An ethnobotanical survey of medicinal plants in Biga (Çanakkale-Turkey)

Ece Sevgi[a,]*, Çağla Kızılarslan-Hançer[a], Muhammet Akkaya[b], Ernaz Altundağ-Çakır[c] & Betül Büyükkılıç-Altınbaşak[a]

[a]Bezmialem Vakif University, Faculty of Pharmacy, Department of Pharmaceutical Botany, 34093, Fatih-Istanbul, Turkey
[b]Forest Management, Biga-Çanakkale, Turkey
[c]Düzce University, Faculty of Arts and Sciences, Department of Biology, 81620, Düzce, Turkey
E-mail: esevgi@bezmialem.edu.tr

Traditional medicine, which is an important part of traditional knowledge, is an aspect of a heritage common to all mankind. We aimed to determine the traditional medicinal uses of plants in Biga and to compare the local data obtained with ethnobotanical studies for neighboring areas. Ethnobotanical data for medicinal plants were collected by means of face-to-face interviews with local people. We recorded 104 taxa belonging to 49 families used for medicinal purposes. Lamiaceae, Rosaceae and Asteraceae were the most common plant families. *Hypericum perforatum* L. is the most used species in Biga for the treatment of gastrointestinal and dermatological ailments. The highest FIC values (0.84) were obtained for respiratory disease, followed by gastrointestinal and dermatological diseases (0.81) and urinary infections (0.79). Only 52% of the species recorded in our study were found in monographs and pharmacopeias. The data reveal the continued use of plants as part of an oral culture among the local population inhabiting the research area. The outcome of this study contributes to the various approaches used to protect the rights of the local people of Turkey, including their resources and knowledge. Furthermore, the study contributes to our knowledge of medicinal plants in the Mediterranean region.

Keywords: Çanakkale, Ethnobotany, Medicinal plant, Quantitative method, Traditional knowledge, Turkey

IPC Code: Int Cl.[22]: A61K 36/00, A61K 36/185

Ethnobotany supports a better understanding of local cultures and in turn, these local cultures enhance our knowledge of the use of local medicinal plant resources[1]. Traditional medicine, which is an important part of traditional knowledge, is an aspect of a heritage common to all mankind. Traditional knowledge of medicinal plants is handed down from one generation to the next and between communities[2]. It is very important that this oral folk culture is documented-knowledge which has been acquired by trial and error and transferred from generation to generation and evaluated by means of ethnobotanical study techniques[3].

There are about 391,000 vascular plant species currently known worldwide and of these, at least 28,187 are currently considered medicinal plants[4]. It is thought that the number of species with medicinal properties will increase gradually as their various medical properties are established by ethnobotanical studies. In studies where plants are investigated for their chemical content and biological activity, it is known that prioritizing those species used in traditional remedies by the local people increases the possibility of the emergence of new 'drug' substances in modern medicine. Developing countries have started to become more interested in traditional medicines and there is now a greater acceptance of phytotherapy and demand for plant-based medicines. Medicinal plants will continue to play this role as long as modern medicine is unable to meet the health-care needs of the people of the developed World[5].

Turkey has played host to many civilizations and therefore boasts a wealth of traditional knowledge established and used practically for centuries in folk medicine. In addition, the plant knowledge of immigrants from the Balkan and Caucasus regions has contributed to this cultural wealth. That the same plant is known by different local names in different regions and that the same local name is used for several different species is indicative of the cultural diversity of Turkey[6]. Turkey, located at the intersection of floristic diversity and cultural wealth, has a very rich tradition of using medicinal plants. It is recorded that approximately 1280 taxa belonging to 114 families and 458 genera are used in Turkey for food or medicinal purposes[7]. Also, each new

―――――――――――
*Corresponding author

ethnobotanical study further reveals the wealth of traditional knowledge in Turkey. The use of plants in the traditional treatment of ailments continues in the form of oral culture among the public. Ethnobotanical studies contribute to our understanding of the transfer of traditional knowledge and cultural heritage which are under threat owing to world-wide spread of popular culture and emphasis on science[8]. Making of research with traditional knowledge holders also helps to develop new strategies on conserving natural resources. Because plants are sources of useful therapeutic agents and also sources for the discovery of many bioactive principles[9,10]. Commencing in the mid-1990s, ethnobotanical studies have been undertaken systematically in order to preserve the traditional knowledge of Turkey[11]. Since then, many studies of medicinal plants occurring in close proximity to our research area have been published[12-37], but none of these studies have been undertaken in Biga.

The aim of this study is to document the ethnomedicinal uses of plants in Biga and to compare these local ethnomedicinal data with those obtained for adjacent regions. The present study is the first extensive ethnobotanical research project undertaken for Biga (Çanakkale). Furthermore, we firmly believe that the data obtained in this investigation will help identify the main plants that should be selected for biological activity studies.

Methodology

Study area

We undertook this research in Biga, which is located in the southwestern part of the Marmara region of Turkey. Biga is the largest district of the Turkish province Çanakkale (Fig. 1). Biga is situated at a latitude of 40° 13' N and a longitude of 27° 15' E, and has an area of 1331 km².

Biga is flanked by Gönen (Balıkesir) in the east, Lapseki (Çanakkale) in the west, Çan and Yenice (Çanakkale) in the south and the Marmara Sea in the north. The coastline (width 70 km), including the Karabiga peninsula, is located along the north-south axis. Armutçuk Mountain (871 m), which is the highest point in the region, is located at the Biga-Gönen border. The regional climate is generally Mediterranean.

A rich folk culture is present in Biga due to the settlement of immigrants of Balkan and/or Caucasian (Yoruk, Muhacır, Bosnian Pomak, Tatar, Circassian, Kumuk) stock. Biga's cultural diversity enriches our traditional knowledge of plants. The main livelihoods in the district are agriculture and husbandry. The main crops are wheat, rice, sunflower, corn, legumes, some vegetables and fruit[38].

Data collection

Biga district was visited several times between 2011 and 2014 at different seasons (between March and October) to carry out ethnobotanical evaluations of the research area. Ethnobotanical data were collected by means of face-to-face interviews with local people (Fig. 2). Information about the medicinal use of plants in the region was compiled as a result of several visits to the same villages. Eight of the villages are located in the forest, 25 next to the forest and 17 on the plain. We interviewed a total of 137 people at the center of Biga and its 49 associated villages. Interviews were conducted on people over 30 years of age living in villages for more than 10 years and who know how to use medicinal plants. Of the informants, 104 were male, 33 were female. The age of the informants varied from 31 to 86. The mean age of the respondents was 64 years. The informants were mainly farmers, shepherds, housewives, a local healer, tradesman, headmen of the village and retired individuals. Interviews were carried out in houses, gardens, fields, village squares, village bazaars and coffee houses. During the interviews, the village headman provided assistance, and we visited houses in accordance with the information obtained during interviews.

