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Collecting and Learning to Identify Edible Fungi in Southeastern Poland: Age and Gender Differences

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*The gathering of 17 folk taxa of edible fungi (most commonly *Boletus edulis*, *Leccinum spp.*, *Xerocomus spp.*, *Suillus spp.*, *Cantharellus cibarius*, *Armillaria spp.*, *Russula spp.*, *Lactarius salmonicolor*, *Macrolepiota procera*, *Boletus erythropus*) was recorded in three villages in southeast Poland, but only 13 of them are gathered by children. Gender and age differences were small (apart from the fact that more adults than children collect non-Boletaceae species), and relatives of both sexes took part in teaching children about mushrooms, although fathers were most frequently mentioned as first teachers. Collecting mushrooms, mainly for own use, sometimes for sale, is still a culturally significant activity.*

KEYWORDS *foraging, inter-generational knowledge transfer, folk taxonomy, mushroom picking, mycophilia*

In these times of decreasing traditional ethnobiological knowledge, an increasing number of studies deal with its transfer, both within tribal communities and in modern, “western” societies. Studies on traditional ethnobiological knowledge usually report its inter-generational loss (e.g., Benz et al. 2000; Eyssartier, Ladio, and Lozada 2008), and only very rarely its maintenance (Zarger and Stepp 2004). However, still not a single article on the issue of ethnomycological knowledge transfer can be found in the scientific literature apart from one conference abstract (Garibay-Orijel and Valencia

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2010), in spite of the fact that fungi supplement nutrition in many areas of the world, particularly in eastern and southern Europe, Africa, the Himalayas, eastern Asia and Mesoamerica (Boa 2004; Arora and Shepard 2008).

Mushrooms, although they contain small amounts of proteins, fats and digestible carbohydrates, have a very low caloric content, comparable to wild green vegetables. Furthermore they are rich in many macro- and microelements (e.g., Kiger 1959; Turner, Kuhnlein, and Egger 1987; Breene 1990; Leon-Guzman et al. 1997; Ereipej and Al-Raddad 1999; Caglarirmak et al. 2002; Sanmee et al. 2003). They also have a high essential aminoacid index, containing a favourable proportion of essential aminoacids, similar to meat (Crisan and Sands 1978). The list of nutritional studies on mushrooms was compiled by Boa (2004), who emphasized that the constituents of an edible fungus are not necessarily a good guide to nutritional value, as the digestibility of different components varies, analytical methods are not always reliably used in testing and the use of different techniques limits the comparison of results from different studies. In spite of the points mentioned by Boa, we can conclude that the consumption of mushrooms can significantly improve the nutritional and medicinal value of food in many rural areas of the world. Mushrooms are also examples of nutraceuticals (i.e., foods with medicinal value), both according to traditional healing systems (particularly in Eastern Asia) and in the light of the new findings concerning the immunostimulatory role of fungal polysaccharides (Wasser and Weis 1999; Reshetnikov 2001; Zhou et al. 2009).

The high cultural importance of fungi is very characteristic for northern Slavic cultures (including Polish). Slavic nations are examples of *mycophilous cultures*, in contrast to *mycophobic* countries such as Britain, where mushrooms are not so widely eaten (Wasson and Wasson 1957; Marczyk 2003). Mushrooms in Poland are not only consumed, they are also widely known, recognized, talked about (Marczyk), and even frequently depicted in children's illustrations (Łuczaj 2009).

Polish ethnographic literature contains extensive data on their use. For example, *The Polish Ethnographic Atlas* contains a few maps devoted to the gathering of fungi species (maps 312–315 in Gajek 1981), Marczyk (2003) wrote a review of the place of mushrooms in Polish folk superstitions and beliefs, and Bartnicka-Dąbkowska (1964) mapped the folk names of a few dozen of the most common mushroom species.

Wild mushrooms are frequently present in Polish countryside cuisine. They are usually used either fresh or dried as ingredients of sauces and soups, fried in batter or pickled. Throughout the twentieth century storing techniques have changed—at the beginning of the twentieth century mushrooms were dried or, more rarely, lacto-fermented, later pickling became popular and lacto-fermenting nearly disappeared. At the turn of the twentieth and twenty-first centuries the freezing of shortly boiled mushrooms became popular (Lehr 2000; Jędrusik 2004; Kujawska and Łuczaj 2011).

