Ethnobotanical knowledge of Khandadevi and Gokulganga Rural Municipality of Ramechhap District of Nepal

Suman Prakash Pradhan, Ram Prasad Chaudhary, Sagar Sigdel and Bishnu Prasad Pandey

Research

Abstract

Background: This study was focused on the ethnobotany of different ethnic communities residing in Majhuwa and Chuchure villages of Khandadevi and Gokulganga Rural Municipality of Ramechhap District of Bagmati Province of the Federal Democratic Republic of Nepal.

Methods: The ethnobotanical study was carried out by using semi-structured questionnaires in which participatory rural appraisal (PRA) and rapid rural appraisal (RRA) tools were used to acquire knowledge from local people regarding ethnobotanical uses of plants of their surroundings. The quantitative data were analyzed by the relative frequency of citation (RFC), use value (UV), and informant consensus factor (ICF).

Results: A total of 139 plant species belonging to 74 families were found to have ethnobotanical significance. Among these species, herbs accounted for 41% followed by trees (29%), shrubs (14%), climbers (9%), grasses (3%), epiphytes (1%), ferns (1%), fungi (1%), and lichens (1%). Out of which, 136 species were of medicinal importance and used to treat different ailments followed by other uses such as fodder, veterinary, religious, pesticide, timber, etc. The new uses of *Lespisorus mehrae*, *Plumbago zeylanica*, *Pterocarpus santalinus*, *Rhus parviflora*, and *Roscoea auriculata* were found. The highest RFC was found to be 0.82 for *Ageratina adenophora*, *Curcuma domestica*, *Acorus calamus*, *Centella asiatica*, *Avena sativa*, and *Allium sativum*. The highest UV was found in *Zingiber officinale* (1.30), and the highest ICF was found in the gastro-intestinal disorders ailment category (0.50).

Conclusions: For the first time, we revealed the ethnobotanical application of plant species from Majhuwa and Chuchure villages of Ramechhap District. This study showed that Majhuwa and Chuchure villages are rich in medicinally important plant species and different ethnic communities have enormous knowledge of ethnobotanical uses of plants. Moreover, illegal collection, trade, and marketing have threatened the abundance and distribution of some high-value medicinal plants. It is of utmost importance to conserve floral diversity through the local peoples' participation.

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Background

The use of plant species as a medicine for treating various ailments is as old as human civilization. Herbal based medicines have been the basis for the cure of various diseases and physiological conditions in traditional methods practiced such as Ayurveda, Unani, and Siddha (Kumar *et al.* 2006). Schultes & Reis (1995) defined ethnobotany as the study of the relationship that exists between people of primitive societies and their plant environment. Since ancient times, people in developing countries gathered plant resources to fulfill different fundamental needs and derive a significant part of their subsistence income (Schippmann *et al.* 2002). Indigenous knowledge systems associated with plant used patterns have contributed significantly to modern science and also play an important role in species conservation (Gemedo-Dalle *et al.* 2005, Kunwar and Bussmann 2008, Leduc *et al.* 2006, Martinez *et al.* 2006). The need for conserving biological diversity and the associated indigenous knowledge has been emphasized since the Rio Convention on Biological Diversity (CBD 1992). Hence, research and documentation of traditional knowledge through the ethnobotanical approach are important for the conservation and sustainable use of highly valuable plant species (Gemedo-Dalle *et al.* 2005).

Nepal is rich in biodiversity and considered as the natural storehouse of medicinal plants which are distributed heterogeneously in the different geographical belts (Chaudhary 1998, Kunwar *et al.* 2006). The country is blessed with the genetic diversity of flora and fauna because of complex topography and varied climatic conditions (Rajbanshi & Thapa 2019). Although the country comprises only 0.09% of the global land area, Nepal shares significant global biodiversity (Bhuju *et al.* 2007, MOFE 2018). Among the 28,000 species of medicinal plants recognized all over the world (IUCN 2015), 750 to 1850 species of the precious medicinal plants are reported to be found in Nepal (Manandhar 2002). Approximately half of the population of these plant species are considered as useful and of ethnobotanical significance (Kunwar & Bussmann 2008, Uprety *et al.* 2010), and around 25-50% are expected to have medicinal properties (Bhattarai *et al.* 2010, Shrestha & Shrestha 1999). The different ethnic communities residing in different geographical belts of Nepal depend on wild plants to fulfill their basic needs and have their own pool of ethno-medicinal knowledge about the plants available in their surroundings (Acharya & Acharya 2009, Bhattarai & Ghimire 2006, Bhattarai *et al.* 2009, Ghimire & Bastakoti 2009, Joshi *et al.* 2011, Kunwar *et al.* 2006, Mahato & Chaudhary 2005, Manandhar 2002, Panthi & Chaudhary 2003, Rokaya *et al.* 2010, Uprety *et al.* 2010).

Traditional knowledge systems are the sources of valuable aspects of modern development, especially for the sustainable use of forests, ecosystem management, and poverty reduction (Pei *et al.* 2009). Medicinal plants are recognized as important sources of novel biomolecules (Heinrich *et al.* 1998) which can be used in treating multiple illnesses (Campbell *et al.* 2002, Cragg & Newman 2003). The bioactive molecules and phytochemicals from plants can be used directly as a healing agent and also formulate drugs to cure various diseases (Andrade-Cetto 2009, Bhat *et al.* 2013, Idu 2009, Malla *et al.* 2015, Verma & Singh 2008). Various scientific evidence supports that numerous plant species are well known for their therapeutic potential (Ghorbani *et al.* 2006, Shanmugasundaram *et al.* 2011). However, traditional knowledge on the utilization of medicinal plants is under threat with current modernization (Gemedo-Dalle *et al.* 2005). Therefore, there is an urgent need for comprehensive studies for documentation and conservation of threatened species, which are vulnerable in condition and might be wiped out in the near future (Shrestha *et al.* 2014, Shrestha *et al.* 2016).

Ramechhap District, a part of Bagmati Province of Nepal has a population of 202,646 according to the national census of 2011 (CBS 2011), and falls within the territory of indigenous Tamangs communities associated with Newars, Chhetri, Thamis, Sherpas, Sunuwars, and Yolmos farming families who live in the rural countryside and utilize plant materials for livelihood (CBS 2009). To our knowledge, one scientific documentation on the ethnobotanical study of Ramechhap District has been reported by Sigdel *et al.* 2013, and since then no such studies were carried out in this region. Our objective was to explore the plant used patterns in Majhuwa and Chuchure villages of Khandadevi and Gokulganga Rural Municipalities (RM) of Ramechhap District. These two villages were selected, based on diversities of ethnic communities, rich floral diversity, and altitudinal gradients covering all the climatic zones of Ramechhap District. Specifically, we aimed to answer the following questions:

(i) What is the status of ethnobotanical knowledge within different communities of the Ramechhap District?
(ii) What conservation practices were undertaken by the indigenous people and local communities

(IPLCs) for the protection of indigenous knowledge, skills, practices, and innovations?

Materials and Methods

Study area

The study areas were located at the Ramechhap District of Bagmati Province of the Federal Democratic Republic of Nepal. The geography and climate of Ramechhap district broadly range from tropical to nival. The two villages of two different Rural Municipalities (RM) of Ramechhap District were selected for the ethnobotanical study; Majhuwa village of Khandadevi RM (27º24'05"N to 27º29'15"N and 85º55'05"E to 85º58'05"E) and Chuchure village of Gokulganga RM (27º29'52"N to 27º40'20"N and 86º09'02"E to 86º23'12"E) (Figure 1). These two rural municipalities of Ramechhap falls under the distinct altitudinal zones and comprises varied ethnic communities. The Khandadevi RM ranges in the altitudinal gradient of 300 meters above sea level (masl) to 2000 masl which comprises the area of 150.7 Km^2, a population of 31,383, and major ethnic groups of Newar, Chhetri, Kami, and Brahman. The Gokulganga RM ranges in the altitudinal gradient of 2000 masl to 4500 masl which comprises the area of 198 Km^2, a population of 20, 074, and major ethnic groups of Sherpa, Chhetri, Newar, and Kami (CBS, 2011) (Figure 2). So, we aimed to cover the uses of diverse plant species from all altitudinal zones and varied ethnic communities of Ramechhap.

Ethnobotanical study

The ethnobotanical studies were carried out during June-August of 2018 by using semi-structured interviews with 56 respondents. In Khandadevi RM, the interviews were carried out with 25 respondents (16 males and 9 females/ 7 were under the age of 30, 12 between the age of 30-60, 6 of the age above 60 including 7 traditional healers). Similarly, in Gokulganga RM, the interviews were carried out with 31 respondents (15 males and 16 females/ 8 were under the age of 30, 19 between the age of 30-60, 4 of the age above 60, including 15 traditional healers). The interviews were carried out in the Nepali language. The rapid rural appraisal (RRA) and participatory rural appraisal (PRA) tools were used for peoples' participation and acquire ethnobotanical knowledge from them (Martin 2010). The plant species were collected, and herbarium specimens were prepared by pressing and drying in the field using a natural drying technique (Forman & Bridson 1989) with slight modifications. All the plant species were scientifically identified at Tribhuvan University Central Herbarium (TUCH), Central Department of Botany, Kirtipur, Kathmandu, Nepal. All the voucher specimens were housed and preserved at the Department of Chemical Science and Engineering, Kathmandu University, Dhulikhel, Kavre, Nepal.

Quantitative ethnobotanical data analysis

Relative frequency of citations (RFC)

The relative frequency of citations (RFC) was used to evaluate the relative importance of plant species cited by informants and calculated as previous investigators (Shaheen *et al.* 2017) by the following formula.

$$RFC=\frac{FC}{N}$$

Where, FC is the number of informants reporting the use of a particular species and N is the total number of informants.

Informant consensus factor (ICF)

The homogeneity of the information in agreement in using plants with medicinal values was determined by informant consensus factor (ICF) which was calculated using the following formula (Heinrich & Gibbons 2001).

$$ICF=\frac{Nur-Nt}{Nur-1}$$

Where, N_{ur} is the number of use reports mentioned by the informant for given particular species and N_t is the number of species used by the majority of people. In each case, if a plant was mentioned by an informant as 'used' then we considered it as one 'use-report' (Amiguet *et al.* 2005, Gazzaneo *et al.* 2005).

Use value (UV)

The use value (UV) was calculated as previous investigators (Rokaya *et al.* 2010) for individual plant species to measure the importance of individual plant species by using the following formula.

$$UV=\sum\frac{U}{n}$$

Where, U is the number of use reports mentioned by the respondent and n is the total number of respondents.

Prior informed consent

Before the study began, we shared the purpose and objectives of our study with the local people, authorities, and relevant stakeholders of Khandadevi RM and Gokulganga RM. Preliminary informed consent about the documentation and dissemination of local knowledge of ethnobotanical uses of plant species was taken from all participants who were involved in PRA and RRA participatory interviews and discussions. As per the respondents' request, their name and the doses of plant extract preparation for medication were kept confidential.

