AN ETHNOVETERINARY STUDY ON MEDICINAL PLANTS USED FOR ANIMAL DISEASES IN RIZE (TURKEY)

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(Received 18th Apr 2022; accepted 11th Jul 2022)

Abstract. Medicinal plants used in the treatment of animals in Rize province in northeast of Türkiye were recorded through semi-structured interviews with farmers and shepherds. The collected data were analyzed using the quantitative indices informant consensus factor (FIC) and fidelity level (FL). It was identified that a total of 38 plants belonging to 30 families were found used in ethnoveterinary. The most cited families were Fabaceae and Asteraceae. The highest FIC was recorded for digestive system diseases (0.93), followed by skin diseases (0.88) and milk production (0.85). The high FL values were *Datisca cannabina* L. for varroa, *Malva sylvestris* L. for wound healing, and *Sambucus ebulus* L. for external parasite (respectively 100%). Ethnoveterinary uses of *Datisca cannabina* L., *Caltha palustris* L., *Bryum schleicheri* Schwägr., *Adiantum capillus-veneris* L., *Solidago virgaurea* L. were recorded for the first time.

Keywords: *ethnoveterinary knowledge, folk remedies, informant consensus factor, livestock ailments, traditional practices*

Introduction

Plants have been a natural resource for humans and their pets to stay healthy. The best way to detect plants used in animal diseases is ethnoveterinary and ethnobotanical studies (Erarslan and Kültür, 2019). About 70000 of the plants on earth are used for therapeutic purposes. A large part of the world's population continues to trust folk medicine in the treatment of animals as well as their private health (WHO, 2021).

Ethnoveterinary medicine is a traditional treatment method applied by local people to protect the health of livestock and pets according to their traditions and cultures (McCorkle, 1986). Ethnoveterinary apps, which are unlike medical veterinary apps, are practiced and developed by farmers and shepherds and are handed down from generation to generation (Pande et al., 2007). This information, which usually does not have a written record, is in danger of being lost over time.

Traditional treatment methods for animals in Türkiye are limited to ethnobotanical studies. There are few resources available for ethnoveterinary knowledge (Sinmez and Aslım, 2017; Sinmez and Yaşar, 2017; Yıpel et al., 2017; Sinmez et al., 2018; Güler et al., 2021; Akbulut, 2022; Babacan et al., 2022). For this reason, recording traditional information in Türkiye will contribute to the development of animal husbandry. It was a decrease in the presence of cattle and a significant increase in bees and small cattle in the last 20 years in Rize. The cattle population, which was over one hundred thousand before, has decreased to 29,522 today. There are 6,908 sheep, 10,855 goats, 173 odd-toed ungulates, 2,425 cats and dogs, and 7,259 poultry. In Rize, the culture breed is Jersey, and there are few Brown Swiss and Holstein breeds. Beekeeping activities have gained momentum in recent years. The number of old type hives (black hives) is 4.159,

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/2005_41094119

and new type hives are 62,952, totaling 67,111. The number of villages dealing with beekeeping is 303. Annual honey production; is 638.250 kg, and wax production; is 22.400 kg. The number of registered farmers is over 10.000. (TR Ministry of Agriculture and Forestry, 2021). The study aims to record the plant taxa used in the ethnoveterinary, their preparation, and application methods used by local farmers and shepherds in treating different animal diseases in Rize and to contribute to animal medicine in this context.

Materials and methods

Study area

Rize is located in the Eastern Black Sea Region of Türkiye (*Fig. 1*). It is adjacent to the Black Sea in the north, Trabzon in the west, Artvin in the east, Bayburt in the southwest, and Erzurum in the south, and located between 40°-21' and 41°-25' east longitudes and 40°-33' and 41°-20' north latitudes. Rize is located in the Euro-Siberian flora region and the A8 squares according to the grid system by Davis (Davis, 1965). It has a significant plant diversity with approximately 1430 plant taxa, 110 of which are endemic (Güner et al., 2000). The region was mentioned for the first time in written records in the 8th century BC. Since then, it has hosted many civilizations covering Urartu, Pontus, Roman, Byzantine, and Ottoman (TR Ministry of Culture and Tourism, 2021). The most significant source of income of the region is tea agriculture. Due to the mountainous terrain, animal husbandry is usually ranched in the plateaus of Rize.

