Phytochemical analysis and antimicrobial activity of stem, leaves and aerial roots of *Epipremnum aureum*: An indoor air pollution removing plant

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ABSTRACT

*Epipremnum aureum* belonging to the family Araceae is commonly known as money plant. The aim of the present study was to investigate the presence of various phytochemical constituents which is responsible for the medicinal properties in aerial parts of the plant. The aerial parts such as leaves, stem and aerial roots were used and successively extracted in three different solvents viz. methanol, ethanol and acetone. The crude extracts of the aerial parts in three solvents were also used for determining antimicrobial activity. Preliminary qualitative phytochemical test for different extract shows the presence of alkaloids, saponins, carbohydrate, glycosides, amino acids and phenol. Among the three extracts methanol extract shows presence of all phytochemicals and shows antimicrobial activity against *E.coli*, *S.aureus*, *B.subtilis* and *P.aeurginosa*. Ethanol and acetone extract of aerial roots shows 12-13 mm zone of inhibition for *E.coli*. Thus the positive results suggest that *Epipremnum aureum* extracts should be further studied to determine the bioactive chemical compounds as well as to understand the possible mechanism of action and evaluate their toxicity looking towards pharmaceutical actions.

Key words: *Epipremnum aureum*, Phytochemical, Antimicrobial activity, *S. aureus*, Zone of inhibition

Introduction

The plant *Epipremnum aureum* is a climbing evergreen shrub which has variegated leaves and aerial roots. Many species of this plant are cultivated for its beautiful leaves as decorative plants and other for its nutritive value. (Meshram and Srivastava 2015). The plant has been reported to have medicinal properties as well as have indoor air pollution removing capacity (Panchal et al., 2021). The plant is known for
its capacity for removing indoor pollutants such as xylene, formaldehyde and Benzene (Srivastava et al., 2011; Arulpriya and Lalitha, 2012; Mehta et al., 2013; Das et al., 2015, Otto and Mustapich, 2017). The effective identification of phytoconstituents play an important role in determining the therapeutic activity (Das et al., 2015)

_E. aureum_ also used as a pollution controlling plant. It absorbs the volatile compounds which are emitted by photocopier (Roiet and Chaikasem, 2021). The plants that are showing medicinal properties are useful for healing and curing of various human diseases due to the presence of plant secondary metabolites. These metabolites are naturally occurring compounds in different parts of plants like leaves, root, bark, seed, fruit and stem and these are also the end products of primary metabolites such as carbohydrates, lipids, proteins etc. _Epipremnum aureum_ plant is common indoor plant and also having different secondary metabolites such as Alkaloids, Flavonoids, Tannins, Reducing sugars and phenols etc. (Das et al., 2015). The plant has significant activity against pathogenic bacteria such as _E. coli, B. subtilis, S. aureus_ etc. This may be due to presence of flavonoids, alkaloids, glycosides etc. (Saswati et al., 2013). The present study was focused on the qualitative screening of leaves, stem and aerial roots of _Epipremnum aureum_ in methanolic, ethanolic and acetonc solvent.

Materials and Methods

**Collection of Plant Material:** The fresh leaves, stem and aerial roots of _Epipremnum aureum_ were collected from the University campus Maharishi Markandeswar (Deemed to be University), Mullana, Ambala, Haryana, India.

**Preparation of the Plant Extract**

The fresh leaves, stems and aerial roots were washed with tap water and air dried. The air dried plant parts were ground into powder form for phytochemical analysis. For further use powder was stored in airtight bottle (Kifayatulla, 2015).

The powdered plant parts were subjected to successive extraction with solvent such as methanol, ethanol and acetone. Two gram plant powder material was taken and dissolved in 20 ml of solvent (methanol, ethanol and acetone) in the conical flask. The conical flask were covered with the help of aluminium foil and then put on the shaker for 24 hours so all phytochemicals are dissolve gradually (Mehta et al., 2013). After shaking the material was centrifuged at 5000 rpm for 5 min. The crude extract in the form of supernatant was collected in separate flask. Qualitative analysis of secondary metabolites was carried out through standard test procedures.

