Asian Pacific Journal of Tropical Biomedicine

journal homepage: www.apjtb.com

Document heading doi:10.12980/APJTB.4.2014C1067

An ethnobotanical study of plants used for the treatment of livestock diseases in Tikamgarh District of Bundelkhand, Central India

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PEER REVIEW

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Comments

This is a valuable research work which deals with ethnoveterinary medicinal plants utilized by rural farmers and experience herbal healers of the studied villages of Bundelkhand. The results are interesting and suggested that surrounding flora of any region may play a key role in the management of animal health care and development of new Ayurvedic preparation.
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ABSTRACT

Objective: To explore and document the information regarding usage of ethnoveterinary medicinal plants utilized by rural farmers and traditional herbal healers for livestock healthcare in Tikamgarh District of Bundelkhnad, Central India.

Methods: The remote villages of Tikamgarh district were regularly visited from July 2011 to June 2012. Following the methods of Jain and Goel (1995) information regarding the usage of ethnoveterinary medicinal plants was collected.

Results: A total of 41 plant species in 39 genera and 25 families were used traditionally with various plant parts and their combinations for the treatment of more than 36 diseases in the studied area. Trees (17 species) were found to be the most used Ethnoveterinary medicinal plants followed by herbs (15 species), shrubs (6 species) and grasses (3) in descending order. The most common diseases cough, diarrhoea and fever were treated by 04 ethnoveterinary medicinal plant species.

Conclusions: The present study recommended that the crop and medicinal plant genetic resources cannot be conserved and protected without conserving/managing of the agro-ecosystem or natural habitat of medicinal plants and the socio-cultural organization of the local people. The same may be applied to protect indigenous knowledge, related to the use of medicinal and other wild plants. Introduction of medicinal plants in degraded government and common lands could be another option for promoting the rural economy together with environmental conservation, but has not received attention in the land rehabilitation programs in this region.

KEYWORDS

Ethnoveterinary medicinal plants, Livestock healthcare, Traditional herbal healers, Bundelkhand, Central India

1. Introduction

The rich and diversified flora of India provides valuable storehouse of medicinal plants. The curative properties of herbs have long been known and are documented in ancient manuscripts such as in Rig Veda, Garuda Purana and Agni Purana. These treatises focus on the potential of plants and herbs to cure human ailments and diseases. Scientists are now documenting various ethnoveterinary practices based on plant drugs. The plant wealth of India also offers the people who tend livestock a rich reservoir in treating the diseases and ailments of the animals. Seventy six percent population of India is predominantly rural[1].

In Indian agriculture, livestock plays a key role in the farmers life, they provide farm power, rural transport, manure, fuel, milk and meat, but also a major role in rural economy by providing income and employment to the small hold farmers and other weaker sections of the society. The indigenous knowledge of the veterinary health care system acquired by traditional herbal healers and elderly learned farmers and is orally transformed from one generation to other. It is less systematic and less formalized

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Article history:
Received 18 Jan 2014
Received in revised form 25 Jan, 2nd revised form 29 Jan, 3rd revised form 5 Feb 2014
Accepted 26 Feb 2014
Available online 5 April 2014

and is usually transferred by word of mouth rather than in writing[2].

Ethnoveterinary medicine, deal with traditional animal health care which encompasses the knowledge, skills, methods, practices and beliefs about animal health care. Ethnoveterinary medicine is developed by farmers in fields and barns, rather than by scientists in laboratories and clinics. Ethnoveterinary medicine often provides cheaper options than comparable western drugs and the products are locally available and more easily accessible. In the face of these and other factors, there is increasing interest in the field of ethnoveterinary research and development[3-8].

The possible benefit of plant derived medications constitutes a rewarding area of research, particularly in countries such as India which have a rich biodiversity of natural plant resources coupled with a high prevalence and variety of infectious diseases. The characteristics, sophistication, and intensity of the ethnoveterinary systems differ greatly among individuals, societies, and regions. Hence, documentation of ethnoveterinary medicine from regions having a rich ethnographic and biodiversity setting would be of great significance. Traditional knowledge of ethnoveterinary medicinal plants and their use by indigenous cultures are not only useful for conservation of cultural traditions and biodiversity but also for community healthcare and drug development in the present and future[9]. Documentation of indigenous knowledge and evaluation of the use of plants for a variety of purposes assume greater significance, not just to retain it, but also to keep it alive and make it available for future use because of rapid socio-economic and cultural changes that are taking place across the traditional community of the region. Keeping this in view, the present studies was initiated, with an aim to identify knowledgeable resource person *i.e.* elderly learned farmers and experienced traditional healers and document their knowledge of on the utilization of ethnoveterinary medicinal plants in Tikamgarh district of Bundelkhand region, India.

