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RESEARCH ARTICLE

Nazmi Durkan
Mustafa Isiloglu*
Kudret Kabar**
Yunus Dogan***

TRACE ELEMENT CONTENTS IN SOME MACROFUNGI FROM BUYUK MENDERES RIVER BASIN

ABSTRACT:

Contents of Cr, Mn, Fe, Ni, Cu, Zn, Cd, and Pb in nine macrofungal species collected from Buyuk Menderes River Basin in Southwestern part of Turkey were determined by ICP-OES. The determined values were 6.316 mg/kg of Cr, 31.346 mg/kg of Mn, 1031.822 mg/kg of Fe, 17.056 mg/kg of Ni, 18.564 mg/kg of Cu, 40.00 mg/kg of Zn, 0.832 mg/kg of Cd and 2.019 mg/kg of Pb (in dry matter). The highest values were: 43.88 mg/kg Mn in *Pisolithus arhizus*, 2.94 mg/kg Cd in *Schizophllum commune* and 17.85 mg/kg Cr, 104.5 mg/kg Mn, 3226 mg/kg Fe, 46.03 mg/kg Cu and 4.511 mg/kg Pb in *Coprinus disseminatus*.

KEY WORDS: Buyuk Menderes River Basin, content, macrofungi, trace element.

CORRESPONDANCE:
Yunus Dogan
E-mail: yunus.dogan@deu.edu.tr

Faculty of Education, Pamukkale University, 20020 Denizli, Turkey
*Faculty of Arts and Sciences, Mugla University, 48000 Kotekli-Mugla, Turkey
**Faculty of Arts and Sciences, Suleyman Demirel University, 32260 Isparta, Turkey
***Buca Faculty of Education, Dokuz Eylul University, 35150 Buca-Izmir, Turkey.

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INTRODUCTION:

The environmental pollution, especially trace metals pollution caused by industrialization, effects quality of life and gives rise to many health problems. Some organisms accumulate trace metals in their body and these accumulations affect their life. Mushrooms are very important organisms in the ecosystem because their ability to biodegrade the substrate and they use the wastes of agricultural production as substrate (Manzi *et al*., 1999). Contents of the metals are primarily species-dependent while role of a genus or a family is of lower importance as is nutritional strategy-mycorrhizal, parasitic or saprophytic (Kalac *et al*., 2004).

Some of articles on contents of trace metals in macrofungi are: Kuusi *et al*. (1981), Kalac *et al*. (1996 & 2004), Sesli and Tuzen (1999), Demirbas (2000), Kalac and Svoboda (2000), Svoboda *et al*. (2000), Isıoğlu *et al*. (2001), Tuzen (2003), Mendil *et al*. (2004), Mendil *et al*. (2005) etc.

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By this study, trace element contents in some macrofungi from Buyuk Menderes River Basin are determined.

MATERIALS AND METHODS:

The research area, Buyuk Menderes River Basin located in Southwest Anatolia. It is a big area as 3.5% part of Turkey. It comes through Aegean Region to Aegean Sea as gathering agricultural and urban wastes from many arms of Buyuk Menderes River (Fig. 1).

The macrofungal samples for this research were collected from some localities of the research area in spring and summer periods of the years of 2004 and 2005. They were dried at 50^{o}C for 48 hours. The dried samples were kept in a polyethylene bags until analysis. After drying

process, 25 mL nitric acid was added on to 2 g dried sample. It was heated slowly in a heater for 30 minutes and was left to get cold. Then 15 mL perchloric acid was added and was boiled about 1 hour until it became colourless in a magnetic heater. After it got cold, 50 mL deionized water was added. The samples were kept in polyethylene bottles at +4°C in a fridge until analyzing stage (Haswell, 1991).

The analysis of Cr, Mn, Fe, Ni, Cu, Zn, Cd, and Pb elements in macrofungi and soil samples were done by Perkin Elmer Optima 2100 DV ICP-OES.

