Ethnoveterinary plants of Renuka tehsil in Sirmour district of Himachal Pradesh (India)

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Research

Abstract

Background: Aboriginal therapeutic awareness of medicinal plants possibly will have realistic inference in the development of novel medications and offer additional imminent for sustenance of their unrelenting utilization in society. But, there was very less documentation on ethno-veterinary formulations, therefore, an assessment was conceded in a precise area of our country to obtain the knowledge on ethnoveterinary medicines amongst the inhabitants of Renuka Tehsil located in district Sirmour of Himachal Pradesh.

Methods: Information on ethno-veterinary medicinal plants has been recorded through intensive field survey, interviews and discussion with the inhabitants of Renuka tehsil of Himachal Pradesh. Information were collected surveying 245 households with the help of semi structured interview and open-ended questionnaires.

Results: Overall 68 ethnic veterinary therapeutic species belonging to 63 genera and 40 families were recorded. Usage of herbs is maximum amongst all the plant species (35.30%) in the region. The medicinal preparations include powder, extract, decoction, paste and among the plant parts usage of leaves was maximum (42.16%). Stomach disorders was predominant in the area and treated through 14 plant species (11.2%). *Vitex negundo, Acorus calamus, Artemisia roxburghiana, Opuntia dillenii* are well known and utmost used plant species in the region.

Conclusions: Significance of ethnoveterinary plants in conventional medicines should be put into practice which endow with an indication to explore original vicinity. This study will be helpful in providing the records of unique ethnoveterinary medicinal formulations. The research work will prove valuable in the maintenance of these plant resources and their acquaintance which are used by the inhabitants of the region.

Keywords: Ethno-veterinary, Inhabitants, Medicinal plants, Renuka, Traditional knowledge

Background

Ever since the prehistoric times, plants have been used for curing various ailments of livestock in India (Assefa & Bahiru 2018, Bhandari & Mukerji 1958, Mazars 1994). The varied traditions of our country are prosperous sources of folk medicines which are mainly obtained from plants. Since time immemorial, ethno-medicines are used by our ancestors for the well-being of people (Singh *et al*. 2017, Tamang *et al*. 2023). It also conveys well thought-out knowledge of tradition and culture of a particular place. Ethnoveterinary practices see the sights regarding principles, processes, measures and practices generally used for the well-being of the animals (Barboza *et al*. 2007, Greene *et al*. 2020, McGaw *et al*. 2020, Oliveira *et al*. 2020). As per the report of WHO, more than 75% population of the earth is reliant on plants for the personal benefits particularly rural population (Dhiman *et al*. 2019, WHO 2000). Usage of therapeutic plants for diverse healing purposes is acknowledged in various reports (Kumar *et al*. 2021, Mekhemar *et al*. 2021, Sharma 2008). Due to swift transformations and urbanization, the conventional knowledge on plants is getting lost (Singh *et al.* 2017, Radha & Pundir 2019). Therefore, it is imperative to record all the systematic and precise folk information across the country (Mathias 2006). Various kinds of ethnoveterinary studies were carried out across the planet on therapeutic uses of plants (Ritter *et al.* 2012). Ethnoveterinary conventional information is essentially required for the well-being of animals (Gonzalez & Vallejo 2021, Khattak *et al*. 2015). The rural people of Himachal Pradesh cure various ailments of domestic animals and human beings through their own knowledge (Sharma & Rana 2016, Sharma *et al*., 2009).

Familiarity with the study area showed that future generations are least concerned with folk acquaintance, therefore, collection and preservation of ethnoveterinary information is essentially required. Very few studies have been conducted on ethnoveterinary practices especially in the hilly region of western Himalaya (Hassan *et al*. 2023, Radha *et al*. 2022). Moreover, ethnobotanical information of ancestors has been diminishing day by day and the present study aims towards preserving this valuable knowledge before it is lost forever. The indigenous knowledge of the veterinary health care system acquired by traditional healers is orally transferred from one generation to the next (Singh *et al*. 2017). Through this study, an effort is made to keep a record of valuable information on plant species used for curing the illness of animals. The folklore knowledge is the strength of the native people, but they are not able to document and preserve the knowledge as the younger generations are not showing their interests in the traditional knowledge, especially livestock related work. Traditional knowledge is declining day by day; thus, we hypothesized that traditional ethnoveterinary knowledge is not very popular among the inhabitants of Renuka tehsil due to the lesser availability of medicinal plants and modern veterinary medicine. The present study is designed to document existing traditional ethnoveterinary knowledge before it is completely lost.

Materials and Methods

Study area

Renuka is one of the predominant tehsils of Sirmour district of Himachal Pradesh, India (Fig. 1). Sirmour, formerly a princely state that was merged into Himachal Pradesh on April 15, 1948. The name 'Renuka' owes its origin due to the presence of a famous lake of Renuka (mother of sage Parshurama) having shape like that of a sleeping woman.

Renuka tehsil lies between the 30°36.000'N to 30°48.000'N and 77°24.000'E to 77°36.000'E. According to census 2011 information (Census of India 2011), entire area of Renuka tehsil is 297km^2 with a total population of 47,388 residents. Renuka tehsil has a population density of 160 inhabitants per square kilometer. There are about 7,276 houses in the tehsil. 60.63% population of Renuka tehsil is literate. The chief livelihood of the people is agriculture and animal husbandry. Maize is the staple food. Mostly livestock are kept in a separate building called 'Overa'.

Methodology

To document firsthand information on the plant species used for veterinary purposes of Renuka tehsil, intensive surveys were carried out during July 2021 to June 2022. The indispensable information on plants was gathered through interviews, focus group discussion (FGD) from experienced farmers, village heads, traditional practitioners, housewives, old and elderly persons of the communities. For the better understanding of local customs, beliefs and uses of plants, knowledgeable informants were selected as key informants and repeatedly interviewed.

Selection of key informants

An informant who is involved in traditional veterinary practices and has knowledge of plant identification, availability, and occurrence of useful medicinal plants in nature was considered as a key informant.

