

## An ethnoveterinary study on plants used in the treatment of dermatological diseases in Central Anatolia, Turkey

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### ABSTRACT

**Aim:** The aims of the present study are to determine the significant plant species utilized in ethnoveterinary medicine of Central Anatolia region (Turkey), identify methods used for different veterinary preparations, and to compare the plants used in the treatment of different animal dermatological diseases in other regions of Turkey and different parts of the world.

**Methods:** Interviews were conducted with 173 individuals in total by means of a semi-structured questionnaire, between 2009 and 2013, for the purpose of recording traditional veterinary remedies and practices employed in animal health care. In order to evaluate the reliability and richness of the knowledge of medicinal plants in the area, quantitative indices, such as “informant consensus factor (FIC),” “use value (UV),” “relative frequency citation,” and “fidelity level,” were used for the data analysis.

**Results:** The findings of this study have revealed about 26 species, including herbs, trees, and green algae belonging to 22 botanical families utilized in the treatment of veterinary dermatological diseases by breeders in Central Anatolia. In the present study, the highest FIC score (0.90) was identified for cracked nipples. It was determined that Pine tar and *Cydonia oblonga* were used for the above-mentioned purpose. The second highest FIC value (0.87) was identified for ringworm. A number of medicinal plants were very popular and utilized intensively in the present research area. In accordance with the calculation performed on the basis of the UV, it was determined that *Pinus nigra* (0.43) and *Allium sativum* (0.28) had the highest UVs.

**Conclusion:** The current study has emphasized the ethnoveterinary knowledge of plants recently in use and their new usage in the Central Anatolia region of Turkey.

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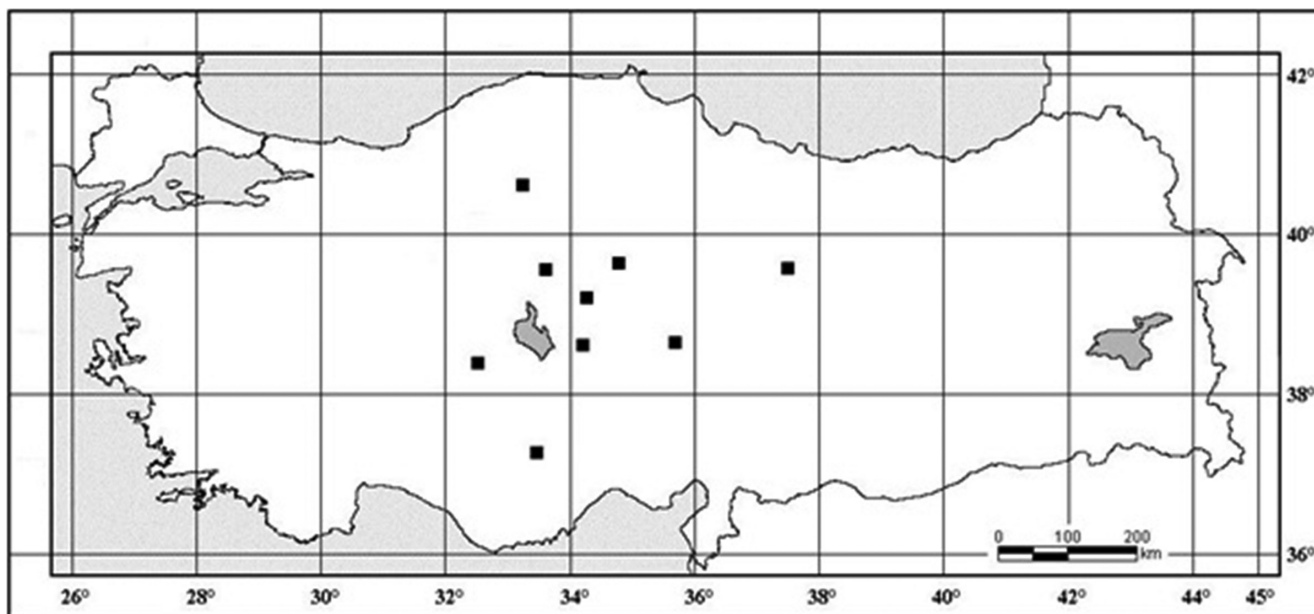
### Introduction

Ethnobotanical studies investigate plants used in the folk tradition of different regions and countries, as well as plants used in ethnoveterinary practices [1]. Ethnoveterinary medicine (EVM), which is the scientific term used for traditional animal health care, contains the knowledge, skills, practices, methods, and beliefs about animal health care present among the members of a certain community [2]. Many farmers use a variety of ethnoveterinary knowledge for the purpose of maintaining the health of their domestic animals, and they have

utilized it in order to prevent and treat livestock ailments [3].

No scientific studies have been conducted on the ethnoveterinary medicinal plants in Central Anatolia. Thus, the current study was carried out for the purpose of recording the indigenous knowledge about the usage, management, and conservation status of ethnoveterinary medicinal plants. Furthermore, in the present study, it was aimed to record the plants utilized in the treatment of animal dermatological diseases and emphasize their preparation, processing, and administration in the present research area,

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**Figure 1.** Map showing the regions studied in the Central Anatolia, Turkey.

and to compare to the plant species used in other regions of Turkey and in other countries. Moreover, the results acquired in the present study may be used for further scientific studies.

## Materials and Methods

### Study area

Central Anatolia represents one of the seven geographical regions of Turkey. The area in question is situated in the central region of Turkey (Fig. 1). The area of Central Anatolia is 151,000 km<sup>2</sup>, and it makes up 21% of Turkey's territory. The study area falls within the latitudes 32°31'N and 37°02'N and longitudes 37°11'E and 40°36'E [4].

There is a rich flora in the area due to the region's climatic characteristics, geological structure, and location [5]. Temperatures range from -25°C/-13F to 40°C/104F, with the rainfall of only 413 mm/15 inches per year. Forests including *Pinus nigra* J. F. Arnold, *Quercus pubescens* Willd., and *Juniperus oxycedrus* L. are mainly situated in the higher sections of the mountains, such as the Akdağlar, which contain a considerable number of these trees utilized for acquiring tar [6].

