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Original Article

Quantitative traditional knowledge of medicinal plants used to treat livestock diseases from Kudavasal taluk of Thiruvarur district, Tamil Nadu, India

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ABSTRACT

Medicinal plants are treating and preventing various diseases. There is urgency in recording such data. This is first ethno botanical study in which statistical calculations about plants are done by Informant Consensus Factor method in the study area. The aim of the present study is to identify plants collected for medicinal purposes by the traditional healers of Kudavasal taluk located in Thiruvarur district of Tamil Nadu, India and to document prepare and use the traditional names of these plants. Field study was carried out for a period of one year in (tk), located in Thiruvarur district of Tamil Nadu. The ethnoveterinary information's were collected through interviews among traditional healers. The collected data were analyzed through RFC, UV, CI, FI, RI and ICF. A total of 54 species of plants distributed in 51 genera belonging to 33 families were identified as commonly used ethno medicinal plants by traditional healers in Kudavasal (tk) for the treatment of 12 ailment categories based on the animal body systems treated. Leaves are the most frequently used plant parts and most of the medicines are prepared in the form of paste, administrated orally and inhalation. The most important species according to their use value are *Oryza sativa* (0.977). In these studies some of the plant species are first position in relative importance *Datura metel* (2.00) followed by *Azadirachta indica* (1.80). ICF values of the present study indicate that a urological ailment is the highest use report. In this study, documenting the medicinal plants and associated indigenous knowledge can be used for conservation and sustainable use of medicinal plants in the area and for validation of these plant preparations for veterinary treatment. The study has various socioeconomic dimensions associated with the local communities.

Introduction

Knowledge can arise from scientific or traditional sources (Santos García-Alvarado et al., 2001). Particularly traditional knowledge has been described as a cumulative body of knowledge, practice and belief, evolving through adaptive processes and handed over through generations by cultural transmission (Berkes et al., 2003). Traditional medicine is used throughout the world as it is heavily dependent on locally available plant species and plant-based products and capitalizes on traditional wisdom-repository of knowledge (Awas and Demissew, 2009). The wide spread use of traditional medicine could be attributed to cultural acceptability, economic affordability and efficacy against certain type of diseases as compared to modern medicines. Thus, different local communities in countries across the world have indigenous experience in various medicinal plants where they use their perceptions and experiences to categorize plants and plant parts to be used when dealing with different ailments (Omoruyi et al., 2012).

The knowledge of medicinal plants has been accumulated in the course of many centuries based on different medicinal system such as Ayurveda, Unani and Siddha (Fabricant and Farnsworth, 2001). Especially knowledge of ethnobotanical is documented in various parts of the Indian sub-continent. Local inhabitants have used several plants and herbs as ethnoveterinary medicine in order to cure the ailments of livestock (Das and Tag, 2006; Udhyan et al., 2005).

Livestock plays a vital role in (Indian) farmer's life. It gives manure, fuel, milk and meat, etc and also generates rural economy and rural employment. Farmers take care of their livestock using ethnoveterinary medicine. These medicines are cheaper than western drugs (Zschocke et al., 2000a; Masika et al., 2000; Tabuti et al., 2003; Yinegar et al., 2007; Masika and Afolayan, 2003; Kone and

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Atindehou, 2008). Ethnoveterinary medicine was practised as early as 1800 BC King Hamurabi of Babylon formulated a law on veterinary fees and charged for treating cattle and donkeys (Schillhorn van Veen, 1996). But for more than a decade now ethnoveterinary medicine has experienced a revival and several reports published. The growing interest in traditional practices has been encouraged by the recognition of some efficacious ethnoveterinary medicinal products. These products are locally available and easily accessible compared with western drugs. In the face of these and other factors, this increases interest in the field of ethnoveterinary research and development (Zschocke et al., 2000b; Masika et al., 2000; Tabuti et al., 2003; Yinegar et al., 2007; Masika and Afolayan, 2003; Kone and Atindehou, 2008). No ethnoveterinary survey has been carried out in Thiruvarur district. Therefore, an attempt has been made to describe the various diseases prevalent animals in district Thiruvarur and also to document the ethnoveterinary plants and practices used to treat them. We also determined the, frequency citation (FC) relative frequency citation (RFC), frequency index (FI), cultural important index (CI), relative importance (RI), informant consensus factor (ICF) of the ethnoveterinary diseases and use-value of the plant species.

Table 1
Demographic profile of the informants included in the survey ($N = 305$).

Demographic features	Number of people	Percent (%)
Age		
30 years	22	7.21%
31–40	47	15.40%
51–60	55	18.03%
61–70	89	29.18%
71–80	69	22.62%
Above 81	23	7.54%
Gender		
Men	201	65.90%
Women	104	34.10%
Education		
a. Able to read and write	24	7.86%
b. Elementary School	38	12.45%
c. Diploma	54	17.70%
d. Degree	77	25.24%
Cattle herders		
a. Goat	63	20.65%
b. Cow	22	7.21%
c. Pig	26	8.52%

Materials and methods

Selection of traditional healers

Scheduled Castes and Scheduled Tribes are accountable for 14.35% and 66% of the population respectively. The average literacy of the town, Kudavasal was 82%, compared to the national average of 72.99% (Census, 2011a). The town had a total of 14,997 households. There were a total of 18,953 workers, comprising 672 cultivators, 960 main agricultural labourers, 318 in house hold industries, 15,596 other workers, 1407 marginal workers, 47 marginal cultivators, 261 marginal agricultural labourers, 52 marginal workers in household industries and 1047 other marginal workers (Censusinfo India, 2011). The population of the Kudavasal taluk according to the 2011 census, the taluk had a population of 205,625 with 102,597 males and 103,028 females. There were 1004 women for every 1000 men. The taluk had a literacy rate of 75.78. Child population in the age group below 6 was 9454 males and 9247 females (http://en.wikipedia.org/wiki/Kudavasal_taluk). The informants or traditional healers were selected based on their knowledge of medicinal plants in the study area (Appendix A). Totally 305 informants were selected out of them 201 men and 104 women between the ages of 30–83 to get the ethnoveterinary information's through direct interviews or oral conversations (Table 1).

