

## ANTIMICROBIAL ACTIVITY OF BIOACTIVE COMPONENT FROM FLOWER OF *LINUM CAPITATUM* KIT

UDC 547.972.2: 543

**Slavica B. Ilić, Sandra S. Konstantinović, Zoran B. Todorović**

Faculty of Technology, Bulevar oslobođenja 124, SCG, 16000 Leskovac

**Abstract.** Different extracts containing bioactive components and etheric oil of the flowers of *Linum capitatum* Kit. (*Linacea*) of Serbian origin were tested for an antimicrobial activity against four bacteria (*Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*), one mold (*Aspergillus niger*) and one yeast (*Candida albicans*). The isolated flavonoids were also tested against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus anthracis*, *Pseudomonas aeruginosa*, *Aspergillus niger*, *Candida albicans* and *Herpes simplex virus* type.

**Key words:** *Linum capitatum* Kit., flavonoid, antimicrobial activity, etheric oil, extracts

### 1. INTRODUCTION

*Linum capitatum* Kit. from *Linacea* family, is widespread on area of carbonate and silicate rocks of south-east Europe [1]. Flavonoids are natural phenolic compounds, which appear as secondary metabolites of plants. Considering the fact that they are widely spread in plants, they have extreme importance from the phylogenetic aspect in clearing up the origin and evolution of plants [1].

The present paper describes the antimicrobial activity of different extracts and etheric oil from *Linum capitatum* Kit. flower against gram-positive, gram-negative bacteria, yeast and mold.

It also describes the antimicrobial activity of isolated flavonoids, such as kaempferol, kaempferol-3-*O*-galactoside, rutin, isoflavones, genistin and orientin from *Linum capitatum* Kit. flower.

### 2. EXPERIMENTAL

**Plant material.** *Linum capitatum* Kit. air dried plant material (flower) was collected in June 2001, in the mountain Varedenik at Vlasina Lake.

**Substrate and microorganisms.** For microbial growth were used staphylococcus substrate (for bacteria) and Sabouraud dextrose agar (SDA) for yield. Microorganisms were gained from biological laboratory of DD "Zdravlje" Leskovac (*Escherichia coli* 95, *Staphylococcus aureus* ATCC 6538, *Aspergillus niger*, *Candida albicans* ATCC 10231), and from "Institute for health protection" Leskovac (*Proteus mirabilis*, *Bacillus subtilis* 6633, *Bacillus anthracis*, *Pseudomonas aeruginosa*, *Herpes simplex virus type*). For the disk method, stock solutions were made with solvent. Into disks, stock solution was dripped, and they were then dried at room temperature. From the 24-hour blood agar culture of the bacteria, suspensions were made and incubated at 310 K for 3 hours.  $0.1\text{mol}\cdot\text{dm}^{-3}$  of the bacterial suspension was transferred to antibacterial test medium and the disk was placed on it. After incubation at 310 K for 18 hours, the incubation zones were measured (mm) using FIBCHEL-LILLY apparatus [2].

### 3. RESULTS AND DISCUSSION

The flavonoids kaempferol (I), kaempferol-3-*O*-galactoside (II), rutin (quercetin-3-*O*-rutinosid) (III), genistin (genistein-7-*O*-glucoside) (IV) and orientin (luteolin-8-*C*-glucoside) (V) were isolated from methanolic extract of *Linum capitatum* Kit. flower .

The etheric oil was isolated as petrolether extract and its chemical composition was determined using gas chromatograph. The determination was done comparing the chromatograph with retention time of standards. Among the great number of components the most dominant is borneol (12.38%) and camphor (18.68%). The experimental inhibition zones (mm) of investigated extracts of *Linum capitatum* Kit. flower are shown in Table 1 and Figure 1 and 2. As can be seen, all extracts have different antibacterial activity *in vitro* against the tested microorganisms [3].

Table 1. Range of inhibition zones (mm) of extracts of *Linum capitatum* Kit.

Extract/ Microorg.	S. aureus 6583	B. subtilis 6633	E. coli 95	P. aeruginosa	A. niger ATCC 10231	C. albicans
95% ethanolic	15.52	15.72	15.17	14.59	15.75	0.00
60% ethanolic	0.00	14.75	14.55	0.00	15.45	0.00
methanolic	+	14.66	14.70	0.00	15.60	0.00
petrolether	+	+	0.00	0.00	0.00	0.00

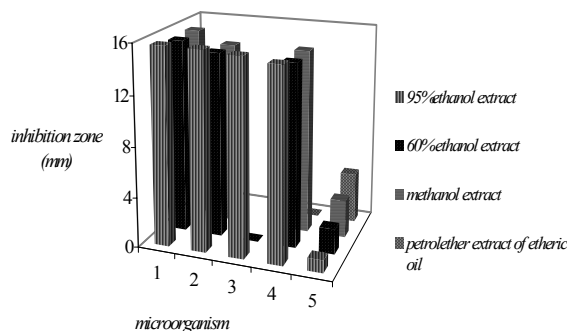
95% ethanol extract posses activity against both of gram positive bacteria (*S. aureus* ATCC 6538 and *B. subtilis* 6633), against gram negative bacteria *E. coli* and against mold *A. niger*. The inhibition zone for all microorganisms is measured. The resistance against 95% extract is shown by *C. albicans*. 60% ethanol extract posses activity against and *B. subtilis* 6633, *E. coli* and *A. niger*. The inhibition zone for all microorganisms is measured. The resistance against 60% extract is shown by *S. aureus* ATCC 6538 *P. aeruginosa* and *C. albicans*. The best activity is shown against mold *A. niger* [4].