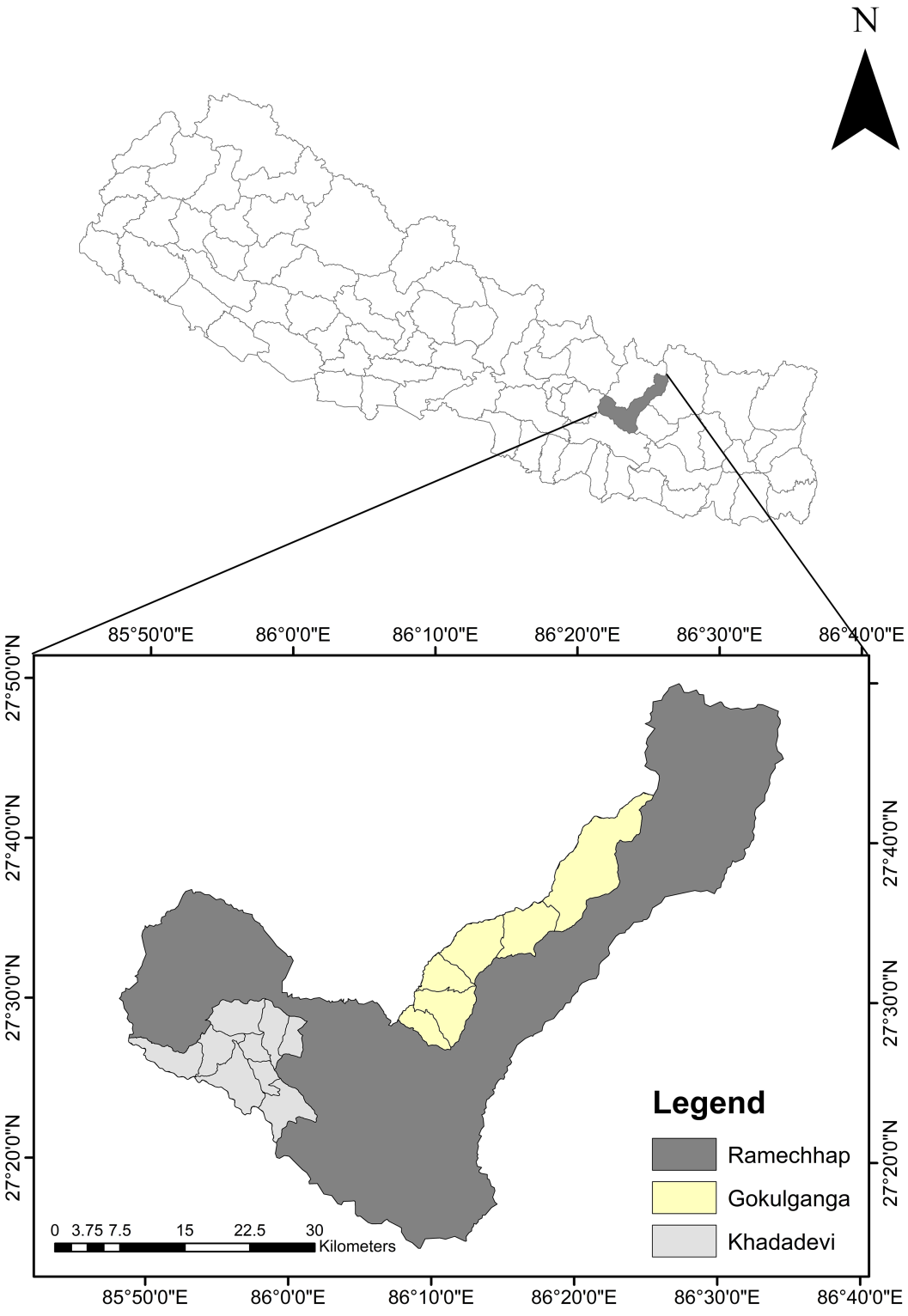

Figure 1. Map of Nepal showing Ramechhap District

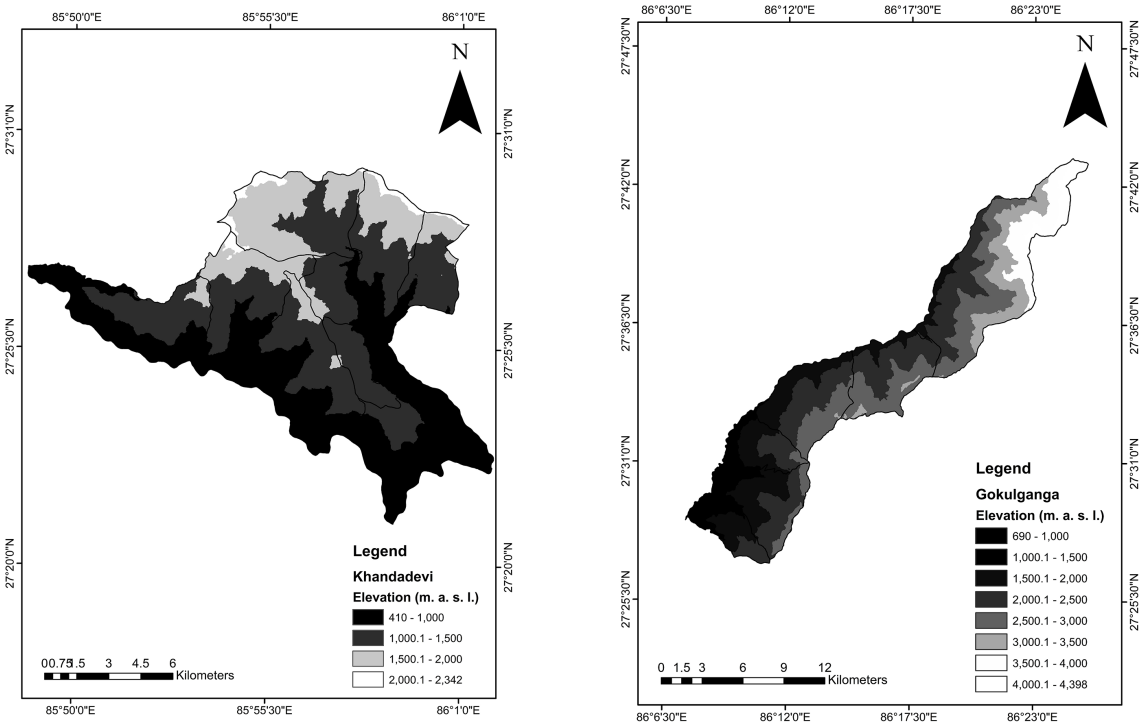

Figure 2. Khandadevi and Gokulganga Rural Municipality with elevation gradients

Results and Discussions

Diversity of uses

A total of 139 plant species (66 from Khandadevi RM, 38 from Gokulganga RM, and 35 commons to both places) belonging to 74 families were found to have ethnobotanical significance based on semi-structured interviews with 56 informants. Out of 139 plant species reported, 136 were of medicinal importance and used to treat different ailments such as gastro-intestinal disorders, cardiovascular disorder, ear, nose and throat (ENT) problems, dermal infection, urinary tract infections, pulmonary disorders, wounds, boils, and cuts. The other uses included religious, traditional rituals, making pickles, essential oil extraction, washing and dyeing, edible, timber, fodder, pesticides, and veterinary (Figure 3). Our results resembled with the reported literature on the plant used pattern in other parts of Nepal (Aryal *et al.* 2018, Bhattarai 2018, Ghimire *et al.* 2018, Rokaya *et al.* 2010, Shrestha & Dhillion 2003), and signified that local peoples have immense knowledge in using plants mainly as medicine. The new uses of *Lespisorus mehrae*, *Plumbago zeylanica*, *Pterocarpus santalinus*, *Rhus parviflora*, and *Roscoea auriculata* were found (Table 1). In comparison, Gokulganga RM was blessed with the high-value medicinal plant species, and some of them were used to export in the domestic and international market, contributing to the livelihoods of local communities. Besides their medicinal uses, the timber trade of high-value plant species such as *Acacia catetchu*, *Pinus roxburghii*, *Pterocarpus santalinus*, *Santalum album*, *Shorea robusta*, *Syzygium cumini*, and *Tamarindus indica* was also in practice in Khandadevi RM.

Leaves were the most used plant parts (18%) followed by root (17%), fruit (14%), whole plant (13%), bark (10%), stem (6%), flowers (5%), and rhizome (3%) (Figure 4) which was comparable with the previous literature in plant materials used pattern in Nepal (Bano et al. 2014, Malla et al. 2015). In Ramechhap, plant materials were used in the form of decoction, paste, juice, powder, soup, and extracted oil as in the other parts of Nepal (Ghimire et al. 2018). However, the juice was the most preferred method of preparation because of easy availability of the plant materials in their surroundings. In general, fresh plant parts were collected in different seasons at different stages of maturity, dried in shade, and stored in a dry place for further use. Oral intake and dermal application followed by nasal and smoking were the other common practices observed in Ramechhap, were also reported practice in the Dolakha District (Shrestha & Dhillion 2003) and the Humla District (Rokaya et al. 2010) of Nepal. The overall enumerations of plant species with ethnobotanical significance are presented in Table 1.

