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## DETERMINATION OF SOME MACRO AND MICROELEMENTS IN *Thymus moesiacus* VELEN. (Lamiaceae) AND ITS WATER EXTRACTS BY ATOMIC ABSORPTION SPECTROMETRY

Tatjana KADIFKOVA-PANOVSKA<sup>1</sup>, Trajče STAFILOV<sup>2</sup>, Stevan BAUER<sup>1</sup>,  
Svetlana KULEVANOV<sup>1</sup> and Kiril DOREVSKI<sup>1</sup>

<sup>1</sup>Faculty of Pharmacy, Skopje, Macedonia institute of Chemistry,

<sup>2</sup>Faculty of Science, Skopje, Macedonia

### ABSTRACT

Kadifkova-Panovska, T., Stafilov, T., Bauer, S., Kulevanova, S., Dorevski. K (1997) Determination of some macro and microelements in *Thymus moesiacus* Velen (Lamiaceae) and its water extracts by atomic absorption spectrometry Ekol Zašt. Živ Sred., Vol. 5 , No. 1, Skopje.

Content of some macro (Ca, Mg, K, Na, Fe, Zn and Mn) and microelements (Cd, Co, Cr, Cu, Ni and Pb) in *Thymus moesiacus* Velen. (Lamiaceae) and its water extracts were determined by atomic absorption spectrometry Distribution of the investigated elements was examined as well as the influence of the duration of extraction of these elements in their water extracts It was found that the value of extraction for macroelements was under 12 5% while for micrioelements the value was higher, almost 55%

**Key words:** *Thymus moesiacus*, Ca, Mg, K, Na, Fe, Zn, Mn, Cd, Co, Cr, Cu, Ni, Pb, water extracts

### ИЗВОД

Кадифкова-Пановска. Т., Стафилов. Т., Бауер, С. Кулеванова, С., Доревски. К (1997). Определување на некои макро и микроелементи во *Thymus moesiacus* Velen (Lamiaceae) и во неговите водени екстракти со атомска апсорпциона спектрометрија Екол Зашт Жив Сред , Том 5, Бр. 1 . Скопје.

Извршено е определуван>е на некои макро (Ca, Mg, K, Na, Fe, Zn и Mn) и микроелементи (Cd, Co, Si, Cu, Ni и Pb) во *Thymus moesiacus* Velen. (Lamiaceae) и неговите водени екстракти со примена на атомска апсорпциона спектрометрија Беше извршено испитувањето на застапеноста на испитуваните елементи како и влијанието на времето на екстрахирање на овие елементи во водените екстракти Утврдено е дека степенот на екстрахирање за макроелементите е под 12,5%, додека за микроелементите е повисок (скоро 55%).

**Клучни зборови:** *Thymus moesiacus*, Ca, Mg, K, Na, Fe, Zn, Mn, Cd, Co, Cr, Cu, Ni, Pb, водени екстракти

## INTRODUCTION

A few different species of the genus *Thymus* L. are collected in Republic of Macedonia as wild thyme. The species themselves are characterized by emphasized polymorphism thus many subspecies, variations and forms occur in Macedonian flora (Matevski 1987). The wild thyme is used as expectorants, spasmolytic, antiseptic and antihelminthic (Dervendji 1992). One of the widely used taxa is *Thymus moesiacus* Velen., prepared in a form of simple water extracts, especially recommended by folk medicine in Macedonia for treating respiratory infections. This taxa has been investigated and its essential oil composition (Kulevanova et al. 1996) and the content of flavonoids (Kulevanova 1995) have been already reported. The importance of the mineral content in the wild thyme was pointed out by some authors as well as the connection between the presence of some elements and certain effects of the wild thyme (Kakias and Loukis 1978; Mumba, 1982; Ivanova and Baranova 1982; Sovljanski et al. 1990). On the other side, the extreme presence of some heavy metals is undesirable and therefore they are plant pollutants. The problem of the extraction of elements could be observed by

two aspects. The first one is necessity of some important microelements presence in the plant extracts, and the second one refers to the undesirable presence of certain heavy metals which higher amount in the extracts should be avoided. For that reason, it seems to be important to determine the concentration of macro and microelements in plant extracts. Some elements were determined in the extract of *Achillea millefolium* L. (Zimna and Pieco 1982) as well as in the extracts of nettle's leaves, roots and seeds (Kulevanova and Ristov 1995). The quantity of some micro and macroelements in Macedonian propolis and its ethanol and water extracts were determined too (Kulevanova and Stafilov 1995). A content of some macro (Kadifkova Panovska et al. 1995) and microelements (Kadifkova Panovska et al. 1996) in a few different species of genus *Thymus* in Macedonian flora has been determined previously. As it is well known that *Thymus* species are commonly used as water extract, the aim of the present work was examination of the content of certain macro and microelements in the plant and water extracts of *T. moesiacus*.