In this study, in face-to-face interviews with local people, local names, medicinal uses and the parts

Fig. 1 — Geographical location of the study area. (http://cografyaharita.com/)

Fig. 2 — Ethnobotanical interviews with local people (at various places)

of the plants used, as well as preparation methods were recorded on Ethnobotanical Information Forms (Supplementary Material 1– Appendix A). The interviews took the form of general conversations and a structured questionnaire. In addition, the plant species collected for sale by villagers in the district markets were recorded.

Plant material

The field study was carried out in each village several times between March and October over a period of 4 years. Medicinal plant samples were collected from the wild in the company of local people and were pressed in the field. We took photographs of each of the species and recorded their location. The collected medicinal plants were identified. They were compared with specimens at the Herbarium of Faculty of Forestry, Istanbul University-Cerrahpaşa (ISTO). Nomenclature followed the *International Plant Name Index*[39] and voucher specimens were deposited at the Herbarium of Faculty of Forestry, Istanbul University-Cerrahpaşa (ISTO).

Comparative analysis of ethnobotanical studies for the neighboring areas

Species whose medicinal use was determined in this study were compared with 26 other ethnobotanical studies undertaken in the neighboring areas[12-37].

Data analysis

Data collected in the interviews were used to calculate ethnobotanical quantitative methods (UV, ICF).

Use value

The use value (UV) demonstrates the relative importance of plant species known locally as a traditional medicine in the study areas. It was calculated using the following formula:

$$UV = \sum Ui/N$$

where Ui = the number of use reports mentioned by each informant for a given plant species, N= the total number of informants interviewed. The UV is helpful in determining the plants with the greatest use (most frequently indicated) in the treatment of an ailment[40].

Informant Consensus Factor

The Informant Consensus Factor (FIC) was calculated to check the homogeneity of the information obtained. All information was placed into categories relating to the ailments for which each plant was mentioned to be used by the informants. It was calculated according to the following formula:

$$FIC = Nur - Nt/Nur - 1$$

where "Nur" refers to the number of use citations in each category and "Nt" the number of the species used. FIC values range from 0 to 1. A low value indicates that the informants disagree on the taxon to be used in the treatment within an ailment category. A high value (close to 1) indicates that fewer species are used by a large proportion of the informants[40].

Category of ailments

In order to calculate this factor, the ailments were classified into 11 categories and the diseases and therapeutic effects were separated into different ailment categories according to *Medicinal Plants*

of the World[41]. 1. Urinary diseases (diuretic, diurnal enuresis, enuresis, kidney pain, kidney stones, nephritis, prostate conditions, renal failure, renal insufficiency), 2. Gastrointestinal diseases (abdominal pain, anthelmintic and carminative purposes, colitis, constipation, diarrhea, duodenal ulcer, gall bladder ailments, gall-stones, gastritis, hemorrhoids, hepatitis, intestinal diseases, liver diseases, liver steatosis, nausea, reflux, ulcer, stomach ailments, stomach-ache, as appetizers), 3. Respiratory diseases (asthma, bronchitis, cough, as an expectorant, flu, hoarseness, respiratory tract diseases, shortness of breath, sinusitis, sore throat, tonsillitis, tuberculosis), 4. Heart and circulatory system diseases/Cardiovascular diseases (atherosclerosis, heart attack, cardiac dilatation, as a cardiotonic, hypercholesterolemia, hypertension, cardiac diseases, haemostatic, varicosis, as an anticoagulant), 5. Dermatological diseases (acne, alopecia, aphtha, bee sting, bug bite, burns, callus, cracked skin, cuts, eczema, foot odour, furuncle, itching of the scalp, psoriasis, for relieving itching, scurf, skin blemish, snake bite, tinea pedis, vitiligo, warts, wounds), 6. Musculoskeletal system (as an analgesic, arm pain, arthritis, bruise, foot-ache, fracture, knee pain, leg pain, muscle pain, rheumatic heart disease, rheumatism, spinal disc herniation), 7. Neurologic and psychological diseases (dysmnesia, epilepsy, headache, insomnia, migraine, Parkinson's disease, as a sedative, as a somniferous agent, syncope), 8. Endocrine system disorders (diabetes, goiter, gynecological diseases, infertility, weight loss), 9. Sensory organs (cataract, earache, eye pain, toothache), 10. Cancer (brain cancer, cancer, skin cancer) and 11. Others (ablactation, antibiotic, anti-inflammatory, antiseptic, immunostimulant, poisoning, prophylactic).

Comparison of medicinal plants in the study area with monographs and pharmacopoeias

The list of medicinal plants obtained as a result of this study was compared with the list of monographs and pharmacopeia published by the World Health Organization (WHO), European Medicines Agency (EMA), European Scientific Cooperative on Phytotherapy (ESCOP), German Commission E (E-Com), British Herbal Medicine Association (BHC, BHP) and Pharmacognosy and Phytotherapy Association-Turkey (FFD)[42].

Results and Discussion

Demographic features of informants

We determined and recorded demographic characteristics of the respondents during the face-to-face interviews. We interviewed 137 respondents, all over 30 years of age. Of the participants, 104 were male and 33 were female. The age of participants varied between 31 and 86 and the mean age was 64. Of the participants, 5 were between the ages of 30 and 40, 8 were between the ages of 41 and 50, 34 were between the ages of 51 and 60, 42 were between the ages of 61 and 70, 43 were between the ages of 71 and 80 and 5 were over the age of 81 (Table 1). The participants were mainly farmers, shepherds, housewives, a local healer, tradesman, headmen of the village and retired individuals. All of the respondents were native to Biga or had lived in Biga for more than 30 years.

