Black Sea Journal of Engineering and Science
doi: 10.34248/bsengineering.1626358

Open Access Journal
e-ISSN: 2619 – 8991

Research Article
Volume 8 - Issue 2: 537-545/ March 2025

TRADITIONAL USAGE OF NATURAL VASCULAR PLANTS IN TAŞKÖPRÜ AND KAYAÜSTÜ PLATEAUS (GÜMÜŞHANE) AND EVALUATION OF CURRENT PRODUCTION METHODS

Arzu ERGÜL BOZKURT[1]*,Nebahat ÇİMEN[2], Diren Uycan SARAÇ[2]

[1]*Artvin Çoruh University, Faculty of Forestry, Department of Forest Engineering, 08000, Artvin, Türkiye*
[2]*Karadeniz Technical University, Faculty of Forestry, Department of Forest Engineering, 61000, Trabzon, Türkiye*

Abstract: Ethnobotanical studies have recorded the interaction between plants and people over the centuries, enabling this interaction to be used for the development of rural areas. The aim of this study, which was conducted in Taşköprü and Kayaüstü plateaus in Gümüşhane province, was to reveal the ethnobotanical uses of natural vascular plants by the local people and to evaluate and recommend the current production methods of these plant species. As a result of interviews with local people in Taşköprü and Kayaüstü plateaus, natural vascular plant taxa used by local people were identified. Information such as local names of these plants, areas of use, parts used, preparation methods were recorded. Twenty-seven natural vascular plant taxa were identified in the study; these plant taxa are *Alchemilla erythropoda* Juz., *A. sericea* Willd., *A. mollis* (Buser) Rothm, *Astragalus acmophyllus* Bunge, *Berberis vulgaris* L., *B. integerrima* Bunge, *Caltha palustris* L., *Crataegus orientalis* Pall. ex M.Bieb. subsp. *orientalis*, *Foeniculum vulgare* Mill., *Pyrus elaeagrifolia* Pall., *Rosa canina* L., *R. boissieri* Crep., *R. spinosissima* L., *Rubus canescens* DC. var. *canescens*, *R. idaeus* L. subsp. *idaeus*, *R. saxatilis* L., *Rumex alpinus* L., *R. angustifolius* Campd. subsp. *angustifolius, R. ponticus* E.H.L. Krause, *R. scutatus* L., *Sempervivum davisii* Muirhead subsp. *furseorum* (Muirhead) Karaer, *Smilax excelsa* L., *Thymus nummularius* M.Bieb., *T. sipyleus* Boiss., *Urtica dioica* L., *Vaccinium myrtillus* L. and *V. uliginosum* L. Taking into account previous studies in the literature, It was concluded that the most common techniques used to production the 27 plant taxa identified in the research area were seed (52%), tissue culture (27%) and cuttings (21%). This study is significant because it demonstrates the diversity of plant capacity in the plateaus, the breadth of traditional plant knowledge, and the recommendations it makes for production methods. Pharmacologists, botanists, economists, and planners working on local development projects are expected to find significant value in the study's findings.

Keywords: Gümüşhane, Traditional usage, Taşköprü and Kayaüstü Plataeus, Production techniques

***Corresponding author:** Artvin Çoruh University, Faculty of Forestry, Department of Forest Engineering, 08000, Artvin, Türkiye
E mail: arzu.ergulbozkurt@artvin.edu.tr (A. ERGÜL BOZKURT)
Arzu ERGÜL BOZKURT https://orcid.org/0000-0003-0612-8120
Nebahat ÇİMEN http://orcid.org/0000-0002-1795-050X
Diren Uycan SARAÇ https://orcid.org/0000-0002-7859-3972

Received: January 24, 2025
Accepted: March 07, 2025
Published: March 15, 2025
Cite as: Ergül Bozkurt A, Çimen N, Saraç DU. 2025. Traditional usage of natural vascular plants in Taşköprü and Kayaüstü plateaus (Gümüşhane) and evaluation of current production methods. BSJ Eng Sci, 8(2): 537-545.

1. Introduction

Türkiye's geographic location, geomorphological structure, and variety of ecological circumstances all contribute to its abundant flora (11,473 plant taxa. Due to this diversity and richness of plant species, the interest in traditional usage of natural vascular plants have a long research history in Türkiye (Güner et al., 2000; Özhatay et al., 2011; Polat et al., 2015)

Ethnobotanical studies not only record the interaction between plants and humans for centuries, but also pave the way for the utilization of the benefits of this interaction for the development of rural areas, the protection of biodiversity, the identification of used, exported and endangered species, and legal regulations in this regard. The number of plants that is collected from various places of Anatolia and used in kitchen is pretty much. This feature is an important example that reflects the relationship between man and geographical environment as well. Human beings have been using plants for food, medicinal, feed, dye, cosmetic and psychological purposes for hundreds of years (Özkan and Akbulut, 2012; Saraç et al., 2013). However, due to unconscious harvests of some plants, these plants are faced with seperation and extinction from the ecosystem. Medical and aromatic plants need to be met from natural sources, determination of the inventory of these species in order to ensure participation to its national economy, being made in accordance with the techniques of harvesting and using methods and also knowing production methods and making production to ensure its sustainability (Atar et al., 2017).

In the Black Sea Region, ethnobotanical research has been done before (Fidan et al., 2004; Ezer and Arısan, 2006; Türkan et al., 2006; Cansaran and Kaya, 2010; Koca and Yıldırımlı, 2010; Sağıroğlu et al., 2012; Akbulut and Bayramoğlu, 2014; Polat et al., 2015). Although ethnobotanical studies (Özkan et al., 2002; Kandemir and

Beyazoğlu, 2002; Korkmaz, 2014; Korkmaz and Karakurt, 2015) have been carried out in Gümüşhane region before, it has been determined that no study has been carried out on the highlands that locally represent the high mountain sections of the region. This study is unique in terms of representing the plant species diversity and utilization in the high altitude plateaus of Gümüşhane region. In this study aim to transfer of knowledge about the traditional usage of natural vascular plant taxa in Taşköprü and Kayaüstü Plateaus (Gümüşhane). In addition, since the production of plant taxa is very important in terms of regional development and continuity, the current production methods of these plant taxa identified in the region were investigated according with literature and suggestions were made about the production methods.

2. Materials and Methods

This study was carried out during the spring and summer of 2017-2018, as this is when people typically visit the plateau. In the province of Gümüşhane, twenty-seven species are gathered as study materials from the Taşköprü and Kayaüstü plateaus, and their intended application is identified. Taşköprü Plateau is 2140 meters and Kayaüstü Plateau is 1950 meters above sea level (Figure 1). At least one plant sample was prepared and deposited at Herbarium of Karadeniz Technical University Faculty of Forestry (KATO). Plant taxa were given Turkish names in accordance with Güner et al. (2012). Before each interview began, an oral Prior Informed Consent (PIC) was obtained. Information about the usage of these plants are obtained from the face to face interviews of the people living at those places. In this study, 30 people (25 women and 5 men) from Taşköprü plateau and 22 people (18 women and 4 men) from Kayaüstü plateau were interviewed. Furthermore, these species production techniques was based on the findings in previous studies.

