



**GC-MS ANALYSIS OF BIOACTIVE COMPONENTS OF  
FICUS RELIGIOSA (LINN.) STEM**

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**ABSTRACT**

*Ficus religiosa* is one of the medically important plants belonging to the family *Moraceae*. It has been used extensively by ayurvedic practitioner in India to treat various ailments such as dysentery, snakebite, skin diseases and constipation. The aim of the study is to verify the presence of major chemical compounds and elucidate the chemical constituents contained in the *Ficus religiosa* stem. The stem showed positive results for the presence of alkaloids, saponins, tannins, triterpenes and steroids. Identification of chemical composition was conducted using the GC-MS equipped with mass detector supplied with helium. Thirteen chemical constituents have been identified based on NIST & WILEY libraries for botanical compounds. The major chemical constituents are 1,2-Benzenediol (9.85%), Caffeine (4.20%) and Stigmasterol,22,23-dihydro (1.81%).

**KEYWORDS:** *Ficus religiosa*, GC-MS, 1,2-Benzenediol, Caffeine and Stigmasterol,22,23-dihydro



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## INTRODUCTION

*Ficus religiosa* (*F. religiosa*) is a large semi-evergreen tree with a trunk diameter of up to 3 m<sup>1</sup> and could grow up to 5,000 ft<sup>2</sup>. It is not uprooted and commonly found growing in shrines and buildings<sup>1</sup>. It has a heart shaped leaves and commonly known as sacred fig or peepul tree. *F. religiosa* belongs to the family *Moraceae* which consist of more than 700 species. For centuries, *F. religiosa* have been used extensively by the Indian folks in India and also Nepalese in Nepal to treat wounds and various diseases. Leaves, stem and roots of *F. religiosa* are known to have medicinal properties and usually used separately or as a whole plant. *F. religiosa* leaves are used to treat ulcers and wounds while its root is used for stomatitis, to clean ulcers and to promote granulation. The stem bark is also used as astringent and tonic, to treat various skin diseases, ulcers, glandular swelling of the neck and scabies<sup>3</sup>. A study by Sreelekshmi<sup>4</sup> in 2007 showed that the stem bark exhibited anti-inflammatory, analgesic and anti-lipid effect activity. *Ficus religiosa*'s uses in treating diabetes mellitus has been described by Thapa<sup>5</sup> (2001), who documented traditional uses of *F. religiosa* by Tharu community in Nepal. Thus, the aim of the present study is to verify the presence of chemical compounds and to identify the phytochemical constituents of the methanol stem extract of *F. religiosa* through GC-MS technique.

## MATERIALS AND METHODS

### **Plant Collections**

Stems of *F. religiosa* were collected from Penang, Malaysia. The plant was identified by Tropical Forest Biodiversity Centre, Forest Research Institute Malaysia (FRIM). A voucher specimen (PID 200710-08) has been kept in the Herbarium Unit, School of Biological Sciences, Universiti Sains Malaysia.

### **Preparation of Powder and Extract**

*F. religiosa*'s stems were oven dried (40°C) and pulverized to a powder in a mechanical grinder. The powder was successively extracted following solvents in increasing order of polarity: petroleum-ether (40-60), chloroform and methanol. Extracts were concentrated in a rotary evaporator (Eyela, USA) under reduced pressure.

### **GC-MS Analysis**

GC-MS analysis was carried out on a Agilent system equipped with Mass Spectrometer detector and split/splitless injection system. The GC was fitted with a HP-5MS capillary column (30 m X 250 m; film thickness: 0.25 m). The temperature program was as follows: injector temperature 280°C, initial oven temperature at 50°C, then increased at 25°C/min to 300°C and was held for 10min. Helium was used as the carrier gas at 17.69 psi pressure with flow 2.1ml/min. Samples were dissolved in methanol and 1 µl aliquot was injected automatically. MS spectra of separated components were identified based on WILEY and NIST Libraries for botanical compounds.

