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Phytochemical Analysis of Stem and Leaf Extracts of *Jasminum sambac* (L.) Aiton by FTIR Method

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Abstract. Plants with the help of secondary metabolites release their stress as well as act like protective substances from toxicity. FTIR (Fourier Transform Infrared Spectroscopy) was considered as a scientific procedure with a high determination that used to distinguish the constituents of compounds and their structures. Spectroscopy was used to check the presence of secondary metabolites in the plants, which is due to valuable data based on composition, quantitative and subjective pattern related to biomolecules was achieved. The analysis of phytochemicals of stem and leaf of *Jasminum sambac* (L.) Aiton (*n*-hexane, chloroform, ethanol and aqueous) extracts demonstrated that the tannins, saponins, flavonoids, alkaloids and reducing sugars were present in all extracts but the presence of chemicals varied in each extract and the presence of these phytochemicals was confirmed by FTIR analysis. The chemical compounds present in *Jasminum sambac* (L.) Aiton were observed very effective as antimicrobial and antioxidant agents.

Keywords: FTIR, antiviral, cytotoxicity, chemical constituents, phytochemical analysis

Introduction

In the past, metabolites of plants were considered to be the most considerable source for nutritional parameters. Now, limitations were imposed on development, promotion and utilization of antibiotics from the animals. On the other hand, scientists upgraded the interest related to plant metabolites which they used as a source for alternative stimulations performer (Adamson *et al*., 2018). Interest of pharmaceutics were diverging towards the secondary source of nutritional metabolites because of their significant uses in the physiology of the plant stress along with its nutritive purposes and cosmetics. Plants with the help of secondary metabolites release their stress as well as they act like protective substances against the toxicity (Ingle and Padole, 2019). Spectroscopy was used to check the secondary metabolites presence in the plants, which gave the valuable data of biomolecules based on composition i.e. quantitative and subjective patterns. FTIR used to show the profile of phytochemicals which contain signals that cover the wide exacerbates and they are available when cells are examined, entirely. FTIR is considered as scientific procedure with high determination that is used to distinguish the constituents of compounds and clarify the structural compounds (Hussain *et al*., 2009; Hashimoto and Kameoka, 2008). Foot and mouth disease of animals occurred by a virus, which is called FMDV. It is a highly infectious disease of the wild animals, cattle, buffaloes, pigs, goats and sheep. FMD virus became a causal agent for this disease which influences domesticated animals and livestock; causes an intense sickness that are characterized by the fever, vesicular, feet's sores, nose, tongue or teals with less morality and high morbidity. Younas *et al*. (2017) used MTT assay that were 3-(4,5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide and observe to the extracts of *Azadirachta indica, Moringa oleifera* and *Morus alba* against FMDV. Similarly, Younas *et al*. (2017) also used MTT assays to highlight the antiviral and cytotoxic activity of the plants against foot and mouth

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disease virus. The present study aimed to discover the natural agent of antivirals that could be essentially and simply utilized to lessen the animal's carrying condition or to decrease the infection in animals during the outbreak of disease. FTIR was used to analyze the presence of chemical compounds which are considered as strong antimicrobial and antioxidant agents. Four kinds of extracts of leaf and stem of this plant in polar and non-polar solvents (*n*-hexane, chloroform, ethanol and aqueous) were used in this study.

Materials and Method

Glassware and apparatus. Whatmann filter paper number 4, droppers, lamp that have spirit, funnels glass stirrers, holders of funnel, quartz cuvettes, test tubes, reagent bottles (amber-coloured), eppendorf tubes, pipettes (1, 10, 20 mL), cylinders that used for measuring (1 L, 0.25 L, 0.05 L and 0.01 L), micropipette, beakers (1 L, 0.25 L, 0.1 L) and vials based on glass.

Maceration instruments or physiochemical tests. Centrifuge (Z36HK, Hermle), weighing balance (RE300, BL-410S, RE300, setra rotary evapourator), lyophilizer (FD1, eyela), UV-vis spectrophotometer (UV-1700, Shimadzu), pH meter (PH100, ecosence), water bath (shaker of maxQ 7000 benchtop, krackeler scientific).

