

Ethnoveterinary practices among the tribal community of Malda district of West Bengal, India

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Received 14.11.12, revised 08.03.13

Present study aimed at documenting and analyzing the ethnoveterinary practices of domesticated animals and birds of Malda district of West Bengal in India. Successive field surveys were conducted to assemble data from tribal practitioners by means of semi-structured individual interviews, open ended questionnaires, informal interviews, group discussion, etc. Present study recorded 70 phytotherapeutic practices involving 60 plants which were used to treat 34 types of disease and disorders of livestock. Out of 34 livestock disease and disorders, mostly treated ailment was agalactia with 7 different therapeutic uses followed by fever, treated with 5 different preparations. Leaves were most frequently used plant parts in preparing medicinal formulations. However, five new ethnoveterinary formulations were documented during this survey for the first time. The informants' consensus factor (F_{IC}) was found very high (0.88 - 1) establishing the study more authentic. This is the first detailed documentation of ethnoveterinary knowledge as well as first report of determining F_{IC} among the tribal communities of this region.

Keywords: Ethnoveterinary practice, Livestock, Medicinal plants, Malda, India

IPC Int. Cl.⁸: A61K 36/00, A61D, A61K

Use of medicinal plants for the treatment of diseases is a recent vogue developed in the western countries. This trend is not only restricted to the treatment of human diseases but also in the disease management of domesticated animals and birds. This branch of science, known as Ethnoveterinary practices or EVPs¹ is gradually pronouncing its impact in the field of ethnobotany in the West. In the 80's and 90's of last century, a few researchers reported the use of medicinal plants as herbal veterinary drugs. Morgan² stated the use of plants treating ailments of livestock in Kenya. McCorkle³ documented a vast introductory research work of ethnoveterinary practices of Latin America whereas Perezgrovas⁴ reported the healthcare management practices of sheep by the women of Tzotzil region of southern Mexico. Farah *et al.*⁵ described the ethnoveterinary practices of *Maasai* ethnic group of Kenya. In the first decade of present century, several researchers^{1,6-13} from west reported ethoveterinary or livestock healthcare management practices.

However, in India, ethnoveterinary practices were common since time immemorial. A few oldest existing book of ancient era such as *Asvayurvedasiddhanta*

(Ayurvedic practices for horses), *Asvacikitsita* (therapeutics of horses), *Asvavaidyaka* (medicines of horses), *Hastyayurveda* (Ayurveda of elephants) are the assets or repository of livestock healthcare practices in India¹⁴. Recently, several workers have also enriched this repository by documenting the knowledge of ethnoveterinary practices of different provinces of India. These include: Tiwari & Pande¹⁴; Katewa & Chaudhary¹⁵; Mistry *et al.*¹⁶; Takhar & Chaudhary¹⁷; Gaur *et al.*¹⁸; Galav *et al.*¹⁹; Phondani *et al.*²⁰; Deshmukh *et al.*²¹; Rajakumar & Shivanna²², Sharma²³, etc.

Besides, in West Bengal, the eastern most provinces of India possess variety of ethnic communities having versatile knowledge about ethnoveterinary uses of plants. A few workers, tried to gather information which are as follows: Bandyopadhyay & Mukherjee²⁴ reported 25 ethnoveterinary preparations for treating various ailments like swelling of abdomen, constipation, intestinal worm, etc. using around 23 plants by ethnic communities of Koch Bihar district. Dey & De²⁵ reported 25 species used by tribal like *Santhali*, *Bhumijis*, *Mundas*, etc. of Purulia district for the preparations of same. Mitra & Mukherjee²⁶ also did the similar kind of work on the tribal of Uttar

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and Dakshin Dinajpur districts and reported 23 medicinal plants of ethnoveterinary interest whereas Mukherjee & Namhata²⁷ and Ghosh²⁸ reported the ethnoveterinary use of plants used by tribal people of Bankura district while Das & Tripathi²⁹ documented the ethnoveterinary knowledge of plants for Sunderbans of West Bengal.

However, despite being rich in biodiversity and with wide array of ethnic communities (*Santala*, *Oraon*, *Rajbanshi*, *Namasudra*, *Polia*, *Mundas*, *Malpaharias*, etc.), Malda district of West Bengal, India still remains elusive for ethnobotanists. The district located between the latitude and longitude of 24°40'20"N to 25°32'08"N and 88°28'10"E to 87°45'50"E, respectively. Malda covers an area of 3455.66 sq km. having population density of 1,071 inhabitants per square km (Fig. 1). Eighty seven per cent of the total population live in villages and the rest are in towns³⁰. Majority of the tribes are directly or indirectly depend on agriculture, rearing of animals and practices of medicinal plants (both human and veterinary purposes). They remain busy throughout the year with their practice of earning from these sectors. Hence, they rarely manage to visit the veterinary hospitals for livestock diseases. Concurrently, high costs of modern medicines and communication problem encourage them to avail old traditional systems to heal their livestock. This is why, the ethnoveterinary practice means a lot to the rural people in this province as because of its accessibility, ease of preparation, low cost and ecofriendly nature.

