

# ETHNO-MYCOLOGICAL KNOWLEDGE OF SOME WILD MEDICINAL AND FOOD MUSHROOMS FROM OSOGOVO MOUNTAINS (NORTH MACEDONIA)

Besnik Rexhepi<sup>1</sup>, Arianit Reka<sup>2</sup>

<sup>1</sup>*Department of Biology, Faculty of Natural Sciences and Mathematics, University of Tetovo, 1200 Tetovo, North Macedonia*

<sup>2</sup>*Department of Chemistry, Faculty of Natural Sciences and Mathematics, University of Tetovo, 1200 Tetovo, North Macedonia*

\*Corresponding author e-mail: besnik.rexhepi@unite.edu.mk

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## Abstract

As important non-timber forest products, wild mushrooms provide diverse benefits, especially nutritional, medicinal and other socio-economic benefits for ethnic groups located in North-East part of the Republic of North Macedonia.

Ethno-mycological knowledge of most frequently used fungi was gathered from 32 inhabitants in 12 localities using in-depth interviews during April and November 2019. Each informant was asked about the local name of the fungus, its edibility, methods of preparation, habitat of growth, mode of consumption and medical use. A total of 33 species of wild mushrooms were cited. The results show that knowledge of useful mushrooms differs between two ethnic groups. The Macedonian ethnic group has the highest ethno-mycological expertise compared to Aromanian, which is expressed in their extensive cultural and practical use of fungi. On both ethnic groups man is more involved in harvesting and is the main holders of cultural aspects related to fungi. Despite the presence of edible ectomycorrhizal taxa in the research area, the two ethnic groups only seem to have an interest in saprotrophic taxa.

*Keywords:* Ethno-mycology, Medicinal Fungi, Edible Fungi, Osogovo Mountains, North Macedonia

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## 1. Introduction

Like in many other countries around the Balkan Peninsula also in Republic of North Macedonia, wild mushrooms constitute important non-timber forest product for both scientific and local knowledge (Lukasz et al, 2013; Uzelac B. 2016 Rusevska et al, 2015; Karadelev et al, 2014; Nikolovska et al, 2013). But at the moment a little portion of studies from Balkans note that the local mushroom knowledge varies with people's culture and beliefs (Bauer & Karadelev, 2014). According to Shauket et al, 2013 wild mushrooms constitute a heterogeneous group of macro-fungi with tremendous nutritional and medicinal importance. Most of them are edible, medicinal, or both, whereas others are poisonous or even lethal.

Within two ethnic groups (Macedonian and Aromanians) vertical transmission of ethno-mycological knowledge is highly conservative and was passed on from one generation to another until the end of Yugoslavian system. Furthermore, this passed ethno-mycological knowledge allows locals elders to recognize several very important issues such are: the edibility, habitat of growth, their temporality and sustainable use. This is where ethno-mycology comes into play. But, within the younger generations, who are not "educated" in this traditional spirit and practice things look completely different. This traditional erosion of knowledge can lead to the use of some toxic fungi and then health consequences such as irreversible damage of the vital organs, such as liver and kidneys (Pérez-Moreno et al, 1994). Therefore, it is necessary to document this remaining knowledge with a view to make it available to the future generation in its original form and also

relate it with present day information. So, this information is quite important to familiarize the present generation about the long drawn dependence of mankind on such minor forest products in traditional uses (Atri et al, 2018).

The two main objectives of this study are (a) to conduct the first ethno-mycological study in North Macedonia (Osogovo Mountains), and (b) to compare findings between two ethnic groups (Macedonians and Aromanians).

## **2. Material and methods**

### **Description of the study area**

The Osogovo Mountains are located in the northeastern part of the country, and a smaller part extends to the Republic of Bulgaria. The Osogovo Mountain Massif lay between 22°5'20" on the west (near Ketenovo v.) to 22°43'21" on the east (near Crvena Kiselica peak, 1141 m), which is difference of 38'1" or of 50 km. In meridian direction, southernmost point (near Ziganci v.) is on 41°53'51", whereas northernmost point (near Krklja v.) is on 42°13'52", which is difference in geographic latitude of 20'01", or linear distance of 35 km (Milevski, 2007). The massif covers an area of 1102.24 km<sup>2</sup> and is the second largest in the Republic of North Macedonia, immediately after the mountain massif Jakupica. According to the height of the highest peak (Rouen, 2,252 m), it is the ninth mountain in a row in North Macedonia and the highest mountain structure in the eastern part of the country. The biodiversity of the Osogovo Mountains is a mixture of habitats and species that are characteristic of different regions of Europe (Milevski, 2007). In the highest parts there are alpine and boreal elements, where most of the endemic species are found. The continental nature of the mountain is best seen in the beech forest belt, which is strongly fragmented in the Osogovo Mountains, and in addition to forest ecosystems, there are other types of ecosystems (pastures, clearings, streams) that significantly increase biological diversity.