Edible mushrooms, although very common in Polish cuisine, are not considered an important nutritional resource. Their low caloric value has been widely realized by the inhabitants. In some areas of Poland, an expression was used for people who looked anemic—that they “had been fed with mushrooms.” They are generally valued for their taste and aroma. Their important role in traditional cooking is maintained by the fact that a large proportion of Christmas Eve dishes contain ceps (*Boletaceae* mushrooms), used mainly for stuffing dumplings and flavoring sourbread soups (Moszyński 1929). Mushrooms are also considered difficult to digest and so avoided in evening meals, while most parents limit their intake by younger children, especially toddlers.

As large amounts of mushrooms are consumed each year, cases of mushroom poisoning are relatively frequent (Bielski and Sikorski 1993). Most deaths are caused by the consumption of *Amanita phalloides* (Vaill. ex Fr.) Link (death cap) confused with *Russula* and *Agaricus* species. In Poland, poisonings by *A. phalloides* constitute 90%–95% of mushroom-related deaths (Ferenc et al. 2009). In order to avoid this, the media often produce special programmes and articles devoted to correct mushroom identification (e.g., Barysz 2007). According to the law, only mushrooms belonging to the official list of species may be sold, and every person selling mushrooms in public is obliged to produce an identity card on request. The list contains 42 taxa, including a few cultivated East Asian species and most traditionally collected species (Rozporządzenie 2008). Other species can be used but not sold to the public (e.g., in markets or as preserves). The commonest edible taxon not included in the list is the genus *Russula*, due to its similarity to *Amanita phalloides*. A few rarer edible species are protected by law (e.g., *Sparassis crispa* [Wulf.] Fr. and *Dendropolyporus umbellatus* [Pers. ex Fr.] Jul.), although most mushroom pickers do not realize this.

Lessons devoted to edible and poisonous mushrooms appear here and there in school nature textbooks (e.g., Kłyś and Sulejczak 1999; Chrzanowska-Szwarc 2005; Chmura n.d.). Until 1999 a special lesson on mushroom identification was obligatory in the fifth grade (11-year-olds). After 1999, when the name of the subject was changed from “biology” to “nature,” teachers have had more freedom in the choice of material, some of them mention the topic when talking about forest habitats, however there is no formal obligation to talk about edible and poisonous mushrooms. According to the methodological supervisor of nature and biology teachers for the Podkarpackie region, Dr. Małgorzata Podolak (pers. comm., March 1, 2011), teachers either do not mention the topic or spend a maximum of an hour on it.

Another source of knowledge about edible mushrooms are the numerous edible fungi identification guides available in every bookstore. Many internet websites devoted to mushrooms have sprung up, including one of

the largest and most comprehensive photographic websites in the world devoted to edible fungi created by Snowarski (1997–2011; in Polish and English). This website even supplies readers with up-to-date maps of occurrence of mushroom fruiting bodies in the country. As collecting mushrooms is a vivid part of folk traditions a large part of the knowledge about them is transmitted via family. Unfortunately no one has ever studied explicitly the process of transferring knowledge about edible mushrooms in Polish society. Hence we wanted to answer the following questions:

1. Which are the main vectors of knowledge about edible mushrooms (school versus media versus family, men versus women)?
2. Are there any intergenerational and gender differences in the number of taxa of mushrooms collected?
3. Are there any intergenerational differences in the names of mushrooms?
4. What is the age when children learn to recognize mushrooms?

METHODS

The study was done in three villages, Czudec (2,900 inhabitants), Pstrągowa (2,500) and Nowa Wieś (870), all in the Carpathian Foothills in southeast Poland (Podkarpackie region, Strzyżów area). The social, economic, and environmental conditions of the studied villages are very typical for the Polish Carpathians. The potential natural vegetation is made up of mixed broadleaved forests of *Tilio-Carpinetum* type (dominated by *Carpinus betulus*) and *Dentario glandulosae-Fagetum* forests (dominated by *Fagus sylvatica* and *Abies alba*). The climate is cold temperate, relatively humid (mean annual temperature 7°C, mean July 19°C, January –4°C, rainfall ca. 800 mm with no regular dry season). The landscape is hilly, densely inhabited, with a rich mosaic of built-up areas, arable lands, grassland and forest. A large proportion of inhabitants can be classified as *chłopo-robotnicy* (i.e., peasant-workers)—people who own small farms, but supplement their income with regular jobs in adjacent towns. The whole Podkarpackie region is one of the most archaic areas of Poland in terms of the state of preservation of traditional folk-lore (Ruszel 2004).