Therefore, authors selected this district as study area and present study is the first effort to survey the livestock healthcare management practices in this territory. Informants consensus factor (F_{IC}) of tribal community was also determined to validate these practices and it is the second report from India next to Kumar *et al.*³¹, as per authors' best knowledge. Furthermore, analysis of different plant parts used, growth forms of those plant species and a few new findings have also been discussed in the present paper.

Methodology

The data had been collected during 2010-2011 from the local tribal healers known as *go-kaviraj* or *go-baidya* or *Ojhas* and also from local knowledgeable person belonging to different ethnic communities of villages namely, Nalagola, Bamongola, Pakuahut, Lakhitur, Aiho, Bulbulchandi, Nityanandapur, Rishipur, Olandar, Kenpukur, Gazole, Old Malda, Habibpur, Valuka, Suvasganj, Vabuk,

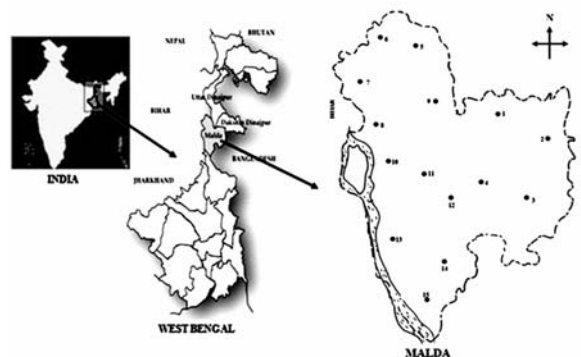


Fig. 1—Location of the study area

Manikchak, Samsi, Krisnapur, Malatipur, Milki, Amriti, Lakkhipur, Enayetpur, Jadupur, etc. with the help of semi-structured individual interviews, open ended questionnaires, informal interviews and group discussion. Cow, buffalo, goat, sheep, horse, duck and hen are the domesticated livestock that the healers treated. The traditional veterinary practitioners were very much cognizant about the surroundings of the villages with experience of at least 10-15 yrs regarding animal healthcare management practices. Hundreds of informants were interviewed and after cross verification from different sources, authors retained only 91 informants confirming the authenticity of their information. Out of ninety one, 47 (33 men, 14 women) were of herbal veterinary practitioners, 5 herbalists (all of men), 28 livestock owners (19 men, 9 women) and 11 (8 men, 3 women) local knowledgeable elderly person. During interview prior informed consent was also obtained from the informants such as, Subed Ali (42 yrs old) of Malatipur village, Nujjum Shekh (68 yrs) of Jadupur village, Kisori Barman (71 yrs) of Nalagola, Jharna Mandal (59 yrs) of Bulbulchandi, Doman Mandal (45 yrs) of Piyasbari, Faeshed Ali (58 yrs) of Kaliyachak, Ratan Mandal (38 yrs) of Jadupur, Lakshmi Mandal (54 yrs) of Kotuali, Jagadish Murmu (52 yrs) and Vaben Barman (75 yrs) of Habibpur, Jhumadebi Sarkar (41 yrs) of Gazole, Sultana Begam (53 yrs) of Lakkhipur, etc. as per the ethical guidelines of the International Society of Ethnobiology³². More emphasis was given to the trained herbal veterinary practitioners as because of their vast experience in management of animal healthcare.

Plants prescribed for the treatment of animal diseases and disorders were collected from various places of study area as per the informants and in presence of them. The plants were properly photographed and herbarium was prepared for each specimen. The collected

specimens were identified with the help of Central National Herbarium (CNH), Kolkata, India. The voucher specimens of each species were deposited at Raiganj University College, Raiganj, India. The method of collection of voucher specimens, preservation and herborization was done as per Jain and Rao³³.

A database has been recorded with parameters like, names of the taxon, family, voucher numbers, vernacular names, plants parts, diseases and disorders, mode of application with the name of informant, etc. The informant consensus factor was determined as per the method of Trotter and Logan³⁴.