### **Phytochemical Screening**

Phytochemicals screening for alkaloids, tannins, saponins, flavonoids, phlobatanins, steroids and terpenoids were carried out following method described by Nisar, Ali and Qaisar<sup>6</sup>.

## RESULTS AND DISCUSSION

The photochemicals screening of the extracts was listed in Table 1. The phytochemical analysis of *F. religiosa* stem extract revealed the presence of alkaloids, tannins, saponins, flavonoids, steroids and terpenoids. The classes of compounds were noted for various contributions to the medicinal activity of the plant. The GC-MS analysis of methanolic stem extract of *F. religiosa* showed the presence of 125 compounds (Figure 1). However, only 13 compounds were positively identified using

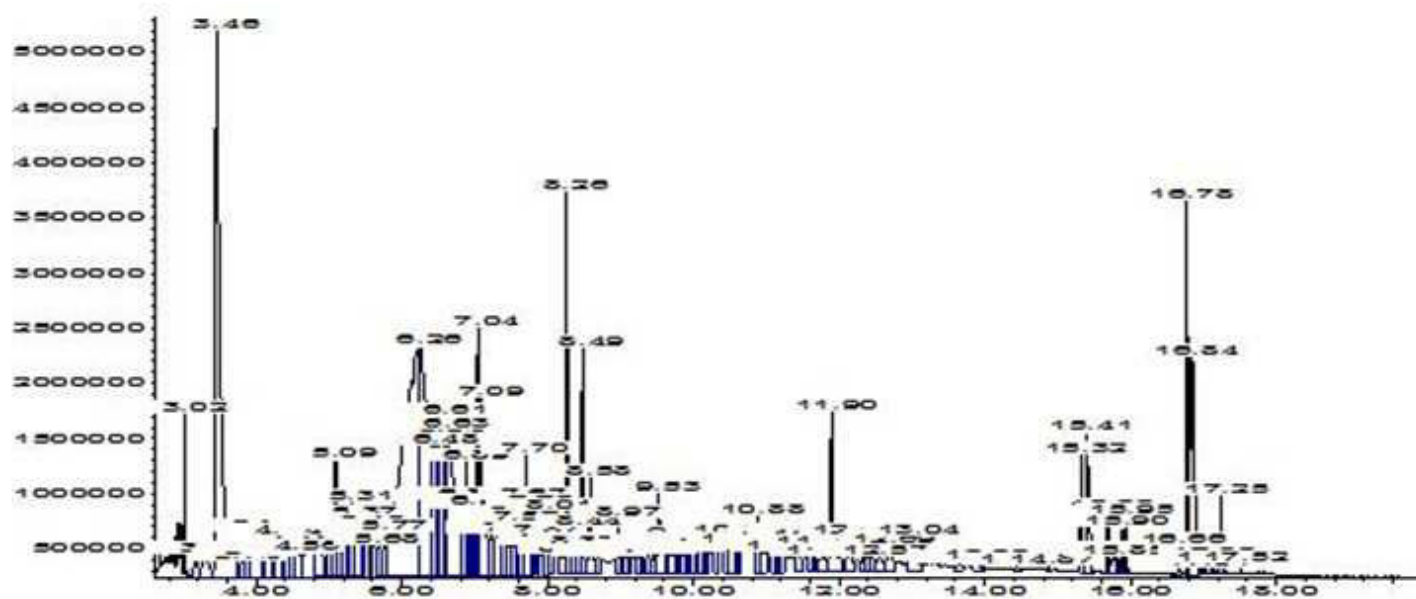
WILEY and NIST Libraries with 80-99% matching (Table 2). The prevailing compounds in methanol extract were 1,2-Benzenediol (9.85%), Caffeine (4.20%) and

Stigmasterol,22,23-dihydro (1.81%). Table 3 lists the various phytochemicals and their biological activities produced by GC-MS study.

