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Phytochemical profile and antimicrobial potential of leaf and floral extracts of *Antigonon leptopus*, *Bauhinia purpurea* and *Spathodea campanulata*

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Abstract

Plants are the primary source of chemicals that are useful to mankind for their variety of medicinal and pharmacological activities. Phytochemical studies on the leaf &floral extracts of *Antigonon leptopus* Hook. & Arn., *Bauhinia purpurea* L., and *Spathodea campanulata* P.Beauv are tested for their phytochemical compounds and antimicrobial activity. Both leaf and floral extracts are collected by using solvents acetone, methanol and chloroform. Among the three plants selected *Bauhinia purpurea* exhibited good phytochemicals and highest antimicrobial potential in both leaf and floral sample extracts tested followed by *Antigonon leptopus* with moderate activity, and *Spathodea campanulata* exhibited poor antimicrobial activity. The present paper reveals the phytochemical constituents and their antimicrobial activity against the test pathogens.

Introduction

Plants have been using for various treatments in curing animals and humans since ages. They are a rich source of phytochemicals that show a variety of effects on living beings. These phytochemicals are responsible for biologically active functions and medicinal properties(Dubey et al., 2011). Different parts of the plant's consist of a diverse chemical compound with great significance. Plants hold diverse secondary metabolites like saponins, flavonoids, steroids, tannins, alkaloids, phenols, glycosides, and terpenes that are used to combat the disease-causing pathogens (Kamal and Amir 2010, Cowan.,1999) Plants produce these compounds as a secondary metabolite that helps them in adverse situations. Bioactive compounds from several parts are screened as natural antioxidants that helps in preventing the oxidation of free radicals, thereby decreasing the effect of diseases and lowers the risk of infections from causative organisms. They act as natural substances that delay or inhibit the oxidation of these free radicals and maintain balance in living systems by preventing cell and tissue damage.

Antigonon leptopus Hook. & Arn., belongs to the family Polygonaceae. It is native to Mexico and an invasive alien species that has naturalized in India. It commonly grows on roadsides and barren lands as a climber with pink coloured inflorescences. It is used traditionally for treating various ailments by different tribal communities. Various parts such as roots, stem, leaves and seeds are used worldwide by traditional practitioners.

*Bauhinia purpurea*L. belongs to the family Fabaceae. It is native to India and is widely used for medicinal applications. The

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flowers are purple and show good aesthetic appearance and also acts as a honey source for many insects. It is a most important species used to treat several ailments in traditional system of medicine.

Spathodea campanulata P. Beauv is commonly called as African tulip that belongs to the family Bignoniaceae. It is native to African sub-continent and spread across Asia and America. In India it is naturally growing well in wild as a large and used in traditional system for treatment of malaria, diabetes, stomach ulcers, wounds, skin infections and viral diseases.

The present study exposes the phytochemicals, and their anti-microbial effects of the plant extracts from leaf and flower of *Antigonon leptopus*, *Bauhinia purpurea* and Spathodea *campanulata*.

Materials and methods

Collection and authentication of plant material

All the selected plants *Antigonon leptopus*, *Bauhinia purpurea*, *Spathodea campanulata,* arecollected, dried and preserved as herbarium and authenticated for confirmation of the species at Department of Botany, Andhra University. Later the leaves and flowers of the above plants are taken from the Andhra University Botanical Garden and Andhra University campus of Visakhapatnam, Andhra Pradesh. The materials collected are rinsed with tap water and later with distilled water to take away the dust and dirt from them. The materials are spread in shade to allow drying at room temperature. After drying the dried plant materials are powdered and stored in poly bags.

Soxhlet Extraction

Plant materials are subjected for Soxhlet extraction by taking about 50 grams of powder and 300 ml of solvents in order of polarity. Two solvents methanol, acetone and chloroform are taken for crude extraction by running the Soxhlet for about 12 to 18 hours and crude extracts of dried leaves and flowers are prepared. The collected extracts are taken for qualitative phytochemical screening.

Qualitative phytochemical screening

The plant samples of both flowers and leaf extracts obtained are tested for phytochemicals. Different phytochemical tests were performed for the presence of compounds such as alkaloids, carbohydrates, coumarins, flavonoids, glycosides, phenol, protein, saponins, tannins, quinone, steroids, and terpenoids using the method described by Schmeller and Wink (1998). Crude extract is dried and about 10 mg is dissolved in distilled water to prepare a stock solution. The chemical tests for various secondary metabolites are performed for their identification of their chemical profile.

Antimicrobial activity

Antimicrobial potential of the collected samples from all the selected plants were tested for their effect on different bacteria (both positive and negative strain) and fungi (filamentous and non-filamentous).

Preparation of test organisms

The preparation of the selected bacteria was tested at Department of Botany, Andhra University, Visakhapatnam. The preparation of active culture is extracted from the pure cultures obtained from Microbial type culture collection and gene bank (MTCC) Chandigarh. The test organism was activated by inoculating the sample isolated from pure culture into the test-tube containing potato dextrose media and allowed them to grow for 5 days at room temperature (28°C). Each organism was tested in triplicates and the results are recorded.

