Acta Societatis Botanicorum Poloniae
Journal homepage: pbsociety.org.pl/journals/index.php/asbp
INVITED REVIEW Received: 2012.07.20 Accepted: 2012.09.12 Published electronically: 2012.11.19 Acta Soc Bot Pol 81(4):359–370 DOI: 10.5586/asbp.2012.031

Wild food plant use in 21st century Europe: the disappearance of old traditions and the search for new cuisines involving wild edibles

Łukasz Łuczaj[1]*, Andrea Pieroni[2], Javier Tardío[3], Manuel Pardo-de-Santayana[4], Renata Sõukand[5], Ingvar Svanberg[6], Raivo Kalle[7]

[1] Department of Botany and Biotechnology of Economic Plants, University of Rzeszów, Werynia 502, 36–100 Kolbuszowa, Poland

[2] University of Gastronomic Sciences, Piazza Vittorio Emanuele 9, 12060 Pollenzo, Cuneo, Italy

[3] Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA), Finca "El Encín", Apdo. 127, 28800 Alcalá de Henares, Spain

[4] Departamento de Biología (Botánica), Universidad Autónoma de Madrid, Darwin 2, 28049 Madrid, Spain

[5] Estonian Literary Museum, Vanemuise 42, 51003 Tartu, Estonia

[6] Uppsala Centre for Russian and Eurasian Studies, Uppsala University, Box 514, 751 20 Uppsala, Sweden

[7] Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, Kreutzwaldi 62, 51014 Tartu, Estonia

Abstract

The aim of this review is to present an overview of changes in the contemporary use of wild food plants in Europe, mainly using the examples of our home countries: Poland, Italy, Spain, Estonia and Sweden. We set the scene referring to the nutrition of 19th century peasants, involving many famine and emergency foods. Later we discuss such issues as children's wild snacks, the association between the decline of plant knowledge and the disappearance of plant use, the effects of over-exploitation, the decrease of the availability of plants due to ecosystem changes, land access rights for foragers and intoxication dangers. We also describe the 20th and 21st century vogues in wild plant use, particularly their shift into the domain of haute-cuisine.

Keywords: wild edible plants, famine, food security, culinary vogues, habitat transformations

Introduction

In several countries and regions of Europe ethnobotanical studies and reviews give us a picture of traditionally used wild food plants (e.g. Poland [1–8], Spain [9–26], Portugal [26,27], Italy [28–37], Greece [38,39], France [40], Bosnia-Herzegovina [41], the whole Mediterranean area [42–44], Austria [45–47], Slovakia [48] and the Nordic countries [49,50]).

Plant use patterns are usually not static. In many cases ethnobotanical studies reveal either a dramatic or gradual loss of traditional knowledge and practices (e.g. [3,50,51]). The changes in patterns of wild plant use differ by region and are associated with lifestyle changes, urbanization, large-scale farming, lesser contact with nature and many other reasons. Moreover, times of famine seem to be in the distant past for industrially developed countries. Food made of cultivated plants and bought from the supermarket appears on the table with relatively little effort, while collecting wild species is more time consuming and season-dependent. In spite of that, the importance of wild food plants for food security and in shaping alternative models of consumption is emphasized [52]. Wild food plants cannot be considered "famine food" only, as many of them were and still are used on several other occasions as well (cf. [53]). Moreover, in Europe there are new phenomena associated with plant use appearing in modern societies. Some of them have to do with migration and new ethnic minorities appearing in cities and bringing new traditions with them. Other phenomena appear due to new trends in nutrition and self-medication facilitated by the instantaneous spread of information via the Internet. On top of that not all the traditions are gone, in some areas for a variety of reasons old traditions are cultivated while in others, they are lost.

In this review we would like to give an overall picture of what is happening to the traditional use of wild food plants in different parts of Europe at the dawn of the 21st century.

What are wild food plants?

The term "wild" refers to those plants that grow without being cultivated. It mostly includes native species growing in their natural habitat, but sometimes managed, as well as introduced species that have been naturalized [15].

Apart from that, a large number of other species are perceived as "wild" and labelled in this way, sometimes for marketing purposes (positive term) or as a negative term (as

* Corresponding author. Email: lukasz.luczaj@interia.pl

This is an Open Access digital version of the article distributed under the terms of the Creative Commons Attribution 3.0 License (creativecommons.org/licenses/by/3.0/), which permits redistribution, commercial and non-commercial, provided that the article is properly cited.

© The Author(s) 2012 Published by Polish Botanical Society

opposed to the "better" developed cultivars). This includes for example trees that have been intensively managed, even promoted, by planting or sowing (e.g. *Juglans regia* L., *Mespilus germanica* L., *Corylus avellana* L., *Prunus avium* L., *Ficus carica* L., *Sambucus nigra* L., etc.), which depending on the area and circumstances can be cultivated, wild or semi-wild, sometimes formerly cultivated and then abandoned. Special cases are wild forms of plants brought to the garden from the wild and cultivated directly for food purposes, either because of the expected greater harvest, instant availability or lack in the region [e.g. *Rumex acetosa* L., *Allium ursinum* L. and *A. schoenoprasum* L. in modern Estonia; *Silene vulgaris* (Moench) Garcke and *Origanum vulgare* L. in Spain; *Scolymus hispanicus* L. in southern Italy; *Angelica archangelica* L. in Norway, Iceland and the Faroes]. Also, many herbs used for making tea are widely cultivated, but people still refer to them as wild plants. On the other hand some of the species that have become naturalized and are gathered from gardens but are still unattended by people, are nevertheless considered cultivated species, for example in Estonia such plants are *Armoracia rusticana* G. Gaertn., B. Meyer & Screb and *Calendula officinalis* L. In other countries the opposite can be true: some of the species cultivated in the past and now naturalized are popularly considered "wild", e.g. *Bidens aurea* (Aiton) Sherff, *Chenopodium ambrosioides* L., *Matricaria recutita* L. in Spain; *Aegopodium podagraria* L., *Carum carvi* L. and *Myrrhis odorata* L. in Scandinavia [9,50].

Moreover, when asked about wild plants, people tell the ethnobotanist about edible uses of species that are mainly cultivated for non-edible purposes or for other edible purposes. For instance, in Spain the immature inflorescences of turnip, a species that is cultivated for the consumption of its roots, were usually eaten cooked. The young shoots of cultivated roses and grape vines were peeled and eaten in the same way as those from wild blackberries (*Rubus ulmifolius* and other species of the genus *Rubus*). Other examples are trees planted in parks and urban settings such as *Robinia pseudoacacia* L. (flowers). All the above-mentioned species are cultivated for the harvesting of a different part of the plant, or planted for ornamental purposes. Therefore, people associate these food-uses with gathering more than farming [15].

A gradual decrease of the necessity of use of wild food plants

Disappearing memories of famine

The use of wild plants in Europe is often associated with times of famine or food scarcity (although not exclusively). Food substitution is the most common individual subsistence strategy in times of want and starvation. Indeed, all the early studies on the use of wild food plants in Europe – from those coming from the 19th century until more or less the 1960s – capture the memory of famine and the use of wild plants as a means of basic survival, including the consumption of starvation foods that in normal times would be discarded by the community (Tab. 1). There were many outbreaks of famine in some parts of Europe in the 19th and 20th centuries. Probably one of the most serious was caused by the potato blight (1844–1849). This affected many potato-dependent countries, from Ireland to Poland [54,55]. Locally, famines due to crop failure appeared in some parts of Europe for a few successive decades [56–59]. A severe famine hit Russia in 1892. Then World War I (1914–1918) brought another serious crisis. The revolution and the establishment of the Soviet Union brought famine and hunger crisis in 1921–1922 to large areas in eastern Europe, as described by the sociologist Pitirim Sorokin [60]. In 1932–1933 millions of people starved to death in the Ukraine due to the policy of the Soviets [55,61]. The Spanish Civil War (1936–1939) and later World War II brought another revival of emergency food. So did the siege of Leningrad 1941–1944, the Athens famine of 1941–1942 and the Dutch winter of hunger, 1944–1945, when people had to use almost anything as alternative sources of nutrients [55,62]. For most European countries this was the last episode of serious malnutrition, apart from the Balkans when the conflicts, which emerged during the collapse of Yugoslavia, caused a food crisis. Probably the best documented one and the longest is the over three year siege of Sarajevo, which was captured from inside by the Bosnian botanist Sulejman Redžić, who not only recorded the emergency plants used, but also tried to alleviate the crisis by running media programs explaining the use of wild plants in the besieged city [63,64].

Two kinds of poverty food are prominent in memories or sources from the 19th century: emergency bread additives and plants to make potherb or soup. The use of potherb/soup wild vegetables survived mainly in the Mediterranean, at least in some rural areas. However, wild bread additives have almost

Tab. 1 Examples of famine plants important in 19th century or early 20th century nutrition in Europe, now nearly forgotten.

