



Altitudinal variation in medicinal plant distribution and ethnomedicinal knowledge among Chepang and Tharu communities in Central Nepal

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Research

Abstract

Background: Medicinal and aromatic plants (MAPs) are important to traditional healthcare and rural livelihoods in Nepal, and their diversity is influenced by altitudinal and climatic variation. This study investigated medicinal plant distribution and ethnomedicinal knowledge among Chepang and Tharu communities in central Nepal.

Methods: A stratified random sampling design was used to assess MAP distribution across four elevation classes (330-535, 536-740, 741-945, and 946-1150 m). Ethnobotanical information was collected from 130 respondents through semi-structured questionnaires and key informant interviews. Descriptive statistics, Informant Consensus Factor (FIC), Relative Frequency of Citation (RFC), correlation, ANOVA, and chi-square tests were used to evaluate plant diversity, cultural importance, and ethnomedicinal knowledge.

Results: The survey documented 142 medicinal plant species belonging to 91 families, while the forest inventory recorded 97 species, including 16 trees, 30 shrubs, and 51 herbs. Herbs were the dominant life form, leaves were the most frequently used plant part, and oral administration was the principal mode of application. *Phyllanthus emblica* and *Terminalia chebula* had the highest RFC among Chepang respondents, whereas *Dioscorea bulbifera* and *Justicia adhatoda* were most frequently cited among Tharu respondents. Medicinal trees were most abundant at 330-535 m, whereas shrubs and herbs reached their highest densities at 741-945 m. Ethnomedicinal knowledge increased significantly with age ($r = .35$, $p < .001$).

Conclusions: The findings demonstrate substantial medicinal plant diversity and ethnomedicinal knowledge, while highlighting the importance of mid-elevation habitats, sustainable management, conservation, and intergenerational knowledge transmission. These patterns underscore the relationship between ecological variation, plant availability, and community-based traditional healthcare practices.

Keywords: Medicinal and aromatic plants, communities, indigenous, healthcare, elevation

Background

Non-timber forest products (NTFPs) are essential for the economic stability and everyday requirements of Nepal's rural people, providing resources such as food, medicine, fiber, and construction materials (Paneru, 2024). According to the Forest Act 2076 of Nepal, NTFPs include all biologically derived materials obtained from forests other than timber and firewood, including products collected from trees and other forest resources, as well as wildlife-related products. Within this broad category, medicinal and aromatic plants (MAPs) are particularly significant because they provide essential medicinal resources, generate income, support local employment, and contribute to the preservation of traditional knowledge and healthcare practices. Consequently, MAPs represent an important component of Nepal's NTFP sector, traditional healthcare systems, and rural livelihoods.

Owing to its remarkable altitudinal and climatic heterogeneity, Nepal harbors a rich diversity of medicinal plant species, with more than 2,000 species reported to be used in traditional medicine (Kunwar *et al.* 2022; Rokaya *et al.* 2014). Plant-based remedies continue to play a vital role in primary healthcare, particularly in developing countries where access to modern medical facilities is often limited. Traditional, complementary, and integrative medicine (TCIM) continues to be an important part of healthcare worldwide. According to the World Health Organization (WHO, 2025), TCIM is utilized in 170 countries, and the WHO's third worldwide survey found that 67% of respondents reported that 40-99% of their country populations use TCIM. These findings illustrate traditional medicine's continued global relevance, particularly in places where medicinal herbs are still available, inexpensive, and culturally acceptable. In Nepal, the use of MAPs is especially prevalent among rural and indigenous communities, where traditional knowledge systems remain closely integrated with everyday healthcare practices (Upriy *et al.* 2012).

The distribution, abundance, and diversity of medicinal plants are strongly influenced by environmental gradients, particularly altitude. Variations in elevation affect temperature, rainfall, soil characteristics, and other ecological factors, which subsequently shape species composition and distribution patterns (Bhattarai & Vetaas 2003). Previous research has found a unimodal or hump-shaped association between medicinal plant diversity and elevation, with species richness peaking at intermediate elevations in Nepal and the central Himalaya (Bhattarai and Ghimire 2007; Acharya *et al.* 2009; Rokaya *et al.* 2012). Moreover, several medicinal plant species possess narrow ecological ranges and are confined to specific altitudinal zones, making them particularly vulnerable to habitat degradation, climate change, and overexploitation (Rokaya *et al.* 2014). Therefore, understanding the altitudinal distribution and ecological dynamics of MAPs is essential for developing effective conservation strategies and ensuring their sustainable utilization. Chitwan District, located in central Nepal, provides an ecologically diverse landscape for studying the distribution and utilization of medicinal plants. The district spans a broad altitudinal range, extending from the lowland Terai region (approximately 150 m) to mid-hill areas exceeding 2,000 m elevation, thereby supporting diverse vegetation types and a rich diversity of medicinal plant species (Joshi *et al.* 2018). This environmental heterogeneity creates favorable conditions for the occurrence of numerous medicinal and aromatic plants MAPs across different ecological zones.

According to the National Statistics Office (NSO 2023), Chitwan District had a population of 719,859 according to the National Population and Housing Census 2021. The district is home to several indigenous nationalities, including the Tharu and Chepang communities. Census data show that 9.52% of the population reported Tharu as their mother tongue, while 3.32% reported Chepang as their mother tongue, indicating the significant presence of these indigenous groups in the district. Traditionally found in the Terai region of Nepal, the Tharu community has a long history of using medicinal plants to treat a variety of illnesses, such as respiratory, dermatological, and gastrointestinal disorders (Thapa 2020; Chaudhary & Rajbhandary 2021; Khanal *et al.* 2022; Gharti *et al.* 2024). More recent ethnobotanical studies have further documented the extensive traditional knowledge of Tharu communities and highlighted concerns that protected area management, land-use change, and socio-economic transformations are increasingly threatening their traditional livelihoods and knowledge systems (Kutal *et al.*, 2026). The Chepang, a socioeconomically vulnerable Indigenous community in Nepal, rely heavily on forest resources for traditional healthcare, food security, and livelihood support, especially through the gathering and utilisation of non-timber forest products and medicinal plants (Gurung 2022; Upriy & Asselin 2023). Previous studies have

shown that the Chepang people utilize a wide range of wild medicinal plants and possess detailed knowledge regarding their collection, preparation, dosage, and therapeutic applications (Rijal 2008; Uprety *et al.* 2012). In addition to their medicinal value, MAPs contribute significantly to the socio-economic well-being of the Chepang community through household use and small-scale trade. Traditional knowledge associated with medicinal plants is primarily transmitted orally across generations and remains closely linked to cultural beliefs, healing practices, and local traditions. Elderly individuals and traditional healers play a central role in preserving and transferring this knowledge, including plant identification, methods of preparation, dosage systems, and healing rituals (Kunwar & Bussmann 2008). However, Chepang Indigenous knowledge is increasingly threatened by modernization and changing social values, potentially weakening its intergenerational transmission (Adhikari 2023). At the same time, habitat degradation and unsustainable harvesting are contributing to declines in medicinal plant populations, raising concerns about their long-term conservation and sustainable use (Lorite 2024; Mishrae *et al.* 2023).

Previous ethnobotanical studies conducted in Chitwan District have documented the medicinal uses of plant species and highlighted their importance in local healthcare systems and rural livelihoods (Joshi *et al.* 2018). Studies from other regions of Nepal, including Palpa, have similarly demonstrated the richness of indigenous medicinal knowledge and its significance for primary healthcare and biodiversity conservation (Neupane *et al.* 2025). Among the Tharu community, ethnobotanical research has documented diverse medicinal plant uses and their continued importance in traditional healthcare systems (Dangol & Gurung 1991; Thapa 2020; Chaudhary & Rajbhandary 2021; Khanal *et al.* 2022; Gharti *et al.* 2024). However, changing lifestyles, modernization, and social values may contribute to the erosion of traditional knowledge and its intergenerational transmission.

Studies focusing on the Chepang community have shown that medicinal and other uncultivated plant resources contribute substantially to household income, food security, and livelihood resilience (Aryal *et al.* 2009; Rijal 2008; Bharati 2020; Gurung 2022; Uprety & Asselin 2023). Despite these studies, most previous research has primarily focused on documenting medicinal plant diversity and traditional uses, while comparatively little attention has been given to the combined influence of altitudinal variation and cultural differences on medicinal plant distribution and ethnomedicinal knowledge among indigenous communities (Manandhar 2000; Rokaya *et al.* 2012; Bhattarai *et al.* 2020; Kunwar *et al.* 2022). Limited attention has been given to how medicinal plant distribution and ethnomedicinal knowledge vary across altitudinal gradients, particularly among the Chepang and Tharu communities. Understanding these relationships is important for identifying conservation priorities, promoting sustainable harvesting, and preserving traditional medicinal knowledge. To address this gap, the present study aimed to: (1) document the diversity and traditional uses of medicinal plants among the Chepang and Tharu communities; (2) compare medicinal plant use patterns, including plant life forms, plant parts used, preparation methods, modes of application, Relative Frequency of Citation (RFC), and Informant Consensus Factor (FIC), between the two communities; and (3) evaluate the altitudinal distribution of medicinal tree, shrub, and herb species within the Kalika Community Forest. By integrating forest inventory with comparative ethnobotanical analyses, this study provides insights into the relationships among altitudinal gradients, medicinal plant diversity, and indigenous ethnomedicinal knowledge in central Nepal.

Materials and Methods

Study area

The study was conducted in Chitwan District (27.53° N, 84.35° E), located in Bagmati Province, Nepal. Within the district, Rapti Municipality was selected as the study area. The study focused on Kalika Community Forest, which covers an area of 1,057.28 ha in Ward No. 8 of Rapti Municipality and lies within the Siwalik and Lower Himalayan zones of the Chitwan foothills (Figure 1). The forest was purposively selected based on records from the District Forest Office (DFO), community forest records, and reconnaissance surveys. The users of this community forest belong to diverse ethnic and social groups, including the Chepang, Tharu, Tamang, Giri, and Brahmin communities. The dominant tree species in the forest include *Shorea robusta*, *Terminalia alata*, and *Adina cordifolia*.

Field work and ethnobotanical data collection

Primary Data Collection

Questionnaire Survey - Among the 2,047 households registered in the Community Forest User Group, 300 households belonged to the Chepang community and 1,200 to the Tharu community (Kalika Community Forest User Group, 2024), both of which actively depend on and utilize forest resources. A total of 130 respondent, comprising 50 Chepang and 80 Tharu respondent, were selected purposively to represent the two communities. The sample size was determined based on the accessibility of households, community representation, and the availability of respondents with relevant ethnomedicinal

knowledge. Within each community, respondents were identified with the assistance of community forest user group representatives and local community leaders, and respondents with knowledge and experience of medicinal plant use were purposively selected for interview from October 2024 to April 2025. The selected respondents ranged from 30 to 80 years of age. Ethnobotanical information, including medicinal plant uses, preparation methods, and modes of application, was collected through open-ended, semi-structured interviews.

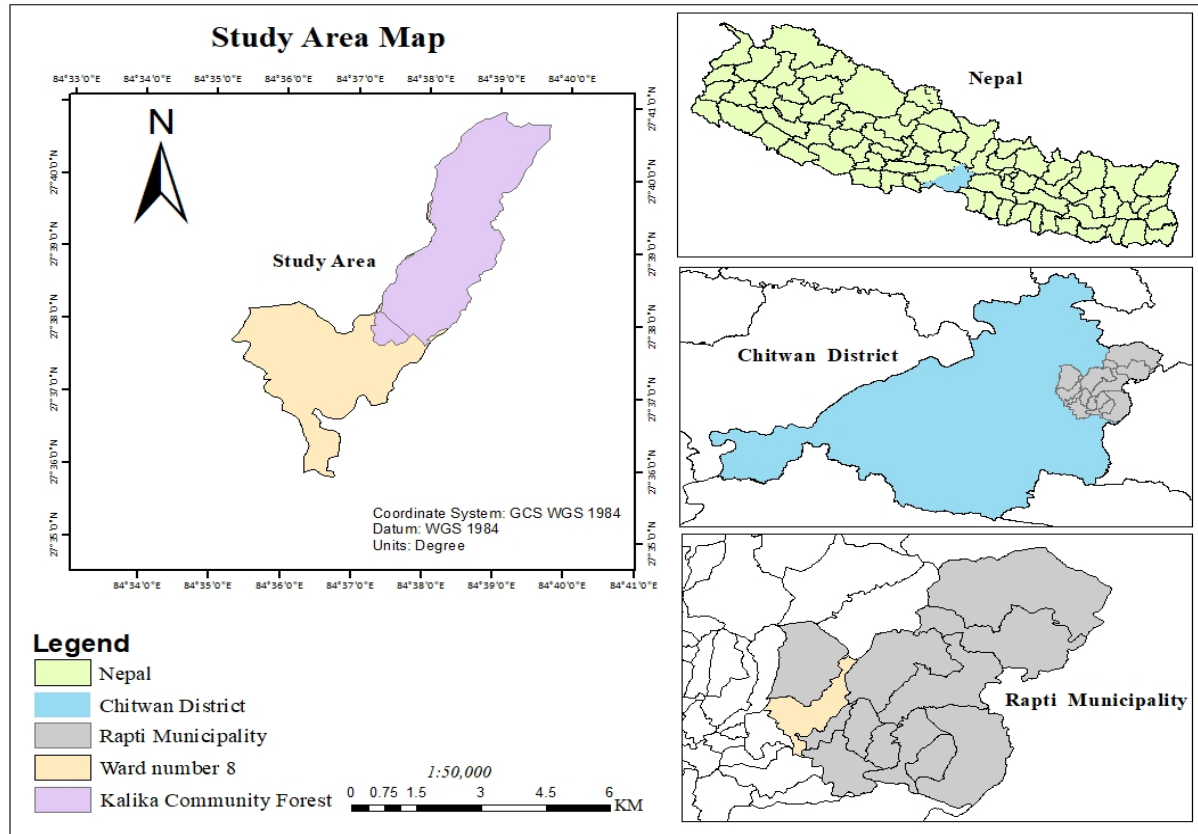


Figure 1. Map of Chitwan District, Rapti Municipality, showing the study area.

