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Traditional medicinal plants used for oral and dental diseases in Turkey

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Abstract

Plants have been utilized to treat a wide range of diseases in Turkey. Dental caries is the most common infectious disease affecting humans. This paper was documented traditional knowledge on medicinal plants used to treat oral and dental diseases in Turkey. Pharmacological and phytochemical studies for each species were also reviewed. According to result of this study, 76 medicinal plants belonging to 30 families were reported. Toothache was the disorder treated by the highest number of species (41 taxa), followed by oral wounds (17 taxa). The most common used medicinal plant species was *Hyoscyamus niger* L.

Key words: ethnobotany, oral and dental diseases, medicinal plants, traditional medicine, Turkey

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Türkiye'de halk arasında ağız ve diş sağlığında kullanılan tıbbi bitkiler

Özet

Türkiye'de çeşitli hastalıkların tedavisinde halk tarafından kullanılan birçok bitki bulunmaktadır. Ağız ve diş sağlığı problemleri ise insanları etkileyen en yaygın infeksiyöz hastalıklardır. Etnobotanik araştırmaların taranması ile hazırlanan bu çalışmada Türkiye'de geleneksel tedavide ağız ve diş hastalıklarına karşı kullanılan 30 familyaya ait 76 tıbbi bitki rapor edilmiş ve bu taksonların bilimsel ve yöresel isimleri, familyaları, kullanılan kısımları ve kullanılış şekilleri hakkında bilgi verilmiştir. Ayrıca, her bitki türü için farmakolojik ve fitokimyasal çalışmalar da taranarak tartışılmıştır. Çalışmamızın sonuçlarına göre, diş ağrısı 41 taksonla halk tarafından en fazla sayıda tedavi edilen hastalıkdır ve onu 17 taksonla ağız yaraları izlemektedir. En yaygın kullanılan bitki ise *Hyoscyamus niger* L.'dir.

Anahtar kelimeler: Etnobotanik, ağız ve diş sağlığı, tıbbi bitkiler, geleneksel tıp, Türkiye

1. Introduction

Turkey is one of the richest countries in the world in terms of plant diversity. To date approximately 11.700 plant taxa have been identified and 31% of them are endemic [1]. The ratio of endemism is one of the most important indicators to evaluate environmental value of an area. Besides, Turkey is considered to be one of the richest countries in terms of cultural heritage. A number of human races and tribes who settled during different periods brought different cultures and customs. For this reason, it is considered that studies carried out in Turkey could display valuable ethnobotanical data.

Medicinal plants have been utilized to treat a wide range of diseases including oral and dental diseases in Turkey. Gürsoy and Gürsoy [2]. reported 17 plants used commonly in oral and dental diseases in Anatolia. Oral health is essential to general health and quality of life. Globally, about 30% of people aged 65–74 have no natural teeth. The most common oral diseases are dental cavities, periodontal (gum) disease, oral cancer, oral infectious diseases, trauma from injuries and hereditary lesions. Risk factors for oral diseases include an unhealthy diet, tobacco use, harmful alcohol use, poor oral hygiene and social determinants. According to the data given by Ministry of Health of the Republic of Turkey 96% of

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Turkish people has oral and dental diseases. Dental screening researches shows that 85% of the participants have oral and dental diseases, oral and dental diseases are common and this situation harms the economics.

The microflora of the mouth contains hundreds of species of aerobic and anaerobic bacteria. Toothaches are mainly due to bacterial infection. Cultural studies indicate that more than 500 distinct microbial species can be found in dental plaque [3]. *Porphyromonas gingivalis*, *Tannerella forsythensis*, *Treponema denticola*, *Candida albicans*, *Streptococcus mutans* are some microorganisms associated with oral and dental diseases [4].

Local antibiotics, local antiseptic drugs and systemic antibiotics widely used for treatment oral and dental diseases. Chlorhexidine, the most commonly used compound in various mouthrinses is a proved antimicrobial agent. But prolonged use of Chlorhexidine can cause several side effects including staining of teeth, gastrointestinal problems, gingivitis, dry mouth and many more [5]. In recent years, multiple drug/chemical resistance human pathogenic microorganisms have been developed.

The bacterial resistance to the antimicrobial traditional agents, besides its adverse effects, stimulates the development of researches on natural products with antimicrobial activity, aiming at new therapeutic alternatives in order to prevent caries. Sage is one of the natural source used for oral and dental diseases. The anti-microbial properties as well as the tannins based astringent activities of sage (active ingredient of dental-care herbal medicinal preparations) benefit the reduction in plaque growth, the inhibition of gingival inflammation and have positive effects on caries prophylaxis [6]. Thymol, menthol, eucalyptol are the natural agents found in antiseptic mouthrinse solutions as an ingredient [7].

