Preliminary Phytochemical and Antibacterial Studies of *Olea europaea* and *Polygonum maritimum* Libyan Plants

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Abstract: *Polygonum maritimum* and *Olea europaea* are the useful plants used in folk medicines for the treatment of various diseases. The present study was conducted to examine preliminary phytochemicals screening of aqueous and ethanolic leaves extracts and antibacterial activity of ethanolic extracts of both plants of Libyan origin. The qualitative phytochemical studies of aqueous and ethanolic extracts of the plants leaves were carried out using standard testing procedures for metabolites viz. tannins, saponins, phlobatanins, flavonoids, terpenoids, cardiac glycosides and alkaloids. The aqueous and ethanolic extracts of *Polygonum maritimum* exhibited the presence of tannins, saponins, flavonoids, terpenoids and cardiac glycosides metabolites, however, the aqueous and ethanolic extracts of *Polygnum maritimum* showed the presence of saponins, phlobatanins, flavonoids, terpenoids and cardiac glycosides metabolites. The antibacterial activity of ethanolic leaves extract of both plants was tested using Gram positive bacterial strains (*Staphylococcus epidermidis, Staphylococcus saprophyticus*) and Gram negative bacterial strains (*Pseudomonas vulgaris, Eschericia coli, Citrobacter freundii*). In general, the extracts of both plants exhibited considerable activity on the bacterial species. Both plants extracts selectively inhibited the growth of both gram positive and gram negative bacteria with zones of inhibition ranging from 8 mm to 10 mm at concentrations of 50 mg/ml. Present findings suggest that *Polygonum* and *Olive* leaves extracts exhibit antibacterial effect against both gram positive and gram negative bacteria and these plants seems to be considered for detailed investigation in an attempt to find the chemical entities combating against pathogenic microorganisms.

Keywords: Libyan plants, *Polygonum maritimum*, *Olea europaea*, Phytochemicals screening, Antibacterial activity.

1. Introduction

Starting from ancient times plants have given us several remedial agents for the treatment of diseases and have an important place in the therapeutic armory of mankind. At least 25% of the prescribed drugs used for the treatment of diseases in the USA and Canada contain bioactive ingredients derived from plant natural products. Therefore such plants should be investigated to understand better about their medicinal properties, safety and efficacy[1-3]. Microbial infections constitute a major cause of morbidity and mortality in humans and medicinal plants are well known as important source of obtaining antimicrobial drugs[4-7].

The olive tree, *Olea europaea* (family Oleaceae) is a evergreen tree or shrub native to the Mediterranean, Asia and Africa. Olive tree parts have shown useful medicinal properties and possess antibacterial activity. [8] has the capacity to lower blood pressure in animals [9], increase blood flow in the coronary arteries, relieve arrhythmia and prevent intestinal muscle spasms [10] and its oil has a number of common phenolic compounds that might possess positive health effect to the human body, as well as a good source of Vitamin E [11].

*Polygonum maritimum* L. (family Polygonaceae) is a perennial herb or small shrub 20-50 cm in height and found in coastal sites in Europe, America, South Africa, and the Mediterranean region [12]. It has been reported as good source of phytochemicals known for biological actions The genus *Polygonum* is well known for producing a variety of plant secondary metabolites such as phenylpropanoids, acetylphenones, chalcones, coumarins, flavonoids, lignans, naphtoquinones, anthraquinones, sesquiterpenoids, triterpenoids, stilbenoids and tannins described in many publications [13-22]. According to our knowledge, there are very few publications available about the characterisation of the antimicrobial activity of crude extract of *P. maritimum* [20-21].

So far no specific study has been carried out for the preliminary phytochemical screening and antibacterial activity of *Olea europaea* and *Polygonum maritimum* grown in Libya. Therefore, in this present investigation, the preliminary phytochemicals screening and antibacterial activity of leaves extracts of both these plants against Gram positive and Gram negative bacteria were investigated and described.

2. Materials and Methods

2.1. Collection of Plants materials:

*Olea europaea* and *Polygonum maritimum* plants were collected from different parts of the Al-khoms city (Libya) in April-May months of 2013. Identification of both these plants was confirmed by Plant taxonomist of the Department of Biology of Al- mergheb University, Al-Khoms, Libya. Leaves of each plant were collected, washed under running tap water and dried under shade and ground into fine powder in the electronic grinder, the powder was stored in plastic bags at room temperature under low humidity condition.