Forest inventory - A stratified random sampling design was used to assess the distribution of medicinal and aromatic plants (MAPs). The study region was divided into four elevation classes: 330-535 m, 536-740 m, 741-945 m, and 946-1150 m. The study area was divided into elevational zones at approximately 205 m intervals to provide a systematic and relatively uniform representation of the altitudinal gradient across the study area. Maintaining an approximately equal elevational interval also facilitates comparison of medicinal plant diversity, species use, and ethnobotanical knowledge across elevation classes while minimizing overlap between adjacent zones. Within each elevation class, 10 sample plots were created at random, for a total of 40 plots. The elevation classes were established to enable comparisons of the distribution and variety of medicinal and aromatic plants along the altitudinal gradient and to provide comparable elevational bands throughout the study region. Tree species were recorded from 20 m × 20 m quadrats, shrub species from 10 m × 10 m nested sub-quadrats, and herb species from 2 m × 2 m sub-plots established within the shrub plots, following the inventory guidelines of the Department of Forests (DoF 2012). Unidentified plant specimens were photographed in the field and voucher specimens of the identified aromatic and medicinal plant species were gathered, dried, and correctly pressed before being sent to the Tribhuvan University Central Herbarium (TUCH), located in Kathmandu, Nepal and later identified through expert consultation. Botanical nomenclature was standardized using the Plant List database (<http://www.theplantlist.org/>). Botanical nomenclature and accepted scientific names were verified using Plants of the World Online (POWO) and World Flora Online.

Key informant interview - Detailed information on the availability, utilization, and traditional knowledge of medicinal and aromatic plants was obtained from 130 respondents. The age and gender distribution and education level of the interviewed respondents are shown in Table 1. Eight Key informants: those in the old-age group above 81 years (n=2), schoolteachers (n=2), Community Forest User Group (CFUG) chairperson (n=1), and local healers (n=3) who have traditional knowledge of using local plants for the treatment of various diseases for a long time were interviewed. The insights from key informants were instrumental in understanding the depth of traditional knowledge and the status of ethnobotanically important species.

In addition, the “artifact/interview” method described by Martin (1995) was employed to further document the diverse uses of medicinal plant species.

Secondary Data Collection

To support the documentation and interpretation of indigenous knowledge related to medicinal and aromatic plants (MAPs) in the study area, secondary information was collected from a variety of sources such as research articles, books, reports, academic theses, and other relevant publications accessed through online databases such as ResearchGate and Google Scholar.

Demographic Characteristics of Respondents

A total of 130 respondents participated in the study, of whom 83 (63.8%) were male and 47 (36.2%) were female. The respondents were largely middle-aged to elderly, with the highest proportion (26.9%) belonging to the 51-60 years age group, followed by those aged 71-80 years (20.8%) and 61-70 years (20.0%). The 31-40- and 41-50-years age groups accounted for 18.5% and 13.8% of the respondents, respectively. Regarding educational status, nearly half of the respondents (44.6%) were illiterate, indicating a generally low level of formal education within the study population. Respondents with primary education were 23.1%, while those with middle and secondary education represented 13.8% and 12.3%, respectively. Only a small proportion (6.2%) had attained university-level education, suggesting that higher educational attainment was relatively uncommon among the respondents (Table 1).

Table 1. Demographic characteristics of the respondents by age group, gender, and educational level

Age group	Gender		Number of Individuals	Education Level	Number of Individuals
	Male	Female			
31-40	15	9	24	Illiterate	58
41-50	7	11	18	Primary	30
51-60	20	15	35	Middle	18
61-70	18	8	26	Secondary	16
71-80	23	4	27	University	8
Total	83	47	130	Total	130

Of the 130 respondents, 50 were Chepang and 80 were Tharu (Table 1). The two communities were demographically well matched: age did not differ significantly between them (Chepang 56.0 ± 14.0 years vs. Tharu 57.6 ± 14.2 years, combined 57.0 ± 14.1 years; Welch's $t(101.9) = -0.62$, $p = .534$), nor did the number of species described (Chepang 3.70 ± 1.22 vs. Tharu 3.61 ± 1.39 , combined 3.65 ± 1.32 ; $t(90.8) = 0.38$, $p = .707$; corroborated by the Mann-Whitney U test, $U = 2087.0$, $p = .671$), nor gender composition (Chepang 29 male : 21 female; Tharu 54 male : 26 female; combined 83 male : 47 female; $\chi^2(1) = 0.83$, $p = .363$) or the distribution of respondents across age classes ($\chi^2(4) = 0.85$, $p = .931$). Knowledge or plant-use differences reported elsewhere between communities therefore cannot be attributed to sampling imbalance.

Respondent age was significantly and positively correlated with species knowledge in both communities and overall (Chepang: $r = .321$, $p = .023$; Tharu: $r = .376$, $p < .001$; combined: $r = .354$, 95% CI [.193, .496], $p < .001$; corroborated by Spearman's $\rho = .288/.375/.337$, respectively, all $p \leq .043$). Knowledge rose by roughly one-third of a species per decade of age in the combined sample (species described = $1.755 + 0.033 \times \text{age}$; SE = 0.008, $t(128) = 4.28$, $p < .001$, $R^2 = .125$), and this relationship changed little after controlling for community and gender (partial $r = .337$), indicating a genuine age effect. Grouping respondents into ten-year age classes showed knowledge rising steadily from 2.96 species (31-40 years) to 4.52 species (71-80 years) in the combined sample, a trend that was significant overall (one-way ANOVA: $F(4,125) = 6.37$, $p < .001$; Kruskal-Wallis: $H = 20.12$, $p < .001$) and within each community individually (Chepang: $F(4,45) = 3.42$, $p = .016$, $H = 10.99$, $p = .027$; Tharu: $F(4,75) = 3.58$, $p = .010$, $H = 11.58$, $p = .021$), lending statistical weight to the pattern of knowledge concentrating among older respondents noted elsewhere in this study.

A smaller, community-specific gender effect was also detected: male respondents described marginally more species than female respondents overall (3.80 ± 1.34 vs. 3.38 ± 1.35 ; Welch's $t = 1.75$, $p = .083$; Mann-Whitney $p = .073$), a difference that reached significance only within the Chepang community, and only by the non-parametric test (Chepang: 3.97 ± 1.32 vs. 3.33

± 0.97 , $t = 1.95$, $p = .057$, Mann-Whitney $p = .041$; Tharu: 3.70 ± 1.35 vs. 3.42 ± 1.47 , $t = 0.82$, $p = .417$, Mann-Whitney $p = .410$) — best read as a localized trend rather than a general sex difference in ethnomedicinal knowledge.

Quantitative Ethnobotanical Analysis

The collected data were compiled and analyzed using Microsoft Excel 2021 to generate descriptive statistics on local names, plant families, parts used, modes of application, and the total number of reported treatments. These variables are presented as frequencies and percentages. The results are illustrated through tables and graphical representations, including bar charts, radar plots, and pie charts, to depict the altitudinal distribution patterns and the traditional knowledge of medicinal plant use among the Chepang and Tharu communities of Chitwan District, Nepal.

Statistical Analysis

Age and species described departed significantly from normality (Shapiro-Wilk: $W = 0.958$, $p < .001$; $W = 0.943$, $p < .001$), so parametric and non-parametric tests were run in parallel throughout, and effect sizes (r^2 , partial r^2) are reported alongside significance tests to indicate the strength of each association. Age-knowledge associations were tested with Pearson and Spearman correlations (95% confidence intervals for Pearson's r computed via Fisher's z -transformation), linear regression, and partial correlation (controlling for community and gender); differences across five ten-year age classes (31-40 to 71-80 years) with one-way ANOVA and the Kruskal-Wallis test; community and gender differences with Welch's t -test and the Mann-Whitney U test; and categorical associations with chi-square tests of independence. As these tests addressed a small, pre-specified set of comparisons rather than an exploratory search across many variables, no correction for multiple comparisons was applied. All tests were two-tailed ($\alpha = 0.05$) and performed in R (v4.3.0; R Core Team 2023).

Informant Consensus Factor

The Informant Consensus Factor (FIC) was determined following the formula outlined by Trotter and Logan (1986) and Bhat *et al.* (2014) to evaluate the consistency of information among informants. Relative Frequency of Citation and FIC were selected because they quantify the cultural importance of medicinal plant species and the level of informant consensus, consistent with the objectives of this study.

The formula for FIC is as follows:

$$FIC = \frac{Nur - Nt}{Nur - 1} (1)$$

where FIC = Informant Consensus Factor; Nur = Number of use reports for a specific illness category by informants; Nt = Number of taxa or species used to treat that category.

Relative Frequency of Citation

The Frequency of Citation (FC) and Relative Frequency of Citation (RFC) for each medicinal plant species were calculated following the method proposed by Tardío and Pardo-de-Santayana (2008), to quantify the local importance of each species based on informant responses. The RFC is expressed as:

$$RFC = \frac{FC}{N}, (0 < RFC < 1) (2)$$

where FC denotes the number of informants who reported the use of a given medicinal plant species, and N represents the total number of respondents participating in the survey.

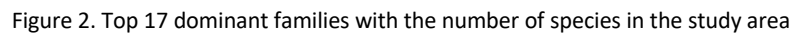
Results

Diversity of medicinal plant species

A total of 142 medicinal plant species belonging to 91 families were documented in the study area and used by the Chepang and Tharu communities to treat 70 different ailments. Detailed information on each species, including scientific name, family, local name, growth habit, plant parts used, medicinal uses, and modes of application, is provided in Appendices 1 and 2.

Dominant families and the number of species in the study area

Fabaceae was the most represented family in this survey, with 9 species, followed by Asteraceae (8 species) and Lamiaceae (7 species) (Figure 2). The unusually high presence of these families could be attributed to their widespread ecological distribution and availability in the study area, as well as their numerous traditional medicinal applications. Elevation, habitat, sampling effort, and local ethnomedicinal knowledge may all contribute to differences in the number of species reported across studies.



Based on the International Classification of Primary Care (ICPC) framework (Miller et al., 2009), the recorded ailments were categorized into 14 major groups. These include digestive (Chepang: N=30; Tharu: N=22), general and unspecified (Chepang: N=17; Tharu: N=12), skin (Chepang: N=14; Tharu: N=26), respiratory (Chepang: N=26; Tharu: N=23), endocrine, metabolic, and nutritional (Chepang: N=9; Tharu: N=8), neurological (Chepang: N=7; Tharu: N=5), musculoskeletal (Chepang: N=16; Tharu: N=6), urinary system (Chepang: N=4; Tharu: N=8), sexual and female health problems (Chepang: N=3; Tharu: N=2), circulatory system (Chepang: N=4; Tharu: N=6), dental problems (Chepang: N=2; Tharu: N=5), nose and mouth (Chepang: N=2; Tharu: N=2), ear-related ailments (Chepang: N=2; Tharu: N=2), and antivenom and poisoning (Chepang: N=7). The distribution of plant species used for each ailment category, along with the number of use-reports and Informant Consensus Factor (FIC), is summarized in Table 2, while detailed species-level information is provided in Appendices 1 and 2 respectively.