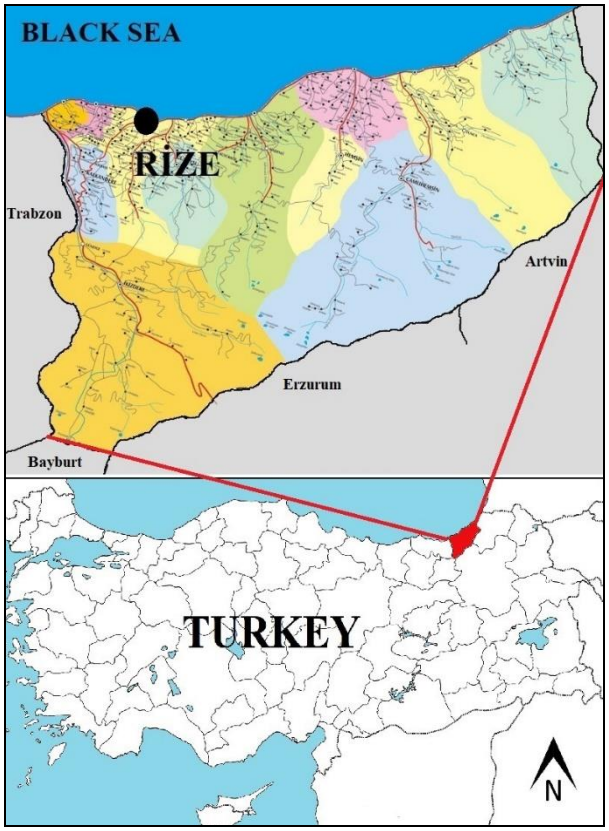

Figure 1. *The geographical location of Rize province*

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Data collection

The study was performed in the villages and highlands of Rize province between March and November 2021. Semi-structured interviews were carried out by 83 locals. Locals were chosen among the farmers and shepherds in the region. A survey was managed to the locals through face-to-face interviews. The demographic characteristics of the informants were noted. In the second part of the survey, the traditional methods related to the treatment of animals, plant species used, and the plant parts were recorded. Prior Informed Consent was taken orally before beginning each survey. Ethical directives considered the Code of Ethics of the International Society for Ethnobiology (ISE, 2008). Plant taxa were identified and named according to the Flora of Turkey (Davis, 1965-1985; Güner et al., 1987; Davis et al., 1988) and World Flora Online (WFO, 2021).

Data analysis

Ethnoveterinary information obtained from the surveys with farmers and shepherds was evaluated using quantitative methods (informant consensus factor and fidelity level).

The informant consensus factor (FIC) was calculated for each disease group to determine the informants' agreement on the noted treatment (Andrade-Cetto, 2009). The FIC formula was (*Eq. 1*):

$$FIC = (Nur - Nt)/(Nur - 1) \quad \text{(Eq.1)}$$

Nur: Total citation in each disease group. Nt: The number of use taxa.

Fidelity level (FL) refers to the specificity of the plants of choice for the diseases most frequently cited by locals (Friedman et al., 1986). The FL formula was (*Eq. 2*):

$$FL(\%) = \frac{Ip}{Iu} \times 100 \quad \text{(Eq.2)}$$

Ip: The number of people recommending utilizes of a plant for a specific disease. Iu: The total people who cited that a taxon is used to treat any disease.

Results

The study results showed that farmers and shepherds in Rize province use various ethnoveterinary methods for the health of their animals.

