

**MINERAL CONTENT, ANTIMICROBIAL AND RADICAL  
SCAVENGING POTENTIAL OF *CAESALPINIA MIMOSOIDES*  
LAMK. (CAESALPINIACEAE)**

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**ABSTRACT**

The plant *Caesalpinia mimosoides* Lamk. (family Fabaceae; sub-family Caesalpinaceae) is a small spiny tropical tree or climbing shrub distributed in several countries such as China, India, Myanmar and Thailand. The present study aimed at estimating the content of major and minor elements and determining antimicrobial and radical scavenging activity of methanol extract of various parts *viz.*, root, fruit, leaf and flower of *C. mimosoides*. The composition of mineral elements was estimated by ICP-OES technique after digestion with nitric acid in microwave digester. Overall, calcium and potassium were found in high quantity among major elements. The content of iron and nickel was high and least among minor elements estimated. Antibacterial activity of extracts was tested against five drug resistant

urinary tract pathogens by Agar well diffusion assay. Among bacteria, Gram positive bacteria showed high susceptibility than Gram negative bacteria to extracts. Among extracts, fruit and leaf extracts were able to inhibit bacteria to high extent. Antifungal activity was tested against five fungi by Poisoned food technique. Among extracts, root and fruit extracts displayed marked inhibition of test fungi when compared to leaf and flower extracts. Radical scavenging potential of extracts was determined by DPPH radical scavenging assay. Among extracts, fruit extract scavenged radicals more efficiently followed by leaf, flower and root extract. Preliminary phytochemical analysis showed the presence of steroids, flavonoids, glycosides and tannins in all extracts. The observed bioactivities could be ascribed to the

presence of phytochemicals in extracts. *C. mimosoides* can be utilized as a source of important mineral elements. The plant can be a potential candidate for developing agents with activity against uropathogens and free radical induced oxidative damage. The plant can also be used to control phytopathogenic fungi.

**KEY WORDS:** *Caesalpinia mimosoides*, Drug resistance, Agar well diffusion, Poisoned food technique, DPPH.

## INTRODUCTION

Every individual is in need of a number of organic and inorganic substances for daily activities. Nutrients viz., carbohydrates, fats and proteins (macronutrients) form the major portion of the diet and are consumed in large amount. Nutrients such as minerals and vitamins (micronutrients) represent comparatively smaller part in the diet and are consumed in much smaller quantities. Minerals play significant role in the physiology of an individual. Mineral elements can be therapeutic and often contribute to the normal health. Around 25 elements are identified as essential for keeping human health. Hence, qualitative and quantitative study on these elements in food and plants is of much interest. Plants represent a major portion of diet and hence their nutritive value is important. Mineral elements perform several functions in the body and their absence or insufficiency results in adverse effects on the body. These minerals act as components of enzymes, regulate cellular energy transduction, gas transport, antioxidant defense, membrane receptor functions, second-messenger systems and integration of physiological functions. Hence mineral elements are involved in the regulation of use of macronutrients<sup>[1,2,3]</sup>.

Urinary tract infections (UTIs) are one among the most common bacterial infections in humans in community as well as hospital setting affecting millions of individuals throughout the world. These are the infections caused by microbes anywhere in urinary tract. UTIs occur in all age groups of both sexes and these infections are more common in females than in males. In almost all cases, there is a requirement for starting the treatment before the final microbiological results are obtained. Many bacteria such as *Staphylococcus aureus*, *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, species of *Enterobacter* and *Enterococcus* are implicated in causing UTIs. The bacteriology of UTIs may be polymicrobial or it may involve single species. In most cases of UTIs, *E. coli* remains the dominant aetiological agent. UTIs are commonly treated using antibiotics. However, the exhaustive use of antibiotics resulted in appearance of

resistant strains of uropathogens. These resistant strains frequently interfere with the successful therapy of UTIs. Since time immemorial, plants have been used as medicine all over the world to treat infections caused by pathogens. It has been shown that plants exhibit inhibitory potential against human pathogenic bacteria including antibiotic resistant strains. Many plant species are known to exhibit marked inhibitory activity against drug resistant uropathogens<sup>[4-8]</sup>.

