Phyto-chemical Analysis and study of antibacterial activity of some selected Medicinal Plants from urban green space of Tricity Chandigarh

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Abstract

The first planned city with properly managed plantations and green space is Chandigarh. In light of growing urbanisation, herbs or medicinal plants found in urban green spaces are important. In the present study, eight medicinal plants such as Asparagus racemosus, Asparagus officinalis, Murraya koenigii, Murraya paniculata, Withania somnifera, Centella asiatica, Cinnamomum tamala, and Glycyrrhiza glabara from the urban green space of Chandigarh were analysed for the presence of selected seven phytochemicals (carbohydrate, protein, alkaloid, flavonoid, steroid, saponin, and tannin). The total phenolic and flavonoid contents of all of these medicinal plants were calculated. Asparagus officinalis (root) had the highest level of antioxidative activity suppression when all eight plants were tested against E. coli (DPPH assay: 86.70%). All of the aforementioned plants appear to have therapeutic potential, according to the available study. However, more investigation is certainly required to properly comprehend the potential relevance of medicinal plants found in urban green spaces.

Key words: Phytochemicals, anti-microbial, phenolic content, flavonoid content, urban plantation, Chandigarh

INTRODUCTION

We are all aware of the importance of plants, but in recent years, the importance of medicinal plants has grown significantly (Yadav & Agarwala, 2011). It is well recognised that several medicinal plants or herbs have the potential to provide significant therapeutic benefits or pharmacological effects on both humans and animals. One of the world's oldest traditional medical systems, that of India, has been fundamental in bringing medical services to human civilization since its inception (Adhikari & Paul, 2018). Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy are the six Indian medical traditions that are widely used and practised in India (AYUSH) (Fitzgerald et al., 2019). A rise in the use of medicinal plants was seen during the COVID-19 pandemic, and their ability to treat COVID-19 was investigated (Ahmad et al., 2021). Urbanisation rates in developing nations like India are constantly rising. India had 37.7 crore urban residents in 2011, according to the census, and by 2030, it is expected to reach 60 crore urban residents (Economic Survey, 2021). Urban green space that contains certain types of medicinal plants or herbs may play a vital role for the people who live in urban areas in the face of this growing urbanisation. Chandigarh, the first planned city in India with appropriate plantations, was chosen to research the phytochemical analysis and pharmacological activity of some selected medicinal plants because it is an urban area with enough green space (Singh, 2003). Additionally, the WHO states that plants are the best source for obtaining a range of treatments, and currently, people in developed nations prefer traditional medicines made from plants.

Photochemical chemicals are found in some medicinal plants. Plants create these substances through either primary or secondary metabolism. Secondary metabolites with physiological effects on the human body include phenolics, flavonoids, terpenoids, tannins, and alkaloids (Nallusamy et al., 2021). These phytochemicals can exhibit a variety of biological activities, such as antioxidant activity (protecting cells against free radicals or reactive oxygen species by scavenging against free oxygen radicals and producing a stable radical, e.g., flavones) (Engwa, 2018), antimicrobial activity (protecting against pathogenic insects, bacteria, fungi, or protozoa, e.g., phenolic acids, terpenes), anti-inflammatory (e.g., essential oils and phenolics), anti-carcinogenic (e.g., polyphenols) activity. In contrast to conventional antibiotics, which may have side effects, natural compounds from medicinal plants have some antibacterial activity that is beneficial in treating diseases without any negative effects (Adeleke Martina TV & Ndah Sharon, 2022). It is desirable to have knowledge of these natural compounds that have been isolated from various plant parts, including roots, leaves, stems, fruits, and seeds, since they have excellent medical benefits for people.

In the current study, photochemical analyses were conducted on eight medicinal plants from the urban areas of Tricity Chandigarh: Asparagus racemosus, Asparagus officinalis, Murraya koenigii, Murraya paniculata, Withania somnifera, Centella asiatica, Cinnamomum tamala, and Glycyrrhiza glabara.

MATERIALS AND METHODS

1. Collection of plant materials

Asparagus racemosus, Asparagus officinalis, Murraya koenigii, Murraya paniculata, Withania somnifera, Centella asiatica, Cinnamomum tamala, and Glycyrrhiza glabara were the eight medicinal plants whose fresh parts were obtained from Tricity Chandigarh's urban area. The department of botany at Panjab University Chandigarh validated and taxonomically recognised the plant sample. Separate samples of the gathered materials were shade dried at 40°C for 48 hours so that water molecules would evaporate and the plants would be sufficiently dried for grinding. Dried plant material was ground into a fine powder and transferred to an airtight container with the appropriate labelling using a mechanical blender.

Table 1. List of plants with their vernacular names, family and part used.