The field study was done in autumn 2007, by the second author who lives in one of the villages (Pstrągowa). Two groups of people took part in the study: 176 primary school children (class IV–VI; e.g., 10–12 years old) and 213 adults aged 40–80. The questionnaire was distributed among children in three local schools and was filled in during lessons—in Czudec (74 children), Pstrągowa (55) and Nowa Wieś (47). Adults (73 from Czudec, 71 from Pstrągowa and 69 from Nowa Wieś) aged 40–80 (most aged 40–55) were studied. They were selected, partly using the snowball technique, and partly through stopping people on the street and asking them to

fill in the questionnaire. A questionnaire was used asking the following questions:

- Which edible mushrooms have you collected?
- At what age did you learn to recognize your first species of edible mushrooms?
- Who taught you this or how did you find out?
- What feature(s) did you learn to recognize it by?
- What was the first species of mushroom you learned? (This question occurred only in the questionnaire for adults, as it was added later.)
- Which mushrooms did you collect before you were 16, and stopped collecting later? (This question was only for adults.)

These questions were accompanied by a few questions about gathering wild edible plants (Nieroda 2009), which are not analyzed in this paper. Unstructured short interviews were performed, while collecting questionnaires about the use of mushrooms (e.g., How do you use mushrooms? What role do mushrooms play in your life?).

Local names of mushrooms were linked to scientific names during conversations with selected respondents using photographic edible fungi field guides. As collecting edible mushrooms is a culturally significant activity, local names had very precise meanings, usually corresponding to a mycological genus, and no cases of names extending beyond a genus (e.g., to name the whole family) were found, in fact an opposing tendency was found - local folk taxonomy, similarly to most of Poland, distinguishes folk taxa within a genus. For instance *Leccinum* is often divided into two groups (“brown ones” and “red big ones”). Also local people know that there are two species of *Suillus*, one growing under larches, another under pines, though no separate names are applied. The diversity of *Russula* species is realized by many respondents, but, again, not expressed by names (green, brownish and bluish capped species with white gills are sought after; red capped species, e.g., *Russula emetica* [Schaeff.] Pers., black capped species, e.g., *R. nigricans* [Bull.]Fr., and badly smelling species, e.g., *R. foetens* Pers. ex Fr. are avoided).

The cultural picture of wild mushroom gathering was also supplemented by observations from other villages in the same part of the Carpathians (Strzyżów and Krosno—*powiat* administrative units). Since 1996, the first author of the article (based 25 km from the studied villages) has been regularly collecting mushrooms in the surrounding area, including lesser known edible species, and has showed them to mushroom pickers of all ages (including groups of children) encountered in the woods. He has also run workshops for school children (both indoor and outdoor). Responses gathered during these activities, concerning mushrooms, which are collected, and those which are avoided, local dishes and general

attitudes, have formed important additional information helping to interpret the results of the questionnaire.

RESULTS

Respondents eagerly answered the questions. As mushroom picking is commonly practised by nearly everyone, they had no problems with giving precise answers. Adults, on average, reported collecting one species more than children (average of 4.9 versus 3.9 species, Mann-Whitney U test, $p > .05$). The fungi from Boletaceae, from genera *Boletus*, *Leccinum*, *Xerocomus* and *Suillus* were the most commonly collected. There were four taxa of fungi known and collected only by adults plus one species, which used to be collected in the past and is not collected any more. There was no taxon gathered exclusively by children (table 1). The total list of mushrooms collected by adults is 17 folk taxa, by children—13. As some of the folk taxa contain several biological species (e.g., in the genera *Leccinum*, *Suillus* and *Russula*), the actual number of scientific species used is probably double this, as we identified at least 28 separate species, but further, more difficult to distinguish species (e.g., from the genera *Russula*, *Armillaria*, *Boletus* and *Leccinum*), could be added to the list if a longer study, documented by voucher specimens identified by a mycologist specializing in the above mentioned genera, were performed.