Medicinal plants and associated knowledge

The plants used for medicinal purposes in Biga are listed in Supplementary Table 1. The list is arranged in alphabetical order according to family and botanical names, together with relevant information. Taxonomical changes to the *International Plant Name Index*[39] are shown in parentheses in Supplementary Table 1. Also comparison of this study with previous medicinal plant studies is presented in Supplementary Table 1. We excluded from the plant list any information that was not clear and for which usage data were described, but the plants not shown. New uses of plants are marked in bold in Supplementary Table 1. Medicinal uses of 104 taxa belonging to 49 families and 87 genera were identified for Biga. Of these, 66 plant taxa were wild and 38 were cultivated. Twenty-seven of these plants were cultivated for food in this particular region. *Papaver somniferum* L. is planted for medicinal use and for food and *Momordica charantia* L. and *Salvia officinalis* L. are planted for medicinal use in Biga. Eight species (*Mesembryanthemum cordifolium* L. *Calendula officinalis* L., *Opuntia* spp., *Tradescantia* spp, *Sedum telephium* L., *Cupressus sempervirens* L., *Pelargonium* spp., *Rosmarinus officinalis* L.) were planted in gardens as ornamental plants but were also used for medical purposes. Lamiaceae and Rosaceae (12.5% each) were the most represented family with

Table 1 — Demographic characteristics of people interviewed

Age	n (%)
30-40	5 (3.65)
41-50	8 (5.84)
51-60	34 (24.82)
61-70	42 (30.66)
71-80	43 (31.39)
81-86	5 (3.65)

13 taxa of medicinal plants, followed by Asteraceae (6.7%) with 7 taxa, Apiaceae, Cucurbitaceae, Fabaceae with 4 taxa (3.8% each), and Asparagaceae, Moraceae (2.9% each) with 3 taxa (Fig. 3). In previous studies, Liliaceae was one of the most used families of medicinal plants, but not so in recent years since some authorities have recircumscribed the family and thus, removed certain genera[39]. Had these taxonomical changes not been made, Liliaceae would have been the fourth-largest family of medicinally used plants in Biga.

Previous studies for Europe and the Mediterranean Basin revealed that Lamiaceae, Asteraceae, and Rosaceae were the most commonly used families for medicinal purposes[8,43]. The relatively frequent use in the Mediterranean region of members of these three families as herbal medicine is not new. Similar results were obtained for other ethnobotanical studies conducted in regions adjacent to our study area, but the use of Lamiaceae, Asteraceae and Rosaceae as traditional treatment was greater[15,16,19,23,24,29,33,34]. This reflects the abundance of these three families in Turkey and their significant use in folk medicine, as well as the considerable cultural diversity of the region.

Comparison with previous studies reveal that 22 of the 104 taxa reported in this study have not hitherto been reported as being used for medicinal purposes. These wild species are: *Crepis zacintha* (L.) Babc., *Heracleum sphondylium* subsp. *ternatum* (Velen.) Brummitt, *Nymphaea alba* L., *Ornithogalum montanum* Cyr., *Quercus pubescens* Willd., *Rumex pulcher* L., *Sorbus domestica* L., *Taraxacum aleppicum* Dahlst., *Thymus thracicus* Velen. var. *longidens* (Velen.) Jalas, *Verbascum densiflorum* Bertol., whereas cultivated or ornamental taxa include: *C. officinalis*, *Cerasus vulgaris* Mill., *Cucurbita maxima* Duchesne, *M. cordifolium*,
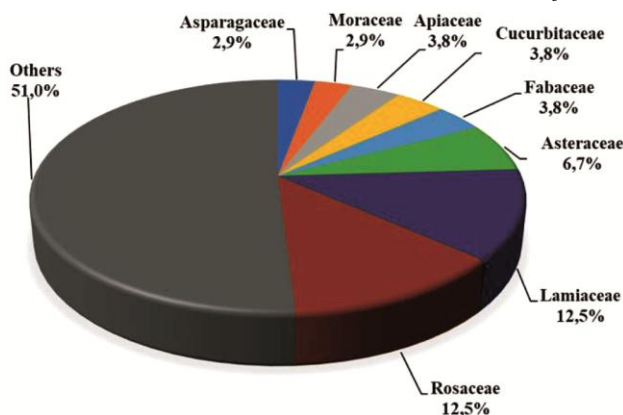

Fig. 3 — The most common families in terms of taxa richness

Opuntia spp., *Lens culinaris* Medik., *P. somniferum*, *Pelargonium* spp., *Tradescantia* spp., *Triticum aestivum* L., *Solanum melongena* L., *S. tuberosum* L. (Supplementary Table 1). *H. sphondylium* sub sp. *ternatum* roots are used as an external application for the treatment of hemorrhoids. Simultaneously, a decoction of the roots is prepared and drunk to treat the same ailment. This observation, however, is not consistent with results obtained for neighboring areas. In Manisa, the aerial parts of *H. platytaenium* Boiss., together with *Verbascum* sp., are also used for hemorrhoids[26,27]. Furthermore, 24 taxa which we have shown in previous studies to be used for medicinal purposes are also well known in Biga and used there for the treatment of various ailments (Supplementary Table 1). These include *Allium cepa* L. (wounds), *Allium sativum* L. (bee sting, insect sting), *Arum maculatum* L. (hemorrhoids) *Centaurium erythraea* Rafn (stomach ailments), *Cydonia oblonga* L. (cough, sore throat), *Ecballium elaterium* (L.) A.Rich. (eczema, hemorrhoids, hepatitis, rheumatism, sinusitis), *Equisetum telmateia* Ehrh. (kidney diseases, prostate), *Ficus carica* L. (earache, toothache, warts) *Hypericum perforatum* L. (stomach ailments, wounds), *Juglans regia* L. (antifungal, hypercholesterolemia), *Lavandula stoechas* L. (cardiac diseases, as a sedative and for shortness of breath), *Matricaria chamomilla* L. (cough, gastrointestinal diseases, sore throat), *M. charantia* (wounds, ulcers), *P. brutia* (stomach ailments, wounds), *Plantago lanceolata* L. and *P. major* L. (wounds), *Pyrus elaeagnifolia* Pallas (diabetes), *Rosa canina* L. (diabetes, flu, rheumatism, stomach-ache), *Rubus canescens* DC., *R. sanctus* Schreb. (wounds), *Tamus communis* L. (hemorrhoids, local pain, rheumatism), *Tilia argentea* Desf. ex DC. (flu, sore throat), *Urtica dioica* L., *U. urens* L. (cancer, hypercholesterolemia, kidney disease).

Overall, we found that 21 taxa are used in Biga to treat diabetes. In particular, 6 of 13 taxa in Rosaceae are used to treat diabetes. We consider this data quite remarkable. For example, a pickle of *P. elaeagnifolia* (Rosaceae), which also has a different medicinal use, is consumed in the study area to treat diabetes.

