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NOTES ON NEGLECTED AND UNDERUTILIZED CROPS

Marsh woundwort, *Stachys palustris* L. (Lamiaceae): an overlooked food plant

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Abstract The aim of this article is to study the geographical distribution and historical patterns of use of a little known root crop native to Europe—marsh woundwort *Stachys palustris* L. The species grows in wet grasslands and arable fields. It produces edible tubers. Both ethnographic literature and archival sources were searched. Seventeen reliable references concerning the consumption of *S. palustris* in southern and south–eastern Poland were found. The tubers were usually dried and powdered, and then added to soups or to bread dough. They were also eaten as raw snacks. The plant was used mainly during food shortages in spring, until the turn of the nineteenth and twentieth century, and later only as an occasional raw snack until the 1970s. Marsh woundwort was also eaten in western Ukraine (one reference). There are many references to the edibility of marsh woundwort in the eighteenth and nineteenth

century European economic botany literature, particularly in Sweden and Great Britain. These publications tried to popularize the use of *S. palustris* as food. However, there is no firm evidence from these countries that marsh woundwort was used as food there. Marsh woundwort was also used, throughout northern and central Europe, as pig fodder and as a medicinal plant, particularly for healing wounds. Further studies on the nutritive value of this forgotten crop should be undertaken, particularly that there is little knowledge of the chemical composition of both marsh woundwort and its Asian relative *Stachys affinis* widely cultivated in China as a vegetable.

Keywords Edible tubers · Famine plants · Food propaganda · *Sium sisarum* · Stachyose · *Stachys affinis* · *Stachys palustris* · *Stachys sieboldii*

Introduction

The young leaves of a large proportion of vascular plants can be utilized as food in the form of potherb, soup or salad. However, humans have always been eagerly seeking plants which can give them calorie-rich parts such as sweet or oily fruits and underground stems, rich in starch or other digestible polysaccharides (e.g., Maurizio 1926; Johns 1990; Kuhnlein and Turner 1991; Etkin 1994). The aim of this article is to study the geographical distribution and historical patterns of use of a potentially

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underutilized and little known root crop native to Europe—*Stachys palustris* L.

Although the issue of using *S. palustris* tubers as potential food received some attention in the eighteenth and nineteenth century, information about its use in various countries has never been reviewed apart from a short article in Polish (Łuczaj 2008a). This paper presents evidence on the use of this species in Europe as food for humans and animals, based on both published and unpublished sources from Poland, Scandinavia and Great Britain.

Distribution, biology and ecology of *S. palustris*

Marsh woundwort (or marsh hedgenettle) *S. palustris* is an erect slightly-smelling perennial growing from 0.5 to 1 m high, with stalked glands in its upper parts, with strong branching surface rhizomes, whose parts swell in September into oblong tubers divided into segments, sometimes even 20 cm long and 2 cm broad (Fig. 1). The above ground shoots of *S. palustris* emerge as some of the latest of all the commoner grassland and ruderal plants (e.g., in SE Poland in mid or late May). It has pinkish-purple flowers, which develop in mid-summer.

S. palustris is a highly polymorphic species with a wide circumboreal range: races with different ploidy levels were distinguished, which are sometimes regarded as separate species. Diploids and tetraploids are native to North America (mainly NE part), whereas the European plants (which also have become weeds in North America) are hexaploid



Fig. 1 Tubers of *Stachys palustris* dug out from a field in southeastern Poland in late April

(Mulligan et al. 1983). Sometimes the closely related East Asian and North American taxa (*S. baicalensis* Fisch. ex Benth., *S. chinensis* Bunge ex Benth., *S. japonica* Miq., *S. aspera* Mich., *S. riederi* Cham. ex Benth., *S. komarovii* Knorr, *S. pilosa* Nutt., *S. homotricha* Rydb.) have been included in it as well. *S. riederi* Cham. ex Benth. has been mistakenly reported from cultivation instead of *S. affinis* (Hanelt and Institute of Plant Genetics and Crop Plant Research (eds) Gatersleben 2001). Marsh woundwort occurs in most of the territory of Europe (Tutin et al. 1972). Meusel et al. (1978) classified it as a (Mediterranean)- sub-Mediterranean-boreal circumpolar element. In Asia it is found mainly in Russia, parts of Central Asia and western China, reaching the Indian side of the Himalayas (USDA).