Figure 1. Location of the Taşköprü and Kayaüstü Plataeus on Turkiye Map (Adapted from Google Earth, 2024, Wikipedia, 2024).

3. Results and Discussion

Twenty-seven natural vascular plant taxa were identified as a result of interviews with 52 people. The majority of the interviewees are primary school graduates. They mostly consist of local people who make their livelihood with animal husbandry. Of the total 52 people; 45 are primary school graduates, 5 are secondary school graduates and 2 are university graduates. The majority of the people surveyed in the region were in the 45-55 age group. As a result of the study, it was determined that *Alchemilla erythropoda* Juz., *A. sericea* Willd., *A. mollis* (Buser) Rothm, *Astragalus acmophyllus* Bunge, *Berberis vulgaris* L., *B. integerrima* Bunge, *Caltha palustris* L., *Crataegus orientalis* Pall. ex M.Bieb. subsp. *orientalis*, *Foeniculum vulgare* Mill., *Pyrus elaeagrifolia* Pall., *Rosa canina* L., *R. boissieri* Crep., *R. spinosissima* L., *Rubus canescens* DC. var. *canescens, R. idaeus* L. subsp. *idaeus*, *R. saxatilis* L., *Rumex alpinus* L., *R. angustifolius* Campd. subsp. *angustifolius*, *R. ponticus* E.H.L. Krause, *R. scutatus* L., *Sempervivum davisii* Muirhead subsp. *furseorum* (Muirhead) Karaer, Smilax excelsa L., Thymus *nummularius* M.Bieb., T. *sipyleus* Boiss., *Urtica dioica* L., *Vaccinium myrtillus* L. and *V. uliginosum* L. plant taxa were intensively used for food purposes in Taşköprü and Kayaüstü plateaus. At the same time, it was determined that these plant taxa were consumed intensively for the treatment of various diseases.

At the end of the study, according with the literature the most commonly used production techniques of the identified 27 plant taxa were seed (52%), tissue cultere (27%) and cuttings (21%) (Figure 2). Rosaceae (11 taxa) and Polygalaceae (4) were the most often used families (Figure 3). Fruits (13 taxa) were the most commonly employed plant components in the preparations and applications, followed by leaves (11 taxa) and aerial parts (8 taxa) (Figure 4). General views of Taşköprü and Kayaüstü plateaus and some pictures of the plant taxa growing naturally there are shown in Figure 5 and Figure 6.

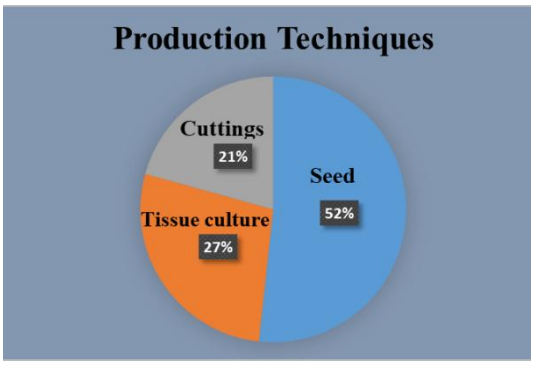

Figure 2. Percentage of plant taxa about production techniques.

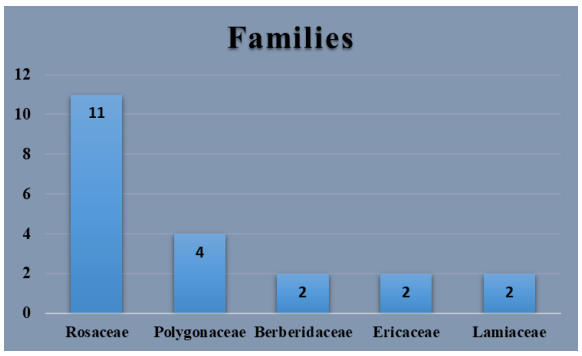

Figure 3. Families include the most number of taxa.

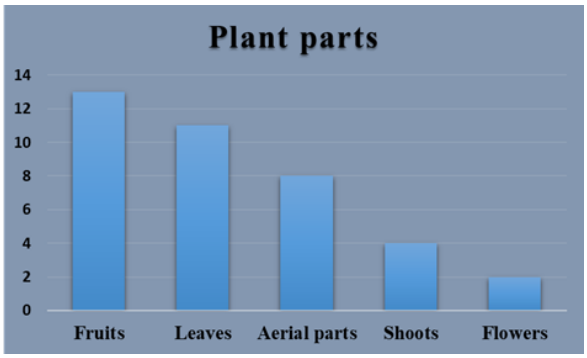

Figure 4. The most frequently used plant parts.

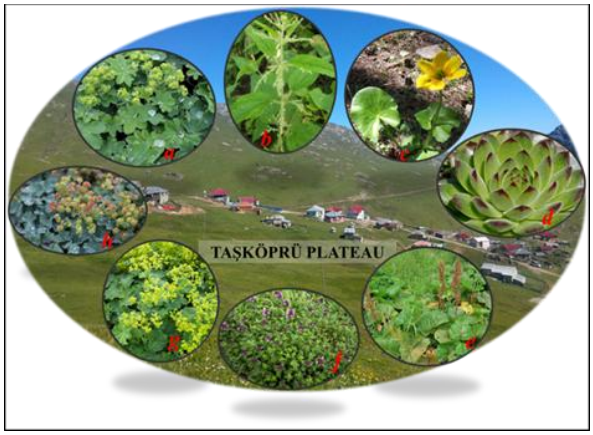

Figure 5. Images of Taşköprü Plateau and some natural vascular plant taxa (a: *Alchemilla sericea*, b: *Urtica dioica*, c: *Caltha palustris*, d: *Sempervivum davisii* subsp. *furseorum*, e: *Rumex alpinus*, f: *Thymus nummularius*, g: *Alchemilla mollis*, h: *Alchemilla erythropoda*).

Figure 6. Images of Kayaüstü Plateau and some natural vascular plant taxa (a: *Vaccinium uliginosum*, b: *Rosa canina*, c: *Smilax excelsa*, d: *Berberis vulgaris*, e: *Crataegus orientalis* subsp. *orientalis*, f: *Astragalus acmophyllus*, g: *Foeniculum vulgare*, h: *Vaccinium myrtillus*).

