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An ethnoveterinary study on plants used for livestock diseases in Theni and Madurai districts, Tamil Nadu, India

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Abstract

The present study deals with the ethnoveterinary plants used to treat livestock diseases in Melmangalam village, Theni district and Thenparankundram of Madurai district, Tamil Nadu. About 59 medicinal plant species belonging to 34 families under 56 genera are used traditionally to treat 30 different livestock disease conditions were recorded in this study with the help of livestock rearers *Naatuvaidyas* of the study area. The collected data suggested that most of the plants' were herbs and the majority belongs to Leguminosae family; the most dominant family in the study area. Leaves were the most common part used to prepare different formulations and the preparations were mostly in the form of paste and administered topically. Some of the common medicinal plants used for ethnoveterinary treatment include *Allium cepa* L., *Allium sativum* L., *Azadirachta indica* A. Juss., *Cissus quadrangularis* L., *Leucas aspera* (Willd.) Link, *Piper nigrum* L., etc. The people in the study area depend on this traditional system of medicine for treating their livestocks like cattle, goat and poultry. Since this indigenous knowledge has been followed for a long time, it is pertinent to identify the herbal potential of the medicinal plants. Hence, this study has documented the ethnoveterinary treatments used by the livestock owners of the study area to treat the livestock diseases along with the botanical names of the plants, family, habit, vernacular names of the plants, mode of preparation of drug, mode of administration, plant parts used and disease conditions.

Keywords: Herbal healers, Indigenous knowledge, Livestock diseases, Traditional system of medicine

1. Introduction

India is one among the twelve mega biodiversity countries with rich vegetation and a huge empire of ethnobotanical wealth (Pal, 2009). The rich and diverse flora of India makes it a reservoir of medicinal plants that can help in treating the human and animal ailments. A large number of people in India depend on traditional herbal medicine (Dubey *et al*., 2004). Ethnoveterinary medicine is defined as an indigenous system of medicine of the rural communities that involves the knowledge, skills, methods, practices, and beliefs about livestock diseases treatment (McCorkle, 1968). Livestock is very important for a farmer's livelihood since it gives him food, fuel and organic manure thereby generating rural livelihood and employment (Parthiban *et al*., 2016). The livestock owners in India have been using plant based herbal medicine since time immemorial (Bhuvaneswari *et al*., 2016). Ethnoveterinary medicine is cost effective and also dynamic (Warren, 1991). The locally available medicinal plants are suitable alternative for the expensive modern medicine. Ethnoveterinary medicine has become popular worldwide especially in primary health care since it is very useful for the poor (Banumathi and Vaseeharan, 2015). Though this herbal system of medicine plays a very important role in the animal healthcare of most developing countries, much effort is not being taken by these countries in research and integration activities (Yinegar *et al*., 2007). India's rich traditional knowledge in the

field of ethnoveterinary medicines and practices has been vanishing due to modernization (Devendrakumar and Anbazhagan, 2012). The rapid depletion of traditional knowledge is due to less or no documentation (Rao *et al*., 2008). The information available on ethnoveterinary medicine is not only scarce but failed to reach rural farmers in India (Geetha *et al*., 1996) and Tamil Nadu in particular (Ganesan *et al*., 2008). Hence, documentation of the indigenous knowledge is very much necessary for conservation as well as utilization of biological resources (Yogeswari *et al*., 2017). The characteristics and intensity of the ethnoveterinary systems differ greatly among individuals, societies, and regions (Viegi *et al*., 2003). Thus, it becomes important to study the locally available plants that are being used as ethnoveterinary medicines in the selected study areas. The main objective of this study was to document the traditional knowledge regarding ethnoveterinary plants used by livestock rearers in Melmangalam village of Theni district and Thenparankundram of Madurai district of Tamil Nadu.

2. Materials and methods

Melmangalam is located in Periyakulam Taluk, Theni district of Tamil Nadu (Fig.1). The latitude is 10.1008016° N and the longitude is 77.5824415° E. The district receives an average annual rainfall of 700 – 800 mm. The minimum and maximum temperature varies between 20°C to 30°C. The study area is 20 km away from the district headquarters Allinagaram. The total geographical area of the village is 3164.64 hectares and it is a Gramapanchayat. The primary occupation in this area is agriculture, cattle rearing and daily wages in farmlands.

Thenparankundram is located in Thirupparankundram town of Madurai district (Fig. 1). The latitude of the study area is 9. 7376° N and the longitude is 78. 4016° E. Average annual rainfall of this district is 840 mm and the average temperature ranges from 28.8°C to 32°C. The primary occupation in this area is cattle rearing and farming.