Marsh woundwort is a common weed in a variety of crops, e.g., cereals, potatoes and beet. Although its abundance has recently been highly reduced in some areas (e.g., in the Carpathians Foothills, Ł.Ł., personal observation), in the Czech Republic it is regarded as a significant weed occurring in sugar beet plantations due to its high resistance to herbicides (Jursík et al. 2007). It is also regarded as a noxious agricultural weed in Hungary (Pinke et Pál 2005). The species was a very common weed in the fields in pre-industrial Scandinavia (Lyttkens 1885: 40; Bolin 1926: 77).

A similar species, *Stachys affinis* Bunge (syn. *Stachys sieboldii* Miquel), called Chinese artichoke, chorogi, knotroot, artichoke betony, or crosne, originating from northern China, with similar tubers, has been cultivated and eaten in China and Japan for centuries. It has been cultivated in Europe, particularly in France and Germany, since the nineteenth century (Rostafiński 1888; Tanaka 1976, Péron and Dubost 1992; Hanelt 2001; Hu 2005). It resembles *S. palustris* closely enough that Hegi et al. (1927) even suspected that it was a subspecies of *S. palustris*. *S. affinis* has broader leaves. Its tubers are very similar to those of *S. palustris*, but shorter and thicker.

Materials and methods

An intense literature search for references to the use of *S. palustris* in eighteenth–twentieth sources concerning the use of wild food plants was performed, in herbals, floras and ethnographic records from

northern and central Europe, particularly Poland, Scandinavia and Great Britain. Sources from Hungary, Slovakia, Romania and Germany were also searched.

In Poland major sets of archival unpublished or partly published data were searched for references to *S. palustris*, or plants whose description may correspond to this species. The most important of these archives are letter responses to Prof. Józef Rostafiński (1850–1928) (for details see Köhler 1993; Łuczaj 2008b, 2010a) and archives of the Polish Ethnographic Atlas (for details see Łuczaj 2008c).

Ethnobotanical interviews with the inhabitants of SE Poland (Krosno, Jasło and Strzyżów area) provided additional material concerning the use of wild food plants, carried out in 2001–2011 by the first of the authors, who, inspired by the information on the local alimentary use of the wild *S. palustris*, successfully cultivated it for 10 years in Pietruszka Wola, SE Poland.

Results and discussion

The traditional use of *S. palustris* in Poland

S. palustris as a food plant in Poland has been studied particularly by Józef Rostafiński from Kraków, a botanist with wide interests, in *Mycetozoa* (*Myxomycota*), plant taxonomy and the history of biology (Zemanek 2000). He was also very interested in the history of crops. In 1883 he issued a questionnaire with 70 questions. It was published in at least 58 newspapers over the former territory of Poland, which was, from the end of the eighteenth century to 1918, partitioned into three countries: Germany, Russia and Austria (later Austro-Hungary). A considerable part of this questionnaire concerned the use of crops, as well as their names (Köhler 1993).

Question number 21 was: *Czy znana jest ludowi, choćby z tradycji, nazwa kucmerki albo słodyczki?* which can be translated as: *Do simple people, at least from tradition, know the names 'kucmerka' or 'słodyczka'?* This question was designed to prompt answers concerning the use of the forgotten vegetable: skirret, *Sium sisarum* L., in Poland whose name in Polish is *marek kucmerka*. The plant was an important root crop in central Europe in medieval times (Rostafiński 1885; Dembińska and Weaver

1999: 126). To his surprise Rostafiński received information on the use of two different species with edible tubers: a wild weedy plant with tubers very similar to those of skirret, i.e., marsh woundwort, *S. palustris* (in some areas of Poland called *kucmerka*) and *Polypodium vulgare* L. (often called *słodyczka*), a woodland fern with very sweet tubers.

