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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 flavanoids, 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 acetonic 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 Markandeshwar (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 grinded 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 ^{o}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 *Escehrachia coli, Staphylococcus aureus, Bacillus subtilis and Pseudomonas aeuroginosa*. 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. Formtion 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 conc. Sulphuric acid was added by the wall of tast 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 I 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 etanol 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 chloremphenicol as control. Antibiotic disc of chloremphenicol 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. aeuroginosa.* 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. aeuroginosa	14	12	10	12	10	10	10	13	10

Table 3. Selected extracts of *Epipremnum aureum* showing maximum antibacterial activity with chloremphenicol as control

Extract	Zone of Inhibition of test organism (in mm)			
	E. coli	*S. aureus*	*B. subtilis*	*P. aeuroginosa*
Methanol leaf	12	13	13	14
Methanol Stem	10	10	10	12
Methanol aerial roots	10	15	14	10
Ethanol aerial roots	12	12	12	10
Acetone aerial roots	13	12	10	10
Acetone Stem	12	12	13	13
Chloramphenicol	15	22	22	20

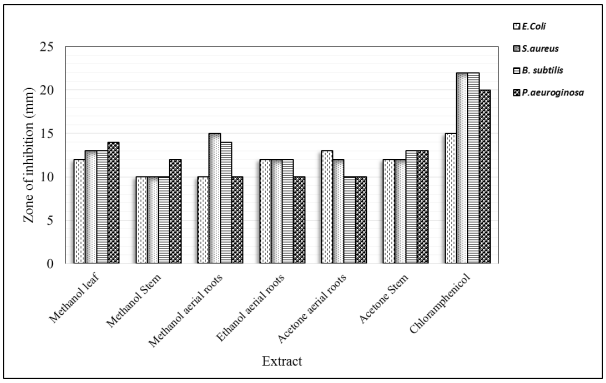

Fig. 1. Zone of Inhibition of Selected extracts of *Epipremnum aureum*

bial activity depending on the extractors. Comparing activities of plant parts extracted with methanol shows maximum antimicrobial activity by root extract followed by leaves and stem. Methanol activated the exudation of the antimicrobial material from all plant parts so leads to more inhibition Mehta *et al.* (2013) reported antimicrobial activity of *E. aureum* leaves extract in methanol against *S.aureus*, *P. aeurogenosa*, *S. typhi* and *S. Paratyphi*. Study by Srivastava *et al.,* 2011 shows antimicrobial activity of aerial roots and leaves of *E. aureum*. Meshram and Srivastava (2015) shows that each part of the plant have antibacterial, antitermite and antioxidant properties in acetone extract. Sonawane *et al.* (2011) found aqueous extract of leaves exhibit significant antimicrobial activity against *E. coli*, *S. aureus* and *C. albicans*. Chloroform extract of leaves shows antitermite activity (Meshram *et al.,* 2021).

Conclusion

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 *E.aureum* have various medicinal properties. The study confirms that aerial roots of this ornamental plant have strong antimicrobial activity against opportunistic pathogens *S. aureus*, *E. coli* and *P. aeuroginosa*. methanolic extract shows presence of more phytoconstituents as well as antimicrobial activity in comparison to ethanol and acetone extract.

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