

An Ethnobotanical approach to animal diseases and biological control in Antalya: Southern Turkey

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The majority of Antalya population originates from nomadic culture. Therefore, animal husbandry and agriculture are considerably advanced business for them. People who reside in the areas far from the settlement have commonly used ethnobotanical culture in the treatment of their animal diseases and in the biological control. It was conducted a questionnaire with 163 informants who have maintained this traditional ethnobotanical culture for hundreds of years in Alanya and Gazipaşa city centers and their villages, and boroughs between 2012 and 2013. Samples of wild plants used for animal diseases and biological control were collected and usage information was recorded after identifying. The results of study suggested that 30 plants belonging to 19 families and 21 plants of 14 families were used in many different ways in veterinary field and biological control by the locals, respectively. The Use value (UV) of plants was calculated. New usage information and methods based on these findings were observed. This study highlights that wild plants are predominantly effective in fighting against animal diseases. Therefore, the promising results from this study provide new insights into further studies that will be conducted to develop new drugs in veterinary field. In addition, this study will be able to add a new and different dimension to biological control.

Keywords: Animal diseases, Biological control, Ethnobotany, Nomadic knowledge, Antalya

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Mankind has lived with plants and got benefit from them since earliest times. Plants have great economic value since they have been utilized for various purposes like food, construction of multiple goods and furniture, lumbering, ornamental flowers, firewood, treatment of animal diseases, animal feed, dye manufacturing, as well as for medical purposes¹. Turkey is a flora-rich country where 11,016 plant taxa inhabit^{2,3}. About five hundred taxa are used for medicinal purposes. The fact that Turkey is located in three phytogeographical regions (Mediterranean, Iran-Turan, and Euro-Siberian) is one of the most important factors that enabled it to have an astonishing biological diversity, as well as presence of relict, endemic and other important species. It is well known that people still focus on the ethnobotanical uses of plants for biological control in an interesting and different manner. Debach (1974) reported that biological control is a part of natural control and acting as parasitoids, predators, or pathogens in

maintaining another organism's population density at a lower average. The chemical agents used for the control of the unwanted organisms surely have substantial adverse effects on both human and environmental health⁴. In addition, chemical control causes serious economic damage to national economy as it is expensive. Use of the chemicals also disrupts the ecological balance in almost all cases. It cannot show a favorable result due to their improper practices⁵. Biological control allows potential pests to be kept under control and natural ecological balance is not disrupted. Natural biological control may be exercised for pest control not only on agricultural land but also goods and food that people have used in their daily life. Thus, it has been economized, and people find an opportunity to live in healthy environmental conditions⁵. It is well known that agricultural activities are substantially done by the locals in the region due to the fact that research area has ideal climatic conditions for being engaged in agriculture. For example, olive trees and greenhouses serve as a host for many pests, thus causing great harm to the

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agricultural crops. Intensive pesticide usage could also disrupt natural balance due to its harmful effects on beneficial organisms. On the other hand, intensive application of pesticides may cause the environment to pollute and may affect negatively human and animal health and even make some pests gradually build up resistance to the pesticides⁶. Local people have, therefore, tried to suggest a solution to biological control, which has an ecological importance, through ethnobotanical culture by following interesting and different approaches to derive benefit from medicinal herbs⁷.

The majority of Antalya population originates from nomadic culture. Therefore, animal husbandry and agriculture are considerably advanced activities for them. People who reside especially in areas far from the settlement have commonly used methods obtained through ethnobotanical culture to find alternative solutions to their medical problems, to treat their animal diseases and in the biological control. This study will enable to explain the ethnobotanical culture which was used effectively by the locals in the treatment of animal diseases and in the biological control, in order to record and transmit it to the next generations. Moreover, it will provide a basis for novel drug development to be performed in laboratory conditions in the veterinary field and for developments in the health areas. It is being considered that this study might contribute to the biological control which is important for ecological balance and human and environmental health and that ethno culture used in this area could also be helpful for new scientific studies.

Ethnobotanical studies have often focused on human diseases in Turkey. But, the aim of this study is to determine how they treated animal diseases with ethnobotanical methods, the manner in which they used them and how they sought a solution to the diseases. It will explain some different approaches due to the facts that local people are commonly engaged in livestock.

Methodology

Study area

Alanya is a tourism city and a component district of Antalya province in Turkey's Mediterranean Region (Fig. 1). It is 132 km away from Antalya city center. It is on the southern coast of Turkey and has an area of 1,598.51 km², with the population of 276.277 as of Turkey's 2013 census; located on the

Gulf of Antalya on the Anatolian coastal plain of Pamphylia. The city is situated between the Taurus Mountains to the North and the Mediterranean Sea to the South and occupies roughly 70 km of coastline within the borders of the Turkish Riviera. It is bordered by Manavgat along the coast from West to East, the mountainous Gündoğmuş to the North west, Hadim to the North, Taşkent and Sarıveliler to the East and Gazipaşa to the South east. It is home to the ancient cities of Manavgat, Side and Selge⁸.