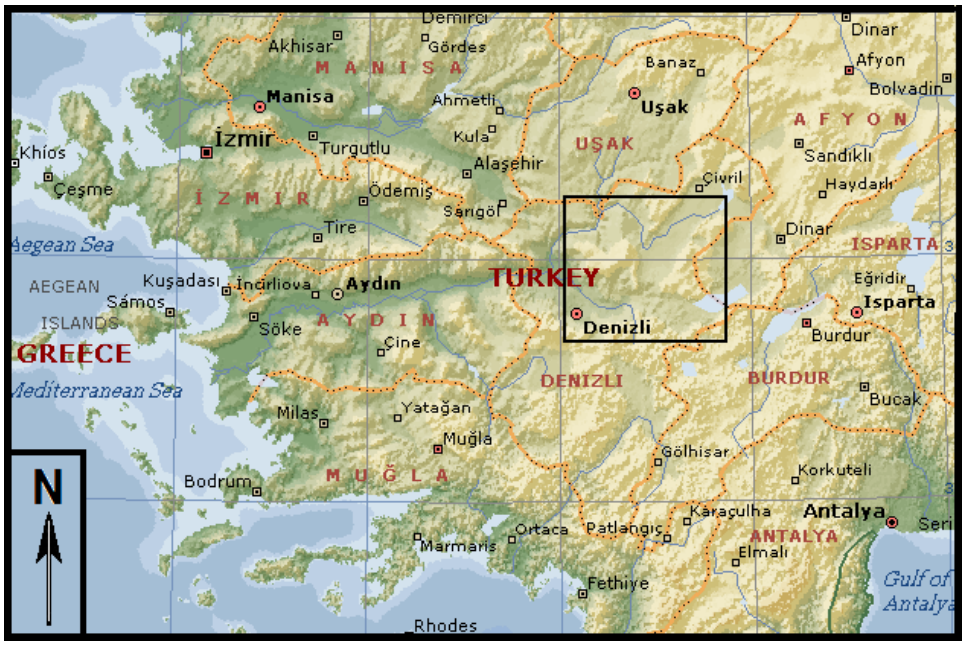

Fig. 1. Map of the study area

RESULTS AND DISCUSSION:

The taxonomic categories, habitats and other characteristics of nine macrofungi taxa are given in table 1. All of the macrofungi specimens are in Basidiomycetes class. Four of these species are used for medical therapy. Also, *Trametes versicolor* is reported as a biological purifier (Thomas *et al*., 1999). This species are not preferred for eating because of their specialty.

Table 1. Studied species and their families and habitats

	Family and species	Habitat and other specialty
1	Fomitopsidaceae *Postia tephroleuca* (Fr.) Jülich	-wet forest, beech forest, on dead *Betula, Fagus* wood and rarely conifers -saprophyte
2	Polyporaceae *Trametes versicolor* (L.) Lloyd	-on dead deciduous wood, sometimes on coniferous wood as well -saprophyte, medicinal mushroom
3	Polyporaceae *Trametes pubescens* (Schumach.) Pilat	-cut down mixed forest, lignicolous causing white rot of wood -saprophyte
4	Schizophllaceae *Schizophyllum commune* Fr.	-scattered on dead hardwood or in crowded groups on live or deadwoods -saprophytic and injury parasitic, medicinal mushroom
5	Sclerodermataceae *Pisolithus arhizus* (Scop.) Rauschert	-solitary to scattered near conifers, especially with *Pinus brutia*, typically in impoverished soils, or disturbed ground, e.g. roadsides, paths, and dry grassy areas; fruiting in the early fall. its ability to form mycorrhizae with a variety of conifer seedlings -saprophyte
6	Tricholomataceae *Xeromphalina campanella* (Batthsch) Maire	-densely gregarious to clustered, on rotting conifer wood. -saprophyte
7	Agaricaceae *Coprinus disseminatus* (Pers.) Gray	-on and beside stumps and rotting wood -saprophyte, medicinal mushroom
8	Psathyrellaceae *Psathyrella candolleana* (Fr.) Maire	-growing alone or gregariously in lawns, pastures, and cultivated areas--also in woods; typically near trees, their roots, stumps -saprophyte, medicinal mushroom
9	Bolbitiaceae *Conocybe tenera* (Schaeff.) Fayod	-solitary, gregarious to clustered on disturbed ground, e.g. grassy areas, in gardens, or along trails -saprophyte

Metal content of macrofungi taxa are given in table 2. The highest value of Cr was 17.85 mg/kg d.w. in *Coprinus disseminatus* whereas the lowest level was 0.450 mg/kg d.w. in *Trametes versicolor.* It was not found any record in related literature about Cr in these species. The reason was massive leather industry in the area and its discharges throughout. In these mushroom species, this metal was probably accumulated from the soil by active transportation.

Table 2. Trace metal content in macrofungi samples (dry weight mg/kg).

	Species	Cr	Mn	Fe	Ni	Cu	Zn	Cd	Pb
1	*Postia tephroleuca*	0.822	16.94	320.4	7.719	27.40	21.10	1.584	1.699
2	*Trametes versicolor*	0.450	12.82	91.10	2.056	7.788	8.357	0.422	1.353
3	*Trametes pubescens*	5.297	21.97	695.1	11.21	4.440	76.44	0.728	1.456
4	*Schizophyllum commune*	7.114	23.72	1038	19.00	6.119	66.26	2.944	2.814
5	*Pisolithus arhizus*	16.90	43.88	1680	41.19	8.357	12.73	0.430	1.758
6	*Xeromphalina campanella*	2.398	15.76	865.9	3.275	12.83	20.34	0.687	1.397
7	*Coprinus disseminatus*	17.85	104.5	3226	40.02	46.03	57.47	0.076	4.511
8	*Psathyrella candolleana*	2.986	19.20	722.4	20.31	35.30	64.66	0.210	1.445
9	*Conocybe tenera*	3.034	23.33	647.5	8.727	18.82	32.69	0.413	1.739

The highest value of Mn was 104.5 mg/kg d.w. in *Coprinus disseminatus* whereas the lowest level was 12.82 mg/kg d.w. in *Trametes versicolor*. It was not found any record in related literature about Mn value in *Coprinus disseminatus*. The origin of Mn is industrial waste. Waste which mix with river then transfer to soil and then eating the organism cause health problems because of metal accumulation by it. High level of Mn in *Coprinus disseminatus* may be metal relation of this species. Because of this relation mushrooms can accumulate high level of metal by active transport.

