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Exploration of Quantitative Ethnoveterinary Knowledge by Tribe in Harishchandra Gad Part of Northern Western Ghats (M.S), India.

Kulbhushan W. Pawar, Sanket P. Gawali, S.A. Patil

Department of Botany and Research Centre, R.B.N.B College, Shrirampur -413709 [Affiliated to Savitribai Phule Pune University, Pune, Maharashtra, India.].

Corresponding Author email- bhushawpawar@yahoo.com

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ABSTRACT

Out of 20 plant species, 13 families, and 17 species are the subjects of the current study's traditional ethno-veterinary knowledge. The residents' knowledge of living in the research region was examined. It contains bark, wood, root, tuber, and leaf from one tree, as well as seeds from three trees, leaves from six trees, trunks from two trees, fruit from four trees, and bark from two trees. Interviews were conducted verbally with informants from the research region informally at work. The informants were aged 16 to 90 years. Male informants (61.90%) and female informants (38.09%) reported having ethno-veterinary knowledge among the 42 participants. Numerous variables, including usage value, use report, and fidelity level, were examined through statistical data analysis. The medicinal properties of natural plants used in traditional domestic animal treatment systems have been validated by science, recognizing and valuing the traditional knowledge of local communities.

INTRODUCTION

To treat animals, tribal people have a variety of beliefs, informative knowledge, innovative ideas, and practices that are studied in ethnoveterinary medicine [1]. The same medicinal plants used to treat human illnesses can also be utilized successfully to treat animal illnesses. With modernization and the gradual migration of tribal healers, traditional knowledge of plants is rapidly vanishing among the tribes [2]. Since the dawn of civilization, humans have depended entirely on natural plants for basic needs and for treating and curing certain diseases. Their contact with wild plants increased, making them a superpower on Earth [3]. Ethnobotany is the scientific documentation of its relationships and interactions with plants. Interest in ethnoveterinary research has grown nationally and internationally in recent years. According to ancient ethnobotanical literature, tribal, non-tribal, and rural populations have long used wild ethnoflora to treat numerous diseases and problems in pets and domesticated animals.

Although much has been written about the ethnobotany and ethno-floristic aspects of plants, there is no specific report on the ethno-veterinary use of indigenous plants of the Harishchandra Gad region. In light of this, the present study was undertaken first to explore plants of ethno-veterinary interest and document the ethno-veterinary knowledge embodied in this article.

STUDY AREA

Harishchandra Gad is a rugged mountain of about 4,000 feet and 1,424 meters above sea level, standing on the left side of Malshej Ghat on the border of Thane, Pune, and Ahmednagar districts. Yethil Peak is one of the highest peaks in the Ahmednagar district. The research area, Harishchandra Gad, is located between Latitude: 19° 23' 17.66" N and Longitude: 73° 46' 33.38" E. The southern damp mixed deciduous vegetation forest is close to the semi-evergreen and semi-deciduous shrub savanna forests on the west coast. The annual rainfall in the region is around 763 mm.