Investigation sites

Thiruvarur lies in the Kaveri River basin and the main occupation of the inhabitants of the town and surrounding regions is agriculture (Palanithurai and Ramesh, 2008). More than 70% of the workforce is involved in agriculture; 14% being cultivators and rest are agricultural labourers (MSME Development Institute, 2012). Paddy is cultivated in three seasons namely Kuruvai (June–August), Samba (August–January) and Thaladi (January–March) (Palanithurai and Ramesh, 2008). The daily wages of the agricultural labourers is more than the rates fixed by the Tamil Nadu government, but due to the decline in number of days of work, the income levels are lower (Palanithurai and Ramesh, 2008). As of 1998, the male labourers were employed 150 days a year, while the female labourers for 120 days (Palanithurai and Ramesh, 2008). A government report in 2006 put these numbers at 120 and 100 days respectively (Palanithurai and Ramesh, 2008). Due to the discontinuity in the working days, the labourers migrate to other states like Gujarat and Kerala. They also shift to other professions like construction industry in the urban centres and textile industry in the district (Palanithurai and Ramesh, 2008). The study area was investigated to get information from local traditional healers having practical knowledge of medicinal plants were interviewed in 13 villages of Adippulevur, Alathur, Iammampatti, Kadakakudi, Kiliyur, Koothanur, Manjakudi, Thiruvidacheri, Serukudi, Suraikayur, Vadavar, Vilagam and Vayalore, Kudavasal (taluk), Thiruvarur (dt), Tamil Nadu, India (Fig. 1). The field surveys were conducted between February 2014 and January 2015 in Kudavasal taluk of Thiruvarur district. A total of 365 field days was spent together for the data. Methods of selecting informants depended upon the distribution of local people having sound knowledge. They were requested to collect specimens of the plants they know or to show the plant species on site. These informants were traditional practitioners themselves or had tradition of healing in their families and had knowledge of the medicinal use of the plants. The wealth of medicinal plants knowledge among the people of this district is based on hundreds of years of beliefs and observations (Appendix B).

Preservation of plant specimens

Standard method was followed with record to collection of plant materials, drying, mounting, preparation and preservation of plant specimens (Jain, 1964). Voucher specimens of medicinal plants in triplicate were collected, prepared and identified. Plants with their correct nomenclature were arranged alphabetically by family name, vernacular name and ethno medicinal uses. The identification and nomenclature of the listed plants were based on the Flora of Presidency of Madras (Gamble, 1935) and the Flora of Tamil Nadu Carnatic (Matthew, 1983). They were later verified at Botanical Survey of India, Southern Circle, Coimbatore, India. All the preserved specimens were deposited at the Herbarium of A.V.V.M.S.P. College (Pushpam Herbarium Cabinet (PHC)), Poondi.

Quantitative analysis

Relative frequency citation (RFC)

This index used here is the relative frequency of citation (RFC). This index is obtained by dividing the number of informants mentioning a useful species (FC or frequency of citation), by the total number of informants in the survey (N). RFC value varies from

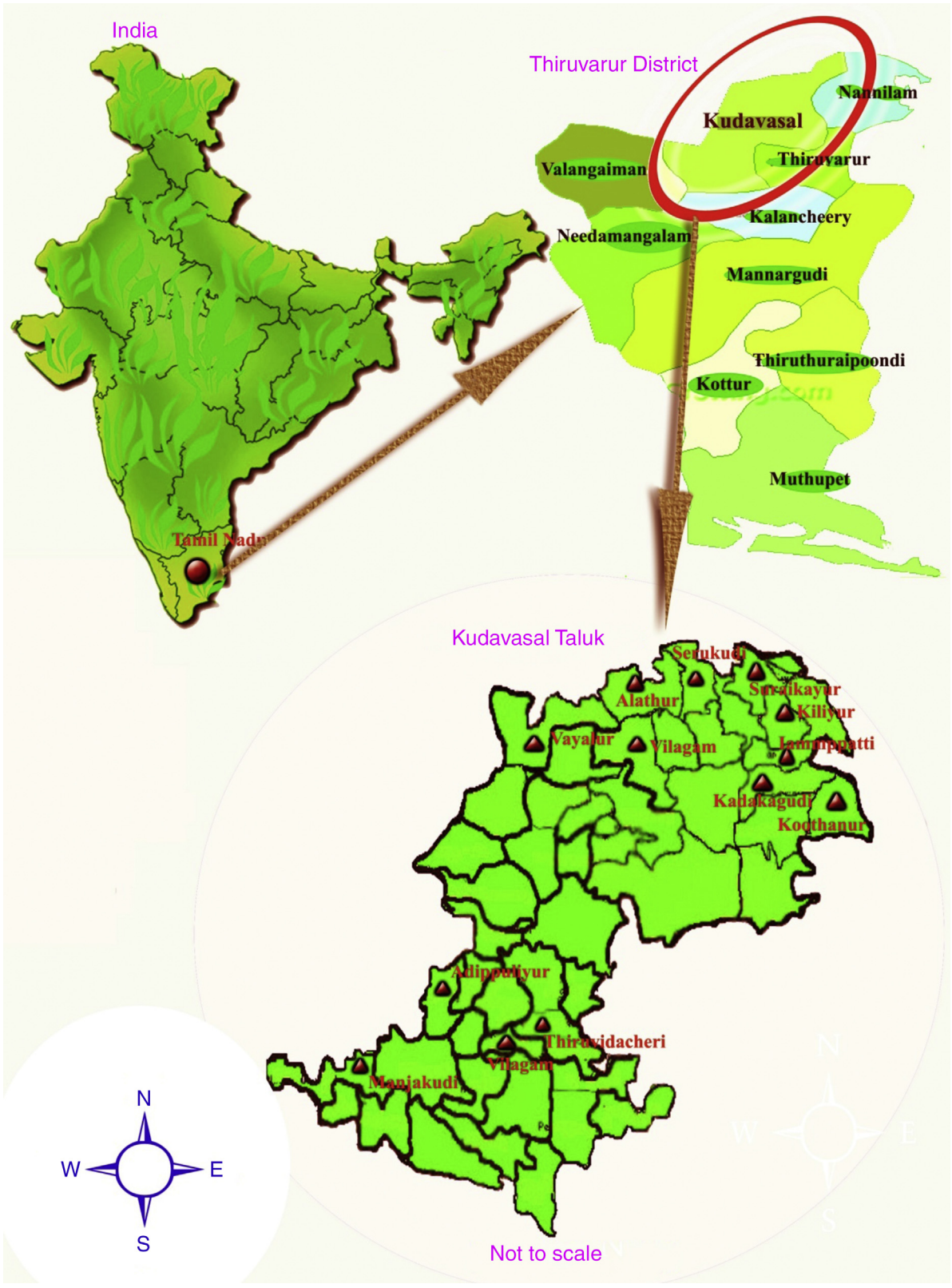

Fig. 1. Investigation sites.

0 (when nobody refers to a plant as a useful one), to 1 (when all the informants mentioning it as useful) (Tardio and Pardo-de Santayana, 2008). RFC index, which does not consider the use-category (UR or use-report is a single record for use of a plant mentioned by an individual) and RFC calculated by the following formula:

$$RFC_s = \frac{FC_s}{N} = \frac{\sum_{i=i_1}^{i_N} UR_i}{N}$$

Use value (UV)

The use value (UV) demonstrates the relative importance of plants known locally. It was calculated using the following formula (Gazzaneo et al., 2005).

$$UV = \sum \frac{U_i}{N}$$

where U_i is the number of uses mentioned by each informant for a given species and N is the total number of informants.

