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GC-MS Analysis, Antimicrobial and Antioxidant Activities of Extracts of the Aerial Parts of *Conyza sumatrensis*

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ABSTRACT:
Phytochemical analyses as well as antimicrobial and antioxidant activities of the extracts of *C. sumatrensis* aerial parts were investigated in this study. **METHODS:** The aerial parts of *C. sumatrensis* were air dried, weighed and exhaustively extracted with hexane, ethyl acetate and methanol successively. The crude extracts were screened for metabolites. These extracts of the plant were evaluated for antimicrobial and antioxidant activities using agar diffusion and DPPH method respectively. The extracts were also analysed using Gas chromatography – Mass spectrometry, and the chromatogram coupled with mass spectra of the compounds were matched with a standard library. **RESULTS:** Preliminary phytochemical investigation of crude n-hexane, ethyl acetate and methanol extracts of the aerial parts of *Conyza sumatrensis* revealed the presence of anthraquinones, flavonoids, terpenoids, phenolics, tannin, glycosides and carbohydrate. All the crude extracts gave a clear zone of inhibition against the growth of the test bacteria (*Staphylococcus aureus, Escherichia coli, Bacillus subtilis, Pseudomona aeruginosa, Salmonella typhi, Klebsiellae pneumonae)* at moderate to high concentrations, as well as test fungi *(Candida albicans, Aspergillus niger, penicillium notatum* and *Rhizopus stolonifer)* at high concentration. Methanolic extract exhibited significant radical scavenging property with IC_{50} of 17.08 µg/mL while n-hexane and ethyl acetate extracts showed no significant antioxidant activity. GC-MS of N-hexane extract showed a total number of eleven chemical constituents with α-Farnesene and spathulenol being the most abundance compounds constituting 20.27 and 22.28% of the extract respectively. Ethyl acetate extract revealed thirteen compounds with two most abundant compounds, cis-β-farnesene (16.64 %) and cis-pinane (21.09 %). While methanolic extract affords seventeen compounds with E-phytol being the most abundant compound (19.36 %). © JASEM

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KEYWORDS: Antimicrobial activity, Antioxidant, GC-MS analysis, Phytochemicals, *Conyza sumatrensis*

Introduction

The World Health Organization estimates that approximately 80 percent of the world's population relies primarily on traditional medicines as sources for their primary health care (Fansworth *et al.*, 1985). Over 100 chemical substances that are considered to be important drugs that are either currently in use or have been widely used in one or more countries in the world have been derived from several natural plants. Approximately 75 percent of these substances were discovered as a direct result of chemical studies focused on the isolation of active substances from plants used in traditional medicine (Cragg and Newman, 2001).

Medicinal plants are plants which contain in one of its organs substances that can be used for therapeutic or which are precursors for the synthesis of useful drugs. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Ncube *et al.*, 2008). *Conyza sumatrensis* commonly called broadleaf fleabane is a dicotyledonous herb of the family of asteraceae widely occurring in Nigeria especially in the Niger Delta region and also in central Kenya. It is an erect, hairy, annual herb up to 120 cm high with sessile and deeply serrated leaves, the stem is covered with two types of hairs: short hairs directed upward and long hairs patent with upward direction. Leaves are numerous, simple and alternate (Opiyo *et al.*, 2010). Traditionally, the plant has been used across West Africa to treat ailments like chickenpox, smallpox, sore throat, ringworm and other skin related diseases, toothache and to stop bleeding from injuries (Ogbeche *et al.*, 1997). The extract of the leaf of *C. sumatrensis* is used in the treatment of pulmonary problems. The plant is used in treating eye problems and its sap is effective in

treating paralysis, epilepsy and convulsion. It can be used in arresting fever. Leaves are used in the treatment of tuberculosis and asthma (Burkill, 1985). These phytochemicals and biological activity studies of *C. sumatrensis* are to establish the scientific facts in order to justify the forklore uses of the plant.

