

Gc-Ms Analysis of Phytocostituents of Some Wild Zingiberaceae Plants Methanolic Rhizome Extracts

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Received November 21, 2013; Revised December 12, 2013; Accepted December 27, 2013

Abstract Aim: To characterize the phytochemical constituents of *Zingiber roseum*, *Curcuma angustifolia*, *Globba marantina* using GC-MS technique. **Methods:** The crude extract form was subjected to column chromatography over silica gel (100-200 mesh) and eluted with n-hexane, chloroform, ethanol and methanol respectively. The methanol fractions of each plant were taken for GC-MS analysis. The component identification was achieved by the GC-MS analysis using HP 6890 series GC (Hewlett-Packard. USA) coupled with mass selective detection (MSD), HP5973 Series (Hewlett-Packard. USA). Helium was used as carrier gas and sample was injected in Split less mode in a column HP5. Phenyl methyl siloxane (25µl (film thickness) ×320µm (internal diameter)×30 m (length of the column)). Mass spectra were acquired over 40-400 atomic mass unit range. Temperature programming: Initial temperature -60°C. Ramping rate -3°/min. Final temperature-243°C. Run time-61 min. **Results:** The GC-MS analysis was provided different peaks of seventeen compounds of *Zingiber roseum*, fifteen of *Curcuma angustifolia*, and nine of *Globba marantina*, *Zingiber roseum* has Deoxynivalenol (0.43%), n-heptane (0.74%), Cyclopentane,1-methyl-2 (2-propyl) trans-(2.76%), Ethyl propionate (0.24%), Ethyl heptanoate (0.21%), Naphazoline (0.76%), Estazolam (3.20%), 2-hexane (20.00%), 3-Heptanone (29.29%), 1,4-butanediol (0.93%), Diehylene glycol methyl ether (0.20%), Iso-propyl benzene (Cumene) (4.47%), Isoprene (0.34%), Propofol (0.51%), Pentadecenol (18.08%), n-Amylmercaptan (8.65%), Methyl cyclopentane (9.20%), *Curcuma angustifolia* has 3-hydroxyhexanoic acid (0.51%), α -thujene (1.41%), β- pinene (1.67%), Cis-p-menth-2,8-dienol (2.14%), 3,5-dimethoxy (Toluene) (1.19%), Caryophyllene (1.39), Flurprimidol (2.61%), 2,7-naphthalenediol (12.44%), Camphor (15.38%), Trans-nerolidol (12.02%), Humulen-6,7-epoxide (9.21%), Octadecanoic acid, butyl ester (11.56%), α-amorphene (23.02%), Aristoloshene (3.80%), Diflobenzuran (1.63%), *Globba marantina* has Heptadecane (6.19%), Pinocarvone (54.27%), L-linalool (2.54%), Alloaromadendrene (4.58%), β -caryophyllene (13.65%), α- humulene (3.88%), Terpeneol (6.31%), Lavandulol (2.63%), 2,6-Dimethyl-1,5,7-Octatrien-3-ol (5.95%). **Conclusions:** Bioactive compounds found in *Zingiber roseum*, *Curcuma angustifolia*, *Globba marantina* has been screened using GC-MS analysis this isolation various compound may helps vital role to find new drugs.

Keywords: GC-MS analysis, phytoconstituents, *Zingiber roseum*, *Curcuma angustifolia*, *Globba marantina*

Cite This Article: Sanghamitra Nayak, Alok Kumar Jena, Deepak Kumar Mittal, and Deepmala Joshi, "Gc-Ms Analysis of Phytocostituents of Some Wild Zingiberaceae Plants Methanolic Rhizome Extracts." *Research in Plant Sciences* 2, no. 1 (2014): 1-5. doi: 10.12691/plant-2-1-1.

