Ethnoveterinary Medicines: A Potential Alternative to Animal Health Care for the Tribal Communities of Koraput, Odisha

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Abstract. Medicinal plants play an important role throughout the world for the treatment and prevention of various diseases of both human and animal. The tribal communities of Koraput still depends on medicinal plants for their first aid remedies to treat some simple ailments of livestock. The present study was initiated to quantitatively document their indigenous knowledge on the utilization of most common medicinal plants for livestock treatment. A total of 40 field surveys were carried out from August 2015 to October 2016 in order to document the utilization of medicinal plants. The ethnoveterinary information was collected through structure interviews among the traditional healers and local livestock farmers. The collected data were analyzed through use value (UV), informant consensus factor (Fic) and fidelity level (FL). A total of 56 species of plants distributed in 54 genera belonging to 36 families were identified as commonly used medicinal plants by the tribal communities of Koraput for the treatment of 20 types of ailments. These ailments were categorized into 9 ailment categories based on the body systems treated. Leaves were the most frequently used plant parts and most of the medicines were prepared in the form of paste and administered orally. Fic values of the present study indicated that there was a high agreement in the use of plants in the treatment of wound infections, dysentery and eye problems among the users. Dermatological infections/diseases and gastro-intestinal disorders had highest use-reports and 2 species of plants had the highest fidelity level of 100%. The most important species according to their use value were *Curcuma longa*, *Ficus religiosa*, *Aloe vera, Ziziphus mauritiana, Tridax procumbens* and *Vitex negundo.* As a result of the present study it can be recommend the plants *Aloe vera, Azadirachta indica*, *Calotropis procera*, *Curcuma longa*, *Datura metel*, *Ficus religiosa*, *Ziziphus mauritiana*, *Vitex negundo* and *Tridax procumbens* can be investigated further for their ethnopharmacological properties for the discovery of potential new drugs for veterinary treatment.

Introduction

Traditional medicine is a part of the indigenous knowledge system of the people all over the world. According to the World Health Organization (WHO), at least 80% of the people in developing countries depend on indigenous practices for treatment of various diseases of both human being and their animals [1]. The medicinal plants are also used extensively and quite effectively for primary health care treatment of the domestic animals [31]. The indigenous knowledge of the veterinary health care system acquired by traditional herbal healers and the information passes from one generation to other. Even though the rate of medicinal plant utility is ever increasing, very little is known about its use patterns. It is very important to document, analyze and evaluate this knowledge for their commercial value, as the medicinal plants is one of the most successful criteria used by the pharmaceutical industry in finding new therapeutic agents [2]. This growing interest in traditional practices had been encouraged by the recognition of some efficient ethnoveterinary medicinal products.

In recent years, increasing attention has been paid to ethno veterinary knowledge and local veterinary practices. There is a growing acceptance in the field of ethnoveterinary research and development in many parts of the developing countries [17, 28, 15, 32, 14]. Some studies on ethno veterinary practices has also been reported by many researchers from different regions of India [6, 13, 5, 21, 12, 31]. But the traditional knowledge is rapidly degrading due to modernization and gradually, these practices are hardly documented and largely lost, diluted and distorted. Therefore, the traditional knowledge of animal healthcare practices requires great attention for pharmaceutical analysis to prospect new drugs in the concerned field.

Odisha is a genetic paradise of natural resources especially Koraput is one of the tribal dominated district of south Odisha, rich in different plant resources and centres of diversity for many forest species [18] and also well known for its rich human cultural diversity [19]. There is no such report on ethnoveterinary practice of medicinal plants used by the tribal communities of Koraput. In view of this, the present study was conducted to quantitatively document the ethnoveterinary medicinal plants and their utilization for primary health care treatments of animals by the tribals of Korapur district. This study provided an inventory of medicinal plants used in ethnoveterinary practices against different diseases and can act as a low cost option than the western drugs.

