot-2020947 Tipola	*Ocimum Sanctum* Linn.	Lamiaceae	Holy basil	Tulsi	Herb	Whole plant	Whole plant decoction for fever, and coughs; 1/2 cups (120 ml) twice daily; also strengthens the immune system.	(Sharma and Mishra, 2009)
48	LU-Bot-2020948 Tipola	*Phyllanthus niruri L.*	Phyllanthaceae	Gale of wind/ Stonebreaker	Bhoomi amla	Herb	Whole plant	Drink whole plant decoction; 1/2 cups (120 ml) to relieve inflammation of the intestine and liver. Whole plant decoction mixed with *Boerhavia diffusa* crushed leaves is used for treating jaundice.	(Kumari et al., 20 11)
49	LU-Bot-2020949 Silor Mahadev	*Pinus roxburghii Sarg.*	Pinaceae	Indian Pine	Chir/Chid	Tree	Resin	Resin (gum) is applied on sprain or injury.	(R.K. Singh and Negi, 2019; Monika et al., 2020)
50	LU-Bot-2020950 Sangura	*Prunus persica* (L.) Batsch	Rosaceae	Peach	Aaru	Tree	Leaves	One to two tablespoon of crushed leaves decoction and drunk for parasitic roundworms.	(Kumari et al., 2011)
51	LU-Bot-2020951 Kotali	*Psidium guajava*	Myrtaceae	Guava	Amrood	Tree	Leaves, Fruit	Three to four fresh leaves are chewed and juice is swallowed for kidney stones and toothache. Gargle of crushed leaves decoction mixed with alum provides toothache relief.	(Kumari et al., 2011; Parihaar et al., 2014)
52	LU-Bot-2020952 Obari	*Punica granatum* L.	Lythraceae	Pomegranate	Aanar	Shrub	Fruit	Grounded to powdered dried fruit peel; 1-2 tablespoon powder mixed with 1 cup (240 ml) of lukewarm water drunk for cough.	(Pandey et al., 2016)

Table 2: Continued

53	LU-Bot-2020953 Naula	*Pyrus pashia Buch.-Ham. ex D. Don*	Rosaceae	Himalayan pear	Mehal/Melu	Tree	Fruit	Raw fruit is eaten for treating digestive disorders.	(M. Kumar et al., 2011)
54	LU-Bot-2020954 Tipola	*Raphanus sativus* Linn	Brassicaceae	Radish	Mooli	Herb	Leaves	Juice extracted from the crushed leaves or eating vegetable of fresh leaves to treat jaundice.	(Sharma and Mishra, 2009)
55	LU-Bot-2020955 Ranikhet	*Rhododendron arboreum* Smith	Ericaceae	Nilgiri Rhododendron	Burans	Tree	Flower	Juice extracted from flowers used in blood pressure and as a heart tonic.	(Kumari et al., 2011; Pandey et al., 2017; Monika et al., 2020)
56	LU-Bot-2020956 Chamdoli Baman	*Ricinus communis* L.	Euphorbiacea	Castor oil	Ein/Arand	Shrub	Leaves	Leaves are heated and tied around the affected joints to cure arthritis.	(Pandey et al., 2017; Dwivedi et al., 2019; Monika et al., 2020)
57	LU-Bot-2020957 Silor Mahadev	*Rubia cordifolia* L	Rubiaceae	Indian Madder	Chatkur	Climber	Whole Plant	Paste of the entire plant is applied on the joint for pain relief. Grind root and filter and mix with milk or lukewarm water; ½ to 1 teaspoon is given in typhoid.	(Kumari et al., 2011; Pandey et al., 2017)
58	LU-Bot-2020958 Kotali	*Rubus ellipticus* Sm.	Rosaceae	Yellow Himalayan Raspberry	Hisalu	Shrub	Fruit	Fruit juice is drunk for cholera.	(Pandey et al., 2017; Monika et al., 2020)
59	LU-Bot-2020959 Tipola	*Rumex hastatus* D. Don	Polygonaceae	Arrowleaf Dock	Bhilmora/ Khatimal	Herb	Leaves	Apply leaf juice on cuts, wounds, and bleeding.	(Kumari et al., 2011; Pandey et al., 2017; Parihaar et al., 2014)
60	LU-Bot-2020960 Obari	*Sapindus mukorossi* Gaertn	Sapindaceae	Soapnut/Soapberry	Reetha	Tree	Fruits	One to two teaspoons of powdered seeds mixed with water used at night and it as shampoo to remove hair problem.	(Suhagia et al., 2011)