2. Material and methods

Bundelkhand region is situated between 23°8′- 26°30′ N latitude and 78°11′- 81°30′ E longitude in central part of India. The geographical location of Bundelkhand is in such a way that it acts as a gateway between the north and south India (Figure 1). The Bundelkhand region comprises of five districts of Uttar Pradesh State *viz*., Jhansi, Lalitpur, Jalaun, Hamirpur and Banda; six districts of Madhya Pradesh State *viz*., Datia, Tikamgarh, Chhatarpur, Panna, Damoh and Sagar and Lahar and Bhander tahsils of Bhind and Gwalior districts, respectively. The topography of the region is characterized by its smooth flat lands and inter-mixed undulating topography of varied slope. The Bundelkhand is bounded by the Yamuna river in the north, escarped ranges of the Vindhyan plateau in south, the Sindh River in the north-west and Bhanrer ranges in the south-east. The region is spread over 71618 km^2 and supports 12.45 million human populations as per 1991 census[10].

Tikamgarh District is located in the northern part of Madhya Pradesh. It lies on the Bundelkhand Plateau between the Jamni, a tributary of Betwa and Dhasan rivers. It

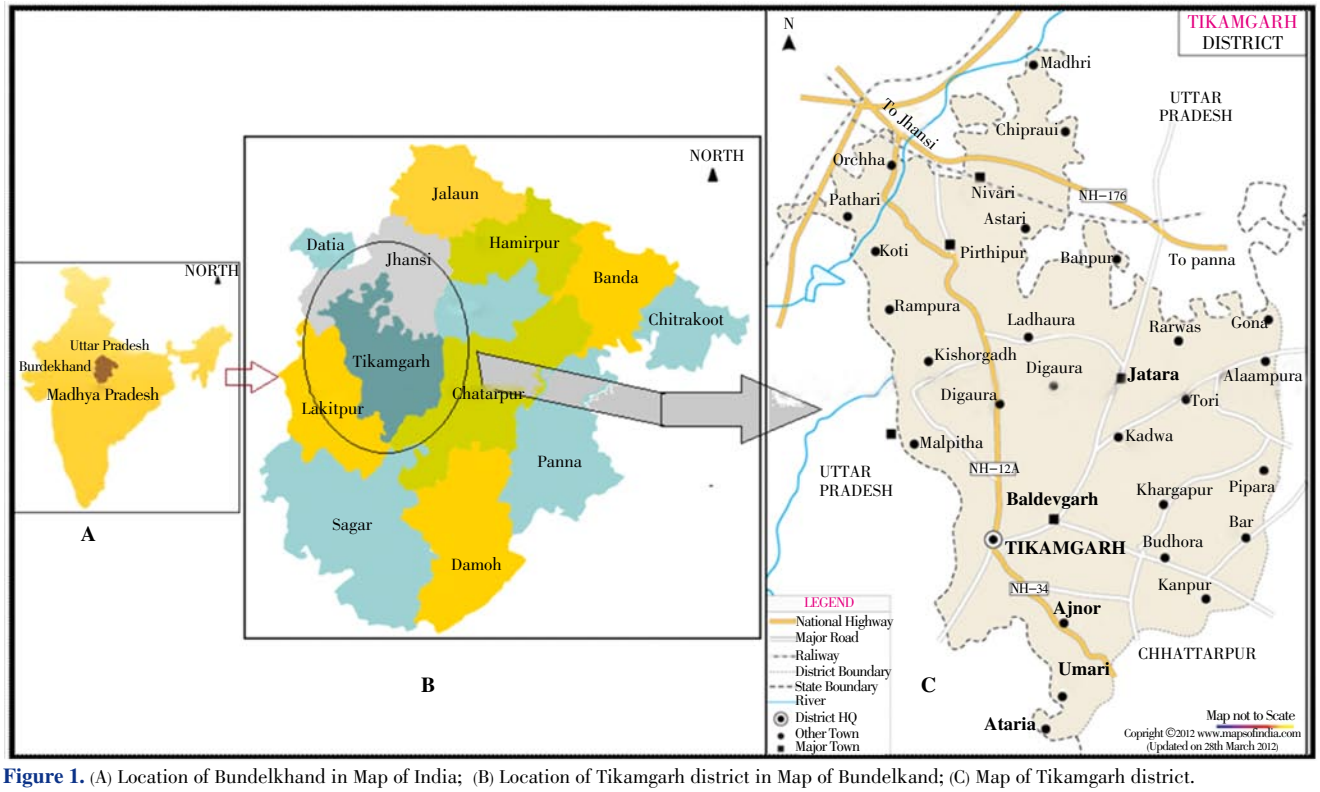

Figure 1. (A) Location of Bundelkhand in Map of India; (B) Location of Tikamgarh district in Map of Bundelkand; (C) Map of Tikamgarh district.

extends between the latitude 24°26′ and 25°34′ N and between 78°26′ and 79°21′ Longitudes. The total geographical area of Tikamgarh District is 5048.00 km^2 and the total population is 1202998. The shape of district is triangular. The northern margin is very irregular. The maximum length of the district is about 119 km from North to South and width about 80 km. Tikamgarh District is bounded by Chhatarpur district to east, Lalitpur district Uttar Pradesh to West, Jhansi to North and Sagar to South. The western and Eastern boundaries are formed by two big rivers.