Plants serve human beings in several ways. However, plants also suffer from diseases caused by several kinds of pathogens *viz.*, bacteria, fungi, viruses, nematodes, mycoplasma etc. Among the pathogens causing diseases in plants, fungi are considered as more aggressive. The fungal diseases of plants have significant role in agriculture in terms of reduction of crop yield. Many strategies are employed for controlling fungal diseases of plants. One among them is the use of synthetic chemical agents. However, these chemical agents often suffer from drawbacks like high cost, toxicity to non-target organisms, residual problem (environmental pollution) and the development of resistance in fungal pathogens. Hence, search for an effective alternate for chemical control of plant diseases is required. Natural products obtained from plants can be the potential candidates which can be used against plant pathogenic fungi. Their use is risk-free when compared to synthetic chemicals and resistance development in pathogens against natural products is not observed. It has been shown that the crude extracts, essential oils and purified compounds from plants possess inhibitory effect against a number of plant pathogenic fungi<sup>[9-12]</sup>.

The onset of 'oxidative stress' can be noticed when the antioxidant defenses of the body are overwhelmed by an excessive production of free radicals such as superoxide radical, hydroxyl radical and others. In oxidative damage, the macromolecules such as proteins, lipids and nucleic acids undergo damage. Oxidative stress is implicated in several diseases or disorders such as cancer, cardiovascular diseases, neurodegenerative diseases, aging etc. In the body, the harmful effects of these free radicals are lowered by antioxidant enzymes and other endogenous or exogenous antioxidants. Antioxidants act at different levels *viz.*, prevention, interception and repair. Preventive antioxidants help in stopping formation of reactive species and include superoxide dismutase and catalase. Interception of free radicals is by scavenging of free radicals and includes effector antioxidants *viz.*, vitamin C and E, glutathione, thiols, carotenoids, flavonoids and polyphenols. At the repair level, many enzymes such as Glutathione peroxidase, DNA glycosylases, DNA endonucleases, DNA

ligases, DNA polymerase I and mismatch correction enzymes are involved in the repair of cellular components such as DNA or membranes. Synthetic antioxidants such as BHT, BHA and PG have been extensively used as antioxidants however they are reported to be carcinogenic and mutagenic on chronic consumption. Hence, discovery of new, safe and effective antioxidants from natural sources is needed. Consumption of fruits, vegetables, nuts, seeds, whole grains have shown to reduce the risk of chronic diseases produced due to oxidative stress<sup>[13-17]</sup>.

The genus *Caesalpinia* L. (family Leguminosae/Fabaceae; subfamily Caesalpinieae) is a genus of trees, shrubs and prickly climbers distributed throughout the world. Several members of *Caesalpinia* have economical, medicinal and horticultural importance. Many species have been used in ethnomedicine in various parts of the world. The members contain several classes of phytochemicals such as flavonoids, diterpenes, and steroids. The species of *Caesalpinia* exhibit a range of bioactivities such as antiulcer, anticancer, antidiabetic, anti-inflammatory, antimicrobial, and antirheumatic activities<sup>[18,19]</sup>.

*Caesalpinia mimosoides* Lamk. (Figure 1) is a small spiny tropical tree or climbing shrub distributed mainly in the south of China and grows in countries such as India, Myanmar and Thailand<sup>[20]</sup>. The plant *C. mimosoides* has got several traditional uses as food and medicine. Young sprouts and leaves are edible and sour and are traditionally used as a carminative and a remedy for dizziness<sup>[20]</sup>. The paste of the fleshy roots taken orally along with the juice of ginger is reported to exhibit anthelmintic property. Tender leaves are used internally in the form of dishes. The decoction of the whole plant is given for painful joint disorders. The oil prepared from the stem and branches with sesame oil is best for many disorders. The folk practitioners of Udupi district of Karnataka, India use the roots for ulcer and wound management, as well as for the treatment of arthritis<sup>[21]</sup>. In Mullu Kuruma tribe of Kerala, the tender leaves along with leaves of *Ricinus*, *Acorus* etc., are taken in the treatment of epilepsy<sup>[22]</sup>. In coastal parts of central Western Ghats of Karnataka, the tender leaves are used for treating boils<sup>[23]</sup>.



