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Traditional uses of locally available medicinal plants in Bardiya district, Nepal

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ABSTRACT

Background & Aim: Medicinal plants are traditionally used worldwide for primary healthcare. Documentation of such traditional ethnomedicinal knowledge is essential because it might be lost after loss of knowledgeable people. This study was conducted to document the traditional uses of locally available medicinal plants in Bardiya district of Nepal during March and April 2021.

Experimental: Questionnaire survey method was used to collect the information about uses, local name and parts used of the medicinal plant species found in the study area. Secondary data were collected through online portals like Google Scholar and Researchgate. Data was pooled and analyzed in Excel software. The data were presented in table, graphs and pie-chart.

Results: A total of 63 species of medicinal plants from 59 genera and 39 families were found to be used to treat 51 types of diseases. Fabaceae family represented the maximum number of plant species used (n=8). Herbs were used most frequently (n=29) among the different habit of plants. Similarly, leaf was used most frequently (n=26) to cure diseases.

Recommended applications/industries: The finding of the present study would be the baseline for further exploration of medicinal plants in the study area.

1. Introduction

Plants are important resources for fulfilling basic needs of human beings i.e. food, shelter, clothes, health (Bhattarai, 2019; Rajbhandary *et al*., 2020); fuel, fodder, fiber and social religious purposes (Rajbhandary and Winkler, 2015). A large number of the rural population depend on plants (especially medicinal and aromatic plants and non-timber forest products) to uphold their livelihood and economy (Angelsen *et al*., 2014; Shackleton and Pullanikkatil, 2018; Lamichhane *et al*., 2021). Plants are being used as a medicine in traditional as well as modern healthcare system. According to Shrestha and Dhillion (2003), more than 60% of the world population relies on herbal medicine. Among them, 80% of population belongs to developing countries. Specially, indigenous rural people use plants for medicinal practices in developed and developing countries (Rokaya *et al*., 2010; Luitel *et al*., 2014; Tomlinson and Akerele, 2015; Kumar and Ashaq, 2021). More than 4.5 billion people from developing countries use medicinal plants for their healthcare (Bhat *et al*., 2013).

Nepal, one of the developing countries, harbors high diversity of plant species. The country occupies only 0.1% of the global land but harbor 3.2% of the worlds' known flora (GoN/MoFSC, 2014). According to Rajbhandari *et al*. (2017), more than 5,309 species of plants exist in Nepal. Among them, more than 1,950 species of plants are used for medicine in Nepal (Ghimire, 2008). A total of 143 species are listed as commercial medicinal plants in Nepal (Bhattarai and Ghimire, 2006). More than 300 species of medicinal plants are traded from Nepal (Ghimire *et al*., 2016). Traditional herbal medicines are cheaper, easily available and have no side-effects. Hence it has been practiced since a long period by rural communities in Nepal (Manandher, 1998; Acharya and Acharya, 2009; Thapa *et al*., 2020). Only in hilly regions, 215 types of

plant species are used to treat 139 types of diseases (Miya *et al*., 2020). Plants are used in different ways and methods to treat different types of diseases (Shrestha and Dhillion, 2003). The knowledge about uses of plants is rich in indigenous ethnic communities.

The innovation and formulation of advance types of medicines is initially based on traditional and ethnic medicines. Hence, the ethnomedicinal knowledge is highly recognized and being explored worldwide (Acharya and Acharya, 2009; Acharya, 2012). Bio-visioning of traditional or indigenous medicinal plants help to discover new drugs (Rahmatullah *et al*., 2012). The indigenous knowledge may get lost due to socio-economic changes, biodiversity loss and loss of knowledgeable person. Hence, it is important to explore and this knowledge about traditional uses of medicinal plants (Singh *et al*., 2012; Kunwar *et al*., 2016).

Many studies have been conducted on exploration of traditional and ethnomedicinal uses of plants in different parts of Nepal (Pandey, 1961; Dhami, 2008; Gaire and Subedi, 2011; Acharya, 2012; Luitel *et al*., 2014; Malla *et al*., 2015; Paudel *et al*., 2018; Bhattarai, 2018; Poudel *et al*., 2021). As far as Bardiya district is considered, Uprety *et al*. (2010) has reported 101 species of NTFPs with their indigenous uses during their study in 2006. The present study was conducted to document the traditional uses of locally available medicinal plants in Bardiya district of Nepal. This study will help for the further exploration of medicinal plants in the study area.

