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Research Article

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# Fungi from the genus of *Trametes Quel* which spread in Azerbaijan as a producents of biologically active substances.

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## Abstract

As a result of the research has been identified 10 species from the genus of *Trametes Quel* which spread in Azerbaijani conditions, also for the first time was determined spread the species such as *T. trogii* Berk and *T. suaveolens* (L) Fr. Is shown, the fungi from the genus of *Trametes Quel* have a high growth speed, the biomass getting from them in general does not have the toxic effects, they have a relatively high absorption capacity, are characterized bactericide and fungicide impact features. All of these seriously grounded for approval that the fungi from the genus of *Trametes Quel* may use as a perspective source of purchase of BAS producers where they could be useful for food, feed, and medical purposes.

**Keywords:** *Trametes Quel*, species composition, growth speed, BAS, polysaccharide, bactericide and fungicide effect.

## Introduction

It is known that, in recent years, fungi attracts more attention as producent of biologically active substances (BAS), polysaccharide and enzymes and this research has shows perspectives to use xylotroph macromycetes as a source to receive this type of compounds[5-6]. Firsly, it related that the fungi compare with other creatures firstly with plants have a higher growth speed, more efficient to cultivate for economic side, easier at the technology aspects and caused by a lack of problems of ecological nature [14].

A number of research confirmed availability of basidiomycetes as one of the most popular groups of fungi which have wide spectrum of effect, also ability to synthesize BAS which has pharmacological activity [8, 13, 16]. But in generally these fungi at the conducted research could not be considered enough properly evaluate for their inherent potential, at least for the reason that, today the number of fungi species involved to the researches contanes only a small part which known to science. Besides, clarifications of application areas of BAS synthesis by fungi are not in the necessary level. All of these allows us to say that the research conducted in this direction are open and topical issue for research in nowadays.

In the rich and colorful nature of Azerbaijan area widespread the basidia fungi, in particular their xylotroph species, but nowadays the researches carried out with regarding to synthesis the various BAS is not enough for a complete assessment of biosynthetic potential peculiar to them [13-14]. On the other side, environmental factors also certain impact to the formation of amount parameters of synthesis BAS which also allows to mark, keep the significance of principle in a concrete conditions a concrete approach. All of these, allow to make it to be open and actual object for research as a producents of BAS of xylotroph micromycetes [10].

In the context of spoken, lately xylotrophic macromycetes from the genus of *Trametes Quel* specially is in the spotlight [9]. The reason for that, is determine the spread of fungi from this genus in Azerbaijan[1] and in most parts of the world and determine the BAS synthesis by this fungi as a perspective in the feed, food and medical aspects. Besides, at the limited aspect was defined influence of environmental factors to the formation of level synthesis BAS and to the indicators of not formation amount, some species from this genus did not become the object of research and their synthesis BAS also was defined in the limited context.

Therefore, the purpose of the presented work was to assessment the fungi from the genus of *Trametes Quel* which spread in Azerbaijan Republic as BAM, more as precisely as a potential of polysaccharide producents to the physiological- biochemical and biotechnological aspects.

## Materials and Methods

As an object of research were selected fungi from the genus of *Trametes Quel* for purchase of pure cultures, for this have been used their fruit body and for their collecting were used forests trees which spread in ecologically different areas (Great Caucasus, Minor Caucasus, Talysh Mountains and the Kura-Araz lowland) of Azerbaijan and the city of Baku. Fruit bodies were collected from the selected places by the metode of route and prepareded for laboratory analysis. The purchase to the pure cultures of fruit body (bazidioma) was carried out in the initial research in the laboratory, for that were used agarical malt juice (AMC) in the 2-$3^0$ B and the process was continued by the known methods before receiving a clean culture belonging to the particular species. To getting the biomass from pure culture of fungi was conducted by metod of deep cultivation (DC), this time was used liquid glucose peptone medium (LGPM) which in these case formed biomass was separated from nutritious medium, both culture solution (CS) and biomass were used as a sources of BAM.

Separation polysaccharides and exopolysaccharides from biomass, quantitative analysis was carried out in accordance with known methods [6, 12, 15, 18].

During determination of amount of protein was used method by Lori [3].

In research, for determine antimicrobial activity of polysaccharide fractions of fungi were used disk diffusion method [7] and as test culture were used both bacteria (*Staphylococcus aureus, Bacillus subtilis, Pseudomonas aeruginosa* and *Escherichia coli*), and fungi (*Aspergillus fumigatus, Candida albicans, Penicillium cuclopium* and *P. brevicompactum*).

The experiment was repeated minimum 4 times and the results were statistically processed [11].