1. Introduction

Herbal products have gained increasing popularity in the last decade, and are now used by approximately 20% of the population [1]. Plants have been a source of medicine for thousands of years and phytochemicals continue to play an essential role in medicine [1]. In developing countries, the practice of medicine still relies heavily on plant and herbal extracts for the treatment of human ailments. Dietary agents consist of a wide variety of biologically active compounds that are ubiquitous in plants, and many of them have been used as traditional medicines [2,3,4] The biological potency of plants parts in the form of secondary metabolites has important role in curing various diseases. Today a substantial number of drugs are developed from plants [5] which are active

against a number of diseases. The majority of these involve the isolation of the active ingredient (chemical compound) found in a particular medicinal plant and its subsequent modification. In the developed countries 25 percent of the medical drugs are based on plants and their derivatives [6]. Plants were capable of synthesizing low molecular organic compounds we called secondary metabolite which is very vital against various diseases.

Zingiberaceae family constituents a various vital groups of rhizomatous medicinal and aromatic plants characterized by presence of volatile oils and oleoresins with great importance. Literature search reveal there were no reports on crude extract analysis in search of phytoconstituents of these medicinal plants *Curcuma angustifolia*, *Zingiber roseum* and *Globba marantina*. Although these plants are used in many developing

countries like India for the treatment of various diseases there are no reports on the phytoconstituents that are responsible for the therapeutic role. With this background the present study was aimed to identify the bioactive constituents of these plants.

2. Material And Methods

2.1 Collection and Preparation of Plant Material

These fresh young rhizomes were collected from Eastern Ghats parallel to coast of Bay of Bengal between river Mahanadi in north and Vagai in south and lies between 77°22' to 85°22' E long and 9°55' to 20°74' N latitude of state Odisha, India. This plant specimen was identified by Dr. P.C Panda, Principal Scientist of Regional Plant Research Centre (RPRC), Bhubaneswar. The specimens were stored at Center of Biotechnology, S`O`A University, Bhubaneswar, India.

2.2. Preparation plant Extract

The fresh plant rhizomes were washed using distilled water thoroughly and cut into small pieces and allowed to air dry at ambient temperature and then pulverized into powder. The powder form was tightly packed in polythene bags and stored at 4°C temperature. 10 g of each crude plant extracts were dissolved in 50 ml of methanol and kept for overnight, then filtered through wattmann filter paper. The crude extract form was subjected to column chromatography over silica gel (100-200 mesh) and eluted with n-hexane, chloroform, ethanol and methanol respectively. The methanol fractions of each plant were taken for GC-MS analysis.

2.3. GC-MS Analysis

The component identification was achieved by the GC-MS analysis using HP 6890 series GC (Hewlett-Packard, USA) coupled with mass selective detection (MSD), HP5973 Series (Hewlett-Packard, USA). Helium was used as carrier gas and sample was injected in Split less mode in a column HP5. Phenyl methyl siloxane (25µl (film thickness) ×320µm (internal diameter × 30 m (length of the column)). Mass spectra were acquired over 40-400 atomic mass unit range. Temperature programming: Initial temperature -60°C. Ramping rate -3°/min. Final temperature-243°C. Run time-61 min. The percentage compositions of the extracts were computed.

2.4. Identification of the Components

Interpretation of mass spectrum GC-MS was conducted using the database of National Institute Standard and Technology (NIST). The spectra of unknown components were compared with the spectrum of the known components stored in the NIST library. The name molecular weight and structure of the components of the material were ascertained [7,8,9].

3. Results

The identified compounds of methanolic rhizome extract of these plants namely *Zingiber roseum*, *Curcuma*

