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Biodiversity for Food and Nutrition: Edible Wild Plant Species of Aegean Region of Turkey

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ABSTRACT: *In Turkey wild edible plants have been used in dietary as a source of food from prehistoric times onwards. The wild plants are common in Turkish cuisine and they are eaten raw, consumed after cooking, dried before use, consumed after processing. However they have different uses in different areas of the country. Wild edible plants have been widely consumed in Aegean region where the traditional foods are still cooked and even served at the local restaurants. The study was developed on the edible wild plants in Aegean Region of Turkey as a multi-disciplinary approach to gather data on the traditional uses of wild edibles; to improve the conservation and use of agricultural biodiversity for food and nutrition, as well as to build support for biodiversity conservation and enhanced well-being by providing evidence and raising awareness of the nutritional value of this diversity and its importance in food-based approaches to tackle unhealthy dietary. Eleven species of wild edible plants of Aegean Region have been prioritized in this study. Surveys were conducted in Izmir, Aydın, Muğla and Balıkesir to determine the baseline status of community biodiversity for food and nutrition, dietary diversity and traditional knowledge. The previous studies conducted on edible plants were the baseline of the survey. The ethno-botanic and socio-economic surveys were conducted at the selected ecological sites in the villages, local markets, local restaurants as well as supermarkets. The socio-economic studies were conducted for detail data with monographic technic. Surveys were carried out to generate the idea on marketing opportunity, to assist to obtain the information for the development of policy to upload the relevant information about the traditional knowledge. During surveys ethno-botanical information and the different type of dishes of wild edible plants were recorded. The data recorded from face to face questioners with 541 collector and 584 consumers for the conclusion of process from harvest to consumption. In the Aegean region, the majority of consumers stated that they consumed wild species 1-2 times a week. The collected amount varies according to the type of market. Some species are usually collected for commercial purposes. Samples were also collected for taxonomic identification and for further study on nutritional value priority species. Awareness activities have been conducted, leaflets, brochures were prepared and disseminated. Over 100 species of wild edible plants and over have been recorded from the study region.*

Keywords: *Wild edible plants, Aegean Region, socio-economic studies, traditional knowledge, ethno-botanical study.*

Beslenme ve Gıda için Biyoçeşitlilik: Ege Bölgesi'nin Yenilebilir Yabani Bitki Türleri

ÖZ: *Türkiye'de yenilebilir yabani bitkiler, tarih öncesi çağlardan beri besin kaynağı olarak diyette kullanılmıştır. Yenilebilir yabani bitkiler Türk mutfağında yaygındır ve bazıları pişmeden çiğ, tüketilirken, bazıları pişirilir, kurutulur ya da, işleme tabi tutulduktan sonra tüketilirler. Bununla birlikte, yenilebilen yabani türler ülkenin farklı bölgelerinde farklı kullanımlara sahipler. Ege Bölgesi'nde yabani yenilebilir bitkiler yaygın olarak tüketilmekte, geleneksel yiyecekleri hala pişirilmekte ve hatta yerel restoranlarda servis edilmektedir. Çalışma, Ege Bölgesi'ndeki yenilebilir yabani bitkilerin, geleneksel kullanımları hakkında veri toplamak için çok disiplinli bir yaklaşımla düzenlenmiştir. Çalışma, Gıda ve beslenme için tarımsal biyoçeşitliliğin korunması ve kullanımını iyileştirmenin yanı sıra, bu çeşitliliğin besin değeri ve gıda temelli yaklaşımlardaki*