Disease and Ailment Category	Bio-medical Terms	Chepang People			Tharu People		
		Total number of Plants used (N_t)	Total use reports (N_{ur})	Informant consensus factor (FIC)	Total number of Plants used (N_t)	Total use reports (N_{ur})	Informant consensus factor (FIC)
General and Unspecified disease	Fever	17	50	0.673	12	32	0.645
	Typhoid						
	Body cooling						
	Ulcer						
Digestive	Nausea and Vomiting	30	108	0.728	22	79	0.730
	Cholera						
	Worm						
	Clean stomach,						
	Piles						
	Diarrhea						
	Constipation						
	Indigestion						
	Button belly swelling						
	Gull stone						
	Gastritis						

Respiratory	Asthma	26	89	0.715	23	71	0.685
	Cough						
	Common cold						
	Throat pain						
	Bronchitis						
	Throat infection						
	Sinusitis						
	COVID-19						
Musculoskeletal	Rheumatism	16	33	0.531	6	15	0.642
	Joint pains						
	Inflammation						
	Sprain						
Skin and veins	Wounds and Cuts	14	42	0.682	26	99	0.744
	Furuncle						
	Scabies						
	Skin disease						
	Hair fall						
	Boils						
	Diaphoretic						
	Burn						
Neurological	Headache	7	12	0.454	5	15	0.714
	Memory power						
Circulatory	Blood pressure	4	4	0.000	6	13	0.583
	Cardiac tonic						
Tooth	Toothache	2	2	0.000	5	7	0.333
Urinary	Kidney stone	4	6	0.400	8	12	0.363
	Hydrocele						
	Diuretic						
	Urinary problems						
Sexual and female	Abortion	3	4	0.333	2	2	0.000
Ear	Earache	2	2	0.000	2	3	0.500
Endocrine, Metabolic and Nutritional	Sugar	9	29	0.714	8	25	0.708
	Jaundice						
Nose and Mouth	Mouth wounds	2	4	0.667	2	2	0.000
Antivenom and poisoning	Fish poisoning	7	14	0.538	0	0	0.000
	Anti-poison						
	Lice & Flea						
	Insecticide						
	Pesticides						

Use Patterns and Informant Consensus

Among the Chepang community the highest number of plant species was recorded for digestive disorders ($N_t=30$; $N_{ur}=108$; $FIC=0.73$), followed by respiratory ailments ($N_t=26$; $FIC=0.72$) and endocrine, metabolic, and nutritional disorders ($FIC=0.71$). Skin-related ailments also showed a relatively high consensus ($FIC=0.68$). Lower FIC values were observed for neurological ($FIC=0.45$), urinary ($FIC=0.40$), and sexual health categories ($FIC=0.33$), while circulatory, dental, and ear-related categories showed negligible or no consensus ($FIC=0.00$ (Table 2). Similarly, in the Tharu community skin-related ailments had the highest representation ($N_t=26$; $N_{ur}=99$; $FIC=0.74$), followed by digestive disorders ($FIC=0.73$) and endocrine, metabolic, and nutritional categories ($FIC=0.71$). Neurological and respiratory categories also showed substantial agreement ($FIC=0.71$ and 0.69 , respectively). In contrast, lower consensus values were observed for urinary ($FIC=0.36$), dental ($FIC=0.33$), and sexual health ($FIC=0.00$) (Table 2).

Habit-wise distribution of medicinal plants

The most often used medicinal plants in the Chepang community among the species surveyed were herbs (35%), followed by shrubs (28%), trees (27%), climbers (9%), and ferns (1%) (Figure 3A). Similarly, Herbs (38%) were the most frequently used therapeutic plants in the Tharu population followed by Trees (27%), shrubs (23%), climbers (11%) and ferns (2%) (Figure 3B).

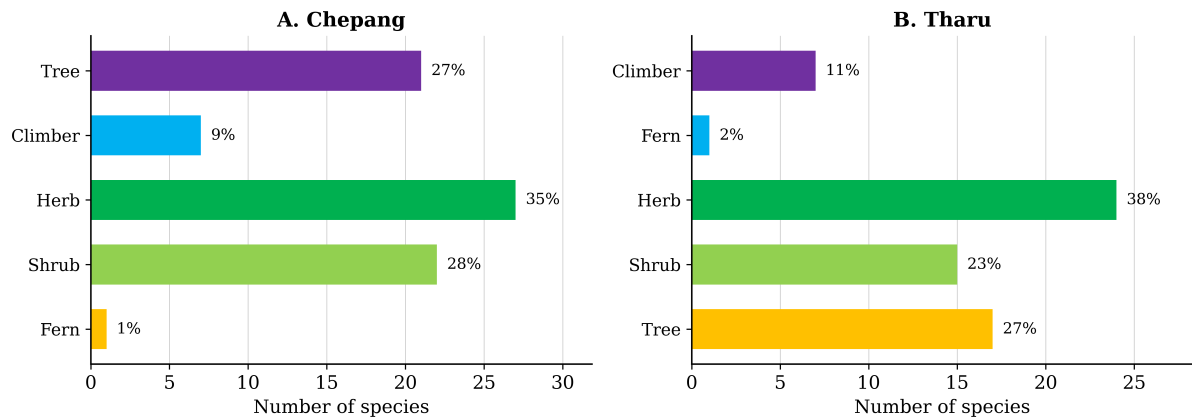


Figure 3. Habit-wise distribution of medicinal plants in (A) Chepang and (B) Tharu communities

Plant parts utilization for medication

In the Chepang community, the most frequently used plant part is the leaf (21%), which is followed by fruit (18%), root (16%), bark (11%), stem (7%), whole plant (6%), sprout (5%), flower (5%), rhizome (5%), seed (4%), and latex (2%) (Figure 4A). Moreover, the most frequently used plant part in the Tharu community is the leaf (21%), which is followed by fruit (17%), root (16%), whole plant (14%), stem (10%), bark (9%), seed (6%), branch (4%), rhizome (2%), and flower (1%) (Figure 4B).

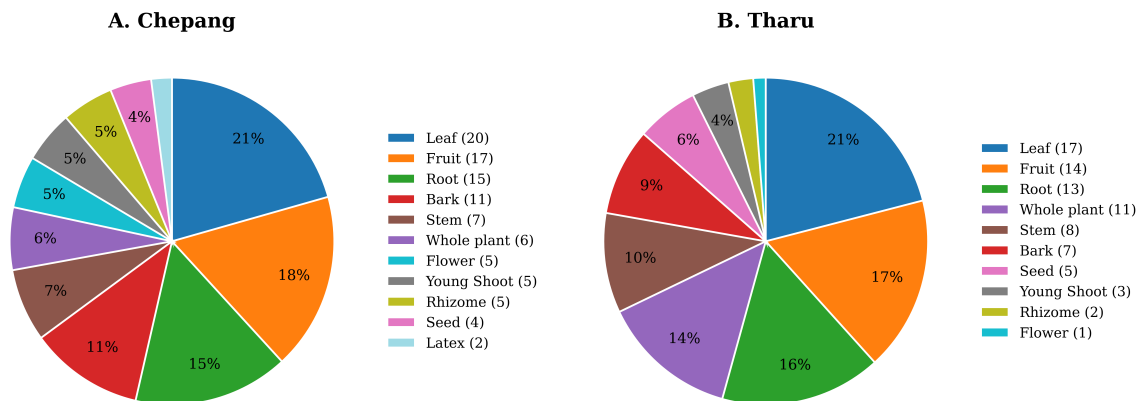


Figure 4. Plant part-wise distribution of medicinal plants in (A) Chepang and (B) Tharu communities

Plant species based on method of preparation of medicine.

In the Chepang community, juice accounted for 27% of plant species and was the most widely used form of medication, followed by paste (17%), raw form (13%), infusion (11%), powder (9%), decoction (7%), dry form (5%), cooked form (4%), latex (3%), oil (3%), and pulp (1%) (Figure 5A). Similarly, juice accounted for 29% of plant species in the Tharu community, making it the most widely used form of medication. Juice (29%), raw form (17%), powder (13%), paste (10%), decoction (9%), infusion (5%), dry form (5%), smoke (5%), and latex (3%) were the next most popular forms, with cooked, steamed, and roasted forms being the least popular (1% each) (Figure 5B).

Plant species based on the mode of application

In the Chepang community, the majority of drugs (74%) were given orally, followed by external application or poulticing (14%), bathing (6%), fumigation (4%), drips (1%), and wearing as a garland or in other ways (1%) (Figure 6A). Similarly, in the Tharu community, the majority of drugs (64%) were taken orally, with external application or poulticing (26%), massage (4%), bathing (4%), and wearing as a garland or in other forms (2%) (Figure 6B).

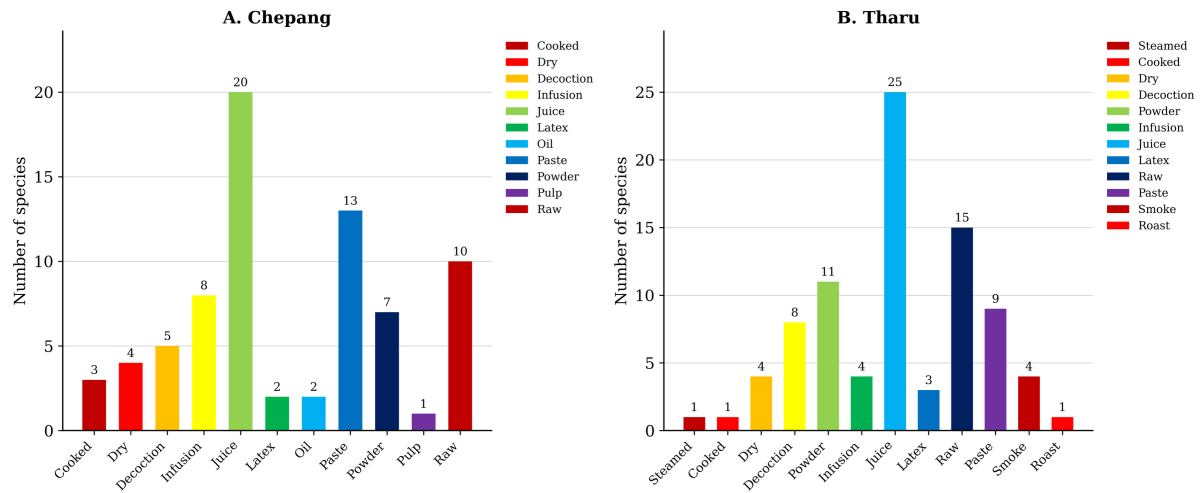


Figure 5. Plant species based on the method of preparation of medicine in (A) Chepang and (B) Tharu communities

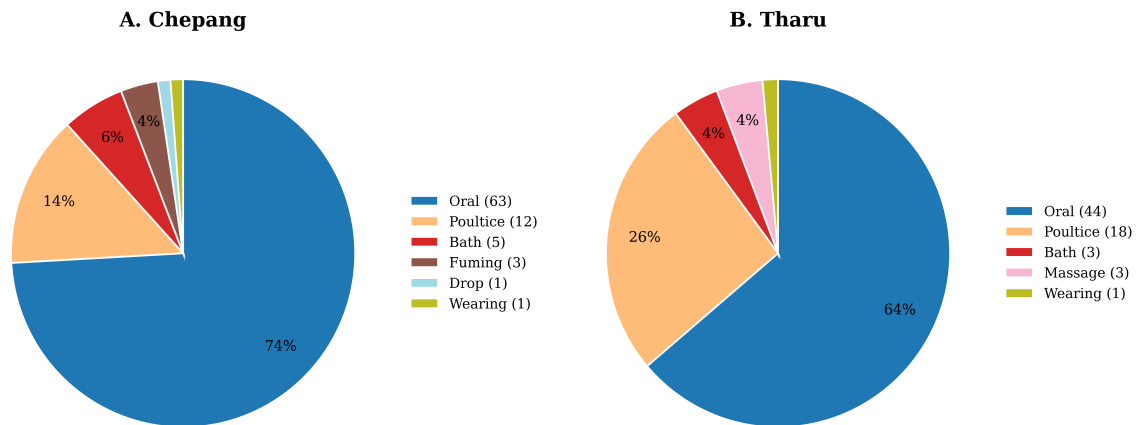


Figure 6. Plant species based on mode of application by (A) Chepang and (B) Tharu communities

Plant species based on collection source

For the Chepang community, forests were the primary source of medicinal plant species, accounting for 50% of the reported collection, followed by farms (16%), home gardens (15%), rangelands (11%), relatives (5%), and markets (3%) (Figure 7A). Similarly, forests constituted the major source for the Tharu community, contributing 44% of the reported medicinal plant species, followed by farmland (38%), home gardens (7%), rangelands (7%), and relatives (3%) (Figure 7B). These findings indicate that forests remain the principal source of medicinal plants for both communities, although the Tharu community showed a relatively greater reliance on farmland than the Chepang community.

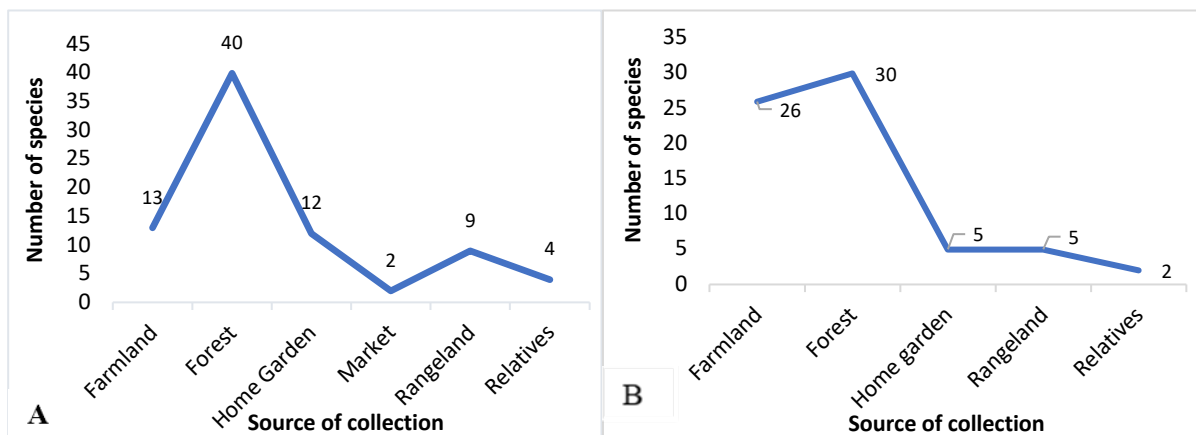


Figure 7. Plant species based on source of collection by (A) Chepang and (B) Tharu

Plant species based on abundance in CF

A total of 64 plant species were found to be farmed or protected in the Chepang community, whereas 38 species were common and unprotected. Furthermore, 59% of the plant species were categorized as common, with uncommon species coming in second at 27% and very common species at 14% (Figure 8A). In a similar vein, 77 plant species were found to be cultivated or protected in the Tharu community, whereas 39 species were common and unprotected. Additionally, 50% of the plant species were classified as common, with uncommon species coming in second at 33% and very common species at 17% (Figure 8B).