Rostafiński wrote about *Sium sisarum* and *S. palustris* in three of his papers: two devoted mainly to *Sium sisarum* (Rostafiński 1884, 1885) and one to *S. palustris* (Rostafiński 1888). He also wrote a letter to *Nature* (mentioned in his paper of 1884), which he signed A. Wentz'1—after his mother's maiden name Wentzel, asking readers to send him information about the use of *S. palustris* for food in other parts of the world (Wentz'1 1883). In the same year he got one response from Dyer (1883) who quoted a few old English sources, which claimed that *S. palustris* is edible and was probably used as food in the British Isles before the introduction of potatoes. However, no evident ethnobotanical data about its current (nineteenth century) use in the British Isles were available to him.

Altogether there are seventeen reliable references to the use of *S. palustris* as food by ordinary people in Poland (Fig. 2, Table 1). The species had been used in southern and south-eastern Poland, predominantly by poor peasants from the Carpathians. They gathered it mainly in spring (more rarely in autumn), dried the tubers and, by pounding, obtained a kind of crude flour which was then used for making flatbread or soup. The use of the plant ceased almost completely at the turn of the nineteenth and twentieth century, with the exception of three instances when it was eaten as a sort of raw snack, after World War II, even up until the 1970s. The edibility of *S. palustris* was also mentioned by the Polish botanist Kluk (1788) in his plant dictionary. He wrote that “its boiled roots can be used instead of bread in the times of scarcity”. This entry was probably inspired by Linnaeus and his contemporaries whom he extensively read (see the further chapter about Scandinavia), as there are no reports on the alimentary use of the species in NE Poland, where he lived.

S. palustris as food in Scandinavia

In 1742, one of Carl Linnaeus's most gifted pupils, Pehr Kalm, travelled through south-western Sweden. Besides his botanical and zoological findings, one of

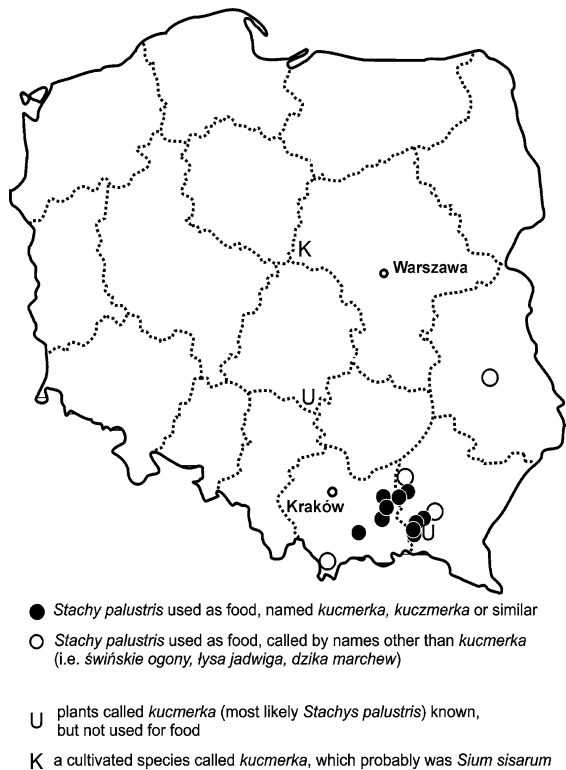


Fig. 2 Distribution of references, which concern or may concern the traditional use of *Stachys palustris* in Poland

