

An ethnoveterinary study on plants used for in the treatment of livestock diseases in Ayvalık (Balıkesir, Turkey)

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In this study, the medicinal plants used in the treatment of livestock diseases by the rural people living in Ayvalık district (Balıkesir) were determined. In addition, how and for what purposes these plants are used was investigated. A total of 50 informants such as breeders, shepherds and farmers were selected randomly for the study. Data were collected through semi-structured interview, focus group discussions, observation and guided field walk with informants. The collected data were analyzed through RFC, ICF, UV, FL, PPV and FUV. A total of 46 taxa of plants distributed in 44 genera belonging to 25 families were identified as commonly used ethnomedicinal for livestock diseases. The most cited families were Hypericaceae (FUV = 0.7), Oleaceae (FUV = 0.6), Pinaceae (FUV = 0.4) and Amaryllidaceae (FUV = 0.35). The majority of the remedies were prepared from infusion (53.9%). Leaves were the most frequently used plant part (PPV 0.31) and *Hypericum perforatum* subsp. *veronense* (UV) was the species most commonly prescribed by local people. The reported ailments were classified into 11 disease categories based on ICF values and the highest number of plant taxa was reported to treat gastrointestinal, lactation, dermatological and parasitic disorders. The results of this study showed that people living in the Ayvalık district are still dependent on medicinal and aromatic plants for animal diseases. The documented plants can serve as a basis for further studies on the region's medicinal plants knowledge and for future phytochemical and pharmacological studies.

Keywords: Ayvalık, Ethnobotany, Livestock, Medicinal plants, Turkey

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Introduction

Ethnobotanical studies started in the middle of the last century and researchers began to use subdivisions in their scientific reports, such as ethnobiology, ethnozoology, ethnobotany, and ethnoveterinary¹. Ethnobotany is defined as the study of the relationships between people and plants and most commonly refers to the study of indigenous uses of plants²⁻⁷. People have a long history of traditional, medicinal and aromatic plants' uses for medical purposes in the world, and nowadays, this is highly actively promoted⁸. The application of plants that local people use for medicinal purposes on animals has revealed ethnoveterinary branch. Ethnoveterinary medicine (EVM) is important in animal healthcare in developing countries. It has become a recognized field of research that includes traditional veterinary

theory, medicines, surgical methods, diagnostic procedures and animal husbandry practices. Ethnozoology is the study of the past and present interrelationships between human cultures and the animals in their environment^{1,9}. It includes the classification and naming of zoological forms, cultural knowledge, and the use of wild and domestic animals³. This branch of science examines the relationship between humans and animals rather than the relationships between plants and animals. However, ethnozoology shares many methodologies and theoretical frame works¹⁰. Livestock plays an important role in a farmer's life. It gives manure, fuel, milk and meat but also plays a major role in the rural economy. Farmers take care of their livestock using ethnoveterinary medicine. These medicines are cheaper than synthetic drugs¹⁰⁻¹².

Turkey is one of the world's richest countries in terms of flora and fauna. The number of vascular plants spreading in Turkey is close to the number of

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vascular plants in Europe¹³. With approximately 11,000 species, Turkey has one of the richest floras in the temperate zone. This richness of Turkish Flora is mostly based on geographic, climatic, topographic and edaphic factors. Turkey is also one of the richest countries in Asia and Europe continents with respect to endemism. The number of endemic taxa is more than 3600 and the endemism ratio is about 34%¹⁴⁻¹⁵.

Although there are many studies on ethnobotany in our country; Ethnoveterinary studies on the treatment of animal diseases with plants are quite limited. Erarslan & Kültür pointed out that ethnoveterinary studies were made in Turkey. In a review, authors reported 251 taxa belonging to 67 families as being traditionally used to treat animal diseases in Turkey¹.

Yipel *et al.*, measured the ethnoveterinary medicinal knowledge of the people living in the Mediterranean region of Turkey. They mentioned that 67 plant taxa are used in animal diseases. *Laurus nobilis* L., *Mentha* spp. and *Urtica urens* L. were found to be the most prominent among these plants used in animal diseases¹⁶.

In ethnobotanical studies conducted in Turkey, such plants that are frequently used in the treatment of animal diseases *Helleborus orientalis* Lam., *Allium sativum* L., *Juniperus oxycedrus* L. subsp. *oxycedrus* var. *oxycedrus*, *Berberis crataegina* DC., *Pinus brutia* Ten. var. *brutia*, *Sambucus ebulus* L., *Cydonia oblonga* Mill., *Viscum album* L., *Urtica* spp., and *Olea europaea* L. are seen as the most cited plants in Turkey¹⁷⁻²⁵.

There are many ethnobotanical studies conducted in Turkey. These studies focused on the plants that people mostly use for medicinal purposes. However, ethnobotanical studies on ethnoveterinary and animal diseases are limited^{16,26-29}. Therefore, an attempt has been made to describe various diseases prevalent in animals in Ayvalık district and also to document the ethnoveterinary plants and practices used to treat them. Informant Consensus Factor (ICF), Relative Frequency Citation (RFC), Fidelity Level (FL), Use Value (UV), Family Use Value (FUV), and Plant Part Value (PPV) of the ethnoveterinary diseases and use-value of the plant species were also determined.

Materials and Methods

Study area

Ayvalık district is a settlement located between the bays and islets of Balıkesir Province on the shore of the Aegean Sea in the north of Western Anatolia. This district is a privileged place that stands out with its history, nature, culture, architectural structure, food

culture, water sports and richness of sea bottom structure, clear sea and beautiful beach³⁰⁻³¹. It belongs to the Mediterranean phytogeographical region and falls within the B1 grid square according to the Grid classification system developed by P.H. Davis¹⁴. During the research, visits were made to 10 villages in Ayvalık district. These villages were Akçapınar, Bağyüzü, Çakmak, Karaayıt, Mutlu, Odaburnu, Tıfillar, Türközü, Üçkabağaç, and Yeniköy. In addition, informants were interviewed in Gömeç district, which is very close to Ayvalık district.

Plant materials

The field studies were carried out over a period of approximately 2 years (2017-2019) after the determination of the informants. The research was carried out in the villages of Ayvalık district where the farmers live intensely. During this period, plants from 46 taxa were collected. These plants were pressed according to the techniques of standard herbarium and prepared for identification. Plants were identified with the help of Turkey's Flora books (11 volumes)¹⁴⁻¹⁵. Voucher numbers were given to each of the identified species. Scientific names of taxa were determined according to the Plant List (2013). Later, identified plants were made in herbarium specimens and were stored to be protected in the botany laboratory of Altınoluk Vocational School, Balıkesir University. Latin names and the families of identified taxa were listed in Table 1.