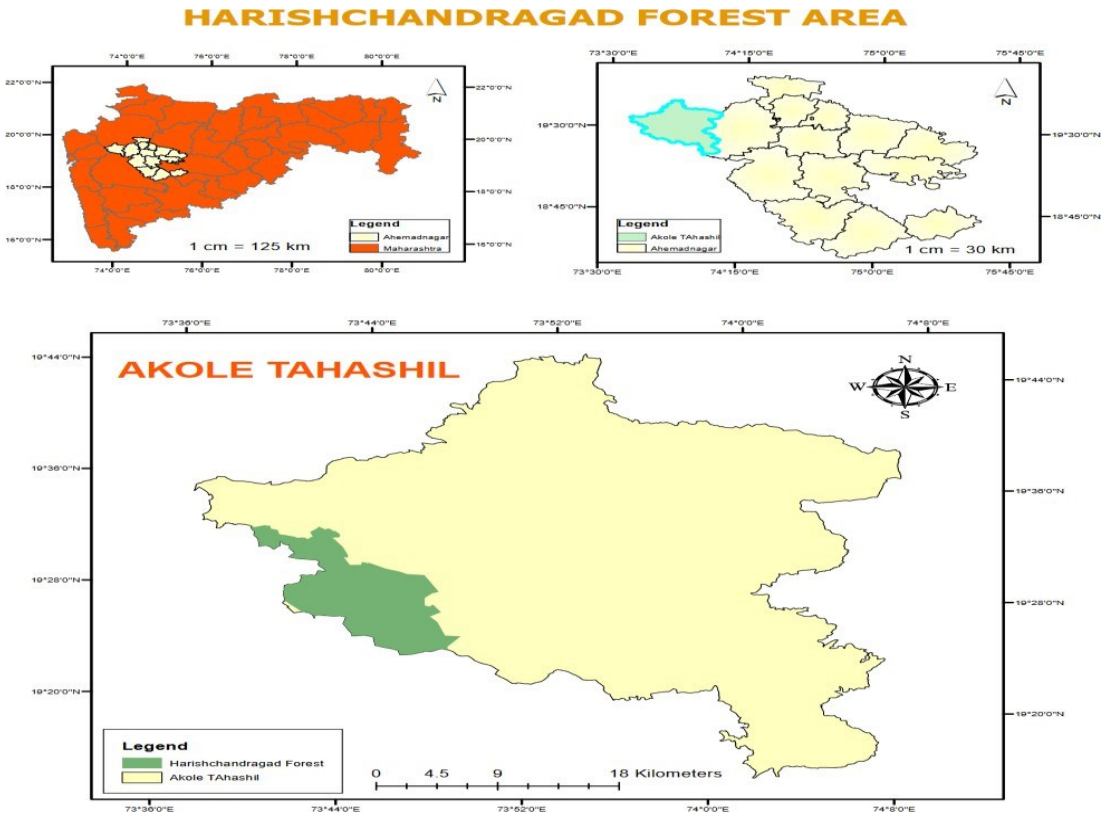


Fig.1.1. Geological location of the study area

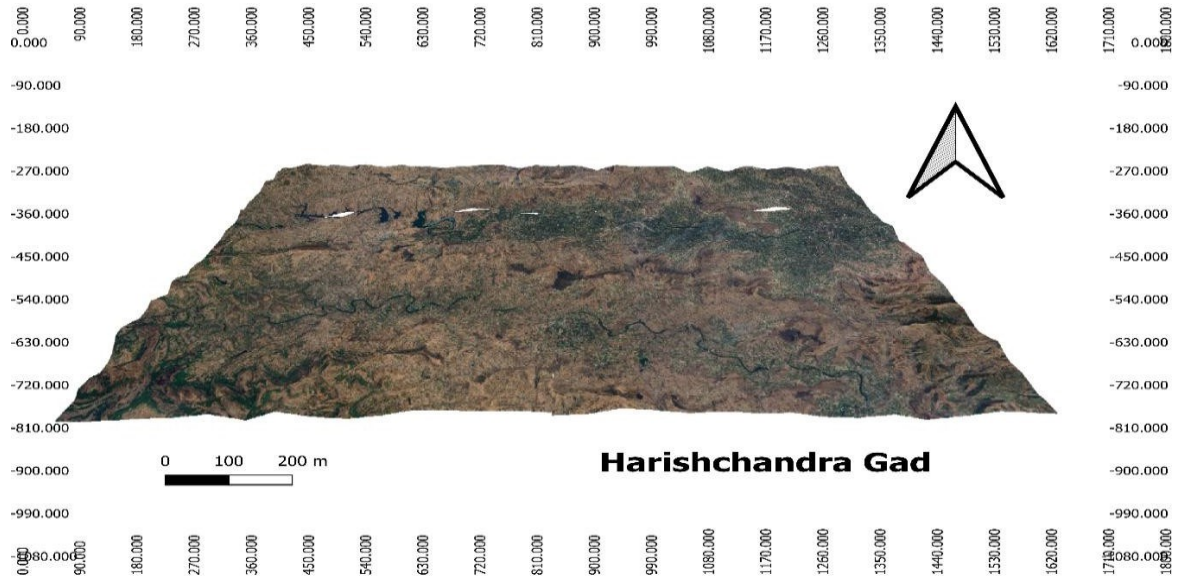


Fig.1.2. Satellite Image Map for Study Area (Harishchandra Gad) RESIDENTS

The area under investigation has been continuously inhabited by tribes such as Mahadev Koli and Thakars, who have practiced traditional ethno-veterinary practices since ancient times. Agriculture, livestock husbandry, and poultry are their primary occupations. As they are enriched with traditional ethno-veterinary knowledge passed down to them from their ancestors informally through word of mouth, the forest resources in their immediate surroundings play an essential role in their daily lives.

LITERATURE SURVEY

This work will lead to innovation in ethnoveterinary studies in ethnobotany at the national and international levels. A valuable contribution has been made in this study and ethnology [4-12]. A careful review of the literature reveals that there is still a gap in ethnoveterinary knowledge in this area. Therefore, in this research paper, a small attempt was made to fill the gap in the knowledge of the studies about these traditional plants in veterinary studies. The contribution of these plants to the daily life of the local people has been explored.

METHODOLOGY:

The survey was conducted at the study site from December 2022 to June 2023. Latent traditional ethno-veterinary information from the local advisees has been collected through informal

dating, questionnaires, and oral interviews through group arrangements. [13-16]. The information was confirmed by interacting with knowledgeable informants, traditional herbal healers, and others living nearby. Certain plant species have traditional veterinary uses and remedies. Plants were identified using published botanical literature, often known as floras. [17-20]

Data Analysis

