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Original Research Article

PHYTOCHEMICAL ANALYSIS ON *ASYSTASIA GANGETICA* (L.) T. ANDERSON

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Abstract

The present study was aimed to scrutinize the phytochemical components present in the various extracts of *Asystasia gangetica* (L.) T. Anderson using FT-IR, TLC and GC-MS. Preliminary phytochemical screening of the extracts was carried out using the standard method**.** The crude powder of *A. gangetica* was passed into the FT-IR and the peak values were recorded. TLC profile for phenolics and steroids was done using the mobile phase chloroform and methanol (9:1) and benzene and methanol at 9:1 ratio respectively. GC-MS analysis was performed on the benzene extracts to find out the chemical constituents. Preliminary phytochemical investigation confirmed the presence of various primary and secondary metabolites with varied degree. FT-IR spectrum revealed the functional constituents present in the crude powder of *A. gangetica*. TLC profile showed distinct bands with varied Rf values. GC-MS analysis results leads to the identification of 27 different compounds. The findings of the present study recommended the use of *A. gangetica* for developing plant based drugs for various ailments. Further study is recommended on other constituents on a road map of development of other phyto-pharmaceuticals for disease management.

Key Words: Phytochemical, *Asystasia gangetica*, Pharmaceuticals, Metabolites

Introduction

Since the beginning of human civilization, nature has provided many things for humans including the tools for the first attempts at therapeutic intervention [1]. During the last century, the practice of herbalism became popular throughout the world. In spite of the great advances achieved in contemporary medicine, plants still make a significant contribution to health care [2,3]. With the development of pharmaceutical industries, much more interest has been created on plant products. They have attaince to isolated active constituents from different plant parts and use them directly as drug or design them as pharmacologically active compounds with

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or without addition of synthetic ones. In India, traditional communities like tribal and rural populations are frequently using the crude extracts of local plants for medicinal and other purposes. The major part of traditional therapy involves the use of plant extract and their active constituents [4]. Phytochemical compounds found in plants are not required for normal functioning of the body, but have a beneficial effect on health and plays an active role in amelioration of diseases. This is due to increased awareness of the limited ability of synthetic pharmaceutical products to control major diseases and the need to discover new molecular structures as lead compounds from the plant kingdom. The basic molecular and active structures for synthetic fields are provided by rich natural sources. In order to promote the use of medicinal plants, it should be thoroughly investigated with their composition, activity and thus validate their use [5].

There are many approaches to search for biologically active principles in plants [6]. The spectrometric and chromatographic screening methods could provide the needed preliminary observations to select crude plant extracts with useful properties for further chemical and pharmacological studies [7]. Analysis of small amounts of chemicals has become easier and more cost-effective owing to the development of hyphenated chromatographic techniques such as GC or LC-MS. GC-MS analysis can identify pure compounds present at less than 1 ng [8]. In the last few years, GC-MS has become confidently established as a key technological platform for secondary metabolite profiling in plant species [9,10]. TLC is a quick, convenient and cost effective technique widely used for pharmaceutical analyses. TLC has the special ability to assay many samples at the same time on a single plate [11]. It is recommended as an effective method for identification of plant derivatives by Chinese, American and European Pharmacopoeias [12]. FTIR is a rapid, noninvasive, high-resolution analytical tool for identifying types of chemical bonds in a molecule by producing an infrared absorption spectrum that is like a molecular fingerprint [13].

The family Acanthaceae consists of a significant number of medicinal plants with broad array of biological activities and attractive number of phytoconstituents. *Asystasia*, member of Acanthaceae family, is a genus comprising of about 70 species distributed in tropical and subtropical regions. *Asystasia gangetica* (L.) T. Anderson (Ganges Primrose) is a fast growing, spreading, perennial herb that grows from 300-600 mm in height. It has green, oval-shaped leaves with white-cream coloured flower with purple markings and the fruit is a club shaped capsule, splitting from tip to base. It is native to tropical Africa, Arabia and tropical Asia, but has been introduced in many other tropical regions where it has often naturalized. It is widely distributed throughout the world [14]. The plant is used in ethnomedicine for the treatment of heart pains, stomach pains, rheumatism and vermifuge. In Nigeria, the leaves are popularly used in the treatment of asthma [15]. In the traditional medicine of East Africa, *A. gangetica* is used as an anthelminthic. Pharmacological studies have shown that the leaves of *A. gangetica* possess bronchospasmolytic and anti-inflammatory properties. The leaf extracts inhibited histamine and serotonin-induced contractions of the guinea pig trachea [16]. The leaves have been shown to contain large amounts of proteins, amino acids, minerals, carbohydrate, lipids and fibre [17]. In order to identify the bioactive compounds responsible for the above pharmacological

activities, the present study was aimed to study the phytoconstituents of *A. gangetica* using FT-IR, TLC and GC-MS.