Qualitative estimation of chemical constituents. Different tests were performed to estimate the chemical constituents, which include alkaloids, anthraquinones, flavonoids, saponins, reducing sugars, cardiac glycosides, tannins and terpenoids. These constituents were observed in *n*-hexane, chloroform, alcohol and aqueous stem and leaf extract of jasmine.

ATR (Attenuated total reflectance) fourier transform infrared (FTIR) spectroscopy. Plant sample in powdered form, was collected and placed directly on the infrared spectrometer's germanium crystal (Thermoscientific Nicolet 10, USA). The pressure was applied constantly on the sample and examined the absorbance of infrared data that collected the range of 550/cm-4000/cm number. Through the crystal the infrared rays pass and start to move towards the sample in the form of evanescent waves. After the passing of rays from the sample, the infrared radiation (IR) was collected with the help of a detector.

Results and Discussion

Stem and leaf macerates' phytochemical analysis of *J. sambac.* Saponins, tannins, reducing sugar terpenoids and flavonoids were found in all stems of *J. sambac* (L) Alton's extract Table 1, while the extract of chloroform only showed the presence of Arthiquinones. The cardiac glycosides available only in the aqueous extract that was ascertained through the test of Keller-Killani. Likewise, Shinoda test got flavonoid which was not perceived in an aqueous extract. On the other hand, NaOH, $FeCl_3$ and lead acetate tests were detected in the aqueous extract. Similarly, all extracts showed tannins except the extract of chloroform, while terpenoids were absent in all types of extracts. Likewise, *J. sambac* (L.) Aiton extract of leaf was revealed by phytochemical screening in which alkaloids were absent in all extracts except chloroform, detected with the help of Mayer's test. In the same way, arthiquinones in good quality was also observed in chloroform and n-hexane extracts, while it was not present in aqueous and ethanol extracts Table 2. In addition, cardiac glycosides were present only in the extract of aqueous that was detected through the test of Keller-Killiani. Flavonoids in small quantity were observed in ethanol and in n-hexane extracts. All extracts were pragmatic with reducing sugar, saponin was detected in water and ethanol extracts. Along with, all extracts except chloroform showed the presence of tannins. However, with the help of a match stick test the tannins and terpenoids were documented only in the extract of n-hexane.

FTIR peak values and functional groups. Analysis of FTIR on stem extract of *Jasminum sambac* revealed that the stretching of O-H vibration came at the 3280/cm peak which showed the polyphenol's presence in the *Jasminum sambac* stem macerates. Similarly, at 2884/cm peak, the spectra was linked with terpenes (C-H). 2353/cm showed the stretches of C=N which were noted as nitrites, shown in Table 3 and Fig. 1. In the same way, at the peak of 1730/cm the C=O (carboxylic) stretches were observed. After that, the alkaloids were present at 1514/cm and highlighted through N-H stretching, while the primary amines were documented at 1600/cm peak (Table 3). Esters showed their presence with stretches of amines (C-N) or C-O at 1232/cm and 1155/cm-1012/cm respectively (Fig. 1). Likewise, various compounds were confirmed with the help of many functional groups at different numbers of wave such as alkanes at 3275/cm, the terpenes at 2919/cm and 2850/cm peak value showed nitrites and saponins at 2351/cm, esters at 1012/cm, alkenes at 1730/cm, alkaloids at 1602/cm and amines at 1514/cm respectively through the analysis of FTIR in *Jasminum sambac* extracts of leaf macerates (Fig. 2).

