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Original Research Article

Comparative Biochemical Studies on *Jasminum* Species

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Abstract

Jasmine is one of the plants with large number of species naturally occurring and cultivated species for fragrant flowers and their multiuse. People make religious sacrifices to gods like Lord Shiva and Lord Vishnu using jasmine flowers. Jasmine leaves can be deciduous or evergreen. This suggests that the leaves will either remain evergreen or drop off when they reach maturity. In the present study, the aqueous extracts of *Jasminum sambac, J. malabaricum, J. grandiflorum* leaves were studied for their phytoconstituents using standard protocols. *Jasminum sambac* and *J.malabaricum* showed the presence of alkaloids, tannin, protein, flavonoid, steroid and carbohydrates. Antioxidant activity was studied by DPPH and FRAP assay methods. DPPH antioxidant assay showed highest reducing power in *Jasminum malabaricum* compared to other two species. Antibacterial activity studied by well diffusion method in which *J.malabaricum* and *J.sambac* showed higher antibacterial activity whereas antifungal property was more showed by *J.malabaricum* extracts.

Keywords: *Jasminum* Species, Antioxidant, Antimicrobial Activity, Phytoconstituents.

INTRODUCTION

The genus *Jasminum* belongs to the family Oleaceae with more than 200 species of flowering climbing shrub and vine grows to a height up to 2-3 m are found all over the world. The WHO essential medicine list contains 252 drugs out of which 11% is exclusively from plant origin. The genus *Jasminum* is distributed throughout tropical and sub-tropical countries. Large numbers of species are distributed in Eurasia, India and Mediterranean regions. 16 taxa are endemic to India mainly reported from Deccan Penisula, Eastern and Western Himalayas and Andaman and Nicobar Islands (Srivatsava, 2002). They are commercially grown for their flowers and essential oil production. The plants of these species are shrub or bush form, vines and trees. Many *Jasminum* plants prominently feature white, yellow or pink flowers with sweet fragrance and others are unscented.

Jasmine tea routinely aids in the treatment of cancer. Its leaf extract is useful against breast cancers, and its oil is particularly effective in calming and relaxing (Shekhar and Prasad, 2013). For the floral, landscaping, medical, and pharmaceutical industries, jasmine plants have a high economic value as a field crop. It may be cultivated in many different types of soil and environment. For healthy development and flowering, it typically prefers a mid-tropical environment. Egypt leads the pack as a producer, with Morocco, India and Italy following.

Since ancient times, the scientific community has been interested in the antioxidant and antibacterial properties of plants. Antioxidants have proven to be effective in delaying the oxidative deterioration of food materials, particularly those with high lipid contents, and they have also demonstrated their ability to shield living cells from oxidative damage caused by the formation of free radicals and reactive oxygen species during the majority of metabolic activity. The development of numerous chronic diseases, including carcinomas, coronary heart disease, and many other health issues related to advanced age, is associated with the oxidative destruction of cellular constituents in the human body. Cell injury may then result in cell death. This has increased interest in natural compounds that are given to humans and animals as food components or particular pharmaceuticals and display antibacterial and antioxidant characteristics. The antibacterial and antioxidant properties of plant extracts and essential oils are well established. Plants are powerful biochemical factories and have been used in phytomedicine all across the world for a long period of time (Shekhar and Prasad, 2015).

In addition to being utilised extensively in traditional societies around the globe, medicinal plants

and products produced from them are now gaining popularity in modern civilization as organic substitutes for synthetic chemicals. Since ancient times, almost all cultures have employed plants as a source of medicine. Over 21,000 plants species classified by the World Health Organization (WHO) are believed to have therapeutic benefits. India is known as the world's botanical garden and is the country that produces the most medicinal herbs (Trivedi, 2007).

Jasminium officinale and *J. multiflorum* is evergreen shrub that typically grows 8 to 10 feet tall as a vine. In English, jasmine is known scientifically as Arabian Jasmine, while in Marathi, it is known as Kunda. The plant has a grayish-green appearance overall due to the downy pubescence that covers the stems and leaves. The leaves opposite, up to 5cm long, ovate, and rounded at the base. Due to its numerous curative properties, the jasmine flower is an essential component of practically all Ayurveda remedies. It is specifically used to get rid of intestinal worms. Jaundice and other venereal illnesses are thought to be effectively treated biologically by it. The flower buds aid in the treatment of eye illnesses, boils, vesicles, ulcers, and skin conditions. Jasmine is also used to add aroma to incense and perfumes. Flowers are utilised in shampoos, soaps, and lotions and are thought to be excellent skin toners and conditioners. *J. sambac*is frequently used in traditional systems of medicine for the treatment of fever, ulcers, diarrhoea, diabetes, and skin conditions like itching and leprosy. The two most researched jasmine species are *Jasminum sambac* and *J. grandiflorum*. Gallstones are treated with *Jasminum sambac* leaves soaked in cold water, while diabetes mellitus is treated with the infusion of the roots heated in water (Sunilson *et al*., 2010).