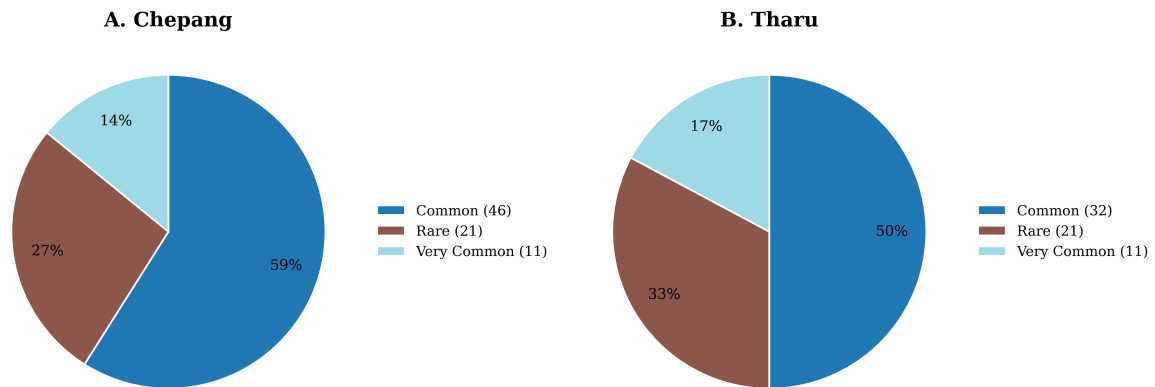


Figure 8. Plant species based on abundance in CF in (A) Chepang and (B) Tharu communities

Source of knowledge of remedies

Among the Chepang community, elderly people (35%), followed by self-practice (30%), traditional healers (13%), parents (8%), neighbors (8%), friends (3%), social media (5%) and market at 1% (Figure 9A). Comparably, elderly people accounted for (39%) of the Tharu community's medicinal plant treatments, with self-practice coming in second at (36%), traditional healers at (12%), parents at (8%), and social media at (5%) Figure (9B).

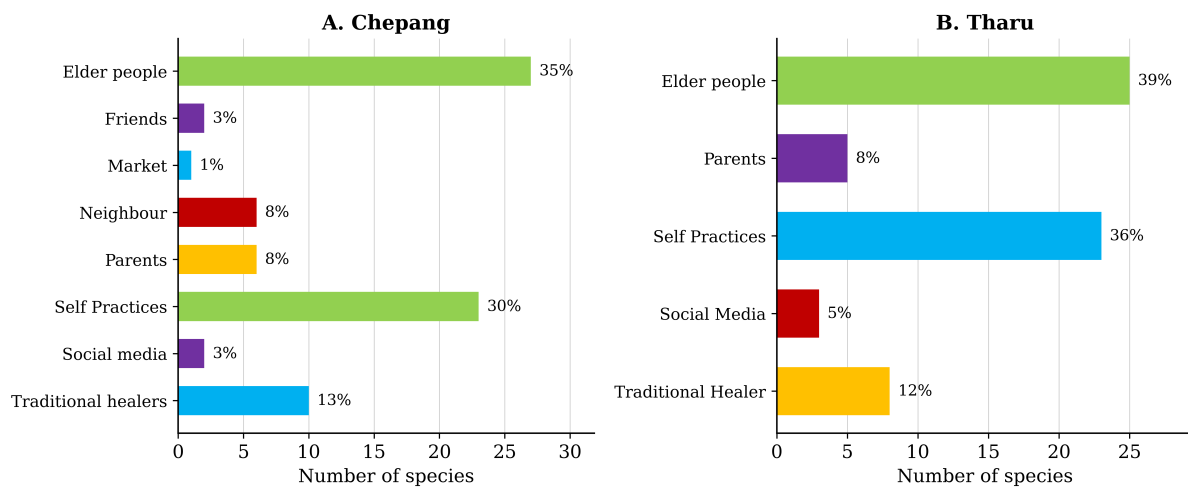


Figure 9. Source of knowledge of remedies in (A) Chepang and (B) Tharu communities

Five most frequently treated diseases

The most commonly treated diseases in both Chepang and Tharu communities were fever (N=11 & N=6), wounds and cuts (N=4 & N=9), gastritis (N=10 & N=8), cough (N=8 & N=7), and headache (N=6 & N=4) (Figure 10).

Frequently cited medicinal plants

In the Chepang community, *Phyllanthus emblica* and *Terminalia chebula* are the most commonly mentioned medicinal plants, with a Relative Frequency Citation (RFC) of 0.44, followed by *Aloe vera* (0.40), *Terminalia bellirica* (0.38), and *Centella asiatica* (0.34) (Figure 11A). However, in the Tharu population, *Dioscorea bulbifera* is the most commonly cited medicinal plant, with a Relative Frequency Citation (RFC) of 0.46, followed by *Justicia adhatoda* (0.44), *Dioscorea deltoidea* (0.42), *Cheilanthes bicolor* (0.4), and *Psidium guajava* (0.36) (Figure 11B).

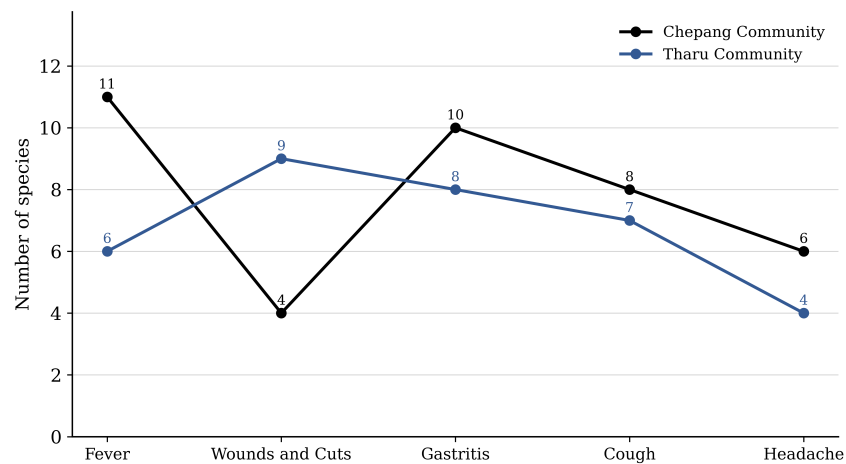


Figure 10. The five most cured diseases with the number of species in the Chepang and Tharu communities

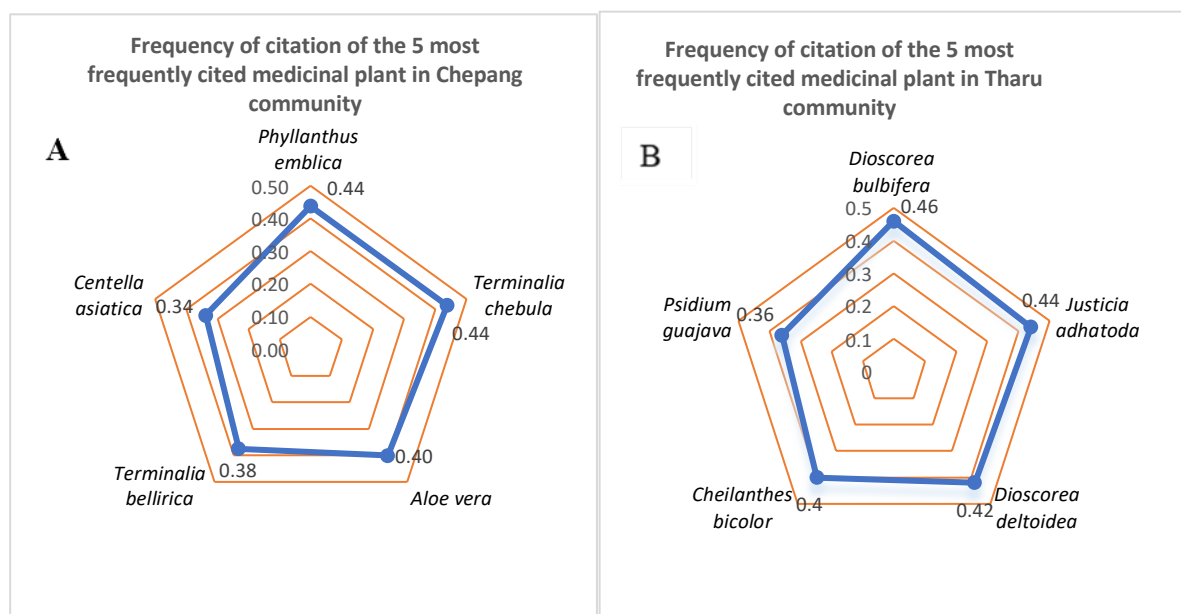


Figure 11. Radar chart showing the relative frequency of five most frequently cited medicinal plants in (A) Chepang and (B) Tharu communities

Altitudinal Distribution of Medicinal Trees, Shrubs and Herbs

Altitudinal Distribution of Medicinal Trees

A total of 16 medicinal tree species were recorded within the altitudinal range of 330-1150 m in the Kalika Community Forest (Table 3). Tree density was highest at the lower elevation range of 330-535 m (75/ha), followed by 67/ha at 536-740 m, 61/ha at 741-945 m, and 50/ha at 946-1150 m. These findings suggest that the lower elevation zone provides comparatively more favorable ecological conditions for medicinal tree species. Among the recorded species, *Terminalia chebula* showed the highest density (29/ha), whereas *Persea bombycina* exhibited the lowest density (5/ha) in the study area. The elevational distribution pattern of medicinal tree species across 205 m intervals within the 330-1150 m range is presented in Table 3.

Altitudinal Distribution of Medicinal Shrubs and Herbs

A total of 30 medicinal shrub species were recorded within the altitudinal range of 330-1150 m in the Kalika Community Forest (Table 4). Shrub density was highest at elevations between 741-945 m, with a density of 4800 individuals/ha, followed by 4500 individuals/ha at 536-740 m, 3250 individuals/ha at 330-535 m, and 2250 individuals/ha at 946-1150 m. These findings suggest that, excluding the influence of other environmental factors, the elevation range of 741-945 m provides comparatively favorable conditions for the growth and distribution of medicinal shrub species. Among the recorded shrubs, *Argemone mexicana* and *Millettia extensa* showed the highest occurrence, each with a density of 1450 individuals/ha, whereas *Cestrum nocturnum* and *Equisetum diffusum* exhibited the lowest density, with only 50 individuals/ha in the Kalika

Community Forest. The distribution pattern of medicinal shrub species across the elevational gradient of 330-1150 m, divided into 205 m intervals, is presented in Table 4 and was found to be random. Similarly, a total of 51 medicinal herb species were documented within the same altitudinal range of 330-1150 m in the Kalika Community Forest (Table 5). Herb density was also highest at elevations between 741-945 m, reaching 59,020 individuals/ha, followed by 38,200 individuals/ha at 536-740 m, 26,645 individuals/ha at 946-1150 m, and 18,950 individuals/ha at 330-535 m. This pattern further indicates that the mid-elevational zone of 741-945 m is comparatively more suitable for the occurrence and growth of medicinal herb species. Among the herbs, *Piper longum* was the most abundant species with a density of 7100 individuals/ha, whereas *Rauvolfia serpentina* was the least abundant, with only 250 individuals/ha recorded in the Kalika Community Forest. The elevational distribution of medicinal herb species across the 205 m intervals within the range of 330-1150 m is presented in Table 5. These findings indicate that medicinal plant availability varies across elevation classes and provide the ecological context for interpreting the ethnobotanical use patterns observed in the Chepang and Tharu communities.

Table 3. Distribution of medicinal trees at Kalika Community Forests.