Gazipaşa is a district settled in Gazipaşa Plain on the Mediterranean coast of southern Turkey, with 10 km long and 7 km width, 180 km East of the city of Antalya (Fig. 1). It is bordered by Anamur to the East, Ermenek to the North east, Sarıveliler to the North and Alanya to the West. Gazipaşa is situated between the Taurus Mountains to the North and the Mediterranean Sea to the South, being parallel to Mediterranean coast and approximately 35 km inland. Much as city center is 3 km inland, with an area of 931 km², new settlements are lying on the beach. It has about 50 km of coastline, half of which is sandy beach and rocky stretches, with magnificent small coves that are ideal places to swim. Low hills are situated between the city center and seashore. There is a mountainous plateau to the North. The local economy depends on agriculture and the red chestnut soil of the coastal strip is used for growing fruits and vegetables, particularly citrus fruits and bananas. Crops have also been grown well in red-colored soil stretching inwards. The mountainous areas become important for livestock⁹.

Alanya and Gazipaşa are adjacent to each other. Mediterranean Basin by their location makes sure



Fig. 1 — Map of study area

that a lot of rain comes during the winter, the summers are long, hot, and arid in comparison to the winter. Research areas have received most of average rainfall between December and January, with an average of 202.4 mm in those months. The hottest months are July and August, with the average temperature of 20.7 °C in these two districts. The majority of people living in especially rural areas are engaged in agriculture and animal husbandry. In the city center, civil servants and tradesmen are in the majority⁸.

Data collection

The survey was conducted during 2012–2013 and revealed that people living in the Alanya and Gazipaşa city centers and 46 villages belonging these two towns. The locals in the study area are using a large number of plants for medicinal (e.g. animal diseases) and biological control purposes. The survey was carried out at the villages of Alanya; Okurcalar, Avsallar, İncekum, Türkler, Payallar, Konaklı, Oba, Tosmur, Kestel, Kargıcak, Demirtaş, Çıplaklı, Emişbeleni, Cıkçilli, Toslak, Mahmutlar and Güzelbağ. Villages of Gazipaşa; Akoluk, Beyrebucak, Gürçam, Hasdere, Çakmak, Korubaşı, Karadağ, Göçük, Çataldaş, Çıglık, Kahyalar, Aydınçık, Çörüş, Yeşilyurt, Macarlar, Karalar, Karaçukur, Doğanca, İnceağrı, Çile, Kırismetler, Gökçeler, Kızılgüney, Yeniğüney, Denizyolu, Kale area, Hacımusa, Sugözü, Çamlıca, Gökkuzluk plateau and Zeytinada. The people who may have an ethno-medicinal knowledge or experience were visited at least five times while they were in houses, fields, plateaus and farms at different seasons of the years of 2012 and 2013. Information about usage of medicinal plants, especially in the treatment of animal diseases and biological control, was obtained from these people using model of a semi-structured ethnobotanical questionnaire (Appendix). 163 inhabitants were selected based on one of the following criteria: they have been living in the region for more than 12 yrs, use plants as the main medicine or identified as medicinal plant extractors or traditional healers. The selection of informants was performed based on a questionnaire having questions about personal experience with medicinal plants.

As a result, a total of 163 people, including 92 women and 71 men, were interviewed face-to-face about use of veterinary purposed plants and the plants used for biological control. In conjunction with families, local names, used parts and preparation

methods of the plants, ethnobotanical indices of plant species used for healing of local people were reported.

Plant materials

Plant samples were collected during field studies carried out between 2012 and 2013. They were obtained from March to September due to their different vegetation period, after collection, they were numbered and pressed by researchers in the field, and dried according to the appropriate herbarium techniques. Then, they were identified using “Flora of Turkey and the East Aegean Islands”², Güner *et al.*¹⁰ and the studies related to Afyonkarahisar by Kargioğlu *et al.*^{11,12}. Additionally, scientific names of plant species were determined according to the International Plant Name Index (IPNI:<http://www.ipni.org>) and the Plant List (<http://www.theplantlist.org>) and then listed in alphabetic order (Table 1). Knowledge about the use of the plant samples were recorded in accordance to local’s expressions. The Latin names, local names, and purpose of using plants were determined. Plants were photographed as well as observed in the research field. Plant samples have been kept in Afyon Kocatepe University, Faculty of Arts and Science, Department of Biology Herbarium (AKUAH) (Table 1). A literature survey was also conducted by considering the flora, ethnobotany, geology and climatic conditions of the region.

Data analysis

The use value (UV) demonstrates the relative importance of plants known locally. It was calculated using the formula:

$$UV = \sum U_i / N$$

where U_i is the number of uses mentioned by each informant for a given species and N is the total number of informants^{13,14}. The UV of the plant taxa with therapeutic use in this research is given in Tables 1&2.

Results

Animal diseases and used plants

The study results revealed that 30 plant taxa of 19 families were used to treat animal diseases by local people. Use values (UV) of medicinal herbs used for the treatment of animal diseases are shown in Table 1.

Fabaceae and Pinaceae (10%) represent the most number of taxa used to treat animal diseases, followed by Amaryllidaceae, Apiaceae, Cupressaceae, Lamiaceae, Moraceae, Oleaceae and Thymelaeaceae (6.6%) (Fig. 2).