Iron has the highest value (3226 mg/kg d.w.) in *Coprinus disseminatus* whereas the lowest level was 91.10 mg/kg d.w. in *Trametes versicolor.* High level of Fe is in *Coprinus disseminatus* is Fe which is found in soil naturally and so this species have more affinity to Fe beside other species. This event shows taking Fe with active transport. It was not found any record in related literature about Fe in these species.

The highest value of Ni was 41.9 mg/kg d.w. in *Pisolithus arhizus* whereas the lowest level was 2.056 mg/kg d.w. in *Trametes versicolor.* It was not found any record in related literature about Ni in these species. Ni was found in soil with Mn. But especially it mixes water and soil by waste of metal industry consequence of growing industry.

Copper has the highest value (46.03 mg/kg d.w.) in *Coprinus disseminatus* whereas the lowest level was 4.440 mg/kg d.w. in *Trametes pubescens.* It was not found any record in related literature about Cu in these species. Cu was used in different kind of industry because of its characteristics. Because of this it is accumulated in atmosphere, water and soil and across different kind of organisms. It was not found any record in related literature about Cu in these species.

The highest value of Zn was 76.44 mg/kg d.w. in *Trametes pubescens* whereas the lowest level was 4.440 mg/kg d.w. in *Trametes versicolor.* Zn is used different kind of industrial branch. Zn level is high in eight species which was studied, except *Trametes versicolor.* High level of Zn in this species may be Zn affinity of this species or the soil which *Trametes versicolor* found has low level of Zn. It was not found any record in related literature about Zn in these mentioned species.

Cadmium has the highest value (2.944 mg/kg d.w.) in *Schizophyllum commune* whereas the lowest level was 0.076 mg/kg d.w. in *Coprinus disseminatus.* Cd has the highest level dissolving capacity metal in water. Because of this, it can accumulate by biological systems. In *Schizophyllum commune* metal levels has accordance but Mn, Fe, Cu, Cd, and Pb are found different levels (Sesli and Tuzen, 1999; Yesil *et al*., 2004).

The highest value of Pb was 4.511 mg/kg d.w. in *Coprinus disseminatus* whereas the lowest level was 1.353 mg/kg d.w. in *Trametes versicolor.* Pb is the first metal which destroys ecological system by human activity. Pb is using by every branch and it can cross organism by different kind of ways so Pb can destroy organism easily. It was not found any record in related literature about Pb in these species.

Chromium, Mn, Fe, Cu, and Pb levels are high in *Coprinus disseminatus* (Agaricaceae) more than other family members. According to related literature, Agaricaceae family has more affinity to especially some metals (Vetter and Berta, 1997; Michelot *et al*., 1998).

Some of macrofungi which were used in this study have medical capability. These are *Coprinus disseminatus*, *Trametes versicolor*, *Schizophyllum commune* and *Psathyrella*

candolleana. It is important to know metal levels of species which are used for medical properties. Because, metal taking, as dry and preparat to organism is same meaning metals which is found in the species were taken in high levels and this can causes serious health problems. If medical species are picking up from nature, it must pick up from unpolluted, clean areas. When a culture of this species are preparing, their substrate mustn't consist of metals and other pests.

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محتوى المعادن النادره فى بعض الفطريات من حوض نهر Buyuk Menderes

نظمي دوركان، * مصطفى إيسيل أوجلو ، ** كودريت كابار ، ***يونس دوحان

كلية التربية، جامعة باموكالي، تركيا
* كلية الفنون والآداب، جامعة موجلا، تركيا
** كلية الفنون والآداب، جامعة سليمان ديميريل، تركيا
*** كلية التربية ببوكا، جامعة دوكوز أيلول، تركيا

تم تقدير محتوى الكروم – المنجنيز – الحديد – النيكل – النحاس – الزنك والرصاص فى تسعة فطريات تم جمعها من حوض نهر Buyuk Menderes فى جنوب غرب تركيا. قدرت قيم من العناصر 6.316 ملجرام/كيلوجرام كروم، 31.346 ملجم/كيلوجرام منجنيز، 1.31 ملجم/كيلوجرام حديد، 17.056 مجم/ كيلوجرام نيكل، 18.564 مجلم/كيلوجرام من النحاس، 40 ملجم/كيلوجرام زنك، 0.832 ملجم/كيلوجرام كادميوم، 2.019 ملجم/كيلوجرام من الرصاص عل أساس الوزن الجاف. وقد وجد أعلى قيمة للمنجنيز وتقدر بـ 43.88 ملجم/كيلوجرام فى *Pisolithus arhizus*، 2.94 ملجم/كيلوجرام كادميوم فى فطر *Schizophllum commune*، 17.85 ملجم/كيلوجرام كروم، 104.5 مجم /كيلوجرام منجنيز ، 3226 ملجم/كيلوجرام حديد، 46.03 ملجم/كيلوجرام نحاس و 4.511 مجم/كيلوجرام رصاص فى *Coprinus disseminatus*.