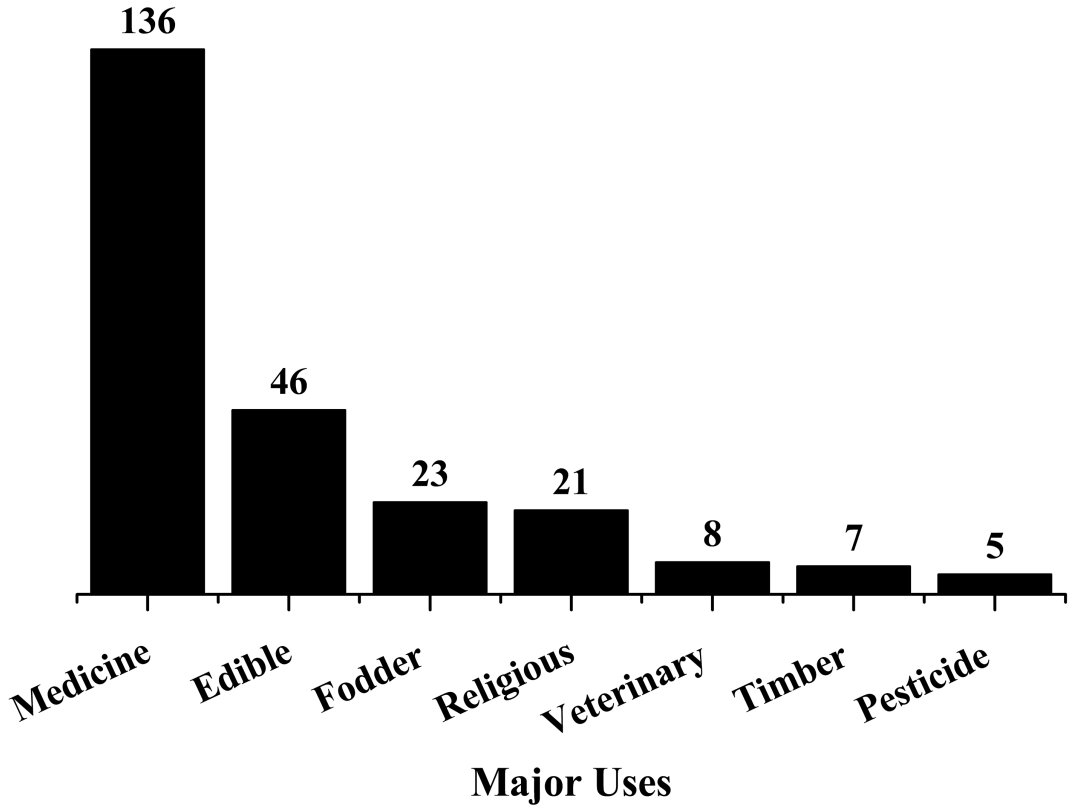

Figure 3. Major uses

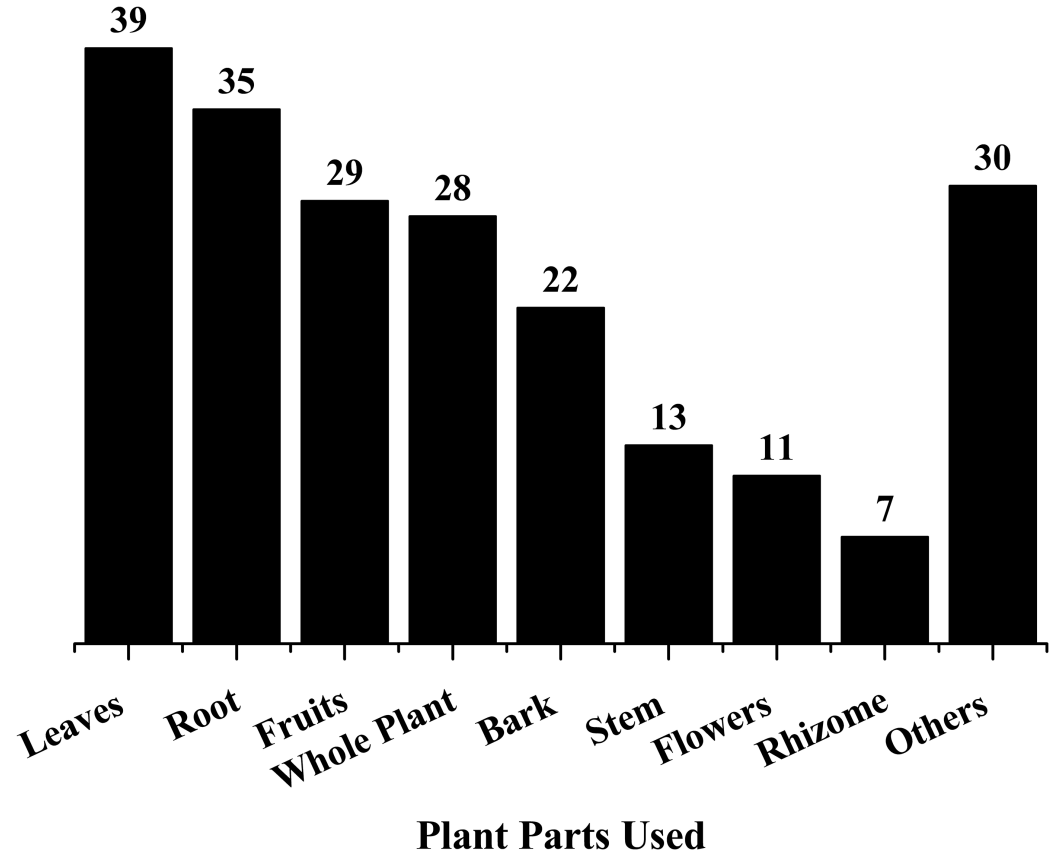

Figure 4. Plant parts used

Table 1. Plant species of Ramechhap District with ethnobotanical uses

Family	Scientific name / Voucher specimen number	Vernacular name / Life form	RFC	UV	Part used	Uses	Similar use references
Acanthaceae	*Justicia adhatoda* L. (RKM13-S4)	Asuro (S)	0.39	0.61	L	**Medicine;** leave juice was used to treat asthma, skin disease, cough and cold, fever, and blood pressure. **Other uses;** green manure, fodder, and fencing.	(Singh *et al*. 2012)
Acoraceae	*Acorus calamus* L. (RKM27-H17)	Bonjho (H)	0.82	1.00	Wh	**Medicine;** juice or paste was used to treat cough and cold, fever, asthma, chest pain, diarrhea, and dysentery. **Pesticides;** rhizome was used as pesticides.	(Aryal *et al*. 2018, Kunwar *et al*. 2006)
Alliaceae	*Fritillaria cirrhosa* D. Don (RGC2-H7)	Banlasun (H)	0.26	0.42	Bl	**Medicine;** the bulb was used to treat cough and cold, diarrhea, and headache in the form of juice or direct consumption. **Edible;** young leaves were used as a vegetable.	(Ghimire *et al.* 2001, Rokaya *et al.* 2010)
Amaranthaceae	*Chenopodium album* L. (RKM23-H11)	Bethu (H)	0.28	0.46	Wh	**Medicine;** the juice was used to treat back pain, bleeding, and body pain. **Fodder;** the plant was used as fodder. **Edible;** leaves were edible. **Additives;** ghee and honey.	(Dixit & Vakshasya 2019, Singh 2015)
	Achyranthes aspera L. (RKM11-H4)	Apamarga (H)	0.28	0.42	Wh	**Medicine;** the juice of the root was used to treat diarrhea, stomach problems, and dysentery. **Veterinary;** to treat the problem regarding expelling the placenta of animals after delivery of different domestic animals. **Religious;** worshiping to the God Shiva in Newari Culture.	(Baral & Kurmi 2006, Kunwar *et al.* 2009)
Amaryllidaceae	*Allium sativum* L. (RKM60-H39)	Lasun (H)	0.82	1.23	Bd	**Medicine;** the juice was used to treat gastritis, furuncles, altitude sickness, and sexual desire. **Edible;** young leaves were used as a vegetable. **Spices;** to make spices and different flavors. **Additives;** honey and ginger.	(Singh *et al.* 2011)
Anacardiaceae	*Mangifera indica* L. (RKM2-T1)	Aanp (T)	0.26	0.32	F, L & B	**Medicine;** leaves juice was used to treat diarrhea, dysentery, cough, and cold. The paste of the bark was used to treat syphilis and wounds. Gums were used to treat scabies and warts. Ripe fruits were diuretic, diaphoretic, and used for hemorrhages of intestines and lungs. **Edible;** fruits were edible. **Other uses;** woods were used to prepare furniture.	(Juárez-Vázquez *et al.* 2013, Singh *et al.* 2019)

	Rhus parviflora Roxb. (RKM69-S15)	Pithauli/ Satibayar (S)	0.33	0.59	F & B	**Medicine;** bark paste was used to treat muscular swelling and decoction was taken for dysentery. **Edible;** ripe fruits were edible. **Tobacco;** leaves were used in smoking. **Manure;** leaves were used to make compost. **Culture;** leaves were an important ingredient in wedding ceremony of '*Newari*' culture. **Religious;** leaves and fruits were used in different Hindu worshiping.	(Burlakoti & Kunwar 2008)
Apiaceae	*Centella asiatica* (L.) Urban (HKM34-H25)	Ghodtabre (H)	0.82	1.19	Wh	**Medicine;** the leave juice was used to treat fever, diarrhea, dysentery, urinary troubles, cut, wounds, throat, and skin diseases.	(Bhattarai 2018)
	Cuminum cyminum L. (RKM47-H34)	Kalo Jeera (H)	0.26	0.48	Wh	**Medicine;** juice was used to treat fever, body aches, and indigestion.	(Nasab & Khosravi 2014)
Apocynaceae	*Calotropis gigantea* (L.) Dryand. (RKM1-H1)	Aank (H)	0.39	0.61	L, B & Fl	**Medicine;** juice of leaves was used to treat cuts, wound, boils, fever, and body pain. Bark juice was used to treat diarrhea and dysentery. Flower powder was used to treat cough and cold. **Additives;** milk.	(Kunwar *et al.* 2009)
	Chonemorpha fragrans (Moon) Alston (RKM39-T11)	Gothale Phul (T)	0.28	0.73	L	**Medicine;** gum from leaves was used to treat skin disease, cuts, and wounds. **Fodder;** young leaves were used as fodder.	(Malla *et al.* 2015)
	Rauvolfia serpentina (L.) Benth. ex Kurz (RKM78-S17)	Sarpaganda (S)	0.64	1.00	R & L	**Medicine;** juice of root and leaves were used to treat dysentery, fever, and stomach problem.	(Rahman *et al.* 2010)
Asparagaceae	*Agave cantala* (Haw.) Roxb. ex Salm-Dyck (RKM51-H35)	Kettuke (H)	0.41	0.69	R & L	**Medicine;** root and leave juice was used to treat urinary tract problems. **Other uses;** cultivated as natural hedges to control soil erosion and the leaves were used to make ropes.	(Pathak 2010)
	Asparagus racemosus Willd. (RKM16-H8)	Ban Kurilo (H)	0.64	0.75	Rh/R	**Medicine;** the root was tonic, appetite-inducing, laxative, and antiseptic. The root juice was used to treat typhoid, loss of appetite, dysentery, stomach problems, and burning sensation during urination. **Veterinary;** root powder was used to increase milk and to treat the mulching disorder. **Edible;** tender shoot was used as a vegetable.	(Aryal *et al.* 2018, Kunwar *et al.* 2009)

Asphodelaceae	*Aloe vera* (L.) Burm.f. (RKM35-H26)	Ghiu Kumari (H)	0.39	0.69	L & Fl	**Medicine;** leave gel was used to treat blood pressure, diabetes, gastritis, indigestion, insomnia, anxiety, constipation, cardiovascular disease, burn, skin disease, pulmonary diseases, and joint pains. **Edible;** flowers were edible and used to make pickles.	(Singh *et al.* 2012)
Asteraceae	*Ageratina adenophora* (Spreng.) King & H. Rob. *(*RKM17-S9*)*	Banmara Kalo (H)	0.82	1.26	L	**Medicine;** leaves powder was used to treat wounds and cuts.	(Aryal *et al.* 2018)
	Ageratum conyzoides L. (RKM36-H27)	Gandhe (H)	0.39	0.61	R, B & L	**Medicine;** paste or juice was used to treat wounds, ruptures, cuts, and remove thorns in the feet.	(Aryal *et al.* 2018)
	Artemisia indica Willd. (RKM89-H56)	Titepati (H)	0.80	1.15	L & St	**Medicine;** juice of leaves and stem was used to treat diarrhea, dysentery, headaches, body pain, anorexia, stomach problem, cough and cold, fever, gastritis, and worms.	(Singh *et al.* 2012)
	Inula cappa (Buch.-Ham. ex D. Don) DC. (RGC14-H)	Gai Tihare (H)	0.23	0.48	Sh & R	**Medicine;** root and shoot juice helps to activate the nervous system and used to treat joints problems, indigestion, and gastritis.	(Thapa 2012)
	Ligularia amplexicaulis DC. (RGC35-H42)	Nagre Jhar (H)	0.28	0.42	S, L & Fl	**Medicine;** paste of the plant was used to treat rheumatic pain and sprain. **Oil;** essential oils were extracted.	(Manandhar 1995)
	Tagetes erecta L. (RKM79-H51)	Sayapatri (H)	0.73	0.98	Wh	**Medicine;** plant juice was used to treat fever, cough and cold, rheumatic pain, eye problems, and skin problems. **Religious;** the plant has ornamental value and flower heads were offered to God. **Cultural;** flowers were used in '*Dashain*' and '*Tihar*' festival.	(Dhami 2008)
Berberidaceae	*Berberis aristata* DC. (RGC11-S6)	Chutro (S)	0.80	1.11	R, Sh & F	**Medicine;** root juice was used to treat fever, diarrhea, and jaundice. **Aesthetic;** root and stem barks were sources of dye. **Edible;** ripe fruits were edible.	(Aryal *et al.* 2018, Rokaya *et al.* 2010)
	Mahonia napaulensis DC. (RGC20-S10)	Jamaneman dro (S)	0.58	1.00	Sh	**Medicine;** bark juice was used to treat diabetes, blood pressure, jaundice, and eye problems. **Dye;** bark was used to make a color. **Edible;** ripe fruits were edible.	(Manandhar 1993, Shrestha & Dhillion 2003)
Betulaceae	*Alnus nepalensis* D. Don (RKM93-T39)	Uttis (T)	0.73	1.17	B	**Medicine;** paste of the bark was used to treat broken body parts and burn skin. **Timber;** wood was widely used as timber for short term purposes. **Other uses;** plants were used to control landslide and other soil erosion.	(Baral & Kurmi 2006, Rokaya *et al.* 2010)