### **Ethnographic background**

During its history North Macedonia has always been a multi-ethnic and multi-faith country. Currently, the main ethnic groups in the region are Macedonian Slavs, who descended from the peoples who arrived in the Balkan in the sixth and seventh centuries they are predominately of Christian Orthodox faith (Lenczowska, 2014; Vangeli, 2018).

The Aromanians are a territorially dispersed ethnic group inhabiting, or rather historically originating from primarily the mountainous regions of the Balkan Peninsula. Their early history is mysterious, and therefore most of the knowledge about the origin comes from linguistic analyses. The language/vernacular of the Vlachs is closely related to the now extinct Latin language, which is often taken as a point of departure in tracing their origins, and in particular the historical ties between the Vlachs and the Latin-speaking population who inhabited the Balkans during the Roman and Byzantine periods Vangeli (2018).

## Field survey

Regular ethno-mycological surveys were arranged from April to November 2019 in twenty localities of the Osogovo Mountains (North Macedonia), with the aim to document the first ethno-mycological knowledge and compare findings between Macedonians and Aromanians (Fig.1). During the face to face interviews (in depth), photographs and freshly collected specimens of each enumerated fungi species were taken. Each informant (total 32) were asked about the Aromanian (Vlachs or Tsintsars) and Macedonian name of the fungus, its edibility, methods of preparation, habitat of growth, mode of consumption and medical use(s). The freshly collected mushrooms specimens were identified using identification keys according to Shepherd & Totterdall (1988) and Tortic, M (1988) and Dugan F.M (2017).

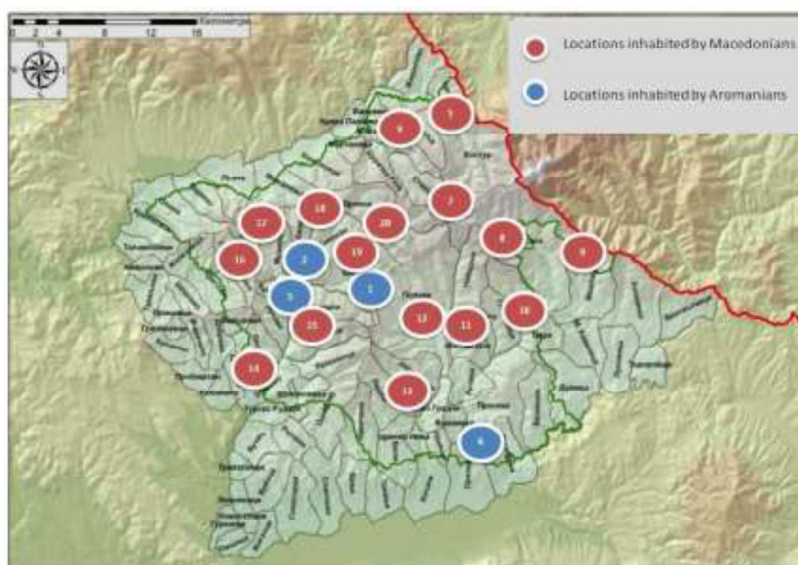


Figure 1. Map of research area

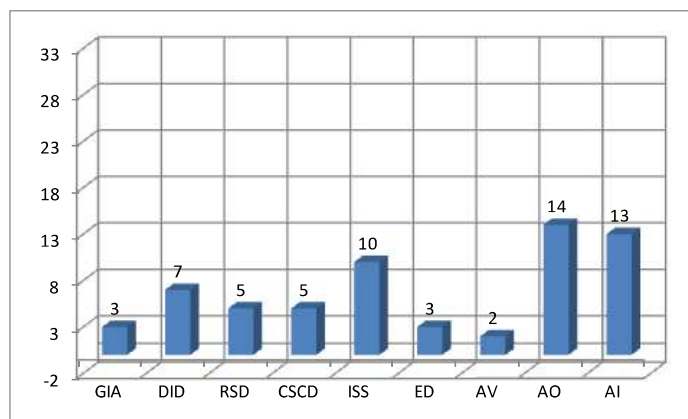
## 3. Results and discussion

This study documented the ethno-mycological uses of 33 most frequently species of medicinal and edible fungi among Macedonians and Aromanians in Osogovo Mountains Massif. The mushroom species collected from the surveyed localities where found in a diverse range of habitats: forest (49%), meadows (27%) and pastures (24%).