S.no	Plant name	Vernacular name	Family	Part used
1	*Asparagus racemosus*	Shatavari	Asparagaceae	Stem and Leaves
2	*Asparagus officinalis*	Sparrow grass	Asparagaceae	Stem and Leaves
3	*Murraya koenigii* L.	Curry Leaf Tree	Rutaceae	Stem and Leaves
4	*Murraya paniculata* L.	Orange jasmine	Rutaceae	Stem and Leaves
5	*Withania somnifera* (L) Dunal	Ashwagandha	Solanaceae	Leaves
6	*Centella asiatica* (L.)	Gotu kola	Apiaceae	Leaves
7	*Cinnamomumtamala* Nees&Eberm	Tejpatta	Lauraceae	Leaves
8	*Glycyrrhizaglabra* Linn.	Mulethi	Leguminosae (Fabaceae)	Leaves

Preparation of plant extracts:

For the manufacture of plant extracts, many extraction techniques were used. In the current study, 80% ethanol was used as the solvent. There are many extraction techniques:

a. Continuous Shaking Extraction (CSE):

A 250-mL conical flask was filled with 6 g of fresh or dried plant material and subjected to a continuous shaking extraction procedure. The flask was placed on an orbital shaker (Rivotek, Riviera, India) and exposed to 50 mL of 80% ethanol. The suspensions were stirred continuously at 110 ±2 rpm for 3–4 hours at a regulated temperature of (25± 5°C). Whatman Filter Paper No. 1 was used to filter all of the extracts, and the filtrates were used in further studies.

b. Evaporation and Weighing:

Using a rotary vacuum evaporator, the solvent was removed from each sample's filtrate. The majority of the solvent needed 15–20 minutes to evaporate from each sample. The residual evaporator solutions were then put into clean, empty vials after they had been weighed. For the purpose of evaporating the remaining solvent and obtaining the final dried extract yield, these vials were maintained in a hot water bath. The extract-containing vials were then weighed.

Yield = [(Final weight- Initial weight)/ Initial weight] * 100

2. Preliminary Screening:

Each of the test samples was first re-constituted in their respective solvent divided into aliquots and used to perform the following tests:

(A) Carbohydrates

Fehling's Test- To 2 ml of each of the test solution, 2 ml of Fehling's solution (prepared by mixing solution A; 7 g of $CuSO_4$.$7H_2O$ in 100 ml distilled water and B: 24 g of sodium potassium tartrate in 100 ml of distilled water, just prior to use) was added and then mixture was heated on a water bath. A rusty brown colour or red precipitate, thus developed, indicate the presence of carbohydrates.

(B) Protein

Biuret test- To equal volume (2ml) of the test solution and 20% KOH solution mixed thoroughly, 1 ml of 0.5% $CuSO_4$ solution was added slowly till a pale purple colour developed indicating the presence of protein.

Ninhydrin test -To 3 ml of each of the test solution 0.5 ml of 0.1% ninhydrin solution in acetone and two drops of pyridine were added and the mixture was heated when the appearance of a blue colour indicates the presence of protein.

(C) Tannins

$FeCl_3$ test- To the aqueous test sample dilute $FeCl_3$ solution gradually was added and the presence of tannin was indicated by the development of a blue colour changing to olive green with the addition of more $FeCl_3$ solution.

(D) Alkaloids

Mayer's reagent: Mercuric chloride (0.3555 g) was dissolved in 60 ml of water and 5 g of potassium iodide was dissolved in 20 ml of water. Two solutions were mixed and volume was made up to 1000 ml with distilled water.

Dragendroff's reagent:

1. Solution A: Basic bismuth nitrate (1.7 g) and 20 g of tartaric acid was dissolved in 80 ml of distilled water.
2. Solution B: Potassium iodide (16 g) was dissolved in 40 ml of distilled water.

Solution A and B were mixed in ratio of 1:1. Plant extracts (0.5-0.6 g) was mixed with about 8 ml of 1% HCl, warmed and filtered. 2 ml of filtrate was treated separately with Mayer's reagent and Dragendroff's reagent. Turbidity or precipitation was observed to indicate the presence of alkaloids.

(E) Flavonoids

Shinoda's test- To the test solution, a piece of magnesium ribbon and conc. HCl was added drop wise (2 ml each separately) and the resulting pink, scarlet, crimson or occasionally green or blue colour indicated the presence of flavonoids.

(F) Triterpenoids

Libermann-Burchard's test- To each of the test samples, a freshly prepared solution of LB reagent (by mixing 1 drop of conc. H_2SO_4 in 1 ml of acetic anhydride) was added. A pink colour changing to bluish-green indicated the positive test for the presence of tri-terpenoids.

(G) Saponins

Plant extract (0.5 g) was dissolved in boiling water in a test tube, and was allowed to cool and then shaken to mix thoroughly. Froth appears indicated the presence of saponins.

