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Singh et al.
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Abstract

Background: Nepal Himalayas have been known as a rich source for valuable medicinal plants since Vedic periods. Present work is the documentation of indigenous knowledge on plant utilization as natural remedy by the inhabitants of terai forest in Western Nepal.

Methods: Study was conducted during 2010–2011 following standard ethnobotanical methods. Data about medicinal uses of plants were collected by questionnaire, personal interview and group discussion with pre identified informants. Voucher specimens were collected with the help of informants, processed into herbarium following standard methods, identified with the help of pertinent floras and taxonomic experts, and submitted in Department of Botany, Butwal Multiple Campus, Tribhuvan University, Nepal for future references.

Results: During the present study 66 medicinal plant species belonging to 37 families and 60 genera has been documented. These plants were used to treat various diseases and ailments grouped under 11 disease categories, with the highest number of species (41) being used for gastro-intestinal disorders, followed by dermatological disorders (34). In the study area the informants’ consensus about usages of medicinal plants ranges from 0.93 to 0.97 with an average value of 0.94. Herbs (53%) were the primary source of medicine, followed by trees (23%). Curcuma longa (84%) and Azadirachta indica (76%) are the most frequently and popularly used medicinal plant species in the study area. Acacia catechu, Bacopa monnieri, Bombax ceiba, Drymaria diandra, Rauvolfia serpentina, and Tribulus terrestris are threatened species which needs to be conserved for future use.

Conclusions: The high degree of consensus among the informants suggests that current use and knowledge are still strong, and thus the preservation of today’s knowledge shows good foresight in acting before much has been lost. The connections between plant use and conservation are also important ones, especially as the authors note that neither the local inhabitants nor the government is addressing the potential loss of valuable species in this region.

Keywords: Ethnobotany, Medicinal plants, Traditional healers, Tharu, Magar, Terai forest, Nepal

Background

The Rig-Veda written during 4500 BC to 1600 BC is believed to be the oldest repository of human knowledge about medicinal usages of plants in Indian subcontinent. In Nepal, although such old documentation is still not rediscovered, but the knowledge on plant utilization is believed to be very old. According to WHO [1], about 80% of the world’s population, especially in the rural areas depends on herbal medicine for their healthcare needs. About 90% of the Nepalese people reside in rural areas where access to government health care facilities is lacking [2]. The ethnic people residing in different geographical belts of Nepal depends on wild plants to meet their basic requirements and all the ethnic communities have their own pool of secret ethnomedicinal and ethnomedicinal knowledge about the plants available in their surroundings [2-20], which has been serving rural people with its superiority. Due to changing life style, extreme secrecy of traditional healers and negligence of youngsters, the practice and dependence of ethnic societies in folk medicines is in rapid decline globally, therefore, ethnobotanical exploitation and documentation of indigenous knowledge about the usefulness of such a vast pool of genetic resources is deliberately needed [21-30]. We selected Terai forest of Rupandehi district and...
adjoining areas for ethnomedicinal investigation because this area is very rich in phytodiversity and tribal population. Besides other usages of plants the practice of oral tradition for healthcare management of human and domesticated animals using herbal medicines is still prevalent among the inhabitants of the area. They have enormous knowledge about medicinal uses of plants and this knowledge is mostly undocumented and transmitted orally from generation to generation. Recently due to unplanned developmental programs, increasing modern healthcare facilities and impact of modern civilization in this area, natural resources as well as traditional knowledge and tribal cultures are depleting rapidly at an alarming rate. Therefore, it is urgent to explore and document this unique and indigenous, traditional knowledge of the tribal community, before it diminishes with the knowledgeable persons. Further, documentation of indigenous and traditional knowledge is very important for future critical studies leading to sustainable utilization of natural resource and to face the challenges of biopiracy and patenting indigenous and traditional knowledge by others. Besides, to the best of our knowledge no ethnobotanical work has been carried out in this area. Keeping these things in mind present study was proposed to document the ethnomedicinal knowledge in terai forest of western Nepal. Aims of the present study are:

(A) Identification and documentation of plant species used for the treatment and prevention of various diseases and ailments in the study area.

(B) Identification of most common and popularly used medicinal plant species for the treatment and prevention of various diseases and ailments in the study area.

(C) Find out the level of consensus agreement between the informants regarding the uses of particular medicinal plant(s) for the treatment of particular disease category.

Study area
Rupandehi district is situated in the Terai region of western Nepal. It lies between 83°27’55” to 83°28’255” E and 27°40’.016” to 27°40’.252” N geographical limits in 1360 Km² area at altitudinal variation from 105 to 258 meters. Rupandehi district (Figure 1) is surrounded by hilly districts (Palpa and Arghakhanchi) in North, by Maharaiganj district of Uttar Pradesh (India) in south, by Nawalparasi district in East and by Kapilvastu district in west. It has tropical climate with maximum temperature beyond 40°C during summer (May- June) and below 10°C during winter (December- January) and annual rainfall is about 1250 mm. Geographically, it is divided into Chure region (14.5%); Bhabar region (0.6%) and Terai region (84.9%). The famous river and rivulets of this district are Tinau, Rohini, Danaw, Pahela, Kanchan, Kothi, Danda, Koili etc. All the rivers flow from north to south. The climatic condition of the study site is tropical type and predominated by Sal forest. The forest area of the district is divided into community forest, religious forest and personal forest [31]. The vegetation of the study is dominated by sal (Shorea robusta) forest along with sissoo (Dalbergia sissoo), saj (Terminalia alata) khayar (Acacia catechu), baheda (Terminalia bellirica), dabdabe (Garuga pinnata), khaniyu (Ficus semicordata), asuro (Justicia adhatoda), dhaiyaro (Woodfordia fruticosa), and titepati (Artemesia indica) etc. The main highway Siddhartha Rajmarga runs from the middle part of Shankar Nagar VDC. All the parts of Shankar Nagar VDC and its surrounding areas are interconnected by network of road and are easily accessible for the field visits.