Species such as *H. perforatum, L. stoechas, E. elaterium* were found to be the most commonly used plants. The reason for this may be related to the widespread of these species in Biga. We have shown that in Biga, *H. perforatum* is the most commonly used species for the treatment of gastrointestinal and dermatological diseases. An olive oil macerate of the flowering aerial parts is popular for ulcers, stomach

pain, and the treatment of wounds. *L. stoechas* is used in Biga as a sedative and for Parkinson's disease. Fruit of *E. elaterium* is used in the traditional medicine of Biga for eczema, hemorrhoids, migraine, sinusitis, headache, epilepsy, hepatitis, leg pain, rheumatism, and arm pain. These uses are common in Turkey and the Mediterranean region[12,13,15-17,19,22-24,26,27,29-34,36,37].

Species of the following genera (*Hypericum* L., *Lavandula* L. and *Ecballium* A. Rich.) are widespread not only in Biga, but also in Turkey. Moreover, they are the most widely used throughout Europe. The most common medicinal species in Biga, such as *H. perforatum*, is also the most commonly used throughout south-western Europe[8].

E. telmateia, H. perforatum, *Helichrysum stoechas* subsp. *barrelieri* (Ten.) Nyman, *L. stoechas*, *Malva sylvestris* L.*, M. chamomilla*, *Melissa officinalis* L., *Origanum vulgare* (Link) Ietsw., *R. canina*, *Rubus canescens*., *R. sanctus, T. argentea, U. dioica* and *U. urens* are harvested from the wild and sold at local markets. Kızılarslan Hançer et al. (2020) stated that *Origanum* L., *Malva* L., *Rosa* L., *Rubus* L., *Tilia* L. and *Urtica* L., which are sold in local markets, are also consumed as food in Biga[44].

One of the important studies allowing the accurate recognition of plants is that of vernacular names. The findings of our previous study of Biga recorded 283 plant names belonging to 142 wild taxa that have been used traditionally for medicinal purposes. A knowledge of many plant names indicates the importance of plants in the life of the local people. Since often different species of the same genus closely resemble each other, they were not only known by the same local name, but were also used for the same medicinal purposes in the study area. For example, *P. lanceolata* and *P. major* are known as "Sinirli ot", *R. canescens* and *R. sanctus* are known as "Böğürtlen, Karamuk"; *Rumex crispus* L. and *R. pulcher* are known as "Eşek labadası, Labada", *T. thracicus* and *T. longicaulis* are known as "Yabani kekik, Yer kekiği" and *U. dioica*. and *U. urens* are known as "Isırgan" (Supplementary Table 1).

Whereas in Biga plants are given local names, they are also often called after the ailment that they are used to treat. They are as follows: "hemoroit otu" = "hemorrhoids weed" in English (*H. sphondylium* subsp. *ternatum*, "mayasıl otu" = "hemorrhoids or eczema weed" in English (*H. sphondylium* subsp. *ternatum*, *Teucrium chamaedrys* L. subsp. *chamaedrys*), "mide otu" = "stomach weed" in English (*H. perforatum*,

Teucrium polium L.), "prostat otu" = "prostate weed" in English (*E. telmateia*), "and "siğil otu" = "wart weed" in English (*C. zacintha*). In addition, *Cnicus benedictus* L. var. *benedictus* is called as "yılanotu" and is used to treat snake bites.

Growth forms and utilization of plant parts

In our present study, herbaceous plants (57%) were found to be the most commonly used, followed by trees (24%), shrubs (14%) and geophytes (5%).

The parts of the plants used for medicinal purpose include leaves, aerial parts, young stems, bulbs, flowers, fruit, cones, and roots. The study revealed that leaves were the most frequently used parts for the treatment of ailments (23%), confirming some ethnobotanical studies for the neighboring areas[16,17,21,25,29,30,33-37]. Fruit (21%), aerial parts (16%), flowers (10%), roots and seed (6% each), as well as tubers (3%) were also commonly used for medicinal purposes in Biga (Fig. 4). In some species, more than one plant part was used. Of the species recorded, *E. elaterium*, *E. angustifolia*, *F. carica*, *J. regia*, *M. sylvestris*, *R. canescens*, *R. sanctus*, *U. dioica*, and *U. urens* were the most popular plants used to treat many ailments (Supplementary Table 1).

Mode of preparation–utilization method

Our present work revealed that various preparation methods such as infusion, decoction, crushing, ingestion, chewing, maceration, and steeping in olive oil are used. The most common preparation methods were decoction (54 usage records) and infusion (46 usage records) (Supplementary Table 1). These results agree with those obtained for other medicinal plant studies conducted in the west of Turkey[22,29,31,33-35,37].

Our data indicate that oral administration (internal) is the form of application most commonly used for herbal preparations in Biga, followed by topical application (external). Oral herbal medicines are administered in the
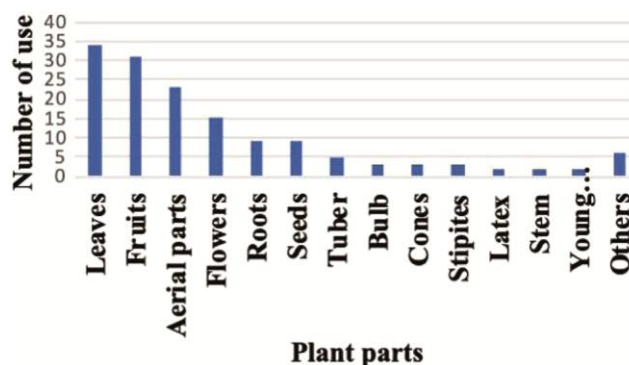

Fig. 4 — Parts of medicinal plants commonly used

form of tea (decoction and infusion), eaten fresh, swallowed directly by cutting plant material into small pieces, or crushing it and mixing with yogurt or honey. The local people also use other ingredients, such as olives, butter, flour, salt, sugar, honey, and lemon to prepare herbal preparations. For example, *Laurus nobilis* L., whose dry fruits are powdered, mixed with honey and eaten for headache. This observation agrees with those of other researchers[35,36]. However, it has been recorded that *L. nobilis* is also used for sinusitis[34], rheumatism[26,34,35], abdominal pain and toothache[14]. Another example, male cones of *P. brutia* var. *brutia* are steeped in honey and eaten as an expectorant by smokers. Turkish Red Pine is used in the west of Turkey for asthma[20,26,30], bronchitis[14,26,27] and tuberculosis[26,27]. Moreover, the use of *P. brutia* for the treatment of asthma has been reported in most studies undertaken in Turkey[45].