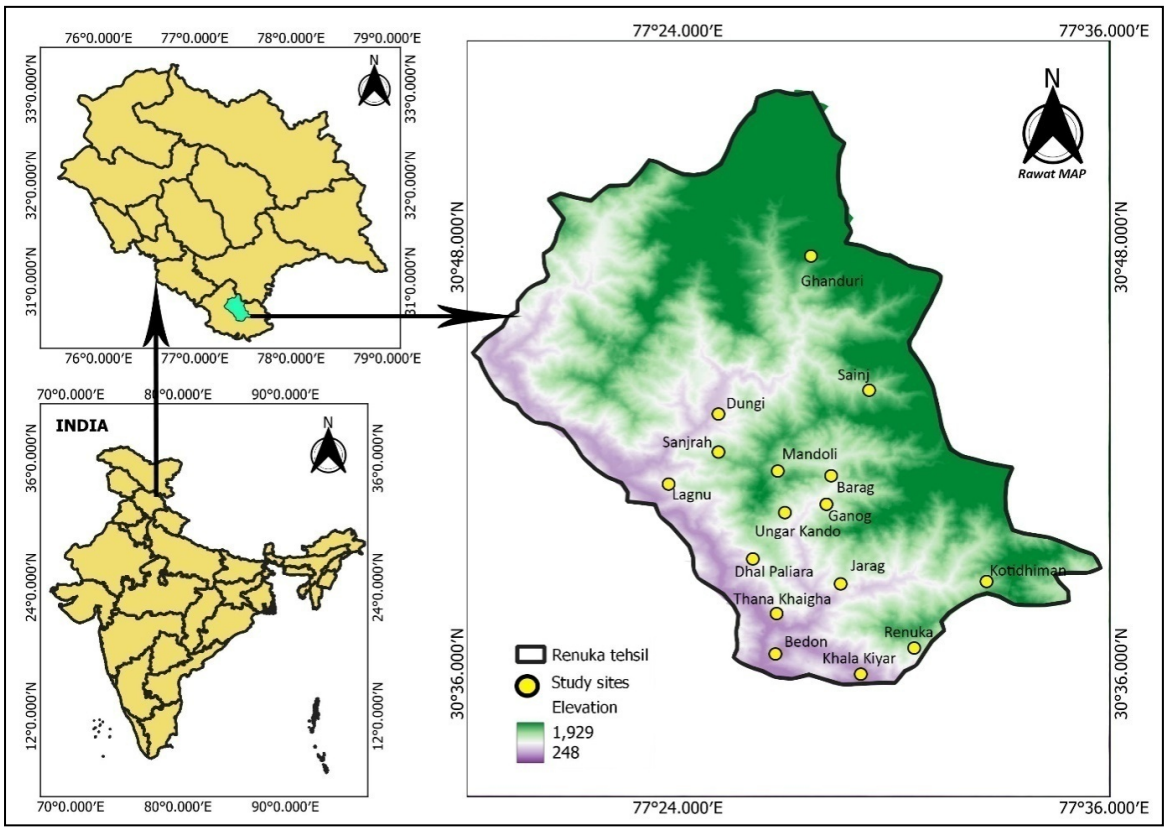

Figure 1. Location of study sites in Renuka Tehsil of Sirmour district of Himachal Pradesh, India

Socio -Demographic Characteristics of Informants

In this study, the information were collected surveying and interview with 86 informants. Informants were further divided into four age groups i.e. 35-50 (14 informants), 51-60 (20 informants), 61-70 (29 informants) and over 70 (23 informants) (Table 1). Moreover, more informants were men and they also take their responsibility of taking plant materials for their livestock and leading to intensive experience in plant utilization.

Table 1. Informants categorized according to age groups.

Demographic feature	Categories	Number of person	Percentage
Informants	Male	58	67.44
	Female	28	32.56
Total		86	
Age group	30-50	14	16.28
	51-60	20	23.26
	61-70	29	33.72
	>70	23	26.74

Collection of data and sampling protocol

The information was recorded through a semi structured questionnaire following Singh *et al*. (2019). (i. e. common name of plant, disease treated, method of drug preparation, mode of administration, doses, any side effect if, any other use). Random sampling were carried out amongst the total of 7,276 houses in the area; 245 households were surveyed. The collected data were further verified in different locations after showing the same specimen to different people. If at least three informants made similar comments, then the ethnobotanical lore was considered justifiable.

Collection, identification and preservation of ethnoveterinary medicinal plants

Specimen of 68 plants species were collected during entire survey. The collected plant specimens were dried, preserved and mounted on herbarium sheet following Jain and Rao (1977) and deposited at Maya Group of Colleges, Dehradun. The specimens were identified using regional floras and various revisionary and monographic works (Chauhan 1999, Chowdhery & Wadhwa 1984, Collett 1902, Dhiman 1976, Nair 1977, Polunin & Stainton 1987, Kaur & Sharma, 2004) and

later got authenticated by carefully matching with the specimens at the herbaria of Forest Research Institute (FRI) and Botanical Survey of India (BSI), Dehradun. Nomenclature of these taxa was confirmed from Bennett (1987), Quattrocchi (2000) and International Plant Names Index (www.ipni.org).

Ethical approval and Nagoya protocol

Ethnoveterinary data were collected after prior informed consent obtained from each informant. Apart from this, permission was obtained from the village-level van panchayat and Biodiversity Management Committee (BMC), and along with the key informants, a person from the van panchayat or BMC was also hired to ensure sustainable collection of wild resources.

Data analysis

Ethnoveterinary data were analyzed using Microsoft Excel 2013 and R version 3.6.2. Further quantitatively analyzed using Use Reports (URs). A species having high use reports means the species is popular among the inhabitant and also has high use efficiency and can be further investigated for pharmacological testing and drug discoveries (Hussain *et al*. 2023).

Results and Discussion

Ethnoveterinary medicinal plants

Present study documented 68 plant species belonging to 63 genera and 40 families for the treatment of livestock diseases among the rural inhabitants of the study area (Table 2). The large number of plants reported in the region confirmed that the local people are still using herbal remedies and depend on medicinal plants for curing various livestock diseases Older people have immense knowledge of medicinal plants than the younger generation, and the illiterate people have more knowledge about ethnomedicines as compared to the literate ones similar to Singh *et al*. (2019).

Life form and plants family

Most of the plant species used were herbaceous (35.30%) followed by trees (29.41%), shrubs (25%), undershrubs (4.41%), climbers (2.94%) and lianas (2.94%) (Fig. 2). Predominant families are Fabaceae and Lamiaceae (5 species each) followed by Euphorbiaceae, Moraceae, Rutaceae and Solanaceae (3 species each). Maximum species belongs to genus *Ficus* (3sp.) followed by *Murraya* (2 sp.), *Opuntia* (2 sp.) and *Solanum* (2 sp.).

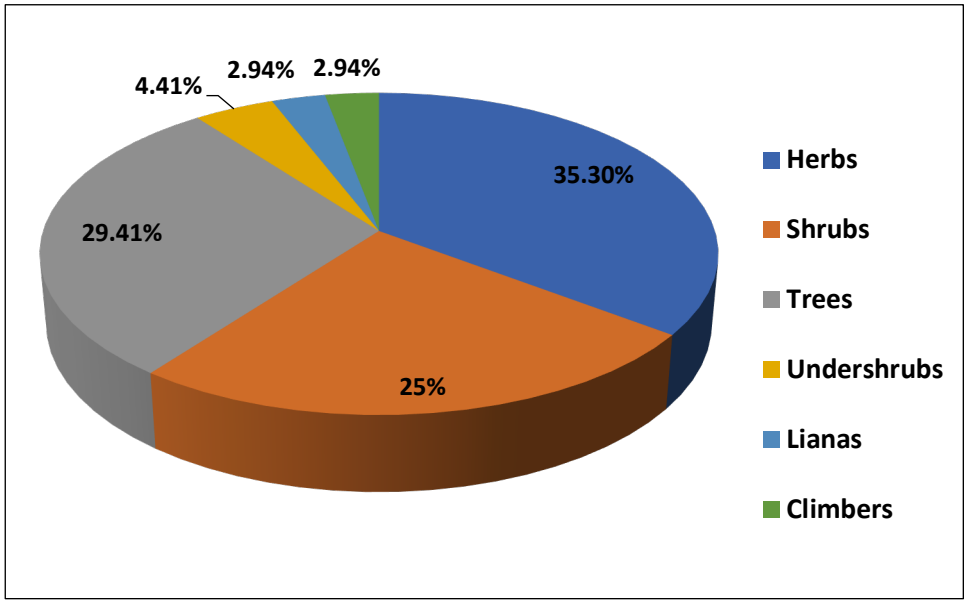

Figure 2. Habit-wise distribution of plants used for ethno-veterinary purposes in Renuka Tehsil of Sirmour district.

Plant parts used in ethnoveterinary medicine

Present study reported nine different plants parts used to cure livestock diseases in study site Leaves showed higher use proportion 42.16% followed by roots (14.45%), stem (12.04%) whole plant (7.23%) aerial parts (6.03%) wood/bark (6.03%), flower / inflorescence (4.82%), fruits (3.62%) and seeds (3.62%) (Fig. 3).

