

REGULAR ARTICLE

The diversity of plants used for the traditional dish *sarma* in Turkey: nature, garden and traditional cuisine in the modern era

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ABSTRACT

The selection of leaves for the traditional dish *sarma* is the result of human experience and observation, and the transfer of traditional knowledge in regions differing in the richness of their species. The purpose of this study is to update the list of leaf vegetable plants that are used to prepare the traditional dish *sarma* and to analyse the biodiversity of the species used and their status in the Turkish flora. Seventy-three taxa whose leaves are used to prepare *sarma* in Turkey are reported. The prevalent species are those of *Rumex* (11), *Salvia* (5), *Beta* and *Malva* (4), *Alcea*, *Arum*, *Brassica*, *Morus*, and *Plantago* (3). Wild herbaceous plants (69.5%) dominate. Trees (8) and shrubs (2) mostly belong to the Rosaceae, Moraceae, Betulaceae and Malvaceae. Grapevine and cabbage predominate, together with beet, dock, sorrel, horseradish, European lime tree, bean, and spinach. The use of leaves of three endemics was recorded: *Centaurea haradjianii*, *Rumex gracilescens*, and *Rumex olympicus*. Some toxic plants are used following preliminary treatment, including those of *Arum*, *Convolvulus*, *Tussilago* and *Smilax* species. *Colocasia esculenta* is a novel *sarma* plant that has been used in cuisine in the last decade, following its introduction to Turkey.

Keywords: Edible leaf; Ethnobotany; *Sarma*; Traditional knowledge; Turkey

INTRODUCTION

Since ancient times, plants have been variously used by humans for food, as dyes, and for ornamental and medicinal purposes. During the last decade, this relationship between people and the plants growing in their environment, in both a historical and socio-cultural context, has been the subject of many ethnobotanical studies in Turkey (Dogan et al., 2003; Dogan et al., 2004; Simsek et al., 2004; Dogan et al., 2008; Ugulu et al., 2009; Nedelcheva et al., 2011; Dogan and Ugulu, 2013). A large number of these studies relate to the use of wild plants as food (Ertug, 2004; Dogan et al., 2004; Ozbucak et al., 2006; Kargioglu et al., 2010; Dogan, 2012), including wild edible plants sold on the open market (Dogan et al., 2013; Dogan and Nedelcheva, 2015).

These studies clearly show that widely used cultivated plants that are consumed as vegetables and fruit in Turkey include many wild plants, many of which have been used as salad and vegetable dishes in traditional recipes. An

important component of Turkish cuisine inherited from the Ottomans consists of *sarmas* and *dolmas*. *Dolma* consists of stuffed or dried fruit and root vegetables, whereas *sarma*, which means "wrapping" in Turkish, consists of rolling vegetable leaves around the ingredients. *Dolmas* and *sarmas* are prepared either with olive oil (with rice or bulgur stuffing with fresh or dried herbs and seasoning and often served hot with yogurt), or with meat (prepared with minced lamb and veal mixed with rice and seasoned with fresh or dried herbs). Additionally, a meatless, so-called pseudo-*dolma* (*yalanci dolma*) is prepared with rice, onion, currants and pine nuts (Basaran, 2009). In Turkish cuisine, the filling ingredients might include pine kernels (*Pinus pinea*), black corinth (*Vitis vinifera*), blackcurrants (*Ribes nigrum*), and even mastic (resin of *Pistacia lentiscus*); an old tradition in Turkey was also to add sour cherries to the filling.

Sarma represents an important part of Ottoman cuisine, in which the term *dolma* is occasionally used to mean *sarma*,

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especially for grapevine leaf-based *sarma*. However, it is more correct to refer to *dolma* only in relation to stuffed vegetables (pepper, eggplant, zucchini, tomato, onion, potato, artichoke, okra and celery). The most widely known *dolmas* and *sarmas* worldwide is *sarma*, which is prepared with olive oil and grapevine leaves (*yaprak sarması*). However, grapevine-leaf sarma is known as “*dolma*” in many parts of the world (Basaran, 2009). *Sarma* represents one of the most widely encountered feasting dishes of Ottoman and Turkish cuisine (Dogan et al., 2015).

Sarma is used in everyday language and in a much broader sense to refer to the form and method of preparing thin wraps. *Tütün sarma* is the name given to some tobacco wrapping products.

Owing to an increased interest in food ethnobotany, research has been conducted in Turkey and the Balkans (Bosnia, Bulgaria, Macedonia, Greece, Albania, in the Balkan areas of Croatia and Romania) into traditional knowledge (TK) about plants that are used to prepare *sarma* (Dogan et al., 2015). This study reviews the species used (taxa), and focuses on the importance of plant leaves and folk botanical knowledge regarding their use, both in the past and today. Eighty-seven taxa were found to represent the Turkish and Balkan *sarma* plant heritage. Turkey retains approximately half the entire *sarma* plant biodiversity recorded in the countries listed above, thus confirming the strong link between this culinary preparation and the Ottoman cuisine of the last four centuries. The results also demonstrate the extremely dynamic and changeable nature of folk ethnobotanical practices. The richness of the species and preservation of TK today justify a closer survey of the ethnobotany of this collection of taxa and its analysis based on plant biodiversity and the various impact factors that have resulted from the expansion of modern society.

