Journal of Pharmaceutical Research, Volume 17, Issue 1, Jan-Mar, 2018

ISSN (Online) : 2454-8405
DOI: 10.18579/jpcrkc/2018/17/1/119382

GC-MS Analysis of Bioactives of *Jatropha gossypifolia* Linn. Leaves

Sapna Saini*[a], Sanju Nanda[b] and Anju Dhiman[c]

*[a]Research scholar, Department of Pharmaceutical Sciences, Maharshi Dayanand University, Rohtak -124001, Haryana, India.

[b]Professor, Department of Pharmaceutical Sciences, Maharshi Dayanand University, Rohtak -124001, Haryana, India.

*[c]Assistant Professor, Department of Pharmaceutical Sciences, Maharshi Dayanand University, Rohtak -124001, Haryana, India.

Research Article

Received on: 11/09/2017 **Revised on:** 3/2/2018 **Accepted on:** 3/27/2018

Abstract

Purpose: *Jatropha gossypifolia* Linn. (Family: Euphorbiaceae), is an ornamental ethnomedicinal plant. The leaves of *J. gossypifolia* L. has been used in treatment of wounds, sores, sprains, rashes, stomach ache, venereal diseases, hemorrhage and tooth infections. The main objective of present research was to carry out the phytochemical screening and Gas Chromatography-Mass Spectrometry (GC-MS) analysis of the leaves of *J. gossypifolia* L. to evaluate its various bioactive components. **Methodology**: The bioactive components of the petroleum ether (40-60˚C), chloroform, methanol and aqueous extracts of the leaves were qualitatively analyzed as per the standard methods. The bioactives of leaves of *J. gossypifolia* were extracted by ultrasonic assisted extraction (UAE) method using methanol as solvent and analyzed by GS-MS method using Thermo scientific TSQ 8000 high resolution Gas Chromatograph-Mass Spectrometer. **Findings:** Maximum bioactive phytocomponents have been reported in methanol leaf extract of *J. gossypifolia* L. *v.i.z.* glycosides, phytosterols, saponins, flavonoids, alkaloids, fatty acids, tannins and phenolic compounds. GC-MS analysis separated and identified the presence of 34 phytocomponents in methanolic leaf extract of *J. gossypifolia* L. The major phytoconstituents identified were 1-Monolinoleoylglycerol trimethylsilyl ether (9.58%); 2, 4-heptadienal (E,E) (6.77%); carotene, 1,1',2,2'-tetrahydro-1,1'-dimethoxy (4.92%); ergosta-5,22-dien-3-ol, acetate (4.59%); lanosterol (31.8%) and stigmasterol (2.07%). Cardenolide and bufadienolide derivatives and various fatty acid derivatives like docosanoic acid, 1,2,3-propanetriyl ester; 9,12,15-octadecatrienoic acid, triolein etc. have been also reported in GC-MS analysis. **Conclusion:** Results of GC-MS analysis justified the ethnomedicinal importance of the leaves of *J. gossypifolia* L. due to presence of various bioactive components belonging to different classes.

Keywords: Euphorbiaceae, GCMS, *Jatropha gossypifolia* L., lanosterol, phytochemicals, stigmasterol

**Author for correspondence:* Sapna Saini, Research Scholar, DOPS, Maharshi Dayanand University, Rohtak -124001, Haryana, India. 01sapnalongia@gmail.com

1. INTRODUCTION

The medicinal plants are unique in their ability to treat as well as to cure various human ailments because they contained various valuable phytoconstituents. Secondary plant metabolites such as alkaloids, steroids, flavonoids, glycosides, terpenoids, tannins, saponins, phenolic compounds etc. are mainly responsible for the therapeutic activity of the plant [1]. There are several medicinal plants that have been used since ages and yielded very useful medicinal products such as steroidal analgesic, morphine isolated from latex of *Papaver somniferum* fruit, an antimalarial alkaloid, quinine isolated from bark of *Cinchona calisaya*, anticancer alkaloidal drugs, vincristine and vinblastine obtained from flower of *Vinca rosea* L., an alkaloidal antiemetic drug, emetine obtained from roots of the *Cephaelis ipecacuanha* and an alkaloidal antihypertensive drug, reserpine, isolated from the roots of the *Rauwolfia serpentine* plant etc [2]. Due to the consequence of the above context, phytochemical screening of plants is required to identify the nature of bioactive components in order to find novel therapeutic agents with better efficacy.