3. Quantification of Total Phenols:

Plant extract absorbance was measured using a spectrophotometer to quantify the total phenolic content of the extracts. Gallic acid was used as the reference standard for this test's positive results (Singleton et al., 1999). Gallic acid stock solution 1% (10 mg/ml or 1 g/100 ml) was produced in methanol for standard testing. This gallic acid stock solution was diluted with methanol to create various concentrations. The total volume was 2 ml, and the concentrations were 0.1 mg/ml, 0.5 mg/ml, 1.0 mg/ml, 2.5 mg/ml, and 5 mg/ml. Now, 500µl of distilled water were added to each of the five test tubes, each containing 100µl of each dilution. Each test tube was then filled with 100µl of Follin's Solution, and the test tubes were let rest for 6 minutes. One millilitre of 7% $Na_2\ CO_3$ and 500µl of distilled water were added to each test tube after six minutes. A 90-minute rest period was given to the test tubes.

After 90 minutes, the absorbance of each concentration was measured using a spectrophotometer at 760 nm, and the concentration of the stock solution was plotted against it on a graph to create a standard curve. Then, using the same process, the total phenolic content of the plant extracts was calculated by measuring the absorbance at 760 nm of 50µl and 100µl of plant extract produced in 80% ethanol.

4. Quantification of Total Flavonoids:

Using the Wilet method (2002), the total flavonoid content of the plant extracts was determined. As a reference, quercetin was employed, which is a flavonoid found in many plants, including onions, green tea, Ginkgo biloba, buckwheat tea, etc. For this study, a 1% stock solution of quercetin (10 mg/ml or 1 g/100 ml) in methanol was produced. This quercetin stock solution was diluted with methanol to create various concentrations. The total volume was 2 ml, and the concentrations were 0.1 mg/ml, 0.5 mg/ml, 1.0 mg/ml, 2.5 mg/ml, and 5 mg/ml. In five distinct test tubes, 100µl of each dilution was added together with 100µl of 5% sodium nitrate ($NaNO_3$).

After that, test tubes were given a six-minute rest period. Each test tube received 150µl of a 10% solution of aluminium chloride ($AlCl_3$) after six minutes. Once more, test tubes were let to rest for 3 to 5 minutes before 200µl of a 1M NaOH (sodium hydroxide) solution were added to each test tube. Each dilution's absorbance at 510 nm was measured using a spectrophotometer, and the concentration of the stock solution was plotted against it on a graph to create a standard curve. Following the same process, the total flavonoid content of the plant extracts was calculated by measuring the absorbance at 510 nm of 50µl and 100µl of plant extracts produced in 80% ethanol.

5. Antioxidant Activity of Plant Extracts:

The DPPH Assay, a technique based on the reduction of the methanolic solution of the colourless radical 1, 1, diphenyl-1-2 picryl-hydra Zyl-hydrate (DPPH) (Prieto et al., 1999) was used to assess the antioxidant properties of the plant material extracts. Throughout this procedure, ascorbic acid served as a reference standard. 3.94 mg of DPPH was dissolved in 100 ml of methanol to create a stock solution. A dose of 25µl of each extract was added to a prepared 3 ml of DPPH stock solution. After 30 minutes at room temperature and in the dark, the absorbance at 517 nm was measured.

The inhibition percentage of the radical scavenging activity of the samples was expressed as follows:

% inhibition = [(A control-A sample)/A control] x 100

6. Antimicrobial Activity of Plant Extracts:

Antimicrobial susceptibility testing was done using the disc diffusion method to detect the presence of antibacterial activities of the plant samples (Soares et al., 2020).

The SRL Diagnostic Lab, Sector 11, Chandigarh, India, kindly provided the gramme-negative bacteria Escherichia coli that was employed as the study's test organism. E. coli was subcultured on Muller Hinton media (MHA) for an overnight period at 35°C to test the organism's vitality. The manufacturer's instructions were followed when preparing Muller Hinton medium (MHA) for bacteria. Petri plates with MHA media were injected with E. coli after they had solidified by streaking with sterile platinum loop under aseptic circumstances. Whatman Filter Paper was used to create blank discs with a 6 mm diameter each. These discs were each covered with the plant extract. Then Whatman Filter Paper disc containing the test compound are placed on MHA surface having E. Coli. The antibiotics Azithromycin and Chloramphenicol were used in this test as a positive control. The plates were incubated at 37°C for 24 hrs. The antimicrobial activity was assessed by measuring the diameter of inhibition growth zone.

7. Separation of sterol compounds through chromatography:

CO-TLC was used to examine extracts made in 80% ethanol using conventional reference markers (cholesterol, stigmasterol, and β-sitosterol). All fractions were applied 1 cm above the edge of the activated TLC plates and developed in a variety of solvent systems, including system A's 8:2 hexane:acetone (Brain et al., 1968) and system B's 85:1 benzene:ethyl acetate(Heble et al, 1968) ratios. However, solvent system A provided the best spot separation. Such chromatograms underwent air drying and UV visualisation. The Rf values of the fluorescent patches that coincided with the standards were measured. These chromatograms were then heated to 100^0C while being individually sprayed with 50% H_2SO_4 (Bennett & Sedce, 1962) and anisaldehyde reagent until an identifiable colour emerged.