Table 2: Continued

61	LU-Bot-2020961 Kotali	*Solanum melongena* L.	Solanaceae	Eggplant	Baigan	Herb	Stem	Burning the stem and applying it to a dog's bitten area will reduce the effect of toxins.	(Pandey et al., 2016)
62	LU-Bot-2020962 Papda	*Solanum nigrum* L	Solanaceae	Black Nightshade	Makoi	Herb	Whole Plant	Whole plant juice is drunk during intermittent fever and for treating jaundice.	(Kumari et al., 2011; Pandey et al., 2017)
63	LU-Bot-2020963 Chamdoli Baman	*Stephania glabra* (Roxb) Mierr.	Menispermaceae	Hairless Tape Vine	Ganjaroo	Climber	Root	Crushed roots are soaked in water; ½ cup (120 ml) of filtrate is drunk for treating piles. One to two drop of extracted juice from the crushed root dropped in eyes to provide relief.	(Pandey et al., 2017)
64	LU-Bot-2020964 Sagneti	*Tagetes erecta* Linn.	Asteraceae	Marigold	Genda/Hajari	Herb	Leaves, Flower	Juice or paste extracted from crushed leaves and flower applied on wound and bleeding. Paste extracted from crushed flower paste with cow urine (gomutra) applied on wound.	(Kapkoti et al., 2014)
65	LU-Bot-2020965 Obari	*Tinospora sinensis* (Lour.) Merr.	Menispermaceae	Heart-Leaved Moonseed	Giloy/Guruch	Climber	Stem	80 ml or 1/3 cup of crushed stem decoction taken twice daily for fever, cough, blood pressure, gas, diabetic and to strengthen the immune system.	(Pandey et al., 2017)
66	LU-Bot-2020966 Naula	*Trigonella foenum-graecum L*	Fabaceae	Fenugreek	Methi	Herb	Leaves, Seed	Half to one tablespoon of seeds are soaked in 1 cup of water overnight. Drink in the morning to treat diabetes. Vegetables of leaves are beneficial for gas problems and stomach bloating.	(Pandey et al., 2016)

Table 2: Continued

67	LU-Bot-2020967 Pipeli	*Urtica dioica* L.	Urticaceae	Stinging nettle	Sisuna /Bichchhu	Herb	Leaves and Stem	Stem and leaves are applied externally for treating body cramp and external pains.	(Gangwar and Gangwar, 2010; Kapkoti et al., 2014; Monika et al., 2020)
68	LU-Bot-2020968 Obari	*Vitex negundo* L	Verbenaceae	Chinese chastetree	Siwain/Nirgundi	Shrub	Leaves	Crushed leaves are boiled and rinsed with water to provide mouth ulcer relief.	(Kumari et al., 2011; Pandey et al., 2017)
69	LU-Bot-2020969 Silor Mahadev	*Withania somnifera* (L.) Dunal.	Solanaceae	Indian ginseng	Ashwagandha	Herb	Root	Half to one teaspoon of grounded and powdered root and mixed with 1 cup (240 ml) of lukewarm water and drunk for constipation.	(Pandey et al., 2017)
70	LU-Bot-2020970 Obari	*Zanthoxylum armatum* DC.	Rutaceae	Winged prickly ash	Timoor/Timur	Shrub	Leaves, Stem	Fresh leaves are chewed for toothache and as mouth wash. Branches are used as a toothbrush which cures toothache.	(Pandey et al., 2017; Monika et al., 2020)
71	LU-Bot-2020971 Papda	*Zingibe rofficinale Roscoe*	Zingiberaceae	Ginger	Adrak	Herb	Rhizome	Rhizome decoction is given to patient with constipation, gas, vomiting, cough, phlegm, and colds.	(Monika et al., 2020)
72	LU-Bot-2020972 Silor Mahadev	*Ziziphus mauritiana* Lam.	Rhamnaceae	Indian plum/ Chinese date	Jungly Ber	Shrub	Leaves, Fruit	Gargling with decoction of fresh leaves cures swelling of the mouth and gum bleeding.	(Kumari et al., 2011; Pandey et al., 2017)