**Figure 1: *Caesalpinia mimosoides* Lamk.**

It has been experimentally shown that the extracts and purified compounds of *C. mimosoides* exhibit many bioactivities. The methanolic extract of shoot tips was shown to exhibit antioxidant activity<sup>[24]</sup>. The aqueous extract and a purified compound gallic acid showed potent inhibitory activity against human bacteria and fungi<sup>[25]</sup>. The leaves showed *in vivo* antiarthritic and analgesic activities<sup>[21]</sup>. Diterpenoids isolated from roots exhibited anti-inflammatory activity in terms of inhibitory activities against lipopolysaccharide induced nitric oxide production and inhibitory effect on LPS-induced tumor necrosis factor-alpha release in RAW264.7 cells<sup>[26]</sup>. Quercetin isolated from ethyl acetate extract of aerial parts enhanced survival and induced neurite outgrowth of P19-derived neurons<sup>[20]</sup>. The stem extract was shown to exhibit antimicrobial and antioxidant properties<sup>[27]</sup>. Polyphenolic fractions from aerial parts inhibited viability of cervical carcinoma cell lines in a dose and time dependent manner<sup>[28]</sup>. In the present study, we determined antimicrobial (against drug resistant uropathogenic bacteria and phytopathogenic fungi) and radical scavenging efficacy of root, leaf, flower and fruit extract of *C. mimosoides*.

## **MATERIALS AND METHODS**

### **Collection and identification of plant**

The plant was collected during December 2013 at a place called Maragalale, Thirthahalli Taluk of Shivamogga district, Karnataka. The plant was identified by Dr. K.S. Vinayaka, Department of Botany, Kumadvathi First Grade College, Shikaripura, Karnataka. Various parts of the plant *viz.*, leaf, flowers, fruit and root were separated, cleaned off extraneous matter, dried under shade and powdered in a blender.

### Estimation of major and minor elements by ICP-OES

1g of each of the powdered material was digested in 10ml of ultrapure nitric acid in a microwave digester (CEM). The content was diluted to 25ml using distilled water. The digested materials were aspirated into ICP-OES to estimate elements viz., calcium, magnesium, sodium, potassium, phosphorus, zinc, copper, iron, manganese, nickel and chromium. The calibration standards were prepared by using multi-elemental standard solution in nitric acid. The instrument configuration and experimental conditions followed are as described in our earlier study<sup>[29]</sup>.

### Extraction and Phytochemical analysis

25g powder of each part of the plant was transferred into separate conical flasks containing 100ml of methanol (HiMedia, Mumbai), mixed well and the flasks were left at room temperature for two days with (occasional stirring). The extracts were filtered through Whatman No. 1 filter paper, concentrated in vacuum under reduced pressure and dried in the desiccator<sup>[7]</sup>. The extracts of various parts of the plant were subjected to preliminary phytochemical analysis to detect the presence of alkaloids, flavonoids, tannins, saponins, glycosides and steroids<sup>[30]</sup>.

### Antibacterial activity of extracts

Five drug resistant urinary tract bacteria viz., *Staphylococcus aureus*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumoniae* were tested for their susceptibility to extracts of various parts of *C. mimosoides* by Agar well diffusion assay. The test bacteria were inoculated into sterile Nutrient broth (HiMedia, Mumbai) tubes and incubated overnight at 37°C. The broth cultures of test bacteria were swabbed aseptically on sterile Nutrient agar (HiMedia, Mumbai) plates. Using sterile cork borer, wells of 6mm diameter were punched in the inoculated plates. 100µl of extracts (20mg/ml of Dimethyl sulfoxide [DMSO; HiMedia, Mumbai]), reference antibiotic (Chloramphenicol, 1mg/ml of sterile water) and DMSO (25%, in sterile water) were transferred into labeled wells. The plates were incubated at 37°C for 24 hours in upright position. The zones of inhibition formed around the wells were measured using a ruler<sup>[7]</sup>.

### Antifungal activity of extracts

Antifungal effect of extracts of various parts of *C. mimosoides* was checked by Poisoned food technique against five molds viz., *Colletotrichum capsici* (from anthracnose of chilli), *Sclerotium rolfsii* (from foot rot of ragi) and *Aspergillus flavus*, *Helminthosporium* sp., and

*Alternaria* sp. (from sorghum grains). Potato dextrose agar (HiMedia, Mumbai) was prepared, poisoned with extracts (1mg/ml of medium), sterilized by autoclaving, dispensed into sterile petri dishes and allowed to solidify. Fungal discs of 5mm diameter were cut from the periphery of 5 days old cultures of test fungi using a sterile cork borer and the discs were transferred aseptically at the centre of poisoned plates. The plates were incubated for 5 days at 28°C. Later, the colony diameter in mutual perpendicular directions was measured using a ruler. Antifungal activity of extracts in terms of inhibition of mycelial growth (%) of test fungi was calculated using the formula:

$$\text{Mycelial growth inhibition (\%)} = (C - T / C) \times 100$$

where 'C' is average colony diameter in control plates and 'T' is average colony diameter in poisoned plates<sup>[12]</sup>.