Species/part used	Country	Reference
Elytrigia repens (L.) Desv. ex Nevski (rhizomes)	Poland	[2]
Arum spp. (bulbs)	Croatia	[87]
Eryngium spp. (roots)	England, Croatia	[87,90]
Trapa natans (fruits)	Poland, Hungary	[5]
Polypodium vulgare (rhizomes)	Poland, Slovakia	[5,48]
Angelica sylvestris L. (young stems)	Estonia	[103]
Anthriscus sylvestris (L.) Hoffm. (young stems)	Estonia	[103]
Equisetum arvense L. (tubers, spring shoots)	Estonia	[103]
Cirsium oleraceum (L.) Scop.(young stems)	Estonia	[103]
Menyanthes trifoliata L. (rhizomes)	Finland	[65]
Crepis vesicaria subsp. *haenseleri* (Boiss. ex DC) P. D. S (basal leaves)	Spain	[20]
Quercus ilex subsp. *ballota* (Desf.) Samp. (acorns)	Spain	[9,16,20]
Crataegus monogyna Jacq. (fruits)	Spain	[9,16,20]
Rosa canina L. (young shoots)	Spain	[20]
Chondrilla juncea L. (young shoots)	Spain	[16,19]
Sonchus asper (L.) Hill (peeled midribs)	Spain	[19]
Cichorium intybus L. (basal leaves)	Spain	[13,16]
Scorzonera laciniata L. (tender leaves and stems)	Spain	[21,22,89]
Silybum marianum (L.) Gaertn. (peeled basal leaves)	Spain	[21,22,89]
Cynodon dactylon (L.) Pers. (rhizomes)	Spain	[21,24]
Bunium bulbocastanum L. (tubers)	NW Italy	[104]

© The Author(s) 2012 Published by Polish Botanical Society

completely disappeared from the European diet. In Spain such famine breads were made with acorns of several species, but mainly from *Quercus ilex* subsp. *ballota* (Desf.) Samp., chestnuts, grains of some Poaceae species (e.g. *Aegilops geniculata* Roth), but also fruits and seeds of other species (e.g. *Caucalis platycarpos* L., *Vicia lutea* L.), and even rhizomes [e.g. *Cynodon dactylon* (L.) Pers.] [9]. In Poland and Estonia a similarly large spectrum of plant material was used for making bread: tree cambium, bark, catkins (inflorescences of wind pollinated trees), roots, rhizomes, bulbs or even wood shavings. Polish 19th century ethnographic works list a large number of famine taxa, e.g. *Elytrigia repens* (L.) Desv. ex Nevski rhizomes, tree buds, bark and wood, *Tilia* leaves, *Corylus avellana* L. catkins and many herbaceous plants [1]. Some of these plants were exclusively regarded as famine plants, and by now the knowledge about their use, of importance in emergency situations, is lost. A Swedish questionnaire concerning substances used as foodstuffs in times of disaster was sent out in 1929 by the Folklore Archives in Uppsala. A large number of time-honoured emergency foods and substances used to make flour last longer were listed. Besides bark from *Pinus sylvestris* L., *Betula pubescens* Ehrh., *Picea abies* L. and *Fraxinus excelsior* L. and other trees (65% of the records), straw (35%), ears of grain and chaff (35%), potatoes (23%), bone flour (19%), mash (13%), root vegetables and turnip greens (6%), also *Elytrigia repens* (L.) Desv. ex Nevski, *Chenopodium album* L., *Calluna vulgaris* L., *Vicia cracca* L. and many wild berries are named as surrogate foods [65].

Still, most of the plants used in times of famine were also used when just a shortage of grain occurred in the springtime. In Spain, wild vegetables were very valuable in the spring (or even in the winter in warmer regions) when fresh agricultural products were scarce [13]. In some Italian and Spanish regions a blend of many different wild species (up to 40 or even 50) has been used in vegetable recipes [13,28,29]. Following the ethnobotanist Timothy Johns [66], one of the reasons for this behaviour is the maintenance of knowledge of the usefulness of some plants of lesser quality that could be necessary in times of scarcity [13]. It is a fascinating question, why these multi-species wild green mixes are remembered in some parts of the Mediterranean (e.g. [13,28,44]), while they were completely forgotten in northern Europe, where they also existed in the 19th century or earlier [2,3]. In northern Sweden and Finland it was a widespread custom to use the rhizomes of *Menyanthes trifoliata* L. and *Calla palustris* L., as well as bark from *Pinus sylvestris*, until the late 19th century, also during non-famine years [56].

The possibility of a more extensive use of wild food plants in nutrition to alleviate food shortages was a topic often occurring in the 18th to early 20th century economic botany literature, from plant dictionaries to government pamphlets. A particularly important position is held by the Swiss-origin botanist and food scientist Adam Maurizio (1862–1941), who spent much of his lifetime teaching in Polish-language universities in Lwów (now Lviv) and Warsaw. He published his treatise on the history of plant food from the earliest times to the present, originally in Polish [54], and later in German [67] and French [68]. This first scientifically based overall presentation of the history of plant food justified Maurizio's international reputation as a cultural historian and the father of food sciences (Bromatology). With its trans-disciplinary approach, he opened completely new perspectives for ethnography, history, agriculture and agricultural geography. It is probably one of the most valuable books in the history of material culture, which never made its way to the English-speaking reader.

In Poland recent ethnobotanical surveys show that respondents are unable to recall famine plants except for *Urtica dioica* L. and *Chenopodium album* [3,6], thus present ethnobotanical studies, even if the oldest people are interviewed, cannot reveal the whole spectrum of plants used even just at the end of the 19th century. That is why it is important to quickly capture the memories of former wild food plants in the countries where few or no ethnobotanical works were carried out, as well as to make use of historical sources.

Diversification of a monotonous diet

Although it was probably not perceived as so by the historical users, many of the uses of wild food plants are related to the diversification of a monotonous diet in non-famine times. For example, in the north of Portugal, the addition of different aromatic wild species [*Foeniculum vulgare* Mill., *Pterospartum tridentatum* (L.) Willk., *Calamintha nepeta* (L.) Savi, *Lavandula stoechas* L. or *Thymus mastichina* (L.) L.] for seasoning soups and purees was a way to diversify the monotonous diet [26,27]. The use of wild food plants for this diversification does not depend so much on the geographical position or the variety of the flora of the users, but on access to supplies and the knowledge and creativity of the cook.

Wild snacks as children's snacks

The earliest work on children's wild food snacks comes from the Slovakian botanist Jozef Ludovit Holuby from 1896 [69]. It is believed that the way children approach nature may be a relic of how our ancestors did [6]. Kids often participated in their mother's gathering activities (e.g. [2]), but they seem to have had a "folklore" of their own, mainly with plants eaten raw [6,9]. These were often flowers (which contain some sugar in their nectar, like *Lamium album* L.), mature fleshy fruits, nuts and seeds, as well as some tasty and interesting-looking immature fruits, e.g. *Capsella bursa-pastoris* (L.) Medik. or *Malva* spp., widely eaten across Europe [6,9,13]. Other children's snacks in Spain consisting of vegetables [13] were: the basal part of the stems of *Scirpus holoschoenus* L.; the leaves and stems of several *Rumex* species with an acidic flavour; the leaves and stems of *Oxalis acetosella* L. and other species of the same genus, also with an acidic taste; the stem and leaves of *Foeniculum vulgare* Mill. and *Scandix australis* L., with their characteristic aniseed taste; the tender parts of the unripe inflorescence, such as the bottom of the inflorescence of *Scorzonera laciniata* L. or the "artichokes" of *Silybum marianum* (L.) Gaertn.; the unripe fruits of several species of *Erodium* or the immature seeds of various species of the Fabaceae family (*Lathyrus cicera* L., *Vicia villosa* Roth and *V. lutea* L.). Swedish children gathered several plants as snacks, but also because of the small amount of food they were granted when working as herdsmen tending animals in the forests and mountains. Commonly used as alternative sources of food among children in northern Sweden were *Rumex acetosa* L., *Oxalis acetosella* L., *Cicerbita alpina* (L.) Wallr., *Angelica sylvestris* L., wild berries like *Vaccinium myrtillus* L., *Vaccinium vitis-idaea* L., *Vaccinium oxycoccos* L., *Rubus chamaemorus* L., and *Rubus idaeus* L., as well as new shoots of *Picea abies*. Many children, as well as the Saami, found the fungus *Chrysomyxa woronini* Tranzschel refreshing [50]. Norwegian and Faroese children have until recently gathered and eaten the nodules attached to the rhizomes of *Equisetum arvense* L. [70]. In Poland, favourite children's

© The Author(s) 2012 Published by Polish Botanical Society

snacks have been the leaves of *Rumex* spp., *Oxalis* spp., the flowers of *Trifolium* spp., *Lamium album*, *Robinia pseudacacia*, the inner stalks of *Acorus calamus* L. and of course a variety of fruits. Most of the snacks children eat are sweet (e.g. fruits, flower nectar or stem bases of grasses and rushes) or sour (like *Rumex* spp., *Oxalis* spp. and *Berberis vulgaris* L. leaves and many fruits). Another category of children's snacks used to be the underground organs of plants, usually containing starch or other sugars. Some examples from Eastern Europe are the sweet rhizomes of *Polypodium vulgare* L., the tubers of *Lathyrus tuberosus* L., *Chaerophyllum bulbosum* L., *Equisetum arvense* L. or *Stachys palustris* L. [5,6,48]. In South-West Europe these were *Conopodium* spp. [*C. majus* (Gouan) Loret, *C. marianum* Lange, *C. pyrenaeum* (Loisel.) Miégev., *C. subcarneum* (Boiss. & Reut.) Boiss. & Reut., and *C. thalictrifolium* (Boiss.) Calest.] and *Bunium* [*B. macuca* Boiss., *B. balearicum* (Sennen) Mateo & López Udias and *B. pachypodum* P. W. Ball], or the bulbs of *Merendera montana* (L.) Lange and *Romulea bulbocodium* (L.) Sebast. & Mauri [9]. These kinds of wild food plants may be the true relics of a hunting-gathering lifestyle.

