

Traditional uses of wild edible plants in the Republic of North Macedonia

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Abstract. The flora of Republic of North Macedonia provides diverse and useful edible species. Wild edible plants are a valuable source of nutrients. This research was conducted from September 2018 to March 2019, in order to obtain information about the traditional uses of wild edible plants in the Republic of North Macedonia. Data were collected by interviewing 154 informants from the Republic of North Macedonia, using structurally designed questionnaires. Of all respondents, 71 % were women and 29 % were men. For each described plant species, the botanical family, local folk names, edible parts, and culinary use were recorded, and the relative frequency of citation index (RFC) was determined. The interviewed informants cited 39 wild edible plants belonging to 21 different botanical families. Most of the wild edible plant species belonged to *Rosaceae* (10) and *Lamiaceae* (5). The species with the highest relative frequency of citation index was *Fragaria vesca* L. (0.422), followed by *Mentha longifolia* (L.) Hunds. (0.363). Most wild edible plants were trees (41 %). The plant parts preferably used were fruits (36 %), leaves (30 %) and flowers (15 %). The plants most often were consumed cooked, in herbal infusions and raw. The present study provides basic information on the traditional uses of wild edible plants in the Republic of North Macedonia. The research also suggests that further ethnobotanical studies should be conducted, in order to preserve the traditional knowledge associated with the wild edible plants for future generations.

Key words: ethnobotany, Republic of North Macedonia, traditional knowledge, wild edible plants

Introduction

Wild edible plants are plants that grow spontaneously in self-maintained populations in natural or semi-natural ecosystems and can exist independently of any direct human action (FAO 1999). Wild, underutilized and neglected plants have constituted the bedrock of diversity in traditional and indigenous food systems, especially among the indigenous and rural communities in developing countries (FAO 2014).

Many researchers and scholars study the wild edible plants in different parts of the world. A remarka-

ble number of field studies have explored ethnobotany of the Southwestern Balkans with the aim of recording folk knowledge and perceptions of wild plants, mainly used for food and in the domain of medicine (Pieroni 2017). Ethnobotanical studies conducted in the Western Balkans have reported rich biocultural diversity and noteworthy resilience of traditional knowledge concerning the local flora in that region (Pieroni & al. 2013). In the last decade, many field studies have researched ethnobotany in the countries of the Balkan Peninsula, with the aim of recording folk knowledge of wild plants used in food (Redžić 2006; Bošnjaković

& al. 2012; Nedelcheva 2013; Łuczaj & al. 2013 2015; Pieroni & al. 2014, 2017; Pieroni & Söukand 2017; Lumpert & Kreft 2017).

According to Pieroni & al. (2014), in Albania, they use as a pie filling the wild *Urtica dioica* mainly in the early spring, as well as *Rumex* spp., which dominates later in the season.

In the research study of Nedelcheva (2013), a total of 88 wild plant species, representatives of *Rosaceae*, *Amaranthaceae*, *Amaryllidaceae*, *Brassicaceae*, *Asteraceae*, and *Polygonaceae* were identified as edible plants in Bulgaria. Nedelcheva (2013) determined eight major food groups, namely: fresh greens and fruits, stuffed pies, stewed and boiled greens, boiled cereals, sweets (boiled fruit products), dried fruits, snacks, and lacto-fermented products.

According to Redžić (2006), 308 wild edible plants were detected in Bosna and Herzegovina. Edible wild plants were used as delicious vegetables, fruits and spices, in fresh, raw or dried state. Plants were used in cooked food (33%), fresh salads (19%), mush and bread (17%), as fresh wild fruits and drinks (13%), or as spices and ethno-pharmacological potions (10%) (Redžić 2006).

Most commonly sold wild plants in the markets of Dalmatia (South Croatia) were: *Sonchus oleraceus* L., *Allium ampeloprasum* L., *Foeniculum vulgare* Mill., *Urospermum picroides* F.W.Schmidt, *Papaver rhoeas* L., *Daucus carota* L., *Taraxacum* sp., *Picris echioides* L., *Silene latifolia* Poir., and *Crepis* spp. (Łuczaj & al. 2013).