Although some ethnobotanical information [7,8] is available for the Central Anatolia region of Turkey, several studies investigating plants utilized in EVM have been encountered in the literature [9-11]. There are a number of studies on the EVM for the other regions of Turkey [12-17].

The Ph.D. fieldwork of the first author [18], which was carried out between 2009 and 2010 in the province of Middle Red River of the Central Anatolia region (Çankırı, Kırıkkale, Kırşehir, Kayseri, and Yozgat), mostly contains data on EVM. The second fieldwork followed the previous study in the eastern part of the Central Anatolia region, Upper Red River province (Sivas) [19]. Our research group conducted the last study in Konya province of the Central Anatolia region (Aksaray, Karaman, and Konya) [20].

### Interviews with local people

In order to collect EVM information, 2015 individuals from nine cities (Aksaray, Çankırı, Karaman, Kayseri, Kırıkkale, Kırşehir, Konya, Sivas, and Yozgat) in Central Anatolia were interviewed by means of semi-structured and structured questionnaires. Interviews were conducted by taking notes and performing the audio or video recordings of the interviewees when it was possible. In total, 173 people comprising almost 9% of the total informants gave information about plants used in the treatment of animal dermatological diseases. Mainly elderly individuals involved in the breeding and maintenance of livestock, such as farmers and shepherds, or who were working in agriculture provided information on EVM. All the individuals interviewed were males aged 50 years on an average, who still have the richest knowledge of traditional domestic medicine.

The information included plant species and family, vernacular name, the parts of the plant utilized, methods of preparation (i.e., infusion, poultice, powder, and latex) and administration, popular use, use value (UV), bioactive compounds, recorded literature uses, and locations.

### **Plant materials**

Field studies were performed during a 4-year period (2009–2013). In the above-mentioned period, 26 plant taxa, which are used in the treatment of veterinary dermatological diseases, were recorded. The standard text entitled “Flora of Turkey and the East Aegean Islands” [21,22] was used for the identification of the scientific names of plant species. The comparison of the plants with herbarium accessions was performed at Selçuk University (Konya). A specialist (Tugay O., botanist) from the Biological Department of Selçuk University assisted us in order to ensure proper identification.

### **Data analysis**

The informant consensus factor (FIC) was used to demonstrate the homogeneity of the information. The FIC was calculated using the formula mentioned as follows:  $FIC = (Nur - N_t) / (Nur - 1)$ , where *Nur* is the number of use citations in each category and  $N_t$  is the number of the species utilized [23]. The FIC gets a low value (close to 0) in case the plants are selected randomly or in case that there is no exchange of information about the usage of plants among informants. The FIC gets a high value (close to 1) in case of a well-defined selection criterion in the community and/or in case the informants share the information [24].

The UV, which represents a quantitative method showing the relative importance of species that are known on a local scale, was also determined by using the formula below:  $UV = U/N$ , where *UV* is the use value of a species, *U* is the number of citations per species, and *N* is the number of informants [23].

The fidelity level (FL) is beneficial for recognizing the plants that are mostly preferred by respondents in order to cure particular ailments. The main purpose of the FL is to calculate the importance of plant species for a specific objective [25]. The FL value was estimated by means of the following formula:  $FL = N_p/N \times 100$ , where  $N_p$  refers to the number of respondents who reported the utilization of medicinal plants for a specific main ailment and *N* refers to the total number of respondents who indicated the same plant for any ailment [26]. The closer the

FL value is to 1, the higher is the number of respondents who have utilized the plant species in question for a specific usage. A high FL value means that a specific plant species is frequently used by the respondents in the research area for the treatment of a specific ailment category [27].

The frequency citation (FC) was acquired by means of the formula below:  $FC = (\text{number of times when a specific species was mentioned} / \text{total number of times when all species were mentioned}) \times 100$ . The above-mentioned formula is employed for a better relative expression of citations. The following formula: relative frequency citation (RFC) =  $FC/N$  ( $0 < RFC < 1$ ) was used to calculate the RFC. In order to acquire the index in question, the number of respondents indicating a useful species FC or frequency of citation is divided by the total number of respondents in the questionnaire (*N*) without considering the categories utilized [27]. In the present study, the FL, RFC, and FC were determined for the plant cited most frequently.

### **Results**

The findings of the present study have indicated 26 species, including herbs, trees, and green algae belonging to 22 botanical families utilized by breeders in Central Anatolia to treat veterinary dermatological diseases (Table 1). Rosaceae, Fabaceae, and Amaryllidaceae were the most common representatives of these families used to treat eight dermatological disease categories with the percentages of 13.6, 9.09, and 9.09, respectively (Fig. 2). There was one species in the other families, as indicated in Figure 2.

Traditional ethnoveterinary plants were identified for the treatment of dermatological diseases of domestic animals. The most treated dermatological diseases encountered were categorized into eight groups. In this study, it was determined that 16 (31.4%) plant species were used for treating open skin wounds, 9 (17.6%) plant species were used for treating mange, 7 (13.7%) plant species were used for treating ringworm, 5 (9.8%) plant species were used for treating papillomatosis and sunstroke-sunburn, 4 (7.8%) plant species were used for treating interdigital dermatitis, 3 (5.9%) plant species were used for treating dermatitis madigans, and 2 (3.9%) plant species were used for treating cracked nipples (Fig. 3).