Ethnography
The Tharu and the Magar are the main ethnic societies of the study area. They live in association with Chhetri, Brahmin, Thakuri, Gurung, Damai, Kumal, Bote, Majhi, Mushahar, Kami, Newar and others communities. Total population of the district was 7, 08,419 [32] The Tharu tribal community share 10.57% population of the district [31]. They are scattered all along the southern foot hills of the Himalayas. The greater parts of their population resides in Nepal, although they are also scattered in the adjacent Indian district of Champaran, Maharajganj, Gorakhpur, Siddharthnagar, Basti, Balrampur, Bahraich, Shravasti, Lakhimpur-Kheri, and Nainital. There are several endogamous sub groups in the Tharu community, such as Rana, Kathuria, Dangauria, Kochila, and Mech. Tharu people choose plain lands at the jungle side or river side for house construction. They like to settle in the group of their own community members, thus their houses are found dense within a small area. Tharu people used to live in joint family traditionally and it is practiced up to now. In Tharu village, the duty of maintaining good relations among villagers, as well as conducting the village's affairs, falls on the Mahaton (Village chief). A mahaton is elected by Gardhurryas (Tharu house hold chief) from among themselves. A Mahaton is elected, but once elected; the office becomes hereditary, unless a particular incumbent is considered a misfit. The assembly of Gardhurryas can remove an unsuccessful Mahaton. The role of mahaton in the assembly of Gardhurryas is like that of a chairman and a judge who keep others view in mind, gives the final communal decision. Due to their own believes, judgement policy and living together in close vicinity, they are considered as native Tribal community of Terai region. In Nepal Tharu tribal community is settled in the southern
part of the country from the east to west along Indo-
Nepal boarder and the adjacent valleys and plains be-
tween the Chure hilly regions. The Tharus are famous
for their ability to survive in the moist Terai region
which is deadly to outsiders due to malaria. They are
farmer by occupation and cultivate rice, mustard, corn
and lentils but also collect forest products such as wild
fruits, vegetables, medicinal plants and material to build
their houses, hunt wild animals and fishes [33].

Materials and methods
Field works and collection of data
Field studies were conducted from March 2010 to May
2011. Methods of Martin [34] were followed for the col-
lection of data and voucher specimen during the field
study. First of all local administrative officers were con-
sulted with the explanation of aims and objectives of the
research for the identification of resource persons (infor-
nants). They give advice regarding the people who
would be the best sources of information. Researchers
meat these peoples and explain the research theme. These informants often suggested other potential infor-
mants. In order to insure a sample that includes represen-
tatives of whole community, we attempted to interview peoples from variety of age groups, sex, socio-
economic and ethnic community (for detail information
about gender, age, ethnicity, and occupation of infor-
mants please see Table 1). The criteria for the selection
of informants for the interview were their reputation in
the society regarding their knowledge about herbal med-
cines and traditional healthcare system. Total 55 infor-
mants were identified from Shankar Nagar VDC and
surrounding areas. They are reputed knowledgeable per-
sons of the society and the collected data from these
informants represent the whole community, because
they are knowledgeable healers, villagers, senior citizens,
teachers, social workers etc. Prior to survey, a question-
naire was designed and pre-tested with five informants

Figure 1 Location map of study site.
| S N | Name                        | Age (Y) | Sex | Address                  | Occupation                                           |
|-----|-----------------------------|---------|-----|--------------------------|------------------------------------------------------|
| 1   | Durga Pd Shrestha           | 69      | M   | Butwal-12, Kalikanagar, Rupandehi | Senior citizen, knowledgeable person                 |
| 2   | Mohan Lal Tharu             | 26      | M   | Motipur-5, Rupandehi     | Plant collector                                      |
| 3   | Babu Ram Rana               | 65      | M   | Paschim Amuwa-5, Rupandehi | Local healer, farmer                                 |
| 4   | Laxman Aryal                | 43      | M   | Shankar Nagar-4, Rupandehi | Secretary, VDC, Shankar Nagar                       |
| 5   | Khandanand Poudyal          | 58      | M   | Shankar Nagar-4, Rupandehi | Shopkeeper                                           |
| 6   | Bhagirathi Tharu            | 63      | M   | Motipur-5, Rupandehi     | Local healer (vaidya), farmer                        |
| 7   | Indra Bdr. Bhujel           | 39      | M   | Paschim Amuwa-4, Rupandehi | Fodder collector, farmer                            |
| 8   | Krishna Bdr. Rana           | 64      | M   | Ram Nagar Butwal-12, Rupandehi | Plant collector, farmer                             |
| 9   | Harka Bdr. Rasaily          | 47      | M   | Semail-7, Rupandehi      | Local healer, farmer                                 |
| 10  | Yamb Bdr. K.C.              | 52      | M   | Manpakadi-8, Rupandehi   | Fodder expert, healer, farmer                        |
| 11  | Indrawati Tharuni           | 58      | F   | Sou. Pharsatikat-4, Rupandehi | Local healer, farmer                                |
| 12  | Khadak Thapa                | 44      | M   | Shankar Nagar-9, Rupandehi | Plant collector, farmer                              |
| 13  | Kishuni Tharuni             | 49      | F   | Dudhkrash-5, Rupandehi   | Plant collector, local healer                       |
| 14  | Yam Bdr. Thapa Magar        | 54      | M   | Sajilhand-4, Rupandehi   | Local healer, plant collector                       |
| 15  | Top Naarayan Ghimire        | 56      | M   | Motipur-4, Rupandehi     | Secretary of chartapa irrigation, local farmer      |
| 16  | Ram Kumari Chai             | 58      | F   | Sikithan-4, Rupandehi    | Active women farmer                                 |
| 17  | Sher Bdr. Budhathoki        | 73      | M   | Kalika Nagar, Butwal-12, Rupandehi | Senior citizen, farmer                             |
| 18  | Gopal Pd. Neupane           | 69      | M   | Shankar Nagar-1 Chaparhatti, Rupandehi | Local knowledgeable healer, farmer               |
| 19  | Khushi Lal Tharu            | 58      | M   | Motipur-5, Rupandehi     | Plant collector, local healer (vaidya)              |
| 20  | Nairjeet Tharu              | 53      | M   | Motipur-7 Rupandehi      | Local healer, farmer                                 |
| 21  | Rajendra Lodh               | 47      | M   | Shankar Nagar-3, Rupandehi | Local healer, farmer                                 |
| 22  | Nar Bdr. G. M.              | 52      | M   | Gopalpur, Kha Bangai-4 Rupandehi | Farmer, local healer                              |
| 23  | Sun Bdr. Gaha               | 67      | M   | Koldanda-1 Lagad, Palpa. | Local Healer, head of Lagad Village, Palpa.        |
| 24  | Luk Bdr. Gaha               | 58      | M   | Koldanda-1 Lagad, Palpa. | Plant collector and exporter.                       |
| 25  | Punam Kunwar                | 33      | F   | Butwal-12, Rupandehi     | Secretary, Butwal –12, service.                    |
| 26  | Laxmi Narayan Chaudhary     | 48      | M   | Parroha-2 Rupandehi      | Farmer, local healer                                 |
| 27  | Nar Bdr. Rana               | 49      | M   | Shital Nagar, Devdaha, Rupandehi | School teacher, farmer                             |
| 28  | Ram Ratan Gupta             | 58      | M   | Siloutiya 5 Marchvar, Rupandehi | Head master, secondary school, odwalia                |
| 29  | Ganga Kharel                | 47      | F   | Shankar Nagar-3 Rupandehi | Health assistant                                     |
| 30  | Bhim Pd Neupane             | 66      | M   | Motipur-4 Rupandehi      | Senior citizen, Ex VDC Chairman                     |
| 31  | Yamb Bdr G.M.               | 43      | M   | Makrahar-6 Rupandehi     | Local healer                                         |
| 32  | Hare Ram Yadav              | 55      | M   | Motipur-2, Rupandehi     | Mukiya, Panchmaua, Chartapa irrigation, farmer      |
| 33  | Mrs. Janaki Aryal           | 48      | F   | Motipur-7, Rupandehi     | Social worker, farmer                                |
| 34  | Salik Ram Aryal             | 64      | M   | Sou-pharsatikar-1, Rupandehi | Senior citizen, Ex VDC chairman                    |
| 35  | Mrs. Rita Wasti             | 52      | F   | Motipur-7, Rupandehi     | Farmer and knowledgeable woman                       |
| 36  | Krishna Chand Chaudhary     | 59      | M   | Kha-Bangai-4, Rupandehi  | Local healer, farmer                                 |
| 37  | Durga Khanal                | 58      | M   | Semlar-3, Rupandehi      | Secretary of Semlar VDC                             |
| 38  | Chhabi Lal Neupane          | 64      | M   | Motipur-7, Rupandehi     | Mukiya, farmer                                      |
| 39  | Chauture Pd. Tharu          | 72      | M   | Motipur-7, Rupandehi     | Local healer, farmer                                 |
| 40  | Krishna Kumar Thapa         | 38      | M   | Motipur-2, Rupandehi     | Plant collector                                     |
| 41  | Om Prakash Aryal            | 38      | M   | Motipur-9, Rupandehi     | Farmer, plant collector                             |
| 42  | Ishwar Raj Lamisal          | 58      | M   | Butwal-10, Deepnagar, Rupandehi | Knowledgeable person                              |
| 43  | Om Prakash Chaudhary        | 52      | M   | Butwal-13, Devinagar, Rupandehi | Knowledgeable local healer & Farmer                |
| 44  | Sohan Lal Chaudhary         | 48      | M   | Karhiya-2, Rupandehi     | Plant collector & Farmer                            |
to find out its suitability for present study and modified according to response of informants. The revised questionnaire was used for gathering data about medicinal plants of the study area. Pre informed consent was obtained from the resource persons before interview. Field survey was conducted taking traditional healers as a guide and voucher specimens of cited medicinal plants were collected and their local identity was re-confirmed by other informants. During data collection three visits (in each visit author stay for four days in study area) was conducted and information were collected. The information obtained was cross checked with the other informants. The local names, habit, wild/cultivated, availability of medicinal plants, need of conservation and efforts made by inhabitants and traditional medicinal uses of plants were carefully recorded. Finally, group discussion were made with the healers and local people to know their perception about the use of traditional folk medicines, awareness about the conservation of phytodiversity and indigenous knowledge.