MATERIALS AND METHODS

*Sample Preparation***:** The plant was collected from Amurin, Ondo state, Nigeria in the month of November, 2014. The plant was identified and authenticated by the plant taxonomist, Mr. Bolu Ajayi of the Department of Plant Biology, University of Ilorin where a voucher specimen (UIH002/1145) was deposited in the herbarium. The plant was extracted using standard procedure according to Das *et al.*, 2010. The aerial parts of *C. sumatrensis* were air dried and crushed into smaller pieces using mortar and pestle. The plant was weighed and extracted using serial exhaustive extraction method by moving from a non-polar (hexane) solvent to a medium polar solvent (ethyl acetate) and then to a polar solvent (methanol).

Phytochemical screening: Preliminary phytochemical screening of the crude extract was carried out using the modified methods described by Pranshant, *et al.*, 2011.

Antimicrobial assay:

*Organisms***:** Cultures of six human pathogenic bacteria made up of four gram negative and two gram positive were used for the antibacterial assay. These include: *Salmonella typhii, Escherichia coli, Pseudomonas aeruginosa* and *Klebsiellae pneumonae* which are gram-negative, while *Bacillus subtilis* and *Staphylococcus aureus* are gram-positive bacteria. Four fungi were also utilized for the Antifungal assay. These are: *Candida albicans, Aspergillus niger, Rhizopus stolon* and *Penicillum notatum.* All the microorganisms used were clinical strains from the Medical Microbiology Department, University College Hospital, Ibadan, screened in the Laboratory of Pharmaceutical Microbiology Department, University of Ibadan.

*Media used***:** Nutrient agar, Sabouraud dextrose agar, nutrient broth and tryptone soya agar were used in this study. N-hexane, ethyl acetate and methanol were also used in solubilizing the extracts and as negative controls in the assays.

*Antimicrobial agents used***:** Gentamycin (10 µg/mL) and Tioconazole (0.7 mg/mL) were employed as standard reference drugs in the study

Determination of Antimicrobial activity

A*gar diffusion-Ditch method (bacteria):* An overnight culture of each organism was prepared by taken two wire-loop of the organism from the stock, each inoculated into 5ml of sterile nutrient broth and incubated for 24 hr at 37^{o}C. 0.1 mL of each organism was taken from the overnight culture and put into the 9.9 mL of sterile distilled water to obtained 10^{-2} inoculum concentration of the test organism. 0.2 mL was taken from the diluted test organism (10^{-2}) into the prepared sterile nutrient agar cooled to about 45^{o}C, then poured into sterile petri dishes and allowed to solidify for about 60 min. A sterile cork-borer of 8mm diameter was used to make 8 wells on the media according to the number of the diluted extracts for the experiment. The graded concentrations (6.25 – 200 mg/mL) of the extracts were put into each well and separated from the controls. The studies were done in duplicates to ascertain the results obtained. The plates were left on the bench for about 2 hr to allow the extract diffuse properly into the nutrient agar i.e. pre-diffusion. The plates were incubated for 24 hr at 37^{o}C.

A*gar diffusion-Surface method (fungi*)**:** A sterile sabouraud dextrose agar was prepared accordingly and aseptically poured into the sterile plates in triplicates and solidified properly. 0.2 mL of the 10^{-2} inoculum concentration of the test organism was spread on the surface of the agar using a sterile Petri-dish to cover all the surface of the agar. Eight wells were bored by using a sterile cork-borer of 8mm diameter. The graded concentrations of the extracts were put into each well separately with the controls. All the plates were left on the bench for 2hr to allow the extract diffuse properly into the agar i.e. pre-diffusion. The plates were incubated at 25^{o}C for 72 hr