The present research work deals with phytochemical screening of leaves of valuable medicinal plant; *Jatropha gossypifolia* L. and also quantitative estimation of bioactive components by GC-MS analysis. The genus Jatropha belonging to family Euphorbiaceae has 175 known species such as *J. curcas, J. glandulifera, J.integerrima, J.gossypifolia, J. nana, J. multifida, J. podagrica,* and *J. tanjorensis* etc. *J. gossypifolia* L. is an ornamental drought-resistance perennial shrub that is widely distributed to the tropical countries of Africa and Asia [3]. Worldwide *J. gossypifolia* L. is commonly known as "bellyache bush" or "physic-nut". But in India it is oftenly termed as "lal-bherenda" or "ratanjot" plant. *J. gosspifolia* L. is a small gregacious, bushy shrub with purplish-red to dark green colored alternate leaves which have been known for its ethno-pharmacological activities (Figure 1) [4]. The plant is native to Brazil and incorporated in the National List of Medicinal Plants of Interest to the Brazilian Public Health System due to its applicability to generate pharmaceutical products of Brazilian public health system [5]. In Ayurvedic Pharmacopoeia of India, a variant of *J. gossypifolia* L. i.e. *J. glandulifera* L. is an official plant [6]. Leaves of *J. gossypifolia* L. are used for treating various skin problems *v.i.z.* eczema, itches, boils, burns, sprains, tongue sores of babies, swollen mammae and also effective in intermittent fevers, stomachache and in venereal disease. Since ages, the leaf decoction due to haemostatic and anti-microbial action is used to bathing wounds [7]. Panda et al., (2009) reported the analgesic and anti-inflammatory activities of methanolic and petroleum ether leaf extracts of *J. gossypifolia* L. [8]. Jain et al., (2015) reported the antioxidant and hepatoprotective activities of ethanolic extract of *J. gossypifolia* L. leaves [9]. Chloroform and methanol extract of the leaves of *J. gossypifolia* L. has been reported to possess antimicrobial activity against pathogenic microbes *v.i.z. salmonella typhi*, *pseudomonas aureoginosa*, *staphylococcus aureus* and *candida albicans* [10].

Figure 1. Habitat of *J. gossypifolia L.*

2. MATERIAL AND METHOD

HPLC grade methanol was obtained from specrochem Pvt. Ltd., Mumbai (India). Pertroleum ether (40-60˚C), chloroform and ethanol were purchased from Loba Chem Pvt. Ltd. (Mumbai), India and were of analytical grade.

2.1 Plant material

The fully mature healthy and uninfected *J. gossypifolia* L. plant leaves were collected in the month of June-2014 from Chandan vatika herbal garden, Jind District, Haryana (India). Identification of plant has been done with the assistance of existing literature. Leaves of *J. gossypifolia* L. has been authenticated by Dr. Sunita Garg, Chief Scientist & taxonomicst at CSIR-NISCAIR, Delhi (India) having NISCAIR/RHMD/Consult/2014/2466/45-1 reference number. A voucher specimen of the same has been deposited in the Department of Pharmaceutical Sciences, MDU, Rohtak, Haryana (India), for future reference.

2.2 Preliminary phytochemical screening

The phytocomponents of pet ether, chloroform, methanol and aqueous extract of dried leaves of *J. gossypifolia* L. were qualitatively analyzed using standard methods

[11, 12]. The extracts were prepared by successive solvent extraction method. The extracts obtained were filtered using Whatman filter paper No. 1. Evaporation of the respected solvents has been done on water bath. The sticky greenish-brown extracts were obtained and stored in dessicator prior to use. Additionally to phytochemical screening, percentage yield of each extract were also calculated.

2.3 Preparation of extract for GC-MS analysis by Ultrasonic assisted extraction method (UAE)

The collected leaves were washed gently with distilled water and dried for 7 days under shade. With the help of mechanical grinder, the dried leaves were ground to coarse powder and stored in an airtight container for further use. Methanol leaf extract was prepared by UAE method. 5 gm of dried leaf powder of *J. gossypifolia* L. was mixed with 100 ml of methanol solvent. The experimental unit consists of a glass container, sonication probe of 250 W power (18 mm tip diameter) and 22 kHz frequency (Harison Pharma Pvt. Ltd. Delhi). The sonication probe was placed directly into the solvent containing the *J. gossypifolia* L. leaf powder and the mixture was irradiated for 30 min. Extraction container was kept inside a constant temperature water bath so that the temperature of the solvent reservoir did not increase significantly. A constant temperature of 40°C was set during the whole process. The filtrate obtained was firstly air dried and then lyophilized to obtain dried leaf extract. To improve the yield of bioactive components, methanol leaf extract of *J. gossypifolia* L. was prepared using non-conventional UAE method.

2.4 GC-MS instrumrntation and conditions

GC-MS analysis of methanol leaf extract of *J. gossypifolia* L. has been done by Thermo scientific TSQ 8000 high resolution Gas Chromatograph-Mass Spectrometer equipped with Elite-5 ms fused silica capillary column of 30 m length, 0.25 mm diameter and 0.25 µm film thickness. The MS part consists of triple quadruple. The mass spectrometer is paired with the TRACE 1300 gas chromatograph along with auto-sampler for automated sample handling. Helium gas (99.999 %) was used as carrier gas with a constant flow rate of 1 ml/min and an injection volume of 2 µl was employed (a split ratio of 10:1). For GC-MS analysis detection, electron capture detector was used. Electron ionization source was programmable to 350 °C. Mass range was kept between 50-700 m/z. Total run time was 29.12 min. The relative percentage of each phytocomponents was expressed as peak area percentage. The GC-MS instrument is equipped with NIST library.

2.5 Identification of phytocomponents

Interpretation of mass spectrum obtained from GC-MS analysis was done using the database of National Institute of Standard and Technology (NIST) library. The mass spectrum of unknown component was compared with mass spectrum of known component having same molecular formula and IUPAC name. Then, the name, molecular weight, chemical structure and probability of the determined components were ascertained.