In Serbia, some popular wild species included different berries (blueberry, blackberry, strawberry, raspberry, etc.), rosehip, hawthorn, dogberry and some others, all readily used as traditional food and/or medicine (Bošnjaković & al. 2012)

According to Pieroni & al. (2017), 79 folk taxa (only 77 botanically identified) represented the remarkable wild-food-based gastronomic cultural heritage of the Gorani of Kosovo.

Altogether, 44 species of wild food and herbal tea plants (36 species, if herbal infusions were excluded) and 24 mushroom taxa were recorded as used presently, or in the recent past (since World War II) in the western part of Romanian Maramureş (Łuczaj & al. 2015).

Most frequently reported wild-growing edible plants in Slovenia were: *Taraxacum officinale*, *Fragaria* sp., *Castanea sativa*, *Vaccinium myrtillus*, *Sambucus nigra*, *Juglans regia*, *Armoracia rusticana*, and *Corylus avellana* (Papež 2010; Lumpert & Kreft 2017).

Unfortunately, ethnobotanical literature is quite incomplete about the wild edible plant species used in the Republic of North Macedonia. According to our knowledge, only a few ethnobotanical studies on the traditional uses of wild edible plants in the Republic of North Macedonia have been published earlier (Pieroni & al. 2013; Rexhepi & al. 2018).

Ethnobotanical surveys of the Western Balkans are important for cross-cultural study of local plant knowledge and also for obtaining baseline data, crucial for fostering future rural development and ecotourism initiatives in the region (Pieroni & al. 2013).

The flora of the Republic of North Macedonia is among the richest floras not only on the Balkan Peninsula, but also in the context of the entire European continent (Niketić & al. 2014). According to Matevski & al. (2003), 210 families, 920 genera and 3700 species comprise the flora of higher plants, angiosperms being the richest group with about 3200 species. Endemic taxa are particularly characteristic and valued in the Republic of North Macedonia flora. Among them, 114 flowering plant species are endemic to the country (Micevski & Matevski 1987; Matevski & al. 2003; Matevski 2013).

According to Pieroni & al. (2014), the Republic of North Macedonia's Traditional Ecological Knowledge (TEK) exceeded the Albanian TEK, especially in herbal and ritual domains. According to surveys conducted in the last 20 years, the European traditional knowledge has been overlooked and was gradually disappearing (Ivanova & al. 2018). Along these lines, documentation and preservation are urgently recommended (D'Antuono 2013; Pieroni & Söukand 2017).

In the past, the use of wild edible plants in Europe has been related usually to times of famine or food scarcity. Presently, the use of wild food plants for nutrition in many European communities, particularly the urban ones, is very low. In large parts of North and East Europe, people collect only wild fruits and mushrooms (Łuczaj 2008, 2010, 2011).

Wild edible plants offer alternative sources of nutrients and bioactive compounds, such as vitamins (B₉, C and E), minerals, fibers, unsaturated fatty acids, and phenolic compounds. Interest in them as contemporary foods is not only due to their nutritional value but also to their peculiar organoleptic characteristics, which help include them as differentiated foods in new gourmet dishes (Pinela 2017). According to Pinela & al. (2016), some wild edible plants have

been described as functional foods, because of their physiologically active ingredients capable of providing health benefits beyond basic nutrition. Zeghichi & al. (2003) found that 25 commonly eaten wild plants on Crete (Greece) contained considerable amounts of antioxidants and appreciable amounts of calcium, iron, zinc, magnesium, and potassium in addition to their low content of nitrates and sodium.

Mention deserves the fact that earlier in the 1990s, a well-known expert on wild foods in the Francophone countries, François Couplan, worked with some leading French chefs on incorporating wild plants in their menus (Łuczaj & al. 2012).

The objective of the present study was to record knowledge on the traditional uses of wild edible plants in the Republic of North Macedonia.

Material and methods

The Republic of North Macedonia is located in the central part of the Balkan Peninsula and has a rich flora.