Materials and Methods

Study area and tribal community

Koraput is the Southernmost district of Odisha lies between 18° 14' to 19' 14' N latitude and 82° 05' to 83° 25' E longitude with a total geographical area of 8, 807 sq km (5.38% of Odisha state) (Fig. 1) Physio-graphically it is contiguous to the main land of Eastern Ghats, High land zone and South-Eastern Ghats zone. The general topography is of broken mountains interrupted by large riverbeds and water courses. Fifty two tribal communities constituting 50.56% of its population live in the district as per the census details of 2011 [18]. The study was conducted in 60 different tribal villages of Koraput district which are inhabited by different tribal communities in the deep forest areas. A total of 40 field surveys were carried out from August 2015 to October 2016 in order to document the utilization of medicinal plants. The indigenous people of the study area are Paraja, Bhumia and Bhatra, the oldest tribal group of the branch of ethnic group in Odisha. They live predominantly in the villages mainly closer to the deepest forest. Most of the tribal have a general knowledge of medicinal plants that are used for first aid remedies, to treat the simple ailments of their animals.
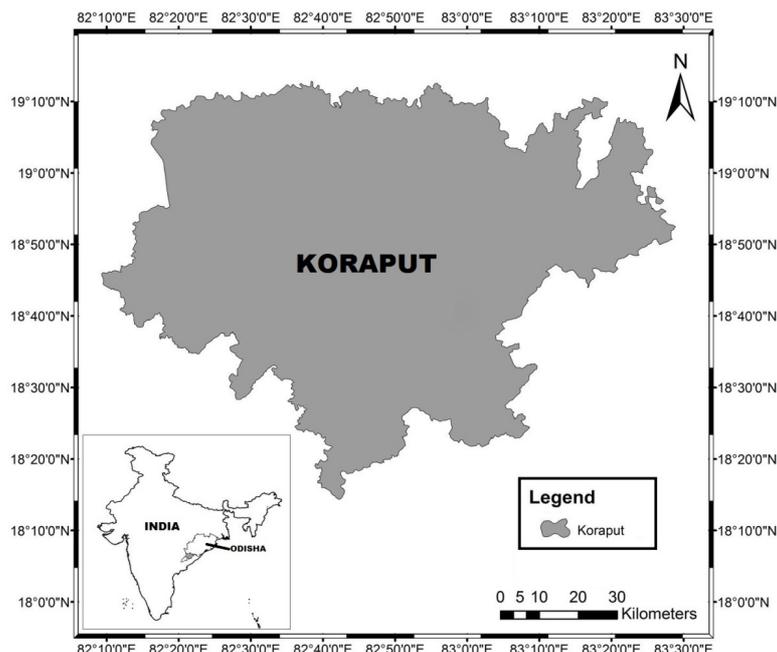
Figure 1. Map showing the origin study area from Koraput, Odisha.

Data collection

Information on ethno-veterinary medicinal plants was collected from different respondents of diversified age groups of different tribal communities of Koraput. A total of sixty four informants with traditional healers were identified to get the ethnoveterinary information by structured questionnaires through direct interviews/oral conversations. They have sound knowledge on medicinal plants found in their surrounding areas and they practice medicine within their families and neighbors. Information on local name of plant, plant part used for curing, method of preparation, any other plants/agents used as ingredients, modes of administration and etc. were recorded. The plants were collected and identified by following the flora of Orissa by Saxena and Brahmam [27] and Botany of Bihar [9].

Ailment categories

Based on the information obtained from the traditional healers in the study area, all the reported ailments were categorized into nine categories such as gastro-intestinal ailments (GIA), dermatological infections/diseases (DID), respiratory systems diseases (RSD), genito-urinary ailments (GUD), fever (FVR), skeleto-muscular system disorders (SMSD), poisonous bites (PB), eye problems (ED) and helminthes diseases (HD). Several diseases were placed in one ailment category based on the body systems treated.

Informant Consensus Factor (Fic)

The informant consensus factor (Fic) was used to determine the acceptance of the plants in the ailment categories by the users of the study area. The Fic was calculated by using the following formula [11].

$$Fic = Nur - Nt/Nur - 1,$$

where Nur refers to the number of use-reports for a particular ailment category and Nt refers to the number of species used for a particular ailment category by all informants.

Use Value (UV)

The relative importance of each plant species used to treat various diseases known locally to be is reported as use value (UV) and it was calculated using the following formula [20].

$$UV = \Sigma U/n \, ,$$

where UV is the use value of a species, U is the number of use reports cited by each informant for a given plant species and n is the total number of informants interviewed for a given plant.

Fidelity Level (FL)

The fidelity level (FL) determine the most frequently used plant species for treating a particular ailment category by the informants. The FL was calculated using the following formula [4].

$$FL \, (\%) = Np/N \times 100 \, ,$$

where Np is the number of use-reports cited for a given species for a particular ailment category and N is the total number of use reports cited for any given species.