The parts of plants utilized most frequently are leaves (27.6%), fruit (17.2%), wood, latex and seed (10.34%), and bulb (6.93%). Gum, resin, bark,

**Table 1.** List of the plants used in the EVM of Central Anatolia region, and scientific literature review.

Family	Plant species/ voucher number	Vernacular name	Part(s) used	Preparation/ administration <sup>a</sup>	Popular use <sup>b</sup> (therapeutic effect)	UV <sup>c</sup>	Bioactive compounds/ recorded literature uses (pharmacological activity)	Locations <sup>c</sup>
Amaranthaceae	<i>Beta vulgaris</i> L. var. <i>altissima</i> Döll O. Tugay 1865 26.909	Şeker pancarı	Root	Powdering/E	OSW	0.01	Terpenoids/anti-inflammatory [28,29]	Y
Amaryllidaceae	<i>Allium cepa</i> L. O. Tugay 3234 26.916	Soğan	Bulb	Poultice/E	OSW ID	0.07	Essential oils, flavonoids/anti-inflammatory, antimicrobial [30]	A, Kar, Ko
Amaryllidaceae	<i>Allium sativum</i> L.*	Sarımsak	Bulb	Crushing (mixed yogurt) /I Pounding (mixed salt or lemon juice, vinegar)/E	SS, R, M ID	0.28	Allicin, ajoene/antiseptic, antibacterial [31], antiparasitic [32–34]	Ç, Kar, Ko, S, Y
Anacardiaceae	<i>Rhus coriaria</i> L. O. Tugay 2952 26.910	Sumak	Fruit	Infusion/E	OSW R	0.20	Tannin, Phenols (myricetin)/ Antibacterial [35] antioxidant [36]	A, Kar, Ko, S
Brassicaceae	<i>Brassica oleracea</i> L. O. Tugay 1444 26.911	Lahana	Leaves	Poultice/E	SS	0.01	Wound healing [37]	Ç
Cladophoraceae	<i>Cladophora glomerata</i> L. Not founded	Yosun	Leaves	Topical application/E	OSW	0.05	Carotenoids, phenols/ antihemorrhagic, antibacterial [38]	A
Convolvulaceae	<i>Convolvulus arvensis</i> L. O. Tugay 1727 26.912	Çoban döşegi otu	Leaves	Poultice/E	OSW	0.02	Not reference	Ko
Cupressaceae	<i>Juniperus oxycedrus</i> L. O. Tugay 1827 26.913	Katran ardıcı	Wood (juniper tar) Branch	Distilled tar (mixed butter)/E Smoke/E	M, OSW, P	0.05	Phenols (giacol, ethyl, creosol)/ Antiseptic, antiparasitic, antipruritic, anti-inflammatory [39], antifungal [40]	A, Kar, Ko, S, Y
Euphorbiaceae	<i>Euphorbia macroclada</i> Boiss. O. Tugay 1544 26914	Sütleşen otu	Latex	Topical application/E	OSW P	0.05	Polyphenolics, terpenoids/ antibacterial, antifungal [41,42]	Kar, Ko, S
Fabaceae	<i>Astragalus</i> L. AK. 1050	Geven	Spina	Punksiyon/E	P	0.01	Not reported	A
Fabaceae	<i>Ceratonia siliqua</i> L.*	Keçiboynuzu	Latex	Topical application/E	P	0.01	Tannins, polyphenols/ antimicrobial, antiproliferative [43,44]	Kar, Ko
Fagaceae	<i>Quercus pubescens</i> Willd. O. Tugay 2244 26915	Tüylü meşe	Bark Wood (ash)	Powdering/E Burning to ashes/E	OSW M	0.02	Flavonoids, tannins/antiseptic [45], antiparasitic [46], antifungal [47]	Kar, Kay, Ko, Y
Linaceae	<i>Linum usitatissimum</i> L. O. Tugay 5600 26.929	Keten	Seed (linseed oil)	Topical application/E	SS, R, M	0.09	Phenols (linoleic, linolenic, oleic acids)/wound healing [48]	Kır, Kırş, Ko, S, Y
Lythraceae	<i>Lawsonia inermis</i> L.*	Kına	Leaves	Powdering/E	R	0.06	Tannin, lawson/antifungal [49]	Ko, S, Y
Moraceae	<i>Ficus carica</i> L.*	İncir	Latex	Topical application/E	P	0.01	Proteolytic enzymes/Keratolytic, proteolytic [44,50]	Kar, Ko