Agar well diffusion method

Agar well diffusion method is a technique used to assess the antimicrobial potential of plant extracts and antibiotics against microorganisms. The different solvent extract samples were tested for their possible antimicrobial activity against the test pathogens. Nutrient agar is used as medium for bacteria for growth and potato dextrose agar is used for fungi as the growth medium. The agar plate surface is inoculated by spreading a volume of the microbial

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inoculum over the entire agar surface using a L-shaped bend rod. Then, a hole with a diameter of 6 mm is punched aseptically with a sterile cork borer or a pipette tip, and a volume (20 µL) of plant extract solution at desired concentration i.e.25 µg/ml, 50 µg/ml, 100 µg/ml were taken and introduced into the well (Olurinola, P.F. 1996). Streptomycin is used as a standard antibiotic against the bacterial pathogens and fungal test organisms are given with fluconazole as positive standard control. DMSO (dimethyl sulfoxide) is used as a negative control. The inoculated plates are kept at room temperature (35^0C) in an incubator for about 20 hours to observe the growth on the culture plates and the results are recorded (Jorgensen et al., 2007). The plant extracts are tested for their efficiency in inhibiting the growth of the test organisms are reported.

The test organisms in bacteria are gram positive (*Bacillus subtilis, Staphylococcus aureus) and* gram-negative (*Streptococcus mutans, Pseudomonas aeruginosa*). The fungal test organisms are filamentous fungi *Candida albicans* and non-filamentous fungi *Aspergillus flavus*. All the test organisms are prepared at Department of Botany, Andhra University, Visakhapatnam.

Results and discussion

Phytochemical results

The extracts obtained by various solvent samples are subjected for preliminary phytochemical analysis and the results are tabulated.

Table 1. Preliminary Phytochemical Results of *Antigonon leptopus*

S. No	Compound	Acetone Leaf	Methanol Leaf	Chloroform Leaf	Acetone Flower	Methanol Flower	Chloroform Flower
1	Alkaloid	**++**	**+++**	**+**	**++**	**++**	**++**
2	Steroids	**+**	**-**	**+**	**+**	**+**	**+**
3	Phenols	**+**	**++**	**+**	**+**	**+**	**+**
4	Tannins	**+**	**+**	**+**	**+**	**+**	**+**
5	Saponin	**-**	**-**	**+**	**-**	**-**	**-**
6	Terpenoids	**+**	**++**	**++**	**+**	**+**	**+**
7	Flavonoids	**++**	**+**	**++**	**+**	**+**	**+**
8	Triterpenoids	**++**	**+++**	**+**	**+**	**+**	**+**
9	Glycosides	**+**	**+**	**+**	**+**	**+**	**+**
10	Proteins	**-**	**-**	**-**	**-**	**-**	**-**
11	Carbohydrates	**+**	**+**	**+**	**+**	**+**	**+**

+: present ++: Moderately present. +++: Highly present - : Absent.

The results of samples tested in *Antigonon leptopus* are presented in Table 1. *Antigonon leptopus*shows rich alkaloids in both floral and leaf extracts obtained from different solvents. Triterpenoids are also seen in all the samples. Flavonoids, tannins, phenols, glycosides, carbohydrates, steroids are seen all the three solvent samples of both floral and leaf extracts. Saponins and proteins are completely absent in all the samples.

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Table 2. Preliminary Phytochemical results of *Bauhinia purpurea*

S. No	Compound	Acetone Leaf	Methanol Leaf	Chloroform Leaf	Acetone Flower	Methanol Flower	Chloroform Flower
1	Alkaloid	**+**	**+**	**+**	**+**	**+**	**+**
2	Steroids	**+**	**++**	**+**	**+**	**+**	**+**
3	Phenols	**+**	**++**	**+**	**+**	**+**	**+**
4	Tannins	**+**	**+**	**+**	**+**	**+**	**+**
5	Saponin	**++**	**++**	**+**	**++**	**+**	**++**
6	Terpenoids	**+**	**++**	**++**	**+**	**+**	**+**
7	Flavonoids	**++**	**+**	**++**	**+**	**+**	**+**
8	Triterpenoids	**++**	**+**	**+**	**+**	**+**	**+**
9	Glycosides	**-**	**-**	**-**	**-**	**-**	**-**
10	Proteins	**++**	**+**	**++**	**++**	**++**	**++**
11	Carbohydrates	**+**	**+**	**+**	**+**	**+**	**+**

+: present. ++: Moderately present. +++: Highly present -: Absent.

The results obtained from samples of *Bauhinia purpurea* are placed in Table 2. *Bauhinia purpurea* shows considerable amount of all the phytochemicals. Alkaloids, steroids phenols, tannins, saponins, flavonoids, proteins and carbohydrates are tested positive in all the three samples of both floral and leaf extracts. Glycosides are completely absent in all samples.

Table 3. Preliminary Phytochemical Results of *Spathodea campanulata*

S. No	Compound	Acetone Leaf	Methanol Leaf	Chloroform Leaf	Acetone Flower	Methanol Flower	Chloroform Flower
1	Alkaloid	**+**	**+**	**+**	**++**	**++**	**++**
2	Steroids	**+**	**+**	**+**	**+**	**+**	**+**
3	Phenols	**+**	**+**	**+**	**-**	**-**	**-**
4	Tannins	**+**	**+**	**+**	**-**	**-**	**-**
5	Saponin	**+**	**+**	**+**	**-**	**-**	**-**
6	Terpenoids	**+**	**+**	**+**	**+**	**+**	**+**
7	Flavonoids	**-**	**-**	**+**	**-**	**-**	**-**
8	Triterpenoids	++	+	+	+	+	+
9	Glycosides	-	-	-	-	-	-
10	Proteins	+	+	+	-	-	-
11	Carbohydrates	+	+	+	-	-	-

+: present. ++: Moderately present. +++: Highly present. -: Absent.