Materials and Methods:

Collection and processing of plants

Healthy, disease free plant samples of *Asystasia gangetica* (L.) T. Anderson (Acanthaceae) were harvested from Marunthuvazh Malai, Kanyakumari district, Tamil Nadu, India. The collected samples were brought to the laboratory and washed well with running tap water for 10 min to remove the soil particles and adhered debris. Then the samples were washed thoroughly with distilled water. For drying, washed plant samples were blotted on the blotting paper and spread out at room temperature under shade for a period of 15 days. The shade dried samples were ground to fine powder using tissue blender. The powdered samples were then stored in refrigerator for further use.

Preparation of extracts

10 g of air dried powder was extracted with 60 mL of solvents viz., petroleum ether, benzene, chloroform, ethanolic and aqueous. The samples were kept in dark for 72 h with intermittent shaking. After incubation, the slurry was filtered through filter paper and the filtrate was collected (crude extracts). The crude extracts were stored in refrigerator for further use.

Physico-chemical parameters

Extractive values and fluorescence analysis were determined by following the standard method [18]. For fluorescence analysis, the different extracts were examined under visible and UV light (265 and 365 nm). The powdered materials were also treated with various reagents such as, H_2SO_4, HCl, NaOH and changes in colour were recorded.

Preliminary phytochemical analysis

The different extracts were tested for steroids, alkaloids, sugars, phenolic compounds, flavonoids, saponins, tannins, anthraquinone and aminoacids. Phytochemical screening of the extracts was carried out according to the standard method [19].

FT-IR analysis

FT-IR analysis was performed using Perkin Elmer Spectrophotometer system, which was used to detect the characteristic peaks and their functional groups. The crude powder of *A. gangetica* was passed into the FT-IR and the peak values were recorded. Each and every analysis was repeated twice and confirmed the spectrum [20].

TLC analysis

TLC was carried out on 10 × 20 cm silica gel plates (Merck, Germany). The phenolic and steroidal compounds present in various extracts of *A. gangetica* were tentatively detected by TLC. The mobile phase used for phenolics was chloroform and methanol at 9:1 ratio. After spraying with the solution composed of Folin-Ciocalteau reagent, the appearance of blue colour spot in the TLC chromatogram indicated the presence of phenolic compounds. The mobile phase used for steroids was benzene and methanol at 9:1 ratio. After spraying with the solution composed of 5% alcoholic sulphuric acid, the appearance of bluish green colour spot in the TLC chromatogram indicated the presence of steroidal compounds.

GC-MS analysis

GC-MS analysis was performed using the Clarus 500 GC-MS (Perkin Elmer). 2 µL of the benzene extracts of *A. gangetica* was employed for GC-MS analysis [9]. The Clarus 500 GC used in the analysis employed a fused silica column packed with Elite-1 (100% dimethyl poly siloxane, 30 nm × 0.25 nm ID × 1µm df) and the components were separated using Helium as carrier gas at a constant flow of 1 mL/min. The 2 µL sample extract injected into the instrument was detected by the Turbo gold mass detector (Perkin Elmer) with the aid of the Turbo mass 5.1 software. During the 36th minute GC extraction

process, the oven was maintained at a temperature of 110^0C with 2 minutes holding. The injector temperature was set at 250^0C (mass analyser).

Results and Discussion:

The results of phytochemical screening of different secondary metabolites of *A. gangetica* were illustrated in Table 1. Thus out of 45 (1 x 5 x 9 = 45) tests for the presence or absence of above compounds, 22 tests conferred positive results and the remaining 23 gave negative results. The 23 positive results showed the presence of steroids, sugars, phenolics, flavonoids, saponins, tannins and aminoacids with varied degree. Alkaloids and anthraquinone did not show any positive result for their presence in any of the tested extracts of *A. gangetica*.