Interviews with study participants

At the beginning of the study, 50 students in 5 village schools (Elementary schools) were visited and were given a questionnaire on "medicinal herbs" used in animal diseases in Ayvalık region. In addition, families dealing with livestock breeding were reached with the help of village headmen and were visits to their homes. According to the results of the survey, the informants were determined. Of the total of 50 informants, 41 men and 9 women were interviewed. In the selection of these informants; Breeders aged 40 and over residing in residential areas at least for 20 years, and farmers were taken into account. By applying the structured and semi-structured interview method with informants in accordance with these criteria, the following questions were asked: 1) What are the sheep/goat's favourite herbs?, 2) Are there any herbs that poison the sheep/goat?, 3) What are cow's favourite herbs?, 4) Are there any herbs that increase the milk/smell?, 5)

Table 1 — List of medicinal plants used in the preparation of herbal remedies for livestock in Ayvalık district

S. No.	Family	Latin name / Voucher number	Turkish name	English name	Application	Part used and Medicinal use	Herbal formulation	Target	RFC	UV	FUV
1	Amaryllidaceae	<i>Allium cepa</i> L./ FA* 105	Soğan	Onion	Internal use (Or. /raw)	<i>Bulb</i> : Reproductive disease, Poisoning <i>Peel</i> : Increasing milk yield	<i>Bulb</i> : Bulb is added to the animal feed to remove fluids formed after birth. <i>Peel</i> : Onionskin are consumed as fodder	Cow, sheep	0.3	0.5	0.35
2	Amaryllidaceae	<i>Allium sativum</i> L./ FA 82	Sarımsak	Garlic	Internal use (Or. /raw)	<i>Bulb</i> : Poisoning, Gastrointestinal diseases	Bulb is added to the animal feed	Cow, buffalo	0.4	0.4	0.35
3	Apiaceae	<i>Coriandrum sativum</i> L./FA 45	Kişniş	Coriander	Internal use (Or. / raw)	<i>Fruit</i> : Gastrointestinal diseases, Increasing milk yield	Fruit is added to the animal feed	Goat, Cow	0.1	0.01	0.19
4	Apiaceae	<i>Foeniculum vulgare</i> Mill. / FA 32	Rezene	Fennel	Internal use (Or.)	<i>Fruit</i> : Gastrointestinal diseases, Increasing milk yield	Fruit is added to the animal feed	Goat, Cow	0.28	0.02	0.19
5	Apocynaceae	<i>Nerium oleander</i> L. FA 37	Zakkum	Oleander	External use (Oin.)	<i>Leaves</i> : Mastitis and scabies, parasitic diseases, Poisoning	Mixture made of olive oil, pine resin and mistletoe is rubbed into the skin of the animal.	Cow	0.3	0.2	0.3
6	Asteraceae	<i>Cichorium intybus</i> L / FA 80	Hindiba	Common chicory	Internal use (Or. /Raw)	<i>Whole plants</i> : Increasing milk yield, Reproductive diseases	Eats while the livestock are grazing	Cow, sheep, goat	0.1	0.3	0.13
7	Asteraceae	<i>Cynara cardunculus</i> L. subsp. <i>flavescens</i> Wiklund / FA 48	Enginar	Artichoke	Internal use (Or. /Dec.)	<i>Leaves</i> : Liver diseases	Leaves are boiled and the water is drunk by the animal	Cow	0.24	0.2	0.13
8	Asteraceae	<i>Matricaria chamomilla</i> L. var. <i>recutita</i> (L.) Fiori /FA 95	Almanpapat yası	Chamomile	External use (Dec.)	<i>Flowers</i> : Eye diseases, Reproductive diseases	Flowers are boiled and boiled water is applied to the animal's eye	Cow	0.08	0.2	0.13
9	Asteraceae	<i>Taraxacum alepicum</i> Dahlst. /FA 121	Halehindibası	Dandelion	External use (Dec.)	<i>Whole plant</i> : Eye diseases, Increasing milk yield	Whole plant is boiled and boiled water is applied to the animal's eye	Cow	0.08	0.1	0.13
10	Cornaceae	<i>Cornus mas</i> L. /FA 125	Kızılcık	Cornelian cherry	Internal use (Or. /Raw)	<i>Fruit</i> : Inflammation, Diarrhoea	Mixed with animal feed	Cow, sheep	0.08	0.1	0.08
11	Fabaceae	<i>Ceratonia siliqua</i> L. / FA 44	Keçiboynuzu	Carob	Internal use (Or. /pow.)	<i>Fruit</i> : Increasing milk yield, gastrointestinal	The fruits are turned into flour and mixed into animal feed	Cow, sheep, goat	0.4	0.4	0.23
12	Fabaceae	<i>Lathyrus sativus</i> L. / FA 71	Burçak	Chickling pea	Internal use (Or. /raw)	<i>Aerial parts</i> : Increasing milk yield, Animal breeding, immunization	Dried parts are mixed into animal feed.	Cow, sheep	0.38	0.3	0.23
13	Fabaceae	<i>Medicago sativa</i> L. subsp. <i>sativa</i> / FA 56	Karayonca	Alfalfa	Internal use (Or. /Raw)	<i>Leaves</i> : Weakness, fatigue	The leaves are crushed and given as mush.	Cow, Buffalo	0.1	0.3	0.23
14	Fabaceae	<i>Phaseolus vulgaris</i> L. / FA 52	Fasulye	Common bean	Internal use (Or. /raw)	<i>Aerial parts</i> : Increasing milk secretion, Animal breeding, immunization	Dried parts are mixed into animal feed	Cow, sheep	0.14	0.3	0.23
15	Fabaceae	<i>Trifolium campestre</i> Schreb. subsp. <i>campestre</i> FA 66	Üçgül	Field clover	Internal use (Or. /Raw)	<i>Aerial parts</i> : Increasing milk secretion, Animal breeding, immunization	Dried parts are mixed into animal feed	Cow, sheep	0.5	0.3	0.23
16	Fabaceae	<i>Vicia ervilia</i> (L.) Willd. / FA 73	Küşne	Bitter vetch	Internal use (Or. /Raw)	<i>Leaves</i> : Dyspepsia, Increasing milk yield	Dried leaves are mixed into animal feed.	Cow	0.2	0.3	0.23

(contd.)

