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Phytochemical Analysis of *Bougainvillea spectabilis* by Using GCMS

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Abstract: *Bougainvillea spectabilis* is an ornamental plant known not only for its aesthetic value but also known for its pharmacological properties. In the present day scenario of antibiotic resistance developing rapidly, there is a constant search for new compounds, specifically plant related bioactive compounds which can be effectively used to treat various pathological conditions. In this context, various studies have been performed about medicinal properties of *Bougainvillea spectabilis*. Therefore, the present study was intended to identify and analyze different bioactive compounds of *Bougainvillea spectabilis*. Gas chromatography–mass spectrometry (GC MS) analysis of leaf extract of this plant yielded 9 different bioactive compounds, between RT 13- 16 minutes, which may be further tested for various biological applications and in future may be used as a natural antibiotic.

Keywords: *Bougainvillea spectabilis*, GC-MS analysis, Bioactive compounds, Antibiotic resistance, Antibacterial, Microencapsulation

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Introduction

Plants have long been used in traditional medicines since many decades. *Bougainvillea spectabilis* is not only popular for its ornamental value, but also known to have valuable medicinal properties (Bilehal *et al.*, 2012). The plant as a whole, i.e. stem, leaves and flowers are known to be used for medicinal preparations. *Bougainvillea spectabilis* has been reported to possess antimicrobial, anti-diabetic, and anti-inflammatory properties (Bhat *et al.*, 2011). It is also known to regulate menstruation and white vaginal discharge (Kim *et al.*, 2019). Most of the pharmacological or healing properties of the plant

has been attributed to its bioactive components. Phytochemical analysis of the various extracts of stems, leaves and flowers of *Bougainvillea spectabilis* have yielded bioactives compounds such as alkaloids, flavinoids, glycosides, plobotannins, saponnins, steroids, tannins, and terpinoids (Giri *et al.*, 1998). Phytochemical studies, to explore bioactive compounds, are very much important as bioactive compounds either found naturally or in processed foods, are known to influence human health (Gesler, 1992). The only disadvantage of these compounds is that their bioavailability is limited because of their

instability. To increase their bioavailability, these compounds are often microencapsulated for a better release and availability in biological systems (Ahmed *et al.*, 2015). These studies suggest that bioactive compounds are very much essential for promoting good health and it is often necessary to explore and discover newer bioactive compounds, present in various plants. In this context, several studies have suggested that *Bougainvillea spectabilis* is known to contain several medicinal properties which may be attributed to its bioactive compounds, which can be processed in to microcapsules, or may be used to develop a plant based antibiotic. Therefore the present study was aimed to explore the bioactive components of *Bougainvillea spectabilis* by using GC MS.

Materials and Methods

Collection of Plant leaf:

The fresh and healthy *B. spectabilis* leaves were collected from the Guindy Snake Park, Chennai, India during the month of July 2019. The plant was taxonomically identified as *B. spectabilis*. Approximately 250 g of leaf sample was collected freshly. After the collection of leaves from wild they have been processed for cleaning. The cleaning process involved the following steps-- Cleaning, washing, peeling or stripping leaves from stems. Cleaning has been done by hands in order to get better results.

The leaves were shadow dried to remove the water content so that the plants can be stored. Plants had been dried immediately as soon as it was collected to avoid spoilage of plant materials. Plant leaves were placed on drying frames and shadow dried (Mishra *et al.*, 2009). Approximately 3 weeks were needed for complete drying. After complete drying the dried leaves were powdered in a blender to fine particles for further analysis of bioactive compounds. The powdered sample was collected into sterile labeled plastic bags. The plant extract was further prepared for GC MS analysis.

GC-MS analysis:

For the GC-MS analysis 1µl of the sample was injected in split mode in the instrument using a Rtx5MS- 30m column with 0.25-mm ID and 0.25 µm df (Mohamed *et al.*, 2014). Mass spectra were recorded at 2 scan sec-1 with a scanning range of 40 to 850 m/z. Quantified each component based on peak areas and normalization based on the internal standard.

Interpretation of mass spectrum GC-MS was conducted using the database of National Institute Standard and Technique (NIST08s), WILEY8 and FAME having more patterns, the spectrum of the component was compared with the spectrum of the known components stored in the library. The chemical name, molecular formula, molecular weight and structure of the component of the test material were identified. The library compares the mass spectrum from a sample component and compares it to mass spectra in the library.

Results

Using GC-MS technique, a total of 9 organic compounds have been identified (Table 1; Fig. 1) and their Molecular weight, Molecular structure, Molecular formula, Retention rate and Nature of the compound have been identified (bioactive compounds have been identified between RT 13 min--16 min). Leaf extract of *Bougainvillea spectabilis* resulted in 9 bioactive active compound in different Retention time (RT) between 13 min to 16 min. The bioactive compounds are as follows-- Flavone resulted at RT 13.07; E, E-6-8-Tridecadien-2-ol, acetate at RT 13.77 and this compounds activities are unidentified; 6-methoxyflavone at RT 14.95; Phytol at RT 16.98 is an acyclic diterpene alcohol and a constituent of chlorophyll; 1-docosene at RT 17.78 is an alkene that is docosane with an unsaturation at position 1; 1-tricosene at RT 19.67; Phenol, 2,4-bis [1,1-dimethyl ethy] at RT 10.73; hexadeconic acid, methyl ester at RT 15.22 ; and 1-eicosene at RT 15.85.