One hundred and fifty-four informants from different parts of the Republic of North Macedonia were selected for this research. Data was collected from September 2018 to March 2019, by means of face-to-face interviews. The informants were asked to share their knowledge about the use of wild edible plants. They were asked about the names of the wild edible plants they used, the way of their use and which plant parts were used. During the interviews, the informants were requested to always show the reported plants. Published literatures were used for identification of the specimens. Local plant names were transcribed in Latin. The received information was recorded and compared with earlier ethnobotanical researches carried out in the Republic of North Macedonia.

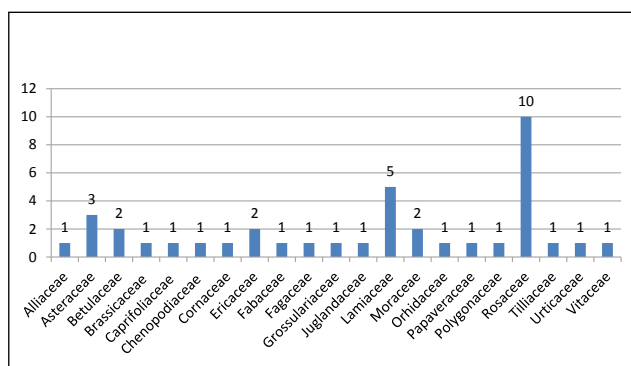


Fig. 1 Family distribution of the wild edible plants.

The relative frequency of citation index (RFC), i.e. the number of informants who cited a specific wild edible plant divided by the total number of informants, was calculated for each mentioned plant species (Sansanelli & al. 2017).

Descriptive statistics in frequencies and percentages were used to summarize the obtained data by a Microsoft Excel spreadsheet and for drawing graphs and pie charts.

Results

The present survey has covered 154 informants, aged 18 or more years. The participants were from both sexes (Table 1).

Table 1. Characteristics of the informants.

Age (yrs)	Male	Female	Total number	Percentage
18–35	22	43	65	42.2 %
36–50	9	35	44	28.6 %
Above 50	14	31	45	29.2 %
Total	45	109	154	100 %

The wild edible plant species mentioned by the informants belonged to 21 different botanical families (Fig. 1).

The plants are arranged alphabetically per their family and botanical names. Further follows the local folk name in the Macedonian language, the edible parts and culinary use (Table 2). In Table 2, the relative frequency of citation index (RFC) for each researched plants is presented. The habit of wild edible plants is presented in Fig. 2. As shown in Fig. 3, different plant parts have been used for consumption.

Wild edible plants are used for different purposes. The culinary uses of the wild edible plants in this study are presented in Fig. 4.

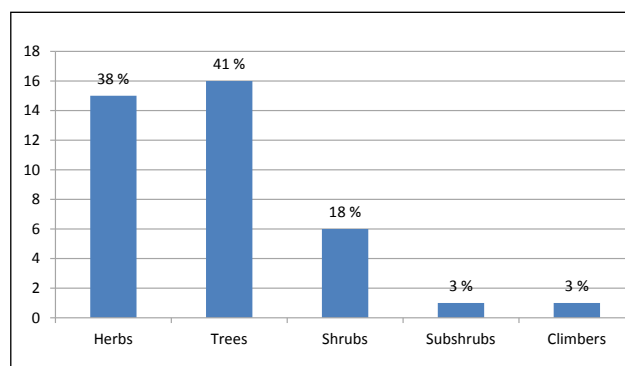


Fig. 2. Distribution of species in each plant habit.

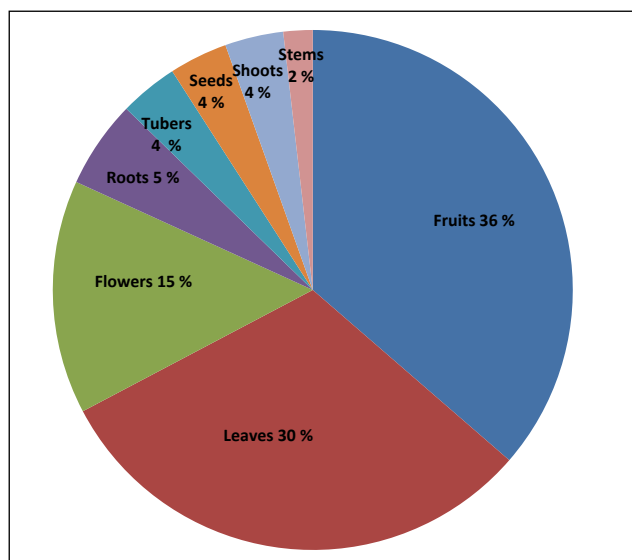


Fig. 3. Consumed plant parts.