Children taste everything, sometimes even poisonous plants, but the bitter taste usually warns against future consumption. Thus early age experimentation may have been a continuing source of introduction or re-introduction of food plants in the diet [6]. Some of the snacks tasted in childhood were still occasionally "in use" in adulthood, but the majority of modern adults simply do not get many chances to eat them again. A recent study carried out in rural areas of the region of Madrid [16] showed that the use of most of these species has been abandoned. An even sharper decline in gathering occurred in Poland [3]. A study of the Saami in Norway shows that adults actually forget what they ate as snacks during childhood, while their kids still continue to utilize the plants [71].

Nowadays, even in rural areas, children do not spend as much time in the fields as their parents or grandparents did. They not only do not take part in pastoral and agricultural activities, but generally spend little time outdoors.

Twentieth century – the era of sugar preserves

A large influence on the use of wild foods in the 20th century was the lowering price of sugar. Sugar was used in cooking centuries before. In Poland already in the 17th and 18th centuries, sweets made with candied *Acorus calamus* rhizomes were used in large quantities by manor houses [72]. However the price of sugar was extremely high. When in the early 20th century it became lower, rural populations in many countries, following the example of the higher classes, started making preserves using sugar. In Poland and Estonia, in the 19th century, the major way of preserving fruits was drying [5,73]. However, later, making jams and pasteurized juices and sweetened wines made of both cultivated and wild fruits became popular. This reached its climax in the 1980s during the economic crises after martial law in 1981 and in Estonia in the 1990s when sugar was in short supply. Later this trend decreased due to the large choice of products in shops and the bad health reputation of sweetened foods.

Berries, mushrooms and common plants are, thanks to the legal right of access to private land, freely available resources for everyone to use in Sweden and Finland. Many berries have therefore actually increased in importance during the 20th century, especially due to the prevelance of cheap sugar. Wild berries are consumed on a large scale in contemporary Scandinavia and widely used in food industry [50]. Of the forty or so various wild edible berries available in the Swedish landscape, most people pick only a few. There are about 50 species of wild fleshy fruits growing in Finland, of which 37 are edible, but only sixteen of these are picked for consumption [50,74–77].

Reasons for the contemporary decrease in the use of wild food plants

Decrease of plant knowledge and contact with nature

The use of wild food plants in nutrition in many European communities, particularly urban ones, is very low nowadays. In large parts of northern and eastern Europe people only collect wild fruits and mushrooms [2,3,5], whereas in southern Europe some wild greens, such as *Taraxacum* spp. *Asparagus acutifolius* L., *Scolymus hispanicus* L. and *Silene vulgaris* are also relatively popular [9,13,37]. In some other areas only a few species of wild vegetables are collected, e.g. *Rumex acetosa* in Poland [3] or *Allium ursinum* in the Alps [46].

The consumption of many wild edible plants in Spain was strongly linked to traditional management activities such as tending livestock, charcoal burning or bracken harvesting. In some cases it was also linked to casual walks in the woods, such as walking to school. As most of these activities are not common anymore, people have also abandoned the behaviours associated with them [11,15,25]. Another important activity in the acquisition and maintenance of knowledge about edible plants was herding. When following cattle or sheep, children and adult herders had a lot of time to observe nature, as they moved through the landscape [2].

Some rural communities in Mediterranean countries still practice the gathering of some wild vegetables, but this knowledge is becoming fragmented and the practice is restricted almost exclusively to older people (e.g. [9,16]). In Spain [13], some species are still gathered or even marketed on a small scale (e.g. *Asparagus acutifolius*, *Scolymus hispanicus*, *Silene vulgaris*, *Tamus communis* L., *Montia fontana* L.). Two recent ethnobotanical studies carried out in rural areas of the province of Madrid tried to chart the present gathering and use of two of these species compared with past uses [17,18]. The results showed that *Scolymus hispanicus* were still gathered by about 20% of the interviewees (used by 35%) while 48% of them recalled collecting it in the past (used by 64%), so the rate of decrease has been 58% in gathering and 45 % in use [17]. In the case of *Silene vulgaris*, Dávila [18] found that only 11% of the interviewees collected it nowadays (used by 18%) whereas 23% of them did so in the past (used by 27%), so the rate of decrease was 53% in the gathering and 33% in use. As stated before, the majority of the people who use these two species is older than 60.

The loss of access to nature causes even such a universal plant use category as children's snacks to gradually vanish. Many children have very little access to the rural environment and the knowledge of greens growing in urban settings is very limited. Among Estonian respondents to the wild food plant questionnaire, those who grew up in towns reported just a few plants tasted, mostly bushes and grass used in hedges, flowers and trees, regardless of their age, while the children raised in rural areas, at least part time, reported a wide variety of tasted plants. In 2011, Finnish citizens were shocked by the Yle radio announcement that hunger in Estonia had reached a stage in which hungry kids were eating leaves from the trees.

© The Author(s) 2012 Published by Polish Botanical Society

A representative of the Red Cross argued that "rhubarb is already all gone, but apples are not ready yet" [78]. The Estonian press broadcasted this news widely, and the comments to the articles generally suggested that eating tree leaves is normal for kids and is not a particular sign of hunger, although they admitted, that there was a group of children who really were in need. The difference in attitudes towards the eating of leaves between two nations living just two hours away by boat is an expressive illustration of how attitudes towards nature change in a welfare society.

Ecosystem changes, pollution and overharvesting

Changes in the availability of species may affect their use. Chenopodium album, once the most widely used wild food plant in Poland, is now difficult to collect in many areas, as herbicide spraying has almost completely eliminated it. Nowadays the use of nettle *Urtica dioica* is more popular as this is a perennial and ruderal species, not affected (or rather positively affected) by changes in agriculture. In the mid-20th century an agricultural cereal weed, cornflower *Centaurea cyanus* L., was extensively used in Poland to make a fermented drink [5], however later this use completely disappeared, probably due to the use of herbicides eliminating the cornflower [5]. Modern agricultural practices, mainly deep ploughing and the use of herbicides, are also responsible for the lesser abundance of wild vegetables in Spain [11,17]. Many of them were weeds of cereal crops and usually exploited as human or animal food when crops were hand-weeded. Some of them are currently consigned to roadsides or abandoned agricultural lands.

In Estonia, as in most of the former USSR and some Eastern European countries (e.g. Slovakia), the Soviet-time agriculture changed the landscape by merging small plots and thus destroying field margins, removing a natural refuge for many species. These new large fields are now often turned into arable land, heavily sprayed with pesticides and fertilizers. A similar process actually occurred in the West (e.g. in parts of lowland England and Germany) in the search for intense high-yield agriculture. Moreover, in Estonia, Poland and probably most countries people avoid the collection of plants growing in cities, around major roads and other potentially polluted areas. As this is a widespread attitude, it is another limitation for access to wild food resources for people who do not own properties in rural areas. Generally, access to wild food resources is limited more by a lack of proper habitats (e.g. for urban dwellers) rather than the lack of access to land. It is probably only England which has so called trespassing laws, an extreme example of limiting access for non-owners to wild resources – limiting public access to paths, roadsides, seaside and common lands (see the Land is Ours campaign on the web against this law). In contrast, in Scotland and mainland Europe, public access rights are much broader with the famous "allemansrätt" (i.e. "all people's right") in Scandinavia (even allowing camping in someone's empty land). Similarly in Poland people roam freely through the landscape collecting fungi and medicinal plants in private lands, although the camping rights are more restrictive than in Scandinavia.

In Eastern Europe, e.g. in Poland and Estonia the recent fashion for large short-mown lawns excludes the traditional ruderal flora abounding with species like *Urtica dioica*, *Aegopodium podagraria* L., *Arctium* spp.), a potential pool of many edibles.

In Ukraine many people stopped collecting birch sap and other wild foods after the nuclear catastrophe in Chernobyl [79]. Also in Poland, Sweden and Estonia many people were scared to collect fungi for a few years after this event.

For the few last years in Estonia and Poland many parents have forbidden their children to eat wild berries in fear of echinococcosis. The disease is spread by foxes, who became abundant due to mass vaccination against rabies.

In Campoo, as in other Spanish regions, an excess of animal excrements and urine (mainly cows) has deteriorated the quality of streams and people do not gather aquatic plants such as *Rorippa nasturtium-aquaticum* (L.) Hayek. This plant requires clean, clear streams in which to grow – environments that are now endangered [25]. Other negative changes in Spain are:

(***i***) With the fall in the number of livestock grazing, species such as *Chamaemelum nobile* (L.) All. are not so abundant [16].

(***ii***) Agrarian laws prescribed the consolidation of fragmented holdings ("Reparcelling" or "Concentración parcelaria") in order to avoid fragmented and small holdings. Hedges were eliminated and many species suffered: bushes (*Ribes*) or *Origanum vulgare* L. are good examples.