Table 2. Medicinal plants used for ethnoveterinary purposes by the inhabitants of Renuka tehsil of Sirmour district, Himachal Pradesh, India

Name/Family/ Voucher No.	Life form	Vernacular Name	Part/s Used	Used against diseases (Use report)	∑ Use Report	Mode of preparation	Folk Uses /dosage/mode of administration	Comparison with other studies
Acacia nilotica (L.) Delile Mimosaceae EBRT - 1749	Tree	Kikar	Leaves	Fever (18)	18	Powder	Leaf powder either mixed with honey or directly fed to animals suffering from fever, twice a day for 3-5 days.	1● 2● 3$ 4● 5● 6● 7● 8● 9●
Achyranthes aspera L. Amaranthaceae EBRT - 1760 Fig. 6 (A)	Herb	Biralkanda	Roots	Scorpion bites (12)	12	Paste, decoction	Paste of the roots is applied externally or decoction of the plant is given orally with the help of bamboo pipes to animals for the treatment of scorpion bites.	1$ 2$ 3● 4$ 5● 6● 7$ 8● 9●
Acorus calamus L. Araceae EBRT - 1820	Herb	Bauch	Roots	Stomach problems (18), blood disorders (22), fever (34), increasing lactation (32)	106	Powder	Finely grounded rootstock (in powder form) is given orally for 2-5 days to animals suffering from stomach problems, hematoma (blood clotting) and general fever. Also useful as a galactagogue (increase the flow of milk in cattle).	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Aerva sanguinolenta Blume Amaranthaceae EBRT - 1704	Under shrub	Safed phulia	Whole Plant	Fever (22)	22	Raw	Garland of the plant tied to the neck of domestic animals to check high fever.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Amorphophallus paeoniifolius (Dennst.) Nicolson Araceae EBRT - 1728	Herb	Zaminkand	Corm (Underground Stem)	For killing lice and termites (16)	16	Powder	Dried corm powder sprayed on the body of cattle for killing lice and termites.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Anethum graveolens L. Apiaceae EBRT - 1748	Herb	Soya	Whole Plant	Stomach disorders (45)	45	Decoction	Plant decoction with 'ajwain' (*Trachyspermum ammi*) given for stomach problems in animals	1● 2● 3● 4● 5● 6● 7● 8● 9●

Artemisia roxburghiana Bess. Asteraceae EBRT - 1738	Herb	Chamber	Aerial parts	Blood disorders (23), respiratory ailments (12), oedema (9), mastitis (7)	8	Extract, poultice	Plant is rubefacient. Giving bath to animals with warm aqueous extract of aerial parts or its poultice is thought to cure hematoma (blood clots), cough, oedema, mastitis (Inflammatory response of the under tissue in the mammary gland caused due to physical trauma or microorganism infections).	1● 2● 3● 4● 5● 6● 7● 8● 9●
Asparagus adscendens Roxb. Liliaceae EBRT - 1720	Herb	Satarayo	Roots	Increase lactation, uterus / vagina prolapse, constipation	51	Powder, decoction	Grinded or powdered roots useful as galactagogue (promote lactation) and also for massaging in case of uterus or vagina prolapsed after delivery. Decoction of roots and crushed leaves along with some common salt cures constipation.	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Avena sativa L. Poaceae EBRT - 1753	Herb	Javi	Aerial plant parts	Fodder (65), bedding (70)	135	Raw	Aerial plant parts used as fodder for livestock. Oat straw (dried stem, leaves) used as an animal bedding.	1$ 2● 3● 4● 5● 6● 7● 8● 9●
Bambusa bambos (L.) Voss Poaceae EBPH - 1739	Tree	Baansa	Leaves	Respiratory problems (24)	24	Raw	Leaves fed to horses to check cough and cold.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Berberis lycium Royle Berberidaceae EBRT - 1824	Shrub	Kashmal	Roots	Fever (14), Eye problems (20), blood disorders (18)	52	Decoction	Decoction of roots is given orally to livestock with the help of bamboo pipes for 3-4 days to cure fever and also used as an eye drops to check redness and clotting of blood.	1● 2● 3$ 4@ 5● 6@ 7● 8$ 9●
Boehmeria rugulosa Wedd. Urticaceae EBRT - 1954	Tree	Singeer, Sangeer	Leaves, Inflore-scence and Bark	Expulsion of placenta (36)	36	Paste	Finely grounded paste of leaves, inflorescence and bark mix with small balls of wheat dough and Gur (crude sugar) is given to animals suffering from retention of placenta after delivery.	1● 2● 3● 4● 5● 6● 7● 8● 9●

Boerhavia diffusa L. Nyctaginaceae EBRT - 1866 Fig. 6 (B)	Herb	Ghanoud	Roots	Blood disorders (22), typhilitis (46)	68	Powder	Finely grinded roots of this plant after mixing with wheat flour are made into dough balls and are given orally to animals suffering from common blood disorders and typhilitis (thickness of bowel wall with fever and abdominal pain).	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Bombax ceiba L. Bombacaceae / Malvaceae EBRT - 1734	Tree	Simbal, Shemal	Fruits	Typhilitis (42), stiffness of body (33)	75	Paste	Paste of the silky cotton of the fruits in mustard oil help in the instant relief from typhilitis and stiffness of body, disease locally known as 'Sarfaria'.	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Cajanus cajan (L.) Huth. Fabaceae EBRT - 1733	Herb	Arhar	Aerial Plant Parts	Stomach disorders (65), fodder (70)	135	Raw	Aerial plant parts fed to livestock to check dysentery and as fodder.	1● 2● 3@ 4$ 5● 6● 7● 8● 9●
Carissa carandas L. Apocynaceae EBRT - 1807 Fig. 6 (C)	Shrub	Karaunda	Roots	Expel intestinal worms (44)	44	Powder	Powdered roots used for expelling intestinal worms. Dose is repeated after every 3-7 days.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Celastrus paniculatus Willd. Celastraceae EBRT - 1935	Liana	Malkamani or Malkangni	Leaves	Promote lactation (28), respiratory problems (14), typhilitis (24),	66	Raw	Leaves used as a galactagogue (promote lactation) and also given to cure common ailments like cold and typhilitis.	1$ 2● 3● 4● 5● 6● 7● 8● 9●
Chenopodium album L. Chenopodiaceae EBRT - 1930	Herb	Bathua	Leaves	Skin problems (56)	56	Paste	Paste of its seeds applied twice daily for various skin diseases and leaf paste for wounds and sores of cattle.	1$ 2● 3$ 4$ 5$ 6$ 7● 8@ 9●
Cissampelos pareira L. Menispermaceae EBRT - 1715 Fig. 6 (D)	Climber	Bataua, Jalamni, Patha	Leaves	Stomach disorders (22)	22	Decoction	Decoction of leaves used as a antidiarrhoeal	1@ 2@ 3$ 4@ 5● 6● 7@ 8● 9●
Colebrookea oppositifolia Smith Lamiaceae EBRT - 1934	Shrub	Dashnoi	Leaves	Skin problems(17), Eye problems (21)	38	Extract	Extract of the leaves used for curing wounds and redness of the eyes.	1@ 2$ 3● 4● 5● 6● 7●8● 9●