Many plants are pre-treated before being used to prepare certain herbal remedies. For example, molasses, oleate, syrup etc. Molasses ("pekmez" in Turkish), produced in Biga from fresh fruit containing large quantities of sugar, such as grapes, black mulberry and watermelon is one of the most popular and traditional Turkish foods and is taken orally. Black mulberry molasses is eaten in Biga for aphtha and cancer, watermelon molasses for bronchitis and asthma, and grape molasses for poisoning. Polat and Satıl[27] reported the use of grape molasses for tonsillitis and anemia[25]. It is also used in the treatment of gastrointestinal diseases.

Some herbal preparations are kept for a period following preparation before using. Aerial parts of *H. perforatum, C. erythraea* and fruit of *M. charantia* are steeped in olive oil for from 15 days to 2 months before use and oil is taken orally before breakfast for ulcer and stomach ailments. Furthermore, we discovered that three oils are used externally for wound healing in the study area. These results agree with those for medicinal plant studies conducted in the west of Turkey[12-16,21-35,37]. However, *M. charantia* fruit, crushed and mixed with honey, is eaten for stomach ailments. Another example of preparation by steeping is *J. regia*. Walnut seeds are steeped in olive oil with sugar for 40 days and one coffee-spoonful of syrup is taken before breakfast for duodenal ulcers. This new medicinal use for this species was recorded for the first time in western Turkey. However, it was found that walnut seed prepared as a maceration can be used for hypercholesterolemia. This result agrees with that of Sargın *et al.*[26,27].

Local people usually avoid using plant material that has not been pre-treated or diluted with water e.g. *A. maculatum* and *E. elaterium*. For example, tubers of *A. maculatum* are kept in milk for 1 week and the milk changed daily. The tuber is swallowed as a remedy for hemorrhoids. Conversely, the tubers of *T. communis* are used in Biga (without pre-treatment) for the internal treatment of hemorrhoids. This agrees with observations made by Tuzlacı and Eryaşar Aymaz (2001)[29]. However, the local people warn about the external use of this plant in the treatment of rheumatism and application of the ointment to the skin should not be prolonged. Careful use of these plants is highly recommended, as any overdose could be harmful[14].

Comparative analysis of ethnobotanical studies

Based on the results of our study, we determined that some traditional uses of medicinal plants in Biga are similar to those documented in other studies. Species whose medicinal use was determined in the study were compared with 26 ethnobotanical studies undertaken in the neighboring areas. Similarity indices are presented in Table 2. Regions with a similarity index above 50% were Enez (Edirne), Marmara Island (Balıkesir), Ezine (Çanakkale), Havran, Çan (Çanakkale), Gönen (Balıkesir), Kapıdağ Peninsula, and Lalapaşa (Edirne)[16,25,29-31,33,34]. The results reveal that maximum similarity occurs for the study conducted in Enez (Edirne), with a value of 65.52%[22]. The reason for the high degree of similarity between Enez and Biga, even though they are not adjacent provinces, may be that both regions have similar floral and cultural characteristics.

Data analysis and literature review

Use Value

The use value (UV) index, which has generally been used to quantify the relative importance of useful plants, was employed to determine that of local plants known to be used medicinally in Biga, as indicated by informants. The UV values of plant taxa which this research indicates are used therapeutically are given in Supplementary Table 1. In our present work, UV ranges from 0.52 to 0.01. The species with the highest use value was *H. perforatum,* popularly known as "sarı kantaron", with an UV of 0.52. The other highest use values were for *L. stoechas* subsp. *stoechas* (0.41), *E. elaterium*, (0.34), *M. chamomilla* L. var. *recutita* (L.) Grierson (0.28), *C. erythraea* (0.25), *T. argentea* (0.24), *U. dioica, U. urens* and

Table 2 — Similarity percentages of neighboring ethnobotanical studies

Studies	Research area (city)	Total medicinal taxa	Number of identical taxa	Similarity percentage %
Güneş (2018)	Enez (Edirne)	29	19	65.52
Bulut (2016)	Marmara Island (Balıkesir)	22	14	63.64
Tuzlacı and Emre Bulut (2007)	Ezine (Çanakkale)	66	39	59.09
Polat and Satıl (2012b)	Havran	9	5	55.56
Uysal et al., (2008)	Çan (Çanakkale)	68	37	54.41
Tuzlacı and Eryaşar Aymaz (2001)	Gönen (Balıkesir)	84	44	52.38
Uysal et al., (2010)	Kapıdağ Peninsula	44	23	52.27
Tuzlacı et al., (2010)	Lalapaşa (Edirne)	55	28	50.91
Bulut and Tuzlacı (2015)	Bayramiç (Çanakkale)	89	43	48.31
Yeşilyurt et al., (2017)	Marmara Region	68	32	47.06
Uysal et al., (2012)	Ayvacik (Çanakkale)	43	20	46.51
Selvi et al., (2013)	Kazdağları (Edremit-Balıkesir)	11	5	45.45
Uysal (2010)	Kazdagi Forest National Park	35	15	42.86
Güler et al., (2015)	Turgutlu (Manisa)	54	22	40.74
Polat and Satil (2012a)	Edremit Gulf	118	47	39.83
Tümen and Sekendiz (1989)	Balıkesir	76	28	36.84
Bulut and Tuzlacı (2013)	Turgutlu (Manisa)	76	27	35.53
Çelik et al., (2008)	Kazdağı	29	10	34.48
Kalankan et al., (2015)	Mount Ida	51	17	33.33
Sargın et al., (2013)	Alaşehir (Manisa)	137	40	29.20
Sargın et al., (2015)	Sarigöl district (Manisa)	141	33	23.40
Duran et al., (2001)	Balıkesir	52	12	23.08
Emre Bulut and Tuzlacı (2006)	Bozcaada (Çanakkale)	81	18	22.22
Akalın and Alpınar (1994)	Tekirdağ	52	10	19.23
Gönüz et al., (2008)	Çan (Çanakkale)	12	2	16.67
Alpınar (1999)	Ayvalık (Balıkesir)	67	17	25.37

Table 3 — Categories of ailments and informant consensus factor (FIC) for each category

	Use categories	Number of use report (N_{ur})	Number of taxa (N_t)	Consensus factor (FIC)
1	Respiratory diseases	190	32	0.84
2	Dermatological diseases	217	41	0.81
3	Gastrointestinal diseases	261	50	0.81
4	Urinary diseases	100	22	0.79
5	Heart and circulation system diseases/ cardiovascular diseases	74	18	0.77
6	Musculoskelatal system	54	15	0.74
7	Cancer	26	8	0.72
8	Endocrin system disorders	77	28	0.64
9	Sensory organs (eye, tooth, ear)	23	10	0.59
10	Neurologic and psychological diseases	25	11	0.58

C. oblonga (0.23), *A. cepa* and *Prunus spinosa* L. subsp. *dasyphylla* (Schur) Domin (0.22) (Supplementary Table 1). The number of times a taxon is cited for a given disease, the more reliable the information is likely to be. Conversely, several studies have demonstrated that an unusual use for a particular plant mentioned by a single informant is also very important[7]. Some studies based on information obtained from ethnobotanical studies undertaken in Turkey reveal pharmacological activity by plants not usually used in traditional medicine. Of these, Yeşilada *et al.*[7] listed the most frequently used in Turkish folk medicine, of which *H. perforatum*, *E. elaterium*, *U. dioica* and *A. cepa* were the most frequently used in Biga.