Table 1: Details of organic compounds isolated from leaf extract of *Bougainvillea spectabilis*

S. No.	Compound Name	RT (min)	Molecular weight (g/mol)	Molecular Formula
1	Flavone	13.07	222.24 g/mol	C ₁₅ H ₁₀ O ₂
2	E, E-6-8-Tridecadien-2-o, acetate	13.77	238.37 g/mol	C ₁₅ H ₂₆ O ₂
3	6-Methoxyflavone	14.95	252.26 g/mol	C ₁₆ H ₁₂
4	Phytol	16.98	296.5g/mol	C ₂₀ H ₄₀ O
5	1-Docosene	17.78	308.6g/mol	C ₂₂ H ₄₄
6	1-Tricosene	19.67	322.6g/mol	C ₂₃ H ₄₆
7	Phenol, 2,4-bis [1,1-dimethylethyl]	10.93	278.5g/mol	C ₁₇ H ₃₀ O
8	Hexadecanoic acid, methyl ester	15.22	270.4507g/mol	C ₁₇ H ₃₄ O ₂
9	1-Eicosene	15.85	280.5 g/mol	C ₂₀ H ₄₀

Fig. 1: Mass Spec of *Bougainvillea spectabilis*

Discussion

In the present study GC MS analysis of leaf extract of *Bougainvillea spectabilis* has yielded nine bioactive compounds. It is estimated that about 30% of the pharmaceuticals are prepared from plant derivatives because of their bioactive properties. The names and the description about bioactive compounds of *Bougainvillea spectabilis* are as follows: Flavone, which is having a varied pharmacological activities including relevance of plant defense mode of action. Formation of oxygen radicals can be prevented by flavonoids thereby inhibiting the enzyme activity (Eliyaraja *et al.*, 2016). E,E-6-8-Tridecadien-2-ol,acetate is another compound, whose physiological role is yet to be identified. 6-methoxyflavone was found at RT 14.95 and is a group of flavones found in large amounts in citrus fruits and is used to treat poor circulation in the legs (venous insufficiency), varicose veins, heart disease, high cholesterol, cataracts and cancer. Phytol is another compound found in *Bougainvillea spectabilis* which is an acyclic diterpene alcohol and a constituent of chlorophyll (Rajab *et al.*, 1998) and is commonly used as a precursor for the manufacture of synthetic forms of vitamin E and Vitamin K1. Furthermore, phytol was also shown to modulate transcription factors PPAR-alpha and retinoid X receptor (RXR) (Inoue *et al.*, 2005). In addition to these, 1-docosene was observed at RT 17.78. 1-docosene is an alkene which is unsaturated at position1 and a metabolite observed in cancer metabolism (Chowdhury *et al.*, 2012). 1-tricosene was observed at RT 19.67 whose properties are still under investigation. Phenol, 2,4-bis [1,1-dimethyl ethy] is another bioactive compound which was identified in the extract, which is colorless solid. Alkylated phenol and its derivatives are used industrially as UV stabilizers and antioxidants for hydrocarbon based products ranging from petrochemicals to plastics. It prevents gumming in aviation fuels (Bhat *et al.*, 2011). Hexadeconic acid, methyl ester has also been identified in the leaf extract and is used in cosmetic-flavor and as fragrance agents and is

known to have waxy type odor (Lim *et al.*, 2006). At RT 15.85, 1-eicosene has been observed, and this is used for oil and gas drilling, extraction and support activities. It is also frequently used in petroleum, lubricating oil and grease manufacturing units (McGinty *et al.*, 2010). There are evidences, wherein leaf extracts of *B. spectabilis* showed strong antiviral activity against plant viruses (Madhusudhan *et al.*, 2011). The antiviral protein present in *B. spectabilis* was characterized by Balasaraswathi *et al.* (1998). Anti-inflammatory activities were reported by Mandal *et al.* (2015).

Several reports suggest that *Bougainvillea spectabilis* have factors responsible for controlling and preventing diabetes. *In vitro* antibacterial activity of *Bougainvillea spectabilis* leaf extracts has been reported by Umamaheswari *et al.* (2008). Considerable antimicrobial activity was observed in *Bougainvillea spectabilis*, which is known to inhibit the growth of few of the bacterial and fungal strains tested with varied effectiveness. The ethanol and chloroform extracts have shown relatively greater activity than that of any other extracts (Swamy *et al.*, 2012). Hajare *et al.* (2015) have evaluated antibacterial activity of various solvent extracts of the leaves of *Bougainvillea spectabilis*. Umamaheshwari *et al.* (2008) have revealed the presence of amino acids, proteins, anthroquinones, saponins, triterpenoids, flavonoids, carbohydrates, alkaloids, phytosterols, glycosidal sugars, tannins, phenols and furanoids in different solvent extracts of *B. spectabilis* and the authors opined that phytochemicals present in extracts may be responsible for the antibacterial activity. Similarly, in the present study, the characterization of compounds present in the partially purified extract has revealed the presence of nine bioactive compounds which are known to have various biological activities. Based upon these observations, we conclude that *Bougainvillea spectabilis* can be considered as a potential drug candidate which may be used for the preparation of plant based antibiotic.

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