Table 1: Preliminary phytochemical analysis of different extracts of *A. gangetica*

Compounds	Aqueous	Ethanol	Chloroform	Pet. ether	Benzene	Total
Steroids	-	+	+	+	+	**4**
Sugars	+	+	-	+	+	**4**
Phenolics	-	+	+	+	+	**4**
Flavonoids	+	-	-	+	+	**3**
Saponins	-	-	+	-	+	**2**
Tannins	-	-	-	+	+	**2**
Aminoacids	+	-	+	-	+	**3**
Total	**3**	**3**	**4**	**5**	**7**	**22**

The results showed the maximum presence of phenolics, steroids and sugars in four different extracts followed by flavonoids and aminoacids in three different extracts. Saponins and tannins were present in two different extracts. Among the tested five different extracts of *A. gangetica*, benzene extracts showed the presence of maximum number of (7/9) compounds. Next to that, petroleum ether extracts illustrated the occurrence of five compounds followed by four compounds in chloroform extracts. Ethanolic and aqueous extracts demonstrated the existence of three different compounds.

Plants can produce many different types of secondary metabolites, which have been subsequently utilized by humans for their valuable characters in a diverse array of applications [21]. Phenolics are often produced and accumulated in the sub-epidermal layers of plant tissues exposed to stress and pathogen attack [22]. The concentration of a particular phenolic compound within a plant tissue is dependent on season and may also vary at different stages of growth and development [23]. Several internal and external factors, including trauma, wounding, drought and pathogen attack affect the synthesis and accumulation of phenolics [24]. Phenolic compounds such as gallic acid, trans-resveratrol, fisetin, quercetin and its glycoside rutin have been reported to have strong antioxidant activity [25]. The arrangement of the hydroxyl groups around the phenolic molecule is also important for antioxidant reactions [26]. The qualitative analysis confirmed the presence of phenolic compounds in all the four extracts of *A. gangetica*.

Flavonoids are responsible for flower colours, protecting the plants from microbes and insects [27]. Flavonoids in plants can function as color definitions and attractants to pollinators and seed dispersers, as antioxidants to protect plants against UV-radiation, as insect feeding attractants in

host-species recognition, as signal molecules to facilitate nitrogen fixation, in inducible defense against bacterial and fungal attack; and as bitter or astringent taste attributes to repel birds and other animals [28]. For humans, several health beneficial properties of dietary flavonoids are recognized for their antioxidant and antiproliferative effects which may protect the body from various diseases, such as cancers, cardiovascular and inflammatory diseases [29]. In the present study, higher degree of flavonoids presence was confirmed in petroleum ether, benzene and aqueous extracts of *A. gangetica*. Thus, it is recognized for antioxidative effects and various health beneficiary aspects. Plant sterols are precursors for plant hormones and other secondary metabolites, i.e., substances interfering with pathogens and insects [30,31]. Sterol composition differs between species as well as between tissues and is furthermore influenced by developmental stage and environmental conditions. For example in *Zea mays*, 61 different sterols and related compound have been identified [32]. In the present study, steroids were present in all the four organic solvent extracts of *A. gangetica*.

The natural role of saponins in plants is thought to be protection against attack by pathogens [33]. Triterpenoid saponins are found primarily in dicotyledonous plants but also in some monocots, whereas steroid saponins occur mainly in monocots, such as the Liliaceae, Droscoraceae and Agavaceae and in certain dicots, such as foxglove [34]. The saponins produced by oats and tomato have potential role in plant defense against phytopathogenic fungi [35]. In the present investigation also, saponins showed its presence in chloroform and benzene extracts of *A. gangetica*. Tannins and related polyphenols have been implicated to various pharmacotherapeutic effects [36]. Tannins have beneficial effect on vascular health and helps to drain out all irritants from the skin. They are useful as an anti-inflammatory agent and in the treatment of burns and other wounds based on their anti hemorrhagic and antiseptic potentials. Tannin containing remedies are used as antihelmintics [37], antioxidants [38], antimicrobials and antivirals [39], cancer treatment [40] and to chelate dietary iron [41]. The results of the present study reported that tannins were present in petroleum ether and benzene extracts of *A. gangetica* which is useful for various pharmacological effects.