Curcuma longa L. Zingiberaceae EBRT - 1826	Herb	Haldi	Rhizome (Under-ground Stem)	Sunstroke (68), internal injuries (91)	159	Powder, Extract	Finely grounded rhizome mixed with butter milk given orally to check sunstroke, also its extract after mixing with wheat flour are made into small balls and are given orally to animals for healing internal injuries.	1$ 2● 3● 4$ 5● 6● 7@ 8● 9●
Cuscuta reflexa Roxb. Cuscutaceae EBRT - 1885	Climber	Amarbel, Ugaasble	Stems, Flowers	Typhilitis (18), promote lactation (28), bone fracture (25)	71	Paste, poultice	Paste of fleshy stems and flowers of this twiner directly or in composition with finely grinded roots of *Asparagus adscendens* given to livestock for checking typhilitis and as a galactagogue (promote lactation). Also, the poultice prepared from its fleshy stems and leaves of *Cannabis sativa* is considered specific for bone fracture and dislocation.	1● 2● 3● 4$ 5● 6● 7● 8● 9●
Daphne cannabina Wall. Thymelaeaceae EBRT - 1873	Shrub	Jungle ki Jari	Roots	Herpes (33)	33	Extract, poultice	Poultice of roots or its extract in cow's urine applied 1-2 times a day over the infected area for 3-4 days to cure herpes. ('Vyadh').	1● 2● 3● 4● 5● 6● 7● 8● 9●
Euphorbia pulcherrima Willd. ex Klotzsch Euphorbiaceae EBRT - 1901	Shrub	Lal Patti	Wood	For killing maggots (27)	27	Latex	Latex from wood applied externally for killing maggots from the skin of cattle	1$ 2● 3● 4● 5● 6● 7● 8● 9●
Ficus glomerata Roxb. Moraceae EBRT - 1799 Fig 5 (E)	Tree	Gullar	Leaves, Stem	Fodder (62), premature delivery (24)/ abortion (20)	106	Raw, Extract	Raw leaves lopped for fodder. Shoot-tips extract considered useful against premature delivery or abortion in cattle.	1● 2● 3● 4$ 5● 6● 7● 8● 9●
Ficus palmata Forsk. Moraceae EBRT - 1825	Tree	Phaegda	Leaves, Bark	Fodder (67), milching (42), fever (36), swollen tongue (Jibhtu) (27)	172	Raw, Extract	Raw leaves lopped for fodder and milching. Extract of the leaves and bark checks ephemeral fever (three days sickness). Also heated them coated with crude sugar (gur) considered effective against swollen tongue ('Jibhtu').	1@ 2● 3@ 4$ 5● 6● 7● 8● 9●

Ficus lacor Buch.-Ham. Moraceae EBRT - 1891	Tree	Pilkhan	Wood	Constipation (19)	19	Powder	Wood powder given to animals in constipation	1● 2● 3● 4● 5● 6● 7● 8● 9●
Flacourtia indica (Burm.f.) Merr. Flacourtiaceae EBRT - 1931	Shrub	Kangu	Leaves, Twigs, Roots	Blood disorders (13)	13	Extract	Extract of leaves, twigs and roots given orally for curing common blood disorders.	1● 2● 3● 4$ 5● 6● 7● 8● 9●
Gossypium arboreum L. Malvaceae EBRT - 1784	Under shrub	Kapas	Seeds	Fever (41)	41	Raw	Highly nutritious seeds ('binola') also given to animals in fever.	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Grewia optiva J.R. Drumm. ex Burret Tiliaceae EBRT - 1857	Tree	Biul	Leaves, Twigs	Promote lactation (77)	77	Raw	Leaves and young twigs considered useful as a galactagogue (promote lactation).	1● 2● 3$ 4● 5● 6● 7$ 8● 9●
Hedychium spicatum Sm. Zingiberaceae EBRT - 1881	Herb	Sheera	Leaves, Roots	Promote lactation (9), bloating (22), stiffness of body (8), joint pains (15)	54	Raw, Powder	Green raw leaves used as a galactagogue (increase the flow of mother's milk). Powdered roots mixed with small ball of wheat dough check bloating, stiffness of body and joint pains.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Ischaemum angustifolium Hack. Poaceae EBRT - 1874	Herb	Babbar, Babari	Aerial parts	Oral ulcers (27)	27	Paste	Paste of the aerial plant parts mixed alongwith common salt affective against mouth ulcers (chichrunde).	1● 2● 3● 4● 5● 6● 7● 8● 9●
Justicia adhatoda L. Acanthaceae EBRT - 1890 Fig. 6 (F)	Shrub	Bashti	Leaves, Stem	Allergy (46), constipation (34)	80	Poultice, Allergy	Poultice of leaves considered useful against general allergy and its extract along with that of stem given orally to check constipation.	1$ 2● 3● 4$ 5$ 6$ 7@ 8● 9●
Lantana camara L. Verbenceae EBRT - 1947	Shrub	Phoolkanda	Roots	Stomach disorders (55)	55	Powder	Powdered roots mixed in water useful against dehydration, thrice a day for 2-3 days.	1● 2● 3● 4● 5● 6● 7● 8● 9●

Mallotus philippensis (Lam.) Euphorbiaceae Mull.Arg. EBRT - 1751	Tree	Kamela	Leaves	Fodder (57), bedding (73)	130	Raw	Raw leaves lopped for fodder; also used as bedding for animals.	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Mangifera indica L. Anacardiaceae EBRT - 1849	Tree	Aam	Seeds	Stomach disorders (64)	64	Powder	Powdered kernels given with water for curing diarrhoea.	1$ 2$ 3● 4@ 5● 6● 7● 8● 9●
Mentha spicata L. Lamiaceae EBRT - 1860	Herb	Pudina	Leaves	Stomach disorders (79)	79	Extract	Extract of leaves effective against indigestion and stomachache.	1$ 2@ 3● 4● 5● 6● 7● 8● 9●
Murraya koeninigii Spreng. Rutaceae EBRT - 1731	Shrub	Gandhlou	Leaves	Respiratory problems (84)	84	Decoction	Decoction of leaves along with some gur (crude sugar) considered effective against cough and throat problems.	1$ 2$ 3● 4$ 5● 6● 7@ 8● 9●
Murraya paniculata (L.) Jack Rutaceae EBRT - 1842	Shrub	Mirchua	Leaves, Twigs	Fodder (36), bedding (24)	60	Raw	Raw leaves lopped for fodder; also used as bedding for animals.	1$ 2● 3● 4● 5● 6● 7$ 8● 9●
Musa paradisiaca L. Musaceae EBRT - 1876	Herb	Kela	Leaves, Roots	Anuria (06)	6	Extract	Extract of chopped fresh leaves and roots mixed with animal's feed considered useful as a coolant and diuretic.	1$ 2● 3● 4$ 5● 6● 7● 8● 9●
Olea cuspidata Wall. Oleaceae EBRT - 1861	Tree	Kou	Leaves	Eye problems (07)	7	Juice	Juice of the fresh leaves used as an eye drops to cure 'Karotitis' (redness in the eyes)	1● 2● 3● 4● 5● 6● 7● 8● 9●
Opuntia dillenii Haw. Cactaceae EBRT - 1927	Shrub	Nagphani	Whole Plant	Bloating (26), Bottle jaw (10), stiffness of body (9), stringhalt disease (14),	59	Raw	Roasted plant given as such to cure bloating, bottle jaw (swelling of mouth and throat), stiffness of body and stringhalt disease (spasmodic hyperflexion of one or both hindlegs).	1● 2● 3● 4● 5● 6● 7● 8● 9●