angustifolia, *Globba marantina*, their retention time, percentage of composition, chemical structure, molecular mass, and their activities are given in Table 1. The compound prediction is based on Dr. Duke's phytochemical and Ethinobotanical Databases. The GC-MS results showed the presence of total forty-one major compounds of these three plants of *Zingiberaceae* family out of which seventeen compounds found from *Zingiber roseum*, fifteen compound from *Curcuma angustifolia* and nine compounds from *Globba marantina* namely has Deoxynivalenol (0.43%), n-heptane (0.74%), Cyclopentane,1-methyl-2 (2-propyl) trans-(2.76%), Ethyl propionate (0.24%), Ethyl heptanoate (0.21%), Naphazoline (0.76%), Estazolam (3.20%), 2-hexane (20.00%), 3-Heptanone (29.29%), 1,4-butanediol (0.93%), Diehylene glycol methyl ether (0.20%), Iso-propyl benzene (Cumene) (4.47%), Isoprene (0.34%), Propofol (0.51%), Pentadecenol (18.08%), n-Amylmercaptan (8.65%), Methyl cyclopentane (9.20%), *Curcuma angustifolia* has 3-hydroxyhexanoic acid (0.51%), α -thujene (1.41%), β - pinene (1.67%), Cis-p-menth-2, 8-dienol (2.14%), 3,5-dimethoxy (Tolune) (1.19%), Caryophyllene (1.39), Flurprimidol (2.61%), 2,7-naphthalenediol (12.44%), Camphor (15.38%), Trans-nerolidol (12.02%), Humulen-6,7-epoxide (9.21%), Octadecanoic acid, butyl ester (11.56%), α -amorphene (23.02%), Aristoloshene (3.80%), Diflobenzuran (1.63%), *Globba marantina* has Heptadecane (6.19%), Pinocarvone (54.27%), L-linalool (2.54%), Alloaromadendrene (4.58%), β -caryophyllene (13.65%), α -humulene (3.88%), Terpeneol (6.31%), Lavandulol (2.63%),2,6-Dimethyl-1,5,7-Octa trien-3-ol (5.95%) respectively. The retention time and individual compounds structure were illustrated in Table 1.

4. Discussion

In this present study total forty-one major compounds were found from three wild varieties of *Zingiber roseum*, *Curcuma angustifolia*, *Globba marantina* of *Zingiberaceae* family. In term of percentage amount 3-Heptanone, 2-hexane, Pentadecenol, Methyl cyclopentane, n-Amylmercaptan were prominent in *Zingiber roseum* methanolic extract, where as α -amorphene, Camphor, 2,7-naphthalenediol, Trans-nerolidol, Octadecanoic acid, butyl ester, Humulen-6,7-epoxide were prominent in *Curcuma angustifolia*, compounds like Humulen-6,7-epoxide, β -caryophyllene, Terpeneol, Heptadecane, 2,6-Dimethyl-1,5,7-Octa trien-3-ol, Alloaromadendrene were prominent in *Globba marantian* plant extract. In case of *Zingiber roseum* plant extracts out of seventeen major compounds, thirteen compounds has activity like Deoxynivalenol has anticancer, trichothecene mycotoxin activity, Cyclopentane,1-methyl-2 (2-propyl) trans, Ethyl propionate, Iso-propyl benzene (Cumene), Pentadecenol compounds has anticancer and antimicrobial activity. Antioxidant activity was shown by Iso-propyl benzene (Cumene) in *Zingiber roseum* plant extracts. Ethyl heptanoate, 3-Heptanone has been used for flavor and aroma in various industrial process. In *Curcuma angustifolia* rhizome extract constituents like α -thujene, β - pinene, Cis-p-menth-2 8-dienol, Caryophyllene, α -amorphene, Diflobenzuran has anticancer, antimicrobial and antitumor activity, where as 3,5-dimethoxy (Tolune),

Caryophyllene, Humulen-6,7-epoxide, has anti-inflammatory activity. β -pinene, Camphor, Trans-nerolidol has been used in flavor and odor industry. Diflobenzuran show insecticide activity. In *Globba marantina* plant compounds like Heptadecane, Pinocarvone, Alloaromadendrene, β -caryophyllene, Terpeneol, Lavandulol has antimicrobial, anticancerous, antioxidant activities where as compounds like Pinocarvone, Terpeneol, 2, 6-Dimethyl-1, 5, 7-Octa trien-3-ol has been used in various industries as source of flavor and aroma. Anti inflammations properties shown by β -

caryophyllene, α - humulene compounds. L-linalool has insecticide properties. There is growing awareness in correlating the phytochemical components and their biological activities [10,11,12]. *Zingiberaceae* family constituents a various vital groups of rhizomatous medicinal and aromatic plants characterized by presence of volatile oils and oleoresins with great importance. The literature search reveals there were no reports on crude extract analysis in search of phytoconstituents of these medicinal plants *Curcuma angustifolia*, *Zingiber roseum* and *Globba marantina*.

