RESEARCH ARTICLE

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Knowledge of wild edible mushrooms depending on the educational level in the Region of Varna

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ABSTRACT

Purpose

Numerous wild edible mushrooms are relatively well-known in Bulgaria and many countries all over the world. The objective of this inquiry study was to analyze some peculiarities of local knowledge of such mushrooms depending on inhabitants' educational level in the Region of Varna, Bulgaria.

Materials and methods

We performed a study of 200 adult individuals, 100 males and 100 females, on the territory of the Region of Varna using anonymous inquiry with a set of 12 concrete items dealing with respondents' knowledge of wild edible mushrooms and focusing on the role of their educational level for this knowledge. Statistical data processing was carried out using descriptive, variation and correlation analysis. Statistical significance was considered at the level of $p<0.05$.

Results

There was a prevalence of respondents with higher education. A total of 122 respondents (61% of the cases) could recognize wild edible mushrooms in the Region of Varna. The respondents with secondary education are most informed about these mushrooms. Numerous mushroom nominations of single concrete mushroom species were reported by the respondents. The edible boletus *Boletus edulis* Bull was the most commonly recognized wild edible mushroom. Respondents' elementary educational level correlated statistically significantly with knowledge acquisition of wild mushrooms (Pearson's coefficient=30.032; $p<0.001$).

Conclusion

This inquiry study demonstrated a satisfactory extent of awareness of these respondents with secondary, elementary, and higher education concerning the wild edible mushrooms in the Region of Varna.

Key words: wild edible mushrooms, knowledge, inquiry, education, Region of Varna

Introduction

The local population's knowledge of wild edible mushrooms and their cultural importance are assessed and compared by means of various qualitative and quantitative methods indicating that non-used resources can be the object of deep traditional knowledge and have a vast cultural importance (Ramírez-Terrazo et al., 2021).

Recently, an international ethnobotanical investigation analyzes noteworthy data on plants, algae, and mushrooms in South Eastern Europe and adjacent regions (Sabovljevic et al., 2021).

The most common popular medicinal plants and mushrooms in the area of the North Black Sea coast in Bulgaria are examined (Cherneva Dj et al., 2017). The ethnobotanical study of traditional knowledge of medicinal plants and mushrooms of the local population in the North Black Sea coast area presents the impact of some demographic indicators such as gender, age, education and place of residence (Cherneva Dj et al., 2017a). A tendency of decreasing interest in medicinal plants among the younger generation living in this area is observed, which on its behalf is weakening the traditional knowledge on medicinal plants and their continuity (Cherneva Dj et al., 2017b). The local population in this area possesses sufficient knowledge of the medicinal plants and herbal remedy treatment (Cherneva Dj et al., 2017c).

Our inquiry investigation aimed at analyzing some aspects of traditional knowledge of wild edible mushrooms among the inhabitants with different educational levels in the territory of the Region of Varna, Bulgaria.

Materials and Methods

In 2020, our inquiry investigation covered a total of 200 adult individuals, 100 males and 100 females with secondary, elementary and higher education and main residence in the Region of Varna concerning their attitude to and individual knowledge of wild edible mushrooms.

Respondents' distribution according to sex and educational level was displayed in Table 1.

Both male and female respondents with higher education prevail followed by those with the secondary one.

The respondents were asked to fill in an anonymous inquiry containing 17 concrete items specifically devoted to their attitude and knowledge acquisition to and awareness of the wild edible mushroom available on the territory of the Region of Varna. Statistical data processing was performed using descriptive, variation, and correlation analysis. Statistical significance was considered at the level of $p<0.05$.

Table 1. *Respondents' distribution according to sex and education*

Education	males		females		total	
	n	%	n	%	n	%
secondary	36	45.57	43	54.43	79	39.50
elementary	14	37.84	23	62.16	37	18.50
higher	50	59.52	34	40.48	84	42.00

Results

Some results from the analysis of the role of the educational level for respondents' traditional knowledge of wild edible mushrooms are demonstrated in the following three figures.

A total of 122 respondents (61%), 64 males (64%), and 58 females (58% of the cases) answer positively to the question of which wild edible mushroom they can recognize. Males recognize a total of 24 and females do a total of 26 different mushroom species.