Since ancient times, plants and herbs have been the most often employed sources of therapeutic chemicals in the traditional medical system. The value of therapeutic plants is described in various Surahs in the Holy Quran. Islamic medicine dates back to Hazrat Adam (A.S.) and stopped with Hazrat Muhammad (SAW), although worldwide research into these medications is still ongoing. A novel possible source of treatment for pathogens that cause infectious diseases, medicinal plant extracts are rich in chemicals or secondary metabolites like tannins, terpenoids, alkaloids and flavonoids. Serious infections are brought on by pathogens, which include bacteria, fungi, viruses and nematodes. In Pakistani folk medicine, dietary plants have a long history of being used to cure infectious diseases due to their low toxicity. Due to a lack of technological support for the value addition of the exported herbal goods, among the significant group of flowering shrubs are *Jasminum officinale*. Due to their alluring fragrance blossoms, they are commonly grown in the Mediterranean, Caucasus, Northern Persia, Eastern Afghanistan, India, China and Pakistan (Cowan *et al*., 1999).

The most commonly employed plant components in traditional medicine include the entire plant, including the stem, barks, leaves, roots, and flowers. Traditional uses of the flowers of *Jasminum officinale* include CNS depressants, sedatives, mild anesthetics and astringents. Flowers are used to make syrup that is used to treat chest conditions like coughs and hoarseness. The entire plant is traditionally used to treat skin conditions, tumors, and persistent ulcers. Flower and leaf juices have emmenagogue, anthelmintic and diuretic properties. Chewing leaves helps heal mouth ulcers according to traditional medicine. Alkaloids, salicylic acid, ascorbic acid, and resin found in leaves are used to treat skin conditions, fevers, and ulcers. The goal of the study was to determine whether the crude extract of the *Jasminum officinale* whole plant and flowers had antimicrobial activity against Gram positive strains like *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Bacillus pumilus*, Gram negative strains like *Escherichia coli*, *Citrobacter freundii*, and *Klebsiella pneumoniae*, as well as two species of fungi *Candida albicans* and *Aspergillus niger*. The methanolic extract of the entire plant's aqueous and organic fractions was also investigated. (Duke *et al*., 2002).

Only 94 plant species have been used to make a total of 122 physiologically active chemicals. It's important to do consistent research to determine whether these plants contain a lot of therapeutic compounds. A substance that prevents other molecules from oxidising is known as an antioxidant. In an oxidation reaction, hydrogen or electrons are transferred from a substance to an oxidising agent. Free radicals can be produced through oxidation processes. These radicals can spark subsequent chain reactions. Antioxidants are frequently reducing agents like thiols, ascorbic acid, or polyphenols since they are oxidised themselves in order to accomplish this (Sushant and Prasad, 2015).

Traditional uses for the *Jasminum* species, which include *Jasminum grandiflorum*, *J. sambac*, *J. flexile*, *J. pubescens*, and *J. angustifolium*, include antimicrobial, antiulcerative, antidepressant, anti-inflammatory, anticancerous, flavouring and fragrance agents as well as treatments for breast cancer, diarrhoea, fever, dermatitis, conjunctivitis and abdominal pain. In aromatherapy, jasmine oil is frequently employed. The wide range of bioactive substances found in *Jasminum* plants, including phenolics, terpenoids, coumarins, glycosides, sterols, esters, and fatty acids, may be the cause of their medical effects. The combined effects of the antibacterial, anti-acne, spasmolytic and aromatherapy essential oil effects. According to phytochemical studies, phenolic compounds are significantly more bioactive than the bulk of terpenoids and other chemicals. Numerous studies have discussed the therapeutic potentials of phenolic constituents, including their antioxidant, anti-aging, antiulcer, anti-inflammatory, lipid peroxidation, ACE inhibitor,

vasodilation, wound healing and protective properties (Tharakan, 2021).

The objective of the present study was to identify the phytochemicals, evaluation of antioxidant activity and to determine the antimicrobial activities of aqueous leaf extract of three *Jasminum* species.

MATERIALS AND METHODS

Collection of Samples:

The leaves of *Jasminum sambac, J. grandiflorum* and *J. malabaricum* (Plate 1) were collected from Siddakatte, Bantwal, Karnataka. They were separately air dried, dried in hot air oven at 80°C for 3-4 h and finally made into course powders for further work.

Plate 1: *Jasminum* species selected for the study a) *Jasminum sambac* b) *J. grandiflorum* c) *J.malabaricum*

Preparation of Extract:

About 10g of powdered samples were soaked in 100 ml distilled water for 6-8h in water bath, filtered through Whatman No.1 filter paper to separate the aqueous extract. The filtrates were concentrated in water bath and used for further phytochemical analysis.

