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Phytochemical Screening, Antioxidant, Antimicrobial activities and GC-MS Analysis of *Ficus benjamina* L. and *Ficus hispida* L. f.

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Abstract:

The current investigation was conducted on the stem bark extracts of *Ficus benjamina* and *Ficus hispida*. The plant parts were gathered, dried in the shade, ground and extracted using Soxhlet equipment for phytochemical, antioxidant, antimicrobial and GC-MS chemical profiling. In phytochemical analysis extracts were tested for carbohydrates, proteins and amino acids, flavonoids, tri terpenoids, alkaloids, cardiac glycosides, anthraquinone glycosides, saponins, tannins and phenolic compounds, fixed oils and fats. *In-vitro* antioxidant activity of the aqueous, acetone and methanol bark extracts of the two species of *Ficus* were investigated by DPPH assay. Results showed that the methanol bark extracts of the two *Ficus* species *(F. benjamina and F. hispida)* exhibited excellent antioxidant activities (at the conc. of 120µg/mL) and the IC_{50} value of the methanol extract of *Ficus benjamina* showed (26.38±1.02 µg/mL) higher antioxidant activity. Two bacterial strains were tested against the stem bark extract i.e., Gram-positive bacteria (*S. aureus)* and Gram-negative bacteria (*E. coli*) and two fungal strains (*A. niger* and *S. cervisiae)*. These plant extracts showed excellent antimicrobial activities. The methanol extracts were analysed in this investigation using GC-MS analysis of *Ficus benjamina and Ficus hispida* will help to identify several chemical substances.

Keywords: Phytochemical, Antioxidant, Moraceae, Methanol extract, Ficus benjamina, Ficus hispida

Introduction:

One of the major genera in the family Moraceae, which has around 800 species worldwide and about 115 species distributed in India, is *Ficus* [1], 2000 *Ficus* tree varieties are timbered trees, bushes and vines occurring in most tropical and subtropical forests worldwide [2]. It has a significant historical role in indigenous medical systems including Ayurveda, Siddha, Unani, and homeopathy. *Ficus* is one of the most loved bonsai. There are about 20 species of Ficus native to Egypt, and many of them have long been used in folk medicine and a variety

of pharmacological actions [3, 4]; some are grown for their edible fruits (*F. sycomorus* and *F. carica*), while others are grown for ornamental purposes (*F. retusa*) or as street trees for shade (*F. religiosa*). In addition to being used as carminatives, astringents, anti-inflammatory, antioxidants, and anticancer agents, the barks, leaves, fruits, and latex are thought to be very effective in treating a wide range of conditions, including diabetes, skin conditions, ulcers, dysentery, diarrhea, stomach aches, piles, and ulcers as well as diabetes.

The current study's objective is to look into the antibacterial and antioxidant properties of the bark of two *Ficus* species (*Ficus benjamina* and *Ficus hispida)* and also, sources of natural antioxidants for use in medicine should be found. Moreover, to identify the GC-MS active compounds

Weeping figs or *Ficus benjamina*, are well-known ornamental plants that are native to Asia and Australia. They thrive in warm climates but can withstand both low and high temperatures [5]. The previous report on *Ficus benjamina* has a distinct aromatic odor because of the presence of essential or volatile oil, which is primarily contained in green leaves. GC-MS analysis typically characterises these oils [6, 7], alkaloids, saponins, flavonoids, and tannins make up the majority of this fragrant volatile oil from leaves [8]. *Ficus hispida* is growing in evergreen forests, moist localities, and deciduous forests, widely grown in villages in India, China, New Australia, Sri Lanka, Myanmar and Andaman Island for shade and its palatable fruits [9]. A previous study of *Ficus hispida* by Acharya et al., (1984) [10] displayed evidence of carbohydrates, alkaloids, glycosides, proteins and amino acids, sterols, flavonoids, gums and mucilage, phenols, saponins, and terpenes. For its delicious edible fruits and folkloric value, the moderately large *Ficus hispida* tree is planted either wild or in cultivation all year round. Historically, various components of the plant have been used as galactagogues and purgatives, as well as to cure ulcers, piles, psoriasis, hepatitis, anemia, jaundice, vitiligo, hemorrhage, diabetes, convulsion, dysentery and biliousness [11].

MATERIALS AND METHODS

Collection of Plant Samples

The barks of the two plant species (*Ficus benjamina* and *Ficus hispida)* were simultaneously collected from Paderu, Allurisitharamaraju district**,** Andhra Pradesh, India in March- 2022. Herbarium was submitted to AUV, Andhra University with Herbarium numbers MV 23382 and MV 23380 respectively. These parts of the plants were identified and authenticated before phytochemical analysis. The bark of the two species was cleaned with water and dried at room temperature for two weeks and was ground and kept for future analysis.

Preparation of an extract

Thirty grams of the powdered bark material of the *Ficus benjamina* and *Ficus hispida* were extracted with 3 distinct solvents (acetone, methanol, aqueous) in Soxhlet equipment in 250 ml of each solvent separately for 48 hours. After extraction, crude liquids were collected and they were utilised for the preliminary phytochemical analysis and later they were concentrated by a slow evaporation process by using a hot water bath at 60°C to remove the

excess solvents. The obtained crude extracts were retained for later use in sealed containers at 4 °C.

Qualitative Phytochemical screening

Crude extracts were subjected to preliminary phytochemical screening by following standard procedures [11-17].