Phytochemical studies on *Asystasia* revealed the presence of iridoids, aliphatic alcohols, mega-stigmanes, phenolics and flavonoids [42]. Ezike *et al* [43] analysed the phytochemical constituents of *A. gangetica* extractives and determined the presence of steroids, flavonoids, terpenes and absence of alkaloids, saponins and tannins. In the present study also, alkaloids were absent but saponins and tannins were present. Kensa [44] studied the phytochemical components in the root, stem and leaves of *A. gangetica* and reported the presence of steroids, alkaloids, phenolics, saponins, tannins, flavonoids, sugar and proteins in methanolic, ethanolic, acetone, chloroform and aqueous extracts. In contrary to Kensa's observation, alkaloids were absent in all the five extracts of *A. gangetica*. Hamid *et al* [45] investigated the phytochemical compounds present in hexane, ethylacetate and methanolic extracts of whole plant of *A. gangetica.* They reported the presence of steroids, glycosides, flavonoids, anthraquinones, saponins, reducing sugars and absence of alkaloids and tannins. But in the present investigation, anthraquinones were absent in all the five different extracts. Hence, the results obtained from the present study were contrary to the previous observations.

The results of the extractive values of petroleum ether, benzene, chloroform, ethanolic and aqueous extracts of *A. gangetica* are 3.89, 6.36, 3.20, 5.11 and 2.32 respectively. This may provide a basis to identify the quality and purity of the drug and help in identification and authentication of the plant material. The fluorescence

analysis of *A. gangetica* treated with different chemical reagents was depicted in Table 2. The colour of the extracts from organic and inorganic solvents were observed both under ordinary and UV light. There is little difference between extracts and the light sources. In organic solvents, the extracts are generally dark green and the colour of the extracts in inorganic solvents is usually light green.

Table 2: Fluorescence analysis of *A. gangetica*

Solvents	***A. gangetica***		
	Visible light	**UV light (265 nm)**	**UV light (365 nm)**
Powder as such	Light green	Dark green	Dark green
Petroleum ether	Light green	Brownish green	Dark red
Benzene	Green	Dark green	Reddish brown
Chloroform	Dark green	Pale green	Dark red
Ethanol	Yellowish green	Yellowish green	Brownish green
Aqueous	Pale green	Yellowish green	Yellowish green
H_2SO_4	Dark green	Dark green	Dark brown
HCl	Dark brown	Reddish brown	Dark brown
NaOH	Light green	Dark brown	Dark green

Similar to the present study, Kala *et al* [46] previously applied the fluorescence characters as a tool to characterize the different medicinal plants of South India. Correct identification and quality assurance of the starting material is an essential prerequisite to ensure reproducible quality of herbal medicine which will contribute to its safety and efficacy [47]. The results of the fluorescence analysis may be helpful to identify the purity of the drug.

FT-IR spectrum was used to identify the functional group of the active components based on the peak value in the region of infrared radiation. The results revealed the similarity and variation in *A. gangetica* based on the presence of functional groups and absorption spectrum. The crude powder of *A. gangetica* validated the presence of alcohols, acid, alkenes, aromatics, nitro compounds, alkyl halides, aliphatic amines, alkynes, primary and secondary amines with the peak values 3780.22, 3313.48, 3195.83, 2362.64, 1668.31, 1454.23, 1400.22, 1334.65, 1195.78, 1112.85, 808.12, 752.19, 653.82, 605.61 and 462.88 respectively (Table 3; Fig. 1).