Table 1 — List of medicinal plants used in the preparation of herbal remedies for livestock in Ayvalık district (*contd.*)

S. No.	Family	Latin name / Voucher number	Turkish name	English name	Application	Part used and Medicinal use	Herbal formulation	Target	RFC	UV	FUV
17	Fabaceae	<i>Vicia faba</i> L. FA 158	Bakla	Broad bean	Internal use (Or. /Raw)	<i>Fruit:</i> Gastrointestinal diseases, Animal breeding immunization	The mature fruits are mixed into animal feed along with the peel.	Cow, sheep	0.4	0.3	0.23
18	Fagaceae	<i>Quercus coccifera</i> L. FA 145	Kermesmeşesi	Kermes oak	Internal use (Or. /Dec.) External use (Gallae.)	<i>Branch:</i> Diarrhoea, Gallae; Open wounds.	Branches It is boiled and its water is drunk to animal Gallae: The powder in gallae is rubbed over the wounds	Cow, goat	0.14	0.2	0.14
19	Geraniaceae	<i>Pelargonium graveolens</i> L'Hér. FA 149	Sardunya	Rose Geranium	External use (Mac.)	<i>Flowers:</i> ticks, fleas and lice	The flowers are kept in olive oil for about 40 days and geranium oil is obtained. This oil is applied to the ticked area	Goat, Cow, Buffalo, Sheep	0.06	0.3	0.06
20	Hypericaceae	<i>Hypericum perforatum</i> L. subsp. <i>veronense</i> (Schrank) H.Linb. / FA 67	Sarikantaron	St John's wort	External use (Mac.)	<i>Flowers:</i> Injury, bleeding, scar, burn, wounds	The flowers are kept in olive oil for about 45 days and centaury oil is obtained. This oil is applied to the skin of the animal	Cow, Buffalo, Sheep	0.7	0.8	0.7
21	Lamiaceae	<i>Mentha x piperita</i> L. FA 41	Nane	Pepper mint	Internal use (Or. /Raw)	<i>Leaves:</i> Inflammation, Parasitic diseases,	Dried leaves are mixed with animal feed	Cow	0.1	0.6	0.27
22	Lamiaceae	<i>Lavandula stoechas</i> L. subsp. <i>stoechas</i> FA 34	Karabaş	Spanish lavender	Internal use (Or. /Dec.)	<i>Aerial parts:</i> Swelling, Gastrointestinal diseases, stomachache	Herbal tea prepared by boiling the dried aerial parts (leaves and spikes) is added to the drinking water of animals	Cow, buffalo	0.5	0.7	0.27
23	Lamiaceae	<i>Origanum onites</i> L. / FA 78	Bilyalıkekik	Greek oregano	Internal use (Or. /Dec.)	<i>Aerial parts:</i> Swelling, Gastrointestinal diseases, stomachache, joint pain	Herbal tea prepared by boiling the dried aerial parts (leaves and flowers) is added to the drinking water of animals.	Cow	0.2	0.3	0.27
24	Lamiaceae	<i>Origanum vulgare</i> L. subsp. <i>hirtum</i> (Link) Ietsw. FA 35	Karamercan	Oregano	External use (Dec.)	<i>Aerial parts:</i> Mouth disease, wounds	Herbal tea prepared by boiling the dried aerial parts is applied to injured areas in the mouth.	Cow	0.2	0.3	0.27
25	Lamiaceae	<i>Salvia fruticosa</i> Mill. / FA 69	Adaçayı	Sage	External use (Dec.)	<i>Leaves:</i> Injury, burn, Gastrointestinal diseases	Dried leaves are boiled and rubbed into the injured area of the animal.	Cow, Sheep	0.6	0.7	0.27
26	Lamiaceae	<i>Teucrium polium</i> L. / FA 104	Acıyavşan	Poley germander	Internal use (Or. /Dec.)	<i>Aerial parts:</i> Gastrointestinal diseases, wounds	Herbal tea prepared by boiling the dried aerial parts is added to the drinking water of animals.	Cow	0.02	0.1	0.27
27	Moraceae	<i>Ficus carica</i> L. subsp. <i>carica</i> FA 8	İncir	Common fig	External use (latex)	<i>Leaves:</i> Warts, chill	The milk that comes out on the leafstalks is rubbed over the cow's udder	Cow	0.2	0.2	0.2
28	Oleaceae	<i>Olea europaea</i> L. subsp. <i>europaea</i> / FA 5	Zeytin	European olive	External use (mash)	<i>Fruit:</i> Joint ailments, wounds, Injury, scars, burn	Fruits are crushed together with olive pit and mixed with olive oil and made into mush. It is applied to places with pain and swelling, such as the knee area.	Cow, Buffalo	0.6	0.8	0.6

(contd.)

Table 1 — List of medicinal plants used in the preparation of herbal remedies for livestock in Ayvalık district (contd.)