his main aims was, in accordance with the Linnaean research project, to record knowledge about the local use of biological resources available. Near Hasslerör in the province of Västergötland he observed on the 10th of July 1742 that the fields were completely covered with *S. palustris*. The peasants told him that the pigs are quite keen on this plant, and eat the tubers rather than oats and also turn the soil over, when they walk up the fields. Kalm tasted the tubers and found that they had a rather pleasant taste. “Who knows if people could not use them for food in times of want?”, he asked himself. “In this way you can get the double benefit of a plant, previously considered as a useless weed, and harmful to the fields. Wet and marshy habitats, as it ideally prefers, could thus be fruitful” (Kalm 1746: 19). Kalm’s interest in its potential as a food plant and flour substitute was due to the economic situation in Sweden in his times. Carl Linnaeus mentions, with Kalm as his source, *S. palustris* as a potential food plant in his *Planta esculentae patriae* (1752) and *De pane diaetico* (Linnaeus 1757).

In this way, the usefulness of *S. palustris* found its way into the general botanical literature and spread all over Europe (Svanberg 2007). Cleric Hans J. Wille in Norwegian Telemark tried it himself and found it to “be excellent not only for vegetable stews and soups, but also to grind into flour” (Wille 1786). Retzius (1806: 704) argued that the tubers could be utilized by humans, and either boiled or crushed, dried and ground, used to substitute flour in baking bread. The tubers of *S. palustris* have been used in Scandinavian famine food recipe books and handbooks for using wild plants as food, up to the twentieth century (e.g., Henriksson 1923: 99; Holmboe 1942: 58–60; Ingmanson 1996: 77). However, these recommendations, which had their origin in Pehr Kalm’s observations in Västergötland in 1742, and spread with the help of propaganda literature throughout the world (cf. Kluk 1788; Meyer 1836), contain no data about its actual use among rural people. There is no proof from Scandinavia, that it had been used as a food plant by peasants (Nelson, Svanberg 1987).

S. palustris as food in Great Britain

In 1828 Joseph Houlton from Lisson Grove received a Silver Ceres Medal from the Society for the Encouragement of Arts, Manufactures and Commerce for *introducing the Roots of Stachys palustris as a new Esculent Vegetable*. In his letter to the Society he described his experiences with the cultivation of the species and proposed selection towards increasing the size of rhizomes. Houlton’s results were very much publicized in contemporary magazines and newspapers, which indicates the interest for this potential crop in the late 1820s.

Already William Withering says, probably repeating Linnaeus, in his handbook on edible wild plants in the British Isles (1776: 355) that “the roots when dried and powdered will make bread. Swine eat them...” A few references to using woundwort as food in the British Isles were collected by Sturtevant (Hedrick 1919): “Lightfoot (1789) says that the roots have been eaten in times of necessity, either boiled or dried and made into bread [This is probable after Linnaeus] Henfrey (1870) says the fleshy, subterranean rhizomes are sometimes collected as a table vegetable. Loudon says these, when grown on rich moist soils, are white, crisp and agreeable to the taste.

Table 1 Summary of records which refer or may refer to the traditional culinary use of *Stachys palustris* in Poland

