Plants used in traditional treatment against diarrhea in Turkey

Seçil Karahüseyin1, 2, Aynur Sarı1* 1
1Department of Pharmacognosy, İstanbul University, Faculty of Pharmacy, İstanbul, Turkey
2Department of Pharmacognosy, Çukurova University, Faculty of Pharmacy, Adana, Turkey

ORCID IDs of the authors: A.S. 0000-0001-8116-7053; S.K.0000-0002-3515-2974.

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ABSTRACT
Turkey is one of the richest countries in the world in terms of flora with its extraordinary plant diversity. Its flora consists of about 10,000 vascular plants and approximately one third of them (34.4 %) are endemic to the country. In recent years, the use of ethnobotanical information obtained from medicinal plant research has gained attention all around the world. For this reason, numerous ethnobotanical studies have recently been published and much has been written about medicinal plants in our country. This study deals with 133 taxa used in traditional treatments against diarrhea in Turkey and it aims to give information about scientific and local names of these taxa, families, used parts and usage in diarrhea.

Keywords: Diarrhea, medicinal plants, traditional treatment, Turkey

INTRODUCTION
Diarrhea is defined as loose stools, increased stool frequency, or urgency by patients. Although most patients use this term to describe changes in consistency (loose or watery stool), diarrhea can be considered as urgency or high stool frequency. In fact, with normal consistency, frequent defecation is often referred to as pseudodiarrhea; for this reason, an abnormal stool form and frequency should not be used to describe diarrhea. Most diarrheal episodes in developed countries are acute and self-limited and are usually caused by infections. In immunocompetent patients, acute contagious diarrhea typically resolves within 4 weeks (most often within 1 week). Therefore, chronic diarrhea is defined as that lasting longer than 4 weeks. It is estimated that 1%-5% of adults suffer from chronic diarrhea. In immunocompetent patients in developed countries, chronic diarrhea is not usually contagious (Lawrence et al. 2017).

Acute bloody diarrhea in children and adults is a difficult diagnostic problem. Acute bloody stools have different spectra between adults and children, but there are overlapping causes (infectious colitis and less frequently intussusception). Identification of patients with infectious causes is mandatory, so that they are suitably treated with antimicrobials and so that infection control measures can be fulfilled (Lori et al. 2009).

Detection of the cause of this disorder may be a problem, because there are many enteric pathogens that cause acute bloody diarrhea and several noninfectious gastrointestinal disorders; these are interpreted as loose, bloody stools, mostly diarrhea (Lori et al. 2009).

There is a battle between the host microbiology of normal flora and the exterminating microbes. Symptomatic infections for the host when invaded can alter the bowel barrier and absorptive functions, or can quickly cause a number of problems that can
lead to lethal dehydration, diarrhea, toxic megacolon or shock. Asymptomatic infections may go unnoticed, but they have durable results for children’s growth and development. Most are acquired through contaminated food or water; however, only few pathogens (such as Shigella, Cryptosporidium, Giardia, rotaviruses, or noroviruses) can cause infection (Pawlowski et al. 2009).

Rotavirus is the leading cause of diarrhea hospitalization among children in the world. In 2003, a world-wide estimate of rotavirus-related deaths was published, based on a review of published literature on deaths from diarrhea and rotavirus hospitalizations in children from 1986 to 1999. Studies published between 1986 and 1999 showed that rotavirus causes ≈22% (range 17%-28%) of diarrheal hospitalizations in childhood. From 2000 to 2004, this rate increased to 39% (range 29%-45%). Application of this ratio to the recent World Health Organization estimates of diarrhea-related childhood deaths gave a predicted 611,000 (range 454,000-705,000) rotavirus-related deaths (Parashar et al. 2006).

In mass tourism, traveler’s diarrhea is one of the most common health problems in long-distance journeys. Globally, there are 40 million cases per year. For this reason, travelers to risky areas should be informed in advance of what measures they should take in case of acute diarrhea and which medicines to include in the first aid kit (Jelinek et al. 2017).

The first choice of treatment of acute uncomplicated traveler’s diarrhea - more than 90% of all cases - is the secretion inhibitor racecadotril. Usual practice, which recommends the anti-motility drug loperamide as the first option, should be rethought in favor of the last active ingredient racecadotril. Antibiotics should be used only in complicated cases. Generally, anticipation of a large number of passengers demanding antibiotic treatment should be impaired. Other therapeutic measures currently available for the treatment of acute diarrhea while traveling play a minor role (Jelinek et al. 2017).

Several studies have shown that antibiotics can reduce the rates of diarrhea in travelers to resource-limited countries. However, preventive antibiotic therapy is not recommended because of its side effects and so, if necessary, rapid-acting, single-dose antimicrobial therapy is used. In some studies, probiotics have shown benefit (Pawlowski et al. 2009).