In this sense, the present study aims to document the traditional uses of medicinal plants used to treat oral and dental diseases in Turkey. Pharmacological properties and identified constituents of medicinal plants were given to support the traditional data and lead to new researches.

2. Materials and methods

We reviewed studies published in journals, reports and books between 1979 and 2014 dealing with traditional uses of medicinal plants in Turkey to treat various oral and dental diseases. A list was produced, providing local names, mode of use, plant part used, ailments treated, identified constituents, pharmacological properties and references for each taxon. Besides, we searched the databases for pharmacological or phytochemical studies which supports medicinal uses in oral and dental diseases of each species. In this context, studies which are including antimicrobial, antiinflammatory, antiplaque, wound healing and analgesic activities of plants were searched.

3. Results

Medicinal plants used for oral and dental diseases in Turkey are presented in Table 1 and arranged in alphabetical order of their family and botanical names, with the relevant information (Table 1). A total of 76 taxa belonging to 30 families were reported as being traditionally used to treat oral and dental ailments in Turkey. Most of the reported medicinal plant species were Angiosperms (71 taxa: 69 Dicotyledones, 2 Monocotyledones). The most common medicinal plant families were Lamiaceae (13), Asteraceae (9), Rosaceae (6), Anacardiaceae (4), Fabaceae (4), Malvaceae (4) and Moraceae (4).

The most frequently used plant parts were the fruits (13) followed by leaves (11), herba (7) and flowers (6). Decoction (24) was the most frequently used preparation technique, followed by infusion (12), crushing (7), vaporization (3), grinding (3), heating (2), and the others (3) (Figure 1). The most frequently used administration methods were gargle (20), applying on tooth (14), and chewing as gum (7) (Figure 2). External application (44) was used more often than internal application (9).

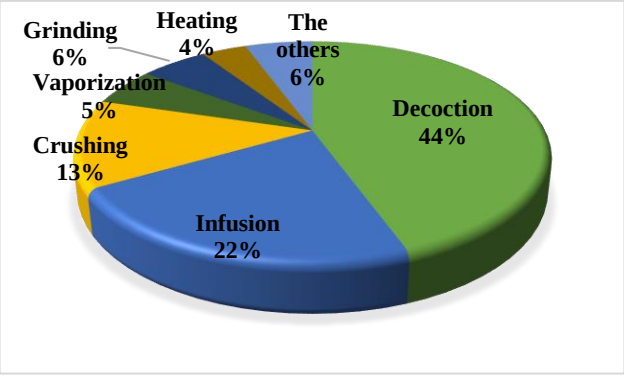

Figure 1. Most frequently used preparation methods

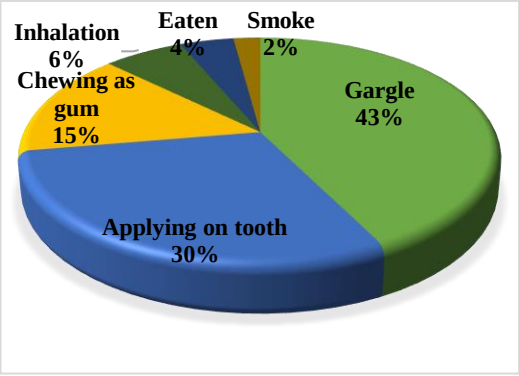

Figure 2. Administration methods of plants

The most widely used medicinal plant species to treat oral and dental diseases were *Hyoscyamus niger*, *Morus nigra* L., *Hypericum perforatum* L., *Rubus sanctus* Schreber, *Pinus brutia* Ten. and *Morus alba* L. (Figure 3). It was

determined that *H. niger* (Diş otu, Ban otu) which has been declared in 18 localities used for toothache in 14 ethnobotanical studies, used for gingival diseases in 7 ethnobotanical studies, used for both of them in 5 studies and used for oral and dental hygiene in 1 ethnobotanical study.