Cultural importance index (CI)

The second approach used in our study is the cultural importance index (CI) (Tardio and Pardo-de Santayana, 2008). This index is calculated by the sum of the proportion of informants mentioning each species use (*i.e.* the sum of the number of participants who mention the use of each species divided by the total number of informants (N)). This index is calculated by the following formula:

$$CIi = \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} \frac{URui}{N}$$

This index takes into account the spread of the use (number of informants) for each species along with its versatility, *i.e.* the diversity of its applications (Tardio and Pardo-de Santayana, 2008).

Relative importance

The relative importance (RI) of plant species cited by the informants is calculated as follows (Kadir et al., 2012): RI = PP + AC; where PP = the number of pharmacological properties (reported specific ailments) attributed to a species divided by the maximum number of properties attributed to the most resourceful species (species with the highest number of properties). AC = the number of ailment categories treated by a given species divided by the maximum number of ailment categories treated by the most resourceful species. A value of 2, is the highest possible value for relative importance (RI) indicating the most versatile species with the greatest number of medicinal properties (Oliveira et al., 2010).

Frequency index

To compare the relative importance of each plant species, frequency index was calculated. According to Mahwasane et al. (2013), frequency index is a numerical expression of the percentage frequency of citation for a single plant species by informants. The following formula was used to calculate frequency index (Madikizela et al., 2012):

$$FI = FC = N \times 100$$

where FC is the number of informants who mentioned the use of the plant species, and N is the total number of informants in each area; 33 in Adippulevur, 34 in Alathur, 25 in Iammampatti, 43 in Kadakakudi, 29 in Kiliyur, 23 in Koothanur, 17 in Manjakudi, 19 in Thiruvidacheri, 20 in Serukudi, 12 in Suraikayur, 10 in Vadavar, 17 in Vilagam and 23 in Vayalore (Fig. 2). The frequency index was high when there were many informants that mentioned a particular plant and low when there were few reports.

Informant consensus factor

The informant consensus factor (ICF) was used to see if there was agreement in the use of plants in the ailment categories between the plant users in the study area. The F_{ic} was calculated using the following formula (Heinrich et al., 1998)

$$ICF = \frac{N_{ur} - N_t}{N_{ur} - 1}$$

where N_{ur} refers to the number of use-reports for a particular ailment category and N_t refers to the number of taxa used for a particular ailment category by all informants. The product of this factor ranges from 0 to 1. A high value (close to 1.0) indicates that relatively few taxa are used by a large proportion of the informants. A low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness.

Results and discussion

Demographic characteristics of informants

Face to face interviews were conducted for resolving and registering demographic characteristics of respondents. Among the healers the age groups of 61–70 was very high compared to other groups. Just 7.21% of healers were below 30 years old. There were no equal dividends as for as male–female ratio concern. Around 63.4% of healers were cattle proprietors (Table 1). Regarding the demography of the informants, both dominated middle aged healers and non-dominated other workers were documented in the study. As indicated high male–female ratio, women's role as traditional healers was less than male traditional healers. Still it remains a male exclusive domain. Even in several previous works with traditional medical practitioners in India the same fact was recorded. Yirga et al. (2012) conducted a study in Seharti-Samre district, Northern Ethiopia and reported that men occupied major of part treated on animals while men occupied major portion of the sellers of traditional medicine. Similar to our study is concerned, major portion of men involved in traditional medicine perform their service as birth attendants. Though the general figure showed a major portion of the healers are uneducated or poorly educated, cattle herders, many of the young practitioners hold degree/diploma. Some of the practitioners also refer the patients to biomedical doctors/technician store view their health status and they are able to read and understand the reports of some basic lab-tests such as blood glucose levels. Some of them are also collecting these reports as a proof efficacy of their treatment. A major portion of the practitioners practice this medicine as a part time job.

Different plant families recorded

The plants used for medicinal purposes in the regions are presented in with Table 2 relevant information. As a result of study, 54 medicinal plant species belonging to 33 families were found in the research area. The most represented family was Fabaceae, Euphorbiaceae, Malvaceae, Poaceae and Solanaceae has the high number of (3 species) followed by Acanthaceae, Anacardiaceae, Asteraceae, Caesalpiniaceae, Liliaceae, Lamiaceae, Meliaceae, Moraceae, Myrtaceae, Rutaceae and Sapindaceae with each two species, Other families with one species each (Table 3). The high proposal of medicinal species Fabaceae families has already reported (Prabhu et al., 2014; Verma, 2014). Fabaceae also known to have the highest number species, more than any other plant family in the world (Marles and Farnsworth, 1995).

Table 2
Plants used livestock diseases in Kudavasal taluk, Thiruvarur (dt).