The climate of Tikamgarh district is semi-arid and has a distinct seasonality on the basis of distribution of rainfall and variation in temperature, the climate of Tikamgarh district can be said to be typically monsoonic and can be divided into four distinct seasons *viz*., winter, summer, rainy and post rainy season. The winter or cold season extents from December to February, and is marked by minimum temperature and moderate humidity. Occasional showers are also occurs in the cold season during December to January. The south-west rains or monsoon starts from middle of June and continue till last end of September. The normal annual rainfall of Tikamgarh district is 1057.1 mm. About 90.3% of annual rainfall is received during monsoon season. Only 9.7% of annual rainfall takes place in rest months of the year. October and middle of November constitute the post monsoon season. Summer season commences from March and continue till mid of June. May is the hottest month of the year with very high temperature and low humidity.

The remote villages of Tikamrarh district were regularly visited from July 2011 to June 2012.

The information regarding the usage of ethnoveterinary medicinal plants available in the local area for treating various ailments and disease of livestock, was collected by directly interviewing elderly learned farmers and experienced traditional healers who have traditional Knowledge about these ethno veterinary medicinal plants in the villages of surveyed district[11]. Questionnaire surveys, participatory observations and field visits were planned to elicit information on the uses of various plants. The plant material was collected and carefully handled for identification by authenticated source. Making herbaria preserved most of the plant materials and all the specimen vouchers were carefully numbered and deposited. The ethno-medicinal value of each plant was enumerated in the following pattern: Botanical name/ Family, Local Name, Parts used and Mode of administration.

The identification of plants was done using the following references: 1)Forest Flora for Pilibhit, Oudh, Gorakhpur and Bundelkhand by P.C. Kanjilal[12]; 2) Flora of British India by Hooker[13]; 3) Silviculture of Indian trees by Troupe[14]; 4) Indian medicinal plants by Kirtikar and Basu[15].

3. Results

The results of the study are presented in Table 1. The plants are arranged in alphabetical order. For each species botanical name, family, local name, parts used, mode of administration and diseases treated are provided. The rural farmers and traditional herbal healers of villages in Tikamgarh District of Bundelkhand region used a number of ethnoveterinary medicinal plants for healthcare of

Table 1

Ethnoveterinary medicinal plants utilized by rural farmers for livestock healthcare in Tikamgarh District, Bundelkhand, India.

Botanical name (Family)	Ailment/Disease	Part used	Mode of administration
Acacia nilotica Linn. (Fabaceae)	Jaundice	Flower	◆About 200 g flower grinded well and mixed with 250 mL. water, the solution so obtained is given orally twice daily for 15-20 d to animal to cure jaundice.
	Dysentery	Bark	◆The extract of bark is given to animal orally twice a day for 10-20 d to cure dysentery.
Adhatoda vasica Nees. (Acanthaceae)	Diarrhoea and dysentery	Leaf, Bark	◆Leaf juice is mixed with equal amount of bark juice of Syzygium cumini is administered thrice a day for one week to treat diarrhoea and dysentery.
Aegle marmelos (L.) Corr. (Rutaceae)	Sun burn	Leaf, Seed	◆About 500 g fresh leaves made into paste by grinding and mixed with 100 mL. seed oil of Ricinus communis. This paste is applied over skin affected till the rest from sun burn.
Allium cepa Linn. (Liliaceae)	Removal of ecto-parasites	Bulb, Leaf	◆Bulb of onion is grinded well and mixed with 100 mL. of mustard oil and 25 g leaf ash of Musa paradisiaca. The mixture so obtained is externally applied on the skin for removal of the ecto-parasites.
	Cough	Bulb	◆Bulb paste mixed with mustard oil and administered thrice daily for one month for the treatment of cough
Asparagus racemosus Wild. (Liliaceae)	Arthritis	Root	◆About 500 g root powder given with milk for one month for the treatment of arthritis in cattle.
Argemone mexicana Linn. (Papavaraceae)	Foots infection, Rheumatism	Leaf, Fruit	◆The juice, extracted from leaves (100 g) and fruits (100 g), is applied over foots suffering from infections. Same juice is also applied over body parts of cattle for relieving pain from rheumatism.
Azadirachta indica A. Juss.(Meliaceae)	Wound	Bark	◆About 500 g bark of Azadirachta indica and 250 g bark of Acacia nilotica is grinded and mixed with water. The paste so obtained is applied over wounds till complete recovery.
Bambusa arundinacea (Retz.) Wild. (Poaceae)	Easier delivery	Leaf	◆The leaves (100-200) g are given to pregnant buffalo for a month twice a day to easier delivery.
	Diarrhoea	Leaf, Rhizome	◆Equal amount of rhizome and fresh leaf of bamboo is made into paste and given twice a day for 7 d to the cattle suffering from diarrhea.
Butea monosperma (Lam.) Taub. (Fabaceae)	Dysurea, paralysis	Flower	◆Decoction of flowers is given to the cattle thrice in a day for one month for the treatment of dysurea and paralysis.