The sample results of *Spathodea campanulata* are tabulated in Table 3. Alkaloids, steroids, terpenoids and triterpenoids are seen in all the samples obtained from both floral and leaf powders. Phenols, tannins, saponins, proteins and carbohydrates are seen in all the leaf samples, but they are absent in all the floral samples. Flavonoids are only observed in chloroform leaf sample.

Antimicrobial activity

The leaf and floral extracts obtained are subjected for screening of antimicrobial activity against various pathogens at different concentrations (µ/ml). The results obtained by zones of inhibition against the pathogen are recorded and tabulated with perfect measurements (Deepika et al., 2023). The results are tabulated and classified into high activity and low activity based up on the inhibitory effects observed by different solvent sample obtained from three selected plants i.e.*Antigonon leptopus*, *Bauhinia purpurea, Spathodea campanulata.* The extracts are obtained by the solvent's acetone, methanol and chloroform. The results are tabulated below.

Table 4. Antimicrobial activity of leaf samples of *Antigonon leptopus*

S. No	Pathogen	Concentration (µ/ml)	Acetone Leaf	Methanol Leaf	Chloroform Leaf
1	*Bacillus subtilis (MTCC-441)*	25 µg/ml	7.21	7.56	6.14
		50 µg/ml	6.88	7.44	7.11
		100 µg/ml	6.76	7.24	7.87
2	*Staphylococcus aureus (MTCC-737)*	25 µg/ml	6.54	7.21	6.68
		50 µg/ml	7.29	7.54	7.22
		100 µg/ml	7.22	7.38	7.43
3	*Streptococcus mutans (MTCC-497)*	25 µg/ml	5.24	5.73	6.22
		50 µg/ml	5.86	5.72	6.14
		100 µg/ml	6.28	5.80	6.48
4	*Pseudomonas aeruginosa (MTCC-2297)*	25 µg/ml	7.25	7.36	6.52
		50 µg/ml	7.57	7.61	7.10
		100 µg/ml	8.32	7.84	7.27
5	*Aspergillus flavus (MTCC-873)*	25 µg/ml	-	-	-
		50 µg/ml	-	-	7.21
		100 µg/ml	-	-	8.22
6	*Candida albicans (MTCC- 317)*	25 µg/ml	-	-	9.23
		50 µg/ml	-	8.24	12.57
		100 µg/ml	-	8.63	13.21

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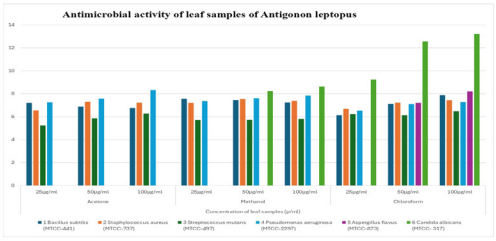

Figure 1. Graph showing antimicrobial activity of leaf samples of *Antigonon leptopus*

The antimicrobial results of the *Antigonon leptopus* leaf extracts are placed in table 4. *Bacillus subtilis* showed maximum inhibition at 100 µg/ml concentration for chloroform extract (7.87mm) and 6.76 mm, 7.24 mm, for acetone and methanol extracts. There is no high variation in the zone of inhibition observed in other concentrations and other solvent samples. There is no increase in inhibitory activity even the concentration is increased further. *Staphylococcus aureus* showed maximum inhibitory activity at chloroform extract at 100 µg/ml concentration and later followed by 7.38mm and 7.22 mm inhibitory zones for methanol and acetone extracts. *Streptococcus mutans* showed a medium inhibition at all concentrations with 6.28mm, 5.80mm, and 6.48mm at 100 µg/ml concentration for acetone, methanol, and chloroform extracts *Pseudomonas aeruginosa* showed maximum inhibitory zones at 100 µg/ml concentration for acetone extract and is the highest inhibition in bacterial test organisms studied.

Chloroform leaf extract showed highest inhibition for *Candida albicans* at all the three concentrations with an inhibition activity of 9.23 mm, 12.57 mm, 13.21 mm, for chloroform extract and the inhibition increased with the increase in concentration of the extract. The zone of 8.24mm, 8.63mm at 50 µg/ml and 100 µg/ml for methanol extract is reported. *Aspergillus flavus* doesn't show any inhibition for all the solvent extracts.

Table 5. Antimicrobial activity of floral samples of *Antigonon leptopus*

S. No	Pathogen	Concentration (µ/ml)	Acetone Flower	Methanol Flower	Chloroform Flower
1	*Bacillus subtilis* (MTCC-441)	25 µg/ml	11.24	11.56	12.37
		50 µg/ml	12.84	12.21	12.54
		100 µg/ml	12.56	12.69	13.27
2	*Staphylococcus aureus* (MTCC-737)	25 µg/ml	8.74	9.62	9.66
		50 µg/ml	9.35	10.12	10.25
		100 µg/ml	10.43	10.24	10.87
3	*Streptococcus mutans* (MTCC-497)	25 µg/ml	13.24	13.56	14.21
		50 µg/ml	13.56	13.73	15.24
		100 µg/ml	14.37	14.02	15.30
4	*Pseudomonas aeruginosa* (MTCC-2297)	25 µg/ml	7.84	7.95	7.25
		50 µg/ml	8.32	8.37	7.81
		100 µg/ml	8.56	9.21	7.53
5	*Aspergillus flavus* (MTCC-873)	25 µg/ml	-	-	-
		50 µg/ml	-	-	-
		100 µg/ml	10.63	11.24	11.87
6	*Candida albicans* (MTCC- 317)	25 µg/ml	-	-	9.76
		50 µg/ml	10.24	10.18	11.23
		100 µg/ml	10.08	11.22	12.51