There are a lot of kinds of diarrhea shown in this study and the drugs used for the treatment of diarrhea have many side effects. Medicinal plants have traditionally been used for the treatment of diarrhea for many decades. In this study, we have compiled 133 taxa used in traditional treatments of diarrhea in Turkey. The aim is to give information about scientific and local names of these taxa, families, used parts and usage in diarrhea (Table 1).

| Botanical name                  | Family            | Local name          | Plant parts used | Preparation, administration and use | Reference          |
|--------------------------------|-------------------|---------------------|------------------|-------------------------------------|--------------------|
| Achillea aleppica DC. subsp. aleppica | Asteraceae        | Civanperçemi        | Aerial parts     | Dec., Int.                          | (Doğan 2014)       |
| * Achillea wilhelmsii C. Koch. | Asteraceae        | Ayvadere, Kedicirnagı, Kedi Tırnağı, Tilki otu | Aerial parts     | +Milk, Dec. or Inf., Int             | (Oral 2007)        |
|                                 |                   |                     |                  | Crushed, Ext. Dec., Int. Inf., Inf.  | (Şenkardeş 2014)   |
|                                 |                   |                     |                  |                                     | (Tuzlacı 2016)     |
| Ailanthus altissima (P. Mill) Swingle | Simaroubaceae     | Össuruk ağacı       | Branches         | Dec., Int.                          | (Güneş et al. 2017) |
| Alchemilla sp.                  | Rosaceae          | Aslanpenceşesi, Dutya | Aerial parts, Flower | Inf., Int.                          | (Karagöz and Serteser 2017) |
| Alhagi maurorum Medik.          | Fabaceae          | Xirnum              | Fruit            | Raw, Int.                           | (Dalar et al. 2018) |
| Alhagi pseudoalhagi (Bieb.) Desv. | Fabaceae          | Hurnif, Çeti, Çoban calisi | Fruit            | Dried Fruits Eaten Crushed, Int.    | (Korkut 2006; Gençay 2007) |
|                                 |                   |                     |                  |                                     | (Tuzlacı 2016)     |
| Allium sativum L.               | Liliaceae         | Sarımsak            | Bulb             | +Yoghurt, Fac.                      | (Uysal 2008)       |
| Alyssum pateri Nydr. subsp. pateri | Brassicaceae      | Keşelmahmut         | Aerial parts     | Dec., Int.                          | (Kavak et al. 2014; Tuzlacı 2016) |
| Anacamptis pyramidalis (L.) Rich. | Orchidaceae       | Sahlep, Salep ciceği | Root             | Dec., Int.                          | (Doğan 2014; Tuzlacı 2016) |
| Anthemis cretica L. subs. pontica (Wild.) Grierson | Asteraceae | Papatyä             | Capitulum        | Inf., Int.                          | (Tütenocakli 2014) |
| Artemisia absinthium L.         | Asteraceae        | Acı yavşan          | Leaf             | Take as a pill, Int.                | (Yıldırım 2015)    |
Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