Many exploratory field visits have been made

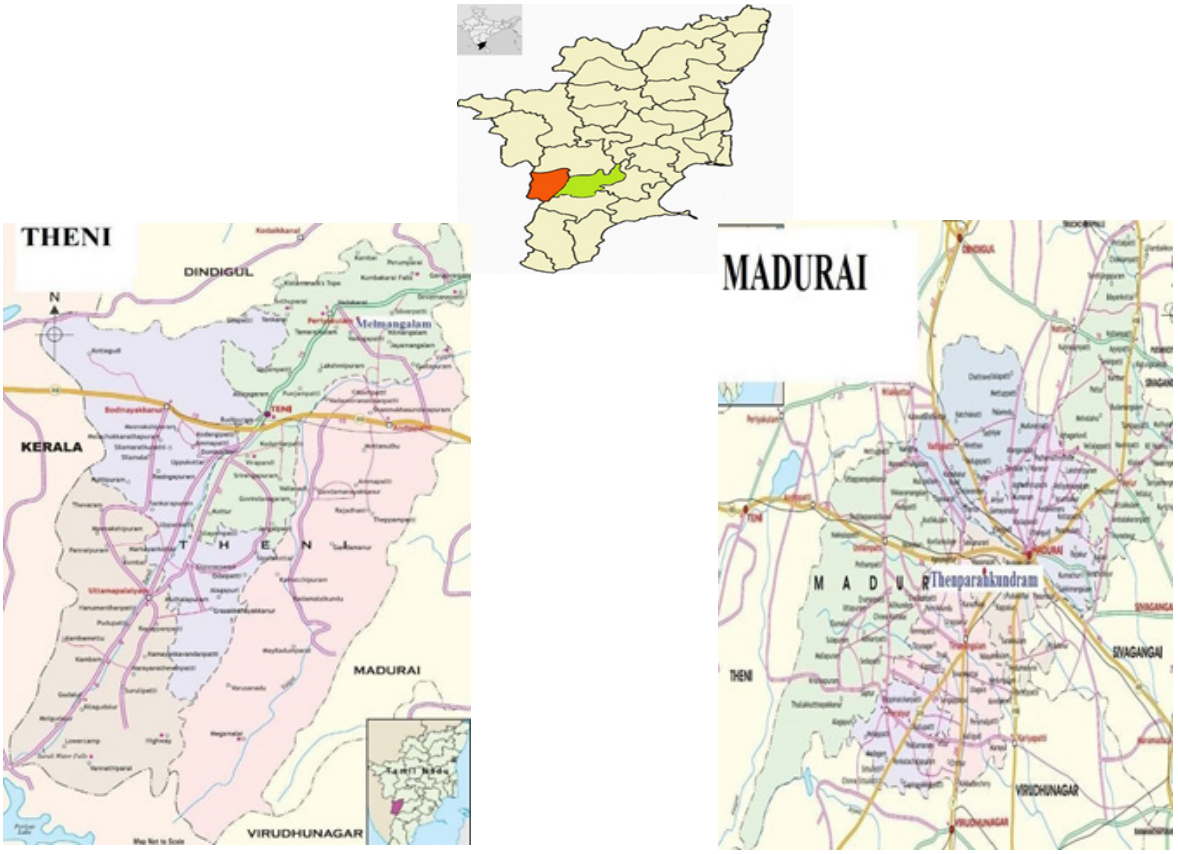

Fig. 1. Study area

Fig. 2. Data collection from the livestock rearers

to the study areas in order to identify the livestock rearers who were willing to share their traditional knowledge between December 2019 and March 2020. During the field visits, face to face interviews (Fig. 2) have been conducted with identified livestock rearers who are having specialized knowledge in the traditional treatment of livestock diseases.

The sampling was non-random, as those livestock rearers who provide information on the use of ethnoveterinary plants for treating their livestock were only selected. The data has been documented through questionnaires and interviews. The semi structured interviews have been conducted through the vernacular language Tamil. The ethnobotanical data has been collected using the methodology suggested earlier (Jain, 2000). Nearly 24 reference livestock owners have been identified and their traditional knowledge has been recorded. They were interviewed for information like local names of the plants, the plant parts used, disease conditions treated, mode of preparation, administration and dosage of the formulation. The plants collected were identified using the Flora of the Presidency of Madras (Gamble, 1995) and the World Flora Online (WFO, 2021).

3. Results and discussion

The results obtained by means of survey were presented in Table 1 and 2. Livestock diseases and the ethnoveterinary treatments followed in the study area are represented in Table 1. While botanical name, family, habit, local name, mode of preparation, route of administration, plant parts used, diseases cured and animals treated are represented in Table 2.

Table 1. Ethnoveterinary treatment for different livestock diseases used by livestock rearers of Melmangalam and Thenparankundram

Sl. No.	Disease	Treatment
1	Bleb	1. Leaves of neem (*Azadirachta indica* A. Juss), turmeric powder (*Curcuma longa* L.) and crystal salt were ground well to paste which was applied topically on blebs of cow once daily for a week. 2. The leaves of neem and turmeric powder were boiled in neem oil (or) water which was ground to paste and applied topically over the blebs of chicken twice a day for ten days.
2	Bloat	1. Betel leaves (*Piper betle* L.) and *pirandai* (*Cissus quadrangularis* L.) stem were ground well with garlic (*Allium sativum* L.), cumin (*Cuminum cyminum* L.), ginger (*Zingiber officinale* Roscoe), turmeric powder (*Curcuma longa* L.), jaggery and salt to a fine paste which was applied topically onto the animal's abdomen twice daily for a week. 2. Five betel leaves, pepper (*Piper nigrum* L.), ginger, fenugreek (*Trigonella foenum-graecum* L.) were ground to juice with palm sugar which was given internally to the goat two times daily for one week.
3	Blood scour	Leaves and fruits of *manathakkali* (*Solanum americanum* Mill.), onion (*Allium cepa* L.), pepper (*Piper nigrum* L.), and aloe (*Aloe vera* (L.) Burm.f.) gel was ground well. The paste was mixed with water and given orally to the chick twice a day for a week.
4	Bone fracture	1. Leaves and stem of *pirandai* (*Cissus quadrangularis* L.) were made into a paste with sesame oil (*Sesamum indicum* L.) and a pinch of turmeric powder (*Curcuma longa* L.) and applied topically over the region two times per day for a week. 2. The leaves of *seenthil* (*Tinospora sinensis* (Lour.) Merr.), *virali* (*Dodonaea viscosa* (L.) Jacq.) and *ulunthu* seeds (*Vigna mungo* (L.) Hepper) were ground with limestone as paste and applied topically over the fractured area for a week. 3. The stem of *pirandai*, *sampulichan* leaves (*Erythroxylum monogynum* Roxb.), sesame oil and a pinch of turmeric powder were ground into paste and applied topically over the fractured area twice a day for a week.
5	Cold	1. The juice from the leaves of *thumbai* (*Leucas aspera* (Willd.) Link) was extracted and mixed with drumstick (*Moringa oleifera* Lam.) leaves juice extract. This juice was then poured into the nose as nasal drops for the goat twice a day for eight days. 2. With leaves of holy basil (*Ocimum tenuiflorum L.*) and drumstick add turmeric powder (*Curcuma longa* L.), cumin (*Cuminum cyminum* L.), pepper (*Piper nigrum* L.) and palm sugar which were ground into paste. This paste was diluted and administered orally twice a day for a week.
6	Constipation	1. Leaf extract of *kolanchi* (*Tephrosia purpurea* (L.) Pers.), chilly (*Capsicum annuum* L.) and red gram (*Cajanus cajan* (L.) Millsp) were ground into juice and given orally to the goat once a day for 3 days to cure completely. 2. Aqueous paste of *sembai* (*Parkinsonia aculeata* L.), leaves of *kolanchi,* chilly and red gram were ground to paste. The ground paste was given orally to the goat once a day until the condition is cured completely.
7	Cowpox	1. Leaves of *kuppaimeni* (*Acalypha indica* L.), neem (*Azadirachta indica* A. Juss.), and *nilavembu* (*Andrographis paniculata* (Burm.f.) Nees) were ground to paste with pepper (*Piper nigrum* L.) and salt and given orally twice a day for eight days. 2. The leaves of neem were boiled in neem oil or water and applied topically over the pox lesions.