**Processing of voucher specimens for herbarium preparation and identification**

The voucher specimens were brought to the laboratory and processed for herbarium specimen preparation [34-36] and identified with the help of available floras and other pertinent literatures [8,11,23,37-42] and submitted in department of Botany, Butwal Multiple Campus, Tribhuvan University, Nepal for future references. The botanical identities of collected specimens were confirmed by Dr. M. P. Panthi, and Mr. B. R. Nepali, Taxonomist, Tribhuvan University, Kathmandu, Nepal. Plant names were checked according to International Plant Name Index [43].

**Statistical analysis**

The data were spreads on Excel sheet to summaries and to identify various proportions like plant families, habit, availability of medicinal plants, plant parts used as medicine, methods of use, frequency of citation and popularly used medicinal plants in the study area. Frequency of citation was calculated by following formula-

\[
\text{Frequency of citation(\%) } = \frac{\text{Number of informants who cited the species}}{\text{Total number of informants interviewed}} \times 100
\]

Factor of informants consensus (FIC) for different ailment categories was calculated for testing homogeneity on the informant’s knowledge followed by the method provided by Trotter and Logan and Heinrich et al. as under [44,45].

\[
F_{\text{IC}} = \frac{N_{UR} - N_{TAXA}}{(N_{UR} - 1)}
\]

Where \(N_{UR}\) = number of use report in a particular illness category and \(N_{TAXA}\) = number of taxa used to treat that particular category by informants.