No.	Binomial name/family and voucher no.	Vernacular name	Habits and habitats	Parts used	Ailment categories, no. of informant with illness	UR and FC	RFC	Use value	CI	FI	RI	Preparations	Applications	Mixed with solvents	Types of animal treated
1.	*Abrus precatorius* L. Fabaceae PHC2501	Kundumani	Herb (roadside)	Leaves Root	PB:6-swellings NA:2-vasoconstrictor	8/56	0.183	0.026	0.142	2.62	1.06	Paste Powder	Topical Oral	Butter milk Cherry	Buffalo and Pig
2.	*Abutilon indicum* G. Don. Malvaceae PHC2512	Thuththi	Herb (garden)	Leaves Fruit	GIA:21-dysentery GIA:14-Diarrhea	35/78	0.255	0.114	0.448	11.4	0.73	Juice Juice	Oral Oral	Cow's buttermilk	Cow and Goat
3.	*Acalypha indica* L. Euphorbiaceae PHC2517	Kuppaimaeni	Herb (wasteland)	Leaves	DA:5-heal wounds	5/34	0.111	0.016	0.147	1.63	0.53	Paste	Topical	Salt	Cow, Goat and Hen
4.	*Achyranthes aspera* L. Amaranthacae PHC2523	Nayuruvi	Herb (wasteland)	Leaves Leaves	EA:34-watering in eyes GIA:29-rectal prolaps	63/87	0.285	0.206	0.724	20.6	1.06	Juice Paste	Topical Oral	– Butter	Donkey, Goat and Hen
5.	*Adhatoda vasica* Nees. Acanthaceae PHC2502	Adathoda	Shrub (roadside)	Leaves Leaves Bark	RA:11-cough GIA:9-diarrhea GIA:2-dysentery	23/44	0.144	0.075	0.522	7.54	1.26	Decoction Juice Juice	Oral Oral Oral	Water Water Water	Cow and goat
6.	*Aegle marmelos* L. Rutaceae PHC2511	Vilvam	Tree (wild)	Leaves Seed	GUA:5-prevent premature delivery DA:6-inflammation	11/23	0.075	0.036	0.478	3.60	1.06	Raw Paste	Oral Topical	– Mustered oil	Buffalo and goat
7.	*Aloe vera* L. Liliaceae PHC2528	Soaththuukatralai	Herb (garden)	Leaves Leaves	PA:17-unconscious condition GUA:17-anoestrus	34/38	0.124	0.111	0.894	11.1	1.06	Paste Raw	Oral Oral		Cow and Horse
8.	*Andrographis paniculata* Burm. F Acanthaceae PHC2513	Chiriyanangai	Shrub (roadside)	Leaves Rhizome	RA:16-cough FA:3-fever	19/22	0.072	0.062	0.863	6.22	1.06	Decoction Decoction	Oral Oral	Water Water	Cow and Pig
9.	*Asparagus racemosus* Willd Liliaceae PHC2503	Thanneervittaan	Creeper (garden)	Whole plant Root	GIA:10-constipation SMA:19-arthritis	29/37	0.121	0.095	0.783	9.50	1.06	Juice Powder	Oral Oral	Water Milk	Cow and Donkey Cow and Goat
10.	*Aristolochia bracteolate* Lam. Aristolochiaceae PHC2541	Aaduthinna paalai	Creeper (riverside)	Leaves	DA:18-skin diseases	18/25	0.081	0.059	0.720	5.90	0.53	Boiled	Topical	Gingelly oil	Cow, goat
11.	*Azadirachta indica* A. Juss Meliaceae PHC2554	Vaembu	Tree (roadside)	Seed Leaves Leaves Bark	DA:2-wounds PB:3-insect bites FA:1-ephemeral fever DA:1-skin diseases	7/32	0.104	0.022	0.021	2.29	1.80	Seed oil Juice Juice Paste	Topical Topical Oral Topical	 Castor oil Water	Cow and Hen
12.	*Calotropis gigantea* (L.) R. Br. Asclepiadaceae PHC2514	Vella erukku	Herb (wasteland)	Root Latex	ENTA:28-running nose DA:20-wounds on legs	58/122	0.367	0.190	0.475	19.0	1.06	Raw Raw	Inhalation Topical		Cow and Horse
13.	*Cardiospermum halicacabum* L. Sapindaceae PHC2542	Mudakaththaan	Creeper (roadside)	Leaves	FA:29-fever	29/101	0.331	0.095	0.287	9.50	0.53	Paste	Oral	Pepper and garlic	Buffalo
14.	*Cassia auriculata* L. Caesalpiniaceae PHC2527	Aavaarai	Shrub (agriculture land)	Stem	GIA:38-dysentery	38/75	0.245	0.124	0.506	12.4	0.53	Paste	Oral	Butter milk and jaggery	Goat

Table 2 (*Continued*)

No.	Binomial name/family and voucher no.	Vernacular name	Habits and habitats	Parts used	Ailment categories, no. of informant with illness	UR and FC	RFC	Use value	CI	FI	RI	Preparations	Applications	Mixed with solvents	Types of animal treated
15.	*Cassia fistula* L. Caesalpiniaceae PHC2522	Konnai	Tree (riverside)	Bark Leaves Ripe pod	FA:13-fever GIA:21-improve appetite GIA:22-constipation	56/97	0.318	0.183	0.577	18.3	1.26	Paste Paste Paste	Oral Oral Oral	Pepper and garlic Mustard oil –	Cow
16.	*Cissus quadrangularis* L. Vitaceae PHC2553	Pirandai	Creeper (wild)	Leaves	FA:63-fever	63/117	0.383	0.206	0.538	20.6	0.53	Decoction	Oral	Pepper and garlic	Donkey
17.	*Cynodon dactylon* Pers. Poaceae PHC2515	Arugan	Herb (mud)	Aerial part Leaves	GUA:52-increasing lactation EA:25-conjunctivitis	77/195	0.639	0.252	0.394	25.2	1.06	Raw Juice	Oral Topical	– –	Cow
18.	*Coccinia indica* (L.) Voigt. Cucurbitaceae PHC2537	Koavai	Creeper (wild)	Leaves	ENTA:78-running nose	78/176	0.577	0.255	0.443	25.5	0.53	Juice	Oral	-	Horse and Goat
19.	*Datura metel* L. Solanaceae PHC2504	Oomathai	Herb (roadside)	Fruit Fruit Fruit Leaves Root	GIA:13-dysentery GIA:27-lack of appetite RA:6-cold DA:14-bleeding wounds DA:3-skin diseases	63/63	0.206	0.206	1.000	20.6	2.00	Roasted Raw Paste Paste Raw	Oral Oral Oral Topical Oral	Gingely oil – – – 	Horse Cow
20.	*Dodonea viscosa* L. Sapindaceae PHC2538	Kannuppeelai	Shrub (wild)	Leaves	DA:32-leg bandage	32/40	0.131	0.104	0.800	10.4	0.53	Paste	Topical	Goat milk	Cow
21.	*Eclipta prostata*. L. Asteraceae PHC2530	Karishalaankanni	Herb (mud)	Leaves	DA:27-wounds	27/77	0.252	0.088	0.350	8.85	0.53	Paste	Topical	Mustard oil	All animals
22.	*Euphobia hirta* L. Euphorbiaceae PHC2529	Ammanpaccarisi	Herb (mud)	Latex	DA:39-wounds	39/68	0.222	0.127	0.573	12.7	0.53	Raw	Topical	–	Horse and Hen
23.	*Ficus benghalensis* L. Moraceae PHC2506	Aalam	Tree (wild)	Latex Root	DA:14-maggot wound GIA:13-stomach ache	27/57	0.186	0.088	0.473	8.85	1.06	Raw Paste	Topical Oral	Oil	Horse
24.	*Ficus religiosa* L. Moraceae PHC2536	Arasam	Tree (wild)	Leaves	ENTA:18-tonsils problems	18/23	0.075	0.059	0.782	5.90	0.53	Juice	Oral	–	Cow and sheep
25.	*Gymnema sylvestre* (L.) R.Br. Asclepiadaceae PHC2518	Sirukurunjaan	Woody Climber (wild)	Leaves	FA:8-fever	8/12	0.039	0.026	0.666	2.62	0.53	Paste	Oral	–	Cow
26.	*Hibiscus rosa-sinensis* L. Malvaceae PHC2507	Sembaruthi	Shrub (garden)	Bark	SMA:6-twitching	6/45	0.147	0.019	0.133	1.96	0.53	Paste	Oral	–	Sheep
27.	*Lannea coromandelica* (Hutt.) Merr Anacardiaceae PHC2552	Uthiyamaram	Tree (pondside)	Bark	FA:9-fever	9/31	0.101	0.029	0.290	2.95	0.53	Paste	Oral	–	Hen