3.1. *Alchemilla erythropoda* Juz., *A. sericea* Willd. and *A. mollis* (Buser) Rothm

Alchemilla spp. naturally dominates the Eastern Black Sea Region and Türkiye. The perennial herbaceous plant Alchemilla L. is a member of the Rosaceae family, which includes species with significant therapeutic uses. With around 1000 species worldwide and 74 in Türkiye, it holds the distinction of being one of the most abundant genera within the Rosaceae family. The leaves of the plant taxon *A. erythropoda* Juz. are evaluated ethnobotanically. This plant taxon, whose leaves are usually consumed as tea, is used as a painkiller, diuretic and for the treatment of gynecological diseases. *A. sericea* Willd. A. sericea Willd. taxon is used in the treatment of Painkiller- AntiInflammation, Diuretic diseases. In traditional medicine, *A. mollis* (Buser) Rothm. is used to cure wounds and heavy menstruation (Küplemez et al., 2022; Ergene et al., 2025) . The production technique of these plant taxa are seed + tissue culture (Evenor et al., 2001; Anowska et al., 2016).

In the research areas, the above-ground parts of Alchemilla sp., which was called Keltat, plant taxa are utilized in the regions. It is intensively used as animal feed since it is known to increase the milk of animals. Local people use these plant taxa to treat diuretic diseases.

3.2. *Astragalus acmophyllus* Bunge

With 425 taxa, Astragalus L. (Fabaceae) is the most abundant genus in Turkish flora. *Astragalus acmophyllus* Bunge has the high antioxidant and antimicrobial activity Traditionally, astragalus has been used to treat leukemia and promote wound healing (Bedir et al., 2000; Albayrak and Kaya, 2018). This plant taxon is produced using seed + tissue culture (Kunz et al., 2016; Atalay et al., 2017).

The aboveground portions of *Astragalus acmophyllus* Bunge, known as Geven, are used in the study areas. It is widely utilized in the area for firewood and beekeeping. This taxon of plants is used by the locals to treat tuberculosis.

3.3. *Berberis vulgaris* L. and *B. integerrima* Bunge

In Türkiye, there are four species of Berberis that grow naturally: *B. vulgaris* L., *B. integerrima* Bunge, *B. cretica* L., and *B. crataegina* (Davis, 1965-1985). Fruits' anti-inflammatory, antibacterial, and antioxidant qualities, as well as their abundance of healthy ingredients, make them popular food supplements that boost immunity and nutrition. While the roots are used to cure jaundice, bronchitis, and colds, the leaves are used to treat wounds and cuts in cases of intestinal problems, and the fruits are used to treat hypertension, stomach and intestinal disorders, and colds (Ercan, 2024; Yaman et al., 2024). The easiest production technique of this species is by seeds and cuttings (Mammadov and Salakhova, 2018).

The entire aerial parts part of *Berberis vulgaris* L. and *B. integerrima* Bunge are used as a broom in Kayaüstü plateau. Local people call it Karamuk. Local people cut and tie the branches of this species and use it as a broom for cleaning the garden. Its fruits are consumed. These plant taxa are used by locals to treat wounds, common colds, and diuretics.

3.4. *Caltha palustris* L.

With 204 species spread across 20 genera, the Ranunculaceae family is one of the largest families of Turkish flora. It includes both herbaceous and climbing woody taxa. There are six species of Caltha L. (Lilpar) throughout the globe. *Caltha palustris* L. species is the sole species of the genus found in Türkiye (Davis, 1965-1985; Güner et al., 2012; Yücel et al., 2019). For renal and digestive diseases, infusion is used as a diuretic, laxative, and sedative. Preliminary blanching eliminates the toxicity of leaves used to make sarma (Tiţă et al., 2009; Dogan et al., 2015; Paniagua-Zambrana et al., 2024). Foot pain was treated using the aerial portions of *Caltha palustris* L. It is well known that this plant's extracts contain immunomodulatory qualities. According to reports, the plant was used to cure skin conditions in China and to treat broken horns and wounds in India (Pande et al., 2007; Shen et al., 2010; Suszko et al., 2012; Akbulut and Özkan, 2022). The production technique of this plant taxon is seed (Blomqvist et al., 2006).

Caltha palustris L., formerly known as Gongoroş, is a plant species used in the plateaus of Taşköprü and Kayaüstü. Its leaves used for food. People in the area treat diuretic diseases with this plant taxon.

3.5. *Crataegus orientalis* Pall. ex M.Bieb. subsp. *orientalis*

The Rosaceae family is the taxonomic home of the genus Crataegus L. across the Northern Hemisphere, there are 1060 species of Crataegus L. across Asia and Europe. Only two of the twenty-one species found in Türkiye are farmed (Dönmez, 2004; Ünsal, 2012). Since ancient times, people have traditionally employed tinctures or extracts made from Crataegus leaves, flowers, and fruits. The primary purpose of the facility is to cure heart conditions. Furthermore, pharmacological research suggests that Crataegus extracts could be employed as antioxidants and anti-inflammatory agents (Mills and Bone, 2000; Barnes et al., 2002; Bahorun et al., 2003; Bor et al., 2012). The production technique of these plant taxon is seed + cuttings propagation (Yahyaoğlu et al., 2006; Ahmadloo et al., 2016).

Crataegus orientalis Pall. ex M.Bieb. subsp. *orientalis*, famously known as Alıç, are used in the Kayaüstü areas. Its fruits are widely consumed as food. Locals believe that this plant taxon has healing properties against cardiovascular diseases.

3.6. *Foeniculum vulgare* Mill.

Grown in nations with a Mediterranean climate, fennel is a useful fragrant and medicinal plant belonging to the Apiaceae family. The food, fragrance, and medicinal industries all make extensive use of fennel fruits. Carminative, diuretic, laxative, antibacterial, sedative, and stimulating properties are all present in fennel fruits. Teas prepared by mothers using fennel fruits help babies with their flatulence and extend the nursing period (Şanlı et al., 2008). This plant taxon is produced via the seed method (Matthäus et al., 2015).

Within the study locations, plant taxa known as Çaşır—the aboveground portions of Foeniculum vulgare Mill.—are used in the Kayaüstü areas. It is extensively utilized as animal and human food. People in the area treat kidney diseases with this plant taxon.

3.7. *Pyrus elaeagrifolia* Pall.

One of the most well-known wild-grown pear species, belonging to the Rosaceae family, is the oleaster-leafed pear (*Pyrus elaeagrifolia* Pall. subsp. *elaeagrifolia*). It is indigenous to Türkiye's central, eastern, and southern Anatolia regions. The fragrant fruit turns soft and tasty once it has been harvested and allowed to ripen. In Turkish traditional medicine, the fruits are mostly used to alleviate diarrhea and cleanse the body of toxins from snake bites (Yerliturk et al., 2008; Baltas, 2017; Sagbas et al., 2021). Seeds and cuttings are used in production (Kucher et al., 2024).

Marmalade is made from the ripe fruits of *Pyrus elaeagrifolia* Pall., which are gathered from the Kayaüstü plateau. It is eaten as fruit as well. This plant taxon is used by locals to treat kidney disorders. Seeds and cuttings are used in production.

3.8. *Rosa canina* L., *R. boissieri* Crep. and *R. spinosissima* L.