Information on scientific name, local names, habitat of growth, mode of consumption, and mode of preparation, medicinal and edible use and exact geographical coordinates of localities from where information was gathered are shown in Table 1.

Study reveals that Macedonians use different mode of preparations for the treatment of GIA –gastro-intestinal ailments (*Suillus luteus* and *Agrocybe cylindracea*), DID- dermatological infections/diseases (*Agaricus campestris*, *Amanita rubescens*, *Agrocybe cylindracea*, *Amanita cesarea*, *Amanita ovidea*, *Calocybe gambosa* and *Russula cyanoxantha*), RSD – respiratory system diseases (*Auricularia auricularia*, *Amanita muscaria*, *Pleurotus pulmonarius*, *Pleurotus, eryngii*, and *Rozites caperata*), CSCD - circulatory system/cardiovascular diseases (*Auricularia auricularia*, *Bovista plumbea*, *Marasimus oreades*), ISS - Immune system strengthening (*Agaricus campestris*, *Agaricus macrospores*, *Amanita rubescens*, *Armillaria mella*, *Auricularia auricularia*, *Amanita muscaria*, *Boletus edulis*, *Cantharellus cibarius*, *Lacatrius deliciosus*, and *Marasimus oreades*), ED – endocrinal disorders (*Agaricus campestris*, *Agaricus macrospores* and *Calocybe gambosa*), LP- Liver problems (*Agaricus cilindreaca*), Rheum (*Agrocybe cylindreaca* and *Marasimus oreades*), AV- Antiviral (*Boletus edulis* and *Russula cyanoxantha*), AO- Antioxidant (*Boletus*

*edulis*, *Cantharellus cibarius*, *Cantharellus cornucopioides*, *Lactarius deliciosus*, *Lactarius Lactarius deterrimus*, *Macrolepiota procera*, *Marasimus oreades*, *Morchella conica*, *Morchella esculenta*, *Pleurotus ostreatus*, *Pleurotus pulmonarius*, *Pleurotus eryngii*, *Suillus granullatus*, *Suillus luteus*), AI – Anti-inflammatory (*Amanita muscaria*, *Boletus edulis*, *Boletus oereus*, *Boletus aestivalis*, *Boletus pinophilus*, *Hydnum rapandum*, *Hydnum rufescens*, *Lactarius deliciosus*, *Morchella conica*, *Morchella esculenta*, *Pleurotus pulmonarius*, *Pleurotus eryngii*, and *Russula cyanoxantha*) compared to Aromanians (Figure 2).



**Figure 2.** Mode of preparation of medicinal uses (GIA –gastro-intestinal ailments; DID- dermatological infections/diseases; RSD – respiratory system diseases; CSCD - circulatory system/cardiovascular diseases; ED – endocrinal disorders; LP- Liver problems; AO- Antioxidant; AV- Antiviral; AI – Anti-inflammatory)

Species such are: *Agaricus capmestris*, *Armillaria mellea*, *Amanita caesarea*, *Boletus edulis*, *Calocybe gambosa*, *Cantharellus cibarius*, *Lactarius deliciosus*, *Macrolepiota procera*, *Morchella conica* and *Suillus luteus* are considered highly delicious, while *Agaricus macrosporus*, *Amanita rubescens*, *Agrocybe cylindracea*, *Auricularia auricularia-judae*, *Amanita caesarea*, *Amanita muscaria*, *Amanita ovoidea*, *Boletus aereus*, *Boletus aestivalis*, *Boletus pinophilus*, *Calocybe gambosa*, *Craterellus cornucopioides*, *Hydnum repandum*, *Hydnum rufescens*, *Hericium spp*, *Lactarius deterrimus*, *Pleurotus pulmonarius*, *Russula cyanoxantha*, *Rozites caperata* and *Suillus granullatus* according to both ethnic groups have good acceptability for consumption.

Some of the mushroom species such as *Morchella*, *Boletus*, *Lactarius*, etc., are sold in the local markets and is a good source of income for the inhabitants of each region. Moreover, it was also observed that people within the age group of 40–60 years had a good knowledge of mushrooms as compared to the youngsters and below 25 years of age, the people had less information or not familiar with regard to mushrooms, their edibility and ethno-medicinal value.