Result and Discussion

### Documentation of indigenous ethnoveterinary knowledge

A total of 56 species of plants distributed in 54 genera belonging to 36 families which were commonly used for the treatment of 20 different ailments by the tribal healers of Koraput. The plant species under the family of Euphorbiaceae was prominent having four species, followed by Caesalpiniaceae, Fabaceae, Lamiaceae, Liliaceae, Mimosaceae and Poaceae with three species each. The scientific name of the plant, family, local name, life form, use value, parts used, ailments treated with method of preparation and mode of application were presented in Table 1 in Appendix. The information on the medicinal values of the plants documented in our study area were compared with the earlier information reported by the researchers from other parts of India. No such plants were reported as a new medicinal plants as all the plants were reported with different uses by other researches of India [31, 6, 13].

Life form and parts used for the preparation of ethnoveterinary medicine

The present study revealed that the plants under trees categories were the primary source of medicine (38%) followed by herb (34%), shrubs (23%) and creeper (5%) (Fig. 2). Leaves (51%) were most frequently used for the preparation of medicine or mixed with other plant parts among the other plant parts used, followed by whole plant (20%) fruit (10%), stem bark (10%), stem (4%), root (4%), latex(3%), root and seed(1% each) (Fig. 3). This result is consistent with the previously reported study by the researchers of the country where they also reported the use of plant leaves for the preparation of herbal medicines by many indigenous communities [31, 5, 6, 13, 22, 10, 24, 26]. The Leaves can be easily collected than the other parts of the plant and they are active in photosynthesis and production of secondary metabolites which may be the reason to use the leaves for herbal medicine preparation [7, 8].
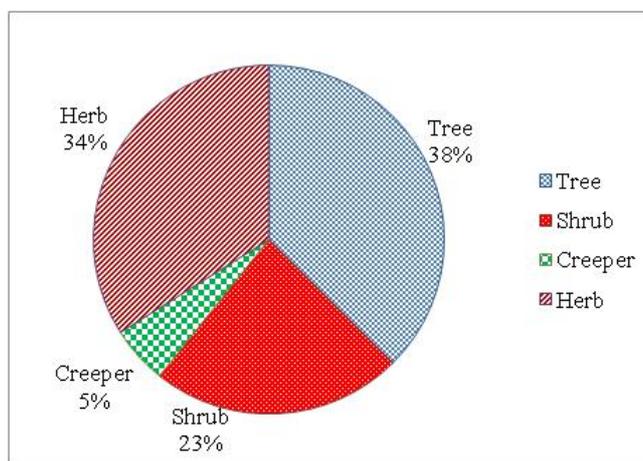

Figure 2. Life forms of reported medicinal plants.
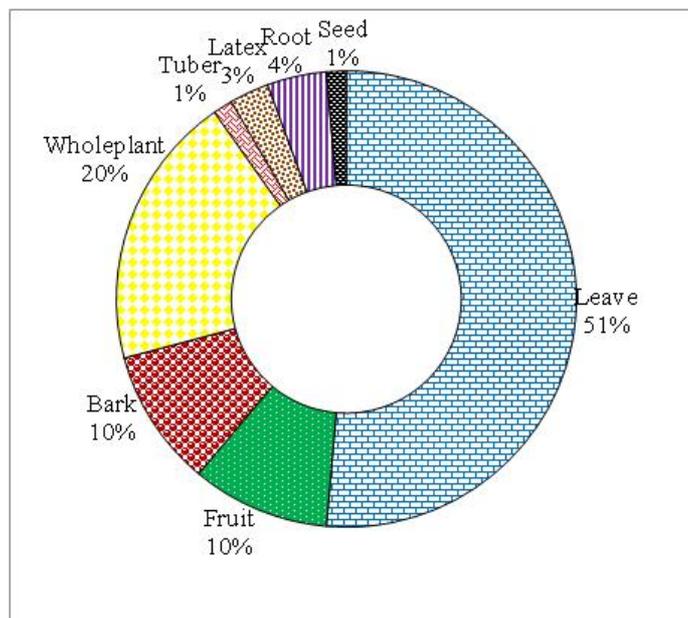
Figure 3. Percentage of plant parts used for the preparation of medicine.