Table 1, continued:

Botanical name (Family)	Ailment/Disease	Part used	Mode of administration
Calotropis procera (L.) R. Br (Asclepiadaceae)	Easier delivery	Flower	◆The paste of flower (50 g) mixed along with jaggery (100 g) and given to animal for easier delivery.
	Snake bite	Latex	◆Milky latex of plants is applied externally on snakebite to neutralized poison.
Cassia fistula Linn. (Fabaceae)	Indigestion	Pod	◆The paste of pods is given twice a day along with wheat bread to cattle in the case of indigestion.
	Improve appetite	Leaf	◆The paste of leaf is mixed along with mustard oil and given twice a day for 5 d to improve appetite.
	As purgative in severe constipation	Leaf, Ripe pod	◆The young leaves are cooked and given as purgative. Paste of ripe pods is also administered for purgative purpose.
Coriandrum sativum Linn. (Apiaceae)	Loose motion	Seed, Leaf	◆The seed powder is mixed with leaves paste of Lawsonia inermis and given twice a daily for 7 d to animal to cure loose motion.
Cynodon dactyIon (Linn.) Pers. (Poaceae)	Increasing lactation	Aerial plant	◆The aerial (0.3 kg per day) plant is given as fodder for increasing lactation and milk quality.
	Conjunctivitis	Leaf	◆One teaspoonful leaf juice is dropped in each eye in morning for three d for the treatment of conjunctivitis.
Dalbergia sissoo Roxb. (Fabaceae)	Stop bleeding	Leaf	◆Juice of 100 g leaves is given twice or thrice in a day for one week to stop bleeding effectively.
Datura metal Linn. (Solanaceae)	Cold	Ripen fruit	◆About 100 g are ripen frits are made in to paste and given to cattle once daily for 7 d to cure cold.
	Wounds	Leaf, Root	◆A paste is prepared from 300 g fresh leaves and 200 g roots and given to animals once daily for 7 d to stop bleeding from the wounds and early healing.
Delonix regia Linn.(Fabaceae)	Fever	Bark	◆Extract of bark is given with black pepper and garlic twice daily until cued for the treatment of fever.
Eclipta prostrata Linn.(Asteraceae)	Wounds	Leaf	◆Fresh leaves are grinded and boiled with mustard oil. The paste so obtained is applied twice daily for 10-15 d on wounds for early healing.
Feronia elephantum Linn.(Rutaceae)	Intestinal worm	Leaf	◆Fresh leaves are grinded well and mixed with 500 L of water and given to cattle once daily 10-20 d in case of intestinal worm.
Ficus benghalensis Linn. (Moraceae)	Stomachache	Root	◆About 100 g root is grinded well and given once daily for 3 to 4 d to cattle suffering from stomachache.
Ficus religiosa Linn. (Moraceae)	Tonsils	Leaf	◆The juice of leaves is used to cure tonsils.
Hibiscus rosa-sinensis Linn. (Malvaceae)	Twitching	Bark	◆Bark, about 150-200 g, is grinded well and given with one liter twice daily till complete rest in case of twitching.
Holoptelia integrifolia (Roxb.) Planch. (Ulmaceae)	Removal of ecto-parasites	Leaf	◆Leaf juice is applied on the skin for removal of ecto-parasites.
Madhuca indica J.F. Gmel (Sapotaceae)	Fever	Flower	◆About 100 g flower paste, 250 jaggery and 50 water is mixed and given twice daily for seven d to cure fever of cattle.
Mangifera indica Linn. (Anacardiaceae)	Indigestion	Fruit	◆The paste is obtained from 50 to 100 g fruit and given along with wheat bread once or twice daily for seven day to cattle in the case of indigestion.
Mentha arvensis Linn. (Lamiaceae)	Fever	Leaf	◆The paste is obtained from 250 g leaves of Mentha arvensis and 200 g leaves of *Centella asiatica* and given to cattle twice in a day for 7 d to cure fever.
Moringa oleifera Lamk. (Moringaceae)	Diarrhoea, Dysentery	Leaf	◆About 100-200 g leaf paste is given twice daily for three to 5 d to cattle for quick relief from diarrhoea and dysentery.
	Rheumatism	Pod	◆The paste is prepared from 450-500 g pods and given approximate one month for relief from rheumatism.
	Ulcers	Root	◆Juice of the roots is applied on the ulcers of cattle for healing and removal of larvae of insects from it.
Musa paradisiaca Linn. (Musaceae)	Body heat	Leaf, Root	◆Young leaves and roots are given with fodder for one week to reduce body heat of cattle
Ocimum sanctum Linn. (Lamiaceae)	Cough, Cold	Leaf	◆The fresh leaf of Ocimum sanctum (350 g) is boiled in water (200-250) mL and the decoction so obtained is given to cure cough and cold.
Ocimum gratissimum Linn. (Lamiaceae)	Removal of ecto-parasites	Leaf	◆Leaf paste is applied externally on skin of cattle for removal of ecto-parasites.
Oryza sativa L.(Poaceae)	To enhance lactation	Grain	◆Rice grains are cooked along with black gram, black salts and black pepper. The recipe so prepared is given once or twice in a day for one month to enhance lactation in cattle.
Psidium guajava Linn.(Myrtaceae)	Fever	Leaf	◆One liter decoction of fresh leaves is given twice daily till recovery to cure fever.
Ricinus communis Linn. (Euphorbiaceae)	Constipation	Seed	◆About 50 g seed is given orally with fodder for 7 d in case of constipation of cattle.
Syzygium cumini (L.) Skeels. (Myrtaceae)	Joint pain	Bark	◆Equal amount of bark of *Syzygium cumini* and *Azadirachta indica* is boiled in water and the decoction so prepared is spread on the affected joints in case of joints pain.
Tamarindus indica Linn.(Fabaceae)	Swelling	Leaf	◆The fresh leaves, about (400-500) g, are boiled in water and these leaves are tie up on affected part of body to cure swelling till the complete relief.
	Tongue sores	Fruit	◆The ripe fruits is made into paste and mixed with *Allium sativum*. The mixture so obtained is fried mildly in oil of mustard and applied on the tongue sores.