Roses are members of the Rosaceae family, specifically the species Rosa. There are more than 100 species of the genus Rosa, and they are found in North America, Europe, Asia, and the Middle East. There are about 25 species of roses known to exist in Türkiye. (Kutbay and Kilinc, 1996; Nilsson, 1997). In Türkiye, rose fruits have long been used for food, medicine, and a variety of other reasons. Rose fruits have been used medicinally in Türkiye to cure a variety of ailments, including the common cold, rheumatism, and osteoarthritis (Selahvarzian et al., 2018). They are also used to make a number of unique traditional goods, including rose hip fruit juice, jam, marmalade, pestil and syrup, and tea (Kurt and Yamankaradeniz 1983; Ercisli and Guleryuz

2005; Kazaz et al., 2009). Seed and cuttings propagation is the method used to produce this plant taxon (Sarıbaş, 2000; Ercişli and Güleryüz, 1999).

Rosa canina L., *R. boissieri* Crep. and *R. spinosissima* L. known as Kuşburnu, are used in the research regions for its fruits. Jam, marmalade, fruit juice, pestil, tea, and syrup are among its many culinary uses. These plant taxa are used by locals to treat common colds.

3.9. *Rubus canescens* DC. var. *canescens, R. idaeus* L. subsp. *idaeus* and *R. saxatilis* L.

With 12 subgenera, including four highly valuable fruiting species, Rubus is one of the most varied plant genera (Jennings, 1988; Deighton, 2000). For millennia, people have grown rubus species (family Rosaceae) for their fruits. Traditionally, these and other plant parts have been utilized for medicinal purposes (Patel et al., 2004). The fruits are nutritious, therapeutic, and aesthetically pleasing. These plants' strong anti-oxidant, anti-inflammatory, anti-neurodegenerative, and anti-cancer properties are attributed to the high concentration of polyphenols, vitamins, and minerals found in their fruits, roots, shoots, and leaves. The use of Rubus species in the prevention and treatment of chronic illnesses like diabetes, heart disease, and some types of cancer is supported by their varied phytochemical profiles (Zia-Ul-Haq et al., 2014; Buczyński et al., 2024). Production is by seed, cuttings and tissue culture (Wei et al., 1992; Busby and Himelrick, 1998).

The fruits of *Rubus canescens* DC. var. *canescens, R. idaeus* L. subsp. *idaeus* and *R. saxatilis* L. taxa are collected intensively in both plateaus. The fruits are used for making compote and jam. In addition, leafy shoots are collected in Taşköprü plateau and given to animals as feed.

3.10. *Rumex alpinus* L., *R. angustifolius* Campd. subsp. *angustifolius*, *R. ponticus* E.H.L. Krause and R. scutatus L.

With 22 species, the genus Rumex is widely distributed in Turkish flora. The Polygonaceae Juss. family includes the genus Rumex. High mountains in western, central, and eastern Europe, such as the Apennines, the mountains of the Caucasus and Balkan Peninsula, Armenia, and North Anatolia, are home to *Rumex alpinus* L. (Cullen, 1972; Šťastná et al., 2010). In Türkiye, the genus has been widely utilized in traditional medicine to treat a range of conditions, including eczema, diarrhea, and constipation. According to Baytop (1996) and Suleyman et al. (1999), the genus also has antipyretic, laxative, diuretic, wound-healing, and anti-inflammatory qualities (Ozturk and Ozturk, 2007). This plant taxon is produced by seed and tissue culture (Yazdi et al., 2013; Ćulafić et al., 1987).

The leaves of *Rumex alpinus* L., *R. angustifolius* Campd. subsp. *angustifolius*, *R. ponticus* E.H.L. Krause and *R. scutatus* L. sometimes referred to as Lapaza and Kuzukulağı, are consumed as food in the study areas. People in the area utilize these plant taxa to cure skin disorders.

3.11. *Sempervivum davisii* Muirhead subsp. *furseorum* (Muirhead) Karaer

There are roughly fifty species of Sempervivum (Crassulaceae), most of which are found in the highlands of southern Europe, Anatolia, and the Caucasus (Stevens et al., 1996). Fresh juice made from the crushed leaves of different Sempervivum plants is widely used in Türkiye to cure dermatological infections and earaches (Yeşilada et al., 1999; Uzun et al., 2017). Seed and tissue culture is the method used to produce this plant taxon (Giménez-Benavides et al., 2005; Dobos et al., 1994).

In the research locations, the rosette leaves of *Sempervivum davisii* Muirhead subsp. *furseorum* (Muirhead) Karaer, known locally as Etlikulak, are eaten as food in the Taşköprü area. The local population uses this taxon of plants to heal wounds.

3.12. *Smilax excelsa* L.

One of the most prevalent and varied climbing plants in many Old and New World habitats is the Smilacaceae family, which includes the genera Smilax L. and Heterosmilax Kunth. The family's core genus, Smilax, has over 200 species (Gentry, 1991; Cameron and Fu, 2006). Syphilis, acute bacillary dysentery, acute and chronic nephritis, eczema, and silver poisoning are among the illnesses that can be treated using Smilax species (Ivanova et al., 2010; Atar et al., 2020). For this plant taxon, seed and cuttings propagation is the method of production (Martins et al., 2011; Rugna et al., 2010).

The fruits and shoots of Smilax excelsa L., referred to locally as Zimlanga, are consumed as food at the study sites. Residents of the area utilize this plant taxon to cure wounds and eczema.

3.13. *Thymus nummularius* M.Bieb. and *T. sipyleus* Boiss.

Thymus L. (Lamiaceae) is a large genus with over 350 species, of which 66 are found growing wild in Europe. This group consists of 38 species and 64 taxa, 24 of which are indigenous to Türkiye. According to Ozen et al. (2011), one species of this genus is known as "kekik" in Turkish and is used as herbal tea, condiments, and traditional medicine (Ozen and Demirtas, 2015). Folk medicine has utilized thymus species as medicinal herbs and condiments for ages to treat rheumatism, coughs, diarrhea, bronchitis, asthma, arteriosclerosis, and colic (Tammar et al., 2018; Gül et al., 2022). Seed, tissue culture, and cuttings propagation are the methods used to produce these plant taxa (Nasiri et al., 2016; Bakhtiar et al., 2016; Bahadori and Sharifi Ashorabadi, 2017).

Known locally as Yaylaçayı, the leaves and flowers of *Thymus nummularius* M.Bieb. and T. *sipyleus* Boiss. are eaten as food (for tea and soup) at the study locations. Locals treat common colds using this plant taxon.

3.14. *Urtica dioica* L.

Urtica dioica L. of family Urticaceae, is a perennial plant which is commonly known as stinging nettle. It is widely distributed throughout the temperate and tropical areas around the world (Krystofova et al., 2010). The plant's leaves and roots have long been used internally to treat

rheumatism, eczema, anemia, nephritis, haematuria, jaundice, menorrhagia, diarrhea, nasal and menstrual hemorrhage, emmenagogue, diuretic, and blood purification (Khare, 2007; Tucakov, 1997; Wetherilt H. 1992). Turkish traditional medicine uses *Urtica dioica* L. plants to alleviate stomachaches. Furthermore, this plant is utilized to treat liver insufficiency, colds, coughs, and rheumatic discomfort (Yeşilada et al., 1993, 2001; Sezik et al., 1997; Joshi et al., 2014). According to Radman et al. (2015), this plant taxon is produced using the seed method.