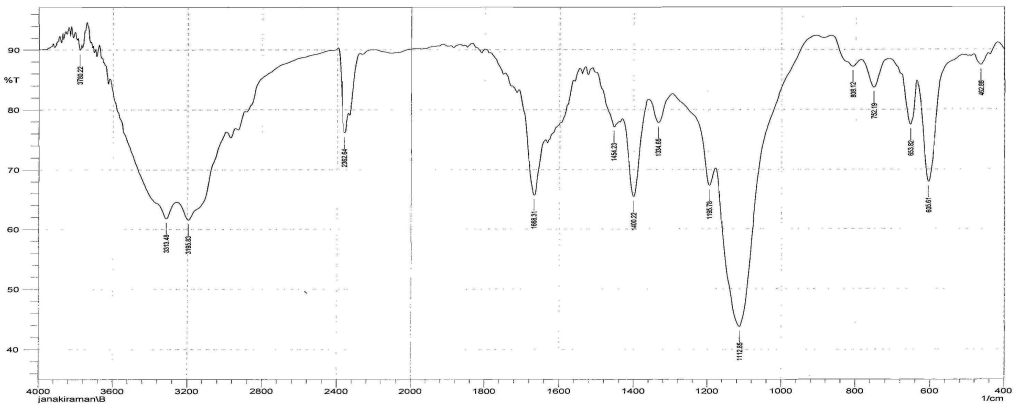

Fig. 1: FT-IR spectrum for crude powder of *A. gangetica*

Table 3: FT-IR peak values for crude powder of *A. gangetica*

Peak values	Functional groups
3780.22	Unknown
3313.48	Alcohols, Phenols
3195.83	Acid
2362.64	Unknown
1668.31	Alkenes
1454.23	Aromatics
1400.22	Aromatics
1334.65	Nitro compounds
1195.78	Alkyl halides
1112.85	Aliphatic amines
808.12	Alkenes
752.19	Primary, Secondary amines
653.82	Alkynes
605.61	Alkyl halides
462.88	Unknown

Spectral differences are the objective reflection of componential differences. By using the peak values of FT-IR spectrum, the origin of different extracts can be tested accurately and effectively, various constituents in the extracts can be traced, medicinal materials can be identified true or false and even evaluate the qualities of

medicinal materials [48]. From the FT-IR spectrum, it was clearly seen that although they show substantial overlap of each absorption spectrum of various components, each band represents an overall overlap of some characteristic absorption peaks of functional groups in the samples. Many workers applied the FT-IR spectrum as a tool for differentiating, classifying and discriminating closely related plants and other organisms [20,49]. The present study results supplemented the previous observations and provided the similarity and variation in functional groups.

TLC profile for ethanolic extracts of *A. gangetica* showed 6 distinct phenolic bands with different Rf values viz., 0.31, 0.46, 0.53, 0.70, 0.85 and 0.95. Chloroform extracts demonstrated 3 phenolic bands with the Rf values 0.73, 0.80 and 0.97. For petroleum ether extracts of *A. gangetica*, 5 phenolic bands were observed with different Rf values viz., 0.36, 0.44, 0.62, 0.78 and 0.90. Benzene extracts illustrated 5 phenolic bands with the Rf values 0.34, 0.43, 0.58, 0.78 and 0.93 (Table 4).

Table 4: Phenolics profile of various extracts of *A. gangetica* using TLC

Rf value	Ethanol	Chloroform	Pet. ether	Benzene
0.31	+	-	-	-
0.34	-	-	-	+
0.36	-	-	+	-
0.43	-	-	-	+
0.44	-	-	+	-
0.46	+	-	-	-
0.53	+	-	-	-
0.58	-	-	-	+
0.62	-	-	+	-
0.70	+	-	-	-
0.73	-	+	-	-
0.78	-	-	+	+
0.80	-	+	-	-
0.85	+	-	-	-
0.90	-	-	+	-
0.93	-	-	-	+
0.95	+	-	-	-
0.97	-	+	-	-

Steroidal profiles present in ethanolic extracts of *A. gangetica* illustrated 6 bands with different Rf values viz., 0.68, 0.73, 0.77, 0.82, 0.86 and 0.95. For chloroform extracts of *A. gangetica*, 3 steroidal bands were detected with the Rf values 0.69, 0.86

and 0.91. Petroleum ether extracts of *A. gangetica*, determined the presence of 3 steroidal bands with different Rf values viz., 0.51, 0.75 and 0.86. Three steroidal bands with the Rf values viz., 0.58, 0.69 and 0.83 were observed in the benzene extracts of *A. gangetica* (Table 5).

Table 5: Steroids profile of different extracts of *A. gangetica* using TLC

Rf value	Ethanol	Chloroform	Pet. ether	Benzene
0.51	-	-	+	-
0.58	-	-	-	+
0.68	+	-	-	-
0.69	-	+	-	+
0.73	+	-	-	-
0.75	-	-	+	-
0.77	+	-	-	-
0.82	+	-	-	-
0.83	-	-	-	+
0.86	+	+	+	-
0.91	-	+	-	-
0.95	+	-	-	-

The inclusion of TLC fingerprints in modern pharmaceutical herbal monographs is now a standard practice. TLC studies employed the Rf values to distinguish the plants from other species and adulterant. In the present study, we developed the phenolics and steroids TLC profile for various extracts of *A. gangetica.* This provides valuable information in authenticating the genuine mother plants along with the nature of phytoconstituents present in it.