*Antioxidant Activity***:** The ability of the samples to scavenge DPPH free radicals was assessed by the standard method adopted with suitable modifications (Sies, 1997)**.** The stock solutions of extracts were prepared in methanol to achieve the concentration of 1 mg/mL. Dilutions were made to obtain concentrations of 1000, 500, 250, 125, 62.5, 31.25, 15.62, 7.81, 3.90 and 1.99 µg/mL. DPPH (2,2-diphenyl-1-hydrazine) is widely used to test the ability of compounds to act as free radical scavengers or hydrogen donors, and to evaluate antioxidant activity. The absorbance was measured in triplicate at varying concentrations and the mean absorbance was determined. Parallel to examination of the antioxidant activity of plant extracts, the value for the standard compound (Ascorbic acid) was obtained (Table 3.16) and compared to the values of the antioxidant activity, the percentage inhibitions of the serial concentrations of the methanolic DPPH extracts and that of the standard which was determined at different concentrations using the expression as shown below.

$$\%inhibition = \left(\frac{A\,of control - A of sample}{A of control}\right) \times 100$$

The IC_{50} values (Inhibition Concentration at 50%) were estimated from the % inhibition versus

concentration plot, using a non-linear regression algorithm.

GC-MS analysis of the extracts: GC-MS was performed with Agilent 19091GC plus automatic sampler system coupled with a quadruple mass spectrometer 433HP-5MS. Compounds were separated in HP5MS column fused with phenyl methyl silox, (length; 30m x 250µm; film thickness 0.25µm). Samples were injected at a temperature of about 250^{o}C with a split ratio of 10:1 with a flow rate of helium 1mL/min. Extracts of the aerial parts of *C summatrensis* were dissolved in the respective solvent (n-hexane, ethyl acetate and methanol) to form solution. After this, the extracts were inserted into GC-MS instruments for chromatographic separation of chromatograms and mass spectra.

RESULTS AND DISCUSSION

The preliminary phytochchemical screening of the crude extracts of *C. sumatrensis* revealed the presence of bioactive compounds such as phenolics, tannins, saponin, anthraquinone, steroids, glycosides and carbohydrate as shown in table 1. The presence of these bioactive compounds is an indication that this plant may contain pharmacological activities

The antimicrobial activity was determined using the Agar diffusion – ditch plate method for the bacteria and the surface plate method for the fungi with 8mm well diameter. The activity of the extracts was measured as clear zone of inhibition of the microbial growth that surrounds each well. The extracts exhibit significant antimicrobial activity against some of the test organisms at a concentration of 200 mg/mL.

Table 1: Phytochemical Screening of hexane, ethyl acetate and methanol extracts of *C. sumatrensis*

Chemical constituents	Hexane extract	Ethyl acetate extract	Methanol extract
Alkaloids	-	-	-
Anthraquinones	-	+	+
Glycosides	-	-	+
Steroids	+	+	+
Phenolics	-	-	+
Flavonoids	-	+	+
Tannins	-	-	+
Saponins	-	+	+
Carbohydrates	-	-	+
Terpenoids	+	+	+

Key: + = present - = absent

Table 2: Antimicrobial activity of hexane extract of *C. sumatrensis*

Microorganisms	Mean zone of inhibition (mm)							
S. aureus	26	24	22	18	14	12	-	40
E. coli	24	22	18	16	14	10	-	38
B. subtilis	24	20	18	14	12	10	-	38
P. aeruginosa	20	18	14	12	10	-	-	38
K. pneumonae	16	14	12	10	-	-	-	40
S. typhi	18	16	14	12	10	-	-	38
C. ablicans	20	18	16	12	10	-	-	28
A. Niger	16	14	12	10	-	-	-	28
P. notatum	18	14	12	10	-	-	-	28
R. stolonifer	16	14	12	10	-	-	-	26
Conc. of extracts (mg/mL)	200	100	50	25	12.5	6.25	-ve	+ve

Key: +ve = Gentamycin10µg/ml (for bacteria), Tioconazole (for fungi); -ve = Solvent of dilution

The antimicrobial assay of the n-hexane, ethyl acetate and methanol extract of the plant gave different mean diameter of inhibition on the six different strains of bacteria and four strains of fungi tested at concentrations ranging from 6.25 – 200mg/mL. N-hexane extract inhibited the growth of the test organisms at moderate to high concentration. The extract inhibits *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis* fairly at a low concentration of 6.25mg/mL, while the sensitivity of the extract was low to all test fungi [Table 2]. The activity of the n-hexane extract against microorganism may be attributed to the presence of bioactive compounds such as terpenoids and steroids i.e. Table 1 which have been reported to exhibit antimicrobial activity.