The aerial parts of Urtica dioica L., commonly referred to as Isırgan, are consumed as food in the research areas. Rheumatism and gastrointestinal issues are treated by locals using this plant taxon.

3.15. *Vaccinium myrtillus* L. and *V. uliginosum* L.

There are around 450 species in the 36 sections that make up the genus Vaccinium (Ericaceae), subfamily Vaccinioideae, and tribe Vaccinieae. It is cosmopolitan, mainly of the Northern Hemisphere, but particularly in Southeast Asia and Malaysia, and primarily montane in the tropics (Lutein, 2007). *Vaccinium myrtillus* L., *V. vitis-idea* L., *V. uliginosum* L. and *V. arctostaphylos* L. are native to North Eastern Anatolia (Eastern Black Sea) in Türkiye. These species are significant for the local wildlife as well as residents and foresters (Celik, 2012; Celik, 2016). 36 species of Vaccinium have over 70 recorded ethnomedical and dietary uses, primarily in the genitourinary, digestive, and endocrine/metabolic systems. Astringent, diuretic, urinary antiseptic, antidiarrheal, antipyretic, and antidiabetic were the most commonly reported uses, aside from food use (Abreu et al., 2014). Production is by seed and cuttings propagation (Debnath, 2007)

Vaccinium myrtillus L. and *V. uliginosum* L. are collected and used intensively by the highlanders of Taşköprü. It is locally known as ligarba and used in jam and marmalade production. These plant taxa are used by the locals to cure urinary problems.

In the research areas, the local uses of the plant taxa and which plant taxon is used in the treatment of which disease were investigated. In addition, the production techniques of the plant taxa identified in the research area were also tried to be determined (Suplementary Table).

4. Conclusion

The current study details how the indigenous Taşköprü and Kayaüstü plateau people employ natural plant species. Based on the study's findings, it can be said that the people who live in the rural settlements of Kayaüstü and Taşköprü Plataeus are quite informed about the edible and therapeutic applications of natural plant species. The findings demonstrate the significance of twenty-seven types of medicinal plants to rural populations. This study also attempted to provide an explanation of the production methods of plant taxa that are important to ethnobotany. To improve the local population's economy and standard of living, it is crucial to apply the traditional knowledge of using plants.The results highlight how crucial it is to protect traditional knowledge and encourage the long-term usage of medicinal plants in rural healthcare.

Author Contributions

The percentage of the authors' contributions are below. All authors reviewed and approved the final version of the manuscript.

	A.E.B.	N.Ç.	D.U.S.
C	50	30	20
D	50	30	20
S	50	30	20
DCP	50	30	20
DAI	50	30	20
L	50	30	20
W	50	30	20
CR	50	30	20
SR	50	30	20

C=Concept, D= design, S= supervision, DCP= data collection, and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision.

Conflict of Interest

The authors declared that there is no conflict of interest.

Ethical Consideration

Before each interview began, an oral Prior Informed Consent (PIC) was obtained.

Acknowledgment

We appreciate the participation of all Gümüşhane residents who provided insightful information in this survey. This study was presented as oral presentation at the "International Forestry & Environment Symposium (07-10 November 2017, Trabzon / Türkiye)" and printed as abstract.

References

Abreu OA, Barreto G, Prieto S. 2014. Vaccinium (Ericaceae): Ethnobotany and pharmacological potentials. Emir J Food Agric, 26 (7): 577-591.

Ahmadloo F, Kouchaksaraei MT, Goodarzi GR. 2016. Effects of IBA, bacterial and mycorrhizal treatments on the rooting of *Crataegus pseudohetrophylla* Pojark. Iran J For Poplar Res, 24 (2): 345-355.

Akbulut S, Bayramoğlu MM. 2014. Reflections of socio-economic and demographic structure of urban and rural on the use of medicinal and aromatic plants: the sample of Trabzon province. Stud Ethno-Med, 8: 89–100.

Akbulut S, Özkan ZC. 2022. An ethnoveterinary study on medicinal plants used for animal diseases in Rize (Turkey). Appl Ecol Environ Res, 20 (5): 4109-4119.

Albayrak S, Kaya O. 2018. Antioxidant and antimicrobial activities of four Astragalus species growing wild in Turkey.

Turk J Biochem, 4(4): 425-434.

Anowska B, Jakubowska P, Antkowiak A, Nawrot D, Krzaczkowska A, Andrzejak R. 2016. The effect of growth regulators on post-harvest *Alchemilla mollis* (Bauser) Rothm. leaf longevity. Folia Hortic, 28 (2): 137-142.

Atalay E, Erkoyuncu MT, Erişen S, Yorgancılar M. 2017. Micropropagation of Endemic *Astragalus trojanus* Stev. with Nodal Culture. Yuz Yil Univ J Agric Sci, 27 (2): 268-275.

Atar F, Bayraktar A, Yıldırım N, Turna İ, Güney D. 2020. Fruit and seed diversity of Smilax excelsa in the Black Sea Region, Turkey. Turk J For Res, 7 (1): 1-8.

Atar F, Turna H, Turna İ. 2017. Production techniques of some woody medicinal and aromatic plants naturally found in Eastern Black Sea Region, 1st International Congress on Medicinal And Aromatic Plants, May 9-12, Konya, Türkiye, pp: 827-827.

Bahadori F, Sharifi Ashorabadi E. 2017. Effects of different concentrations of IBA and IAA on rooting of *Thymus kotschyanus* Boiss. Cuttings. Iran J Med Aromat Plants Res, 33 (1): 148-156.

Bahorun T, Aumjaud E, Ramphul H, Rycha M, Luximon Ramma A, Trotin F, Aruoma OI. 2003. Phenolic constituents and antioxidant capacities of Crataegus monogyna (Hawthorn) callus extracts. Nahrung, 47: 191-198.

Bakhtiar Z, Mirjalili MH, Sonboli A. 2016. In vitro callus induction and micropropagation of *Thymus persicus* (Lamiaceae), an endangered medicinal plant. Crop Breed Appl Biotechnol, 16 (1): 48-54.

Baltas N. 2017. Investigation of a wild pear species (Pyrus eaeagnifolia subsp elaeagnifolia Pallas) from Antalya, Turkey: Polyphenol oxidase properties and anti-xanthine oxidase, and antioxidant activity. Int J Food Prop, 20: 585–595.

Barnes J, Anderson LA, Phillipson JD. 2002. Herbal medicines: a guide for health care professionals. London: Pharmaceutical Press, Royal Pharmaceutical Society, London, UK, pp: ix + 296.

Baytop T. 1996. Türkiye'de Bitkiler ile Tedavi. Istanbul Universitesi Basimevi, Istanbul, Turkey, I.U. Yayinlari No: 3255, Eczacilik Fak, No: 40, pp: 444 (in Turkish).