Table 1. Chemical composition of methanolic extracts of *Zingiber roseum*, *Curcuma angustifolia*, *Globba marantina* by GC/MS

RT	Methanolic extract constituents Zingiber roseum.	Molecular Formula	Molecular Weight	Peak Area (%)	Activity
7.54	Deoxynivalenol	C ₁₅ H ₂₀ O ₆	296.32	0.43	Anticancer, trichothecene mycotoxin
7.71	n-heptane	C ₇ H ₁₆	100.21	0.74	No activity reported
9.21	Cyclopentane,1-methyl-2(2-propyl) trans-	C ₉ H ₁₈	126.23	2.76	
9.41	Ethyl propionate	C ₅ H ₁₀ O ₂	102.13	0.24	Antimicrobial, Anticancer
9.45	Ethyl heptanoate	C ₉ H ₁₈ O ₂	158.27	0.21	Flavor industry
9.50	Naphazoline	C ₁₄ H ₁₄ N ₂	246.73	0.76	Not reported
11.48	Estazolam	C ₁₆ H ₁₁ ClN ₄	294.7	3.20	Anxiolytic, anticonvulsant, sedative and skeletal muscle relaxant properties.
11.90	2-hexane	C ₆ H ₁₄	86.18	20.00	Industrial uses manufacturing. Toxic.
13.92	3-Heptanone	C ₇ H ₁₄ O	114.18	29.29	Flavor and fragrance agents
14.98	1,4-butanediol	C ₄ H ₁₀ O ₂	90.12	0.93	No activity reported
15.08	Dichylene glycol methyl ether	CH ₃ OCH ₂ CH ₂ OCH ₂ CH ₂ OH	120.15	0.20	No activity reported
15.21	Iso-propyl benzene(Cumene)	C ₉ H ₁₂	120.19	4.47	Antidiabetic, anticancer, antioxidant, anticancer.
15.43	Isoprene	C ₅ H ₈	68.12	0.34	No activity reported
15.49	Propofol	C ₁₂ H ₁₈ O	178.27	0.51	Pharmacokinetics, induction and maintenance of anesthesia,
15.74	Pentadecenol	CH ₃ (CH ₂) ₁₄ OH	228.41	18.08	Antimicrobial,antitumor,Anticancer
16.62	n-Amylmercaptan	C ₅ H ₁₂ S	104.21	8.65	No activity reported
18.10	Methyl cyclopentane	C ₆ H ₁₂	84.16	9.20	Antioxidant
RT	Methanolic extract constituents of <i>Curcuma angustifolia</i>				
7.05	3-hydroxyhexanoic acid	C ₆ H ₁₂ O ₃	132.15	0.51	Not reported
8.40	α -thujene	C ₁₀ H ₁₆	136.23	1.41	Antimicrobial,antitumor,Anticancer
8.55	β - pinene	C ₁₀ H ₁₆	136.23	1.67	Aroma and flavor, Antimicrobial,antitumor,Anticancer, Antioxidant