28.	*Leucas aspera* Spreng. Lamiaceae PHC2516	Thumbai	Herb (wasteland)	Leaves Flower	DA:8-wounds FA:4-fever	12/45	0.147	0.039	0.266	3.93	1.06	Juice Juice	Oral Oral	– –	All animals
29.	*Madhuca indica* J.F. Gmel Sapotaceae PHC2550	Iluppai	Tree (riverside)	Flower	FA:19-fever	19/22	0.006	0.062	0.863	6.22	0.53	Paste	Oral	Jaggery	Sheep
30.	*Mangifera indica* L. Anacardiaceae PHC2539	Maa	Tree (roadside)	Leaves Fruit	GUA:9-placenta GIA:13-indigestion	22/30	0.098	0.072	0.733	7.21	1.06	Raw Paste	Oral Oral	– –	Cow, sheep and horse
31.	*Melia azedarachta* L. Meliaceae PHC2549	Malai vaembu	Tree (wild)	Leaves	DA:13-mange mites	13/35	0.114	0.042	0.371	4.26	0.53	Juice	Oral	Water	Sheep
32.	*Mimosa pudica* L. Mimosaceae PHC2535	Thottasiningi	Herb (mud)	Leaves	FA:29-fever	29/37	0.121	0.095	0.783	9.50	0.53	Paste	Oral	– Lime juice	Donkey
33.	*Moringa oleifera* Lampk. Moringaceae PHC2519	Murungai	Tree (garden)	Leaves Pod Root	GIA:7-dysentery SMA:11-rheumatism GIA:15-ulcers	33/41	0.134	0.108	0.804	10.8	1.26	Paste Paste Juice	Oral Oral Oral	– – Water	Goat
34.	*Murraya koenigii* (L). Spreng Rutaceae PHC2543	Karivaeppilai	Tree (wild)	Leaves	GUA:45-repeat bleeding problem	45/199	0.652	0.147	0.226	14.7	0.53	Raw	Oral	–	Sheep
35.	*Musa paradisiaca* L. MUSACEAE PHC2545	Vaazhai	Tree (agricultural land)	Leaves	GHA:29-body heat	29/61	0.200	0.095	0.475	9.50	0.53	Raw	Oral	–	All animals
36.	*Nerium oleander* Sol. Apocynaceae PHC2533	Arali	Tree (wild)	Latex	DA:69-maggot wound	69/220	0.072	0.226	0.313	22.6	0.53	Raw	Topical	–	Hen
37.	*Ocimum tenuiflorum*. L. Lamiaceae PHC2508	Thulasi	Herb (wasteland)	Leaves Stem Leaves	RA:11-cold DCA:5-teeth crack RA:13-cough	29/42	0.137	0.095	0.690	9.50	1.26	Juice Juice Decoction	Oral Topical Oral	 Cow butter	Sheep
38.	*Oryza sativa* L. Poaceae PHC2544	Nel	Herb (agricultural land)	Seed	GUA:94-to enhance lactation	298/305	1.000	0.977	0.977	30.8	0.53	Boiled	Oral	Water	Cow
39.	*Pedalium murex* L. Pedaliaceae PHC2551	Perunerunjil	Herb (wild)	Leaves	FA:48-fever	48/270	0.885	0.157	0.177	15.7	0.53	Paste	Oral	–	Sheep
40.	*Pongamia glabra* Vent. Fabaceae PHC2534	Pungan	Tree (wild)	Bark	GIA:46-dysentery	46/305	1.000	0.150	0.383	15.0	0.53	Decoction	Oral	Water	Sheep
41.	*Psidium guajava*. L. Myrtaceae PHC2547	Koyya	Tree (garden)	Leaves	FA:36-fever	36/69	0.226	0.118	0.565	11.8	0.53	Decoction	Oral	Water	Cow
42.	*Ricinus communis* L. Euphorbiaceae PHC2546	Aamanakku	Herb (agricultural land)	Seed Seed	GIA:41-bottle jaw GIA:22-constipation	63/280	0.918	0.206	0.225	20.6	1.06	Paste Raw	Oral Oral	–	Donkey

Table 2 (*Continued*)

No.	Binomial name/family and voucher no.	Vernacular name	Habits and habitats	Parts used	Ailment categories, no. of informant with illness	UR and FC	RFC	Use value	CI	FI	RI	Preparations	Applications	Mixed with solvents	Types of animal treated
43.	*Sida acuta*. Burn. Malvaceae PHC2524	Arival manai poondu	Shrub (waste land)	Leaves	DA:83-cuts	199/204	0.980	0.652	0.956	27.2	0.53	Paste	Topical	–	Cow, horse and sheep
44.	*Solanum trilobatum* L. Solanaceae PHC2548	Thoodhuvalai	Herb (roadside)	Fruit	EA:61-eye problem	61/305	1.000	0.200	0.200	20.0	0.53	Juice	Topical	–	Donkey
45.	*Solanum nigrum* SW. Solanaceae PHC2526	Manathakkaali	Herb (garden)	Leaves	FA:49-fever	49/63	0.206	0.160	0.777	16.0	0.53	Raw	Oral	–	Sheep
46.	*Syzygium cumini* Walp. Myrtaceae PHC2532	Naval	Tree (wild)	Bark Bark	GIA:23-diarrhoea SMA:26-joint pain	53/78	0.255	0.173	0.679	17.3	1.06	Decoction Decoction	Oral Oral	Water	Horse
47.	*Tamarindus indica* L. Fabaceae PHC2540	Puliyam	Tree (roadside)	Leaves Fruit	SMA:17-swelling ENTA:35-tongue sores	52/75	0.245	0.170	0.693	17.0	1.06	Boiled Paste	Topical Topical	Mustard oil	Horse
48.	*Tinospora cordifolia* (Thunb.) Miers Menispermaceae	Seenthil kodi	Creeper (waste land)	Stem	RA:64-cough	64/98	0.321	0.209	0.653	20.9	0.53	Raw	Oral	–	Sheep
49.	*Tribulus terrestris* L. Zygophyllaceae PHC2531	Nerinchil	Herb (waste land)	Leaves	GIA:63-diarrhoea	63/99	0.324	0.206	0.636	20.6	0.53	Juice	Oral	Water	Donkey
50.	*Tridax procumbens* L. Asteraceae PHC2525	Mookuththi poo	Herb (mud)	Leaves	DA:57-wound	57/97	0.318	0.186	0.587	18.6	0.53	Paste	Topical	–	Horse
51.	*Vigna mungo* (L.) R. Wilczek Fabaceae PHC2521	Passi payaru	Herb (agriculturtal land)	Seed	RA:64-cold	64/250	0.819	0.209	0.533	20.9	0.53	Powder	Oral	–	Sheep, goat and Buffalo
52.	*Vitex negundo* L. Verbenaceae PHC2509	Noachi	Tree (wild)	Leaves Root Leaves	DA:12-infectious diseases GIA:8-diarrhoea GIA:11-dysentery	31/40	0.131	0.101	0.775	10.1	1.26	Paste Decoction Dried	Oral Oral Oral	– Water Water	Buffalo
53.	*Zingiber officinale* L. Zingiberaceae PHC2520	Inji	Herb (agricultural land)	Rhizome Rhizome	EA:17-conjuctivitis GHA:19-physical strength	36/77	0.252	0.118	0.467	11.8	1.06	Juice Boiled	Oral Oral	– Cow milk	Donkey
54.	*Zizyphus jujupa* L. Rhamnaceae PHC2510	Ilanthai	Tree (wild)	Fruit Leaves	RA:8-cough DA:77-burns	203/205	0.836	0.659	0.980	27.8	1.06	Raw Paste	Oral Oral	– –	Goat