Species			Tree density/hectare			
Scientific Name	Family	Voucher Number (Plant voucher specimens collected at Tribhuvan University Central Herbarium)	Elevation in Meter			
			330-535	536-740	741-945	946-1150
<i>Semecarpus anacardium</i> L.	Anacardiaceae	26-TUCH-8761	5	7	3	0
<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	26-TUCH-8733	5	0	5	0
<i>Cleistocalyx operculatus</i> (Roxb.) Merr. & Perry.	Myrtaceae	26-TUCH-8771	10	10	0	0
<i>Syzygium cumini</i> (L.) Skeels, Bull.	Myrtaceae	26-TUCH-8781	10	2	0	5
<i>Mallotus philippinensis</i> Muell.-Arg.	Euphorbiaceae.	26-TUCH-8796	15	8	5	0
<i>Buchanania lotifolia</i> Roxb.	Anacardiaceae	26-TUCH-8788	10	10	5	0
<i>Terminalia chebula</i> Retz.	Combretaceae	26-TUCH-8800	5	10	9	5
<i>Cassia fistula</i> L.	Fabaceae	26-TUCH-9762	10	10	0	0
<i>Desmodium oojinensis</i> (Roxb.) H. Ohashi	Fabaceae	26-TUCH-8809	5	5	0	0
<i>Diospyros tomentosa</i> Roxb.	Ebenaceae	26-TUCH-8814	0	5	5	0
<i>Phyllanthus emblica</i> L.	Phyllanthaceae	26-TUCH-8739	0	0	10	10
<i>Diploknema butyracea</i> (Roxb.) H.J. Lam	Sapotaceae	26-TUCH-8805	0	0	5	5
<i>Bridelia retusa</i> Spreng.	Phyllanthaceae	26-TUCH-8818	0	0	4	5
<i>Madhuca longifolia</i> (Koenig) Mac.	Sapotaceae	26-TUCH-8772	0	0	5	10
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	26-TUCH-8782	0	0	5	5
<i>Persea bombycina</i> (King ex Hook. f.) Kost.	Lauraceae	26-TUCH-8763	0	0	0	5
Total			75	67	61	50

Table 4. Distribution of medicinal shrubs at Kalika Community Forests

Shrub density/hectare						
Species			Elevation in Meter			
Scientific Name	Family	Voucher Number (Plants voucher species collected at Tribhuvan University Central Herbarium)	330-535	536-740	741-945	946-1150
<i>Argemone Mexicana</i> L.	Papaveraceae	26-TUCH-8750	500	900	550	-

<i>Asparagus racemosus</i> Willd.	Asparagaceae	26-TUCH-8795	200	300	100	-
<i>Woodfordia fruticosa</i> (L.) Kurz	Lythraceae	26-TUCH-8789	-	100	350	-
<i>Catunaregam spinosa</i> (Thunb.)	Rubiaceae	26-TUCH-8756	200	200	100	50
<i>Justicia adhatoda</i> L.	Acanthaceae	26-TUCH-8815	-	600	-	-
<i>Lindera neesiana</i> (Wall. ex Nees)	Lauraceae	26-TUCH-8797	-	-	-	150
<i>Rubus ellipticus</i> Sm.	Rosaceae	26-TUCH-8730	-	-	200	100
<i>Berberis aristata</i> DC.	Berberidaceae	26-TUCH-8749	-	-	-	100
<i>Lyonia ovalifolia</i> (Wall.)	Ericaceae	26-TUCH-8783	-	-	200	100
<i>Maesea montana</i> A. DC.	Primulaceae	26-TUCH-8743	-	-	100	100
<i>Murraya koinichi</i> L.	Rutaceae	26-TUCH-8773	400	250	0	-
<i>Colebrookea oppositifolia</i> Sm	Lamiaceae	26-TUCH-8731	150	250	350	200
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	26-TUCH-8748	100	50	50	-
<i>Equisetum diffusum</i> L.	Equisetaceae	26-TUCH-8727	-	50	-	-
<i>Cestrum nocturnum</i> L.	Solanaceae	26-TUCH-8740	-	-	-	50
<i>Pennisetum typhoidis</i> (Burm.f.)	Poaceae	26-TUCH-8751	-	150	200	200
<i>Mussaenda macrophylla</i> Wall.	Rubiaceae	26-TUCH-8728	-	-	200	150
<i>Milletia extensa</i> (Benth.)	Fabaceae	26-TUCH-8780	150	200	100	100
<i>Murraya paniculate</i> (L.)	Rutaceae	26-TUCH-8810	-	150	200	-
<i>Toddalia asiatica</i> (L.) Lam.	Rutaceae	26-TUCH-8821	-	-	-	100
<i>Osyris wightiana</i> Wall.	Santalaceae	26-TUCH-8757	150	150	100	250
<i>Persicaria barbata</i> (L.)	Polygonaceae	26-TUCH-8764	400	100	-	-
<i>Pogostemon benghalensis</i> (Brum.f.) Kuntze	Lamiaceae	26-TUCH-8808	200	100	250	-
<i>Clerodendrum serratum</i> (L.) Moon.	Lamiaceae	26-TUCH-8790	-	150	100	-
<i>Ribes takare</i> D.Don.	Grossulariaceae	26-TUCH-8770	-	250	150	100
<i>Paspalum distichum</i> L.	Poaceae	26-TUCH-8813	-	-	400	-
<i>Maoutia puya</i> (Buch. -Ham. & Wall. ex Hook.)	Urticaceae	26-TUCH-8774	-	-	150	150
<i>Bauhinia vahlii</i> Wight & Arn.	Fabaceae	26-TUCH-8819	450	350	400	-
<i>Melastoma malabathricum</i> L.	Melastomataceae	26-TUCH-8732	350	150	200	100
<i>Reinwardtia indica</i> Dumort.	Linaceae	26-TUCH-8724	-	50	350	250
Total			3250	4500	4800	2250

Table 5. Distribution of medicinal herbs at Kalika community forests.

Herb density/hectare						
Species			Elevation in Meter			
Scientific Name	Family	Voucher Number (Plants voucher species collected at Tribhuvan University central Herbarium)	330-535	536-740	741-945	946-1150
<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	26-TUCH-8738	850	1500	2250	1000
<i>Dioscorea deltoidea</i> Wall. ex Griseb	Dioscoreaceae	26-TUCH-8734	950	1250	1200	400

<i>Dioscorea pentaphylla</i> L.	Dioscoreaceae	26-TUCH-8752	500	750	960	500
<i>Pogostemon benghalensis</i> (Brum. f.) Kuntze	Lamiaceae	26-TUCH-8804	1350	2500	2300	750
<i>Smilax aspera</i> L.	Smilacaceae	26-TUCH-8784	500	1100	1100	-
<i>Cleome viscosa</i> L.	Cleomaceae	26-TUCH-8758	-	1125	1500	-
<i>Aleuritopteris albomarginata</i> (C.B.Clarke) Ching	Pteridaceae	26-TUCH-8816	-	1125	2300	1250
<i>Cyperus rotundus</i> L.	Cyperaceae	26-TUCH-8822	750	625	1350	-
<i>Piper longum</i> L.	Piperaceae	26-TUCH-8791	4000	2000	1100	-
<i>Lygodium japonicum</i> (Thunb.) Sw.	Lygodiaceae	26-TUCH-8765	1800	1550	1960	-
<i>Swertia angustifolia</i> Buch. - Ham. ex D. Don	Gentianaceae	26-TUCH-8794	-	-	720	250
<i>Polypodium vulgare</i> L.	Polypodiaceae	26-TUCH-8812	750	750	530	325
<i>Bergenia ciliata</i> (Haw.) Sternb.	Saxifragaceae	26-TUCH-8769	-	-	150	200
<i>Urtica dioica</i> L.	Urticaceae	26-TUCH-8798	-	-	2000	1500
<i>Matteuccia struthiopteris</i> (L.)	Onocleaceae	26-TUCH-8775	-	1625	2100	1100
<i>Persicaria barbata</i> (L.) H. Hara	Polypodiaceae	26-TUCH-8779	-	1000	2050	1250
<i>Begonia palmata</i> D. Don	Begoniaceae	26-TUCH-8744	-	-	1200	700
<i>Tinospora cordifolia</i> (Thunb.) Miers	Menispermaceae	26-TUCH-8785	450	625	600	250
<i>Cissampelos pareira</i> L.	Menispermaceae	26-TUCH-8753	-	1100	800	-
<i>Lycopodium clavatum</i> L.	Lycopodiaceae	26-TUCH-8820	-	-	1400	700
<i>Spilanthes paniculata</i> Wall. ex DC.	Asteraceae	26-TUCH-8741	-	-	500	600
<i>Achyranthes aspera</i> L.	Amaranthaceae	26-TUCH-8807	500	1625	1750	820
<i>Elephantopus scaber</i> L.	Asteraceae	26-TUCH-8801	-	1250	1950	1000
<i>Trichosanthes tricuspidata</i> Lour.	Cucurbitaceae	26-TUCH-8759	-	250	650	250
<i>Rauvolfia serpentina</i> Benth.	Apocynaceae	26-TUCH-8817	-	250	-	-
<i>Curcuma aromatica</i> Salisb.	Zingiberaceae	26-TUCH-8726	-	950	1125	125
<i>Elsholtzia blanda</i> (Benth.)	Lamiaceae	26-TUCH-8729	-	250	625	-
<i>Costus speciosus</i> (Koeing Sm.)	Costaceae	26-TUCH-8768	-	1250	1000	-
<i>Thespesia lampas</i> (Cav.) Dalzell & A. Gibson	Malvaceae	26-TUCH-8725	-	950	1500	350
<i>Drimys indica</i> (Roxb.) Jessop.	Asparagaceae	26-TUCH-8803	-	500	500	-
<i>Crinum amoenum</i> Roxb.	Amaryllidaceae	26-TUCH-8811	-	-	1500	350
<i>Cissampelos pareira</i> L.	Menispermaceae	26-TUCH-8737	-	700	1100	625
<i>Cyanthillium cinereum</i> (L.) H. Roxb.	Asteraceae	26-TUCH-8823	750	750	500	-
<i>Smilax rotundifolia</i> L.	Smilacaceae	26-TUCH-8735	-	350	1000	-
<i>Imperata cylindrica</i> (L.) Raeurch	Poaceae	26-TUCH-8792	1750	1050	1250	500
<i>Zingiber cassumunar</i> Roxb.	Zingiberaceae	26-TUCH-8776	1500	250	950	-
<i>Dryopteris goldieana</i> (Hook.)	Dryopteridaceae	26-TUCH-8754	-	1300	1350	1625
<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	26-TUCH-8778	-	950	1250	700
<i>Pilea scripta</i> (D. Don).	Urticaceae	26-TUCH-8786	-	850	1500	2000

<i>Blumea lacera</i> var. <i>lacera</i>	Asteraceae	26-TUCH-8760	850	1500	750	-
<i>Polygala arillata</i> Buch. - Ham. ex D.Don	Polygalaceae	26-TUCH-8806	-	850	750	-
<i>Cautleya spicata</i> (Sm.) Baker	Zingiberaceae	26-TUCH-8802	-	-	500	1100
<i>Girardinia diversifolia</i> (Link) Friis	Urticaceae	26-TUCH-8767	-	-	1050	1000
<i>Artemisia indica</i> Willd.	Asteraceae	26-TUCH-8799	-	-	1150	1500
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	26-TUCH-8793	350	-	-	-
<i>Piper boehmeriifolia</i> (Miq.) C. DC.	Piperaceae	26-TUCH-8736	350	625	750	-
<i>Xanthosoma sagittifolium</i> (L.) Schott	Araceae	26-TUCH-8742	-	500	1150	-
<i>Euphorbia hirta</i> L.	Euphorbiaceae	26-TUCH-8787	1000	1125	-	-
<i>Elatostema</i> J.R.Forst. & G.Forst.	Urticaceae	26-TUCH-8766	-	-	1750	1750
<i>Ocimum tenuiflorum</i> L.	Lamiaceae	26-TUCH-8777	-	-	500	625
<i>Daphne jezoensis</i> Maxim.	Thymelaeaceae	26-TUCH-8755	-	1500	950	-
Total			18950	38200	56870	25095

Discussion

Diversity and Life Forms of Medicinal Plants

The present study documented 142 medicinal plant species belonging to 91 families that were traditionally used by the Chepang and Tharu communities for the treatment of 70 different ailments. Fabaceae was the most represented family in the present study, with 9 species, followed by Asteraceae (8 species) and Lamiaceae (7 species). This pattern is broadly comparable to a recent review of ethnobotanical studies from Bagmati Province, which reported Fabaceae as the most diverse family, comprising 43 species, followed by Asteraceae (33 species) and Lamiaceae (27 species), supporting the prominence of these three families in traditional plant use in central Nepal (Subedi et al., 2025). Herbs were the major life form in both the Chepang and Tharu communities. The predominance of herbs found in the current study is largely consistent with previous ethnobotanical investigations in Nepal. Tamang *et al.* (2017) identified 226 medicinal plant species in the Chepang community, with 95 (42.0%) being herbaceous, followed by trees (69 species, 30.5%), shrubs (38 species, 16.8%), and climbers (24 species, 10.6%). Similarly, Thapa (2020) found that in Rupandehi and Nawalparasi, herbs were the most often represented life form, accounting for 47% of the therapeutic plants documented. These findings lend credence to the relatively high representation of herbs seen in the current study, implying that herbaceous species are an important component of traditional medicinal plant use in various ecological and cultural situations across Nepal. Similar patterns, where herbs dominate over trees and shrubs, have also been reported by Rokaya *et al.* (2012), Gautam and Timilsina (2022), and Acharya *et al.* (2025). The greater reliance on herbs may be associated with their easy accessibility, rapid regeneration, and widespread availability in local ecosystems. In particular, the Chepang community demonstrated strong familiarity with herb-based remedies, which is consistent with the findings of Rijal (2008). Likewise, the Tharu community heavily depends on herbs because of their perceived effectiveness and ease of collection and cultivation. Traditional healers often prefer herbs due to their simple preparation methods and year-round availability (Faruque *et al.* 2018).

Plant Parts Used and Preparation Methods

Leaves were the most commonly used plant portion in both groups. Different plant parts were produced in a variety of ways, including juice, paste, powder, oil, and direct use of raw ingredients. Among these, juice was the most commonly employed preparation method in both communities. Similar observations have been reported in previous studies conducted in Nepal (Adhikari *et al.* 2019; Thapa 2020; Yadav and Chaudhary 2022). The frequent use of leaves may be attributed to their ease of collection and the presence of high concentrations of bioactive compounds. Moreover, harvesting leaves is generally less destructive than collecting roots, bark, or whole plants, thereby contributing to plant conservation. Juice preparation is also comparatively simple, requires minimal processing, allows flexible dosage, and preserves the medicinal properties of fresh plant materials (Thapa 2020).