The acquired data were statistically analysed using two quantitative indices, Use value (U.V.) and Fidelity level (F.L.).

Make use of value (U.V.).

The U.V. was calculated for each species using a method devised by Phillips et al. in 2002 and modified by Ferreira et al. (2009). This quantitative method evaluates the relative relevance of each edible species based on its utilization among informants. The following formula was used to compute U.V.:

UV = ΣU/n

Where n is the number of informants, and U represents the number of times a species is mentioned. As a result, the U.V. accurately assesses each plant's relative value (21).

F.L. stands for fidelity level.

The following formula was used to compute the FL:

(Ip/Iu) 100 FL(%)

Ip denotes the total number of informants who referenced the plant for any significant ethnoveterinary use, and Iu denotes the number of informants who separately indicated the use of a species for the same major ethnoveterinary purpose (Friedman et al., 1986). The level of fidelity reveals how significant a species is for producing ethnoveterinary results.

Where n is the number of informants, and U represents the number of times a species is mentioned. As a result, the U.V. accurately assesses each plant's relative value (21).

Table1. Features of the research sample, N = 42

Sr. No.	Age groups	Male	Female
1.	16-25	2	-
2.	26-35	4	2
3.	36-45	3	1
4.	46-55	5	3
5.	56-65	3	4
6.	66-75	4	3
7.	76-85	3	3
8.	>-90	2	-
Total informants		**26+16=42**	

Percentage: Male- 61.90%, Female- 38.09% RESULT AND DISCUSSION

The plants of traditional veterinary importance are arranged according to the botanical alphabet (Table 1). Name of the plant, Local name, Family name (in brackets), followed by the diseased plant part used and ethno-veterinary use.

Table-2. Locally used ethnoveterinary medicinal plants and their uses for livestock healthcare in Harishchandra Gad District, Ahmednagar, Maharashtra.