RESULT

Plant extract yield

Yield of plant extract vary from the highest of Asparagus officinalis root extract (163mg/g.dw) followed by *Withania somnifera* (161mg/g.dw) and lowest of *Asparagus racemosus* root (103mg/g.dw). All the data of eight plants on plant extract yield is given in Table no. 2 and a step-by-step depiction of the process is shown in figure 1.

Table 2. Medicinal plants with their yield in (mg/g) of dry weigh

S. No.	Plant Sample	Yield (mg/g.dw)
1	*Asparagus racemosus*(Roots)	103mg/gdw
2	*Asparagus racemosus*(Leaves)	145mg/gdw
3	*Asparagus officinalis* (Roots)	163mg/gdw
4	*Asparagus officinalis* (Stem)	155mg/gdw
5	*Murraya koenigii* (leaves)	141mg/gdw
6	*Murraya koenigii* (stem)	130mg/gdw
7	*Murraya paniculata* (leaves)	136mg/gdw
8	*Murraya paniculata* (stem)	128mg/gdw
9	*Withania somnifera*	161mg/gdw
10	*Centella asiatica*	141mg/gdw
11	*Cinnamomumtamala*	126mg/gdw
12	*Glycyrrhizaglabra*	158mg/gdw

Fig 1. Plant extract yield: (A) Continuous shaking extraction (B) Filtration (C) Solvent evaporation using rotary vacuum evaporator (D1) Plant extract of Asparagus racemosus (Roots), Asparagus racemosus (Leaves), Asparagus officinalis (Roots), Asparagus officinalis (Stem) (D2) Murraya koenigii leaves, Murraya koenigii stem, Murraya paniculata leaves, Murraya paniculata stem (D3) Withania somnifera, Centella asiatica, (D4) Cinnamomum tamala, Glycyrrhiza glabra

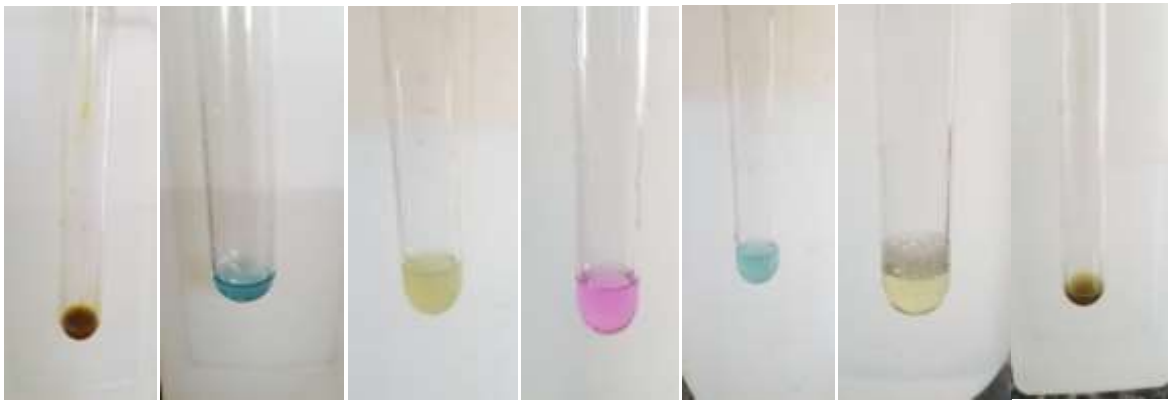
Phytochemical screening

The existence of several primary and secondary phytochemical components, such as amino acids, proteins, common sugars, alkaloids, steroids, flavonoids, tannins, etc., is discovered through phytochemical screening. All eight of the studied plants, which are listed in Table No. 3, included the seven targeted phytochemicals (carbohydrate, protein, alkaloids, flavonoids, steroids, saponin, and tannin) that were examined in the current study. Furthermore, Figure 2 demonstrates the presence of these phytochemicals.