**Preparation of plant extract for antimicrobial activity**

The supernatant collected after centrifugation were collected in different beakers. The solvent were evaporated at 50-60 °C. The dried extract was weighed and 1 ml DMSO was added in beaker and extract was collected in vials.

**Antimicrobial activity**

The plant extracts were analysed for antimicrobial activity against pathogenic strain such as _Escherichia coli, Staphylococcus aureus, Bacillus subtilis_ and _Pseudomonas aeruginosa_. Antimicrobial activity was carried out by agar well diffusion method.

**Phytochemical Screening**

The crude extract of different plant part was analysed for the presence of different photochemicals. (Kiran et al., 2012)

**Test for alkaloids**

One ml of plant extract was taken in test tube and few drops of mayer’s reagent were added from the side of the test tube followed by adding few drops of iodine solution. Formation of cremish yellow coloured precipitate shows the presence of alkaloids.

**Test for Glycosides**

Killer Killani test: 1 ml of plant extract was taken in test tube and add equal amount of killer killani reagent. Few drops of conc. Sulphuric acid were added. Yellow colour solution shows the presence of glycosides.

**Test for tannins**

1 ml of plant extract was taken in test tube and add 3-4 drops of lead acetate. Formation of yellow precipitate showed the presence of tannins. (Meshram and Shrivastav, 2016)

**Test for Saponins**

Foams test: 1 ml of extract was boiled directly with addition of 2 ml of distilled water and shake for 30
sec. Formation of froath shows the presence of saponins.

**Test for Flavonoids**

1 ml of plant extract was added with 4-5 drops of 5% flavonoid reagent through the wall of test tube. Generation of yellow colour showed the presence of flavonoids.

**Test for Terpenoids**

1 ml of plant extract was taken and 3-4 drops of chloroform and equal volume of con. Sulphuric acid was added by the wall of test tube. Formation of reddish brown colour shows presence of Terpenoids.

**Test for Phenol**

In 1 ml of test solution add 3-4 drops of ferric chloride solution. Formation of bluish green and black colour shows the presence of phenol.

**Test for Amino acid**

In 1 ml of plant extract add 3-4 drops of ninhydrin reagent. Development of purple colour shows the presence of amino acid. (JP, 2017)

**Test for carbohydrates**

Take 1 ml of test solution and add 1ml of Barfoed reagent. Heat on water bath for 1 minute. Formation of brown coloured precipitate shows the presence of carbohydrates (Arulpriya and Lalitha, 2012).

**Results and Discussion**

The results demonstrate the presence of secondary metabolites which are useful in medicinal and in physiological activities shown in Table 1. As per results of qualitative analysis of leaves, stem and aerial roots; extract of methanol showed the presence of Alkaloids, carbohydrate, glycosides, amino acid, phenol and saponins (Das et al., 2015; Lalitha et al., 2010). Extract of acetone and ethanold shows presence of alkaloids and saponin (Table 1).

The plant extract shows the presence of different types of phytoconstituents which were used for antibacterial assay against some pathogenic organisms. Methanolic extract of aerial roots shows maximum inhibitory action against S. aureus and B. subtilis with a zone of inhibition 15 and 14 mm (Table 2). Acetone extract of aerial roots shows inhibitory action towards E. coli with a zone of 13 mm. Antimicrobial activity of the extracts were also screened taking chloramphenicol as control. Antibiotic disc of chloramphenicol shows a zone of inhibition of 15 and 22 mm against E. coli and S. aureus respectively. Methanolic extract of aerial roots shows zone of inhibition of 10 and 15 mm for the same organisms. Leaf extract in methanol shows maximum zone of inhibition of 14 mm against P. aeruginosa. Acetone extract of stem and aerial roots shows 12-13 mm zone of inhibition against E. coli and S. aureus (Table 2, Fig.1).