Quantitative phytochemical screening

Here we are estimating the total phenol content of both species. The protocol employed by Sulaiman and Indira 2012 [18] was used to estimate the TPC of selected Indian medicinal plants by using the Folin-Ciocalteu phenol reagent. The standard here used is Gallic acid. The TPC calculation was done by using the following formula;

Calculation of TPC = $\frac{GAE\ (Gallic\ acid\ equivalents) in\ mg}{grams\ of\ extract}$

Anti-oxidant activity

In this research, the antioxidant activity of three solvent extracts (acetone, methanol and aqueous) of *Ficus benjamina* and *Ficus hispida* were examined by DPPH free radical scavenging assay. Following M.S. Blois' instructions (1958) [19], a DPPH assay was performed. In brief, the stock solution of DPPH was prepared at the conc. of 0.1mm in methanol and temperature-controlled storage in the dark to avoid further oxidation. The different concentrations of plant extracts with methanol (20, 40, 60, 80, 100 and 120 µg/mL) were prepared in separate test tubes. Then each extract was given 3.0 mL of DPPH, mixed properly and incubated for 30 min. in the dark. Afterward, a UV-Visible Spectrophotometer was used to measure each solution at 517 nm (Agilent). Similarly, the standard ascorbic acid (20, 40, 60, 80, 100, 120 µg/mL) was also measured using the same procedure. Here, methanol was used as the blank and 1.0 mL methanol with 3.0 mL of DPPH solution was served as the control. Each experiment was carried out in triplicate. The equation below was used to compute the % of inhibition of the DPPH free radical.

$$\% \text{ of inhibition of DPPH} = \frac{\text{Absorbance of Control} - \text{Absorbance of test sample}}{\text{Absorbance of control}} \times 100$$

Microbial strains used for Anti-microbial activity

The extracts were tested against two bacterial strains one Gram-negative bacteria (*E. coli* MTCC 28) and one Gram-positive bacteria (*Staphylococcus aureus* MTCC 29) and two fungal species (*Aspergillus niger* MTCC 279) and (*Saccharomyces cerevisiae* MTCC 282) and these were gathered from Andhra University's Microbiology Department. Every single bacterial sample was kept and maintained in nutrient agar slants. On PDA medium plates, the fungus sample was kept and maintained.

Anti-bacterial activity

For anti-bacterial activity, the cup plate agar diffusion method is used. A Petri plate was filled with the prepared nutrient agar medium after being inoculated with 18-hour-old cultures of the test organism. In a laminar airflow, at room temperature, the plates' medium was given time to harden. Four 5mm-diameter cups were created on each plate at an identical spacing

when the media solidified. The stock solutions with different concentrations were prepared (800 µL, 600 µL and 400 µL). Using sterile micropipettes, 50 µL of each concentration was added to the cups. Each plate containing one cup was utilised for the standard drug. The prepared Petri plates were placed in an incubator and kept at 37°C for 24 hours before being measured for inhibitory zones and analysed.

Anti-fungal activity

For anti-fungal activity, potato dextrose agar medium is utilised and 50 µL of the fungal test organism, *Aspergillus niger*, which was made from 48-hour-old cultures, is inoculated with it and transferred into sterile petri plates. The same procedure is repeated as anti-bacterial activity, from solidification of the medium to preparing different concentrations of stock solutions. Stock concentrations were put into the cups using sterile pipettes. In each plate, one cup is left for control. As a result, the plates were incubated at 35 °C for 24 to 48 hours. The studies were carried out in duplicate, and tabular records of the average diameters of the zones of inhibition were made.

GC-MS analysis

Procedure: The Agilent Technologies GC-MS (GC-8890, GC/MS 5977 MSD) was used to analyse the extracts. Injection mode; Split with 18 mL/min split flow and purge flow of 3 mL/min. The oven's temperature was programmed starting from 75°C to reach a maximum of 360°C. The column; Polar Columns (DB-WAX) & HP-5 MS UI; flow rate - 1.21 mL/min and the carrier gas utilized was helium gas (99.99%). The column temperature range was adjusted between 60^{o}C to 325^{o}C. The GC-MS runs for 53.5 minutes in total. EI mode was used for the ionization of the sample parts (70 eV). The proportion of each component's respective amount was computed through a comparison of each component's average peak area to the overall area.

Statistical Analysis:

To study the variance of antioxidant activity, data were processed by one-step ANOVA statistical analysis. The means of experiments conducted in triplicates are used to represent all outcomes. In these experiments, the significance of the difference between test extracts was determined using analysis of variance (ANOVA) and a student t-test, where probability ($p < 0.05$) was regarded as significant.

Results and Discussion

The present study was carried out on the stem bark of the two *Ficus* species (*Ficus benjamina* and *Ficus hispida).* The plants were gathered, dried in the shade, ground, and extracted using Soxhlet apparatus for phytochemical, antioxidant, antimicrobial and GC-MS Chemical profiling.

Preparation of plant extract and Percent yield:

The plant extracts of *Ficus benjamina* and *Ficus hispida* were carried out with acetone, methanol and aqueous solvents. The highest percent yield was recorded in acetone stem bark extract *of Ficus hispida* with 11.5% yield and the lowest percentage yield was recorded by *Ficus benjamina* with 10.5% yield. While methanol stem extract of *Ficus benjamina* with

10.5 and *Ficus hispida* stem bark with 12.5%. The percent yield was recorded in the aqueous stem extract of *Ficus benjamina* with 15.5% yield and the percentage yield was recorded by *Ficus hispida* with 14.0%. The Plant extract and % yield of two *Ficus* species graph shown in figure 1.

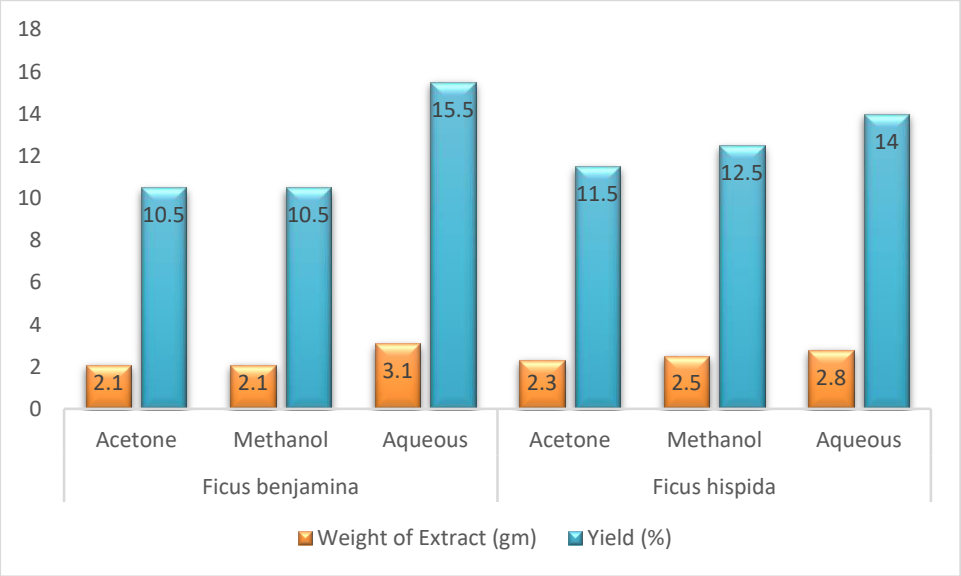

Figure1. Plant extract and % yield of two *Ficus* species.