Bedir E, Pugh N, Calıs I, Pasco DS, Khan IA. 2000. Immunostimulatory effects of cycloartane-type triterpene glycosides from Astragalus species. Biol Pharm Bull, 23: 834-837.

Blomqvist MM, Tamis WLM, Bakker JP, Van der Meijden E. 2006. Seed and (micro) site limitation in ditch banks: Germination, establishment and survival under different management regimes. J Nat Conserv, 14 (1): 16-33.

Bor Z, Arslan R, Bektaş N, Pirildar S, Dönmez AA. 2012. Antinociceptive, antiinflammatory, and antioxidant activities of the ethanol extract of *Crataegus orientalis* leaves. Turk J Med Sci, 42 (2): 315-324.

Buczyński K, Kapłan M, Jarosz Z. 2024. Review of the report on the nutritional and health-promoting values of species of the Rubus L. genus. Agri, 14 (8): 1324.

Busby AL, Himelrick DG. 1998. Propagation of blackberries (Rubus spp.) by stem cuttings using various IBA formulations. ISHS Acta Horticulturae 505: VII International Symposium on Rubus and Ribes, June 23 – 27, Palencia, Spain, pp: 327-332.

Cameron KM, Fu CX. 2006. A nuclear rDNA phylogeny of Smilax (Smilacaceae). Aliso: J Syst Floris Bot, 22 (1): 598-605.

Cansaran A, Kaya ÖF, 2010. Contributions of the ethnobotanical investigation carried out in Amasya district of Turkey (Amasya-Center, Bağlarüstü, Boğaköy and Vermiş villages; Yassıçal and Ziyaret towns). BioDiCon, 3: 97–116.

Celik H. 2012. Highbush blueberry growing. Edition: 1, Publisher: GIFİMEY, London, UK, pp: 152.

Celik H. 2016. Blueberry culture in Turkey, today and in the future. In XI International Vaccinium Symposium, April 10-14, Orlando, FL, USA, pp: 85-92.

Ćulafić L, Samofalova A, Nešković M. 1987. In vitro organogenesis in two dioecious species, *Rumex acetosella* L. and *R. acetosa* L. (Polygonaceae). Plant Cell Tissue Organ Cult, 11: 125-131.

Cullen J. 1972. Rumex. In: Davis PH, ed., Flora of Turkey and East Aegean Islands, Vol 2. Edinburgh, Edinburgh University press, Edinburgh, Scotland, pp: 281–293.

Davis PH. 1965-1985. Flora of Turkey and the East Aegean Island Vol.:I and Supplament, Edinburg: Edinburg Univesity Press, Edinburgh, Scotland, pp: 567.

Debnath SC. 2007. Propagation of Vaccinium in vitro: A review. Int J Fruit Sci, 6 (2): 47-71. https://doi.org/10.1300/J492v06n02_04.

Deighton N, Brennan R, Finn C, Davies HV. 2000. Antioxidant properties of domesticated and wild Rubus species. J Sci Food Agric, 80 (9): 1307-1313.

Dobos É, Dános B, László-Bencsik Á. 1994. Callus induction and shoot regeneration in *Sempervivum tectorum*. Plant Cell Tissue Organ Cult, 36: 141-143.

Dogan Y, Nedelcheva A, Łuczaj Ł,Drăgulescu C, Stefkov G, Maglajlić A, Ferrier J, Papp N, Hajdari A, Mustafa B, Dajić-Stevanović Z, Pieroni A. 2015. Of the importance of a leaf: the ethnobotany of sarma in Turkey and the Balkans. J Ethnobiol Ethnomed, 11: 26. https:// doi.org/10.1186/s13002-015-0002-x.

Dönmez AA. 2004. The Genus Crataegus L. (Rosaceae) with special reference to hybridization and biodiversity in Turkey. Turk J Bot, 28 (1): 29-37.

Ercan L. 2024. Bioactive components, antioxidant capacity, and antimicrobial activity of Berberis crataegina fruit. Pharmacolog Res Nat Produc, 2: 100020. https://doi.org/10.1016/j.prenap.2024.100020.

Ercişli S, Güleryüz M. 1999. A study of the propagation of the hardwood cuttings of some rose hips. Turk J Agric For, 23 (8): 305-310.

Ercisli S, Guleryuz M. 2005. Rose hip utilization in Turkey. Acta Hortic, 490: 77–83.

Ergene Öz B, İlhan M, Ozbilgin S, Küpeli Akkol E, Bahadır Acıkara Ö, Saltan G, Keleş H, Süntar İ. 2025. Effects of *Alchemilla mollis* and *Alchemilla persica* on the wound healing process. Bangladesh J Pharmacol, 11 (3): 577-584.

Evenor D, Shlomo E, Reuveni M. 2001. In: Plant cell, Tiss Org Cult, 65 (2): 169-172.

Ezer N, Arısan ÖM, 2006. Folk medicines in Merzifon (Amasya, Turkey). Turk J Bot, 30: 223–230.

Fidan MS, Alma MH, Çınar İ, Ertaş M, Köse E. 2004. Ethnobotanical characteristics of traditional plants used in Tokat regions (Turkey). Yüzüncü Yıl Üniversitesi 1. Geleneksel Gıdalar Sempozyumu, September 23-24, Van, Türkiye, pp: 63.

Gentry AH. 1991. The distribution and evolution of climbing plants. Putz, R.E., Mooney, H.A. (eds.), The biology of vines, New York: Cambridge University Press, New York, USA, pp: 3-49.

Giménez-Benavides L, Escudero A, Pérez-García F. 2005. Seed germination of high mountain Mediterranean species: altitudinal, interpopulation and interannual variability. Ecol Res, 20 (4): 433-444.

Google Earth. 2024. URL: https://earth.google.com/web/search (accessed date: December 23, 2024).

Gül LB, Özdemir N, Gül O, Çon A. 2022. Evaluation of *Thymus pseudopulegioides* plant extracts for total phenolic contents, antioxidant and antimicrobial properties. Eur Food Sci Eng, 3

(1): 1-4.

Güner A, Özhatay N, Ekim T, Başer KHC. (Eds.) 2000. Flora of Turkey and the East Aegean Islands, vol. 11. Edinburgh University Press, Edinburgh, Scotland, pp: 656.

Güner A, Aslan S, Ekim T, Vural M, Babaç MT. (edlr.) 2012. Türkiye bitkileri listesi (damarlı bitkiler). Nezahat Gökyiğit botanik bahçesi ve flora araştırmaları derneği yayını, İstanbul, Türkiye, pp: 1290.

Ivanova A, Mikhova B, Kostova I, Evstatieva L. 2010. Bioactive chemical constituents from *Smilax excelsa*. Chem Nat Compd, 46: 295-297.

Jennings DL. 1988. Raspberries and Blackberries: Their Breeding, Diseases and Growth, Academic Press, London, UK, pp: 230.

Joshi BC, Mukhija M, Kalia AN. 2014. Pharmacognostical review of *Urtica dioica* L. Int J Green Phar, 8 (4): 201-209.