Qualitative Tests for Phytochemicals: The following tests were performed by using the standard protocols (Ganatra *et al*., 2013).

Tests for Alkaloids:

Mayer's test: Most alkaloids are precipitated from neutral or slightly acidic solution by Mayer's reagent to give a cream- colored precipitate.

Test for Amino Acids:

Ninhydrin test: Two drops of ninhydrin solution are added to 2 ml of aqueous filtrate. Appearance of purple colour indicates the presence of amino acids.

Tests for Carbohydrates:

Molisch's Test:

The test solution is combined with 2-3 drops α-naphthol in a test tube. After mixing, concentrated sulphuric acid is slowly added down the sides of the sloping test-tube, without mixing, to form a layer. A positive reaction is indicated by appearance of a purple red ring at the interface between the acid and test layers.

Benedict's Test:

Approximately 1 ml of sample was taken in a clean test tube to which 2 ml of Benedict's reagent was added. The solution was then heated in a boiling water bath for 3-5 min. Observe for color change in the solution of test tubes or precipitate formation.

Test for Phenolic Compounds and Tannins:

Ferric chloride test: To 2 ml of the sample filtrate, few drops of 10% ferric chloride solution were added. A green-blue or violet coloration indicated the presence of a phenolic hydroxyl group.

Test for Proteins:

Biuret Test:

Add 1-2 ml of the test solution. Add 1-2 ml of Biuret reagent to test tube. Shake well and allow the mixtures to stand for 5 min. If blue colour changes to deep purple, it indicates the presence of proteins.

Test for Flavonoids:

Shinoda Test:

Four pieces of magnesium fillings (ribbon) are added to the ethanolic extract followed by a few drops of concentrated hydrochloric acid. A reddish color indicates the presence of flavonoid.

Test for Phytosterols:

Salkowski Test:

A red color produced in the lower chloroform layer when 2 ml of organic extract was dissolved in 2 ml of chloroform and 2 ml concentrated sulphuric acid was added. Red color indicates the presence of steroids.

Test for Saponins: One millilitre extract was treated with 1% lead acetate solution. Formation of white precipitates indicates the presence of saponins.

Test for Glycosides:

Wagner's Test:

To 2-3 ml filtrate few drops of Wagner's reagent were added. Appearance of reddish brown precipitates revealed the presence of alkaloids.

Test for Phlobatannins:

Two millilitres of the aqueous solution of the extract were added into dilute hydrochloric and formation of red precipitate indicates the presence of phlobatannins.

***In Vitro* Antioxidant Assay:**

The antioxidant activities of leaf aqueous extracts of *Jasminum sambac, J. grandiflorum, J. malabaricum* were measured based on the scavenging activity of the stable 1, 1- diphenyl 2-picrylhydrazyl (DPPH) free radical (Nandini and Anil, 2024). One millilitre of 0.1 mM DPPH solution in ethanol was mixed with various concentrations (20-100 µg/mL) of leaf extract. The mixture was then allowed to stand for 30 min incubation in dark. One millilitre ethanol mixed with 1mL DPPH solution was used as control. The decrease in absorbance was measured at 517 nm using spectrophotometer. Ascorbic acid used as standard.

The percentage of inhibition was calculated as:
% of DPPH radical inhibition = [OD Control –OD sample/OD Control]×100

Ferric Reducing Antioxidant Power:

This analysis was performed by the method of Barreira *et al.*, (2018). Various concentration of extract was mixed with 2.5mL of 200mM Sodium phosphate buffer (6.6) and 2.5mL of 1% potassium ferricyanide and the mixture was incubated at 50^0C for 20min. Then 2.5mL of 10% trichloroacetic acid are added. To 5mL of the above solution 5mL of distilled water and 1mL of 0.1% ferric chloride were added and the absorbance was measured spectrophotometrically at 700nm. Butylated hydroxyl anisole (BHA) was used as standard.

Antibacterial Activity by Agar Well Diffusion Method (Radhaverma *et al.*, 2018): The microorganisms used were *Escherichia coli, Bacillus subtilis* and *Staphylococcus aureus*.

Preparation of Inoculum:

A loop full of culture was inoculated into nutrient broth and incubated at 37°C for 24 h to obtain a bacterial culture. *Escherichia coli, Bacillus subtilis* and *Staphylococcus aureus* species were collected from the laboratory of PG Department of Biotechnology, Alva's College, Moodbidri. The isolates were sub-cultured on nutrient broth and maintained.