Phytochemical analysis:

During the present investigation, Phytochemicals were qualitatively estimated in acetone, methanol and aqueous extract of *Ficus benjamina* and *Ficus hispida*. The extracts of *Ficus* species stem bark were evaluated for the detection of its phytochemical constituents. The extracts were tested for carbohydrates, proteins and amino acids, tri terpenoids, alkaloids, cardiac glycosides, flavonoids, anthraquinones glycosides, saponins, tannins and phenolic compounds, fixed oils and fats. According to the majority of studies on Ficus species, phenolic compounds can be found in significant amounts in the plant's leaves, stem wood, branches, stem bark, roots, root bark, fruits, and seeds [20-22]. In *Ficus benjamina* bark the acetone extract shows the presence of alkaloids, flavonoids and triterpenoids and methanol extract also shows the presence of triterpenoids, alkaloids and flavonoids, while the aqueous extract shows the presence of carbohydrates, alkaloids and Flavonoids. While the *Ficus hispida* bark the acetone extract shows the presence of triterpenoids and flavonoids. The methanol extract shows carbohydrates, alkaloids and flavonoids and the aqueous extract shows the presence of proteins, alkaloids and flavonoids. The phytochemical results of both plants were presented in table 1.

Table 1. Phytochemical analysis of bark extract of *Ficus* species.

S. No	Name of the test	*Ficus benjamina*			*Ficus hispida*		
		AC	Me	Aq	AC	Me	Aq
Carbohydrates							
1	Polish's test	-	-	+	-	-	-
2	Fehling's test	-	-	+	-	+	-

3	Benedict's test	-	-	-	-	+	-
4	Barfoed's test	-	-	-	-	-	-
Proteins and amino acids							
5	Mallon's test	-	-	-	-	+	-
6	Ninhydrin test	-	-	-	-	+	+
7	Xanthoprotein test	-	-	-	-	-	+
8	Ninhydrin test	-	-	-	-	+	-
Triterpenoids							
9	Salkowski test	+	+	-	+	+	-
10	Liberman Burchard	+	+	-	+	+	-
Alkaloids							
11	Dragendorff's test	+	+	+	-	+	+
12	Mayer's test	+	+	+	-	+	-
13	Hager's test	+	+	+	-	-	-
14	Wagner's test	+	+	+	-	+	+
Cardiac glycosides							
15	Baljet's test	-	-	-	-	-	-
16	Legal's test	-	-	-	-	-	-
17	Keller killiani test	-	-	-	-	-	-
Anthraquinone glycosides							
18	Borntrager's test	-	-	-	-	-	-
Saponin glycosides							
19	Foam test	-	-	-	-	-	-
20	Haemolysis test	-	-	-	-	-	-
Flavonoids							
21	Shinoda test	+	+	+	+	+	+
Tannins and phenolic compounds							
22	Fecl3 test	-	-	+	+	+	+
Fixed oil and fats							
23	Spot test	-	-	+	-	+	-

Anti-Oxidant Properties of *Ficus* species

In this study bark extract parameters were statistically evaluated for two different *Ficus* species for anti-oxidant potential. Antioxidants are chemical constituents composed of polyhydroxy functional groups that are present in plant species which are known as bioactive phytochemicals. Bioactive phytochemicals have important medical uses that are widespread worldwide. Secondary metabolites such as phenolic compounds, flavonoids, saponins, tannins, terpenoids, and alkaloids have been related to these bioactive chemicals in these plant species. These plant metabolites are said to have biological and therapeutic effects that include lowering platelet aggregation, eliminating free radicals, and inhibiting cell proliferation [23]. The secondary metabolites are responsible for high antioxidant capacities which are mainly polyphenols and flavonoids. In other words, the presence of hydroxyl

groups in phenolic compounds makes them effective electron donors, which can directly contribute to their anti-oxidant properties [24].

In-vitro antioxidant activity of the acetone, methanol and aqueous bark extracts of *Ficus* species were investigated by DPPH assay. Using this method, it was demonstrated that the extracts were more effective than the ascorbic acid reference standard. DPPH radical scavenging activity is a highly helpful technique as it is sensitive and rapid. This assay is not dependent on the polarity of the substrate where DPPH can accept an electron or hydrogen radical to transform into a stable diamagnetic molecule. The colour of the DPPH solution changes from purple to yellow when an antioxidant donates hydrogen to scavenge the free radical, and this change may be observed spectrophotometrically at 517 nm. The result of the study indicates that the different solvent extracts have a noticeable effect on DPPH radicals. Studies were done with two *Ficus* species in three different solvents (acetone, methanol and aqueous) for antioxidant activity.

In this study, the DPPH assay percentage of radical scavenging activity (RSA %) of bark extract of *Ficus* species against concentration was shown in table 2. Different extracts' radical scavenging abilities grew in a concentration-dependent way.

Table 2. Concentration and the % of RSA of *Ficus* species in different extraction.