	Betula utilis D.Don (RGC6-H15)	Bhujapaat (H)	0.39	0.65	B, Wh	**Medicine;** paste of the bark was used to treat wounds, burns, and cuts. Juice of bark was used to treat fever, cough and cold, internal bleeding, diarrhea, bronchitis, and jaundice. **Fodder;** leaves were used as fodder and shoots for construction.	(Manandhar 2002)
Bignoniaceae	*Oroxylum indicum* (L.) Benth. ex Kurz (RKM86-T36)	Totalo (T)	0.33	0.59	F	**Medicine;** bark juice was used to treat fever, diarrhea, and jaundice. Seed paste was used to treat would and cuts. **Religious;** fruits and seeds were used to offer goddesses.	(Kunwar *et al.* 2009)
Brassicaceae	*Brassica campestris* L. (RKM91-H57)	Tori (H)	0.75	1.15	Wh	**Medicine;** root juice was used to treat bronchitis. Oil was used to relieve earaches and body pain. **Oil;** edible oil was obtained from seeds. **Edible;** leaves were used as vegetables. **Preservatives;** oil was used as a preservative for dry food and pickles. **Other uses;** husks were used as fertilizer in the cultivation of different plants.	(Tamang & Singh 2014)
Bromeliaceae	*Ananas comosus* (L.) Merr. (RKM26-H14)	Bhuikatahar (H)	0.39	0.53	F & L	**Medicine;** leaves and fruit juice were used to treat indigestion, dehydration, fever, blood pressure, and mental problem. **Edible;** fruits were consumed directly.	(Baral & Kurmi 2006)
Cannabaceae	*Cannabis sativa* L. (RGC15-H24)	Ganja (S)	0.62	1.05	Fl	**Medicine;** leaves juice was used to treat stomach problems, diarrhea, inflammation, cough, and cold. Flowers were used as a nervous stimulant. **Edible;** seeds were roasted to make pickles.	(Rana *et al.* 2015)
Caprifoliaceae	*Nardostachys grandiflora* DC. (RGC21-H31)	Jatamansi (H)	0.75	1.11	R/ Rh	**Medicine;** rhizome juice and paste were used to treat diarrhea, fever, dysentery, and stomach problem. **Other uses;** dried leaves were used as incense.	(Ghimire *et al.* 2001, Lama *et al.* 2001)
Caryophyllaceae	*Drymaria diandra* Blume (RKM3-H2)	Abhijalo (H)	0.30	0.50	Wh	**Medicine;** the juice of the plant was used to treat headaches, sinusitis, diarrhea, dysentery, fever, and stomach problem.	(Singh *et al.* 2012)
Combretaceae	*Terminalia bellirica* (Gaertn.) Roxb. (RKM19-T16)	Barra (T)	0.39	0.69	F	**Medicine;** fruits were considered as digestive, tonic, and laxative. Powder of fruits was used to treat gastritis, fever, bronchitis, and respiratory problems. **Edible;** fruits were edible. **Other uses;** woods were used as timber and fuelwood.	(Baral & Kurmi 2006)

	Terminalia chebula Retz. (RKM42-T12)	Harro (T)	0.51	0.75	F & Hw	**Medicine;** fruits were purgative, tonic, and stomachic. Powder of fruit was used to treat indigestion, loss of appetite, and throat, liver, tooth, and eye problems. **Edible;** fruits were edible. **Other uses;** heartwoods were used as timber and fuelwood.	(Rahman *et al.* 2010)
Convolulaceae	*Cuscuta reflexa* Roxb. (RKM6-CH1)	Akash Beli (CH)	0.64	0.86	Wh	**Medicine;** plant juice was used to treat jaundice and ash of plant were used to treat cuts and wound.	(Shaheen *et al.* 2017)
Crassulaceae	*Bryophyllum pinnatum* (Lam.) Oken (RKM66-H46)	Pattharchatta (H)	0.57	0.92	L	**Medicine;** the leave juice was used to treat inflammation, snake bite, stomach problem, joint pain, constipation, dysentery, and stone. But poisonous to some animals.	(Baral & Kurmi 2006, Malla *et al.* 2015)
Cucurbitaceae	*Coccinia grandis* (L.) Voigt (RKM38-CH3)	Gol Kakri (CH)	0.57	1.00	R & F	**Medicine;** root and fruit juice were used to treat dysentery, body pain, and syphilis. **Edible;** fruit can be consumed directly.	(Shrestha *et al.* 2016)
	Herpetospermum pedunculosum (Ser.) C.B. Clarke (RGC4-CH2)	Bankarela (CH)	0.17	0.23	R	**Medicine;** root juice or paste was used to treat bleeding, fever, cough, headache, urinary infection, and snake bite.	(Lama *et al.* 2001, Manandhar 2002)
	Momordica charantia L. (RKM48-CH7)	Karela (CH)	0.46	0.69	F	**Medicine;** fruit juice was used to treat indigestion, boost appetite, fever, skin diseases, and diabetes. **Edible;** fruits were used as a vegetable.	(Dhami 2008)
	Trichosanthes tricuspidata Lour. (RGC19-CH6)	Indreni Lahara (CH)	0.41	0.63	R	**Medicine;** root juice was used to treat asthma, stomach problem, fever, cough, and cold.	(Bhattarai & Khadka 2016)
Cupressaceae	*Juniperus recurva* Buch.-Ham. ex D. Don (RGC13-T9)	Dhupi (T)	0.69	1.05	L, B & F	**Medicine;** fruits were eaten directly to treat fever and bark paste were used to treat wounds. **Religious;** leaves were used to make incense.	(Rokaya *et al.* 2010)
Dipterocarpaceae	*Shorea robusta* Gaertn.f. (RKM76-T32)	Saal (T)	0.39	0.57	L & Hw	**Medicine;** the resin was used to treat fever, dysentery, blood regulation, pneumonia, and skin disease. **Timber;** heartwoods were used as timber. **Fodder;** leaves were used as fodder. **Religious;** leaves were important ingredients for different Hindu worships.	(Singh *et al.* 2012)
Elaeocarpaceae	*Elaeocarpus sphaericus* (Gaertn.) K. Schum.* (RKM75-T31)	Rudrakchya (T)	0.39	0.61	F	**Medicine;** seeds were used to treat skin disease, blood pressure, and heart diseases. **Religious;** seeds were used for worshiping God Shiva in the Hindu religion.	(Bhattarai 2017)

Equisetaceae	*Equisetum diffusum* D. Don (RGC28-H36)	Kurkure Jhar (H)	0.21	0.38	R	**Medicine;** root juice was used to treat jaundice, fever, eye problem, and cough, and cold.	(Manandhar 1998)
Ericaceae	*Gaultheria fragrantissima* Wall. (RGC12-S7)	Dhasingare (S)	0.51	0.78	L & Sh	**Medicine:** leaves and barks paste were used to treat body pain, joints pain, cough, and cold. **Other uses;** essential oils were extracted from leave and seed.	(Baral & Kurmi 2006)
	Rhododendron anthopogon D. Don (RGC44-S19)	Sunpaati (S)	0.39	0.69	L	**Medicine;** juice and paste of leaves were used to treat fever, cough, and cold, joints pain, body pain, headaches, and vein pain. **Veterinary;** plant odor was considered as the anti-poisonous agent for animals. **Essential oil;** leaves were used to extract essential oil and perfumes. **Religious;** leaves were used to make incense sticks.	(Kumar *et al.* 2009)
	Rhododendron arboretum Sm. (RGC30-T23)	Laligurans (T)	0.64	1.07	Fl	**Medicine and Edible;** flowers were consumed directly or in the form of juice and paste to treat throat problems, diarrhea, and dysentery, wound, and bleeding.	(Joshi & Joshi 2009)
Euphorbiaceae	*Jatropha curcas* L. (RKM77-S16)	Sajiwan (S)	0.39	0.59	R & Sd	**Medicine;** root juice was used to treat inflammation, boils, wound, tooth problems, poisonous, cough, fever, and asthma. **Oil;** seeds were used to extract oil. **Other uses;** plants were cultivated to control soil erosion.	(Dhami 2008)
	Phyllanthus emblica L. (RKM7-T2)	Amala (T)	0.28	0.42	F & L	**Medicine;** Juice of bark, leaves, and fruits were used to treat gastritis, dysentery, and constipation. **Fodder;** leaves were used as fodder. **Edible;** fruits were edible.	(Baral & Kurmi 2006)
Fabaceae	*Acacia catetchu* (L.f.) Willd. (RKM53-T18)	Khayar (T)	0.46	0.76	Hw & L	**Medicine;** the decoction of heartwood was used to treat chest pain, asthma, cough and cold, skin diseases, and fever. **Timber;** heartwood was strong and used as timber, poles, and other household purposes. **Fodder;** leaves were used as fodder.	(Singh *et al.* 2012)
	Bauhinia vahlii Wight & Arn. (RKM24-C1)	Bharla Rato (C)	0.17	0.30	R & Fl	**Medicine;** root juice was used to treat bleeding, dysentery, diarrhea, indigestion, and toxicity.	(Singh 2016)
	Bauhinia variegata (L.) Benth. (RKM55-T21)	Koiralo (T)	0.46	0.73	B & Fl	**Medicine;** bark and flower juice were used to treat dysentery, constipation, bleeding, diabetes, diarrhea, and indigestion. **Edible;** flowers and young seeds were used as vegetables and pickles. **Other uses;** heartwood was used in the construction of houses and other furniture.	(Joshi & Joshi 2000)

	Cassia fistula L. (RKM70-T28)	Raj Brikchya (T)	0.33	0.57	F & B	**Medicine;** bark of the stem was boiled and consumed to treat throat problems, cough, and cold. Fruits were consumed directly to treat urinary tract infections, diarrhea, and constipation.	(Tamang *et al.* 2017)
	Dalbergia sissoo Roxb. (RKM83-T34)	Sisso (T)	0.39	0.61	B & R	**Medicine;** root or bark juice was used to treat fever, diarrhea, and dysentery. **Other uses;** heartwood was widely used in construction and as fuelwood.	(Singh *et al.* 2012)
	Macrotyloma uniflrorum (Lam.) Verdc.* (RKM32-H23)	Gahat (H)	0.26	0.51	Lg	**Medicine;** legume was consumed to treat diabetes and kidney stone. **Edible;** legume was used as a vegetable.	(Malla *et al.* 2014)
	Mimosa pudica L. (RKM58-H38)	Lajjawoti Jhar (H)	0.46	0.55	R	**Medicine;** root juice was used to treat joints pain, stomach problems, and body cooling.	(Uprety *et al.* 2011)
	Mimosa rubicaulis Lam. (RKM12-H5)	Areri Kanda (H)	0.32	0.50	Wh	**Medicine;** paste of the bark was used to treat skin problems, wound healing, and strain. The decoction of leaves was used to treat fever and urinary disorder. **Fodder;** young leaves were used as fodder.	(Baral & Kurmi 2006, Manandhar 2002)
	Pterocarpus santalinus L.f.* (RKM71-T29)	Raktachandan (T)	0.39	0.57	Hw	**Medicine;** paste and powder of bark and heartwood were used to treat stomach problems, skin disease, fever, and mental aberrations. **Religious;** leaves and heartwood were used for worshiping Gods. **Timber;** heartwood was used as timber and has high economic value.	(Saikia *et al.* 2006)
	Quercus lanata Sm. (RGC3-T4)	Banjh (T)	0.30	0.46	St, B, L & Hw	**Medicine;** bark paste was used to treat body pain. **Fodder;** leaves were lopped for fodder. **Other uses;** heartwoods were used to make different agricultural equipment, especially the plowing machine.	(Rokaya *et al.* 2010)
	Tamarindus indica L. (RKM90-T38)	Titri (T)	0.28	0.36	R, B & F	**Medicine;** bark and root juice were used to treat diarrhea, constipation, inflammation, indigestion, and rheumatic pain. **Edible;** fruits were edible and used as pickles. **Fodder;** leaves were used as fodder. **Timber;** heartwood was used as timber.	(Joshi *et al.* 2011)
	Trigonella foenum-graecum L.* (RKM62-H40)	Methi (H)	0.57	0.88	Sd & L	**Medicine;** seeds were used to boost appetite. **Edible;** leaves were used as vegetables.	(Baral & Kurmi 2006)
Gentianaceae	*Swertia chirayita* (Roxb. ex Fleming) H. Karst. (RGC10-H20)	Chiraito (H)	0.75	1.03	Wh	**Medicine;** juice or tea of plant was used to treat fever, body pain, and anxiety. **Additives;** milk and honey.	(Bhattarai 2018)

