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Perspectives of Edible Species of *Xylotrophic macromycetes* as a Producer of Biologically Active Substances

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Abstract

Both fruit body and vegetative micelles of nine edible fungi species from the forest ecosystem of Azerbaijan have been assessed for their biochemical composition. It became clear that substances such as protein, sugar, fat etc. have been found in both substances and their quantitative indicators are characterized in more favorable indicators in fungi such as *G. lusidum, L.sulphureus and P.ostreatus.* Presence of biologically active components in both FB and VM of the mentioned fungi shows that they are promising source for obtaining useful products for the usage in food, forage and medicine.

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Introduction

Problems of a similiar nature either exist or signs are felt albeit faintly in our gradually globalizing world. One of the problems corresponding to the latter characteristic is food lack. Thus according to data from UN today millions of people feel lack of food clearly and gradual increase of this number is undoubt (6, 16). Therefore investigations with various aspects are carried out for the solvation of food lack. In such type of works either creating new sources or increasing the efficiency of the use of the existing ones are preferred. Fungi play an important role in the increase of the efficiency of the use of such sources.

Some of fungi, especially those belonging to macromycetes were used in food and folk medicine by people since ancient times (13). Currently cultivation of fungi with intensive methods is widespread and today the quantity of products produced in this way is measured in tonnes in all over the world (10).

Biochemical composition of fungi characterised by similar signs both in plants and animals and also distinguished in both is defined with specific signs. Thus fungi are able to synthesize a wide range of strong and colorful biological active substances (15), and the biomass produced by them is more balanced for their organic composition. On the other hand the aforementioned are found both in vegetative micelles and fruit bodies naturally produced by most of fungi (9). It's no coincidence that today biologically active substances of fungal origin as well as those with pharmacological activity are obtained from both substances.

Fungi are also characterised by a great diversity in taxonomic terms and presently the number of species known in the science is around 100 thousand (1), however there are opinions that the actual number of species in nature is many times more (7). Fungi with such strong and wide diverse potentials are systematized according to a number of features for their more eficient use and according to the approaches one of the most noticeable groups of fungi in recent times is *Xylotrophic macromycetes* (5). *Xylotrophic macromycetes*, one of the unique and ecological groups of fungi perform wide and important functions (production, destruction). Namely these properties of *Xylotrophic macromycetes* stay on the basis of their use with practical purposes.

It should be noted that, although the fungi are used in the practice for long, generally the number of used species is not so high and according to the calculations the number of such type fungi does not constitute even 1% of what is known to science today. It is supposed that today the fungi known to science constitute small part of what actually exists in nature. In this case the reality that fungus sample contain great biological resource with still unknown potential is of no doubt.

The most widespread place of *Xylotrophic macromycetes* is forest ecosystems and presently the number of species known in the science is around 100 thousand and about 20% of them are encountered in the territory of the Republic of Azerbaijan (2). At present the assessment of potentials of *Xylotrophic macromycetes* found both in world and Azerbaijan in terms of practical requirement is not in the desired level and they are one of the objects open to investigations and keep their actuality.

Taking into account the aforementioned the present article is devoted to the assessment of the use possibility of both fruit body produced in nature and vegetative micelles of species belonging to the edible fungi category of *Xylotrophic macromycetes* distributed in Azerbaijan condition for food purposes according to the biochemical composition.

Materials and Methods

During the progress of study edible fungi species such as *Armillaria mellea (Vahl) P. Kumm., Fistulina hepatica (Schaeff.) With., Ganoderma lusidum (Curtis) P. Karst., Kuehnerómyces mutábilis (Schaeff.) Singer & A.H. Sm., Laetiporus sulphureus (Bull.) Murrill, Panus tigrinus (Bull.) Singer, Pleurotus ostreatus (Jacq.) P. Kumm., Polyporus squamosus (Huds.) Fr.* and *P.umbellátus (Pers.)* Fr. belonging to *Xylotrophic macromycetes* were used and starting from 2015 in the course of the study the fruit bodies (FB) taken from territories of Azerbaijan with different ecology (Greater Caucasus, Lesser Caucasus, Kur-Araz lowland and Talysh mountains) were transferred to pure culture and identified according to certain determinants(4).

The assessment of fruit body (FB) naturally produced by fungi according to the biochemical composition has been carried out in the following way: the collected FBs are crushed (with wet weight) in the produced form and extracted in magnetic mixer with water in 40^0C for two hours. The obtained extract is filtered and the liquid is used for analysis.

During the assessment of vegetative micelles (VM) the fungus is cultivated in glucosic- peptonic liquid nutrient medium (2) for 7 days at 28^0C under the deep cultivation condition. Following the completion of the cultivation the obtained biomass is passed through tissue grinder together with cultural solution (3 mins., 3 times), then filtered and the obtained solution is used for biochemical analysis. During the cultivation in liquid nutrient medium as cultivation material the cut parts (with 0,5-1x0,5-1 cm dimension) of colony produced by fungus in malty agarized juice are used.

The determination of biochemical composition (quantity of protein, carbohydrate, fat, nucleic acids) of FB and VM has been carried out according to the known methods (12).

