Research Article

Bioactive Compounds Investigated from *Cardiospermum canescens* Wall. (Sapindaceae) by Liquid Chromatography and Mass Spectroscopy

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ABSTRACT

Cardiospermum canescens is commonly consumed leafy vegetable of high therapeutic value in Indian system of medicine. This plant provides clinical benefit for rheumatism, chronic bronchitis, stiffness of limbs and snake bite. It is one of the unexplored medicinal plant obtained in southern Tamilnadu. The methanolic cold extraction of whole plant of *C. canescens*, was analyzed by the LC-MS technique. This analysis revealed the presence of various phytoconstituents in the plant sample. They are both primary as well as secondary phytocompounds. The volatile as well as non-volatile compounds were elucidated from this technique. The successive elution was performed and the potential bio-availabilities of thirty compounds like alkaloids, indole alkaloids, flavonoids, phytosterols, terpenoids, phenolic compounds and glycosides were identified. Out of these Confertin, evodin, biapigenin, rutin, citronellol, copalliferol B and myricoside important compounds were confirmed in the LC-MS study. The pharmacological activities of these identified compounds were also discussed.

Keywords: Bioactive compounds, *Cardiospermum canescens,* liquid Chromatography, mass spectroscopy

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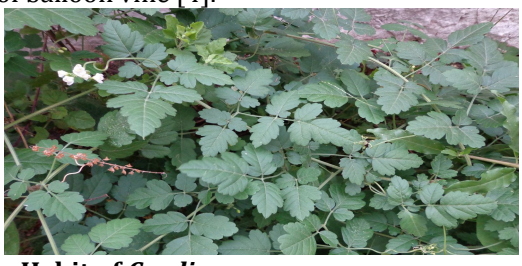
INTRODUCTION

The widespread use of herbal remedies and healthcare preparations has been traced to the occurrence of natural products with medicinal properties [1]. Increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction of development with several drugs and chemotherapeutics, from these plants as well as from traditionally used rural herbal remedies [2]. *Cardiospermum* is a genus of approximately 15 species of herbaceous tendrillar climbers in the soapberry family Sapindaceae. It is chiefly distributed in the tropical and subtropical regions of America, India and Africa. The genus name has been derived from the Greek words '*kardia*' and '*sperma*', meaning heartshaped seed [3]. In the global market, balloon vine has been utilized as several products, 'Love in a Puff', 'Balloon Vine' and 'Heart-seed'. Various forms of products like gel, cream, shampoo, spray etc… were available in the market. These products are useful for dry itchy skin and scalp. These products are supported by the various claims concerning with medicinal properties of balloon vine [4].



Habit of *Cardiospermum canescens*

MATERIALS AND METHODS

Plant Material

The whole plant of *Cardiospermum canescens* was collected during May 2012 from remote areas in the Aanaikatti, Western Ghats, Coimbatore. The plant was identified and authenticated by Dr. M. Murugesan, Taxonomist, SACON, Coimbatore.

Extraction of crude extract

The whole plant of *Cardiospermum canescens* was shade dried (25 days) at room temperature and immersed into methanol for 1 week. Then the extract is filtered through whatman paper. The extract is concentrated and stored in the refrigerator (4°C).

