Mycopath (2018) 16(1): 11-14 **Research Article**

Antioxidant and antimicrobial activity of *Cerrena unicolor*

[*]Mustafa Sevindik

Department of Biology, Faculty of Science, Akdeniz University, Antalya, Turkey
[*]Corresponding author's email: sevindik27@gmail.com

Abstract

In this study, it was aimed to determine antioxidant and antimicrobial activity of *Cerrena unicolor* (Bull.) Murrill which is a wood decaying mushroom. Mushroom samples were extracted with ethanol, methanol and dichloromethane in soxhlet apparatus. Total antioxidant status (TAS), total oxidant status (TOS) and oxidative stress index (OSI) of the extracts were determined by Rel Assay Diagnostics kits. Antimicrobial activity was determined by using the modified agar dilution method against 9 bacterial and fungus strains (*Staphylococcus aureus, S. aureus* MRSA, *Enterococcus faecalis, Escherichia coli, Pseudomonas aeruginosa, Acinetobacter baumannii, Candida albicans, C. krusei*, and *C. glabrata*). TAS value of *C. unicolor* was found 6.706±0.059 mmol L^{-1}, TOS value was 19.308±0.114 μmol L^{-1} and OSI value was 0.288±0.003. Mushroom extracts were found to be effective against microorganisms at concentrations of 25-400 μg mL^{-1}. In addition, the anti-candidal activity of the extracts were higher. As a result, it was determined that *C. unicolor* has antioxidant and antimicrobial potential.

Keywords: *Cerrena unicolor*, Antioxidant, Oxidant, Antibacterial, Antifungal.

Introduction

Antioxidants are defined as substances that delay or inhibit oxidative damage caused by the presence of high doses of reactive oxygen species (ROS). Exogenous antioxidants play a key role in the delicate balance between oxidation and antioxidant in living systems. Many natural materials such as plants and mushrooms are rich in point of antioxidant compounds (Bouayed and Bohn, 2010; Selamoglu *et al.,* 2016). In this study, antioxidant potential of *C. unicolor* was determined.

The pharmacology industry has produced many new antibiotics over the past three decades, but the resistance of microorganisms to these drugs has increased. The increase in the problem of microbial resistance has revealed uncertainty about the use of antimicrobial drugs in the future. Therefore, to reduce this problem, it is important to control the use of antibiotics to understand the mechanisms of genetic resistance of bacteria and to continue to develop new synthetic or natural drugs (Nascimento *et al.,* 2000; Gonelimali *et al.,* 2018). In this study, antibacterial and antifungal activity of *C. unicolor* was determined in the determination of new natural antimicrobial agents.

Macrofungial species have been reported about 2200 species in Turkey until today (Sesli and Denchev, 2008; Altuntaş *et al.,* 2017). In recent years, biological activities on these macrofungi have accelerated studies in Turkey, which is macrofungi rich in terms of biodiversity. Saprotrophic mushroom species can produce different bioactive secondary metabolites in their bodies. It is in the family Polyporaceae, wood decaying *Cerrena unicolor* causes white decay. *C. unicolor* is cosmopolitan in regions such as Europe, Africa and South America and is an aggressive wood decay organism. *C. unicolor*, *Aesculus hippocastanum* L., *Fraxinus excelsior* L., *Acer* sp. L., *Betula* sp. L., *Fagus* sp. L. or *Quercus* sp. L. can be found in many deciduous hardwoods. Recently, it has been reported that *C. unicolor* may be the source of bioactive compounds of pharmacological and medical importance (Mizerska-Dudka *et al.,* 2015). In this study, it was aimed to determine the antioxidant and antimicrobial capacity of *C. unicolor* extracts of ethanol (EtOH), methanol (MeOH) and dichloromethane (DCM).

Materials and Methods

C. unicolor samples were collected from Gaziantep (Turkey) in 2017. The collected mushroom samples were extracted with ethanol (EtOH), methanol (MeOH) and dichloromethane (DCM) at 50 °C for about 6 hours (Gerhardt EV 14). The extracts were concentrated by rotary evaporator (Heidolph Laborota 4000 Rotary Evaporator).