S. Family No.	Latin name / Voucher number	Turkish name	English name	Application	Part used and Medicinal use	Herbal formulation	Target	RFC	UV	FUV
29	Papaveraceae <i>Papaver rhoeas</i> L. FA 14	Gelincik	Common poppy	Internal use (Or. /Raw)	<i>Aerial parts:</i> Gastrointestinal diseases	Dried parts are mixed into animal feed.	Cow	0.1	0.1	0.1
30	Pinaceae <i>Pinus brutia</i> Ten. FA 51	Kızılcıam	Turkish red pine	External use (Res.)	<i>Leaves:</i> Cracked nipples, and scabies	Mixture made with olive oil is rubbed into the skin of the animal	Cow	0.4	0.3	0.4
31	Plantaginaceae <i>Plantago lanceolata</i> L. FA 20	Damarlıca	Ribwort plantain	External use (mash)	<i>Leaves:</i> Open skin wounds, parasitic diseases	Leaves are crushed and made into mush. It is applied to skin wounds.	Cow	0.1	0.2	0.1
32	Poaceae <i>Avena sativa</i> L. FA 22	Yulaf	Common oat	Internal use (Or. /Raw)	<i>Aerial parts:</i> Gastrointestinal diseases, Increasing milk secretion	Aerial parts are mixed into animal feed.	Cow, Sheep, Lamb	0.04	0.4	0.12
33	Poaceae <i>Cynodon dactylon</i> (L.) Pers. var. <i>dactylon</i> FA 17	Köpekdişi	Bermuda grass	Internal use (Or. /Raw)	<i>Aerial parts:</i> Increasing milk secretion; Gastrointestinal diseases	Dried parts are mixed into animal feed.	Cow, Goat	0.4	0.5	0.12
34	Poaceae <i>Elymus repens</i> (L.) Gould / FA 142	Sabankıran	Quack grass	Internal use (Or. /Raw)	<i>Aerial parts:</i> Gastrointestinal diseases, Increasing milk secretion	Dried parts are mixed into animal feed.	Cow	0.4	0.2	0.12
35	Poaceae <i>Hordeum vulgare</i> L. FA 28	Arpa	Barley	Internal use (Or. /Raw)	<i>Aerial parts:</i> Increasing milk secretion, Animal breeding	Aerial parts are mixed into animal feed.	Cow	0.06	0.2	0.12
36	Ranunculaceae <i>Nigella sativa</i> L. FA 39	Çörekotu	Black cumin	Internal use (Or. /Raw)	<i>Seed:</i> Gastrointestinal diseases, Reproductive diseases	Seeds are mixed into animal feed.	Cow	0.64	0.4	0.06
37	Rosaceae <i>Crataegus monogyna</i> Jacq. FA 178	Aliç	Hawthorn	Internal use (Or. /Raw)	<i>Fruit and Flowers:</i> Gastrointestinal diseases, Reproductive diseases	Fruit and flowers are mixed into animal feed.	Cow	0.3	0.3	0.25
38	Rosaceae <i>Cydonia oblonga</i> Mill. FA 26	Ayva	Quince	Internal use (Or. /Inf.)	<i>Fruit and Leaves:</i> Diarrhoea, Gastrointestinal diseases,	Herbal tea prepared by boiling fruit and leaves is added to the drinking water of animals.	Cow	0.22	0.2	0.25
39	Rosaceae <i>Pyrus elaeagnifolia</i> Pall. subsp. <i>elaegnifolia</i> /FA 81	Ahlat	Oleaster-leafed pear	Internal use (Or. /Pow.)	<i>Fruit:</i> Diarrhoea, oedema	After the fruit is dried and powdered, it is mixed with water and added especially to the water of cows	Cow	0.22	0.3	0.25
40	Rutaceae <i>Citrus limon</i> (L.) Burm.f. /FA 83	Limon	Lemon	External use (Juice)	<i>Fruit:</i> Tick, parasitic diseases, cough	Lemon juice is applied to the side contact with the parasites of animals	Buffalo, Goat	0.02	0.4	0.02
41	Salicaceae <i>Salix alba</i> L. subsp. <i>alba</i> /FA 106	Aksögüt	White willow	Internal use (Or. /Inf.)	<i>Leaves:</i> Diarrhoea, tick, joint pain	Herbal tea prepared by boiling fruit and leaves are added to the drinking water of animals	Cow	0.08	0.3	0.08
42	Santalaceae <i>Viscum album</i> L. subsp. <i>austriacum</i> (Wiesb.) Vollman FA 107	Çamgüveleği	European mistletoe	Internal use (Or. /Dec.) External use (Oin.)	<i>Leaves:</i> Worms (pinworm) <i>Mixtur (Oin.)</i> Mastitis and scabies	<i>Leaves:</i> Herbal tea prepared by boiling leaves are added to the drinking water of animals. <i>Mixtur (Oin.):</i> Mistletoe mixed with olive oil, and pine resin is rubbed into the skin of animal	Cow	0.4	0.6	0.1

(contd.)

Table 1 — List of medicinal plants used in the preparation of herbal remedies for livestock in Ayvalık district (*contd.*)

S. Family No.	Latin name / Voucher number	Turkish name	English name	Application	Part used and Medicinal use	Herbal formulation	Target	RFC	UV	FUV
43	Solanaecae <i>Capsicum annuum</i> L. /FA 84	Biber	Bell pepper	External use (fume)	<i>Fruit</i> : Stuffiness, parasitic diseases	Dried fruit is turned into incense. The nose canals are opened by burning them at the level of the nose of the livestock animals	Cow, Buffalo, Sheep, Goat, Lamb	0.14	0.1	0.14
44	Urticaceae <i>Urtica dioica</i> L. subsp. <i>dioica</i> FA 31	Isırgan	Stinging nettle	External use (Dec.)	Leaves: Skin diseases, itch, apse	The water obtained by boiling the leaves is applied to the diseased area	Cow	0.6	0.7	0.24
45	Xanthorrhoeaceae <i>Asphodelus aestivus</i> Brot. FA 53	Kirgiçkökü	Asphodel	External use (Or. /Dec.)	Tuber: Skin wounds, Swelling (foot)	The water obtained by boiling the tubers is applied to the diseased area	Cow, Buffalo	0.3	0.6	0.3
46	Zingiberaceae <i>Curcuma longa</i> L.FA 38	Zerdeçal	Turmeric	External use (oin.)	<i>Fruit</i> : Stuffiness, swelling	The ointment prepared by powdering the dried fruit is applied to the diseased area	Cow	0.04	0.2	0.04

Abbreviations: FA: Funda AKÇAY (Voucher name), Or: oral, Dec: Decoction, oin: Ointment, inf: Infusion, Res: Resinous, pow: Powder

What herbs are good for farm animals when they get sick?, 6) What do you do when a curtain falls on the eyes of cattle?, 7) What do you do if there is a tick or a parasitic insect on the skin of livestock?, 8) When the farm animal is sick, which plant/s do you use suitable for that disease?, 9) Which method do you use most (Infusion, decoction, powder, raw etc.)

A questionnaire was applied to the local people, through face-to-face interviews. During the interviews, the demographic characteristics of the study participants, local names, utilized parts, and preparation methods of the plants were recorded.

Calculations

The ethnobotanical data were analyzed using different quantitative indices including Informant Consensus Factor (ICF), Relative Frequency Citation (RFC), Fidelity Level (FL), Use Value (UV), Family Use Value (FUV) and Plant Part Value (PPV). Data were reported in proportions and percentages. All statistical analyses were carried out with Statistical Package for Social Science (SPSS) version 10 and Microsoft Excel 2019.

Informant Consensus Factor (ICF)

ICF was used for the analysis of the general use of plants and calculated as the number of use citations in each category (N_{ur}) minus the number of species used (N_i), divided by the number of use citations in each category minus one. The formula was expressed as $ICF = \frac{N_{ur} - N_i}{N_{ur} - 1}$ ³²⁻³³. All citations were placed into one of 12 categories: undefined poisoning;

gastrointestinal; dermatological; wounds; Reproductive diseases; diarrhoea; liver diseases; eye diseases; inflammation; joint ailments; parasitic diseases; and stuffiness.