This study was based on phytochemicals analysis that were applied on the *Jasminum sambac* (L) Aiton. The tannins, saponins, flavonoids, alkaloids and reducing sugar showed their presence in all *Jasminum sambac* (L) Aiton's extracts but their presence varied from one extract to another extract (Malik, 2015; Sabharwal *et al.*, 2012; Mahjoub, 2011; Siddiqui *et al*., 2011). Alkaloids carried significant biological potential and also have pharmacological characteristics which include antioxidant without the cytotoxic, antiviral, antimicrobial, herbicidal anti-inflammatory, spasmolytic and antitumor effects (Baker *et al*., 2018). Alkaloids showed their toxicity mechanism for microbes that linked with hydrolytic enzymes' inhibition. Various interaction and

Table 1. Stem macerates' phytochemical analysis of *J. sambac*

Constituent	Phytochemical test	Stem extracts			
		n-Hexane	Chloroform	Ethanol	Aqueous
Alkaloids	Dragendorff's test	-	-	-	-
	Mayer's test	-	-	-	-
	Wagner's test	-	-	-	-
Anthraquinones	Bornträger's test	-	+	-	-
Cardiac glycosides	Keller-Killiani test	-	-	-	+
Flavonoids	$FeCl_3$ test	-	-	-	+
	Lead acetate test	-	-	+	+
	NaOH test	-	-	+	+
	Shinoda test	Flavonoids +	Flavonoids +	Flavonoids +	Flavonoids -
Reducing sugars	Fehling's test	+	+	+	+
Saponins	Frothing test	-	-	-	+
Tannins	$FeCl_3$ test	Gallic +	Gallic -	Gallic +	Gallic +
	Matchstick test	+	-	+	+
Terpenoids	Salkowski test	-	-	-	-

Table 2. Leaf macerates' phytochemical analysis of *J. sambac*

Constituent	Phytochemical test	Stem extracts			
		n-Hexane	Chloroform	Ethanol	Aqueous
Alkaloids	Dragendorff's test	-	-	-	-
	Mayer's test	-	+	-	-
	Wagner's test	-	-	-	-
Anthraquinones	Bornträger's test	+	++	-	-
Cardiac glycosides	Keller-Killiani test	-	-	-	+
Flavonoids	$FeCl_3$ test	-	-	+	-
	Lead acetate test	+	-	+	-
	NaOH test	+	-	-	-
	Shinoda test	Flavonoids -	Flavonoids -	Flavonoids -	Flavonoids -
Reducing sugars	Fehling's test	+	+	+	+
Saponins	Frothing test	-	-	+	+
Tannins	$FeCl_3$ test	Gallic -	Gallic -	Gallic +	Gallic +
	Matchstick test	+	-	-	-
Terpenoids	Salkowski test	-	-	-	-

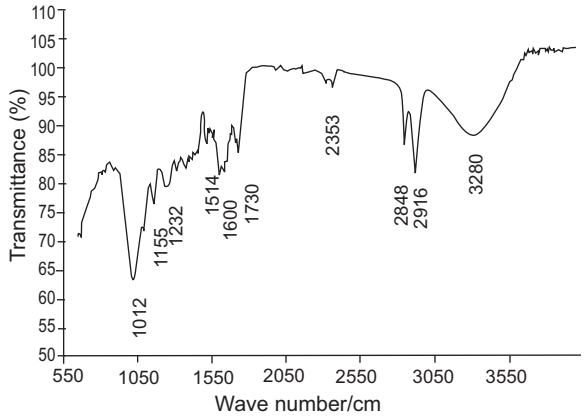

Fig. 1. *Jasminum sambac* stem's FTIR spectra.