**Result and discussion**

**Medicinal plants and their uses**

Altogether 66 medicinal plants belonging to 37 families and 60 genera were documented from the study area (Table 2). The documented medicinal plants and their ethnomedicinal uses along with common name have been summarized in Table 2. These plant species are used for the treatment and prevention of many ailments and diseases grouped under 11 ailment categories (Table 3). The common sickness for the tribal in the study area are cold, cough, bronchitis, diarrhoea, dysentery, gastritis, headache, backache, cuts, wounds etc. Symptoms of the diseases given by the tribes in local language with their bio-medical terms are given in Table 4. Exact doses and duration of treatment are considered as intellectual property of informants, so as per their request this information is not included in the present paper. *Curcuma longa* (84%), *Azadirachta indica*
| Botanical name, family, voucher no. | F | Local name/habit/ availability | Parts used | Usages |
|-------------------------------------|---|-------------------------------|------------|--------|
| *Acacia catechu* (L.) Wild, Fabaceae, AGS-45 | 22 | Khayar (N/M)/Tree/Wild/Rare | Bark, wood | *Bark powder is applied on tooth ache. *Wood decoction is given orally in intestinal pain. Bark paste is applied in skin diseases. |
| *Acalypha indica L.*, Euphorbiaceae, AGS-66 | 15 | Mukta barshi jhar (N)/ Herb/Wild/Easily | Entire plant | *Plant decoction is given orally in toothache and earache. *Leaf paste is applied on burns. *Flesh leaf juice is applied on rheumatoid arthritis. |
| *Acorus calamus* L. Acoraceae, AGS-71 | 27 | Bojho (N)/Katara (Th)/Herb/Wild | Root | Juice of root is given orally in stomach disorders, bronchitis, fever and its small piece chewed to clear the throat and open the voice. |
| *Achyranthes aspera* L. Amaranthaceae, AGS-33 | 33 | Ulta chirchiri (Th)/Datiwan (N)/Herb/Wild/Easily | Entire plant | Decoction of plant is given as diuretic. Root juice is applied to treat toothache. *Root juice is given orally asthma. Stem is used as toothbrush in tooth problems. |
| *Aegle marmelos* (L.) Correa ex Roxb., Rutaceae, AGS-25 | 20 | Bel (N/Th) /Tree/Cultivated | Fruit pulp, leaf and root | Fruit juice is given orally in diarrhoea and dysentery. Leaves are given orally in stomach disorders. *Root juice is given orally in fever and vomiting. |
| *Agaratum conyzoides* L. Asteraceae, AGS-49 | 38 | Gandhe jhar (N)/Gandhauila (Th)/Herb/Wild/Easily | Leaf | Leaf juice is given to cure bleeding from cuts and wounds. Plant paste is applied to cure muddy wounds between toes during rainy season. |
| *Aloe vera* Aiton, Asclepiadaceae, AGS-15 | 35 | Ghiu Kumari (N)/Ghrit Kumari (Th)/Herb/Cultivated | Leaf juice Leaf pulp | *Leaf pulp is given orally in lung disease and stomach disorders. Leaf pulp is applied on skin burns. |
| *Amaranthus spinosus* L. Amaranthaceae, AGS-15 | 38 | Ban lunde (N)/Kande Lundo (M)/Herb/Wild, easily | Tender shoot, root | Root decoction is given as diuretic. Tender shoot is given to cure leucorrhoea, flatulence, and colic pain. |
| *Argemone mexicana* L. Papaveraceae, AGS-11 | 36 | Bharbhandha (Th)/Herb/Wild, easily | Milky juice and root | Milky juice of the plant is applied on tumors and skin diseases. Root paste is applied on skin diseases and flatulence. |
| *Artemisia indica* Wild. Asteraceae, AGS-52 | 18 | Tite pati (N)/Pati (Th)/Herb/wild or cultivated | Tender shoot and leaves | *Leaf juice is given orally in bronchitis. Leaf paste is applied in skin diseases. Dried tender shoot powder is given orally in fever. |
| *Asparagus racemosus* Wild, Liliaceae, AGS-28 | 31 | Kurilo(N)/Santawar (Th)/Herb/Cultivated | Tuberous root | Dried root powder is given orally with hot water to cure urinary troubles. Root decoction is given orally after delivery as tonic. Tuberous root powder is given orally to increase lactation. |
| *Azadirachta indica* A. Juss., Meliaceae, AGS-8 | 76 | Neem (N/M/Th)/Tree/Wild and cultivated | Tender shoot, leaf and bark | Decoction of fresh leaves is used to wash skin to treat scabies. Young stem is used as tooth brush in tooth problems. Fresh leaves are given orally for the purification of blood and for control of sugar level. Tender twigs paste is applied on wounds for early healing. |
| *Bacopa monnieri* (L.) Pennel, Scrophulariaceae, AGS-21 | 16 | Jal nirm, Brahmi(N)/Whole Sag (M/Th)/Herb/Wild/Easily | Entire plants/Herb | Plant juice is given orally as diuretic, cardiac tonic and memory enhancer. Plant juice is given as hair tonic especially in thinning and falling hairs. |
| *Bauhinia variegata* L. Fabaceae, AGS-68 | 42 | Koiralo (N)/Kolar (Th)/Tree/Herb/ wild cultivated | Bark and flower juice | *Bark decoction and flower juice are given in diarrhoea, dysentery, indigestion and body ache. *Bark decoction is given to cure tumors. |
| *Bombax ceiba* L. Bombacaceae, AGS- 35 | 22 | Sinal (N)/Sernar (Th)/Tree/ Wild/Rare | Root | Root decoction is given as tonic, anti-dysenteric and in urinary troubles. *Bark decoction is given orally in bronchial diseases. |
| *Calotropis gigantea* (L.) W.T. Aiton, Asclepiadaceae, AGS-12 | 15 | Aank (N)/Madar (Th)/Shrub/Wild/Easily | Root, Milky latex and flower/Shrub | Root paste applied on boils, pimples, and skin disease. Milky latex is applied on muscular pain, cut, wounds, boils, and ringworm. *Flower powder is given orally in cough, cold, and bronchitis. |
| *Carica papaya* L. Caricaceae | 18 | Mewa (N)/Papita, Larmewa (Th)/Shrub/Cultivated | Latex and fruit | *Milky latex is given in toothache and dysentery. |
| *Centella asiatica* (L.) Urb. Apliaceae, AGS- 36 | 29 | Ghod Tapre (N)/Ghotapya, Bhatbhata (Th)/Herb/Wild | Entire plant | Plant decoction is given orally as diuretic, tonic, blood purifier and in skin diseases, leprosy, and mental disorder. Leaf juice is given orally in indigestion. |
| *Chenopodium album* L Chenopodiaceae, AGS-9 | 27 | Bithi (N)/Bhithuwa (Th)/Herb/Wild | Tender shoot and flower | Tender shoot and flower juice is given orally to kill and expel the round worm and in constipation. |
| *Citrus limon* (L.) Burm. f. Rutaceae, | 49 | Kagati (N)/Nibwua (Th)/Shrub/Cultivated | Leaves and fruit | *Leaves are chewed to expel intestinal worms. *Rind paste and flower juice is applied in pimples and dandruff. |
| *Colocasia esculenta* (L.) Schott, Araceae, AGS-19 | 20 | Pindalu, Karkalo (N)/Gabha, Ghuiya (Th)/Herb/Cultivated | Corn and tender aerial parts | *Petiololes used as green vegetables in liver problems. *Corn paste is applied over cuts/wounds to stop bleeding. |
| *Coriandrum sativum* L. Apiaceae | 18 | Dhaniya (N/M/Th)/Herb/cultivated | Leaf and seeds | *Leaf paste is applied on allergic inflammation. *Green leaves are used in the preparation of soft drink along with sugar and given orally in stomachache. |
### Table 2 Ethnomedicinal plants of Terai forest in western Nepal and their traditional therapeutic uses (Continued)