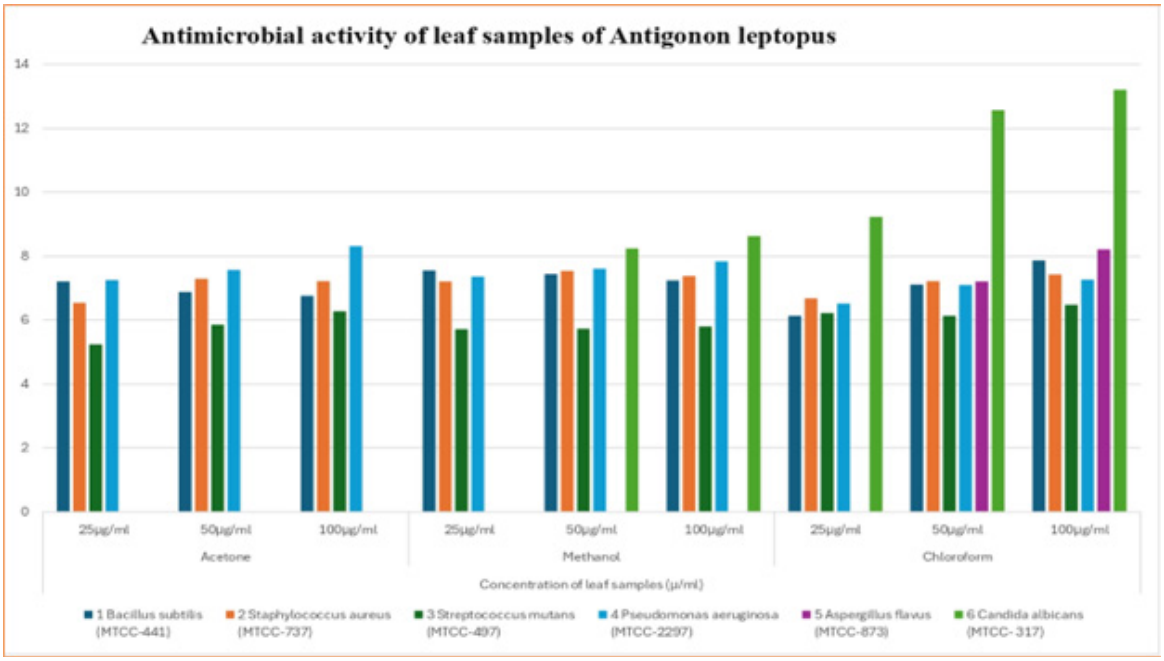

Figure 2. Graph showing antimicrobial activity of floral samples of *Antigonon leptopus*

The antimicrobial results of the *Antigonon leptopus* flower extracts are placed in table 5. *Streptococcus mutans* expressed highest zone of inhibition among all the extracts at 100 µg/ml concentration with 15.30mm, 14.37mm, 14.02mm by chloroform, acetone and methanol extracts. *Bacillus subtilis* responded maximum at 100 µg/ml in chloroform extract by creating a zone of 13.27mm and followed approximately by 12.69 and 12.56 by the methanol and acetone extracts almost in all the concentrations. Staphylococcus showed moderate inhibition by 10.87mm, 10.43mm, 10.24mm by chloroform, acetone and methanol extracts. *Pseudomonas aeruginosa* expressed minimum among the bacterial test organisms with 9.21mm, 8.56mm,7.53 mm, at 100 µg/ml concentration.

Candida albicans showed maximum zone of inhibition for chloroform extract at 100 µg/ml concentration with 12.51mm, followed by 11.22mm, 10.08mm, in methanol and acetone extracts. Aspergillus flavus expressed moderate zones in 100 µg/ml concentration with 11.87mm, 11.2mm,10.63mm, by chloroform, methanol and acetone extracts and no zone of inhibition at 25 µg/ml and 50 µg/ml were reported for all the three floral extracts.

Table 6. Antimicrobial activity of leaf samples of *Bauhinia purpurea*

S. No	Pathogen	Concentration (µ/ml)	Acetone Flower	Methanol Flower	Chloroform Flower
1	*Bacillus subtilis (MTCC-441)*	25 µg/ml	11.52	10.22	11.72
		50 µg/ml	12.54	14.67	12.34
		100 µg/ml	15.73	15.16	15.83
2	*Staphylococcus aureus (MTCC-737)*	25 µg/ml	10.42	11.56	11.36
		50 µg/ml	11.53	12.33	12.51
		100 µg/ml	12.37	13.20	13.54