Relative Frequency Citation (RFC)

The importance of each plant used in the treatment of animal diseases was assessed by the RFC and calculated using the following formula: $RFC = FC/N$; where FC is the number of subjects mentioning the taxa use and N is the number of subjects who participated in the survey. This RFC index ranges from 0 to 1. If the RFC index is 0, it shows that there is no one among the subjects referring to the animal as useful, and if the RFC index is 1, it means that all of the subjects participating in the survey refer to the animal as useful³⁴⁻³⁵.

Fidelity Level (FL)

For the data analysis, the FL was calculated to identify the most widely used animal species for a particular disease category's treatment. Fidelity level is helpful for determining the resident's most preferred species in use in the treatment of certain illnesses.

FL is calculated using the following formula:

$$FL = (N_p/N) \times 100$$

where N_p = Number of informants that claim a use of a plant species to treat a particular category and N = Number of informants that use the plants as a medicine to treat any given category³⁶⁻³⁷.

Use Value (UV)

The UV indicates the relative importance of the plants known locally. It was calculated according to the following formula: $UV = U/N$ where U is the number of uses mentioned by each informant for a given species and N is the total number of informants³².

Family Use Value (FUV)

The FUV defines the significance of plant families. This is an index of cultural importance which can be applied in ethnobotany to calculate a value of plant taxon. The formula to calculate this index is: $FUV = UVs / Ns$. Where UVs is the number of informants mentioning the family and Ns is the total number of taxa within each family 8,36,37.

Plant Part Value (PPV)

PPV is equal to the ratio between the total number of total uses reported for each plant part and the total number of reported uses for the plant. The most often used parts of the plant by the informants from an ethnic group are those having high values of PPV. This index was calculated by the formula: $PPV = RU_{(Plant\ part)} / RU$. Where RU is the number of uses reported of all parts of the plant and $RU_{(plant\ part)}$ is the sum of uses reported per part of the plant. The part with the highest PPV is the most used one by the informants^{8,38}.

Results

The list of plants used in animal diseases by local people (informants) was given in Table 1. Families of the taxa were arranged with respect to alphabetical order. For each taxon, family, Latin, Turkish and English names, applications, parts used and medicinal use, herbal formulation, targets and statistical calculations (RFC, UV, FUV) were provided.

A total of 46 plant taxa in 44 genera and 25 families were used traditionally with various plant parts and their combinations for the treatment of livestock with more than 15 diseases in the studied area. The rural farmers, shepherds and herbalists were using these plants to treat the various diseases of livestock like gastrointestinal, wounds, inflammation, warts, injury, parasitic diseases, increasing lactation, skin diseases, stuffiness, diarrhoea, eye diseases, joint pain, liver diseases, and poisoning.

The demographic data of the informants were given in Table 2. In total, 50 local informants including 9 females and 41 males (with a sex ratio

Table 2 — Demographic profile of the informants included in the survey (N = 50)

Demographic features		Number of people	%
Gender	Male	41	82
	Female	9	18
Age	<40	8	16
	40-60	32	64
	>60	10	20
Marital status	Married	38	76
	Unmarried	6	12
	Widower	4	8
	Divorced	2	4
Education level	Illiterate	3	6
	Primary school	8	16
	Secondary school	35	70
	High school	4	8
Duration of residence in the region	Less than 10 years	8	16
	10 years or more	42	84
Working status	Shepherd	10	20
	Housewife (feeding livestock)	6	12
	Farmer	20	40
	Herbalist	5	10
	Retired (Farmer)	6	12
	Unemployed (Shepherd)	3	6

female/male of 0.22) were interviewed. The age of informants varied from 40 to 72, with an average age of 56.5 years. About 76% of informants were married and 24% were widowed, divorced, or unmarried. While investigating the education level of the informants, it was observed that the majority (70%) were graduated from a secondary school and only 4 of them (8%) had a high school degree. The duration of residence in the region of participants was shown to be 10 years or more (84%). About 60% of informants were farmers or shepherds. However, housewives designated as informants were also engaged in animal husbandry on their farms.

The most representative families, in terms of the number of taxa, were Fabaceae (7 taxa), and Lamiaceae (6 taxa) followed by Asteraceae and Poaceae (4 taxa each) and Rosaceae (3 taxa), while other families were represented by two or single taxa (Fig. 1). Based on the FUV index, the 5 most cited families were Hypericaceae (% 0.7), Oleaceae (% 0.6), Pinaceae (% 0.4), Amaryllidaceae, (% 0.34) and Apocynaceae (% 0.3) (Fig. 1).

People of Ayvalık district harvest different plant parts for the preparation of traditional remedies (e.g., leaf, fruit, flower, seed, tuber, aerial plant and whole

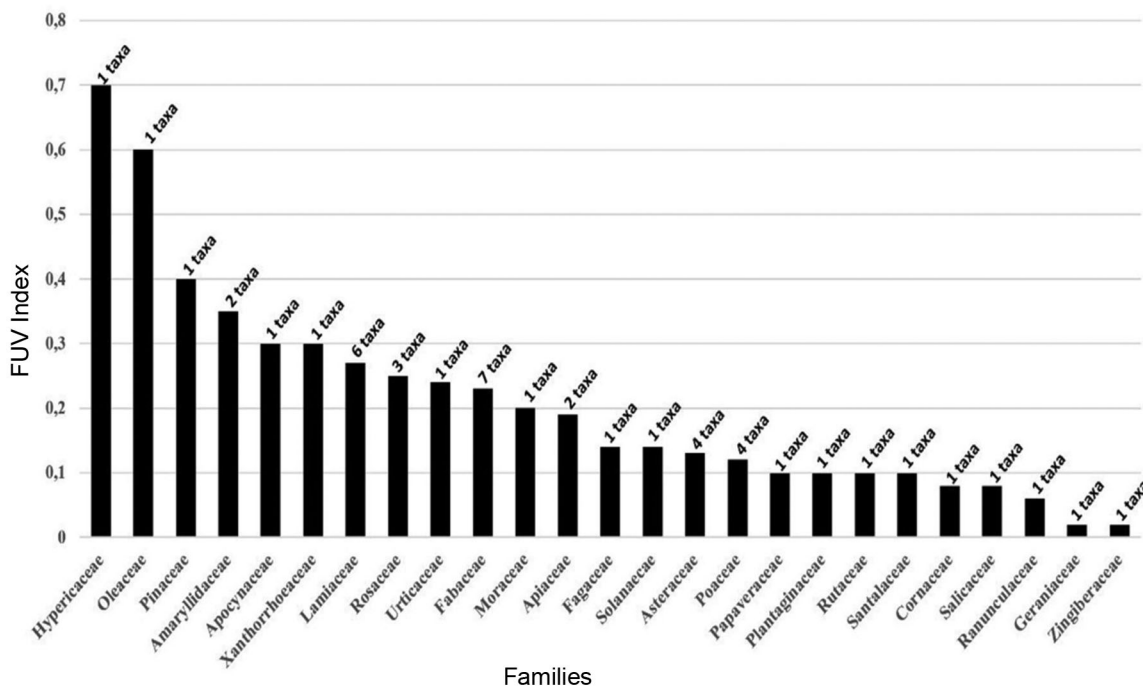


Fig. 1 — Taxa number and Family use value (FUV) index of medicinal plants used in livestock diseases.