Ethnoveterinary records were compiled from face-to-face interviews with 83 locals. The informant ages ranged from 33 to 82, and the average was 52 (*Table 1*). The results showed that besides using the plants medicinally were used for milk yield and egg production (*Table 2*).

Ethnoveterinary medicine was usually used in cattle and small cattle. This is followed by bees, poultry, and horses. In the current study, a total of 38 plant taxa from 30 families used by farmers and shepherds for animal health were identified (*Table 2*). Plants were commonly used in the treatment of diseases such as wounds, cough, varroa, external parasites, and diarrhea. The most dominant family in terms of the number of species in the region was Fabaceae (4 taxa) and Asteraceae (3 taxa), and the remaining families had one or two taxa (*Fig. 2*). Leaves (15 taxa) and aerial parts (12 taxa) were used more for therapeutic effects, followed by flowers (6), fruits (3), and roots (2), respectively (*Fig. 3*).

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Table 1. *Demographic features of informants*

Indicator		Number of informants	Percentage (%)
Gender	Male	31	37.35
	Female	52	62.65
Educational level	Elementary school	6	7.23
	Secondary school	24	28.92
	High school	43	51.81
	University	10	12.05
Age groups	30-40	19	22.89
	41-50	33	39.76
	> 50	31	37.35

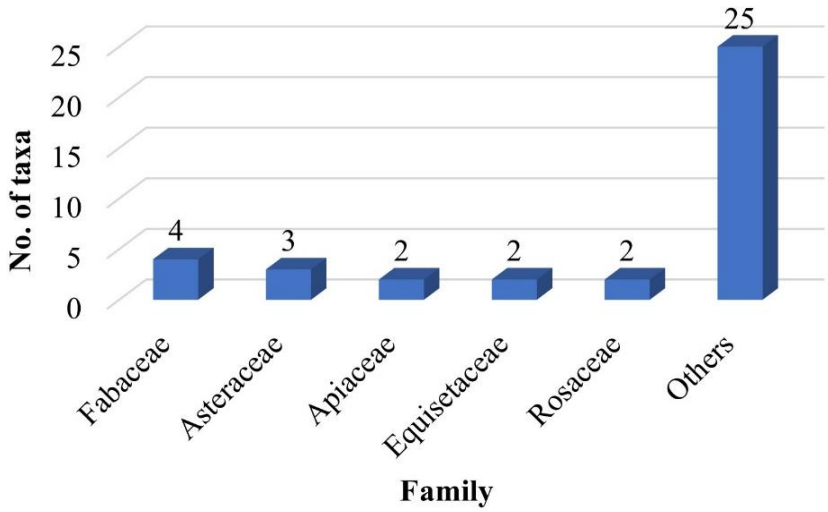

Figure 2. *The most frequently used plant families*

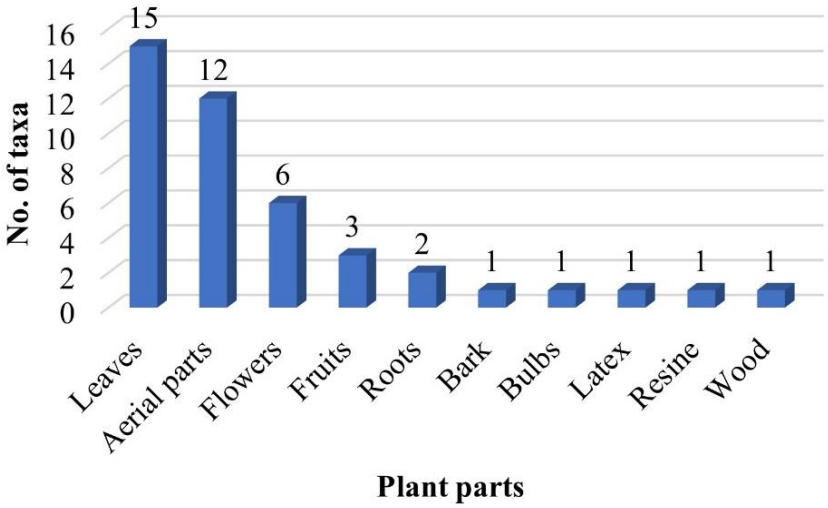

Figure 3. *Plant parts used*

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Table 2. *Ethnoveterinary uses of plant taxa in Rize (Türkiye)*