| Botanical name                        | Family            | Local name (Turkish) | Plant parts used | Preparation, administration and use | Reference                                      |
|----------------------------------------|-------------------|----------------------|------------------|-------------------------------------|-----------------------------------------------|
| *Arum conophalloides* Kotsch. ex Schott | Araceae           | Yılan bıçağı         | Seed             | Raw, Swallowed                      | [Güneş et al. 2017]                           |
| *Arum dioscoridis* SM. Kotsch. ex Schott | Araceae           | İilan purçulağı       | Flowering and Fruity Branches | Dec., Int. Raw, Int.                | [Yıldırım 2015]                               |
| *Berberis crataegina* DC.             | Berberidaceae     | Karamuk, Karamik, Kızılcık | Flowering and Fruity Branches | Dec., Int. Raw, Int.                | [Özkan 2002; Tuzlacı 2016]                    |
| *Berberis vulgaris* L.                | Berberidaceae     | Karamuk, Kadintuzluğü | Fruit            | Raw, Int.                           | [Korkmaz and Karakus 2013]                    |
| *Camellia sinensis* (L.) Kuntze       | Theaceae          | Siyah çay            | Leaf             | Inf., Int. Raw or Inf., Int.        | [Saraç et al. 2013; Tuzlacı 2016]            |
| *Capparis spinosa* L. var. aegyptia (Lam.) Boiss. | Capparaceae       | Gebere, Keberе Gemma | Aerial parts     | Cooked, Int.                        | [Kazan 2007]                                  |
| *Cardiospermum helicacabum* L.        | Sapindaceae       | Balon sarmaşığı, Japon feneri | Young Shoots | Dec., Int.                           | [Güzel et al 2015]                           |
| *Celtis tournfeltii* Lam.             | Ulmaceae          | Dérodoğan           | Fruit            | Raw, Int.                           | [Doğan 2014; Tuzlacı 2016]                    |
| *Centaurea pteroacaule* Trautv.      | Asteraceae        | Şermnik              | Leaf             | Dec., Int.                           | [Kavak et al. 2014]                          |
| *Centaurea solstitialis* L. subsp. solstitialis | Asteraceae        | İshal dikeni         | Aerial parts     | Inf., Int.                           | [Şenkardeş 2014; Tuzlacı 2016]                |
| *Cerasus avium* (L.) Moench           | Rosaceae          | Kiraz                | Stem and Branch Bark | Dec., Int.                           | [Kural 2012; Tuzlacı 2016]                    |
| *Ceratonia siliqua* L.                | Fabaceae          | Buynuz, Harip, Hamrun, Keciboyuzu, Kecibuyunu | Fruit | Raw, Int. Jam, Int. Mac., Int. | [Bulut 2006; Tuzlacı 2016; Gürdal and Kültür 2013; Yıldırım 2015] |
| *Ceterach officinarum* DC.            | Aspleniaceae      | Altın otu, Mayasıl otu | Aerial parts     | Cooked, Int. Dec., Int.             | [Güzel et al. 2015; Bulut 2006; Tuzlacı 2016] |
| *Chenopodium foliosum* Aschers        | Chenopodiaceae    | Kedi üzümü, Kuş üzümü | Aerial parts     | Inf., Int.                           | [Doğan 2014; Şenkardeş 2014; Tuzlacı and Şenkardeş 2011; Tuzlacı 2016] |
| *Cicer arietinum* L.                  | Fabaceae          | Nohut                | Seed             | Cooked, Int.                         | [Uysal 2008; Tuzlacı 2016]                    |
| *Cistus creticus* L.                  | Cistaceae         | Pamuk otu            | Leaf             | Dec., Int.                           | [Onar 2006; Tuzlacı 2016]                     |
| *Citrus limon* L.                     | Rutaceae          | Limon, Limon ağacı   | Fruit            | Juice, Int.                          | [Sargın et al. 2013]                         |
| *Convolvulus arvensis* L. Convolvulaceae | Convolvulaceae    | Başırık (Bağırsak) otu, Mahmude otu | Branches and Leaves | Dec., Int.                           | [Günes et al. 2017]                         |
| *Corylus avellana* L.                 | Corylaceae        | Kızılçık, Kirene, Zaye | Fruit           | Syrup, Int. Dec., Int. Inf., Int.    | [Kocyiğit and Özhatay 2006; Ayan 2015; Tuzlacı 2016; Polat 2010; Korkmaz and Karakurt 2014; Karci 2013; Güter et al. 2015] |
| Botanical name                          | Family          | Local name | Plant parts used | Preparation, administration and use | Reference                                      |
|----------------------------------------|-----------------|------------|------------------|-------------------------------------|------------------------------------------------|
| *Crataegus monogyna* *Jacq.* subsp. *monogyna* | Rosaceae        | Alıç,    | Fruit            | Eaten                              | [Sargın et al. 2013]                            |
|                                        |                 | Ekeçi müsüm, Keci aliç, Kız elması, Kocakar hurması | Leaf, Flower                   | Inf., Int.             | [Furkan 2016]                                  |
| *Cupressus sempervirens* L.            | Cupressaceae    | Mezarlık selvisi, Selvi | Cone               | Dec., Int.          | [Uysal 2008; Tuzlacı 2016]                     |
| *Cydonia oblonga* *Miller*             | Rosaceae        | Ayva       | Leaf             | Inf., Int.           | [Sargın et al. 2013]                           |
|                                        |                 |            | Seed             | Dec., Int.          | [Günes et al. 2017; Uysal 2008; Metin 2009; Kayabası 2011; Deniz 2008; Kincal 2018; Tuzlacı 2016] |
|                                        |                 |            | Flower           | Dec., Int.          | [Uysal 2008; Yüzbaşıoğlu 2010; Tuzlacı 2016]   |
|                                        |                 |            | Dec., Int.       | Eaten                | [Yıldırım 2015]                                |
|                                        |                 |            | Inf., Int.       |                      | [Pınar 2011]                                   |
| *Cyperus rotundus* L.                  | Cyperaceae      | Topalak otu | Root             | Crushed, Ext.       | [Uysal 2008]                                   |
| *Diospyros lotus* L.                   | Ebenaceae       | Laz hurması, Kaka hurma | Leaf               | Inf., Int.           | [Saraç et al. 2013; Tuzlacı 2016]              |
| *Elaeagnus angustifolia* L.            | Elaeagnaceae    | Iğde       | Seed             | Dec., Int.           | [Altundağ 2009]                                |
|                                        |                 |            | Fruit            | Eaten                | [Güzel et al 2015; Korkmaz and Karakurt 2014]  |
|                                        |                 |            | Leaf             | Inf., Int.           | [Polat 2010]                                   |
| *Erica manipuliflora* *Salisb.*        | Ericaceae       | Funda, Püren, Süpürge otu | Young Shoots | Dec., Int.           | [Bulut 2006]                                   |
| *Eriobotrya japonica* (Thunb.) *Lindly* | Rosaceae        | Malta eriği, Muşmula | Leaf               | Inf., Int.           | [Uysal 2008]                                   |
| *Euphorbia denticulata* Lam.           | Euphorbiaceae   | Hekletis, Sütleğen otu | Latex             | Int.                | [Kavak et al. 2014; Tuzlacı 2016]              |
| *Fagus orientalis* Lipsky              | Fagaceae        | Doğu kayını | Stem Bark        | Dec., Int.           | [Kural 2012]                                   |
| *Ficus carica* L. subsp. *carica*      | Moraceae        | Incir      | Leaf             | Raw, Int.            | [Alkaç 2013]                                   |
|                                        |                 |            |                  | Dec., Int.           | [Tuzlacı 2016]                                 |
| *Glaucium leiocarpum* Boiss.           | Papaveraceae    | Gelincik   | Flower           | Inf., Int.           | [Doğan 2014]                                   |
|                                        |                 |            |                  | Dec., Int.           | [Tuzlacı 2016]                                 |
| *Gundelia tournefortii* L.             | Asteraceae      | Kenger     | Root             | Latex, Eaten        | [Hayta et al. 2014; Çakıcıoğlu and Türkdoğan 2010] |
|                                        |                 |            |                  |                      | [Pınar 2011]                                   |