The solidified Mueller-Hinton agar in the Petri plates were inoculated by dispensing the inoculums using sterilized cotton swabs which is previously immersed in the inoculumcontaining test tube and spread evenly onto the solidified agar medium. Then using sterile cork borer wells of 6mm were drilled on the agar plate.The leaf extract of 90µL, 110µL was then pipetted into each well. Streptomycin was used as positive control and distilled water as negative control. The zones of inhibition were observed after 24 h incubation at 37ºC and diameter of the inhibition zone formed around the well were measured.

Antifungal Activityby Poison Bait Method (Nene and Thaplial, 1975): Using the poison bait approach, antifungal properties of *Jasminum* species were assessed.

Standardization of Fungus Strains and Inoculums: *Cladosporium sphaerospermum, Botrytis cinerea,* and *Fusarium oxysporum* were maintained in PDA broth.

In this experiment, 100 ml Erlenmeyer flask containing 50 mL of PDA broth and 2 mL of *Jasminum* extract was added with a single mycelia disc of each test strain. Then flasks were incubated at 27°C± 3°C for four days. The mycelial biomass was filtered through Whatman No. 1 filter paper that had been pre-weighed and dried. Mycelia biomass was dried in a hot air oven at 60°C until the weight was consistent, at which point the biomass weight was recorded.

Statistical analysis: All the parameters were performed in triplicates. Results analysed and expressed as mean± Standard deviation.

RESULTS

Phytochemical Screening

The phytochemical screening for aqueous extract of the plant *Jasminum sambac, J. malabaricum* and *J. grandiflorum* showed positive results for carbohydrates, proteins, phenolic compounds, flavonoids and steroids (Table 1).

Table 1: Phytochemical analysis of aqueous extract of *Jasminum* species

Phytochemicals	Test	Observation	*J.sambac*	*J.malabaricum*	*J.grandiflorum*
Alkaloids	Mayers test	Turbidity	+	+	_
Tannin/ Phenolics	Lead test	Yellow / green precipitate	+	+	+
Saponin	Foam test	Presence of emulsion	+	+	_
Protein	Biuret test	Purple	+	--	+
Flavonoids	Ferric chloride test	White precipitate	+	_	_
Steroid	Chloroform test	Red colour	+	+	--

Carbohydrates	Molisch's test Benedict's test	Red colour	+	+	+
Phytosterols	Salkowski test	Reddish brown	--	+	+
Glycosides	Ferric chloride	Brown ring	+	+	+

+ present, - absent

It clearly reveals the phytochemical analysis performed on aqueous extract of *Jasminum sambac, J. malabaricum* and *J. grandiflorum* leaves and indicates the presence of high amount of alkaloids, flavonoids, saponins were also present but in lesser extent. This study also revealed complete absence of phlobatanins, anthocyanins. Thus the medicinal values of the plant leaves may be due to these specific groups of phytochemicals present in it. The phytochemical screening of qualitative estimation of the plants studied showed that the *J. sambac* and *J. malabaricum* are rich sources of medically active metabolites.

DPPH Radical Scavenging Assay: DPPH (1,1-diphenyl-2-picrylhydrazyl) analysis is one of the best-known, accurate, and frequently employed methods for evaluating antioxidant activity. Ascorbic acid was used as the standard for the determination of the antioxidant activity by DPPH method. Different concentrations of extracts were used (20,40,60,80 and 100µg/mL. The obtained results were expressed as percentage inhibition (Fig .1).

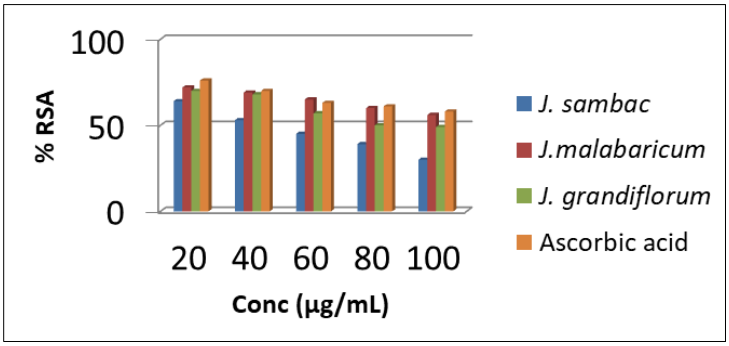

Fig. 1: DPPH radical scavenging activity leaf extracts of *Jasminum* species

The antioxidant activity was determined with ascorbic acid as standard. The aqueous extract of *Jasminum sambac* of different concentration 20,40,60,80 and 100 µg/mL showed 69,53,48,59 and 77 percentage of radical scavenging activity respectively. Whereas, the leaf aqueous extract of *Jasminum malabaricum* at concentrations 20,40,60,80,100 µg/mL shown percentage of radical scavenging activity of 37,40,75,83 and 78 respectively. The leaf aqueous extract of *Jasminum grandiflorum* of concentrations 20,40,60,80,100 µg/mL shown percentage of radical scavenging activity of 76,46,30,52 and 69 respectively. Hence *Jasminum malabaricum* showed the highest antioxidant activity compared to others.