Scientific name	Family	Vernacular name	Parts used	Preparation	Route	Ethnoveterinary uses/therapeutic effect
Sambucus ebulus L.	Adoxaceae	Livor	Aerial parts	Decoction	Dermal	External parasites
Chenopodium polyspermum L.	Amaranthaceae	Sirken, Düdülü otu	Aerial parts	Fresh (fodder)	Oral	Increasing milk secretion
Allium sativum L.	Amaryllidaceae	Sarımsak	Bulb	Fresh	Dermal	Wound healing
				Cooking	Oral	Abdominal distension
Rhus coriaria L.	Anacardiaceae	Sumak	Fruits	Decoction	Dermal	Wound healing
Ferula szowitziana DC.	Apiaeae	Çakşır	Roots (dried)	Powder	Oral	Muscle pain (The powder is added to the water the animal will drink.)
Sanicula europaea L.	Apiaceae	Kadra	Aerial parts	Dried (fodder)	Oral	Boosting the immune system (for chicks)
Hedera helix L.	Araliaceae	Sarmaşık	Leaves	Decoction	Oral	Wound healing
Achillea millefolium L.	Asteraceae	Mayasıl otu	Leaves, flowers	Crushing	Dermal	Wound healing (for cat and dog)
Helichrysum plicatum DC.	Asteraceae	Altınotu, İspir çiçeği	Flowers	Decoction	Dermal	Wound healing
Solidago virgaurea L.	Asteraceae	Altınbaşak	Leaves (dried)	Powder	Oral	Burn wounds
Anchusa azurea Mill.	Boraginaceae	Sığırotu, Goriz	Leaves	Fresh	Oral	Poisoning
Bryum schleicheri Schwägr.	Bryaceae	Yosun	Leaves	Decoction	Oral	Sore mouth
Cannabis sativa L.	Cannabaceae	Kenevir	Leaves	Set on fire (dried)	Dermal	Varroa
Colchicum speciosum Steven	Colchicaceae	Göçkovan	Flowers	Decoction	Dermal	Cleaning cow udders
Juniperus communis L.	Cupressaceae	Ardıç	Bark	Set on fire	Dermal	Varroa
Datisca cannabina L.	Datiscaceae	Renkotu	Aerial parts	Set on fire (dried)	Dermal	Varroa
Equisetum arvense L.	Equisetaceae	Atkuyruğu	Aerial parts	Crushing	Dermal	Wound healing
Equisetum fluviatile L.	Equisetaceae	Atkuyruğu	Aerial parts	Crushing	Dermal	Wound healing
Euphorbia djimilensis Boiss.	Euphorbiaceae	Sütleğen	Aerial parts	Fresh	Oral	Snake poisoning (for goat)
Astracantha microcephala (Willd.) Podlech	Fabaceae	Geven	Leaves, roots	Decoction	Oral	Increasing milk secretion
				Poultice	Dermal	Swollen leg and foot
Medicago sativa L.	Fabaceae	Yonca	Aerial parts	Fresh (fodder)	Oral	Increasing milk secretion
Onobrychis viciifolia Scop.	Fabaceae	Korunga, Alapur	Aerial parts	Decoction	Oral	Increasing milk secretion
				Dried	Oral	Antitussive
Trifolium pratense L.	Fabaceae	Yonca	Leaves	Fresh (fodder)	Oral	Increasing milk secretion
				Poultice	Dermal	Wound healing
Populus tremula L.	Fagaceae	Kavak, Çençi	Wood	Wooden ash	Oral	Fungal infection (on the face of cattle)
Hypericum perforatum L.	Hypericaceae	Kantaron	Flowers	Centaury oil	Dermal	Wound healing, burn wound
Rosmarinus officinalis L.	Lamiaceae	Biberiye	Aerial parts	Crushing	Dermal	Cleaning up fleas
Malva sylvestris L.	Malvaceae	Ebegümeci	Leaves	Crushing	Dermal	Wound healing
Ficus carica L.	Moraceae	İncir	Latex	Fresh	Dermal	Warts (on cow udder)
Epilobium angustifolium L.	Onagraceae	Yakıotu	Leaves	Decoction	Dermal	Wound healing
				Crushing	Dermal	Wound healing, hemostasis
Picea orientalis (L.) Peterm.	Pinaceae	Karaçam	Resine	Cooking	Dermal	Wound healing (with olive oil)
Plantago major L.	Plantaginaceae	Çıbanotu, Damarotu	Leaves	Fresh	Oral	Antitussive, diarrhea
Triticum aestivum L.	Poaceae	Buğday	Leaves Fruits	Crushing	Oral	Antitussive
				Grind	Oral	Increasing egg production in chickens