### Radical scavenging activity of extracts

DPPH (1,1-diphenyl-2-picrylhydrazyl) free radical scavenging assay was performed to investigate radical scavenging efficacy of extracts of *C. mimosoides*. Here, 1ml of different concentrations of extracts (0.5-50µg/ml of methanol) was mixed with 3ml of DPPH solution (0.004% in methanol) in clean and labeled tubes. The test tubes were incubated in dark for 30 minutes at room temperature. The optical density at 517nm was measured in a UV-Vis spectrophotometer (ELICO, SL159). The absorbance of the DPPH control (1ml methanol+3ml DPPH solution) was also noted. Ascorbic acid was used as reference standard. The scavenging activity was calculated using the formula:

$$\text{Scavenging activity (\%)} = [(A_o - A_e) / A_o] \times 100,$$

where  $A_o$  is absorbance of DPPH control and  $A_e$  is absorbance of DPPH in the presence of extract/standard<sup>[31]</sup>. The  $IC_{50}$  value for each of the extracts was calculated.  $IC_{50}$  denotes the concentration of extract required to scavenge 50% of DPPH free radicals.

## RESULTS

### Content of major and minor mineral elements in *C. mimosoides*

Table 1 shows the content of various elements in different parts of *C. mimosoides*. Overall, the content of calcium and potassium was high among major elements. The content of iron was found highest among minor elements estimated. The content of sodium and nickel was least among major and minor elements respectively.

**Table 1: Content of mineral elements (in ppm) in different parts of *C. mimosoides***

Element	Fruit	Root	Flower	Leaf
Calcium	1653.93	6284.59	1834.36	8381.35
Magnesium	755.83	1022.52	1229.73	1547.06
Sodium	51.48	174.04	82.41	48.02
Potassium	6145.50	5396.80	1227.15	5626.54
Phosphorus	1020.00	386.93	2232.20	1317.18
Zinc	14.42	6.94	28.23	24.66
Copper	15.17	24.73	111.55	24.24
Iron	315.82	1515.81	248.37	521.00
Manganese	27.01	41.41	39.20	139.67
Nickel	1.21	2.94	1.72	1.36
Chromium	3.50	13.55	2.99	2.21

**Phytochemicals detected in parts of *C. mimosoides***

The phytoconstituents detected in various parts of *C. mimosoides* are shown in Table 2. Steroids, flavonoids, glycosides and tannins were detected in all parts whereas alkaloids and saponins were not detected.

**Table 2: Phytoconstituents detected in parts of *C. mimosoides***

Phytoconstituent	Root	Leaf	Flower	Fruit
Alkaloids	-	-	-	-
Steroids	+	+	+	+
Flavonoids	+	+	+	+
Saponins	-	-	-	-
Glycosides	+	+	+	+
Tannins	+	+	+	+

**Antibacterial activity of parts of *C. mimosoides***

The result of antibacterial potential of extracts of various parts of *C. mimosoides* is shown in Table 3. The extracts were effective against test bacteria but to a varied extent. Among bacteria, Gram positive bacteria showed high susceptibility to extracts when compared to Gram negative bacteria. Among extracts, fruit and leaf extracts were able to inhibit test bacteria to high extent followed by root and flower extracts. *K. pneumoniae* was inhibited to least extent by extracts. Overall, *S. aureus* and *P. aeruginosa* were inhibited to high extent among Gram positive and Gram negative bacteria respectively. Inhibition caused by reference antibiotic (standard) was higher than that of extracts. Like extracts, reference antibiotic caused higher inhibition of Gram positive bacteria. DMSO did not cause inhibition of any test bacteria.