FRAP assay was carried out to check reduction in the ferric compounds and all the aqueous extract which exhibited similar kind of reduction. All the samples showed higher activity suggesting that they had a higher potential of antioxidant property. The aqueous extract of *Jasminum malabaricum* showed higher antioxidant activity. The least antioxidant activity was shown by *Jasminum grandiflorum* and *J.sambac* extracts (Fig. 2). The better radical scavenging effect noted was 74.33±2.56% at concentration of 500µg/mL.

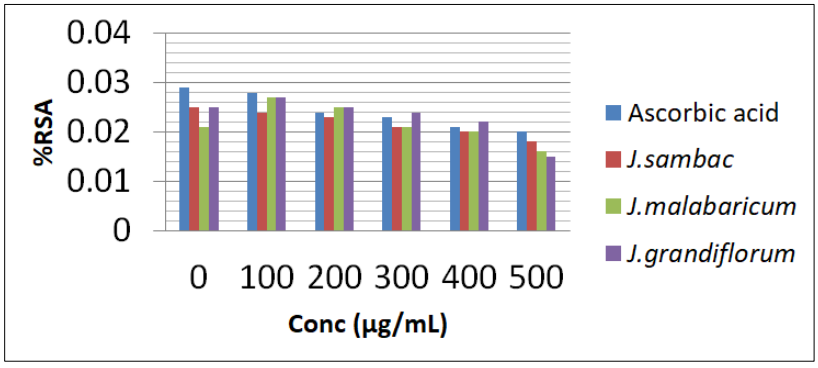

Fig. 2: FRAP assay of leaf aqueous extracts of *Jasminum* species

The crude aqueous leaf extracts of three *Jasminum* were tested against 3 microorganisms, *Escherichia coli*, *Bacillus subtilis* and *Staphylococcus aureus*. Zone of inhibition were observed in crude untreated leaf extract. The zone of inhibition was observed in the positive control. The zone of inhibition was measured. The results of antimicrobial activity of leaf extracts were shown in plates 2-4.

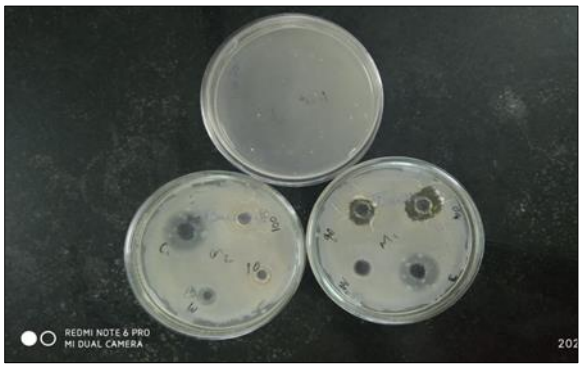

Plate 2: Aqueous extract of *Jasminum sambac* against *E. coli*

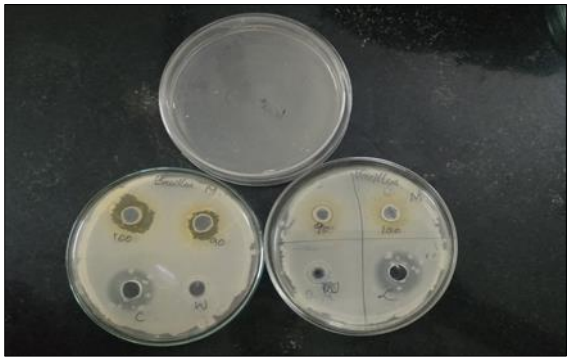

Plate 3: Aqueous extract of *Jasminum malabaricum* against *B. subtilis*

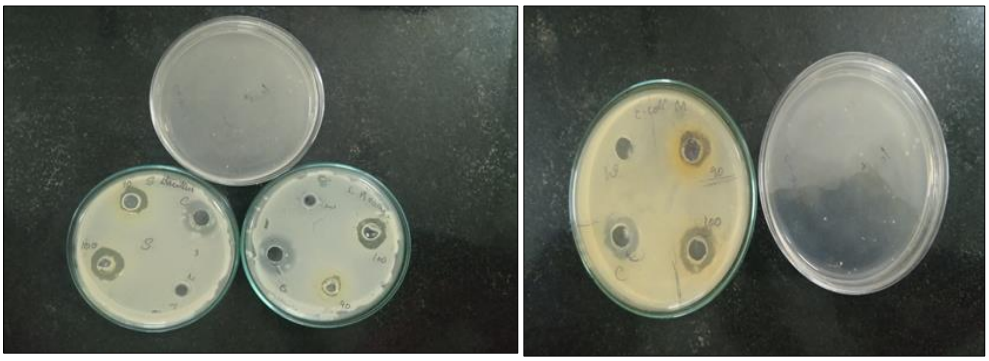

Plate 4: Aqueous extract of *Jasminum grandiflorum* against *S. aureus*

Table 2: Antibacterial activity of aqueous leaf extracts of *Jasminum* spp. against different bacterial strains