When gender was taken into account there were no significant differences between girls and boys, but there were some differences between men and women, as significantly more adult women collect honey fungus (*Armillaria mellea*) and chanterelles (*Catharellus cibarius*) than men (table 1). For all commonly collected Boletaceae species there were no significant generational differences between children and adults. However, a significantly larger proportion of adults collected *Macrolepiota*, *Russula*, *Lactarius* and *Agaricus* ($p < .05$).

Every child and adult stated that they knew how to recognize at least a single species of wild edible mushroom. There was a significant difference between the mean age of learning the first mushroom in children and adults (6.7, $SD = 1.6$ and 9.7, $SD = 3.3$ respectively; Mann-Whitney U test, $p < .0001$), which suggests that children today are learning mushrooms earlier than they were a couple of generations ago. There was no significant difference between girls and boys (Mann-Whitney U test, $p = .77$), however there was a small but significant difference (Mann-Whitney U test, $p = .04$) between adult men and women—men learned to recognize mushrooms earlier (mean = 9.3, modal age = 8) than women (mean 10.1, modal age 10).

The species which were reported as the first taxa people learned to recognize were usually *Boletus edulis*, *Leccinum*, *Cantarellus cibarius*, *Russula*, *Xerocomus* or *Suillus* (table 2).

TABLE 1. Mushrooms Gathered Nowadays

Local name	English name	Scientific name	% Girls	% Boys	% S1	% Children together	% Women	% Men	% S2	% Adults together	S3
prawdziwek / borowik / grzyb prawdziwy kozak	Porcini (cep)	<i>Boletus</i> sect. <i>Edules</i> , mainly <i>Boletus edulis</i> Bull.: Fr.	73	81	ns	77	76	78	ns	77	ns
	A kind of cep	<i>Leccinum</i> spp. – all species (at least 4 species are used, <i>L.</i> <i>aurantiacum</i> (Bull.) S.F. Gray is most prized)	65	69	ns	67	63	59	ns	61	ns
podgrzybek	A kind of cep	<i>Xeroconus</i> spp. – all species (mainly <i>X.</i> <i>badius</i> (Fr.:Fr.) Gilbert and <i>X. subtomentosus</i> (L.:Fr.) Quélet; also <i>X.</i> <i>chryseniteron</i> (Bull.) Quélet is collected but viewed as inferior)	57	46	ns	51	52	34	ns	44	ns
maslak	Slippery jack	<i>Suillus</i> spp. – all species, mainly <i>S.</i> <i>luteus</i> (L.:Fr.) Roussel and <i>S. grevillei</i> (Klotzsch) Singer	44	42	ns	43	53	41	ns	48	ns
kurka	Chanterelle	<i>Cantharellus cibarius</i> Fr.	38	34	ns	36	58	36	.022	49	.07
kania	Parasol mushroom	<i>Macrolepiota procera</i> (Scop. ex Fr.) Sing.	32	24	ns	28	45	37	ns	41	.02
gołąbka / gołąbek / jarząbek		<i>Russula</i> spp. – (at least 5 species are used)	23	26	ns	25	45	36	ns	41	.007

(Continued)

TABLE 1 (Continued)

Local name	English name	Scientific name	% Girls	% Boys	S1	% Children together	% Women	% Men	S2	% Adults together	S3
opieńka / podpinka	Honey fungus	<i>Armillaria</i> spp.	25	23	ns	24	44	21	.004	34	.07
pieczarka	Field mushroom	<i>Agaricus</i> spp. – only specimens from pastures	12	10	ns	11	31	40	ns	35	<.001
rydz	Saffron milk cap	<i>Lactarius</i> sect. <i>Deliciosi</i> spp. (mainly <i>L. salmonicolor</i> L. Heim & Leclair)	5.2	6.1	ns	5.7	22	27	ns	24	<.001
podciecz	A kind of cep	<i>Boletus erythropus</i> (Fr.) Krmblh.	5.2	7.1	ns	6.2	5.1	11.2	.09	8	ns
gąska	Blewitt	<i>Lepista nuda</i> (Bull.) Cooke	0	2		1.1	2.5	9.5		5.6	
smardz	Morel	<i>Morchella</i> sp.	0	1		.6	4.2	3.1		3.8	
sitówka	A kind of Cep	some unidentified <i>Boletaceae</i>	0	0		0	5.1	2.1		3.8	
krówka	–	<i>Lactarius volemus</i> Fr.	0	0		0	5.1	2.1		3.8	
gronówka	–	<i>Dendropolyporus umbellatus</i> (Pers.: Fr.) Jul.	0	0		0	3.4	3.2		3.3	
purchawka	Puffball	<i>Lycoperdon</i> sp.	1.3	3		2.3	.8	1		.9	
kofpak	–	<i>Rozites caperatus</i> (Pers.) P. Karst. [§]	0	0		0	.8	1		.9	

Notes: Significance of difference between two categories (p value of the chi-square test): S1: girls versus boys, S2: women versus men, S3: children versus adults; ns: $p > .1$.