Antioxidant activity tests

TAS and TOS values of mushroom were determined using Rel Assay kits (Assay Kit Rel Diagnostics, Turkey). Trolox as calibrator was used for the TAS value. Results are shown as mmol Trolox equiv. L^{-1} (Erel, 2004). H_2O_2 (hydrogen peroxide) as calibrator was used for the TOS value. The results were shown as μmoL H_2O_2 equiv.L^{-1} (Erel, 2005). The following formula was used to calculate the OSI (arbitrary unit: AU) and the percentage was expressed (Erel, 2005). In this study,

6 samples were taken from mushroom samples and 5 replicates were studied.

$$\text{OSI (AU)} = \frac{\text{TOS, } \mu\text{mol } H_2O_2 \text{ equiv. } L^{-1}}{\text{TAS, mmol Trolox equiv. } L^{-1} \times 10}$$

Antimicrobial activity tests

The antimicrobial activity tests of the EtOH, MeOH and DCM extracts of *C. unicolor* were determined by the agar dilution method. Minimal inhibitory concentrations (MIC) for each extract were determined against standard bacteria and fungus strains. *Staphylococcus aureus* ATCC 29213, *S. aureus* MRSA ATCC 43300, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and *Acinetobacter baumannii* ATCC 19606 were used as test bacteria. *Candida albicans* ATCC 10231, *C. krusei* ATCC 34135 ATCC 13803 and *C. glabrata* ATCC 90030 were used as fungus strains. Bacterial strains were cultured on Muller Hinton Broth medium and fungus strains were pre-cultured on RPMI 1640 Broth medium. To obtain a standard inoculum, the blur of bacteria and fungi was prepared according to McFarland 0.5. Standard extract concentrations were prepared with distilled water as 800-12.5 µg mL^{-1}. Fluconazole and amphotericin B for fungi, was used as a reference drug, whereas Amikacin, Ampicillin and Ciprofloxacin for bacteria were used as reference drugs. The lowest concentration inhibiting the growth of bacteria and fungi was determined as the minimum inhibitor concentration (MIC) (Bauer *et al.,* 1966; Hindler *et al.,* 1992; CLSI, 2012; EUCAST, 2014; Matuschek *et al.,* 2014; EUCAST, 2015).

Results and Discussion

Antioxidant activity

It is known that a wide range to pathological damages such as carcinogens and rheumatoid arthritis may be caused by oxygen free radicals. Nearly all organisms are well protected against free radical damage by many antioxidant compounds such as superoxide dismutase, catalase, ascorbic acid, tocopherols and glutathione. However, sometimes the antioxidant protection mechanism becomes unstable and then its oxidative damage can be reduced with many reinforcing antioxidants (Mujić *et al.,* 2010). In this study, TAS, TOS and OSI values of *C. unicolor* were determined for the first time. The results are shown in Table 1.

In this study, the TAS value of *C. unicolor* was reported 6.706±0.059 mmol L^{-1}, the TOS was 19.308±0.114 µmol L^{-1} and the OSI value was 0.288±0.003. In previous studies, TAS value of *Fomitopsis pinicola*, which is wild wood decaying mushrooms, was reported 1.44 mmol L^{-1}, TOS value was 14.21 µmol L^{-1} and OSI value was 0.99 (Sevindik *et al.,* 2017a). TAS value of *Ompholatus olearius* was reported 2.836 µmol L^{-1}, TOS value was 8.262 µmol L^{-1} and OSI value was 0.291 (Sevindik *et al.,* 2017b). TAS value of *Tricholoma terreum* was reported 0.38 µmol L^{-1}, TOS value was 16.76 µmol L^{-1} and OSI value was 4.41 (Akgül *et al.,* 2016). Compared to these studies, it was determined that TAS and TOS values of *C. unicolor* used in our study were higher than *F. pinicola, O. olearius* and *T. terreum* mushrooms. In this context, it has been determined that it has higher antioxidant potential of *C. unicolor*. However, it has been observed that higher oxidant compounds produced by the metabolic activities due to environmental and structural factors. When compared to OSI values, *C. unicolor* was found to be lower than *T. terreum*, *F. pinicola* and *O. olearius*. In addition, the differences in these TAS, TOS and OSI values among the fungi are thought to be due to the living environment, lifestyle, substrate and stress factors of habitat of mushroom. It was previously reported that *C. unicolor* had antioxidant activity (Jaszek *et al.,* 2013). In our study, it was determined that *C. unicolor* has high antioxidant potential.