Mode of Application and Sources of Medicinal Plants

Oral administration was the most common route of use in both groups, followed by external applications including poultices and topical therapies. Similar trends have been widely documented in ethnomedicinal studies, where oral administration remains the preferred route for treating a wide range of ailments because of its convenience and perceived effectiveness. Forests served as the primary source of medicinal plants, contributing 50% and 44% of the medicinal species used by the Chepang and Tharu communities, respectively. This finding highlights the strong dependence of local communities on surrounding forest ecosystems for primary healthcare and traditional healing practices. Similar dependence on forest resources has been reported in several ethnobotanical studies from Nepal (Upreti *et al.* 2010; Singh *et al.* 2012; Kunwar *et al.* 2022).

Availability Status and Transmission of Ethnomedicinal Knowledge

A total of 64 medicinal plant species were recorded in the Chepang community and 77 species in the Tharu community. Most species were categorized as common, accounting for 59% and 50% in the Chepang and Tharu communities, respectively, followed by uncommon and dominant species. The relatively high proportion of common species may indicate that many medicinal plants are still reasonably available in the study area. However, the presence of uncommon species suggests that certain medicinal plants may be vulnerable to overharvesting, habitat disturbance, and increasing anthropogenic pressure. The transfer of ethnomedicinal knowledge in both communities was found to be largely dependent on elderly individuals. Previous studies have similarly reported that older generations possess greater knowledge regarding medicinal plant identification, preparation, and application compared to younger people (Adhikari *et al.* 2019; Karki *et al.* 2023). Consistent with this pattern, respondent age was significantly correlated with the number of species described in both communities (combined $r = .354$, $p < .001$; Chepang $r = .321$, $p = .023$; Tharu $r = .376$, $p < .001$). In the present study, approximately 35% of Chepang respondents and 39% of Tharu respondents reported acquiring their medicinal plant knowledge from elders, emphasizing the importance of family-based and intergenerational knowledge transmission. Comparable findings have been reported in other traditional communities worldwide (Schultz *et al.* 2020; Agize *et al.* 2022). However, the gradual decline in knowledge transfer to younger generations may threaten the long-term preservation of traditional ethnomedicinal practices.

Medicinal Plants Used for Different Ailments

The most commonly treated ailments in both communities included fever, wounds and cuts, gastritis, cough, and headache. Similar disease treatment patterns have been documented in numerous ethnobotanical investigations (Asfaw *et al.* 2023; Aremu *et al.* 2024), indicating that medicinal plants continue to play a crucial role in treating common health problems in rural communities where access to modern healthcare facilities may be limited.

Relative Frequency of Citation (RFC)

The Relative Frequency of Citation (RFC) analysis demonstrated that both communities strongly depend on a relatively small number of highly valued medicinal plant species. In the Chepang community, species such as *Phyllanthus emblica*, *Terminalia chebula*, *Aloe vera*, *Terminalia bellirica*, and *Centella asiatica* showed high RFC values, whereas the Tharu community commonly cited *Dioscorea bulbifera*, *Justicia adhatoda*, *Dioscorea deltoidea*, *Cheilanthes bicolor*, and *Psidium guajava*. These findings indicate strong cultural preferences and repeated use of particular medicinal species, which is consistent with earlier ethnobotanical studies (Kunwar and Bussmann 2009; Asfaw *et al.* 2023).

Informant Consensus Factor (FIC)

The Informant Consensus Factor (FIC) analysis revealed the highest consensus for digestive ailments in both communities (0.728), followed by respiratory, general and unspecified, and neurological disorders. High FIC values generally indicate strong agreement among informants on the use of specific plant species to treat particular disease categories, which may further suggest the perceived effectiveness of these medicinal plants. Similar findings have been reported in previous studies conducted among the Tamang community and other ethnic groups of Nepal (Shrestha *et al.* 2014; Gautam and Timilsina 2022; Acharya *et al.* 2025), as well as in ethnobotanical research from Bhutan (Mukhia *et al.* 2026). The high level of agreement observed in this study reflects a well-established and widely shared traditional healthcare knowledge system within both the Chepang and Tharu communities. Overall, higher FIC values in the digestive, respiratory, and skin-related categories suggest strong agreement among informants and indicate well-established traditional knowledge for treating these ailments. In contrast, lower FIC values in other categories may reflect limited knowledge sharing or a wider diversity of plant-use practices among informants.

Elevational Distribution of Medicinal Trees, Shrubs and Herbs

The elevational distribution analysis conducted in the Kalika Community Forest revealed important ecological patterns in medicinal plant diversity and abundance across the 330-1150 m altitudinal gradient. The distribution patterns varied among life forms, indicating that elevation may influence the occurrence and abundance of medicinal plant species.

A total of 17 medicinal tree species were recorded between elevations of 330 and 1150 m. Tree density gradually decreased with increasing elevation, with the highest density observed at 330-535 m (75/ha) and the lowest at 945-1150 m (50/ha). These findings suggest that lower elevations provide comparatively more suitable environmental conditions for medicinal tree species. Similar elevational patterns have been reported by Acharya *et al.* (2009) and Kunwar *et al.* (2022), who observed greater medicinal plant richness in lower to mid-hill regions of Nepal. Among tree species, *Terminalia chebula* showed the highest abundance (29/ha), whereas *Persea bombycina* exhibited the lowest abundance (5/ha), indicating species-specific ecological adaptability. Although the lower elevation range appears favorable for medicinal tree species, increasing human demand and harvesting pressure may threaten their long-term sustainability, emphasizing the need for effective conservation and sustainable resource management strategies.

Similarly, 32 medicinal shrub species and 52 medicinal herb species were recorded within the same elevational range of 330-1150 m in the Kalika Community Forest. The varied elevational patterns across the three life forms indicate that elevation may affect medicinal plants differently depending on their growth mode. The decrease in medicinal tree density from lower to upper elevation classes may represent the increasing restrictions on tree establishment and growth caused by differences in temperature, growing season length, and resource availability along elevation gradients. Similar declines in tree diversity and structural attributes with increasing elevation have been observed in Himalayan forests, where climatic conditions and associated changes in soil and vegetation characteristics have been identified as important factors shaping tree communities (Carpenter 2005; Rana *et al.* 2019; Yadav *et al.* 2025). In contrast, the higher density of medicinal shrubs and herbs at 741-945 m suggests that the understory layer responds differently to the elevational gradient. Middle-elevation zones may be transitional settings in which changes in overstory composition and canopy structure can result in diverse light and resource conditions that support a larger abundance of understory plants. Evidence from the temperate Himalaya also demonstrates that shrub and herb richness can follow a hump-shaped pattern, growing from lower elevations, peaking at intermediate elevations, and decreasing at higher elevations (Sangry *et al.* 2024). At the Himalayan scale, shrubs and herbs have mid-elevation peaks in species richness, whereas tree richness generally falls or follows a distinct elevational pattern (Rana *et al.* 2019). Thus, the comparatively high shrub and herb density observed at 741-945 m in the current study could be attributed to the combined influence of elevation-related climatic conditions and difference in overstory and understory resource habitats. However, the environmental factors were not directly measured in this study; therefore, differences in temperature, moisture availability, soil conditions, canopy cover, topography, and disturbance may potentially contribute to the observed pattern, but these factors cannot be confirmed as mechanisms based on the present data (Bhandari *et al.* 2021; Kunwar *et al.* 2022; Acharya *et al.* 2025). Among shrubs, *Argemone mexicana* and *Millettia extensa* exhibited the highest densities, whereas *Cestrum nocturnum* and *Equisetum diffusum* were the least abundant. Similarly, among herbs, *Piper longum* showed the highest density, while *Rauvolfia serpentina* exhibited the lowest density. Such variation in species abundance may reflect differences in ecological adaptability, regeneration potential, habitat preference, and anthropogenic disturbances, as reported in previous ethnobotanical studies (Bhandari *et al.* 2021). For instance, *Urtica dioica*, which was recorded at mid-elevations in this study, is widely recognized for its diverse ethnopharmacological applications, including antidiabetic, anti-inflammatory, and antimicrobial properties (Dhakal *et al.* 2024).

Conclusion

This study documented substantial ethnomedicinal knowledge among the Chepang and Tharu communities, recording 142 medicinal plant species from 91 families, most notably Fabaceae, used to treat 70 ailments. Herbs were the dominant life form, leaves the most-used plant part, and oral administration the principal mode of application, with forest ecosystems the primary source, reflecting continued reliance on natural resources for primary healthcare. Knowledge was concentrated among older, less formally educated respondents (age-knowledge correlation, $r = .35$, $p < .001$; age-group ANOVA, $F(4,125) = 6.37$, $p < .001$), indicating it is transmitted mainly through practical experience and oral tradition rather than formal schooling. High FIC values for digestive and respiratory ailments reflected strong informant agreement, while RFC highlighted several culturally important, widely cited species. Plant distribution varied along the 330-1150 m elevation gradient: tree density peaked at lower elevations, shrub and herb densities at mid-elevations, with *Terminalia chebula* and *Piper longum* relatively abundant and *Persea bombycina* and *Rauvolfia serpentina* comparatively scarce. As environmental variables such as temperature, moisture, soil, canopy cover, and disturbance were not measured, their role here remains a plausible explanation rather than a demonstrated one. Future research should incorporate these environmental variables and more

balanced sampling across elevations and communities to better distinguish the ecological, geographic, and cultural drivers of medicinal plant use. Community-based documentation, youth participation, and knowledge-sharing programs should be strengthened to preserve traditional knowledge before it is lost with the passing of elder knowledge-holders.

Declarations

List of abbreviations: H=Herbs, Sh=Shrubs, Tr=Tree, Cl=Climbers, Or=Orchids, Ep=Epiphytes, Fe=Fern, Le=Leaf, St=Stem, R=Root, Rh=Rhizome, B=Bark, Fr=Fruits, Fl=Flower, Tu=Tuber, WP=Whole Plants, Se=Seeds, YS=Young Shoots, BL=Bark Latex, VC=Very Common, C=Common, Ra=Rare

Ethics approval and consent to participate: All participants provided oral prior informed consent when the questionnaire was administered to collect ethnomedicinal knowledge. Similarly, during the field inventory, necessary coordination and oral prior informed consent were also obtained from the concerned Community Forests (CF), Division Forest Office (DFO), Sub-Division Forest Office (SDFO), and the local community.

Consent for publication: Verbal informed consent was obtained from all data providers before they participated in the surveys and informal discussions. They were informed about the nature and purpose of the study, and that anonymized data would be used for publication. All authors have read and agreed to publish the manuscript.

Availability of data and materials: The dataset generated during the present study is available from the authors upon reasonable request.

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Appendix 1. Ethnomedicinal uses of plant species in the Chepang community of Chitwan District, Nepal