## Results and Discussion

During the research firstly has been clarify of issues to specification of species from the genus of *Trametes Quel* which spread in Azerbaijan and as a result were determined 10 spread species from this genus (Tab. 1). As seen, the registered species have similar

Table 1 Common characteristics of fungi species from the genus of *Trametes Quel* which spread in Azerbaijan

| № | | The life term of Basidioma | Ecolo-trophic relationship | Type of decay | Hyphal system | The attitude to substrate |
|---|---|---|---|---|---|---|
| 1 | *Trametes cervina* | One year | Polytroph | white | dimitic | Eurythrophy |
| 2 | *T. heteromorpha* | | Saprotroph | brown | dimitic | |
| 3 | *T.hirzuta* | | Polytroph | white | trimitic | |
| 4 | *T. hohneli* | | Saprotroph | brown | dimitic | |
| 5 | *T.ochraceus* | | Saprotroph | white | trimitic | |
| 6 | *T. pubecsens* | | Polytroph | white | trimitic | |
| 7 | *T. suaveolens* | | Polytroph | white | trimitic | |
| 8 | *T.* trogii | | Polytroph | white | trimitic | |
| 9 | *T.verzicolor* | | Polytroph | white | trimitic | |
| 10 | *T. zonata* | | Polytroph | white | trimitic | |

characteristics with other registered species like as distribution of substrate and the life cycle of basidia, but differs from remaining indicators. So that, fungi from to the genus of *Trametes Quel* almost were found in the all trees (on the main forest-forming tree species suhc as, oak, hornbeam, peanuts and on the ironwood, linden, poplar, ash, safor, pistachios, almonds, inaba, sucker, plum, apple and so on.) so, they eurythrophy species which does not have specificity of substrate. From the comparison of results with the literature data it became clear that the species such as *T.suaveolens* and *T.trogii* first time were registered in conducted studies in the Azerbaijan conditions.

For getting BAS from xylotroph macromycetes generally are useing or their basidiomas or vegetative mycelium (VM). The reason for this that the BAS are enough in the above mentioned both substances. However, in the studies was considered reasonable to use only vegetative mycelium of fungi from the genus of *Trametes*. The reason for this is that, biological resources of FB formed by fungi from this genus are limited in the natural conditions and it is possible to collect them only certain times of the year and has not been yet developed the technology to intensive cultivate none of these fungi in the artificial conditions.

During selections producents of BAS firstly were selected strains which had high growth speed and this process was carried out in liquid glucose peptone medium (LGPM) by method of deep cultivation (DC). From the results became clear that, all explore strains are capable to growth in a nutritious medium and differ from each other only by amount of formed biomass (tab. 2).

Table 2 Assessment of fungi strains from the genus of *Trametes* by amount of formed biomass.

| N | Species | The number of isolated strains | Biomass yield (5 days, g / l) |
|---|---|---|---|
| 1 | *Trametes cervina* | 4 | 2,7-5,1 |
| 2 | *T. heteromorpha* | 4 | 2,3-4,2 |
| 3 | *T. hirzuta* | 5 | 5,5-8,0 |
| 4 | *T. hohneli* | 4 | 1,3-4,0 |
| 5 | *T. ochraceus* | 4 | 1,3-3,9 |
| 6 | *T. pubecsens* | 4 | 2,8-4,0 |
| 7 | *T. suaveolens* | 3 | 1,9-4,1 |
| 8 | *T. trogii* | 4 | 2,5-4,5 |
| 9 | *T. verzicolor* | 5 | 4,9-8,1 |
| 10 | *T. zonata* | 6 | 2,2-4,3 |

As seen, strains belongs to the species such as *T.hirsuta* and *T.versicolor* are characterized by a higher indicator for the total yield of biomass and maximum biomass formed by them compared with other strains are higher 1,6-6,2 times. It should be noted that, the growth speed of the strains do not fall behind at the strain which are considered prospective in this respect and even higher in some cases. For this reason, as a finish of this phase, strains like as *T.hirzuta F-2* and *T.versicolor F-35* were selected as a active produsent for the next phase of conducted research. Were caried out research for optimize the primary liquid medium which were used for selected strains. It should be noted that, the optimization in the study were carried out according to the carbon and nitrogen sources of medium, for primary acidity, cultivation teperature, to the method of preparation of growing material and period, and after that was found optimim medium. The position of the next phase of research were implementing of biochemical analysis of biomass which were received from selected strains as a active produsent during optimization. In this regard from the research it became clear that, despite that the biomass formed by both of fungi are characterized by same component items but they differ from each other by indicators of quantity (tab.3). As seen, in the mycelium of both fungi β-glucans are characterized by a higher indicator, which it can be noted as a indicator of height biological activity of polysaccharides. Thus, at the point view of biological this types glucans are considered more active than α-glucans [2, 5].

Table 3 The biochemical composition of biomass formed by fungal strains which selected as active produsent

| Composition components | Amount indicators (%) | |
|---|---|---|
| | *T. hirzuta F-2* | *T. versicolor F-35* |
| Protein | 17,4 | 16,9 |
| Difficult hydrolysing polysaccharides | 42,1 | 43,4 |
| Easy hydrolysing polysaccharides | 14,5 | 15,3 |
| α- glucan | 10,6 | 12,4 |
| β- glucan | 30,2 | 29,2 |
| Absorption capability (according to pepsin) | 42,4 | 44,5 |

In general, it should be noted that polysaccharides synthesis by xylotroph macromycetes becomes the center of attention of research in recent years and their composition is characterized as main indicator of biologically activity [8, 17]. Thus, the bond involved in the formation of polysaccharides and their soluble and insoluble forms are plays great importance role. For this reason, it was considered appropriate to study the polysaccharides synthesized by active producers. It became clear that, polysaccharide synthesis by the strain of both fungi can be divided to 3 parts (table 4): soluble(S+), insoluble(H-), and exopolysaccharides (EP). As seen, in spite of amount indicators of factions differs from each other, the main components all of polysaccharides consists of glucans and it as a characteristic feature of basidia fungi have been confirmed in a number of research.