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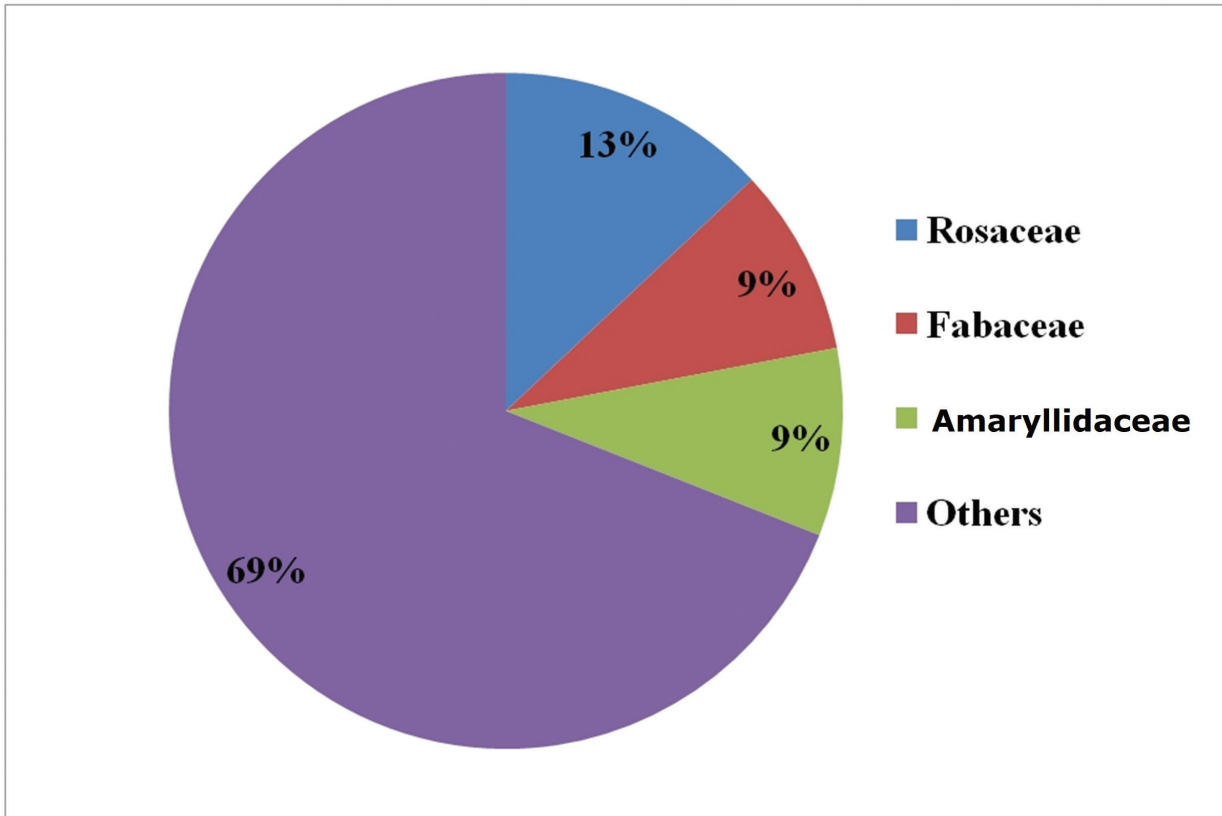
Family	Plant species/ voucher number	Vernacular name	Part(s) used	Preparation/ administration <sup>a</sup>	Popular use <sup>b</sup> (therapeutic effect)	UV <sup>c</sup>	Bioactive compounds/ recorded literature uses (pharmacological activity)	Locations <sup>c</sup>
Oleaceae	<i>Olea europaea</i> L.*	Zeytin	Fruit (olive oil)	Topical application/E	SS M	0.14	Phenols/antimicrobial [51,52]	Kar, Kir, Ko, S
Pedaliaceae	<i>Sesamum indicum</i> L.*	Susam	Seed (tahini)	Topical application/E	R	0.08	Sesamin, sesaminol, sesamol/ antioxidant [53], antifungal [54]	A, Kar, Ko
Pinaceae	<i>Pinus nigra</i> J.F. Arnold O. Tugay 2219 26.921	Karaçam	Gum Pine resin Wood (tar)	Direct application/E Powdering/E Distilled tar/E	DM, OSW, ID SS, OSW, CN, ID R	0.43	Essential oils/antimicrobial [55], vulnerary [56], antiparasitic [57]	A, Ç, Kar, Kay, Kir, Ko, S, Y
Plantaginaceae	<i>Plantago lanceolata</i> L. O. Tugay 1493 26.922	Damarlıca	Leaves	Poultice/E	OSW	0.03	Flavonoids, polysaccharides/ antiseptic [58], antihemorrhagic, antihelminthic [57]	Kir, Kay
Rosaceae	<i>Cydonia oblonga</i> Mill. O. Tugay 3510 26.923	Ayva	Seed	Crushing/E	CN	0.02	Pectin, tannin/wound healing [59], antioxidant [60]	A, Kar, Ko
Rosaceae	<i>Malus pumila</i> Mill. O. Tugay 3194 26.924	Elma	Fruit (vinegar)	Topical application/E	DM, OSW, P, M	0.08	Acetic acid/antiseptic [31,51,52]	A, Ç, Kar, Kay, Ko, Y
Rosaceae	<i>Prunus persica</i> (L.) Batsch.*	Şeftali	Leaves	Infusion/E	OSW	0.10	Polyphenols/antimicrobial, antioxidant [61]	A, Kar, Ko
Rutaceae	<i>Citrus limon</i> (L.) Burm. f. O. Tugay 10.273 26.926	Limon	Fruit	Topical application/E	OSW, M	0.02	Citric acid/antiseptic [62]	Ko
Scrophulariaceae	<i>Verbascum cheiranthifolium</i> Boiss. O. Tugay 3114 26.927	Sığirkuyruğu- kurtkulağı-bozkulak	Leaves	Poultice/E	OSW	0.03	Flavonoids, iridoids, saponins, polysaccharides/Wound healing [63]	Ç, Ko, S, Y
Solanaceae	<i>Nicotiana tabacum</i> L.*	Tütün	Leaves	Infusion/E	M	0.01	Alkaloid (nicotine)/antiparasitic [64]	Ko
Vitaceae	<i>Vitis vinifera</i> L. O. Tugay 3518 26.928	Üzüm	Fruit (molasses)	Topical application/E	R	0.08	Phenolic acids/antifungal [65]	A, Kar, Kir, Ko

<sup>a</sup>Administration: E = external; I = internal.

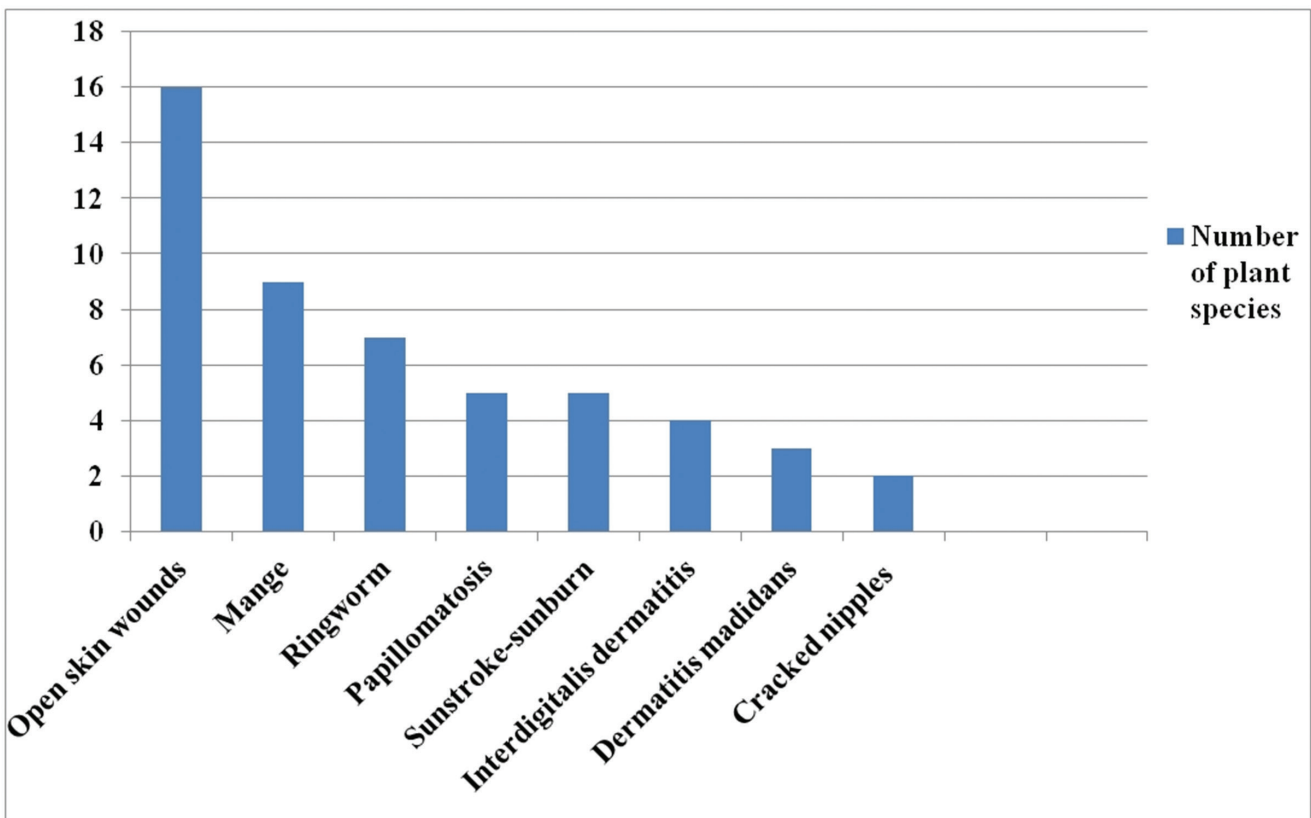
<sup>b</sup>Popular use: DI = dermatitis madidans; OSW = open skin wounds; SS = sunstroke and sunburn; CN = cracked nipples; P = papillomatosis; R = ringworm; ID = interdigital dermatitis; M = mange.