Table 1, continued:

Botanical name (Family)	Ailment/Disease	Part used	Mode of administration
Tegetus erecta Linn. (Asteraceae)	Hydrophobia	Leaf	◆About (20–40) g leaves are boiled in 500 mL. of water and the decoction so obtained is given once in a day for a month to cattle suffering from hydrophobia.
Tribulus terrestris Linn. (Zygophyllaceae)	Colic, cough	Leaf	◆Juice of fresh leaves is given to animals in case of colic and chronic cough.
Trigonella foenum- graecum L.(Fabaceae)	Easier delivery	Seed,	◆About 100 g sprouted seed is given to pregnant animal once daily for one month for easier delivery.
	Twitching	Seed	◆About (25–30) g dried seed powder is given twice daily for 5 to 7 d to animal suffering from twitching.
Vigna radiata (L.) R. Wilczek (Fabaceae)	Cough,Cold	Seed,Seed Oil	◆About 250 g seed powder is mixed with 100 mL oil of *Arachis hypogea* and given twice daily for 7 d to cattle suffering from cough and cold.
Zingiber officinale Rosc. (Zingiberaceae)	Physically disability	Rhizome	◆About 100 g fresh rhizomes is boiled in half liter cow milk and given to physically disable animal twice a day for 15 d.
Vitex negundo Linn. (Verbenaceae)	Diarrhoea	Leaf	◆Dried leaves mixed with fodder are given to the cattle for one week to cure diarrhoea.
Ziziphus jujuba Linn. (Rhamnaceae)	Skin burn	Leaf,Seed Oil	◆Leaf paste is mixed with oil of *Linum usitatissimum* and applied over the areas suffering from skin burn. This treatment is given thrice or fourth a day for one week.

livestock. A total of 41 plant species in 39 genera and 25 families were used traditionally with various plant parts and their combinations for the treatment of more than 36 diseases in the studied area. The rural farmers and traditional herbal healers were using these plants to treat the various diseases of livestock like arthritis, body heat, cold, colic, conjunctivitis, constipation, cough, diarrhoea, dysentery, dysurea, easier delivery, fever, foots infections, hydrophobia, improve appetite, increasing lactation, indigestion, intestinal worm, jaundice, joint pain, loose motion, paralysis, physically disability, removal of ecto-parasites, rheumatism, skin burn, snake bite, stomachache, stop bleeding, sun burn, swelling, tongue sores, tonsils, twitching, ulcers and wounds.

Tree (17 species) was found to be the most used Ethnoveterinary medicinal plant followed by herb (15 species), shrub (6 species) and grass (3) in descending order (Figure 2). Out of 15 herbaceous plant species Asparagus racemosus of family Liliaceae was climbing herb and *Musa paradisiaca* of family Musaceae was only large herbaceous plant while out of 3 three grasses *Bambusa arundinacea* was woody perennial grass. The highest number of ethno veterinary medicinal plants was recorded from family Fabaceae having eight plant species followed by Lamiaceae and Poaceae each having three plants species. Five families namely Asteraceae, Liliaceae, Moraceae, Myrtaceae, Rutaceae were contribute two species. Rest of the reported families contributed one species each (Table 2, Figure 3).

