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Floristic composition of ethnomedicinal plants used by indigenous people in Tarai region, Kumaun Himalaya

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Abstract
Tarai region comprises with coarse gravel and deposits. This region is very rich in fauna and flora. The Tarai belt having long and narrow strips of and separates the upper limits of Gangetic plains. The study was conducted for the documentation of ethno-medicinal use of plants from Tarai region, Kumaun Himalaya. Study was conducted in Tarai region of Kumaun in order to collect information from respondent including both men and women. PRA technique was used to collect the information. Total 70 ethno-medicinal plant species belonging to 33 families, 61 genera were recorded and different habitats such as herbs (44%), trees (29%), shrubs (24%), climbers (3%), which were further classify according to plants parts used such as: root (22%), leaves and whole plants (17%), bark (9%), fruits (8%), stem-bark (6%), seeds (5%), flowers and rhizome (3%) and gum (2%). It was found that 70 medicinal plant species were used by local people for curing 48diseases such as dysentery, diarrhea, cough, skin diseases, asthma, fever, piles, bronchitis, rheumatism, cold, cut and wounds, eye diseases etc.

Keywords: Diversity, ethnomedicinal plants, PRA technique, tarai region, kumaun himalaya

1. Introduction
The Himalaya comprises the largest mountain chain covering approximately 8 million km2 in surface area and occupying a length of approximately 3000 km. The Himalaya represents a complete transaction from tropical to temperate conditions despite its location near the tropics. The state of Uttarakhand comprised of Kumaun and Garhwal divisions, represents the Central Himalaya part of India. It overlapped by western and eastern Himalayan floras [33]. The Tarai region is a water-logged alluvial plain and having slope, deep, fertile, moist loamy soil. The Tarai belt includes long and narrow strips of low lying plains of about10-25km width. It separates the upper limits of Gangetic plains [11]. Some studies have been shown that altitude primarily dictates the vegetational strata [6] and livelihood patterns of the local people. In Kumaun Himalayan region, the bhabar and tarai lie in the southeast and southwest regions and are surrounded by somewhat tropical and sub-tropical vegetation [6] and grassland [9]. In Kumaun region of Central Himalaya, the central tarai region includes a higher diversity of angiospermic vegetation in both natural and planted forest. The central tarai region has experienced anthropogenic pressure that has also affect the flora of the area due to developmental activities. There are approximately 1748 species of medicinal plant have been reported from the Indian Himalayan region, out of these 701 species occur in Uttarakhand state (West Himalaya).
From ancient time, medicinal plants and their uses in the medicine indigenously are well known to the nation. The medicinal plants are the basic ingredients of the traditional medicine, which decreasing with faster rate due to increase in consumption and many of them ready to extinct from the forests. Initially these plants were the main part of folk knowledge and Ethnomedicine.
Practices in India. Later these plants consider in the different systems of medicines such as Ayurveda, Yunani, Sidha or other systems as well as with the advancement in the techniques of phytochemistry and pharmacology. In modern system of medicine, there is notable number of active compounds isolated from medicinal and introduce as valuable drugs in drug industry.
Documentation of the indigenous knowledge through ethnobotanical studies is important for the conservation and utilization of biological resources [22]. Therefore, establishment of the local names and indigenous uses of plants has significant potential societal benefits [3].

It would be beneficial to conduct pharmacologic studies, if such plants used to treat the same disease in different places across the world. In addition to the requirement for conservation and cultivation of medicinal plants, it has also become essential to protect and patent the traditional knowledge [30]. In the region most medicinal plants are being extracted for drug and pharmaceutical.

Industries from the wild [2, 21]. Almost every plant has economic value from either a nutritional, esthetics or medicinal purposes.

2. Material and Methods

2.1 Study area

The study was conducted in the central tarai region of Kumaun Himalaya in Lalkuan and Haldwani of Nainital district during 2016-2018. The area is located approximately between 28°41'–29°05'N latitude and 79°18'–79°31'E longitude with altitude ranging from 200 to 300m amsl. The Lalkuan site starts just after the bhabar of the foot-hill region and Haldwani is situated just after hill region. Lalkuan is well known for its paper mill and timber industries. Due to the paper mill industry there is a monoculture plantation occupying the major part of the study area.

The tarai area is water logged alluvial plain with a gentle south east lope. The entire study area was divided into two sites and 4 sub sites (Natural forest, planted and agriculture fields).