Sr. No.	Botanical Name/Vernacular Name/Family	Ailments/Treatment	Part used	Mode of Utilization
1.	*Abutilon indicum* (L.) Sweet Ban Bhindi Malvaceae	Urination problems	Leaf, Root	For 5–6 days, or until the condition improves, take half a cup of leaf or root extract orally twice daily. Heartwood charred powder combined with sesame oil or brassica
2.	*Acacia catechu (L.f.)* Wild Khair (Fabacea)	Foot and Mouth disease	Heart wood	Sesamum indicum (sesame) oil or Brassica campestris (mustard) oil is administered to the affected part of the animal. Wash the affected area three or four times and then apply powder or paste till it heals.
3.	*Acacia nilotica Benth.* Babul/Kikar (Fabaceae)	Burning	Bark	Stem bark extract mixed with Sesamum indicum (sesame) oil and administered on wounds or burns.
4.	*Aegle marmelos Webb.* & Benth Bael/Bill (Rutaceae)	Asthma	Fruit Pulp	Fruit juice that has been extracted is ingested twice daily till complete recovery. Fruit pulp, boiled Cassia fistula pods, added jaggery, and administered orally once per day.
5.	*Allium cepa L.* Kanda (Liliaceae)	Unknown insect bite	Fresh leaves	To treat an unknown bug bite, a paste made from 2-3 tola (approximately 20-30 grammes) of fresh leaves and the same amount of fresh
				leaves from Lajalu (Mimosa pudica) in a cupful of water is applied externally to the bitten area of the body.
6.	*Asparagus adscedens Roxb.* Shatmuli (Liliaceae)	Increasing lactation period	Root tuber	To extend the lactation period and produce higher-quality milk, a certain amount of tuber powder is combined with hay and frequently given to breastfeeding cows and buffaloes in the evening.
7.	*Azadirachta indica A.* Neem (Meliaceae)	Skin problem Allergy, Fever Constipation	Leaf Leaf/ Bark Leaf	Leaf extract is applied to the skin or given orally in feed. Oral decoction of the leaf or bark is given twice a day till recovery. Leaf paste combined with an equal amount of turmeric powder and administered orally to the animal for 5-7 days to treat constipation.
8.	*Canvalia cathartica L.* Abaiwel (Fabaceae)	Lactation period	Fruit	For influential conception, a powder made from seeds and fruits is mixed with fodder and offered to cows and buffaloes in the latter stage of lactation once a day for 15-18 days.
9.	*Carissa congesta L.* Karonda (Apocynaceae)	Reducing fever	Leaf	Leaves are fed to animals to boost milk production. Orally administered Cassia tora and Cassia occidentalis seed powder in 1-2 litres of curd or lassi.
10.	*Catharanthus roseus G.* Don. Sadafuli (Caesalpinaceae)	Dog bite	Leaf	Paste from the 1-2 tola (approximately 20-30 grammes) fresh leaves in a cup of water mixed with a small amount of lemon fruit (Citrus sinensis) juice and applied externally at the site of inflammation. Once a day for 6-8 days to heal the bitten area of the body of wounds due to dog bite.
11.	*Jatropha gossypifolia L.)* Mogali Erand (Euphorbiaceae)	Relief of ringworm and dermal itching	Stem bark	Dogs with ringworm and cutaneous itching are given thorough applications of stem latex and seed oil twice or thrice daily until complete alleviation.