2. Materials and Methods

2.1. Study area

The study was conducted in Bansgadhi municipality, ward-3 of Bardiya district, Nepal during March and April 2021. The district lies between 28.3102° N latitudes and 81.4279° E longitudes. It covers an area of 2,025km^2. It extends from low land Terai (68.76%) to Siwalik hill (31.24%) (Maharjan and Shakya, 2020).The district lies in tropical region with an average annual temperature of the district is 33° C and annual rainfall of 248 mm. It is bounded by Surkhet district in the north, India in the south and Banke district in the east and Kailali district in the west (Figure 1). The forests are dominated with *Shorea robusta*, *Terminalia tomentosa*, *Dalbergia sisoo* and *Acacia catechu*. According to the CBS (2011), the district has total population of 426,576. Among them, 53% are Tharu, followed by Chhetri (11.45%), Brahmins (8.72%), Dalit (5%), Magar (3%), Yadav (2%), Muslim (3%), Thakuri (2%) and others (10%). Most of the people depend upon agriculture for their major source of income.

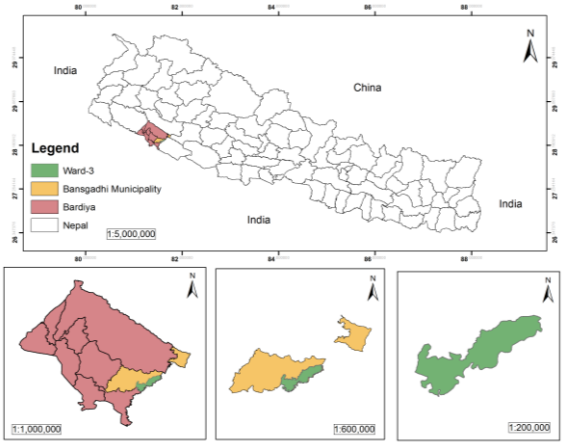

Fig 1. Map showing study area

2.2. Data collection

Questionnaire survey method was used to collect the information about uses, parts used, and local name of medicinal plant species found in the study area. A total of n= 42 individuals of age (46 to 60 years old) were consulted for the data collection. Among them n=29 were male and n=13 were female. Two focus group discussions were conducted to add more information. These people were selected randomly based on their knowledge of medicinal plants for self medication or treating others. Plant species were photographed in the field and verified their identification with the help of local peoples. Secondary data were collected through online portals like Google Scholar and Researchgate.

2.3. Data analysis

Data was pooled and analyzed in Excel software. Arc GIS was used to prepare study area map. The data are presented in table, graphs and pie-chart.

3. Results and discussion

A total of 63 species of plants from 59 genera and 39 families were used to treat 51 types of diseases. Plant species with their scientific name, local name, family name, habit, parts used and uses is mentioned in Table 1.

Table 1. Plant species with their local uses.