§: collected outside the studied villages.

TABLE 2 The First Taxon Adults Learned When They Were Children

Taxon	Women <i>n</i> = 118	Men <i>n</i> = 95	Together <i>n</i> = 213
<i>Boletus edulis</i>	32	30	62
<i>Leccinum</i> spp.	25	22	47
<i>Russula</i> spp.	15	8	22
<i>Cantharellus cibarius</i>	16	6	22
<i>Xerocomus</i> spp.	10	5	15
<i>Suillus</i> spp.	6	6	12
<i>Agaricus</i> spp.	2	9	11
<i>Armillaria</i> spp.	4	3	7
<i>Macrolepiota procera</i>	2	3	5
<i>Lactarius</i> section <i>Deliciosi</i>	1	1	2
<i>Morchella</i> sp.	1	1	2
<i>Boletus erythropus</i>	1	0	1

TABLE 3 Mushrooms Which Adults Ceased to Collect after the Age of 16

Taxon	No. adults <i>n</i> = 213
<i>Macrolepiota procera</i>	24
<i>Agaricus</i> spp.	18
<i>Russula</i> spp.	17
<i>Leccinum</i> spp.	16
<i>Cantharellus cibarius</i>	11
<i>Suillus</i> spp.	11
<i>Boletus edulis</i>	11
<i>Lactarius</i> sect. <i>Deliciosi</i>	8
<i>Xerocomus</i> spp.	5
<i>Armillaria</i> spp.	5
<i>Morchella</i> sp.	5
<i>Dendropolyporus umbellatus</i> sp.	3
<i>Boletus erythropus</i>	2
<i>Lycoperdon</i> spp.	1
<i>Paxillus involutus</i> Fr. (Fr.)	1

Among the species that the adults used to collect when they were children *Agaricus* spp. and *Macrolepiota procera* were most frequently reported (table 3). The decrease in gathering of these species was attributed by respondents to the disappearance of pastures—a favorable habitat of these taxa.

Both sexes and various generations of the extended family took place in the knowledge transfer. Male relatives, particularly the father, were slightly more frequently reported as the first teachers (table 4). Media and school were only mentioned by a couple of respondents.

The names used by children and adults were nearly identical. Mushroom names used nowadays as official Polish names in field guides

TABLE 4 First Teachers of Mushroom Identification in Two Age Groups: Children Aged 10–12 and Adults Aged 40–80 (Data Given in Percentages)

	Girls <i>n</i> = 77	Boys <i>n</i> = 99	Children together <i>n</i> = 176	Women <i>n</i> = 118	Men <i>n</i> = 95	Adults together <i>n</i> = 213	All together <i>N</i> = 389
Father	61.0	47.0	53.0	25.0	25.0	25.0	38.0
Mother	53.0	30	40	14.0	15.0	14.0	26.0
Family	3.9	3.0	3.4	36.0	26.0	32.0	19.0
Grandmother	13.0	14.0	14.0	5.9	6.3	6.1	9.5
Grandfather	12.0	12.0	12.0	3.4	6.3	4.7	8.0
Pictorial field guide	5.2	7.0	6.2	3.4	1.0	2.3	4.1
Uncle	5.2	8.0	6.8	0	3.2	1.4	3.9
Brother	5.2	4.0	4.5	1.7	5.3	3.3	3.9
Colleagues	0	0	0	4.2	3.2	3.8	2.1
Sister	1.3	1.0	1.1	.8	4.2	2.3	1.8
Aunt	2.6	2.0	2.3	1.7	0	.9	1.5
School	1.3	1.0	1.1	.8	3.2	1.9	1.5
Myself	0	0	0	1.7	1.0	1.4	.8
TV	1.3	0	.6	0	0	0	.3
No answer	0	0	0	.8	0	.5	.3