3. RESULTS

3.1 Phytochemical analysis

Results of qualitative phytochemical analysis of pet ether, chloroform, methanol and aqueous extracts and percentage yield of each extract are compiled in Table 1 & 2.

3.2 GC-MS analysis

In the present study, GCMS analysis of methanolic leaf extract of *J. gossypifolia* L. revealed the presence of thirty five phytocomponents. GC-MS running time was 29.12 min. A distinct chromatogram of methanol extract of *J. gossypifolia* L. leaf is shown in Figure 2. The analysis separated and identified various phytochemicals belonging to different chemical classes. The bioactive compounds with their retention time (RT), molecular formula, molecular weight (MW) and peak area (%) are presented in the Table 3. The spectra of the compounds are matched with NIST libraries. The nature and uses of the phytoconstituents are presented in the Table 4 and molecular structure and their mass spectrum are depicted in the Table 5. The phytocomponents in the methanol leaf extract of *J. gossypifolia* showed a chromatogram with retention time ranging from 5.05 to 31.98. Among the identified 34 phytocomponents 24 are more than 1% concentration. The most abundant components were 1-monolinoleoylglycerol trimethylsilyl ether (9.58%), 2, 4-heptadienal (E,E) (6.77%); carotene, 1,1',2,2'-tetrahydro-1,1'-dimethoxy (4.92%);

ergosta-5,22-dien-3-ol, acetate (4.59%); 2,4-decadienal (4.45%); ethyl iso-allocholate (3.50%), lanosterol (3.18%); l-proline (2.30%), stigmasterol (2.07%) (Figure 1-9). Beside these, few other components found in methanolic extract are 9, 12-octadecadienoic acid; bufa-20, 22-dienolide-14,15-epoxy-3,16-dihydroxy; β-ylangene, docosanoic acid, 1,2,3-propanetriyl ester, 17-pentatriacontene, pregnane-3,20a-diol, oleic acid triglyceride, glubulol, card-20(22)-enolide etc. The most prevailing component in the extract is 1-monolinoleoylglyceroltrimethylsilyl ether (9.58); a steroidal compound that has been reported to possess antimicrobial, antioxidant, antiarrythmic, anti-inflammatory, antiasthma, diuretic and antidiabetic activities [13]. As per Dr. Duke's ethnobotanical database, fatty acid esters; 9,12-Octadecadienoic acid (2-phenyl-1,3-dioxolan-4-yl) methyl ester, 9,12-octa-

Table 1. Phytochemicals present in different extracts of *Jatropha gossypifolia L.* leaf

Tests	Pet ether extract	Chloroform extract	Methanol extract	Aqueous extract
Carbohydrates and glycosides				
Molisch's test	+	-	+	-
Fehling test	+	-	+	+
Libermann's test	-	-	+	-
Borntrager's test	-	-	+	-
Protein and amino acids				
Millon's test	+	-	-	-
Ninhydrin test	-	-	-	-
Biuret test	-	-	-	-
Alkaloidal compounds				
Mayer's test	+	+	++	-
Dragendorff's test	+	-	++	-
Phytosterols				
Libermann-Buchard's test	+	+	++	+
Salkowski test	-	-	+	-
Saponins				
Foam test	-	-	++	-
Phenolic compounds and tannins				
Ferric chloride test	+	++	++	+
Lead acetate test	+	+	++	+
Gums and mucilage				
Benedict's test	-	-	+	+
Ruthenium test	-	-	-	-
Flavonoids				
Sulphuric acid test	+	++	+++	+

Table 2. Percentage yield of various extracts of *Jatropha gossypifolia* Linn. leaf

S.No.	Extract	Consistency	Color	% yield
1	Pet ether	Semi-solid	Dark green	18.75
2	Chloroform	Solid	Green	12.68
3	Methanol	Solid	Green	19.78
4	Aqueous	Solid	Brown	9.45

Table 3. Phytocomponents identified in the methanol leaf extract of *J. gossypifolia* L. by GC-MS analysis