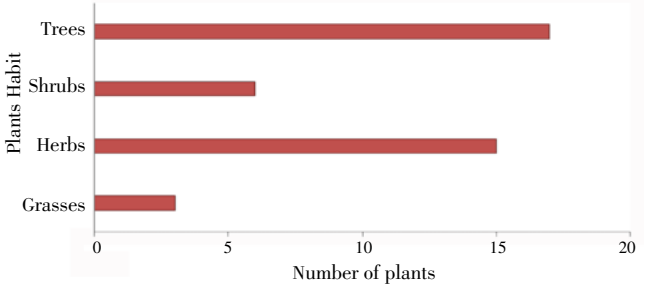

Figure 2. Habit of ethno-medicinal plants used by traditional healers.

Table 2

Representation of the families and plants studied at study site.

S.N.	Name of family	Name of plants
1.	Acanthaceae	*Adhatoda vasica* Nees.
2.	Anacardiaceae	*Mangifera indica* Linn.
3.	Apiaceae	*Coriandrum sativum* Linn.
4.	Asclepiadaceae	*Calotropis procera* (L.) R. Br.
5.	Asteraceae	*Eclipta prostrata* Linn.
		Tegetus erectus Linn.
6.	Euphorbiaceae	*Ricinus communis* Linn.
7.	Fabaceae	*Acacia nilotica* Linn
		Butea monosperma (Lam.) Taub.
		Cassia fistula Linn.
		Dalbergia sissoo Roxb.
		Delonix regia Linn.
		Tamarindus indica Linn.
		Trigonella foenum-graecum L.
		Vigna radiata (L.) R. Wilczek
8.	Lamiaceae	*Mentha arvensis* Linn.,
		Ocimum gratissimum Linn.
		Ocimum sanctum Linn.
9.	Liliaceae	*Allium cepa* Linn.
		Asparagus racemosus Willd.
10.	Malvaceae	*Hibiscus rosa-sinensis* Linn.
11.	Meliaceae	*Azadirachta indica* A. Juss.
12.	Moraceae	*Ficus benghalensis* Linn.
		Ficus religiosa Linn.
13.	Moringaceae	*Moringa oleifera* Lamk.
14.	Musaceae	*Musa paradisiaca* Linn.
15.	Myrtaceae	Psi*dium guajava* Linn.
		Syzygium cumini (L.) Skeels.
16.	Papavaraceae	*Argemone mexicana* Linn.
17.	Poaceae	*Bambusa arundinacea* (Retz.) Wild.
		Cynodon dactyIon (Linn.) Pers.
		Oryza sativa L.
18.	Rhamnaceae	*Ziziphus jujuba* Linn.
19.	Rutaceae	*Aegle marmelos* (L.) Corr.
		Feronia elephantum Linn.
20.	Sapotaceae	*Madhuca indica* J.F. Gmel
21.	Solanaceae	*Datura metel* Linn.
22.	Ulmaceae	*Holoptelia integrifolia* (Roxb.) Planch.
23.	Verbenaceae	*Vitex negundo* Linn.
24.	Zingiberaceae	*Zingiber officinale* Rosc.
25.	Zygophyllaceae	*Tribulus terrestris* Linn.

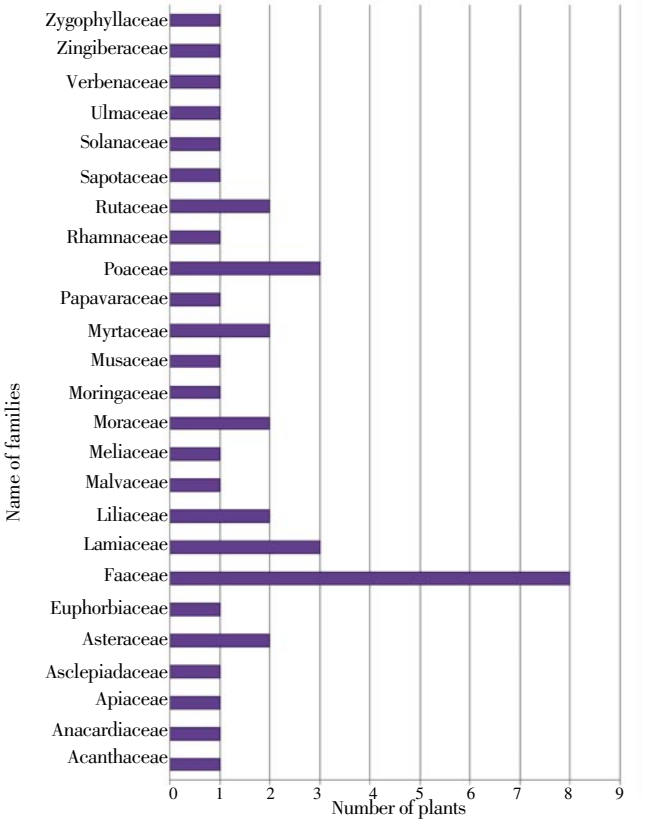

Figure 3. Representation of the families and no. of plants studied at study site.