2.2 Preparation of Extract
The crude powdered plants leaves were extracted in water and ethanol separately at a 40% (w/v) concentration (200g leaves powder in 500 ml water) by using Soxhlet method for 8 h and filtered. The extracts were stored in refrigerator at 4°C until further use.

2.3 Phytochemicals screening

Chemical tests were performed for the aqueous and ethanolic leaves extracts of both the plants using standard procedures to identify the presence of various phytochemicals as described by Sofowora, 1993[23] and Raman, 2006 [24].

2.3.1 Tannins

A small quantity of each extract was heated on water bath and filtered. A few drops of ferric chloride was added to the filtrate. A dark green solution indicated the presence of tannins.

2.3.2 Saponins

Small amount of filtered plant extract was shaken and heated to boil. Frothing (appearance of creamy mass of small bubbles) shows the presence of saponins.

2.3.3 Phlobatanins

Small amount of filtered extract was boiled with 2% HCl solution. Red precipitate shows the presence of phlobatanins.

2.3.4. Flavonoids

Filtered extract of each plant was mixed with diluted NaOH and HCl was added. A yellow solution that turns colorless indicates the presence of flavonoids.

2.3.5. Terpenoids

Small amount of each extract was filtered and mixed with 2 ml of chloroform (CHCl₃) and concentrated H₂SO₄ (3 ml) was carefully added to form a layer. A reddish brown coloration of the interface was formed to indicate positive results for the presence of terpenoids.

2.3.6. Cardiac glycosides

Small amount of each extract was filtered and shaken with 1ml of glacial acetic acid. A drop of ferric chloride and a drop of concentrated sulfuric acid was added. Green blue color to upper layer and reddish brown color at the junction of two layers indicates the presence of cardiac glycosides.

2.3.7. Alkaloids

Small amount of the extracts was filtered and warmed with 2% H₂SO₄ for two minutes. It was filtered and few drops of Dragendoff reagent were added. Orange red precipitate indicated the presence of alkaloids.

2.4. Antibacterial screening

2.4.1 Test Organisms

Two Gram positive strains (Staphylococcus epidermidis, Staphylococcus saprophyticus) and three Gram negative bacterial strains (Proteus vulgaris, Eschericia coli, Citrobactor freundii) from standard cultures were used as test strains. Standard bacterial strains were procured from Microbiology Medical Laboratory, Central Hospital, Al-Khoms, Libya.

2.4.2 Determination of Antibacterial activity by disc diffusion method:

Ethanolic leaves extracts of both plants were investigated for antibacterial activity against two Gram positive bacterial strains and three Gram negative bacterial strains by the paper disc diffusion method [25]. From the 50 mg/ml stock solution of ethanolic extracts of both plants, 40 μl aliquots were transferred onto blank sterile paper discs (6 mm diameter). Dried discs were placed onto nutrient agar medium (UK) previously inoculated with a bacterial suspension and incubated at 37°C for 24 h. Ethanol solvent was used as control to determine the sensitivity of the tested strains. After incubation, plates were examined for the presence of zones of growth inhibition, and the diameters of these zones were measured in mm. Tests were performed in duplicate under sterile conditions.

3. Results

3.1. Phytochemicals screening:

Table 1 shows the results of phytochemicals screening of aqueous and ethanolic leaves extracts of *Olea europaea* and *Polygonum maritimum* plants. *Olea europaea* leaves extracts revealed the presence of tannins, saponins, phlobatanins, flavonoids, terpenoids and cardiac glycosides, however, *Polygonum maritimum* leaves extracts revealed the presence of tannins, saponins flavonoids, terpenoids and cardiac glycosides.