<sup>c</sup>Locations: A = Aksaray; Ç = Çankırı; Kar = Karaman; Kay = Kayseri; Kir = Kirikkale; Kirş = Kirşehir; Ko = Konya; S = Sivas; Y = Yozgat.

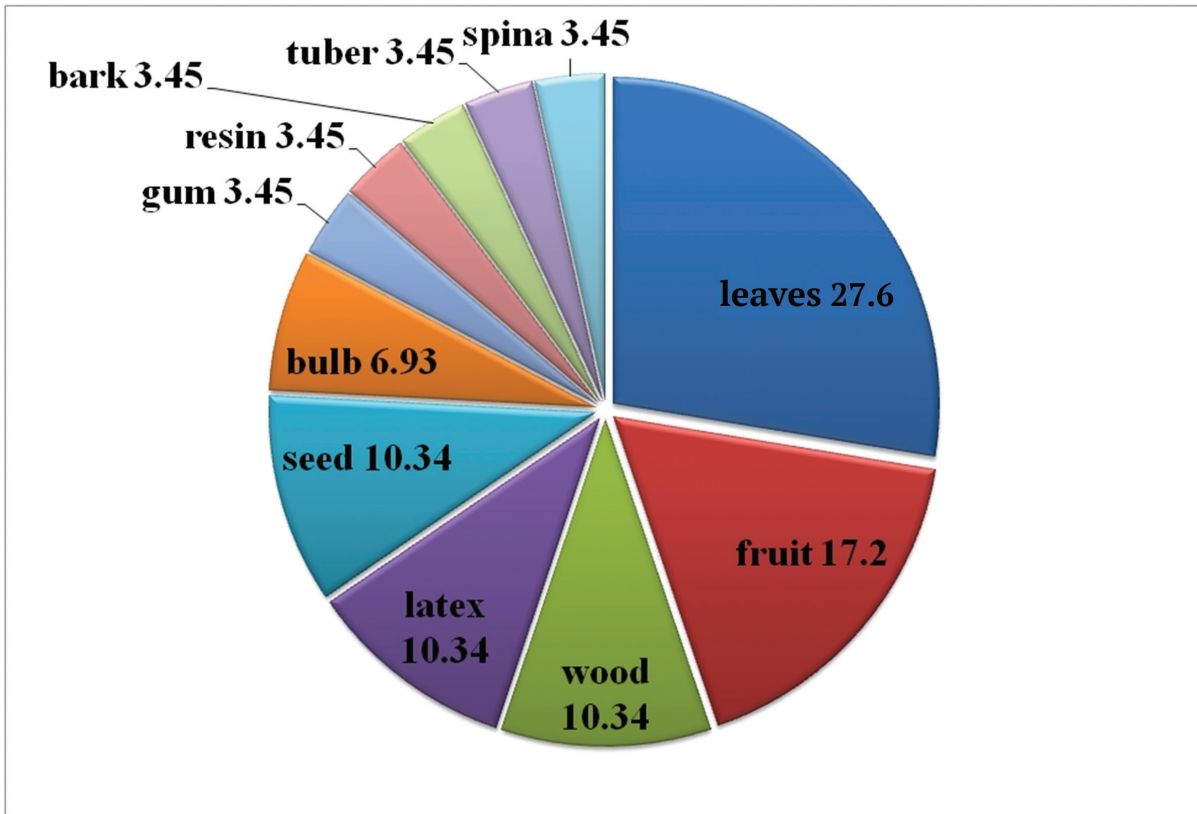
\*The voucher number was not given to these plants because they were purchased from the markets.