S.N.	Scientific name	Local name	Family	Habit	Parts used	Ailments/ Diseases	Mode of application
1.	*Acacia catechu* (L.f.) Willd.	Khayar	Fabaceae	Tree	Stem	Body pain, dental and oral infections	Hard wood is boiled in water and consumed.
2.	*Achyranthes aspera* L.	Datiwan	Amaranthaceae	Herb	Leaf	Fever, cuts, scorpion bite, swelling and eczema	Leaf juice is applied on cuts, scorpion bite, swelling and eczema and taken orally for fever.
3.	*Acmella oleracea* (L.) R.K. Jansen	Marethi	Asteraceae	Herb	Flower	Toothache, mouth wounds and skin diseases	Flower paste is applied.
4.	*Acorus calamus* L.	Bojho	Acoraceae	Herb	Rhizome	Cough, cold and tonsillitis	The Rhizome piece is consumed orally.
5.	*Adiantum capillus-veneris* L.	Pakhaale uniu	Pteridaceae	Herb	Whole plant	Snake bite, scorpion bite, and cuts	Leaf paste is applied on the bites and cuts.
6.	*Aegle marmelos* (L.) Correa,	Bel	Rutaceae	Tree	Fruit and root	Diarrhea, dysentery and wounds	Fruit is eaten to cure diarrhea and dysentery. Root and fruit paste is applied on wounds.
7.	*Albizia lebbeck* (L.) Benth.	Kalo siris	Fabaceae	Tree	Leaf, stem and bark	Skin disease, toothache, bronchitis	Paste is applied on skin disease, toothache and juice is taken orally for bronchitis.
8.	*Allium sativum* L.	Lasun	Amaryllidaceae	Herb	Bulb	Control high blood pressure, reduce fats in blood, wounds in ear	Paste is consumed daily to control high blood pressure and reduce fats in blood. Bulb is boiled in oil and cooled then this oil is applied on air to cure wounds.
9.	*Aloe vera* (L.) Burm.f.	Ghiukumari	Asphodelaceae	Herb	Leaf	Burn and skin diseases	Leaf gel is applied on burnt area and skin.
10.	*Alternanthera sessilis* (L.) R. Br. ex. DC	Bhiringi jhar	Amaranthaceae	Herb	Leaf	Wounds	Leaf juice is applied on wounds
11.	*Amaranthus tricolor* L.	Rato latte	Amaranthaceae	Herb	Leaf	Ulcer	Leaf is consumed as curry to cure ulcer.
12.	*Amaranthus viridis* L.	Lunde sag,	Amaranthaceae	Herb	Leaf	Fever, pain and eye diseases	Leaves are consumed as curry to cure fever, pain and eye diseases.
13.	*Annona squamosa* L.	Sitaphal	Annonaceae	Tree	Leaf	Skin diseases, cuts and wounds	Leaf paste is applied.
14.	*Arisaema tortuosum* (Wall.) Schott	Baanko	Araceae	Herb	Rhizome	Headache, toothache and scorpion bite	Dried rhizome paste is applied on headache and toothache and bite. Also it is consumed to cure headache.
15.	*Artemisia indica* Willd.	Titepati	Asteraceae	Herb	Leaf and root	Cuts, Wounds, control bleeding from nose, stomach worms and scabies	Leaf juice is applied on cuts, wounds, to stop bleeding from nose, and scabies. Leaf and root juice is taken orally for stomach worms.
16.	*Asparagus racemosus* Willd.	Kurilo	Asparagaceae	Herb	Tuber	Stomach problem, tonic, diabetes and urinary problems	Dried tuber is consumed orally.
17.	*Azadirachta indica* A. Juss.	Neem	Meliaceae	Tree	Leaf	Skin problems, intestinal worms, stomach problems	Leaf paste is applied on skin and the juice is taken orally for intestinal worms, stomach problems
18.	*Bauhinia variegate* (L.) Benth.	Koiralo	Fabaceae	Tree	Bark	Diarrhea	Bark juice is consumed
19.	*Bombex ceiba* L.	Simal	Malvaceae	Tree	Root and leaf	Cuts, wound, gastritis and diarrhea	Root juice is consumed to cure diarrhea and gastritis. Leaf juice is applied on cuts and wounds.
20.	*Brassica campestris* L.	Tori	Brassicaceae	Herb	Seed	Body pain, cough and fever	Seed oil is applied on body and massage to cure body pain. It is also applied on head and massage to cure cough and fever.