Results and discussion

The present study revealed that a total of 60 medicinal plants belonging to 38 families with 70 different formulations were used for the treatment of 34 veterinary diseases and disorders. Out of 70 formulations, 57% were orally administered, while the rest were for external use only. In most cases, more than one plant was used for the preparation of many formulations. The authors interviewed several tribal people and ultimately kept information of only 91 informants based on their efficiency in veterinary treatment and knowledge of medicinal plants (Table 1). The result from F_{IC} value shows the greater agreement ($F_{IC}= 0.88 - 1$) of selecting plant taxa among tribal informants.

Out of the 60 medicinal plants, 18 species were shrub followed by 16 species of herbs, 14 climbers, 11 trees and 1 parasite (Fig. 2) belonging to 38 plant families. Amongst 60 plant species, 8 species were recorded in curing various diseases and disorders. *Oroxylum indicum* and *Persicaria glabra* were used for three different treatments; *Alstonia scholaris*,

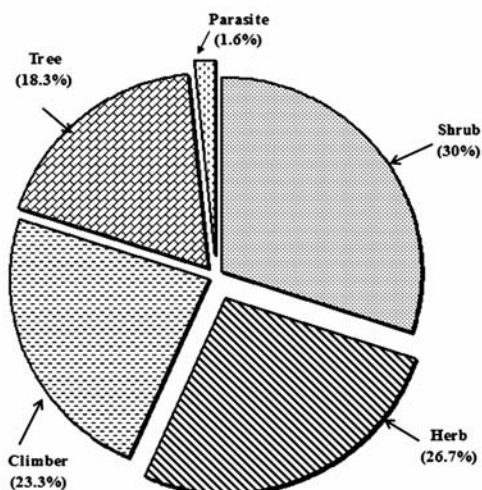


Fig. 2—Distribution of growth form of studied plant species

Amaranthus spinosus, *Andrographis paniculata*, *Azadirachta indica*, *Calotropis gigantea* and *Physalis minima* were used for the treatment of two different types of disease and disorder each including drowsiness, nipple crack, tonsillitis, paralysis, intestinal worm, anorexia, flatulence, eczema, agalactia, appetizer, lice and itching problem, etc.

Agalactia was the most treated ailment with 7 different preparations followed by fever, treated with 5 different preparations whereas loose motion and lice problems were treated with 5 different preparations each (Fig. 3). In most of the cases, traditional healers prepared a veterinary drug using several plant parts along with their own secret ingredients which they did not disclose and apply those formulations according to their own understanding. Sometimes, Veterinarians use a particular formulation for a particular group of animal which had also been discussed separately in Table 1. Leaves were used in 18 occasions whereas in 15 cases roots were found to be used; seeds and flowering branches were used in 5 and 4 cases respectively whereas bark was used in 3 cases and whole plant parts were used for 6 cases to make herbal veterinary preparations (Fig. 4).

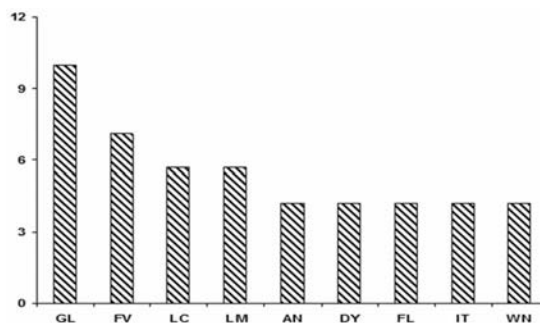


Fig. 3—Frequency of different types of diseases treated in Malda (GL= Agalactia; FV= Fever; LC= Lice; LM= Loose Motion; AN= Anorexia; DY= Dysentery; FL= Flies; IT= Itching; WN= Wound)

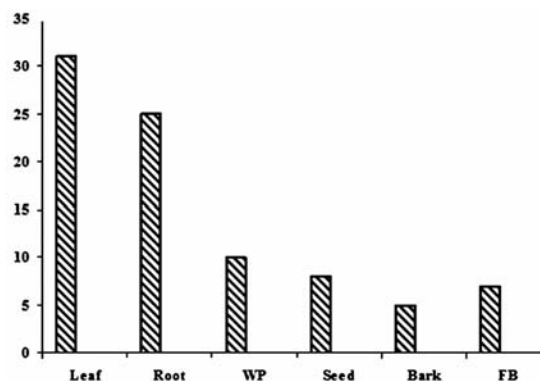


Fig. 4—Frequency of floral parts, used in veterinary treatment (WP= Whole Plants, FB= Flowering Branch)

Table 1—Animal healthcare management practices in Malda district (*contd.*)