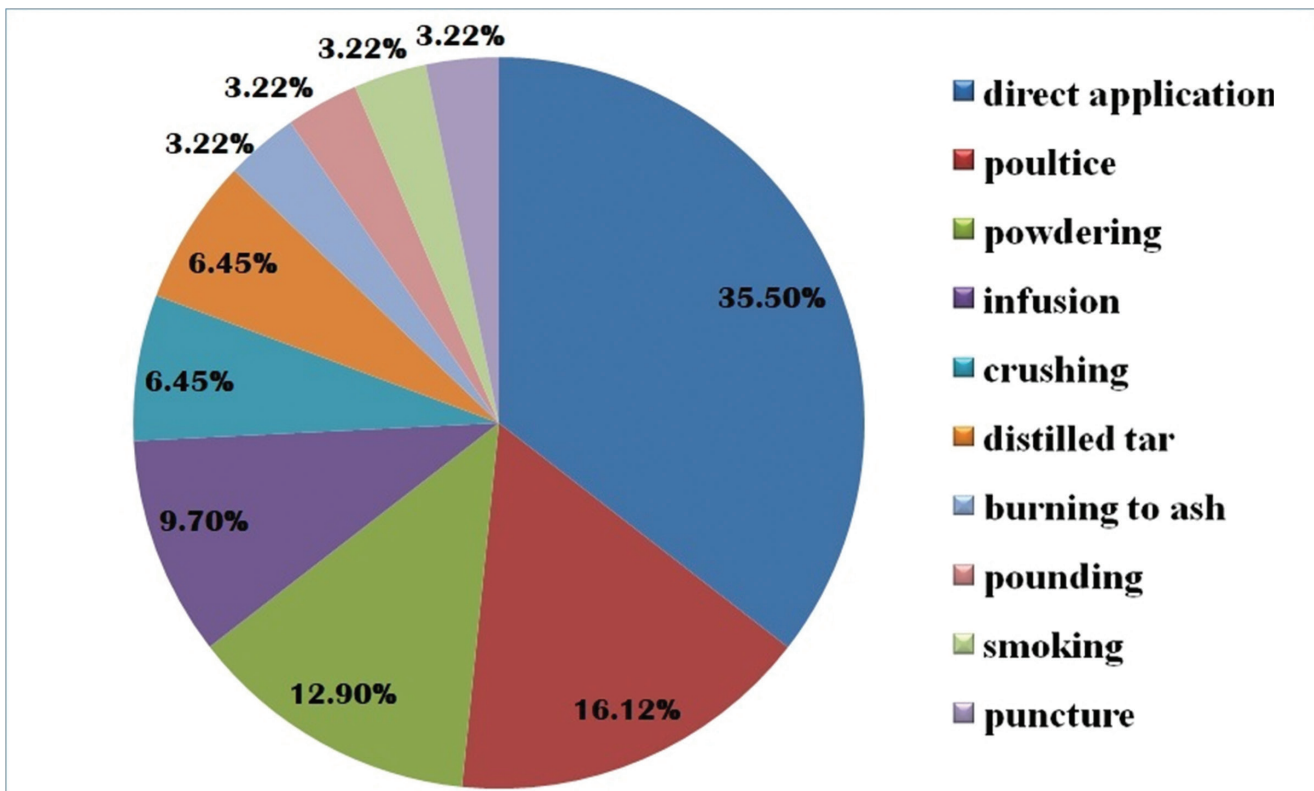
**Figure 2.** Relative frequency of plant species by family utilized for veterinary purposes in Central Anatolia.



**Figure 3.** A number of reported plants used for the treatment of different veterinary dermatological diseases.



**Figure 4.** Fractions of plant part used in EVM of Central.



**Figure 5.** Methods of preparation and administration used in the EVM of Central Anatolia..

**Table 2.** Categories of animal dermatological diseases treated in Central Anatolia region, with associated FIC.

No	Dermatological diseases	Use citations	All use citations (%)	FIC
1	Dermatitis madidans	7	3.1	0.66
2	Open skin wounds	73	32.3	0.86
3	Sunstroke and sunburn	23	10.2	0.81
4	Cracked nipples	12	5.3	0.90
5	Papillomatosis	7	3.1	0.17
6	Ringworm	48	21.2	0.87
7	Interdigital dermatitis	14	6.2	0.85
8	Mange	42	18.6	0.80

tuber, and Spina were used in a low proportion (3.45% each one) (Fig. 4). Moreover, in this study, products of plant origin, for example, olive oil, vinegar, tahini, linseed oil, and molasses were utilized alone or in combination with other substances for the preparation of remedies. We noted that preparations are administered in two ways, being internal administration and external administration, in order to treat dermatological diseases. The drugs are usually applied externally rather than internally on the area affected. External use was more common when compared to internal use (96% versus 4%) (Table 1).

It was identified that local people made medicinal preparations from plants for treating purposes by employing simple methods. The most popular methods of application are making a direct application (35.5%), poultice (16.1%), powdering (12.9%), and infusion (9.7%). The preparation of plants by crushing and distilled tar (6.45%) was reported on only two occasions, while burning to ash, pounding, smoking, and puncture (3.22%) were the least used preparation methods (Fig. 5).

The FIC was determined for all disease categories, and it varied between 0.17 and 0.90. Table 2 shows disease categories with relatively higher FIC values: the highest FIC score (0.90) was identified for cracked nipples. It was determined that Pine tar and *Cydonia oblonga* Mill. were used for the above-mentioned purpose. The second highest FIC value (0.87) was identified for ringworm, which was followed by open skin wounds with the FIC of 0.86, and interdigital dermatitis with the FIC value of 0.85. The sunstroke and sunburn were ranked to be the fifth ailment with the FIC value of 0.81. Mange had the FIC value of 0.80. Dermatitis madidans was ranked as the seventh with the FIC value of 0.66. Papillomatosis was determined to have the lowest

**Table 3.** List of most frequently cited plants.

Plant species	No. of interviews in which it was cited	FC (%)	RFC
<i>Pinus nigra</i>	53	74.64	0.43
<i>Allium sativum</i>	48	67.60	0.39
<i>Rhus coriaria</i>	43	60.56	0.35
<i>Olea europaea</i>	25	35.21	0.20
<i>Prunus persica</i>	18	25.35	0.14
<i>Linum usitatissimum</i>	17	23.94	0.13
<i>Malus pumila</i>	16	22.53	0.13
<i>Vitis vinifera</i>	14	19.71	0.11
<i>Sesamum indicum</i>	13	18.30	0.10
<i>Allium cepa</i>	12	16.90	0.09
<i>Beta vulgaris</i>	11	15.49	0.08

FIC value of 0.17. Upon examining this study, it is observed that the FIC values are high, i.e., the FIC value is close to 1. The higher FIC values are determined for the medicinal plants that are considered to have an effect on the treatment of a particular disease. No study, in which the calculation of the FIC values has been performed, has been carried out by people from our region.

