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## WILD EDIBLE PLANTS SOLD IN THE LOCAL MARKETS OF IZMIR, TURKEY

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### Abstract

In recent years, Mediterranean diet has been promoted as a model for healthy eating. One of the main characteristics of the Mediterranean diet is an abundance of plant food as fruits, vegetables, whole-grain cereals, nuts, and legumes. This paper compiles and evaluates the ethnobotanical knowledge currently available on wild edible plants sold in the local markets and traditionally used for human consumption in Izmir, a province on the Mediterranean coast of Turkey. The information about the use of wild edible plants was collected from 18 different open-air-markets in the city during two-year period, through unstructured interviews. In this study, a total of 46 wild edible plant taxa were established and also plant parts used, ethnographic data related to vernacular names, traditional tools and recipes were recorded. Family *Asteraceae* is represented by the highest number of taxa (7), followed by *Apiaceae* (6), *Polygonaceae*, *Liliaceae* and *Lamiaceae* (4), *Amaranthaceae* and *Brassicaceae* (2). The study showed that the plants used are either eaten raw, cooked by boiling in water, frying in oil or baked to be served as dishes such as stew, salad as hot drink. During this ethnobotanical research, it was verified that wild edible plants play an important role in diet in Izmir. However, it was observed that the transfer of folk uses of these plants decreased in the last generations. In this context, the ethnobotanical research about wild edible plants should be extended to other areas of Turkey in order not only to preserve the traditional knowledge related to plants, but also to make it available for future generations as well.

### Introduction

The livelihood of the rural people does not depend only on the agricultural and animal products, but also on other natural resources, such as plants and the forests (Sundriyal & Sundriyal, 2004, Khan *et al.*, 2011, Alam *et al.*, 2011). Several previous studies have described the traditional knowledge about the plants in the research area and the uses and different needs for them such as nutrient, medicine, household items, traditional crafts, and more (Dogan *et al.*, 2003; Nedelcheva *et al.*, 2007; Dogan *et al.*, 2008; Dogan *et al.*, 2010; Ugulu & Baslar, 2010; Nedelcheva *et al.*, 2011; Ugulu, 2011; Ugulu, 2012). In addition to all these uses, wild edible plants constitute a significant part of the human diet, especially in poor rural communities (Luczaj & Szymanski, 2007). The high nutrient and vitamin value of many wild edible plants (Wehmeyer & Rose, 1983, Hussain *et al.*, 2009) makes them particularly important contributors towards a balanced diet in resource poor communities. Wild sources of food are still important particularly for the poor and are especially important during times of famine or conflict (Shackleton *et al.*, 1998, Hussain *et al.*, 2009a). Even under normal living conditions, wild plants have played an important role by complementing staple foods in terms of providing a balanced diet by supplying trace elements, vitamins, and minerals (Tardio *et al.*, 2006, Hussain *et al.*, 2010, Hazrat *et al.*, 2011).

Marketing plays an important role in the socio-economic development of any area as it helps serve the people and the region (Sundriyal & Sundriyal, 2004). A large variety of wild edible, medicinal and ornamental plants and various ethnobiological utility items are often sold at a much smaller level, probably at the local level only, and very few items flow out of the region in most of the areas (Jana, 1997). Local markets are important for large settlements and cities in terms of making wild edible

plant consumption available, normally more common in rural areas. People living in rural areas sell wild edible plants in local markets that are set up in close-by settlements and consequently these plants are consumed in larger areas.

It is reported that wild gathered food plants have been part of human diet since ancient times and it is argued that past societies made more use of the wild flora to overcome hunger than is done today (Leonti *et al.*, 2006; Agea *et al.*, 2011). Despite the primary reliance of agricultural societies on crop plants and the advent of agriculture, the tradition of consuming wild plants has not been fully eliminated (Pardo-De-Santayana *et al.*, 2005). Increasing interest in the wild edible foods of the Mediterranean region has led to ethnobotanical studies centered on edible plants (Bonet & Valles, 2002; Pieroni *et al.*, 2002; Guarrera, 2003; Dogan *et al.*, 2004; Ertug, 2004; Pieroni *et al.*, 2005; Tardio *et al.*, 2005; Nebel *et al.*, 2006).