önemi hakkında kanıt sağlayarak ve farkındalık yaratarak biyoçeşitliliğin korunması, sağlıksız diyetle mücadele ve refah düzeyinin arttırılması için destek oluşturmayı amaçlamaktadır. Bu çalışmada Ege Bölgesi yenilebilir yabani bitkilerin 11 türü öncelik verilmiştir. Gıda, beslenme, diyet çeşitliliği ve geleneksel bilgi için yerel biyolojik çeşitliliğinin temel durumunu belirlemek üzere İzmir, Aydın, Muğla ve Balıkesir'de anketler yapılmıştır. Yenilebilir bitkiler üzerinde yapılan ön çalışmalar anketin temelini oluşturmuştur. Etno-botanik ve sosyo-ekonomik anketler köylerde, yerel pazarlarda, lokantalarda ve süpermarketlerde seçilen ekolojik alanlarda gerçekleştirilmiştir. Sosyo-ekonomik çalışmalar, monografi tekniği ile ayrıntılı veriler için yürütülmüştür. Geleneksel bilgi ile ilgili bilgileri kaydetmek, politikanın geliştirilmesi için bilgi edinmeye yardımcı olmak amacıyla pazarlama fırsatı fikrini üretmek için anketler yapılmıştır. Anketler sırasında etno-botanik bilgi ve yenilebilir yabani türlerin farklı yemekleri kaydedilmiştir. Anketler, yüz yüze olarak hasattan tüketime geçiş sürecinde 541 koleksiyoncu ve 584 tüketiciyle yapılmıştır. Ege Bölgesi'ndeki tüketicilerin çoğunluğu haftada 1-2 kez yabani türleri tükettiklerini belirtmiş olup, Toplanan miktar piyasa türüne göre değişiklik göstermiştir. Bazı türlerin genelde ticari amaçlı olarak toplandığı belirlenmiştir. Öncelikli türler üzerinde taksonomik tanımlama ve beslenme değeri analizleri örnekler de toplanmıştır. Bilinçlendirme çalışmaları yapılmışı, broşürler hazırlanmış ve yayınlanmıştır. Çalışma bölgesinde 100'den fazla yabani yenilebilir bitki türü kaydedilmiştir.

***Anahtar Sözcükler**: Yabani yenilebilir bitkiler, Ege Bölgesi, sosyo-ekonomik çalışmalar, geleneksel bilgi, etno-botanik çalışma.*

INTRODUCTION

In Turkey wild edible plants (WEP) have been used as a source of food from ancient times onward. Although wild species are known to have played an important role in the regional economies and edible plant species may have different uses in different areas of the country (Tan and Taskın, 2009, 2011). The nutritional properties of edible wild plant and mushroom species are indicated in various studies (Etkin, 1996; Ayan *et al*., 2006; Aslantas *et al.*, 2007; Ozbucak *et al*., 2007; Tan and Taskin, 2009; Ozen, 2010; Caglarirmak, 2011; Adanacioglu *et al.*, 2016). Local people as well as people in the cities nowadays utilize wild plants and mushrooms as food and for other use also (dye and for medical purposes) (Baytop, 1999). Local people given local names to the wild plants grow in surroundings villages (Cakilcioğlu and Turkoglu, 2010). There are various references to the various uses of plants in Anatolia in the old Hittite texts (Ertem, 1987). Recent studies have indicated that several basic food plants were first domesticated in Anatolia. However, the domestication of plants and cultivation of many species never decreased the demand of wild plant gathering. Gathering was one of the oldest traditions in Anatolia. Very earliest inhabitants used plants for food, fuel and medicine, formed traditional knowledge and passed on this heritage from one generation to the next and from one area to another. The wild edible plants and wild edible mushrooms are common in Turkish cuisine and they are used in pie (Borek in Turkish), either eaten raw, boiled, fried in oil or baked to be served as dishes such as stew, stuffed and rolled vegetables or as cold or hot drinks for certain occasions and seasons (Tan and Taskin, 2009, 2011; Adanacıoglu *et al.*, 2016).

The study on the edible wild plants WEP of Aegean Region (West of Turkey) was developed within the frame work of Biodiversity for Food and Nutrition Project as a multi-disciplinary research to gather data on the traditional uses of plants as well as to improve the conservation and use of agricultural biodiversity for food and nutrition by providing evidence and raising awareness of the nutritional value of this diversity and its importance in food-based approaches to tackle unhealthy dietary.

MATERIALS AND METHODS

The materials of this study were the edible wild species in western part of Turkey (Aegean Region of Turkey).

Surveys were conducted to determine the baseline status of community biodiversity for food and nutrition, dietary diversity and traditional knowledge. The previous studies conducted on edible wild plants (Tan and Taskin, 2009; Tan, 2010; Tan and Taskin, 2011) were the baseline of the survey. In according to information gathered from the

previous studies and also from the pre-survey about the wild edible plants and land races of local crops, the plants to be studied were selected (Table 1). From the pre-survey the sites where traditional uses of wild plants for food are very common were also selected. So, Izmir, Balikesir, Aydın and Mugla Provinces of west part of Anatolia were selected the study sites.

The pre-survey was carried to determine the edible wild plants used as food by village people in Western Anatolia. Study was mainly conducted in the villages, local markets as well as supermarkets to collect the information about the plant and their use. The local markets were visited and the wild edible plants sellers were interviewed. The famous local restaurants serve the foods cooked from the wild edible plants were visited to get the information about the use and local cooking. Information from super-markets was also collected for the packed and marketed wild vegetables. In the face-to-face interviews conducted with the local people, the wild plants they consumed as food were listed. The plant parts used by the locals and their methods of food preparation and usage were recorded.