12.	*Jatropha podogrina* L. Errand (Euphorbiaceae)	Loose motion	Seed	Make chapatis the following morning by combining the seed powder with the wheat flour you soaked in warm water the previous night. The same chapati is eaten twice a day for 5–6 hours to treat loose motion in bulls and buffaloes.
13.	*Momordica dioica Roxb.* ex Willd. Kartule (Cucurbitaceae)	Mouth ulcer	Fruit	In order to treat mouth ulcers in cows and buffaloes, about 250gm young fruits are crushed with a few teaspoons of black pepper (Piper nigrum) and an egg white in a cup of curd. The mixture is then fed to the animals twice daily for five to six days.
14.	*Sesbania grandiflora (L.)* Poiret. Hatga (Fabaceae)	Sexual vigour and strength	Seed	A specific quantity of seed powder is combined with wheat flour and fed to the chapatis as prepared. Male buffaloes and bulls typically do this once or twice daily, usually in the morning, to maintain their sexual strength and power.
15.	*Syzygium cumini (L.)* Skeels. Jambhul (Myrtaceae)	Vitality	Fruit	For the horses to experience maximum and healthy growth, an adequate amount of semi-
				ripe fruit extract is blended with the fodder, and the same preparation is supplied.
16.	*Terminalia arjuna* (Roxb) Wight. Arjuna (Combretaceae)	Wounds	Leaf	Animals can be given a leaf combined with food or bark boiled in water until only 1/4 is left, then given orally twice daily until they recover.
17.	*Terminalia bellirica* (Gaertn.) Roxb. Behada (Combretaceae)	Blood dysentery	Stem bark	To treat bleeding dysentery in goats, 2-3 tolas (about 20–30 grams) of dried stem bark powder are cooked in a glass of water for 3–4 minutes. The resulting decoction is then given orally, along with 1-2 teaspoons of Nilgiri (*Eucalyptus globulus*) oil, to the goats twice daily for 3–4 days.
18.	*Tinospora cordifolia* Miers. Gulwel (Menispermaceae)	Q fever.	Fruit	Goats are given 100 g of powdered, half-ripe fruit (*Zingiber officinale*) twice daily for 10–12 days to treat Q fever. a teaspoon of each) Moreover, turmeric (*Curcuma domestica*) powder is used to create the extract that is consumed internally.
19.	*Urena lobata ssp.* sinuata (L.) Borssum. Van-bhend (Malvaceae)	Mastitis	Seed	To treat mastitis (a mastication issue), a cup of Erand *(Ricinus communis*) seed oil is combined with a teaspoon of Nilgir (*Eucalyptus globulus*) oil. This mixture is then administered orally to sheep and goats once daily for three to four days.
20.	*Vitex negundo Linn.* Nirgundi (Lamiaceae)	Dysentery.	Leaves, Fruit	Worms can be removed from the body using leaves and dried fruits. Additionally, it is used on swellings. Cattle are given leaves to help them recover from diarrhoea.

Table No. 2 shows 20 plant species, 11 genera, and 13 families studied as ethnoveterinary medicinal plants used locally for animal health care in the study area. The leaves of five species, the fruits of four, the seeds of three, the bark of two, and the root of one are utilized. A root tuber is used medicinally, and detailed information is provided on how to use it for specific ailments.

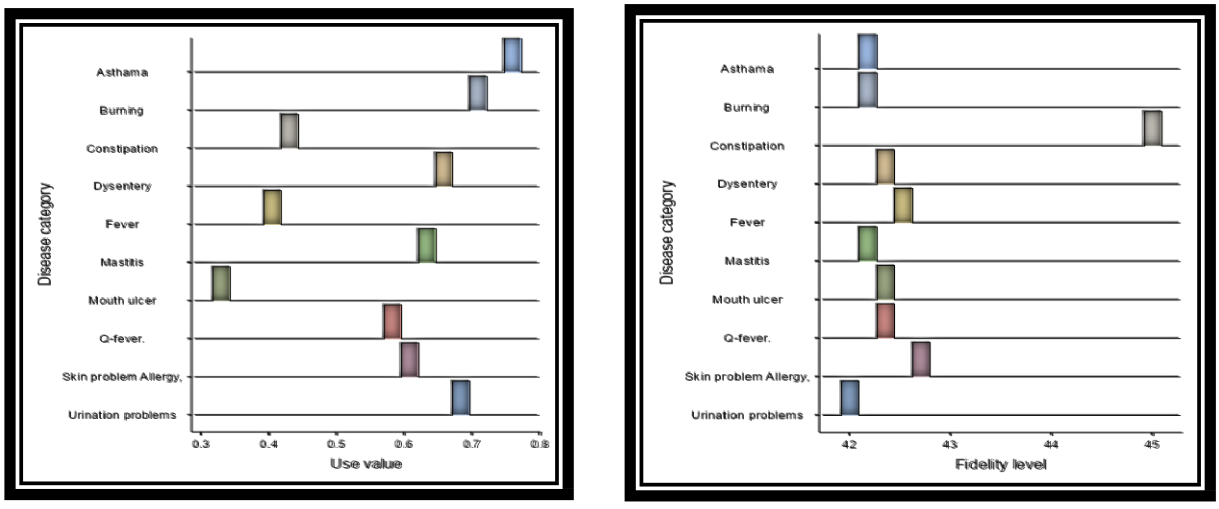
In the study area, we have identified 20 plant species, which we compared with findings from other researchers in the same field. Ariharan and Revathi (2021) reported a total of 50 plant species used for ethnomedicinal purposes and 25 species for ethnoveterinary applications in the Kurugani Hills of the Western Ghats, located in the Theni district of Tamil Nadu. Among these, three species from the Euphorbiaceae family and two species from the Zingiberaceae family have been noted for their use in ethnoveterinary medicine. Their research highlights the proportions of ethnomedicinal and ethnoveterinary plant parts utilized in the preparation of medicinal remedies.