3	*Streptococcus mutans (MTCC-497)*	25 µg/ml	10.24	11.52	11.23
		50 µg/ml	11.59	12.34	12.47
		100 µg/ml	12.75	12.58	13.21
4	*Pseudomonas aeruginosa (MTCC-2297)*	25 µg/ml	10.22	11.52	11.55
		50 µg/ml	11.64	12.34	12.30
		100 µg/ml	11.80	12.16	12.52
5	*Aspergillus flavus (MTCC-873)*	25 µg/ml	-	-	-
		50 µg/ml	-	9.32	-
		100 µg/ml	-	10.22	8.21
6	*Candida albicans (MTCC- 317)*	25 µg/ml	7.06	7.56	8.00
		50 µg/ml	8.32	8.47	8.52
		100 µg/ml	8.54	9.21	9.21

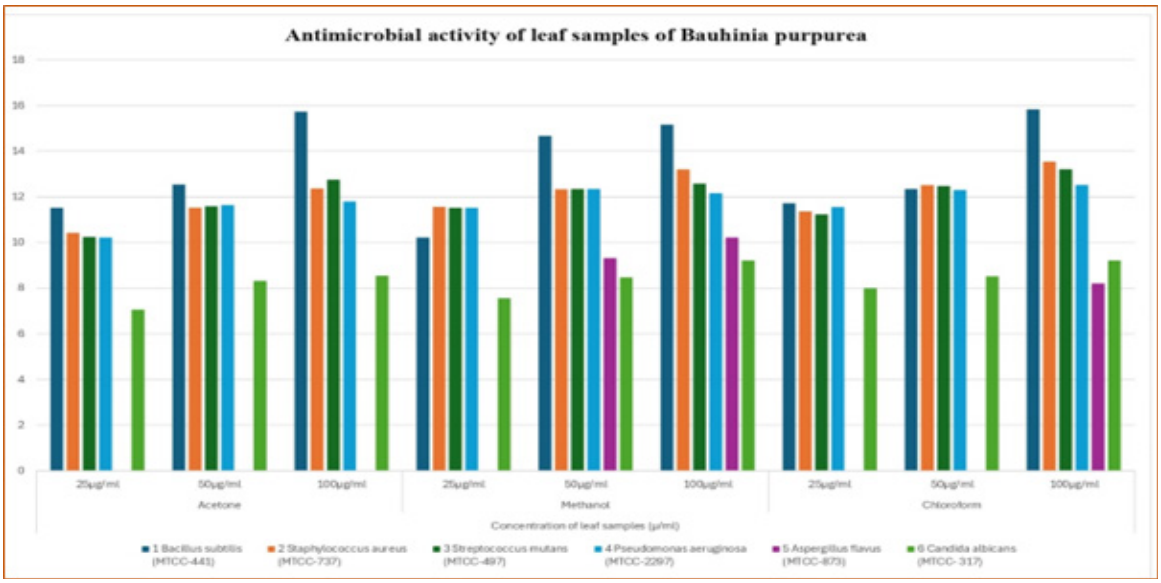

Figure 3. Graph showing antimicrobial activity of leaf samples of *Bauhinia purpurea*

The antimicrobial results of the *Bauhinia purpurea* leafextracts are placed in table 6. The highest inhibition zone was observed in *Bacillus subtilis* with 15.83 at 100 µg/ml concentration of chloroform sample followed by acetone and methanol samples with 1.73 and 15.16 at 100 µg/ml. *Staphylococcus aureus* occupies the next by 13.54 at 100 µg/ml of chloroform extract. *Streptococcus mutans* expressed moderate zone of inhibition by 12.47 for chloroform sample and 12.75 and 12.58 for acetone and methanol samples. Pseudomonas aeruginosa expressed moderate zone of inhibition for all the three samples.

Candida albicans showed less activity at all the three concentrations for all the three samples in which 100 µg/ml concentration exhibited highest. *Aspergillus flavus* expressed medium zone of inhibition at 100 µg/ml concentration for methanol and chloroform, sample. Acetone sample has no inhibition activity at all the three concentrations.

Table 7. Antimicrobial activity of floral samples of *Bauhinia purpurea*

S. No	Pathogen	Concentration (µ/ml)	Acetone Flower	Methanol Flower	Chloroform Flower
1	*Bacillus subtilis* (MTCC-441)	25 µg/ml	12.52	12.21	11.58
		50 µg/ml	13.27	13.56	11.94
		100 µg/ml	16.22	13.54	12.65
2	*Staphylococcus aureus* (MTCC-737)	25 µg/ml	10.23	11.24	12.55
		50 µg/ml	11.83	11.67	12.34
		100 µg/ml	11.59	12.34	13.62
3	*Streptococcus mutans* (MTCC-497)	25 µg/ml	11.21	12.34	11.21
		50 µg/ml	11.82	12.67	13.24
		100 µg/ml	12.36	14.51	14.57
4	*Pseudomonas aeruginosa* (MTCC-2297)	25 µg/ml	10.28	11.84	11.64
		50 µg/ml	11.65	12.58	12.54
		100 µg/ml	11.37	14.23	12.35
5	*Aspergillus flavus* (MTCC-873)	25 µg/ml	8.05	9.22	8.22
		50 µg/ml	10.24	10.22	9.37
		100 µg/ml	11.62	10.37	9.24
6	*Candida albicans* (MTCC- 317)	25 µg/ml	-	7.52	7.54
		50 µg/ml	7.65	7.26	8.32
		100 µg/ml	8.28	8.91	9.12