Mode of administration of plants and method of preparation

The use and preparation of medicinal plant parts were grouped into four categories (Fig. 4). Most commonly used method of preparation for the herbal medicine was paste (51%) followed by used as feed stuff (28%), juice (13%) and decoction (8%). Preparation of paste for the treatment of different ailments is a common practice in human and animal healthcare system among the tribals in India [1, 16]. The fresh leave or bark paste was prepared with oil or water and the decoction was prepared by boiling the plant parts in water until the volume was reduced to required amount. In the present study most of the tribal healers suggested that internal uses (74%) of the herbal preparation were predominant over external or topical uses (26%). The plant paste or medicated oil were used topical and directly applied on the affected area for the treatment of diseases like skin disorders, wounds, poison bites, dysentery and stomach worm.
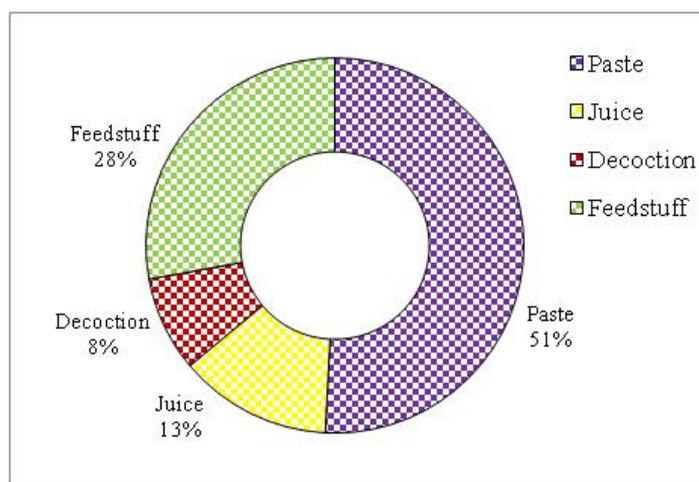
Figure 4. Categories of mode of utilization for the preparation of medicine.

Plant use values

The most commonly used species was *Curcuma longa* with 109 use-reports by 64 informants, giving the highest use value of 1.76. *Curcuma longa* is use in the treatment of various diseases in all animals and it is well known as traditional spice of India with antiseptic properties . Other important plants with high use value were *Ficus religiosa* (85 use reports by 64 informants with a UV of 1.33), where as *Aloe vera, Ziziphus mauritiana, Tridax procumbens* and *Vitex negundo* (76 use-

reports by 64 informants with a UV of 1.18). The plant with very low use value was *Phoenix acaulis* which is reported by only seven informants with UV of 0.11, but the informant is regularly using this plant in the treatment of stomach worms in case of calf, goat and sheep. The scarce availability of these plants in the study area may be the reason for low use value [25] as in the case of Koraput. Similar to our study, most of the reported plants in the present study are also used by the different types of tribal people in India for the treatment of various diseases in livestock [26, 22].

Informant consensus factor

In order to use the informant consensus factor (Fic), we classified the diseases into nine broad ailment categories. The Fic values in the present study are ranged from 0.96 to 1.00. The use categories with more than 400 use-reports were dermatological of infections/diseases (469 use-reports, 15 species), gastro-intestinal diseases (405 use-reports, 12 species) and helminthes infection (245 use-reports, 10 species) (Table 2). In the present study, fever followed by eye disease had the highest Fic of 1.00 and 0.99 respectively. The informant consensus factor (Fic) determines the local knowledge of the people for the treatment of diseases which mainly depends on the availability of the plant species in the study area [23]. The least agreement between the informants was observed in the respiratory system disorder with a Fic of 0.95 (Table 2). Thus the present study indicates that the information on the use of medicinal plants in the livestock treatment shared by the users in the study area is high. Our findings showed that these ailment categories had high number of use-reports among the tribal communities of Koraput with high Fic values.

Table 2. Informant consensus factor for commonly used medicinal plants for the treatment of livestock.

Ailment category	Number of use-reports (Nur)	Number of taxa (Nt)	Informant consensus factor (Fic)
Gastro intestinal ailments	405	12	0.97
Poisonous bite	98	2	0.98
Dermatological infection/Disease	469	15	0.97
Eye disease	201	4	0.99
Fever	231	8	1.00
Respiratory system disorder	137	5	0.95
Skeleto muscular system disorders	80	3	0.97
Genito urinary diseases	221	7	0.97
Helminthes disease	245	10	0.96
TOTAL	2087	67	