Ethyl acetate extract of the aerial parts of *Conyza sumatrensis* inhibited the growth of all the test bacteria from range of different concentrations used (200 – 100mg/mL), and a fungus, *Candida albicans* at range of concentrations from 200 – 50mg/mL. The extract inhibits *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Pseudomona aeruginosa*, *Salmonella typhi*, *Klebsiellae pneumonae and Candida albicans* at high range of concentrations from 200-100mg/mL. However, three fungi (*Aspergillus niger*, *Penicillium notatum* and *Rhizopus stolonifer*) showed resistance to the ethyl acetate extract of the aerial parts of *Conyza sumatrensis* and at lower concentration of 12.5 and 6.25mg/mL all the

test organisms shows resistance to the crude ethyl acetate extract [Table 3].

Methanol extract of the aerial parts of *Conyza sumatrensis* inhibited the growth of all the test bacteria at range of concentration from 200 – 25mg/mL, and three fungi at range of concentration from 200 – 100 mg/mL. The methanol extract inhibits *Staphylococcus aureus, Escherichia coli, Bacillus subtilis, Pseudomona aeruginosa, Salmonella typhi, Klebsiellae pneumonae, Candida albicans, Aspergillus niger and penicillium notatum* at concentrations of 50 - 200mg/mL. However, *Rhizopus stolonifer* exhibits resistance at all concentrations to the methanolic extract of *Conyza sumatrensis.* At lower concentrations of 12.5 and 6.25mg/ml all the test organism exhibits resistance to the crude methanolic extract as shown in Table 4. The artificial culture medium used for the antimicrobial assay showed that the methanol and ethyl acetate extracts of *Conyza sumatrensis* exhibit antimicrobial activity. However, when the ethyl acetate extract was tested on fungi, it only inhibits the growth of *Candida albicans*. While the methanolic extract has moderate effect on three fungi namely; *Candida albicans*, *Aspergilus niger* and *penicillium notatum* at high concentrations.

This inhibition gives credence to the fact that aerial parts of *Conyza sumatrensis* exhibit antibacterial and antifungal activities and hence can be used for the treatment of various illnesses due to bacteria and fungi.

Table 3: Antimicrobial activity of ethyl acetate extract of *C. sumatrensis*

Microorganisms	**Mean zone of inhibition (mm)**							
S. aureus	18	14	12	12	10	-	-	40
E. coli	16	14	12	10	-	-	-	38
B. subtilis	14	12	10	-	-	-	-	38
P. aeruginosa	14	10	-	-	-	-	-	38
K. pneumonae	12	10	-	-	-	-	-	38
S. typhi	14	12	10	-	-	-	-	40
C. ablicans	16	12	10	-	-	-	-	28
A. Niger	-	-	-	-	-	-	-	28
P. notatum	-	-	-	-	-	-	-	28
R. stolonifer	-	-	-	-	-	-	-	26
Conc. of extracts (mg/mL)	200	100	50	25	12.5	6.25	-ve	+ve

Key: +ve = Gentamycin10µg/ml (for bacteria), Tioconazole (for fungi); -ve = Solvent of dilution