| *Helichrysum arenarium* (L.) *Moench.* | Asteraceae      | Altın otu | Capitulum, Leaf | Inf., Int.           | [Akan and Sade]                                |
| *Helichrysum plicatum* DC. subsp. *plicatum* | Asteraceae | Arı Çiçeği, Ölmbez Çiçek, Yaşa Çiçeği | Aerial parts Flowering Branches | Inf., Int. | [Arısan 2010]                                |
| *Helleborus orientalis* L.             | Ranunculaceae   | Bohça, Bohça otu, Cöp otu, Cöpleme | Leaf, Rhizome | Eaten                | [Kızılarslan and Özhatay 2012]                 |
| *Hordeum vulgare* L.                   | Poaceae         | Arpa      | Spike Whole plant | Inf., Int.           | [Sargın et al. 2013]                           |
|                                        |                 |            |                  |                      | [Korkmaz and Karakurt 2014]                    |
| *Hypericum cerastoides* (Spach) N. *Robson* | Hypericaceae | Kantaron, Küçük Kantaron | Aerial parts | Dec., Int.           | [Kızılarslan and Özhatay 2012; Tuzlacı 2016]   |
| *Hypericum scabrum* L.                 | Hypericaceae    | Mide otu, Yara otu | Aerial parts | Inf., Int.           | [Doğan 2014; Tuzlacı 2016]                     |
| Botanical name                  | Family             | Local name                  | Plant parts used | Preparation, administration and use | Reference                        |
|--------------------------------|--------------------|-----------------------------|------------------|-------------------------------------|-----------------------------------|
| *Inula viscosa* (L.) Aiton      | Asteraceae         | Khışıkes, Micve, Yerce, Zimbit | Leaf             | Eaten                               | [Güzel et al. 2015]               |
| *Juglans regia* L.             | Juglandaceae       | Ceviz                        | Seed, Leaf, Fruit Bark | Inf., Dec., Int.                    | [Aktan 2011; Şenkardeş 2014; Tuzlacı 2016; Sargın et al. 2013] |
| *Juniperus drupacea* L.        | Cupressaceae       | Andiz                        | Tar              | +Water, Int.                        | [Orhan 2011]                      |
| *Juniperus oxycedrus* L.       | Cupressaceae       | Ardıç                        | Leaf, Branches   | Dec., Int.                          | [Orhan 2011]                      |
| *Jurinella moschus* (Habl.) Bobrov subsp. pinnatisecta (Boiss.) Danin and PH.Davis | Asteraceae         | Gazangulpou, Kazankulpu     | Whole plant      | Dec., Int.                          | [Altundağ 2009]                   |
| *Lysimachia vulgaris* (L.) Pohl | Primulaceae        | Giya baluk                   | Leaf             | Dec., Int.                          | [Dalar et al. 2018]               |
| *Malva neglecta* Wallr.        | Malvaceae          | Ebegümeci, Ebemköpüci        | Aerial parts     | Dec., Int.                          | [Altundağ 2009]                   |
| *Matricaria chamomilla* L. var. recutita (L.) Grierson   | Asteraceae         | Papatyat                     | Aerial parts [Without Flower] | Inf., Int.                        | [Sargın et al. 2013]               |
| *Melissa officinalis* L.        | Lamiaceae          | Oğul otu                     | Leaf and Young Shoots | Inf., Int.                        | [Bulut 2006; Tuzlacı 2016]         |
| *Mentha longifolia* (L.) Hudson subsp. longifolia | Lamiaceae          | Bung, Pung, Yarpiz, Yarpuz   | Leaf             | Inf., Int.                          | [Altundağ 2009; Tuzlacı 2016]      |
| *Mentha x piperita* L.         | Lamiaceae          | Bünk, Mentol nane, Kedi nanesi, Tibbi nane | Aerial parts      | Dec., Int.                          | [Akan and Sade 2015]               |
| *Mespilus germanica* L.        | Rosaceae           | Beşbyyık, Döngel, Muşmula, Töngel | Leaf, Fruit      | Inf., Dec., Int. Eaten              | [Karcı 2013; Onar 2006; Tuzlacı 2016; Bulut 2006; Kural 2012; Güler et al. 2015; Tuzlacı 2016] |
| *Morus alba* L.                | Moraceae           | Akdut, Beyaz dut, Dut        | Leaf             | Inf., Int.                          | [Sargın et al. 2013]               |
| *Musa sapientum* L.            | Musaceae           | Muz                          | Fruit            | Eaten                               | [Uysal 2008; Tuzlacı 2016]         |
| *Myrtus communis* L.           | Myrtaceae          | Mersin, Murt                 | Leaf             | Dec., Int. Inf., Int.               | [Günes et al. 2017; Tuzlacı 2016]  |
| *Olea europaea* L.var. sylvestris [Mill.] Lehr. | Oleaceae           | Zeytin                       | Leaf and Stem Bark | Inf., Int.                        | [Bulut 2006]                      |
| *Opuntia ficus-indica* [L.] Mill. | Cactaceae          | Frenk inciri, Kaynana dili, Tin sabir | Fruit            | Eaten                               | [Güzel et al 2015; Güler et al. 2015] |
| *Orchis coriophora* L.         | Orchidaceae        | Sahlep                       | Root             | Dec., Int.                          | [Doğan 2014; Tuzlacı 2016]         |
| *Orchis palustris* Jacq.        | Orchidaceae        | Sahlep                       | Root             | Dec., Int.                          | [Doğan 2014; Tuzlacı 2016]         |
| *Orchis punctulata* Steven ex Lindley | Orchidaceae       | Sahlep                       | Root             | Dec., Int.                          | [Doğan 2014; Tuzlacı 2016]         |
| *Origanum onites* L.           | Lamiaceae          | Beyaz kekik, Deli kekik, Eşek kekiği, Güve otu, Karakkekik, Kekik | Aerial parts Leaf | Cooked with +Monk’s pepper, Thyme, Flour, Water, Ext. Inf. or Dec., Int. Aromatic Water, Int. Inf., Int. | [Uysal 2008; Gürdal and Kültür 2013; Tuzlacı 2016; Tütenocakli 2014] |
| Botanical name            | Family            | Local name | Plant parts used | Administration and use | Reference                          |
|--------------------------|-------------------|------------|------------------|------------------------|------------------------------------|
| *Parietaria judaica* L.  | Urticaceae        | Duvar reyhani, Yapisık ot | Aerial parts | Inf., Int. | Tuzlacı and Şenkardes 2011       |
| *Phlomis pungens* Wild.var. *hirta* Veien | Lamiaceae | Ayıkulağı, Calba | Aerial parts | Eaten | Vural 2008                      |
| *Pinus brutia* Ten.     | Pinaceae          | Çam, Kızılcım | Dried Stem Bark and Mastic | Crushed, Int. | Günes et al. 2017                |
| *Pinus nigra* Aiton subsp. *pallasiana* [Lamb.] Holmboe | Pinaceae | Çam gidişi, Karaçam | Tar | Ext. | Arısan 2010                     |
| *Pinus pinea* L.        | Pinaceae          | Fistik çami | Branches | Dec., Int. | Kökcü 2015                       |
| *Pistacia eurycarpa* Yalt. Anacardiaceae | Rosaceae | Menengeç | Fruit | Eaten | Doğan 2014; Tuzlacı 2016          |
| *Pistacia vera* L.      | Anacardiaceae     | Kaliki-fistığa | Fruit Bark | Dec., Int. | Dağlı 2015                      |
| Plantago lanceolata L.  | Plantaginaceae    | Sinir otu, Sinirlı ot | Seed | Int. Dec., Int., | Genç and Özhataý 2006; Kolaç 2018 |
| Plantago major L. subsp. major | Plantaginaceae | Damar otu, Kara kabarcık, Siğilli ot, Sinir otu, Sinirlı ot | Flower Seed | Dec., Int. Dec., Int. +Yoghurt, Int. | Genç and Özhataý 2006; Kızılarslan and Özhataý 2012 |
| *Platanus orientalis* L. | Platanaceae       | Çınar, Kavak | Fruit Leaf Stem Bark | Dec., Int. Dec., Int., Dec., Int. | Bulut and Tuzlacı 2009; Kökcü 2015; Tuzlacı 2016; Kocyigşit and Özhataý 2006 |
| *Populus tremula* L.    | Salicaceae        | Bodur kavak | Stem Bark | Dec., Int. | Doğan 2014; Tuzlacı 2016          |
| Potentilla recta L.     | Rosaceae          | Açı hayıt, Beşparmak otu | Root | Dec., Int. | Deniz 2008                       |
| Potentilla reptans L.    | Rosaceae          | Beşparmak otu | Leaf | Dec., Int. | Yılmaz 2011; Öztürk 2006; Tuzlacı 2016 |
| *Prosopis farcta* [Banks and Sol.] J.E.F.macbr. | Fabaceae | Çeti, Hişhaş | Fruit Root | Eaten Dec., Int. | Gencyay 2007; Tuzlacı 2016; Balos and Akan 2007 |
| *Prunus cerasus* L.     | Rosaceae          | Vişne | Fruit | Juice, Int. Eaten | Korkmaz and Karakurt 2014; Metin 2009 |
| *Prunus divaricata* Ledeb. Rosaceae | Rosaceae | Dağ eriği, Oakka, Kuş eriği | Fruit | Juice, Int. | Korkmaz and Karakurt 2014 |
| *Prunus x domestica* L. | Rosaceae          | Erik | Fruit | Boiled with Turkish Coffee, Int. | Kolaç 2018 |