8	Diarrhoea	1. Fresh flowers of *vazhai* (*Musa paradisiaca* L.) were fed orally to the cow thrice a day for a week. 2. Whole plant of *pillaimarathuchedi* (*Acorus calamus* L.) was ground to juice and administered orally with coconut (*Cocos nucifera* L.) oil to the affected goat once a day until it was cured completely. 3. Leaves juice of *kallathi maram* (*Ficus tinctoria* G. Forst.) was given orally to the affected goats once a day for three days
9	Dysentery	1. The tubers of *thanneervittan kilangu* (*Asparagus racemosus* Willd.) were ground into juice and given orally in early morning and evening for two days. 2. The tender shoots of *thanneervittan kilangu* were ground into paste and mixed with jaggery and butter milk. This paste was administered orally in the early morning and in the evening for two days. 3. Leaves of *sangu poo* (*Clitoria ternatea* L.) were ground and with 100 g of leaf paste, garlic (*Allium sativum* L.), turmeric powder (*Curcuma longa* L.) and jaggery were added. This paste is administered orally two times per day for two days.
10	Exhalation	1. To the betel leaves (*Piper betle* L.), a small amount of pepper paste (*Piper nigrum* L.) was added, rolled and given to the cattle orally two times a day for a week. 2. The whole plant of *nayuruvi* (*Achyranthes aspera* L.) was ground into juice and given orally two times per day for three days. 3. Leaves of *sangu poo* (*Clitoria ternatea* L.) were ground into juice, mixed with jaggery and buttermilk and then given orally two times a day for three days. 4. Five betel leaves, pepper, five garlic (*Allium sativum* L.)/ginger (*Zingiber officinale* Roscoe)/limestone were ground to paste and administered orally to the cow/goat twice/thrice/once daily for a week.
11	Eye infection	Leaves of *puliyarai* (*Oxalis corniculata* L.) were ground to juice with water and used as eye drops for cows and goats.
12	Fever	Roots of *aanai katralai* (*Agave americana* L.), tubers of *nilabanai* (*Curculigo orchioides* Gaertn.), roots of *nilavembu* (*Andrographis paniculata* (Burm.f.) Nees), leaves of *nochi* (*Vitex negundo* L.) and leaves of *veppalai* (*Wrightia tinctoria* R. Br.) were ground into paste. With 100 g of paste, pepper (*Piper nigrum* L.) and garlic (*Allium sativum* L.) were ground into juice. This juice was given orally for 3 days.
13	Jaundice	1. The leaves and roots of *keelanelli* (*Phyllanthus niruri* L.) were ground to juice with water. The juice was administered orally twice every day for a week. 2. The leaves and roots of *keelanelli* were ground to juice with water and mixed with turmeric powder (*Curcuma longa* L.). The juice was given orally to the cow twice a day for 8 days.
14	Foot and Mouth Disease (FMD)	1. The leaves of *tulasi* (*Ocimum tenuiflorum* L.), neem (*Azadirachta indica* A. Juss.), *kuppaimeni* (*Acalypha indica* L.), *marudhani* (*Lawsonia inermis* L.), 10 g turmeric powder (*Curcuma longa* L.) and five garlic (*Allium sativum* L.) were ground to paste which was applied to the lesions in the mouth and foot twice a day for a week and the decoction prepared using the same plants was also administered orally. 2. Neem leaves, turmeric tuber and salt were ground into paste which was diluted and given orally to the goat two times daily for one week. 3. Leaves of *kuppaimeni* (*Acalypha indica* L.), boiled coconut (*Cocos nucifera* L.) and palm sugar were ground with cumin (*Cuminum cyminum* L.), pepper (*Piper nigrum* L.), *anise* (*Pimpinella anisum* L.) and fenugreek (*Trigonella foenum-graecum* L.) into paste which was diluted and applied topically over mouth thrice a day for two weeks. 4. Porridge made with finger millet (*Secale cereale* L.) and bananas (*Musa paradisiaca* L.) were given three times daily for one week. 5. Neem leaves, turmeric powder and neem oil were ground to paste, diluted and applied topically over the lesions in the mouth and foot of cattle twice a day for one week.