Lamiaceae	*Dracocephalum heterophyllum* Benth. (RGC9-H19)	Chinchine Jhar (H)	0.69	0.92	L	**Medicine;** leave juice was used to treat cough and cold, indigestion, sinusitis, burn, and fever. The paste of leaves was used for curing snakebites.	(Baral & Kurmi 2006)
	Ocimum basilicum L. (RKM15-H6)	Babari (H)	0.75	1.00	Wh	**Medicine;** leaves juice was used to treat fever, cough and cold, headache, stomach problems, and jaundice. **Edible;** leaves were used as pickles. **Pesticide;** the whole plant was used as a pesticide.	(Baral & Kurmi 2006)
	Pogostemon benghalensis (Burm.f.) Kuntze (RKM74-H49)	Rudilo (H)	0.64	0.88	L	**Medicine;** leaves paste and juice were considered as antidandruff and antifungal and used to treat skin disease, warts and, wounds, cough, cold, and fever.	(Dhami 2008)
	Ocimum tenuiflorum L. (RKM92-H58)	Tulasi (H)	0.64	0.96	Wh	**Medicine;** leave juice was used to treat fever, cough and cold, typhoid, skin disease, anorexia, bronchitis, dysentery, diarrhea, and toothache. **Religious;** plant was used in worshiping Gods in the Hindu religion.	(Acharya & Pokhrel 2006)
Lauraceae	*Cinnamomum glaucescens* (Nees) Hand.-Mazz. (RGC32-T24)	Malagiri (T)	0.46	0.67	Sd	**Medicine;** paste of seed was used to treat muscular swelling. **Oil;** seeds were used to extract oils.	(Manandhar 2002)
	Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm. (RKM87-T37)	Tejpatta (T)	0.75	1.13	L	**Medicine;** leaves and bark were consumed directly to treat cough and cold, diarrhea, vomiting, and stomach problems. **Essential Oils;** leaves were used to extract oils. **Edible;** bark and leaves were edible and used in daily meals.	(Ranjitkar & Rajbhandary 2008)
	Lindera neesiana (Wall. ex Nees) Kurz. (RGC43-S18)	Siltimur (S)	0.46	0.67	F	**Medicine;** fruits were directly consumed to treat diarrhea, indigestion, cough and cold, and blood pressure. **Veterinary;** fruits were used to treat different ailments of domestic animals.	(Rokaya *et al*. 2010)
	Persea odoratissima (Nees) Kostermans (RGC26-T17)	Kharani (T)	0.57	0.76	B & L	**Medicine;** bark juice and paste were used to treat wounds, allergy, and dislocated bones. **Pesticide;** leaves powder was used to kill rodents. **Fodder;** fresh and young leaves were used as fodder.	(Bhattarai 2017)
Lycopodeceae	*Lycopodium clavatum* L. (RGC34-CH10)	Nagbeli Lahara (CH)	0.33	0.42	Fl & R	**Medicine;** paste and juice of plant were used to treat fever, headache, wound, and skin disease.	(Rana *et al.* 2015)

Lythraceae	*Punica granatum* L.* (RKM10-S3)	Anar (S)	0.39	0.55	F & B	**Medicine;** bark paste was used to treat inflammation. Powder of rind of fruits was used to treat diarrhea and dysentery. Bark act as an antifungal agent and used in wound healing. **Edible;** fruits were edible and can be consumed directly.	(Ghimire *et al.* 2001)
Malvaceae	*Hibiscus rosa-sinensis* L. (RKM33-S9)	Ghanti Phul (S)	0.28	0.53	Fl	**Medicine;** root and flower juice were used to cool down the body and treat blood pressure, urinary problems, and excess bleeding. **Religious;** plants were cultivated for ornamental purposes and religious use.	(Baral & Kurmi 2006)
Melanthiaceae	*Paris polyphylla* Sm. (RGC42-H50)	Satuwa (H)	0.60	0.84	R	**Medicine;** root paste was used to treat burn, cut, wound, diarrhea, dysentery, and poison. **Veterinary;** the root was used to treat different ailments of domestic animals.	(Bhattarai 2018)
Meliaceae	*Azadirachta indica* A.Juss.* (RKM63-T25)	Neem (T)	0.46	0.53	L & Sh	**Medicine;** bark juice was used to treat fever, body pain, pneumonia, dysentery, cough and cold, tooth problems, and urinary complaint.	(Joshi & Joshi 2000)
	Cipadessa baccifera (Roth) Miq. (RKM64-S14)	Paileti (S)	0.33	0.50	R, Sh & B	**Medicine;** root juice was used to treat cough and cold, indigestion, and stomach problem. **Edible;** ripe fruits were edible. **Other uses;** twigs were used as toothbrushes.	(Malla & Chhetri 2009, Rao *et al.* 2011)
Menispermaceae	*Tinospora sinensis (Lour.)* Merr. (RKM41-CH5)	Gurjo (CH)	0.62	0.86	Wh	**Medicine;** plant juice was used to treat urinary tract infection and diabetes. **Other uses;** the stem was used to make herbal tea.	(Malla *et al.* 2015)
	Stephania glandulifera Miers (RKM40-CH4)	Gundru Gano (CH)	0.28	0.61	Tu	**Medicine;** root juice was used to treat constipation, bleeding, skin disease, gastritis, diarrhea, and indigestion. **Veterinary;** tuberous roots were given to cattle to treat diarrhea.	(Bhattarai & Khadka 2016)
Moraceae	*Ficus benghalensis* L. (RKM18-T5)	Bar (T)	0.44	0.69	R & L	**Medicine;** infusion of the bark and root juice was used to treat diarrhea, dysentery, and hair problems. **Religious;** leaves and branches were important ingredients for different religious and cultural functions. **Fodder;** young leaves were used as fodder. **Other uses;** heartwood was used as timber and fuelwood.	(Rahman *et al.* 2010)
	Ficus benjamina L. (RKM85-T35)	Swami (T)	0.39	0.61	Hw & L	**Medicine;** leaves paste and latex were used to treat boils, cuts, and wounds. **Religious;** leaves were important ingredients in the different events of the Hindu religion. **Timber;** heartwood was used as timber.	(Kunwar & Bussmann 2006)

	Ficus religiosa L. (RKM67-T27)	Pipal (T)	0.46	0.73	L, Rn & Hw	**Medicine;** infusion of bark and leaves juice were used to treat strain, muscle crack, broke, skin disease, and headache. **Religious;** important plant for Hindu and Buddhist cultures. **Fodder;** leaves were used as fodder. **Other use;** heartwood was used as timber and fuelwood.	(Singh & Hamal 2013)
	Ficus semicordata Buch.-Ham. ex Sm. (RKM52-T16)	Khanyu (T)	0.46	0.75	Wh	**Medicine;** root juice was used to treat leprosy and fever. Fruit act as a laxative. **Fodder;** leaves were used as fodder. **Edible;** fruits ae edible and can be consumed directly. **Other uses;** bark was used to make rope and woods were used as fuelwood.	(Kunwar & Bussmann 2006)
Musaceae	*Musa paradisiaca* L. (RKM50-ST1)	Kera (ST)	0.39	0.61	R, F & Fl	**Medicine;** root juice was used to treat diarrhea, joints pain, body heating, and excess bleeding. **Edible;** flowers were used as pickles and fruits were edible.	(Thapa 2012)
Myricacea	*Myrica esculenta* Buch.-Ham. ex D.Don (RGC25-T14)	Kaphal (T)	0.57	0.80	B & F	**Medicine;** bark paste was used to treat broken body parts and decoction of the bark was used to treat dysentery. **Edible;** ripe fruits were edible and can be consumed directly.	(Joshi & Joshi 2009)
Myrtaceae	*Psidium guajava* L. (RKM8-T3)	Amba (T)	0.28	0.42	L, F & B	**Medicine;** bark and leaves juice were used to treat gastritis, fever, dysentery, and constipation. **Fodder;** young leaves were used as fodder. **Edible;** fruits were edible.	(Raut *et al.* 2018; Rokaya *et al.* 2014)
	Syzygium cumini (L.) Skeels (RKM43-T13)	Jamuna (T)	0.46	0.73	F, B & Hw	**Medicine;** bark and leaves juice were used to treat diarrhea and diabetes. **Edible;** fruits were edible and can be consumed directly. **Fodder;** young leaves were used as fodder. **Other uses;** heartwood was used as construction material, furniture, and fuelwood.	(Baral & Kurmi 2006)
	Syzygium operculatum (Roxb.) Nied. (RKM57-T22)	Kyamuno (T)	0.39	0.61	B, L & Hw	**Medicine;** smoke of leaves and barks powder were used to treat headaches and sinusitis. **Other uses;** Heartwood was used as timber and fuelwood.	(Thapa 2012)
Nephrolepidaceae	*Nephrolepis cordifolia* (L.) K. Presl (RKM25-H_FN12)	Bhui Amala (Fn/H)	0.46	0.80	R & F	**Medicine;** root and flower paste were used to treat jaundice, boils, and skin problems.	(Kichu *et al.* 2015)
Nyctaginaceae	*Mirabilis jalapa* L. (RKM59-S13)	Lankasani Phul (S)	0.35	0.69	Fl, R & L	**Medicine;** root juice was purgative and poultices which was used to treat diarrhea and menstrual disorder.	(Bhattarai & Khadka 2016)