due to presence of Chalcone-6'-hydroxy-2',3,4-trimethoxy-4'-O-β-D-glucopyranoside, Quercetin, Quercetin-7-O-β-D-glucopyranoside, 3',4',5,6-Tetrahydroxy-7-O-[β-D glucopyranosyl-(1→6)-β-D-glucopyranosyl-(1→6)-β-D-glucopyranosyl-(1→3)-α-L-rhamno-pyranoside] isoflavone-3',4',5,6-Tetrahydroxy-7-O-[β-D-gluco-pyranosyl- (1→3)-α-L rhamno-pyranoside] isoflavone.

Another study indicates the, essential oils of *Ageratum conyzoides* L. showed anti-hemorrhagic, analgesic, diuretic, antipyretic, insecticide and antibacterial activity due to presence of various phytochemicals such as 6- -demethoxyageratochromene (precocene I), β-caryophyllene, β-copaene, hexanal, trans-cadina-1(6),4-diene, α-calacorene, caryophylla-4(12),8(13)-diene-5-β-ol, 1,10-di-epi-cubenol, (E)-nerolidol, germacrene-D, desmethoxyencecalin, androencecalinol, (E)-β-farnesene, β-cubebene, trans-muurola-4(14),5-diene, bicyclogermacrene, bornyl acetate, and thymol (Kouame et al., 2018). Similarly, Chander et al. (2017) recorded the presence of barberine, oxyberberine, berbamine aromoline, karachine, palmatine, oxyacanthine,