Table 3. Phytochemical analysis of plant extracts

S. No.	Plant Name	Phytochemicals						
		Carbohydrates	Proteins	Alkaloids	Flavonoids	Steroids	Saponins	Tannins
1	*A. rac* (Roots)	+	+	+	+	+	+	+
2	*A.rac* (Leaves)	+	+	+	+	+	+	+
3	*A.off* (Roots)	+	+	+	+	+	+	+
4	*A.off* (Stem)	+	+	+	+	+	+	+

5	*M. koenigii (leaves)*	+	+	+	+	+	+	+
6	*M. Koenigii (stem)*	+	+	+	+	+	+	+
7	*M. paniculata* (leaves)	+	+	+	+	+	+	+
8	*M. paniculata (*stem)	+	+	+	+	+	+	+
9	*Withania somnifera*	+	+	+	+	+	+	+
10	*Centella asiatica*	+	+	+	+	+	+	+
11	*C. Tamala*	+	+	+	+	+	+	+
12	*G. glabra*	+	+	+	+	+	+	+



A B C D E F G

Fig 2. Positive test results for phytochemicals: A) Carbohydrates B) Proteins C) Alkaloids D) Flavonoids E) Steroids F) Saponins G) Tannins

Total phenolic content and total flavonoid content

Asparagus officinalis (root) extract had the lowest TPC (total phenolic content) value, at 4.08 mg GAE/gm, and Glycyrrhiza glabra extract had the highest TPC (total phenolic content), at 122.78 mg GAE/gm. Withania somnifera plant extract had the highest Total Flavonoid Content (TFC) value of 99.87 mg QE/g, while Asparagus officinalis (root) extract had the lowest TFC value of 18.90 mg QE/g. Table No. 4 provides information on all plant extracts, including their total phenolic and flavonoid content.

Table 4. Total flavonoid and phenolic content of all eight plants taken for study.

S. No.	**Plant Extract**	**TFC**	**TPC**
1	*Asparagus racemosus*(Roots)	25.40 mgQE/g	81.5 mgGAE/g
2	*Asparagus racemosus*(Leaves)	81.38 mgQE/g	71.88 mgGAE/g
3	*Asparagus officinalis* (Roots)	18.90 mgQE/g	4.08 mgGAE/g
4	*Asparagus officinalis* (Stem)	45.73 mgQE/g	70.97 mgGAE/g

5	*Murraya koenigii* (leaves)	24.24 mgQE/g	77.55 mgGAE/g
6	*Murraya koenigii* (stem)	73.72 mgQE/g	66.14 mgGAE/g
7	*Murraya paniculata* (leaves)	41.65 mgQE/g	77.3 mgGAE/g
8	*Murraya paniculata* (stem)	33.07 mgQE/g	77.21 mgGAE/g
9	*Withania somnifera*	99.87 mgQE/g	61.39 mgGAE/g
10	*Centella asiatica*	61.89 mgQE/g	76.3 mgGAE/g
11	*Cinnamomumtamala*	89.54 mgQE/g	63.47 mgGAE/g
12	*Glycyrrhizaglabra*	92.21 mgQE/g	122.78 mgGAE/g