Kandemir A, Beyazoğl O. 2002. Köse Dağları'nın (Gümüşhane) tıbbi ve ekonomik bitkileri, Süleyman Demirel Üniv Fen Bilim Enst Derg, 6 (3): 148-157.

Kazaz S, Baydar H, Erbaş S. 2009. Variations in chemical compositions of *Rosa damascena* Mill. and *Rosa canina* L. fruits. Czech J Food Sci, 27(3): 178-184.

Khare CP. 2007. Indian Medicinal Plants an Illustrated Dictionary. First Indian Reprint, Springer (India) Pvt. Ltd., New Delhi, India, pp: 910.

Koca AD, Yıldırımlı S. 2010. Ethnobotanical properties of Akçakoca district in Düzce (Turkey). Hacettepe J Biol Chem, 38: 63–69.

Korkmaz M. 2014. Kelkit (Gümüşhane) aktarlarında satılan tıbbi bitkilerin etnobotanik özellikleri. Süleyman Demirel Üniv Fen Bilim Enst Derg, 18 (3): 60-80.

Korkmaz M, Karakurt E. 2015. An ethnobotanical investigation to determine plants used as folk medicine in Kelkit Gümüşhane/Turkey district. BioDiCon, 8 (3): 290-303.

Krystofova O, Adam V, Babula P, Zehnalek J, Beklova M, Havel L, et al. 2010. Effects of various doses of selenite on stinging nettle (*Urtica dioica* L.). Int J Environ Health Res Public Health, 7: 3804-15.

Kucher N, Hrabovyi V, Opalko O, Zamorskyi V, Opalko A. 2024. In vitro propagation of Pear (Pyrus L.). Біологічні студії/ Stud Biologica, 18 (4): 157-174. doi: https://doi.org/10.30970/sbi.1804.797.

Kunz M, Randall JL, Gray JB, Wall WA, Hohmann MG. 2016. Germination and propagation of *Astragalus michauxii*, a rare southeastern US endemic legume. Native Plants J, 17 (1): 47-52.

Küplemez H, Aykutlu AÖ, Yurteri E, Seyis F. 2022. Distribution of Alchemilla species in Rize and their usage in folk medicine. Diff Pers Med Aromat Plants, 6: 133-148.

Kurt A, Yamankaradeniz R. 1983. The composition of rose hip is grown naturally in Erzurum province and their processing possibilities to different products. Turk J Agric For, 7: 243–248.

Kutbay HG, Kilinc M. 1996. Taxonomic properties of rose hip species are grown in Turkey. In: Proceedings of Rose Hip Symposium, September 5–6, Gümüşhane, Türkiye, pp: 75–83. (in Turkish)

Lutein J. 2007. New York Botanical Garden. Ericaceae-Ethnobotanical Studies. URL: http://www.nybg.org/bsci/res/lut2/ name-use.htm (accessed date: December 24, 2012).

Mammadov T, Salakhova E. 2018. The propagation and morphogenesis of sprouting of some Berberis L. species. Int J Agric Innov Res, 7 (3): 308-311.

Martins AR, Pütz N, Novembre ADDLC, Piedade SMDS, Glória BAD. 2011. Seed germination and seedling morphology of Smilax polyantha (Smilacaceae). Biota Neotrop, 11: 31-37.

Matthäus B, Özcan MM, Al Juhaimi F. 2015. Variations in oil, fatty acid and tocopherol contents of some Labiateae and Umbelliferae seed oils. Qual Assur Saf Crop, 7 (2): 103-107.

Mills S, Bone K. 2000. Principles and practice of phytotherapy. Churchill Livingstone; 1st edition, Edinburgh, pp 664.

Nasiri M, Seedian SE, Sharifi Ashorabadi E. 2016. Investigation of seed germination, establishment and identification of different Thymus species available in natural resources gene bank of Iran. Iran J Med Aromat Plants Res, 32 (1): 115-126.

Nilsson O. 1997. Rosa. In: Davis P.H. (ed.): Flora of Turkey and the East Aegean Islands. Edinburgh University Press, Edinburgh, 4: 106–128.

Ozen T, Demirtas I, Aksit H. 2011. Determination of antioxidant activities of various extracts and essential oil compositions of *Thymus praecox* subsp. *skorpilii* var. *skorpilii*. Food Chem, 124: 58-64.

Ozen T, Demirtas I. 2015. Antioxidative properties of *Thymus pseudopulegioides*: comparison of different extracts and essential oils. J Essent Oil-Bear Plants, 18 (2): 496-506.

Özhatay N, Kültür Ş, Güldal MB. 2011. Check-List of additional taxa to the Supplement Flora of Turkey V. Turkish Journal of Botany, 35; 589–624.

Özkan ZC, Merev N, Terzioğlu S, Üçler AÖ, Gümüş C, Toksoy D. 2002. Gümüşhane yöresi doğal tıbbi bitkilerinin tanınması. yetiştirilmesi ve değerlendirilmesi, Proje sonuç raporu, Gümüşhane Valiliği, Gümüşhane.

Özkan ZC, Akbulut S. 2012. Trabzon İli'nin etnobotanik özellikleri., KTÜ BAP Proje Kod No: 1098.

Ozturk S, Ozturk A. 2007. Antibacterial activity of aqueous and methanol extracts of *Rumex alpinus* and *Rumex caucasicus*. Pharm Biol, 45 (2): 83-87.

Pande PC, Tiwari L, Pande HC. 2007. Ethnoveterinary plants of Uttaranchal - A review. – Indian J Tradit Know, 6 (3): 444-458.

Paniagua-Zambrana NY, Bussmann RW, Jan HA. 2024. *Caltha palustris* L. Ranunculaceae. In Ethnobotany of the Mountain Regions of Eastern Europe: Carpathians. Cham: Springer International Publishing, London, UK, pp: 1-5.

Patel AV, Rojas-Vera J, Dacke CG. 2004. Therapeutic constituents and actions of Rubus species. Curr Med Chem, 11 (11): 1501-1512.

Polat R, Cakilcioglu U, Kaltalioğlu K, Ulusan MD, Türkmen, Z. 2015. An ethnobotanical study on medicinal plants in Espiye and its surrounding (Giresun-Turkey). J Ethnopharmacol, 163: 1-11.

Radman S, Žutić I, Fabek S, Frkin A, Benko B, Toth N. 2015. Influence of temperature and light on seed germination of stinging nettle (*Urtica dioica*). 50th Croatian & 10th International Symposium on Agriculture, February 16-20, Opatija, Crotia, pp: 271-275.

Rugna AZ, Romero O, Mazzeo M, Santamaría JM, Gurni AA, Wagner ML. 2010. Polyphenols production from specimens of *Smilax campestris* Griseb. (Smilacaceae) growing under controlled conditions culture. Museo Farmacobot, Univ Buenos Aires, 26 (2): 21-36.