## MATERIAL AND METHODS

*Plant material.* - Herb of *Thymus moesiacus* Velen., collected at the northwestern part of Macedonia, during the summer of 1995. The identity was confirmed by Dr. V. Matevski, Department for Botany, Faculty of Science, Skopje, Macedonia. A voucher specimen deposited at the Herbarium of the same institution. Before examining, they were all milled.

*Preparation of extract.* - 100 ml of extract was prepared by simple extraction of 5 g of plant material at room temperature. The duration of extraction was 15, 30 and 60 minutes.

*Mineralization.* - Sample of plant was mineralized by wet and dry procedure described previously (Kadifkova Panovska et al. 1996).

*Determination of elements.* - Macroelements were determined by atomic absorption spectrometry (AAS) (Kadifkova Panovska et al. 1995), Perkin-Elmer Model 370 - instrument; Microelements were determined by electrothermal atomic absorption spectrometry (ETAAS) (Kadifkova Panovska et al. 1996), Perkin-Elmer Model 303, deuterium background corrector and HGA-72 graphite furnace.

## RESULTS AND DISCUSSION

The content of macroelements Ca, Mg, K, Na, Fe, Zn and Mn as well as microelements Cd, Co, Cr, Cu, Ni and Pb in the sample of plant and plant extracts are presented in the Tab. 1. The amount of K was found to be the highest ( $18240 \mu\text{g g}^{-1}$ ) followed by Ca ( $4710 \mu\text{g g}^{-1}$ ) and Mg ( $3410 \mu\text{g g}^{-1}$ ). Significant quantities of Fe

( $720 \mu\text{g g}^{-1}$ ) and Mn ( $203 \mu\text{g g}^{-1}$ ) were determined too. Regarding microelements, the amounts of Cr, Cu and Ni were  $14.44$ ,  $13.19$  and  $12.03 \mu\text{g g}^{-1}$ , respectively.

Differences in duration of the extraction process (15, 30 and 60 minutes), caused certain differences in the degree of extraction. The con-

centration of some elements varied more. Thus, the concentrations of 0,274, 0,38 and 0,45  $\mu\text{g}\cdot\text{cm}^{-3}$  for Mn in the respective extracts were obtained, representing 2,70, 3.70 and 4.40% of extraction. The variation in the degree of extraction for some microelements was higher. For 15, 30 and 60 minutes extraction, Cu 25.8, 27.3 and 30.7% of extraction were obtained respectively. From the results shown in the Table, it could be noticed that the quantity of extracted macroelements, after extraction process of 60 minutes is the highest of all (Ca - 0.7% of the quantity determined in the sample, Mg - 0.06%, K - 0.10%, Na - 0.96%, Fe - 6.7%, Zn - 12.5% and Mn - 4.4%). It should be mentioned that K found in the highest quantity in the plant (18240  $\mu\text{g}\cdot\text{g}^{-1}$ ), got nearly the lowest degree of extraction (0.10%), while, Zn found in the lowest quantity (32.0  $\mu\text{g}\cdot\text{g}^{-1}$ ), 12.5% of it were extracted, presenting the highest degree of extraction.

The duration of extraction has a different influence on the extraction degree of microelements too (Tab.), Thus, for Cd and Co the high-

est value were obtained after 30 minutes, while for Cu, Cr, Ni and Pb, after 60 minutes. The concentration of Cd, Co, Cr and Pb in all examined extracted extracts was low, ranging from 0,01 to 0.06  $\mu\text{g}\cdot\text{cm}^{-3}$ . Only for Cu and Ni higher concentration was found (0,20 and 0.32  $\mu\text{g}\cdot\text{cm}^{-3}$ , respectively).

Generally, the value of extraction for macroelements was under 12.5% while for microelements the value was higher, almost 55%. As it is shown, much more amounts of macroelements in *T. moesiacus* stand unaffected in the extraction procedures.

The water extract of *T. moesiacus* could not be used as a drink for organism daily necessities substitute with certain elements. On the other side, K which was found in higher quantity in this plant (can cause heart decompensation) in the water extract was presented very low, and it could not cause any damage. Cd and Pb as extreme toxic metals, being in extreme low concentration in the extracts of *T. moesiacus*, do not represented a potential danger for human health.