Fidelity level

The ailment categories were analyzed in order to highlight the most important plants in each category (Table 3). Among the 56 reported plants, 2 species had highest fidelity level of 100% which were used in treatment of single ailment category with multiple informants. For the analysis of fidelity level, the plants with less than seven use reports were not considered. The plants with highest FL of 100% were *Achyranthus aspera* (ED) and *Ficus religiosa* (GUD). The maximum FL for the above plants indicated the 100% choice of the interviewed informants for treating specific ailments and this could be an indication of their healing potential. *Tridax procumbens, Albizia lebbeck, Mimosa pudica, Ocimum tenuiflorum, Cassia fistula, Boerhavia diffusa, Cordia oblique, Euphobia hirta, Portulaca oleracea, Calotropis procera* and *Leucas aspera* were documented to have above 50% of FL for treatment of various ailment category by the local tribal of Koraput. The fidelity level of the present study was comparable with the study of ethnoveterinary study of the tribal society of Sulaiman range by Tariq et al. [29].

Table 3. Diseases grouped by different ailment categories with fidelity level (FL) values for common medicinal plants used by tribal communities**.**

Sl. no	Ailment categories	Medical terms	Most preferred species with specific ailment	Fidelity level (%)
1.	Gastro intestinal ailments (GIA)	Diarrhea	*Abutilon indicum*	20.00
		Dysentery	*Aegle marmelos*	20.00
		Stomach disorder	*Bambusha arundinacea*	15.38
		Indigestion	*Cynodon doctylon*	25.00
		Piles/Constipation	*Dalbergia sissoo*	15.00
			Mangifera indica	11.11
			Ricinus communis	21.11
2.	Poisonous bite (PB)	Snake bite	*Terminalia arjuna*	38.46
		Poison consumption	*Tamarindus indica*	20.00
3.	Dermatological infection/Disease (DID)	Tic problem	*Annona reticulata*	30.80
		Wound	*Cuscuta reflexa*	30.80
			Tridax procumbens	54.50
			Cassia tora	21.40
4.	Eye disease (ED)	Tearing of eye	*Achyranthes aspera*	100.00
			Albizia lebbeck	56.10
5.	Fever (FVR)	Fever	*Andrographis paniculata*	42.86
		Pox	*Mimosa pudica*	66.67
			Pongamia pinnata	42.86
6.	Respiratory system disorder (RSD)	Cough	*Ocimum tenuiflorum*	70.00
		Cold	*Cassia fistula*	58.78
7.	Skeleto muscular system disorders (SMSD)	Fracture	*Abrus precatorius*	15.00
		Joint swelling	*Azadirachta indica*	21.05
8.	Genito urinary diseases (GUD)	Lactation	*Asparagous recemosus*	21.00
		Pregnency delivery	*Ficus religiosa*	100.00
		Fertility	*Boerhavia diffusa*	81.00
			Cordia obliqua	75.60
			Euphobia hirta	74.00
			Portulaca oleracea	53.43
9.	Helminthes disease (HD)	Helminthes infection	*Bryophyllum pinnatum*	33.33
		Worm infection	*Calotropis procera*	71.43
			Carica papaya	50.00
			Leucas aspera	65.00

Reliability of reported uses

The plants which are used in more than one ailment could have biologically active component or pharmacologically active components [30]. The tribals of Koraput used the bark decoction of *Ficus religiosa* for easy delivery of calf and to maintain the pregnancy with a use value of 1.33 and FL of 100%. Most of the plants reported in this study have more use value and Fic which indicate the effectiveness of the plant to treat various ailments in livestock. This indicates that locally available plant populations are a major determinant of the plant species used in ethnoveterinary medicines in the study area. In support of our study, *Ficus religiosa, Ziziphus mauritiana* has been reported by other researches for the presence of various metabolites which implies a good ethnoveterinary medicinal plants [17, 31]. The ethnoveterinary studies evident that, the efficiency of these reported plants species should be investigate to proven the drugs used in modern medicines [3].

Conclusion

The traditional folk medicines were still practiced by the tribal communities and only a few individuals in the tribal communities have accurate knowledge on the medicinal application of the plants. Thus, our work would be useful in preventing the loss of ethnoveterinary traditions of the tribal communities. The plants with highest fidelity level and use values in the present study may indicate the possible occurrence of valuable phytochemicals. The efficacy and safety of all the

reported ethnoveterinary plants needs to be evaluated for phytochemical and pharmacological studies to carry out future bioassay and toxicity studies. Among all the reported plant species, *Aloe vera, Azadirachta indica, Calotropis procera, Curcuma longa, Datura metel, Ficus religiosa, Ziziphus mauritiana, Vitex negundo* and *Tridax procumbens* had the high use values which may be use further for ethnopharmacological studies. These ethnoveterinary medicinal plants can be a cheap and readily available alternative source of medicines to costly drugs. Hence a need for detailed investigation of ethnoveterinary knowledge held by each tribal community is required before such valuable knowledge vanishes.