UR – use-reports; FC – frequency citation; RFC – relative frequency citation; CI – cultural index; FI – frequency index; RI – relative importance.

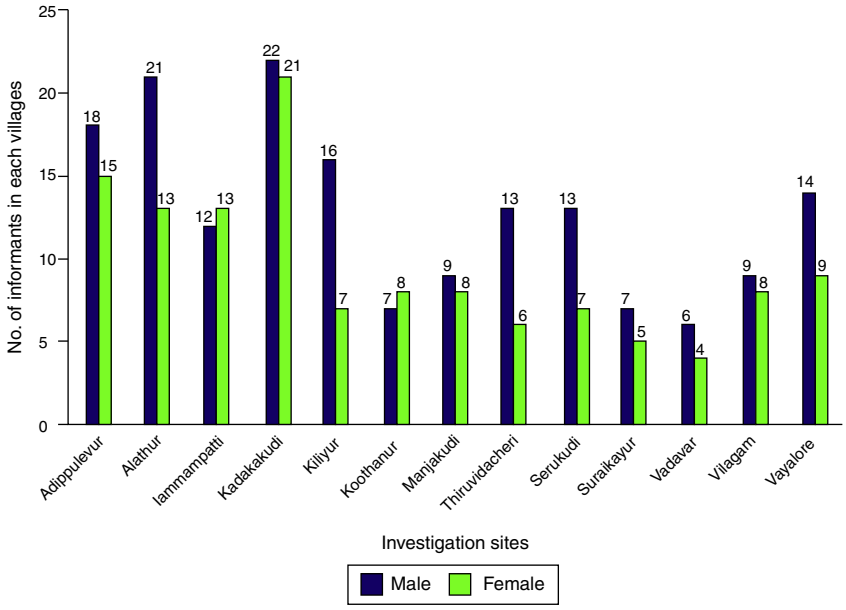

Fig. 2. Number of male and female informant's on investigation sites.

Habit of medicinal plants

In the current survey, 42% of the reported species are herb. Other highly reported species are tree (36%), climber and shrub (each 11%) (Fig. 3). The common use of herbaceous medicinal plants was also reported in other parts of the world (Addo-Fordjour et al., 2008) and attributed to their wide range of bioactive ingredients (Gazzaneo et al., 2005). Traditional healers used herbs and trees most commonly as medicine due to the availability in nature (Uniyal et al., 2006; Sanz-Biset et al., 2009).

Habitat of medicinal plants

Most of the ethnoveterinary medicinal plants were collected from the different parts of the locality such as garden, roadside, riverside, ponds side, wasteland, agriculture land and wild. Plants are collected from the areas are given in (Table 2) and also percentage of cultivated areas are shown in Fig. 4. Most of the ethnoveterinary medicinal plants were collected from the garden (28%) followed by roadside (24%), wild (19%), mud (11%), riverside (8%), agriculture land (6%) and wasteland (4%). The similar study

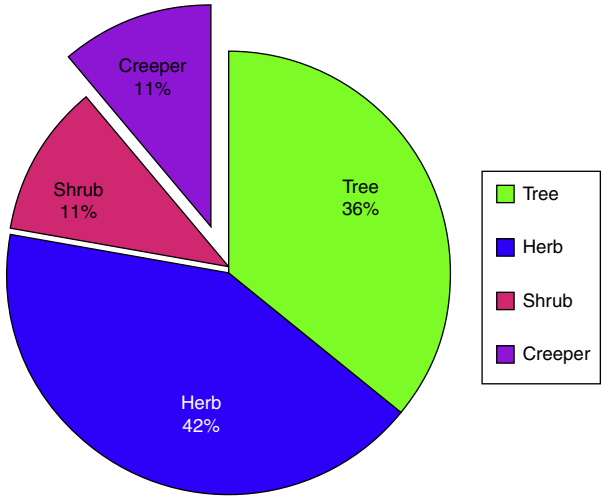

Fig. 3. Percentage of habits.

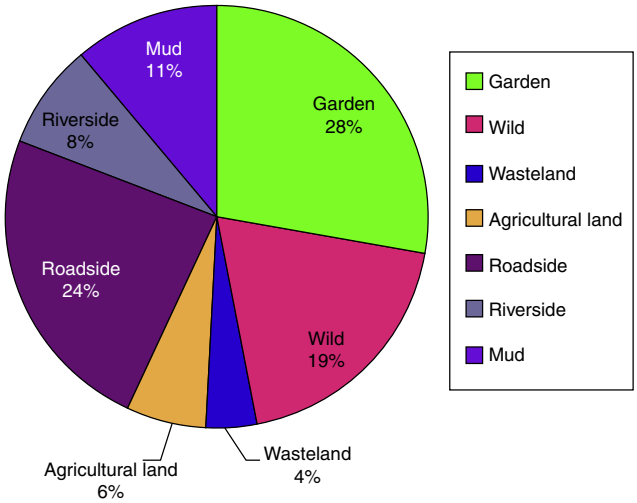

Fig. 4. Percentage of habitats.

Table 3
Percentage of plant families.