Concentration	*F. benjamina*			*F. hispida*		
(µg/ml)	Acetone	Methanol	Aqueous	Acetone	Methanol	Aqueous
20	45.68+ 0.24	42.87+5.21	10.25±1.80	21.63+1.15	35.77+2.01	10.89+0.85
40	49.89+0.18	54.6+ 4.81	18.55±3.97	32.61+2.88	46.2+0.07	24.66+0.52
60	54.89±1.56	67.48+ 1.20	21.85±2.27	41.85+3.47	65.87+1.06	31.08+0.98
80	68.24±0.66	72.56+2.86	29.78±2.28	58.63+1.66	73.2+4.32	39.85+1.61
100	75.89+0.32	83.45+3.14	34.58±0.81	62.78+5.14	85.95+3.54	42.47+0.85
120	89.54± 0.58	94.52+ 1.25	49.52+1.08	79.54+3.54	90.11+2.52	45.65+5.03

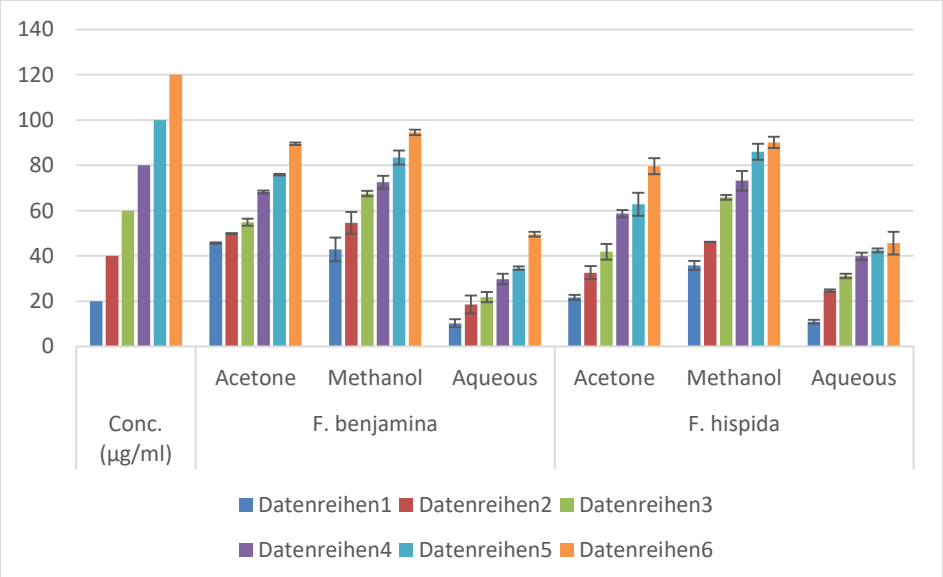

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Figure 2. Concentration and the % of RSA of *Ficus* species in different extraction.

The DPPH radical scavenging activity of the acetone extracts of *Ficus benjamina* and *Ficus hispida* is represented in figure 2. As can be seen, at all concentrations, *Ficus benjamina* exhibited greater antioxidant activity than *Ficus hispida*. At a concentration of 120µg/mL, *Ficus benjamina* extract had the highest value for DPPH radical inhibition at 89.54+ 0.58%, whereas *Ficus hispida* extract had the lowest value for antioxidant activity when compared to *Ficus benjamina* at 79.54+ 3.54%. Corresponding to this, the antioxidant activity of *Ficus benjamina* extract was 45.68 + 0.24% at the lowest concentration of 20µg/mL and was 21.63+1.15% for *Ficus hispida*.

The DPPH radical scavenging activity of the aqueous extracts of *Ficus benjamina* and *Ficus hispida* showed a significant effect in inhibiting DPPH radical, 49.52+1.08, 45.65+5.03 respectively at the same concentration (120µg/mL). According to Figure 2, antioxidant compounds identified through GC-MS are higher in *Ficus benjamina* compared to the *Ficus hispida*, While the DPPH radical scavenging activity of the methanol extracts of *Ficus benjamina* showed greater antioxidant action compared to *Ficus hispida* at almost all the concentrations (except 80 & 100µg/mL) shown in table 2. At a concentration of 120µg/mL, the highest value of *Ficus benjamina* extract for inhibition of DPPH radical was 94.52+ 1.25% whereas for *Ficus hispida* extract, it was 90.11+2.52%. Corresponding to this, the antioxidant activity of *Ficus benjamina* extract was 42.87+5.21% at the lowest concentration of 20µg/mL and was 35.77+2.01% for *Ficus hispida*. Also, as indicated in table 2, it was shown that the methanol extracts of both plants demonstrated greater antioxidant activity in comparison to aqueous and acetone extracts.

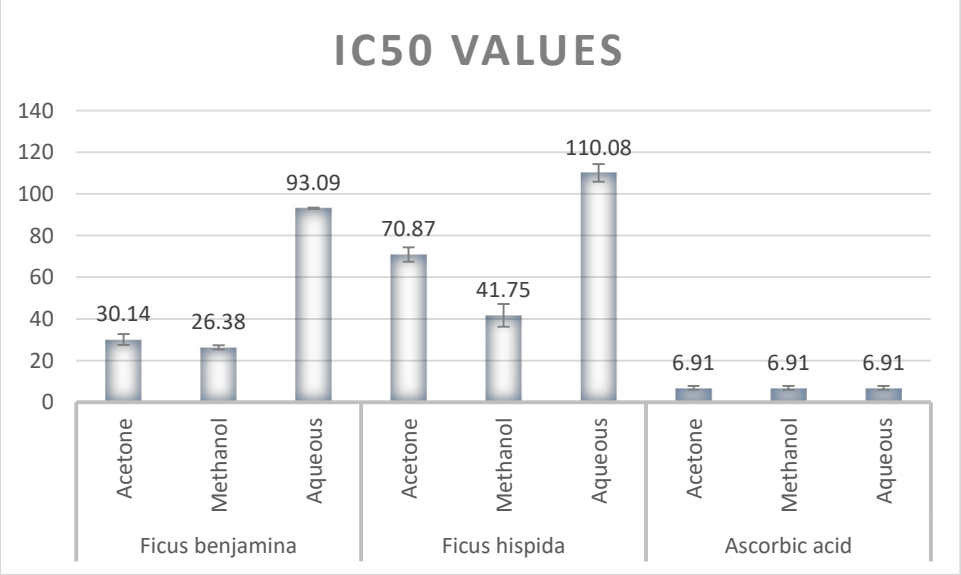

Figure 3. IC_{50} calculations of DPPH assay of different extracts.