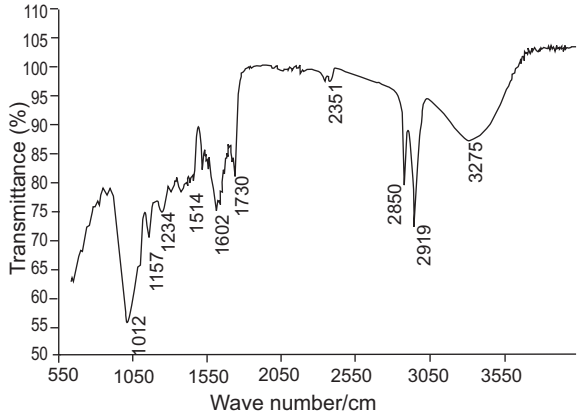

Fig. 2. FTIR leaf spectra of *J. sambac.*

Table 3. FTIR peak values and functional groups

Wave number	Bonds/compounds
3290	O-H Polyphenols
3280	-
3275	-
3273	-
2919	C-H Methylene alkanes
2918	Phenols
2916	Phenols
2850	C-H Terpenes
2848	C-O Carboxylic acid
2357	C=O Glycosides
2355	C=O Glycosides
2353	C=N Nitriles
2351	C=N Nitriles
1730	C=O Saponins
1728	Quinones
1633	Primary amines
1631	C=O Flavonoids
1612	Unknown
1602	Alkenes
1600	Primary amines
1514	N-H Alkaloids
1454	C-H Terpenes
1315	Nitro compounds
1305	S=O Sulphate esters
1234	C-N Amines
1232	C-N Amines
1157	C-O Esters
1155	C-O Esters
1012	C-O Esters

protease of alkaloids inactivate the adhesions of microbes and interact with the non-specific carbohydrates or transport the enveloped proteins (Pyla *et al*., 2010). In the same way, alkaloids also possessed the antioxidants activity because they have the ability to act like scavengers of free radicals, the ability to donate hydrogen electrons and the activity of metal chelating (Singh *et al*., 2012). Flavonoid has a yellow colour that can be utilized for the treatment of hypertension and atherosclerosis (Naili *et al*., 2010). Likewise, the antioxidant effects were extensively examined by number, substitution and configuration of hydroxyl groups like chelation of metal ions or activity of radical scavenging (Karak, 2019; Montoro *et al*., 2005). In addition, various parts of plants gave tannins and few parts of plant found in aqueous portions. But they obtained, mostly through the treatment of less polar solvents. Tannins also have antiviral potential and use in the leather industry (Rashed *et al*., 2014) as well as it also has antibacterial characteristic (Ekambaram *et al*., 2016). Colonies of bacteria disintegrate by the compounds of tannins because of their interloping with the cell wall of bacteria due to which it inhibits the growth of bacteria (Saeed and Shahwar, 2015). In the same way, tannins contribute in the form of antidote and anti-inflammatory in treatment of alkaloid poisoning, piles, diarrhea, burn, leucorrhoea and gonorrhea (Kazmi *et al*., 2015).

Meanwhile, saponins had an antibacterial activity (Mbaveng *et al*., 2018) that prevented the dysfunction through the increasing stability of the membrane with the help of inhibiting the formation of free radicals as well as protecting the bilayer of membrane from free radicals (Akinpelu *et al*., 2014). Apoptotic and anti-proliferative involved the cardiac glycosides in cell lining of many cancer cells which include renal adenocarcinoma, melanoma, leukaemia and neuroblastoma with less side effect as compared to

traditional therapies of cytotoxic (López-Lázaro, 2018). Dastagir *et al*. (2012) explained that the Anthraquinons mostly have antibacterial activities. Likewise, terpenoid had capability to inflamed the mucus membranes along with heal the wounds or described as it protects the fluids of blood against the reactive species of oxygen (Omojokun *et al*., 2020). Leaf and stem powders of *Jasminum sambac* were subjected for the analysis of FTIR which was used for documenting the functional groups that present in different parts of plants. On the basis of peak portions which have fingerprint characters and functional groups, the variation and similarities were identified among the parts of plants. In this study, various functional groups were characterized as C-O, N=O, C=O, C-N, C-H and C-O and identified at their respective peaks of absorption. However, these functional groups have responsibility for the alkyl, either anhydrites deoxyribose, esters and alcoholic group formation (Sohrabi and Ebrahiminezhad, 2020). Present study agreed with the work of Mariswamy *et al*. (2012) who performed the analysis of FTIR on *Aerva lanata* (L.) Juss. Ex Schult. Similarly, this study also lined up with Maobe and Nyarango (2013) study or with Bobby *et al*. (2012), they reported that in *Utrica dioica* as well as in *Albizia lebbeck* Benth's leaves these groups showed the relevant absorption values of peaks.

Conflict of Interest. The authors declare that they have no conflict of interest.

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