Table 4: Antimicrobial activity of methanol extract of *C. sumatrensis*

Microorganisms	**Mean zone of inhibition (mm)**							
S. aureus	20	18	14	10	-	-	-	40
E. coli	18	16	14	12	10	-	-	38
B. subtilis	16	14	12	10	-	-	-	38
P. aeruginosa	16	14	12	10	-	-	-	38
K. pneumonae	18	14	12	10	-	-	-	38
S. typhi	16	14	12	10	-	-	-	40
C. ablicans	16	14	12	10	-	-	-	28
A. Niger	14	12	10	-	-	-	-	28
P. notatum	12	10	-	-	-	-	-	28
R. stolonifer	16	14	12	10	-	-	-	26
Conc. of extracts (mg/mL)	200	100	50	25	12.5	6.25	-ve	+ve

Key: +ve = Gentamycin10µg/ml (for bacteria), Tioconazole (for fungi); -ve = Solvent of dilution

Antioxidant activity of n-hexane, ethyl acetate and methanol extracts of the aerial parts of *C. sumatrensis* and that of standard control, Ascorbic acid were shown in Table 5 – 9. Methanol extract of the plant revealed high free radical scavenging activity with IC_{50} of 17.08 µg/mL. N-hexane and ethyl acetate extracts of the aerial parts of *C. sumatrensis* showed low antioxidant activity (Figure 1). The percentage of inhibition of DPPH radicals by the extracts were compared with that of control, ascorbic acid [Table 5 & 6].

Table 5. Absorbance and Percentage Inhibition of Ascorbic Acid Standard for DPPH Absorbance for control is 1.265

Conc(µg/mL)	A1	A2	A3	AV±SD	%I of A
1000	0.138	0.138	0.140	0.139±0.0012	89.02
500	0.150	0.150	0.150	0.15±0.000	88.14
250	0.161	0.162	0.160	0.161±0.001	87.26
125	0.180	0.180	0.180	0.180±0.000	85.79
62.5	0.193	0.195	0.194	0.194±0.001	84.26
31.25	0.245	0.245	0.245	0.245±0.000	80.67
15.62	0.311	0.311	0.311	0.311±0.000	75.440
7.81	0.453	0.452	0.454	0.453±0.001	64.18
3.9	0.782	0.781	0.78	0.781±0.001	38.26
1.95	0.991	0.991	0.991	0.991±0.000	21.66

Table 6: DPPH Antioxidant activity and %inhibition of Aerial Parts Extracts of *C. sumatrensis and 0*.566, 0.566 and 0.518 as absorbance for control

ANTIOXIDANT ACTIVITY OF N-HEXANE EXTRACT OF *C. sumatrensis*					
Conc.(µg/mL)	Absorbance	Absorbance	Absorbance	Mean absorbance	% Inhibition
1000	0.125	0.126	0.122	0.124±0.0021	78.09
500	0.192	0.189	0.189	0.190±0.0017	66.43
250	0.227	0.225	0.229	0.227±0.0020	59.89
125	0.255	0.257	0.254	0.255±0.0015	54.95
62.5	0.257	0.260	0.257	0.258±0.0017	54.42
31.25	0.273	0.273	0.272	0.272±0.0006	51.94
15.62	0.269	0.267	0.266	0.267±0.0015	52.83
7.8	0.270	0.269	0.270	0.270±0.0006	52. 30
3.9	0.275	0.278	0.276	0.276±0.0015	51.24
1.95	0.283	0.284	0.282	0.283±0.0010	50.00
ANTIOXIDANT ACTIVITY OF ETHYL ACETATE EXTRACT OF *C. sumatrensis*					
Conc.(µg/mL)	Absorbance	Absorbance	Absorbance	Mean absorbance	% Inhibition
1000	0.329	0.327	0.329	0.328±0.0012	42.05
500	0.298	0.296	0.295	0.296±0.0015	47.70
250	0.291	0.290	0.291	0.291±0.0006	48.59
125	0.304	0.303	0.303	0.303±0.0006	46.47
62.5	0.297	0.295	0.295	0.296±0.0012	47.70
31.25	0.310	0.311	0.308	0.310±0.0015	45.22
15.62	0.304	0.303	0.303	0.303±0.0006	46.47
7.8	0.285	0.284	0.284	0.284±0.0006	49.82
3.9	0.307	0.306	0.306	0.306±0.0006	45.94
1.95	0.285	0.283	0.286	0.285±0.0015	49.65
ANTIOXIDANT ACTIVITY OF METHANOL EXTRACT OF *C. sumatrensis*					
Conc.(µg/mL)	Absorbance	Absorbance	Absorbance	Mean absorbance	% Inhibition
1000	0.176	0.178	0.175	0.176±0.0015	66.02
500	0.126	0.125	0.122	0.124±0.0021	76.06
250	0.101	0.101	0.101	0.101±0	80.50
125	0.176	0.177	0.175	0.176±0.0010	66.02
62.5	0.201	0.201	0.199	0.200±0.0012	61. 39
31.25	0.229	0.230	0.229	0.229±0.0006	55.79
15.62	0.261	0.263	0.262	0.262±0.0010	49.42
7.8	0.267	0.266	0.265	0.266±0.0010	48.65
3.9	0.272	0.269	0.272	0.271±0.0017	47.68
1.95	0.278	0.279	0.279	0.279±0.0006	46.14