LC-MS Analysis

LC-MS analyses were done on a Shimadzu liquid chromatography modular system consisting of two LC- 10AD pumps coupled to an LC/MS QP 8000 quadruple detector. The data were processed using Shimadzu's Class-8000 system. Analyses using the APCI (atmospheric pressure chemical ionization) interface were performed in a reverse phase C-18 column (25 cm x 205 mm) fitted with a guard column (C-18, 20 mm x 4.0 mm x 5 µm), both Supelco, at an oven temperature of 35°C. The samples were introduced using a Rheodyne injection valve fitted with a 20 µL loop. The mobile phase consisted of aqueous and methanol (50:50) at a flow rate of 2mL min^{-1}. The mass detector was operated in both positive and negative mode with nitrogen as the nebulizer gas at a flow rate of 2ml/ min, under the following conditions: the capillary temperature was 230°C; deflector voltage, + 47 V; CDL voltage and temperature, - 28 V and 250°C; probe voltage and temperature, +3.5 V and 400°C; acquisition range, 100 -700 m/z at 2.0 scan s^{-1}. Analyses using ESI (electrospray ionization) interface were done under the same chromatographic conditions as described for the APCI analysis, except for the guard column, which was not used in the ESI analysis. The mass detector conditions were: nitrogen as the nebulizer gas at a flow rate of 4.5 L min^{-1}; deflector voltage, + 54 V; CDL voltage and temperature, - 10 V and 230°C; probe voltage, +4.5 V; acquisition range,50-800 m/z for negative and 50-950 m/z for positive at 2.0 scan s^{-1}.

RESULTS AND DISCUSSION

The constituents of *C. canescens* are listed in order of their elution on the C^{13} column (Fig.1). In total thirty polar and volatile compounds representing in the composition were identified in the crude extract by mass spectroscopy analysis using Metwin 2.0 Library and retention time programme confirmed the presence of these compounds (**Table 1**). The pharmacological activities of the identified compounds were shown in (**Table 2**).