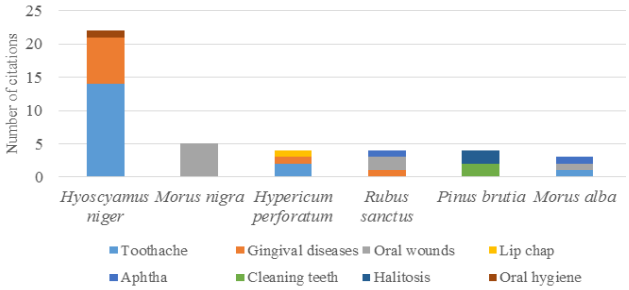

Figure 3. Most frequently mentioned plants and purpose of use

The reported plants were used in 9 different oral and dental disease categories (Toothache, oral wounds, gingival diseases, aphtha, oral hygiene, weakness of gums, halitosis, lip chap, bleeding of gum). Toothache was the ailment treated by the highest number of species (41), followed by oral wounds (17) (Figure 4). All of the 76 medicinal plants in our report, 26 of them have antibacterial activity, 18 of them have antifungal activity, 19 of them have analgesic activity, and 17 plants of them have antiinflammatory activity according to studies carried out previously (Figure 5). Out of the 76 plants reviewed in this paper, 21 of them have no experimental evaluation of their antimicrobial, analgesic, antiinflammatory or antiplaque effects.

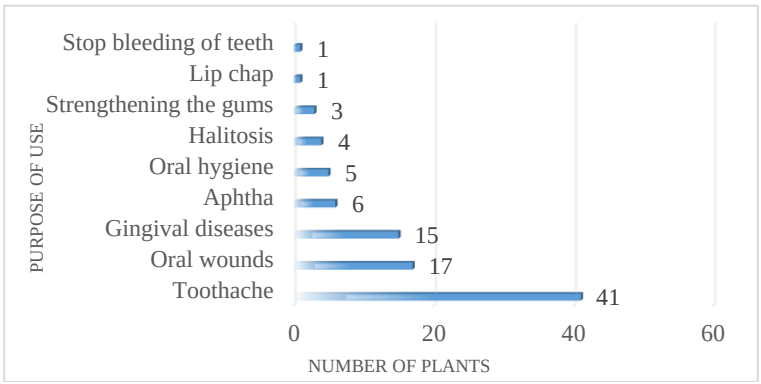

Figure 4. Use frequency of remedy purposes

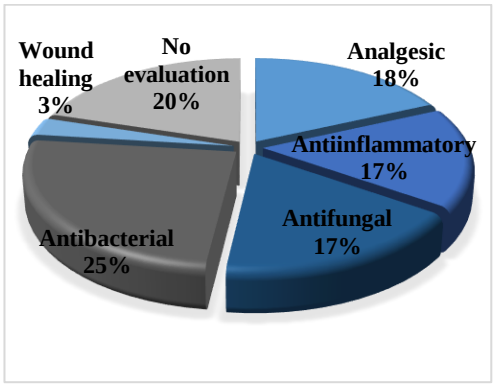

Figure 5. Pharmacological properties of the plants

4. Conclusions and discussion

Dental caries is the most common infectious disease affecting humans. Systemic diseases such as cardiovasculer diseases, low birth weight, bacterial pneumonia and diabetes mellitus are associated with oral infection [8]. There are a number of herbs that can help eliminate inflammation and infection associated with periodontal diseases. A total of 76 taxa belonging to 30 families were reported in the literature as being traditionally used in Turkey to treat different oral and dental ailments. Vieira et al. [9]. reported 34 plant species used in dental diseases in the study which conducted in Maranhao State of Brazil. Hebbar et al. [10] reported 35 plants species used in oral health care in Karnataka, India. Ganesan [11] reported 114 plants species as traditional oral care medicinal plants from Tamil Nadu. Some species reported in those studies are similar to our findings such as *Allium sativum*, *Ficus carica*, *Malva sylvestris*, *Melissa officinalis*, *Plantago major* and *Salvia officinalis*. Toothache was determined as being treated by the highest number of species not only in the present study, but also in Hebbar et al. [10] and Ganesan's [11] study.

Lamiaceae and Asteraceae which were represented by the highest number of species in our paper were the most common families used to treat oral and dental diseases in India, Brazil and Mexico as well [9,11,12]. Infusion was the most frequently used preparation method in the studies carried out by Rosas-Pinon et al. [12] and Vieira et al, [9] while decoction was the most frequently used method in the present study.

Convolvulus galaticus Rostan ex Choisy which was the only endemic plant reported in this study was grouped under "Least concern" category according to the Red Data Book of Turkish Plants. *Salvia fruticosa* Miller was the other plant species that was stated in "Vulnerable" threat category [13].