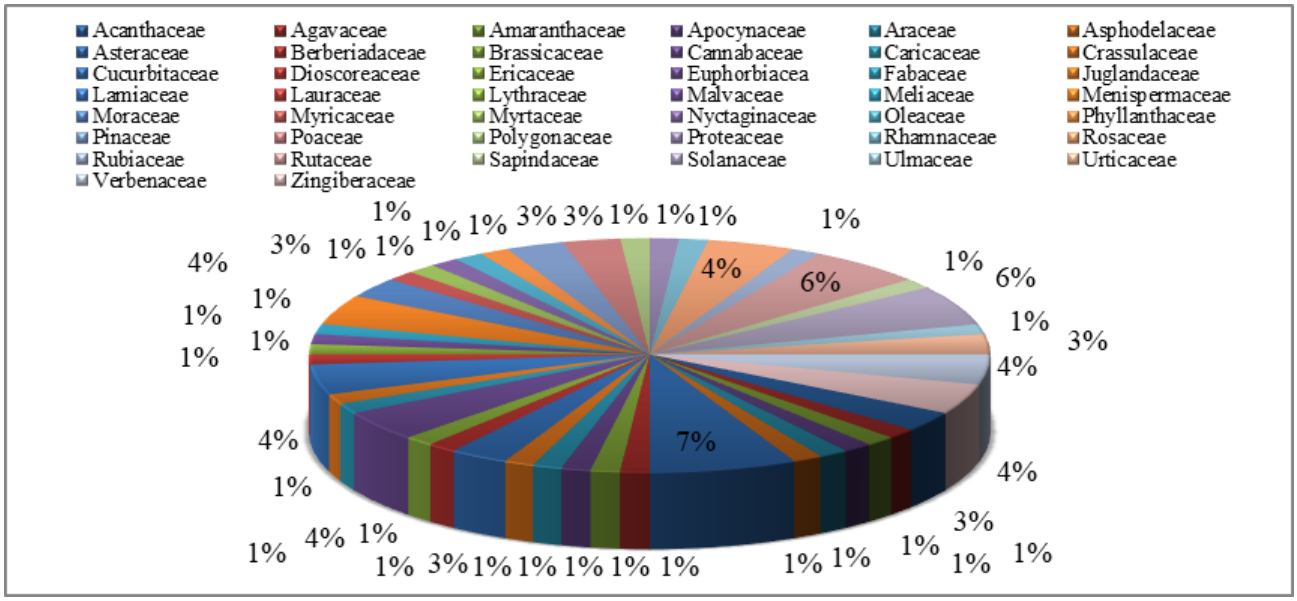

Figure 2: Pie diagram showing number of families and ethno-medicinal plant belong to different families.

taxilamine, protoberberine and bis isoquinoline type of alkaloid in root of *Berberis aristata* which showed anti-diabetic, anti-diarrheal, antibacterial, antifungal, and antiprotozoal properties. Ahmad et al. (2016) reported the presence of 5-ethyl-2(5H)-furanone, trimethylacetic anhydride, cyclooctanone, 5-methyl-3-heptanol, methyl 2-vinylbutanoate, 2-(p-methylphenyl)-2-nitropropne, azelaaldehydic acid, 2,4,6-trimethyloctane and trans-3-nonen-2-one in the essential oil of *Rumex hastatus* D.

Don. Gill et al. (2015) were screened the presence of phytochemicals, that is, Quercetin-3-rhamnoside, Ericolin (arbutin), Ursolic acid, Alpha-amyrin, Epifriedelinol, Triterpenoids (Campanulin, quercetin and hyperoside), Quecetin, Rutin, and Coumaric acid in *Rhododendron arboreum* Smith which showed anti-inflammatory, antidiarrheal, hepatoprotective, antifungal and anticancer properties. Subasini et al. (2013) further showed that, photochemical derived from tuber of *Dioscorea bulbifera* L. such as diosbulbin, bafoudiosbulbin, diosbulbisin, dioscoreanoside, lutein, zeaxanthin, neoxanthin, auroxanthin, violaxanthin, cryptoxanthin, daucosterol, β-sitosterol, palmatic acid, succinic acid, shikimic acid, 3, 5-dimethoxykaempferol, 3, 5, 3′-trimethoxyquercetin, caryatin, (+) catechin, myricetin, myricetin-3-o-β dgalactopyranoside, myricetin-3-o-β-dglucopyranoside, hyperoside, kaempferol show antimicrobial efficacy. Kurade et al. (2010) recorded the presence of 1-napthalenol, α-bisabolol, bornyl acetate, β-bisabolene, germacrene-D, α- phellandrene, di-epi-α-cedrene, (Z,E)-β-farnesene, β-caryophyllene, acorenone, cedrene-13-ol acetate and γ-curcumene in the essential oil of *Eupatorium adenophorum* Sprengel and the presence of phytochemical compounds viz., 3,7,11-trimethyl-1,6,10-dodecatriene, β-caryophyllene, zingiberene, γ-curcumene, α-humulene, β-curcumene, 1-octene-3-ol, linalool, germacrene-D, bicyclogermacrene and t-sesquisabinene hydrate in *Lantana camara* L. which showed antiseptic and antimicrobial activity. This indicates the potential use of the medicinal plants.