A number of medicinal plants were very popular and utilized intensively in the present research area. In accordance with the calculation performed on the basis of the UV, it was determined that *Pinus nigra* (0.43), *Allium sativum* L. (0.28), *Rhus coriaria* L. (0.20), *Olea europaea* L. (0.14), and *Prunus persica* (L.) Batsch. (0.10) had the highest UVs (Table 1). The high UV of plant species indicates that the plants in question represent the most recommended, utilized, and known by the respondents, which means the importance of these plants.

It was identified in the present study that the plants cited most frequently had minimum 10 or more citations (Table 3). The RFC was determined for the plant cited most frequently, and it ranged from 0.08 to 0.43 (Table 3). *Pinus nigra* (0.43), *Allium sativum* (0.39), and *Rhus coriaria* (0.35) were determined to be the plant species that had the highest RFC.

The FL was found for the plants cited most frequently (26 plants), and the plant species with the FL between 50 and 100 (three plants) were regarded as important and significant (Table 4). Two plants (*Pinus nigra* and *Malus pumila* Mill.) had the highest FL of 100%, and they were used to treat dermatitis madidans. *Euphorbia macroclada* Boiss. had the FL value of 57%, and it was followed by *Olea europaea* with the FL value of 47%. The high fidelity value of medicinal plants proved the fact

**Table 4.** FL values for the most cited plants.

Dermatological diseases	Plant species	N <sub>p</sub>	N	FL (%)
Dermatitis madidans	<i>Pinus nigra</i>	7	7	100.0
	<i>Malus pumila</i>	7	7	100.0
Open skin wounds	<i>Prunus persica</i>	18	73	24.65
Sunstroke and sunburn	<i>Linum usitatissimum</i>	6	23	26.08
	<i>Olea europaea</i>	6	23	26.08
Cracked nipples	<i>Pinus nigra</i>	8	12	66.66
	<i>Cydonia oblonga</i>	4	12	33.33
Papillomatosis	<i>Euphorbia macroclada</i>	4	7	57.14
Ringworm	<i>Allium sativum</i>	19	48	39.58
Inderdigital dermatitis	<i>Pinus nigra</i>	12	14	85.71
Mange	<i>Olea europaea</i>	20	42	47.61

that the plants in question were preferred more by respondents when compared to other plants in the same category, and it also confirmed their frequent usage by the respondents.

The collection of the resources is mostly performed from their natural habitat due to the fact that most of them are autochthonous plants in the region (presented in Table 1 with the voucher numbers). The collection of such species as *Plantago lanceolata* L., *Convolvulus arvensis* L., *Verbascum cheiranthifolium* Boiss., *Rhus coriaria*, and *Euphorbia macroclada* that are found in natural habitat. Such plant species as *Beta vulgaris* L., *Allium cepa* L., and *Malus pumila* are grown, while *Allium sativum*, *Olea europaea*, *Prunus persica*, *Ceratonia siliqua* L., *Ficus carica* L., *Sesamum indicum* L., *Lawsonia inermis* L., and *Nicotiana tabacum* L. are obtained from local markets.

## Discussion

Despite the fact that the present study does not focus on bioactive compounds, it contains effective compounds and phytochemical references [28–65] on a number of the plants that are listed in the current paper (as shown in Table 1), in particular those with higher consensus of use or with a greater number of veterinary uses.

On the other hand, plant species, which previously had been shown to have very good wound healing, antimicrobial, antiparasitic, and antifungal properties in laboratory studies were mentioned by the interviewees. For example, *Pinus nigra* (tar, resin, and gum) exhibited strong antimicrobial [55], wound healing [56], and antiparasitic [57] activity

properties. *Allium sativum* was found to have antibacterial [31] and antiparasitic [32–34] effects. *Rhus coriaria* was found to have potent antibacterial [35] and antioxidant properties [36]. *Olea europaea* was determined to have antimicrobial effects [51,52]. *Prunus persica* extracts were analyzed in recent phytopharmacological studies and antimicrobial, antioxidant properties were found [61]. *Cladophora glomerata* L. was found to be the endemic plant used for a hemostatic effect [38] in Central Anatolia, Turkey. The traditional usage of the plants in the research area may be confirmed by the above-mentioned effects.

When comparing the findings of the present study with other ethnoveterinary studies in other areas of Turkey, *Pinus nigra* is also found to be the most relevant plant [14,15]. Pinus tar is used on animals as a treatment for mange, tick, and to cure wounds inflicted by wolves in Afyonkarahisar province, Central Western Turkey [66]. For widespread species, similar uses were found in different regions of Turkey. For example, *Allium cepa* for open skin wounds [14,15], *Ficus carica* (latex) for papillomatosis [12,14] and mange [13], *Allium sativum*, *Nicotiana tabacum*, and *Quercus pubescens* (ash) for mange are used in the EVM of the Lower Euphrates Basin [14]. Olive oil is used for ringworm, open skin diseases [13], and mange [12]; tar is used for dermatitis madidans and mange in the Aegean region [13] as well as open skin diseases in Antalya province [16].

Ethnoveterinary practices are discussed according to the reports of similar procedures in other countries. Tobacco (*Nicotiana tabacum*) is used in Central Anatolia in preparations against mange (Table 1) as it is in Israel [67]. Tobacco is usually used as a folk remedy in different regions of Africa, America, and Europa, especially as a parasiticide [68–70]. It is used to cure mange, wounds, and eyes infections in Sardinia (Italy) [1].

The use of garlic (*Allium sativum*) as an antiseptic, antifungal, and antiparasitic agent is reported here (Table 1). The above-mentioned findings are parallel to the results of the study conducted by Martínez and Luján [69], who recorded garlic as a remedy for wounds and injuries in Argentina. The garlic is most commonly known to have an antiparasitic effect [71,72], but it is reported in EVM in Italy also as a gastrointestinal agent [70]. Moreover, it is used in Ethiopia to treat evil eye, hepatitis, and blackleg [2].