**Table1**  
**Phytochemical screening of methanol stem extract of *F. religiosa***

Phytochemical Constituents	
Alkaloids	++
Saponins	+
Phlobatannins	-
Flavonoids	++
Tannins	+++
Terpenoids	+++
Steroids	+++

+ weakly positive; ++ mildly positive; +++ strongly positive; - absence



**Figure 1**  
**GC-MS Chromatogram of methanol stem extract of *F. religiosa***

**Table 2**  
**GC-MS analysis of methanol stem extract of *F. religiosa***

No	RT (min)	Name of the Compounds	Molecular Formula	Molecular Weight	Peak Area (%)
1	3.16	4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl	C <sub>6</sub> H <sub>6</sub> O <sub>4</sub>	144	0.30
2	3.462	1,2-Benzenediol	C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	110	9.54
3	4.288	Phenol,2,6-dimethoxy	C <sub>8</sub> H <sub>10</sub> O <sub>3</sub>	154	0.47
4	4.827	Methylparaben	C <sub>8</sub> H <sub>8</sub> O <sub>3</sub>	152	0.80
5	5.087	Phenol,2,4-bis(1,1-dimethylethyl)	C <sub>14</sub> H <sub>22</sub> O	206	0.95
6	6.634	Caffeine	C <sub>8</sub> H <sub>10</sub> N <sub>4</sub> O <sub>2</sub>	194	4.07
7	6.893	Hexadecanoic acid, methyl ester	C <sub>17</sub> H <sub>34</sub> O <sub>2</sub>	270	0.73
8	6.991	n-Hexadecanoic acid	C <sub>16</sub> H <sub>32</sub> O <sub>2</sub>	256	0.38
9	7.789	Octadecanoic acid	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	284	0.50
10	11.444	Ergost-5-en-3-ol(3 beta)	C <sub>28</sub> H <sub>48</sub> O	400	0.45
11	11.598	Stigmasterol	C <sub>29</sub> H <sub>48</sub> O	412	0.32
12	11.899	Stigmasterol,22,23-dihydro	C <sub>29</sub> H <sub>50</sub> O	414	1.76
13	12.152	Lanosta-8,24-dien-3-ol, acetate(3 beta)	C <sub>32</sub> H <sub>52</sub> O <sub>2</sub>	468	0.57

**Table 3**  
**Phytoconstituents present in methanol stem extract of *F. religiosa* and their biological activities**

Name of the Compounds	Bio-activity*
4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl	Antimicrobial, Anti-inflammatory
1,2-Benzenediol	Anticancer (breast), Antioxidant, Pesticides
Phenol,2,6-dimethoxy	Antiaggregant, antiprostaglandin
Methylparaben	Antioxidant
Phenol,2,4-bis(1,1-dimethylethyl)	Antioxidant, antibacterial
Caffeine	Antiviral, CNS stimulant, Antitumor, Insecticide, Pesticide, Stimulant, Antioxidant, Hypoglycemic
Hexadecanoic acid, methyl ester	Antioxidant, Hypercholesterolemic, Pesticide
n-Hexadecanoic acid	Antioxidant, Hypercholesterolemic
Octadecanoic acid	Hypocholesterolemic
Ergost-5-en-3-ol(3 beta)	Antioxidant, Hypocholesterolemic
Stigmasterol	Anti-inflammatory, Antioxidant, Antiviral, Sedative
Stigmasterol,22,23-dihydro	Anticancer (lung, cervix, breast), Antioxidant, Hypoglycemic, Hypocholesterolemic, Antiviral
Lanosta-8,24-dien-3-ol, acetate(3 beta)	Anti-amylase inhibitor, Antimicrobial, Anti-diabetic

\*Dr.Duke's phytochemical and ethnobotanical databases [Online database].

## CONCLUSION

The present study found 13 chemical constituents from methanol stem extract of *F. religiosa* by Gas Chromatography Mass Spectrometry (GC-MS) analysis. The presence of bioactive compound justified the extensive use of the stem bark by the traditional practitioner to treat various ailments. It could be concluded that *F. religiosa* stem contains various bioactive compounds of medicinal importance. However, further studies are needed to evaluate its bioactivity and toxicity profile.

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