21.	*Butea monosperma* (Lam.) Taub.	Palas	Fabaceae	Tree	Flower	Stomach worms and diarrhea	Dried flower paste is consumed.
22.	*Cajanus cajan* (L.) Millsp.	Arahar	Fabaceae	Shrub	Leaf	Tong infection and mouth wounds	Leaf juice is applied on infected tong and wounds.
23.	*Calotropis gigantea* (L.) W.T. Aiton	Aank	Apocynaceae	Shrub	Bark and root	Fever, joint pain and snake bite	Dried bark and root is consumed to cure joint pain and fever. Paste is applied on snake bite.
24.	*Cannabis sativa* L.	Ganja	Cannabaceae	Herb	Seed and leaf	Stomachache, diarrhea, cough and blood purifier	Leaf paste is consumed to cure cough. Seeds are consumed to purify blood and treat stomachache and diarrhea.
25.	*Carica papaya* L.	Mewa	Caricaceae	Tree	Fruit	Jaundice, control blood pressure	Fruit is consumed to control jaundice and blood pressure.
26.	*Cassia fistula* L.	Raj brikshaya	Fabaceae	Tree	Bark and fruit	Ulcer, diarrhea and constipation	Fruit is consumed to cure constipation and diarrhea. Bark is used to treat ulcer.
27.	*Chenopodium album* L.	Bethe	Chenopodiaceae	Herb	Seed	Abdominal pain	Seed paste is consumed.
28.	*Clerodendrum infortunatum* L.	Bhat	Lamiaceae	Shrub	Leaf and root	Skin diseases, scorpion bite and snake bite	Leaf and root juice is applied on body during bathing to control skin diseases. Paste is applied on bites.
29.	*Coccinia grandis* (L.) Voigt.	Kundaru	Cucurbitaceae	Climber	Leaf and fruit	Liver disease and toothache	Fruit is consumed to reduce toothache. Leaf is used to treat liver diseases.
30.	*Curcuma longa* L.	Besar	Zingiberaceae	Herb	Rhizome	Cough, cold, wounds, cuts and cholera	Rhizome mixed with water is consumed to recover from cough, cold and cholera. Paste mixed with oil is applied on cuts and wounds.
31.	*Cuscuta reflexa* Roxb.	Aakash beli	Convolvulaceae	Climber	Whole plant	Jaundice, joint pain, control hair fall and wounds	Paste is applied on wounds, on head to control hair fall. Juice is consumed every morning to control jaundice and joint pain.
32.	*Cymbopogen citratus*	Kagati ghas	Poaceae	Herb	Leaf	Cough, pain, fever and stomach problem	Leaf juice is mixed with cool water and consumed.
33.	*Cynodon dactylon* (L.) Pers.	Dubo	Poaceae	Herb	Whole plant	Stomachache	Paste is consumed.
34.	*Eleusine indica* (L.) Gaertn.	Kodo ghas	Poaceae	Herb	Whole plant	Diabetes and fever	Juice is consumed in every morning with water.
35.	*Engelhardtia spicata* Lesch. ex Blume	Mauwa	Juglandaceae	Tree	Bark and seed	Cough and cold	The seed and bark are consumed.
36.	*Euphorbia hirta* L.	Dudhe jhaar	Euphorbiaceae	Herb	Latex and leaf	Cuts and wounds	The latex is applied on cuts and wound.
37.	*Euphorbia royleana* Boiss.	Siudi	Euphorbiaceae	Shrub	Stem	Cough and stomachache	Dried stem paste is consumed.
38.	*Ficus religiosa* L.	Pipal	Moraceae	Tree	Bark and leaf	Skin disease and gastritis	Dried bark paste is consumed to recover gastritis. Fresh leaf paste is applied on scabies.
39.	Ipomoea purpuria (L.) Roth.	Lare saag	Convolvulaceae	Climber	Seed	Constipation	Seeds are consumed.
40.	*Jatropha curcas* L.	Sajjiwan	Euphorbiaceae	Shrub	Latex and stem	Cuts and wounds	Latex from stem is applied on cuts and wounds.
41.	*Justica adhatoda* L.	Asuro	Acanthaceae	Shrub	Flower and leaf	Jaundice, control vomiting and mouth problems	Flower and leaf paste is consumed to recover jaundice .
42.	*Lawsonia intermis* L.	Mehendi	Lythraceae	Shrub	Leaf	Common cold and headache	Paste is applied on head to recover headache and common cold.
43.	*Mangifera indica* L.	Aanp	Anacardiaceae	Tree	Fruit and bark	Stomach problem, diarrhea and toothache	Bark paste and fruit is consumed.
44.	*Mentha spicata* L.	Pudina	Lamiaceae	Herb	Whole plant	Fever, stomach problems and toothache	Plant paste mixed with cool water is consumed.