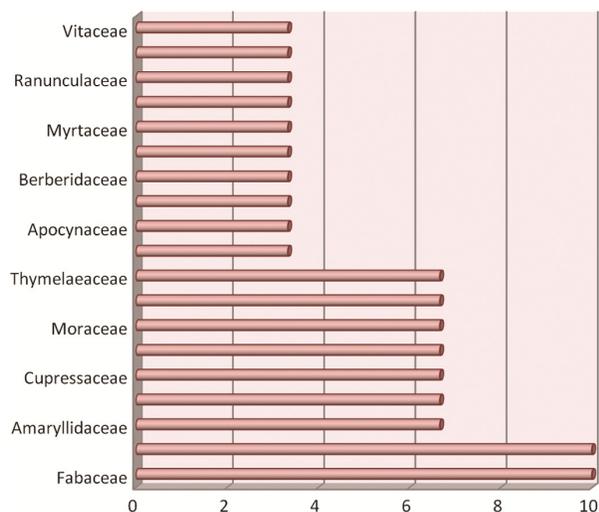


Fig. 2 — The most common families of the Veterinarian plants in terms of species richness

Local people have used 30 taxa of medicinal plants and their different parts to cure domestic animal diseases by preparing them in different methods since ages. Common plant organs and structures used to cure the diseases in animals are fruits, seeds, boughs, leaves, fresh roots, aerial organs, stems, latex (Fig. 3). The results of previous studies conducted in immediate vicinity clearly demonstrate that similar plant organs might usually be used for medical and veterinarian purposes by local people¹⁴⁻¹⁵.

Medicinal plants are effectively utilized from ethnobotanical aspects to cure 33 different diseases in the domestic animals such as sheep, cattle, poultry, cat and dog. The diseases and/or problems are cold, endoparasites, mastitis, animal breeding, abdominal distention, abdominal pain, an open sore, anthrax, miscarriage, cough, enteric, hoof & mouth diseases, liver pain, mouth sores, animal blindness, animal weakness, beak blackout and blindness (Fig. 4). While previous studies carried out in surroundings are similar in terms of diseases controlled in medical and veterinarian fields, some differences are emerging especially in animal diseases like mastitis, miscarriage, chicken diseases, scabies, brucellosis, piroplasmosis^{7,14,17}.

Plants and biological control

The second focus of the study is biological control. Table 2 shows plants and their usage in biological control. 21 taxa belonging to 14 families are used for biological control. Asteraceae, Lamiaceae and Pinaceae (21 %) mainly represent the number of taxa

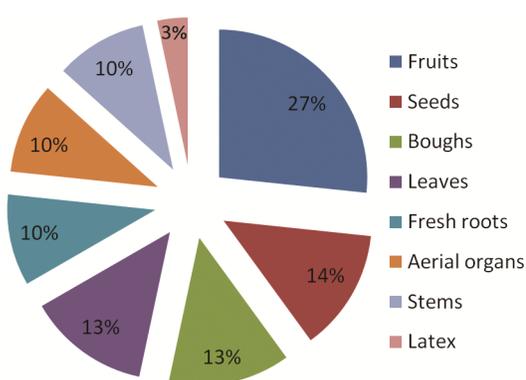


Fig. 3 — Parts of the Veterinarian plants that commonly used

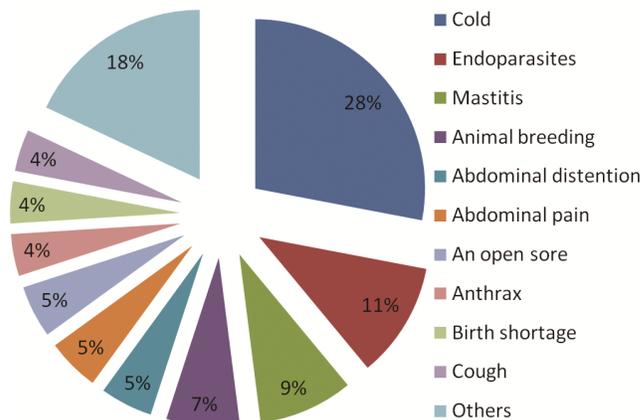


Fig. 4 — Animal diseases rates of the Veterinarian plants that commonly used

used for biological control, followed by Euphorbiaceae (14 %) and other families (7 %) (Fig. 5a). Frequently used plant parts for biological control are aerial organs (40 %), fruit (25 %), flower (10 %), bark (10 %), stem, leaves and tuber (5 %), respectively (Fig. 5b). Taxon with the highest use value for biological control is *Cedrus libani* var. *libani* (0.57).

This study has been conducted in the area of southern Anatolia where local economy depends mainly on tourism in coastal areas. In the study area local people are of nomadic origin, and they keep very remarkable knowledge from the point of Turkish ethnobotanical culture and try to pass it on to the future generations. From point of this study, plants used in veterinary field are noteworthy. One of the most striking features in field trip surveys was that the female informants had more accumulation of knowledge about animal diseases and biological control and they were more effective in practice than male counterparts.

Table 1 — List of the medicinal plants (animal diseases) used by local people in Alanya-Gazipaşa (Turkey).