The second step of survey was to identify the sites for the sampling of the selected species for the analysis of the nutritional values. The sampling was carried in according to the sampling protocol that describes the sampling process. Sampling Form was prepared and filled during collecting of samples which contains information about species names, sampling region, origin of sample, sampling date etc.

The taxonomic determination of the collected plants was carried out according to "Flora of Turkey and the East Aegean Islands" (Davis, 1965-1985; Guner *et al.,* 2000). The herbarium specimens were conserved at Aegean Agricultural Research Institute (AARI) Herbarium.

The ethno-botanic and socio-economic surveys were conducted at the selected ecological sites of Aegean Region, to get more information on the prioritized wild plant species. Socio-economic study was planned to investigate in detail the process from the collection to consumption for the aim of analysis and conclusion of process from collection/harvest to consumption; generate the idea on marketing opportunity; to upload the relevant information about the traditional knowledge on use of wild edible plants. Monographic research technique was used in the study. Information on this technique was obtained through questionnaires. At the same time, preliminary data collection work was carried out in selected areas in villages and markets.

Survey interviews techniques was preferred for questioning. The interview is data collection techniques via verbal communication.

The information was collected on the consumption of target Agricultural Biodiversity (AgBD) and local uses and traits of prioritized AgBD, as well as the data on associated traditional knowledge of targeted AgBD from local people in various ages who are collected the wild plants for family consumption or for selling the local markets. Information especially about the harvesting sites and villages for the plants and species were recorded.

The interview were started to determine the baseline status of local biodiversity for food and nutrition, dietary diversity and traditional knowledge.

The questionnaires were comprised:

1. Village information form
2. WEP species questionnaire collector survey
3. WEP consumer survey

Questionnaires were done on village base (Village Questionnaire), species base for collectors and for consumers. All gathered information was recorded into the project databases which were linked with the National Plant genetic Resources Data Bases. An inventory of wild edibles was also produced from that information.

RESULTS AND CONCLUSIONS

According to the results of that study WEPs have been widely consumed in Aegean region. Thus, ethno-botanical knowledge is still alive in the study. However, the use of wild edible plants is generally widespread among elderly people in the rural area. Some information gathered from survey for the studied species were given in Table 1. Over 100 species of wild edible plants and over have been recorded from the study region.

Seasonal vegetables derived from wild plants are sold in local markets in villages and markets or street vendors in the cities and towns. In villages local people collect wild plants for their home consumption and for selling in the markets (Tan and Taskin, 2009, 2011). Generally, collectors collect the wild plants for income since they are low-income families. The highest consumption is usually in the places of the villages where those plants are grown. Traditionally consumed known species are found in the local markets. Those species are usually send to the nearest town to sold in local markets or send directly to the consumers. A species consumed in a village or in a county may not be recognized and not consumed in the neighboring village or district.

According to the results of that study wild edible plants have been widely consumed in Aegean region. Thus, ethno-botanical knowledge is still alive in the study. However, the use of wild edible plants is generally widespread among elderly people in the rural area.

During the surveys over ninety species are determined which are gathered and consumed as vegetables in the study areas. The selected WEP species, their used part, the purpose of consumptions is given in Table 1. Within the edible plants, leaves, stems and flowers were the plant parts most widely used. 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 or as salad, and some others eaten cooked and thus require a more or less complex preparation process. Within the study areas in the most localities, most plants with edible leaves, roots, or fruits are eaten raw (e.g., *Rumex acetosella* leave). The majority of these plants are eaten fresh, directly after they are gathered. Many of them (e.g., *Foeniculum vulgare*, *Crithmum maritimum*, *Raphanus raphanistrum, Cichorium intybus*) are used in salads and dressed with olive oil and lemon or are eaten with yogurt. A number of plants are gathered and preserved to be stored and consumed on longer periods of the year (sometimes all year round, e.g., deepfreezed roots of *Scolymus hispanicus*, pickled *Crithmum maritimum*). Many of the wild edible plants have been eaten cooked. Some plants are consumed fried or roasted in olive oil (e.g., *Foeniculum vulgare, Opopanax hispidus, Rumex acetosella, Cichorium intybus*) and especially used in an omelette (e.g., *Cichorium intybus, Glebionis coronaria*) and a number of wild edible plants are used in traditional recipes. For example, the leaves of *Beta vulgaris* subsp. *maritima* (L.) Arcang., *Smyrnium olusatrum* and some others are used as filling for a traditional pie called in Turkish ‘börek’. The leaves of *Beta maritima*, are also used to make stufed (sarma), in which the boiled leaves are filled with rice and/or minced meat, and condiments and made into rolls before cooked and eaten with yogurt. Several parts of some wild edible plants like *Raphanus raphanistrum* are also used traditionally for soup called çorba in Turkish.