Wild edible plants are important in Mediterranean Diet, which is a source of food and income for poor communities, and considered a healthy diet by many. Diets consumed by Mediterranean populations have been a subject of interest since antiquity, with more recent investigations focused on their evident health benefits. The main characteristics of the Mediterranean diet include an abundance of plant food (fruits, vegetables, whole-grain cereals, nuts, and legumes); olive oil as the principal source of oil; fish and poultry consumed in low-to-moderate amounts; relatively low consumption of red meat; and moderate consumption of wine, normally with meals (Hu, 2003).

Given the dramatic loss of traditional knowledge regarding wild edible plants, our aim was to document the indigenous knowledge of these plant taxa in Izmir, evaluating the socio-economical importance of edible plants gathered as food. It is hoped that the results of this

research will help play an important role in initiating dialogue and planning among national and international scientific communities.

### Materials and Methods

**Study area:** Izmir Province, which is located (26° 15' - 28° 20' E and 37° 45' - 39° 15' N) in the Aegean subdivision (one of seven subdivisions of Turkey), is comprised of 28 districts. Izmir is Turkey's third largest city after Ankara and Istanbul, and its population is 3,370,866 (Altay *et al.*, 2010; Anonymous, 2012; Osma *et*

*al.*, 2012). Izmir covers approximately 11.973 km<sup>2</sup>, located in the West Anatolian part of Turkey (Fig. 1). The city is surrounded by Aegean Sea in the West, Balikesir in the North, Manisa in the East and Aydin in the South.

Izmir Province is subject to the influence of the Mediterranean climate, characterized by hot, dry summers and mild, rainy winters. According to the data of the State Meteorology Department, July and August are the hottest and driest, while January and February are the coldest months. Most of the annual precipitation occurs in December and January in the form of rain (Ugulu *et al.*, 2009).



Fig. 1. The map of the study area.

**Data collection:** The field work was carried out between 2009 and 2011. The information, including various data such as local names, the parts used, food preparation methods, was obtained through unstructured interviews and was collected from 18 different open-air-markets throughout the city. More than 120 adults were interviewed, average age 50, who have used wild plants in their diet under varied circumstances and sold these plants in the local markets of Izmir. Interviewees, 62% women and 38% men, were members of different ethnic groups. Efforts were made to double-check any information by asking the opinion of people in neighboring open-air-markets.

**Plant identification:** We recorded the plants, the parts used by the locals and their methods of food preparation and usage. The taxonomic determination of the plant material was carried out according to Davis (1965-1988) and Guner *et al.*, (2001). The determined plants, their families, the parts used, and the recipe of consumption are presented in Table 1, with names of the taxa in alphabetical order. Herbarium specimens are kept in the personal collection of the first author.

### Results and Discussion

In this study, 46 wild edible plant taxa belonging to 24 botanical families are reported as being consumed. All data pertaining to plant materials are listed based on their respective taxa, and are ordered alphabetically together with their botanical, vernacular and English names, the part(s) used and the recipes (Table 1). Wild edible plants we recorded belong to 24 different plant families. Family Asteraceae is represented by the highest number of taxa (7), followed by Apiaceae (6), Polygonaceae, Liliaceae and Lamiaceae (4), and Amaranthaceae and Brassicaceae (2) (Fig. 2).

Some of the recorded plants are cultivated in the area as well as growing in the wild. In our study, plants growing in the wild and sold in local open-air markets are investigated and it was determined that wild forms of *Coriandrum sativum*, *Mespilus germanica* and *Rosmarinus officinalis* are sold. Of these plants, *Coriandrum sativum* is grown especially for consumption as a spice and its fresh form is sold in open-air markets.

Table 1. Wild edible plants sold in the local markets of Izmir.