Different plant parts shows various antimicro-

| Table 1. Phytochemical constituents present in different extract of Epipremnum aureus |
|----------------|----------------|----------------|----------------|----------------|
| Name of Test   | Ethanol Extract | Methanol Extract | Acetone extract |
|                | Leaves | Stem | Aerial Root | Leaves | Stem | Aerial roots | Leaves | Stem | Aerial Roots |
| Alkaloid       | +      | +    | +           | +      | +    | +            | +      | +    | +             |
| Carbohydrate   | -      | -    | -           | +      | +    | +            | -      | -    | -             |
| Glycosides     | -      | -    | -           | +      | +    | +            | -      | -    | -             |
| Amino Acid     | -      | -    | -           | +      | +    | +            | -      | -    | -             |
| Phenol         | +      | +    | +           | +      | +    | +            | +      | +    | +             |
| Saponin        | +      | +    | +           | +      | +    | +            | +      | +    | +             |

| Table 2. Antimicrobial activity of methanolic, ethanolic and acetone extract of Epipremnum aureum |
|----------------|----------------|----------------|----------------|----------------|
| Test Organism  | Methanol (zone of Inhibition in mm) | Ethanol (Zone of Inhibition in mm) | Acetone (Zone of Inhibition in mm) |
|                | Leaves | Stem | Aerial roots | Leaves | Stem | Aerial roots | Leaves | Stem | Aerial roots |
| E.coli         | 12     | 10   | 10           | -      | -    | 12          | 12     | 12   | 13           |
| S. aureus      | 13     | 10   | 15           | -      | 13   | 12          | -      | 12   | 12           |
| B.subtilis     | 13     | 10   | 14           | 11     | -    | 12          | 12     | 13   | 10           |
| P. aeruginosa  | 14     | 12   | 10           | 12     | 10   | 10          | 10     | 13   | 10           |
and also has indoor air pollution removing capacity with various secondary metabolites such as alkaloids, flavonoids, reducing sugars, tannins, phenols etc. Due to presence of various secondary metabolites \textit{E. aureum} have various medicinal properties. The study confirms that aerial roots of this ornamental plant have strong antimicrobial activity against opportunistic pathogens \textit{S. aureus}, \textit{E. coli} and \textit{P. aeuroginosa}. methanolic extract shows presence of more phytoconstituents as well as antimicrobial activity in comparison to ethanol and acetone extract.

Table 3. Selected extracts of \textit{Epipremnum aureum} showing maximum antibacterial activity with chloramphenicol as control

<table>
<thead>
<tr>
<th>Extract</th>
<th>Zone of Inhibition of test organism (in mm)</th>
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<tbody>
<tr>
<td></td>
<td>\textit{E. coli}</td>
</tr>
<tr>
<td>Methanol leaf</td>
<td>12</td>
</tr>
<tr>
<td>Methanol Stem</td>
<td>10</td>
</tr>
<tr>
<td>Methanol aerial roots</td>
<td>10</td>
</tr>
<tr>
<td>Ethanol aerial roots</td>
<td>12</td>
</tr>
<tr>
<td>Acetone aerial roots</td>
<td>13</td>
</tr>
<tr>
<td>Acetone Stem</td>
<td>12</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>15</td>
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</tbody>
</table>

Fig. 1. Zone of Inhibition of Selected extracts of \textit{Epipremnum aureum}

\textbf{Conclusion}

\textit{Epipremnum aureum} is an indoor ornamental plant and also has indoor air pollution removing capacity with various secondary metabolites such as alkaloids, flavonoids, reducing sugars, tannins, phenols etc. Due to presence of various secondary metabolites \textit{E. aureum} have various medicinal properties. The study confirms that aerial roots of this ornamental plant have strong antimicrobial activity against opportunistic pathogens \textit{S. aureus}, \textit{E. coli} and \textit{P. aeuroginosa}. methanolic extract shows presence of more phytoconstituents as well as antimicrobial activity in comparison to ethanol and acetone extract.

\textbf{References}


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