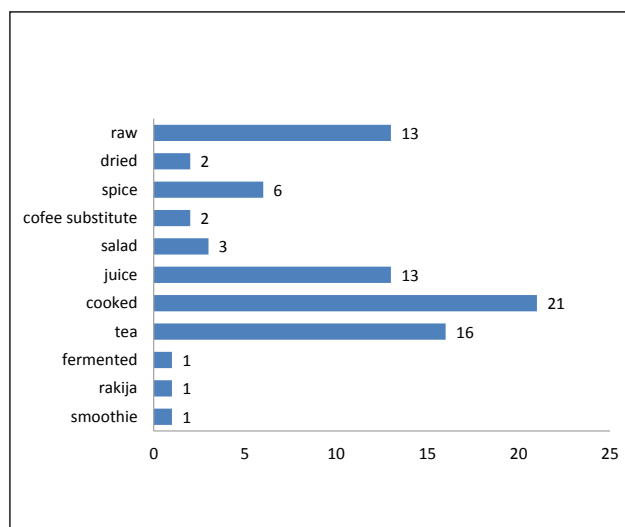


Fig. 4. Culinary uses of the wild edible plants traditionally consumed in the study.

Table 2. Wild edible plants used by the informants in this research.

Plant No.	Botanical family	Botanical name	Local name	Edible parts	Culinary use	RFC
1.	Alliaceae	<i>Allium ursinum</i> L.	Div luk, mechkin luk, shumski luk	Leaves	Eaten raw; as spice	0.012
2.	Asteraceae	<i>Cichorium intybus</i> L.	Cikorija	Roots	Consumed as coffee substitute	0.012
3.	Asteraceae	<i>Helianthus tuberosus</i> L.	Zemjeno jabolko, krtolest sonchogled	Tubers	Eaten raw	0.006
4.	Asteraceae	<i>Taraxacum officinale</i> Weber.	Gluvarche	Roots, leaves, flowers	Fresh leaves eaten as salad, roots as coffee substitute	0.084
5.	Betulaceae	<i>Betula pendula</i> Roth.	Breza	Stems	As juice	0.006
6.	Betulaceae	<i>Corylus avellana</i> L.	Leshnik, leska	Fruits	Eaten raw and roasted fruits;	0.012
7.	Brassicaceae	<i>Brassica nigra</i> (L.) Koch.	Crn sinap, crna zelka	Leaves, seeds	As spice	0.006
8.	Caprifoliaceae	<i>Sambucus nigra</i> L.	Bozel	Flowers	As tea and juice	0.012
9.	Chenopodiaceae	<i>Chenopodium album</i> L.	Loboda, guskina noga	Leaves	Eaten as salad	0.012
10.	Cornaceae	<i>Cornus mas</i> L.	Drenka, dren	Fruits	As jam, juice and tea	0.181
11.	Ericaceae	<i>Vaccinium myrtillus</i> L.	Borovinka	Fruits	Eaten raw; processed as juice and jam	0.149
12.	Ericaceae	<i>Vaccinium vitis-idaea</i> L.	Brusnica	Fruits	Eaten raw; dried fruits; processed as juice; tea	0.058
13.	Fabaceae	<i>Robinia pseudoacacia</i> L.	Bel bagrem	Flowers	As tea	0.006
14.	Fagaceae	<i>Castanea sativa</i> Mill.	Kosten	Fruits	Eaten boiled and roasted fruits	0.032
15.	Grossulariaceae	<i>Ribes alpinum</i> L.	Ribizla	Leaves, fruits	As tea and jam	0.025
16.	Juglandaceae	<i>Juglans regia</i> L.	Orev	Fruits	Raw and processed fruits	0.064
17.	Lamiaceae	<i>Melissa officinalis</i> L.	Matochina	Leaves	As tea	0.019
18.	Lamiaceae	<i>Mentha longifolia</i> (L.) Hunds.	Nane	Leaves	As tea; leaves cooked as vegetable; dried leaves as spice	0.363
19.	Lamiaceae	<i>Origanum vulgare</i> L.	Origano, Rigan, Planinski čaj	Flowers and leaves	As tea; as spice	0.123

Table 2. Continuation.