Village (nearest town and area of Poland in brackets)	Period	Mode of use	Local name	Source	Identification credibility
Biały Dunajec—Stołowe (near Nowy Targ, S Poland)	Up until world war I	Tubers dried into flour, made into soup, as famine food	<i>dzika marchew</i>	PAE 1948 (Łuczaj 2008c)	H
As above	At least until 1948	Tubers eaten raw by children	As above	As above	As above
Staszówka (Gorlice, S)	Still used in 1885	Commonly eaten in spring food shortages	<i>kucmerka</i>	Niedzielski B.1885 (ROST)	N
Rojówka [now Skrzętla-Rojówka] (Nowy Sącz, S)	Still used in the 1880s	Added to vodka	<i>kuczmerka</i>	Żuk Skarszewski F. 1883 (ROST); Rostański (1885, 1888)	N/A
Dębowiec (Jasło, SE)	Ca. mid-nineteenth century	Tubers eaten in former times during famine	<i>kucmerka</i>	Gurwiński R. 1883 (ROST)	N
Dębowiec and surrounding area (Jasło, SE)	Ca. mid-nineteenth century.	No data, during famines, in older times	<i>Kuczmerka</i>	Kowalski F. 1909 (ROST)	L
Cieklin (Jasło, SE)	Until 1970	Tubers grated, eaten raw as salad	No data	Łuczaj (2008a)	A
Łęki Strzyżowskie (Krosno, SE)	“Former times”	Tubers used as food	<i>kuśmyrka</i>	PAE 1964	N
Pietrusza Wola (Krosno, SE)	At least until the 1970s	Raw tubers used as a prized children snack	<i>kuczmyrka</i>	Łuczaj, new field data	A
Dulczówka and Łęki (Pilzno, SE)	Still used in 1883	During food shortages in spring	<i>Kuczurka</i>	Pallan S. 1883 (ROST)	N
General information from Tamów, Dębica, Dąbrowa, Żabno and Ropczyce (SE)	Used still in 1883 but more in former times	Dried and powdered into flour for making bread	<i>kucmerka</i> or <i>wężiołka</i>	Stu[...] M. 1883 (ROST)	N
Tuchów and vicinity (Tarnów, S)	Still used in 1883	Made into <i>kasza</i> (i.e., probably cut into small pieces and boiled) or ground for bread flour during spring food shortages	<i>kucmury</i>	Przybytkiewicz J. 1883 (ROST)	N
Tarnów (Tarnów, S)	Still used in 1883	Collected in spring, dried in the stove and crushed in a wooden mortar, or simply wrapped in a cloth and pounded with a heavy object	<i>kucmery</i>	Przybytkiewicz J. 1883 (ROST)	N
Villages near Radomyśl Wielki: Wadowska, Smyków, Bór, Wierzchowiny and Kadzielna (Mielec, SE)		Tubers ground and made into flatbread	<i>świńskie ogony</i>	Kijński S. 1883 (ROST); Rostański (1885, 1888)	A (Rostański identified fresh plants)

Table 1 continued

Village (nearest town and area of Poland in brackets)	Period	Mode of use	Local name	Source	Identification credibility
Majdan Kawęczynski (Lublin, E)	Earlier, during famine in mid-nineteenth century	Tubers ground, dried and later added to soups	<i>tyśa jadviga</i>	Marcin N. 1948 (PAE)	D
Lutcza (Strzyżów, SE)	1860s, during famines	Boiled with flour	<i>kuczmyrka</i>	Kępski J. 1948 (PAE)	H
Kraczkowa (Łańcut; SE)	?	“Roots” used as food	<i>świńskie ogony</i>	Kunysz W. 1948 (PAE)	N
Żyraków (Dębica, SE)	Nineteenth century	Tubers, dried and powdered used for famine flatbread	<i>kuczmyrka</i> , <i>kuczmyrek</i>	Sygnarski T. 1948 (PAE)	H
Potok, Turaszówka (Krosno, SE)	1883	Tubers used only as pig fodder	<i>kucmerka</i>	Łozińska J. 1883 (ROST)	N
Silnica (Radomsko, C)	Nineteenth century.	Known, not planted in gardens	<i>kucmera</i>	Czarniecka U. 1883 (ROST)	NU

Credibility codes after Łuczaj (2010b): H—herbarium specimen verified by Łuczaj (2008b); N—identification using the local name, D—identified using a detailed plant description, L—Latin name given, A—identified by a botanical expert

PAE—Polish Ethnographic Atlas archives, ROST—letters—responses to Rostafński (authors and dates of letter are given first)

Johnson (1862) says the young shoots, though of agreeable taste, are of disagreeable smell but may be eaten as asparagus.” Dyer (1883) in response to the Rostafński’s query in *Nature* found two more quotes suggesting its potential use as food: Withering (1787)—who wrote that “the root, when dried and powdered, will make bread” and Bromfield (1856)—who wrote that: “The roots of *Stachys palustris* are said to become edible by cultivation”.