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Adiantum capillus-veneris L.	Pteridaceae	Baldırıkara	Leaves	Poultice	Oral	Increasing milk secretion
					Dermal	Sprains and swelling
Caltha palustris L.	Ranunculaceae	Gongoros	Aerial parts	Decoction	Dermal	Foot pain
Alchemilla sericea Willd.	Rosaceae	Kapara otu, Tifilica	Leaves, flowers	Dried (fodder)	Oral	Antitussive (for horses)
Alchemilla speciosa Buser	Rosaceae	Kapara otu, Tifilica	Leaves, flowers	Dried (fodder)	Oral	Antitussive (for horses)
Viscum album subsp. *austriacum* (Wiesb.) Vollm.	Santalaceae	Çabu	Fruits	Crushing	Dermal	Wound healing
Urtica dioica L.	Urticaceae	Sığran, Erengiç	Aerial parts	Dried	Oral	Enterozoa
				Cooking	Oral	Eclampsia

The decoction was the most preparation method in traditional remedies (10 taxa), followed by fresh (8 taxa), crushing (7 taxa), and dried (7 taxa) (*Fig. 4*). Two routes of administration, dermal and oral, were used in the treatments. Both were equally cited.

Ethnoveterinary data were collected in 8 main categories in the FIC evaluation. In the current study, the FIC value ranged from 0.67 to 0.93 (*Table 3*). The medicinal plants are mostly used for skin diseases and wound healing, followed by digestive system diseases, milk production, and respiratory system diseases. Digestive system diseases have the highest FIC value (0.93). Skin diseases have the second-highest FIC value (0.88), milk production has the 3rd highest FIC value (0.85). The lowest FIC value with 0.67 corresponds to internal system diseases.

Table 3. *Informant consensus factor (FIC) for each disease category*

Disease categories	Diseases	Nt	Nur	FIC
Digestive system diseases	Enterozoa, diarrhea, stomach ailments, dyspepsia	3	30	0.93
Skin diseases	External parasites, skin inflammation, flea, varroa	9	66	0.88
Milk production	Milk production	5	27	0.85
Respiratory system diseases	Cough	4	18	0.82
Wound healing	Wound, burn, fungus, tomies	14	65	080
Poisonings	Poisonings	2	5	0.75
Orthopedics and traumatology	Sprains and strains, mouse, foot pain, muscle pain	4	12	0.73
Internal system diseases	Eclampsia, tonic	2	4	0.67