		6. Cumin (*Cuminum cyminum* L.), pepper (*Piper nigrum* L.), *anise*, *pirandai* (*Cissus quadrangularis* L.) stem, boiled coconut and onion (*Allium cepa* L.) were ground to paste and applied topically over mouth.
15	Goat pox	Neem leaves (*Azadirachta indica* A. Juss.) and turmeric tubers (*Curcuma longa* L.) were ground well, the paste was applied topically onto the pox lesions thoroughly. Repeat this once daily for a week.
16	Hoof inflammation	1. Neem leaves (*Azadirachta indica* A. Juss.) and turmeric powder (*Curcuma longa* L.) were boiled in neem oil and ground to paste with crystal salt which was applied topically over hoof inflammation twice a day for a week. 2. *Marudhani* leaves (*Lawsonia inermis* L.) and turmeric powder (*Curcuma longa* L.) was boiled with neem oil which was used to wash the inflammation of hoof externally twice a day for two weeks.
17	Maggot wound	1. Whole plant of *Thottasinungi* (*Mimosa pudica* L.) was extracted and the juice is mixed with turmeric powder (*Curcuma longa* L.) and goat milk. The juice was applied topically to the affected area twice a day for five days. 2. Seeds of *aavarai* (*Senna auriculata.* (L.) Roxb.) were ground into paste and mixed with turmeric powder, *thottasinungi* leaves juice and goat milk. The paste was applied topically to the affected area twice a day for five days.
18	Mastitis	1. Fruit juice of lemon (*Citrus limon* (L.) Osbeck), Aloe vera (*Aloe vera* (L.) Burm. f.) gel, turmeric powder (*Curcuma longa* L.) and five betel leaves (*Piper betle* L.) were ground to paste with water and applied topically around the udder twice a day for two weeks. 2. Lemon juice and limestone were ground to paste which was diluted and applied topically around the udder thrice a day until inflammation subsides completely. 3. Aloe gel and turmeric powder were ground to paste which was diluted and applied topically around the udder three times daily for a week.
19	Insect bite	1. The root juice of *nilavembu* (*Andrographis paniculata* (Burm. f.) Nees) was mixed with pepper (*Piper nigrum* L.) and given orally thrice a day for two days. 2. Along with roots of *thalai suruli* (*Aristolochia indica* L.) and stem of *seenthil* (*Tinospora sinensis* (Lour.) Merr.), 10 g of pound pepper was boiled in water. The decoction was given orally two times a day for two days.
20	Neck swelling	1. Fruits of *kachampuli* (*Garcinia gummi-gutta* (L.) Roxb.) were well ground to paste and applied topically on the animal's neck once daily for a week. 2. Fruits of *sarakondrai* (*Cassia fistula* L.) were ground to paste and applied topically on the neck to cure swelling due to cold.
21	Parasitic infection	1. Neem leaves (*Azadirachta indica* A. Juss.), turmeric tuber (*Curcuma longa* L.) and fenugreek (*Trigonella foenum-graecum* L.) were ground well into paste which was diluted with water and administered orally to the cow twice a day. 2. Latex of papaya (*Carica papaya* L.) was mixed with cattle feed and administered orally once a day for six days.
22	External parasite infestation	1. Leaves and flowers of *nayuruvi* (*Achyranthes aspera* L.) were ground to paste with butter and it was applied topically over wounds of cows. 2. Leaves of *kuppaimeni* (*Acalypha indica* L.) and neem leaves (*Azadirachta indica* A. Juss.) were ground and boiled with neem oil. Diluted paste was applied topically over the affected area of cow once a day for two weeks. 3. Neem leaves and turmeric tubers (*Curcuma longa* L.) were boiled well in water which is used to bath the cow once a day for three weeks.

		4. Neem leaves were ground to paste and mixed with neem oil which is applied topically over the skin once a day for three weeks. 5. Leaves of *kuppaimeni* and neem leaves were ground to paste and applied topically to the chick once every day for a week.
23	Retention of placenta	Whole plant of *kundumani* (*Abrus precatorius* L.) was ground to juice (about 100 ml) and was given orally twice a week.
24	Poisonous bite	Leaves of *thumbai* (*Leucas aspera* (Willd.) Link), *nilavembu* (*Andrographis paniculata* (Burm.f.) Nees), pepper (*Piper nigrum* L.), cumin (*Cuminum cyminum* L.), onion (*Allium cepa* L.), betel leaves (*Piper betle* L.) were ground to paste. To which banana stem (*Musa paradisiaca* L.) juice 50 ml, jaggery/palm sugar and salt were added and applied topically to the affected area once daily for a week.
25	Reproductive disorder	Fennel seeds (*Foeniculum vulgare* Mill.) were powdered and administered orally once a day for seven days.
26	Rheumatism	1. Seeds of *kacchuram* (*Caesalpinia bonduc* (L.) Roxb.) and leaves of *mudakkathan* keerai (*Cardiospermum halicacabum* L.) were ground to paste and applied topically over the joints twice a day for a week and the decoction was orally given to the cow twice a week. *2. Kacchuram* seed paste was mixed with turmeric powder (*Curcuma longa* L.) and goat milk and the paste was applied topically over the joints while the decoction was given orally twice a week. 3. Leaves of *nilavarai* (*Senna alexandriana* Mill.) were dried, powdered and made into paste with water, applied topically over joints once a day for eight days.
27	Scour	Curry leaves (*Murraya koenigii* (L.) Spreng.), three garlic (*Allium sativum* L.), onion (*Allium cepa* L.), jaggery/palm sugar were ground to paste. Cumin (*Cuminum cyminum* L.), poppy seed (*Papaver somniferum* L.), fenugreek (*Trigonella foenum-graecum* L.), pepper (*Piper nigrum* L.), asafoetida were ground to paste with turmeric powder (*Curcuma longa* L.) and then mixed with the first paste. To the paste, crystal salt was added. This was applied on the cow's tongue once daily for a week.
28	Snake bite	Leaves of *siriyanangai* (*Andrographis paniculata* (Burm. f.) Nees) were ground and the juice was given orally to the affected cow.
29	White scour	The roots of *keelanelli* (*Phyllanthus niruri* L.), cumin (*Cuminum cyminum* L.), pepper (*Piper nigrum* L.), three garlic (*Allium sativum* L.) and five onion (*Allium cepa* L.) were ground to paste which were then mixed with the feed and fed as chick feed two times daily for five days.
30	Wound	1. Leaves of *vilvam* (*Aegle marmelos* (L.) Correa) were made into paste and mixed with turmeric powder (*Curcuma longa* L.) and applied to the wounds topically once a day for five days. 2. Stem bark paste of *mulvengai* (*Bridelia montana* (Roxb.) Willd.) was mixed with a pinch of turmeric powder and moderately applied on the wound topically twice a day for five days. 3. Leaf paste of *Poonaikali* (*Mucuna pruriens* (L.) DC.) was mixed with turmeric powder and applied to the wounds topically two times a day for a week.