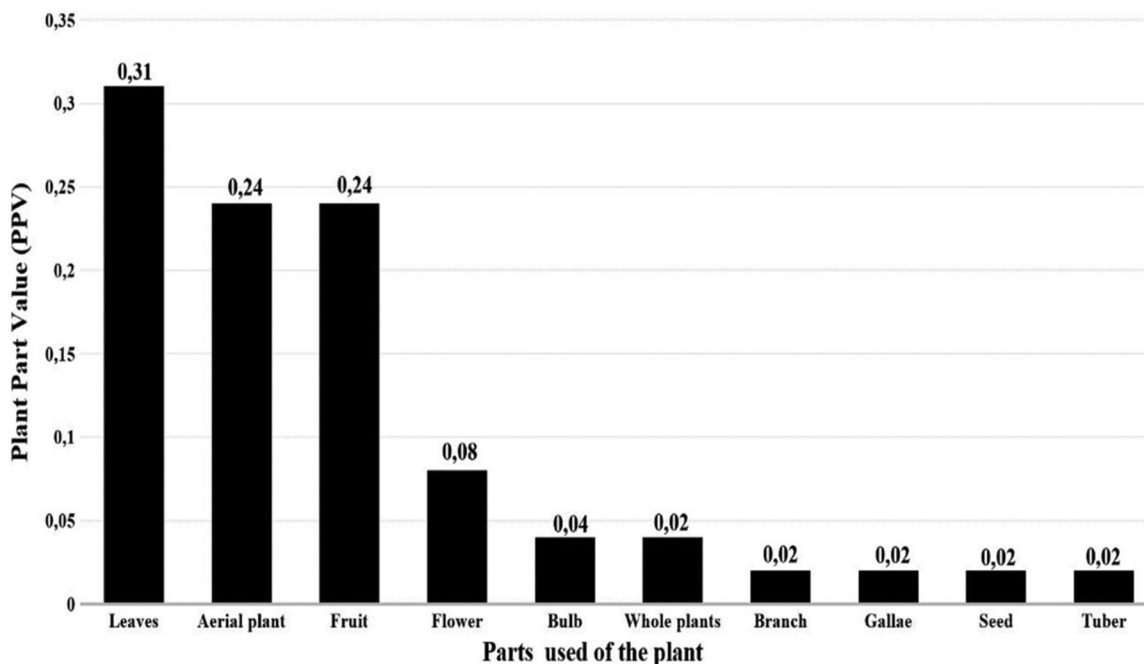


Fig. 2 — Plant part used to treat metabolic diseases of livestock in the research region.

plant) for livestock diseases. Based on the PPV (Plant Part Value) index, leaves were reported as the dominant plant part to prepare herbal medicine in the study area (0.31), followed by aerial plant (0.24), fruit (0.24), flower (0.08), bulb (0.04), and whole plant (0.02) respectively (Fig. 2).

The FL is an important means to see for which ailment a particular species is more effective. FL values in this study varied from 57 to 100%. This study revealed 17 medicinal plants having high FL values (Table 3). We determined 4 taxa (*Asphodelus aestivus*, *Cynara cardunculus* subsp. *flavescens*,

Table 3 — Fidelity level value of medicinal plants commonly reported against a given ailment

S. No.	Ailments	Medicinal plants	Lp	Lu	FL (%)
1	<i>Allium cepa</i>	Reproductive diseases	12	15	80
2	<i>Allium sativum</i>	Gastrointestinal	17	20	85
3	<i>Asphodelus aestivus</i>	Wounds	15	15	100
4	<i>Capsicum annum</i>	Stuffiness	4	7	57
5	<i>Cynara cardunculus</i> subsp. <i>flavescens</i>	Liver diseases	12	12	100
6	<i>Hypericum perforatum</i> subsp. <i>veronense</i>	Dermatological	35	35	100
7	<i>Hypericum perforatum</i> subsp. <i>veronense</i>	Wounds	29	35	83
8	<i>Lavandula stoechas</i> subsp. <i>stoechas</i>	Gastrointestinal	23	25	92
9	<i>Matricaria chamomilla</i> var. <i>recutita</i>	Eye diseases	3	4	75
10	<i>Mentha x piperita</i>	Inflammation	3	5	60
11	<i>Olea europaea</i> subsp. <i>europaea</i>	Joint ailments	20	30	67
12	<i>Pelargonium graveolens</i>	Parasitic diseases	3	3	100
13	<i>Pyrus elaeagnifolia</i> subsp. <i>elaeagnifolia</i>	Diarrhoea	9	11	82
14	<i>Salvia fruticosa</i>	Dermatological	25	30	83
15	<i>Viscum album</i>	Worm	16	20	80
16	<i>Vicia faba</i>	Dyspepsia	15	20	75
17	<i>Urtica dioica</i> subsp. <i>dioica</i>	Itch	27	30	90