Tab. 1 Contents of macro and microelements in *Thymus moesiacus* Valen. and its water extracts determined by AAS and ETAAS

Таб. 1 Сadržина на макро и микроелементи во *Thymus moesiacus* Valen. и негови водени екстракти определена со AAS и ETAAS

Element Елемент	Sample Проба $\mu\text{g}\cdot\text{g}^{-1}$	Extract 1 Екстракт 1 $\mu\text{g}\cdot\text{cm}^{-3}$ % extr.*		Extract 2 Екстракт 2 $\mu\text{g}\cdot\text{cm}^{-3}$ % extr.*		Extract 3 Екстракт 3 $\mu\text{g}\cdot\text{cm}^{-3}$ % extr.*	
Ca	4710	1.50	0.64	1.62	0.69	1.65	0.70
Mg	3410	0.05	0.03	0.068	0.04	0.10	0.06
K	18240	0.71	0.078	0.73	0.08	0.88	0.10
Na	260	0.033	0.25	0.075	0.58	0.125	0.96
Fe	720	1.09	3.02	2.09	5.8	2.40	6.7
Zn	32	0.08	5.0	0.125	7.8	0.20	12.5
Mn	203	0.274	2.7	0.38	3.7	0.45	4.4
Cd	0.32	0.0017	10.9	0.0023	14.4	0.0023	14.4
Co	1.31	0.007	10.7	0.01	15.3	0.01	15.3
Cr	14.44	0.0028	3.9	0.05	6.93	0.065	9.0
Cu	13.19	0.17	25.8	0.18	27.3	0.203	30.7
Ni	12.03	0.30	49.9	0.30	49.9	0.325	54.0
Pb	1.05	0.01	19.0	0.011	20.9	0.0112	21.4

1, 2, 3 - extracts prepared by extraction in time of 15, 30 and 60 min;

% extr.\* - the amount of element in the extract counted as % of that element in drug

1, 2, 3 - екстракти подготвени со екстракција од 15, 30 и 60 минути;

% extr.\* - количина на елемент во екстрактот пресметан како проценти од тој елемент во дрогата

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# ОПРЕДЕЛУВАЊЕ НА НЕКОИ МАКРО И МИКРОЕЛЕМЕНТИ SO *Thymus moesiacus* VELEN. (Lamiaceae) И ВО НЕГОВИТЕ ВОДЕНИ ЕКСТРАКТИ СО АТОМСКА АПСОРПЦИОНА СПЕКТРОМЕТРИЈА

Татјана КАДИФКОВА-ПАНОВСКА<sup>1</sup>, Трајче СТАФИЛОВ<sup>2</sup>, Стеван БАУЕР<sup>1</sup>, Светлана  
КУЛЕВАНОВА<sup>1</sup> и Кирил ДОРЕВСКИ<sup>1</sup>

<sup>1</sup>Фармацевтски факултет, Скопје, Македонија

<sup>2</sup>Институт за хемија, Природно-математички факултет, Скопје, Македонија

## РЕЗИМЕ

Извршено е определување на некои макро (Ca, Mg, K, Na, Fe, Zn и Mn) и микроелементи (Cd, Co, Cr, Cu, Ni и Pb) во *Thymus moesiacus* Velen. (Lamiaceae) и неговите водени екстракти со примена на пламената и електротермичката атомска апсорпциона спектрометрија. Пробите од *Thymus moesiacus* Velen. се собирани во северозападна Македонија во летен период во 1995 година. Пробите пред испитувањето беа сушени и мелени. Екстрактите се припремени за различни времиња од 15, 30 и 60 минути. Минерализацијата на

пробите е вршена со сувата постапка. Испитувањата покажаа дека од микро и макроелементите најзастапен е K ( $18240 \mu\text{g}\cdot\text{g}^{-1}$ ), потоа Ca ( $4710 \mu\text{g}\cdot\text{g}^{-1}$ ), Mg ( $3410 \mu\text{g}\cdot\text{g}^{-1}$ ), Fe ( $720 \mu\text{g}\cdot\text{g}^{-1}$ ). Mn ( $203 \mu\text{g}\cdot\text{g}^{-1}$ ), додека содржината на микроелементите е под  $15 \mu\text{g}\cdot\text{g}^{-1}$ .

Испитувањата покажаа дека растворањето на елементите во екстрактите се зголемува со зголемување на времето на растворање, Исто така, утврдено е дека степенот на екстрахирање за макроелементите е под 12,5%, додека за микроелементите е повисок (скоро 55%).