Ophiocordycipitaceae	*Ophiocordyceps sinensis* (Berk.) Sung et al. (RGC46-FU1)	Yarshagumba (Fu)	0.46	0.67	Wh	**Medicine;** the whole plant was consumed directly to boost up body strength. **Additives;** milk and honey. **Other uses;** commercial values.	(Devkota 2006)
Orchidaceae	*Dactylorhiza hatagirea* (D.Don) Soó (RGC40-H45)	Panch Aunle (H)	0.62	0.88	R/ Rh	**Medicine;** root powder and paste were used to treat wounds, snake bite, and burn. **Edible;** young leaves were used as a vegetable.	(Shrestha *et al.* 2016)
	Dendrobium densiflorum Lindl. (RGC23-E2)	Jeewanti (E)	0.28	0.50	Wh	**Medicine;** paste of pulps was used to treat skin disease. **Other uses;** flowers were considered ornamental.	(Subedi *et al.* 2013)
Oxalidaceae	*Oxalis corniculata* L. (RKM28-H18)	Chari Amilo (H)	0.69	1.00	Wh	**Medicine;** plant juice was used to treat wounds, eye problems, stomach problems, joints pain, dysentery, fever, and diarrhea.	(Manandhar 2002)
Papaveraceae	*Argemone mexicana* L. (RKM84-H53)	Satyanasi (H)	0.57	0.88	R	**Medicine;** root juice or milky juice was used to treat skin disease, jaundice, cough, and cold.	(Singh *et al.* 2012)
Parmeliaceae	*Parmelia nepaulensis* Tayl. (RGC24-L1)	Jhyau Seto (L)	0.57	1.11	Th	**Medicine;** thallus powder was used to treat wounds and cuts.	
Pedaliaceae	*Sesamum orientale* L. (RKM88-H55)	Til Kalo (H)	0.39	0.57	R & Sd	**Medicine;** juice and paste of seed and root were used to treat dysentery, bleeding, constipation, and skin dryness. **Oil;** seeds were used to extract oil. **Edible;** seeds were eaten in the form of pickles and also consumed directly.	(Baral & Kurmi 2006)
Pinaceae	*Pinus roxburghii* Sarg. (RKM54-T20)	Khote Salla (T)	0.69	1.11	Hw, Rn, Sd & L	**Medicine;** paste and juice of resin, seed, and bark were considered as antiseptic and tonic and used to treat indigestion, cough and cold, skin disease, asthma, and tuberculosis. **Timber;** heartwood was used as timber and also used to make furniture and other construction materials. **Other uses;** powder of heartwood, seed, and leaves were used to make incense.	(Rajbhandari 2001)
	Pinus wallichiana A. B. Jacks. (RKM37-T10)	Gobre Salla (T)	0.69	1.00	Hw & L	**Timber;** wood was used as timber. **Medicine;** resins were used to treat cuts and wounds. **Other uses;** powder of bark, leaves, and heartwood were used to make incense.	(Joshi & Joshi 2009, Rokaya *et al.* 2010)
Piperaceae	*Piper longum* L. (RKM68-H47)	Pipla (H)	0.41	0.63	Wh	**Medicine;** fruit juice was used to treat fever, cough, and cold.	(Malla *et al.* 2015)
Plantaginaceae	*Plantago major* L. (RGC36-H43)	Nase Jhar (H)	0.28	0.42	Wh	**Medicine;** plant juice was used to treat, fever, stomach problems, cough, and cold.	(Kunwar & Adhikari 2005)

Plumbaginaceae	*Plumbago zeylanica* L. (RKM30-H21)	Chitu/Chitrak (H)	0.46	0.82	R	**Medicine;** root juice and paste were used to treat skin disease, cold and cough, asthma, constipation, diarrhea, and dysentery. The milky juice of the root was used to treat scabies.	(Xavier *et al.* 2014)
Poaceae	*Avena sativa* L.* (RGC22-H_G32)	Jaun (G)	0.82	0.50	Gr	**Medicine;** spikes were laxative. Powder of grains was used to treat indigestion. **Edible;** grains were edible. **Fodder;** plants were used as fodder. **Religious;** grains were used in different Hindu worships.	(Ahmad *et al.* 2011)
	Cynodon dactylon (L.) Pers. (RKM31-H22)	Dubo Seto (H)	0.57	0.88	Wh	**Medicine;** plant juice was used to treat cut, wound, urinary, and bladder complaints. **Religious;** in worshiping during various religious events. **Cultural;** at the wedding ceremony.	(Singh *et al.* 2012)
	Dendrocalamus hamiltoni Neer & Arn. ex Munro (RKM14-G1)	Baans (G)	0.46	0.69	Cl & L	**Medicine;** water inside the stem helps in increasing body strength and sexual desire. **Edible;** tender shoots were used as a vegetable (Commonly called *TAMA*). **Fodder;** leaves were used as fodder. **Other uses;** culms were used in construction and making baskets and mats.	(Aryal *et al.* 2018)
	Drepanostachyum intermedium (Munro) Keng f. (RGC37-G2)	Nigalo (G)	0.69	1.01	Wh	**Fodder;** leaves were used as fodder. **Other uses;** in the preparation of weaving mats and baskets and walking sticks.	(Malla & Chhetri 2009)
	Imperata cylindrica (L.) P.Beauv. (RKM81-G3)	Siru (G)	0.46	0.75	R	**Medicine;** root juice was used to treat worms, fever, and diarrhea. **Fodder;** plants were gathered for fodder.	(Manandhar 2002, Rokaya *et al.* 2010)
	Thysanolaena maxima (Roxb.) O. Ktze. (RKM9-GS1)	Amliso (GS)	0.58	0.67	R & In	**Medicine;** root juice was used to treat fever, constipation, body pain, and joints problems. **Fodder;** plants were gathered as fodder. **Other uses;** inflorescences were used as a broom.	(Maity *et al.* 2004)
	Zea mays L.* (RKM61-G1)	Makai (G)	0.64	0.94	Gn	**Medicine;** grains were used to reduce sugar levels in diabetes patients. **Edible;** grains were edible. **Fodder;** leaves were used as fodder. **Other uses:** husks were used to make household goods.	(Malla & Chhetri 2009)

Polygonaceae	*Rheum acuminatum* Hook f. and Thomson ex Hook. (RGC38-H43)	Padamchal (H)	0.57	0.75	R	**Medicine;** root juice was used to treat fever, cough and cold, and body pain. **Edible;** petioles can be consumed as pickles. **Side effects;** overconsumption may cause gastritis and stomach problems. **Additives;** sugar and salt.	(Bhattarai & Khadka 2016)
	Rumex nepalensis Spreng. (RGC16-H28)	Halhale (H)	0.57	0.80	L	**Medicine;** boiled leaves juice was used to treat lung disease, cough and cold, sinusitis, headache, wound, and body pain. **Edible;** tender leaves and shoots were used as vegetables.	(Singh *et al.* 2012)
Polypodiaceae	*Lepisorus mehrae* Fraser-Jenk. (RGC7-E1)	Bispech (E)	0.73	1.03	Rh	**Medicine;** rhizome powder was used to treat back pain, stomach problems, and fever. **Pesticide;** rhizome powder was used as a pesticide. **Veterinary;** rhizome powder was used to treat diarrhea in animals and wound on their mouth.	(Uprety *et al.* 2010)
Pteridaceae	*Cheilanthes dalhousiae* Hook. (RKM72-H_FN48)	Rani Sinka (Fn/H)	0.64	0.86	Rh	**Medicine;** rhizome powder was used to treat gastritis and stomach problems.	(Rana *et al.* 2015)
Ranunculaceae	*Anemone vitifolia* Buch.-Ham. ex DC. (RGC18-H30)	Homachar (H)	0.62	0.86	Wh	**Medicine;** the paste of plant was used to treat stomach problems, headache, mental disorder, diarrhea, vomiting, and constipation. **Edible;** shoot can be consumed as vegetable and spices.	(Malla *et al.* 2015)
	Aconitum ferox Wall. ex Ser. (RGC8-H16)	Bismar (H)	0.69	1.03	R	**Medicine;** root paste and powder were used to treat fever, diarrhea, vomiting, stomach problem, and indigestion. **Pesticide;** roots powder was mixed with food to kill rodents and wild animals.	(Baral & Kurmi 2006, Joshi & Joshi 2001)
	Clematis buchananiana DC. (RGC41-CH11)	Pinase Lahara (CH)	0.60	0.92	Wh	**Medicine;** root powder was used to treat sinusitis.	(Bhattarai 2018)
Rhamnaceae	*Ziziphus jujuba* Mill. (RKM20-S5)	Bayar (S)	0.30	0.55	F & R	**Medicine;** root and fruit juice and paste were used to treat fever, indigestion, and measles. **Edible;** pulp fruits can be consumed directly.	(Ahmad *et al.* 2018)

Rosaceae	*Prunus cerasoides* D. Don (RKM65-T26)	Painyu (T)	0.75	1.00	Sh & B	**Medicine;** bark paste was used to treat the broken body parts. **Edible;** fresh fruits were edible. **Religious;** shoots were important ingredients for '*Bratabandha*' in Hindu culture. **Fodder;** fresh leaves were used as fodder.	(Manandhar 2002, Rokaya *et al.* 2010)
	Rubus ellipticus Sm. (RKM5-S1)	Ainselu (S)	0.53	0.75	Bd, R and F	**Medicine;** root juice and paste were used to treat wounds, cuts, snake bite, fever, indigestion, diarrhea, and pneumonia. **Edible;** Fruit can be consumed directly.	(Manandhar 1992)
Rubiaceae	*Leptodermis lanceolate* Wall. (RGC5-H13)	Bhuichampa (H)	0.33	0.53	Wh	**Medicine;** paste of the plant was used to treat broken body parts. Plant juice was used to treat cuts and wounds. **Additives;** Snails.	(Manandhar 2002)
	Rubia manjith Roxb. Ex Fleming (RGC31-CH9)	Majitho (CH)	0.46	0.75	Wh	**Dye;** the whole plant was used in making dye. **Medicine;** paste and juice of root and stem were used to treat diarrhea, dysentery, wound, jaundice, broken bones, diabetes, cough and cold, and skin diseases.	(Shrestha *et al.* 2016)
Rutaceae	*Aegle marmelos* (L.) Corrêa (RKM21-T7)	Bel (T)	0.23	0.42	F	**Medicine;** root juice was used to treat diarrhea, dysentery, gastritis, typhoid, jaundice, and body heating. **Edible;** pulps of ripe fruits were edible and can be consumed directly. **Religious;** leaves were used for worshiping the God Shiva. **Fodder;** leaves were used as fodder. **Other uses;** the juice of fruits was traded commercially.	(Singh 2015)
	Citrus aurantiifolia (Cristm.) Swingle* (RKM45-S12)	Kagati (S)	0.71	1.11	F	**Medicine;** fruit juice was used to treat indigestion, blood pressure, and wounds.	(Joshi *et al.* 2010)
	Murraya koenigii (L.) Spreng.* (RKM49-T15)	Kari patta (T)	0.46	0.69	R, B & L	**Medicine;** bark paste was used to treat bites of poisonous animals, dysentery, skin diseases, vomiting, diarrhea, and inflammations. **Edible;** leaves were used as a flavor. Ripe fruits can be consumed directly.	(Kunwar *et al.* 2009)
Santalaceae	*Santalum album* L.* (RKM80-T33)	Shrikhanda (T)	0.42	0.50	Hw & L	**Medicine;** paste of heartwood was used to treat skin problems, joint pain, and body cooling purposes. **Religious;** heartwood and leaves were important ingredients for different Hindu cultural events. **Timber;** heartwood was high valued timber.	(Ignacimuthu *et al.* 2008)