(***iii***) People used to disseminate highly prized plants (e.g. *Sambucus nigra*, *Silene vulgaris*), but this practice is not so common now (M. P. personal observations in Cuenca, Spain).

The examples of over-harvesting of wild food plants in Poland are actually not so common, compared to the over-harvesting of medicinal plants. This can be attributed to the fact that food plants must be common to become food plants, whereas some medicinal plants can be a rare expensive produce, susceptible to extermination. The examples of over-harvesting in Europe include: *Rorippa nasturtium-aquaticum* in Campoo, Spain [25], *Artemisia granatensis* for beverages in Spain [23] and *Polypodium vulgare* in Poland [5]. In Estonia due to the danger of overharvesting, some wild edible species are taken under protection (e.g. *Allium* spp.) [73]. In Poland and Estonia traditionally special combs are used to collect *Vaccinium myrtillus* berries. However, as they also damage the plant's leaves, forest authorities banned them long ago.

New trends emerging

Wild food plants as health food

More recently, in times of the decreasing quality of supermarket foods, the interest in wild collected foods is gaining a lot of media attention. Numerous field guides are issued, and wild food/foraging workshops are organized. New culinary vogues are promoted by media and health-oriented people (Tab. 2).

As a part of this trend, articles such as acorn coffee, *Allium ursinum*-enriched products and birch sap have appeared in health food shops in Poland and many other countries [6]. In Estonia, health food shops offer mostly products of non-local origin, although acorn and *Cichorium intybus* L. based coffee have also been re-introduced (in Spain and Poland up until the mid-20th century it was poor people's coffee, and now it is a health food; though in Poland and many other countries it has been industrially added to cereal coffees), also syrups made of *Juniperus communis* L. and *Taraxacum* spp. are sold. As a new trend, probably following the example of a similar German product available in health food shops in Estonia, pasta made with the powder of *Urtica* spp., *Vaccinium myrtillus* and *Cantharellus cibarius* Fr. is making its way to the customer. In

© The Author(s) 2012 Published by Polish Botanical Society

Tab. 2 Examples of new culinary vogues involving the use of wild plants which have not been previously used in a given country.

Plant	Country	Dish	Remarks	Origin
Allium ursinum leaves	Poland	salad, sandwiches	becoming popular in the last 10 years in areas when it occurs	media, observations from Germany and Ukraine
Quercus ilex subsp. *ballota* acorns	Spain	liqueur	in the 1980s the species became the symbol of Extremadura	popularization of liqueurs as typical products
Epilobium angustifolium L. young shoots and leaves	Estonia	salad, tea	became popular in the last decade	media, literature, use for tea is probably of Russian influence

2010, the company Eesti And (Estonia Gift) started to produce and market pickled and salted forest mushrooms (http://www.eestiand.ee) in the larger stores – food that was just a few decades ago made and stored in every household regardless of status and distance from the forest, but now is more frequently practiced among the Slavic and Setu population (in other countries, e.g. Poland, pickled mushrooms have been sold in shops for decades but are still widely gathered and preserved as well).

Immigrants from other countries, also outside Europe, are a very little-studied category when it comes to harvesting in the wild. However, observations made in Sweden show that for instance Turks, Kurds, Chinese, Koreans and Thai immigrants are rather widely using the free access to private land and are harvesting wild plants, berries and mushrooms for their own consumption, and also for selling in the markets [80].

Wild plants in the vegetable markets

Wild food plants have always been sold in vegetable markets. In the 19th century Poland these were wild fruits, grains of manna grass (*Glyceria* spp.) and in one town (Jasło) even the rhizomes of *Polypodium vulgare* [5,8]. Apart from that a variety of mushrooms has been sold in the mycophilous parts of Europe. For example at the beginning of the 20th century around 70 taxa of fungi were sold in the market of Poznań, Poland [81].

Nowadays in most Eastern European countries the selling of wild food plants in the market is restricted to wild berries, mushrooms and herbs for making tea, and occasionally also *Rumex acetosa* leaves or horseradish roots – in Estonia also horseradish leaves.

Green wild vegetables are rarer than fruits in the markets. However, they are often sold around the Mediterranean, frequently in Italy, Greece and Croatia [37], and occasionally also in Spain [13] (Fig. 1).

The 20th century has seen a decline in the sales of wild food plants not only in Poland, but all over Europe. However in the 21st century we may witness the re-occurrence of wild products not only in specialist health food stalls but also in ordinary vegetable markets. Such a phenomenon can already be seen in Germany and Austria. Probably the only wild vegetable that has survived from the peasant society in Sweden is *Urtica dioica*, which is still popular among many urban people. However, wild forest berries (*Vaccinium*, *Rubus*) continue to be very much used among Swedes in general and hold a time-honoured place in both home-cooking and restaurant kitchens. Since the mid-20th century there has also been an increasing demand for wild mushrooms. Many people pick their own mushrooms, recognising everything from 2–3 species to almost 30 edible taxa. Nettles, wild berries and mushrooms are also available in the weekly street-markets during summertime and autumn, but berries and mushrooms can also be found in supermarkets [80].

Fig. 1 A mix of mainly wild vegetables sold in a Dalmatian market (Omiš, southern Croatia, March 2012). Photograph by Ł. Ł.

Wild food workshops, popular literature and Internet

Lost traditional knowledge on wild food plants is rediscovered and re-created by individuals particularly interested in the issue. This knowledge is later spread via a variety of workshops, seminars and particularly media (books and television programs). As far as media is concerned, it teaches edible plants in a new way. Traditionally this knowledge was gained from parents, grandparents or peers and was a cognitive process not only involving visual, abstract learning, but "rambling" through the countryside, smelling plants and learning their location [82]. Maybe that is why edible plant workshops are so popular, being more akin to a traditional way of learning plants. However, usually both neither the published guides nor the workshops relate to local practices. They are an amalgamation of proposals regarding how to utilize local floras referring to the traditions of use of these plants in North America, Asia and other parts of Europe. Thus new species are becoming utilized. For example, in Poland the use of *Allium ursinum* leaves as food has not ever been recorded in ethnographic sources, but now it is common among many families in the Carpathians due to the media attention this plant has gained [6]. The lessening access to wild food plants created a longing for such food, and this gives good ground for all kinds of courses and books. In Estonia during the recent decades the publishing of books on the use of wild food plants has increased, as have all publications regarding the use of plants and alternative medicine. Alongside, dozens of courses, local and general, are advertised

© The Author(s) 2012 Published by Polish Botanical Society

every year, reintroducing old local uses and introducing new uses of autochtonous and alien plants into the diet of Estonians. Since regaining independence, the Estonian Defence League (voluntary) organizes regular survival courses, which include teaching on the use of wild plants and animals for food. The influence of those books and courses can be evaluated only years later, as people tend to accept teachings selectively, sometimes in a random way [83].

The users of most wild food guides are people who are interested in food independence, survival or a healthy lifestyle. Probably the first widely known European guide of this style was Richard Mabey's "Food for free" sold in Britain in hundreds of thousands of copies [84]. Later in the 1990s and 2000s the French botanist François Couplan published several similar guides in French and German (e.g. [85]). In the 1980s and 1990s a wild food guide by the Czech author Dagmar Lánská was sold in large numbers of copies in Eastern Europe, e.g. in Czechoslovakia, Poland [86], and even in Spain. In the countries of former Yugoslavia a similarly influential author was the botanist Ljubiša Grlić [87]. Some of the authors of this article also published wild food guides for the general public [88,89] or even created TV culinary series ("Dziki obiad Łukasza Łuczaja", i.e. "Łukasz Łuczaj's wild lunch", by Canal Plus). An influential photographic guide by Roger Phillips should also be mentioned [90]. Another promoter of wild food was the most known European (British) survival handbook writer Ray Mears (also the author of film series). It should also be noted that Mears authored a book and a TV series with the prominent British archeobotanist Gordon Hillman [91].

One very special book should also be mentioned, L'Ensalada champanèla [40]. The new edition of this French guide to wild salad plants also contains a large amount of material on the traditional use of this group of plants in southern France, thus being a guide and a regional monograph in one. A similar guide was published in Albacete, Spain [92]. Picchi and Pieroni's monograph of wild edible herbs of Italy [34] has the same merits (though it does not contain plant pictures).

Yet another effort worth mentioning is the Plants for a Future database created by Ken Fern from England [93]. Though it does not contain data from modern ethnobotanical studies it is an influential source in spreading knowledge on edible plants.

Agritourism and haute and avant-garde cuisine

It is noteworthy that this loss of local knowledge and use of wild gathered plant species is paralleled by an increased interest in such resources by the gastronomic and intellectual elite in the search for new stimuli, culinary experiences, and health food (for example, visit http://www.slowfood.it). The increasing presence of wild food products can also be seen by agritourism farms or local rural restaurants as a part of the local traditional heritage offered by them (Tab. 3, Fig. 2). In Poland this is, for example, nettle soup and a variety of wild fruit products [5]. In Spain, herbal teas prepared with species such as *Jasonia glutinosa* (L.) DC. or *Sideritis hyssopifolia* L. are served in restaurants of tourist areas like Picos de Europa or Serranía de Cuenca. Moreover, in the case of *Jasonia glutinosa* new products are appearing and some restaurants offer ice cream made with its infusion. *Siderits hyssopifilia* is also used to aromatise homemade and commercial herb liqueurs, and it is even available on the Web [25]. Another interesting liqueur is patxaran/pacharán. It is usually made by macerating *Prunus spinosa* fruits, cinnamon bark, a few coffee seeds and sugar in anisette and/or liquor. The tradition of preparing liqueurs with its fruits is old, but this recipe is originally from Navarre and now commonly prepared or bought throughout the country. In fact, it is cultivated in the region for the industry of pacharán.