Plant No.	Botanical family	Botanical name	Local name	Edible parts	Culinary use	RFC
20.	Lamiaceae	<i>Sideritis scardica</i> Gris.	Sharplaninski chaj, makedonski chaj	Leaves, flowers, shoots	As tea	0.019
21.	Lamiaceae	<i>Thymus</i> sp.	Majcina dushica	Leaves, flowers	As tea, as spice	0.194
22.	Moraceae	<i>Ficus carica</i> L.	Diva smokva	Fruits	As jam and preserve	0.025
23.	Moraceae	<i>Morus nigra</i> L.	Dudinki	Fruits	As preserve	0.012
24.	Orhidaceae	<i>Orhis morio</i> L.	Kachunka, salep	Tubers	As coffee supplement	0.038
25.	Papaveraceae	<i>Papaver rhoeas</i> L.	Bulka	Flowers	As tea	0.006
26.	Polygonaceae	<i>Rumex crispus</i> L.	Shtavej	Leaves	Eaten fresh as salad; cooked, used in pie (zelnik) making	0.058
27.	Rosaceae	<i>Fragaria vesca</i> L.	Jagoda	Fruits, leaves	Eaten raw, as jam, juice, preserve	0.422
28.	Rosaceae	<i>Malus sylvestris</i> Mill.	Divo jabolko, shumsko jabolko	Fruits	Eaten raw; for making apple cider vinegar	0.012
29.	Rosaceae	<i>Prunus avium</i> L.	Diva cresha	Fruits	Eaten raw; as jam, juice and compote	0.012
30.	Rosaceae	<i>Prunus cerasifera</i> Ehrh.	Sliva djanki, prsliva sliva	Fruits	Eaten raw, as compote, juice, jam; for making rakija (brandy)	0.071
31.	Rosaceae	<i>Prunus spinosa</i> L.	Trninka (modri), crn trn	Fruits	As juice and jam	0.032
32.	Rosaceae	<i>Pyrus pyraeaster</i> L.	Diva krusha	Fruits	As jam and juice	0.038
33.	Rosaceae	<i>Rosa canina</i> L.	Shipka, shipinka	Fruits, leaves	As tea; processed as jam, preserve, juice	0.214
34.	Rosaceae	<i>Rubus fruticosus</i> L.	Kapina	Fruits, leaves	Eaten raw; as tea; processed as jam, juice, preserve and smoothie	0.272
35.	Rosaceae	<i>Rubus idaeus</i> L.	Malina	Fruits	Eaten raw; as juice and jam	0.240
36.	Rosaceae	<i>Sorbus domestica</i> L.	Oskorusha	Fruits	Eaten raw; as tea, dried fruits	0.006
37.	Tilliaceae	<i>Tillia cordata</i> Mill.	Lipa	Leaves, flowers	As tea	0.025
38.	Urticaceae	<i>Urtica dioica</i> L.	Kopriva	Leaves, roots, shoots, seeds	As tea, dried leaves as spice; cooked as vegetable	0.233
39.	Vitaceae	<i>Vitis sylvestris</i> Gmel.	Diva loza	Leaves, fruits	Used for stuffed leaves meals	0.006

Discussion

The Republic of North Macedonia is an interesting place for studying the use of wild edible plants, considering the fact that it is on top of the list of countries with impressive biodiversity in Europe („hot spot“). The flora of higher plants in the Republic of North Macedonia comprises about 3700 species (Matevski & al. 2003). Since 2009, no field studies have been conducted in the country into the relationship between

plants and humans (Rexhepi & al. 2014). The number of ethnobotanical surveys about wild edible plants in the country is quite limited.