Some of the studied WEPs are also indicated to use for medicinal purposes by local people said to be a folk remedy (e.g., *Scolymus hispanicus* for renal diseases, like kidney stone; *Opopanax hispidus* for blood purifier; *Salicornia emericii* and *Crithmum maritimum* for goiter; an ointment is made from the *Cichorium intybus* leaves for wound healing; *Foeniculum vulgare* stomach disorders).

For the socioeconomic analysıs total 1125 consumers and collectors were surveyed. The details were given in Table 2. In the Aegean region, the majority of consumers stated that they consumed wild species 1-2 times a week. The collected amount varies according to the type of market. Some species are usually collected for commercial purposes.

Table 1. The wild edible plants studied in Aegean Region.
Çizelge 1. Ege Bölgesi'nde çalışılan yenilebilen yabani bitkiler.

Family Familya	Botanical name Botanik adı	English name İngilizce adı	Turkish name Türkçe adı	Local Names Yerel adları	Parts used Kullanılan kısmı	The way to consume Kullanımı
Amaranthaceae	*Beta vulgaris* subsp. *maritima* (L.) Arcang.	Sea beet	Kıyı pancarı	Deli pazı, yabani pancar, yaban pazısı, ova mancarı, pezik, deniz pancarı, dağ pancarı, kır pazısı, zık, yaban pancarı, kara mancar, deli ıspanak, yaban ıspanağı,	Rosette leave	Stuffed, pancake, pie, raw with salad, roasted. meal
Amaranthaceae	*Salicornia emericii* Duval-Jouve, Lectotype:*Salicornia europaea* L.	Glasswort or samphire	Deniz börülcesi	Kurşun otu, tuzlu ot, geren otu	Young plant	raw, stew, salad
Apiaceae	*Crithmum maritimum* L.	Rock samphire	Deniz teresi, Kaya koruğu	Deniz marulu, deniz otu, ada börülcesi, genevir, kereviz otu	Young plant and leave	stew, pickle, salad, omelet
Apiaceae	*Foeniculum vulgare* Mill.	Fennel	Arapsaçı	Rezene, çaşır, çaşıra, kokar ot, malatura, erezene, raziyane, sıra, marata	Whole plant	meal, roasted, pilaf, seasoning
Apiaceae	*Opopanax hispidus* (Friv.) Gris.		Kaymacık,	Sarı ot, sarı bacı, kaymaklık, kaymak otu, kırk sıralı, gaymecik, tülü ot	Young basal leave	meal, roasted, omelet
Apiaceae	*Smyrnium olusatrum* L.	Alexanders	Deli kereviz	Yabani kereviz, baldıran	Shoot and leave	stew, pie, salad, roasted, meal, fry
Asteraceae	*Glebionis coronaria* (L.) Spach Syn: *Chrysanthemum segetum* L.	Crown daisy	Ala gömeç	Ale gümeci, sarı papatya, öküz gözü, koyun gözü, yabani krizantem	Young sprouts	stew, salad, roasted, meal, omelet
Asteraceae	*Cichorium intybus* L.	Wild mustard	Hindiba	Hindibag, yabani hindiba, kara hindiba, tatlı hindiba, ak hindiba, günek, güneyik, yatlı günek, ak günek, radika, bahçe radikası, altlık, çatlangoz	Whole plant	meal, salad, omelet
Asteraceae	*Scolymus hispanicus* L.	Golden thistle	Şevketi bostan	Akkız, akçakızı, altın dikeni, ak dikeni, diken otu,çetmi dikeni, sarı diken, sütlü diken, süt dikeni, güzel hisar dikeni	Roots, young leaves	stew, salad, soup, omelet, meal
Brassicaceae	*Raphanus raphanistrum* L.	Wild radish	Eşek turpu	Turpotu, yaban turpu yabani turp, çalgıcı otu, yabani hardal	Shoot and leaf	roasted, salad, meal, omelet, stew, soup
Polygonaceae	*Rumex acetosella* L.	Sorrel	Kuzukulağı	Ekşi kuzukulağı, lutka, ekşi kulak, eğşimene, ekşice, ekşimik, ekşilik ekşimelek, ekşimek, ekşimen, turşu otu, ebem ekşisi, ebenekşisi, oğlak kulağı, küçük kuzukulağı	Leaf	roasted, stuffed, pie, soup, meal, salad