Table 2. Range of inhibition zones (mm) of flavonoids from *Linum capitatum* Kit.

Extract/ Microorg.	S. aureus 6583	B. anthracis 6633	E. coli 95	P. aeruginosa	A. niger ATCC 10231	C. albicans	Herpes simplex virus type
I	+	+	+	–	–	–	15.90
II	+	+	+	–	–	–	15.88
III	+	14.60	–	14.50	+	–	–
IV	–	–	14.36	–	+	–	–
V	–	+	+	–	15.25	–	–

+ weak activity, – no activity

Methanol extract possesses activity against *B. subtilis* 6633, *S. aureus* ATCC 6538, *E. coli* and the mold *A. niger*. The inhibition zone for all microorganisms, except for the *S. aureus* is measured. The resistance against 60% extract is shown by *P. aeruginosa* and *C. albicans* [4].

Fig. 1. The dependence between inhibition zone (mm) and different extracts of *Linum capitatum* Kit. flower

Petrolether extract of etheric oil possesses activity against *B. subtilis* 6633 and *S. aureus* ATCC 6538. The inhibition zone is not measured. Chloroformic and carbon tetrachloride extract have bacteriostatic activity, but inhibition zone is not measured. Because the elimination of microorganisms is diffudional. Since 1-butanol as solvent possesses antimicrobial activity this result is not considered for this work. *n*-hexane extracts are not antimicrobial active [4].

It can be concluded that 95% ethanol extract exhibits the best antimicrobial activity, and the petrolether extract exhibits the less activity.

The results show that the extracts exhibit the best activity against *Aspergillus niger* and the less against *Pseudomonas aeruginosa* and *Candida albicans*.

The isolated flavonoids (Figure 3) also exhibit different antimicrobial activity. Among tested, only kaempferol-3-*O*-galactoside express the activity against two microorganisms including *B. anthracis* and *P. aeruginosa*. Also, as it can be seen, the large inhibition zones show kaempferol and kaempferol-3-*O*-galactoside against *Herpes simplex virus type*.

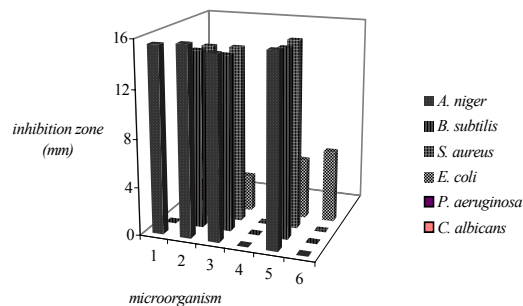


Fig. 2. The dependence between inhibition zone (mm) for different extracts of *Linum capitatum* Kit. flower and microorganism

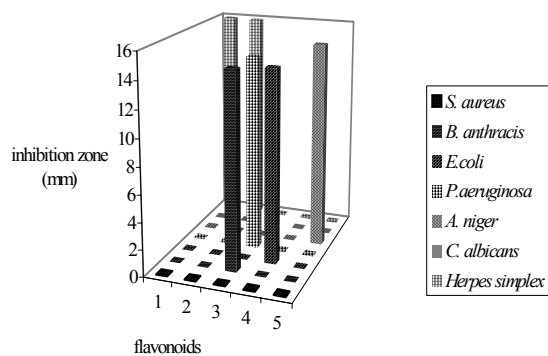


Fig. 3. The dependence between inhibition zone (mm) and isolated flavonoids from flowers of *Linum capitatum* Kit. flower

**Acknowledgments:** This work was supported by the Serbian Ministry of Science and Technology of the Republic of Serbia.

#### REFERENCES

1. Flora of the Republic of Serbia, Serbian Academy of Sciences and Arts, 6<sup>th</sup>ed., Belgrade, 1976.
2. S. Miletic, S. Ilic, S. Djordjevic, B. Gudzic and M. Cakic, Bulten of Macedonian Chemists and Technologists, (8), 236 (1990).
3. A. Aljadi, and K. M. Yusoff, Turk. J. Med. Sci. (33), 229, 2003.
4. O. Kunle, E. Okogun, E. Emojevwe and M. Shok, Antimicrobial activity of various extracts and carvacrol from *Lippia multiflora* leaf extract. Phytomedicina (10), 59, (2003).

## **ANTIMIKROBNA AKTIVNOST BIOAKTIVNIH KOMPONENTI IZ CVETA *LINUM CAPITATUM* KIT.**

**Slavica B. Ilić, Sandra S. Konstantinović, Zoran B. Todorović**

*Različiti ekstrakti koji sadrže bioaktivne komponente, kao i eterična ulja iz cveta biljke *Linum capitatum* Kit. (Linacea), a sa područja južne Srbije, su testirana na antimikrobnu aktivnost. Kao test mikroorganizmi korišćeni su *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Aspergillus niger* i *Candida albicans*. Izolovani flavonoidi su takođe testirani u odnosu na mikroorganizme i to *Staphylococcus aureus*, *Escherichia coli*, *Bacillus anthracis*, *Pseudomonas aeruginosa*, *Aspergillus niger*, *Candida albicans* and *Herpes simplex virus* type.*