Scientific name	Family	Local name	English name	Edible part	Recipe	Frequency of citation
<i>Allium subhirsutum</i> L.	Liliaceae	köremen	hairy garlic	leaf	As pastry. Fried with egg.	4
<i>Anethum graveolens</i> L.	Apiaceae	dercotu	dill	aboveground	Added to salads. Cooked with many vegetables.	38
<i>Arbutus unedo</i> L.	Ericaceae	kocayemiş	strawberry tree	fruit	Its fruits are eaten.	16
<i>Asparagus acutifolius</i> L.	Liliaceae	kuşkonmaz	spiny asparagus	young shoot	Roasted as black bryony. Fried either alone or with black bryony and egg is added on top.	12
<i>Bellis perennis</i> L.	Asteraceae	koyungözü	daisy	leaf	Cooked with rice. Its salad is prepared with other vegetables.	5
<i>Berula erecta</i> (Huds.) Coville	Apiaceae	sukazayığı	cutleaf waterparsnip	aboveground	Cooked with onion. Added to salad or eaten alone.	3
<i>Castanea sativa</i> Mill.	Fagaceae	kestane	chestnut	seed	Eaten fresh, roasted or boiled.	13
<i>Ceratonia siliqua</i> L.	Fabaceae	keçiboynuzu	carob tree	fruit	Its dry fruits are eaten.	25
<i>Chenopodium album</i> L.	Amaranthaceae	sirken	lamb's quarters	fresh aboveground	Boiled, prepared as salad with lemon and olive oil. Fried with onion.	13
<i>Coriandrum sativum</i> L.	Apiaceae	kişniş	coriander	aboveground	Added to salad as fresh plant. Fried with onion. Chopped into various soups.	9
<i>Cornus mas</i> L.	Cornaceae	kızılek	cornelian cherry	fruit	Its fruit is eaten. Consumed as compote, sherbert, jam and marmelade.	15
<i>Echinophora tenuifolia</i> L. subsp. <i>sibthorpiana</i> (Guss.) Tutin	Apiaceae	çördük, tarhana otu	tarhana herb	fresh aboveground	Added to tarhana.	7
<i>Eremurus spectabilis</i> Bieb.	Liliaceae	çiriş	foxtail lily	fresh leaf	Fried with onion.	8
<i>Erodium cicutarium</i> (L.) L'Hérit	Geraniaceae	iğnelik	redstem filaree	fresh aboveground	Fried. Added to stuffing of "sheet iron pastry (sac böreği)".	11
<i>Ficus carica</i> L. subsp. <i>carica</i>	Moraceae	erkek incir	caprifig	male fruit	Unripened caprifigs are consumed as jam.	18
<i>Foeniculum vulgare</i> Mill.	Apiaceae	arapçaçı	fennel	fresh aboveground	Cooked with lamb meat. Fried with onion and egg.	6
<i>Malva sylvestris</i> L.	Malvaceae	ebegümeci	common mallow	aboveground	Cooked with minced meat or olive oil. Prepared as soup or put in pastry, fried with other herbs.	19
<i>Mespilus germanica</i> L.	Rosaceae	muşmula	common medlar	fruit	Fruits are eaten.	17
<i>Nasturtium officinale</i> R. Br.	Brassicaceae	su teresi	watercress	aboveground	Fried with onion. Eaten as salad.	3
<i>Opuntia ficus-indica</i> (L.) Mill.	Cactaceae	Hint inciri	Indian fig	fruit	Its fresh fruits are eaten.	4
<i>Origanum onites</i> L.	Lamiaceae	Izmir kekığı	oregano	leaf	Its leaves are freshly eaten in breakfast, added to various salads. It is a spice plant.	22
<i>Papaver rhoeas</i> L.	Papaveraceae	gelincik	corn poppy	young shoot	Mixed with green salad. Used as pastry stuffing.	4
<i>Pistacia terebinthus</i> L.	Anacardiaceae	menengic, çitlenbik	terebinth	young shoot	Fresh shoots are eaten alone. Added to pickle. Fried with onion and egg.	8
<i>Polygonum cognatum</i> Meisn.	Polygonaceae	madımak	knot-grass	fresh aboveground	After chopping, fried with egg or made into soup with wheat grains and yoghurt. Prepared as pastry.	5
<i>Portulaca oleracea</i> L.	Portulacaceae	semiz otu	purslane	aboveground	Consumed as salad freshly or with yoghurt and garlic. Cooked with onion.	21