Plant species, family and voucher number	Local name	Ailments treated / Therapeutic effect	Administration	U _i	UV
<i>Acanthus hirsutus</i> Boiss. (Acanthaceae, AKUAH 1204)	<i>Akdiken</i>	Cold	Int.	79	48
* <i>Allium cepa</i> L. (Amaryllidaceae, AKUAH 1205)	<i>Soğan</i>	Cold, Abdominal distention	Eaten	57	35
* <i>Allium sativum</i> L. (Amaryllidaceae, AKUAH 1207)	<i>Sarımsak</i>	Chicken diseases	Eaten	89	55
<i>Artemisia absinthium</i> L. (Asteraceae, AKUAH/1084)	<i>Acı yavşan</i>	Cold, Abdominal pain, an open sore	Eaten	76	47
<i>Berberis crataegina</i> DC. (Berberidaceae, AKUAH 1202)	<i>Karamuk</i>	Endoparasites, Liver pain, Mastitis	Eaten	35	21
<i>Cedrus libani</i> A. Rich. (Pinaceae, AKUAH 1217)	<i>Katran, Ardiç</i>	Cold, Scabies, fungal infections, Mastitis, Poisoning	Wrapped in a cloth (Tar), ext.	58	36
<i>Ceratonia siliqua</i> L. (Fabaceae, AKUAH 1315)	<i>Keçiboynuzu</i>	Mouth sores	Int.	34	21
<i>Citrus limon</i> (L.) Burm.fil. (Rutaceae, AKUAH 12855)	<i>Limon</i>	Poisoning, Hypocalcemia, blindness	Int.	30	18
<i>Cupressus sempervirens</i> L. (Cupressaceae, AKUAH 1228)	<i>Ardıç</i>	Mastitis, Endoparasites	Wrapped in a cloth, ext	90	55
<i>Daphne gnidioides</i> Jaub. & Spach (Thymelaeaceae, AKUAH 1125)	<i>Havaza</i>	Cold, tympany, anthrax	Int.	49	30
<i>Daphne oleoides</i> Schreber subsp. <i>oleoides</i> (Thymelaeaceae, AKUAH 1101)	<i>Havaza</i>	Cold	Int.	76	47
<i>Euphorbia kotschyana</i> Fenzl (Euphorbiaceae, AKUAH 9870)	<i>Sütlük, sütleğen</i>	An open sore, hoof-and-mouth disease	Int.	56	34
<i>Ferulago trachycarpa</i> Boiss. (Apiaceae, AKUAH 1238)	<i>Yayla çağşırı</i>	Animal breeding	Eaten	55	34
<i>Ficus carica</i> L. subsp. <i>carica</i> (Moraceae, AKUAH 14382)	<i>İncir, yemiş</i>	Cold	Eaten	55	34
<i>Juniperus drupacea</i> Lab. (Cupressaceae, AKUAH 1004)	<i>Andız</i>	Cough	Int.	12	7,4
* <i>Lathyrus sativus</i> L. (Fabaceae, AKUAH 14222)	<i>Burçak</i>	Animal breeding	Eaten	59	36
* <i>Lens culinaris</i> Medik. (Fabaceae, AKUAH 14408)	<i>Mercimek</i>	Cold	Eaten	77	47
* <i>Morus nigra</i> L. (Moraceae, AKUAH 11322)	<i>Karadut, gara dut</i>	Mouth sores	Int.	55	34
<i>Myrtus communis</i> L. subsp. <i>communis</i> (Myrtaceae, AKUAH 11355)	<i>Murt, kara murt</i>	Animal weakness	Int.	42	26
<i>Nerium oleander</i> L. (Apocynaceae, AKUAH 1148)	<i>Zakkum, ağu, ağı</i>	Endoparasites,hoof-and-mouth disease	Int.	24	15
* <i>Nigella sativa</i> L. (Ranunculaceae, AKUAH 13100)	<i>Otçam, çörek otu</i>	Bruise- sprain, abdominal pain	Int.	29	18
* <i>Olea europaea</i> L. var. <i>europaea</i> (Oleaceae, AKUAH 1270)	<i>Sitin, zeytin</i>	Poisoning, Abdominal distention, cold	Int.	58	36

(Contd.)

Table 1 — List of the medicinal plants (animal diseases) used by local people in Alanya-Gazipaşa (Turkey).

Plant species, family and voucher number	Local name	Ailments treated / Therapeutic effect	Administration	U _i	UV
<i>Phillyrea latifolia</i> L. (Oleaceae, AKUAH 1265)	<i>Kesme</i>	Animal blindness	Int.	61	37
<i>Pinus brutia</i> Ten. (Pinaceae, AKUAH 1247)	<i>Çam, İşam, Kızılşam</i>	Cold, enteric, Birth shortage, endoparasides	Wrapped in a cloth, ext.	81	50
<i>Pinus nigra</i> J. F. Arnold subsp. <i>pallasiana</i> (Lamb.) Holmboe (AKUAH 1247)	<i>Çam, işam, gara şam,</i>	Cold, enteric, Birth shortage, endoparasides	Wrapped in a cloth (Tar), ext.	90	55
<i>Satureja cuneifolia</i> Ten. (Lamiaceae, AKUAH 1115)	<i>Yayla kekiği, kara kekik</i>	Cough, cold, viral diseases	Int.	43	26
<i>Seseli gummiferum</i> Pallas ex Smith subsp. <i>corymbosum</i> (Boiss. & Heldr.) Davis (Apiaceae, AKUAH 1094)	<i>Çağşır, çaşır, çakşır</i>	Animal breeding	Eaten	99	61
<i>Thymus cherlerioides</i> vis. var. <i>cherlerioides</i> (Lamiaceae, AKUAH 1278) - E.(NT)	<i>Geven diken, dikenli kekik</i>	Cold	Eaten	61	37
<i>Vitis</i> spp. (Vitaceae, AKUAH 11543)	<i>Üzüm, asma, tefek</i>	beak blackout, malaria, nodule exanthema(LSD)	Int.	33	20
* <i>Zea mays</i> L. subsp. <i>mays</i> (Poaceae, AKUAH 11055)	<i>Mısır, darı</i>	Intestinal diseases, brucellosis, piroplasmosis	Int.	90	55

Abbreviations: Cultivated plant; * UV; Use value U_i ; The number of uses mentioned by each informant for a given species.