GC-MS analysis results leads to the identification of number of compounds from the GC fractions of the benzene extracts of *A. gangetica*. They were identified through mass spectrometry attached with GC. The compound prediction is based on Dr. Duke's Phytochemical and Ethnobotanical Databases. The phytoconstituents identified in the benzene extracts of *A. gangetica* by GC-MS were demonstrated in Table 6. It showed the presence of 27 different compounds viz., Benzene ethanol (0.66%), Hydrazine, (Phenylmethyl)- (0.18%), Tetraethyl silicate (0.17%), Benzene, 1-ethyl-2-methyl- (0.53%), dl-Allo-cystathionine (0.09%), Benzene, 1,3,5-trimethyl- (0.61%), 1,3-dichloro-2-(2-nitrovinyl)benzene (0.34%), 2-Formylhistamine (0.34%), 1-Octadecanamine (0.15%), Dodecane (0.21%), N-Ethyl-N'-nitroguanidine (0.70%), 2-Phenazinecarboxylic acid (0.24%), 2,5-Cyclohexadien-1-one (0.25%), Octadecane (-0.32%), Octadecanoic acid (-0.01%), 1,3-Isoindolinedione (0.21%), Isopropyl Palmitate (1.90%), N-methyl-1-

adamantaneacetamide (12.11%), Propanoic acid (10.51%), Cyclotrisiloxane, hexamethyl- (2.37%), 2,4,6-cycloheptatrien-1-one (8.85%), 1,2-Benzenediol (11.56%), 5-methyl-2-phenylindolizine (12.27%), Dibutyl phthalate (19.09%), 1,3-bis(trimethylsilyl) benzene (2.47%), 2-Methyl-3-(2-(4-phenyl-1-piperazinyl)ethyl) indole (5.99%) and Anthracene (7.88%). The GC-MS spectrum of *A. gangetica* confirmed the presence of 27 major constituents with the retention time 11.78, 12.55, 13.75, 14.17, 14.74, 15.00, 15.93, 16.35, 18.13, 18.49, 20.08, 20.51, 21.11, 26.88, 27.91, 28.36, 29.45, 31.95, 33.16, 33.45, 34.45, 35.67, 36.77, 38.04, 38.79, 39.24 and 40.13 respectively (Fig. 1). The name, molecular weight, molecular formula and structure of the component of the test material were ascertained [32].

Table 5: Compounds present in the benzene extracts of *A. gangetica* by GC-MS

Peak	RT	Area %	Compound Name	Mol. Wt.	Molecular formula
1	11.78	0.66	Benzene ethanol	122.16	$C_8H_{10}O$
2	12.55	0.18	Hydrazine, (Phenylmethyl)-	122.16	$C_7H_{10}N_2$
3	13.75	0.17	Tetraethyl silicate	208.32	$C_8H_{20}O_4Si$
4	14.17	0.53	Benzene, 1-ethyl-2-methyl-	120.19	C_9H_{12}
5	14.74	0.09	dl-Allo-cystathionine	222.26	$C_7H_{14}N_2O_4S$
6	15.00	0.61	Benzene, 1,3,5-trimethyl-	210.18	$C_9H_{10}N_2O_4$
7	15.93	0.34	1,3-dichloro-2-(2-nitrovinyl)benzene	218.03	$C_8H_5Cl_2NO_2$
8	16.35	0.34	2-Formylhistamine	139.15	$C_6H_9N_3O$
9	18.13	0.15	1-Octadecanamine	269.50	$C_{18}H_{39}N$
10	18.49	0.21	Dodecane	170.33	$C_{12}H_{26}$
11	20.08	0.70	N-Ethyl-N'-nitroguanidine	132.12	$C_3H_8N_4O_2$
12	20.51	0.24	2-Phenazinecarboxylic acid	240.21	$C_{13}H_8N_2O_3$
13	21.11	0.25	2,5-Cyclohexadien-1-one	422.64	$C_{29}H_{42}O_2$
14	26.88	-0.32	Octadecane	254.49	$C_{18}H_{38}$
15	27.91	-0.01	Octadecanoic acid	284.47	$C_{18}H_{36}O_2$
16	28.36	0.21	1,3-Isoindolinedione	265.26	$C_{16}H_{11}NO_3$
17	29.45	1.90	Isopropyl Palmitate	298.50	$C_{19}H_{38}O_2$
18	31.95	12.11	N-methyl-1-adamantaneacetamide	207.31	$C_{13}H_{21}NO$
19	33.16	10.51	Propanoic acid	74.07	$C_3H_6O_2$
20	33.45	2.37	Cyclotrisiloxane, hexamethyl-	222.46	$C_6H_{18}O_3Si_3$
21	34.45	8.85	2,4,6-cycloheptatrien-1-one	376.87	$C_{20}H_{25}ClN_2O_3$
22	35.67	11.56	1,2-Benzenediol	154.18	$C_8H_{12}NO_2^+$
23	36.77	12.27	5-methyl-2-phenylindolizine	207.27	$C_{15}H_{13}N$
24	38.04	19.09	Dibutyl phthalate	278.34	$C_{16}H_{22}O_4$
25	38.79	2.47	1,3-bis(trimethylsilyl) benzene	310.49	$C_{14}H_{22}O_4Si_2$
26	39.24	5.99	2-Methyl-3-(2-(4-phenyl-1-piperazinyl)ethyl) indole	319.44	$C_{21}H_{25}N_3$
27	40.13	7.88	Anthracene	178.22	$C_{14}H_{10}$