Their distribution according to sex and age groups is illustrated in Fig. 1.

Their distribution according to sex and educational level is demonstrated in Fig. 2.

The respondents with secondary education are informed to the greatest extent about the wild edible mushrooms available on the territory of the Region of Varna.

There is a great variety of mushroom nominations of single concrete mushroom species reported by the respondents that reflect the level of traditional knowledge of the local population.

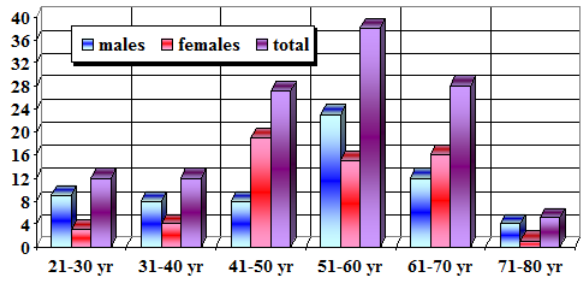

Figure 1. *Respondents' distribution according to sex and age groups*

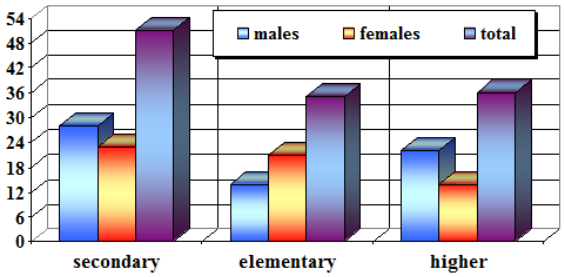

Figure 2. *Respondents' distribution according to sex and educational level*

The edible boletus *Boletus edulis* Bull is the most commonly recognized wild edible mushroom on the territory of the Region of Varna. Next follow the parasol mushroom *Macrolepiota procera* S. F. Gray, the chanterelle *Cantharellus cibarius* Fr. and the agaric *Marasimus oreades* Fr.

The difference between male and female respondents concerning the number of persons who recognize the wild edible forest mushroom *Agaricus silvaticus* Schaeff (45 versus 13) is statistically significant ($t=4.485$; $p<0.001$).

Respondents' relatives along with books and the Internet serve most commonly as a source of useful information about wild edible mushrooms.

A statistically insignificant correlation dependence between respondents' knowledge of mycotherapy as a scientific discipline, on the one hand, and their educational level, on the other hand (Pearson's coefficient=2.048; $p=0.359$), is established.

The distribution of all the respondents according to their educational level in terms of the acquisition of knowledge about wild mushrooms is presented in Fig. 3.

The difference between the positive and negative responses to this question is in favour of the first one among

the respondents with elementary education (by 6.4 times). The negative answer prevails over the positive one by 1.90 times among the respondents with higher education.

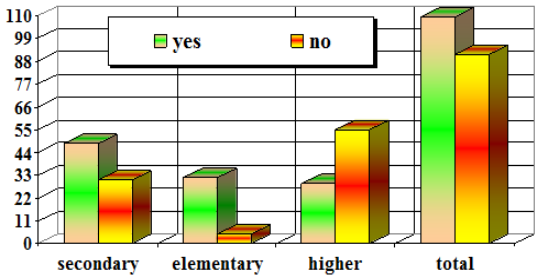

Figure 3 *Respondents' distribution according to educational level concerning this knowledge acquisition*

There exists a statistically significant correlation dependence between the elementary educational level, on the one hand, and knowledge acquisition of wild mushrooms, on the other hand (Pearson's coefficient=30.032; $p<0.001$).

More respondents (109 versus 91) present with self-confidence concerning their capacity to properly recognize wild mushrooms. Only two females have ever heard about any form of training for wild mushroom recognition. On the other hand, much more respondents (139 versus 61) have already seen toxic mushrooms. The minority of respondents (56 towards 144) have any idea of mycotherapy.

These data allow drawing the conclusion that the extent of awareness of this sample from the local population on the territory of the Region of Varna concerning the wild edible mushrooms is satisfactory. Additional purposeful measures for its further enhancement are needed in order to warrant the effective prevention of undesired mushroom intoxications.

Discussion

During the last few years, several ethnobotanical, ethnomycological, and sociological investigations of the local population in various countries worldwide are devoted to the issues of knowledge of wild mushrooms.