Plant species	**Leaf extract**	**Zone of inhibition (mm)***		
	Conc (µg/mL)	***Staphylococcus aureus***	***Escherichia coli***	***Bacillus subtilis***
Jasminum sambac	90	3.3±0.4	3.3±0.3	3.6±0.4
	110	3.6 ±0.6	3.3±0.9	4.6±0.9
J.grandiflorum	90	3.8±0.4	3.5±0.4	3.6±0.4
	110	3.6 ±0.7	3.3±0.9	4.6±0.9
J. malabaricum	90	3.6±0.4	4.0±0.3	4.3±0.4
	110	3.6 ±0.5	3.3±0.7	4.6±0.7
Positive control		8±0.2	8±0.2	8±0.2

*Mean± SD, N=3

The highest inhibition zone is seen in aqueous extract of *J. sambac* against *Staphylococcus aureus* was 3.6 ±0.6 at 110 µg/mL. In *J. malabaricum* against *Bacillus subtilis* zone of inhibition was 4.6±0.7 at 110 µg/mL (Table 2).

Jasminum malabaricum showed highest range of antifungal activity against *Fusarium oxysporum* and *J. grandiflorum* against *F.oxysporum*. This shows the higher antifungal property in *J. malabaricum* (Table 3).

Table 3: Antifungal activity of Jasmine leaf extracts against different fungal strains

Fungal isolates	Mycelial weight (g)*		
	J.sambac	***J.malabaricum***	***J.grandiflorum***
Fusarium oxysporum	0.03±0.002	0.39±0.01	0.26±0.018
Cladosporium sphaerospermum	0.1±0.015	0.15±0.05	0.2±0.014
Botrytis cineria	0.35±0.016	0.5±0.016	0.5±0.016

*Mean± SD, N=3

DISCUSSION

Plants have been widely used to treat various diseases due to its medicinal properties. Therefore, phytochemical analysis on plants is required to observe compounds class that might possess medicinal activities.

In the present study aqueous extract of *Jasminum sambac* and *J. malabaricum* showed the presence of phytochemical constituents like alkaloids, tannin, protein, flavonoid, steroid, carbohydrates. *J. grandiflorum* exhibited the presence of proteins, carbohydrates, sterols, tannins and glycosides. There were number of studies indicated the presence of various constituents in different species of *Jasminum*. The leaves and flowers of *Jasminum polyanthum* contain alkaloids, phenols, quinines, saponins, and terpenoids (Shen *et al*., 1996). Raja Sekharan *et al*., (2010) studied the detailed pharmacognostical composition of the leaves of *Jasminum grandiflorum* and found that the ethanol, acetone solvent extract showed the presence of some phytochemical compounds whereas benzene solvent extracted sample did not show presence of any compounds. Akash Jain *et al*., (2011) reported that the presence of terpenoids, flavonoids, steroids, glycosides, tannins and saponins in solvent extract of leaves and flowers of *Jasminum arborescens*. Similarly, the findings of Mittal *et al.,* (2016) in *Jasminum auriculatum* are in accordance with the findings of present work on three *Jasminum* species.

Shekhar and Prasad (2015) studied the various alcoholic extract of leaf showed presence of alkaloids, tannins, carbohydrates, sterols and terpenoids, flavonoids, cardiac glycosides, proteins and amino acids and the secondary metabolites like phlobatannins and saponins. Among the different solvents used in the extraction, the ethanol extract of leaves showed maximum number of phytoconstituents, alkaloids, tannins, flavonoids, cardiac glycosides, protein and amino acids followed by methanol extract, which exhibited tannins, sterols and terpenoids, flavonoids and cardiac glycosides. The extract of other solvents- Ethyl acetate (alkaloids, flavonoids and cardiac glycosides), chloroform (flavonoids, carbohydrates, sterols and terpenoids) petroleum ether (tannins, flavonoids, protein and amino acids) and aqueous (tannins, flavonoids and sterols and terpenoids) showed minimum number of components. Regarding flower extracts the maximum number of components was detected in ethanol extract (alkaloids, tannins, flavonoids, cardiac glycosides, proteins and amino acids) followed by methanol (alkaloids, tannins, cardiac glycosides, proteins and amino acids) and petroleum ether extracts (carbohydrates, sterols and terpenoids, flavonoids, proteins and amino acids). Comparatively less number of components was observed in flower extract of ethyl acetate (flavonoids, cardiac glycosides, proteins and amino acids), chloroform (sterols and terpenoids, flavonoids, proteins and amino acids) and aqueous extract (tannins, carbohydrates and flavonoids.