We reported that *Hyoscyamus niger* was the most widely used medicinal plant to treat oral and dental diseases. It is used for toothache, gingival diseases and oral and dental hygiene. Hyoscyamine and scopolamine which are active compounds of the plant were shown to have analgesic activity [14]. Begum et al. [15] reported analgesic and antiinflammatory activity of the methanolic extract of *H. niger* seeds. Therefore, *H. niger* is supposed to be useful for

oral and dental health products. Although analgesic and antiinflammatory activity of the plant was shown, clinical studies should be cary out.

According to Table 1 a wide range of phenolic compounds have been identified as active principle(s) in some of the plants. Polyphenolic compounds from *Glycyrrhiza glabra* L. root namely glabridin, licochalcone A was proved to have antifungal activity on *C. albicans.* As a consequence, it is suggested that licochalcone A and glabridin should have therapeutic efficacy for *C. albicans* oral infections [16]. Thymol and carvacrol, monoterpenoid phenolic compounds, is responsible for antiinflammatory and antifungal activity of some *Origanum* L. and *Thymus* L. species [17-18]. Gentisic acid and dihydroxybenzoic acid from *Ceratonia siliqua* L. was demonstrated to have analgesic and antiinflammatory activity. Alkaloids are the other active component group has been widely represented in the plants. Berberine and Berbamine were the main antiinflammatory, antinociceptive and antipyretic alkaloids in the roots of *Berberis vulgaris* L. [19]. Tropane alkaloids hyoscyamine and scopolamine from some *Hyoscyamus* L. species was shown to have analgesic activity [14]. The analgesic activity of morphine from *Papaver somniferum* L. was known commonly [20].

Medicinal plants also need to be evaluated in terms of their toxicity, potential side effects and drug interactions. For intance, glabridin and licochalcone A were demonstrated to have toxicity towards oral epithelial cells while glycyrrhizic acid have no toxicity [16]. Warfarin is one of the most frequently used oral anticoagulants for prevention of blood clotting. Combination of warfarin and *Allium sativum* has been reported to cause postoperative bleeding and spontaneous spinal epidural haematoma [21].

As a conclusion, the folk medicinal plants used in oral and dental disease in Turkey and their pharmacological properties with phytochemical constituents were recorded by this research. Our study shows potential for institutionalization of medicinal plants as an alternative and complementary medical system. The 55 plants reported in this study have been found to assay for their related pharmacological activities and 51 plants have been found to determine their phytochemical constitutents. More phytochemical and pharmacological studies are needed for the rest of the plants. These available data can provide evidential support for the development of potential plant-based products which will be cheaper and with fewer side effects.

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Table 1. Medicinal plants used to treat oral and dental diseases in Turkey

Family	**Species**	**Part(s) used**	**Prep/ Adm**	**Purpose of use**	**Pharmacological activities**
Amaryllidaceae	*Allium sativum* L./ Sarımsak	Fruit	Cru/ apt	Toothache	Analgesic [22]
Anacardiaceae	*Cotinus coggyria* Scop./ Sumak	Fruit	Gar, ext	Oral wounds	Antibacterial, antifungal [23]
	Pistacia khinjuk Stocks/ Bıttım	Resin	Che	Toothache	Antiinflammatory activity [24]
	Pistacia terebinthus L.subsp. *palaestina* (Boiss.) Engler/ Menengiç, Çıtımık	Root	Dec/ ext	Oral wounds	
	Rhus coriaria L./ Sumak,Tetri	Fruit	Dec/ ext	Oral wounds	Antibacterial, antifungal, antiinflammatory [25]
Apiaceae	*Petroselinum crispum* (Mill.) Nyman ex A.W. Hill./ Maydanoz	Herb	Eat	Mouthsores	Antiinflammatory activity [26]
Araceae	*Arum conophalloides* Kotschy ex Schott./ Livik		Dec/ gar	Strengthening the gums	