Istanbul J Pharm 49 (1): 33-44
Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

| Botanical name | Family | Local name | Plant parts used | Preparation, administration and use | Reference |
|----------------|--------|------------|------------------|-------------------------------------|------------|
| Prunus persica (L.) Batsch. | Rosaceae | Şeftali | Fruit | Eaten | [Korkmaz and Karakuş 2013; Metin 2009; Kolaç 2018] |
| Prunus spinosa L. | Rosaceae | Dağ eriği | Fruit | Eaten | [Esen 2008] |
| Punica granatum L. | Punicaceae | Hennar, Hinar, Nar | Seed | Cooked in Cinder, Ext. Eaten Crushed, Int. | [Gencay 2007; Uysal 2008; Güzel et al 2015] |
| Pyrus amygdaliformis Vill. subsp. amygdaliformis | Rosaceae | Ahlat, Çakal armudu, Çördük armudu, Deli armut, Yaban armudu | Immature Fruit | Raw, Eaten | [Korkmaz and Karakurt 2014; Tuzlacı 2016] |
| Pyrus elaeagnifolia Pall. subsp. elaeagnifolia | Rosaceae | Dağ armudu, Yabani armut | Fruit | Eaten | [Tuzlacı and Şenkardes 2011; Tsetsekos 2006; Güldaş 2009; Keskin 2011] |
| Pyrus syriaca Boiss. var. syriaca | Rosaceae | Çakal armut, Dağ armudu, Yaban armudu | Fruit | Eaten | [Furkan 2016; Tuzlacı 2016] |
| Quercus cocciifera L. | Fagaceae | Kermes meşesi, Piynar | Gall | Dec., Int. | [Metin 2009; Çilden 2011] |
| Quercus ithaburensis subsp. macrolepis (Kotschy) Hedge and Yalt. | Fagaceae | Meşe palamudu | Gall | Eaten | [Akan and Sade 2015; Tuzlacı 2016] |
| Rhus coriaria L. | Anacardiaceae | Simak, Sumak | Fruit | Eaten | [Güldaş 2009] |
| Rosa canina L. | Rosaceae | İtburnu, İtgülü, Kuşburnu, Öküzgözü | Fruit | Dec., Int. Eaten | [Sargın et al. 2013; Karataş 2007] |
| Rosa damascena Mill. | Rosaceae | Gül | Flower | Inf., Int. | [Güter et al. 2015; Tuzlacı 2016] |
| Rubus canescens DC. var. glabratus (Gordon) Davis and Meikle | Rosaceae | Bogürtlen, Kapina, Karamik | Root | Dec., Int. Eaten | [Genç and Özhataý 2006; Tuzlacı 2016; Kayabaşı 2011] |
| Rubus sanctus Schreb. | Rosaceae | Bogürtlen, Eksilik, Kuzukulaği | Root | Dec., Int. Eaten | [Uysal 2008] |
| Rumex acetosella L. | Polygonaceae | Ekşilik, Kuzukulaği | Leaf | Eaten | [Güter et al. 2015] |
Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