Alimentary use in other countries

Information on the potential use of the species as food is present in some German sources (Meyer 1836; Hegi et al. 1927), which, however, were influenced by the publications of Linnaeus and his students, as well as Houlton. According to Hegi et al. (1927) an attempt to cultivate the species in northern Germany was made in the mid-nineteenth century. Also Julius Troost (1884), an author of several publications on economic plants, writes about the edibility of *S. palustris*, but he only repeats the information given in earlier sources, for example by describing Houlton’s studies. The tubers were also used as emergency food in western Ukraine, in the Carpathians, south from Lviv (Łuczaj 2008b).

Surprisingly, there are no confirmed records of the medicinal or alimentary uses of *S. palustris* from the countries south of Poland: Slovakia, Hungary and Romania—the local uses of the species were not mentioned in such important ethnobotanical publications as those by Péntek and Szabó (1985), the Romanian ethnobotanical dictionary of Butură (1979) or the numerous papers of Holuby (e.g., Holuby 1891) or Markuš (e.g., 1961). Its use was not recorded even in places where it is very common, e.g., in marshy areas around the Lake Balaton (Szabó 2000).

Fodder for pigs

Many observers have noted that free-ranging pigs searched for tubers of *S. palustris* on the fields in pre-industrial northern Europe (Osbeck 1922: 30–31; Høeg 1974: 618). That the pigs sought after its tubers in the fields seems to have been observed in many places in Europe, which is also reflected in the popular names recorded. In Scottish Banffshire it was known as *swinen arnit* i.e., ‘swine earth–nut’

referring to its tubers (Darwin 1996: 127). In Shetland it was referred to as *swine's beads* and on Orkney *swines murricks* (Darwin 1996: 127). Similar names are also recorded from other Germanic languages: *svinerod* in Danish (Brøndegaard 1980: 119); *svinerot*, *griserove*, *griserot* and *svindill* in Norwegian (Høeg 1974: 618); *svinknöl*, *svinmynta* and *svinlök* in Swedish (Linnaeus 1751: 422; Fries 1880; Svanberg 2005); among the Swedish-speakers in Finland it was known as *svinnässla* (Olsson 1896: 10); *Schweinzrübe* in German (Marzell 1979). In some areas of SE Poland the plant is called *świńskie ogony* (i.e., 'swine tails', Table 1).

A few sources from Scandinavia mention that the tubers were actually gathered as food for pigs, but these records are very general and sometimes scholars doubt that this ever took place (Brøndegaard 1980: 119; Svanberg 2005). However, Norwegian records from the early twentieth-century give indications that it sometimes was actually gathered as fodder. It "was used as food for swine, but not harvested systematically", says one record from Vinje in Telemark, southern Norway. Another record from Bremanger in western Norway says that it was "collected on the fields in a bucket and taken home. There they heated boiling water over them and gave it to the hogs" (Høeg 1974: 618). In the sources from Sweden, it is sometimes said that the tubers were gathered as pig fodder by the peasantry, but documentation is sparse. There is one record from Dalecarlia, which says that the tubers were cooked and given to pigs (Eriksson 1987: 99). It was also recommended as a fodder plant, for instance for chickens, in some Swedish nineteenth-century agricultural handbooks (Lilja 1869: 264). In Poland the plant is regarded as food, which pigs eat eagerly and, although the human food value is forgotten, the attraction of the animals to this plant is still remembered (Table 1 and Łuczaj, unpublished data). Also Kluk in his plant dictionary wrote that it is "beloved by pigs" (Kluk 1788).