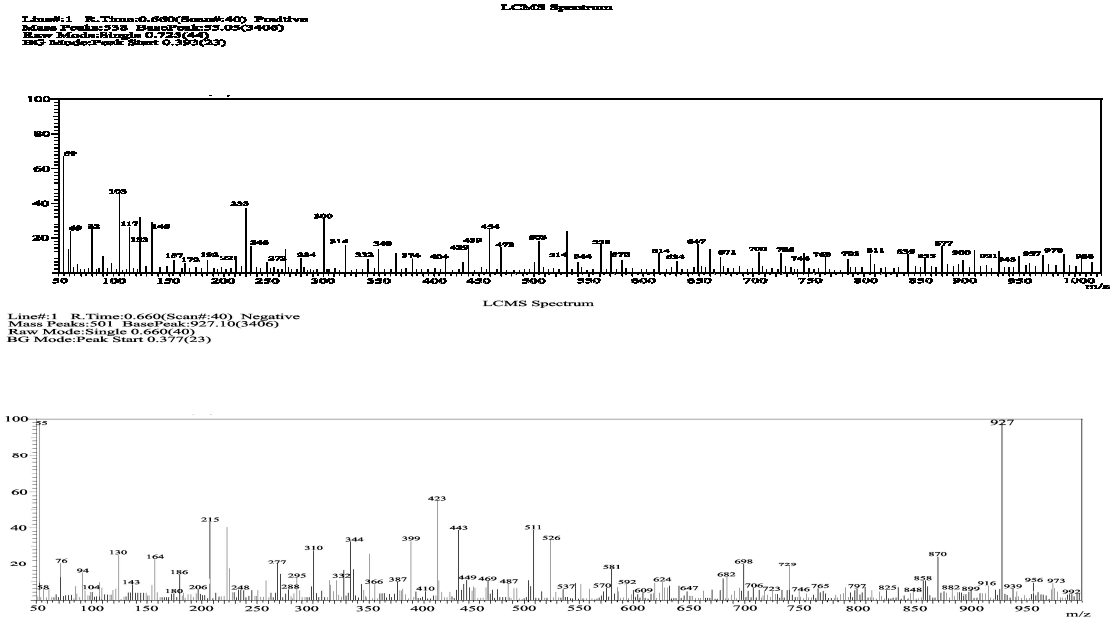


Fig.1: Chromatogram of Positive and Negative ionization mode

Table 1: List of compounds identified in LC-MS technique

S. NO	COMPOUND NAME	MOLECULAR MASS
1	HYDROXY L PROLINE	131.13
2	OCTANOIC ACID	144.22
3	PHENYL ALANINE	165.19
4	TYROSINE	181.19
5	ETHYLPARA METHOXY CINNAMATE	206.24
6	XANTHOTOXIN	216.2
7	CONFERTIN	248.33
8	LINOLENIC ACID	278.44
9	CALOPHYLLIN B	296.33
10	ARISTOLOCHIC ACID II	311.25
11	USNIC ACID	344.33
12	CAMPESTAROL	400.69
13	RUTARIN	424.41
14	VITAMIN K	450.71
15	EVODIN	470.53
16	OCTADIENOYL ACETATE	512.65
17	BIAPIGENIN	538.47
18	RUTIN	610.53
19	LUTEOLIFLAVAN GLUCOSIDE	724.68
20	AMINO BUTYRIC ACID	103.12
21	HAXANOIC ACID	116.16
22	GLUTARIC ACID	132.12
23	OCTANOIC ACID	144.22
24	CITRONELLOL	156.27
25	CARYOPHYLLENE OXIDE	220.36
26	MYRICYL ALCOHOL	438.83
27	CYANIDIN 3-SOPHOROSIDE CHLORIDE	646.99
28	COPALLIFEROL B	680.72
29	LUTEOLIFLAVAN GLUCOSIDE	724.68
30	MYRICOSIDE	743.71

Table 2: Identified compounds with their pharmacological activities

S. NO	COMPOUND NAME	COMPOUND NATURE	PHARMACOLOGICAL ACTIVITIES
1	HYDROXY L PROLINE	Aminoacid	Stimulate collagen synthesis, Retain keratin synthesis
2	OCTANOIC ACID	Fatty acid	Antimicrobial, Anticancer, Antiaging, Anti-autism
3	PHENYL ALANINE	Aminoacid	Anti-depression, osteoarthirities and rheumatoid arthirities
4	TYROSINE	Aminoacid	Anti tuberculosis and Antibacterial
5	XANTHOTOXIN	Flavonoid	Antibacterial
6	CONFERTIN	Alkaloid	Antimicrobial
7	LINOLENIC ACID	Fatty acid	Atherosclerosis, Antiobesity and anticancer
8	CAMPESTAROL	Phytosterol	Antidiabetic and Anti-inflammatory
9	EVODIN	Indole alkaloid	Anticancer
10	BIAPIGENIN	Flavonoid	Antioxidant and Anticancer
11	RUTIN	Flavonoid	Vasoprotectant
12	LUTEOLIFLAVAN GLUCOSIDE	Flavonoid	Antimicrobial and Antioxidant
13	HAXANOIC ACID	Fatty acid	Antimicrobial
14	CITRONELLOL	Terpenoid	Antimicrobial and Anticancer
15	CYANIDIN 3-	Anthocyanin	Anti-inflammatory, anticancer

	SOPHOROSIDE CHLORIDE		and Anticarcinogenic
16	COPALLIFEROL B	Phenolic compound	Antiasthma and Antibacterial
17	MYRICOSIDE	Glycoside	Antifeedant, antimicrobial and Antileukemia

LC-MS is a sensitive, powerful and robust technique, capable of analyzing very diverse complex compounds [5]. The ethanolic extract of stem bark of *Schleichera oleosa* (Sapindaceae) by GC-MS technique and compared its activities using phytochemical and ethnobotanical databases. 1,2-Benzenedicarboxylic acid, di-iso-octyl ester and squalene were identified in the extract by the parameters of mass spectral analysis includes retention time, base peak area and other characteristics of the peak using NIST library. Stem bark of *S. oleosa* is traditionally used for skin disorders, pain, inflammations, boils, ulcers etc. The data bases of the identified compounds also show the similar activities [6].

CONCLUSION

The present study was conducted to investigate the polar and volatile compounds of *C. canescens* using LC-MS technique. The thirty compounds identified from the crude extract of *C. canescens*. LC-MS analysis is the first step towards understanding the nature of active principles in this medicinal plant and this type of study could be helpful for further investigations into the pharmacological importance of *C. canescens.*

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