45.	*Mimosa pudica* L.	Lajawati	Fabaceae	Herb	Whole plant	Piles, wounds, sinus and urogenital disorders	Leaf paste is applied on wounds. Plant paste is consumed as medicine to recover piles, sinus and urogenital disorders.
46.	*Moringa oleifera* Lam.	Sital chini	Moringaceae	Tree	Bark and leaf	Skin disease and stomach problem	Bark paste is consumed to recover stomach problem. Leaf paste is applied scabies.
47.	*Morus alba* L.	Kimbu	Moraceae	Tree	Fruit and bark	Cough, fever and sore throat	Fruit and bark are consumed as to recover fever, cough and sore throat.
48.	*Musa paradisiaca* L.	Kera	Musaceae	Herb	Fruit and flower	Ulcer, dysentery, diabetics and diarrhea	Raw flower and fruits are consumed.
49.	*Ocimum basilicum* L.	Baabari	Lamiaceae	Herb	Leaf	Cold and fever	Leaves are mixed with hot water and consumed.
50.	*Ocimum sanctum* L.	Tulasi	Lamiaceae	Herb	Leaf and stem	Cough, headache and kidney stone	Leaf and stem are mixed with hot water and consumed.
51.	*Oxalis corniculata* L.	Chariamilo	Oxalidaceae	Herb	Leaf	Headache, stomachache, wounds and scurvy	Fresh leaf is consumed.
52.	*Phaseolus vulgaris* L.	Simi	Fabaceae	Climber	Leaf	Skin disease	Leaf paste is applied on skin.
53.	*Phyllanthus emblica* L.	Amala	Phyllanthaceae	Tree	Fruit	Jaundice, diarrhea, control hair fall and inflammation	Fruit paste is applied on head to control hair fall and. Fruit is consumed to cure jaundice, diarrhea and inflammation.
54.	*Physalis peruviana* L.	Bhamara	Solanaceae	Herb	Leaf	Sore throat	Leaf paste is consumed.
55.	*Piper longum* L.	Pipala	Piperaceae	Climber	Fruit	Gastritis, stomachache and lose weight	Dried fruit paste mixed with hot water and consumed.
56.	*Sida cordifolia* L.	Balu	Malvaceae	Herb	Leaf	Boils	Leaf paste applied.
57.	*Solanum nigrum* L.	Jungali bihi	Solanaceae	Herb	Fruit	Cough and stomach problem	Fruits are consumed.
58.	*Syzygium cumini* (L.) Skeels	Jamun	Myrtaceae	Tree	Bark and fruit	Cough, headache and diarrhea	Bark paste and fruit are consumed.
59.	*Tagetes erecta* L.	Sayapatri	Asteraceae	Herb	Flower	Cuts, wounds, skin disease and body pain	Flower paste is applied on infected body parts.
60.	*Terminalia belerica* (Gaertn.) Roxb.	Barro	Combretaceae	Tree	Fruit	Gastritis, cough, sore throat and tonsillitis	Fruit paste is consumed.
61.	*Terminalia chebula* (Gaertn.) Retz.	Harro	Combretaceae	Tree	Fruit	Fever, cough and eye pain	Fruit paste is consumed.
62.	*Tinospora cordifolia* (Thunb.) Miers	Gurjo	Menispermaceae	Climber	Rhizome	Cough, tonsillitis and gastritis	Small pieces of rhizome are consumed.
63.	*Ziziphus mauritiana* Lam.	Bayar	Rhamnaceae	Shrub	Fruit	Stomach problem and body cooling	Fruit paste is consumed.

3.1. Family-wise use of the plant species

Plant species from total of 39 families were used to treat different types of diseases. Family Fabaceae represented the maximum number of species used (n=8), followed by Amaranthaceae (n=4), Lamiaceae (n=4), Asteraceae (n=3), Euphorbiaceae (n=3), Poaceae (n=3), Combretaceae (n=2), Convolvulaceae (n=2), Malvaceae (n=2), Moraceae (n=2), Solanaceae (n=2) (Figure 2). A single species (n=1) were represented by families; Acanthaceae, Acoraceae, Amaryllidaceae, Anacardiaceae, Annonaceae, Apocynaceae, Araceae, Asparagaceae, Asphodilaceae, Brassicaceae, Cannabaceae, Caricaceae, Chenopodiaceae, Cucurbitaceae, Juglandaceae, Lythraceae, Meliaceae, Menispermaceae, Moringaceae, Musaceae, Myrtaceae, Oxalidaceae, Phyllanthaceae, Piperaceae, Poaceae, Pteridaceae, Rhamnaceae, Rutaceae, and Zingiberaceae (Table 1). Uprety *et al*. (2010) has also reported the Fabaceae as a dominant plant family (11 species out of 101 species from 48 families) used for medicine in their study in Bardiya. This study supports the similar results with the previous studies in Rupandehi (Acharya and Acharya, 2009), in Nawalparasi (Bhattarai *et al*., 2009), in Chepang inhabitant districts (Tamang *et al*., 2017), in Rupandehi and Nawalparasi (Thapa, 2020), in Kanchanpur (Bhatt and Kunwar, 2020), in Ilam (Bhattarai, 2020).