Medicinal use

There are also records of the use of *S. palustris* as a medicinal plant (Johnson 1999: 806). This is especially true for the British Isles. The famous English herbalist John Gerard gives an ethnographic glimpse in his *Great Herball* of 1597, where he reports his

personal observation of the use of the species as a remedy for curing wounds by an English farmer. After recording this, John Gerard used marsh woundworts himself in a similar way. James Newton in a manuscript from around 1683 wrote that "Lady Swan of Southfleet in Kent hath cur'd many deplorable and dismal sores in the legs and other parts with this [plant] made into an Ointment with Hog's Grease" (Vickery 1995: 234). Another old record is found in Martin Martin's famous description of the Outer Hebrides in 1695. From the Isle of Lewis he writes that the inhabitants cure "green wounds with ointment made of golden-rod, allheal, and fresh butter (Martin 1999: 19). Allheal is interpreted as *S. palustris* or a hybrid thereof with *S. sylvatica* L. (i.e., *S. × ambigua* Smith), which in the north of Britain is commoner than the parent plants (Allen and Hatfield 2004: 213). Allen and Hatfield (2004) present further records of its medicinal use from various parts of England and Ireland (e.g., Newman and Wilson 1951).

S. palustris was also used as medicine by Native Americans, but only by the Delaware, against venereal disease (Tantaquidgeon 1942, Moerman 1998).

Other uses

It is mentioned among traditional Scottish dye plants. Yellow and blue can be obtained from the whole plant. If it is used with *Potentilla erecta* L. it also gives a red dye (Darwin 1996: 127). It is also known from nineteenth-century Shetland Islands for producing a yellow dye called *hundie* when mixed with tormentil or the non-native logwood (Milliken and Bridgewater 2004: 177).

Gosiute Indians used the seeds of *S. palustris* as food (Chamberlin 1911: 383), however, no use of the seeds from European sources was found.

Prospects of bringing *S. palustris* into cultivation

The question arises, why did one of the most productive and tasty wild indigenous root crops never become established as a domesticated plant?

One answer is that it was probably available in large quantities in the wild growing among other crops, and so was widely used as supplementary nutrition, like *Chenopodium album* L. In the eighteenth and nineteenth century when potatoes became

a staple food in Northern Europe its role diminished and it was used only as emergency food.

Another answer is that in East Asian cooking a larger number of vegetables are used (see e.g., Hu 2004), and *S. affinis* is not the only example of a species which is cultivated in East Asia, and its close relatives were never grown as food in Europe (others are *Arctium*, *Polygonatum*, *Iris*, *Lilium* etc.).

Yet another explanation may lie in its chemical composition. Unfortunately there are hardly any data on the nutritive values of *S. palustris* nor *S. affinis*. The latter species is known as one of the main sources of stachyose, an oligosaccharide (tetrasaccharide composed of glucose, fructose and galactose), which is not digested by humans and passes to the guts where it is broken down in the process of fermentation by gut bacteria (Yin and Yang 2006; Coulston and Boushey 2008). Stachyose constitutes around two thirds of the dry weight of the tubers of *S. affinis* (Hegi et al. 1927; Becker-Dillingen 1950). The same and similar oligosaccharides are present in pulses (Yin and Yang 2006; Coulston and Boushey 2008). The tubers of both edible *Stachys* species however, probably contain other, more digestible carbohydrates as well, as *S. palustris* is sought after by rodents and pigs. Actually, Kartsev et al. (1994), in their review of the chemical composition of the genus *Stachys*, reported the presence of large amounts of starch in the tubers of *S. palustris*. However, they quote relatively uncertain sources (Grossheim 1952; Aaronova 1968).

Although stachyose and other α -galactosides originate flatulence, these oligosaccharides selectively stimulate the growth of bifidobacteria in the colonic microbiota and they are model type “prebiotics.” Therefore, α -galactosides can be recognized as “functional food ingredients” for which “health claims” may become authorized (Tomomatsu 1994; Martínez-Villaluenga et al. 2008).