Family	Scientific Name	Local Name	Habit	Part used	Use for medicine	Forms of medication	Mode of application	Source of Collection	Source of identification	Status	FC	RFC
Acanthaceae	<i>Justicia adhatoda</i> L.	Asuro	Sh	Le	Fever, Asthma, Cough, Formicide	Juice	Oral	Farmland	Self-Practices	Co	22	0.44
Acoraceae	<i>Acorus calamus</i> L.	Katara	H	Rh	Cold, Cough, Asthma, Toothache,	Raw	Oral	Home Garden	Self-Practices	Co	6	0.12
Agavaceae	<i>Agave americana</i> L.	Kettuke	Sh	Le	wound, formicide, Fish poisoning	Paste	Poultice	Farmland	Elder people	Ra	1	0.02
Aginaceae	<i>Plantago major</i> L.	Isabgol Plant	H	Se	Fever, Dysentery	Dry	Oral	Farmland	Elder people	Ra	11	0.22
Anacardiaceae	<i>Magnifera indica</i> L.	Jungle Aanp	T	B	Diarrhea, Fever, Body pain	Powder	Oral	Forest	Traditional healers	Ra	2	0.04
Apiaceae	<i>Centella asiatica</i> (L.) Urb.	Ghodtapre	H	WP	Fever, Nervous System increase	Raw Le and Juice	Oral	Farmland	Self-Practices	Co	9	0.18
Apocynaceae	<i>Alstonia scholaris</i> (L.) R. Br.	Chhatwan	T	B	Diarrhea, Skin disease, Ulcer, Abortion	La	Oral	Forest	Elder people	Ra	3	0.06
Apocynaceae	<i>Plumeria rubra</i> L.	Chuwa	T	B	Stomachache	Powder	Oral	Home Garden	Self-Practices	Co	6	0.12
Apocynaceae	<i>Tabernaemontana divaricata</i> . (L.) R.Br. ex Roem. & Schult.	Firfirey	Sh	R	Pneumonia	Juice	Oral	Home Garden	Elder people	Ra	2	0.04
Asclepiadaceae	<i>Calotropis gigantea</i> (L.) Dryand.	Aank	Sh	Le, La & S	Sprain & Sinusitis	La & Smoke	Poultice & Fuming	Rangeland	Traditional healers	Co	9	0.18
Asclepiadaceae	<i>Dischidia nummularia</i> R.Br.	Khirju	Ors	WP	Body pain	Decoction	Oral	Forest	Self-Practices	V Co	3	0.06
Asclepiadaceae	<i>Marsdenia roylei</i> Wight	Dudhe lahara	Cl	S	Gastritis, Ulcer	La	Oral	Forest	Elder people	Co	3	0.06
Asparagaceae	<i>Asparagus racemosus</i> Willd.	Santawar	Sh	R&YS	Sugar, Gastric, Fever & Typhoid	Juice	Oral	Forest	Parents	Ra	8	0.16
Asteraceae	<i>Artemisia indica</i> Willd.	Titapate	Sh	Le & YS	Itching & Gastric	Juice	Oral/Bath	Rangeland	Market	Co	12	0.24
Asteraceae	<i>Eclipta prostrata</i> (L.)	Vringaraj	H	WP	Jaundice, Blood pressure, Covid -19	Juice	Oral	Farmland	Self-Practices	Co	6	0.12
Asteraceae	<i>Elephantopus scaber</i> L.	Mulapate	H	R	Fever	Juice	Oral	Rangeland	Self-Practices	Co	6	0.12
Asteraceae	<i>Spilanthes paniculata</i> Wall.ex DC.	Ban Marauti	H	Fl	Toothache	Raw	Oral	Farmland	Neighbor	Co	11	0.22
Asteraceae	<i>Tagetes erecta</i> L.	Saya patri ful	H	Le	Headache, Blood pressure, Common cold, Cough	Juice + citrus+ Water	Oral	Home garden	Self-Practices	Co	4	0.08
Berberidaceae	<i>Berberis aristata</i> DC.	Chutro	Sh	Bs & Fr	Skin disease, Jaundice, Piles	Decoction	Oral	Rangeland	Parents	Co	5	0.1
Bignoniaceae	<i>Oroxylum indicum</i> (L.) Kurz	Tata	Sh	Fr	Wounds and Cuts	Powder	Poultice	Rangeland	Elder people	Co	3	0.06
Cannabaceae	<i>Cannabis sativa</i> L.	Ganja	H	Le	Diarrhea, Headache	Smoke	Fuming	Relatives	Traditional healers	Ra	2	0.04
Combretaceae	<i>Shorea robusta</i> Gaertn.	Sal Dhup	T	BL	Amoebiasis	Powder +Curd + rice	Oral	Forest	Traditional healers	V Co	6	0.12

Combretaceae	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Barro	T	Fr	Gastric, Asthma	Powder	Oral	Forest	Traditional healers	Co	12	0.24
Combretaceae	<i>Terminalia chebula</i> Retz.	Harro	T	Fr	Cough	Dry	Oral	Forest	Elder people	Co	5	0.1
Costaceae	<i>Cheilocostus speciosus</i> (J. Konig) C.Spec ht.	Bet lauri	H	S&R	Ear infection	Juice	viscous Juice Drip inside the ear	Forest	Elder people	Co	3	0.06
Crassulaceae	<i>Kalanchoe pinnata</i> Lam.	Patharchatta	H	Le	Kidney Stone, Gastric,	Raw Le	Oral	Home garden	Neighbor	V Co	1	0.02
Dilleniaceae	<i>Dillenia pentagyna</i> Roxb.	Tatari	T	B	Vitamin "C"	Raw	Oral after cooking	Forest	Elder people	Co	5	0.1
Dioscoreaceae	<i>Dioscorea deltoidea</i> Wall ex Kunth.	Vyakur	Cl	Fr	Gastric, Animal Fever	Raw	Oral	Forest	Elder people	Co	21	0.42
Dioscoreaceae	<i>Dioscorea bulbifera</i> L.	Ban Tarul	Cl	Rh & Fr	Stomach Problems, Cough	Raw & Roast	Oral	Forest	Self-Practices	Co	23	0.46
Dipterocarpaceae	<i>Terminalia alata</i> Heyne ex Roth.	Saaj	T	B	Wounds and Cuts	Paste	Poultice	Forest	Elder people	Co	1	0.02
Ericaceae	<i>Lyonia ovalifolia</i> (Wall.)	Angeri	T	Le	Scabies, Insecticide	Juice	Poultice	Forest	Elder people	Co	5	0.1
Fabaceae	<i>Acacia catechu</i> (L. f.) Willd.	Khayar	T	S	Fracture, Body ache	Infusion	Oral	Forest	Self-Practices	Co	4	0.08
Fabaceae	<i>Cassia fistula</i> L.	Rajbrikcha	T	B & Fr	Diarrhea, Constipation	Infusion	Oral	Forest	Traditional healers	Co	9	0.18
Fabaceae	<i>Erythrina arborescens</i> Roxb.	Phaledo	T	B & Fl	Dysentery	Infusion	Oral	Forest	Elder people	Co	4	0.08
Fabaceae	<i>Millettia extensa</i> Benth.	Gaujo	Sh	R	Scabies, Skin ring	Juice	Poultice	Forest	Friends	V Co	4	0.08
Fabaceae	<i>Mimosa pudica</i> L.	Lajjawati	H	R	Kidney Stone	Juice	Oral	Farmland	Social media	Co	2	0.04
Lamiaceae	<i>Callicarpa macrophylla</i> Vahi	Dahe kamal	Sh	Fr	Mouth Wounds & Cuts	Raw	Oral	Farmland	Self-Practices	Ra	6	0.12
Lamiaceae	<i>Mentha arvensis</i> L.	Pudina	H	Le	Cold, Toothpaste	Raw & Juice	Oral	Home Garden	Neighbor	Co	14	0.28
Lamiaceae	<i>Ocimum basilicum</i> L.	Bamari	H	Le & Se	Throat pain, Common cold	Raw	Oral	Home garden	Self-Practices	Co	3	0.06
Lamiaceae	<i>Pogonon benghalensis</i> (Brum. f.) Kuntze	Rudilo	Sh	YS, R & Le	Pneumonia, Fever & Headache	Smoke	Oral	Forest	Elder people	V Co	4	0.08
Lamiaceae	<i>Vitex negundo</i> L.	Simali	Sh	Le	Headache	Juice & Paste	Oral & Poultice	Forest & Farmland	Self-Practices	Co	5	0.1
Lauraceae	<i>Lindera neesiana</i> (Wall. ex Nees)	Siltimur	T	Fr	Cough & CO Cold	Decoction	Oral	Market	Elder people	Ra	5	0.1
Lecythidaceae	<i>Careya arborea</i> Roxb.	Kumbhi	T	B	Fish poison, Skin disease, Ulcer	Decoction & Paste	Oral	Forest	Self-Practices	Co	3	0.06
Liliaceae	<i>Aloe vera</i> (L.) Burm. f.	Ghiu kumari	H	Le	Burn, Uric acid, Constipation, Piles	Juice	Oral & Poultice	Home Garden	Self-Practices	Co	9	0.18
Liliaceae	<i>Smilax aspera</i> L.	Kukurdaino	Cl	S	Gastric, Stomach problems	After Dry	Oral one night remaining after cooking	Forest	Traditional healers	Ra	7	0.14

Lythraceae	<i>Woodfordia fruticosa</i> (L.) Kurz	Dhairi	Sh	Fl	Amoebiasis, Mouth wounds	Powder	Oral	Forest	Elder people	Co	7	0.14
Meliaceae	<i>Azadirachta indica</i> A. Juss.	Neemapat	T	Le	Headache & Blood pressure	Decoction	Oral	Home Garden	Elder people	Co	6	0.12
Menispermaceae	<i>Cissampelos pareira</i> L.	Gurje gano	Cl	Rh	Gastric, Asthma, Sex power increaser	Powder	Oral	Neighbor	Neighbor	Co	8	0.16
Menispermaceae	<i>Tinospora sinensis</i> (Lour.) Merr.	Gurjo	Cl	S	Blood pressure, Covid -19, Cough	Juice	Oral	Neighbor	Self-Practices	Ra	17	0.34
Myrsinaceae	<i>Ardisia solanacea</i> Roxb.	Damai fal	Sh	R	Indigestion	Juice	Oral	Rangeland	Self-Practices	Ra	1	0.02
Myrtaceae	<i>Psidium guajava</i> L.	Amba	T	Le, B & Fr	Gastritis, Fever, Diarrhea, Dysentery	Infusion & Raw	Oral	Home Garden	Parents	Co	18	0.36
Myrtaceae	<i>Syzygium cumini</i> (L.) Skeels, Bull.	Jamun	T	Le	Sinusitis	Smoke	Fuming	Forest, Farmland	Elder people	Co	4	0.08
Oleaceae	<i>Nyctanthes arbor-tristis</i> L.	Parijat	Sh	Fr & Fl	Pneumonia, Cough	Decoction	Oral	Forest	Elder people	Co	6	0.12
Oraceae	<i>Bulbophyllum pachyrachis</i> (A. Rich)	Dankera	Or	Fr	Rheumatic & Kidney Stone	Powder	Oral mixed with water	Forest	Elder people	Co	2	0.04
Papavaraceae	<i>Argemone mexicana</i> L.	Thakal	Sh	R	Jaundice	Raw	Oral	Forest	Friends	V Co	12	0.24
Phyllanthaceae	<i>Nephrolepis cordifolia</i> (L.) C. Presl	Pani amala	H	Fr	Back pain, Energy supplement, Relief from heat	Raw Fr	Oral	Forest	Self-Practices	Co	6	0.12
Phyllanthaceae	<i>Phyllanthus emblica</i> L.	Amala	T	Fr	Cough, Common cold, & Hair Dye	Vapor & Raw	Oral /Bath	Forest	Parents	Ra	12	0.24
Poaceae	<i>Eulaiopsis pinnata</i> (Retz.) C. E. Hubb.	Babiyo	H	WP	Body ache due to hit	Paste	Poultice	Rangeland	Neighbor	V Co	3	0.06
Poaceae	<i>Thysanolaena maxima</i> (Roxb.) Kuntze.	Amriso	Sh	Rs	Malaria Fever	Juice (Bhati R+ kuinet R)	Oral	Forest	Self-Practices	Co	13	0.26
Polygonaceae	<i>Persicaria barbata</i> (L.) H. Hara	Pirre	H	WP	Scabies, Fish poisoning	Paste	Bath	Forest	Self-Practices	Co	3	0.06
Polypodiaceae	<i>Polypodium vulgare</i> L.	Bishfej	Ep fern	Rh	Back pain	Powder	Oral	Forest	Social media	V Co	4	0.08
Pteridaceae	<i>Cheilanthes bicolor</i> (Forssk.) Kaulf.	Ranisinka	H	WP	Wounds	Juice	Oral	Forest	Elder people	Co	20	0.4
Rosaceae	<i>Rubus ellipticus</i> Sm.	Aiselu	Sh	R&YS	Fever	Decoction & Raw	Oral	Forest	Self-Practices	V Co	7	0.14
Rutaceae	<i>Aegle marmelos</i> L.	Bel patra	T	Le	Diarrhea, Gastric, Skin disease	Juice	Oral	Rangeland	Parents	Co	4	0.08
Rutaceae	<i>Zanthoxylum armatum</i> DC.	Timur	Sh	Se	To cure indigestion	Decoction	Oral	Relatives	Neighbor	Ra	2	0.04
Sapotaceae	<i>Diploknema butyracea</i> (Roxb.) H.J. Lam	Churi	T	Fr & Se	Diet and Portentous	Oil & Raw	Oral	Forest & Farmland	Elder people	Co	35	0.7
Saxifragaceae	<i>Astilbe rivularis</i> Buch. - Ham. ex D. Don	Harchur /Thulo okhati	H	R	Bone Fracture	Paste	Poultice	Forest	Self-Practices	Co	8	0.16
Saxifragaceae	<i>Bergenia ciliata</i> (Haw.) Sternb.	Pakhanbed	H	Rh	Body pain, Back pain & Mental disorder	Powder	Oral	Market	Relatives	Ra	12	0.24
Solanaceae	<i>Capsicum annum</i> L.	Khursani	Sh	R	Typhoid	Juice	Oral	Home garden	Elder people	Co	2	0.04

Solanaceae	<i>Datura metel</i> L.	Kalo Dhaturu	H	Fr	Headache, Neck problem	Dry	Wearing	Farmland	Self-Practices	V Co	4	0.08
Solanaceae	<i>Datura stramonium</i> L.	Seto Dhaturu	H	Fr	Body pain	Paste	Oral & Poultice	Farmland	Traditional healers	Ra	2	0.04
Solanaceae	<i>Nicotiana tabacum</i> L.	Surti	H	Le	Lice & Flea	Juice	Oral/Bath	Home Garden	Elder people	Ra	1	0.02
Talinaceae	<i>Talinum paniculatum</i> (Jacq) Gaertn.	Seto Jara	Sh	R	pregnancy periods (Improve lactation & Energy)	Juice	Oral after cooking	Forest	Traditional healers	Ra	2	0.04
Theaceae	<i>Schima wallichii</i> DC.	Chilaune	T	B	Pesticides	Powder	Oral	Forest	Elder people	Co	4	0.08
Urticaceae	<i>Girardinia diversifolia</i> (Link) Friis	Allo	H	YS & FI	Diabetes, Fiber, Fracture	After Cooking	Oral & Poultice	Forest	Self-Practices	V Co	17	0.34
Urticaceae	<i>Gonostegia hirta</i> (Blume) Miq	Kuchyurung	H	R & Le	Anti-poisons	Juice	Oral	Forest	Traditional healers	Ra	5	0.1
Verbenaceae	<i>Clerodendrum viscosum</i> Vent.	Sitapati	Sh	Le	Throat pain	Juice	Oral	Rangeland	Elder people	Ra	2	0.04
Vitaceae	<i>Cissus repens</i> Lam. C S fracture	Charchare lahara	CI	S	Fracture	Paste	Poultice	Forest	Elder people	Ra	3	0.06