2.2 Data collection

The species collected were preserved for taxonomic identification following [15] and identified with help of following flora [12, 14, 27]. In all the said locations respondents were interviewed individually and group discussion. The PRA technique used to collect the information. The respondents were interviewed in their own houses and in nearby places of study area where they would normally be collects fodder, fuel, etc. Out of total Population, 10% of people were interviewed. The respondents were different in age, gender and education. People of different genders, different age groups, economy class, and activity (Like serving person, landless wager, traditional knowledge holder and farmers etc.). Local name, family of species, part(s) used, ethnobotanical use(s), and mode of utilization was noted in field diary (Table 1).

3. Results and Discussion

A Total 70 ethnomedicinal plants species belonging to 33 families, 61 genera were recorded (Table 1). These plant species used by the local people for treating their various diseases. Different habit of the ethnomedicinal plants, such as herbs (44%), trees (29%), shrubs (24%), climbers (3%) were records (Figure 2) which were further classify according to plants parts used such as: root (22%), leaves and whole plants (17%), bark (9%), fruits (8%), stem-bark (6%), seeds (5%), flowers and rhizome (3%) and gum (2%) (Figure 3). It was found that 70 medicinal plant species were used by local people for curing 48 diseases such as dysentery, diarrhea, cough, skin diseases, asthma, fever, piles, bronchitis, rheumatism, cold, cut and wounds, eye diseases etc. From the Figure 1, It was recorded that family fabaceae (8) was observed highly dominated species followed by apocynacea (6), malvaceae (6), asteraceae (4), Euphorbiaceae (4), acanthaceae (4), amaranthacea (3), combretaceae (3) and solanaceae (3). Some of the families were reported as 2 species in each family and rest of the families are monotypic.

The aim of this study is to document the floristic composition and ethnomedicinal aspects of flora in tarai region. It was observed that both women and men were collected plants for fodder, fuel, and food value from the forest. These people have been dependent on these plant products and have their own different mode of use for a very long time. Thus they gave their consents in collecting the knowledge of ethnomedicinal plants. Many previous studies have been support the present study to make contributions for indigenous ethnomedicinal knowledge. Some studies told about the sourcing of raw materials for development of Commercial pharmaceuticals [5, 6]. Some authors did precious work in the field of Ethnobotany and Ethnomedicine from different parts of India, such as [4, 9, 11, 13, 16, 17, 23, 34]. Notable contributions were made by different workers for the Central Himalaya region [1, 8, 18, 19, 20, 26, 28, 33, 35]. They recorded very useful plants in their studies which were used by local inhabitants frequently. In our knowledge, published literature indicates that in this region very few investigations were made for ethnomedicinal study in particular. It was found that around 30 species of Garhwal Himalaya have been listed in various categories under threat in the Indian Red Data Books [25] of which 24 species are from high altitude alpine regions which need special attention for conservation. Rawat *et al*, 2001 reported 45 more species (Excluding Red Data Book) and Nautiyal *et al.* 2004 recorded 30 species from high altitudes. These ethnomedicinal plants are also a source of income for the local communities. In this region, many rural people collect these medicinal plants from the wild and use differently by different people for their survival.