Thus, the purpose of this study was to update the list of leaf vegetable plants that are used to prepare the traditional dish *sarma* and to analyse the biodiversity of these species and their status in the Turkish flora.

MATERIALS AND METHODS

Study site and traditional cuisine

Turkey has the largest coastal area of all Mediterranean countries and due to its climate and geographical position, possesses an extraordinarily rich flora, with more than 10,000 taxa. One-third of Turkey's plant taxa is endemic (Dogan, 2012).

Turkish cuisine is mostly based on Ottoman cuisine, which is influenced by Chinese, Iranian, Byzantine, Arab,

European and Mediterranean cuisines. Although it contains many contributions, Ottoman cuisine, in essence, is based on Turkish eating habits (Fragner, 1994; Savkay, 2000; Bilgin, 2014).

Even though vegetables entered Turkish cuisine relatively late, Ottoman cuisine was very rich in terms of vegetable dishes. Vegetables, which are important in the nourishment of the poor, were cheap in the capital when in season. Vegetables were consumed in great quantities, both by the public and the Palace. Amongst the vegetables purchased were spinach, cabbage, celery, beet, leek, chard, parsley, broad bean, pumpkin, carrot, cucumber, eggplant and vine leaves for sarma with meat. Chief among the Turkish cuisine inherited from the Ottomans are sarmas and dolmas (Yerasimos, 2002).

Data collection

Field data collection

The study was conducted during the undertaking of ethnobotanical field studies in Western Anatolia (Izmir and Manisa), Central Anatolia (Ankara and Eskisehir), Black Sea (Duzce); Eastern Anatolia (Malatya) and South Anatolia (Adana and Antalya) regions, and also during several ad hoc investigations by the authors between 2011 and 2015. Data were collected by means of semi-structured interviews. A total of 47 women (59%) and 32 men (41%) were interviewed. The informants were divided into three age groups (i) 35–50, (ii) 51–60 and (iii) 61–83 years old. Most of the informants belonged to the age group 64–73 years.

Informants were asked to mention all plants whose leaves were used as wrapping material for preparing homemade *sarma*. Informants did this by showing fresh plants directly in the field, or parts thereof, as well as leaves that had been dried or preserved in various ways. When interviewed, people are asked questions regarding some particular aspect of *sarma* and plants which are used to prepare it. The questionnaire comprised two main parts: Part (i) consisted of demographic data which included age, gender, level of education, occupation, income, and religious belief. Part (ii) of the questionnaire asked for information about the local vernacular name of the plant, plant collection or delivery (wild, cultivated or from market), part(s) of the plant used, method of use (raw, preliminary treated), preservation (dry, fermented), method of wrapping, stuffing ingredients, the spices used, cooking method and specific taste.

Collected herbarium specimens are stored in the ethnobotanical voucher collection of one of the authors (AN) at the Department of Botany, Sofia University, together with photographic studies. Ethical guidelines drafted by the American Anthropological Association

(AAA, 2012) were followed during the interviewing process and data documentation.

Literature survey

In total, thirty-five (35) sources, mostly published articles and books, were reviewed and analyzed. Data from field studies were supplemented with published ethnobotanical works for the study area and, increasingly in recent years, unpublished Masters and Ph.D. ethnobotanical theses, which are available online at the Thesis Center, Council of Higher Education (<https://tez.yok.gov.tr/UlusalTezMerkezi/istatistikler.jsp>). They were summarized with references to folklore and gastronomic literature based on field investigations and papers published in international and national scholarly journals.

Taxonomic identification was conducted by the authors, and plant nomenclature followed Flora Europaea (Tutin et al., 1964-1980), the Angiosperm Phylogeny Group III system (Stevens, 2012), and The Plant List database (TPL, 2013).

Data analysis

All the collected ethnobotanical data were filed in a database (analytical table) and analyzed and summarized using Microsoft Excel 2016.

The collected information was analysed quantitatively using a synthetic index of relative frequency citation (RFC). This index shows the local importance of each species in terms of frequency of citation (FC, the number of informants mentioning the use of the species) divided by the total number of informants in the survey (N).

$$RFC = FC/N \quad (0 < RFC < 1)$$

RFC value varies from 0 (when nobody refers to a particular plant as being useful), to 1 (when all the informants mention it as useful) (Tardio and Pardo-DeSantayana, 2008).

This study is based both on data obtained from a survey of the literature (L) and data obtained from informants by means of semi-structured interviews, referred to here as a personal observation (PO). Consequently, two synthetic indices were calculated: RFC_L which shows the importance of the species based on literature sources, where one source is equivalent to one citation (FC), and RFC_{PO} which is based on field studies.

RESULTS AND DISCUSSION

Quantitative results

Seventy-three (73) plant taxa are recorded in this study. The detailed list of plants resulting from our observations

and a review of the literature, is presented in Table 1. The plants belong to thirty-nine (39) genera and twenty-two (22) families, mainly comprising members of Polygonaceae (16%), Asteraceae (12%), Malvaceae (11%), Amaranthaceae (8%), and Brassicaceae (7%) (Fig. 1). Only four plant genera are monocots: *Allium*, *Arum*, *Colocasia* and *Smilax*. The largest number of taxa was recorded for the genera *Rumex* (11), *Salvia* (5), *Beta* and *Malva*, (4), and *Alcea*, *Arum*, *Brassica*, *Morus* and *Plantago* (3). Of these taxa, most were herbaceous plants (63, 84.9%), whereas trees (8) and shrubs (2) were mostly members of Moraceae, Betulaceae, Rosaceae, Fabaceae and Malvaceae, and two species were represented by lianas (*Smilax* and *Vitis*). The list predominantly contained wild species, (51), followed by cultivated (20) and semi-domesticated species (2). Of the recorded species, only *Smilax excelsa*, a climbing plant, is evergreen.