Table 2 — List of the plants (biological control) used by local people in Alanya-Gazipaşa (Antalya-Turkey).

Plant species, family and voucher number	Local name	Parts used	Administrations
<i>Rhus coriaria</i> L. (Anacardiaceae, AKUAH 1310)	<i>Sumak, Mavru</i>	Fruits	A mixture of extract (obtained through crushing ripe sumac fruit) and salt is applied over exterior surface of "Yanlık", a kind of bag made of goatskin that is used to make butter, to stop nearing pests.
<i>Nerium oleander</i> L. (Apocynaceae, AKUAH 1148)	<i>Zakkum, Ağu</i>	Leaves	Leaves are used for agricultural pests in the greenhouse cultivation in a way that added to plant irrigation water after cooling the boiled one.
<i>Artemisia absinthium</i> L. (Asteraceae, AKUAH 1084)	<i>Acı yavşan</i>	Aerial parts	Aerial parts of <i>Artemisia absinthium</i> are embedded in cowpat. Then, the cowpat is placed into beehive by burning, thus indicating that they are highly successful in fighting against parasites and pests.
<i>Helichrysum plicatum</i> DC. subsp. <i>plicatum</i> (Asteraceae, AKUAH 1321)	<i>Düvenci çiçeği, Altın otu, Yılan otu</i>	Capitula	Plenty of capitula collected is placed into home and stable in order to prevent nearing snake and scorpions.
<i>Inula viscosa</i> (L.) Aiton Hort. Kew. [W. Aiton] (Asteraceae, AKUAH 1328)	<i>Zinbit, Zinebit</i>	Aerial parts	It is reported that this protects plants against plant mites when boiled water extract of above-ground organs of <i>Inula viscosa</i> was applied to plants through the instrument of pulverizator.
<i>Euphorbia davisii</i> M.S. Khan (Euphorbiaceae, AKUAH 1005)	<i>Yayla sütlüğü</i>	Aerial parts	When adding them to the pool after aerial parts of <i>Euphorbia davisii</i> are cut into small pieces, it is observed that the frog faecal matter was cleaned.
<i>Euphorbia kotschyana</i> Fenz (Euphorbiaceae, AKUAH 1198)	<i>Sütlük, sütleğen</i>	Aerial parts	Its released juice is boiled after cutting the whole of <i>Euphorbia kotschyana</i> into small pieces. Then, this resultant mixture is used as a drug against the parasitic nematodes.
<i>Calicotome villosa</i> (Poiret) Link (Fabaceae, AKUAH 1129)	<i>Azgan, Deve diken, Kör diken, Sardiken</i>	Aerial parts	It is prevented vermin from entering into greenhouse by fencing so that plants in the greenhouse do not damage.

(Contd.)

Table 2 — List of the plants (biological control) used by local people in Alanya-Gazipaşa (Antalya-Turkey).