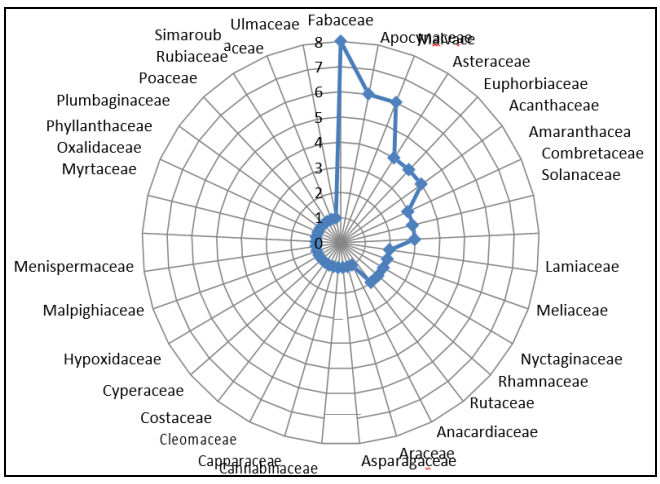

Fig 1: Dominant families belonging to ethnomedicinal plant species

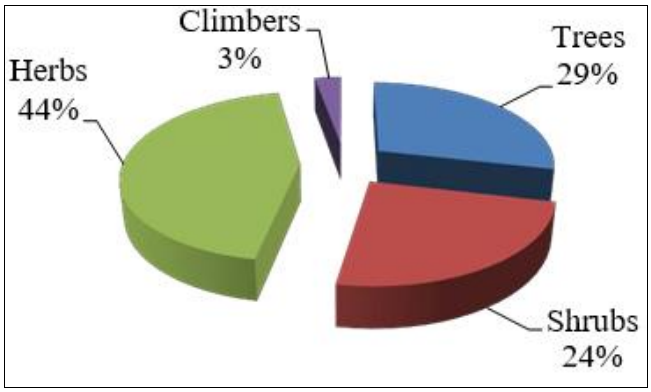

Fig 2: Habit of Ethnomedicinal plant species

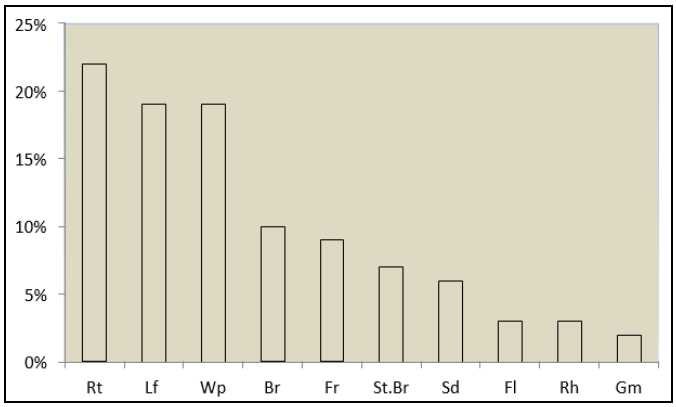

Fig 3: Percent distribution of plant part used

Table 1: Ethnomedicinal plants of tarai region

Vernacular Name	Botanical Name	Family	Habit	Part Used	Ethno-medicinal Uses
Kirayat	*Andrographis paniculata* (Burm. f) Wall.ex Nees	Acanthaceae	H	Wp	Plant used in dysentery, dyspepsia and fever.
Karunta	*Barleria cristata* L.	Acanthaceae	H	Lf	Leaves used in cuts and wounds and headache.
Kawgari	*Dicliptera bicalyculata* (Retz.) Kostel.	Acanthaceae	H	Wp	Plant used in dysentery.
Basing	*Justicia adhatoda* L.	Acanthaceae	Sh	Lf, Fl, Rt	Leaves and root useful in cough, bronchitis, asthma.
Latjeera	*Achyranthus aspera* L.	Amaranthacea	H	Rt	Root used in diabetes and dysentery.
Guderesag	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthacea	H	Lf, St	Leaves and stem used in dysentery, diarrhea, skin diseases and fever.
Astamabayda	*Aerva sanguinolenta* (L.) Blume.	Amaranthaceae	H	Rt	Root used in headache.
Aam	*Mangifera indica* L.	Anacardiaceae	T	Sd	Seed used in treatment of vomiting, dysentery and diarrhea.
Dhudhibel	*Cryptolepis buchanani* Roem. & Schult.	Apocynaceae	Sh	Br, Lf	Bark and leaves used in cough, cold and fever.
Madar	*Calotropis gigantea* R.Br. ex. Ait.	Apocynaceae	Sh	Rt, Br	Root bark used in asthma, boils, cold, cough, dysentery, eczema and skin diseases, indigestion, piles, and toothache.
Madar	*Calotropis procera* (Aiton) R. Br.	Apocynaceae	Sh	Rt	Root used in asthma, cold, cough, dysentery, skin diseases and indigestion.
Kura	*Holarrhena antidysenterica* Wall.	Apocynaceae	T	Br, Lf, Sd	Bark, leaves and seeds used in dysentery, diarrhea, headache, fever, piles, ulcers, cuts & wounds and skin diseases.
Dudhi	*Ichnocarpus frutescens* (L.) R. Br.	Apocynaceae	Cl	Lf	Leaves used in fever.