Antimicrobial activity

Nowadays, many diseases with microorganism factors have been defined and continue to be defined day by day. In this context, synthetic antibiotics used today against infectious diseases are insufficient. Also, the resistance against these synthetic antibiotics of bacteria creates serious problems (Peres-Bota *et al.,* 2003; Lima *et al*., 2016). In this context, new antimicrobial sources to be obtained are very important. In this study, antimicrobial activity of EtOH, MeOH and DCM extracts of *C. unicolor* against 9 bacteria and fungus strains was determined and the results are shown in Table 2.

In previous studies, the ethanol extracts of *C. unicolor* have been reported to be effective against *Bacillus cereus, B. subtilis, Listeria monocytogenes, Staphylococcus epidermidis* and *Streptococcus agalactiae* in different concentrations (Altuner *et al.,* 2012). In a different study, polysaccharides of *C. unicolor* have been reported to have antibacterial effects on *Escherichia coli* and *Staphylococcus aureus* (Jaszek *et al.,* 2013). In our study, EtOH, MeOH and DCM extracts of *C. unicolor* were used and it has been found to have effects against *Staphylococcus aureus, S. aureus* MRSA, *Enterococcus faecalis, Escherichia coli, Pseudomonas aeruginosa, Acinetobacter baumannii, Candida albicans, C. krusei* and *C. glabrata* in 25-400 µg mL^{-1} concentrations. EtOH extracts of the mushroom were determined to have higher activity than MeOH and DCM extracts. In addition, the anticandidal activity of EtOH, MeOH and DCM extracts was found to be higher. In this context, *C. unicolor* can be used as an antimicrobial agent

against test microorganisms used in the study.

Conclusion

In this study, total antioxidant capacity, total oxidant capacity, oxidative stress index and antimicrobial activity of *C. unicolor* mushroom collected from Gaziantep (Turkey) province were determined. *C. unicolor* has been found to have high antioxidant potential. In addition, the mushroom extracts had high anticandidal activity. As a result, it was determined that *C. unicolor* has antioxidant and antimicrobial potential.

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Table 1: TAS, TOS and OSI values of *C. unicolor*

	TAS (mmol/L)	TOS (µmol/L)	OSI
C. unicolor	6.706±0.059	19.308±0.114	0.288±0.003

Values are presented as mean±SD.

Table 2: MIC values of different extracts of *C. unicolor* and standard antibiotics against test microorganisms

	S. aureus	***S. aureus* MRSA**	***E. faecalis***	***E. coli***	***P. aeruginosa***	***A. baumannii***	***C. albicans***	***C. glabrata***	***C. krusei***
EtOH	200	200	100	50	100	400	25	25	50
MeOH	200	200	100	50	200	400	25	25	50
DCM	200	200	200	50	200	400	25	50	50
Ampicillin	1.56	3.12	1.56	3.12	3.12	-	-	-	-
Amikacin	-	-	-	1.56	3.12	3.12	-	-	-
Ciprofloksasin	1.56	3.12	1.56	1.56	3.12	3.12	-	-	-
Flukanazol	-	-	-	-	-	-	3.12	3.12	-
Amfoterisin B	-	-	-	-	-	-	3.12	3.12	3.12

The MIC values are presented in units of µg mL^{-1}.

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