Based on index analyses, RFC_L ranges from 0.3 to 0.26, and reveals the cultural importance of the following taxa: *Rumex crispus* (0.26), *Rumex patientia* (0.23), *Cydonia oblonga* (0.14), *Rumex conglomeratus* (0.14), *Trachystemon orientalis* (0.14), *Plantago major* ssp. *major* (0.11), *Rumex tuberosus* (0.11), *Vitis vinifera* (0.11). About 16 of the identified plants are based on data collected at interviews. The highest RFC_{PO} is recorded for *Malva neglecta* (0.78), *Rumex patientia* (0.67) and *Trachystemon orientalis* (0.35).

The diversity of plants used for Sarma

Fourteen species were found to be used in the form of vegetable leaves for *sarma* in the Balkans, but not in Turkey. Some of these species are used in mountainous rural areas, and include early spring plants, such as *Primula veris* (Albania), *Allium ursinum* (Bulgaria) and shrubs of certain *Rubus* and *Ribes* species (Bosnia and Herzegovina, Romania). Others are alternative cultivated plants, such as *Atriplex hortensis*, *A. rosea*, *Vicia faba*, *Brassica oleracea* var. *gongylodes* (Bulgaria), *Vitis labrusca* and *Solanum tuberosum*

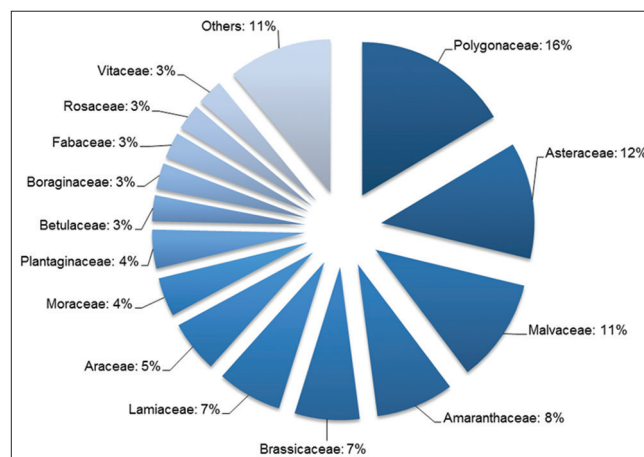


Fig 1. Systematic structure of plant families used.

Table 1: Plants whose leaves are used for preparing *sarma* in Turkey

Taxon	Family	English name	Local name (s)	Status	Area (s) of use	Source (s)	RFC _i ; RFC _{po}
<i>Alcea flavovirens</i> (Boiss. & Buhse.) Ijin	Malvaceae	Yellow-Green Hollyhock	hero, hiro	W	East Anatolia	Kaval, 2011	0.03
<i>Alcea hohenackeri</i> (Boiss. & Huet.) Boiss	Malvaceae	Hohenacker's Hollyhock	Fatma gülü, gül hatmi, hero, hiro	W	East Anatolia	Arik, 2003	0.03
<i>Alcea kurdica</i> (Schlecht) Alef	Malvaceae	Kurdish Hollyhock	hero, heru	W	East Anatolia	Kaval, 2011; Mükemre, 2013	0.06
<i>Allium ampeloprasum</i> L.	Amaryllidaceae	Leek	pirasa	C	Izmir	Baytop 1999; PO	0.03; 0.15
<i>Amaranthus viridis</i> L.	Amaranthaceae	Green Amaranth	delisirken, hoşguran, kızılca mancar, semlik	W	Şırnak	Gençay, 2007	0.03
<i>Arctium minus</i> (Hill) Bernh.	Asteraceae	Lesser Burdock	devetabani, dulavratotu, galabah, kabalak	W	Erzurum	Baytop, 2007; Tuzlaci, 2011	0.06
<i>Arctium platylepis</i> (Boiss. & Bal.) Sosn. ex Grossh.	Asteraceae	Halehorth	baldikeni, devetabani, garahort	W	Iğdir	Tuzlaci, 2011	0.03
<i>Arum dioscoridis</i> Sm.	Araceae	Spotted Arum	sarmalık, yılan bacağı, yılan ekmeği, yılan pancarı	W	South & South-Eastern Anatolia	Baytop, 2007; Güneş, 2010; Tuzlaci, 2011	0.09
<i>Arum maculatum</i> L.	Araceae	Snakeshead	yılan ekmeği, yılan yastığı	W	West & Central Anatolia	Dogan et al., 2004	0.03
<i>Arum rupicola</i> Boiss.	Araceae		yılan bacağı, yılan yastığı	W	South Anatolia	Güneş, 2010	0.03
<i>Beta trigyna</i> Waldst. & Kit.	Amaranthaceae	Beet/Chard	mançar, süt mançar, efelek pazı	C	Ankara	Simsek et al., 2004; Tuzlaci, 2011	0.06
<i>Beta vulgaris</i> L. ssp. <i>vulgaris</i> convar. <i>cicla</i>	Amaranthaceae	Sugar Beet	şekerpancarı	C	Duzce, Tokat, Malatya	Simsek et al., 2002; PO	0.03; 0.29
<i>Beta vulgaris</i> L. ssp. <i>vulgaris</i> convar. <i>vulgaris</i> var. <i>altissima</i> AMN 34/25	Amaranthaceae	Beetroot	pancar	C	Afyon	PO	0.34
<i>Beta vulgaris</i> L. ssp. <i>vulgaris</i> convar. <i>vulgaris</i> var. <i>vulgaris</i> AMN 34/27s	Amaranthaceae	Beetroot	pancar	C	Izmir, Malatya	PO	0.39
<i>Brassica oleracea</i> Acephala group Kale	Brassicaceae	Collards	kara lahana	C	Black Sea & Marmara Regions	Kızılsarı, 2008; Doğru Koca and Yıldırım, 2010; Kızılsarı and Özhatay, 2012	0.09
<i>Brassica oleracea</i> Capitata Group	Brassicaceae	Cabbage	lahana	C	All over the country	PO	0.81
<i>Brassica rapa</i> L. var. <i>rapa</i>	Brassicaceae	Turnip	kırmızı çukündür	C	Duzce	Doğru Koca and Yıldırım, 2010	0.03
<i>Campanula sclerotracha</i> Boiss.	Campanulaceae	Bellflower	büyük kökü, çançeği, nermeden	W	Hakkari	Kaval, 2011	0.03
<i>Centaurea haradjianii</i> Wagenitz*	Asteraceae	Judas Tree	kaputkulak	W	South Anatolia	Mart, 2006	0.03
<i>Cercis siliquastrum</i> L.	Fabaceae	Creeping Thistle	erguvan, boynuz, yemişen	W/C	Diverse areas of Turkey	Tuzlaci, 2011	0.03
<i>Cirsium arvense</i> (L.) Scop.	Asteraceae	Creeping Thistle	köygöçüren, köygöçerten	W	West & Central Anatolia	Dogan et al., 2004	0.03