Table 3. Quantitative ethnoveterinary study of highly utilized species.

Number	Plant species	Disease category	Use Report	Use value	Fidelity level
1.	*Abutilon indicum* (L.)	Urination problems	**29**	**0.69**	**42.0**

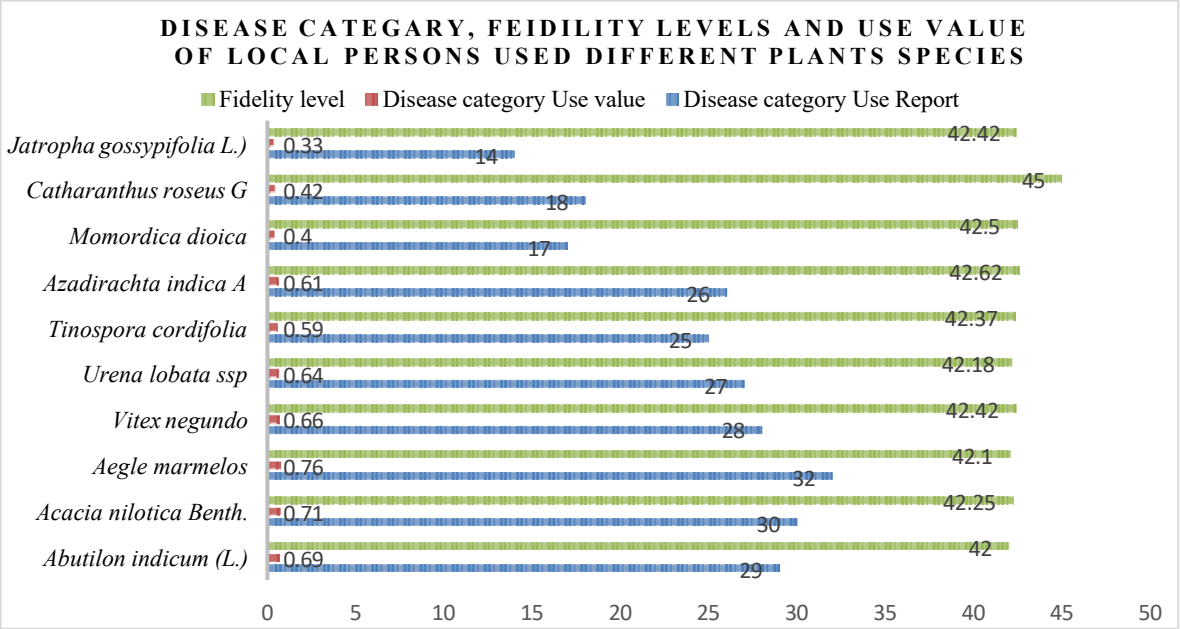
2.	*Acacia nilotica Benth.*	Burning	**30**	**0.71**	**42.25**
3.	*Aegle marmelos*	Asthma	**32**	**0.76**	**42.10**
4.	*Vitex negundo*	Dysentery	**28**	**0.66**	**42.42**
5.	*Urena lobata ssp*	Mastitis	**27**	**0.64**	**42.18**
6.	*Tinospora cordifolia*	Q fever.	**25**	**0.59**	**42.37**
7.	*Azadirachta indica A*	Skin problem Allergy, Fever Constipation	**26**	**0.61**	**42.62**
8.	*Momordica dioica*	Mouth ulcer	**17**	**0.40**	**42.5**
9.	*Catharanthus roseus G*	Dog Bite	**18**	**0.42**	**45**
10.	*Jatropha gossypifolia L.)*	Relief of ringworm and dermal itching	**14**	**0.33**	**42.42**