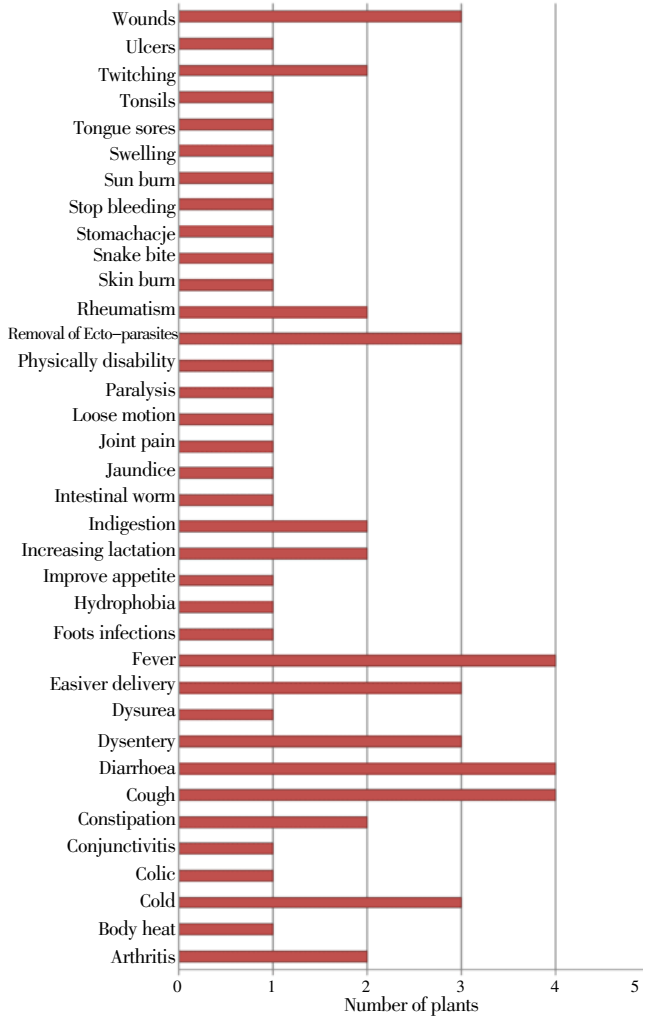

Figure 4. Frequency of plant species used for treatment of various diseases.

The most common disease cough, diarrhoea and fever were treated by 4 ethnoveterinary medicinal plant species followed by cold (3 species), dysentery (3 species), easier delivery (3 species), removal of ecto-parasites (3 species), wounds (3 species), constipation (2 species), indigestion (2 species), rheumatism (2 species), twitching (2 species), while rest of reported ailments were treated by only one plant species (Figure 4).

Different parts of ethnoveterinary medicinal plants were used as medicine by the rural farmers and traditional herbal healers for the treatment of different diseases of livestock. Among the different plant parts, the leaves were found to be most frequently used part for the treatment of various ailments followed by seed, bark, fruit, root, flower, pod, rhizome, bulb and whole aerial plant. The methods of using these plant parts vary according to the nature of diseases. The methods of preparation fall into nine categories *viz.* ash, decoction, extract, juice, oil, paste, powder, solution, boiled form. In some cases various plant parts also used in dried and fresh form directly. Most common method of preparation was paste of different plant parts followed by Juice, decoction, oil, powder, solution, extract, boiled and ash.

The rural farmers and traditional herbal helers were commonly using only two plants namely *Cassia fistula* and *Moringa oleifera* to treat more than two numbers of diseases of livestock. *Acacia nilotica*, *Adhatoda vasica*, *Allium cepa*, *Argemone mexicana*, *Bambusa arundinacea*, *Butea monosperma*, *Calotropis procera*, *Cynodon dactyIon*, *Datura metal*, *Ocimum sanctum*, *Tamarindus indica*, *Tribulus terrestris*, *Trigonella foenum-graecum* and *Vigna radiata* were reported to be used in two numbers of different ailments of livestock. Rest of the plant species were being used for treating one number of different ailments of livestock. Internal consumption of the preparations is involved in the treatment of most of the ailments except skin (sun burn, removal of ecto-parasites foots infections, wounds, ulcers, skin burn) joints and muscle (rheumatism, swelling, joint pain) related health problems and snake bite.

4. Discussion

In Bundelkhand region, diseases are fundamental troubles for the living being including human and animals. Living being has constantly been struggling with diversified types of sickness since early periods. Domestic animals keepers who have close to their animals often have thorough information on diverse disease, their causes and manage. Local people may use a single term for several diseases that cause similar symptoms. Male are dedicated observers of diseases effecting domestic animals, due to their association with milking and grazing and have awareness about troubles associated to lactation, milk letdown, milk quality, *etc*. The most frequently used resources of drugs are locally and easily accessible plants and their products. The studies conducted in other part of India also support to this finding of present study[16-19]. Rural farmers and traditional herbal healers have good knowledge of animal behavior and can easily identify sick animal quickly. In most cases they are the first observer of diseases. The farmers of studied area rear their livestock as

a part of the family. This knowledge was gained from their own experience or from elders of villages through the word of mouth. The studies carried out by other workers in different part of India also exhibits that rural people and traditional herbal healers have very vast knowledge of ethnoveterinary medicinal plants[20–25].