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Table 1: (Continued)

Taxon	Family	English name	Local name (s)	Status	Area (s) of use	Source (s)	RFC _L ; RFC _{PO}
<i>Colocasia esculenta</i> (L.) Schott	Araceae	Taro	göleğez	C	Adana, Antalya	PO	0.10
<i>Convolvulus stachydifolius</i> Choisy	Convolvulaceae		sermaşık, sarmaşık	W	Sirnak	Gençay, 2007	0.03
<i>Corylus avellana</i> L. AMN 34/14	Betulaceae	Hazelnut	findık	C	Duzce, Malatya	Doğru Koca and Yıldırımli, 2010; PO	0.03;0.13
<i>Corylus maxima</i> Mill. AMN 34/21	Betulaceae	Filbert	findık	C	Duzce, Malatya	Doğru Koca and Yıldırımli, 2010; PO	0.03;0.09
<i>Cydonia oblonga</i> Mill.	Rosaceae	Quince	ayva	C	Malatya	PO	0.14
<i>Heracleum trachyloma</i> Fisch. & C.A. Mey.	Apiaceae	Downy cow-parsnip	baldirgan	W	Igdir	Tuzlaci, 2011	0.03
<i>Lactuca sativa</i> L. AMN 34/33	Asteraceae	Lettuce	marul	C	West Anatolia, Malatya	PO	0.22
<i>Malva neglecta</i> Wallr.	Malvaceae	Dwarf Mallow	ebegümeci, ebeğümeci,	W	All over the country	Mükemre, 2013; PO	0.03;0.78
<i>Malva nicaeensis</i> All.	Malvaceae	French Mallow	develik, ebeğümeci	W	Canakkale, Mugla	Emre Bulut, 2008; Tuzlaci, 2011	0.06
<i>Malva parviflora</i> L.	Malvaceae	Cheeseweed Mallow	ebegümeci, ilmik, kabalık	W	Mugla	Tuzlaci, 2011	0.03
<i>Malva sylvestris</i> L.	Malvaceae	Mallow	ebegümeci, develik, gömeç	W	West Anatolia	Dogan et al., 2004; Emre Bulut, 2008; Tuzlaci, 2011	0.09
<i>Morus alba</i> L.	Moraceae	White Mulberry	akdut, dut, tuye	C	All over the country	Dogan et al., 2004; Tuzlaci, 2011; Alpaslan, 2012	0.09
<i>Morus nigra</i> L.	Moraceae	Black Mulberry	dut, karadut, tuye	C	All over the country	Dogan et al. 2004; Alpaslan, 2012	0.06
<i>Morus rubra</i> L.	Moraceae	Red Mulberry	mordut, kırmızı dut	C	West & Central Anatolia	Dogan et al., 2004	0.03
<i>Onopordum illyricum</i> L.	Asteraceae	Illyrian Thistle	deli kenger, dolma kenkeri, eşek diken	W	Mugla	Ertug, 2004; Tuzlaci, 2011	0.06
<i>Pelargonium quercetorum</i> Agnew	Geraniaceae	Turkish Pelargonium	tolk	W	Hakkari	Kaval, 2011	0.03
<i>Petasites hybridus</i> (L.) G. Gaertner, B. Meyer & Scherb.	Asteraceae	Butterbur	galdirel, kaldirek, kaldirek	W	Balıkesir	Poyraz Kayabaşı, 2011	0.03
<i>Phaseolus vulgaris</i> L.	Fabaceae	Bean	fasülye	C	West & East Anatolia, Malatya	Dogan et al., 2004; PO	0.03;0.11
<i>Plantago lanceolata</i> L.	Plantaginaceae	Narrowleaf Plantain	sinirliot, damarotu, yaraotu	W	West & Central Anatolia	Simsek et al., 2002; Dogan et al., 2004; Tuzlaci, 2011	0.09
<i>Plantago major</i> L. ssp. <i>intermedia</i> (Gilib.) Lange	Plantaginaceae	Broadleaf Plantain	yedidamarotu, damarotu, kesikotu, sinirotu, yaraotu	W	Igdir	Tuzlaci, 2011	0.03
<i>Plantago major</i> L. ssp. <i>major</i>	Plantaginaceae	Broadleaf Plantain	belghreviz, damarotu, kesikotu, sinirotu, yaraotu	W	East Anatolia, Kocaeli, Ordu, Samsun	Baytop, 2007; Kızıllarslan, 2008; Tuzlaci, 2011; Mükemre, 2013	0.11
<i>Primula vulgaris</i> Huds.	Primulaceae	Primrose	ak meneksen, çuha çiçeği	W	South Anatolia	Demirci, 2010; Güneş, 2010	0.06