R. no.	Name of the families	No. of species	% of species
1.	Euphorbiaceae	3	5.55%
2.	Fabaceae	3	5.55%
3.	Malvaceae	3	5.55%
4.	Poaceae	3	5.55%
5.	Solanaceae	3	5.55%
6.	Acanthaceae	2	3.70%
7.	Anacardiaceae	2	3.70%
8.	Asteraceae	2	3.70%
9.	Caesalpiniaceae	2	3.70%
10.	Liliaceae	2	3.70%
11.	Lamiaceae	2	3.70%
12.	Meliaceae	2	3.70%
13.	Moraceae	2	3.70%
14.	Myrtaceae	2	3.70%
15.	Rutaceae	2	3.70%
16.	Sapindaceae	2	3.70%
17.	Others	17	31.48%

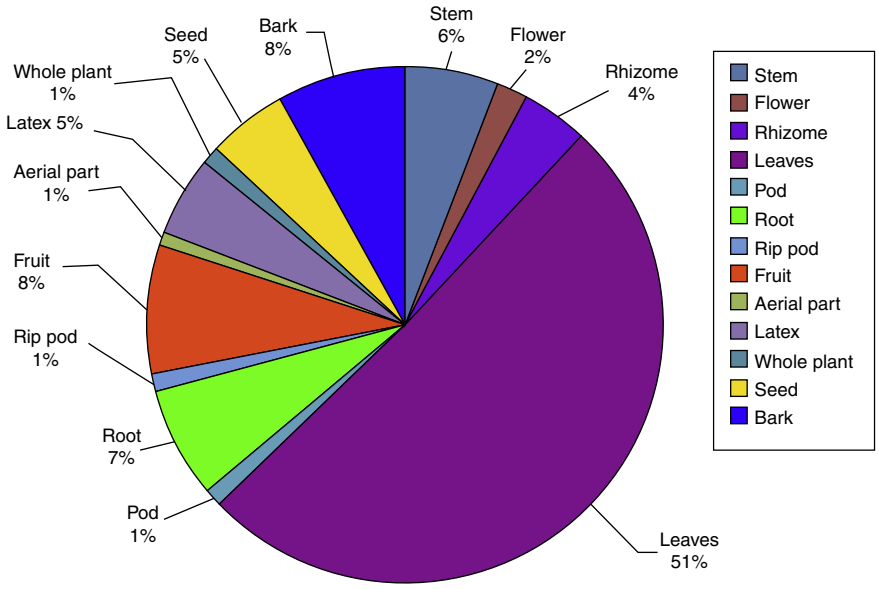

Fig. 5. Percentage of parts used.

Yirga et al. (2012) reported that habitat of ethnoveterinary medicinal plants collected by different places.

Plant parts used for indigenous medicine

Plant parts used by the traditional healers of Kudavasal (taluk) to treat various ailments were mainly leaves, fruits and seeds. Aerial parts of plant and whole plants were also used in case of small herbaceous plants. The most frequently utilized medicinal plants parts were leaves (51%) used for the preparation of medicine solely, it was followed by fruit and bark (each 8%), root (7%), stem (6%), seed and latex (each 5%), rhizome (4%), flower (2%), aerial part, pod, rip pod and whole (each 1%) (Fig. 5). All over the world tribal communities, utilized for the preparation of herbal medicine using leaves (Ullah et al., 2013; Morvin Yabesh et al., 2014; Prabhu et al., 2014; Vijayakumar et al., 2015). The reason why leaves were used mostly is that they are collected very easily than underground parts flowers and fruits etc. (Giday et al., 2009) and in scientific point of view leaves are active in photosynthesis and production of metabolites (Ghorbani, 2005).

Mode of preparations and administrations in indigenous medicine

Considering the mode of preparation of herbal medicines, reports include paste, powder, decoction, juice, raw and fumes. Among these majority of the plant remedies were prepared by paste (36%) followed by juice (23%), raw (20%), decoction (10%), boiled (5%), powder (3%) and seed oil, dried and roasted (each 1%) (Fig. 6). Similarly Saha et al. (2014) reported that paste can often be found as one of the major forms of drug preparation in ethnoveterinary practices as it is easy to prepare by pestle and mortar with or without water. In some cases, the processing involves drying of the plant material followed by grinding into fine powder. Water is commonly used if a solvent is required for the preparation. Sometimes milk or honey is used as a matrix or added to increase a viscosity of the preparation (Islam et al., 2014). The present study

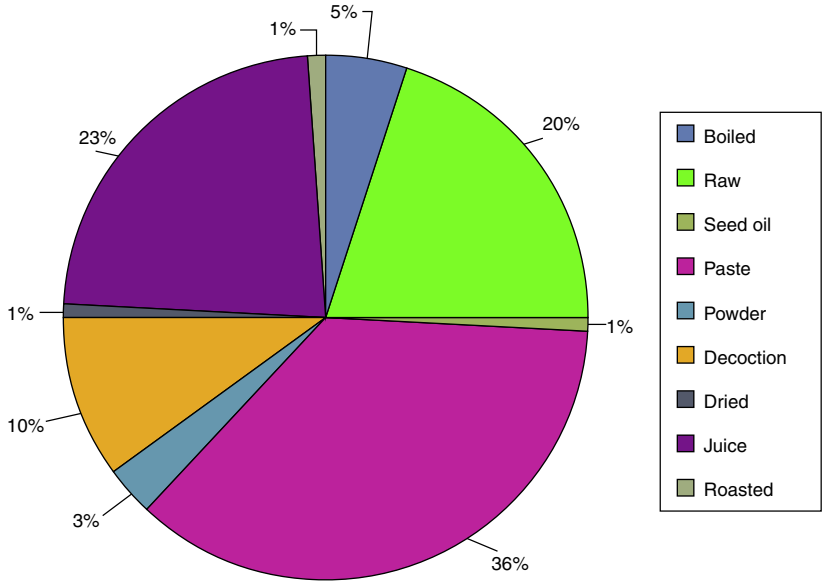

Fig. 6. Percentage of preparation.

Table 4
Informant consensus factor for ailment categories.

S. no.	Ailment categories	Number of use reports (N_{ur})	Number of taxa (N_t)	Informant consensus factor (ICF)
1.	Urological ailments (UA)	2	1	1.00
2.	Psychological ailments (PA)	17	1	1.00
3.	Ear, nose, throat ailments (ENTA)	159	4	0.98
4.	General health ailments (GHA)	48	2	0.98
5.	Eye ailments (EA)	137	4	0.97
6.	Gynecological/andrological ailments (GAA)	227	7	0.97
7.	Dermatological ailments (DA)	500	19	0.96
8.	Respiratory ailments (RA)	193	8	0.96
9.	Fever ailments (FA)	311	13	0.96
10.	Gastro-intestinal ailments (GIA)	468	22	0.95
11.	Skeleto-muscular ailments (SMA)	79	5	0.95
12.	Poisonous bites ailments (PBA)	9	2	0.87
	Total	2150	88	

traditional healers of this region often add castor oil used as bark paste and water used as leaves juice (*e.g. Azadirachta indica*). Paste is made by crushing plant parts using pestle and mortar and when mixing it with mustered oil (*e.g. Aegle marmelos*). Oral administration was the main mode (75%) of intake of medicine and external administration of topical (25%) these modes of preparation and administration are the most used in traditional medicine. Similar results were obtained in previous ethnoveterinary surveys carried out in Northern Ethiopia and Vhembe region, Limpopo province, South Africa (Yirga et al., 2012; Luseba and Tshisikhawe, 2014).