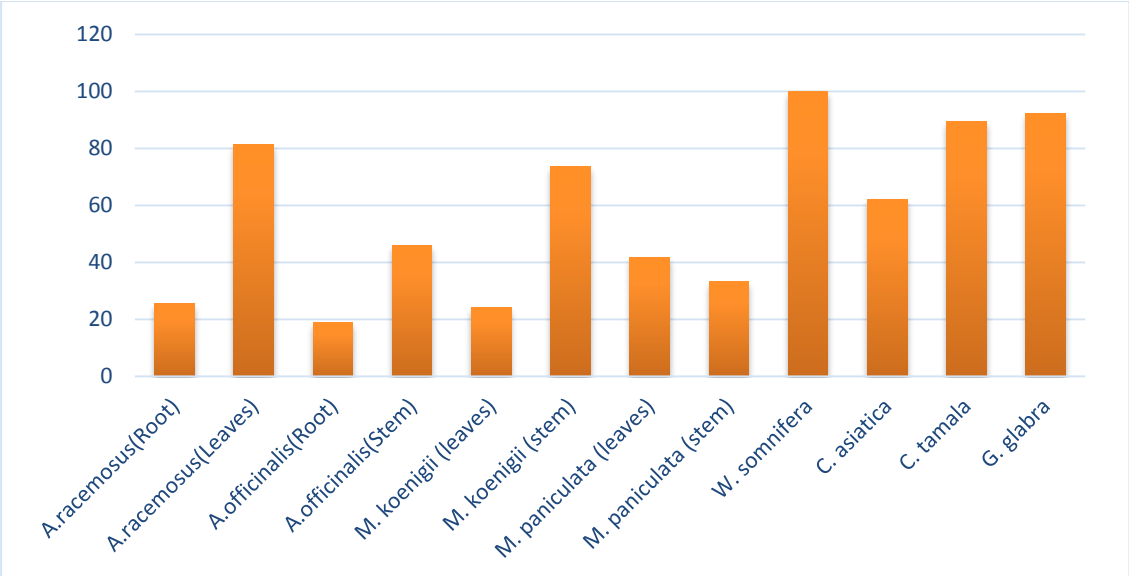


Fig 3. Total flavonoid content of eight plants extract

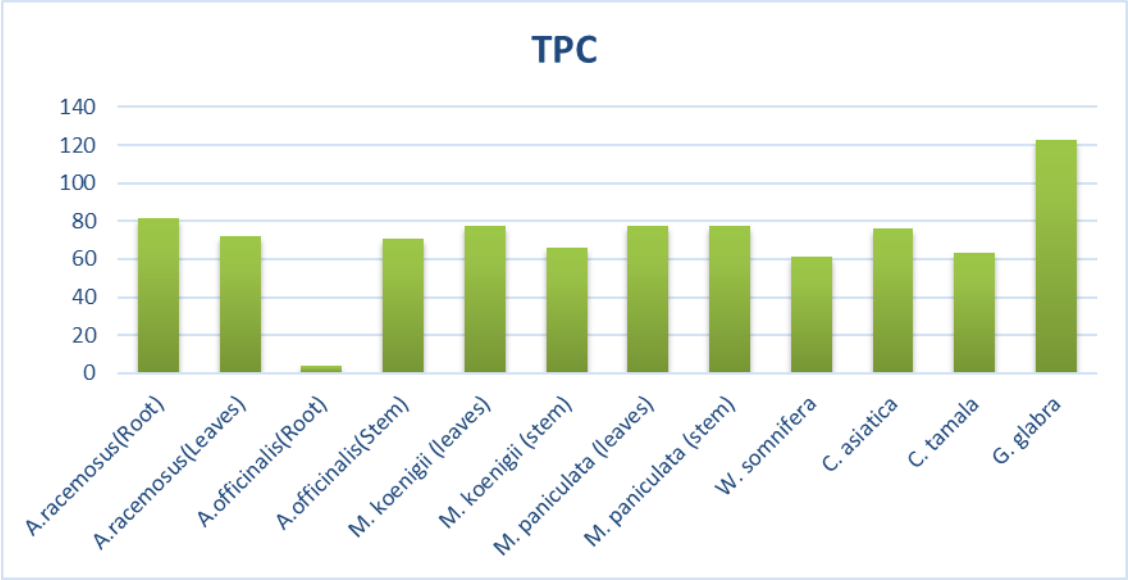


Fig 4. Total phenolic content of eight plants extract

Antioxidant and antibacterial activity

All plants exhibit some degree of inhibition (Table 6); however, Asparagus officinalis roots exhibit the highest percentage of inhibition (86.70%), whereas Murraya koenigii leaves exhibit the lowest proportion (65.90%). Asparagus racemosus root extract and Glycyrrhiza glabra extract had the highest

antibacterial activity against E. coli bacteria, while Asparagus officinalis stem extract had the lowest. Antibiotic activity is measured by measuring the diameter of the inhibition zone using the disc method (figure 6). Using the DPPH assay, the antioxidant capacity of all eight plants was evaluated; the results are shown in Table 7.

Table 6. Diameter of inhibition zone of antibiotics and plant samples measured using disc method.

S. No.	**Plant Extract**	**Inhibition Zone**	**Chloramphenicol**	**Azithromycin**
1	*Asparagus racemosus*(Roots)	11	20	15
2	*Asparagus racemosus*(Leaves)	7	20	15
3	*Asparagus officinalis* (Roots)	9	20	15
4	*Asparagus officinalis* (Stem)	6	20	15
5	*Murraya koenigii* (leaves)	9	20	15
6	*Murraya koenigii* (stem)	8	20	15
7	*Murraya paniculata* (leaves)	10	20	15
8	*Murraya paniculata* (stem)	7	20	15
9	*Withania somnifera*	8	20	15
10	*Centella asiatica*	10	20	15
11	*Cinnamomumtamala*	7	20	15
12	*Glycyrrhizaglabra*	11	20	15

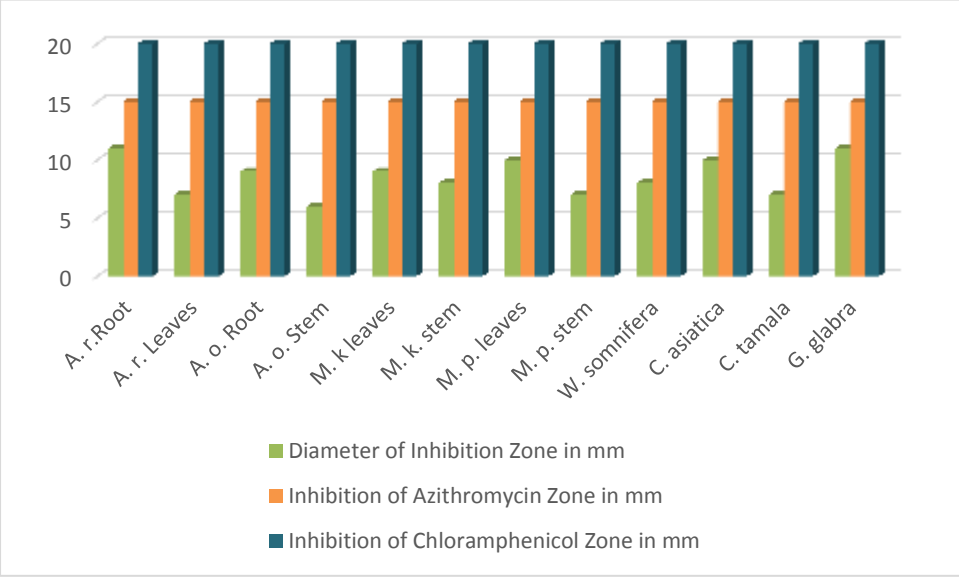


Figure 5. Bacterial inhibition zone diameter (nm) by extracts and fractions.