| Family            | Common Name                        | Scientific Name                                      | Locality       | Part Used                        | Use                                                                 |
|-------------------|-----------------------------------|------------------------------------------------------|----------------|----------------------------------|----------------------------------------------------------------------|
| **Zingiberaceae** | *Curcuma longa*                    | AGS-34                                               |                | Rhizome/Cultivated               | Rhizome decoction is given as stimulant, tonic, and blood purifier. Rhizome paste is externally applied on strains, wounds, and injuries. Fresh rhizome juice is given as anthelmintic. Rhizome powder is given orally with luk warm water in jaundice and liver disorders. |
| **Zingiberaceae** | *Curcuma amada*                    | AGS-30                                               |                | Entire plant/Herb/Cultivated     | *Rhizome powder is given as digestive to clean throat and tongue. Rhizome paste is externally applied on strains; rheumatism, and inflammation. |
| **Convulvulaceae**| *Cuscuta reflexa*                  | AGS-65                                               |                | Entire plant                     | *Juice of the plant is given orally to treat fever. Plant paste is applied externally to treat headache, stomachache and rheumatism. Plant paste is applied on fractures. |
| **Cymbopogon citratis** | *Cymbopogon citratis* (DC. ex. Nees) Stapf | AGS-50                                               |                | Leaves                           | Leaves are used to make tea and given orally in cough, cold, headache, and fever. |
| **Cyperus rotundus** | *Cyperus rotundus*                | AGS-48                                               |                | Tuber                            | Tuber infusion, with sugar/salt is given orally in dysentery, Diarrhoea, and indigestion and as anti inflammatory agent. |
| **Cynodon dactylon** | *Cynodon dactylon*                | AGS-5                                                 |                | Entire plant                     | Plant paste is applied on cuts and wounds. *Root infusion along with sugar is given orally in bleeding piles and indigestion. *Plant juice used as eardrop in earache. |
| **Dalbergia sissao Roxb.** | *Dalbergia sissao*                | Fabaceae, AGS-40                                      |                | Bark and leaf juice              | Bark and leaf juice are given orally in Diarrhoea, dysentery and as anthelmintic. It is applied externally on cut and wounds. *Leaf decoction is given orally in gonorrhoea. |
| **Datura metel** | *Datura metel*                     | L. Solanaceae, AGS-3                                 |                | Leaf, stem and seed              | Leaves juice is given orally in epilepsy. *Dried stem and leaves are smoked in asthma. *Seeds are boiled in mustard oil and massaged on joint pains. |
| **Dioscoreaceae** | *Dioscorea pentaphylla*            | Dioscoreaeae, AGS-32                                 |                | Rhizome/Cultivated               | *Sterm node paste is applied on boils. *Tender shoots (Tama) is consumed as vegetable as aphrodisiac. |
| **Drymaria diandra** | *Drymarias diandra*              | Blume Caryophyllaceae, AGS-64                         |                | Entire plant                     | Root juice is inhaled to treat sinusitis. |
| **Eclipta prostrata** | *Eclipta prostrata*               | Asteracaeae, AGS-6                                  |                | Entire plant                     | Plant paste is applied on cut, wound, skin diseases, and pimples. |
| **Euphorbia hirta** | *Euphorbia hirta*                  | L. Euphorbiaceae, AGS-22                             |                | Entire plant                     | Plant juice is applied on cuts and wounds. Leaf juice is given orally in diarrhoea. |
| **Ficus benghalensis** | *Ficus benghalensis*              | Moraceae, AGS-30                                    |                | Bark and milky latex/Tree        | Bark infusion is given orally in diabetes. *Milky latex is applied on muscular pain. |
| **Gloriosa superba** | *Gloriosa superba*                | L. Cucurbitaceae, AGS-31                             |                | Entire plant                     | *Rhizome paste is applied externally on ringworm and other skin diseases. |
| **Ipomoea aquatica** | *Ipomoea aquatica Forsk.*         | Convolvulaceae, AGS-16                               |                | Latex, leaf, and tender shoot    | *Tender shoot is used as vegetable in gastric trouble and general debility. *
| **Ipomoea batatas** | *Ipomoea batatas*                 | L. L. Solanaceae, AGS-18                             |                | Tuberous root and leaf juice     | *Leaf juice is given orally in diabetes. *
| **Ipomoea camaea Jacq. ssp. fistulosa (Mart. ex Choisy) D. Austin, Convolvulaceae** | *Ipomoea camaea*   | Convolvulaceae, AGS-23                               |                | Latex of leaf and tender shoot   | *Latex of leaf and tender shoot are applied as antiseptic on wounds between toes in rainy seasons. |
| **Justicia adhatoda** | *Justicia adhatoda*               | L. Acanthaceae, AGS-14                               |                | Leaf                             | Warm decoction of the leaves is given to treat asthma. Juice of fresh leaves along with honey is given orally as expectorant. Juice of leaf is inhaled in bleeding nose (sinusitis). Dried powder of entire plant parts is given in bronchitis and cough. |
| **Lagenaria sicarina** | *Lagenaria sicarina*              | (Molina) Standl., Cucurbitaceae, AGS-23              |                | Leaf, fruit and seed             | *Leaf decoction with sugar is given in jaundice. Fruit juice is given in diarrhoea and, dysentery *Seeds are given as mental tonic. |
| **Lepidium sativum** | *Lepidium sativum*                | Brassicaceae, AGS-63                                 |                | Entire plant                     | Seed paste is applied on rheumatism. *Fresh leaves are given orally in liver problems. |
Table 2 Ethnomedicinal plants of Terai forest in western Nepal and their traditional therapeutic uses (Continued)