Informant consensus factor

Informant consensus factor (FIC) values of the ailments for which the medicinal plants recorded in this survey are used to treat are listed in Table 3. The highest FIC values (0.84) were obtained for respiratory disease,

followed by gastrointestinal and dermatological diseases (0.81) and urinary infections (0.79). Heart and circulatory system diseases/ cardiovascular diseases (0.77), musculoskeletal system (0.74), cancer (0.72), endocrine system disorders (0.64) and sensory organs (eye, tooth, ear) (0.59) followed. The use category with the lowest FIC value was neurologic and psychological diseases (0.58). These results show that herbal treatment is mostly used in the region for respiratory, gastrointestinal and dermatological illnesses. Moreover, the high FIC value indicates that these diseases are more prevalent in Biga. These results agree with other studies conducted in Turkey and other countries[14]. The natives of the region use a total of 50 plant species for gastrointestinal disease, followed by 41 for dermatological diseases and 32 for respiratory disease. According to our study, in this particular area, the greatest number of plant species was used to treat gastrointestinal disorders. The use of such a large number of plant species for the treatment of these ailments in the region may be due to the possible high occurrence of such medical problems in the study area.

Comparison of medicinal plants in the study area with monographs and pharmacopoeias

Fifty-five taxa of 104 determined to be used medicinally in Biga and its surrounding areas were documented in the monographs and pharmacopoeias (WHO, EU, ESCOP, E-Com, BHC/BHP, FFD) examined (Table 4). Of the 104 plant taxa, 19 were found to be in WHO monographs, 32 in EU monographs, 22 in ESCOP monographs, 35 in E-Com monographs, 26 in BHC/BHP monographs and only 38 species in FFD monographs. Only 52% of the species mentioned in our study are found to be in these monographs. This demonstrates the wealth of knowledge in the region of using species for medicinal purposes.

We may not be able to predict what people mainly prefer to use when they get sick, however, it is often said that initially they prefer to use a herbal treatment for simple illnesses like colds, flu, etc. In addition, we discovered that some edible plants such as nettle are consumed for health purposes. It is widely believed by the

Table 4 — The place of medicinal plants in Biga in monographs and pharmacopoeia

Plant name	WHO	EMA	ESCOP	E-Com	BHC/BHP	FFD	Plant name	WHO	EMA	ESCOP	E-Com	BHC/BHP	FFD
*Allium cepa**	x	x		x			*Papaver somniferum**						
*Allium sativum**	x	x	x	x	x	x	*Pelargonium* spp.*		x				
*Brassica oleracea**						x	*Petroselinum crispum**		x	x	x	x	
Calendula officinalis	x	x	x	x	x	x	*Plantago lanceolata*		x	x	x		x
Capsella bursa-pastoris		x		x	x	x	*Prunus spinosa* subsp. *dasyphylla*				x		
Centaurium erythraea		x	x	x	x	x	*Quercus pubescens*		x		x	x	
Cnicus benedictus var. *benedictus*				x	x		*Ranunculus ficaria* subsp. *ficariiformis*					x	
Crataegus monogyna subsp. *monogyna*	x	x	x	x	x	x	*Rosa canina*			x	x		x
Crataegus pentagyna							*Rosmarinus officinalis**	x	x	x	x	x	x
*Cupressus sempervirens**						x	*Rubus idaeus**		x		x	x	
Daucus carota				x	x		*Rumex crispus*						x
Ecballium elaterium						x	*Ruscus aculeatus* var. *aculeatus*		x	x	x		x
*Ficus carica**				x			*Ruscus aculeatus* var. *angustifolius*		x	x	x		x
Foeniculum vulgare		x			x	x	*Salix alba*	x	x	x	x	x	
Hypericum perforatum	x	x	x	x	x	x	*Salvia officinalis**	x	x	x	x	x	x
*Juglans regia**		x		x		x	*Silybum marianum*	x	x	x	x	x	x
Juniperus oxycedrus subsp. *oxycedrus*						x	*Solanum tuberosum**						
Lavandula stoechas subsp. *stoechas*						x	*Tilia argentea*		x		x		

(*Contd.*)

Table 4 — The place of medicinal plants in Biga in monographs and pharmacopoeia

Plant name	WHO	EMA	ESCOP	E-Com	BHC/BHP	FFD	Plant name	WHO	EMA	ESCOP	E-Com	BHC/BHP	FFD
Malva sylvestris		x	x	x		x	*Tribulus terrestris*	x					x
Matricaria chamomilla var. *recutita*	x	x	x	x	x	x	*Triticum aestivum**						
Melissa officinalis subsp. *altissima*	x	x	x	x	x	x	*Urtica dioica*	x	x	x	x	x	x
Mentha x *piperita**	x	x	x	x	x	x	*Urtica urens*	x	x	x	x	x	x
Momordica charantia *	x					x	*Verbascum densiflorum*		x		x	x	
*Morus alba**						x	*Viscum album* subsp. *album*		x		x	x	x
*Morus nigra**						x	*Vitex agnus-castus*	x	x	x	x	x	x
*Olea europaea**		x		x		x	*Vitis vinifera**		x	x			x
Origanum vulgare subsp. *hirtum*	x			x		x	*Zea mays**	x				x	
Papaver rhoeas				x		x							

(*Cultivated; WHO: Who Monographs on Selected Medicinal Plants, Vol. 1,2,3,4 and WHO Monographs on Medicinal Plants Commonly Used in the Newly Independent States; EMA: European Medicines Agency, Herbal Medicines for Human Use; ESCOP: European Scientific Cooperative on Phytotherapy Monographs; E-Com: The Complete German Commission E Monographs; BHC: British Herbal Compendium; BHP: British Herbal Pharmacopoeia; FFD: Monographs of Pharmacognosy and Phytotherapy Association)

participants that it must be eaten at least once a year for health purposes[45].