S.No.	RT	Name of the compound	Peak (%)	Molecular formula/ Molecular weight (g/mol)
1	5.05	2,4-Heptadienal (E,E)	6.77	$C_7H_{10}O$/110.15
2	6.16	Nonanal	1.19	$C_9H_{18}O$/142.23
3	7.38	Ethyl iso-allocholate	3.50	$C_{26}H_{44}O_5$/436.63
4	7.52	9,12-Octadecadienoic acid (2-phenyl-1,3-dioxolan-4-yl) methyl ester	1.34	$C_{28}H_{42}O_4$/442.64
5	7.82	3,9-Epoxypreg-16-en-20-one-3-methoxy-7,11,18-triacetoxy	0.99	$C_{28}H_{38}O_9$/518.19
6	8.16	Rhodopin	0.66	$C_{40}H_{58}O$/554.88
7	8.34	2-Decenal	1.18	$C_{10}H_{18}O$/154.24
8	8.81	2,4-Dodecadienal	2.66	$C_{12}H_{20}O$/180.11
9	9.14	2,4-Decadienal	4.45	$C_{10}H_{16}O$/152.23
10	9.50	Ergosta-5,22-dien-3-ol, acetate	4.59	$C_{30}H_{48}O_2$/440.70
11	9.71	2-Undecenal	2.46	$C_{11}H_{20}O$/168.27
12	9.95	β-Ylangene	1.60	$C_{15}H_{24}$/204.35
13	10.10	Docosanoic acid, 1,2,3-propanetriyl ester	1.99	$C_{69}H_{134}O_6$/1059.79
14	10.56	Bufa-20,22-dienolide, 14,15-epoxy-3,16-dihydroxy	0.48	$C_{24}H_{32}O_5$/400.19
15	11.08	Astaxanthin	0.62	$C_{40}H_{52}O_4$/596.36
16	13.48	17-Pentatriacontene	0.92	$C_{35}H_{70}$/490.35
17	14.82	9,12,15-Octadecatrienoic acid, 2-phenyl-1,3-dioxan-5-yl-ester	0.99	$C_{28}H_{40}O_4$/440.24
18	15.85	Trilinolein	1.08	$C_{57}H_{98}O_6$/879.40
19	17.03	Lycoxanthin	0.52	$C_{40}H_{56}O$/552.88
20	17.79	Rhodopin	0.43	$C_{40}H_{58}O$/554.88
21	19.76	9,12,15-Octadecatrienoic acid, 2,3bis[(trimethylsilyl)oxy]propyl ester, (Z,Z,Z)	1.36	$C_{27}H_{52}O_4Si_2$/496.41
22	22.01	1-Monolinoleoylglycerol trimethylsilyl ether	9.58	$C_{27}H_{54}O_4Si_2$/498.88
23	22.37	Glycine, N-[(3à,5á,7à,12à)-24-oxo-3,7,12-tris[(trimethylsilyl)oxy]-cholan-24-yl]-, methyl ester	0.60	$C_{36}H_{69}NO_6Si_3$/695.57
24	22.72	(22S)-6à,11á,21-Trihydroxy-16à, 17à-propylmethyle nedioxypregna-1,4-diene-3,20-dione	1.69	$C_{25}H_{34}O_7$/446.54
25	23.01	Glubulol; 1,1,4,7-Tetramethyldecahydro-1H-cyclopropa[e]azulen-4-ol, (1aα,4α,4aα,7α,7aβ,7bα)	1.49	$C_{15}H_{26}O$/222.36
26	25.32	Carotene,-1,1',2,2'-tetrahydro-1,1'-dimethoxy	4.92	$C_{42}H_{64}O_2$/600.97
27	26.10	Triolein	1.18	$C_{57}H_{104}O_6$/885.43

28	26.33	L-Proline,1-[O-(1-oxohexyl)-N-[N-[N6-(1-oxohexyl)-N2-[N-(1-oxohexyl)-L-valyl]-L-lysyl]L-valyl]L-tyrosyl]-, methyl ester	2.36	$C_{49}H_{80}N_6O_{10}$/913.19
29	27.14	3-Pyridinecarboxylicacid, 2,7,10-tris-(acetyloxy)- 1,1a,2,3,4,6,7,10,11,11a-decahydro-1,1,3,6,9-pentamethyl-4-oxo-4a-cycloundecen-7-yl ester	0.31	$C_{32}H_{39}NO_{10}$/597.22
30	27.80	Milbemycin b, 13-chloro-5-demethoxy-28-deoxy-6,28-epoxy-5-(hydroxyimino)-25-(1-methylethyl), (6R,13R,25R)	1.83	$C_{33}H_{46}ClNO_7$/602.71
31	29.31	Octadecanoic acid, 1[(1-oxohexadecyl) methyl]-1,2-etanediyl ester	1.33	$C_{55}H_{106}O_6$/863.44
32	29.92	Card-20(22)-enolide,3-[(6-deoxy-3,4-O-methylenehexopyranos-2-ulos-1-yl)oxy]-5,11,14-trihydroxy-12-oxo, (3á,5à,11à)	0.48	$C_{30}H_{40}O_{11}$/576.19
33	31.71	Stigmasterol	2.07	$C_{29}H_{48}O$/412.69
34	31.98	Lanosterol	3.18	$C_{30}H_{50}O$/426.31