**Table 3: Antibacterial activity of parts of *C. mimosoides***

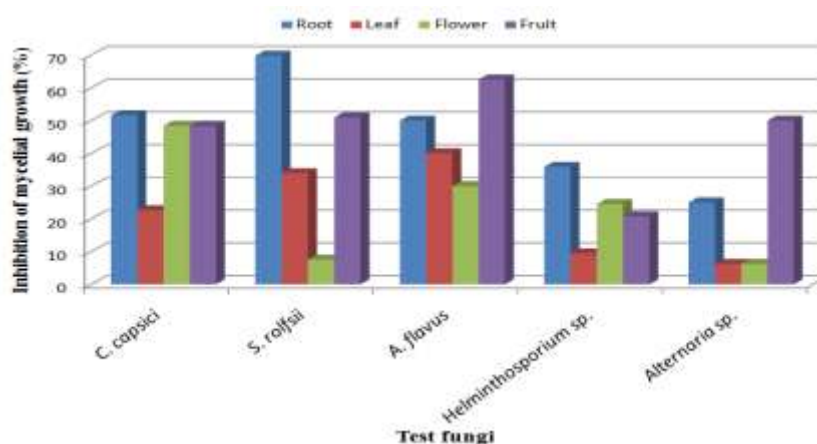
Test bacteria	Zone of inhibition in cm					
	Root	Leaf	Flower	Fruit	Standard	DMSO
<i>E. coli</i>	1.0±0.1	1.1±0.1	0.0±0.0	1.1±0.1	2.5±0.0	0.0±0.0
<i>P. aeruginosa</i>	1.4±0.2	1.6±0.2	1.2±0.1	1.5±0.2	2.5±0.0	0.0±0.0
<i>K. pneumoniae</i>	0.0±0.0	0.8±0.1	0.0±0.0	0.8±0.1	2.3±0.0	0.0±0.0
<i>S. aureus</i>	1.4±0.1	1.8±0.2	1.4±0.1	1.9±0.1	3.5±0.2	0.0±0.0
<i>E. faecalis</i>	1.6±0.1	1.6±0.0	1.4±0.1	1.6±0.2	3.5±0.2	0.0±0.0

**Antifungal activity of parts of *C. mimosoides***

Table 4 and Figure 2 depict the result of antifungal potential of extracts of *C. mimosoides*. The test fungi were susceptible to varied extent to extracts. Root extract was found to be highly effective in inhibiting *C. capsici*, *S. rolfsii* and *Helminthosporium* sp. *A. flavus* and *Alternaria* sp., were susceptible to fruit extract to higher extent. Among fungi, least inhibition of *C. capsici*, *Helminthosporium* sp., and *Alternaria* sp., was observed in case of leaf extract. Extent of inhibition of *S. rolfsii*, *A. flavus* and *Alternaria* sp., was least in case of flower extract.

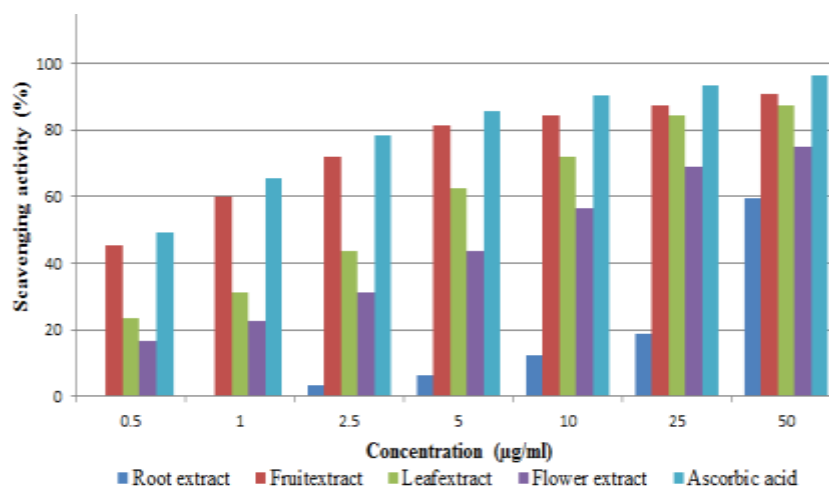
**Table 4: Colony diameter of test fungi on control and poisoned plates**