dominated (e.g., *podgrzybek*—*Xerocomus* spp., *maślak*—*Suillus* spp., *gotąbek/gotabka*—*Russula* spp., *kania*—*Macrolepiota procera*, *kurka*—*Cantharellus cibarius*, *pieczarka*—*Agaricus* spp., *rydz*—*Lactarius* section *Deliciosi*, only *Boletus erythropus* and *Leccinum* spp. were usually named using a local designate (*podciecz* and *kozak* respectively). *Armillaria* spp. is named using the official *opieńka* and the local *podpinka* designates interchangeably (more often the former). Some adults used the traditional local name *jarząbek* for *Russula* spp., but no children mentioned this name.

Mushrooms are frequently used in various dishes in the studied villages, mainly in summer and autumn (freshly after collection) and at Christmas at traditional Christmas Eve dishes. They are eaten mainly fried in sauces and in *bigos* (a dish of meat, cabbage and mushrooms), boiled in soups, and pickled (with vinegar, salt, sugar, bay leaves and allspice). Pickled mushrooms are served with bread and sausages as a side dish for breakfast, supper or at parties. Most species are used interchangeably in sauces, soups and pickles, apart from *Macrolepiota* and *Russula*, which are only used fried, coated in batter. Only Boletaceae species are dried for winter. Some transformations in the use of mushrooms have appeared as freezing for winter use has become popular and new dishes are introduced. For example boiled and minced mushrooms (mainly *Armillaria*) are used as topping for toast (*zapiekanka*) or home-made pizzas. Before freezing the fungi are usually boiled briefly and drained.

The majority of mushrooms are used by the members of the families who gather them. It is not uncommon to give someone a jar of pickled mushrooms as a present. Small amounts are sold in local vegetable markets,

usually by poorer people, those without steady jobs. There are no companies in the area who buy mushrooms for the food industry, in contrast to some lowland areas with pinewoods, where rich populations of chanterelles and ceps occur and are bought on a large scale. In the lowlands collecting mushrooms and selling them for cash is a popular occupation. Also in the Beskid Niski Mts and the Bieszczady Mts (south-east from the study area) some agritourist farms have started buying mushrooms, mainly *Lactarius* section *Deliciosi*, and selling them as pickles in Warsaw (Łukasz Łuczaj personal observation). *Lactarius* spp. are rare in the lowlands, and attain relatively high prices in Warsaw. Their populations underwent a mysterious decline at the end of the twentieth century, which lasted for about 20–30 years, and they have now reappeared in larger quantities in the studied region, which will probably bring the price down in the future.

Roadside mushrooms sellers are not observed in the study area. The nearest roads where this practice can be observed are over 60 km away (selling Boletaceae and chanterelles). These are the section of the route between Tarnobrzeg and Rzeszów, and the road between the Polish border crossing in Barwinek and the Slovakian town of Svidnik. In the latter, Roma inhabitants specialize in selling mushrooms (Łukasz Łuczaj personal observation).

There are considerable annual fluctuations in the availability of particular species. Full moon periods (apart from rainy days) are considered the most conducive to larger mushroom occurrences. The mushroom season usually begins at the end of June or in July, with the collection of chanterelles or ceps (spring occurring morels are very rare). The largest amounts of mushrooms are collected in September, when most species are available. The season finishes in October, when mainly honey fungus and saffron milk caps are collected.

The history of poisoning cases has not been studied. However, minor fungi poisoning and the fear of poisoning were sometimes mentioned. This is one of the reasons most people stick to a few species, which they learned to recognize in their childhood. Boletaceae mushrooms are considered the safest, as no deadly poisonous species from this family are found in the region (apart from a few bitter species causing minor digestive problems). Mushrooms with gilled caps are considered suitable for collecting by more experienced pickers, and some people would refuse to eat pickled gilled mushrooms presented by someone else for fear of poisoning (usually each species of mushrooms is pickled separately). Mushrooms are never stir-fried or eaten raw. They are boiled or fried for a long time (usually at least 15 min.). Particular attention is paid to honey fungus preparation. The fungi of this genus are usually first boiled for a short time, or at least hot water is poured over them before the main cooking or frying. Honey fungus is also occasionally confused with *Pholiota squarrosa* (Müll. ex Fr.) Kummer, which causes minor poisonings.