Kumaresan *et al*., (2019) revealed that the various alcoholic and aqueous leaf extract of *J. multiflorum* showed presence of alkaloids, tannins, carbohydrates, sterols and terpenoids, flavonoids, cardiac glycosides, proteins and amino acids and the secondary metabolites like phlobatannins and saponins were not detected. Among the different solvents used in the extraction, the ethanol extract of leaves showed maximum number of phytoconstituents andaqueous (tannins, flavonoids and sterols and terpenoids) showed minimum number of components. Similarly the flower extracts the maximum number of components was detected in ethanol extract (alkaloids, tannins, flavonoids, cardiac glycosides, proteins and amino acids) andaqueous extract (tannins, carbohydrates and flavonoids).

Phytoconstituents like alkaloids, saponins, flavonoids and glycosides were present in all *J, sambac* leaf extracts (n-hexane, chloroform, ethyl acetate, methanol and water). Phytosteroids were present in water and ethyl acetate plant extracts but absent in n-hexane, chloroform and methanol. In the same way, tannins and phenolic compounds are only present in water extract while absent in all remaining plant extracts. Fixed oils and fats were absent in all plant extracts (Tomar *et al*., 2020). Bioactive compounds like iridoids, secoiridoids, essential oils and lactones have been isolated and characterized from *J. multiflorum*, *J. sambac* and *J.polyanthum* (Rattan, 2023).

In the present study, DPPH antioxidant assay showed highest in *J.malabaricum* compared to other two. *J. malabaricum* and *J.sambac* showed greater inhibition zone. Sushanth and Prasad (2015) investigated for phytochemical compounds and antioxidant property of three *Jasminum* species using different solvents such as ethanol, methanol, butanol, propanol and acetone by DPPH and FRAP assay which showed high content of antioxidant compounds indicating the use of these plants for medicinal purposes. Khidzir *et al*., (2015) found the methanolic extract of flowers of *J. multiflorum* scavenging activity of DPPH radicals with IC_{50} value 81 µg/mL using BHT (IC_{50} 12.5 µg/mL) as positive control and the GC-MS analysis of methanolic extract showed the presence of nerolidol, benzyl benzoate and jasmolactone as main chemical constituents.

The antioxidant activity by DPPH free radical scavenging and β-carotene-linoleic acid assays, the IC_{50} value of essential oil and methanol extract were respectively 7.43 and 2.30µg/ml. In the β-carotenelinoleic acid system, oxidation was effectively inhibited by *J. sambac* and the RAA (Relative antioxidant activity) value of essential oil and methanol extract were respectively 96.6% and 93.9% (Latif *et al*., 2010). The methanol extract of flowers of *J.sambac* showed DPPH scavenging ability with IC_{50}= 208 and leaves collected from the sites Arabian night and Grand Duke of Tuskeny in 80% of methanol extract have DPPH scavenging ability with IC_{50}= 103.7 and IC_{50}= 155.5 respectively (El Hawary *et al*., 2019). The antioxidant potential of ethanol extract of *J. polyanthus* have been investigated by DPPH Assay flower powder of different concentrations (10-30 mg) were taken in different test tube and 0.1ml of 0.1M DPPH solution. FRAP assay also conducted. Both assays showed good activity compared with standard ascorbic acid (Bhagath *et al*., 2010). The leaf and flower extracts of *Jasminum multiflorum* possess inhibiting activity but the maximum inhibiting activity was found in ethanolic extract of leaves (141.2 ±1.24 µg/ml) and minimum in aqueous extract (524.6 ±2.35 µg/ml), while in flower extracts, the maximum reduction of free radicals was found in ethanolic extract (252.4 ±2.41 µg/ml) and minimum in aqueous extract (556.6 ±1.51 µg/ml). Compared to flower extracts, the maximum reduction was found in leaf extract (Kumaresan *et al*., 2019). Similar observations made in earlier studies too with scavenging activity from 20-80% in *J. arborescens* and *J. auriculatum* (Bhagath *et al.*, 2010; Srivastava *et al.*, 2014). In the present study, the aqueous extract of *J. malabaricum* showed higher antioxidant activity by FRAP assay, while least antioxidant activity was exhibited by *J.grandiflorum* and *J. sambac* aqueous leaf extracts.There are some earlier reports supports the antioxidant activity of Jasmine species (Hurakadle *et al*., 2011; Widowati *et al*., 2018).