| Botanical name                      | Family                | Local name                         | Plant parts used | Preparation, administration and use | Reference             |
|-------------------------------------|-----------------------|------------------------------------|------------------|-------------------------------------|-----------------------|
| Rumex crispus L.                   | Polygonaceae          | Ekşi ot, Gıcıracağız, Labada       | Root             | Dec., Int.                          | [Oral 2007]           |
|                                     |                       | Ebelik, Kalınık çay, Labada, Tırşık karan, Yılkıkulak | Leaf             | Inf., Int.                          | [Oral 2007]           |
|                                     |                       |                                    | Seed             | Eaten                               | [Kökcü 2015]          |
| Rumex patientia L.                 | Polygonaceae          | Gıcırgıcır, Leaf Inf., Int.         | Root             | Dec., Int.                          | [Uysal 2008]          |
|                                     |                       |                                    |                  | Inf., Int.                          | [Yeşil and Akalın 2009]|
| Salvia tomentosa Mill.             | Lamiaceae             | Boğac otu, Boşçapula, Elik otu, Sancı otu, Şabila, Salpa, Yaki otu | Aerial parts     | Inf., Int.                          | [Sargin et al. 2013] |
| Sanguisorba minor Scop. subsp. magnolii (Spach) Briq. | Rosaceae              | Amel otu, Çayır düşümesi, Kara gömdürme, Kelek otu | Aerial parts     | Raw, Eaten                          | [Furkan 2016]         |
| Scolymus hispanicus L.             | Asteraceae            | Altın diken, Sarıçınık             | Leaf, Capitulum  | Dec. Int.                           | [Metin 2009]          |
| Secale cereale L.                  | Poaceae               | Çavdar                             | Seed             | Inf., Int.                          | [Yıldırım 2015]       |
| Sideritis tmolea PH. Davis          | Lamiaceae             | Sarı çiçekli yaki otu              | Aerial parts     | Inf., Int.                          | [Sargin et al. 2013]  |
| Silene vulgaris (Moench) Garcke. var. vulgaris | Caryophyllaceae       | Crıvınlık                         | Aerial parts     | Dec., Int.                          | [Doğan 2014; Tuzlacı 2016] |
| Solanum nigrum L.                  | Solanaceae            | Köpek sirkeni                      | Fruit            | Cooked with +Thyme, Monk’s pepper, Flour, Water, Ext. | [Uysal 2008]         |
| Solanum tuberosum L.               | Solanaceae            | Gümürt, Kitola, Kumpir, Patola, Patati | Tuber            | Cooked, Int.                        | [Uysal 2008; Korkmaz and Karakuş 2013; Karakurt 2014; Ayändin 2010; Saday 2009; Yıldırım 2015; Tuzlacı 2016; Kincal 2018; Kolaç 2018] |
| Sorbus aucuparia L.                | Rosaceae              | Kuş üvezi                          | Fruit            | Jam                                 | [Kural 2012]          |
| Sorbus domestica L.                | Rosaceae              | Hüvez                             | Fruit            | Eaten                               | [Kökcü 2015]          |
| † Taraxacum androssovii Schischk.   | Asteraceae            | Acıgıcı, Hapsı接收 otu, Zeze       | Capitulum        | Dec., Int.                          | [Altundağ 2009]       |
| † Taraxacum farinosum Hausskn. and Bornm. ex Hand. - Mazz. | Asteraceae            | Hindiba, Karahindiba               | Leaf             | Inf., Int.                          | [Günes et al. 2017]   |
| † Taraxacum fedtschenkoi Hand. - Mazz. | Asteraceae            | Acıgıcı, Hapsı接收 otu, Zeze       | Capitulum        | Dec., Int.                          | [Altundağ 2009]       |
| † Taraxacum macrolepidum Schischk.  | Asteraceae            | Acıgıcı, Hapsı接收 otu, Zeze       | Capitulum        | Dec., Int.                          | [Altundağ 2009]       |
| Teucrium chamaedrys L. subsp. chamaedrys | Lamiaceae            | Bodur Mahmut, Leaf                 | Aerial parts     | Dec., Int.                          | [Oral 2007]           |
|                                     |                       | Bodurca Mahmut, Cüce Mahmut        |                  | Inf., Int.                          | [Oral 2007]           |
|                                     |                       |                                   |                  | Dec., Int.                          | [Alkaç 2013]          |
MATERIALS AND METHODS