In the present study, the 154 informants were divided into three age groups: young (18–35 years), adult (36–50) and elderly (above 50). Of the participants who took part in the research, 42.2% were between the age of 18 and 35 years, 28.6% were between 36 and 50, and 29.2% were above 50. Young people were covered in this research in order to see how

much they know about the traditional uses of wild edible plants. Of all participants, 45 were male and 109 female (Table 1). The results showed that traditional knowledge was better preserved by women than men and this was in agreement with the conclusions of Sansanelli & al. (2017).

Thirty-nine wild edible plants, belonging to 21 families, were documented. Most of the wild edible plant species belonged to *Rosaceae* (10), *Lamiaceae* (5) and *Asteraceae* (3) (Fig. 1). In the study in Pelagonia region (southwestern part of the Republic of North Macedonia), the most abundantly represented families were *Rosaceae*, *Lamiaceae* and *Asteraceae* (Rexhepi & al. 2018).

The value of the relative frequency of citation (RFC) index may vary from 0 (when nobody mentions the plant as useful) to 1 (when all informants mention the use of the species) (Tardio & al. 2008). Determination of the RFC index for each wild edible plants is important because this provides information about the degree of knowledge shared by the informants. In our study, the species with the highest relative frequency of citation index is *Fragaria vesca* L. (0.422), followed by *Mentha longifolia* (L.) Huds. (0.363), *Rubus fruticosus* L. (0.272), *Rubus idaeus* L. (0.240), *Urtica dioica* L. (0.233), and *Rosa canina* L. (0.214) (Table 2). In Reka Valley (West Republic of North Macedonia), they mentioned as very commonly used the following wild plants: *Rumex patientia*, *Urtica dioica*, *Hypericum perforatum*, and *Primula veris* (Pieroni & al. 2013). According to Pieroni & al. (2014), *Urtica dioica* and *Rumex* spp. were the primary wild edible plants used in Albania too.

Some of the mentioned plants had more than one local folk name (Table 2). This was explained by the fact that a different name for same plant was used in different regions of the Republic of North Macedonia.

The trees dominated among the plant life forms with 16 species (41%). The herbs were represented by 15 species (38%), shrubs by six species (18%) and subshrubs (3%) and climbers (3%) by only one species each (Fig. 2).

The consumed plant parts included fruits, leaves, flowers, roots, tubers, seeds, stems, and young shoots. Fruits (36%) were dominant as edible parts, followed by leaves (30%), flowers (15%), roots (5%), tubers (4%), shoots (4%), and stems (2%), consumed by the people included in this study (Fig. 3). Dominant consumption of fruits, leaves and flowers was due to the

fact that most of the wild edible plants in the research belonged to the botanical families of *Rosaceae*, *Lamiaceae* and *Asteraceae*. Furthermore, according to Łuczaj (2008), fruits were the most frequently collected part of plants. In our survey, the leaves were usually used in infusions, while only seven wild vegetables were utilized as greens (*Allium ursinum*, *Taraxacum officinale*, *Brassica nigra*, *Chenopodium album*, *Urtica dioica*, *Vitis sylvestris*, and *Rumex crispus*). Low cultural significance of wild greens could be observed in Poland, while stronger and still extant traditions of the use of wild greens were present in East Asia (Łuczaj 2010).

The ways of consumption of the above-mentioned wild edible plants and the number of species in each group are shown in Fig. 4. Most often they are consumed cooked, in teas and raw.

In the category of cooked plants, 21 wild edible plants were reported (*Corylus avellana*, *Cornus mas*, *Vaccinium myrtillus*, *Castanea sativa*, *Ribes alpinum*, *Juglans regia*, *Mentha longifolia*, *Ficus carica*, *Morus nigra*, *Rumex crispus*, *Fragaria vesca*, *Prunus avium*, *Prunus cerasifera*, *Prunus spinosa*, *Pyrus pyraster*, *Rosa canina*, *Rubus fruticosus*, *Rubus idaeus*, *Urtica dioica*, *Orchis morio* and *Vitis sylvestris*). The category of cooked plants covers the wild edible plants that are roasted, boiled, or processed as jam, preserve or compote. The consumption of leaves of *Rumex crispus* was reported as a filling in pies (zelnik). The tubers of *Orchis morio* were reported as a coffee supplement.