Appendix

Table 1. List of commonly used medicinal plants used by tribals of South Odisha for the treatment of various diseases of animal. Gastro intestinal ailments (GIA); Poisonous bite (PB); Dermatological infection/Disease (DID); Eye disease (ED); Fever (FVR); Respiratory system disorder (RSD); Skeleto muscular system disorders (SMSD); Genito urinary diseases (GUD); Helminthic disease (HD).

Sl .no	Botanical name	Local name	Family	Live form	Use value	Parts use	Ailment category- no. of use reports (Ailments treated)	Preparation	Application	Affected animal
1.	*Abrus precatorius* L.	Gunja	Fabaceae	Creeper	0.67	Leaf and seed	SMSD- 43 (muscular swelling)	Paste	Topical	Cow and Buffaloes
2.	*Abutilon indicum* (L.)	Pedipedika	Malvaceae	Shrub	0.83	Leaf	GIA- 53 (dysentery)	Paste	Oral	Goat and Sheep.
3.	*Acacia nilotica* (L.) Delile.	Bamura	Mimosaceae	Tree	0.50 0.21	Leaf	GIA- 32 (diarrhoea) HD- 13 (stomach worms)	Paste	Oral	Cow and Buffaloes
4.	*Acalypha indica* L.	Indramaricha	Euphorbiaceae	Herb	0.37 0.21	Leaf	DID- 24 (wounds) RSD- 13 (cold and cough)	Paste	Topical Oral	Goat and Sheep
5.	*Achyranthes aspera* L.	Apamaranga	Amaranthaceae	Herb	0.87	Leaf	ED-56 (watering in eyes)	Juice	Internal	Cow and Buffaloes
6.	*Adhatoda vasica* Nees. .	Basanga	Acanthaceae	Shrub	0.32	Leaf	FVR- 21 (fever)	Decoction	Oral	Goat and Sheep.
7.	*Aegle marmelos* (L.) Correa.	Bela	Rutaceae	Tree	0.76	Fruit	DID- 49 (dysentery and diarrhoea)	Paste	Oral	Goat and Sheep
8.	*Albizia lebbeck* (L.) Benth.	Sirisa	Mimosaceae	Tree	0.76	Leafs	ED-49 (eye problem).	Juice	Internal	Goat, Cow and Buffalo
9.	*Allium cepa*	Piyaja	Lilliaceae	Shrub	0.16 0.31	Leaf	RSD- 10 (cold, cough) HD- 20 (worm)	Juice	Oral	Goat and Cow
10.	*Aloe vera* (L.) Burm f.	Ghiakuanri	Lilliaceae	Herb	1.18	Whole plant	ED- 76 (tearing of eye)	Juice	Internal	Cow and Buffalo