RESULT AND DISCUSSION

We recorded a total of 72 medicinal plan species that the local people use traditionally. The plant species collected from the sites belong to 44 families. Local healers and professionals confirmed that they were mainly used to treat ailments like dengue fever, jaundice, inflammation, cough, cold, stomachache, diarrhea, kidney problems, cuts, wounds, bleeding, boils, eye diseases, insecticides, as a mouthwash to treat mouth ulcer and other dental ailments, indigestion, pimples, diabetes, pain, burning skin, bone cracking, blood pressure, and ear problem (Table 2). The plant families which are arranged in alphabetical order are given with their botanical names followed by the vernacular names, habitat, plant parts used and their medicinal uses. The highest reported plant species are Asteraceae (5 species); Solanaceae and Rutaceae (4 species each), Euphorbiacea, Lamiaceae, Menispermaceae, Rosaceae, Verbenaceae and Zingiberaceae (3 species each); Acanthaceae, Cucurbitaceae, Moraceae, Pinaceae, Poaceae, Urticaceae (2 species each); and 1 specie from each rest of the families (Figure 2). Out of the 72 plant species, 31 species belong to herbaceous and exhibited maximum

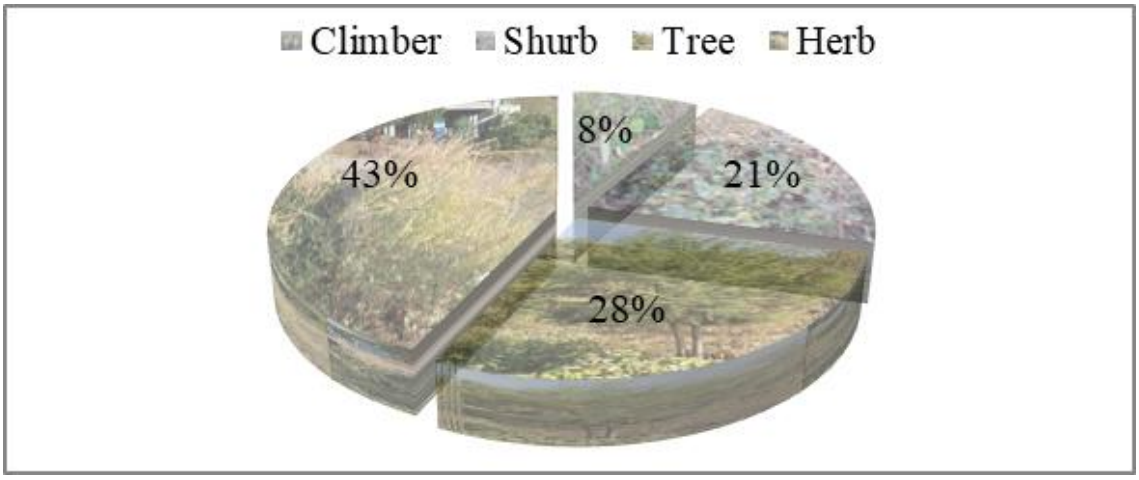

Figure 3: Habitat of plants used in Ethno-medicines.