Table 1. Continued

Asteraceae	*Achillea biebersteinii* Afan./ Vılıka, Çeker	Herb	Inf/ int	Toothache	Antibacterial, antifungal [27]
	Achillea wilhelmsii C. Koch./ Ayvadene	Inflorescence		Toothache	
	Anthemis pseudocotula Boiss./ Papatya, Akbubeç	Capitulum	Inf/ ext	Toothache	Antibacterial, antifungal [28]
	Carduus sp./ Hoppan dikeni	Phloem	Eat	Oral wounds	
	Carlina lanata L./ Keygana	Seed	Vap	Oral wounds	
	Gundelia tournefortii L. var *armata* Freyn & Smith/ Kenger	Seed	Dec/ int	Toothache	Antibacterial, antiinflammatory [29]
	Matricaria chamomilla L./ Papatya	Capitulum	Inf	Oral wounds, mouthsore	Antibacterial, antifungal [30]
	Taraxacum officinale Weber/ Karahindiba	Latex	Ext	Cleaning the teeth	Antibacterial [31]
	Xeranthemum annuum L./ Süpürge otu	Leaf	Vap	Toothache	Antibacterial, antifungal [32]
Berberidaceae	*Berberis vulgaris* L./ Hanım tuzluğu			Oral wounds	Antiinflammatory, analgesic [19]
Brassicaceae	*Capsella bursa-pastoris* (L.) Medik./ Çoban çantası		Inf/ int	Stop the bleeding of tooth, toothache	Antibacterial [33]
Capparaceae	*Capparis spinosa* L. var. *spinosa*/ Gevil		Cru/ apt	Toothache	
Convolvulaceae	*Convolvulus galaticus* Rostan ex Choisy/ Sarmaşık	Flower	Cru/ apt	Toothache	
Cucurbitaceae	*Ecballium elaterium* A. Rich/ Eşek hıyarı, Acır	Fruit	Squ	Toothache	Analgesic [34]
Cupressaceae	*Cupresus sempervirens* L./ Selvi	Fruit	Dec/ gar	Toothache	
	Juniperus drupacea L./ Andız	Root	Inf	Toothache, tooth abscess	Antibacterial [35]
	Thuja orientalis L./ Mazı	Seed, the fleshy part	Gri/ apt	Toothache	Analgesic [36]
Ephedraceae	*Ephedra major* Host/ Deniz üzümü	Shoots	Apt	Cleaning the teeth	Antifungal [37]
Euphorbiaceae	*Euphorbia macroclada* Boiss./ Sütleğen	Latex	Apt	Toothache	Antifungal activity [38]

Table 1. Continued

	Euphorbia stricta L./ Sütleğen	Latex	Apt	Toothache	
Fabaceae	*Colutea cilicica* Boiss. et. Bal./-	Fruit	Inf/ gar	Gingival diseases	Wound healing [39]
	Glycyrrhiza glabra L./ Meyan	Root	Apt	Cleaning the teeth	Antibacterial [40]
	Hedysarum syriacum Boiss./-	Fruit	Inf/ gar	Gingival diseases	
	Ceratonia siliqua L./ Keçiboynuzu	Fruit	Dec	Toothache	Antibacterial [41]
Fumariaceae	*Fumaria officinalis* L./ Şahtere	Herb	Dec/ gar	Toothache, gingival diseases	Analgesic, antibacterial [42]
Hypericaceae	*Hypericum perforatum* L. / Kantaron	Flower	Pom	Lip chap, toothache	Antiinflammatory [43]
	Hypericum retusum Aucher/ Bahtof	Plant	Gar/ ext	Gingival diseases	Antibacterial [44]
	Hypericum triquetrifolium Turra/ Bahtof	Plant	Dec/ gar	Gingival diseases	Antiinflammatory [45]
Juglandaceae	*Juglans regia* L./ Ceviz	Leaf	Cru/ ext	Toothache	Antibacterial, antifungal [46]
Lamiaceae	*Melissa officinalis* L./ Oğul otu	Leaf	İnf, dec	Toothache	Antibacterial, antifungal [47]
	Mentha longifolia (L.) Hudson subsp. *longifolia*/ Yarpuz	Leaf	Cru/ apt	Aphtha	Antbacterial, antifungal [48]
	Mentha sp./ Nane, Kara nane	Leaf	Che	Toothache	Antibacterial, antifungal [49]
	Origanum onites L./ Taş kekiği, Dağ kekiği	Branches with leaves	Dec/ int	Toothache	Analgesic [50]
	Origanum vulgare L./ Deli kekik,Karakekik	Leaf	Che	Toothache	Antiinflammatory [51]
	Origanum vulgare L. subsp. *hirtum* (Link) Ietswaart/ Güve otu, Kekik	Herb	Dec, inf/ int oil/ext	Gingival diseases	Antifungal [18]
	Salvia fruticosa Miller/ Adaçayı, Moşaplı	Herb		Gingival diseases	Antifungal [18]