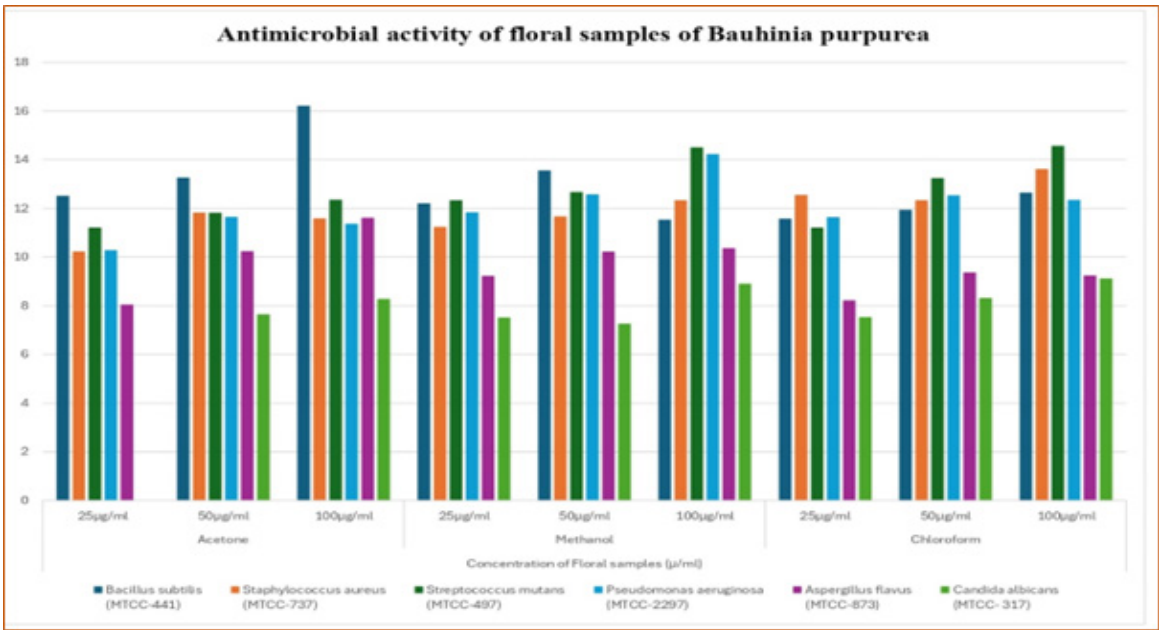

Figure 4. Graph showing antimicrobial activity of floral samples of *Bauhinia purpurea*

The antimicrobial results of the *Bauhinia purpurea* flowerextracts are placed in table 7. Among all the test pathogens *Bacillus subtilis* expressed highest zone of inhibition with 16.22 for acetone sample at 100 µg/ml followed by methanol and chloroform samples with 13.54 and 12.65 at 100 µg/ml. *Staphylococcus aureus exhibited* maximum at 100 µg/ml with 13.62 for chloroform sample and followed by 12.34 and 11.59 for methanol and acetone sample extracts. All the samples at three concentrations exhibited a moderate zone of inhibition. *Streptococcus mutans* showed the maximum inhibition activity at chloroform and methanol samples with 14.57 and 14.51 at 100 µg/ml followed by the acetone extract with 12.36. all the three samples showed highest inhibition. *Pseudomonas aeruginosa* expressed maximum at 100 µg/ml concentration with 14.23 for methanol extract followed by 12.35 and 11.37 for chloroform and acetone extracts at same concentration. Moderate inhibition activity is observed for all the three samples at all concentrations.

Aspergillus flavus showed maximum zone of inhibition with 11.62 at 100 µg/ml concentration for acetone extract followed by methanol and chloroform extracts with 10.37 and 9.24 at 100 µg/ml concentration. Reported a moderate zone of inhibition in all the samples at all concentrations for all sample extracts. *Candida albicans* expressed maximum at100 µg/ml concentration with 9.12 for chloroform extract followed by 8.91 and 8.28 inhibition activity. Moderate to low inhibition activity is observed in all the samples except in acetone extract at 25 µg/ml concentration.

Table 8. Antimicrobial activity of leaf samples of *Spathodea campanulata*

S. No	Pathogen	Concentration (µ/ml)	Acetone Flower	Methanol Flower	Chloroform Flower
1	*Bacillus subtilis* (MTCC-441)	25 µg/ml	10.25	12.94	10.43
		50 µg/ml	11.64	13.27	11.61
		100 µg/ml	13.25	14.12	12.35
2	*Staphylococcus aureus* (MTCC-737)	25 µg/ml	10.27	11.72	9.54
		50 µg/ml	12.22	12.35	11.25
		100 µg/ml	12.54	11.68	12.76
3	*Streptococcus mutans* (MTCC-497)	25 µg/ml	9.65	10.64	9.36
		50 µg/ml	9.35	11.25	10.25
		100 µg/ml	10.73	12.38	11.76
4	*Pseudomonas aeruginosa* (MTCC-2297)	25 µg/ml	-	8.12	9.47
		50 µg/ml	-	9.62	9.84
		100 µg/ml	8.54	10.88	10.23
5	*Aspergillus flavus* (MTCC-873)	25 µg/ml	-	-	-
		50 µg/ml	-	-	-
		100 µg/ml	-	-	7.86
6	*Candida albicans* (MTCC- 317)	25 µg/ml	-	8.24	8.32
		50 µg/ml	7.02	8.63	8.77
		100 µg/ml	8.24	8.80	9.58