<i>Ranunculus ficaria</i> L.	Ranunculaceae	yağlıot, katırnalı	lesser celandine	young leaf	Fried. Prepared as salad after boiling.	3
<i>Raphanus raphanistrum</i> L.	Brassicaceae	turpotu	wild radish	fresh shoot and leaf	Cooked with olive oil. Prepared as salad after boiling.	16
<i>Rheum ribes</i> L.	Polygonaceae	ışgın	rhubarb	fresh shoot and young petiole	Skin is removed and consumed raw or salad is made with olive oil and lemon. Fried with oil and egg is added.	5
<i>Rosmarinus officinalis</i> L.	Lamiaceae	kuşdili	rosemary	leaf	Added to salads as fresh or to meat dishes or other dishes as spice after dried.	10
<i>Rumex acetosella</i> L.	Polygonaceae	kuzukulağı	sheep sorrel	young shoot and leaf	Because of sour taste, commonly consumed as salad. Or prepared as salad with yoghurt.	14
<i>Rumex patientia</i> L.	Polygonaceae	labada, evelik	patience dock	leaf	Fried with onion and egg. Added to pastry. Leaves are rolled with rice inside (sarma).	12
<i>Salicornia europaea</i> L.	Amaranthaceae	deniz börülcesi	glasswort	tip of the young shoot	Boiled and salad is prepared.	13
<i>Satureja thymbra</i> L.	Lamiaceae	taş kekliği	thyme-leaved savory	leaf	Its leaves are eaten raw in the breakfast. Added to salads. It is a spice plant.	24
<i>Scolymus hispanicus</i> L.	Asteraceae	şevket-i bostan	blessed thistle	bark of the root and young basal leaf stalk	Cooked with lamb meat.	12
<i>Scorzonera cana</i> (C.A.Meyer) Hoffm.	Asteraceae	yakıotu, iskorçına	salsify	leaf	Added to salad or eaten alone. Added to bulgur (cracked wheat) pilaf. Chopped into various soups.	3
<i>Scorzonera elata</i> Boiss	Asteraceae	tekesakalı	viper's grass	leaf	Added to salad or eaten alone. Added to bulgur (cracked wheat) pilaf. Chopped into various soups.	3
<i>Smilax aspera</i> L.	Liliaceae	gıcır	sarsaparilla	young shoot and leaf	After boiling, fried with onion and egg or cooked with rice. Pickled.	4
<i>Smyrniun olusatrum</i> L.	Apiaceae	yabani kereviz	lovage	leaf	Cooked. Leaf saps are eaten raw. Added to pickle.	5
<i>Solanum nigrum</i> L.	Solanaceae	istifno, köpek üzümü	black nightshade	young shoot and leaf	Boiled with zucchinis, prepared as salad with lemon, garlic and olive oil.	5
<i>Sonchus asper</i> (L.) Hill subsp. <i>glaucescens</i> (Jordan) Ball	Asteraceae	sütlot, sütlen	spiny sow thistle	leaf	Fried with onion and egg. Boiled and prepared as salad. Used as pastry stuffing.	3
<i>Sonchus oleraceus</i> L.	Asteraceae	eşek marulu, yalancı marul	sow thistle	leaf	Fried with onion and egg. Boiled and prepared as salad. Used as pastry stuffing.	4
<i>Stellaria media</i> (L.) Vill.	Caryophyllaceae	kuşotu	chickweed	aboveground	Prepared as salad freshly. Used as pastry stuffing.	3
<i>Tamus communis</i> L.	Dioscoreaceae	sarmaşık	black bryony	young shoot	Fresh shoots fried with onion and egg is added.	12
<i>Taraxacum</i> sp.	Asteraceae	radika, karahindiba	dandelion	leaf	Boiled and prepared as salad with olive oil, garlic and lemon.	8
<i>Thymbra spicata</i> L.	Lamiaceae	zahter	za'atar	leaf	Leaves are eaten in breakfast. Commonly consumed as salad. A spice plant.	9
<i>Urtica urens</i> L.	Urticaceae	ısırgan	dwarf nettle	young shoot and leaf	Fried with onion and mallow. Added to pastry stuffing. Added to salad as fresh.	32