Table 1. Continued

	Salvia officinalis L./ Adaçayı	Herb	Inf/ gar	Gingivitis	Antibacterial, antiinflammatory [6]
	Teucrium polium L./ Mayasıl otu			Toothache	Analgesic, antifungal, antibacterial [52]
	Teucrium chamaedrys L./ Yer meşesi	Herb	Inf, dec/int	Toothache	Antiinflammatory and analgesic activity [53]
	Thymbra spicata L. var. *spicata/* Nevazil otu, Zahter	Plant	Dec/ gar	Toothache	Antibacterial and antifungal [54]
	Thymus longicaulis C. Persl./ Kekik	Aerial parts	Dec/ int	Gingival diseases	
	Thymus vulgaris L./ Kekik	Oil of aerial parts	Int	Toothache	Antiinflammatory, analgesic [17]
Lauraceae	*Laurus nobilis* L./ Defne, Teynel	Leaves	Cru/ ext	Toothache	Antiinflammatory, analgesic [55]
Malvaceae	*Alcea pallida* Waldst. & Kit./ Alakurtaran	Herb	Dec, inf	Gingival diseases	
	Althaea officinalis L./ Hatmi	Flower, leaf, seed, root		Gingivitis	Antibacterial activity [56]
	Malva neglecta Wallr./ Ebegümeci	Leaf	Che	Oral wounds	Antibacterial, antifungal [57]
	Malva sylvestris L./ Ebegümeci,Develik	Aerial parts	Dec	Aphtha	Antibacterial, antifungal, wound healing [57]
Moraceae	*Ficus carica* L. subsp. *carica/* Deli yemiş, incir	Latex	Apt	Toothache	
	Morus alba L./ Dut, Akdut	Fruit	Squ	Aphtha, toothache, oral wounds	Antiinflammatory and antibacterial activity [58]
	Morus nigra L./ Karadut	Fruit	Dec/ gar	Oral wounds	Analgesic [59]
	Morus rubra L./ Karadut	Fruit	Squ/ gar	Oral wounds	
Oleaceae	*Olea europaea* L./ Zeytin, Delice	Resin, Leaf	Che	Toothache, oral wounds	Analgesic [60]
Papaveraceae	*Papaver rhoeas* L./ Gelincik	Flower	Dec/ int	Aphtha (esp. children)	
	Papaver somniferum L./ Haşhaş	Latex	Apt	Toothache	Analgesic [20]

Table 1. Continued

Pinaceae	*Pinus brutia* Ten./ Çam, Kızıl çam	Stem, branch Resin	Dec/ gar Che	Cleaning the teeth, mouthsores	Antibacterial [61]
Plantaginaceae	*Plantago major* L. subsp. *intermedia* (Gilib.) Lange/ Damar otu			Toothache	
Plumbaginaceae	*Plumbago europaea* L./ Serkel otu	Root	Squ/ apt	Gingival diseases	
Ranunculaceae	*Clematis vitalba* L./ Akbağ	Branch, stem	Apt	Toothache	Antiinflammatory, analgesic [62]
	Helleborus orientalis Lam./ Bohça otu	Root	Cru/ apt	Toothache	Antiinflammatory, analgesic [63]
Rosaceae	*Potentilla recta* L./ Beş parmak otu, Acı hayıt	Root Flower	Gar Che	Oral wounds, toothache	
	Prunus spinosa L. subsp. *dasyphylla* (Schur) Domin./ Güvem otu	Fruit	Dec/ gar	Toothache	
	Rosa damescena L./ Gül	Petal	Squ/ ext	Oral wounds	Antiinflammatory activity [64]
	Rubus canescens D.C. var *canescens*/ Böğürtlen	Leaf, fruit	Dec/ gar	Oral wounds	
	Rubus sanctus Schreber/ Böğürtlen, karamık	Root	Dec/ gar	Gingival diseases, oral wounds, aphtha	Wound healing, analgesic [63]
	Sorbus domestica L./ Üvez	Leaf	Dec/ gar	Aphtha	
Solanaceae	*Hyoscyamus albus* L./ Göz otu	Seed	Smo/ inh	Toothache	Analgesic [14]
	Hyoscyamus niger L./ Diş otu, Ban otu	Seed Leaf Seed	Hea/ inh Smo Dec/ gar	Toothache, gingival diseases, oral and dental hygiene	Antiinflammatory, analgesic [15]
	Hyoscyamus reticulatus L./ Dağdağan	Root, seed	Vap/ inh	Toothache	Analgesic [65]
Urticaceae	*Parietaria judaica* L./ Duvar fesleğeni	Leaf	Dec/ gar	Oral wounds	Antibacterial [66]

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