Opuntia stricta (Haw.) Haw. Cactaceae EBRT - 1795 Fig. 6 (G)	Shrub	Nagphani	Stem	Bloating (30),stomach disorders (27), joint pains (32)	89	Decoction	1-2 litre decoction of stem given to animals for flatulence, stomachache and Nakalanakasha, a kind of arthritis problem in animals.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Pogostemon benghalensis Kuntze Lamiaceae EBRT - 1713	Shrub	Bhuan	Aerial Parts	Skin problems (11)	11	Ash	Ash of aerial parts mixed with mustard oil applied to worm's infested animal wounds.	1$ 2● 3● 4● 5● 6● 7● 8● 9●
Pongamia pinnata (L.) Pierre Fabaceae EBRT - 1880	Tree	Karanj	Leaves, Seeds	Fodder (44), miching (29), fever (35), Respiratory ailments (21),	129	Raw, Powder	Raw leaves lopped for fodder and considered good for milching animals. 100-150g of its leaves grounded with 20-21 black peppers and given thrice daily till cure to check high fever in domestic animals. Powdered seeds given with 'gur' twice daily for cough in animals.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Prunus persica (L.) Batsch Rosaceae EBRT - 1718	Tree	Aadu	Leaves	Bloating (18)	18	Powder	Leaf powder in combination with that of leaf powder of *Viola serpens* and root of *Canna*indica effective against bloating in livestock.	1$ 2● 3● 4$ 5● 6● 7$ 8● 9●
Pyrus pashia Ham. Rosaceae EBRT - 1806	Tree	Kainth	Fruits, Leaves	Stomach problems (14), fodder (42)	56	Powder, Raw	Small balls of wheat dough mixed with its powdered fruits given to cure diarrhoea. Leaves (raw) are lopped for fodder.	1$ 2● 3● 4$ 5● 6● 7$ 8$ 9●
Quercus annulata Smith Fagaceae EBRT - 1750	Tree	Moru	Bark	Oral ulcers (17)	17	Decoction	Decoction of bark recommended for stomatitis (oral ulcers).	1● 2● 3● 4● 5● 6● 7● 8● 9●
Rabdosia rugosa (Wall. ex Benth.) H.Hara Lamiaceae EBRT - 1886	Shrub	Chichra	Leaves	Blood disorders (6), skin problems (8)	14	Juice	Juice of leaves helps in blood clotting and healing of wounds.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Rhus parviflora Roxb. Anacardiaceae EBRT - 1730	Herb	Tung	Leaves	Eye problems (11)	11	Juice	Juice from fresh crushed leaves added to eyes for curing redness.	1● 2● 3● 4● 5● 6$ 7● 8● 9●

Ricinus communis L. Euphorbiaceae EBRT - 1707	Shrub	Arandi	Leaves	Bone fracture (66)	66	Poultice	Poultice of leaves effectively employed against fractured and dislocated bones.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Saccharum officinarum L. Solanaceae EBRT - 1909	Herb	Ganna	Stem	Expulsion of placenta (36)	36	Raw	Shoot tips given orally to the needy animal for expulsion of placenta.	1$ 2● 3● 4● 5● 6● 7● 8● 9●
Senna obtusifolia (L.) H.S.Irwin & Barneby Fabaceae EBRT - 1782	Herb	Panwad	Leaves	Skin problems (24), bedding (16)	40	Raw	Leaves purgative and applied externally for itching in animals and also used as bedding for cattle.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Shorea robusta C.F. Gaertn. Diptero-carpaceae EBRT - 1818	Tree	Sal	Leaves	Fodder (67), bedding (78)	145	Raw	Leaves useful as fodder. Leaves also used as bedding for animals during rainy season.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Solanum khasianum Clarke Solanaceae EBRT - 1917	Under shrub	Jakori	Fruits	Expel leeches (4)	4	Extract	Fruit extract added to nostrils for expelling leeches.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Solanum verbascifolium L. Solanaceae EBRT - 1769	Tree	Harkadu	Leaves	Expel leeches (3)	3	Extract	Leaf extract used for expelling leeches.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Syzygium cumini (L.) Skeels Myrtaceae EBRT - 1804	Tree	Jamun	Fruits	Rumination (54)	54	Raw	Fruits also given to induce rumination in livestock.	1● 2$ 3$ 4$ 5● 6● 7● 8● 9●
Taxus wallichiana Zucc. Taxaceae EBRT - 1705	Tree	Thuno, Thuner	Leaves	Stomach disorders (15)	15	Decoction	Decoction of leaves effectively used against diarrhoea.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Thalictrum foliolosum DC. Ranunculaceae EBRT - 1884	Herb	Pili Jari, Mameri	Roots	Fever (9), stomach disorders (6), scorpion/snake bite (4)	19	Powder	Powdered roots given orally as an antipyretic, antidiarrhoeal and antidote against snake bites.	1● 2● 3● 4$ 5● 6● 7$ 8● 9●
Thymus serpyllum L. Lamiaceae EBRT - 1721	Shrub	Jungli Ajwain	Whole Plant	Bloating (3), stomach disorders (7)	10	Raw	Plant given as such for flatulence/bloating, stomachache and indigestion.	1● 2● 3● 4● 5● 6● 7● 8● 9●

Tinospora cordifolia Miers Menispermaceae EBRT - 1921	Liana	Giloy	Leaves, Stem	Fodder (22), sunstroke (37), swollen tongue (6)	65	Raw, decoction	Raw leaves and stem given as a fodder and their decoction along with that of *Foeniculum vulgare* (2:1) ratio used against sunstroke and any inflammation in the tongue.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Toona ciliata M.Roem. Meliaceae EBPH - 1810 Fig. 6 (H)	Tree		Leaves, Stem	Fodder (44), bedding (52), promoting lactation (33)	129	Raw	Leaves used as such as fodder and bedding for animals. Stem used as cattle feed to promoting lactation.	1● 2● 3● 4● 5● 6● 7● 8● 9●
Trigonella foenum-graecum Fabaceae EBRT - 1712	Herb	Maethi	Leaves	Bloating, facilitates delivery (16), promote lactation (23)	39	Extract, decoction	Decoction of leaves is antibloating and also facilitates delivery. Extract of freshly cut leaves and boiled wheat given to cattle as a galactagogue (promote lactation).	1@ 2● 3● 4$ 5● 6● 7● 8● 9●
Urtica dioica L. Urticaceae EBRT - 1816	Herb	Bichhu booti	Whole Plant, Roots	Promote lactation (27), snake-bite (22)	49	Raw, Powder	Sun-dried plants given as such for promoting lactation. Grinded roots given orally against snake bites.	1● 2● 3● 4$ 5● 6$ 7● 8$ 9●
Viola pilosa Blume Violaceae EBRT - 1845	Herb	Banafsha	Leaves, Flowers	Bloating (18), typhilitis (7)	25	Powder	Finely chopped leaves (almost in powder form) and flowers along with powdered roots of *Canna* species and wheat dough made into small balls which are recommended for flatulence and typhilitis.	1● 2● 3● 4● 5● 6● 7● 8● 9●

Vitex negundo L. Verbenaceae EBRT - 1779 Fig. 6 (I)	Herb	Shanvali, Samalu, Nirgundi	Leaves, Twigs	Fever (48), stomach disorders (38),bloating (17), eye problems (26), skin problems (41)	170	Raw, Extract	Extract of boiled leaves and flowers antipyretic, stomachic and also given for flatulent colic or bloating. For any eye injury, fresh leaf drops are added. Also, whole plant extract is believed to have soothing nature for skin problems. The plant is also believed to possess super natural and protecting powers. A garland of its twigs is tied around the animal's neck for protecting it from the eyes of evil people and also when the cattle stops giving milk without any reason.	1$ 2● 3● 4$ 5$ 6$ 7@ 8● 9●
Zanthoxylum armatum DC. Rutaceae EBRT - 1856	Shrub	Timoor	Seed	Skin problems (23), stomach disorders (12)	35	Oil, powder	Seed oil effective against general skin inflammation of cattle; its powder anthelmintic and also recommended against dehydration (twice a day for 2-3 days).	1@ 2● 3● 4$ 5$ 6● 7● 8● 9●
Zea mays L. Poaceae EBRT - 1768	Herb	Makai	Flowers	Bloating (19), anuria (4)	23	Decoction	Decoction of boiled silken stigmas of maize in composition with thyme (ajwain) given to animals suffering from bloating and retention of urine (anuria).	1$ 2● 3● 4$ 5● 6● 7● 8● 9●

(@) Similar Use, ($) Disimilar Use, (●) Not reported, 1- (Sehgal & Sood 2013), 2-(Sharma *et al*. 2014), 3-(Kumar & Chander 2018), 4-(Kumar & Chander 2018a), 5-(Radha & Puri 2018), 6-(Radha *et al*. 2019), 7-(Kalpana *et al.* 2021), 8-(Prakash *et al*. 2021), 9-(Bishist *et al*. 2022)