The ethnobotanical survey by means of semistructured questionnaires of a total of 328 subjects from six municipalities in the Lombard Stelvio National Park, Lombardy Region, Northern Italy, particularly in Alta Valtellina, and in Central Alps, Italy, indicates that in this area of high naturalistic interest, ethnobotanical knowledge is at the risk of passing covering a secondary role compared to other aspects of the local culture (Vitalini et al., 2015). However, the popular knowledge of mushroom species is still alive in Alta Valtellina.

The state of traditional ecological knowledge concerning the use of wild and cultivated mushrooms for human health, food, maritime, and agricultural purposes on the Aegadian Islands of Levanzo, Favignana and Marettimo, Sicily, Italy, is evaluated using in-depth semistructured interviews with 48 participants (La Rosa et al., 2021). *Pleurotus eryngii var. ferulae* is the most preferred edible mushroom. Documenting this traditional ecological knowledge before it disappears from oral history is a key factor in reducing the loss of biocultural diversity.

Ethnomycological knowledge is assessed using semistructured interviews with 62 participants from different mycological associations in Serbia (Živković et al., 2021). Eighty-five mushroom species belonging to 28 families are identified. All of them are pointed out as edible as only 15 are declared as medicinal. The family *Boletaceae* is represented by the highest number of species followed by *Russulaceae*, *Agaricaceae* and *Polyporaceae*. Males report a higher level of ethnomycological knowledge than females.

Ethnomycological knowledge about several members of the genus *Lignosus*, which are collectively known as tiger's milk mushrooms with an emphasis on cultural associations is comprehensively and systematically compiled based on a detailed library literature search and electronic search in *Web of Science*, *PubMed* and *GoogleScholar* (Lau et al., 2015). The most commonly encountered *Lignosus spp*. in Malaysia is *Lignosus rhinocerotis* (Cooke) Ryvarden.

The ethnomycological field survey of the traditional knowledge of mushrooms among ten rural communities in the Kilum-Ijim mountain forest reserve, Northwest Region, Cameroon between 2014 and 2015 identifies 14 mushrooms (Teke et al., 2018). Semistructured questionnaires, focus group discussions and the pictorial method are used to collect information on edibility, local names, indigenous knowledge and the role of macrofungi. Local names are a very important factor in distinguishing between edible, medicinal and poisonous mushrooms.

The ethnomycological questionnaire investigation of several edible wild mushroom species from the Western Himalayas (Neelum Valley), Azad Jammu, India, and Kashmir, Pakistan, reveals that the local communities are familiar with the morphological features, habitats, and qualities of these mushrooms (Ullah et al., 2017). The ethnomycological investigation of 923 informants in rural areas of Azad Jammu, India, and Kashmir, Western Himalayas, Pakistan, between 2015 and 2019 by means of a semi-structured questionnaire about indigenous mycological knowledge of wild edible mushrooms identifies a total of 131 mushroom species of which 97 species are new for these regions (Ullah et al., 2022).

The results from a study of the traditional ethnomycological knowledge in three communities in Amealco de Bonfil, Quéretaro, México, between August 2013 and November 2014 demonstrate that according to the

records from 100 informants, 33 mushrooms species are registered (Robles-García et al., 2018). The three species with the highest 'Edible Mushrooms Cultural Significant Index' are *Amanita basii*, *Fistulinella wolfeana*, and *Lactarius indigo*. Both mushroom searching and collection are crucial for the transfer of this knowledge through generations.

Within a total of 695 semistructured interviews with 556 respondents in 38 localities of Mazovia, Poland, a large mycophilous region of Europe, 35 mushroom taxa are mentioned by at least five respondents (Kotowski et al., 2021). Collective folk descriptions of habitat preferences and a list of 98 different macro-, meso-, and microhabitats of macrofungi described by the respondents are created. Some 366 respondents (52.66% of the cases) notice a steady decrease and only one person observes a steady local mushroom abundance increase. *Imleria badia* is the only species with increased abundance reported by 15 independent respondents. The main reason for abundance decrease is drought.