Fig. 2 In many parts of NE Poland, Lithuania and Belarus homemade bread used to be baked on *Acorus calamus* leaves. Such wild food additives enhance regional food identity and are promoted in slow food movements. This loaf was sold in Kurowo, NE Poland, in 2009, by a Lithuanian baker. Photograph by Ł. Ł.

The use of wild food plants has also been recently promoted by avant-garde restaurants. Here we should above all mention the pioneering experiences of the chefs Michel Bras and Marc Veyrat in France more than a decade ago, and nowadays what is considered the best restaurant in the world, NOMA in Copenhagen, run by René Redzepi, whose cuisine is largely based on local wild products, including a very wide selection of wild food plants (Tab. 4), which are also sometimes foraged by the NOMA staff. Following the aesthetic lines drafted by

Tab. 3 Examples of restituted traditions.

Plant and its part	Country	Dish	Remarks	Origin
Juniperus communis pseudo-fruits	Poland	beer	becoming popular in the last 10 years in the Kurpie area (NE Poland), however mainly served to tourists	once widespread in N and NE Poland (till early 20th century, then practically extinct), revived as tourist attraction
Scolymus hispanicus shoots	Spain	vegetable	today cultivated and commercialized in some regions, sold as gourmet produce	traditionally used, now also widely gathered as entertainment

© The Author(s) 2012 Published by Polish Botanical Society

Redzepi in his "Time and place in Nordic cuisine" [94], wild plants are considered to be a crucial element of a given place, and therefore one of the pillars of a cuisine, which would like to express the "sense of place".

In the meantime, many other top European restaurants are using a large number of wild taxa in their kitchen (among them the Argentinian top chef Mauro Colagreco, who in his restaurant on the French-Italian border uses many dozens of different wild plants). Earlier in the 1990s, a well-known expert on wild foods in the francophone countries, François Couplan (http://www.couplan.com), worked with leading French chefs incorporating wild plants in their menus. Recently, the Polish top chef, Wojciech Amaro published a book "Natura kuchni polskiej" which incorporates many wild foods into haute-cuisine dishes [95]. In Spain there are also some luxury restaurants, as the restaurant of the Hotel Alfonso VIII in the city of Plasencia, whose menus offer traditional and recreated dishes with at least six wild plant species, such as *Urtica dioica*, *Tamus communis*, *Rorippa nasturtium-aquaticum*, *Montia fontana*, *Allium ampeloprasum*, *Asparagus acutifolius*, and *Scolymus hispanicus* [96].

Until recent times the use of wild food plants in restaurant menus was not practiced in Estonia. But slowly it is becoming an attractive option, for example an invitation for the employment of a "gatherer" by a cafe in Tallinn was newsworthy for several news portals during 2012 spring season [97]. In England, there is a small rural enterprise called "Forager" engaged in gathering and supplying wild food, mostly to the restaurant trade (http://www.forager.org.uk), having also written "The Forager handbook", a guide to the edible plants that grow in Britain [98]. Wild berries have a long tradition within Swedish restaurant culture. However, some other wild plants, earlier used only locally by peasants, have become regional specialities. *Allium scorodoprasum* L. was traditionally used in coastal areas as a spring vegetable, especially in stews. On Gotland island, it has been harvested for centuries, used as a remedy against spring fatigue. Nowadays it is an appreciated early vegetable for the regional speciality, leek soup, and is also available in restaurants. Also, berries of *Rubus caesius* L., very little used earlier, are nowadays used as jam and considered a regional specialty of Gotland [80]. In Finland, products, especially desserts, made with berry juice from *Hippophaë rhamnoides* L., are seen as regional specialities of Österbotten and Åland Islands and found in many restaurants. In the Faroes and Iceland, and to some extent also in Norway, stalks of *Angelica archangelica* have become a fashionable food made into various products, which can be found in restaurants or bought canned in stores [49,50,99].

In Italy, we (A. P. and co-workers) recently surveyed ten top-chefs, who use flowers in their cuisines (Tab. 5). The most interesting finding was that the large parts of the used flowers (including also a few cultivated ornamental plants) do not have any connection to the culinary folk traditions and/or food ethnobotanical literature in Italy.

Tab. 4 Wild plant taxa, traded by a small southern-Swedish foraging enterprise, which is also the main provider of wild food plants at the restaurant NOMA (Copenhagen).

Species	Part
Blackthorn (Sloe), *Prunus spinosa* L.	fruits
Bramble (Blackberry), *Rubus* sp.	fruits and unripe fruits
Camomile, *Matricaria recutita* L.	flowers
Chickory, *Cichorium intybus* L.	leaves and flowers
Chickweed, *Stellaria media* (L.) Vill.	aerial parts
Chives, *Allium schoenoprasum* L.	flowers
Cow Parsley, *Anthriscus sylvestris* (L.) Hoffm.	leaves, buds, and flowers
Cuckooflower (Lady's Smock), *Cardamine pratensis* L.	aerial parts
Daisy, *Bellis perennis* L.	leaves and flowers
Dandelion, *Taraxacum officinale* Weber s.l.	leaves, buds, and flowers
Elder, *Sambucus nigra* L.	flowers and fruits
Garlic Mustard, *Alliaria petiolata* (M. Bieb.) Cavara & Grande	leaves, shoots, and seeds
Grass-Leaved Orache, *Atriplex littoralis* L.	leaves and unripe fruits
Ground-Elder, *Aegopodium podagraria* L.	shoots, buds, and flowers
Harebell, *Campanula* sp.	flowers
Hop, *Humulus lupulus* L.	shoots
Nettle (Stinging Nettle), *Urtica dioica* L.	shoots and unripe fruits
Orpine, *Hylotelephium telephium* (L.) H. Ohba	aerial parts
Ostrich Fern, *Matteuccia struthiopteris* (L.) Tod.	shoots
Ramsons (Wild Garlic), *Allium ursinum* L.	shoots, leaves, flowers, unripe fruits, and young seedlings
Raspberry, *Rubus idaeus* L.	leaves and fruits
Red Clover, *Trifolium pratense* L.	flowers
Purple Dead Nettle, *Lamium purpureum* L.	aerial parts
Ribwort Plantain, *Plantago lanceolata* L.	leaves and unripe inflorescences
Rose, *Rosa* spp.	flowers and fruits
Sand Leek, *Allium scorodoprasum* L.	leaves and seeds
Scurvy grass, *Cochlearia* sp.	aerial parts
Sea arrowgrass, *Triglochin maritima* L.	leaves and unripe fruits
Sea Aster, *Tripolium vulgare* Nees	leaves
Sea Pea, *Lathyrus japonicus* Willd.	flowers and shoots
Sea Plantain, *Plantago maritima* L.	aerial parts
Leaf Sea Rocket, *Cakile maritime* Scop.	leaves and flowers
Sea Sandwort, *Honckenya peploides* (L.) Ehrh.	aerial parts
Sea-Kale, *Crambe maritime* L.	leaves, flowers, buds, and fruits
Small-Flowered Winter-Cress, *Barbarea stricta* Andrz.	leaves and flowers
Sorrel (Common Sorrel), *Rumex acetosa* L.	leaves
Spruce (Norway Spruce), *Picea abies* (L.) H. Karst.	shoots
Swedish Whitebeam, *Sorbus intermedia* (Ehrh.) Pers.	fruits
Sweet Cicely, *Myrrhis odorata* Scop.	leaves, flowers, and unripe cones
Tansy, *Tanacetum vulgare* L.	flowers
Violet, *Viola* sp.	flowers
Water Mint, *Mentha aquatica* L.	leaves
Water-Cress, *Rorippa nasturtium-aquaticum* Schinz & Thell.	leaves
White Deadnettle, *Lamium album* L.	leaves
Wild Marjoram, *Origanum vulgare* L.	leaves

Passing vogues

Changes in plant use are not linear. Some species can become the subject of temporary vogues. In Poland, making a fermented, fizzy, *Centaurea cyanus* flower lemonade was very common in the mid-20th century but has not been reported earlier or later (it probably disappeared mainly due to the decline of *C. cyanus* populations due to the development of intense agriculture), and *Taraxacum* flower syrup was very

© The Author(s) 2012 Published by Polish Botanical Society

Tab. 4 *(continued)*

Species	Part
Wild Onion, *Allium vineale* L.	leaves and fruits
Wild Thyme (Creeping Thyme), *Thymus serpyllum* L.	leaves
Winter-Cress, *Barbarea vulgaris* W. T. Aiton	flowers
Wood Sorrel, *Oxalis acetosella* L.	aerial parts
Woodruff, *Galium odoratum* Scop.	aerial parts
Wych Elm, *Ulmus glabra* Huds.	unripe fruits
Yarrow, *Achillea millefolium* L.	leaves and flowers
Yellow Archangel, *Lamium galeobdolon* (L.) Crantz	young shoots and flowers

popular in the 1990s women's press but now seems to be much less common [5,8]. Also, in Estonia, *Taraxacum* syrup (often called "dandelion honey") and wine, as well as pickle buds, suddenly became popular in the 1980s–1990s, and although some people still make it at home, *Taraxacum* syrup is mainly sold in health food shops nowadays. In Poland the use of dandelion (*Taraxacum*) leaves has had its ups and downs. Dandelion leaves were usually regarded as famine food and there are very few reports of using them (as Polish cuisine avoids bitter tastes). However, vogues for eating dandelion leaves entered Poland a few times, directly from France: first at the end of the 19th century among the upper classes, and later in the mid-20th century among the families who came back from emigration in France. Both times the trend passed, as it did not withstand the "anti-bitter" attitude of the majority of the Polish population [5,8]. As Kujawska and Łuczaj put it [8] Polish dishes are now undergoing "Mediterranisation" (e.g. by replacing butter and lard with olive oil and by adding Mediterranean-style aromatic herbs to traditional Polish recipes). One may wonder how long this fashion will last.