**Table 1.** Ethno-mycological most frequently used wild mushrooms

Scientific name of the mushroom	Common name	Habitat f growth	Consumption	Preparations	Medicinal uses	Localities
<i>Agaricus capmestris</i> L.	Livadski shampinjon Polski shampinjon	Meadows, pastures, and rarely in forests	Food Soup Tonic Eaten roasted or baked	Mixed onion, garlic and milk are added in flour and cooked about 20 minutes.	Getting relief from burning, itching and healing minor skin infections as tonic; diabetes, ulcers, immuno-stimulator as soup	1-9,11,12,16-20
<i>Agaricus macrosporus</i> (Moll.& Schaeff.) Pilat	Golem shampinjon	Grow in natural forests without any pollution and human intervention	Food Soup Tonic Pie Salads	Chopped mushroom with thinly sliced onion or garlic are added in water with some butter.	Diabetes Immune system strengthening	1-14, 18
<i>Amanita rubescens</i> Pers.:Fr	Biserka	Grow in mixed forest	Food Soup	Simple soup with fresh mushrooms, onions, salt, tomato, flour and butter.	Skin problems Immune system strengthening	5-20
<i>Agrocybe cylindracea</i> (DC.:FR.) Maire	Bela topolka	It grows all year round on pens and dry poplar stems (rarely willow) in large colonies.	Food Soup	Simple soup with fresh mushrooms, onions, salt, flour and butter.	Digestion problems healing of bums liver problems Rheum	1-4, 9-12,17-19
<i>Armillaria mellea</i> (Vahl.:Fr) P.Kumm. s.str.	Medenka	Around trees and logs of deciduous trees (especially oak and beech)	Food Tonic	Fried approximately for 10 minutes	Immune system strengthening Stress	1-4
<i>Auricularia auricularia-judae</i>	Judova pecurka	Meadows and pastures	Food Salads Tonic Direct application	Fried approximately for 10 minutes	Stop bleeding Immune system strengthening inflammation of the throat Eye irritations	5-20

<i>Amanita caesarea</i> (Scop). Pers	Jajcara	It is found in open and warm places in bright deciduous forests, along forest edges, forest paths, etc.	Food Salads	Fried approximately for 10 minutes	Skin diseases	1-20
<i>Amanita muscaria</i>	Muvomorka	Meadows and pastures	Food Tincture	Fried approximately for 10 minutes	Sore throat Anti-inflammatory	5-20
<i>Amanita ovoidea</i> (Bull.:Fr.)	Jajcesta muvomorka	Meadows and pastures	Food Soup	Butter, flour and onions mixed	Skin diseases	11-16
<i>Boletus edulis</i> Bull ex Fr	Vrganj	Grows in association with several tree species, mostly conifers, and fruits from the ground near their roots	Food Soup	Fruitbody is cooked with oil and spices	Anti inflammatory Immune system strengthening Antiviral antioxidant	1-20
<i>Boletus aereus</i> Bull.	Crn vrganj	Mixed forest	Food Soup	Fruitbody is cooked with oil and spices	Anti inflammatory	1-20
<i>Boletus aestivalis</i> Paulet: Fr.	Mrzhestonog vrganj	Mixed forest	Food Soup	Fruitbody is cooked with oil and spices	Anti inflammatory	6-18
<i>Boletus pinophilus</i>	Borov vrganj	Mixed forest	Food Soup	Fruitbody is cooked with oil and spices	Anti inflammatory	19,20
<i>Bovista plumbea</i> Pers.:Pers	Pravutka	Meadows, Pastures	Food Soup	Applied in the wounds	Stop bleeding	1-4, 14,16
<i>Calocybe gambosa</i> (Fr.) Donk	Gjurgjevka	Meadows	Food		Skin infections Diabetes	1-20
<i>Cantharellus cibarius</i> Fr	Lisicarka	Deciduous and evergreen forests	Food Soup	Butter, flour and onions mixed	Antioxidant energy, immunity, insecticidal	1-20
<i>Craterellus cornucopioides</i> (L.:Fr.) Pers	Crna truba	Mixed forest	Food	Butter and flour	Antioxidant	1-4, 8-16
<i>Hydnum repandum</i> L.	Ovca peta	Grows in deciduous and in evergreen forests	Food Pie	Butter, flour and onions mixed	Anti-inflammatory	5-11,18-19