DISCUSSION AND CONCLUSIONS

The presented results reveal the high importance of vertical, post-figurative knowledge transfer, *sensu* Mead (1978). Both extra-family and co-figurative knowledge transfer play minor roles, at least in the initial stage of learning. It may be suspected that some horizontal transfer of knowledge appears later among older children and adults. However, as children aged ten to twelve know nearly the same number of mushroom types as adults, it may be suspected that most of their knowledge originates from within the family and the further process is based mainly on deepening knowledge about identifying the species people learned in childhood, rather than looking for new species to use. This conclusion is supported by the interviews.

The utilized number of fungi taxa is similar to that reported by other folkloristic studies from the twentieth century (e.g., Dekowski 1968, 1973; Jędrusik 2004; Marciniak 2008), which suggests that the use of mushrooms is still culturally important. For example, in the Koziencice Forest (Central Poland) 27 species were utilized in the mid-twentieth century (Dekowski 1973) and in the Łowicz region 26 species were eaten commonly and eight more by some families (Dekowski 1968). Only the consumption of *Paxillus involutus* (Batsch ex Fr.) Fr. and *Gyromitra esculenta* (Pers. ex Fr.) Fr. in Poland stopped almost completely after a late-twentieth century campaign emphasizing its toxic potential. In the studied area, similarly to the rest of Poland (Bartnicka-Dąbkowska 1964), very few names exist for poisonous mushrooms (e.g., *muchomor*—for *Amanita*-looking species, *psiak*—for small unknown mushrooms). Large changes in mushroom names may already have occurred by the beginning of the twentieth century, as even older respondents use many local names not indigenous to this area but disseminated by media and field guides.

We may wonder what the number of mushrooms collected in the area in the nineteenth century was, in times of frequent famines and no field guides. Tync in his study from 1891 (published from manuscript in 1994) reported the use of 22 folk species in an area of the Carpathian foothills only some 50 km from the study area—a number only slightly higher than the number reported in this study. From the review of ethnomycological literature in the work of Boa (2004) we can conclude that seventeen edible taxa listed by informants in the study can be classified as an example of strong mycophilia. A similar number of edible taxa is used in other mycophilous regions of the globe. For example in a study in Oaxaca in Mexico 22 folk taxa belonging to 37 scientific species were listed by 95 respondents (Garibay-Orijel et al. 2007). The number of species sold in some large markets in Mexico is higher. For example in a market in Ozumba 60 species of mushrooms are sold throughout the year (Pérez-Moreno et al. 2008)—a number identical to the number reported from a Polish market (in Poznań) from the beginning of the twentieth century (Szulczewski 1996).

Knowledge about mushrooms is the domain of both sexes, although men are slightly more involved in the practice of gathering. This is in contrast to plant gathering, which in Poland has been performed mainly by women and children. Only hazelnut (*Corylus avellana* L.) gathering shows a similar pattern of slight male domination (Łuczaj 2008). A parallel study on gathering wild plants in the same three villages showed a stronger role for women, and a larger decrease in gathering, compared to gathering mushrooms (Nieroda 2009). It is however usually the case that only women prepare the mushrooms, as cooking is still mainly a female domain in the countryside. There are numerous exceptions to this rule, particularly in the case of men living on their own, and the processing of mushrooms collected by men themselves is not unusual, though rarer than handing the mushrooms over to the wife. The dominant role of women in food and medicinal plant gathering seems to be a rule (Ruddle 1993; Ertug 2003; Dannigelis 2003; Price 2006; Wayland 2001; Voeks 2007), so it is interesting that the gender specializing of mushroom gathering in Poland has a more unisex character than plant gathering—a female domain. It can be hypothesized that mushroom activity is more similar to hunting, usually a male domain, than collecting berries or herbs, as the appearance of fungal fruiting bodies is temporal. A strong element of chance is thus introduced, making mushroom gathering more exciting, similar in character to collecting marine foods. Possibly connected to the extent of male involvement in gathering mushrooms, it has a highly competitive character—mushroom pickers compare their finds in the forests and neighbours usually boast how many *prawdziwki* (*Boletus edulis*, highest prized species) they found.

It is not clear why adults reported a higher age at which they learned to recognize mushrooms than that for contemporary children. Developmental acceleration cannot be an explanation. In the past, children started guarding grazing cows from an early age, and they spent much more time outside than nowadays, so they had more opportunities for learning directly about nature. Some adults may just not remember exactly when they started learning mushroom recognition. This is probably also why they more often mentioned “family” as the first source of knowledge about fungi, instead of specifying a particular family member.