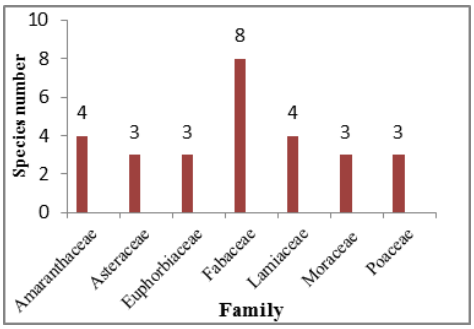

Fig 2. Dominant plant families with their species number.

3.2. Habit-wise use of plant species

Among the total plant species, 47% were herb (n=29), followed by tree (30%, n=19), shrub (13%, n=8) and climber (10%, n=6) (Figure 3). Herbs as a major plants used for ethnomedicine was also observed by Singh (2015) in Rupandehi district where 35 species were herbs out of 51 species. The result of present study supports the results of previous studies in Chepang inhabitant districts (Tamang *et al.*, 2017), in Chitwan (Poudel and Singh, 2016), in Jhapa (Ghimire, 2016), in Rupandehi and Nawalparasi (Thapa, 2020).

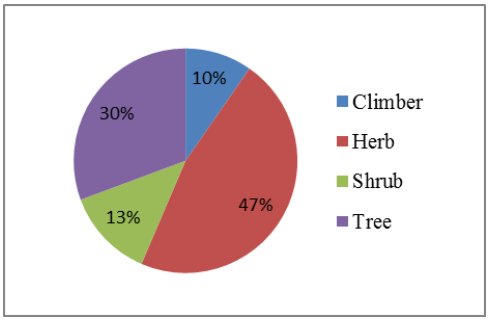

Fig 3. Habit of plant species used.

3.3. Part-wise uses of plant species

A total of n=8 types of parts from plant were used. Among them, leaf was used most frequently (n=26), followed by fruit (n=14), bark (n=10), flower (n=5), root (n=5), rhizome (n=4), latex (n=2) and bulb (n=1) (Figure 4). The result of present study supports the results of previous studies in Parbat (Malla *et al.*, 2015), in Ilam (Bhattarai and Khadka, 2016), in Chitwan (Poudel and Singh, 2016), in Rupandehi and Nawalparasi (Thapa, 2020). The most frequent use of leaf for medicinal proposes might be due to the presence of more active compounds as compared to other parts (Faruque *et al.*, 2018), ease of collection and preparation (Coley *et al.*, 2003).

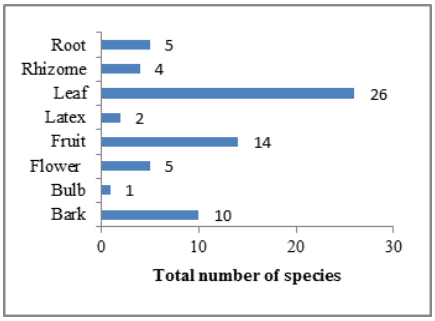

Fig 4. Plants parts used from different species.

The present study documents the plants species only in the small area of the district. Although people are rich in ethnobotanical knowledge, it might be lost after their death. Hence, proper documentation of ethnobotanical knowledge is required in other parts of the district.

4. Conclusion

The study documented the traditional uses of locally available plants in Bardiya. A total of 63 species of medicinal plants from 59 genera and 39 families were found to be used to treat 51 types of diseases. Fabaceae family represented the maximum number of plant species used. Herbs were used most frequently among the different habit of plants. Similarly, leaf was used most frequently to cure diseases. The finding of the present study would be the baseline for further exploration of medicinal plants in the study area.

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