IC_{50} values are defined as the concentration of substrate that causes a 50 % loss of the DPPH activity. The lower the IC_{50} value, the higher will be the antioxidant activity. The effect of solvent influences the scavenging capacity of plant extracts because of the presence of polyhydroxy or polyphenolic compounds. The IC_{50} values of the DPPH assay of aqueous extract from the linear equation graph are represented in Fig.3. The results from Fig. 3

showed higher IC_{50} values indicating lower antioxidant activity. The IC_{50} values of standard ascorbic acids 6.91 ± 0.95 µg/mL exhibited higher antioxidant activity. The IC_{50} value of the aqueous extract of *Ficus benjamina* showed (93.09 ±0.35µg/mL), whereas The IC_{50} value of the aqueous extract of *Ficus hispida* showed (110.08±4.21 µg/mL) that indicated *Ficus benjamina* showed higher antioxidant activity. The IC_{50} value of the methanol extract of *Ficus benjamina* showed (26.38±1.02 µg/mL) whereas the IC_{50} value of the methanol extract of *Ficus hispida* showed (41.75±5.44 µg/mL) thereby methanol extract of *Ficus benjamina* showed higher antioxidant activity. While the IC_{50} value of the acetone extract of *Ficus benjamina* (30.14±2.66 µg/mL) showed higher antioxidant activity than *Ficus hispida* (70.87±3.45 µg/mL).

Antimicrobial properties

Antimicrobial activity of *Ficus benjamina*

The antimicrobial activity of *F. benjamina* was investigated by the agar well diffusion method. Acetone, methanol and aqueous extracts of *F. benjamina* stem bark were tested against two bacterial strains (*E. coli* and *S. aureus*) and two fungal strains (*A. niger* and *S. cervisiae*).

When compared to all the three solvent extracts of *Ficus benjamina* methanol extract showed a maximum zone of inhibition of 2.8±01mm at the concentration of 800µg/mL against *E. coli*, followed by 2.5±05mm and 2±05mm at the concentration of 600µg/mL and 400mg/ml against *E. coli* and showed 2.5±01mm diameter of zone of inhibition against *S. aureus* at the concentration of 800mg/ml followed by 2.3±01mm and 2±05mm diameter of zone of inhibition against *S. aureus* at the concentration of 600mg/ml and 400mg/ml. On the other hand, the methanol extract showed maximum zone anti-fungal activity of 2.3±01mm against *A. niger* at the concentration of 800mg/ml. The lowest zone of inhibition was observed at the concentration of 400mg/ml against *A. niger*. Imran and co-workers (2014) [25] have demonstrated that the extracts and their fractions of stem, root and leaves exhibited considerable antimicrobial activity against 4 bacterial (*P. aeruginosa* locally isolated, *E. coli, Bacillus subtilis, Bacillus cereus* locally isolated) and 2 fungal strains (*Aspergillus niger* and *Candida albicans*). Ramakrishnaiah (2012) [26] reported that the methanol extracts of *F. benjamina* barks have inhibitory effects against *E. coli and P. aeruginosa*. The antibacterial activity against various bacterial strains is mostly attributed to the presence of phenolic chemicals and flavonoids (Imran 2014) [25].

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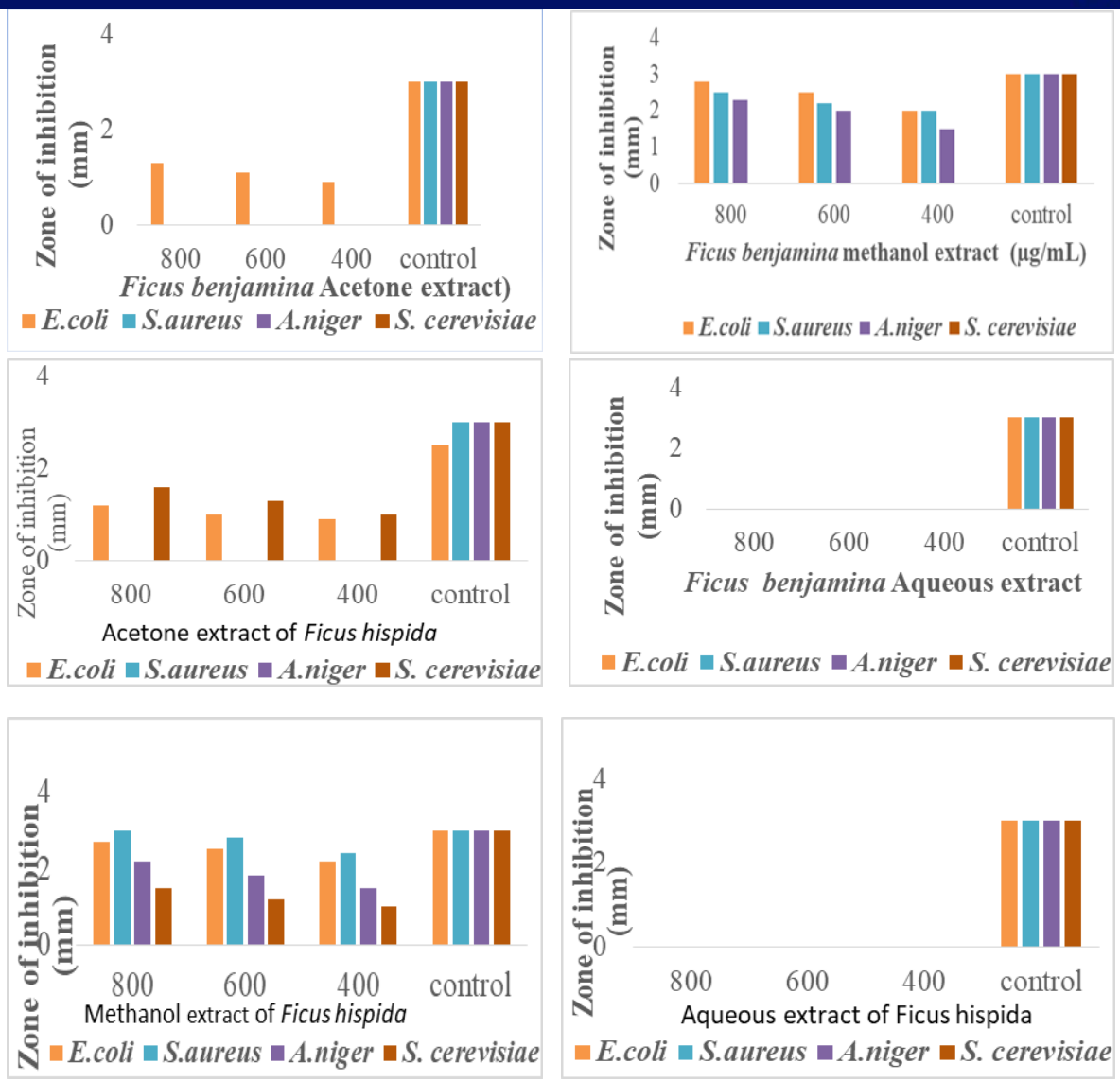

Fig 4. Different solvent extracts of two *Ficus* species show antimicrobial activity.