| Linum usitatissimum L., Linaceae | 18 | Tishi (Th), Alasa (N)/Herb/Cultivated | Seed, and seed oil are placed on burns and boils. *Seed poultice is applied on rheumatic and swellings. |
| Malva parviflora L., Malvaceae, AGS-31 | 25 | Laphe sag (N)/Baryara (Th)/Herb/Wild/Easily | Tender shoots & Seeds are used for decoction that is given orally in cough and bronchitis. Tender shoots are given orally to treat swollen glands of throat. *Decoction of tender shoot and seeds are given orally to control irregular menstrual cycle. |
| Melia azadirachta L., Meliaceae, AGS-41 | 60 | Bakaino (N)/Bakain (Th)/Tree/Wild/Easily | Entire plant | Root decoction is given orally as blood purifier. Leaf paste is applied on scabies. Poultice of flower is applied externally in skin eruption. |
| Mentha spicata L., Lamiaceae, AGS-18 | 38 | Pubina (N)/Patina (Th)/Herb/Cultivated | Entire plant | Leaves decoction is given orally to cure throat infection and indigestion. *Decoction of leaves with cinnamon is given orally to women for easy delivery. |
| Mimosa pudica L., Fabaceae, AGS-60 | 20 | Boohari Jhar (N)/Lajalu Jhar (Th)/Herb/Wild/Easily | Entire plant | *Leaf paste is applied on hydrocele. *Leaf and root paste are given orally in piles. Decoction of plant is given in Diarrhoea, dysentery and leucorrhoea. |
| Mucuna pruriens (L.) DC., Fabaceae, AGS-53 | 27 | Kauso (N)/Kewanch (Th)/Climber/Wild/Easily | Roots, fruits and seeds are used for decoction that is useful in frequent urination. *Leaf decoction is given orally in weakness and headache. |
| Musa paradisiaca L., Musaceae | 18 | Keru (N/W/Th)/Shrub/Cultivated | Leaf, flower and fruit are used for decoction that is given orally in Diarrhoea and bloody dysentery. Extract of flowers, fruits and leaves are applied on skin burns. Stem extract reduces sugar level in blood. |
| Ocimum tenuitfolium L., Lamiaceae, AGS-24 | 47 | Krishna Tuls (N)/Kalo Tuli (M)/Tisi (Th)/Herb/Wild/Easily | Entire plants/Herb | Decoction of plant is given in fever, cough, cold, headache, nausea, diarrhoea, dysentery and skin diseases. Leaf juice is used as ear drops in earache. Leaf powder with honey is given orally in diabetes. |
| Pheangites vallatonia (L.) Veldkamp, Poaceae, AGS-64 | 21 | Narkat (N/M/Th)/Herb/Wild/Easily | Root/Herb | *Root decoction is given orally as refrigerant, diuretic and diaphoretic. |
| Phyllanthus emblica L., Euphorbiaceae, AGS-17 | 45 | Amala (N)/Aura (Th)/Tree/cultivated. | Bark juice and fruit. | Bark juice is given orally in dysentery, constipation, and body ache. Fruits decoction is given orally in shore throat and as tonic. |
| Polygonum barbatum L., Polygonaceae, AGS-26, | 13 | Pire Jhar (N)/Bisnair (Th)/Tree/Wild/Easily | Entire plant | Poultice is applied externally on swelling parts of the body. *Root is given orally as astringent and cooling agent. Leaf decoction is applied externally to wash ulcers. |
| Rauvolfia serpentina Benth. ex Kurz Apocynaceae, AGS-37 | 47 | Sarpagandha (N)/Chand maruw (M)/Dhalchaliya (Th)/Shrub/Rare in southern parts and Cultivated in northern parts | Leaf & root | Dried root powder is given orally to reduce high blood pressure. Root infusion is given orally in intestinal disorders. *Leaf juice is used as remedy for the removal of opacities of cornea. Root paste is applied on cuts, wounds, or boils. |
| Rumex nepalensis Sprenge, Polygonaceae, AGS-61 | 24 | Hailahale Sag (N/Th)/Ban Palungo (M)/Herb/Wild/Easily | Entire plant | Seeds infusion is used in mouth disorders. Root paste applied externally on joint pains and wounds. Fresh leaf extract and sap is applied on cuts, wounds, and swellings. |
| Richus communis L., Euphorbiaceae, AGS-4 | 31 | Ander (N)/Redi, Yamyam (Th)/Shrub/Wild/Easily | Root and seed | Root juice is given orally in diarrhoea, dysentery, and skin diseases. *Seed oil is applied as massage for babies and also applied on sole to relief from burning sensation. Seed oil is given orally in constipation and rheumatic pain. |
| Shorea robusta C.F. Gaertn., Dipterocarpaceae, AGS19 | 20 | Sal (N)/Sakhuwa (Th)/Tree/Wild and cultivated | Root, Bark, resin and seed | Decoction is given orally in Diarrhoea and bloody dysentery. *Bark juice is used as eardrop in earache. |
| Solarium rugosum L., Solanaceae, AGS-2 | 36 | Kali gedi (N)/Kamai (Th)/Tree/Wild/Easily | Entire plant | *Unripe fruits paste is applied on ringworm. Ripe fruits are given orally in constipation. Plant paste is applied externally in headaches and joint pain. Plant juice is given orally in liver enlargement, dysentery and fever |
| Syzygium cumini (L.) Skeels, Myrtaceae, AGS-29 | 48 | Phader (N)/Jamnu (M)/Jarn (Th)/Tree/Wild and cultivated | Bark and fruit | Bark juice is given orally in Diarrhoea, dysentery, cut and wounds. Fruits are given orally in indigestion and constipation. Bark, Leaf and seed powder is given orally to reduce sugar level in blood. |
| Terminalia bellirica (Gaertn.) Roxb., Combretaceae, AGS-39 | 36 | Baro (N)/Baheda (Th)/Tree/cultivated. | Stem bark and fruit. | Bark juice is applied externally in cut, wounds, and skin diseases. Fruits powder is given orally in cough, cold, respiratory troubles, fever, and indigestion. |
| Terminalia chebula Retz., Combretaceae, AGS-64 | 36 | Haro (N)/Harad (Th)/Tree/cultivated. | Stem bark and fruit. | *Bark is chewed in urinary problems. Fruits are given orally in cough, cold, respiratory troubles, fever, and indigestion and stomach problems. |
| Tribulus terrestris L., Zygophyllaceae, AGS-47 | 16 | Godharu, Gaikhure Jhar (N)/Herb/Wild/Rare | Entire plant | *Decoction is given orally in urinogenital tract infection. |
are the most frequently and popularly used medicinal plant species in the study area.

Growth forms, plant parts used, method of collection, processing and administration
Out of 66 medicinal plants recorded from study area, highest number of plants belongs to herb (53%) followed by tree, shrubs and climber (Figure 2). Higher uses of herbs for medicinal purposes may be due to easy availability and high effectiveness in the treatment of ailments in comparison to other growth forms. Almost every plant parts are used for the medication either singly or in combination with other plants. Entire plant is used in the majority of cases followed by leaf, root and bark (Figure 3). Plant parts used as medicine is collected by healers themselves from natural resources. Generally fresh parts are collected for use from nature. Various plant parts are collected in different seasons at different stage of maturity and are dried in shade and stored in dry places away from direct sunlight for their use during off season/unavailability. As far as mode of use and administrations are concerned majority of the plants are used in form of juice, followed by decoction (Figure 4). Majority of the medicinal formulations are administrated orally in ailment categories other than dermatological. In dermatological problems plants are administrated topically as well as orally.