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Table 2. The ethnoveterinary plants in the study area

Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
1.	*Abrus precatorius* L.	Leguminosae	Shrub	*Kundumani*	Whole plant	Retention of placenta in cattle	Juice/ oral
2.	*Acalypha indica* L.	Euphorbiaceae	Herb	*Kuppaimeni*	Leaves	Cattle pox in cattle	Paste/ oral
						Foot & Mouth disease – FMD in cattle, goat	Paste/ topical & Decoction/ oral
						Parasitic infection in cattle	Paste/ topical
						External parasitic infestation in poultry	Paste/ topical
3.	*Achyranthes aspera* L.	Amaranthaceae	Herb	*Nayuruvi*	Whole plant, Leaves	Exhalation in cattle, goat	Juice/ oral
					Flowers	Parasitic infection in cattle	Paste/ topical
						External parasitic infestation in cattle	Paste/ topical
4	*Acorus calamus* L.	Acoraceae	Herb	*Pillaimaratthu chedi*	Whole plant	Diarrhoea in goat	Juice/ oral
5.	*Aegle marmelos* (L.) Correa	Rutaceae	Tree	*Vilvam*	Leaves	Wounds in cattle	Paste/ topical
6.	*Agave americana* L.	Asparagaceae	Herb	*Aanai katralai*	Roots	Fever in cattle	Juice/ oral
7.	*Allium cepa* L.	Amaryllidaceae	Herb	*Vengayam*	Bulb	Blood scour in poultry	Paste/ oral
						FMD in cattle, goat	Paste/ topical
						Poisonous bite in cattle	Paste/ topical
						White scour in poultry	Paste/ oral

Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
8.	*Allium sativum* L.	Amaryllidaceae	Herb	*Vellai poondu*	Bulb	Bloat in cattle	Paste/ topical
						Dysentery in cattle	Paste/ oral
						Exhalation in cattle, goat	Paste/ oral
						Fever in cattle	Juice/ oral
						FMD in cattle goat	Paste/ topical
						Scour in poultry	Paste/ topical
						White scour in poultry	Paste/ oral
9.	*Aloe vera* (L.) Burm.f.	Xanthorrhoeaceae	Herb	*Katralai*	Gel	Mastitis in cattle	Paste/ topical
						Blood scour in poultry	Paste/ oral
10.	*Andrographis paniculata* (Burm.f.) Nees	Acanthaceae	Shrub	*Nilavembu/ siriyanangai*	Roots	Insect bites in cattle	Juice/ oral
					Leaves	Poisonous bite in cattle	Paste/ topical
						Cattle pox in cattle	Paste/ oral
						Fever in cattle	Juice/ oral
						Snake bite in cattle	
11.	*Aristolochia indica* L.	Aristolochiaceae	Herb	*Thalai suruli*	Roots	Insect bite in cattle	Decoction/ oral
12.	*Asparagus racemosus* Willd.	Asparagaceae	Shrub	*Thaneervittan kilangu*	Tuber	Dysentery in cattle	Juice/ oral
					Tender shoots		Paste/ oral

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Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
13.	*Azadirachta indica* A. Juss.	Meliaceae	Tree	*Vembu*	Leaves	Blebs in cattle, poultry	Paste/ topical
						Cattle pox in cattle	Paste/ oral & Juice/ topical
						Goat Pox in goat	Paste/ topical & Decoction/ oral
						FMD - Foot & Mouth disease in cattle, goat	Paste/ oral & Paste/ topical
						Hoof inflammation in cattle	Juice/topical
						Parasitic infections in cattle	Paste/ topical
						External parasitic infestation in poultry	
14.	*Bridelia montana* (Roxb.) Willd.	Phyllanthaceae	Tree	*Mulvengai*	Stem bark	Wounds in cattle	Paste/ topical
15.	*Caesalpinia bonduc* (L.) Roxb.	Leguminosae	Shrub	*Kacchuram*	Seeds	Rheumatism in cattle	Paste/ topical & Decoction/ oral
16.	*Cajanus cajan* (L.) Millsp.	Leguminosae	Shrub	*Thuvarai*	Seeds	Constipation in goat	Juice/ oral & Paste/ oral
17.	*Capsicum annuum* L.	Solanaceae	Herb	*Milagai*	Fruits	Constipation in goat	Juice/ oral & Paste/ oral
18.	*Cardiospermum halicacabum* L.	Sapindaceae	Herb	*Mudakkathan keerai*	Leaves	Rheumatism in cattle	Paste/ topical
19.	*Carica papaya* L.	Caricaceae	Tree	*Pappali*	Latex	Parasitic infections in cattle	Fresh/ oral
20.	*Cassia fistula* L.	Leguminosae	Tree	*Sarakondrai*	Fruits	Neck swelling in goat	Paste/ topical
21	*Cissus quadrangularis* L.	Vitaceae	Shrub	*Pirandai*	Stem	Bloat in cattle	Paste/ topical
					Stem	FMD in cattle, goat	
					Stem & leaves	Bone fracture in cattle	
22.	*Citrus limon* (L.) Osbeck	Rutaceae	Tree	*Elumichchai*	Fruits	Mastitis in cattle	Paste/ topical

Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
23.	*Clitoria ternatea* L.	Leguminosae	Herb	*Sangu poo*	Leaves	Dysentery in cattle	Paste/ oral
						Exhalation in cattle	Juice/ oral
24.	*Cocos nucifera* L.	Arecaceae	Tree	*Thennai*	Fruits	Diarrhoea in goat	Juice/ oral
						FMD in cattle, goat	Paste/ topical
25.	*Cuminum cyminum* L.	Apiaceae	Herb	*Jeeragam*	Fruits	Cold in goat	Paste/ oral
						White scour in poultry	
						FMD in cattle, goat	Paste/ topical
						Poisonous bite in cattle	
						Scour in poultry	
						Bloat in cattle	
26.	*Curculigo orchioides* Gaertn.	Hypoxidaceae	Herb	*Nilabanai*	Tuber	Fever in cattle	Juice/ oral
27.	*Curmcuma longa* L.	Zingiberaceae	Herb	*Manjal*	Tuber	Bloat in cattle	Paste/ topical
						Bone fracture in cattle	
						Cold in goat	Paste/ oral
						Dysentery in cattle	
						Jaundice in cattle	Juice/ oral
						FMD in cattle, goat	Paste/ topical
						Goat Pox in goat	
						Hoof inflammation in cattle	
						Maggot wound in cattle	
						Mastitis in cattle	
						Wound in cattle	
						Rheumatism in cattle	Paste/ topical & Decoction/oral
						Scour in poultry	Extract/ oral
						Parasitic infection in cattle	Paste/ oral & Juice/ topical