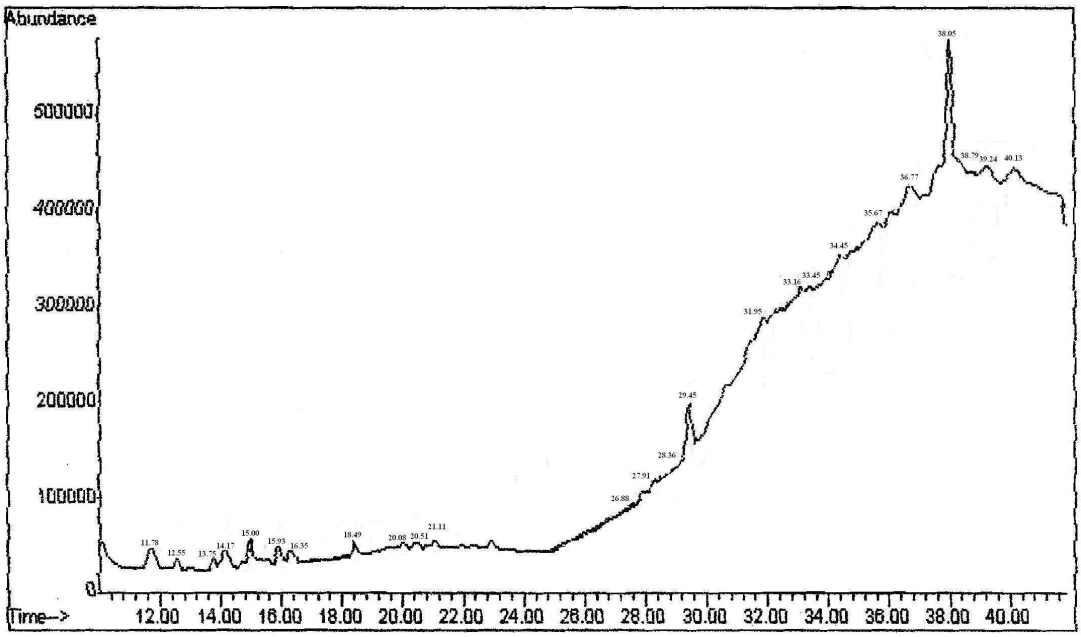

Fig. 2: GC-MS chromatogram of benzene extracts of *A. gangetica*

The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. The gas chromatogram of benzene extracts of *A. gangetica* shows the relative concentrations of various compounds getting eluted as a function of retention time. The heights of the peak indicate the relative concentrations of the components present in *A. gangetica*. The results of the GC-MS profile can be used as pharmacognostical tool for the identification of *A. gangetica*.

Conclusion:

The results of the present phytochemical analysis are possibly suggesting the roles played by *A. gangetica* in the traditional recipe and also it can help the manufacturers for identification and selection of raw materials for drug production. Further study is recommended on other constituents on a road map of development of other phyto-pharmaceuticals for disease management.

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