8.71	Cis-p-menth-2,8-dienol	C ₁₀ H ₁₆ O	152.23	2.14	Antioxidant ,Antimicrobial,antitumor,Anticancer,
9.68	3,5-dimethoxy(Toluene)	C ₉ H ₁₂ O ₂	152.19	1.19	Anti-inflammatory
9.76	Caryophyllene	C ₁₅ H ₂₄	204.36	1.39	Anti-inflammatory Antioxidant ,Antimicrobial,antitumor,Anticancer
11.64	Flurprimidol	C ₁₅ H ₁₅ F ₃ N ₂ O ₂	312.29	2.61	Not reported
11.96	2,7-naphthalenediol	C ₁₀ H ₈ O ₂	160.16	12.44	Not reported
13.95	Camphor	C ₁₀ H ₁₆ O	152.23	15.38	Moth repellent, Antimicrobial , flavoring, anti-odor element,Anticancer.Antioxidant
14.67	Trans-nerolidol	C ₁₅ H ₂₆ O	222.37	12.02	Flavoring agent and in perfumery
15.30	Humulen-6,7-epoxide	C ₁₅ H ₂₄	204.35	9.21	Anti-inflammatory
15.76	Octadecanoic acid, butyl ester	C ₂₂ H ₄₄ O ₂	340.58	11.56	No reported
16.63	α -amorphene	C ₁₅ C ₂₄	204.35	23.02	Antimicrobial.Antioxidant
18.13	Aristoloshene	C ₁₅ H ₂₄	204.35	3.80	Industrial use,
19.01	Diflobenzuran	C ₁₄ H ₉ ClF ₂ N ₂ O ₂	310.68	1.63	Insecticide ,Anticancer, Antioxidant, Antimicrobial.
Sl.No	Methanolic extract constituents of <i>Globba marantina</i>				
11.93	Heptadecane	C ₁₇ H ₃₆	240.47	6.19	Antimicrobial. Antioxidant.
13.94	Pinocarvone	C ₁₀ H ₁₄ O	150.22	54.27	Flavor and fragrance agents, Antimicrobial. Antioxidant.
14.08	L-linalool	C ₁₀ H ₁₈ O	154.25	2.54	Industrial use, Insecticide
15.13	Alloaromadendrene	C ₁₅ H ₂₄	204.35	4.58	Anticancer, Antioxidant, Antimicrobial.
15.25	β -caryophyllene	C ₁₅ H ₂₄	204.36	13.65	Anti inflammatory Anticancer, Antioxidant, Antimicrobial
15.47	α - humulene	C ₁₅ H ₂₄	204.35	3.88	Anti-inflammatory,Flavor
15.71	Terpeneol	C ₁₀ H ₁₈ O	154.25	6.31	Flavor and aroma,Antioxidant,Antimicrobial.
15.75	Lavandulol	C ₁₀ H ₁₈ O	154.25	2.63	Antioxidant,Antimicrobial.
15.83	2,6-Dimethyl-1,5,7-Octa trien-3-ol	C ₁₀ H ₁₆ O	152.23	5.95	Flavoring agents