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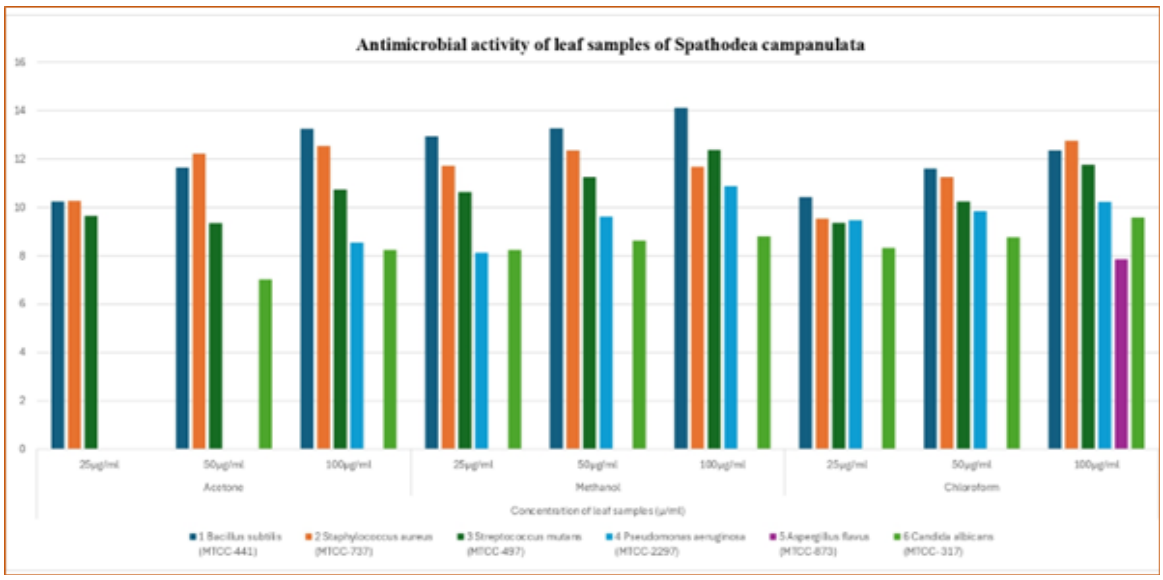

Figure 5. Graph showing antimicrobial activity of leaf samples of *Spathodea campanulata*

The antimicrobial results ofleafextracts of *Spathodea campanulata*are placed in table 8. *Bacillus subtilis*exhibited highest activity with 14.12 at 100 µg/ml for methanol extract followed by acetone and chloroform extracts with 13.25 and 12.35 reporting a moderate to highest zone of inhibition for all samples at all concentrations tested. *Staphylococcus aureus* showed maximum for chloroform extract at 100 µg/ml followed by 12.54 and 11.68 by acetone and methanol at the same concentration. All the samples tested exhibited a moderate activity of inhibition at all concentrations. *Streptococcus mutans* exhibited maximum zone of inhibition at 12.38 for methanol extract at 100 µg/ml concentration followed by 11.76 and 10.73 by chloroform and acetone extracts at the same concentrations. All the samples expressed moderate zone of inhibition at all three concentrations tested. *Pseudomonas aeruginosa* exhibited maximum inhibition activity for methanol extract followed by chloroform and acetone extracts with 10.88, 10.23, 8.54 at 100 µg/ml concentration. Among the three extracts acetone performed no activity at low concentrations except at 100 µg/ml. moderate to low activity is reported in Pseudomonas *aeruginosa.*

Candida albicans expressed maximum zone of inhibition for chloroform extract at 100 µg/ml with 9.58 followed by methanol and acetone extracts with 8080 and 8.24 at the same concentration of extracts. Moderate activity is reported for all the extracts except for acetone at 25 µg/ml concentration no activity is reported. *Aspergillus flavus* reported no activity except at 100 µg/ml concentration with 7.86 for chloroform extract.

Table 9. Antimicrobial activity of floral samples of *Spathodea campanulata*

S. No	Pathogen	Concentration (µ/ml)	Acetone Flower	Methanol Flower	Chloroform Flower
1	*Bacillus subtilis (MTCC-441)*	25 µg/ml	11.56	10.52	-
		50 µg/ml	12.52	11.02	-
		100 µg/ml	12.64	11.58	10.34

2	*Staphylococcus aureus* (MTCC-737)	25 µg/ml	-	-	-
		50 µg/ml	-	8.23	9.57
		100 µg/ml	8.74	9.42	10.38
3	*Streptococcus mutans* (MTCC-497)	25 µg/ml	-	-	8.32
		50 µg/ml	8.27	8.65	9.52
		100 µg/ml	9.33	8.24	10.76
4	*Pseudomonas aeruginosa* (MTCC-2297)	25 µg/ml	-	-	-
		50 µg/ml	-	-	-
		100 µg/ml	7.84	8.26	7.53
5	*Aspergillus flavus* (MTCC-873)	25 µg/ml	-	-	-
		50 µg/ml	-	-	6.54
		100 µg/ml	-	7.33	8.28
6	*Candida albi-cans* (MTCC- 317)	25 µg/ml	-	-	-
		50 µg/ml	6.52	6.85	7.42
		100 µg/ml	7.68	7.57	8.23