Sarpagandha	*Rauvolfia serpentina* Benth. ex. Kurz	Apocynaceae	H	Rt, Lf	Root used for reduce blood pressure, bowels. Leaves for eye troubles.
Vacha	*Acorus calamus* L.	Araceae	H	Rh	Rhizome used in fever, constipation, bronchitis, cough, diarrhea, dysentery and piles.
Satawar	*Asparagus racemosus* Willd.	Asparagaceae	Sh	Rt	Root used in blood disease, diarrhea, dysentery, rheumatism
Kukrondha	*Ageratum conyzoides* L.	Asteraceae	H	Wp	Plant used in cuts and wounds, diarrhoea, headache, scabies, swellings.
Kumeriya	*Bidens pillosa* L.	Asteraceae	H	Wp	Plant used in cough, eye complaints, headache, leprosy, skin diseases, sores, cuts and wounds.
Bhangraya	*Eclipta prostrata* L.	Asteraceae	H	Wp	Plant used in ear & eye trouble, headache, liver disorder and skin diseases.
Katari	*Tridax procumbens* L.	Asteraceae	H	Lf	Leaves used in diarrhea, dysentery, cut and wounds.
Bhang	*Cannabis sativa* L.	Cannabinaceae	H	Lf, Fl	Leaf and flowers used in bronchitis, cuts, dyspepsia, skin disorders, cold, cough, epilepsy, sores.
Kabra	*Capparis spinosa* L.	Capparaceae	H	Rt, Br	Root and bark used in arthritis and paralysis.
Jakhiya	*Cleome viscosa* L.	Cleomaceae	H	Wp	Plant used in fever, indigestion, cough, earache And skin diseases.
Sanja	*Terminalia alata* Roth	Combretaceae	T	Br	Bark used in diarrhea and ulcer.
Bahera	*Terminalia bellirica* Roxb.	Combretaceae	T	Fr	Fruits used in biliousness, diarrhea, dropsy, dyspepsia, eye troubles, headache, fever, leprosy, piles, and skin diseases.
Harar	*Terminalia chebula* (Gaertn.) Retz.	Combretaceae	T	Fr	Fruit used in chronical ulcer, cough and wounds.
Kyol	*Costus speciosus* Smith.	Costaceae	H	Rh	Rhizome used in cough and cold.
Nagarmotha	*Cyperus rotundus* L.	Cyperaceae	H	Rt	Tuberous root used in stomach and bowels.
Khokali	*Acalypha indica* L.	Euphorbiaceae	H	Wp	Plant used in bronchitis, pneumonia and asthma. Leaves used in scabies.
Danti	*Baliospermum montanum*	Euphorbiaceae	Sh	Lf, Rt, Sd	Leaves, root and seeds used in asthma, dropsy, constipation,