<i>Hydnum rufescens</i> Pers.	Ezheska ovca peta	Deciduous and evergreen forests	Food Soup	Butter, flour and onions mixed	Anti-inflammatory	5-20
<i>Hericium spp</i>	Iglicarka	Meadows	Food Soup	Butter, flour and onions mixed	Stress, depression, anxiety	5-20
<i>Lactarius deliciosus</i> (L.Fr.) S.F.Gray	Rujnica	It grows in evergreen forests, usually under pines, mostly on limestone soils	Food Soup	Butter, flour and onions mixed	Antioxidant Immune system strengthening Antibacterial, antifungal, cytotoxic, anti-inflammatory,	5-20
<i>Lactarius deterrimus</i> Gröger.	Smrcina rujnica	It grows in forests under spruce, and less often under pines	Food Soup	Butter, flour and onions mixed	Antioxidant	8-11, 18-19
<i>Macrolepiota procera</i> (Scop).Singer	Soncarka	Deciduous trees, evergreen forests, Meadows, pastures	Food Soup	Butter, flour and onions mixed	Antioxidant	1-20
<i>Marasmius oreades</i> (Bolton: Fr.) Fr.	Livadarka	It grows on clearings, pastures, meadows and fields	Food Soup	Butter, flour and onions mixed	Antioxidant Immune system strengthening Blood purification, antiinflammatory, nerves problem and rheumatism	1-20
<i>Morchella conica</i> Pers.	Smrcak	Mixed forest	Food Soup	Butter, flour and onions mixed	Anti-inflammatory, pneumonia, cough, fever, cold, Antioxidant Stomachache	1-20
<i>Morchella esculenta forma retunda</i>	Rotonda	Mixed forest, meadows, pastures	Food Sup	Butter, flour and onions mixed	Anti-inflammatory Antioxidant	15
<i>Pleurotus pulmonarius</i> (Fr.) Quél	Bukovka	It grows on logs, stems and	Food Soup	Butter, flour and onions mixed	Respiratory problems	1-20

		deciduous trees usually in beech trees			Anti-inflammatory Antioxidant	
<i>Pleurotus ostreatus</i> (Jacq.:Fr.) Kummer	Bukovka	It grows on logs, stems and deciduous trees usually in beech trees	Food Soup	Butter, flour and onions mixed	Respiratory problems Anticancer Anti-inflammatory Antioxidant	1-20
<i>Pleurotus eryngii</i> (D.C.: Fr.) Quel.	Kralska bukovka	Meadows and pastures	Food Pie	Butter, flour and onions mixed	Respiratory problems Antiviral Anti-inflammatory	1-20
<i>Russula cyanoxantha</i> Schaeff.:Fr.	Gulapka	Meadows and pastures	Food Soup	Butter, flour and onions mixed	Weakness Skin diseases and wound healing Antiviral Anti-inflammatory	1-4, 6-9, 14-20
<i>Rozites caperata</i> (Pers.:Fr.) Karsten	Cigance	Meadows and pastures	Food Soup	Butter, flour and onions mixed	Respiratory problems	1-4, 6-17, 18
<i>Suillus granulatus</i> (L.) Roussel	Ligav vrganj	It grows in coniferous forests	Food Soup	Butter, flour and onions mixed	Antioxidant	1-20
<i>Suillus luteus</i> (L.: Fr.) Roussel	Zholt vrganj	Mixed forest	Food	Butter, flour and onions mixed	Antioxidant Stomachache	1-20



## Discussion

Wild edible mushrooms are still remaining important sources of food, medicine and other socio-economic aspects for both Macedonians and Aromanians living in Osogovo Mountains. This ethno-mycological knowledge passed from generation to generation seems to be in line with scientific evidences on antioxidant activities especially in case of the following fungi species: *Boletus edulis*, *Cantharellus cybarius*, *Cantharellus cornicopoides*, *Lactarius deliciosus*, *Lactarius Lactarius deterrimus*, *Macrolepiota procera*, *Marasimus oreades*, *Morchella conica*, *Morchella esculenta*, *Pleurotus ostreatus*, *Pleurotus pulmonarius*, *Pleurotus eryngii*, *Suillus granullatus* and *Suillus luteus* (Pogoń *et al*, 2013; Palacios *et al*, 2011; Senka *et al*, 2010). In addition, the same was found for some anti-inflammatory reports for *Boletus edulis*, *Boletus oereus*, *Boletus aestivalis*, *Boletus pinophilus*, *Hydnum rapandum*, *Hydnum rufescens*, *Lactarius deliciosus*, *Morchella conica*, *Morchella esculenta*, *Pleurotus pulmonarius*, *Pleurotus eryngii*, and *Russula cyanoxantha* (Smiderle *et al*, 2014; Kunjadia (2014). It is interesting to note that perhaps the high number of citations of ISS (Immune system strengthening) it's due to Aromanian life style.

## 4. Conclusion

It's obvious that ethno-mycological knowledge is restricted to the elder people. Therefore, it becomes imperative to document the vertical transmission of knowledge since they are no more transmitted to the new generations. Therefore, awareness should be raised about the palatability of wild mushrooms, and training should be provided to new generations.

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