Identification of new claims and reliability of reported claims
Reported uses of various medicinal plants were compared with previously published ethnobotanical literatures in Nepal and adjoining areas of India [2-20,25,30] which identifies new medicinal uses of

Table 2 Ethnomedicinal plants of Terai forest in western Nepal and their traditional therapeutic uses (Continued)

| Plant | Genus and Family | Genus and Family | Uses |
|-------|------------------|------------------|------|
| Ziziphus mauritiana Lam. | Rhamnaceae | Bayer (N)/Tree/Wild/easily | Stem bark and fruit. The juice of bark is given orally to treat Diarrhoea and dysentery. Ripe fruit are given orally in indigestion, constipation and other stomach problems. |
| Zingiber officinale Roscoe | Zingiberaceae | 73 Aduwa (N)/Sontho (Th)/Herb/cultivated | Rhizome juice is given in cough, cold, fever, indigestion, and constipation. Rhizome is chewed in bronchial infections. |
| Vitex negundo L. | Vitaceae, AGS-69 | 38 Simal (N)/Shrub/Wild/Easily | Leaf juice and bark Leaf juice is given orally in cough, cold, sinusitis, fever, stomach problems, and rheumatic swellings. Bark paste is applied on boils. |

Table 3 Different ailments of study area grouped under different ailment categories with their biomedical terms and factor of informants’ consensus

| Ailment categories | Biomedical terms | \(N_{\text{NTAXA}}\) | \(N_{\text{NUR}}\) | \(F_{\text{IC}}\) |
|--------------------|------------------|----------------|----------------|--------------|
| Gastro-intestinal disorders | Constipation, Diarrhoea, Dysentery, Nausea, Indigestion, Vomiting, Stomach-ache, Gastric trouble, Loss of appetite, Intestinal worms, colic pain, Flatulence, Piles | 41 | 836 | 0.95 |
| Dermatological disorders and cosmetics | Cut, Wounds, Boils, Pimples, Skin rashes, Ringworm, Scabies, Leprosy, Skin burns, Skin blemishes, Ecto-parasites, Skin diseases, Hair problems, Body Inflammation | 34 | 591 | 0.94 |
| Respiratory diseases | Common cold, cough, asthma, Bronchitis, Chest pain, Lung disorders | 13 | 235 | 0.94 |
| Fears | Ordinary fever, diaphoretic Malaria, Typhoid, | 11 | 213 | 0.95 |
| Ureno-genital problems | Sexual debility, Infertility, Leucorrhoea, Gonorrhoea, Menstrual disorders, Frequent urination, Diuretic, aphrodisiac | 14 | 190 | 0.93 |
| Ear, Nose, Throat problems | Earache, Throat shore, Noise bleeding, Sinusitis | 12 | 205 | 0.94 |
| Oral and dental disorders | Toothache, Mouth shore, | 8 | 141 | 0.95 |
| Mental disorders | Mental tonic, memory tonic, Epilepsy | 4 | 44 | 0.93 |
| Skelto-muscular pain and swelling | Body ache, muscular pain, Sprain, Strain, Rheumatism, Arthritis, Head ache, Joint pain, swelling | 16 | 245 | 0.93 |
| Cardio-vascular disorder | Cardiac, blood pressure | 2 | 35 | 97 |
| Other | Fracture, Tonic, Lactation, Easy delivery, Tumour, Diabetes, Cooling agent, stimulant and Eye problems | 20 | 414 | 0.95 |
| Total | | 175 | 3149 | 0.94 |

\(N_{\text{NUR}}\) = number of use report in a particular illness category and
\(N_{\text{NTAXA}}\) = number of taxa used to treat that particular category by informants.
\(F_{\text{IC}}\) = Factor of informants consensus = \(N_{\text{NUR}} - N_{\text{NTAXA}} / (N_{\text{NUR}} - 1)\), value of \(F_{\text{IC}}\) ranges from 0 to 1, high value shows agreement and low value shows disagreement among informants about the uses of taxa for the treatment of particular ailment category.

* Many plants are used for more than one ailment category.
### Table 4 Symptoms of the diseases given by the tribes in terai forest of western Nepal and their equivalent bio-medical terms (Continued)

| Ailment categories          | Bio-medical terms                              | Local terms               |
|-----------------------------|------------------------------------------------|---------------------------|
| Gastro-intestinal disorders | Constipation                                   | Kabijyat hunu/Pet safa na hune |
|                             | Diarrhoea                                       | Pani jasto patlo dish hune |
|                             | Dysentery                                       | Aau pareko                |
|                             | Nausea                                          | Kamjori hune wak-wak lagne |
|                             | Indigestion                                     | Khana apach hune          |
|                             | Vomiting                                        | Banta/Ulti hune           |
|                             | Stomachache                                     | Pet dukhne                |
|                             | Gastric trouble                                 | Pet dhadiyeko             |
|                             | Loss of appetite                                | Khana ruchi na lagne/Bhok na lagne |
|                             | Intestinal worms                                | Pet ma juka pamu          |
|                             | Colic pain                                      | Tallo pet dukhne          |
|                             | Flatulence                                      | Bayu gola le pet dukhne   |
|                             | Piles                                           | Disha game thaun ma mushu palaune |
| Dermatological disorders & cosmetics | Cuts                                       | Katiyeko                  |
|                             | Wounds                                          | Ghau                      |
|                             | Boils                                           | Pilo, Khatira             |
|                             | Pimples                                         | Dandiphore                |
|                             | Skin rashes                                     | Chhala ma chilaune, rato dana hune |
|                             | Ringworm                                        | Daad hune, Chhala ko rog  |
|                             | Scabies                                         | Luto, Kanaune rog, Khujali hune |
|                             | Leprosy                                         | Kushta rog                |
|                             | Skin burns                                      | Ghamle chhala dadeko      |
|                             | Skin blemishes                                  | Chhala ma hune rog        |
|                             | Ecto-parasites                                  | Jumra pamu, juka lagnu    |
|                             | Skin diseases                                   | Pana dhadiyeko            |
|                             | Hair problems                                   | Rauko rog, Kapal ko samsya |
|                             | Body inflammation                               | Sarir sunnine ra polne   |
| Respiratory diseases & Fever | Common cold                                    | Chiso lageko              |
|                             | Cough                                           | Khoki lageko              |
|                             | Asthma                                          | Dam rog bhayeko, Swash phulne rog |
|                             | Bronchitis                                      | Ghanti ko rog             |
|                             | Chest pain                                      | Chhati Dukheko            |
|                             | Lung disorders                                  | Fokwo ko jhar daheko      |
|                             | Ordinary fever                                  | Samanaya rog              |
|                             | Diaphoretic                                     | Pasina bagaune rog        |
|                             | Malaria                                         | Aulo Jwaro                |
|                             | Typhoid                                         | Miyadi Jwaro              |
|                             | Sexual debility                                 | Sarink Karmjori           |
|                             | Infertility                                      | Youn Durbalta             |
|                             | Leucorrhoea                                     | Swet Pradad/Yoni bat seto panii bagne |
|                             | Gonorrhoea                                      | Yoni bat ganaune panii jasto aau/ne/ Estree hau ma youn rog |
| Cardiovascular disorders    | Menstrual disorders                             | Nachune huda ko rog/Mahinwari huda lagne rog |
|                             | Frequent urination                              | Pishab aayee rakhne       |
|                             | Diuretic                                        | Pishab kholne             |
|                             | Aphrodisiac                                     | Youn bardhak/Youn ko tagat |
|                             | Ear, Nose, Throat problems                      | Kan dukhne                |
|                             | Earache                                         | Ghati bakeso              |
|                             | Throat sore                                     | Nak bat ragat bagne       |
|                             | Nose bleeding                                   | Sinusing                  |
|                             | Sinusing                                        | Pinas bhayeko             |
|                             | Oral & Dental disorders                         | Tootachhe                 |
|                             | Mouth sore                                      | Mokhna ghaub, dana hune   |
|                             | Mental disorders                                | Buddh badhaunye aushadhi  |
|                             | Mental tonic                                     | Smaranshakti badhaunye aushadhi |
|                             | Memory tonic                                     | epilepse                  |
|                             | Ecto-parasites                                  | Chhare rog/Mirgi rog      |
|                             | Skeleto-muscular pain & swelling                | Jiu dukhiko               |
|                             | Muscular pain                                   | Mans presha haru dukhiko  |
|                             | Sprain                                          | Mriekho                   |
|                             | Strain                                          | Tanaw bhayeko             |
|                             | Rheumatism                                      | Baath bhayeko             |
|                             | Arthritis                                       | Jori dukhiko              |
|                             | Headache                                        | Tako dukhiko              |
|                             | Joint pain                                       | Jomiharu dukhiko          |
|                             | Swelling                                        | Sunnayeck                 |
|                             | Cardiovascular disorders                        | Muju lai tagat dine aushadhi |
|                             | Blood pressure                                  | Rakha chaap bhayeko       |
|                             | Others                                           | Hadi bhandekeyo           |
|                             | Fracture                                        | Tagit dine aushadhi       |
|                             | Lactation                                       | Dush badhaunye            |
|                             | Easy delivery                                   | Sajilai surkeri garaune   |
|                             | Turnour                                         | Mushu badheko             |
|                             | Diabetes                                        | Chinor/Madhumeb bhayeko   |
|                             | Cooling agent                                   | Shitaile dine aushadhi    |
|                             | Stimulant                                       | Uttejana badhaunye aushadhi |
|                             | Eye problems                                    | Aanik ko rog              |
pudica, Mucuna pruriens, Phragmites vallatorum, Polygonum barbatum, Rauvolfia serpentina, Ricinus communis, Shorea robusta, Solanum nigrum, Terminalia chebula, and Tribulus terrestris are reported for the first time in Nepal and adjoining areas of India. Some of the medicinal plants reported during the present study were reported for biological activities and bioactive constituents responsible
for their therapeutic properties [7,17,46-50] which justify and validate the usages of these species for medicinal purposes in the study area.