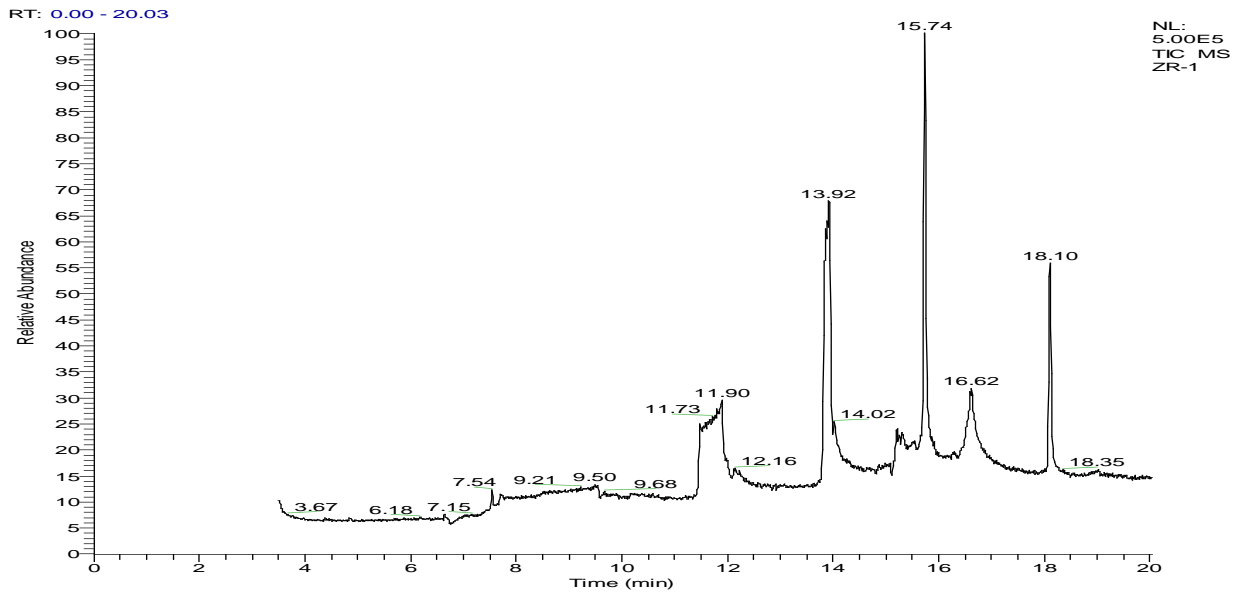


Figure 1. GC-MS chromatogram of methanolic extract of *Zingiber roseum*

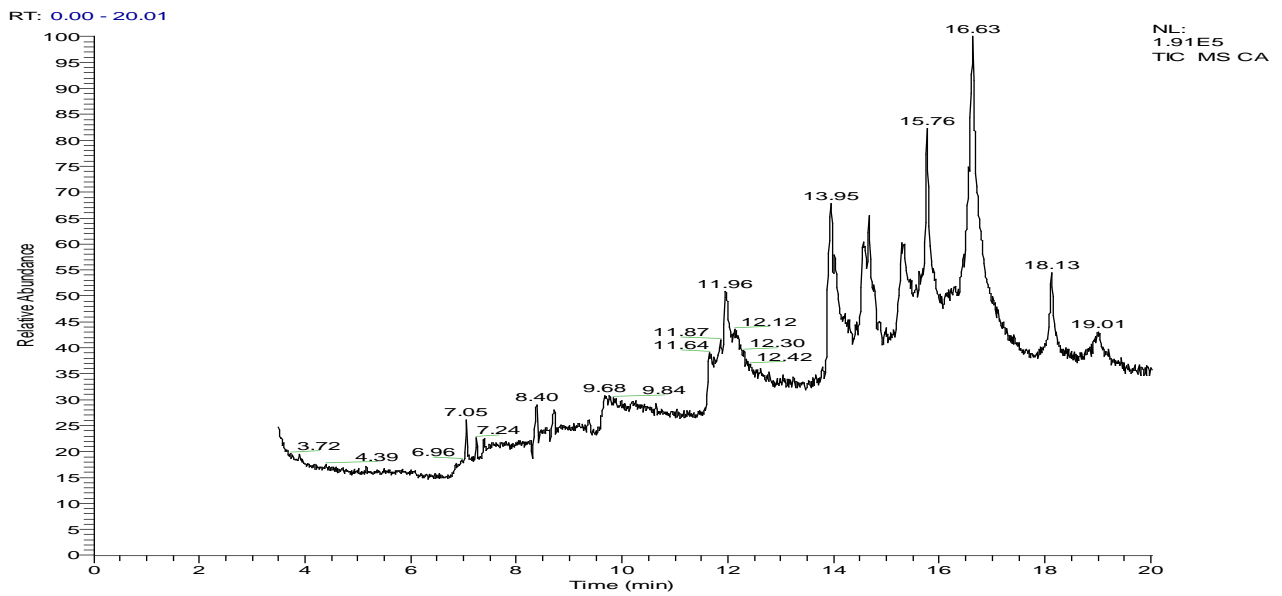


Figure 2. GC-MS chromatogram of methanolic extract of *Curcuma angustifolia*

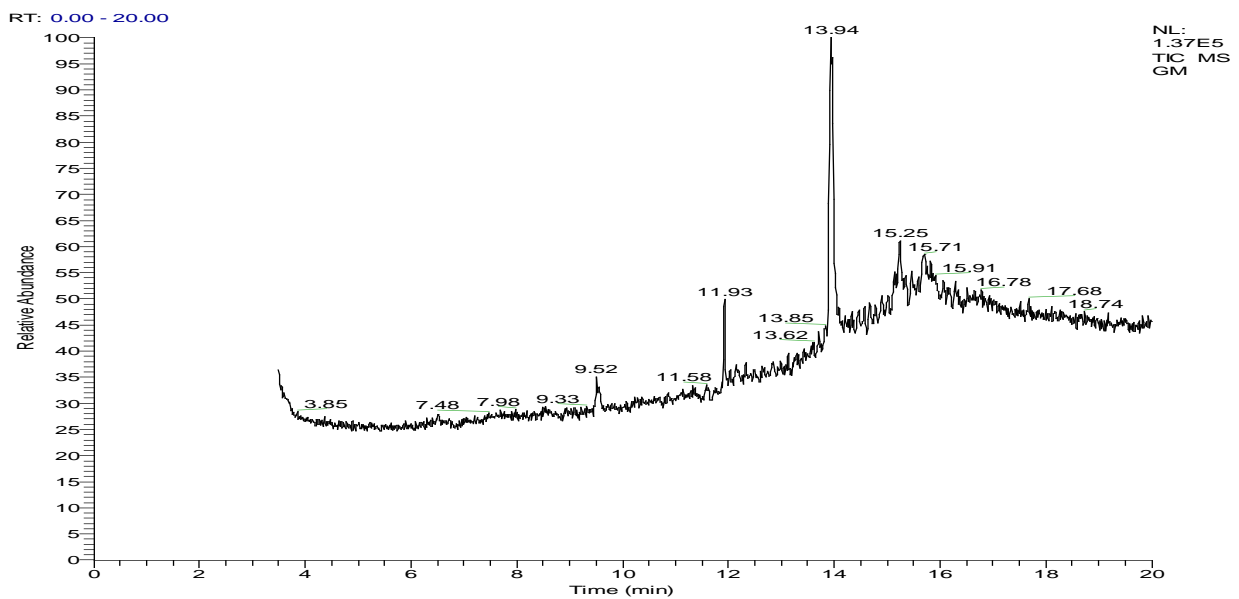


Figure 3. GC-MS chromatogram of methanolic extract of *Globba marantina*

Zingiber roseum fresh rhizome extract have hepatoprotective effect, antioxidant and anticancerous activities [13]. *Zingiber roseum* essential oils consist 47 major constituent has antiplasmodic activity [14]. *Zingiber roseum* rhizome extract was moderate anticancer, antioxidant and antimicrobial activities [15]. *Curcuma angustifolia* commonly known as wild turmeric being used in consumption, excessive thirst, jaundice, kidney disorder, fever and for vitality and flattening the body [16]. The rhizome are used in bone fracture, inflammation, intestinal disease etc by tribal people [17]. The literature search revealed that there is no report on chemical constituents of *Curcuma angustifolia*. *Globba marantina* commonly known as dancing girl ginger, oil rich with b-caryophyllene, α -humulene [18]. As best of our knowledge there is no such report on study on crude extract of *Globba marantina*.

5. Conclusion

These plants have been used in many tribal people as traditional recipes in various parts India. The phytochemical analysis of rhizome extracts of these plants was done first time. We report the phytocostituents of these plants for the first time; this study will be helpful for further detail analysis of these medicinal plants.

Conflict of Interest Statemate

We declare that we have no conflict of interest.

Acknowledgement

The authors are grateful to National Science Education and Research(NISER), Bhubaneswar, Odisha, India. for GC-MS analysis and encouraging throughout.

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