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Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
28.	*Dodonaea viscosa* (L.) Jacq.	Sapindaceae	Shrub	*Virali*	Leaves	Bone fracture in cattle	Paste/ topical
29.	*Erythroxylum monogynum* Roxb.	Erythroxylaceae	Tree	*Sampulichan*	Leaves	Bone fracture in cattle	Paste/ topical
30.	*Ficus tinctoria* G. Forst	Moraceae	Tree	*Kallathi maram*	Leaves	Diarrhea in goat	Juice/ oral
31.	*Foeniculum vulgare* Mill.	Apiaceae	Herb	*Sombu*	Seeds	Reproductive disorder in goat	Powder/ oral
32.	*Garcinia gummi-gutta* (L.) Roxb.	Clusiaceae	Tree	*Kachampuli*	Fruits	Neck swelling in cattle	Paste/ topical
33.	*Lawsonia inermis* L.	Lythraceae	Shrub	*Marudhani*	Leaves	Hoof inflammation in cattle	Juice/ topical
						FMD in cattle, goat	Paste/ topical & Decoction/ oral
34.	*Leucas aspera* (Willd.) Link	Lamiaceae	Herb	*Thumbai*	Leaves	Cold in goat, cattle	Juice/ nasal drops
						Poisonous bite in cattle	Paste/ topical
35.	*Mimosa pudica* L.	Leguminosae	Herb	*Thottasinungi*	Whole plant or Leaves	Maggot wound in cattle	Paste/ topical
36.	*Moringa oleifera* Lam.	Moringaceae	Tree	*Murungai*	Leaves	Cold in goat	Juice/ nasal drops & Paste/ oral
37.	*Mucuna pruriens* (L.) DC.	Leguminosae	Shrub	*Poonaikali/ poonaipidukan*	Leaves	Wound in cattle	Paste/ topical
38.	*Murraya koenigii*(L.) Spreng.	Rutaceae	Tree	*Kariveppilai*	Leaves	Scour in poultry	Paste/ topical
39.	*Musa paradisiaca* L.	Musaceae	Tree	*Vaazhai*	Flowers	Diarrhoea in cattle	Fresh/ oral
					Fruits	FMD in cattle, goat	Fresh/ oral
					Stem	Poisonous bite in cattle	Paste/ topical
40.	*Ocimum tenuiflorum* L.	Lamiaceae	Herb	*Tulasi*	Leaves	Cold in goat	Paste/ oral & Paste/ topical
41.	*Oxalis corniculata* L.	Oxalidaceae	Herb	*Puliyarai*	Leaves	Eye infection in cattle, goat	Juice/ eye drops
42.	*Papaver somniferum* L.	Papaveraceae	Herb	*Kasakasa*	Seeds	Scour in poultry	Paste/ topical

Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
43.	*Parkinsonia aculeata* L.	Leguminosae	Shrub	*Sembai*	Leaves	Constipation in goat	Paste/ oral
44.	*Phyllanthus niruri* L.	Phyllanthaceae	Herb	*Keelanelli*	Roots	White scour in poultry	Paste/ oral
					Leaves & Roots	Jaundice in cattle	Juice/ oral
45.	*Pimpinella anisum* L.	Apiaceae	Herb	*Sombu*	Fruits	FMD in cattle, goat	Paste/ topical
46.	*Piper nigrum* L.	Piperaceae	Shrub	*Milagu*	Fruits	Bloat in goat	Juice/ oral
						Blood scour in poultry	Paste/ oral
						Cold in goat	
						Cattle pox in cattle	
						Exhalation in cattle	
						Fever in cattle	Juice/ oral
						Insect bite in cattle	Juice/ oral Decoction/ oral
						FMD in cattle, goat	Paste/ topical
						Poisonous bite in cattle	
						Scour in poultry	
						White scour in poultry	Paste/ oral
47.	*Piper betle* L.	Piperaceae	Shrub	*Vetrilai*	Leaves	Exhalation in cattle	Paste/ oral
						Bloat in goat, cattle	Paste/ topical, Juice/ oral
						Mastitis in in cattle	Paste/ topical
						Poisonous bite in cattle	
48.	*Secale cereale* L.	Poaceae	Herb	*Kambu*	Fruits	Foot & Mouth disease in cattle	Porridge/ oral