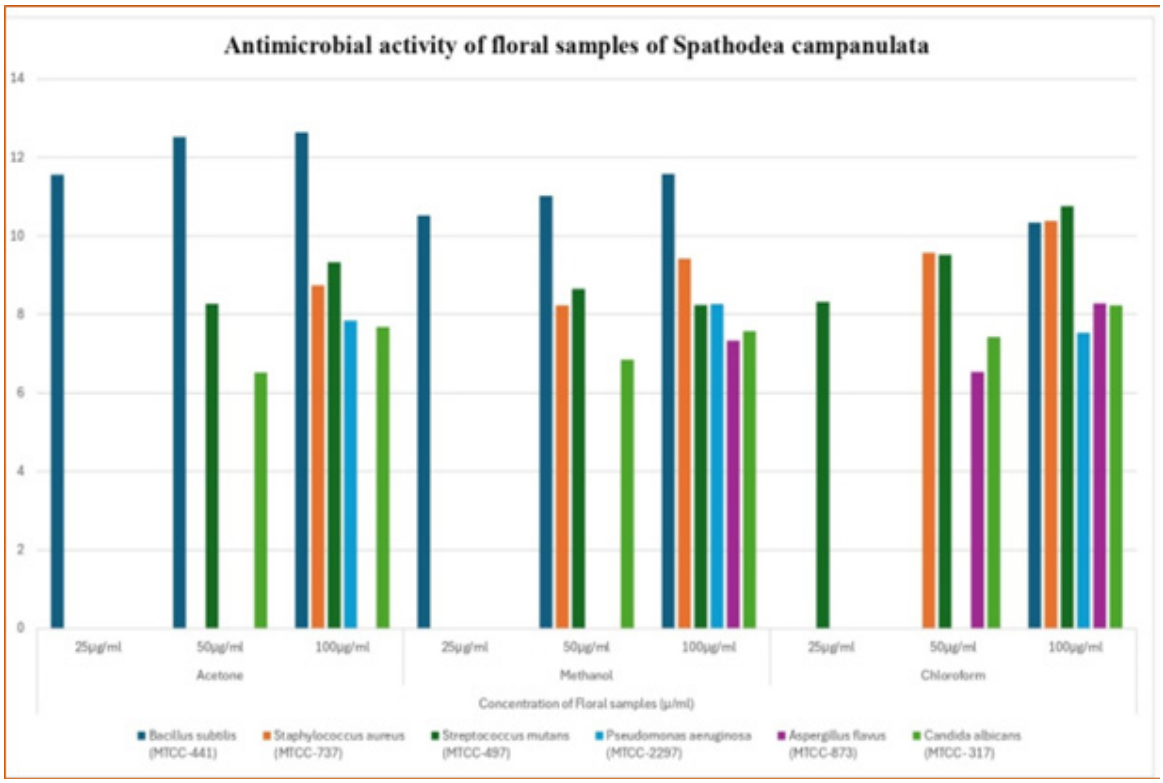

Figure 6. Graph showing antimicrobial activity of floral samples of *Spathodea campanulata*

The antimicrobial results of flower extracts of *Spathodea campanulata* are placed in table 9. *Bacillus subtilis* exhibited highest zone of inhibition with 12.64 for acetone extract at 100 µg/ml concentration followed by 11.58 and 1.34 for methanol and chloroform extracts at the same concentrations. Moderate activity was observed for all extracts and no zone of inhibition was observed for chloroform samples at 50 µg/ml and 25 µg/ml concentrations. Staphylococcus *aureus* showed maximum zone of inhibition with 10.38 for chloroform extract followed by 9.38 and 8.74 for methanol and acetone extracts at 100 µg/ml concentration. No activity was reported for all the three extracts tested at 25 µg/ml concentration and acetone extract at 50 µg/ml concentration. *Streptococcus mutans* showed 10.76 as the maximum zone of inhibition for chloroform extract at 100µg/ml followed by 9.33 and 8.24 for acetone and methanol extracts. Low activity is reported in the samples tested at all concentrations and no activity was reported at 25 µg/ml concentration for acetone and methanol extracts. *Pseudomonas aeruginosa* showed no activity for all the samples at 25 µg/ml and 50 µg/ml concentrations. Lowest activity was reported for the all the samples at 100 µg/ml concentration.

Candida albicans expressed highest inhibition activity with a zone of 8.23 for chloroform extract followed by 7.68 and 7.57 for acetone and methanol extracts. No activity was reported for all the samples at 25 µg/ml concentration and a low activity is reported in the increased concentration. *Aspergillus flavus* showed the maximum activity for chloroform extract at 100 µg/ml concentration and followed by 7.33 for methanol extract at the same concentration. No activity was reported for acetone extracts at all concentrations tested and samples at 25 µg/ml and 50 µg/ml concentrations of methanol has no inhibition activity. Chloroform extract have no activity at the least concentration tested at 25 µg/ml.

Conclusion

Among the selected three plants*Bauhinia purpurea* showed a varied phytochemicals and a good anti-microbial potential against the test pathogens followed by *Antigonon leptopus* and*Spathodea campanulata*. All the tested extracts of the three plants showed good inhibition activity against the *Bacillus subtilis (*MTCC-441) and least activity was reported in *Pseudomonas aeruginosa (*MTCC-2297) among the bacteria. *Candida albicans* expressed maximum inhibition for floral samples of *Bauhinia purpurea* and *Antigonon leptopus*. Leaf samples showed response with the increase in concentrations. *Aspergillus flavus*showed poor inhibition activity for all the test sample extracts except for the floral samples of *Bauhinia purpurea.*

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