Plant species, family and voucher number	Local name	Plant parts used	Administrations
* <i>Ocimum basilicum</i> L. (Lamiaceae, AKUAH 10980)	<i>Feslikan, Fesleğen</i>	Aerial parts	Consumers asserted that pests cannot approach the environment or places where <i>Ocimum basilicum</i> is found.
<i>Origanum majorana</i> L. (Lamiaceae, AKUAH 1244)	<i>Eşek kekiği, Köy kekiği, Ak kekik</i>	Aerial parts	<i>Origanum majorana</i> is inserted into clothing and beds cupboards, fighting against the pests.
<i>Satureja cuneifolia</i> Ten. (Lamiaceae, AKUAH 1091)	<i>Yayla kekiği, Kara kekik</i>	Flowering parts	Oil extracted from <i>Satureja cuneifolia</i> is used as fly spray, applying over the animals.
<i>Laurus nobilis</i> L. (Lauraceae, AKUAH 1162)	<i>Defne, Tehmel, Tehni</i>	Leaves	Leaves of <i>Laurus nobilis</i> are commonly used against insects or pests by placing on dried fruits.
<i>Myrtus communis</i> L. subsp. <i>communis</i> (Myrtaceae, AKUAH 1282)	<i>Murt, Kara murt, Gara murt</i>	Fruits	It is expressed that this dried fruit protects against pests and moth when fig was rinsed with water extract and re-dried by boiling the boughs of <i>Myrtus communis</i> subsp. <i>communis</i> with the decoction and infusion methods
<i>Olea europaea</i> L. var. <i>europaea</i> (Oleaceae, AKUAH 1270)	<i>Sitin, Zeytin</i>	Fruits	Women and children are extracted oil from this plant's fruits and they spread it on their hair through the instrument of comb to avoid being infested with lice and fleas.
<i>Cedrus libani</i> A. Rich (Pinaceae, AKUAH 1217)	<i>Katran, Ardiç</i>	Stems	Tar is extracted by the locals from <i>Cedrus libani</i> . Greenhouses are enclosed by fences covered with tar in order to avoid approaching insects, mites, bacteria, fungi, viruses and nematodes and damaging crops there.
<i>Pinus brutia</i> Ten (Pinaceae, AKUAH 1248)	<i>Çam, İşam, Kızılşam, Gızılşam</i>	Barks	Tar is extracted by the locals from <i>Pinus brutia</i> . A mixture of 'Ekki' and salt is applied over exterior surface of "Yanlık", a kind of bag made of goatskin that is used to make butter, to prevent nearing pests and parasites. Greenhouses are enclosed by fences covered with tar in order to avoid approaching insects, mites, bacteria, fungi, viruses and nematodes and damaging crops there.
<i>Pinus nigra</i> J. F. Arnold subsp. <i>pallasiana</i> (Lamb.) Holmboe (Pinaceae, AKUAH 1247)	<i>Çam, İşam, Karaçam</i>	Barks	Tar is extracted by the locals from <i>Pinus nigra</i> subsp. <i>pallasiana</i> . A mixture of 'Ekki' and salt is applied over exterior surface of "Yanlık", a kind of bag made of goatskin that is used to make butter, to prevent nearing pests and parasites. Greenhouses are enclosed by fences covered with tar in order to avoid approaching insects, mites, bacteria, fungi, viruses and nematodes and damaging crops there.
* <i>Punica granatum</i> L. (Lythraceae, AKUAH 14322)	<i>Nar</i>	Fruits	A mixture of <i>Punica granatum</i> peel and salt is spread on their containers during the production of food products such as butter, tomato paste and fig to avoid approaching life-threatening pathogens and parasites.
<i>Paliurus spina-christi</i> Mill. (Rhamnaceae, AKUAH1056)	<i>Çaltı diken, Aslanpençesi</i>	Aerial parts	It is put-around the garden to prevent harmful animals such as pig from entering into the garden.
* <i>Vitis</i> spp. (Vitaceae, AKUAH 1543)	<i>Üzüm, Asma, Tefek</i>	Fruits	A mixture of grape (<i>Vitis</i> spp.) molasses and water is used to irrigate eggplant in the fight against pests such as red spider.
<i>Asphodelus aestivus</i> Brot. (Xanthorrhoeaceae, AKUAH 1010)	<i>Çiriş, Kiriş</i>	Root tubers	The water of <i>Asphodelus aestivus</i> root tubers are used to protect flowers and leaves against parasites that may lead to a significant yield loss.

Ethno-veterinary information was collected during the interviews by following the instructions on ethnobotanical and ethno-pharmacological surveys proposed by Etkin²¹ and Hedberg²².

Although local people in the study area suggest they used about 200 plants for veterinary and biological control purposes, we have considered 30

plants for veterinary use and 21 plants for biological control, which are different and have higher use values than the others. Their usage and forms of utilization are presented in Tables 2&3. Several different ethno-medicinal and ethnobotanical studies have been previously carried out in areas close to the present study area until now^{14, 15, 18, 23}. However, there

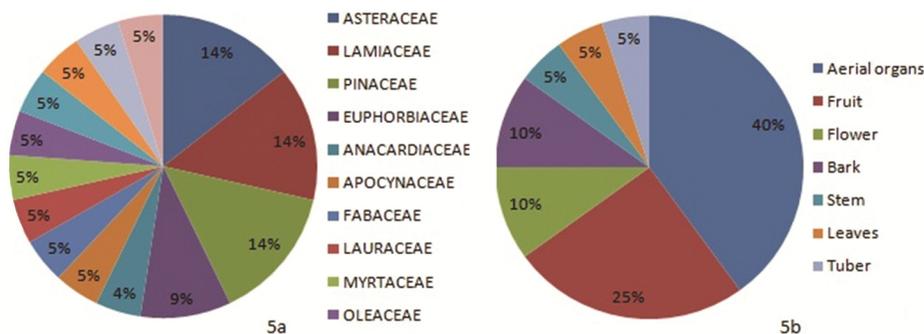


Fig. 5 — (a) The most common families in terms of species richness (Biological control), (b) Parts of the plants (Biological control) that commonly used.



Fig. 6 — Application of Tar

have almost been no studies focused directly on the plants used for both veterinary purposes and biological control in the area studied. Thus, this study has concentrated on both veterinary usage and biological control usage of the plants.

Medicinal plants used in animal diseases

There are a number of studies about medicinal usages of the plants for human health^{14-16,20}.

Around the world, medicinal plants are known to be used in the veterinary medicine and undertaken researches into this field. A number of plant genera used in the veterinary field in different parts of the world are 23/105 for UK/Ireland - Allen & Hatfield²⁴, 20/76 for Spain Catalonia- Agelet & Vallès²⁵, 14/77 for Italy Tuscany - Uncini Manganelli *et al.*²⁶. We should stress that studies on maintaining the ethnobotanical tradition are carried out in veterinary medicine in the world.

Our study suggests that *Nigella sativa* oil with a 0.74 of use value (UV) has commonly been used for bruise-sprain and abdominal pain diseases. *Seseli*

gummiferum subsp. *corymbosum* ranks second, with a 0.61 of use value. Its leaves are given to animals for breeding activities.