11.	*Andrographis paniculata* Nees.	Bhuinnimba	Acanthaceae	Herb	0.11 0.23	Whole plant	FVR- 7 (fever) RSD- 15 (cough)	Decoction	Oral	Goat
12.	*Annona reticulata* Linn.	Sitaphala	Annonaceae	Tree	0.24	Leaf	DID- 15 (tics and lice)	Paste	Topical	Cow and Buffalo
13.	*Argemone mexicana* L.	Bhejiri kanta	Papaveraceae	Herb	0.42	Whole plant	GIA-27 (constipation)	Whole plant	Oral	Cow and Buffalo
14.	*Asparagus recemosus* Willd.	Satavari	Liliaceae	Creeper	1.05	Tuber	GUD-67 (heat production)	Whole tuber	Oral	Cow and Buffalo
15.	*Azadirachta indica* A. Juss.	Nimba	Meliaceae	Tree	0.42 0.23 0.11	Leaf	GIA-27 (stomachache) SMSD-15 (fractured horns) DID-7 (injury)	Paste	Oral and Topical	Cow and Buffalo Bird and parrots (heal injury)
16.	Bambusha arundinacea (L) Schreb	Baunsa	Poaceae	Shrub	1.08	Leaf	GID-69 (dysentery)	Juice	Oral	Cow
17.	*Boerhaavia diffusa* L.	Puruni	Nyctaginaceae	Herb	0.18	Whole plant	GUD- 12 (easy delivery of calf)	Feed stuff	Oral	Cow and Buffaloes
18.	*Bryophyllum pinnatum* (Lam.) Kurz	Patragaja	Crassulaceae	Shrub	0.18	Leafs	HD -12 (stomach worm)	Feed stuff	Oral	Cow
19.	*Calotropis procera* (Aiton) Dryand.	Arakha	Asclepiadaceae	Shrub	0.16 0.23 0.37	Leafs and root	HD-10 (worms) GUD- 15 (increase the milk quantity) DID- 24 (wound)	Feed stuff, Root paste	Oral and Topical (wound)	Sheep, Goat, Cow and Buffaloes
20.	*Cardiospermum halicacabum*	Phutuphutika	Sapindaceae	Shrub	1.00	Whole plant	FVR- 64 (fever)	Paste	Oral	Goat, and Cow
21.	*Carica papaya* Linn.	Amruta bhanda	Cari caceae	Tree	1.00	Fruit	HD- 64 (Worms)	Juice	Oral	Sheep, Goat, Cow, Buffaloes and Birds
22.	*Cassia fistula* L.	Sunari	Caesalpiniaceae	Tree	0.79	Bark	RSD – 51 (cough)	Paste	Oral	Sheep, Goat, Cow and Buffaloes
23.	*Cassia tora* L.	Chakunda	Caesalpiniaceae	Tree	0.50	Leaf and seed	DID- 32 (skin diseases and wound)	Paste	Topical	Sheep and Goat
24.	*Cassius quadrangularis* L.	Hadabhanga	Vitaceae	Herb	0.74	Whole plant	DID- 47 (wound)	Paste	Topical	Sheep and Goat
25.	*Cordia obliqua* Willd.	Guhgali	Boraginaceae	Tree	0.18	Leafs	GUD-12 (lactation)	Feed stuff	Oral	Sheep, Goat, Cow and Buffaloes
26.	*Curcuma longa* Linn.	Haldi	Zingiberaceae	Herb	1.24 0.21 0.31	Root	GID- 76 (loose motion) HD-13 (stomach worms) DID- 20 (wound)	Paste	Oral	Sheep, Goat, Cow and Buffaloes
27.	*Cuscuta reflexa* Roxb. .	Nirmuli	Convolvulaceae	Creeper	1.13	Whole plant	DID- 72 (remove worms in wound)	Paste	Topical	Cow and Buffaloes