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Sl. No.	Botanical name	Family name	Habit	Vernacular name	Part used	Disease condition treated	Mode of preparation/ route of administration
49.	*Senna alexandrina* Mill.	Leguminosae	Shrub	*Nilavarai*	Leaves	Rheumatism in cattle	Paste/ topical
50.	*Senna auriculata* (L.) Roxb.	Leguminosae	Shrub	*Aavarai*	Seeds	Maggot in cattle	Paste/ topical
51.	*Sesamum indicum* L.	Pedaliaceae	Herb	*Ellu*	Seeds	Bone fracture in cattle	Paste/ topical
52.	*Solanum americanum* Mill.	Solanaceae	Shrub	*Manathakkali*	Leaves, Fruits	Blood scour in poultry	Paste/ oral
53.	*Tephrosia purpurea* (L.) Pers.	Leguminosae	Shrub	*Kolanchi*	Leaves	Constipation in goat	Juice/ oral & Paste/ oral
54.	*Tinospora sinensis* (Lour.) Merr.	Menispermaceae	Shrub	*Seenthil*	Leaves	Bone fracture in cattle	Paste/ topical
					Stem	Insect bite in cattle	Decoction/ oral
55.	*Trigonella foenum- graecum* L.	Leguminosae	Herb	*Venthayam*	Seeds	Bloat in goat	Juice/ oral
						Parasitic infection in cattle	Paste/ oral
						FMD in cattle, goat	Paste/ topical
						Scour in poultry	
56.	*Vigna mungo* (L.) Hepper	Leguminosae	Herb	*Ulunthu*	Seeds	Bone fracture in cattle	Paste/ topical
57.	*Vitex negundo* L.	Lamiaceae	Tree	*Nochi*	Leaves	Fever in cattle	Juice/ oral
58.	*Wrightia tinctoria* R. Br.	Apocynaceae	Tree	*Veppalai*	Leaves	Fever in cattle	Juice / oral
59.	*Zingiber officinale* Roscoe	Zingiberaceae	Herb	*Ingi*	Rhizome	Bloat in cattle	Paste/ topical & Juice/ oral
						Exhalation in cattle, goat	Paste/ oral

The present investigation revealed that the livestock owners of the study area have been following a variety of ethnoveterinary practices to cure animal disorders and diseases. A total of 59 ethnoveterinary plant species that were being used by the livestock owners of Melmangalam and Thenparankundram villages to treat 30 different livestock diseases condition have been documented along with the type of formulation. The usage of *Azadirachta indica* A. Juss. for foot and mouth disease treatment has already been reported in many studies across India (Sharma *et al*., 2012, Dhanam and Elayaraj, 2014). The usage of *Cissus quadrangularis* L. for treatment of fractured bones has already been reported in other studies (Dhanam and Elayaraj, 2014). Similarly, plant species like, *Allium cepa* L. (Aziz *et al*., 2020), *Allium sativum* L. (Sharma and Kumar, 2012) were reported to have many ethnoveterinary medicinal values across India and Pakistan.

3.1. Families recorded

The documented medicinal plants families were presented in Table 2. From the results, it was evident that there were 59 medicinal plant species belonging to 34 families and 56 genera in the study area, i.e. thirteen species from Leguminosae, three species each in Lamiaceae, Rutaceae and Apiaceae, two species each in Phyllanthaceae, Amaryllidaceae, Asparagaceae, Sapindaceae, Zingiberaceae, Piperaceae, Solanaceae and the other families constituting one species each. It was found that family Leguminosae had been the major contributor of ethnoveterinary plants in the study area (Fig. 3). In an earlier study, it was reported that family Fabaceae was the major contributor of medicinal plant species (Prabhu *et al*., 2014). The reason for Fabaceae being the most dominant family in the study area was because it has been known to have the largest number of species than any other family across the globe (Marles and Farnsworth, 1995).

3.2. Habit

In the present survey, 47% of the documented species were herbs. The other species that were recorded include shrubs (28%) and trees (25%) (Fig. 4). Similarly, there were reports of usage of herbaceous plants as ethno medicine in many areas (Addo- Faordjour *et al*., 2008; Reang *et al*., 2016) due to the accumulation of bio active compounds (Gazzaneo *et al*., 2005) in herbs and their easy availability (Uniyal *et al*., 2005).

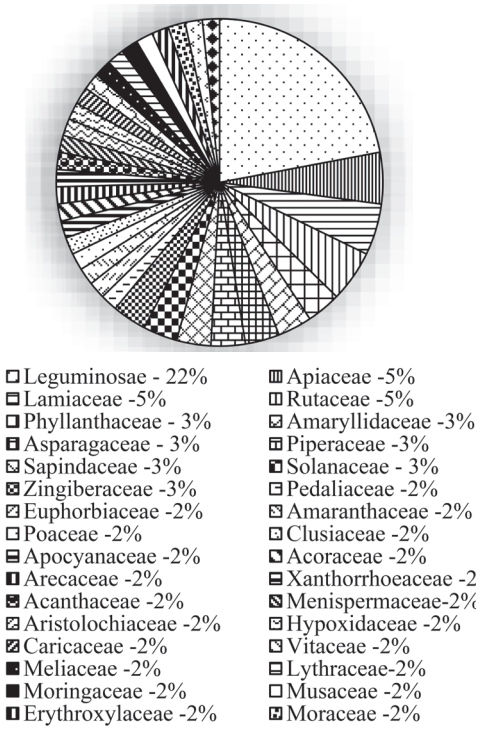

Fig. 3. Families of ethnoveterinary plants

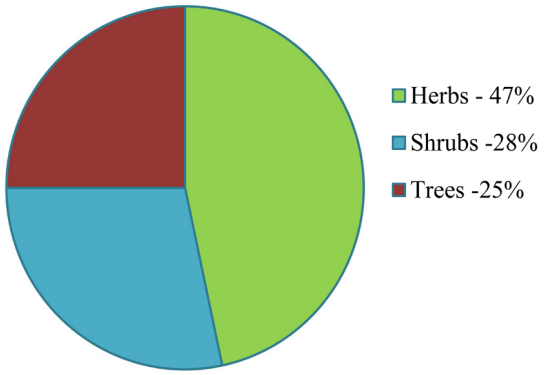

Fig. 4. Habit of ethnoveterinary plants

3.3. Mode of preparation

From the Fig. 5, it was evident that paste (59%) was the most common mode of preparation of ethno medicine. There were also reports stating that paste is one of the major modes of ethnoveterinary drug preparation since it could be prepared easily even without water (Kamatchi *et al*., 2020; Saha *et al*., 2014).