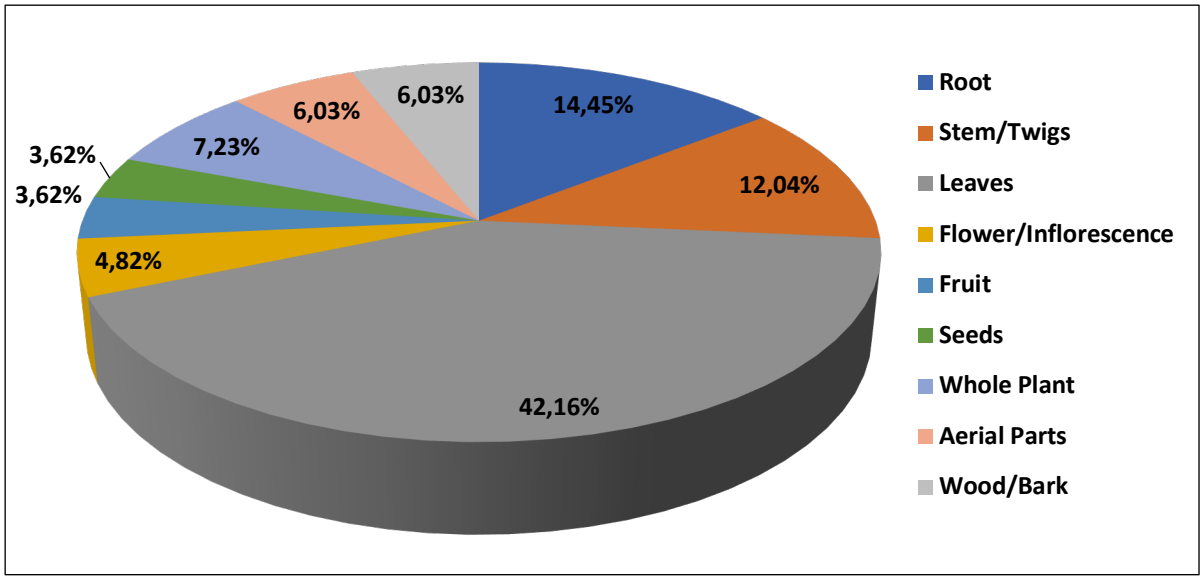

Figure 3. Relative percentage of plant parts used for ethnoveterinary purposes by the rural populace of Renuka tehsil of district Sirmour.

Drug preparation methods

Ten methods of drug preparations for ethnoveterinary uses were recorded i.e. raw 24 species (27.90%) followed by extract of 14 species (16.27%), powder of 17 species (19.76%), decoction of 12 species (13.95%), paste of 6 species (6.98%), poultice of 6 species (6.98%), juice of 4 species (4.65%), ash of 1 species (1.17%), latex of 1 species (1.17%) and oil of 1 species (1.17%) (Fig. 4).

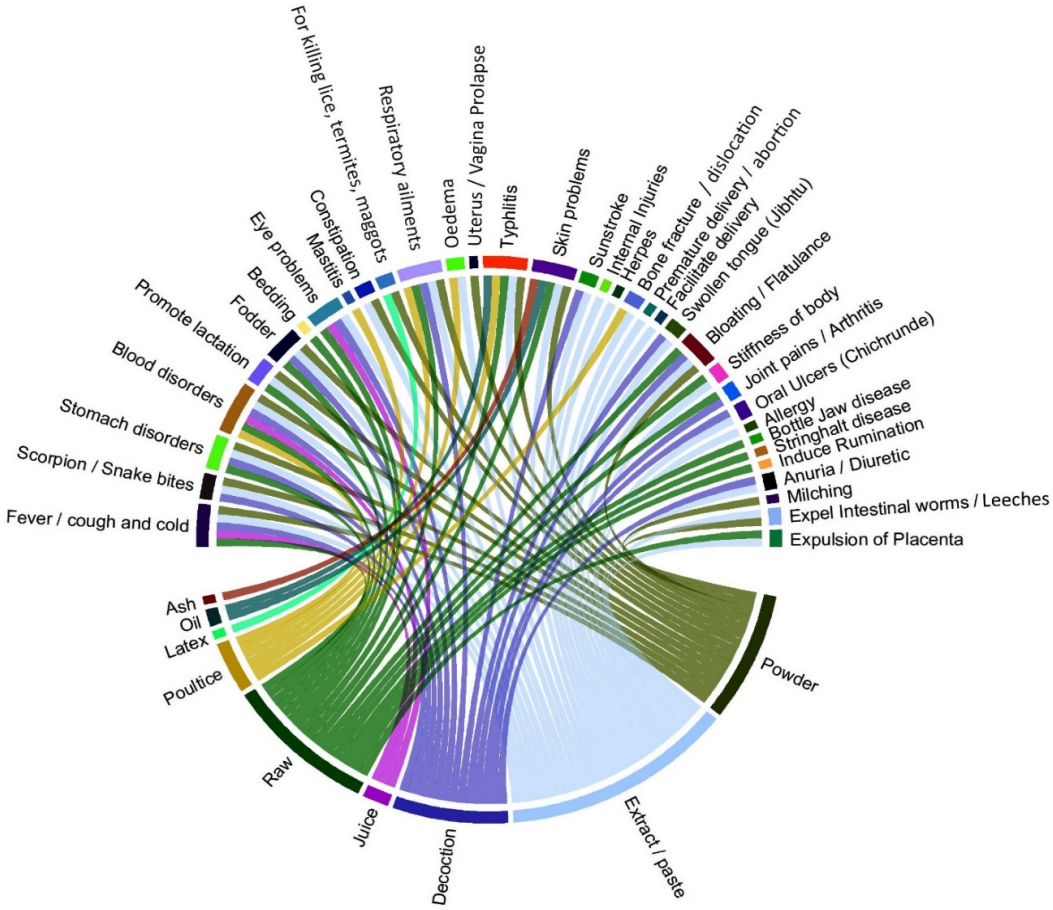

Figure 4. Drug preparation used to cure different ailments, lower half of chord diagram showing drug preparation methods and upper half showing disease cured by respective drug formulation.

Livestock diseases and ethnoveterinary medicinal uses

Domestic animals play an imperative role in the expansion of human civilization. The rural people of Renuka tehsil are enormously familiar with the therapeutic potential of medicinal plants as ethnoveterinary medicines. Among all the 35 veterinary disease in the study area, the indigenous healers and other local informants reported stomach disorders as the most common problem treated through 14 plant species (11.2%) followed by usage of 11 species as fodder (8.8%); 09 species each for curing for bloating / flatulence and for promoting lactation (7.2%); 08 species to cure fever (6.4%); 06 species each are used as bedding, for curing blood disorders and skin problems (4.8% each); for curing respiratory ailments, eye problems and typhilitis (05 species each) (4% each); constipation, expel intestinal worms, stiffness of body and snake bite / scorpion bite (03 species each) (2.4% each); for killing lice, termites, maggots etc., sunstroke, bone fracture / dislocation, swollen tongue (Jibhtu), oral ulcers (Chichrunde /stomatitis), joint pains / arthritis, anuria / diuretic, milching, expulsion of placenta (02 species each) (1.6% each); allergy, bottle jaw disease, induce rumination, stringhalt disease, facilitate delivery, premature delivery / abortion, herpes, internal injuries, oedema, mastitis, for the treatment of uterus / vagina prolapse (1 specie each) (0.8% each). This clearly shows that livestock of the region suffers from many diseases and the local people treat them with local formulations prepared from medicinal plants. In this way, native people take care of their domestic animals appropriately.