Table 7. Antioxidant capacity of plant extracts by DPPH assay

S. No.	Plant Sample	% Inhibition
1	*Asparagus racemosus*(Roots)	85%
2	*Asparagus racemosus*(Leaves)	82.90%
3	*Asparagus officinalis* (Roots)	86.70%
4	*Asparagus officinalis* (Stem)	80.50%
5	*Murraya koenigii* (leaves)	65.90%
6	*Murraya koenigii* (stem)	85%
7	*Murraya paniculata* (leaves)	80%
8	*Murraya paniculata* (stem)	81.50%
9	*Withania somnifera*	82%
10	*Centella asiatica*	85.07%
11	*Cinnamomumtamala*	83.80%
12	*Glycyrrhizaglabra*	84.30%

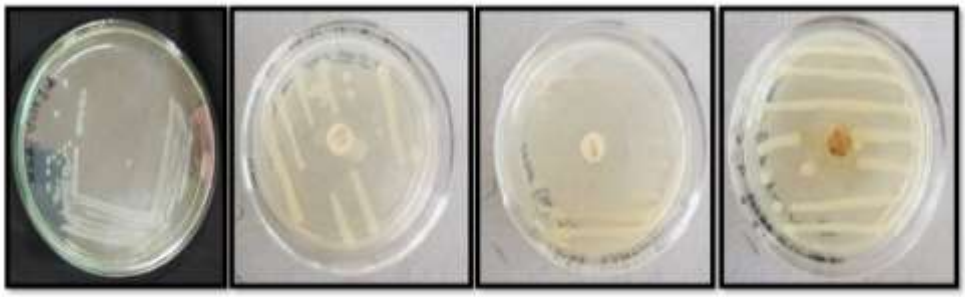


Fig 6. Testing antimicrobial activity using disc diffusion method

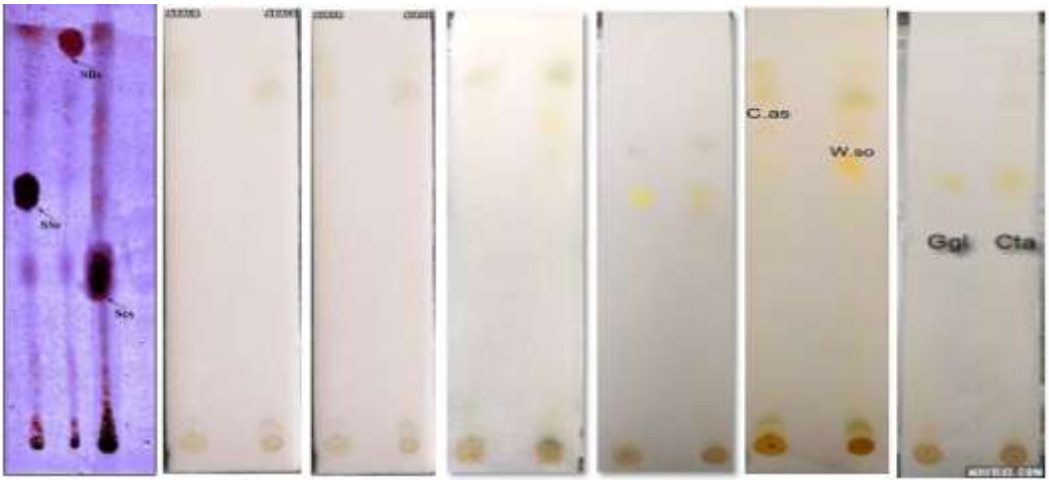
Sterol compounds

Sterols have been separated for the investigation from ethanol-extracted plant material. They were separated using thin-layer chromatography in an 8:2 hexane: acetone solvent solution. Stigmasterol, β-sitosterol, and cholesterol were used as reference markers in CO-TLC to analyse the chromatographic behaviour that served as the basis for their identification. Table 8 and figure 7 displays the findings regarding the chromatographic behaviour of substances.

Table 8. Rf value and colour of sterols from plant extracts.