Abbreviations key: U.R., use report, U.V., use value, F.L., fidelity level.



Graphical Representation of fidelity level and use value

Table 3 presents the analysis of 10 plant species showing a high level of fidelity in treating various veterinary diseases. Out of these, 4 plant species, namely *Catharanthus roseus* G, *Azadirachta indica*, and *Tinospora cordifolia*, show a high level of fidelity in treating a large number of diseases, while *Vitex negundo* and *Jatropha gossypifolia* L. show a similar level of fidelity. It is important to note that the use of these species involves a considerable daily expenditure. In addition, other botanical options are effectively used to treat various veterinary diseases such as dermatological problems, dog bites, mouth ulcers, pyrexia, dysentery, and mastitis, which highlights their importance in veterinary medicine. The analysis of Table 3 above is compared with the research paper given below. The information is as follows: A total of 72 plants were used to treat 33 common diseases of dairy animals in the Kathua district. Fabaceae (7 species) was the most represented family, followed by Poaceae (6 species). The highest ICF (0.95) was recorded for urinary diseases and the lowest for nutritional diseases (0.80). ICF values were generally high, indicating that the informants shared knowledge about the disease with each other. The important ethnoveterinary plant species based on use values were: *Brassica campestris*, *Saccharum officinarum*, *Emblica officinalis*, *Trachyspermum ammi*, *Shatavari ascendens*, *Musa paradisica*, *Oryza sativa*, *Curcuma longa*, *Azadirachta indica*, *Tychomaradinospolia*, and *Tachomarifolia* [22]. Detailed graphical representation is shown below.



Proximity Matrix

	Correlation between Vectors of Values									
	Abutilon indicum (L.)	*Acacia nilotica Benth.*	*Aegle marmelos*	*Vitex negundo*	Urena lobata	*Tinospora cordifolia*	*dirachta indica*	*omordic a dioica*	*tharanthu s roseus*	*Jatropha gossypifolia L.)*
Abutilon indicum (L.)	1.000	1.000	.997	.999	.998	.994	.996	.945	.945	.917
Acacia nilotica Benth.	1.000	1.000	.999	.998	.997	.991	.994	.938	.938	.908
Aegle marmelos	.997	.999	1.000	.994	.991	.982	.986	.918	.918	.884
Vitex negundo	.999	.998	.994	1.000	1.000	.997	.998	.956	.956	.930
Urena lobata	.998	.997	.991	1.000	1.000	.998	.999	.962	.962	.938
Tinospora cordifolia	.994	.991	.982	.997	.998	1.000	1.000	.976	.976	.956
Azadirachta indica	.996	.994	.986	.998	.999	1.000	1.000	.971	.971	.949
Momordica dioica	.945	.938	.918	.956	.962	.976	.971	1.000	1.000	.997
Catharanthus roseus	.945	.938	.918	.956	.962	.976	.971	1.000	1.000	.997
Jatropha gossypifolia L.)	.917	.908	.884	.930	.938	.956	.949	.997	.997	1.000

This is a similarity matrix

The proximity matrix in this table is a correlation matrix. It shows the "vectors of values" for ten distinct plant species and their pairwise associations.