Diseases and disorders	Plants species used with their family	Mode of application	
Abdominal pain	<i>Vernonia anthelmintica</i> (L.) Willd. (Asteraceae)	The seeds (50-100 gm) of <i>Vernonia anthelmintica</i> (<i>somraji</i>) are crushed with slight water and juice is fed orally.	
	<i>Holarrhena antidysenterica</i> (L.) Wall. (Apocynaceae)	1 A juice prepared from the bark powder of <i>Holarrhena antidysenterica</i> (<i>kurchi</i>) and 6-10 slices of <i>Carica papaya</i> fruits (<i>pepe</i>) with water, is fed orally thrice a day to induce lactation.	
	<i>Amaranthus spinosus</i> L. (Amaranthaceae)	2 A paste prepared from the whole plant (2-5 plants) of <i>Amaranthus spinosus</i> (<i>kantakhure</i>) along with the roots (50 gm) of <i>Glycosmis pentaphylla</i> (<i>atiswar</i>) is fed orally.	
Agalactia	<i>Ampelocissus latifolia</i> (Roxb.) Planch. (Vitaceae)	3 Whole plants of (100-200 gm) <i>Ampelocissus latifolia</i> (<i>goalialatala goal lata</i>) are chopped into pieces and fed with the straw.	
	<i>Asparagus racemosus</i> Willd. (Asparagaceae)	4 Fresh roots (80-150 gm) of <i>Asparagus racemosus</i> (<i>satamul</i>) are fed orally to induce lactation.	
	<i>Centella asiatica</i> (L.) Urban (Apiaceae)	5 Whole plant (300-400 gm) of <i>Centella asiatica</i> (<i>thankuni</i>) fed orally.	
	<i>Glycosmis pentaphylla</i> Retz. (Rutaceae)	6 The roots (50-60 gm) of <i>Glycosmis pentaphylla</i> (<i>atiswar</i>), whole plant (2-4 plants) of <i>Amaranthus spinosus</i> (<i>kantakhure</i>) and 500 gm of tender grass are fed together to induce lactation.	
	<i>Tinospora cordifolia</i> (Willd.) Hook. f. (Menispermaceae)	7 Whole plant (200-400 gm) of <i>Tinospora cordifolia</i> (<i>goronchlatala gulancha</i>) is also used as galactagogue.	
	Anorexia	<i>Cardiospermum halicacabum</i> Linn. (Sapindaceae)	1 The leaf decoction (250 ml) of <i>Cardiospermum halicacabum</i> (<i>latafatki</i>) is fed orally.
		<i>Zingiber cassumunar</i> Roxb. (Zingiberaceae)	2 The rhizome (50-70 gm) of <i>Zingiber cassumunar</i> (<i>banada</i>) are cut into pieces and fed orally.
<i>Alstonia scholaris</i> R. Br. (Apocynaceae)		3 A paste prepared from the roots (100-200 gm) of <i>Alstonia scholaris</i> (<i>chatim</i>) and zinger is fed orally.	
Anthelmintic	<i>Allium sativum</i> L. (Liliaceae)	The bulbs (200-400 gm) of <i>Allium sativum</i> (<i>peyaj</i>) are crushed along with fodder and fed thrice in a day.	
Appetizer	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees (Acanthaceae)	1 The leaves (200-400 gm) of <i>Andrographis paniculata</i> (<i>kalmegh</i>) are crushed along with <i>Nyctanthes arbor-tristis</i> (<i>siuli</i>) leaf and the juice is mixed with husk and fed as appetizer.	
	<i>Nyctanthes arbor-tristis</i> L. (Oleaceae)	2 The leaves (250 gm) of <i>Nyctanthes arbor-tristis</i> (<i>siuli</i>) are chopped into pieces and fed along with tender grasses.	
Black quarter	<i>Oroxylum indicum</i> (L.) Vent. (Bignoniaceae)	A paste is prepared from the bark powder (75-100 gm) of <i>Oroxylum indicum</i> (<i>krishnadingalnoukadinga</i>) and fed thrice a day.	
Bloat	<i>Trigonella foenum-graecum</i> L. (Fabaceae)	A decoction prepared from the seed (50-75 gm) of <i>Trigonella foenum-graecum</i> (<i>methi</i>) and fed orally.	
Body Pus	<i>Chrysopogon gryllus</i> L. (Poaceae)	1 A paste is prepared from the roots (25-40 gm) of <i>Chrysopogon gryllus</i> (<i>chorkanta</i>) along with 1 gm <i>Piper nigrum</i> seeds (<i>golmorich</i>) and given under the tongue of cattle.	
	<i>Curcuma longa</i> L. (Zingiberaceae)	2 A paste is prepared from the rhizomes of <i>Curcuma longa</i> (<i>halud</i>) and applies as emollient on tongue at every morning and evening for 5 days to cure from pusses.	
Bodyache	<i>Cuscuta reflexa</i> Roxb. (Convolvulaceae)	A paste is prepared from the whole plant (300-500gm) of <i>Cuscuta reflexa</i> (<i>swarnalata</i>) along with the roots (75 gm) of <i>Achyranthes aspera</i> (<i>baro chirchiri/apang</i>) and applies externally on body.	