The usage form of the plants or their products could differ in different regions. A certain amount of natural tar obtained from *Pinus nigra* subsp. *pallasiana* added to water in broiler poultry husbandry. Their digestive troubles have been cured by removing endoparasites from their gastrointestinal tract, thus enabling chicken to gain more weight. Natural tar obtained by burning *Pinus brutia* wood at 300 °C are applied over skin wounds in the sheep and dogs, thereby protecting against dermatitis. When bandaging foot fracture of goat and sheep with mixture of barley flour and tar, their foot fractures healed up after 18 days (Fig. 6).

The tar implementation in the animal (breaking, sprain, wound, scabies, etc.) by local people.

If udder of cow is wiped up or washed with natural tar extracted from *Cedrus libani* before and after milking in particularly dairy farming, this process

prevents it from mastitis and ensures udder care and hygiene in cows. Similar applications were reported in the studies carried out in nearby areas of current study^{12,17}. *Berberis crataegina* proves remarkably effective in fighting diseases like liver pain and mastitis and controlling endoparasites in cattle. Previous studies in neighboring area reported that this plant has an analgesic effect²⁰ as well as curing kidney stones and liver diseases⁷. Cone of *Juniperus drupacea* has been stated to protect animals against the cold. Studies in the neighbouring area reveal, however, that it has an effect on asthma, bronchitis and diseases related to human without paying attention to animal diseases¹⁴. Our study showed that *Euphorbia* spp was useful for an open sore and hoof-and-mouth diseases in the animals while other studies conducted in the surrounding areas did not deal much with the diseases in animals. It is emphasized that this plant species was used in the treatment of common diseases²⁰, toothache⁷ infection¹⁴ toothache²⁷ eczema, burn wound care, wart treatment, itch and rash treatment and scorpion stings in human. Whereas our study shows that *Ceratonia siliqua* is used for mouth sore of animals. A few reports indicated that it has an expectorant effect and provides an effective solution to both bronchitis and stomach disorders in humans²³.

Table 1 compiling the data obtained from the study indicates that other plant species evaluated in the veterinary field are used peculiar to this district to cure various animal diseases. However, similar studies stressed that some of these plants were used for diseases in the human while some were used except for medical purposes^{7,15,20,23,28}, suggesting that these studies usually become unfocused on animal diseases.

In other countries, some of these plants are used for ethnoveterinary aims: *Zea mays* for udder edema²⁹; *Vitis* spp. for animal illness²⁹; *Allium cepa* for endoparasites³⁰; *Berberis* spp. for animal wounds²⁹; *Allium sativum* for endo parasites and as animal respiratory tonic³¹; *Pinus* spp. for diarrhea, grey pasty young animals and endoparasites²⁹.

The world has been looking for alternative solutions for animal diseases using ethnobotanical culture. As learnt from the studies that they found solutions to diseases, disorders and pests such as mastitis, wound and endoparasites using the same type of plants in this region, it is also seen that some plants are used only unique to this region.

Ethnobotanical approach to biological control

Although it is not known exactly when biological control was first applied, it is believed in that first applications were performed by Chinese. They used an ant species for various caterpillars and beetles which cause harm to the citrus fields by resulting the yield loss. The first applications of biological control in Europe date back to the end of the 1700s³².

Approximately 2,000 species were studied in more than 5000 places for their possible application as biological control agents against pests in 196 countries. Adverse effect of these practices on environment and beneficial organisms has rarely seen for 120 years ever since these studies were conducted³³.

Natural enemy species inhabit each of organisms such as insects, mites, bacteria, fungi, viruses, nematodes, fish, birds, mammals, slugs and snails, protozoa commonly found in nature. They are grouped under the name of parasitoids, predators, entomopathogens and antagonists. People are often used chemical substances in order to conserve cultivated area, goods and foods against such natural enemies. Therefore, they have long been tried to find effective ways of biological control. But this time they undertook various investigations of classical biological control. For example, first importation of parasitoids and predators for classical biological control can be traced back to 1910 when *Rodolia cardinalis* Mulsant against cottony cushion scale was introduced into Turkey³⁴. Since then many predator species for biological control have been introduced into Turkey, for example: *Chilocorus bipustulatus* L. against cottony cushion scale, *Aphelinus mali* Holdeman against woolly apple aphid, *Prospaltella berleseii* Howard against mulberry cochineal, *Trissolcus* spp. San-Jose against sunn pest, *Prospaltella perniciosi* Tower against cochineal, *Cryptolaemus montrouzieri* Mulsant and *Leptomastix dactylopii* Howard against citrus mealy bug, *Phanerotoma flavitestacea* Pisch. against locust moth, *Aphytis* spp. and *Chilocorus nigritus* F. against red cochineal, *Rumina decollata* L. against brown snail *Helix aspersa* Müller, *Hippodamia convergens* Guerinmeneville against aphids, *Eretmocerus dabachi* Rose and Rosen against laurus whitefly and *Encarsia lahorensis* Howard against citrus whitefly³⁵. As observed in this study, the best method to prevent pests or keep them under control in the plant conservation is to bring into the relevant area natural enemies or predators rather than to use pesticides or

chemical substances not to damage the environment and beneficial organisms.

Our study suggests biological control may occur through using ethnobotanical culture, which means that we need to approach pest or other problems from a different perspective. For example, *Nerium oleander* is used for agricultural pests in the greenhouse cultivation in a way that adds to plant irrigation water after cooling by boiling its leaves, so pest control works can perform free of cost without any side effect.