Sapindaceae	*Sapindus mukorossi* Gaertn. (RKM73-T30)	Riththa (T)	0.57	0.88	F & Hw	**Medicine;** lather of fruit was used to treat burn and hair problems. **Timber;** heartwoods were used as timber and fuelwood. **Other uses;** lather of fruit was used to make soup.	(Kunwar *et al.* 2013)
Saxifragaceae	*Astilbe rivularis* Buch.-Ham. ex D. Don (RGC45-H54)	Thulo Okhati (H)	0.64	0.96	R	**Medicine;** root juice was used as a pain killer and to treat muscular swelling.	(Shrestha *et al.* 2016)
	Bergenia ciliata (Haw.) Sternb. (RGC39-H44)	Pakhanbhed (H)	0.75	1.07	R	**Medicine;** root juice was used as a painkiller and to treat cut, diarrhea, kidney stone, dysentery, and fever. **Side effects;** excessive use of juice causes body heating. **Additives;** honey and milk.	(Tamang *et al.* 2017)
Scrophulariacea	*Neopicrorhiza scrophulariiflora* (Pennell) D.Y.Hong (RGC29-H37)	Kutki (H)	0.69	0.94	Wh	**Medicine;** rhizome paste was used to treat stomach problems, fever, and headache. **Additives;** milk and honey.	(Ghimire *et al.* 2001, Manandhar 2002)
Smilacaceae	*Smilax aspera* L. (RKM56-CH8)	Kukur Daina (CH)	0.44	0.71	Sh & R	**Medicine;** root paste was used to treat syphilis and skin disease. **Religious;** shoot was kept in the upper side of doors of house believing that it provides positive vibration in the house.	(Rana *et al.* 2015)
Solanaceae	*Capsicum microcarpum* DC. (RKM44-S11)	Jire Khursani (S)	0.75	1.15	F	**Medicine;** green pods and pickles were consumed directly which helps to treat indigestion and stomach problems.	
Symplocaceae	*Symplocos pyrifolia* Wall. (RGC27-T19)	Kholme (T)	0.21	0.30	Sd	**Edible oil;** seeds were used to prepare the oil. **Medicine;** seed paste was used to treat skin diseases.	(Shrestha & Dhillion 2003)
Theaceae	*Schima wallichii* (DC.) Korth. (RKM29-T8)	Chilaune (T)	0.46	0.76	B & Hw	**Medicine;** bark paste was used to treat cuts, wounds, and swollen areas. **Veterinary;** park powder was used to treat different animals' ailments. **Timber;** heartwood was used as timber.	(Hossan *et al.* 2017)
Urticaceae	*Girardinia diversifolia* (Link) Friis (RGC1-S2)	Allo (S)	0.21	0.23	L	**Medicine;** leaves juice was used to treat constipation, headaches, and joints pain. **Edible;** young leaves were used as a vegetable. **Other uses;** leaves were commercially used in making clothes.	(Malla *et al.* 2015)
	Urtica dioica L. (RKM82-H52)	Sisnu (H)	0.75	1.11	L & R	**Medicine;** root and leaves powder and paste were used to treat chest pain, gastritis, cuts, and wounds. **Edible;** young leaves were used as a vegetable.	(Shrestha *et al.* 2016)

Zingiberaceae	*Curcuma angustifolia* Roxb. (RKM46-H33)	Kalo Haledo (H)	0.57	0.88	R	**Medicine;** powder of rhizome was used to treat cough and cold, wounds, and throat.	(Panthi & Singh 2013)
	Curcuma domestica Valet. (RKM22-H10)	Besar (H)	0.82	1.15	Rh	**Medicine;** boiled powder of rhizome was used to treat throat, cough and cold, fever, chest pain, and body pain. **Spice;** rhizome powder was used as a spice and coloring agent in vegetables. **Additives;** salt and water.	(Bhattarai & Khadka 2016)
	Globba racemosa Smith (RGC17-H29)	Harkato (H)	0.46	0.69	R	**Medicine;** paste and juice of root were used to treat stomach problems, urinary infections, and body pain.	(Rao *et al.* 2011)
	Roscoea auriculata K. Schum. (RGC33-H41)	Musali Kalo (H)	0.46	0.61	R	**Medicine;** juice and powder of root were act as a tonic. Juice of root was used to treat urinary problems, fever, and to increase body strength. **Edible;** the root was edible. **Additives;** milk and sugar.	
	*Zingiber officinale** Roscoe (RKM4-H3)	Aduwa (H)	0.67	1.30	Rh	**Medicine;** juice of rhizome was used to treat throat, cough and cold, fever, and body pain. **Edible;** rhizome can be consumed directly or in the form of tea.	(Rokaya *et al.* 2010)

*; Cultivated plants C; Climber, CH; Climber herb, G; Grass, H; Herb, S; Shrub, ST; Shrub like tree, T; Tree, Fn; Fern, Fu; Fungi, Li; Lichen, Wh; Whole Plant, L; Leaves, F; Fruits, Fl; Flower, B; Bark, Bd; Bud, St; Stem, Rh; Rhizome, Rn; Resin, R; Root, Th; Thallus, Gn; Grain, Sd; Seed, Hw; Heartwood, Rn; Resin, Lg; Legume, Sh; Shoot

Major life forms

Herbs were the most used life form (41%) followed by trees (29%), shrubs (14%), climbers (9%), grasses (3%), epiphytes (1%), ferns (1%), fungi (1%), and lichens (1%) (Figure 5), a similar pattern was reported in other parts of Nepal (Bhattarai *et al.* 2010, Ghimire *et al.* 2018, Kunwar *et al.* 2015, Rokaya *et al.* 2010, Uprety *et al.* 2010). In Khandadevi and Gokulganga RM, herbs were readily available, easy to collect, and have the most potent application in the treatment of various ailments compared to trees and shrubs. Many traditional healers preferred herbs for the primary treatment of gastro-intestinal problems, cuts and wounds, cough and cold, ENT problems, and urinary problems. Many people from Gokulganga RM collected herbs from high altitudinal areas which are considered rich in floral diversity and medicinal herbs. For example, the local people collected herbs like *Aconitum forex*, *Astilbe rivularis*, *Bergenia ciliata*, *Lepisorus mehrae*, *Nardostachys grandiflora*, and *Rheum acuminatum* in seasonal basis from different high altitudinal belts of Gokulganga RM and near Umakunda RM. Similarly, people from Khandadevi RM collected herbs like *Achyranthes aspera*, *Acorus calamus*, *Ageratina adenophora*, *Aloe vera*, *Curcuma angustifolia*, *Cuscuta reflexa*, and *Tinospora sinensis* for different medicinal application. Furthermore, specific parts of trees and shrubs were used for its application. For example, leaves of *Murraya koenigii* were used as a flavor and to treat dysentery, skin diseases, vomiting, diarrhea, and inflammations. Whereas, leaves of shrub *Justicia adhatoda* were used in making the green manure. On the other hand, the bark of *Alnus nepalensis* was used to treat muscular crack and the root of *Ziziphus jujuba* was used to treat fever, indigestion, and measles.

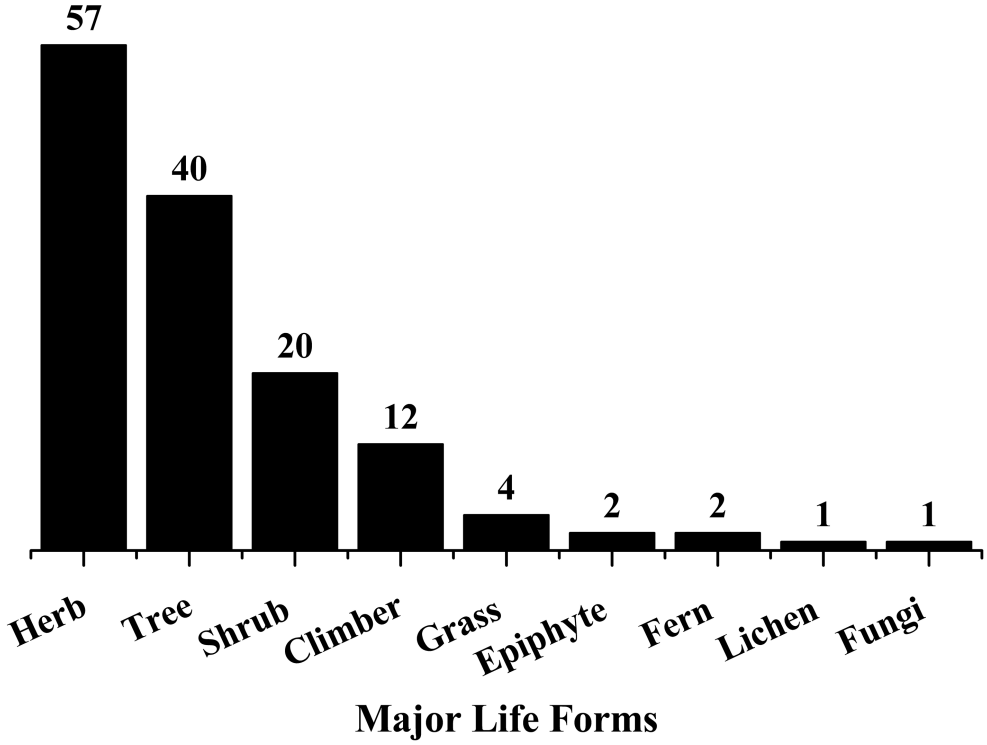

Figure 5. Major life forms

Relative frequency of citation (RFC), Use value (UV) and Informant consensus factor (ICF)

The relative frequency of citation (RFC) is the informants reporting the use of a particular plant species for different purposes because of their easy availability and effectiveness with minimum side effects (Kayani *et al.* 2015, Vitalini *et al.* 2013). The highest RFC was found to be 0.82 for *Ageratina adenophora*, *Curcuma domestica*, *Acorus calamus*, *Centella asiatica*, *Avena sativa*, and *Allium sativum* and least was observed in *Bauhinia vahlii* and *Herpetospermum pedunculosum* (0.17) (Table 2).

The use value (UV) is the number of use reports mentioned by the respondent. The higher use values of plant species reflect the higher abundance of that particular plant in a given area and thus are more familiar and likely to be collected than the rarely encountered plants (Giday *et al.* 2003, Kunwar *et al.* 2019). The highest UV was observed for *Zingiber officinale* (1.30) and least for *Girardinia diversifolia,* and *Herpetospermum pedunculosum* (0.23) (Table 1). Our interviews included people of diverse ethnic and age groups. Khandadevi RM has Tamang, Newar, Chhetri, and Brahmin as the main ethnic

groups whereas, Sherpa, Newar, and Chhetri are the main ethnic group of Gokulganga RM. However, the knowledge of different ethnic groups regarding the utilization of plants for particular purposes did not vary to a large extent. Although plants with high RFC and UV were the most preferred species in study areas, low RFC and UV plant species should not be neglected, as it also carries the information to the future generation. Moreover, conservation initiatives at the community level are required for the protection of threatened species.

Table 2. Informant consensus factor (ICF) calculation for different ailment categories

Ailment categories	Use reports	Number of taxa	Informants consensus factor (ICF)
Circulatory System and Cardiovascular Disorders	36	33	0.08
Cough and Cold	59	29	0.49
Cuts and Wounds	47	32	0.32
Dental	5	5	0.00
Dermatological Disorders	39	33	0.15
Ear, Nose and Throat (ENT) Problems	14	12	0.15
Fever	52	51	0.01
Gastro-intestinal Disorders	140	70	0.50
Genito-urinary Ailment	19	18	0.05
Ophthalmological	5	5	0.00
Respiratory System Problems	21	18	0.15
Skeleto-muscular Disorders	59	48	0.18
Others	43	43	0.00

The informant consensus factor (ICF) is the homogeneity of the informants' agreement in using plants with medicinal values to treat particular ailment category (Madikizela *et al.* 2012, Ragupathy *et al.* 2008). The highest ICF was found for gastro-intestinal disorder (0.50), followed by cough and cold (0.49), dermatological disorders (0.33), cuts and wounds (0.32), skeleton-muscular disorders (0.18), and least for the dental and ophthalmological disorders (0.00). These results were comparable with published ethnobotanical uses of plant species in the Humla District of Western Nepal (Rokaya *et al.* 2010). This indicates that the maximum number of participants utilized a significant number of plant species to cure gastrointestinal disorders and only a few participants used plant species to cure dental and ophthalmological disorders (Table 2). This is the common scenario in the rural communities of Nepal (Shrestha *et al.* 2016). Future research and development on highly prioritized plant species such as ethnopharmacological studies (*in-vitro* and *in-vivo*) are required for the scientific validation and authentication of their uses. Such scientific background will enable in the long run for the development of herbal based industry and also help for conservation and sustainable management for the different plant species.