(contd.)

Table 1—Animal healthcare management practices in Malda district (*contd.*)

Diseases and disorders	Plants species used with their family	Mode of application
Boil	<i>Urena lobata</i> L. (Malvaceae)	The leaves (100 gm) of <i>Urena lobata</i> (<i>hegra</i>) are crushed to make paste and applied externally on affected area.
	<i>Cissus quadrangularis</i> L. (Vitaceae)	1 300-400 gm of stem of <i>Cissus quadrangularis</i> (<i>harjora</i>) are crushed to make paste and applied on broken leg of cattle tying up with bamboo stick.
	<i>Litsea glutinosa</i> L. (Lauraceae)	
Bone fracture		2 A paste is made from the roots (200-250 gm) of <i>Litsea glutinosa</i> (<i>darodmoyda</i>), leaves (70 gm) of tamarind and rhizome (10-20 gm) of zinger and applied on bone cracked area, tying up with bamboo stick.
	<i>Acacia catechu</i> Willd. (Mimosaceae)	1 A juice is prepared from the roots (200 gm) of <i>Acacia catechu</i> (<i>khayer</i>) and given to prevent constipation.
Constipation	<i>Fumaria officinalis</i> L. (Fumariaceae)	2 Whole plants (400 gm) of <i>Fumaria officinalis</i> (<i>khetsapra</i>) are chopped and fed orally to cattle.
	<i>Cocculus hirsutus</i> (L.) Diels (Menispermaceae)	1 The tender leaves (500 gm) of <i>Cocculus hirsutus</i> (<i>joljomani</i>) are chopped with straw and fed orally.
Diarrhoea	<i>Rauwolfia serpentina</i> (L.) Benth. ex Kurz (Apocynaceae)	2 A paste is made The roots (200 gm) of <i>Rauwolfia serpentina</i> (<i>sarpagandha</i>) along with 200 gm of <i>Azadirachta indica</i> leaves (<i>neem</i>) and fed orally.
	<i>Eleusine indica</i> (L.) Gaertn. (Poaceae)	1 The roots (70-100 gm) of <i>Eleusine indica</i> (<i>jabra ghasl katilaghas</i>) are crushed along with slight zinger to make paste and fed orally.
Drowsiness	<i>Oroxylum indicum</i> (L.) Vent. (Bignoniaceae)	2 A paste is prepared from the bark powder (100 gm) of <i>Oroxylum indicum</i> (<i>krishnadinga</i>) along with whole plant (100 gm) of <i>Tinospora cordifolia</i> (<i>goronchlata</i>) and given against drowsiness.
	<i>Allium sativum</i> Lin. (Liliaceae)	1 The bulbs (200-400 gm) of <i>Allium sativum</i> (<i>peyaj</i>) are crushed along with fodder and fed orally thrice in a day.
Dysentery	<i>Cannabis sativa</i> L. (Urticaceae)	2 The chopped leaves (250 gm) of <i>Cannabis sativa</i> (<i>bhanga</i>) along with fruits (250 gm) of <i>Ficus glomerata</i> (<i>dumur</i>) are fed together orally.
	<i>Ficus glomerata</i> Roxb. (Moraceae)	
Dyspepsia	<i>Aristolochia indica</i> L. (Aristolochiaceae)	The tender leaves and buds (150 gm) of <i>Aristolochia indica</i> (<i>iswarnath/iswarmul</i>) are crushed with 25 gm of black pepper and slight salt to make paste and fed to cattle.
Ear Pus	<i>Eclipta prostrata</i> L. (Asteraceae)	A paste is prepared from the leaves (25-50 gm) of <i>Eclipta prostrata</i> (<i>kesut</i>) and applies on ears.
	<i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees (Acanthaceae)	1 A leaf paste of <i>Andrographis paniculata</i> (<i>kalmegh</i>) and <i>Azadirachta indica</i> (<i>neem</i>) is prepared (1:1 ratio) and applied on the body of the cattle.
Eczema	<i>Datura metel</i> L. (Solanaceae)	2 A paste is prepared from the root (50-75 gm) of <i>Datura metel</i> (<i>kalo dhtura</i>) along with 2 teaspoon of mustered oil and applies on body.
	<i>Pergularia daemia</i> (Forssk.) Chiov. (Asclepiadaceae)	1 The leaves (50 gm) of <i>Pergularia daemia</i> (<i>ajashringi</i>) are crushed to make juice and apply externally on the eyes of cattle.
Eye cataract	<i>Stephania japonica</i> (Thunb.) Miers. (Menispermaceae)	2 The young leaves (50 gm) of <i>Stephania japonica</i> (<i>gorochlatal ghapatalaknadi</i>) are crushed to make juice and pour in the ear of goat externally for 12-15 days. [This preparation is applied only on goat.]