The study of the cultural role of the ethnomycological knowledge of wild mushrooms for the people in Tlaltenango, Zacatecas, Mexico, establishes that although the highlanders have a deeper knowledge of mushrooms, lowlanders and highlanders have similar fungal backgrounds and prefer the same species, regardless of the mushrooms surrounding their territory (Haro-Luna et al., 2022).

The results from semi-structured interviews with mushroom vendors in 11 markets and with mushroom collectors in natural habitats in Pu'er Prefecture, Yunnan, China, demonstrate that 101 species belong to 22 families and 39 genera thus proving a wealth of ethnomycological knowledge (Wang et al., 2022). Participants aged 45-65 years judge mushroom species more accurately, and men, usually, have a deeper mushroom knowledge than women.

Knowledge of medicinal mushrooms from *Phellinus* species in Far East Asia as safe remedies for many disorders makes them attractive fortifying ingredients and will increase the interest in the manufacture of functional foods with extracts from these wild mushrooms (Dimitrova-Shumkovska et al., 2022).

The results from a case study using focus groups and semi-structured interviews and addressing the traditional knowledge systems for artisanal mycoculture in order to identify cultivation practices enhancing the sustainable utilization of natural resources in five districts in Uganda show that artisanal practices are characterized for the cultivation of six wild *saprophytic* mushroom species such as *Volvariella speciosa*, two *Termitomyces sp*., *Agaricus* sp., Agrocybe sp. and one exotic *Pleurotus sp*. (Wendiro et al., 2019).

Taxonomic knowledge in terms of the diversity and distribution of some *Tricholoma spp*. (*Agaricales*, *Basidiomycota*) is analyzed by morphological and molecular methods based on 70 collections from Yunnan, China, 45 from Central Europe, 32 from Colorado, USA, nine from Japan, and thee from Ukraine (Reschke et al., 2018). *Tricholoma foliicola* is recognized as a species of the genus *Gerhardtia*.

The level of knowledge of mushrooms as a food supplement in six local government areas of Cross River State, Nigeria, is assessed by using a structured questionnaire filled-in by a total of 250 participants, 200 females and 50 males (MgBekem et al., 2019). There are 191 inhabitants of villages in five mostly rural areas and 59 ones of towns in one predominantly urban area. Some 178 respondents (71.2% of the cases) have good knowledge of mushrooms as a food supplement. There is a statistically significant association between knowledge and utilization of mushrooms ($p<0.05$).

Currently, the demand for oyster mushroom, *Pleurotus* HK-37 in Tanzania is growing rapidly due to the increasing awareness among the population of its nutrition, health, and economic benefits (Mpatani & Vuai, 2019).

Picking mushrooms, especially in summer and autumn, is still very popular in Poland and despite raising awareness of poisonous mushrooms in Polish society, year after year hospitals treat many patients diagnosed with poisoning with the most common toxic species of mushrooms (Marciniak et al., 2010). The growing interest in hallucinogenic mushrooms among young people is a serious medical problem. Websites make it incredibly easy for people to obtain information on the morphology and appearance of mushrooms with psychoactive properties, which leads inexperienced pickers to misidentification and frequently to a fatal outcome. The most common mushrooms with neurotropic effects are Amanita muscaria, *A. pantherina*, *Inocybe rubescens*, *Clitocybe dealbata*, *Clitocybe rivulosa* and *Psilocybe semilanceata*.

The knowledge and ability to differentiate the wild gucchi mushroom, *Morchella esculenta* from other poisonous wild mushrooms in District Doda of Jammu, India, and Kashmir, Pakistan, is inherited from the elders and community members (Paul et al., 2018). The ethnomycological study of wild edible and medicinal mushrooms in the district of Jammu, India, performed among 192 informants interviewed show that the locals have knowledge of fourteen fleshy fungi and report various medicinal values of some of these mushrooms (Sharma et al., 2022). Knowledge of the edibility of mushrooms is mainly based on folk taxonomy and traditional knowledge of indigenous people in the Tribes in the State of Kerala, India (Krishnakumar & Ceasar, 2022).

Conclusions

Our inquiry study establishes certain essential features of knowledge acquisition of wild edible mushrooms by the

inhabitants with different educational levels in the Region of Varna. The further improvement of the awareness of these mushrooms among the population in Bulgaria could be promoted by more complex and large-scale ethnomycological and sociological investigations.

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