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Table 1: (Continued)

Taxon	Family	English name	Local name (s)	Status	Area (s) of use	Source (s)	RFC _i ; RFC _{po}
<i>Prunus avium</i> L.	Rosaceae	Cherry	kiraz	C	Malatya, Sakarya	Koyuncu, 2005; PO	0.03;0.14
<i>Raphanus raphanistrum</i> L.	Brassicaceae	Wild Radish	turpotu	W	West & Central Anatolia, Kahramanmaraş	Dogan et al., 2004; Demiroi, 2010	0.06
<i>Rheum ribes</i> L.	Polygonaceae	Syrian Rhubarb	işgın, govalak, uçkun	W	East Anatolia	Tuzlaci, 2011	0.03
<i>Rumex acetosa</i> L.	Polygonaceae	Sorrel	ekşi labada, ekşiküçük labada	W	West & Central Anatolia	Dogan et al., 2004	0.03
<i>Rumex acetosella</i> L.	Polygonaceae	Red Sorrel	ebem ekşisi, ekşikulağ, kuzukulağı, tırşik	W	East Anatolia	Alpaslan, 2012	0.03
<i>Rumex alpinus</i> L.	Polygonaceae	Alpine Dock	dağ pazısı, ışgın	W	East Anatolia, Afyon	Baytop, 2007; Tuzlaci, 2011; Alpaslan, 2012	0.09
<i>Rumex conglomeratus</i> Murray	Polygonaceae	Sharp Dock	labada, kuzukulağı, tırşo, tırşik	W	South, East & South-Eastern Anatolia, Balıkesir	Arik, 2003; Gençay, 2007; Poyraz Kayabaşı, 2011; Tugay et al., 2012; Akaydin et al., 2013	0.14
<i>Rumex crispus</i> L.	Polygonaceae	Curly Dock	efekek, efelek, kıvrıkcık labada, tırşo, labada, tırşik	W	All over the country	Dogan et al., 2004; Koyuncu, 2005; Baytop, 2007; Gençay, 2007; Kargoglu et al., 2008; Sarper et al., 2009; Deniz et al., 2010; Yucel et al., 2010; Tuzlaci, 2011	0.26
<i>Rumex gracilescens</i> Rech.*	Polygonaceae		acımancar, efelek, göylek, güyrek	W	Ankara	Simsek et al., 2004; Elçi and Erik, 2006; Tuzlaci, 2011	0.09
<i>Rumex obtusifolius</i> L. AMN 34/17	Polygonaceae	Broad-Leaved Dock	yabani labada	W	West & Central Anatolia	Dogan et al., 2004; PO	0.03;0.28
<i>Rumex olympicus</i> Boiss.*	Polygonaceae		ebelek, ilabada	W	Bursa	Baytop, 2007	0.03
<i>Rumex patientia</i> L. AMN 34/30	Polygonaceae	Patience Dock	akilli labada, at kulağı, efelek, evelik, göbede, güylek, labada	W	All over the country	Dogan et al., 2004; Simsek et al., 2004; Kargoglu et al., 2008; Vural, 2008; Yucel et al., 2010; Poyraz Kayabaşı, 2011; Dogan et al., 2013; Koca et al., 2015; PO	0.23;0.67
<i>Rumex pulcher</i> L.	Polygonaceae	Fiddle Dock	labada, ilabada, acı labada	W	Çanakkale, Kocaeli, Mugla	Emre Bulut, 2008; Kızıllarslan, 2008; Tuzlaci, 2011	0.09
<i>Rumex tuberosus</i> L.	Polygonaceae	Swollen Sorrel	efekek, kuzukıkrıdağı	W	East Anatolia, Eskişehir	Abay and Kılıç, 2001; Yucel et al., 2010; Kaval, 2011; Mükemre, 2013	0.11
<i>Salvia brachyantha</i> (Bordz.) Pobed.	Lamiaceae		kazan şalbası, gazangulpu, kazankulpu	W	Iğdir	Tuzlaci, 2011	0.03
<i>Salvia forskahlei</i> L.	Lamiaceae	Forskhal's Sage	şalba, dolma yaprağı, müsellim	W	Kastamonu	Tuzlaci, 2011; Aras, 2013	0.06
<i>Salvia pocolata</i> Náb.	Lamiaceae		bares, öküzporçuğu, ezmandag	W	East Anatolia	Kaval, 2011; Mükemre, 2013	0.06
<i>Salvia solarea</i> L.	Lamiaceae	Clary Sage	tüylü adaçayı, misk adaçayı, pune, ayıkulağı	W	East Anatolia	Alpaslan, 2012	0.03
<i>Salvia staminea</i> Montbr. & Aucher ex Benth.	Lamiaceae	Iranian Sage	rozetli ada çayı, kazankulpu	W	Iğdir	Tuzlaci, 2011	0.03
<i>Silybum marianum</i> (L.) Gaertn.	Asteraceae	Milk Thistle	dededikeni, kenger, başkavkas	W	Mugla	Tuzlaci, 2011	0.03