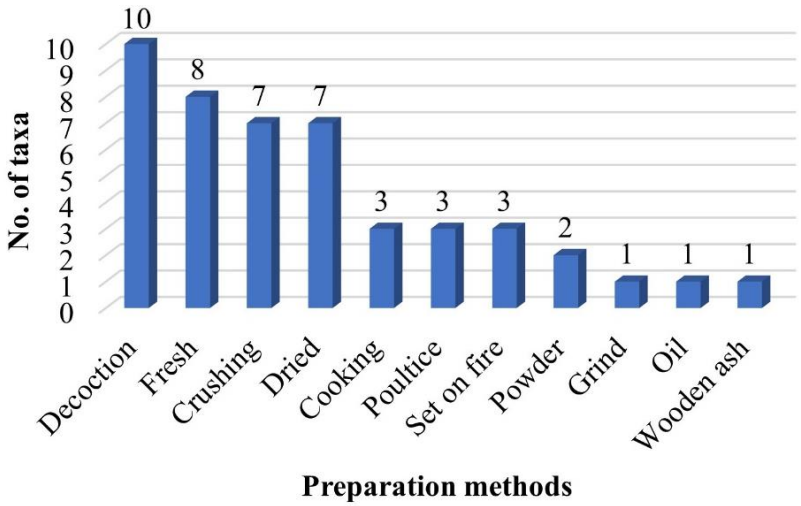

Figure 4. *Usage preferences in traditional remedies*

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An evaluation had made of the FL values of the cited plants. These values were found for the six most frequently cited plants, and their ranks ranged from 47.8 to 100 (*Table 4*). High FL was *Datisca cannabina* for varroa, *Malva sylvestris* for wound healing, and *Sambucus ebulus* for external parasite (respectively 100%).

Table 4. *Fidelity level (FL) index for the most cited medicinal plants*

Scientific name	Disease	Ip	Iu	FL value (%)
Datisca cannabina L.	Varroa	15	15	100
Malva sylvestris L.	Wound healing	11	11	100
Sambucus ebulus L.	External parasite	16	16	100
Hypericum perforatum L.	Wound healing	18	26	69.2
Allium sativum L.	Wound healing	8	13	61.5
Plantago major L.	Cough	12	23	52.2
Plantago major L.	Diarrhea	11	23	47.8

Discussion

In the current study, locals used mostly the leaves for treatment. Similarly, it was reported that leaves were the most preferred plant part in ethnobiology studies, especially in ethnoveterinary medicine in Türkiye (Erarslan and Kültür, 2019). Difference from those, aerial parts took place in the first place in the study conducted in Trabzon, which is adjacent to the research area (Akbulut, 2022).

The decoction was the most frequently used method for treatment in the study area that was like the various research from Northeast and Eastern Anatolia (Güler et al., 2021; Akbulut, 2022; Babacan et al., 2022). In the studies carried out in Central Anatolia and the Mediterranean, different preparation methods took the first place (Yaşar et al., 2015; Sinmez and Aslım, 2017; Yıpel et al., 2017; Sinmez et al., 2018).

Ethnoveterinary uses of *Datisca cannabina, Caltha palustris, Bryum schleicheri, Adiantum capillus-veneris, Solidago virgaurea* were recorded for the first time in Türkiye. Different usage areas of *Populus tremula, Astracantha microcephala, Cannabis sativa, Juniperus communis* were reported.

Beekeeping is so common and is a significant source of income in the region. Various measures are taken for varroa disease, which is effective in honey yield. The "set on fire" method, which is applied using various plants to protect bees from varroa disease, has not been included in the records before. In this method, especially *Datisca cannabina*, *Cannabis sativa*, and *Juniperus communis* are fired and the bees are exposed to smoke.

The majority of recorded plants are in general use for the treatment of all animals. Some plant species are used specifically to treat animals in different categories, as in beekeeping. The main groups and the plants used in the treatment resume in *Table 5*.

Some studies have shown that *Adiantum capillus-veneris* extract has been used on animals in clinical studies (Yadegari et al., 2019). It was reported that *Adiantum capillus-veneris* was used for increasing milk secretion, sprains, and swelling. The use of the plant in our study area was different from the world and it was reported that it was used for diarrhea and birth (Benítez et al., 2012; Shoaib et al., 2021). It was recorded that different species of *Adiantum* were used for different purposes such as skin diseases (Prakash et al., 2021) and abdominal pain (Abbasi et al., 2013).