The use of flowers of *Sambucus nigra* and *Filipendula ulmaria* for making cordial is a widespread practice in Sweden, which has become popular since the 1970s. They are still very much harvested. The vogue of harvesting berries of *Prunus spinosa* for making liqueur or cordial, very popular in the 1970s and 1980s, seems to have decreased. Another berry, which earlier was only used very locally along the coastal areas of northern Sweden and Finland, is *Hippophaë rhamnoides*. It is harvested from wild bushes in Uppland and on the Åland Isles, but due to the increasing market most berries are nowadays coming from cultivated plants. Many new products made from wild berries are found in the market too [80].

Safety

In many European countries the sales of fungi in markets is heavily regulated due to the danger of poisoning. For example in Poland forty species or genera are legally sold [100]. One of the most commonly eaten fungi – *Russula* spp. – cannot be sold to the public due to its similarity to the most deadly mushroom, death cap *Amanita phalloides* (Fr.) Link. The sales of wild food plants have not seen such regulation, probably for two reasons: they are less present in many countries, and also because of the fact that in the large majority of cases the toxic plants are very bitter.

Tab. 5 Plant taxa, whose flowers are used by ten selected top-chefs in Italy.

Species
Allium sativum L.
Begonia sp.
Bellis perennis L.
Borago officinalis L.
Capparis spinosa L.
Citrus sinensis Osbeck
Cucurbita pepo L.
Dahlia sp.
Jasminum sp.
Hibiscus sp.
Lathyrus odoratus L.
Lavandula angustifolia Moench
Malva sylvestris L.
Leucanthemum vulgare Lam.
Papaver rhoeas L.
Petunia sp.
Pelargonium sp.
Primula acaulis Hill
Prunus avium (L.) L.
Robinia pseudoacacia L.
Rorippa nasturtium-aquaticum Schinz & Thell.
Rosa spp.
Rosmarinus officinalis L.
Salvia pratensis L.
Sambucus nigra L.
Taraxacum officinale Weber
Thymus serpyllum L.
Trifolium repens L.
Viola odorata L.

The list is made up both by garden ornamentals and wild species (some species can be collected both from the wild and from gardens).

From our own experience, the experience of other people dealing with wild food promotion, and from media coverage, we identified two possibly most dangerous issues (however both of them with only a few cases around Europe):

(***i***) Poisonings with *Convallaria majalis* L. and *Colchicum autumnale* L. leaves by confusing them with the edible *Allium ursinum* [101,102].

(***ii***) Confusing edible Apiaceae (e.g. *Pastinaca sativa* L. and *Daucus carota* L.) with the poisonous ones (*Oenanthe crocata* L. and *Conium maculatum* L. respectively) – this issue was extensively discussed by Irving [98].

Conclusions

In this review we have shown that the use of wild food plants is not a static process. Although the traditional use of wild edibles is largely decreasing due to socioeconomic and ecological changes, wild plants are becoming a part of the new thinking about food: they are very important as health food, and in food security and slow food movements.

© The Author(s) 2012 Published by Polish Botanical Society

References

1. Łuczaj Ł, Szymański WM. Wild vascular plants gathered for consumption in the Polish countryside: a review. J Ethnobiol Ethnomed. 2007;3(1):17. http://dx.doi.org/10.1186/1746-4269-3-17
2. Łuczaj Ł. Archival data on wild food plants used in Poland in 1948. J Ethnobiol Ethnomed. 2008;4(1):4. http://dx.doi.org/10.1186/1746-4269-4-4
3. Łuczaj Ł. Changes in the utilization of wild green vegetables in Poland since the 19th century: a comparison of four ethnobotanical surveys. J Ethnopharmacol. 2010;128(2):395–404. http://dx.doi.org/10.1016/j.jep.2010.01.038
4. Łuczaj ŁJ. Plant identification credibility in ethnobotany: a closer look at Polish ethnographic studies. J Ethnobiol Ethnomed. 2010;6(1):36. http://dx.doi.org/10.1186/1746-4269-6-36
5. Łuczaj Ł. Dziko rosnące rośliny jadalne użytkowane w Polsce od połowy XIX w. do czasów współczesnych. Etnobiologia Polska. 2011;1:57–125.
6. Łuczaj Ł, Kujawska M. Botanists and their childhood memories: an underutilized expert source in ethnobotanical research. Bot J Linn Soc. 2012;168(3):334–343. http://dx.doi.org/10.1111/j.1095-8339.2011.01205.x
7. Łuczaj Ł, Dumanowski J, Köhler P, Mueller-Bieniek A. Manna grass (Glyceria) in Poland: the use and economic value of this wild cereal from the Middle Ages to the twentieth century. Hum Ecol. 2012;40:721–733. http://dx.doi.org/10.1007/s10745-012-9513-4
8. Kujawska M, Łuczaj Ł. Studies of wild food plants in communist and post-communist Poland. changes in use and in research methodology. In: Pochettino ML, Ladio A, Arenas P, editors. Tradiciones y Transformaciones en Etnobotánica. San Salvador de Jujuy: CYTED – Programa Iberoamericano Ciencia y Tecnología para el Desarrollo; 2010. p. 545–551.
9. Tardio J, Pardo-De-Santayana M, Morales R. Ethnobotanical review of wild edible plants in Spain. Bot J Linn Soc. 2006;152(1):27–71. http://dx.doi.org/10.1111/j.1095-8339.2006.00549.x
10. Bonet MÀ, Vallès J. Use of non-crop food vascular plants in Montseny biosphere reserve (Catalonia, Iberian Peninsula). Int J Food Sci Nutr. 2002;53(3):225–248. http://dx.doi.org/10.1080/09637480220132841
11. Tardío J, Pascual H, Morales R. Wild food plants traditionally used in the province of Madrid, central Spain. Econ Bot. 2005;59(2):122–136. http://dx.doi.org/10.1663/0013-0001(2005)059[0122:WFPTUI]2.0.CO;2
12. Rivera D, Obon C, Inocencio C, Heinrich M, Verde A, Fajardo J, et al. The ethnobotanical study of local Mediterranean food plants as medicinal resources in Southern Spain. J Physiol Pharmacol. 2005;56(1 suppl):97–114.
13. Tardío J. Spring is coming: the gathering and consumption of wild vegetables in Spain. In: Pardo de Santayana M, Pieroni A, Puri RK, editors. Ethnobotany in the new Europe: people, health, and wild plant resources. New York NY: Berghahn Books; 2010. p. 211–238.
14. Parada M, Carrió E, Vallès J. Ethnobotany of food plants in the Alt Emporda region (Catalonia, Iberian Peninsula). J Appl Bot Food Qual. 2011;84(1):11–25.
15. Menendez-Baceta G, Aceituno-Mata L, Tardío J, Reyes-García V, Pardo-de-Santayana M. Wild edible plants traditionally gathered in Gorbeialdea (Biscay, Basque Country). Genet Resour Crop Evol. 2012;59(7):1329–1347. http://dx.doi.org/10.1007/s10722-011-9760-z
16. Aceituno-Mata L. Estudio etnobotánico y agroecológico de la Sierra Norte de Madrid [PhD thesis]. Madrid: Universidad Autónoma de Madrid; 2010.
17. Polo S, Tardío J, Vélez-del-Burgo A, Molina M, Pardo-de-Santayana M. Knowledge, use and ecology of golden thistle (*Scolymus hispanicus* L.) in Central Spain. J Ethnobiol Ethnomed. 2009;5(1):42. http://dx.doi.org/10.1186/1746-4269-5-42
18. Dávila P. Estudio etnobotánico comparativo de la colleja [*Silene vulgaris* (Moench) Garcke] en dos localidades de la Comunidad de Madrid. Proyecto de Fin de Carrera. Madrid: Universidad Autónoma de Madrid; 2010.
19. Velasco Santos JM, Criado Coca J, Blanco Castro E. Uso tradicional de las plantas en la provincia de Salamanca: una aproximación al estudio de las relaciones de las plantas y los pueblos de Salamanca. Salamanca: Instituto de las Identidades, Diputación de Salamanca; 2010.
20. González JA, García-Barriuso M, Amich F. The consumption of wild and semi-domesticated edible plants in the Arribes del Duero (Salamanca-Zamora, Spain): an analysis of traditional knowledge. Genet Resour Crop Evol. 2010;58(7):991–1006. http://dx.doi.org/10.1007/s10722-010-9635-8
21. Verde A, Rivera D, Heinrich M, Fajardo J, Inocencio C, Llorach R, et al. Plantas alimenticias recolectadas tradicionalmente en la provincia de Albacete y zonas próximas, su uso tradicional en la medicina popular y su potencial como nutracéuticos. Rev Estud Albacetenses. 2003;(4):35–72.
22. Benítez G. Etnobotánica y Etnobiología del poniente granadino [PhD thesis]. Granada: Universidad de Granada; 2009.
23. Pardo-de-Santayana M, Morales R. The dynamics of plant nomenclature. In: Pardo de Santayana M, Pieroni A, Puri RK, editors. Ethnobotany in the new Europe: people, health, and wild plant resources. New York NY: Berghahn Books; 2010. p. 283–307.
24. Criado Coca J, Fernández López JM, Leocadio G, Núñez RM, Blanco E. Uso tradicional de las plantas en Toledo: una contribución al estudio etnobotánico de la provincia de Toledo. Toledo: Diputación Provincial de Toledo; 2008.
25. Pardo-de-Santayana M, Blanco E, Morales R. Plants known as té in Spain: an ethno-pharmaco-botanical review. J Ethnopharmacol. 2005;98(1–2):1–19. http://dx.doi.org/10.1016/j.jep.2004.11.003
26. Pardo-de-Santayana M, Tardío J, Blanco E, Carvalho A, Lastra J, San Miguel E, et al. Traditional knowledge of wild edible plants used in the northwest of the Iberian Peninsula (Spain and Portugal): a comparative study. J Ethnobiol Ethnomed. 2007;3(1):27. http://dx.doi.org/10.1186/1746-4269-3-27
27. Carvalho AM, Morales R. Persistence of wild food and wild medicinal plant knowledge in a northeastern region of Portugal. In: Pardo-de-Santayana M, Pieroni A, Puri RK, editors. Ethnobotany in the new Europe: people, health, and wild plant resources. New York NY: Berghahn Books; 2010. p. 147–171.
28. Paoletti MG, Dreon AL, Lorenzoni GG. Pistic, traditional food from Western Friuli, N.E. Italy. Econ Bot. 1995;49(1):26–30. http://dx.doi.org/10.1007/BF02862273
29. Pieroni A. Gathered wild food plants in the upper valley of the Serchio River (Garfagnana), Central Italy. Econ Bot. 1999;53(3):327–341. http://dx.doi.org/10.1007/BF02866645
30. Pieroni A. Evaluation of the cultural significance of wild food botanicals traditionally consumed in Northwestern Tuscany, Italy. J Ethnobiol. 2001;21:89–104.
31. Pieroni A, Nebel S, Quave C, Münz H, Heinrich M. Ethnopharmacology of liakra: traditional weedy vegetables of the Arbëreshë of the Vulture area in southern Italy. J Ethnopharmacol. 2002;81(2):165–185. http://dx.doi.org/10.1016/S0378-8741(02)00052-1
32. Guarrera PM. Food medicine and minor nourishment in the folk traditions of Central Italy (Marche, Abruzzo and Latium). Fitoterapia. 2003;74(6):515–544. http://dx.doi.org/10.1016/S0367-326X(03)00122-9
33. Pieroni A, Nebel S, Santoro RF, Heinrich M. Food for two seasons: culinary uses of non-cultivated local vegetables and mushrooms in a south Italian village. Int J Food Sci Nutr. 2005;56(4):245–272. http://dx.doi.org/10.1080/09637480500146564
34. Picchi G, Pieroni A. Atlante dei prodotti tipici: le conserve. Roma: AGRA; RAI-ERI; 2005.
35. Guarrera P, Salerno G, Caneva G. Food, flavouring and feed plant traditions in the Tyrrhenian sector of Basilicata, Italy. J Ethnobiol Ethnomed. 2006;2(1):37. http://dx.doi.org/10.1186/1746-4269-2-37
36. Ghirardini M, Carli M, del Vecchio N, Rovati A, Cova O, Valigi F, et al. The importance of a taste. A comparative study on wild food plant consumption in twenty-one local communities in Italy. J Ethnobiol Ethnomed. 2007;3(1):22. http://dx.doi.org/10.1186/1746-4269-3-22
37. di Tizio A, Łuczaj Ł, Quave CL, Redžić S, Pieroni A. Traditional food