Consensus of agreement about uses of medicinal plants among informants
To gain credibility, scientific studies that utilize traditional knowledge must be reliable. In ethnobotanical studies, consensus analysis provides a measure of reliability for any given claim providing reliable evidence. The product of $F_{IC}$ ranges from 0 to 1. High value of $F_{IC}$ indicates the agreement of selection of taxa between informants, whereas a low value indicates disagreement [51]. Recently consensus analysis has been used as an important tool for the analysis of ethnobotanical data [19,22,51-58]. In the study area the informants’ consensus about usages of medicinal plants ranges from 0.93 to 0.97 with an average value of 0.94 (Table 3), which shows high level of agreements among the informants. The high level of consensus among the informants about the usages of medicinal plants for the treatment and prevention of various diseases and ailments prevalent in the study area suggests that the ethnomedicinal uses of plants are currently in practice in the study area.

Availability of medicinal plants in terai forest, conservation efforts and needs
As for as availability of medicinal plants is concerned 39% medicinal plants are cultivated for food, fruit, spices and trade; thus are easily available for medicinal purposes. Majority of the 61% wild medicinal plant species are available without difficulty in the study area except *Acacia catechu, Bacopa monnieri, Bombax ceiba, Drymaria diandra, Rauvolfia serpentina and Tribulus terrestris* which are available with difficulty and needs to be conserved for future use. Unfortunately, neither local inhabitants nor Government is making serious efforts for conservation of medicinal plants in the study area. Unsustainable collection of generative and vegetative parts of medicinal plants from natural resources reduces their population as well as decrease multiplication and regenerative power. There is an urgent need to create awareness among the inhabitants of the study area about sustainable collection, conservation, domestication, small scale (home garden for personal use) as well as large scale (for trade) cultivation of medicinal plants. This will also improve the socio-economic condition of the inhabitants as well as reduce pressure on natural resources.

Knowledge about traditional healing system and its transfer from one generation to other
Bhagirathi Tharu, Mandal Tharu and Khadanand Poudyal are the main expert from the study area. These experts are working in this field since more than 30 years. Though there is a sub health post with less equipped facility in Shankar Nagar VDC and the modern hospital facilities are available in Butwal municipality which is near about 10 km far from Shankar Nagar VDC. The tribal people of the study area prefer traditional medicinal practice to the modern medicinal system because they know more about the medicinal plants which are easily available in their local area and herbal formulations are cooperatively cheaper and free from side effects. The tribal communities of the study area are not exception to the present stream of modernization and the traditional medicinal practice seems to be disappearing among the tribal communities of the study area. During present study it was found that the knowledge about utilization of medicinal plant species is generally accumulated by observation and experiences and transferred to the next generation by words of mouth. Our finding was similar to findings in other parts of India and abroad [24-30]. As indigenous knowledge on usages of medicinal plants is transmitted without any systematic process, and younger generations of the tribes are not interested in traditional healing system because it has no/very little scope for money, so they engage themselves in other occupations. Thus, it is certain that such knowledge is at the risk of disappearance in the future [21].

Conclusion
Present study revealed that the local traditional healers of Rupandehi district, western Nepal are rich in ethnomedical knowledge and majority of people rely on plant based remedies for common health problems like headache, body ache, constipation, indigestion, cold, fever, diarrhea, dysentery, boils, wounds, skin diseases, urinary troubles, fractures, round worms, etc. The survey also revealed that all the traditional healers have strong faith on ethnomedicines although they were less conscious about the documentation and preservation of ethno medicinal folklore and medicinal plants. The group discussion and personal interviews show that youngsters of both Tharu and migrant society are less aware about the use of ethnomedicines; our findings are similar to reports from India [58]. On the other hand, traditional healers who are the main repository of ethnomedicinal knowledge claim extreme secrecy over their ethnomedicinal knowledge. The traditional healers have strong belief that if they disclose the secrecy about the medicinal properties of particular plant all the medicinal potentialities of the plant will be lost and the remedy will not work properly.

Competing interest
The authors declare that they have no competing interests.

Authors’ contributions
AGS, AK and DDT developed and designed the research study. AGS conducted field survey work, collected data and prepared draft of the
manuscript. AK conducted statistical analysis and revised the manuscript. All
authors have read and approved the final manuscript.

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