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Table 5. *Main animal groups and plants used in their treatment*

Main groups	Plants used especially and diseases
Cattle-raising	*Colchicum speciosum* - Cleaning cow udders *Populus tremula* - Fungal infection *Ficus carica* - Warts
Sheep and goat breeding	*Euphorbia djimilensis* - Snake poisoning
Poultry farming	*Sanicula europaea* - Boosting the immune system *Triticum aestivum* - Increasing egg production
Odd-toed ungulates	*Alchemilla sericea* - Antitussive *Alchemilla speciose* - Antitussive
Domestic animals	*Achillea millefolium* - Wound healing
Beekeeping	*Datisca cannabina* - Varroa *Cannabis sativa* - Varroa *Juniperus communis* - Varroa

In the research area, it was recorded that the aerial parts of *Caltha palustris* were used in the treatment of foot pain. Extracts from this plant are known to have immunomodulatory properties (Suszko et al., 2012). The plant was reported to be used in skin diseases in China (Shen et al., 2010) and the treatment of worm-infested wounds and broken horns in India (Pande et al., 2007). With this study, the use of the plant for foot pain has also been added to the world literature.

Bryum schleicheri is a species from the bryophyte flora of the region. The plant, a type of moss, was recorded for the first time in ethnoveterinary folk medicine in Türkiye and the world. The decoction prepared from the leaves is given to animals for treatment of mouth sores.

Solidago virgaurea was included in the list of folk medicine for the first time in Türkiye and the world as a species used in the treatment of burns. The use of the plant for different purposes has been reported in the literature, such as antitoxic and abscess (Pande et al., 2007; Carrió et al., 2012). It has already been reported that the active ingredients of *Solidago virgaurea* are used in veterinary homeopathy in clinical signs (EMEA, 2000). Ajaib et al. (2021) stated in their study in Pakistan that *Solidago lacustralis* was used for ethnobotanical purposes in the treatment of burns in human medicine.

High FIC values document the use of herbs by many informants to treat a particular disease (Heinrich et al., 1998). In the current study, the highest FIC value of 0.93 belongs to digestive system diseases. In similar studies from Türkiye, the FIC value of dermatological ailments is generally higher (Erarslan and Kültür, 2019; Güler et al., 2021; Akbulut, 2022). In other countries, different disease groups come to the fore in high FIC values. It has the highest FIC values for respiratory disorders in China (Xiong and Long, 2020), gastrointestinal diseases in Lebanon (Arnold-Apostolides et al., 2020), dermatological and gastrointestinal diseases in Pakistan (Ahmad et al., 2015; Sharma and Manhas, 2015), and digestion in Indonesia (Pratama et al., 2021).

Plants with high FL are more preferred by local people compared to plants in the same category. High FL values have *Sambucus ebulus* for parasites and *Malva sylvestris* for wounds in the current study. It was also similar using methods and diseases in the various research from Türkiye and the world (Akerreta et al., 2010; Yıpel et al., 2017; Güler et al., 2021; Pascual and Herrero, 2021; Akbulut, 2022). *Datisca cannabina* has been accepted as the species used in traditional treatment methods for varroa disease in beekeeping.

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Conclusion

Traditional treatment methods are significant for livestock activities in mountainous terrains and rural areas. It has been determined that the local people dealing with animal diseases in Rize province use 38 plants in ethnoveterinary practices. Each study adds new plants used in treatment to the literature. In this study, it was determined that *Datisca cannabina, Caltha palustris, Bryum schleicheri, Adiantum capillus-veneris, Solidago virgaurea* species were used in the treatment of diseases. It is thought that such determinations can be a source for medical and veterinary research.

Acknowledgments. The authors thank Rize locals and informants for their contributions to the study.

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