Having an understanding of correlation: As a statistical measure, correlation indicates how much two variables tend to change together. The "vectors of values" for each plant in this case most likely correspond to a collection of numerical measurements or attributes (although the table does not specify which particular attributes are included). Within each plant species, these vectors might, for instance, provide measurements of various chemical components, morphological characteristics, or levels of gene expression. There are two possible values for the correlation coefficient: -1.0 and +1.0. A value of +1.0 indicates a fully positive connection. As a result, the other vector's values will increase in proportion to the first vector's values.

0.0: Shows no linear association. There is no discernible pattern to the values in the two vectors.

A perfect negative correlation is shown by a value of -1.0. This indicates that the values in the other vector fall proportionately as the values in the first vector rise.

Different degrees of positive or negative correlation are indicated by values ranging from -1.0 to +1.0. The association is stronger when the absolute value is closer to 1.

The Proximity (Correlation) Matrix Interpretation:

Columns and Rows: The eleven plant species are represented by the matrix's rows and columns. Both (*Acacia nilotica, Abutilon indicum*, etc.) are in the same order.

Diagonal Values: The diagonal elements, such as *Abutilon indicum* vs. *Abutilon indicum*, are always

1.000. This is the point where a species intersects itself. Given that a vector of values has a perfect positive correlation with itself, this makes logical sense.

Values Off-Diagonal: The correlation coefficient between the vectors of values for the two related plant species is shown by the off-diagonal values. For instance, 1.000 is the number at the junction of the "*Abutilon indicum*" row (row 2) and the "*Acacia nilotica*" column (column 3). This shows that the vectors of values for these two species have a perfect positive connection. This implies that these two plants' measurable traits tend to alter in a similar manner and proportion.

When the row for "*Abutilon indicum*" (row 2) and the column for "*Momordica dioica*" (column 9) overlap, the result is 0.945. This suggests a robust positive association. Though not always, the vectors of values for these two species tend to rise or fall together.

0.018 is the number at the junction of the "*Aegle marmelos*" row (row 4) and the "*Catharanthus roseus* " (column 10). This suggests that there is virtually no linear relationship between the two species' assessed features, only a very faint positive correlation.

CONCLUSION

There are fewer local nomads and farmers. Different medicinal plants are utilized to heal animals because of economic factors and the high expense of Western treatment. Herbal preparations of medicinal plants are a specialty of traditional healers. Gastrointestinal diseases were the most common in the study location; therefore, cattle should be provided with high-quality feed and water. Plants with high levels of informant consensus and faithfulness should be subjected to additional in vitro screening for active chemical constituent analysis and medicinal activity. Young people should be encouraged to become interested in ethno-veterinary practices to conserve this knowledge. All of these plant species are used worldwide, so there is a need to safeguard and conserve them for future use. A total of 20 ethno-veterinary plant species from 11 genera and 13 families have been identified. More surveys will be required in the future to determine plant resources. According to the study, they are essential to the local advisees and their daily lives and well-being. It entails preserving traditional ethno-veterinary knowledge and passing it down from tribe to tribe. Generations will help save and nurture trees on the edge of extinction due to deforestation, global warming, industrialization, and urbanization.

The matrix is symmetrical about the diagonal. This means that the correlation between species A and species B is the same as the correlation between species B and species A. For example, the correlation between *"Abutilon indicum"* and *"Acacia nilotica"* is 1.000, and the correlation between *"Acacia nilotica"* and *"Abutilon indicum"* is also 1.000.

Author contributions- Author 1: Conceptualization, Formal analysis, Investigation, Interpretation of the data, Author 2**:** Writing – Original Draft; RM: Formal analysis, Interpretation of the data, Supervision; Author 3: Conceptualization, Writing-Review and Editing, Critical revising, Supervision

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Declaration: Ethics approval and consent to publish have been obtained from all authors. The authors declare that this study is original work. All references have been appropriately cited. The study does not involve human or animal experiments; rather, the information and methods were acquired through interviews. The authors did not utilize any generative or AI-assisted technology in the creation of this manuscript. Consent for publication has been fully obtained from all authors and has been approved for publication. The authors declare that there are no competing interests.

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