It must be emphasized that the presented data on the sources of ethnomycological knowledge concern its beginnings, thus further horizontal transfer of knowledge among peers was not studied. According to Garibay-Orijel and Valencia (2010) horizontal transfer can be an important factor in preventing the loss of traditional ethnomycological knowledge. As previously mentioned, basic knowledge about the commonest taxa is acquired by children, but this knowledge can be enriched by learning to recognize one or a few more rarer species in the adulthood, at least in the case of some individuals.

Some methodological limitations of the questionnaire method should be emphasized. Gathering statements that people can recognize certain mushroom species does not necessarily mean that they can do it, it may just prove that they know their names (“passive knowledge”). This can be an important issue in the case of children, even though effort was made to prevent children copying the content of the questionnaires among themselves. However high expertise in mushroom picking in the Podkarpacie region was personally observed by both authors.

The discrepancies between the lists of mushrooms collected by adults and children are surprisingly small. This is an argument for the conclusion that mushroom picking is an important family activity and is learned very early. Such similarity between the ethnobiological knowledge of children and adults, concerning wild foods, is observed in other places when gathering wild food is still practiced (e.g., in rural Thailand; Setalaphruk and Price 2007).

School has surprisingly little influence on mushroom gathering knowledge. It is probably mushroom-picking field guides, used in many houses, that shape the present practice of mushroom gathering more than school or electronic media. From our observation we hypothesize that they do not introduce new species, as people are very conservative about the species of mushroom they collect. Kalle and Sõukand (2010) hypothesize that ordinary people, even in modern societies, prefer knowledge given personally, by other people, rather than identification guides. This is particularly true for mushrooms due to the toxicity of some species. However, field guides are still influential, in that they tend to cause unification of mushroom names throughout the country.

The question arises to what extent freelisting using a written questionnaire—a quick way to obtain quantitative data—enabled us to obtain a full list of utilized taxa? From the in-depth interviews done in other villages of the same mountain range (25 km south from the study area) by the first author, only two more utilized taxa, *Sparassis crispa* (Wulf.) Fr. and *Hydnum repandum* L., were found. The former is quite rare and may not occur in the study area, and the latter, though common, is used rarely and is partly a covert taxon—many people who use it do not know its name. Thus the omission, if it occurred, is probably not larger than two species.

People in the studied region, as in most places in Poland, collect a high number of fungi species. They, however, do not gather for consumption many species reported as edible by Polish field guides, in spite of the fact that they are very common in the study area. These are, in particular: *Amanita rubescens* (Pers. ex Fr) S.F.Gray, *Cantharellus tubiformis* Fr.Fr, *Auricularia auricula-judae* (Bull.) Wetstein and *Laccaria amethystina* (Huds.) Cooke. Thus even in strongly mycophilous societies there is a cultural bias towards some edible species, and avoidance of others.

Although there are numerous ethnographic publications containing information on the use of wild mushrooms in local cuisines, there are very few ethnomycological publications, which could enable cross-cultural comparisons of various parts of Europe. Hopefully, parallel studies from other countries can give us a broader picture in the future.

Although the set of species collected has remained largely the same over the last several decades, the forms of preserving and cooking mushrooms, as previously mentioned, have changed. Further transformations can be predicted, due to the popularity of new spices, recipes and the spread of ethnic cuisines among rural inhabitants. Already after our field study, in 2009 and 2010, a wave of popularity of a dish called *rydze po cygańsku* (“Gypsy style saffron milk caps”), swept suddenly through the region via women’s magazines and culinary websites. The mushrooms in this recipe are fried with onions, red peppers, and tomato concentrate (or tomatoes), sugar, salt, and spirit vinegar, and often heavily spiced. Then they are sealed in a jar for future use. The ingredients correspond to a Hungarian dish called *lecsó* (Polish *leczo*), which has become popular in the region over the last decade, together with the cultivation of red peppers and courgettes (zucchini). This is one of a series of changes, which have accompanied the preparation of traditional recipes in the region (e.g., lacto-fermented cucumbers, traditionally made with dill, garlic, and horseradish, in some houses now have hot chilli or curry powder added to them).

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