© The Author(s) 2012 Published by Polish Botanical Society

and herbal uses of wild plants in the ancient South-Slavic diaspora of Mundimitar/Montemitro (Southern Italy). J Ethnobiol Ethnomed. 2012;8(1):21. http://dx.doi.org/10.1186/1746-4269-8-21
38. Della A, Paraskeva-Hadjichambi D, Hadjichambis AC. An ethnobotanical survey of wild edible plants of Paphos and Larnaca countryside of Cyprus. J Ethnobiol Ethnomed. 2006;2:34. http://dx.doi.org/10.1186/1746-4269-2-34
39. Forbes MHC. Gathering in the argolid: a subsistence subsystem in a Greek agricultural community. Ann NY Acad Sci. 1976;268(1):251–264. http://dx.doi.org/10.1111/j.1749-6632.1976.tb47647.x
40. Marco C, Ubaud J, Molina J, Chauvet M. Les salades sauvages: l'ensalada champanèla. Sant Jean de Cuculles: Les Écologistes de l'Euzière; 2003.
41. Redzic S. Wild edible plants and their traditional use in the human nutrition in Bosnia-Herzegovina. Ecol Food Nutr. 2006;45(3):189–232. http://dx.doi.org/10.1080/03670240600648963
42. Rivera D, Obón C, Heinrich M, Inocencio C, Verde A, Fajardo J. Gathered mediterranean food plants – ethnobotanical investigations and historical development. In: Heinrich M, Müller WE, Galli C, editors. Local Mediterranean food plants and nutraceuticals. Basel: Karger; 2006. p. 18–74. (Forum of Nutrition; vol 59).
43. Leonti M, Nebel S, Rivera D, Heinrich M. Wild gathered food plants in the European Mediterranean: a comparative analysis. Econ Bot. 2006;60(2):130–142. http://dx.doi.org/10.1663/0013-0001(2006)60[130:WGFPIT]2.0.CO;2
44. Hadjichambis A, Paraskeva-Hadjichambi D, Della A, Elena Giusti M, De Pasquale C, Lenzarini C, et al. Wild and semi-domesticated food plant consumption in seven circum-Mediterranean areas. Int J Food Sci Nutr. 2008;59(5):383–414. http://dx.doi.org/10.1080/09637480701566495
45. Christanell A, Vogl-Lukasser B, Vogl CR, Gütler M. The cultural significance of wild gathered plant species in Kartitsch (eastern Tyrol, Austria) and the influence of socio-economic changes on local gathering practices. In: Pardo-De-Santayana M, Pieroni A, Puri RK, editors. Ethnobotany in the new Europe: people, health, and wild plant resources. New York NY: Berghahn Books; 2010. p. 51–75.
46. Schunko C, Vogl CR. Organic farmers use of wild food plants and fungi in a hilly area in Styria (Austria). J Ethnobiol Ethnomed. 2010;6(1):17. http://dx.doi.org/10.1186/1746-4269-6-17
47. Schunko C, Grasser S, Vogl CR. Intracultural variation of knowledge about wild plant uses in the Biosphere Reserve Grosses Walsertal (Austria). J Ethnobiol Ethnomed. 2012;8(1):23. http://dx.doi.org/10.1186/1746-4269-8-23
48. Łuczaj Ł. Ethnobotanical review of wild edible plants of Slovakia. Acta Soc Bot Pol. 2012;81(4):245–255. http://dx.doi.org/10.5586/asbp.2012.030
49. Svanberg I. The use of wild plants in the Faroe Islands 1590–1990: a contribution to Scandinavian ethnobotany. Svenska Linnésällskapets Årsskrift. 1998;1996–1997:81–130.
50. Svanberg I. Folklig botanik. Stockholm: Dialogos; 2011.
51. Sõukand R, Kalle R. Change in medical plant use in Estonian ethnomedicine: a historical comparison between 1888 and 1994. J Ethnopharmacol. 2011;135(2):251–260. http://dx.doi.org/10.1016/j.jep.2011.02.030
52. Turner NJ, Łuczaj ŁJ, Migliorini P, Pieroni A, Dreon AL, Sacchetti LE, et al. Edible and tended wild plants, traditional ecological knowledge and agroecology. Cr Rev Plant Sci. 2011;30(1–2):198–225. http://dx.doi.org/10.1080/07352689.2011.554492
53. Muller J, Almedom AM. What is "famine food"? Distinguishing between traditional vegetables and special foods for times of hunger/scarcity (Boumba, Niger). Hum Ecol. 2008;36(4):599–607. http://dx.doi.org/10.1007/s10745-008-9179-0
54. Maurizio A. Pożywienie roślinne i rolnictwo w rozwoju dziejowym. Warsaw: Kasa Mianowskiego; 1926.
55. Ó Gráda C. Famine: a short history. Princeton NJ: Princeton University Press; 2009.
56. Svanberg I. Fattigmanskost. In: Broberg G, Lindell G, editors. Till livs med Linné. Stockholm: Atlantis; 2007. p. 185–195.
57. Svanberg I, Nelson MC. Bone meal porridge, lichen soup, or mushroom bread: acceptance or rejection of food propaganda 1867–1868. In: Häkkinen A, editor. Just a sack of potatoes? Crisis experiences in European societies, past and present. Helsinki: Societas Historica Finlandiae; 1992. p. 119–147.
58. Häkkinen A. On attitudes and living strategies in the Finnish countryside in the years of famine 1867–68. In: Häkkinen A, editor. Just a sack of potatoes? Crisis experiences in European societies, past and present. Helsinki: Societas Historica Finlandiae; 1992. p. 149–166.
59. Nelson MC. Bitter bread: the famine in Norrbootten 1867–1868. Uppsala: Almqvist & Wiksell International; 1998.
60. Sorokin P. Hunger as a factor in human affairs. Gainesville FL: University Press of Florida; 1975.
61. Conquest R. The harvest of sorrow: Soviet collectivization and the terror-famine; famine in the Ukraine, 1932–1933. Oxford: Oxford University Press; 1987.
62. Matalas AL, Grivetti LE. Non-food during famine: the Athens famine survivor project. In: MacClancy J, Henry CJK, Macbeth HM, editors. Consuming the inedible: neglected dimensions of food choice. New York NY: Berghahn Books; 2007. p. 131–139.
63. Redžić S, Barudanović S, Pilipović S. Wild mushrooms and lichens used as human food for survival in war conditions; Podrinje – Zepa region (Bosnia and Herzegovina, W. Balkan). Hum Ecol Rev. 2010;17(2):175–181.
64. Redžić S. Use of wild and semi-wild edible plants in nutrition and survival of people in 1430 days of siege of Sarajevo during the war in Bosnia and Herzegovina (1992–1995). Coll Antropol. 2010;34(2):551–570.
65. Nelson MC, Svanberg I. Lichens as food: historical perspectives on food propaganda. Svenska Linnésällskapets Årsskrift. 1987:1986–1987.
66. Johns T, Etkin NL. Ambivalence to the palatability factors in wild plants. In: Eating on the wild side. Tucson AZ: University of Arizona Press; 1994. p. 46–61.
67. Maurizio A. Die Geschichte unserer Pflanzennahrung von den Urzeiten bis zur Gegenwart. Berlin: Parey; 1927.
68. Maurizio A. Histoire de l'alimentation depuis la Préhistoire jusqu' à nos jours. Paris: Payot; 1932.
69. Holuby JL. Aus des Botanik slowakischer Kinder des Trentschiner Komitates in Ungarn. Deutsche Botanische Monatsschrift. 1896;19(8–9):126–131.
70. Svanberg I. Field horsetail (*Equisetum arvense*) as a food plant. Fróðskaparrit. 1997;45:45–55.
71. Anderson M. Sami children and traditional knowledge. In: Svanberg I, Tunón H, editors. Ecological knowledge in the North. Uppsala: Swedish Science Press; 2000. p. 55–65.
72. Dumanowski J. Tatarskie ziele w cukrze czyli staropolskie słodycze. Warsaw: Wilanów Palace Museum; 2010.
73. Kalle R, Sõukand R. Ajalooline ülevaade eestlaste looduslikest toidu- ja ravimtaimedest. In: Kusmin T, Meikar T, editors. Metsa kõrvalkasutus Eestis. Tartu: Eesti Metsaselts; 2011. p. 29–44. (Akadeemilise Metsaseltsi Toimetised; vol 25).
74. Boman M, Bostedt G, Hörnsten L. Skogens alternativa nyttjandeformer. In: Statsskogsutredningen (SOU 2002:40). Stockholm: Statens Offentliga Utredningar; 2002. p. 167–202.
75. Kangas K, Markkanen P. Factors affecting participation in wild berry picking by rural and urban dwellers. Silva Fennica. 2001;35:487–495.
76. Kardell L. Occurrence and berry production of *Rubus chamaemorus* L., *Vaccinium oxycoccus* L., *V. microcarpum* Turcz. & *V. vitis-idaea* on Swedish peats. Scand J Forest Res. 1986;1:125–140.
77. Saastamoinen O, Kangas J, Naskali A, Salo K. Non-wood forest products in Finland: statistics, expert estimates and recent development. In: Lund HG, Pajari B, Korhonen M, editors. Sustainable development of non-wood goods and benefits from boreal and cold temperate forests: proceedings of the international workshop, Joensuu, Finland, 18–22 January 1998. Joensuu: European Forest Institute; 1998. p. 131–146. (vol 23).