(contd.)

Table 1—Animal healthcare management practices in Malda district (*contd.*)

Diseases and disorders	Plants species used with their family	Mode of application
Fever	<i>Achyranthes aspera</i> L. (Amaranthaceae)	1 The roots (100-200 gm) of <i>Achyranthes aspera</i> (<i>baro chirchiril apang</i>) are crushed with cumin seeds (10-15 gm) and water to make paste and the pate is fed orally.
	<i>Costus speciosus</i> (J.Konig) Sm. (Costaceae)	2 A paste is prepared from the root of <i>Costus speciosus</i> (<i>kuttus</i>), 3-5 pieces of carrot and stem (50 gm) of <i>Tinospora cordifolia</i> and given thrice a day for 3-4 days.
	<i>Erythrina indica</i> Lam. (Papilionaceae)	
	<i>Heliotropium indicum</i> L. (Boraginaceae)	3 Young tender branches (200-300 gm) of <i>Erythrina indica</i> (<i>madar</i>) are feed at early morning before taking water for 3-4 days.
	<i>Leonurus japonicas</i> Houtt. (Lamiaceae)	4 A paste is prepared from the flowering inflorescences (250 gm) of <i>Heliotropium indicum</i> (<i>hatisur</i>) along with 5 gm of black pepper seeds (<i>golmorich</i>) and fed thrice a day.
		5 A juice from <i>Leonurus japonicas</i> (<i>raktodron</i>) root (150 gm) along with the roots (150 gm) of <i>Achyranthes aspera</i> is prepared and fed orally.
Flatulence	<i>Calotropis gigantea</i> (L.) W. T. Aiton (Asclepiadaceae)	1 The apical twigs (30-50 gm) of <i>Calotropis gigantea</i> (<i>akanda</i>) are crushed along with slight amount of salt to make paste against flatulence.
	<i>Physalis minima</i> L. (Solanaceae)	2 A paste is prepared from the roots (50 gm) of <i>Physalis minima</i> (<i>pokapaialtepari</i>) and cumin seeds with slight water and given to cattle.
Flies problem	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	1 The branches of <i>Azadirachta indica</i> (<i>neem</i>) are burnt in the cowshed at evening as repellent.
	<i>Hyptis suaveolens</i> (L.) Poit (Lamiaceae)	2 The branches of <i>Hyptis suaveolens</i> (<i>bontulsi</i>) are burnt in the cowshed to prevent mosquitoes or flies.
	<i>Tragia involucrata</i> L. (Euphorbiaceae)	3 The roots (50-100 gm) of <i>Tragia involucrata</i> (<i>bichutilbichatu</i>) are crushed with mustered oil and the paste is applied externally on horns of cattle.
Intestinal worm	<i>Acacia auriculiformis</i> A. Cunn. ex Benth. (Fabaceae)	1 The seeds (50 gm) of <i>Acacia auriculiformis</i> (<i>akashmoni</i>) are crushed and mixed with cattle-food and given orally.
	<i>Alstonia scholaris</i> R. Br. (Apocynaceae)	2 The roots (50-100 gm) of <i>Alstonia scholaris</i> (<i>chatim</i>) are crushed with water and the juice is given to cattle.
Itching	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	1 The leaves (50-100 gm) of <i>Azadirachta indica</i> (<i>neem</i>) are crushed with mustered oil and the paste is applied on the body of cattle.
	<i>Jatropha gossypifolia</i> L. (Euphorbiaceae)	2 The leaves of (100 gm) <i>Jatropha gossypifolia</i> (<i>varenda</i>) are rubbed on the whole body.
	<i>Phyla nodiflora</i> (L.) Greene (Verbenaceae)	3 The leaves (100 gm) of <i>Phyla nodiflora</i> (<i>koi okhra</i>) are rubbed on the body to cure from itching.
Lice problem	<i>Clerodendrum viscosum</i> Vent. (Verbenaceae)	1 The apical twigs (75 gm) of <i>Clerodendrum viscosum</i> (<i>ghetu</i>) are crushed and the juice is macerated over the head of cattle.
	<i>Mikania micrantha</i> Kunth. (Asteraceae)	2 The flowering branches (8-10) of <i>Mikania micrantha</i> (<i>bantulsi</i>) are kept in poultry house to keep away lice from the body of hen. [This procedure is applicable only for poultry birds.]
	<i>Ocimum kilimandscharium</i> Guerke (Lamiaceae)	3 The flowering branches of <i>Ocimum kilimandscharium</i> (<i>dulalbabu</i>) are kept in poultry house to keep away lice from the body of hen. [This procedure is applicable only for poultry birds.]
	<i>Persicaria glabra</i> (Willd.) M.Gomez (Polygonaceae)	4 The leaves (350 gm) of <i>Persicaria glabra</i> (<i>bis-kantallaltota</i>) are rubbed on the body of cattle.