28.	*Cymbopogen citratus*	Dhanwantari	Poaceae	Shrub	0.55	Whole plant	DID- 35 (antitics and lice)	Paste	Topical	Cow and Buffaloes
29.	*Cynodon dactylon* (L) christias hendrik pers	Duba ghasa	Poaceae	Herb	1.00	Whole plant	GID-64 (stomach problems)	Feed stuff	Oral	Sheep, Goat, Cow and Buffaloes
30.	*Dalbergia sissoo* Roxb.	Sisu	Febaceae	Tree	0.26	Leaf	GID-17 (loose motion)	Feed stuff	Oral	Sheep, Goat, Cow and Buffaloes
31.	*Datura metel* L.	Dudura	Solanaceae	Shrub	0.53 0.21 0.34	Fruit, Leaf	GID- 34 (dysentery) RSD- 13 (cough) SMSD- 22 (pain and swelling)	Feedstuff, leaf paste	Oral Topical	Sheep, Goat, Cow and Buffaloes
32.	*Eclipta alba* (L.) Hassk.	Kalabhaunra	Asteraceae	Herb	0.24	Leaf	DID- 21 (wound)	Paste	Topical	Cow
33.	*Euphobia hirta* L.	Gadni	Euphorbiacea	Shrub	0.34	Latex , whole plant	DID- 3(wound) Whole plant is used as feedstuff for increase milk production	Latex Feed stuff	Topical	Sheep, Goat, Cow and Buffaloes
34.	*Ficus bengbalesis* Linn.	Bara	Moraceae	Tree	0.32	Milk bark	DID- 20 (wounds)	Latex	Topical	Cow, Goat, Sheep and Buffaloes
35.	*Ficus religiosa* L.	Peepal	Moraceae	Tree	1.33	Bark	GUD-85 (ease delivery)	Decoction	Oral	Cow and Buffaloes
36.	*Lawsonia inermis* L.	Manjuati	Lythraceae	Tree	0.26	Leafs	GUD- 17 (maintain pregnancy)	Paste	Oral	Goat and Sheep
37.	*Leucas aspera* (Willd.)	Gayasha	Lamiaceae	Herb	0.37 0.21	Whole plant	DID- 24 (wound) HD- 13 (intestinal worms)	Juice	Oral	Goat and Sheep
38.	*Mangifera indica* Linn.	Aamba	Anacardiaceae	Tree	0.16	Bark	GIA- 10(loose motion)	Paste	Oral	Goat
39.	*Mimosa pudica* L.	Lajakuli	Mimosaceae	Herb	0.16	Leaf	FVR -10 (fever)	Paste	Oral	Cow
40.	*Ocimum sanctum* Linn.	Tulasi	Lamiaceae	Herb	1.11	Leaf	FVR- 71 (smallpox)	Paste	Oral	Poultry
41.	*Ocimum basilicum* L.	Dhala dahana	Lamiaceae	Herb	0.55	Leaf	RSD- 35 (cold)	Juice	Oral	Goat and Sheep
42.	*Phoenix acaulis* Roxb.	Sindhi khajuri	Palmaceae	Tree	0.11	Leaf	HD- 7 (stomach worm)	Decoction	Oral	Calf, Goat and Sheep
43.	*Piper nigram* Linn.	golamaricha	Piperaceae	Herb	0.29	Leaf and seed	FVR- 19 (chickenpox)	Paste	Oral	Poultry and birds
44.	*Plumbago zeylanica* L.	Sweta chitaparu	Plumbaginaceae	Shrub	0.16	Leaf	GIA- 10 (improve hunger and digestion)	Feed stuff	Oral	Goat
45.	*Pongamia pinnata* (L.)	Karanja	Fabaceae	Tree	0.37 0.41	Leaf and bark	FVR- 24 (fever) GIA- 26 (dysentery)	Paste and juice	Oral	Cow, Goat and Sheep
46.	*Portulaca oleracea* L.	Nuni saga	Portulaceae	Herb	0.21	Whole plant	GUD- 13 (easy delivery)	Whole plant	Oral	Goat and Cow
47.	*Punica granatum*	Dalimba	Punicaceae	Herb	0.26	Fruit	HD- 17 (stomach worm)	Fruit as feed	Oral	Goat and Cow

48.	*Ricinus communis* L.	Jada	Euphorbiaceae	Shrub	0.37 0.23	Leaf , Seed oil	GIA- 24 (dysentery) GIA-15 (constipation)	Whole leaf as feed	Oral	Goat and Sheep
49.	*Rouwolfia serpentina* (L.) G Bentham ex W.S. Kurtz	Serpagandha	Euphorbiaceae	Shrub	0.87	Root	GIA- 56 (dysentery)	Paste	Oral	Cow
50.	*Solanum indicum*	Bhejibaigana	Solanaceae	Herb	0.32	Fruit	ED- 20 (watering in eye)	Juice	Internal	Cow and Goat
51.	*Tamarindus indica* Linn.	Tentuli	Caesaipiniaceae	Tree	0.76	Fruit	PB- 49 (Poisonous feed)	Fruit pulp	Oral	Cow and Oxen
52.	*Terminalia arjuna* Roxb.	Shaja	Combre taceae	Tree	0.76	Bark	PB- 49 (anti venom for snake bite)	Paste	Topical	Goat and Sheep
53.	*Terminalia chebula* Retz.	Harida	Combretaceae	Tree	0.16 0.23	Fruit and bark	GIA- 10 (digestion and stomach ache) FVR- 15 (fever)	Decoction	Oral	Sheep and Goat
54.	*Tridax procumbens* L.	Bisalyakarani	Asteraceae	Herb	1.18	Whole plant	DID-76 (wound)	Paste	Topical	Cow and Goat
55.	*Vitex negundo* L. Nocchimaram	Nirgundi	Verbenaceae	Tree	1.17	Leaf	GIA- 75 (stomach infection)	Paste	Oral	Cow
56.	*Ziziphus mauritiana* Lam.	Barakoli	Rhamnaceae	Tree	1.18 0.62	Whole plant	HD- 76 (intestinal worms) GIA- 40 (diarrhoea)	Leaf	Oral	Goat and Sheep

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