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Table 1: (Continued)

Taxon	Family	English name	Local name (s)	Status	Area (s) of use	Source (s)	RFC _L , RFC _{PO}
<i>Sinapis arvensis</i> L.	Brassicaceae	Field Mustard	hardlotu, acirga, eşek turbu	W	Tokat	Simsek et al., 2002; Tuzlaci, 2011	0.06
<i>Smilax excelsa</i> L.	Smilacaceae	Smilax	melevcen	W	Black Sea Region	Aras, 2013	0.03
<i>Spinacia oleracea</i> L. AMN 34/28	Amaranthaceae	Spinach	ıspanak	C	West Anatolia	PO	0.41
<i>Symphytum kurdicum</i> Bois. & Hausskn.	Boraginaceae	Kurdish Comfrey	karakafesotu, ezmangag	W	Hakkari	Kaval, 2011	0.03
<i>Tilia argentea</i> Desf. ex DC.	Malvaceae	Silver Lime	gümüşi ihlamur	W/C	Istanbul	Tuzlaci, 2011; PO	0.03;
<i>Trachystemon orientalis</i> (L.) D. Don	Boraginaceae	Abraham-Isaac-Jacob	galdirik, hoda, ispit, kaldirik, kaldurak otu	W	Istanbul, Yalova	Simsek et al., 2002; Koçyiğit, 2005; Doğru Koca and Yıldırımli, 2010; Tuzlaci, 2011; Koca et al., 2015; PO	0.14;0.35
<i>Tussilago farfara</i> L.	Asteraceae	Coltsfoot	öksürükotu, akkız, kabalak	W	West & Central Anatolia, Kastamonu	Dogan et al., 2004; Baytop, 2007; Tuzlaci, 2011	0.09
<i>Urtica dioica</i> L.	Urticaceae	Nettle	ısıran	W	South-Eastern Anatolia	Balos, 2007	0.03
<i>Vitis sylvestris</i> Gmelin	Vitaceae	Wild Grapevine	çivek, deli asma, deli üzüm, kuşüzümü	W	Yalova	Koçyiğit and Özhatay, 2008-2009; Tuzlaci, 2011	0.09
<i>Vitis vinifera</i> L.	Vitaceae	Grapevine	asma, tiri, jur	C	All over the country	Koçyiğit, 2005; Demirci, 2010; Kaval, 2011; Kızılarslan and Özhatay, 2012	0.11

*: Endemic, C: Cultivated; W: Wild; PO: Personal observation; RFC: Relative frequency citation index; RFC_L: importance of species in literature sources (L); RFC_{PO}: importance of species based on personal observation (PO)

(Albania), whereas other species, such as *Caltha palustris* (Romania), are native to marshes, fens, ditches and wet woodland. In Turkey, wild edible greens are predominantly used, whereas leaves from cultivated plants tend to be used in other Balkan regions. Invasive and newly introduced species are little used in modern culinary *sarma* practices, although in Turkey, *Colocasia esculenta* is used, which is not used in other Balkan countries, and *Reynoutria japonica* is used in Romania (Dogan et al., 2015).

The use of leaves of three endemic species was recorded: *Centaurea haradjianii* (South Anatolia), *Rumex gracilescens* (Central Anatolia), and *R. olympicus* (Northwestern Anatolia). These species are very variable in terms of leaf morphology, and their leaves thus resembled those of other species of the same genus, which have also been traditionally used. The use of these species is relatively rare, especially in conjunction with common widely used species. They are present as well-developed populations, and thus, their conservation status is not compromised by their use as food plants. The identification of *Rumex gracilescens* and *R. olympicus* based on The Plant List is taxonomically problematic. These endemic species are included in the lists of rare and endangered species in The Red Data Book of Turkish Plants (Ekim et al., 2000): *C. haradjianii* (VU, vulnerable), *R. gracilescens* (LR/nt, lower risk, near threatened), and *R. olympicus* (DD, data deficient). Based on our data for anthropogenic threats, and in order to evaluate the importance of the former

two species, protection measures might be necessary. No other species recorded in this study is classified as a rare and protected species.