(contd.)

Table 1—Animal healthcare management practices in Malda district

Diseases and disorders	Plants species used with their family	Mode of application
Loose motion	<i>Alocasia macrorrhiza</i> Schott. (Araceae)	1 A paste is prepared from the rhizomes (10-15 gm) of <i>Alocasia macrorrhiza</i> (<i>mankachu</i>) with slight lemon juice and given to the poultry birds. [This preparation is applied only for poultry birds.]
	<i>Eleusine indica</i> (L.) Gaertn. (Poaceae)	2 The roots (50-100 gm) of <i>Eleusine indica</i> (<i>jabra ghas</i>) are crushed along with unripe banana (10-12 pieces) and the paste is fed to cattle.
	<i>Lawsonia inermis</i> L. (Lythraceae)	
	<i>Physalis minima</i> L. (Solanaceae)	
		3 The chopped leaves (400-600 gm) of <i>Lawsonia inermis</i> (<i>mehandi</i>) are fed to cattle at empty stomach for 3-4 days.
		4 The root (60-100 gm) of <i>Physalis minima</i> (<i>pokapaia</i>) is crushed along with black pepper seed (5 gm) and the paste is fed orally for 3 days.
Nipple crack	<i>Oroxylum indicum</i> (L.) Vent. (Bignoniaceae)	A paste is prepared from the bark (100 gm) of <i>Oroxylum indicum</i> (<i>krishnadinga</i>) along with mustered oil and applied on cracked nipple of cattle.
Paralysis	<i>Persicaria glabra</i> (Willd.) M.Gomez (Polygonaceae)	The leaves (40-50 gm) of <i>Persicaria glabra</i> (<i>biskantal</i>) are crushed and the paste is taken in a cloth and tied on legs of poultry till they can walk well. [This preparation is applied only for poultry birds.]
Sex stimulant	<i>Mucuna pruriens</i> (L.) DC. (Fabaceae)	The seed (250-500 gm) of <i>Mucuna pruriens</i> (<i>alkushi</i>) is crushed to make paste and fed to cattle.
Stomachache	<i>Premna corymbosa</i> (Burm.f.) Rottl. & Willd. (Verbenaceae)	A paste is made from the leaves (250 gm) of <i>Premna corymbosa</i> (<i>gonal</i>) along with the seeds (70-100 gm) of <i>Trigonella foenum-graecum</i> (<i>methi</i>) and given to cattle.
Swelling of neck	<i>Calotropis gigantea</i> (L.) W. T. Aiton (Asclepiadaceae)	The leaves of <i>Calotropis gigantea</i> (<i>akanda</i>) are warmed with ghee (made from milk) and applied on neck.
Tonsillitis	<i>Argyreia nervosa</i> (Burm. f.) Bojer (Convolvulaceae)	1 The leaves (70-100 gm) of <i>Argyreia nervosa</i> (<i>briddhadarak</i>) are crushed along with 40 gm of <i>Azadirachta indica</i> (<i>neem</i>) leaves and slightly warmed mustered oil (2-4 teaspoon) to make paste and keep this paste in a cloth and tied up on neck of cattle.
	<i>Persicaria glabra</i> (Willd.) M.Gomez (Polygonaceae)	2 The leaves (50-100 gm) of <i>Persicaria glabra</i> (<i>biskantal</i>) are crushed along with zinger (20 gm) and the paste is kept in a cloth and tied on the neck of cattle.
Post natal disorder	<i>Dendrophthoe falcata</i> (L.F) Etting. (Loranthaceae)	The stem bark (40-50 gm) of <i>Dendrophthoe falcata</i> (<i>dhara</i>) is crushed along with 35 gm of <i>Azadirachta indica</i> (<i>neem</i>) leaves and zinger (3 gm) to make paste and applied on vagina of cattle to reduce its enlargement after delivery.
Wound	<i>Ricinus communis</i> L. (Euphorbiaceae)	1 The seed (60-100 gm) of <i>Ricinus communis</i> (<i>veri</i>) are crushed to make oil and applied externally until it cures the wounds.
	<i>Saccharum munja</i> Roxb. (Poaceae)	2 The root (80-100 gm) of <i>Saccharum munja</i> (<i>biyanal sikighas</i>) along with small amount of horn scales of cattle are crushed and applied externally on the affected area, occurred by sharp ends of plough.