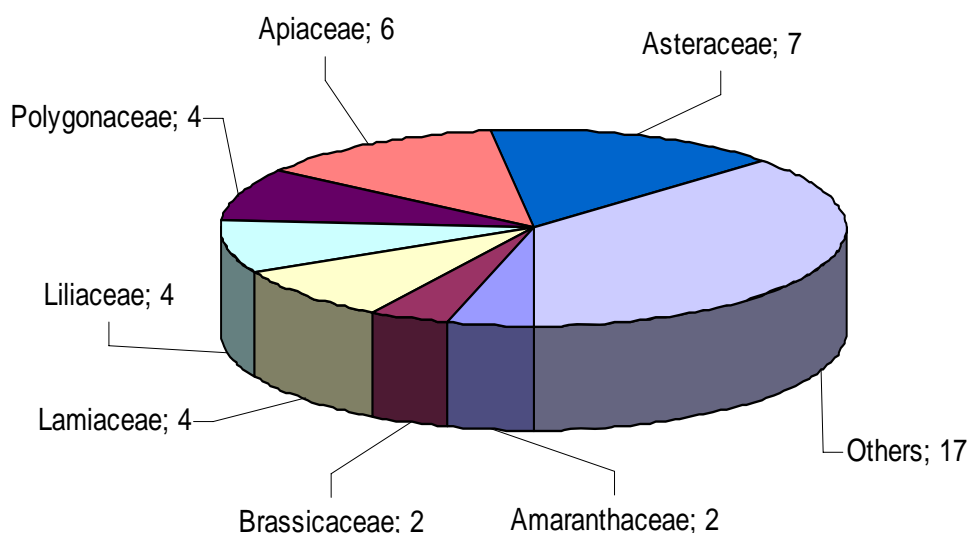


Fig. 2. Plant families with higher number of species in the study area.

The wild edible plants are consumed in many different ways and are prepared using diverse recipes according to local traditions. Some of them are eaten raw, and some others eaten cooked. Cooked recipes constitute 77% of the modes of consumption while raw edibles follow with the relatively high percentage of 59%. The high percentage of raw consumption of plants could be explained by consumption of plants as salad with olive oil, one of the important characteristics of Mediterranean diet. *Portulaca oleracea*, *Rumex acetosella*, *Stellaria media*, *Thymbra spicata* and *Papaver rhoeas* are examples to these plants.

When we examined the ways of consumption of plants in the study area, we determined that they are mostly consumed as main course. However some species, such as *Arbutus unedo*, *Ceratonia siliqua*, *Cornus mas*, *Mespilus germanica* and *Opuntia ficus-indica*, are consumed as fruit. It was determined that *Cornus mas* and *Ficus carica* subsp. *carica* are consumed as jam. *Ficus carica* subsp. *carica* is the fruit (caprifig) of male fig tree and the caprifigs are collected before ripening and consumed only as jam. Fruits of *Arbutus unedo* and *Ceratonia siliqua* are commonly consumed as in other Mediterranean Basin countries (Leonti *et al.*, 2006; Pardo-De-Santayana *et al.*, 2005; Dogan *et al.*, 2004; Ertug, 2004; Pieroni *et al.*, 2005; Ghirardini *et al.*, 2007; Lentini & Venza, 2007; Hadjichambis *et al.*, 2008; Kocyigit & Ozhatay, 2009; Kargioglu *et al.*, 2010). These species are distributed depending on the climate and the consumption diminishes in inner parts of the area. Especially the consumption of fruits of *Arbutus unedo*, whose fresh fruits are consumed immediately, is less compared to *Ceratonia siliqua*, whose dry fruits are consumed.

*Polygonum cognatum*, which does not grow naturally in the study area, is commonly consumed outside of the study area (Ozbucak *et al.*, 2006; Aksakal & Kaya, 2008; Yucel *et al.*, 2010; Kargioglu *et al.*, 2010). This species is consumed in various ways. *Rheum ribes* is consumed especially raw and as salad. However, because of the

habits of nomads that come from areas where the consumption is common, the plants are brought to the study area from other places and sold. These people also bring their unique ways of using the plants and food culture. This is one of the factors that increase the variety of dishes. Although the consumption of these plants is not as much as that of local wild plants, parallel to the studies performed in areas close to the study area (Dogan *et al.*, 2004; Ertug, 2004), *Tamus communis* and *Asparagus acutifolius* are among the most widely consumed wild plants in the area (Kaya *et al.*, 2004). This could be explained by the fact that the plants are preferred as food by the people coming from rural areas to city rather than those born in the city.

*Origanum onites*, *Satureja thymbra*, and *Thymbra spicata* are members of Lamiaceae and consumed as spice as well as freshly. Fresh leaves of the plants are either eaten or prepared as salad (Kizil, 2010) or chopped into other salads. *Salicornia europaea*, a halophyte plant, is the only species growing on the seashore. It is commonly consumed as salad, especially with olive oil, in areas close to the coast and its consumption decreases in inner areas. *Echinophora tenuifolia* subsp. *sibthorpiana*, a very well known and commonly used species and known as tarhana herb, is consumed as an addition to the tarhana soup, a soup that is unique to Anatolia (Dogan *et al.*, 2004; Ertug, 2004; Chalcat *et al.*, 2011). No other use of this plant other than soup has been reported.