Frequently used ethnoveterinary plant species of the region

In the present study, some of the utmost used plant species are *Vitex negundo, Acorus calamus, Artemisia roxburghiana,* and *Opuntia dillenii*. *Vitex negundo* is the frequently used plant of the region; it may be due to its abundance in the region. It is antipyretic, stomachic, antibloating, used for curing eye injury and also used for curing skin problems due to its soothing nature. *Acorus calamus* is galactagogue (increase the flow of milk in cattle or promote lactation) and used for curing stomach problems, hematoma (blood clotting) and fever. *Artemisia roxburghiana* is rubefacient, cures hematoma (blood clots), cough, oedema (accumulation of fluid in the body which causes affected tissue to become swollen) and mastitis. *Opuntia dillenii* cures bloating or flatulence, bottle jaw disease, stiffness of body and stringhalt disease. *Asparagus adscendens, Berberis lycium, Celastrus paniculatus, Cuscuta reflexa, Ficus palmata, Grewia optiva, Opuntia stricta, Pongamia pinnata, Thalictrum foliolosum, Tinospora cordifolia, Toona ciliata, Trigonella foenum-graecum* are some of the other common used plant species in the region.

Livestock Diseases

Present study documented thirty five veterinary disease cured by local formulations by the informants in the region. Some of them are Typhilitis (thickness of bowel wall with fever and abdominal pain) ailment of livestock which is cured by the usage of 05 species viz. *Boerhavia diffusa, Bombax ceiba, Celastrus paniculatus, Cuscuta reflexa, Viola pilosa*; Stiffness of body (Sarfaria): 03 species - *Bombax ceiba, Hedychium spicatum, Opuntia dillenii*; expel intestinal worms or leeches: 03 species - *Carissa carandas, Solanum verbascifolium, Solanum khasianum*; Jibhtu (swollen tongue): 02 species i.e. *Ficus palmata, Tinospora cordifolia*; Chichrunde (oral ulcers): 02 species i.e. *Quercus annulata, Ischaemum angustifolium*; Nakalanakasha (a kind of arthritis in livestock): 02 species - *Hedychium spicatum, Opuntia stricta*; For the expulsion of placenta: 02 species - *Boehmeria rugulosa, Saccharum officinarum*; Anuria: 02 species *Musa paradisiaca, Zea mays*; for milching: 02 species - *Ficus palmata, Pongamia pinnata*; for allergy: *Justicia adhatoda*; Bottle jaw disease (swelling of mouth and throat): *Opuntia dillenii*; for inducing rumination: *Syzygium cumini*; for Stringhalt disease (spasmodic hyperflexion of one or both hindlegs): *Opuntia dillenii*; for facilitating delivery, *Trigonella foenum-graecum*; for premature delivery / abortion: *Ficus glomerata*; Herpes: *Daphne cannabina*; for internal injuries: *Curcuma longa*; Mastitis (inflammatory response of the under tissue in the mammary gland caused due to physical trauma or microorganism infections): *Artemisia roxburghiana*; Oedema and for the treatment of uterus / vagina prolapse *Syzygium cumini* are used to cure the problem.

Comparison with previous studies and novel uses

Previous studies carried out in adjoining regions of the study area showed a similarity to the ethnoveterinary uses of some recurrently used plants but regions which are distant from the study area showed less similarity. (Table 2) All over, similarity of ethnoveterinary uses was only 3% and dissimilarity was 13%; however, the majority of the uses were reported for the first time (84% not reported) (Fig. 5). In this study *Achyranthes aspera* used for the treatment of scorpion bites however, Studies performed by Rehman *et al*. (2022) in the tribal area of Pakistan reported that it is used to expel urinary bladder stones; studies in Eastern India performed by Mandal and Rahaman (2022) confirmed that it is used to cure liver trouble, maggot infested wounds and fever related problems of cows; studies performed in Hasan district of Karnataka by Kumar and Nagayya (2017) reported it for curing of bone fracture while studies conducted by Sehgal and Sood (2013) in Hamirpur district of Himachal Pradesh reported its use for curing expulsion of placenta.

Ricinus communis used against fractured and dislocated bones, however, studies carried out by Rehman *et al*. (2022) in the tribal area of Pakistan reported its use for expelling the placenta; in Hasan district of Karnataka Kumar and Nagayya (2017) reported its use to cure constipation; work done by Eshetu *et al*. (2015) in selected districts of southern Ethiopia reported that the plant is used for mastitis and poor mothering.
Justicia adhatoda useful against general allergy and its extract along with that of stem given orally to check constipation however, Kumar and Nagayya (2017) in Hasan district of Karnataka reported its use to cure dysentery while work carried out in Hamirpur district of Himachal Pradesh by Sehgal and Sood (2013) reported its use against loss of appetite and relief from cough.

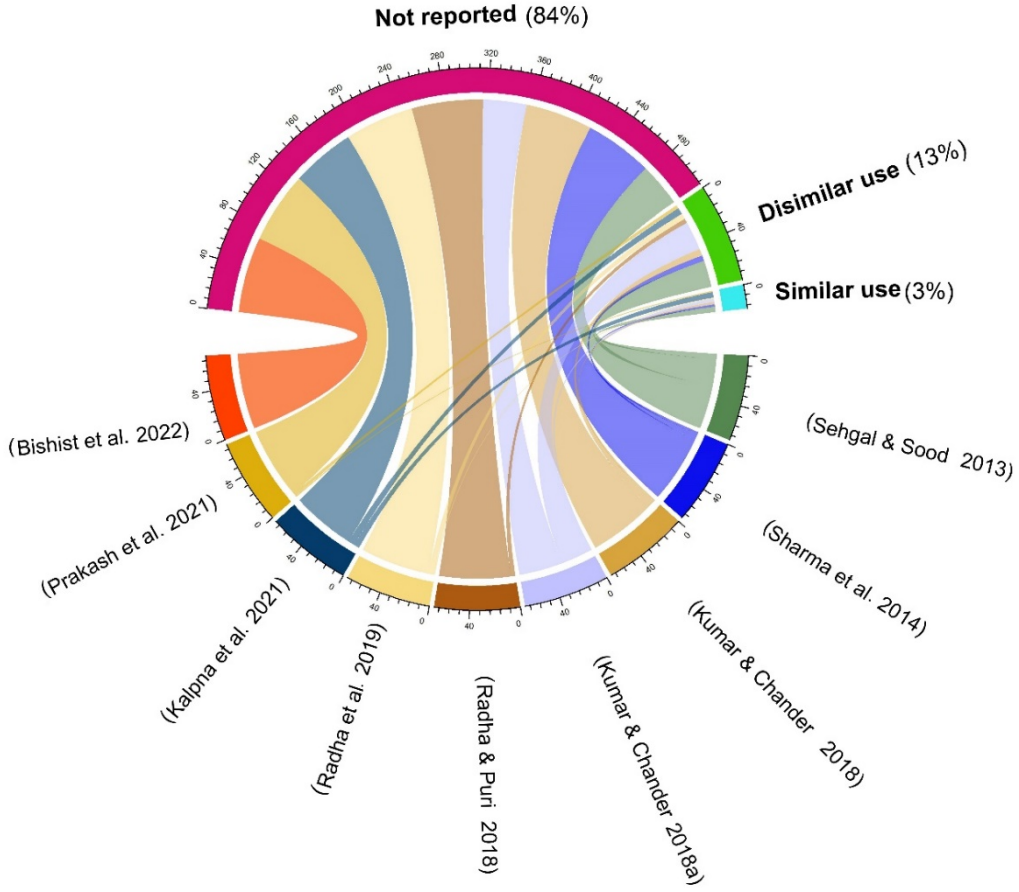

Figure 5. Comparison of present study with other studies, lower half of chord diagram showing studies carried out by several authors and upper half showing similarity, dissimilarity and uses not reported before this study.