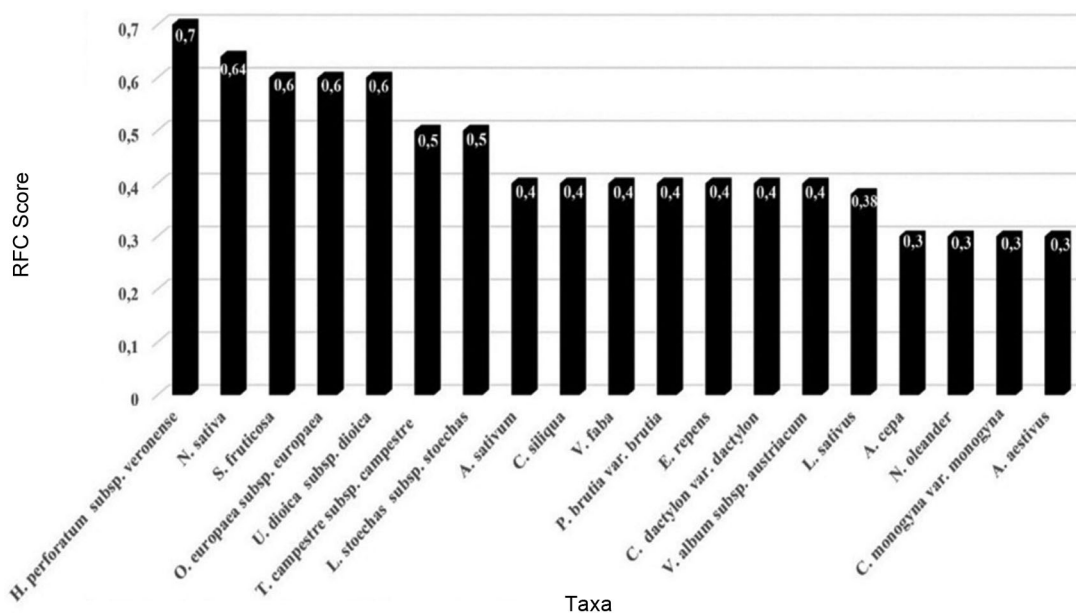


Fig. 3 — Plant taxa with the highest RFC score.

Hypericum perforatum subsp. *veronense*, *Pelargonium graveolens* with an FL of 100% followed by *Lavandula stoechas* subsp. *stoechas* (FL 92%), *Urtica dioica* subsp. *dioica* (FL 90%), and *Allium sativum* (FL 85%) respectively. *L. stoechas* subsp. *stoechas* (FL = 92) and *Allium sativum* (FL = 80) were reported to treat gastrointestinal diseases. The most important plants in the dermatological category were *H. perforatum* subsp. *veronense* (FL 100) and *Salvia fruticosa* (FL 83). *Asphodelus aestivus* for wounds (FL 100), *Cynara cardunculus* subsp. *flavescens* for liver diseases (FL 100),

Pelargonium graveolens for parasitic diseases (FL 100), and *Urtica dioica* subsp. *dioica* for itch (FL 90) were reported as the most important plants used in the treatment of various ailments according to the FL index.

RFC and UV scores were calculated from the use reports expressed by the informants about the treatment of the various diseases. The value of RFC covered the ranges from 0.02 to 0.07 in the medicinal use of the taxa. The 16 most cited plants were admitted by a majority of the locals for the use of ailment purposes (Fig. 3). The maximal value of RFC

was recorded from *Hypericum perforatum* subsp. *veronense* (0.7) followed by *Nigella sativa* (0.64), and *Salvia fruticosa* (0.6) respectively.

Plants that have the highest Use Values (UV) were *Hypericum perforatum* subsp. *veronense*, *Olea europaea* subsp. *europaea*, *Salvia fruticosa*, *Lavandula stoechas* subsp. *stoechas*, and *Urtica dioica* subsp. *dioica* (Fig. 4). Among the common uses attributed to these plants were *H. perforatum* subsp. *veronense* externally used for injury, burn, scar, wounds on the skin and bleeding. For animal diseases, the flowers of this plant are kept in olive oil (*Olea europaea* subsp. *europaea*) for about 45 days and centaury oil is obtained and this oil is applied on the diseased skin of the animals such as cow, buffalo, and sheep. *O. europaea* subsp. *europaea* is externally used for joint ailments, injury, scar and burn for cows and buffalo. The mature fruits of its are crushed to get her with olive pit and mixed with olive oil and made into mush. It is applied to places with pain and swelling, such as the knee area. *Salvia fruticosa* is externally exploited for injury, burn and gastrointestinal diseases, by decoction method. Dried leaves of this plant are boiled and rubbed into the injured area of livestock such as cows and sheep. *Lavandula stoechas* subsp. *stoechas* has remedial efficacy in swelling, gastrointestinal diseases and stomachache. Herbal tea prepared by boiling the dried aerial parts (leaves and spikes) is added to the drinking water of animals such as cows and buffalo. *Urtica dioica* subsp. *dioica* is externally used for skin diseases and itch. The water obtained by boiling the

leaves is applied to the diseased area of cows. In addition to, while the villagers are milking, they rub the leaves of this plant on the cow's udder so that the cows do not crumble. In this way, it has been reported that the cow has not changed while milking because the cow's udder is itchy.

To determine the Informant Consensus Factors (ICF), ailments were first classified into 11 different categories and the plants were distributed according to these major categories³³. ICF were calculated for their corded plants and ranged from 0.58 to 1.00 (Table 4). It was seen that the greatest number of the locally used taxa (14 taxa) were used to treat gastrointestinal disorders, followed by 12 taxa for the treatment of lactation and 9 taxa for dermatological and parasitic diseases.

Table 4 — Informant consensus factor for ailment categories

Disease categories	Number of use reports (N _{ur})	Number of taxa (N _t)	Informant consensus factor (ICF)
Toxicity complaints	22	3	0.90
Gastrointestinal	32	14	0.58
Dermatological	45	9	0.82
Healing wounds	26	7	0.76
Female sexual disorders	24	6	0.78
Diarrhoea	15	4	0.79
Liver disorders	5	1	1.00
Ophthalmological	48	2	0.85
Inflammation and pain	24	7	0.98
Parasitic diseases	46	9	0.82
Lactation	30	12	0.62

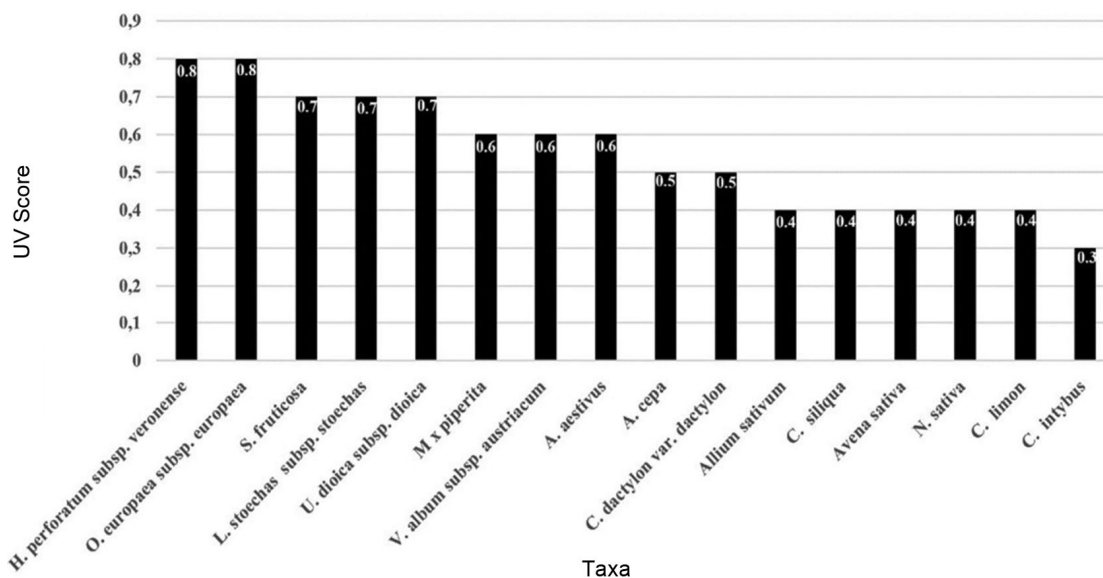


Fig. 4 — Plant taxa with the highest use score (UV).