In addition, the consumption of plants in an area, especially that of wild edible plants as food, is closely associated with the socio-cultural features of the area. Especially the increase in ethnic variety in the area is supportive of variety of plant usage and occurrence of more recipes. In light of this, Izmir is a city that is host to many a historical culture and received immigration in the past. This fact has naturally influenced variety of consumption of wild edible plants. For instance, the role of Cretan immigrants (Turkish origin) has been great in this regard. In our study, it was concluded that the information regarding the consumption and recipes of

plants such as *Scolymus hispanicus*, *Solanum nigrum* and *Taraxacum* sp., were transferred to the area by citizens of Crete origin.

According to the frequency of citation, the most important species were *Anethum graveolens*, *Malva sylvestris*, *Portulaca oleracea*, *Raphanus raphanistrum* and *Urtica urens* among the green vegetables; *Satureja thymbra* and *Origanum onites* among the condiments; and *Arbutus unedo*, *Ceratonia siliqua*, *Cornus mas*, *Ficus carica* subsp. *carica*, and *Mespilus germanica* among the fruits. When most cited plants are evaluated, it can be said that familiarity with especially fruits and spices was high due to fact that they are consumed without the need for cooking or a recipe.

Regional features are important in high number and variety of wild edible plants that are recorded at the end of the study. The study area, Izmir, lies on the coast of Aegean Sea, which is an inner sea and the continuation of the Mediterranean, and exhibits the characteristics of the Mediterranean climate. When the studies regarding wild edible plants in countries lying on the shores of the Mediterranean Sea were evaluated, it was concluded that many species, such as *Scolymus hispanicus* and *Taraxacum* sp., are commonly consumed, albeit some differences in recipes (Leonti *et al.*, 2006; Pardo-De-Santayana *et al.*, 2005; Nebel *et al.*, 2006).

When looking at the study in a global perspective, it is seen that one of the most important issues of this era is hunger (Redzic, 2006). Food production is great a concern as the world's population rises. Currently 20% of the population of the developing world is affected by malnutrition (Anon., 2000), and people in Nepal are undernourished and lacking on average 260 kcal. per person per day (Anon., 2000). Sustainable consumption of wild edible plants could help alleviate this problem (Addis *et al.*, 2005; Bhattarai *et al.*, 2009). In that context, it is seen that international studies on the subject is on the increase as a consequence of the understanding of wild edible plants' importance in alleviating malnutrition, as well as their ethnic value.

An ethnobotanical study on edible wild plants in a few districts of Ethiopia (Addis *et al.*, 2005) has revealed 30 plants used in human nutrition, especially in periods of food shortage. The same study has showed that children consume edible wild plants much more than adults do. Similar experiences have been reported in Senegal (Becker, 1983), where the local population uses many of wild edible plant species.

The usage of wild edible plants is also common in many European countries. For example, several hundred wild plants are being used in human nutrition in Italy (Guarrera, 2003). In other parts of the world, such as in southeastern Asia, wild plants are highly valued as an important food source, as well. Investigations carried out by Britta *et al.*, (2003) have showed that over 90 species of edible wild plants are being used in Vietnam, of which many are also a necessary part of human medicine. Usage of wild edible plants as a nutrition is well documented among inhabitants of South America, where several hundred species have been recorded (Ladio & Lozada, 2000a, 2000b, 2000c, 2001, 2004; Hanazaki *et al.*, 2000).

When compared with these reports, especially considering that only the species sold on the local markets are recorded in this study, it can be said that the study area is quite rich in terms of wild edible plants. On the other hand, when taken into account the fact that the studies mentioned in literature analysis were mostly conducted on a national level, the wild edible richness of the study area becomes more apparent.

As a result, in this modern era where the malnutrition and fast-food culture is increasing and the transfer of ethnobotanical knowledge from old generation to the young is decreasing, this study will be beneficial in terms of both recording of information regarding the consumption of wild edible plants as food source and providing new ideas for people with nourishment problems. As mentioned in a number of studies (Bonet & Valles, 2002; Della *et al.*, 2006; Tardio *et al.*, 2006; Menendez-Baceta *et al.*, 2012), it is a matter of urgency to record the traditional knowledge of wild edible plant uses in Mediterranean countries for posterity.

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