Treatment	Colony diameter of test fungi (in cm)				
	<i>C. capsici</i>	<i>S. rolfsii</i>	<i>A. flavus</i>	<i>Helminthosporium</i> sp.	<i>Alternaria</i> sp.
Control	3.1±0.1	5.3±0.1	4.0±0.0	5.3±0.2	3.2±0.2
Root	1.5±0.1	1.6±0.1	2.0±0.1	3.4±0.1	2.4±0.1
Leaf	2.4±0.0	3.5±0.0	2.4±0.2	4.8±0.2	3.0±0.0
Flower	1.6±0.1	4.9±0.0	2.8±0.2	4.0±0.1	3.0±0.1
Fruit	1.6±0.2	2.6±0.1	1.5±0.1	4.2±0.1	1.6±0.2

**Figure 2: Inhibition of test fungi (%) by parts of *C. mimosoides***

### Radical scavenging activity of parts of *C. mimosoides*

The result of scavenging effect of extracts of various parts of *C. mimosoides* is shown in Figure 3. All the extracts scavenged DPPH radicals in a dose dependent manner. Among extracts, fruit extract scavenged radicals more effectively followed by leaf, flower and root extracts. The IC<sub>50</sub> value for root, fruit, leaf and flower extract was 44.99µg/ml, 0.59µg/ml, 3.41µg/ml and 7.76µg/ml respectively. Ascorbic acid scavenged DPPH radicals more efficiently than extracts of *C. mimosoides* as indicated by lower IC<sub>50</sub> value (0.26µg/ml).



**Figure 3: Scavenging of DPPH radicals (%) by parts of *C. mimosoides***

### DISCUSSION

In most of the analytical determinations done for estimating mineral elements in plants, sample digestion is required. It is done using acids or their combination in different digestion equipment such as open beakers heated on hot plates, block digesters and digestion units placed in microwave ovens. Many analytical techniques are available for estimating mineral content of variety of samples. These techniques are mainly based on atomic spectrometry with mono-elemental detection for example, flame atomic absorption spectrometry, graphite furnace atomic absorption spectrometry. ICP-OES has an advantage that it encompasses multi-elemental determination and hence, high samples can be processed. Due to this, the technique of ICP-OES is widely used for elemental determination and several studies have been done to validate this method for metals analysis in a large variety of sample types including plant samples<sup>[29,32,33]</sup>. In the present study, we estimated the content of mineral elements in various parts of *C. mimosoides* by ICP-OES technique. The content of potassium, calcium and phosphorus was high in fruit, root and leaf, and flower respectively among major elements. Sodium was estimated in least quantity in all parts. The content of iron was high

while the quantity of nickel was least in all parts among minor elements. Root contained high iron content followed by leaf, fruit and flower.

In the present study, we determined the effect of extracts of various parts of *C. mimosoides* against five drug resistant uropathogens by agar well diffusion assay. It has been observed that the extracts inhibited Gram positive bacteria viz., *S. aureus* and *E. faecalis* to high extent when compared to Gram negative bacteria. Least inhibitory activity was observed against *K. pneumoniae*. Fruit and leaf extracts were more effective in inhibiting test bacteria. Antimicrobial potential of *C. mimosoides* is documented. In an earlier study, Chanwitheesuk *et al.*<sup>[25]</sup> observed potent antimicrobial activity of aqueous extract and purified gallic acid of *C. mimosoides*. In another study, the ethyl acetate extract of stem was shown to exhibit antimicrobial activity against *E. coli*, *B. subtilis* and *C. albicans*<sup>[27]</sup>. In this study, it has been observed that Gram positive bacteria exhibit high susceptibility to extracts when compared to Gram negative bacteria. The low susceptibility of Gram negative bacteria could be ascribed to the presence of an outer membrane which acts as an additional barrier for the entry of extracts into the cells. Similar observation was made in an earlier study of Vivek *et al.*<sup>[8]</sup> in which leaf extract of *Anisomeles indica* displayed high inhibition of Gram positive drug resistant uropathogens than Gram negative uropathogens. It has been shown that species of *Caesalpinia* exhibit inhibitory activity against several clinical strains of bacteria including drug resistant bacteria. The Oleanolic acid isolated from Argentinean legume *C. paraguariensis* was found to be active against *Bacillus subtilis* and both methicillin-sensitive and -resistant *Staphylococcus aureus*<sup>[34]</sup>. *C. ferrea* fruit extract was shown to inhibit *in vitro* growth of oral pathogens viz., *C. albicans*, *S. mutans*, *S. oralis*, *S. salivarius* and *L. casei* in planktonic and biofilm models<sup>[35]</sup>. The solvent extracts of *C. pulcherrima* caused inhibition of 4 strains of uropathogens<sup>[36]</sup>. The hexanic partition of methanol extract of aerial parts of *C. melanadenia* was shown to exhibit antimicrobial activity against strains including clinical isolates<sup>[37]</sup>.