Liver disorders (1.00), Inflammation and pain (0.98), toxicity complaints (0.90), ophthalmological (0.85), and dermatological (0.82) ailments had the highest ICF scores.

Lavandula stoechas subsp. *stoechas* (FL: 92%) and *Allium sativum* (FL 85%) are the most used plants in the gastrointestinal diseases as for *Hypericum perforatum* subsp. *veronense* (FL 100%) and *Salvia fruticosa* (FL 80%) (Table 3, 4). they are the most used plants in dermatological diseases.

Discussion

In this study, local people living in the Ayvalık district located in the west of Balıkesir investigated plants used in animal diseases such as cow, buffalo, sheep, lamb and goat. During their search, 50 informants were interviewed and as a result of the information received from these people, 46 taxa belonging to 25 families were applied on animals for medicinal purposes. Except for 2 plants, 44 taxa grow naturally in our country. *Citrus limon* is grown as a culture while *Curcuma longa* is imported from abroad as a spice plant.

Hypericum perforatum subsp. *veronense*, *Salvia fruticosa*, *Lavandula stoechas*, *Olea europaea*, *Viscum album* subsp. *austriacum* and *Allium sativum* were the most utilized medicinal plant species with the highest used value. *H. perforatum* subsp. *veronense* is used externally on animals. Its internal uses have not been found. However, in several studies, it has been reported that the plant is toxic and poisoning may occur if animals eat^{3,17,23}. It has been revealed that the use of the animal of this plant is similar to that used in people. In both of them, maceration with olive oil is used in skin diseases such as wounds, skin and bleeding^{1,17}.

Dried leaves of *Salvia fruticosa* are boiled and rubbed into the injured area of cows. This use of *S. fruticosa* has not been found in previous studies and was registered for the first time. In a study made with a close taxa; it has been observed that *S. officinalis* L. is used for cataract treatment²⁸. *S. pratensis* L. is used for appetizing¹, *S. tomentosa* Mill. is used for urinary system diseases and *S. virgata* Jacq. is used for gastrointestinal diseases³⁹. *Lavandula stoechas* is used in headache and cold treatment swelling, gastrointestinal diseases, and stomachache in cows and buffalos. In the study by Yipel *et al.*, it has been reported that this species is used as respiratory diseases, dermal diseases and wounds.

The mixture obtained by keeping *H. perforatum* subsp. *veronense* in olive oil for about 1,5 or 2 months in the sun is sold as centaury oil in the markets and in the bazaars in Ayvalık. Local people use this oil for animal diseases such as joint ailments, wounds, injuries, scars, burns^{4,17,39}. In related literature, it has been reported that *Viscum album* subsp. *austriacum* is used in gastrointestinal parasites of ruminants²⁹. In the present study, leaves are used as wormers (pinworms). Also, a mixture made with olive oil and pine resin is indicated as an ointment for the treatment of mastitis and scabies. A study conducted by Ari *et al.* reported that *Allium sativum* was used in chicken diseases³⁹. In the present study, it has been seen that it is used in gastrointestinal poisoning in cows and buffalo (Table 1).

Özen and Doğan researched the plants used in veterinary medicine folklore in the Elazığ region (Turkey). In their studies, it has been reported that *Cynodon dactylon* (aerial plants are used for lactation), *Cydonia oblonga* (leaves are used for diarrhoea), *Asphodelus aestivus* (root used for bone fracture), *Phaseolus vulgaris*, (aerial plants are used for wound, lactation, and fracture), *Urtica dioica* subsp. *dioica* (leaves and roots are used for apse, boil, and wound), *Citrus limon* (fruits are used for cough and appetizer), *Allium cepa* (bulbs are used for the boil, wound, and female sexual disorders), *Olea europaea* subsp. *europaea* (olive oil is used for swelling, constipation, and mastitis) and *Ficus carica* (latex of petiole is used for papillomatosis) are used in animal diseases⁴⁰.

The mentioned uses of these species in the treatment of livestock diseases were found similar in the present study. In addition to these, the present study revealed that *Cynodon dactylon* had an effect on lactation, *Ficus carica* subsp. *carica* had warts and chill, *Asphodelus aestivus* had wounds, *Urtica dioica* subsp. *dioica* had an itch and *Citrus limon*'s had the effect of tick and parasitic diseases. When a veil falls over the eyes of livestock (cataract-like); It has been observed that there is no herbal treatment for this veil. In this case, the livestock is said to be cured when the breeders blow the crystal sugar into their mouths with a straw. It has been recorded that this method is the most applied in eye diseases. *Matricaria chamomilla* var. *recutita* and *Taraxacum aleppicum* are also used less frequently for eye diseases. Milk is an important food product obtained from livestock (cow, sheep, goat, buffalo) and has economic value. In the

questions directed to the informants, it was recorded that fennel and coriander were mostly used to increase the milk secretion of livestock.

Conclusion

The number of plant species used successfully in the prevention and treatment of animal diseases in Anatolia is quite high and their registration is of great importance. Although ethnoveterinary studies have been conducted in some regions of Turkey it is seen that these studies are limited. However, despite the floral potential and remarkable accumulation of traditional usage of plants, there is no previous research reporting the ethnobotany of the western part of the Mediterranean region. The ethnoveterinary study reveals that traditional plant knowledge still exists in Ayvalık and its surroundings, particularly among elder people. As a result of the study, it was seen that the use of medicinal plants used in the ethnoveterinary as a single or in combination (synergic) has great preventive and therapeutic potential. However, today information on this topic is still very lacking. Therefore, it is necessary to concentrate on phytochemical, physiological, and phytopharmacological research on these plant species that have not been sufficiently studied and are used in the little-known Ethnoveterinary.

Conflict of interest

We declare that there is no conflict of interest.

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