Conclusion

In the present study, the traditional uses of medicinal plants are investigated for Biga for the first time. The results reveal much information about the traditional use of plants in Biga for the treatment of ailments. Now, in the twentieth century, and for many areas, our knowledge of plants used in traditional medicine, which has a long history, is quickly disappearing as it is replaced by modern medicine and this, in turn, has a detrimental effect on the population's use of plants for medicinal purposes. Naturally, many people prefer to use modern medical drugs, as recommended by doctors. However, some people in rural areas still use herbal treatment methods. This study reveals that traditional herbal medicine, which is a cultural heritage in the study area, is still alive and this is mainly due to the elderly people of the region. The fact that such information is mostly known by elderly people may indicate that young people have become estranged from the use of plants in their region owing to their education and more rapid adaptation to modern life. It is obvious that unless researchers document ethnobotanical information obtained in studies of this kind, that this traditional information will be lost forever.

Consequently, this study contributes towards a move to protect the rights of the local people of Turkey, their resources and knowledge, as well as contributing to our knowledge of Mediterranean medicinal plants.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at http://nopr.niscpr.res.in/jinfo/ijtk/IJTK_21(03)(2022)583-594_SupplData.pdf

Conflict of Interest

Authors should declare no competing or conflict of interest.

Authors' Contributions

Conceptualization: ES, CKH, MA, Funding Acquisition: ES, Resources: ES, CKH, BBA, EAÇ,

Software: ES, CKH, Supervision: ES, Roles/Writing-original draft: ES, CKH, BBA, MA, Writing – Original Draft Preparation: ES, CKH, BBA, MA, Writing – Review & Editing: ES, CKH, BBA, MA, EAÇ.

References

1 Heinrich M, Ethnobotany and its Role in Drug Development, *Phytother Res*, 14 (2000) 479-488.

2 Pieroni A & Quave C L, Traditional pharmacopoeias and medicines among Albanians and Italians in southern Italy: a comparison. *J Ethnopharmacol*, 101 (1-3) (2005) 258-270.

3 Silva H C H, Caraciolo R L F, Marangon L C, Ramos M A, Santos L L, *et al.,* Evaluating different methods used in ethnobotanical and ecological studies to record plant biodiversity, *J Ethnobiol Ethnomed,* 10 (2014) 48. https://doi.org/10.1186/1746-4269-10-48.

4 Willis K J (eds.), *State of the World's Plants 2017 Report*, (Royal Botanic Gardens, Kew), 2017.

5 Yeşilada E, Halk İlacından İlaç Geliştirilmesinde Saha ve Deneysel Çalışma, In: *Tıbbi ve Aromatik Bitkilerin Eczacılık ve Ormancılıktaki Önemi Çalıştayı* edited by N Sadıkoğlu, (İnönü Üniversitesi, Malatya, Turkey) 2014, p. 141-152.

6 Baytop T, *Türkiye'de Bitkiler ile Tedavi: Geçmişte ve Bugün*, 2nd edn, (Nobel Tıp Kitabevleri, İstanbul), 1999.

7 Yesilada E, An overview of turkish folk medicine; Past and present, *Curr Drug Deliv*, 10 (1) (2013) 92-95. https://doi.org/10.2174/1567201811310010015.

8 Pardo-de-Santayana M, Quave C L, Sõukand R & Pieroni A, Medical Ethnobotany and Ethnopharmacology of Europe, In: *Ethnopharmacology*, edited by M Heinrich & Anna K Jäger 2015, p. 343-355. https://doi.org/10.1002/9781118930717.ch29.

9 Mahapatraa M, Gurunga B, Somkuwarb B G, Thorata S S, Raia B, *et al.*, Perspectives of traditional health care system of Sikkim, North-East India – An ethno-pharmacological survey and analysis, *Indian J Tradit Know,* 20 (4) (2021) 965-981.

10 Geethu Krishna M G & Sanilkumar M G, Indigenous knowledge of coastline sacred groves in Central Kerala, India, *Indian J Tradit Know*, 18 (3) (2019) 541-546.

11 Ertuğ F, Etnobotanik, In: *Resimli Türkiye Florası*, Cilt 1, edited by A Güner & Tuna Ekim, (Ali Nihat Gökyiğit Vakfı, Flora Araştırmaları Derneği ve Türkiye İş Bankası Kültür Yayınları, İstanbul), 2014, p. 319-380.

12 Akalın E & Alpınar K, Tekirdağ'ın tıbbi ve yenen yabani bitkileri hakkında bir araştırma, *Ege Üniv Ecz Fak Derg*, 2 (1994) 1-11.

13 Alpınar K, *Ayvalık (Balıkesir) ve yakınındaki adaların floristik ve etnobotanik açıdan değerlendirilmesi*, (The Scientific and Technical Research Council of Turkey-TUBİTAK), 1999, TBAG Project No: 1407. https://trdizin.gov.tr/ publication/project/detail/TXpRek16TT0=

14 Bulut G & Tuzlaci E, An ethnobotanical study of medicinal plants in Turgutlu (Manisa-Turkey), *J Ethnopharmacol*, 149 (3) (2013) 633-647. https://doi.org/10.1016/ j.jep.2013. 07.016.

15 Bulut G & Tuzlacı E, An ethnobotanical study of medicinal plants in Bayramiç, *Marmara Pharm J*, 19 (2015) 268-282. https://doi.org/10.12991/mpj.201519392830.

16 Bulut G, Medicinal and wild food plants of Marmara Island (Balikesir-Turkey), *Acta Soc Bot Pol*, 85 (2) (2016) Article 3501. https://doi.org/10.5586/asbp.3501.

17 Çelik S, Karabacak E & Uysal I, Plants have been collected from mythological Kazdaği (Mt. Ida) National Park, West Turkey by Turkmens and their folk, cultural and social uses, *Eur J Sci Res*, 19 (2008) 835-843.

18 Duran A, Satıl F & Tümen G, Balıkesir yöresinde yenen yabani meyveler ve etnobotanik özellikleri, *Ot Sist Bot Dergisi*, (*The Herb Journal of Systematic Botany*), 8 (2001) 87-94.

19 Emre Bulut G & Tuzlacı E, An ethnobotanical study in Bozcaada (Çanakkale-Turkey), In: *Proceedings of the IV. International Congress of Ethnobotany,* edited by F Ertuğ, (*ICEB 2005*), 2006, p. 581-583.