The result of antifungal effect of extracts of various parts of *C. mimosoides* against fungi from various sources viz., anthracnose of chilli, foot rot of ragi and moldy grains of sorghum was promising. Overall, root and fruit extracts were effective to high extent against test fungi. Leaf and flower extracts displayed lower inhibitory potential against test fungi when compared to other two extracts. Few studies have been carried out on antifungal potential of *C. mimosoides*. In an earlier study, the ethanolic extracts of *C. mimosoides* showed potent

activity against dermatophytic fungi viz., *M. gypseum* and *T. rubrum* and gallic acid was detected as the main principle of the extract<sup>[25]</sup>. Ethyl acetate extract of stem was shown to inhibit *C. albicans* in a dose dependent manner<sup>[27]</sup>. It is shown that species of *Caesalpinia* possess inhibitory effect against a variety of fungal pathogens including phytopathogens. The phenolics from *C. cacalaco* (cascalote) were shown to exhibit inhibitory activity against *Colletotrichum lindemuthianum*, causative agent of anthracnose in common beans<sup>[38]</sup>. Methanol extract of *C. coriaria* was shown to exhibit inhibitory effect against 8 pathogenic fungi of paddy<sup>[39]</sup>. Flower extract of *C. pulcherrima* was shown to inhibit pathogenic fungi *T. rubrum*, *T. mentagrophytes* and *E. floccosum*<sup>[40]</sup>. It has been observed that extract of *C. coriaria* exhibit potent inhibitory activity against fungi such as *Colletotrichum gleosporioides*, *C. orbiculare*, *Cladosporium* sp., *Curvularia* sp. and *Fusarium* sp. etc<sup>[41]</sup>. Aqueous leaf extract of *C. pulcherrima* was found to inhibit the mycelial growth of *Slerotium oryzae* causing stem rot of paddy<sup>[42]</sup>.

DPPH assay is one of the most popular *in vitro* assays performed to screen radical scavenging potential of several kinds of samples including plant extracts and their purified metabolites. In the present study, the radical scavenging nature of various parts of *C. mimosoides* was evaluated by DPPH assay. The DPPH radical is a stable, organic, nitrogen centred free radical with maximum absorption at 517nm in methanolic solution. On receiving an electron or hydrogen atom from the donor, the free radical nature of DPPH is lost, the purple color of the radical changes to yellow (diphenylpicrylhydrazine) and the radical becomes a stable diamagnetic molecule<sup>[31,43-46]</sup>. In the present study, the decrease in absorption of DPPH radical solution was monitored in the presence of varying concentrations of extracts of various parts at 517nm. It is noticed that the extracts demonstrated dose dependent scavenging of DPPH radicals. Among extracts, fruit and root extracts exhibited high and least scavenging of radicals respectively. Reference antioxidant ascorbic acid scavenged radicals to maximum extent when compared to extracts. It is evident from the result that the extracts possess hydrogen donating ability and therefore these extracts can serve as free radical scavengers, acting possibly as primary antioxidants<sup>[43]</sup>. Couple of studies has been done on antioxidant activity of *C. mimosoides*. In a study, the methanolic extract of shoot tips was reported to display antioxidant activity<sup>[24]</sup>. In another study, the methanol extract of stem was shown to scavenge DPPH, hydroxyl, superoxide and nitric oxide radicals to higher extent when compared to other solvent extracts<sup>[27]</sup>.

## CONCLUSION

The plant *C. mimosoides* is shown to contain various elements having significant roles in the physiology of the body. Various parts of the plant can be used as sources of mineral elements. The extracts from various parts displayed inhibitory activity against drug resistant uropathogens and phytopathogenic fungi isolated from different sources and scavenging effect against DPPH radicals. The observed antimicrobial and radical scavenging effect could be ascribed to the presence of phytochemicals in the extracts. The plant can be used against infectious microorganisms and oxidative stress. Further *in vivo* studies are to be conducted.

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