The presence or not of biologically active components in FB and VM of fungi has been determined in relation to Tetrahymena pyriformis infusoria and seeds of wheat plant. While implementing this work methods and approaches used in the works of some authors have been used (3, 14).

All experiments in the studies have been repeated at least four times and the results have been statistically processed (11).

Results and Discussions

From the result of biochemical analysis of extracts obtained from FB and VM of fungi cultures selected as a study object it became apparent that both of them have protein, fat, sugar but their quantitative indicators differ according to cultures (Table 1). As seen according to the quantity of protein the highest indicator is observed in

VM of the fungus *Pleurotus ostreatus*, the lowest in FB of the fungus *Armillaria mellea*. According to the total quantity of carbohydrates the highest indicator is observed in VM of the fungus *Ganoderma lusidum*, the lowest in the naturally produced FB of the fungus *P.umbellátus*. In other words although all component elements are found in both substances, biochemical analysis of substances is characterized by different quantitative indicators and the interesting thing is that in all cases the quantity of components in VM is rather higher than those in the FB. Fungi such as *G. lusidum*, *L.sulphureus* and *P.ostreatus* are also more favorable than others for all the components that characterize the biochemical composition. Therefore, as a result of studies carried out at this stage they were selected for the next stage and the presence of biologically active substances both in FB and VM were studied. For this purpose, solution obtained from alchocol extraction of both substances of the mentioned fungi was used.

Table.1 Biochemical composition of FB and VM of *Xylotrophic macromycetes* (as per dry weight, %)

Fungus species	Protein		Carbohydrates (including soluted sugar)		Fat		Nucleic acid	
	FB	VM	FB	VM	FB	VM	FB	VM
Armillaria mellea	20,3	22,4	29,3(1,8)	32,2(2,2)	1,4	1,6	0,67	0,89
Fistulina hepatica	27,1	30,2	26,7(1,5)	27,5(1,4)	2.2	2,5	0,64	0,81
Ganoderma lusidum	26,5	29,3	31,2(2.4)	33,4(2,7)	2,1	2,2	0,47	0,76
Kuehnerómyces mutábilis	27,5	22,5	27,3(1,5)	28,5(1,7)	1,7	1,9	0,59	0,87
Laetiporus sulphureus	28,5	29,0	30,5(2,3)	32,1(2,5)	1,1	2,7	0,54	0,78
Panus tigrinus	23,2	24,1	29,4(1,9)	30,3(2,3)	1,8	2,0	0.59	0,90
Pleurotus ostreatus	29,4	32,2	29,3(2,4)	30,7(3,2)	2,3	2,7	0,52	0,64
Polyporus squamosus	24,2	25,2	26,2(2,1)	28,9(2,2)	1,5	1,7	0,62	0,77
P.umbellátus	22,4	23,2	23,2(1,6)	27,6(2,0)	1,4	1,7	0,61	0,75

Table.2 Effect of extracts obtained from some of edible species of *Xylotrophic macromycetes* on the increase of number of *Tetrahymena pyriformis* cells

Fungi	Number of infusorium cells (cell/300 mkl)		Growth index (times)
	first	After 24 hours	
G. lusidum	160	440	2,75
L.sulphureus	165	438	2,66
P.ostreatus	163	423	2,60
Control (1% alchocol)	146	260	1,78

Table.3 Effect of extracts from some edible species of *Xylotrophic macromycetes* on the germination ability of seeds of wheat plant

Fungi	Number (piece) of seeds taken for germination	Number of germinated seeds (piece)	Share of germinating seeds in total number (%)
G. lusidum	200	184	92
L.sulphureus	200	182	91
P.ostreatus	200	176	88
Control (liquid glucosic-peptonic nutrientmedium)	200	170	85

From the studies carried out for the determination of the presence or not of biologically active components in the composition of extracts obtained from fungi it became apparent that both substances belonging to the selected fungi have biologically active components and this is evidenced by an increase in the number of infusoria in a medium where extracts belonging to fungi were added (Table 2). At this time the effect of increase becomes different depending on the source of extract and the highest effect (2,75 times) is observed in the extract obtained from VM of the fungus *G.lucidum.*

It should be noted that the quantity of increase in the number of infusoria from the effect of extracts obtained from both substances of other *Xylotrophic macromycetes* by the same methods ranges between 1,7-2,9 times (8, 14) which allows to note more effective effect of extracts obtained from fungi selected by us.

A similiar situation shows itself in the germination ability of seeds as well. Thus, the effect of extracts obtained from fungus on germination of wheat seeds was positive in all cases, and the germination ability of seeds depending on fungi increased by 3–7% (Table 3). All of these, although not directly, allow us to note the presence of biologically active metabolites in the extracts obtained from the noted fungi.

From the results we can also state that the influence effect of extracts belonging to this or other fungus is characterized by different quantitative indicators, although their obtainment was done under the same conditions. This fact, in turn, allows us to note that the metabolites in the composition of extract belonging to each fungus are similar in effect direction, also different for the participation combination of the components. Further clarification of these rissues shall be the task of future research.

Thus, the nutritional value of the studied fungi, the presence of biologically active substances in the composition of naturally produced FB, as well as the VM is promising in terms of obtaining nutritional products that are felt in the world today. The fact that the components contained in the VM are higer than those in the FB suggests that the products from them can be realized throughout the year.

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