ANTIMICROBIAL ACTIVITY OF BIOACTIVE COMPONENT FROM FLOWER OF LINUM CAPITATUM KIT

UDC 547.972.2: 543

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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 antracis, 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 roks 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.

Received August 16, 2004
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. 0.1mol⋅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.

<table>
<thead>
<tr>
<th>Extract/Microorg.</th>
<th>S. aureus 6538</th>
<th>B. subtilis 6633</th>
<th>E. coli 95</th>
<th>P. aeruginosa</th>
<th>A. niger ATCC 10231</th>
<th>C. albicans</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% ethanolic</td>
<td>15.52</td>
<td>15.72</td>
<td>15.17</td>
<td>14.59</td>
<td>15.75</td>
<td>0.00</td>
</tr>
<tr>
<td>60% ethanolic</td>
<td>0.00</td>
<td>14.75</td>
<td>14.55</td>
<td>0.00</td>
<td>15.45</td>
<td>0.00</td>
</tr>
<tr>
<td>methanolic petrolether</td>
<td>+</td>
<td>14.66</td>
<td>14.70</td>
<td>0.00</td>
<td>15.60</td>
<td>0.00</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Extract/ Microorg.</th>
<th>S. aureus 6583</th>
<th>B. anthracis 6633</th>
<th>E. coli 95</th>
<th>P. aeruginosa ATCC 10231</th>
<th>A. niger ATCC 10231</th>
<th>C. albicans</th>
<th>Herpes simplex virus type</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>II</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>15.90</td>
</tr>
<tr>
<td>III</td>
<td>−</td>
<td>14.60</td>
<td>14.50</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>IV</td>
<td>−</td>
<td>+</td>
<td>14.36</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>V</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>15.25</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

+ 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

Petroether 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 diffusional. Since 1-buthanol 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 least 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. aureginosa. Also, as it can be seen, the large inhibition zones show kaempferol and kaempferol-3-O-galactoside against Herpes simplex virus type.
**Acknowledgments:** This work was supported by the Serbian Ministry of Science and Technology of the Republic of Serbia.

**REFERENCES**

ANTIMIKROBNA AKTIVNOST BIOAKTIVNIH KOMPONENTI IZ CVETA LINUM CAPITATUM KIT.

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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.