An olive oil is used to treat mange in Central Anatolia, Turkey (Table 1). A similar report was

also given by Piluzza et al. [1] from the island of Sardinia. In Spain, the olive oil is employed as a detoxifying agent internally [73], and as a vulnerary, antiseptic, and cicatrizing agent [74], and to cure mastitis [75], and to treat eye infections in Israel [67] as in Greece [76].

Infection of wolf bite and open skin wounds in cows and sheep are prevented with the poultice of *Allium cepa* in Central Anatolia (Table 1). *Allium cepa* is used orally once a day to treat worms in the Indian EVM [72]. In Spain, it is used to facilitate delivery [73]. Furthermore, the bulb of *Allium cepa* is used as an anti-inflammatory agent in the Iberian Peninsula [74]. Papillomatosis is treated with *Juniperus oxycedrus*, *Malus pumila*, *Euphorbia macroclada*, the latex of *Ficus carica*, and *Ceratonia siliqua* in Central Anatolia (Table 1). Furthermore, the warty area is eliminated with the thorns of field *Astragalus* L. Similar use is described for it in Israel [67].

The usage of fig tree (*Ficus carica*) as an antifungal agent reported here (Table 1) was described before in Italy for the treatment of warts in humans [77]. Furthermore, it is used against scabies in Israel [67] and insect bites in West Bank of Palestine [78]. Also, it is utilized as an antitussive agent in Galicia, Spain [71].

For healing purposes against sunburn, the fresh leaves of *Brassica oleracea* L. are wrapped on the cow skin in Central Anatolia. The juice of the young leaves of *Brassica oleracea* is used against gastric ulcer [71]. The decoction of the seeds or the leaves was considered to act as a vermifuge agent in Italy [77].

According to the finding of the present study, the poultice of *Plantago lanceolata* cures skin wounds (Table 1). *Plantago* spp. has also been frequently reported in the European EVM as a vulnerary drug [70]. *Plantago lanceolata* leaves are used as an antiseptic post-labor drug in cows [74]. It is used for the treatment of diarrhea in British Columbia, Canada [79], and in the Iberian Peninsula [74].

The leaves of *Lawsonia inermis* are used to treat the ringworm of cattle in Central Anatolia (Table 1), but according to Upadhyay et al. [24], the leaves of the plant in question are given to cattle for the purpose of curing body heat in India. *Lawsonia inermis* has also been used for the treatment of trauma and ulcers in West Bank of Palestine [78]. On the national and international scale, we have noted the antifungal effect of *Lawsonia inermis* leaves as a new usage identified for the first time in Turkey. *Pinus nigra* (tar, resin, and gum) and *Juniperus oxycedrus*

(juniper tar) are very common plants in Turkey. These plants were employed in the study area as an antiseptic, a parasiticide, and for wound healing remedies (Table 1) in domestic animals. Pine tar is employed for the purpose of healing wounds and keeping flies out [79]. *Juniperus oxycedrus* is used as the most promising agent against ectoparasites in the European EVM [70]. It is used in Italy as an antiseptic, a parasiticide and a purgative (Spain) remedy in animals [73,80].

The seeds of *Linum usitatissimum* L. (linseed oil) were used to treat mange and ringworm, to heal sunburn, or to prevent sunstroke in the study area (Table 1). The use of linseed oil against mange and ringworm was not cited in other countries, even though it is used against otitis in humans in Italy [81]. Furthermore, it was indicated for the first time that *Cladophora glomerata* is used as a homeostatic agent in comparison with the results of various international studies.

This survey indicated that the seed of *Sesamum indicum* (tahini) was used to treat ringworm (Table 1), although it is employed for the retention of the placenta in the Indian EVM [72]. Moreover, sesame tahini and carob (*Ceratonia siliqua*) syrup mixed and rubbed on affected skin areas are used for wound healing in EVM in Israel [67].

While the crushed seeds of *Cydonia oblonga* are used to heal cracked nipples in Central Anatolia (Table 1), *Cydonia oblonga* leaves are used to treat diarrhea in EVM in Turgutlu/Manisa [82] and ethnomedicine in Balıkesir/Turkey [83]. The bark of *Quercus pubescens* has been employed for the same purpose in the Iberian Peninsula [74].

*Prunus persica* has been used in Pakistan as a parasiticide remedy in ruminants [84], *Vitis vinifera* L. (grape syrup) has been used to cure belly-ache in Israel [67], and these are not cited as wound healing elsewhere. *Verbascum cheiranthifolium* has been used for wound healing in the study area (Table 1). Different species of genus *Verbascum* have traditionally been used in the treatment of diseases of domestic animals and human in Spain, Italy, and Ethiopia [3,73,74,80]. However, among them, only the use of *Verbascum sinaiticum* as a treatment of wound healing is similar to our records in Central Anatolia.

It was indicated in the literature that many plant species are utilized in human medicine and veterinary medicine. However, for two species, *Astragalus* L. (Spina) and *Convolvulus arvensis*, bibliographic references on their usage in veterinary and human medicine have not been found in the scientific

studies. Furthermore, the high coincidence was identified between the plant species employed in human and veterinary medicine since humans utilize particular plants to treat both themselves and their domestic animals, which play a significant role in their daily life. Many plant species reported (22) are medicinal plants used in human medicine.

According to Pirbalouti et al. [85], about one-third of all traditional medicinal plants are employed for curing skin disorders and wounds. The comparison of our results with other published sources from the distinct regions of Turkey and all over the world has indicated that new usages for therapeutic purposes have been revealed in this study and same or similar plants are often utilized for curing dermatological diseases.

## Conclusion

This survey demonstrates that EVM is still widespread in certain societies, and especially in rural areas. Thus, there should be prevention for the destruction of EVM in terms of keeping the cultural tradition, as well as conserving the data on beneficial plant species.

We believe that the present study will stimulate further ethnoveterinary research, particularly in the other regions of Turkey, and clinical studies on treating livestock by using promising plants, for the purpose of re-establishing veterinary phytotherapy as an integral element of sustainable treating of the health issues of livestock reared under organic and conventional conditions.

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## Conflict of Interest

The authors declare no conflict of interest.

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