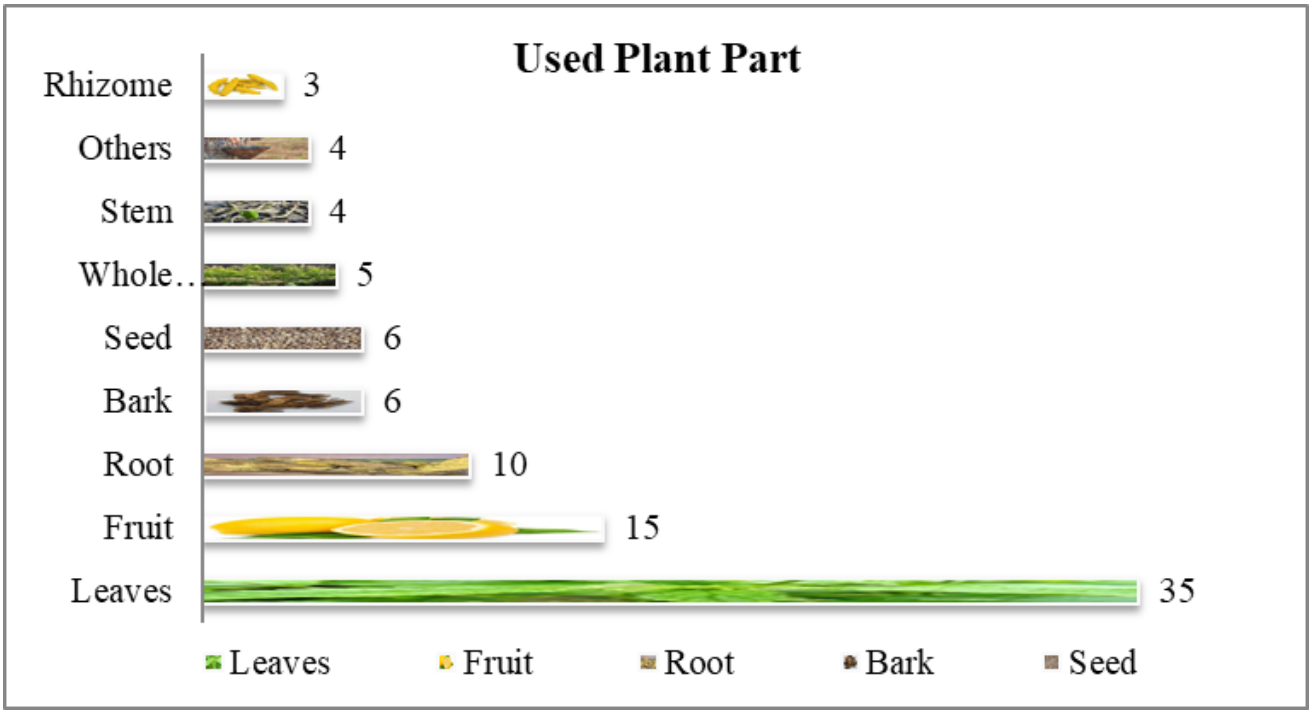

Figure 4: Bar diagram showing ethno- medicinal plant parts used in preparing medicines for various ailments.

diversity (43%), trees (28%), shrubs (21%), and climbers (8%) (Figure 3). The local people of Tarikhet block confirmed that leaves (40%) were commonly used followed by fruit (17%), root (11%), bark (7%), seed (7%), whole plant (6%), stem (4%), rhizome (3%) and others (5%) (Figure 4).

We also observed that the traditional ethnobotanical knowledge was higher in the age group 61 and above followed by 41-60 and 20-40. In addition, because women spend considerable amount of time in forests for wood collection and in fields for food production, they have extensive ethnobotanical knowledge (Montanari 2013; 2014). However, traditional ethnobotanical knowledge in this part of the Himalaya is rapidly eroding. This is due to development and urbanization, an increased spread of healthcare facilities and services, a growing dependence on allopathic medicine and a general lack of interest as the new generations migrate to urban centers for employment.

The erosion is further exacerbated by a growing population, increasing development activities, deforestation, and the impact of tourism on the natural landscape and the over-exploitation of natural resources. In addition, local merchants and physicians exploit the medicinal plants from their natural habitats causing considerable damage to the natural populations of flora (Dwivedi et al., 2019). Thus, as medicinal plants become increasingly threatened of extinction, the need for conserving biodiversity and the conservation of local knowledge becomes vital (Pandey et al., 2017; Amritesh et al., 2018).

CONCLUSION

The study indicates that the medicinal plants are widely used for treating a wide range of ailments and this is attributed to the phytochemical constituents. However, to preserve the traditional uses and proceed with the conservation of these indigenous medicinal plants before the ethnobotanical knowledge is lost, we recommend that the medicinal plants be documented and scientifically screened for their validation.

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