In this study, a thesis search was carried out at the National Higher Education Center alongside an analysis of ethnobotanical studies conducted in various parts of Turkey with selecting regional plants used for the treatment of diarrhea.

Table 1. List of the plants used in traditional treatment against diarrhea in Turkey (continued)

| Botanical name       | Family          | Local name       | Plant parts used | Preparation, administration and use | Reference                        |
|----------------------|-----------------|------------------|------------------|--------------------------------------|----------------------------------|
| *Vicia faba* L.      | Fabaceae        | Bakla, Pakla     | Seed             | Eaten                                | (%Yıldırım 2015)                 |
| *Viscum album* L.    | Loranthaceae    | Ökse otu         | Leaf             | Dec., Int.                           | (Saraç et al. 2013)             |
| *Vitex agnus-castus* L. | Verbenaceae    | Hayit            | Seed             | Dec., Int. Swallowed, Int. Crushed, Int. Poultice, Ext. | (Sargın et al. 2013) (Poiat 2010; Tuzlacı 2016) (Uysal 2008) (Gürdal and Kültür 2013) |
| *Vitis vinifera* L.  | Vitaceae        | Üzüm, Asma, Tevek | Fruit            | Juice, Int.                          | (Furkan 2016)                    |

RESULTS AND DISCUSSION

Plants have always been an important source for not only nutrition but also therapeutic use against a considerable number of human diseases. Recent phytochemical studies on medical plants have supported the effectiveness of folkloric medicines. Since ancient times, plants have been used for curing various diseases and infections (Singh et al. 2017).