20 Gönüz A, Yağan B D, Hürkan K, Ataş S & Döver E, Çan (Çanakkale-Türkiye) İlçesi Bitkisel Değerleri, In: *Çan Değerleri Sempozyumu* , edited by A Akdemir, Osman Demircan, Selehattin Yılmaz, Turan Takaoğlu & Evren Erginal, 28-29 Ağustos 2008, (Çanakkale Onsekiz Mart Üniversitesi Yayınları, Çanakkale, Türkiye), 2008, p. 13-32.

21 Güler B, Kümüştekin G & Ugurlu E, Contribution to the traditional uses of medicinal plants of Turgutlu (Manisa-Turkey), *J Ethnopharmacol*, 176 (2015) 102-108. https://doi.org/10.1016/j.jep.2015.10.023.

22 Güneş F, An ethnobotany study in Enez town from Edirne, *CUPMAP*, 1 (2018) 28-35.

23 Kalankan G, Özkan Z C & Akbulut S, Medicinal and aromatic wild plants and traditional usage of them in Mount İda (Balikesir/Turkey), *JABS*, 9 (2015) 25-33.

24 Polat R & Satil F, Research on some medicinal plants commercially sold in the Havran and Burhaniye region (Balıkesir-Turkey), *Bocconea*, 24 (2012a) 311-317.

25 Polat R & Satıl F, An ethnobotanical survey of medicinal plants in Edremit Gulf (Balıkesir-Turkey), *J Ethnopharmacol*, 139 (2) (2012b) 626-641. https://doi.org/10.1016/ j.jep.2011.12.004.

26 Sargin S A, Akçicek E & Selvi S, An ethnobotanical study of medicinal plants used by the local people of Alaşehir (Manisa) in Turkey, *J Ethnopharmacol*, 150 (3) (2013) 860-874. https://doi.org/10.1016/j.jep.2013.09.040.

27 Sargin S A, Selvi S & López V, Ethnomedicinal plants of Sarigöl district (Manisa), Turkey, *J Ethnopharmacol*, 171 (2015) 64-84. https://doi.org/10.1016/j.jep.2015.05.031.

28 Selvi S, Dağdelen A & Kara S, Kazdağlarından (Balıkesir-Edremit) Toplanan ve çay olarak tüketilen tıbbi ve aromatik bitkiler, *J Tekirdag Agric Fac*, 10 (2013) 26-33.

29 Tuzlacı E & Eryaşar Aymaz P, Turkish folk medicinal plants, Part IV: Gönen (Balikesir), *Fitoterapia*, 72 (4) (2001) 323-343. https://doi.org/10.1016/S0367-326X(00)00277-X.

30 Tuzlaci E & Emre Bulut G, Turkish folk medicinal plants, part VII: Ezine (Çanakkale), *J Pharm Istanbul Univ*, 39 (2007) 39-51.

31 Tuzlaci E, Alparslan Işbilen D F & Bulut G, Turkish folk medicinal plants, VIII: Lalapaşa (Edirne), *Marmara Pharm J*, 14, (2010) 47-52. https://doi.org/10.12991/201014463.

32 Tümen G & Sekendiz O A, Balıkesir ve merkez köylerinde halk ilacı olarak kullanılan bitkiler, In: *Proceedings of the VIII. Symposium on plant originated crude drugs,* edited by B Çubukçu, Günay Sarıyar & Afife Mat, (Istanbul University), 1989, p. 347–354.

33 Uysal I, Avcıoğlu N & Karabacak E, Çan ilçesinin köylerinde kullanılan tıbbi bitkiler, In: *Çan Değerleri Sempozyumu* edited by A Akdemir, Osman Demircan, Selehattin Yılmaz, Turan Takaoğlu & Evren Erginal, 28-29 Ağustos 2008, (Çanakkale Onsekiz Mart Üniversitesi Yayınları), 2008, p. 127-142.

34 Uysal I, Onar S, Karabacak E & Çelik S, Ethnobotanical aspects of Kapıdağ Peninsula (Turkey), *Biodivers Conserv*, (2010) 15-22.

35 Uysal I, Gücel S, Tütenocakli T & Öztürk M, Studies on the medicinal plants of Ayvacik-Çanakkale in Turkey, *Pak J Bot*, 44 (2012) 239-244.

36 Uysal I, An overview of plant diversity of Kazdagi (Mt. Ida) Forest National Park, Turkey, *J Environ Biol*, 31 (1-2) (2010) 141-147.

37 Yeşilyurt EB, Şimşek I, Tuncel T, Akaydın G & Yeşilada E, Marmara bölgesi'nin bazı yerleşim merkezlerinde halk İlacı olarak kullanılan bitkiler, *Marmara Pharm J*, 21 (2017) 132-148. https://doi.org/10.12991/marupj.259891.

38 Gürsu E, *Biga-Pegai*, (Biga Doğuş Matbaacılık, Çanakkale, Türkiye), 2001.

39 The Plant List, http://www.theplantlist.org, 2020, 02 Mar. 2020.

40 Trotter R T & Logan M H, Informant consensus: A new approach for identifying potentially effective medicinal plants, In: *Plants in Indigenous Medicine and Diet, Behavioural Approaches*, edited by N L Etkin, (Redgrave Publishing Company, Bredford Hills, New York), 1986, p. 91-112. https://doi.org/10.4324/9781315060385-6.

41 Van Wyk B E & Wink M, *Medicinal Plants of the World*, (Timber Press, Portland, Oregon), 2004.

42 Öztürk B, Demiröz T, Özdemir S & Karaalp C, Türkiye'nin tıbbi bitkilerinin farmakope ve bitki monograflarındaki yeri ve önemi, *Türk Farmakope Dergisi*, 3 (2018) 10-30.

43 Popovic Z, Smiljanic M, Matic R, Kostic M, Nikic P, *et al.*, Phytotherapeutical plants from the Deliblato Sands (Serbia): Traditional pharmacopoeia and implications for conservation, *Indian J Tradit Know*, 11 (3) (2012) 385-400.

44 Kizilarslan Hançer Ç, Sevgi E, Büyükkiliç Altinbaşak B, Altundağ Çakir E, *et al.*, Traditional knowledge of wild edible plants of Biga (Çanakkale) Turkey, *Acta Soc Bot Pol*, 89 (1) (2020) Article 8914. https://doi.org/10.5586/asbp.8914.

45 Kızılarslan Hançer Ç & Sevgi E, Ethnobotanical uses of genus *Pinus* L. (Pinaceae) in Turkey, *Indian J Tradit Know*, 12 (2013) 209-220.