	Muell. Arg.				jaundice, piles, skin diseases and stone.
Dudhi	*Euphorbia hirta* L.	Euphorbiaceae	H	Wp	Plant used in cough, gonorrhea, dysentery, asthma and bronchitis.
Roli	*Mallotus philippinensis* (Lamk) Muell.- Arg.	Euphorbiaceae	T	Fr	Fruit used in boils, blisters, constipation and dysentery.
Ratti	*Abrus precatorius* L.	Fabaceae	Cl	Sd	Seeds are used in nervous disorder, skin diseases, fever and asthma.
Sakina	*Desmodium gangeticum* DC.	Fabaceae	Sh	Rt	Root used in fever, biliousness, cough, asthma.
Khair	*Acacia catechu* Willd.	Fabaceae	T	St. Br	Stem bark used in cough, cold and diarrhea. Katha is used in mouth ulcer, boils, piles, skin and skin diseases.
Sanja	*Terminalia alata* Roth	Combretaceae	T	Br	Bark used in diarrhea and ulcer.
Bahera	*Terminalia bellirica* Roxb.	Combretaceae	T	Fr	Fruits used in biliousness, diarrhea, dropsy, dyspepsia, eye troubles, headache, fever, leprosy, piles, and skin diseases.
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Danti	*Baliospermum montanum* Muell. Arg.	Euphorbiaceae	Sh	Lf, Rt, Sd	Leaves, root and seeds used in asthma, dropsy, constipation, jaundice, piles, skin diseases and stone.
Dudhi	*Euphorbia hirta* L.	Euphorbiaceae	H	Wp	Plant used in cough, gonorrhea, dysentery, asthma and bronchitis.
Roli	*Mallotus philippinensis* (Lamk) Muell.- Arg.	Euphorbiaceae	T	Fr	Fruit used in boils, blisters, constipation and dysentery.
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Khair	*Acacia catechu* Willd.	Fabaceae	T	St. Br	Stem bark used in cough, cold and diarrhea. Katha is used in mouth ulcer, boils, piles, skin
Lapetua	*Sida rhombifolia* L.	Malvaceae	H	Lf, Rt	Leaf useful in swelling. Root used in rheumatism
Kanghi	*Abutilon indicum* (L.) Sweet.	Malvaceae	Sh	Rt	Infusion of root used in fever.
Chutkura	*Urena lobata* L.	Malvaceae	Sh	Rt	Root used as a remedy of rheumatism.
Neem	*Azadirachta indica* A. Juss.	Meliaceae	T	Wp	Plant used in headache, rheumatism, leprosy.
Bakain	*Melia azedarach* L.	Meliaceae	T	Wp	Flower and leaves used in headache. Seed used in rheumatism. Leaves, fruit and bark used in leprosy and scrofula.
Patta	*Cissampelos pareira* Linn.	Menispermaceae	H	Rt	Root used in diarrhea, dropsy, cough and urinary troubles.
Jamun	*Syzygium cumini* (L.) Skeel.	Myrtaceae	T	Wp	Plant used in diabetes, leucorrhoea, bronchitis, asthma, dysentery.
Godahpurna	*Boerhavia diffusa* L.	Nyctaginaceae	H	Rt	Root used in asthma, stomach-ache, anemia and jaundice.
Harsingar	*Nyctanthes arbortristis* L.	Nyctaginaceae	Sh	Lf	Leaves useful in fever, rheumatism, intestinal worm.
Chamori	*Oxalis corniculata* L.	Oxalidaceae	H	Lf	Leaves used in eyes to cure cataract, toothache and earache and cuts and wounds.
Awala	*Phyllanthus emblica* L.	Phyllanthaceae	T	Fr	Fruits used in diarrhea, dysentery, inflammation of eyes, jaundice, liver disorders and indigestion.
Chitter	*Plumbago zeylanica* L.	Plumbaginaceae	H	Rt	Root used in biliousness, cough, diarrhea, piles, rheumatism, scabies and ulcers.
Doob ghas	*Cynodon dactylon* (L.) Pers.	Poaceae	H	Wp	Plant used in cuts and wounds, dropsy, epilepsy, Diarrhea and dysentery.
Baer	*Zizyphus mauritiana* Lam.	Rhamnaceae	Sh	Br, Fr, Sd	Bark used in dysentery, boils and diarrhea. Fruits and seeds used in cough, asthma, leucorrhoea.
Baer	*Zizyphus xylopyrus* (Retz.) Willd.	Rhamnaceae	Sh	Fr	Fruits used in Dysentery.
Maindul	*Catunaregam spinosa* (Thunb.) Tirveng.	Rubiaceae	Sh	Fr, St. Bk	Fruit pulp used in dysentery. Bark used in rheumatism
Kari-patta	*Murraya koenigii* (L.) Spr.	Rutaceae	Sh	Wp	Plant used in stomach-ache, skin diseases, dysentery, vomiting.
Bel	*Aegle marmelos* Corr.	Rutaceae	T	Wp	Plant used in typhoid, constipation, diabetes, diarrhea, bronchitis and dysentery, piles.
Arru	*Ailanthus excelsus* Roxb.	Simaroubaceae	T	St. Bk	Bark used in dyspeptic complaints, asthma, diarrhea and dysentery.
Kantkari	*Solanum indicum* L.	Solanaceae	Sh	Rt	Root used in asthma, bronchitis, colic, cough and cold and skin diseases.
Makoi	*Solanum nigrum* L.	Solanaceae	H	Wp	Plant used in fever, diarrhea, eye diseases and liver disorder.
Kantkari	*Solanum surattense* Burm. f.	Solanaceae	H	Wp	Plant used in cough, asthma, fever, dropsy and rheumatism.
Kanju	*Holoptelea integrifolia* Planch.	Ulmaceae	T	Br	Bark used in rheumatism, swelling.

Abbreviation Used- H- Herb; Sh- Shrub; T- Tree; Cl- Climber; Lf- Leaf; Rt- Root; Br- Bark; Wp- Whole plant; Fl- Flower; Fr- Fruit; Sd- Seed, St- Stem; St.Br- Stem Bark; Bd- bud; Rh- Rhizome, Gm-Gum.

4. Conclusion

The main focus of this study was to gather the information of medicinal plants used by the rural communities for curing their various diseases of the tarai region. It is crucial to preserve the precious traditional knowledge because of over-exploitation and unscientific tapping into these regions by the local inhabitants. Thus resulted in the loss of many important ethnomedicinal plants and become rare endangered species soon. It needs to be protecting its identity before their extinction in the region.

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