S. No.	Plant Extract	Rf value	Colour of spot
1	*Asparagus racemosus*(Roots)	0.61	Brown
2	*Asparagus racemosus*(Leaves)	0.65	Brown
3	*Asparagus officinalis* (Roots)	0.6	Brown
4	*Asparagus officinalis* (Stem)	0.64	Brown
5	*Murraya koenigii* (leaves)	0.65	Grey
6	*Murraya koenigii* (stem)	0.66	Grey
7	*Murraya paniculata* (leaves)	0.84	Yellowish Brown
8	*Murraya paniculata* (stem)	0.84	Yellowish Brown
9	*Withania somnifera*	0.78	Yellowish green
10	*Centella asiatica*	0.84	Yellowish green

11	*Cinnamomumtamala*	0.85	Brown
12	*Glycyrrhizaglabra*	0.7	Yellowish Brown



A B C D E F G

Fig 7. Chromatographic behavior of sterols of (A) Reference markers (B) A.racemosus (C) A.officinalis. (D) Murraya paniculata (E) Murraya koenigii (F) Centella asiatica and Withania somnifera (G) C. tamala and G. glabra.

DISCUSSION

Although plants are thought to be the source of many medications, only a small number of plant species, especially from tribal areas, are examined for the presence of different phytochemicals and their potential for use as traditional medicines. In the current study, eight medicinal plants were gathered from various urban green spaces in Tricity Chandigarh in order to examine the presence of different phytochemicals in the ethanolic extract of the plants as well as some antibacterial activities. Phytochemical analysis conducted on eight selected medicinal plant extracts, i.e., Asparagus racemosus, Asparagus officinalis, Murraya koenigii, Murraya paniculata, Withania somnifera, Centella asiatica, Cinnamomum tamala, and Glycyrrhiza glabara, revealed the presence of carbohydrate, protein, alkaloid, flavonoid, steroid, saponin, and tannin in all the eight plants taken for study. Phytochemicals are substances that are biologically active and have pharmacological and physiological effects. The bioactivity of plant extracts may vary depending on many geographic and environmental factors. The presence or lack of various phytochemicals, however, varies depending on the type of material (Raval, 2010). Additionally, the presence or lack of certain phytochemicals varies within the same plant with different extraction techniques (Shah et al., 2013). (Behera, 2018) claims that a methanolic extract of the Asparagus racemosus root exhibits the presence of alkaloids in Mayer's, Hanger's, and Dragendroff's tests but not in Wagner's test. Arshiya (2011) demonstrates that the Asparagus racemosus root is devoid of alkaloids, proteins, tannins, flavonoids, and steroids, but in this study, the existence of these compounds was found in the plant extract. According to Arumugam S. Muniappan Ayyanar et al.'s 2011 study, tannin was present in the methanol, aqueous, and acetone extracts of Centella asiatica leaves but was absent from the chloroform extract. A number of previous studies on

medicinal plants have produced conflicting findings regarding the presence or absence of various phytochemicals in plant extracts (Acharya et al., 2012; Agidew, 2022; Bernard et al., 2014; Dhanani et al., 2017; Gaurav & Bisht, 2016; Gautam & Goel, 2012; M. Hassan & Kumari, 2012; W. Hassan & Zainab Kazm; Hosseini et al., 2021; Al-Snafi, 2018; Arshiya, 2011; Gupta et al., 2008; L et al., 2015; Alkaloids have antibacterial effects and prevent the growth of biofilms (Bhandari et al., 2021). The anti-helmintic and anti-diarrheal properties of alkaloids have also been reported (M. Hassan & Kumari, 2012; W. Hassan & Zainab Kazmi, 2015). One of the key phytonutrients is flavonoids, which have been shown in numerous studies to have antioxidant, anti-malignant, anti-viral, and antimutagenic properties (Bendjedid et al., 2021; Singh et al., 2021; Refaat et al., 2013). Additionally, its effects on the signal transduction pathway and apoptosis have been linked to its function in the therapy of cancer (Lutfia et al., 2021; Mobaraki et al., 2021). Tannin and terpenoids are recognised for their capacity to produce an effective defence mechanism against free radical assaults and exhibit natural antioxidant activity. The study of these phytochemicals from therapeutic plants is crucial from both a social and business perspective. Analysing the photochemical properties of medicinal plants becomes important for the production of novel medications and the treatment of various diseases.

CONCLUSION

The outcome showed that each of the eight plant extracts used for the study included various phytochemicals as well as antioxidant and antibacterial properties. Early studies tended to concentrate on plants from tribal or rural areas, but in the current environment, where the entire world is moving towards urbanisation, medicinal plants from urban green space become important if they reveal the presence of active biocomponents that contribute to these plants' physiological and medicinal properties. It is advised that more research be done to isolate, purify, and pinpoint the active ingredient responsible for the action of these medicinal plants from urban green spaces as well as traditional medicinal practices.

Acknowledgement: The authors are thankful to Dr. Manvi Malwal for support in data collection, and Botany Department, PG GCG 42 Chandigarh, for providing lab facilities.

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