© The Author(s) 2012 Published by Polish Botanical Society

78. Kuusik I. Soome raadiokanal: näljas Eesti lapsed söövad puulehti [Internet]. 2011 [cited 2012 Jul 4]; Available from: http://www.tarbija24.ee/521112/soome-raadiokanal-naljas-eesti-lapsed-soovad-puulehti/
79. Łuczaj Ł. Birch sap, ramsons and green borsch – an ethnobotanical survey among Ukrainian botanists. Etnobiologia Polska. 2012;2:5–22.
80. Svanberg I. Att se med allmogens ögon. In: Ett växande vetande. Vetenskapsrådets temabok 2002. Stockholm: Vetenskapsrådet; 2002. p. 45–46.
81. Szulczewski JW. Pieśń bez końca: zbiór tekstów folkorystyczno-etnograficznych. Poznań: PSO; 1996.
82. Sõukand R, Kalle R. Plant as object within herbal landscape: different kinds of perception. Biosemiotics. 2010;3(3):299–313. http://dx.doi.org/10.1007/s12304-010-9078-9
83. Sõukand R, Kalle R. The use of teetaimed in Estonia, 1880s–1990s. Appetite. 2012;59(2):523–530. http://dx.doi.org/10.1016/j.appet.2012.06.017
84. Mabey R. Food for free. London: Collins; 1972.
85. Couplan F. Le régal végétal: plantes sauvages comestibles. Flers: Equilibres; 1989. (vol 1).
86. Lánská D. Jadalne rośliny dziko rosnące. Warsaw: Delta W-Z; 1992.
87. Grlić L. Enciklopedija samoniklog jestivog bilja. Rijeka: Ex libris; 2005.
88. Łuczaj Ł. Dzikie rośliny jadalne Polski, przewodnik survivalowy. Krosno: Chemigrafia; 2002.
89. Tardío J, Pascual H, Morales R. Alimentos silvestres de Madrid. Madrid: Ediciones La Librería; 2002.
90. Phillips R. Wild food. London: Macmillan; 1983.
91. Mears R, Hillman G. Wild food. London: Hodder and Stoughton; 2007.
92. Rivera D, Verde A, Fajardo J, Inocencio C, Obón C, Heinrich M. Guía etnobotánica de los alimentos locales recolectados en la província de Albacete. Albacete: Instituto de Estudios Albacetenses "Don Juan Manuel"; 2006.
93. Plants for a future [Internet]. 2012 [cited 2012 Jul 17]; Available from: http://www.pfaf.org
94. Redzepi R. NOMA. Time and place in Nordic cuisine. London: Phaidon; 2010.
95. Amaro W. Natura kuchni polskiej. Warsaw: AmarONE; 2006.
96. Recetario extremeño [Internet]. 2005 [cited 2012 Jun 1]; Available from: http://www.caceresPatrimonio.com/Gastronomia/index.htm
97. Tallinna restoran võtab tööle korilase [Internet]. 2005 [cited 2012 Jul 4]; Available from: http://eestielu.delfi.ee/eesti/tallinn/kesklinn/elu/tallinna-restoran-votab-toole-korilase.d?id=64102593
98. Irving M. The forager handbook. Wild food guide to the edible plants of Britain. London: Ebury Press; 2009.
99. Hosking R. Angelica: from Norwegian mountains to the English trifle. In: Fosså O, editor. Wild food: proceedings of the Oxford symposium on food and cookery, 2004. Totnes: Prospect Books; 2006. p. 131–142.
100. Łuczaj Ł, Nieroda Z. Collecting and learning to identify edible fungi in southeastern Poland: age and gender differences. Ecol Food Nutr. 2011;50(4):319–336. http://dx.doi.org/10.1080/03670244.2011.586314
101. Davanzo F, Miaglia S, Perego S, Assisi F, Bissoli M, Borghini R, et al. Plant poisoning: increasing relevance, a problem of public health and education. North-western Italy, Piedmont region. J Pharm Sci Res. 2011;3(7):1338–1343.
102. Pilegaard K. Ramson confusable with poisonous plants [Internet]. 2012 [cited 2012 Jul 17]; Available from: http://www.food.dtu.dk/upload/f%C3%B8devareinstituttet/food.dtu.dk/publikationer/2012/ramson%20confusable%20with%20poisonous%20plants.pdf
103. Kalle R, Sõukand R. Historical ethnobotanical review of wild edible plants of Estonia (1770s–1960s). Acta Soc Bot Pol. 2012;81(4):271–281. http://dx.doi.org/10.5586/asbp.2012.033
104. Mattalia G, Quave CL, Pieroni A. Traditional uses of wild food and medicinal plants among Brigasc, Kyé, and Provençal communities on the Western Italian Alps. Genet Resour Crop Evol. 2012. http://dx.doi.org/10.1007/s10722-012-9859-x

© The Author(s) 2012 Published by Polish Botanical Society