Antimicrobial activity of Ficus hispida

The methanol extract of *Ficus hispida* stem showed maximum 3±0.1mm and 2.7±0.5mm antibacterial activity against *S. aureus* and *E. coli* at the concentration of 800µg/mL, followed by 2.5±0.1mm diameter of zone of inhibition, 2.2±0.1mm diameter of zone of inhibition against *E. coli* at the concentration of 600µg/mL and 400µg/mL and 2.8±0.1mm diameter of zone of inhibition, 2.4±0.2mm diameter of zone of inhibition against *S. aureus* at the concentration of 600 and 400µg/mL. The acetone extract showed a maximum zone of inhibition 1.2±0.1mm against *E. coli* and the aqueous extract showed no activity when compared to the other solvent extracts. The methanol extract showed a maximum zone of 2.2±0.5mm antifungal activity against *A. niger* at the concentration of 800µg/mL and 1.8±0.1mm diameter of zone of inhibition, 1.5±0.1mm diameter of zone of inhibition against *A. niger* at the concentration of 600 and 400µg/mL. The acetone extract showed a maximum

zone of 1.6±0.5mm antifungal activity against *S. cerevisiae* at the concentration of 800µg/mL. The aqueous extract showed no antifungal activity.

GC- MS Chemical profiling of two *Ficus* species:

The technique known as Gas Chromatography-Mass Spectrometry (GC-MS) is useful for accurately identifying bioactive chemicals [27]. It is a valuable tool used to identify the bioactive components of long-chain hydrocarbons, steroids alcohols, esters, alkaloids, acids, amino and nitro compounds, etc., GC-MS is the most effective method [28]. In this study, this tool was used for the analysis of the methanol extract of *Ficus benjamina and Ficus hispida* resulting in the discovery of several compounds. The various components present in the bark of *Ficus benjamina* species that were identified by the GC-MS are displayed in (Table 1). Hexanoic acid, 2-ethyl-, 3-Heptanol, 4-methyl-, Catechol, Hexadecanamide, bis (2-ethylhexyl) ester, di (2-propyl pentyl) ester, (±)-Marmesin, 1,2-trans-1,5-trans-2,5-dihydroxy-4-methyl-1-(1-hydroxy-1-i) Phthalic acid, 1,3-Benzenedicarboxylic acid, W-18 (4-chloro-N-[1-[2-(4-nitrophenyl) ethyl]-2-piperidinylidene]-benzenesulfonamide) were present in the methanol extracts of *Ficus benjamina* species.

The various components present in the bark of *Ficus hispida* that were identified by the GC-MS are displayed in (Table 4). Catechol, 9-Oxabicyclo[3.3.1]nonan-2-one, 5-hydroxy-Hexadecanoic acid, 6-Octadecenoic acid methyl ester, n-Hexadecanoic acid, 9,12-Octadecadienoic acid (Z,Z)-, methyl ester, methyl ester, (Z)-, γ-Sito sterol, Lup-20(29)-en-3-ol, acetate, (3β)- were present in the methanol extracts of *Ficus hispida*. A similar compound was reported from *F. benjamina* through hydro distillation and subsequently subjected to GC-MS analysis. 2-pentanone, hexadecanoic acid, palmitic acid, and 9,12-octadecadienoic acid were all present in the essential oil from the stems. Methanamine, cyclopentanone, methyl-2 phenylindole, cyclopropaneoctanal, arsenous acid, hexadecanoic acid, palmitic acid and 9,12-octadecadienoic acid were all present in the essential oil from the roots [25]. Based on a comparison of the components' mass spectra with those in the NIST mass spectra library, the components were identified [29]. *Ficus hispida* bark contains lupeol acetate, beta-amyrine acetate, and beta-sitosterol, according to previous reports given by Acharya et al., From the stem and leaves of *Ficus hispida* Venkatachalam et al., isolated two significant phenanthroindolizidine alkaloids, 6-O-methytylophorinidine and 2-demethoxytylophorine, as well as a novel biphenylhexahydroindolizine hispidin [30]. In another investigation, the purification of acetates of *n*-tricontanol, beta-amyrin and gluanol was carried out from the petroleum ether extracts of the dried bark powder [31]. S. Wang and D. A. Coviello (1975) [32] obtained a new, unique and unusual compound, 10-ketotetracosyl arachidate, when the bark was extracted with light petroleum.

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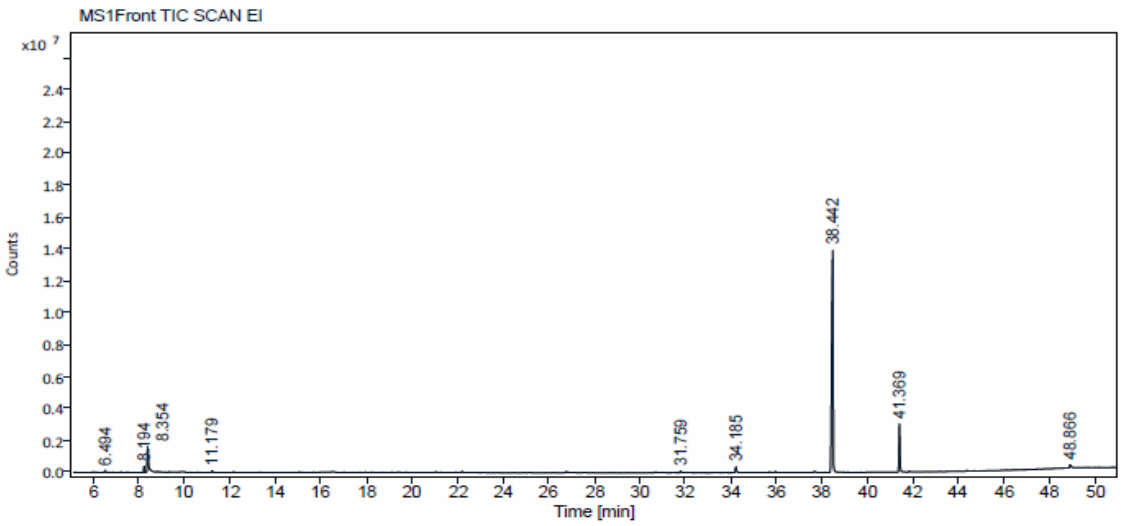