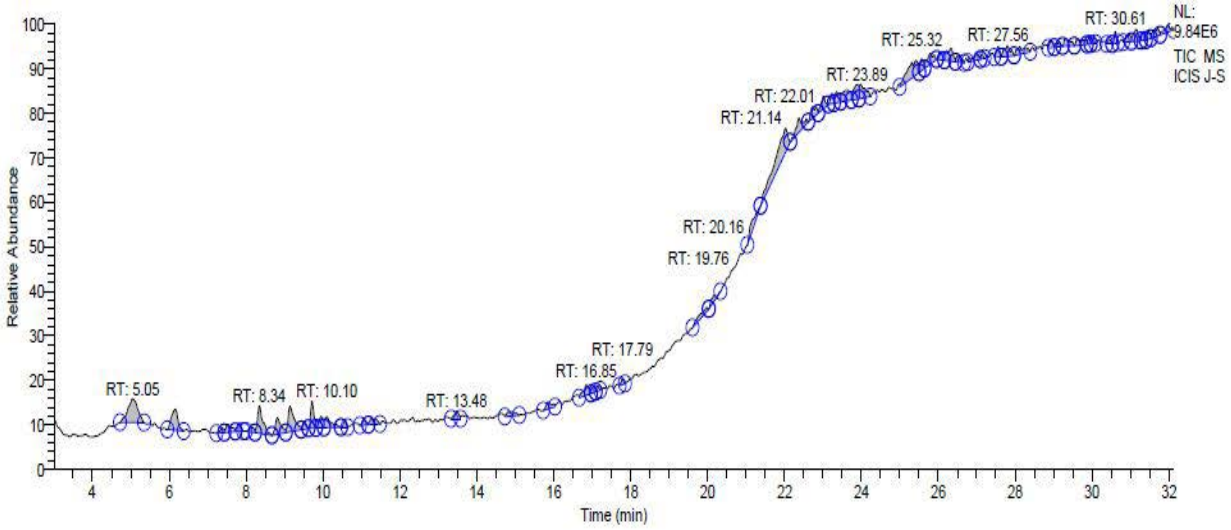


Figure 2. Chromatogram of methanol extract of *Jatropha gossypifolia* Linn. leaf

decadienoic acid; docosanoic acid, 1,2,3-propanetriyl ester possess anti-inflammatory, cancer preventive, hepatoprotective, hypocholesterolemic, nematicide, pesticide and flavouring activities. Phytosterol, lanosterol possess antiarthritic, anticancer hepatoprotective, antimicrobial antiasthma and diuretic acivities [14]. Stigmast-5-en-3-ol is a phytosterol that has antioxidant and antidiabetic potential [15].

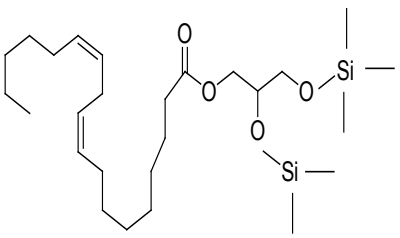
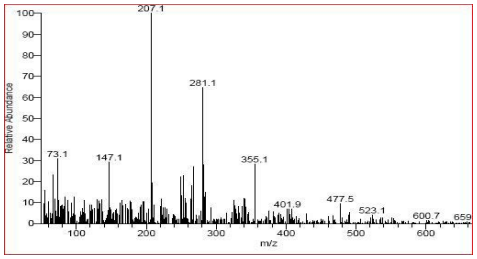
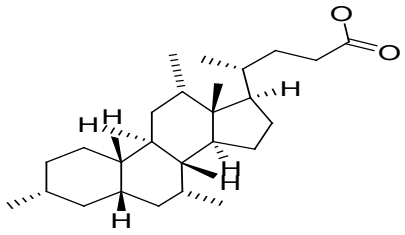
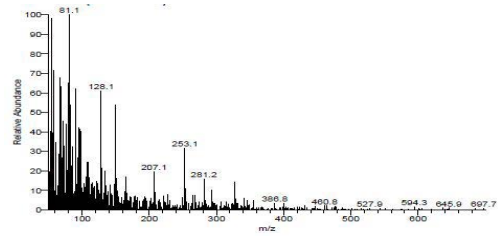
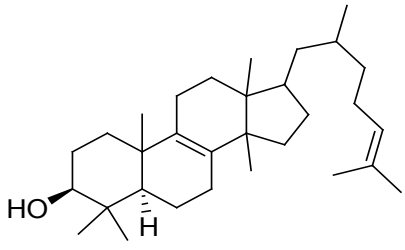
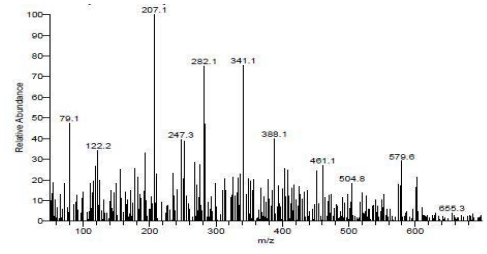
4. DISCUSSION