It is reported that this protects plants against plant mites when boiled water extract of above-ground organs of *Inula viscosa* was applied to plants through the instrument of pulverizator. Consumers asserted that pests cannot approach the environment or places where *Ocimum basilicum* is found. Leaves of *Laurus nobilis* are commonly used against insects or pests by placing on dried fruits. It is expressed that this dried fruit protects against pests and moth when fig was rinsed with water extract and re-dried by boiling the above-ground organs of *Myrtus communis* subsp. *communis* with the decoction and infusion methods.

Local people in the study area use the traditional method for biological control and as a result of this they keep their foods (paste, butter, yogurt, etc.) safe from parasites and pests. This could be exemplified for example, a mixture of *Punica granatum* peel and salt is spread on their containers during the production of food products such as butter, tomato paste and fig to avoid approaching life-threatening pathogens and parasites.

Red bark of *Pinus brutia* is called “Ekkı”. A mixture of *ekki* and salt is applied over exterior surface of “*Yanlık*”, a kind of bag made of goat skin that is used to make butter, to prevent nearing pests and parasites.

One of the different forms of biological control performed in this locality is also greenhouse that is an important part of agricultural activities. Tar is extracted by the locals from *Pinus nigra* subsp. *pallasiana*, *Pinus brutia* and *Cedrus libani*. Tar produced by natural methods^{7,17,27} has been used in different usages by local people. Greenhouses are surrounded by fences and covered with tar in order to keep the insects, mites, bacteria, fungi, viruses and nematodes away. Locals claim that their productivity and product quality are very high when comparing to those who use chemicals. Similarly, tar has been spread on wooden parts of houses in order to stop

nearing centipedes and scorpions. Tar soaps are put into unused clothes to keep them from moth. Tar is applied on the back of sheep and goat so that ticks cannot live in their skin. If tar is spread on storage boxes, parasites cannot approach and they keep their food in these boxes. It is reported that tar smell keeps worms off. Similar results regarding tar were reported earlier by Arı *et al.*^{7,17} (Fig. 6).

Local people stress that they do not want to use the chemicals to even prevent school children from being infested with lice in the kindergarten due to the fact that these potentially toxic and hazardous substances are difficult to clean and have side effects on both human and environment health. Local people conveyed to us that they achieve good results when spreading natural and pure tar soap and cream over children’s hair as a solution to pediculosis and louse.

Local people apply biological control to fight against pests in beekeeping. For this, aerial organs of *Artemisia absinthium* are embedded in cowpat. Then, the cowpat is placed into beehive as burning, and this activity seems to be highly successful in fighting against beehive parasites and pests. Yet another example of the remarkable biological methods is that a mixture of *Vitis* spp. grape molasses and water is used to irrigate eggplant in order to fight against red spider. The juice of *Asphodelus aestivus* root tubers are used to protect flowers and leaves against parasites that may lead to a significant yield loss. *Satureja cuneifolia* oil is used as fly spray, when applying over the domestic animals. *Origanum majorana* is inserted into clothing and bed cupboards, fighting against the pests. When adding them to the pool after aerial parts of *Euphorbia davisii* are cut into small pieces, it is observed that the frog faecal matter was cleaned. Its released juice is boiled after cutting the whole of *Euphorbia kotschyana* into small pieces. Then, this resultant mixture is used as a drug against the parasitic nematodes.

Conclusion

Located in the southern part of Turkey, Antalya (Alanya and Gazipaşa) is one of the pearl of the Mediterranean region. A large portion of its indigenous peoples represent the ethnically nomadic culture. In general, nomadic culture defines the nomadic way of life that nomads spend certain part of their life on plateau not on the city center. They have been continuing this ancient culture from the past to today. Therefore, Mediterranean people have maintained their traditional culture up to now. This

culture is an accumulation of the result of their good communication with the nature over hundreds of years. Due to its climatic hotspot, the study area is extremely suitable for agriculture and livestock breeding activities. In this study, 163 informants were introduced a questionnaire during the field works. Our main focus was on the plants used in biological control and veterinary medicine. The results of the study suggest that 30 plants of 19 families and 21 plants of 14 families were employed for many different purposes by locals in veterinary medicine and biological control, respectively. We obtained new usage information and methods based on these findings. This study highlights that wild plants are predominantly effective in fighting against animal diseases. For example, local people claimed that they got benefit from tar obtaining plants to get more milk from cows and prevent these animals from contacting the mastitis disease. It has also been known that some expensively treated diseases can now be easily cured by using these plants. The promising results from this study provide new insights into further studies that would be conducted to develop new drugs in veterinary medicine.

In addition, this study provides new information regarding biological control unique to the study region. In our belief, the information about ethonbotanical culture obtained from the study area will add a new and different dimension to biological control.

Appendix

1. Name and surname of the participant, 2. Age and sex of the participant, 3. Telephone and address of the participant, 4. Educational level of the participant, 5. Date of interview, 6. Place of residence of the participant, 7. Duration of residence of the participant, 8. What is the local name of the plant used?, 9. For which diseases do you use the plant?, 10. Which parts of the plant do you use? (Root, stem, flower, leaves, fruit, etc.), 11. How do you prepare the plant for use?, 12. How and when do you use the plant?, 13. Approximately what dose do you use?, 14. How long does the convalescence period take?, 15. Did any complication occur from the plants you used?

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