Appendix 2. Ethnomedicinal uses of plant species in the Tharu community of Chitwan District, Nepal

Family	Scientific Name	Local Name	Habit	Part use	Use for medicine	Forms of medication	Mode of application	Source of Collection	Source of identification	Status	FC	RFC
Acanthaceae	<i>Justicia adhatoda</i> L.	Asuro	Sh	Le	Mouth Wounds, Asthma, Sinusitis, Bronchitis	Decoction	Oral	Forest	Parents	C	20	0.25
Amaranthaceae	<i>Achyranthes aspera</i> L.	Datiwon	H	WP	Diuretic, Toothache, Asthma, Gastritis	Infusion	Oral, Poultice	Forest	Self-practice	V C	21	0.26
Annonaceae	<i>Annona reticulate</i> L.	Sarifa	T	Le & Fr	Sugar	Powder, Raw	Oral	Farmland	Elder people	Ra	6	0.08
Apiaceae	<i>Centella asiatica</i> (L.)	Bhatbhate	H	Le	Body cooling, Indigestion, gastritis	Juice	Oral	Farmland	Traditional healer	Ra	27	0.34
Apocynaceae	<i>Alstonia scholaris</i> (L.) R. Br.	Chhatiwon	T	Le	Worm in stomach	Powder	Oral	Farmland	Elder people	Ra	12	0.15
Apocynaceae	<i>Rauvolfia serpentina</i> Benth.	Sarpagandha	Sh	R	Typhoid, Fever, High Blood pressure	Powder, infusion	Oral	Forest	Traditional healer	Ra	9	0.11
Araceae	<i>Acorus calamus</i> L.	Bojho	H	R	Cough, Fever, Common cold	After Dry	Oral	Farmland	Parents	C	24	0.3
Asclepiadaceae	<i>Calotropis gigantea</i> (L.) W.T.	Aank	Sh	S, R	Wounds, abortion	Latex, Juice	Poultice	Farmland	Self-practice	C	12	0.15
Asparagaceae	<i>Asparagus racemosus</i> Willd.	Kurilo	Sh	R	Toothache, Wounds by iron nail	Decoction	Oral	Forest & Farmland	Parents	Ra	26	0.33
Asparagaceae	<i>Drimys indica</i> (Roxb.)	Ban Pyaj	H	Tu	Inflammation	Paste	Poultice	Forest	Parents	Ra	6	0.08
Asteraceae	<i>Ageratum conyzoides</i> L.	Gandhe	H	Le	wounds and cuts	Juice	Poultice	Farmland	Elder people	V C	19	0.24
Asteraceae	<i>Artemisia dubia</i> Wall. ex Besser	Tetepati	H	Le & S	Scabies, High blood pressure	Juice	Bathing	Farmland	Elder people	C	19	0.24
Asteriaceae	<i>Eclipta prostrata</i> L.	Bhringraj	H	WP	Wounds and cuts	Paste	Poultice	Farmland	Elder people	C	11	0.14
Bombaceaceae	<i>Bombax ceiba</i> L.	Simal	T	R & S	Boils, Furuncles	Juice, Paste	Oral, Poultice	Forest	Social Media	C	2	0.03
Cannabaceae	<i>Cannabis sativa</i> L.	Ganja	H	Le & Se	Diarrhea, Earache	Paste	Oral	Farmland	Self-practice	Ra	4	0.05
Caricaceae	<i>Carica papaya</i> L.	Mewa	Sh	Fr & R	Jaundice, Kidney Stone	Raw, Infusion	Oral	Farmland	Elder people	C	8	0.1
Caryophyllaceae	<i>Drymaria diandra</i> Blume	Abhijalo	H	WP	Sinusitis, Common cold	Juice	Oral	Forest	Traditional healer	Ra	6	0.08
Combretaceae	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Barro	T	S, B & Fr	Urinary problems, Cough, Fever	Raw, Juice	Oral	Forest	Traditional healer	Ra	30	0.38
Combretaceae	<i>Terminalia chebula</i> Retz.	Harro	T	Fr	Cough	After Dry	Oral	Forest	Elder people	C	35	0.44
Convolvulaceae	<i>Cuscuta reflexa</i> Roxb.	Aakashbeli	Cl	WP	Jaundice	Raw	Wearing	Forest	Traditional healers	C	7	0.09
Convolvulaceae	<i>Ipomoea carnea</i> Jacq.	Besaram	Sh	S	Boils	Latex	Poultice	Forest	Self-practice	V C	9	0.11

Crassulaceae	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Pattharchatta	H	Le	Gull Stone, Diarrhea	Infusion	Oral	Farmland	Self-practice	V C	13	0.16
Cucurbitaceae	<i>Bryonia laciniosa</i> L.	Shivlinge	Cl	WP	Wounds, skin disease, boils	Infusion	Bathing	Forest	Elder people	C	9	0.11
Euphorbiaceae	<i>Acalypha indica</i> L.	Muktabarshi Jhar	H	WP	Toothache, earache, burn, rheumatoid arthritis	Paste, Juice	Oral, Poultice	Forest	Elder people	Ra	3	0.04
Euphorbiaceae	<i>Euphorbea royleana</i> Boiss.	Siudi	H	Le	Fever	Infusion	Oral	Forest	Elder people	Ra	4	0.05
Euphorbiaceae	<i>Ricinus communis</i> L.	Ander	Sh	R & Se	Constipation, Rheumatic pain	Oil, Juice	Massage	Forest	Social Media	C	5	0.06
Fabaceae	<i>Acacia arabica</i> (Lam.) Willd.	Babul ko phul	T	Fl	Fever during pregnancy	Infusion	Bathing	Forest	Elder people	C	3	0.04
Fabaceae	<i>Bauhinia vahlii</i> L.	Bhorla	Cl	Le & R	Abortion	Raw	Oral	Rangeland	Elder people	C	19	0.24
Fabaceae	<i>Cassia fistula</i> L.	Rajbrikshya	T	Fr	Body cooling, Sugar, Vomiting, Diarrhea, Urine problems	Infusion	Oral	Forest	Self-Practices	C	17	0.21
Fabaceae	<i>Cassia tora</i> L.	Tapre	H	Se	Gastritis	Se powder	Oral	Farmland	Elder people	VC	7	0.09
Fabaceae	<i>Mimosa pudica</i> Linn.	Lajawoti Jhar	H	WP	Hydrocele, Piles	paste	Poultice	Farmland	Traditional healer	V C	5	0.06
Fabaceae	<i>Tamarandus indica</i> L.	Emli	T	Le	Sprain	Paste	Poultice	Farmland	Elder people	C	14	0.18
Lamiaceae	<i>Mentha spicata</i> L.	Pudina	H	WP	Throat infection	Decoction	Oral	Farmland	Self-practice	C	17	0.21
Lamiaceae	<i>Phragmites vallatoria</i> L.	Narkat	H	R	Diuretic, Diaphoretic	Decoction	oral	Forest	Traditional Healer	C	4	0.05
Liliaceae	<i>Aloe vera</i> (L.)	Ghiu kumari	H	Le	Burn, Headache	Pulp	Poultice	Home garden	Elder people	V C	32	0.4
Linaceae	<i>Lepidium sativum</i> L.	Alasa	H	Se	Burn, boils, Inflammation	Massage	Massage	Farmland	Elder people	C	3	0.04
Lythraceae	<i>Woodfordia fruticosa</i> (L.) Kurz	Dhurseli	Sh	R	Wounds	Paste	Poultice	Rangeland	Parents	C	4	0.05
Malvaceae	<i>Thespesia lampas</i> (Cav.) Dalzell & A.Gibson	Ban kapas	Sh	R, B	Wounds and Cuts	Paste	Poultice	Forest	Self-Practices	Ra	5	0.06
Meliaceae	<i>Azadirachta indica</i> A. Juss.	Neem	T	YS & Le	Toothache, Wounds, Headache, Blood pressure	Paste, Juice	Oral, Poultice	Forest and Farmland	Elder people	C	17	0.21
Meliaceae	<i>Melia azadirachta</i> L.	Bakaino	T	B	Gastritis	Juice	Oral	Farmland	Self-practice	V C	7	0.09
Menispermaceae	<i>Tinospora cordifolia</i> (Wild)	Gurjo	Cl	B	Blood pressure, Covid -19, Headache	Juice	Oral	Relatives	Self-Practices	Ra	25	0.31
Moraceae	<i>Ficus benghalensis</i> L.	Bar	T	B	Gastritis, Ulcer	Powder	Oral	Home garden	Self-Practices	C	4	0.05
Moraceae	<i>Ficus racemose</i> (L.)	Gullar	T	S	Toothache, boils	Juice	Oral, Poultice	Forest	Elder people	C	4	0.05

Moringaceae	<i>Moringa oleifera</i> Lam.	Sitalchini	T	B	Asthma, Sugar	Powder	Oral	Farmland	Elder people	C	6	0.08
Musaceae	<i>Musa paradisiaca</i> L.	Kera	Sh	Le & Fr	Burn, Diarrhea	Le juice	Poultice, oral	Farmland	Self-practice	C	9	0.11
Myrtaceae	<i>Psidium guajava</i> L.	Amba	T	Le	Body cooling, Jaundice	Raw	Oral	Home garden	Elder people	C	15	0.19
Myrtaceae	<i>Syzygium cumini</i> (L.)	Jamun	T	Fr	wounds inside mouth	Raw	Poultice	Forest, Farmland	Self-practice	C	9	0.11
oleaceae	<i>Nyctanthus arbortristis</i> L.	Parijaat	H	R	Button belly swelling	Paste	Poultice	Home garden	Self-Practices	C	2	0.03
Onocleaceae	<i>Matteuccia struthiopteris</i> (L.) Tod.	Kalo neuro	Fe	Ys	Throat pain, gastritis	After cooking	Oral	Forest	Self-practice	C	6	0.08
Phyllanthaceae	<i>Phyllanthus emblica</i> L.	Amala	T	Fr	Gastritis, Common cold	Raw	Oral	Forest, Rangeland	Self-Practices	Ra	35	0.44
Piperaceae	<i>Piper longum</i> L.	Pipla	Cl	Fr	Cough, Common Cold	After Dry	Oral	Forest	Traditional healer	C	12	0.15
Piperaceae	<i>Piper nigrum</i> L.	Marich	Cl	Fr	Cough, Bronchitis	Powder	Oral	Farmland	Social Media	Ra	7	0.09
Poaceae	<i>Cynodon dactylon</i> (L.)	Dubo	H	WP	Fever, Headache	Juice	Oral	Rangeland	Elder people	V C	9	0.11
Poaceae	<i>Saccharum officinarum</i> L.	Ukhu	Sh	S	Jaundice	Juice	Oral	Farmland	Elder people	VC	9	0.11
Polygonaceae	<i>Rheum austral</i> D.Don	Padamchal	H	Rh	wounds and cuts	Paste	Poultice	Relatives	Self-practice	Ra	2	0.03
Rutaceae	<i>Aegle marmelos</i> (L.) Corrêa	Bel	T	Fr	Gastritis, Induce hunger, clean stomach	Juice	Oral	Rangeland	Self-Practices	C	2	0.03
Scrophulariaceae	<i>Bacopa monnieri</i> L.	Brahami	H	WP	Diuretic, Cardiac tonic	Juice	Oral	Forest	Self-practice	Ra	3	0.04
Scrophulariaceae	<i>Roroppa nasturtiumaquaticum</i> (L.) Hayek	Khole sag	H	WP	Diuretic, Memory, Hair fall	Juice	Oral	Forest	Self-practice	C	21	0.26
Solanaceae	<i>Datura metel</i> L.	Dhaturo	H	Fr	Cholera	Raw	Oral	Forest	Self-practice	Ra	16	0.2
Solanaceae	<i>Solanum virginianum</i> L.	Kanta Kari	Sh	Fr	Body cooling, Stomach problems	Raw or After cooking	Oral	Farmland	Elder people	Ra	3	0.04
Verbenaceae	<i>Clerodendron viscosum</i> Vent.	Bhate	Sh	S	Cough, Asthma	After Dry	Oral	Forest	Self-Practices	VC	6	0.08
Vitaceae	<i>Cissus quadrangularis</i> L.	Hadjor	Sh	Fr, Se & YS	Clean stomach, Blood pressure, sugar	After cooking	Oral	Farmland	Elder people	Ra	3	0.04
Vitaceae	<i>Vitex negundo</i> L.	Simali	Sh	Le & B	Cough, Sinusitis, Stomach problem	Juice, B paste	Oral	Forest	Elder people	C	12	0.15
Vitaceae	<i>Vitis vinifera</i> L.	Bhauwa	Cl	R & Le	Joint pain	Decoction	Massage	Home garden	Self-Practices	Ra	3	0.04