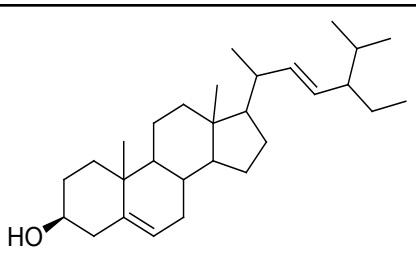
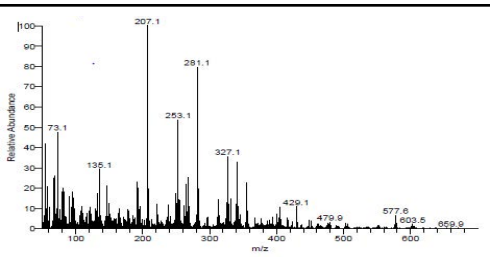
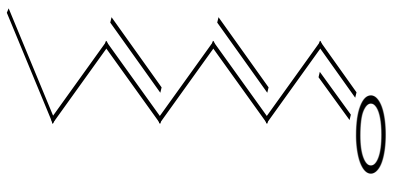
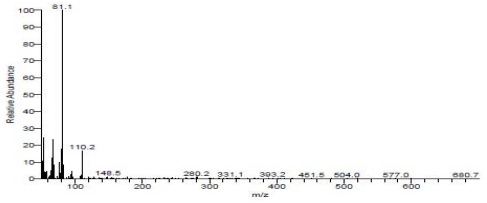
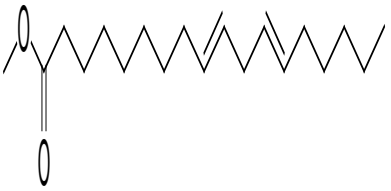
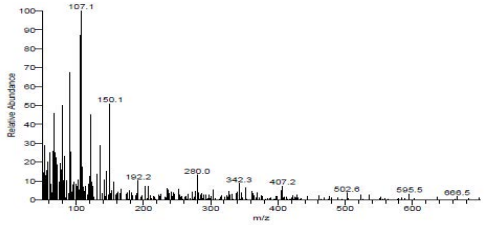
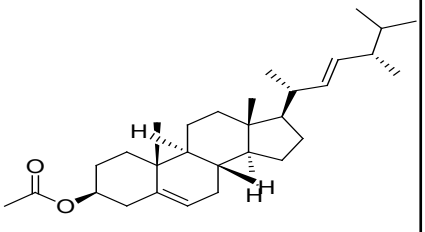
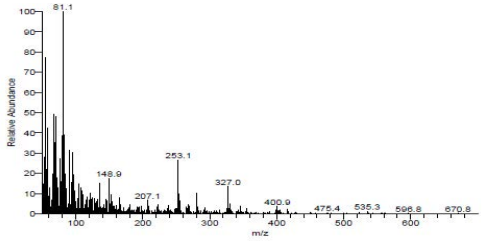
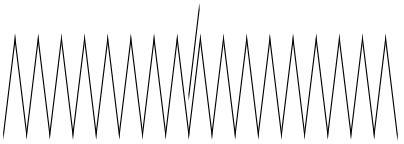
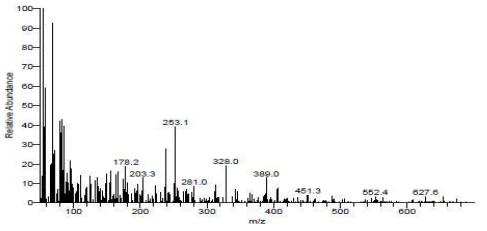
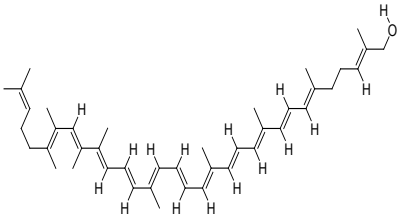
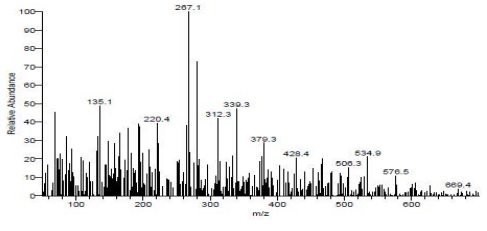
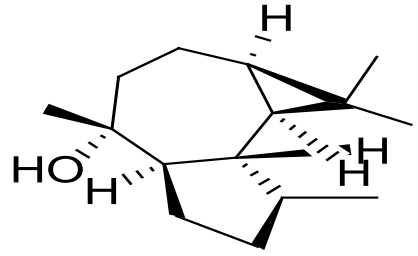
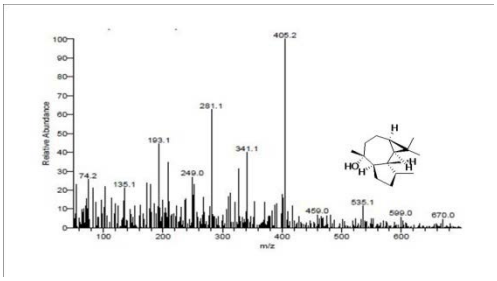
Jatropha gossypifolia L. contains both primary and secondary metabolites. Secondary metabolites are bioactive compounds mainly responsible for pharmacological activities. The preliminary phytochemical analysis indicates that as compare to all other extracts namely; petroleum ether, chloroform and aqueous extracts, meth-

Table 4. Activity of major compounds identified by GC-MS analysis of methanol leaf extract of *J. gossypifolia L.*