<table>
<thead>
<tr>
<th>Phytochemical Component</th>
<th>Olea europaea</th>
<th>Polygonum maritimum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ag. ext</td>
<td>eth. ext</td>
</tr>
<tr>
<td>Tannins</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phlobatanins</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cardiac glycosides</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Key: + = present; - = absent

3.2. Antibacterial activity

Table 2 shows the results of antibacterial activity of both of plants leaves ethanolic extracts. The ethanolic extract of *Olea europaea* exhibited antibacterial activity against a Gram positive bacterial strains (*S. Epidermidis*) among the two tested Gram positive bacterial strains and a Gram negative bacterial strain (*Citrobactor freundii*) among the three tested Gram negative bacterial strains, while the ethanolic extract of *Polygonum maritimum* revealed antibacterial activity against both tested Gram positive bacterial strains (*S. epidermidis*).
S. saprophyticus) and a Gram negative strain Proteus vulgaris among the three tested Gram negative bacterial strains. Olea europaea and Polygonum maritimum plants exhibited maximum antibacterial activity against Gram negative bacteria Citrobacter freundii (zone of inhibition: 9 mm) and Proteus vulgaris (zone of inhibition: 10 mm), respectively.

Table 2: Antibacterial activity of leaves of ethanolic extracts (50 mg/ml) of Olea europaea and Polygonum maritimum:

<table>
<thead>
<tr>
<th>Bacterial strains</th>
<th>O. europaea (Zone of inhibition)</th>
<th>P. maritimum (Zone of inhibition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. saprophyticus</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Proteus vulgaris</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Citrobacter freundii</td>
<td>9</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: Discs injected with 40 μl of ethanol solvent served as controls against each bacterial strain and showed nil zone of inhibition.

4. Discussion

The results of the screened phytochemicals (tannins, saponins, phlobatanins, flavonoids, terpenoids, cardiac glycosides, and alkaloids) of aqueous and ethanolic extracts of both the plants showed the common presence of tannins, saponins, flavonoids, terpenoids, and cardiac glycosides. However, phlobatanins was present in ethanolic extract of Olea europaea but not in Polygonum maritimum. Further, ethanol extraction is widely used to obtain crude extracts of phytochemicals from plant materials in the herbal medicine industry for therapeutic applications and most of the previous studies have indicated that ethanolic extracts of the plants leaves contains more biological activity and showed richer in phytochemicals than the aqueous and other organic solvents extracts of other parts of the plants. Therefore, ethanolic leaves extract of the plants was chosen for the preliminary investigation of both the plants for antibacterial activity. Previous some reports have indicated that the aqueous and alcoholic extract of Olea europaea and Polygonum maritimum are found to have remarkable biological and therapeutic effects including antibacterial action [10], [19], [21-22]. The results on both of the studied plants of Libyan origin lacking in previous reports prompted us for the present study. The results of antibacterial activities of both of the plants leaves ethanolic extracts have shown good antibacterial effects against standard strains of Gram positive and Gram negative bacterial strains. Zone of inhibition produced by the extracts (50 mg/ml) in paper disc diffusion method against the susceptible bacteria ranged from 8 to 10 mm diameter. It was interesting to note that Proteus vulgaris (Gram negative bacterial strain) indicated maximum sensitivity to the investigated plants leaves extracts of Polygonum maritimum. Results have shown that the anti-bacterial activities of Olea europaee and Polygonum maritimum are not comply well with the previous reports [21] [22]. This may be due to the effect of the regional variation of environment and soil composition in different places. The extracts contain many phytochemicals substances including flavonoids. Antibacterial activity shown by both of these plants are assumed to be due to the presence of flavonoids content due to its ability to form complex with extracellular and soluble proteins and to complex with bacterial cell walls. Lipophilic flavonoids may also disrupts bacterial membranes. However, search of exact phytochemical as antibacterial agent from both of these plants extracts warrants further detailed study involving the isolation, purification and antibacterial screening of different constituents of both of the plants to find out the bio-active ingredient(s).

5. Conclusion

The present study revealed antibacterial activity of ethanolic leaves extracts of Olea europaea and Polygonum maritimum of Libyan origin. Aqueous and ethanolic leaves extracts of both these plants showed the presence of tannins, saponins, flavonoids, terpenoids and cardiac glycosides phytochemicals. The phytochemical constituents present in the plant may be responsible to exert such medicinal properties. Future study that involves the isolation and purification of the bioactive compound that may help to investigate the bio-active ingredient(s) of both the plant’s leaves extracts.

6. Acknowledgement

The authors are grateful to the authorities of Faculty of Sciences, Al-khums, Al-mergheb University, Libya for their technical support, and providing the necessary laboratory facilities.

References


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