Wild edibles amount per household and annual consumption amounts per capita in Aegean Region for prioritized species in Aegean Region are shown in Table 3. The data we have presented here showed that gathering, processing and consuming wild edible plants are still important activities in west Anatolia. The consumption of wild edible plants is an addition or a complement to a diet of cultivated food plants, while the quantity and quality of traditional knowledge varies slightly among the studied region. With change in nutritional habits and the influence of contemporary western life style, interest of younger generation has seemed declined to the traditional knowledge necessary to identify, gather and process these species. However, in the cities the habit to consume the natural foods for health reason, in the markets the wild edible foods are sold and consumption of those getting increased. So even big firms are collected and packaged to sell in the supermarkets. In the region acquisition of economic benefits from species might promote local people's interest in conservation and maintenance of such locally important and threatened species. Sustaining wild edible plants is meaningful only if conservation efforts take into account the food plants inextricable connections with cultural heritage (Tan and Taskın, 2011).

Young people should be included when recruiting participants to ethnobotanical studies or to any type of consultation about WEP. The habit of using wild edible plants is still alive and is a traditional culinary practice that demonstrates rich traditional knowledge of local people. WEP were found to be important for livelihood as well as showing great potential for crop improvement. Priority species should be promoted for income generation activities through sustainable collection and trade. Communities should engage in minimizing the threats to these valuable resources.

Table 2. Number of survey carried out in Aegean Region.
Çizelge 2. Ege Bölgesinde yürütülen anket sayısı.

Number of Provinces Surveyed	4
Number of Counties Surveyed	19
Number of Site Surveyed	48
Number of Consumer Surveyed	584
Number of Collector Surveyed	541

Table 3. Wild edibles plants amount per household and annual consumption amounts per capita in Aegean Region.
Çizelge 3. Ege Bölgesi'nde yenilebilen yabani bitkilerin hane başı ve kişi başı yıllık tüketimi.

Wild edible plants Yenilebilir yabani türler	Engilish name İngilizce adı	Consumption per household (kg/year) Hane başı tüketim (kg/yıl)	Consumption per capita (kg/year) Kişi başı tüketim (kg/yıl)
Smyrnium olusatrum L. Baldıran/Deli kereviz	Alexanders	11.5	3.5
Salicornia emericii Duval-Jouve Deniz börülcesi	Glasswort or samphire	13.9	3.8
Raphanus raphanistrum L. Eşek turpu	Wild radish	15.0	4.0
Beta vulgaris subsp. *maritima* (L.) Arcang. Kıyı pancarı	Sea beet	11.1	3.0
Foeniculum vulgare Mill. Arapsaçı	Fennel	10.2	2.7
Crithmum maritimum L. Deniz teresi/kaya koruğu	Rock samphire	11.0	3.5
Cichorium intybus L. Hindiba	Chicory	9.4	2.6
Opopanax hispidus (Friv.) Gris. Kaymacık	Yellow herb	7.4	2.2
Rumex acetosella L. Kuzu kulağı	Sorrel	7.1	1.9
Glebionis coronaria (L.) Spach Alagömeç	Crown daisy	4.2	1.4

In addition to food value to the local people, the documented species are marketable and can provide the opportunity to supplement household income of rural people with limited economic opportunities. The survey of trade centers showed that many species possess potentialities for livelihood enhancement and socio-economic development by making widely popular value added products that could be easily sold.

Having surveyed WEP in a relatively large area, our study provides empirical evidence about diversity and status of WEP, as well as methodological insights about the proper knowledge holders to consult. Our results showed that WEP are not only sources of food and nutrients to the local communities, but could also be means of income generation, if managed sustainably. We also highlighted the potential species that could be used in genetic improvement of crop species. Several WEP can benefit local people not only as food, but also for their medicinal properties. These multi-valued resources are threatened by several anthropogenic and natural causes such as land-use change, habitat destruction, over-harvesting, over-grazing, and invasive species. Therefore, sustainable management of these resources for the wellbeing of the local communities as well as to conserve biodiversity is of the utmost importance and could also contribute to preserve cultural and genetic diversity. Inclusion of WEP in community forest management plans would be the most realistic conservation and livelihood approach for the study areas as most forests are managed by community forest user groups.

Our study also revealed an intriguing finding about WEP knowledge holders that will be very important to consider when designing samples to study WEP. Elders are often consulted and young people are generally ignored in ethnobotanical studies, but we demonstrated that young people who spend most of their time in the forests herding animals and foraging wild food hold WEP knowledge that older people do not hold. Therefore, ignoring young people during WEP surveys might result in the omission of valuable information.

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