Trade, agriculture, and livelihood

Almost all medicinal plant species available in Nepal are collected from the wild (Ghimire *et al.* 2018, Kunwar *et al.* 2015, Luitel *et al.* 2014). A large number of people residing in our study areas relied on non-timber forest products (NTFPs) for livelihoods. Mostly, wild-collected plant materials were sold to the traders at low prices. Lack of processing skills and facility center at the community level were the major bottleneck, and actual collectors were less benefited from it. Although government of Nepal has set up the legal route for collection and trade of some specified plant species, illegal collection, and trade were still rampant in the region as in other parts of Nepal (Cameron 2009, Chaudhary *et al.* 2015). As per the information obtained from local people, some species of medicinal plant such as *Aconitum ferox*, *Paris polyphylla*, *Swertia chirayita*, *Roscoea auriculata, Bergenia ciliata, Nardostachys grandiflora, Neopicrorhiza scrophulariiflora, Tinospora cordifolia, Fritillaria cirrhosa, Terminalia bellirica, Terminalia chebula*, and *Ophiocordyceps sinensis* that were traded legally and illegally in large amount because of their high monitory values. Although the local people get benefitted by trading medicinal plants, the unsustainable harvesting and collection were causing greater harvesting pressure and habitat destruction of important plant species.

Our study revealed that the harvesting practices of important plant species in these regions were unsustainable because of poor harvesting techniques, wasteful mechanism, and destructive nature as in other parts of Nepal (Rokaya *et al.* 2010, Shrestha *et al.* 2016). For example, in order to obtain the roots, they uprooted the whole plant. Similarly, to obtain the bark of the trees, they scratched all the

barks which ultimately leads to the death of the tree, and to obtain leaves, all the branches of the trees and shrubs were cut down. In addition to the haphazard collection, the plants were destroyed by deforestation, habitat encroachment, shifting cultivation, haphazard animal husbandry, and uncontrolled forest fires were common practices in many forests of Nepal (Camm *et al.* 2002, Chaudhary 1998) and in Ramechhap District as well. The most important species were facing the problems of the greatest harvesting pressure (De Albuquerque *et al.* 2007). In the context of our study area, *Dactylorhiza hatagirea*, *Fritillaria cirrhosa*, and *Neopicrorhiza scrophulariiflora* of high land areas were in the risk of gradual disappearance due to haphazard animal husbandries, forest fires, and illegal collections and trades. On the other hand, different herbs, shrubs, and trees of the low land areas were collected illegally and traded for different purposes which exacerbated the floral diversity.

The good agricultural practices must be formulated to regulate the production, ensure quality, and facilitate the standardization of edible crops and medicinal plants (Chan *et al.* 2012). In the context of our study areas, agriculture was the main occupation of the people. The agricultural pattern was still traditional, and the farmers were planting three major crops around the year namely *Oryza sativa*, *Hordeum vulgare*, and *Solanum tuberosum* in three different seasons. In addition, they were cultivating the intercrops like *Glycine max*, *Brassica camprestris*, *Zea mays*, beans, and other seasonal vegetables. This form of agricultural practice was adequate to feed the two-third of households living in these areas for at least 8 months, matching with the results from previous findings (Aryal *et al.* 2018). In the context of the Khandadevi RM, people were cultivating the cereal crops along with high-value plants such as *Aloe vera*, *Pterocarpus santalinus*, *Elaeocarpus sphaericus*, *Ziziphus budhensis*, *Mangifera indica*, *Musa paradisiaca*, etc. of high monitory and market values. However, the local people also provided information about the drought problems since the last decade and shift in agriculture calendar in the Khandadevi RM where the rainfall was extremely low as compared to other parts of the Ramechhap District. This made people to import food grains from external markets to overcome the problems of food scarcity in the low land areas of Ramechhap.

The ethnic communities have great knowledge on the utilization of plant species and their parts for the regulation and enhancement of daily livelihood practices (Acharya & Acharya 2009). We observed the ethno-medicinal knowledge of the different ethnic communities of our study areas has been transmitted from one generation to another mostly by oral means and without any systematic documentation. This form of knowledge transfer about the traditional uses of plants was at risk of extinction (Bussmann & Sharon 2006). In order to protect plant species and indigenous knowledge, the documentation, identification, proper harvesting techniques, cultivation of the high-value plant species, participatory management practice, and awareness programs play vital roles (Sharma *et al.* 2004). We observed only a few involvements of young people in these conservation practices. Out of 15 respondents (under the age of 30), only a few respondents were aware of the knowledge regarding the efficient utilization of plants. The respondents of the age group of over 30 were rich in the knowledge of sustainable use of plants for different purposes. This signified that the ethnobotanical knowledge of these areas was at the risk of extinction as the younger generation of the indigenous communities was not interested in the traditional medicinal system of healing. Moreover, they engaged themselves in some other occupations where they could make more money. So, it is of utmost importance to conserve this knowledge by encouraging the participation of young people for the betterment of the biodiversity conservation and sustainability of the future generation.

People of Khandadevi and Gokulganga RM were involved in the cultivation of different plant species with great ethnobotanical and ethnomedicinal significance, as a source of income generation. For example, in Gokulganga RM, people were cultivating *Avena sativa* for food, but they also used to treat indigestion. On the same note, in Khandadevi RM, people were cultivating *Pterocarpus santalinus* for income generation as well as for religious activities and to treat stomach disorders and fever. This signified that the cultivated plant species did not only provide economic benefits to the people, they also have medicinal, cultural, and religious importance in sustainable livelihood. For the very first time, we documented important plant species under cultivation with their ethnobotanical significance (Table 1).

Knowledge on plant toxicity

The indigenous peoples of different belts of Nepal have extensive knowledge of the potential toxicity of the plant species, and they can easily distinguish the toxic and non-toxic plants (Rokaya *et al.* 2010). In the context of Ramechhap, people have immense knowledge of plant toxicity. Taking into accounts that, the local peoples were aware that *Paris polyphylla, Aconitum forex*, and *Cannabis sativa* have great medicinal values in proper consumption, but excessive intake causes intoxication, nausea,

and nervous disorder. Excessive consumption of *Aloe vera* causes miscarriage in pregnant women. Likewise, the disproportionate consumption of tender leaves of *Anemone vitifolia* causes nausea and vomiting. The local peoples of both places of the study areas were aware of the toxicity of plant species that made them to prefer varied harvesting and utilization techniques for different plant species.

Local level conservation initiatives

Indigenous people and their knowledge about nature and biodiversity have assumed key importance in modern conservation practice. This traditional knowledge is, therefore, of great relevance not only to the culture of local societies but also to scientists and planners striving to improve local livelihoods (Pei *et al.* 2009, Rist *et al.* 2008). The Gaurishankar Conservation Area Project (GCAP) in Chuchure village is one of the national level conservation initiation undertaken by the National Trust for Nature Conservation (NTNC), and have initiated many conservation approaches with the livelihood uplifting activities such as cultivation and trade of high-profile plants and tourism (NTNC 2010). This conservation initiation by NTNC was being very effective in controlling illegal trade of both wild flora and fauna, management and optimum use of natural bases, forest management, and in reducing habitat destruction and encroachment. The different community, religious, and private forestry practices in Majhuwa village of Khandadevi RM were being superlative for improvement of the biological diversity and livelihood uplifting.

Availability of medicinal plants

The majority of people residing in rural areas of Nepal depends on traditional practices of herbal remedies with the available local resources (Thorsen & Pouliot 2015) and is especially important for mountain people due to lack of modern health care facilities (Kunwar & Bussmann 2008). Medicinal plants are distributed heterogeneously and available easily to some extent in many localities of Nepal. During our study, we found that the greatest numbers of traditional healers were from the Gokulganga RM which falls under the high-altitude area of Ramechhap which signified that people from mountain areas still relied on herbal medicinal practice and have the greatest expertise in this field. In the Khandadevi RM, the majority of the medicinal plant species that were distributed near peoples' residents were available without any difficulties but that was not always the case of Gokulganga RM. The high-profile medicinal plants that have been utilizing by the people from Gokulganga RM were collected mostly from the high altitudinal areas of above 3000 masl. The unsustainable collection and trade of medicinal plants reduced the availability and regenerating power of those important plant species ultimately which were leading to the loss of those important floras (Chen *et al.* 2016). So, there are needs of awareness on sustainable collection, conservation, and large-scale cultivation of the medicinal plants which might also help in improving the socio-economic condition of the inhabitants as well as reduces the pressure of dependency on the natural resource bases (Malla & Chhetri 2009, Pei *et al.* 2009, Sigdel *et al.* 2013).

Conclusions

This study provides strong evidence that the local people of Khandadevi RM and Gokulganga RM of Ramechhap District were blessed with the immense knowledge of ethnobotanical uses of plants of their surroundings. The present study revealed that there was an abundance of enormous knowledge on ethnobotanical uses of plant species within different ethnic communities that were not fully explored yet. The majority of people relied on plant-based medication for common health problems. However, an ethnobotanical knowledge among the young generation was being declined due to the lack of communication and systematic transmission. The present status of knowledge regarding ethnobotany among old aged people of different ethnic communities was more remarkable compared to the young generation. The effective herbal medicine practice was found in Gokulganga RM as compared to Khandadevi RM. In the context of the conservation approaches initiated by indigenous people and the local community (IPLCs) to conserve their knowledge, skills, and innovation, local level conservation practices played a significant role. Traditional harvesting techniques of crops, precise herbal medicine practices, local food production, and knowledge sharing were important efforts undertaken by the local communities but those practices were still unsustainable. So, more conservation initiatives should be carried out to conserve available natural resources at an optimal level. The local people were aware of the rapid mislaying of the floral and faunal diversity by haphazard harvesting and illegal trades. Indigenous people were conserving the plant species for supplementary uses such as religious and cultural aspects, timber production, food, and esthetic purposes, besides the medicinal uses. Indigenous people and local communities contributed foremost for the conservation from the local level to the national level. It is of utmost importance to enhance the local knowledge, skills, innovations, and practices of these areas which played a significant role in the conservation of biological diversity and traditional knowledge in a scientifically precise manner.

Recommendations

More extensive and additional exploration can be made in the field of ethnobotany of Ramechhap District. The traditional knowledge, skills, and motivations of the ethnic communities should be conserved and utilized for the conservation of biological diversity and enhance the livelihoods of the people. The assessment of important plant species for different phytochemicals and biochemical activities can be made for scientific studies of the pharmacological, biological, and chemical mechanisms of actions. It opens up the possibility in the future to study these medicinal plant resources for the identification of bioactive components as well as the development of herbal based high-value products for the upliftment of livelihoods of the local communities.

Declarations

List of abbreviations: ENT: Ear, Nose, and Throat, GCAP: Gaurishankar Conservation Area Project, IFC: Informant Consensus Factor, IPLCs: Indigenous Peoples' and the Local Community, masl: meter above sea level, NTFPs: Non Timber Forest Products, NTNC: National Trust for Nature Conservation, PRA: Participatory Rural Appraisal, RFC: Relative Frequency of Citation, RM: Rural Municipality, RRA: Rapid Rural Appraisal, and UV: Use Value.

Ethics approval and consent to participate: Permission letter was taken from Department of National Park and Wildlife Conservation, Babarmahal, Kathmandu prior to data collections. Oral agreements were obtained from the local informants and all field data were collected through their oral consents.

Consent for publication : Not applicable.

Availability of data and materials: The voucher specimens were deposited at Department of Chemical Science and Engineering, School of Engineering, Kathmandu University, Dhulikhel, Kavre, Nepal. Data will be available from corresponding author in especial request.

Competing interest: Authors declared there is no any interest of conflicts between them.

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Authors' contribution: SPP, RPC, and BPP conceptualized the work. SPP and SS did the preliminary work, semi-structured interviews, plant collection, and data generation. SPP, BPP, and RPC did the data analysis, verification, and authorization. SPP, RPC, and BPP wrote, revised, and edited the manuscript.

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