Fig.4 GC- MS Chromatogram of the methanol Bark extract of *Ficus benjamina*

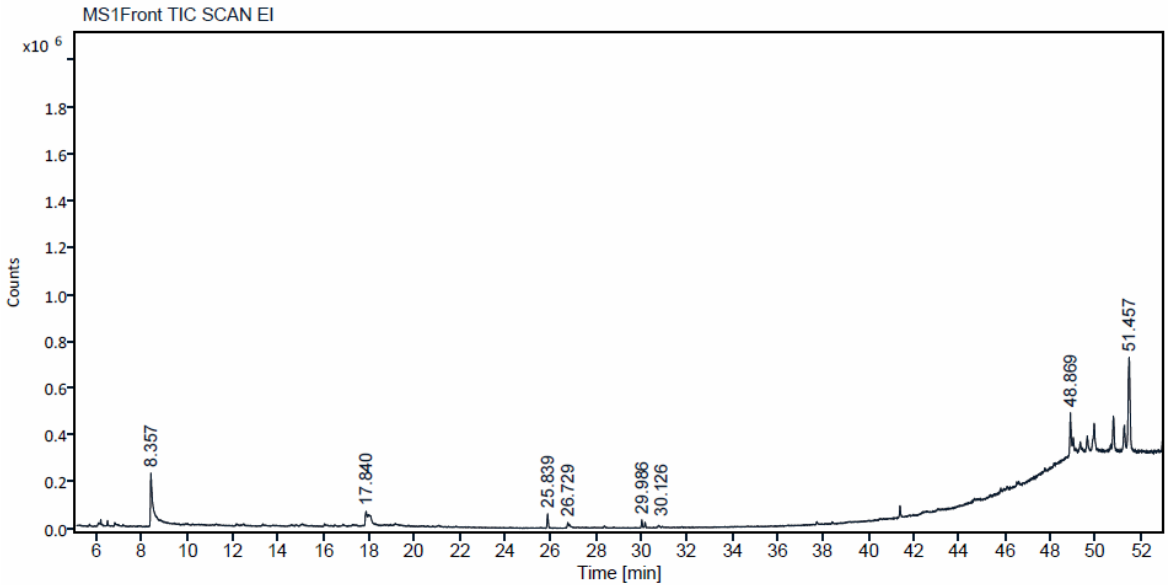

Fig 4. GC- MS Chromatogram of the methanol Bark extract of *Ficus hispida*

Conclusion:

Ficus species have been employed as astringents, carminatives, stomachic, vermicides, hypotensive, anthelmintics, and anti-dysentery medications in traditional medicine. Nearly all Ficus species that are members of the Moraceae family have historically been used as folk medicine to treat respiratory and skin conditions. In this study, Phytochemicals were qualitatively estimated in acetone, methanol and aqueous extract of *Ficus benjamina* and *Ficus hispida.* During investigation, certain phytoconstituents were studied namely carbohydrates, proteins, triterpenoids, amino acids, flavonoids, alkaloids, cardiac glycosides, anthraquinone glycosides, saponins, tannins, phenolic compounds and fixed oil and fats. In the field of medicine and pharmaceuticals, phytochemicals—the bioactive elements of

plants—play a significant role. Because of their strong antioxidant potential, the majority of these phytochemical compounds show health-promoting effects in humans. *Ficus* plant species have great antioxidant potential because of their higher phytochemical contents. From the above investigation, the results indicate that the methanol extracts of the bark of *Ficus* species exhibit high antioxidant activity due to the presence of hydroxyl functional groups in the chemical constituents.

The antimicrobial activity of *F. benjamina* and *F. hispida* was investigated in this study by acetone, methanol and aqueous extracts. Stem bark extracts of these 2 species were tested against two bacterial strains (*E. coli* and *S. aureus*) and two fungal strains (*A. niger* and *S. cervisiae*). The presence of various bio-active compounds which are detected after GC-MS analysis using the methanolic extract of *Ficus* species justifies the use of whole plants for various compounds by traditional practitioners. However, isolating certain phytochemical constituents and submitting them to biological activity would undoubtedly produce profitable results and offer a new area of inquiry into specific individual components and their pharmacological potency. From these results, it could be concluded that *Ficus* species contains a wide range of various bio-active compounds.

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References:

[1] Hayat MM, Amandeep S, Hardeep K. Bioassay Guided Fractionation and in vitro Anti-plasmodial Activity of *Ficus deltoidea* and *Ficus benzamine*. Pharmacog J. 2018; 10(2):235- 40.

[2] Hamed MA. Beneficial effect of *Ficus religiosa* Linn on high fat-induced hypercholesterolemia in rats. Food Chem, 2011; 129: 162-170.

[3] Trivedi C, Shinde S, Sharma, RC (1969). Preliminary phytochemical and pharmacological studies on *Ficus racemosa* (Gular). Indian J. Med. Res. 57:1070–1074.

[4] Mousa O, Vuorela P, Kiviranta J, Abdel Wahab S, Hiltunen R, Vuorela H (1994). Bioactivity of certain Egyptian *Ficus* species. J. Ethnopharmacol. 41:71–76.