This BAS are used as a practical purposes like as feed, food or medical and they are characterized by certain indicators for using in these areas. Considering this, in the end of studies were caried out research to determine the biomass formed by fungi from the genus of *Trametes* and determine availability for use this polysaccharides which synthesis by this fungi in the above-mentioned areas. From the results became clear that, the biomass formed by strain of this fungi and their polysaccharides do not have toxic effect. Then, were studied toxicity of aquatic and alcohol extract maken from their biomass and became clear tha, both of fungi do not have toxicity regarding to the fungi *Paramecium caudatum*. Thus, in the solution preparation in different proportions noted organism retains their viability about 2 hours which is considered that they the lack of toxicity by the used methods.

Table 4 The chemical composition of polysaccharide fractions received during research

| | Factions | The materials of reduction | Pro-tein | Ash | Monosaxaridlər | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Glucose | Man-noza | Galac-tose | Others |
| *T.hirzuta* F-22 | H- | 71,0 | 6,4 | 0,52 | 66,4 | 18,9 | 8,8 | 5,0 |
| | H+ | 78,0 | 1,8 | 0,30 | 57,6 | 20,6 | 13,1 | 6,7 |
| | EP | 76,2 | 1,4 | 0,22 | 56,7 | 23,3 | 9,2 | 8,8 |
| *T.versi-color* F-35 | H- | 70,1 | 7,1 | 0,61 | 63,6 | 20,2 | 9,7 | 4,8 |
| | H+ | 78,4 | 1,7 | 0,24 | 60,2 | 17,8 | 15,8 | 5,6 |
| | EP | 75,6 | 1,5 | 0,20 | 56,4 | 23,7 | 11,6 | 7,2 |

Thise fact allows to noted that, biomass received from the fungi and, also polysachatides are available for use in the feed, food and medicinal purpose. Thus, finished products intended for use in the above-mentioned areas both should not be having a toxic effect and also should be kept in structure toxic items in allowed limite. In this regard, received biomass could be considered as perspective.

Antimicrobial, namely antibacterial, antivirus and antifungal activity of products which intended for use in the above mentioned areas are one of the aspects in the center of attention and assessed in a positive sense. For the assessment this issue have been used some bacteria and fungi cultures. From the results became clear that, the materials received from fungi, namely from biomass and polysaccharides have bactericide and fungicide effect. Thus, the materials received from both of fungi showed activity against the bacteria which were used as test-culture and activity of polysaccharides was characterized by a more higher indicators of quantity(tab.5). According to the accepted method antibacterial activity of mycelium of both fungi may be considered weak, but activity of polysaccharides average. Thus, if indicator of lysis zone is 20 mm it considered weak, if 20-29 mm it considered avarage.

Table 5 Biomass taken from fungi and antibacterial activity of polysaccharides.

| Test bacteria | Antibacterial activity (Diameter of lysis zone, mm) | | | |
|---|---|---|---|---|
| | *T.hirzuta F-2* | | *T.versicolor F-35* | |
| | Biomass | Polysaccharide | Biomass | Polysaccharide |
| *Bacillus subtilis* | 12 | 21 | 11 | 21 |
| *Staphylococcus aureus* | 11 | 19 | 12 | 25 |
| *Escherichia coli* | 15 | 24 | 14 | 29 |
| *Psedomonas aeroginaza* | 14 | 22 | 13 | 21 |

Despite, similar situation also was observe at the fungi (tab 6), antifungal activity comparison with antibaterial activity were characterized by a high indicator of quantity both in the generally biomass, and in the polysaccharides in their content. All of these allows us to say that the noted materials are characterized by the indicator which available for use for practice purpose. İf add to all that, in the some of researches antibacterial and antifungal activity of biomass characterized by relatively low indicators, have been approved of effectivity [6, 16] to use in the practice then the perspectivity of strains from the genus of *Trametes* does not create doubts.

Tablel 6 Biomass taken from fungi and fungicide activity of polysaccharide

| Test culture | Fungicide activity ( Diameter of lysis zone, mm) | | | |
|---|---|---|---|---|
| | *T.hirzuta F-2* | | *T.versicolor F-35* | |
| | Biomass | Polysaccharide | Biomass | Polysaccharide |
| *Candida alpicans* | 11 | 18 | 15 | 28 |
| *Aspergillus fumigatus* | 14 | 23 | 17 | 29 |
| *Penicillium cuclopium* | 16 | 28 | 19 | 31 |
| *P.brevicompactum* | 19 | 31 | 21 | 32 |

Thus, biomass of these fungi also their polysaccharides do not have toxicity, and characterized by a high absorption capacity. All of these, are necessary conditions for use the strains as a produsents of BAS for food, feed, and medical purposes.

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