Alike present study, leafy part of the plants rank first, among the various plant parts used for treatment of various diseases of the livestock in other studies at different part of India[26–28]. Of the plants used for the treatment of ailments by the farmers in the present study, some of the plants were reported to treat different types of diseases in animals by the previous researchers in the different states of India[29–34]. However, disease concepts and treatments vary extensively across societies, and even within a single community among gender, age, learning, and caste.

The flora of district Tikamgarh district of Bundelkhand region has immense pharmaceutical and commercial potential. However, very scanty work[35–38] have been done on ethnoveterinary medicinal plants in Bundelkhand region. There are several species in this district with very rich commercial importance, but are valuable only in the wild. Nearby accessible and easily available ethnoveterinary medicinal plants provide a cheaper source for treatment of various ailments and diseases as compared to western drugs. The only restriction is the seasonal accessibility of certain plants, for which farmers have acquired different ways to preserve them for off-season uses. The farmers of studied area located in Tikamgarh district have very vast knowledge of traditional ethnoveterinary medicines. However, due to their constant and progressive exposure to modernization, there is danger about disappearance of such rich heritage of information in the course of time. Therefore, documentation of this knowledge is valuable for the farmers and their future generations and for scientific consideration of wider uses of traditional knowledge in treating domestic animals. There is an urgent need of collective efforts from botanist, ethnobotanists and ethnopharmacologists to document, conserve and evaluate the efficiency of these valuable drugs. In order to sustainable development and long term conservation of natural resources of the area; there is a need of active participation of local people in evaluation, planning, implementation and monitoring processes as they are the best judges of the area.

The present study recommended that the crop and medicinal plant genetic resources cannot be conserved and protected without conserving/managing of the agro-ecosystem or natural habitat of medicinal plants and the socio-cultural organization of the local people. The same may be applied to protect indigenous knowledge, related to the use of medicinal and other wild plants. Introduction of medicinal plants in degraded government and common lands could be another option for promoting the rural economy together with environmental conservation, but has not received attention in the land rehabilitation programs in this region.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

The author show their deep thanks and gratitudes to the Vice-Chancellor Prof. Avinash Chandra Pandey, Bundelkhand University, Jhansi, India, for providing facilities to undertake this very special thanks to Dr. S.R. Gupta, a well known Ecologist of Bundelkhand for extending help in identification of various plant species. Author also acknowledged to the respondents who were interviewed during data collection.

Comments

Background

Livestock play very imperative role in the life of rural inhabitant of India. In the villages of Bundelkhand region of India rural inhabitant are still dependent on ethnoveterinary plants for the treatment of various ailments of livestock, which evolved over generation of experience and practices and this knowledge is mysterious to the modern world. The available information on ethnoveterinary medicinal plants in Bundelkhand region is not enough. Therefore, there is need to documents this great knowledge of rural farmers and experience herbal healers concerning with heath care of livestock.

Research frontiers

The findings of this research paper are very remarkable particularly ethnoveterinary utilization of *Acacia nilotica* (jaundice), *Asparagus racemosus* (arthritis), *Argemone maxicana* (foots infection), *Holoptelia integrifolia* (removal of ectoparasite), *Oryza sativa* (to enhance lactation), *Tegetus erecta* (hydrophobia), *Tamarindus indica* (tongue sores). The modes of administration of ethnoveterinary plants for treatment of various ailments are also very distinctive.

Related reports

The findings of this paper are not in close agreement of earlier studied of other workers who have worked on ethnoveterinary medicinal plants in Bundelkhand region. This may be due to several reasons like availability of plants, societies of villages, past gain experience of plants, knowledge of diagnose of disease, availability of modern health facility *etc*.

Innovations and breakthroughs

In India, enough attention has not yet been given to the traditional veterinary herbal remedies. Even ancient Indian literature has not provided much information on veterinary remedies. There has been a rich tradition and indigenous knowledge about animal healthcare in India including Bundelkhand region. Considering above fact the work carried out by author have great significance.

Applications

Ayurveda is a very significance Indian healthcare system, in which drugs are prepared from plants. Thus studied plants may also play a significant role in formulations of new ayurvedic drugs for human and domestic animals.

Peer review

This is a valuable research work which deals with ethnoveterinary medicinal plants utilized by rural farmers and experience herbal healers of the studied villages of Bundelkhand. The results are interesting and suggested that surrounding flora of any region may play a key role in the management of animal health care and development of new Ayurvedic preparation.

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