Of the cited plants, grapevine (fresh or in brine) and cabbage are widely used species, together with beet, dock, sorrel, horseradish, lime tree, bean, and spinach (Fig. 2). Most of the documented wild and cultivated plants are already well known edible plants used for preparing salad, soup or main meals and pies in local culinary outlets in the study area.

Sarma made from leek is part of the traditional cuisine of only some areas of Turkey, such as Western Anatolia. In contrast to other types of *sarma*, those prepared from leek (*Allium ampeloprasum*) are triangular in shape (Fig. 2). The common types of *sarma* made in Turkey are mostly long and cigar-shaped. In addition to triangular leek *sarma*, rolled leek leaves can also be used to prepare leek *dolma* (Durlu-Ozkaya and Kizilkaya, 2009).

Ten of the established plants are sold as edible greens on the open market: Cabbage, grapevine, lime, beet, sorrel, common mallow, nettles, leeks and lettuce (Dogan et al., 2013; Dogan and Nedelcheva, 2015). Grapevine leaves (fresh or in brine) are sold especially for *sarma* preparation and are grouped together for easy sale and use, and to preserve the shape and size of the leaf blade (Fig. 2). The plants used for *sarma* in open markets are mostly cultivated



Fig 2. Some *sarma* samples; leaves and flowers for *sarma* in an open market in Turkey. A: Cabbage, B: Leek, C: Collards, D: Grapevine, E: Beet leaves, F: Zucchini flowers, G: Fresh grapevine leaves H: Grapevine leaves in brine.

species. The majority of the wild edible greens are collected individually and are used locally in different regions.

The leaves of some of the recorded species are also used for medicinal purposes such as home remedies, mostly as herbal teas. These species form more than 20% of the listed taxa and belong to the genera *Salvia*, *Tussilago*, *Urtica*, *Plantago*, *Primula*, *Rumex* and *Symphytum*.

Tradition vs the modern era in the selection of plant leaves for sarma

Colocasia esculenta (taro, elephant ear or cocoyam) is a new root crop of southern provinces of Turkey and is grown for its edible corms (the root vegetables) (RFC_{PO} (0.10)). Taro is also used as an ornamental plant. *Colocasia esculenta* is a novel *sarma* plant, which has been introduced into cuisine within the last decade, following its introduction to Turkey (Sen et al., 2001; Matthews, 2006). Fresh taro leaves are poisonous (attributed to the presence of a specific enzyme (protease) that is bound to crystals of calcium oxalate that occur as sharp, needle-like raphides), and this toxicity is reduced by cooking or soaking the leaves for several hours before they can be safely consumed. Taro leaves contain high concentrations of vitamins A and C and are a better source of protein than the roots. The leaves have a large, heart-shaped blade, with a tender-firm and succulent texture. One of the problems in using taro leaves is their acidity; however, cultivars of very low acidity are grown in Turkey, and thus, no special cooking techniques are required to reduce this. In many recipes, the leaves are rolled tightly, tied in a knot, and then simmered in coconut, red chili, tamarind, coriander and garlic. In the Philippines, the petioles and blades of young leaves are commonly used to prepare pinangat (a leaf packet), or fresh young blades are wrapped and tied around fish or shrimp paste, and are then cooked in coconut milk (Matthews et al., 2012). These leaf properties, probably together with the rapid exchange of information, has led to the incorporation of this new plant into traditional Ottoman cuisine. This extends our knowledge of the use of leaves, since the use of taro leaves in cuisine has not previously been recorded for the Eastern Mediterranean (Ramanatha et al., 2010; Matthews et al., 2012).

Modern science and the current requirements for Food Safety questions the use of some plant species for food. Recently, plants that contain pyrrolizidine alkaloids (PAs) have been brought into question. These are represented in this study by members of the Asteraceae, Boraginaceae and some Fabaceae. Data suggest that ingestion of PAs as a tea, or as a dish of butterbur (*Petasites hybridus*) and coltsfoot (*Tussilago farfara*), as served according to a traditional recipe, can lead to serious hepatic dysfunction and at high doses, PAs can lead to fatal liver failure (EFSA, 2011). This poses

challenges to the traditional use of these plants as food, and more detailed information about their potential harm needs to be made available, together with the increased regulation of wild products currently readily available on the open market (Nedelcheva et al., 2015).

Some species are common members of the urban flora, including *Tilia* spp., *Morus* spp., *Cercis siliquastrum*, *Vitis* spp., *Pelargonium quercetorum* and *Colocasia esculenta*. Plants are perceived as sources of multivalent resources and their continued use represents a national way of thinking. Conversely, the preservation and development of TK present new considerations. For example, urban and industrial environments contain plants that grow in polluted air and soil, and therefore, the collection of leaves from such habitats is not safe, and this, in turn, presents problems that affect both wild ruderal and weed species.

The collection, marketing and use of some plants today highlight issues related to the response of natural habitats to human activity. Some species occur in disturbed areas, such as roadsides and pastures, but also in degraded forests. Since plants are often widely distributed and may grow in areas that, owing to their ruderal nature, are subject to anthropogenic agents, eating such plants may pose a risk. Considering that plants are widely used by local inhabitants as a fresh and dried food source, as well as for medicine, the importance of washing the plant before use is clear. A study of the heavy metal content of *Malva sylvestris* sold as an edible green in the local markets of Izmir (Turkey) showed that these plants were mostly collected from low-risk areas (Unver et al., 2015); however, there remains a need for vigilance and strict control as current anthropogenic influences establish new rules for the use of traditionally used plants.