In the present study, the highest zone of inhibition was observed in aqueous extract of *J. sambac* against *Staphylococcus aureus* (3.6 ±0.6 mm)at 110 µg/mL while in *J. malabaricum* it was against *Bacillus subtilis* (4.6±0.7mm). *Jasminum malabaricum* showed highest antifungal activity against *Fusarium oxysporum* and *J. grandiflorum* against *F.oxysporum*. This shows the higher antifungal property in *J. malabaricum.* The essential oil and methanol extract of flowers of *J. sambac* exhibited antimicrobial activity against *E. faecalis*, *E. coli, S. enteric, B. cereus* and *S. pyogenes* by using disc diffusion and micro dilution methods (Latif *et al*., 2010). The aqueous extract of flowers and leaves of *J. polyanthum*2mg/ml expressed potential antibacterial activity against bacterial strains in comparison to the positive control gentamycin. The zone of inhibition in disc diffusion method against *Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa* and *Aspergillus flavus* for flower extract = 8,9,13,13,8 mm and leaves extract = 7,8,11,12,10 mm respectively (Jesteena, 2016). Antimicrobial efficiency of *Jasminum sambac* aromatic plants leaf extracts were examined using petroleum ether, chloroform, ethyl acetate and ethanol as solvents and tested against eight human pathogens like Bacteria: *Bacillus subtilis, B. cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*, Fungi: *Aspergillus niger, A.flavus, Candida albicans* using agar disc diffusion method. The ethanol extracts of *Jasminum sambac* showed highest antibacterial activity against than that moderate the ethyl acetate, petroleum ether and chloroform the bacterial strains tested. The mean zone of inhibition produced by the extracts in disc diffusion assays were ranged from 5 mm to 27 mm. All the plants showed significant activity against all pathogens. The minimum zone of inhibition and comparatively greater inhibitory concentration were determined in petroleum ether and chloroform extract of *Jasminum sambac* showing less antimicrobial activity against all the experimental strains. The preliminary phytochemical analysis of presence and absence of different solvent extracts of alkaloid, flavonoid, tannin, saponin, glycoside, steroid and terpinoid. The Spectrum of activity observed in the present study may be indicative of the present study ethanolic extracts of these plants could be a possible source to obtained new and effective herbal medicines to treat infections, hence justified the tribal uses of *Jasminum sambac* against various (Gowdhami, 2015).

The water leaf extract of *J. sambac* did not show any activity against tested pathogens. Methanol, n-hexane and chloroform plant extract showed activity against reference cultures but ethyl acetate showed very good activity against *P. aeruginosa*. The n-hexane plant extract also showed good activity against *E. coli* and *S. aureus* (Tomar *et al*., 2020). A total of 14 *Jasminum* species were investigated for their anti-microbial activity against Gram positive and negative bacterial strains, and fungal pathogens. In terms of efficacy against a wide variety of bacterial pathogens and minimal antifungal activity, all of the *Jasminum* plants are extremely encouraging. A fraction of acetone extract

from the leaves of *Jasminum azoricum* has shown anti-*Staphylococcus aureus* activity with the highest inhibition zone of 30 mm at 30 mg/mL among all the 14 species studied, whereas methanolic extract of *Jasminum syringifolium* leaves exhibited a 22.67-mm inhibition zone against *Shigella flexneri*. The jatamansone extract from leaves of *Jasminum brevilobum* has shown the lowest minimum inhibitory concentration (MIC 0.05 µg/mL) against *Staphylococcus aureus* among all the studied species, whereas, it showed the highest MIC against *Escherichia coli* (MIC 0.07 µg/mL) (Balkrishna *et al*., 2021). There are number of reports on *Jasminum* supports the present investigation ((Joy and Raja, 2008; Patil *et al*., 2012; Hussain *et al*., 2013; Nagarajappa *et al*., 2015; Manoranjan *et al*., 2016).

The experiments conducted in the present study provide promising guideline regarding the potential uses of *Jasminum sambac* as antioxidant agent. Antioxidant-rich plant extracts serve as sources of nutraceuticals that alleviate the oxidative stress and therefore prevent or slow down the degenerative diseases.

CONCLUSION

The phytochemical and the biological activities of crude aqueous extracts of *Jasminum sambac, J. malabaricum, J. grandiflorum* leaves were studied and it indicated the presence of Flavonoids, saponins, tannins and Carbohydrates. Antibacterial activities were seen in crude extract of the leaves. The antioxidant activity showed the good result.From the overall studies *Jasminum sambac, J.grandiflorum* and *J. malabaricum* leaf extract were used to determine various activities. Phytochemical screening showed the presence of alkaloids, tannins, carbohydrates, sterols and terpenoids. Hence, study in this area may reveal the potential thrust of *Jasminum* species to be used in pharmaceutical industry. Medicinal plants play a significant role as therapeutics aids in health system all over the world. A major factor impeding the development of the medicinal plant is lack of information about utilization of medicinal plants. Here we summarised some of the activities of *Jasminum* species which may be open a new era for development of new drug for various ailments. *Jasminum* species which is being selected for the study is proved to be having antioxidant, antimicrobial, antiaging properties, which is being further, studied and used in pharmaceuticals.

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