In this study, 13 of the mentioned wild edible plants were eaten raw (*Allium ursinum*, *Helianthus tuberosus*, *Corylus avellana*, *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Juglans regia*, *Fragaria vesca*, *Malus sylvestris*, *Prunus avium*, *Prunus cerasifera*, *Rubus fruticosus*, *Rubus idaeus* and *Sorbus domestica*). More than half of the cited taxa (7) belonged to the *Rosaceae* family, which was in agreement with the conclusions of Rexhepi & al. (2017).

Leaves of three wild edible species have been used in salads (*Taraxacum officinale*, *Chenopodium album* and *Rumex crispus*). The flowers of *Taraxacum officinale* were also used in salads, which is in agreement with the research data obtained in the Pelagonia region (southwestern part of the Republic of North Macedonia) by Rexhepi & al. (2017). *Taraxacum officinale* is more frequently reported as a salad species in 13 reports. The leaves of Chicory (*Cichorium intybus* L.) have been used for centuries in Montenegro and other Mediterranean countries as a vegetable in

salads, sauces and other types of appetizers and meals and could be regarded as a healthy food in the well-balanced diets (Jančić & al. 2016).

Six wild plants have been used as spice (*Allium ursinum*, *Brassica nigra*, *Mentha longifolia*, *Origanum vulgare*, *Thymus* sp., and *Urtica dioica*). Two wild edible plants are consumed as dried fruits (*Vaccinium vitis-idaea* and *Sorbus domestica*). The mentioned wild edible plants are used in the preparation of beverages: tea, coffee substitute, juice, rakija, and smoothie. The roots of *Cichoria intybus* and *Taraxacum officinale* are used for making coffee substitute.

Thirteen species were reported as used for juice (stem of *Betula pendula*, flowers of *Sambucus nigra*, and fruits of *Cornus mas*, *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Fragaria vesca*, *Prunus avium*, *Prunus cerasifera*, *Prunus spinosa*, *Pyrus pyraeaster*, *Rosa canina*, *Rubus fruticosus*, and *Rubus idaeus*). More than half of the cited plant species used for juice belonged to the *Rosaceae* family.

It is a well-known fact that many wild edible plants are also used for medicinal purposes. Altogether, 16 wild edible plants were reported as used in infusions (*Sambucus nigra*, *Cornus mas*, *Vaccinium vitis-idaea*, *Robinia pseudoacacia*, *Ribes alpinum*, *Mellisa officinalis*, *Mentha longifolia*, *Origanum vulgare*, *Sideritis scardica*, *Thymus* sp., *Papaver rhoeas*, *Rosa canina*, *Rubus fruticosus*, *Sorbus domestica*, *Tilia cordata*, and *Urtica dioica*).

In this research, only one plant species was mentioned for making a smoothie (*Rubus fruticosus*), and another one for making rakija (brandy) (*Prunus cerasifera*).

Malus sylvestris was included in the category of fermented plant foods because its fruits were used for making apple cider vinegar.

Taking into consideration the above-mentioned facts, it could be concluded that one plant may have many uses.

Conclusions

In the present study, 39 wild edible plants belonging to 21 families were documented. Most species belonged to *Rosaceae*, *Lamiaceae* and *Asteraceae* families. *Fragaria vesca* L. was a species with the highest relative frequency of citation index. Trees dominated among the plant life forms. Different plant parts were used,

but the most frequently used parts were fruits, leaves and flowers. The Republic of North Macedonia is very rich in wild edible plants, which were most often consumed cooked, in teas and raw.

This study entails several recommendations. Further ethnobotanical researches should be conducted in the Republic of North Macedonia in order to preserve the traditional knowledge about wild edible plants for future generations. A monitoring of wild edible plants in nature is necessary. This type of study could be also used for the development of strategies for sustainable use of wild edible plants as a natural resource, as well as for promotion of sustainable ecotourism.

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