Name of compound	Nature of compound	Pharmacological activities
1-Monolinoleoylglycerol trimethylsilyl ether	Steroid	antimicrobial, antioxidant, antiarthritic, anti-inflammatory, antiasthmatic, diuretic and antidiabetic [13]
Ethyl iso-allocholate	Steroid	Antimicrobial, antioxidant anti-inflammatory, antiarthritic antiasthma and diuretic [16]
Lanosterol	Phytosterol	Antiarthritic, anticancer hepatoprotective, antimicrobial antiasthma and diuretic [11, dr. duke)
Stigmasterol	Phytosterol	Antioxidant, antidiabetic and thyroid inhibitory [17]
2,4-Heptadienal (E,E)	Volatile aldehydic compound	antibacterial and antifungal [18]
9,12-Octadecadienoic acid (2-phenyl-1,3-dioxolan-4-yl) methyl ester	Linolic acid ester	Anti-inflammatory, cancer preventive, hepatoprotective [11]
Ergosta-5,22-dien-3-ol, acetate		
Trilinolein	Linolic acid triglyceride	Anti-ischemic, Antiarrhythmic, and Antioxidant [19]
17-Pentatriacontene	Unsaturated alkene	Antibacterial and antiviral [20]
Lycoxanthin	Carotenoids	Anti-inflammatory, anti nociceptive, anticancer and antioxidant [21]
Docosanoic acid, 1,2,3-propanetriyl ester	Fatty acid ester	Antioxidant, hypocholesterolemic, nematicide, pesticide, flavouring agent, lubricant and anti-androgenic [22]
Globulol	Susquiterpene	Anticancer, analgesic, antibacterial, anti-inflammatory, sedative [11]
l-proline	Amino acid	Nutrient [11]

Table 5. Structure and Mass spectrum of major bioactive compounds of methanolic leaf extract of *J. gossypifolia* L.

Compound name	Structure	Mass spectra
1-Monolinoleoylglycerol trimethylsilyl ether		
Ethyl iso-allocholate		
Lanosterol		

Stigmasterol		
2,4-Heptadienal (E,E)		
9,12-Octadecadienoic acid (2-phenyl-1,3-dioxolan-4-yl) methyl ester		
Ergosta-5,22-dien-3-ol, acetate		
17-Pentatriacontene		
Lycoxanthin		
Globulol		

anol leaf extract of *J. gossypifolia* contained large number of phytoconstituents with high degree of precipitation (++ or +++). Phytoconstituents; saponins, flavonoids and phenolic compounds were found in small concentration but alkaloids, terpenoids and phytosterols were present in high concentration. It also showed the presence of appreciable amount of flavonoids. The calculated percentage extraction yield of pet ether, chloroform, methanol and aqueous extracts of leaves of *J. gossypifolia* revealed that methanol extract had higher percentage yield (19.78%). It may be due to high polarity of methanol solvent which can solublize a number of phytoconstituents than any other solvents [23]. The presence of these valuable bioactive compounds in *J. gossypifolia* leaf support its use in herbal medicine. The antimicrobial activity of leaf of *J. gossypifolia* could be due to the presence of phenols, flavonoids and saponins. The outcomes of the qualitative phytochemical screening study encourages for quantitative estimation of various phytoconstituents in methanol leaf extract of *J. gossypifolia* L. For this, GC-MS analysis was employed. Methanol extract for GC-MS analysis was prepared by UAE method. As compare to conventional extraction methods, UAE is an efficient extraction method because it shortens extraction time and decrease solvent consumption.

Based on spectral data it was found that the extract contained a large number of bioactive compounds. A total of thirty four peaks were observed with retention time vary from 5.05 to 31.98. GC-MS analysis showed that fatty acid esters (1-Monolinoleoylglycerol trimethylsilyl ether) and phytosterols (lanosterol ans stigmasterol) are chief phytoconstituents of methanol leaf extract of *J. gossypifolia* L. In-depth systematic study and complete cataloguing of plant can helpful for researchers for developing new biomarkers compounds having pharmaceutical, neutraceutical and cosmaceutical applications. Both of chief bioactives have antibacterial and antioxidant potential. So, further study is needed to separate these bioactive compounds from methanol extract and to form suitable pharmaceutical dosage form to cure various skin disorders like sprains, sores, cuts, wounds (accidental or surgical) in which antibacterial and antioxidant potential of medicament is required primarily.

5. CONCLUSION

J. gossypifolia L. is an ornamental plant with appreciable medicinal properties. Our investigation revealed that leaves of *J. gossypifolia* L. contain phytosterols, fatty acids, caroteinods, glycosides, proteins, tri-terpenoids and alkaloids. Methanol extract contains phytosterol, flavonoids, alkaloids and terpenoids in high concentration. However, isolation of individual bioactive components using column chromatography and testing them for different therapeutic activities will certainly give some rewarding results. Finally, we can conclude that, leaf contains various valuable bioactive compounds. Therefore, *J. gossypifolia* L. is recommended in the category of phytopharmaceutical important plant. However, for safety issues, further studies are needed to be carrying out for its bioactivity and toxicity profile. In addition to this, GC-MS profile of leaf of *J. gossypifolia* L. can be used as biochemical markers to identify the authenticity of the plant and differentiate it from adulterants.

6. CONFLICT OF INTEREST

The authors do not have any conflicts of interest.

7. ACKNOWLEDGEMENTS

The authors would like to acknowledge the financial support provided by University grant commission by providing UGC-BSR fellowship for research work.