Turkey has an extraordinary plant diversity and varies by region. Its flora consists of about 10,000 vascular plants and approximately one third of its flora (34.4 %) is endemic to the country (Demirci and Özhatay 2012; Gürdal and Kültür 2013). Recently, the use of ethnobotanical information obtained from medicinal plant research has gained attention all around the world. For this reason, numerous ethnobotanical studies have recently been published and much has been written about medicinal plants in our country (Gürdal and Kültür 2013). Since these medicinal plants have been used in folk medicine by the public for many years, the information about how to use these plants in the treatment of illnesses has been passed down for generations.

In this study, we compiled 133 plant species used in folk medicine for the treatment of diarrhea in Turkey from the ethnobo-
tanical studies and the theses published at the National Higher Education Center between the years of 2002-2018.

Accordingly, this study reveals that Achillea wilhelmsii C. Koch, Parietaria judaica L., Punica granatum L., Rubus canescens DC. var. glabratus (Godron) Davis and Meikle, Vitezagnus-castus L., shown as a in the table, are used for the treatment against diarrhea in both humans and animals.

Moreover, some species such as Helleborus orientalis L., Inula viscosa(L.) Aiton, Phlomis pungens Wild. var. hirta Velen, Pinus brutia Ten., Taraxacum androssovi Schischk., Taraxacum fedtschenkoi Hand.-Mazz., Taraxacum macrolepium Schischk., Viscum album L. which are marked as b in the Table 1 are only used for the treatment of diarrhea in animals.

In Figure 1, there is a graph of the main families used in the treatment of diarrhea in Turkey. The plants used for the treatment of diarrhea are mainly from Rosaceae, Asteraceae, Lamia-ceae, Fabaceae, Anacardiaceae, Orchidaceae, Cupressaceae, Fagaceae and Solanaceae families (Figure 1). The plants of these families mainly take bioactive molecule groups in their different parts such as fruit, seed, root, aerial parts (Bilaloluğ and Harmanar 1999).

Phytomedicines have a significant role, both as traditional home remedies and as galenic preparations, in the symptomatic treatment of diarrhea. Three groups of preparations are particularly important: tannin-containing herbs, pectins, and a special strain of live dried yeast (Schulz et al. 2004).

Since diarrhea may occur because of fungal, bacterial, viral, and non-infectious causes and many of the plants reported in this study contain pharmacologically bioactive compounds, including flavones, flavonoids, phenolic acids, tannins, an-thocyanin compounds, volatile oil, minerals, vitamins, and polysaccharides (Bilaloluğ and Harmanar 1999). In these molecular groups, tannins especially are medicinally significant because of their astringent properties. Inwardly tannins are administered in cases of diarrhea, intestinal catarrh and as an antidote in cases of heavy metal poisoning (Adhikari and Kundu 2017). They can provide short-term healing and anti-inflammatory effects on the gut wall, though they are likely to rapidly reduce in transit through the tract unless they are in a slowly dispersing solid form. Effects on the bowel, can be significant if the symptom is a reflex consequence of irritation in the gastric or upper enteric passages. The use of tannins is not to be recommended as a long-term solution. Because when they are used as long-term therapy, they can cause constipation, iron deficiency anemia and malnutrition. Therefore long-term therapy with high doses of tannins is to be avoided (Bone and Mills 2013). In this study, Potentilla, Quercus, Camellia, Vaccinium and Alchemilla sp. are known as plant remedies traditionally used for tannin constituents (Schulz et al. 2004; Bone and Mills 2013).

For centuries, physicians have used preparations containing flavonoids as basic physiologically active components and lay healers attempt to treat human diseases (Cushnie and Lamb 2005). Up till today, plant-derived flavonoids have showed nu-

merous biological activities, including antiallergic, antibacterial, anti diabetic, antiflammatory, antiviral, anti-proliferative, anti-mutagenic, antithrombotic, anticarcinogenic, hepatoprotec-tive, oestrogenic, insecticidal, and antioxidant activities (Cush-nie and Lamb 2005; Orhan et al. 2010). Flavonoid containing poultices, infusions, spices and balms have been used in many cultures based on ethnomedical use for centuries (Cushnie and Lamb 2011). As stated above, there are many kinds of diarrhoea and some are caused by infections. In this way, flavonoids in terms of having antimicrobial activities might show a strong ability to cure the pathogenesis. As a result, flavonoids can also be used as a drug to treat diarrhea.

Consequently, these compounds should be investigated in order to determine the main component which is effective against diarrhea and produce natural-based and effective drugs used for this common disease with fewer side effects than chemical drugs. We assume that this study would lead to the development and optimization of new antidiarrheal drugs with no side effects.

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