Sagbas HI, Ilhan G, Ercisli S, Anjum MA, Holubec V. 2021. Characterization of Oleaster-Leafed Pear (*Pyrus elaeagrifolia* Pall. subsp. *elaeagrifolia*) Fruits in Turkey. Agron, 11(3): 430.

Sağıroğlu M, Arslantürk A, Akdemir ZK, Turna M. 2012. An ethnobotanical survey from Hayrat (Trabzon) and Kalkandere (Rize/Turkey). BioDiCon, 5: 31–43.

Şanlı A, Karadoğan T, Baydar, H. 2008. Doğal olarak yetişen tatlı rezene (*Foeniculum vulgare* Mill. var. *dulce*)'nin farklı büyüme ve gelişme dönemlerinde uçucu yağ miktarı ile bileşenlerinin

belirlenmesi. Ziraat Fak. Derg, 3 (2): 17-22.

Saraç DU, Özkan ZC, Akbulut S. 2013. Ethnobotanic features of Rize/Turkey province. BioDiCon, 6 (3): 57-66.

Sarıbaş M. 2000. Activation of the Germination on the Seeds of Some Plants. Turk J Agric For, 24 (5): 579-584.

Selahvarzian A, Alizadeh A, Baharvand PA, Eldahshan OA, Rasoulian B. 2018. Medicinal properties of *Rosa canina* L. Herb Med J, 3 (2): 77-84.

Sezik E, Yeşilada F, Tabata M, Honda G, Takaishi Y, Fujita T, Tanaka T, Takeda Y. 1997. Traditional medicine in Turkey VIII. Folk medicine in East Anatolia Erzurum Erzincan Ağrı, Kars, Iğdır provinces. Econ Bot, 51: 195–211.

Shen S, Qian J, Ren J. 2010. Ethnoveterinary plant remedies used by Nu people in NW Yunnan of China. J ethnobiol ethnomed, 6: 1-10.

Šťastná, P, Klimeš L, Klimešová J. 2010. Biological flora of Central Europe: *Rumex alpinus* L. Perspect. Plant Ecol. Evol. Syst, 12 (1): 67-79.

Stevens JF, Hart HT, Elema ET, Bolck A. 1996. Flavonoid variation in eurasian Sedum and Sempervivum. Phytochem, 41 (2): 503-512.

Suleyman H, Demirezer LO, Kuruuzum A, Banoglu ZN, Gocer F, Ozbakir G, Gepdiremen A. 1999. Antiinflammatory effect of the aqueous extract from *Rumex patientia* L. roots. J Ethnopharmacol, 65: 141–148.

Suszko A, Szczypka M, Lis M, Kuduk-Jaworska J, Obminska-Mrukowicz B. 2012. Influence of polysaccharide fraction C isolated from *Caltha palustris* L. on T and B lymphocyte subsets in mice. Cent. Eur. J. Immunol, 37(3): 193- 199.

Tammar S, Salem N, Bettaieb Rebey I, Sriti J, Hammami M, Khammassi S, Marzouk B, Ksouri R, Msaada K. 2018. Regional effect on essential oil composition and antimicrobial activity of *Thymus capitatus* L. J Essent Oil Res, 31 (2): 129-137. doi:10.1080/10412905.2018.1539415

Tiţă I, Mogoşanu GD, Tiţă MG. 2009. Ethnobotanical inventory of medicinal plants from the South-West of Romania, Farm, 57 (2): 141.

Tucakov J. 1997. Lecenje biljem-fitoterpija. Beograd: Rad; p. 405.

Türkan Ş, Malyer H, Aydın SÖ, Tümen G. 2006. Ordu ili ve çevresinde yetişen bazı bitkilerin etnobotanik özellikleri. Süleyman Demirel univ fen bilim enst derg, 10: 162–166.

Ünsal G. 2012. Alıcın (*Crataegus orientalis* Pallas ex. Bieb. var. *orientalis*) odun ve yarı odun çelikleriyle çoğaltılma performansının belirlenmesi, Master's thesis, Fen Bilimleri Enstitüsü, Gaziosmanpaşa Üniversitesi, Tokat, Türkiye, pp: 25.

Uzun Y, Dalar A, Konczak I. 2017. Sempervivum davisii: phytochemical composition, antioxidant and lipase-inhibitory activities. Pharm Biol, 55 (1): 532-540.

Wei J, Ying G. Shen-Zhi Z. 1992. In vitro propagation of Rubus species. Sci Hortic, 49 (3-4): 335-340.

Wetherilt H. 1992. Evaluation of urtica species as potential sources of important nutrients. Dev Food Sci, 29: 15-25.

Wikipedia. 2024. URL: https://tr.wikipedia.org/wiki (accessed date: December 26, 2024).

Yahyaoğlu Z, Ölmez Z, Göktürk A, Temel F. 2006. Effects of cold stratification and sulphuric acid pretreatments on germination of Hawthorn (Crataegus spp.) seeds. J Bartın Fac For, 8 (10): 74-79.

Yaman M, Sun M, Sümbül A, Demirel F, Tunç Y, Khadivi A, Yılmaz KU. 2024. Multivariate analysis of morphological variation, biochemical content, antioxidant activity, and molecular characteristics of autochthonous *Berberis crataegina* DC. genotypes in Central Türkiye. BMC Plant Biol, 24 (1): 1155.

Yazdi SAF, Rezvani M, Mohassel MHR, Ghanizadeh H. 2013. Factors affecting seed germination and seedling emergence of sheep sorrel (*Rumex acetosella*). Rom Agric Res, 30 (1): 373-380.

Yerliturk FU, Arslan O, Sinan S, Gencer N, Ozensoy GO. 2008. Characterization of polyphenoloxidase from wild pear (*Pyrus elaegnifolia*). J Food Biochem, 32: 368–383.

Yeşilada E, Honda G, Sezik E, Tabata M, Goto K, Ikeshir, Y. 1993. Traditional medicine in Turkey IV. Folk medicine in the Mediterranean subdivision. J Ethnopharmacol, 39: 31–38.

Yeşilada E, Sezik E, Honda G, Takaishi Y, Takeda Y, Tanaka T. 1999. Traditional medicine in Turkey IX: folk medicine in north-west Anatolia. J Ethnopharmacol, 64: 195–210.

Yeşilada E, Sezik E, Honda G, Takaishi Y, Takeda Y, Tanaka T. 2001. Traditional medicine in Turkey X. Folk medicine in Central Anatolia. J Ethnopharmacol, 75: 95–115.

Yücel TB, Fandaklı S, Terzioğlu S, Yaylı N. 2019. *Caltha palustris* L. bitkisinin çiçek ve yaprak kısmının uçucu yağlarının kimyasal bileşimi ve antimikrobiyal aktiviteleri. Gümüşhane Üniv Fen Bilim Enst derg, 9 (2): 189-195.

Zia-Ul-Haq M, Riaz M, De Feo V, Jaafar HZ, Moga M. 2014. *Rubus fruticosus* L.: constituents, biological activities and health related uses. Mol, 19 (8): 10998-11029.