In SE Poland it is known to many farmers as “the root which mice store”. Stories about large caches with these tubers found during autumn and winter ploughing of fields are still frequently mentioned by farmers in the Krosno area and occurred in the letter-responses to Rostafiński in the nineteenth century (Łuczaj 2010b). The first author of this article occasionally encountered these caches. The tubers are probably stored by voles—*Microtus* spp. or, less likely, *Agricola amphibius* L. (Dr Karol Zub,

Mammal Research Institute of Polish Academy of Sciences, Białowieża, e-mail communication). Plundering rodent nests, particularly those of root vole (*Microtus oeconomus* Pallas), in search of edible seeds and roots was a common practice among the inhabitants of Siberia in previous centuries (Ståhlberg, Svanberg 2010).

In China, the tubers of *S. affinis* are usually eaten in the fermented state (Hu 2004; Sebastian Cebula, personal communication). This preparation technique causes the transformation of oligosaccharides into substances, which are digestible by humans, e.g., lactic acid (Martínez-Villaluenga et al. 2008).

Plants with storage organs which contain carbohydrates other than starch, such as *Helianthus tuberosus* L., *Campanula rapunculus* L. and *S. palustris* have decreased in importance in Europe since the introduction of potato, which provided an easily digestible form of starch (Maurizio 1926).

An interesting issue is the difference in ploidy of *Stachys palustris* between European-origin populations of the species present in North America (hexaploids) and native American diploid and tetraploid populations (Mulligan et al. 1983). Maybe this is a result of the long history of agriculture in Europe? In Europe due to large areas of disturbed vegetation the species could create a larger and more genetically diverse populations.

S. palustris has a pleasant taste. When cooked or fried it becomes slightly sweet. This fact was emphasized by many authors and should be borne in mind as many other wild plants used in the times of food shortages had an unpleasant taste, e.g., another edible rhizomatous species used as food in Poland—couchgrass *Elytrigia repens* (L.) Desv. ex Nevski (syn.: *Agropyron repens* (L.) P. Beauv.). One of the authors of the article (ŁŁ) has served dishes of raw, boiled, fried and lacto-fermented *S. palustris* to a few hundred participants of wild food culinary workshops over the last 7 years (www.luczaj.com). It has always been the favourite dish, out of dozens of plant species, to the extent that many participants took it home to cultivate it in their gardens for food.

An interesting feature of *S. palustris* is its very late development in spring. This fits ideally with the agricultural cycle of late spring-planted crops such as potatoes, making it a troublesome weed. But on the other hand, late ploughing or tilling (in Poland—at the turn of April and May) encourages its growth and

removes the competition of other weeds, if it is grown as the main crop. Also glyphosate spraying around the first of May strongly encourages the growth of *S. palustris*, as earlier-emerging competing weeds are killed (Ł.Ł.—personal experiments).

S. palustris could become a local indigenous European vegetable grown on a small scale in home gardens. As it is a perennial species, it fits well into the current trends of permaculture gardening and sustainable use of food plants of local origin (Fern 2000). Its presumed high oligosaccharide content could make it a pre-biotic food supplement (Walker et al. 2008; Martínez-Villaluenga et al. 2008).

Conclusions

The dried and powdered tubers of *S. palustris* were used as an emergency food in southern Poland, as an ingredient of soup or bread, until the turn of the nineteenth and twentieth century, whereas earlier (eighteenth and nineteenth century) in the British Isles and Scandinavia several people attempted to popularize the use of this plant as a wild vegetable or a cultivated crop. They were eaten raw as a snack until the 1970s in at least two villages in SE Poland.

S. palustris could become an indigenous European cultivated vegetable. However, more studies on the chemical composition and food value of *S. palustris*, and its close relative, Chinese artichoke, are needed to evaluate their nutritional value and the spectrum of carbohydrates they contain.

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