8. REFERENCES

1. Bargah RK. Preliminary test of phytochemical screening of crude ethanolic and aqueous extract of *Moringa pterygosperma* Gaertn. Journal of Pharmacognosy and Phytochemistry. 2015; 4(1): 7-9.
2. Sultana J, Shakil-Ahmed FR. Phytochemical investigations of the medicinal plant *Swertia Chirata* Ham. Biochemistry and Analytical Biochemistry. 2013; 2(4): 1-7.
3. Misra M, Misra AN. Jatropha: the biodiesel plant biology, tissue culture and genetic transformation-a review. International Journal of Pure and Applied Science and Technology. 2010; 1(1): 11-24.
4. Felix-Silva J, Giordani RB, Silva-Junior AA, Zucolotto SM, Fernandes-Pedrosa MDF. *Jatropha gossypiifolia* L. (Euphorbiaceae): a review of traditional uses, phytochemistry, pharmacology, and toxicology of this medicinal plant. Evidence Based Complementary and Alternative Medicine. 2014; 1-32.
5. Felix-Silva J, Souza T, Menezes YAS, Cabral B, Camara RBG, Silva-Junior AA et al. Aqueous leaf extract of *Jatropha gossypiifolia* L. (Euphorbiaceae) inhibits enzymatic and bio-

logical actions of Bothrops jararaca snake venom. Plos One. 2014; 9(8): 1-14.
6. The Ayurvedic Pharmacopoeia of India, Governement of India, Ministry of Health and Family Welfare. Part I, Volume-V, 2011; 33-35.
7. Oduola T, Adeosun GO, Oduola TA, Avwioro GO, Oyeniyi MA. Mechanism of action of *Jatropha gossypifolia* stem latex as a haemostatic agent. European Journal of General Medicine. 2005; 2(4): 140-43.
8. Panda BB, Gaur K, Kori ML, Tyagi LK, Nema RK. Sharma CS et al. Anti-inflammatory and analgesic activity of *Jatropha gossypifolia* in experimental animal model. Global Journal of Pharmacology. 2009; 3(1): 01-05.
9. Jain S, Choudhary GP, Jain DK, Antioxidant and hepatoprotective potential of ethanolic leaves extract of *Jatropha gossypifolia*. International Journal of Plant Science Ecology. 2015; 1(1): 190-95.
10. Ogundare AO. Antimicrobial effect of *Tithonia diversifolia* and *Jatropha gossypifolia* leaf extracts. Trends in Applied Science Research. 2007; 2(2): 145-50.
11. Kokate CK. Plant constituents. In: Practical Pharmacognosy. 4th ed. Delhi: Vallabh Prakashan; 2007; 107-11.
12. Tiwari P, Kumar B, Kaur M, Kaur G, Kaur H. Phytochemical screening and extraction: a review. Internationale Pharmaceutica Sciencia. 2011; 1(1): 98-06.
13. Janarthanan S, Vardharajulu RM, Panagal M. Molecular docking identification of best drug molecule from *Ipomoea sepiaria* (Koenig Ex. Roxb) leaves against type 2 diabetes mellitus. International Journal of Current Biotechnology. 2016; 4(4): 7-12.
14. Dr. Duke's phytochemical and ethnobotanical databases. (Cited 2017 September 15). Available from URL:https://phytochem.nal.usda.gov/phytochem/chemicals/show/16611?et
15. Kumar RP, Sujatha D, Mohamed Saleem TS, Chetty CM, Ranganayakulu D. Potential antidiabetic and antioxidant activities of *Morus indica*and *Asystasia gangetica* in alloxan-induced diabetes mellitus. Journal of Experimental Pharmacology. 2010; 2: 29-36.
16. Sheela D, Uthayakumar F. GC-MS analysis of bioactive constituents from coastal sand dune taxon-*Sesuvium portulacastrum* (L.). Bioscience Discovery. 2013; 4(1): 47-53.
17. Panda S, Jafri M, Kar A, Meheta BK. Thyroid inhibitory, antiperoxidative and hypoglycemic effects of stigmasterol isolated from *Butea monosperma*. Fitoterapia. 2009, 80, 123–26.
18. Tanaka K, Taniguchi S, Tamaoki D, Yoshitomi K, Akimitsu K, Gomi K. Multiple roles of plant volatiles in jasmonate induced defense response in rice. Plant Signal Behaviour. 2014; 9: 1-3.
19. Srivastava R, Mukerjee A, Verma A. GC-MS analysis of phytocomponents in, pet ether fraction of *Wrightia tinctoria* seed. Phcognosy Journal. 2015; 7(4): 249-53.
20. Paramanantham M, Murugesan A. GC-MS analysis of *Holarrhena antidysentrica* Wall flower. International Journal of Science Engineering and Technology Research. 2014; 3(3): 631-39.
21. Yamuna P, Abirami P, Vijayashalini P, Sharmila M. GC-MS analysis of bioactive compounds in the entire plant parts of ethanolic extract of *Gomphrena decumbens* Jacq. Journal of Medicinal Plants Studies. 2017; 5(3): 31-37.
22. Geetha DH, Rajeswari M, Jayashree I. Chemical profiling of *Elaeocarpus serratus* L. by GC-MS. Asian Pacific Journal of Tropical Biomedicine. 2013; 3(12): 985–87.
23. Senguttuvan J, Paulsamy S, Karthika K. Phytochemical analysis and evaluation of leaf and root parts of the medicinal herb, *Hypochaeris radicata* L. for *in vitro* antioxidant activities. Asian Pacific Journal of Tropical Biomedicine. 2014; 4(1): S359–67.