Zea mays used for bloating and retention of urine (anuria), however, Kumar and Nagayya (2017) reported that it is used to cure urinary inflammation while, Sehgal and Sood (2013) reported it to use for the cure of constipation.

Vitex negundo used as antipyretic, stomachic and also given for flatulent colic or bloating, eye injuries however, Sehgal and Sood (2013) reported it use as appetizer and for mastitis while Rehman *et al*. (2022) reported it for expelling worms in camels and cattle *Berberis lycium* used to cure fever and also used as an eye drops to check redness and clotting of blood however, Rehman *et al*. (2022) reported it as body tonic and for internal fractures; *Mentha spicata* indigestion and stomachache however, Rehman *et al*. (2022) reported it to remove external parasites (eg. anti lice).

Boerhavia diffusa used against blood disorders and typhilitis (thickness of bowel wall with fever and abdominal pain) however, Kumar and Nagayya (2017) reported it to cure blood dysentery and dropsy.

Musa paradisiaca considered as a coolant and diuretic however, Kumar and Nagayya (2017) reported it to cure haematuria and loose motions. *Curcuma longa* used to prevent sunstroke and internal injuries however, Sultan *et al*. (2022) reported to cure wounds and cuts.

Comparison of local uses with previous ethnobotanical studies from Hamirpur district of Himachal Pradesh (Sehgal & Sood 2013) showed variability among ethnoveterinary uses and many plant species showed some novel uses such as *Acorus calamus* for relief from joint pains; *Asparagus adscendens* as emetic and coolant; *Avena sativa* for promoting lactation; *Bombax ceiba* for stomach disorders; *Celastrus paniculatus* for providing strength; *Chenopodium album* for expulsion of placenta; *Colebrookea oppositifolia* for burn, injuries, appetizer; *Euhorbia pulcherrima* for throat problems; *Ficus palmata* for Padjibhi (glossitis/inflammation of tongue); *Gossypium arboreum* for checking abortion and promoting lactation; *Mallotus philippensis* for stomach pains; *Mangifera indica* for expulsion of placenta (jer girana); *Mentha spicata* for repulsion of exoparasite; *Murraya koenigii* for providing cooling effect against sunstroke; *Murraya paniculata* for patrara (acute tympany); *Musa paradisiaca* for pregnancy loss; *Prunus persica* for wounds and intestinal worms; *Pyrus pashia* for foot sores; *Saccharum officinarum* for abdominal pain and constipation; *Tinospora cordifolia* for promoting lactation; *Trigonella foenum-graecum* for bloating while *Zanthoxylum armatum* is reported to be used for the problem of indigestion. This clearly shows that different regions use the plants in a different manner to cure various problems of the livestock.

Polyherbal formulations

Some plants are used in combination with other plants for treating the veterinary diseases e.g. Decoction of *Anethum graveolens* with *Trachyspermum ammi* is given for stomach disorders in animals.

Paste of fleshy stems and flowers of *Cuscuta reflexa* in composition with finely grinded roots of *Asparagus adscendens* is given to livestock for checking typhilitis and as a galactagogue (promote lactation).

The poultice prepared from fleshy stems of *Cuscuta reflexa* and leaves of *Cannabis sativa* is considered specific for bone fracture and dislocation.

The decoction of leaves and stem of *Tinospora cordifolia* along with that of *Foeniculum vulgare* in 2:1 ratio is used against sunstroke and inflammation in the tongue.

Finely chopped leaves (almost in powder form) and flowers of *Viola pilosa* along with powdered roots of *Canna indica* and wheat dough made into small balls which are recommended for flatulence and typhilitis.

Conclusion

Ethno-veterinary medicines used for livestock health care are significant with low-cost alternatives to allopathic medicines. The utilization of traditional ethno-veterinary remedies provides easier, cost-effective and more sustainable alternative to synthetic drugs. The present study generates the valid information about the utility of ethno-veterinary plant species used by indigenous people for curing the diseases of their livestock. It can help us in better understanding of the flora of the region also.

The present study was based on the hypothesis that traditional ethnoveterinary knowledge is least popular among the inhabitants of Renuka tehsil due to less availability of medicinal plants and the availability of modern veterinary medicine. However, traditional ethnoveterinary medicinal plant knowledge is plentiful among the inhabitants, and they are still using local medicinal plant therapies to cure their livestock diseases i.e. fever, bloating, promoting lactation, oral ulcers, abdominal pain, allergy, inducing rumination, herpes, bone fracture / dislocation, snake bite / scorpion bite, mastitis, uterus / vagina prolapse, stringhalt disease, expel leeches, nakalanakasha (a kind of arthritis in animals) etc. Therefore, the observations are much more interesting as compared to the proposed hypothesis i.e. poultice of roots of *Daphne cannabina* or its extract in cow's urine used to cure herpes; paste of the aerial plant parts of *Ischaemum angustifolium* mixed along with common salt affective against chichrunde or ulcers; juice of the fresh leaves of *Olea cuspidata* used to cure karotitis; roasted plant of *Opuntia dillenii* given as such to cure stringhalt disease (spasmodic hyperflexion of one or both hindlegs); juice of leaves of *Rabdosia rugosa* is useful in blood clotting while the fruit extract of *Solanum khasianum* added to nostrils for expelling leeches. Moreover, rural people are very much concerned about the health problems of their livestock and take care of them very efficiently without taking too much time as livestock is the major source of income of rural populace of Renuka tehsil of Sirmour district and food & nourishment (milk, curd, butter, ghee, etc.) has

special place in their lives. Therefore, these plants provide useful alternatives to modern health care systems and are used for the formulation of ethnoveterinary medicines also. The present work is the first of its kind to record and analyze ethnoveterinary practices used for the well-being of livestock by the rural populace of Renuka tehsil, Himachal Pradesh. The native people gave the most noteworthy information of usage of medicinal plants for ethnoveterinary practices. The study highlights the local ethnovetrinary knowledge in the study area. Documentation of ethnoveterinary practices is not only helpful in preservation of traditional knowledge but also helpful for future researchers.

Figure 6. Ethno medicinal plants used for veterinary disease by the rural populace of Renuka Tehsil of district Sirmour, Himachal Pradesh (India).
A. *Achyranthes aspera,* B. *Boerhavia diffusa,* C. *Carissa carandas,* D. *Cissampelos pareira,* E. *Ficus glomerata,* F. *Justicia adhatoda,* G. *Opuntia stricta,* H. *Toona ciliate,* I. *Vitex negundo*

Future prospectus and recommendation

The surveys and interviews are focused on rebuilding the local knowledge system. Although knowledge holders possess an intact acquaintance of ethnobotanical information, but they are not actively involved in research through online platforms. Therefore, ethnobotanists should continue to explore the strengths and limitations of the concerned area.

The reliable prospective of these plant species needs to be analyzed and assessed in a methodical manner to find out the active constituents. Moreover, such novel information will provide an opportunity in the research field by providing the

ethno-veterinary evidence to the scientists for scientific validation, standardization and safety estimation of the plant species before their reference as ethno-veterinary medicine. Unfortunately, some of these native species are declining continuously. Therefore, these species should be protected along with their habitats and should be managed by following conservation-oriented practices. The collaborative efforts of traditional and modern knowledge are needed here to develop new efficacious drugs for livestock diseases with minimum or no side effects.

Declarations

Ethics approval and consent to participate: Verbal prior informed consent was obtained from each informant during the survey.

Data Availability: Supporting data available in article and if generated data required available upon request.

Competing Interests: The authors declare that they have no competing interests.

Funding: Not applicable

Author contributions: Parul Singhal, carried out the field survey and collected specimens, analyzed data, prepared the manuscript, Prabhakar Semwal revised the manuscript, Ankit Singh, Analyzed data and revised the manuscript, V.K. Purohit revised the manuscript. All the authors read and approved the final manuscript.

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