Use report and use ailments

A total of 2148 use reports have been documented in these surveys which are categorized in twelve different ailments. These include dermatological ailments totally 500 use reports which is the highest number of records (Table 4). Similarly Saha et al. (2014) reported that the dermatological ailment is the highest use category in India.

Quantitative analysis

Cultural index and relative frequency citation

Oryza sativa has the highest number of use-reports (298 UR) in our study followed by *Zizyphus jujupa* and *Sida acuta* with 201 and 199 use-reports, respectively, and are placed in first position by CI indices (Table 2). This means that this species has been mentioned by all informants and is the most recognized plant in the region. Also, because of the highest values of these species have the most diverse uses. *O. sativa*, *Z. jujupa* and *S. acuta* which were ranked first by RFC respectively (Table 2).

Use value

The most commonly used species was *O. sativa* with 94 use reports by 298, giving the highest use value of 0.977 *O. sativa* is attributed to its use in the treatment of various diseases and it is well recognized all the informants as an lactation (Table 3). The similar study from the ethnoveterinary remedies of diseases among milk yielding animals in Kathua, Jammu and Kashmir, India, traditional healers ethnoveterinary uses of *O. sativa* in treatment of hair fall, increase milk (Sharma et al., 2012) followed by *Z. jujupa* (85 use reports by 203 informants with a UV of 0.659), *S. acuta* (83 use reports by 83 informants with a UV of 0.652), *Coccinia indica* (78 use reports by 78 informants with a UV of 0.255), *Cynodon dactylon* (52 use reports by 77 informants with a UV of 0.252), *Nerium oleander* (69 use reports by 69 informants with a UV of 0.226) and *Vigna mungo* (64 use reports by 64 informants with a UV of 0.209). Generally these plants are frequently used by the traditional healers in other parts of the world (Naik et al., 2012; Selvaraju et al., 2011). The value of use value was generally on the high side, which emphasis that the informants have great rate of dispersal of knowledge about the ethnoveterinary plants and practices.

The very low use value *Acalypha indica* (five use reports by five informants with a UV of 0.016), *Hibiscus rosa-sinensis* (six use reports by six informants with a UV of 0.019), *Abrus precatorius* (eight use reports by eight informants with a UV of 0.026), *A. indica* (seven use reports by seven informants with a UV of 0.022), *Gymnema sylvestre* (eight use reports by eight informants with a UV of 0.026), *Lannea corromandalica* (nine use reports by nine informants with a UV of 0.0.029), *A. marmelos* (11 use reports by 11 informants with a UV of 0.036) and *Leucas aspera* (12 use reports by 12 informants with a UV of 0. 039) of which *A. indica* was a new claim and also used in poison bites and ephemeral fever, others are regularly using this plant in the treatment of wound and insect bites. Similar were supported (Selvaraju et al., 2011; Naik et al., 2012). The present study reported 14.8% species were lowest use values. Similarly Sharma et al. (2012) reported that 27.8% of the species were lower (<0.50) use value. Plants with low use-values are not necessarily unimportant, but having low use-values indicates that traditional knowledge about them is at risk of not being transmitted and that it may be gradually disappearing (Chaudhary et al., 2006) or the scarcity of plant species (Benz et al., 1994).

Relative importance

The plants with the greatest number of medicinal purposes (five) were found to be *Datura metel* followed by *A. indica* (four medicinal uses). Moreover, the high relative importance (RI) value of *D. metel* (RI = 2.00) reported might be an indication of its high availability and affordability in the study area. *D. metel* is used for the one medicinal uses from the tribal community of Malda district of West Bengal, India (Saha et al., 2014).

Informant consensus factor

The Informant consensus factor (*ICF*) 12 ailments were shown in Table 4. The most ailment categories have both the highest level of informant agreement (mean *ICF* = 0.95) and the total consensus (*ICF* = 1.00) obtained for urological ailments (UA) (ICF = 1.00) (Table 4). In an ethnoveterinary study of remedies of diseases among milk yielding animals in Kathua, Jammu and Kashmir, India informants had the highest level of agreement for most of the ailments (mean *ICF* = 0.95) dermatological ailment obtained (ICF = 1.00) (Sharma et al., 2012). This shows the persistent use of traditional medicinal plants by local people in one part of India (Naik et al., 2012). This point to the fact that although the local people have access to government health care systems, still medicinal plants have not lost their values among the people living. Also, high *ICF* values can be used to pinpoint interesting species in search of bioactive compounds (Canales et al., 2005).

Conclusion

In the present study, first quantitative ethnoveterinary survey in the thirteen selected sites of Kudavasal taluk, Thiruvarur district of Tamil Nadu, India. Among the documented 54 plant species belonging to 33 families Euphorbiaceae, Malvaceae, Poaceae and Solanaceae are the mostly used families in the area. The leaves are the favoured part of local users. The most treated illnesses of the Kudavasal taluk is using medicinal plants are grouped into 12 ailment categories. Documentation of this knowledge is valuable for the communities and their future generations and for scientific consideration of wider uses of traditional knowledge in treating domestic animals. The low cost and no side effects of these traditional preparations with medicinal plants make them adaptable by the local community. The wealth of this traditional knowledge of medicinal plants points to a great potential for research and the discovery of new drugs to cure the diseases of animals. So, further scientific assessment of these medicines for phytochemical, biological, pre-clinical and clinical studies is, however, greatly needed. The present research work indicates that research projects should be designed in priority on this area for the pharmacological evaluation and conservation of medicinal plants of this area.

Authors contributions

RP assisted in collecting and identifying plant samples, making a herbarium. JEMY assisted in the conducting data analysis and drafting the paper. SV undertook a critical reading of the manuscript. SP was responsible for maintenance of herbarium. All the authors have read the final manuscript and agreed to its submission for appraisal.

Conflicts of interest

The authors declare no conflicts of interest.

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Appendix A.

1. Participant's name and surname.
2. Age and gender.
3. Name of the village.
4. Educational qualification of the participant.
5. Occupation of traditional healers.
6. How long do you live in the residential place?
7. Name of the used local plant.
8. What are the diseases cured by this plant?
9. How can you make the plant for use with solvents?
10. Do you know how and when will you use the plant?
11. How to prepare traditional medicine?
12. How to apply on affected area?
13. Which animal is mostly affected in this area?
14. How many cattle herders are living?

Appendix B.

1. Which pharmaceutical local plants their parents and grandparents use?
2. Which part of the pharmaceutical plants they use?
3. Which purpose they use?
4. How they use them?

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