[5] Kim, K. J., Kil, M. J., Song, J. S., Yoo, E. H., Son, K., & Kays, S. J. (2008). Efficiency of Volatile Formaldehyde Removal by Indoor Plants: Contribution of Aerial Plant Parts versus the Root Zone, *Journal of the American Society for Horticultural Science J. Amer. Soc. Hort. Sci.*, *133*(4), 521-526. Retrieved Mar 17, 2023, from https://doi.org/10.21273/JASHS.133.4.521

[6] Ahmad, M.A. Hanif, R. Nadeem, M.S. Jamil, M.S. Zafar (2008). Nutritive evaluation of medicinal plants being used as condiments in South Asian Region. Journal of the Chemical Society of Pakistan. 30(3): 400-405.

[7] Hanif M.A, A.Y. Al-Maskri, Z.M.H. Al-Mahruqi, J.N. Al-Sabahi, A. Al-Azkawi, M.Y. Al-Maskari. (2011). Analytical evaluation of three wild growing Omani medicinal plants. Natural product communications. 6(10).

[8] Batool, S. Nisar, L. Hamrouni, M.I. Jilani. (2018). Extraction, Production and Analysis Techniques for Menthol: A review. *International Journal of Chemical and Biochemical Sciences.* 14: 71-76.

[9] Ripu M, Kunwar I, Rainer WB. *Ficus* (Fig) species in Nepal a review of diversity and indigenous uses. *J Ecol Appl.*2006; 11: 85–7.

[10] Acharya, B.M, K. A. Kumar (1984). Chemical examination of the bark of *Ficus hispida* Linn. *Curr. Sci*. 53, 19, 1034-1035.

[11] Ali M, Chaudhary N. *Ficus hispida* Linn.: A review of its pharmacognostic and ethnomedicinal properties. Pharmacogn Rev. Jan; 5(9):96-102. doi:10.4103/0973-7847.79104. PMID: 22096323; PMCID: PMC3210011.

[12] Amarsingham, P.P. et al., 1964. Phytochemical survey of Malaya, Part 3. Alkaloids and saponins. Econ. Taxonomic Bot., 18: 270278.

[13] Chhabra, S.C., F.C.Viso and E.N.Mshiu- Phytochemical screening of Tanzanian Medicinal plants 1. -1984, J. Ethno pharmacology 11: 157-179.

[14] Gibbs R D, Chemotaxonomy of flowering plants. I-IV. Mc Gill Queen's University Press, Montreal, London, 1974.

[15] Sofowara, E.A. (1982). Medicinal plants and traditional medicines in Africa. John Wiley and Sons Ltd. Nigeria: 64-79.

[16] Trease E and Evans W C, Pharmacognosy 1987; Billiare Tindall, London.

[17] Harborne JB. 1984. Phytochemical methods. 2nd ed. Chapman and Hall. London.

[18] Sulaiman, C.T, Indira Balachandran 2012. Total phenolic content and Total flavonoid in selected Indian medicinal plants. *Indian J. Pharm. Sci*. 74, 3, 258-260.

[19] Blois, M.S, (1958). Antioxidant determinations by the use of a stable free radical. *Nature*, 181, 1199–1200.

[20]Abdel-Hameed ESS (2009). Total phenolic contents and free radical scavenging activity of certain Egyptian *Ficus* species leaf samples. *Food Chem*. 114:1271–1277.

[21] Sultana, B., & Anwar, F. (2008). Flavonols (kaempeferol, quercetin, myricetin) contents of selected fruits, vegetables and medicinal plants. Food chemistry, 108(3), 879-884.

[22] Veberic R, Colaric M, Stampar F (2008). Phenolic acids and flavonoids of fig fruit (*Ficus carica* L.) in the northern Mediterranean region. Food Chemistry 106:153–157.

[23] Lin Song, F. G.You Gan, Y. Zhang, Q. Xiao, L. Kuang, &H.Bin Li, H, (2010). Total phenolic contents and antioxidant capacities of selected Chinese medicinal plants. *International Journal of Molecular Sciences*, *11*, 2362–2372.

[24] Kumar, N., Gupta, S., Chand Yadav, T., Pruthi, V., Kumar Varadwaj, P., & Goel, N. (2019). Extrapolation of phenolic compounds as multi-target agents against cancer and inflammation. Journal of Biomolecular Structure and Dynamics, 37(9), 2355-2369.

[25] Imran M., Rasool N., Rizwan K., Zubair M., Riaz M., Zia-Ul-Haq M., Rana U.A., Nafady A., Jaafar H.Z (2014). Chemical composition and biological studies of *Ficus benjamina.* Chem. Cent. J., 8(1): - P. 12.

[26] Ramakrishnaiah G and Hariprasad T. In vitro antimicrobial activity of leaves and bark extracts of *Ficus religiosa* (Linn.). Indian Journal of Pharmaceutical and Biological Research 2013; 1(1): 37-42.

[27] Johnson F, Westra S, Sharma A and Pitman AJ, 2011. An assessment of GCM Skill in stimulating persistence across multiple time scales, Journal of Climate, 24(14): 3609-3623.

[28] Muthulakshmi A, Joshibhi Margret R, Mohan V.R, (2012). GC-MS analysis of bioactive components of Feroniaelephantumcorrea (Rutaceae), App. pharmac. Sci. 69-74.

[29] Massada Y (1976). Analysis of essential oils by gas chromatography and massspectrometry. NewYork: Wiley. Mass Spectral Library, NIST/EPA/NIH: USA; 2002.http://www.nist.gov/srd/ nist1a.cfm.

[30] Kirtikar KR, Basu BD, 1956. Indian medicinal plants, Allahabad, India: Lalit Mohan Basu; P. 2322.

[31] Peraza-Sánchez SR, Chai HB, Shin YG, Santisuk T, Reutrakul V, Farnsworth NR, Cordell GA, Pezzuto JM, Kinghorn AD. Constituents of the leaves and twigs of *Ficus*

hispida. Planta Med. 2002 Feb;68(2):186-8. doi: 10.1055/s-2002-20257. PMID: 11859479.

[32] Wang S, Coviello DA. The isolation, characterization and synthesis of 10-ketotetracosyl arachidate from *Ficus hispida*. *Tetrahedron.* 1975; 31:929–32