Present study showed greater agreement among the tribal informants on selection of plant species for a particular livestock healthcare management category. The informants' consensus ratio, i.e. F_{IC} value ranges from 0.88-1 (Table 2), with an average of 0.96 indicating high level of agreement factor and confirmed the homogeneity among informants knowledge and reliability of the traditional knowledge of this district. Hence, *Andrographis paniculata*,

Amaranthus spinosus, *Asparagus racemosus*, *Trigonella foenum-graecum*, *Heliotropium indicum*, *Mucuna pruriens*, *Oroxylum indicum*, etc. plant species, having high F_{IC} value may be used for the development of future eco-friendly veterinary drugs.

The authors found 5 species with new reports of treatment which had not been reported previously in any literature till date. These include- *Cardiospermum halicacabum* for anorexia; *Tragia involucrata*

for the prevention of flies; *Dendrophthoe falcata* for post natal disorders; *Alocasia macrorrhiza* for loose motion and *Heliotropium indicum* for fever. Interestingly one species namely, *Heliotropium indicum* had not been previously documented to be used as medicinal plant in any ethnoveterinary practices of India. Thus, present study provides the first report of the use of this taxon in livestock healthcare management.

Table 2—Consensus ratio of the ethnoveterinary practices among the tribes of Malda district

Animal healthcare management category	N _{TAXA}	N _{UR}	F _{IC}
Abdominal pain	1	4	1
Agalactia	7	120	0.95
Anorexia	3	30	0.93
Anthelmintic	1	9	1
Appetizer	2	39	0.97
Black quarter	1	4	1
Bloat	1	7	1
Bodyache	1	9	1
Body pus	2	42	0.98
Boil	1	3	1
Bone fracture	2	56	0.98
Constipation	2	20	0.95
Diarrhoea	2	15	0.93
Drowsiness	2	10	0.89
Dysentery	3	35	0.94
Dyspepsia	1	20	1
Ear Pus	1	6	1
Eczema	2	31	0.97
Eye cataract	2	9	0.88
Fever	5	50	0.92
Flatulence	2	15	0.93
Flies problem	3	21	0.90
Intestinal worm	2	22	0.95
Itching	3	53	0.96
Lice problem	4	33	0.91
Loose motion	4	45	0.93
Nipple crack	1	4	1
Paralysis	1	3	1
Sex stimulant	1	10	1
Stomachache	1	7	1
Swelling of neck	1	22	1
Tonsillitis	2	12	0.91
Post natal disorder	1	7	1
Wound	3	28	0.93

$F_{IC} = \frac{N_{UR} - N_{TAXA}}{(N_{UR} - 1)}$; Where, N_{UR}= Total number of use reports found for the treatment of a particular illness category; N_{TAXA}= Total number of taxa used for treatment of that particular category by informants.

Conclusion

Since time immemorial, the tribal healers of this region had acquired their own traditional system of treatment from their ancestors, which is unique and varies from community to community and even from village to village. Present study also observed that some of healers uproot the whole plant and virtually throw them out after collecting the required portion of the plant parts like roots, rhizomes, etc. This is causing a great deal of erosion of medicinal plants from the study area. Thus increasing demand of medicinal plants and their improper uses may result in disappearance of important plant species in near future. The problem is compounded by massive deforestation and urbanization of the region. The study also revealed that almost all the studied species, showing high informant consensus factor may be regarded as the resource of future veterinary eco-friendly drug. So, a comprehensive phytochemical investigation with those studied plants would be a handy work to prove the efficacy and validation of herbal veterinary medicine. Therefore, the need of hour is to cultivate the medicinal plants along with their conservation, proper documentation and phytochemical investigation. This is very much required for the sustainability of the ethnoveterinary practices of this region.

Acknowledgement

The authors are very much grateful to the informants who had shared their worthy knowledge without any hesitation. Thanks are also due to DST, West Bengal, India for financial support to conduct this survey and UGC for meritorious fellowship.

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