In some cases, toxic plants are used following preliminary treatment of their leaves. Such plants include *Arum*, *Convolvulus*, *Tussilago* and *Smilax* species. The TK relating to their toxicity is reflected in the availability of detailed descriptions of pre-treatment and cooking methods (Dogan et al., 2015).

According to Table 1, the greatest diversity of plants used for types of *sarma* is consumed in Western Anatolia (in Izmir and its surroundings, e.g., leaves of *Allium ampeloprasum*, *Beta vulgaris*, *Lactuca sativa*, *Morus rubra*, *Phaseolus vulgaris*, *Rumex obtusifolius*, and *Spinacia oleracea*) and in Eastern Anatolia, especially in Malatya and its surroundings (e.g., leaves of *Beta vulgaris*, *Cydonia oblonga*, *Lactuca sativa*, *Phaseolus vulgaris*, and *Prunus avium*).

Plant use categories

Most notably, the rhizomes, flowering branches, petioles and leaves of *Trachystemon orientalis*, which is mostly

distributed throughout Northern Anatolia, are very commonly consumed as vegetables in different parts of the Black Sea Region (RFC_L (0.14) and RFC_{PO} (0.35)). The stems and rhizomes are fried or boiled in water with onions and eggs and the roots and the petioles are used for making pickles. In addition, its *sarma* is widely consumed by the local people (Ergen Akcin et al., 2004; Dogan et al., 2015; Koca et al., 2015). In areas where it occurs naturally, it is known under various names, including acı hodan, balıkotu, burğı, çiçeklimancar, doğu hodanı, galdirek, hodan, ıspıt, kaldırık, kaldırayak, kaldırak, kaldirek, kaldirik, somara, tomara, tomari and zılbit. However, *Borago officinalis* L. (Boraginaceae) is also called “hodan”. Due to this similarity, this plant is erroneously mentioned as a *sarma* plant on the internet. Another possible reason may be that various unscientific sources (including internet web sites) may refer to *Trachystemon orientalis* (L.) G. Don. by its synonym *Borago orientalis* L. and is thus mistaken with *Borago officinalis* L. (as accepted in the Flora Europaea). Although there are no reports of this plant being used for *sarma* in Turkey, there are many reports for the use of *T. orientalis* (Baytop, 1984; Simsek et al., 2002; Ergen Akcin et al., 2004; Kocyigit, 2005; Dogru Koca and Yildirimli, 2010; Dogan et al., 2015; Koca et al., 2015).

The horse chestnut, *Aesculus hippocastanum* L., is an ornamental tree species that is naturally distributed throughout the Balkans and is commonly planted in parks, gardens and roadsides, because of its beautiful flowers and foliage. On many websites referring to this tree, its use as leaf *sarma* during Ottoman times is described, as well as its current use; however, no cook books or scientific reports confirm this.

Sarma and Dolma

Only two plants from Turkey are used for preparing both *sarma* and *dolma*: Leek and artichoke (*Cynara scolymus* L.). Artichoke *dolma* is very famous in Turkey, as opposed to artichoke *sarma*, which is mostly unknown. This *sarma* is typical mostly for the area of Izmir.

In addition to the leaf *sarmas* mentioned above, *dolmas* made with zucchini blossoms are commonly consumed in the Aegean region. Cretan migrants settled in this region and zucchini blossom is sold in the open markets of Izmir (Fig. 2). As with regular *sarma*, these *dolmas* are also stuffed with cheese (Berik and Varlik, 2009; Hancerli, 2011; Altay and Karakan, 2012; Karaca et al., 2015). Owing to the delicacy of the flowers, the preparation of zucchini blossom *dolmas* is comparatively more demanding.

Melon dolma occupied an important place in the Ottoman palace kitchen during the fifteenth and sixteenth centuries, although it is no longer a common meal in Turkish cuisine.

Apple and quince *dolmas* are examples of fruit *dolmas* that currently exist.

Regional variations exist for the preparation of stuffing for *sarmas* and *dolmas* in Turkish cuisine. The most striking example is *Tokat sarma*, whose stuffing is prepared with dry broad (fava) beans (Akin and Lambraki, 2003).

Despite the importance of plants in the preparation of traditional *sarma*, only three species have names that reflect their use: *Arum dioscoridis* (*sarmalık*, yılan bıçağı, yılan ekmeği, yılan pancarı), *Onopordum illyricum* (deli kenger, *dolma* kenkeri, eşek diken) and *Salvia forskalei* (şalba, *dolma* yaprağı, müsellim). These, however, are not plants that are most frequently used today, but each has more than one folk name.

CONCLUSIONS

Turkey is home to the greatest number of diverse species of edible greens used for *sarma* and this diversity reflects that found both in the region and in the Balkans. The traditional botanical folk knowledge for preparing *sarma* is well preserved, although contemporary methods of exchanging information, and the movement of people impact on traditional practices and the introduction of new plant products. Knowledge of these methods and trends is essential for the sustainable use and conservation of biodiversity and the control and use of safe foods and herbal products.

Authors' Contributions

All authors YD, AN and AP contributed equally to this work.

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