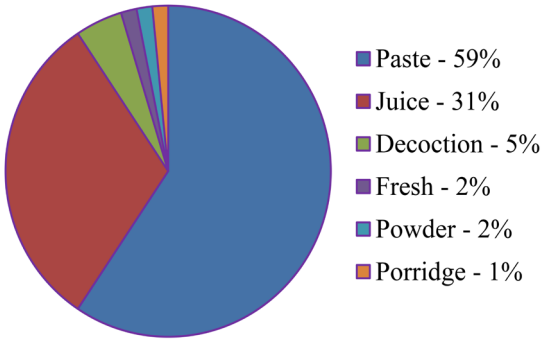

Fig. 5. Mode of preparation of drugs

3.4. Route of administration

There were different routes of administration like oral (internal), topical (external), nasal drops and eye drops that have been widely followed in the study area. Topical (51%) application of ethnomedicine was the most common route of administration that has been followed in the study area while oral mode occupied 47% (Fig. 6).

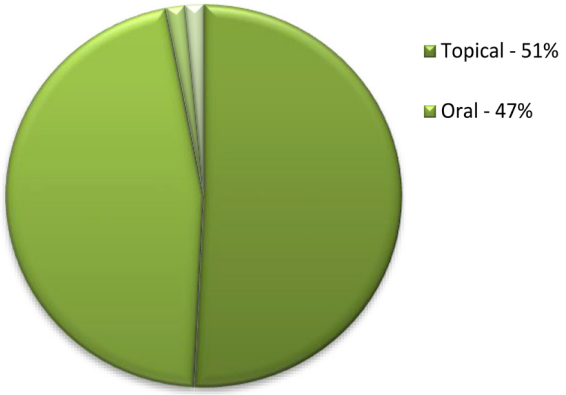

Fig. 6. Route of administration of drugs

3.5. Plant parts used

The livestock owners of the study area used different plant parts for the preparation of ethnoveterinary formulations (Fig. 7). They mainly consisted of leaves (53%), fruits (10%), seeds (10%), stem (7%), roots (5%), whole plant (4%), tuber (3%), gel (2%), flowers (2%), bulb (2%), rhizome (1%) and latex (1%). There were many reports of usage of parts above the ground especially leaves being the most preferred part used for drug preparation than any other underground parts (Miara *et al*., 2019; Tiwari and Pande, 2010). This was because leaves could be easily collected than any other parts (Giday *et al*., 2009) and leaves were very much active in photosynthesis and metabolite production (Ghorbani, 2005).

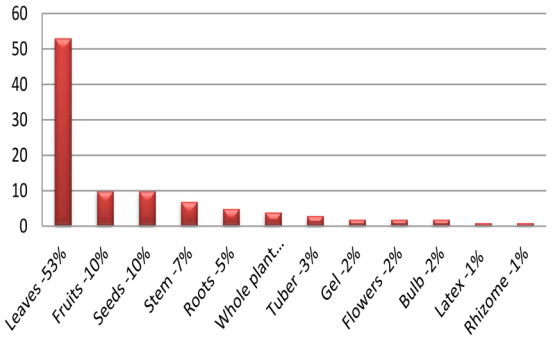

Fig. 7. Parts used for drug preparation

3.6. Animals treated

The livestock owners of the study areas have different ethnoveterinary treatments but the major portion of these treatments was aimed to cure diseases and disorders of cattle (69%). Though there were treatments for diseases of goat and chicken, they were very few when compared to the treatments being provided to the cattle (Fig. 8). This was because of the large population of cattle as well as their major role in farming.

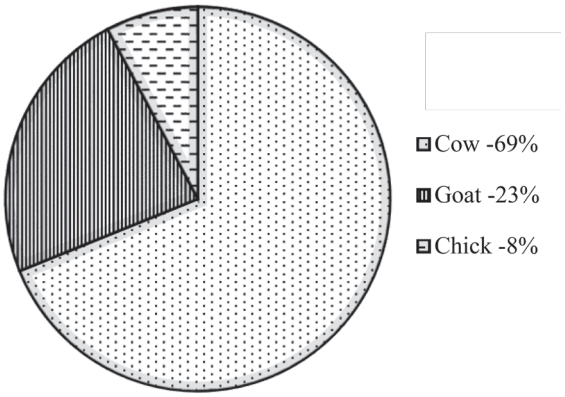

Fig. 8. Ethnoveterinary treatments for animals

3.7. Plant formulations

The ethnoveterinary formulations were prepared using a single plant or two plants or a combination of two or more plants. There were reports that showed plants that were used in combinations were more effective (Eswaran *et al*., 2013).

Similarly, in the study area, the livestock owners preferred multiple plant formulations for ethnoveterinary treatment than using single plant formulations (Fig. 9).

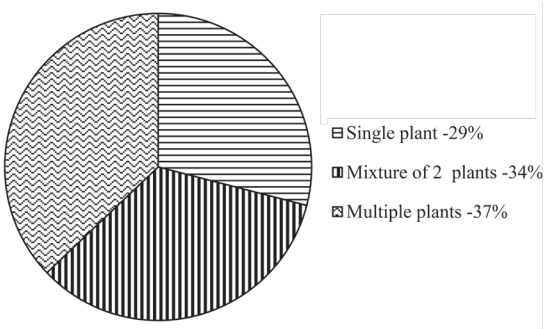

Fig. 9. Plant drug formulations

4. Conclusion

Surveys were conducted in Melmangalam village of Theni district and Thenparankundram of Madurai district in Tamil Nadu to document the ethnoveterinary plants used by livestock owners to treat various disease conditions affecting livestock. About 59 different medicinal plants belonging to 34 families were recorded; of which, Leguminosae was found to be the most used family, leaves were the most used part, paste was the most preferred mode of preparation, topical mode was the most preferred route of administration and cattle had the most number of ethnoveterinary treatments. The objectives of the study, namely, identification of the livestock owners with traditional knowledge and documentation of the different ethnoveterinary plants used to cure livestock diseases had been met with. Ethnoveterinary treatments have been accepted widely as an alternative to the modern system of medicine (Buch *et al*., 1973). It is necessary for us to conserve this kind of traditional knowledge since it has been developed through many generations, or this valuable resource could get depleted (Siva *et al* ., 2009). These traditional systems of medicine could help us to provide leads for further research in identifying novel compounds (Sharma and Kumar, 2012). Therefore, pharmacological potential of such medicinal plants have to be explored in order to help in the discovery of new formulations.

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