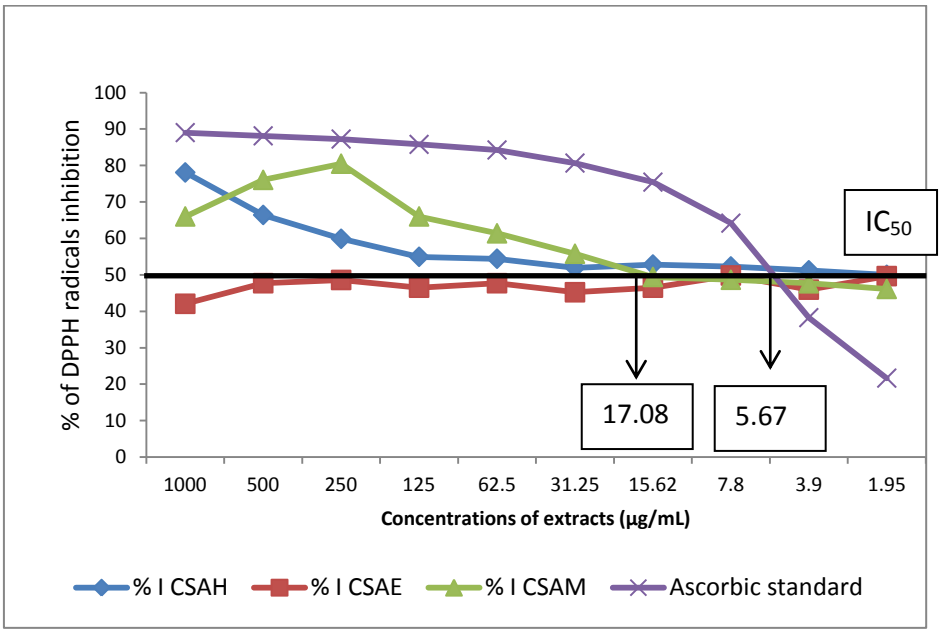

Fig 1: % of DPPH radical inhibition versus concentration (mg/mL) for determination of Antioxidant Activity of the aerial parts extracts of *C. Sumatrensis*

KEY: **SD** = Standard deviation; **% I** = Percentage inhibition; CSA = *Conyza sumatrensis* aerial parts; CSAH – N-hexane extract of *Conyza sumatrensis* aerial parts; CSAE – Ethyl acetate extract of *Conyza sumatrensis* aerial parts; CSAM – Methanol extract of *Conyza sumatrensis* aerial parts

GC-MS analysis results revealed that n-hexane extract showed the presence of 11 vertical peaks, the comparison of the peaks with pherobase library indicated the presence of eleven compounds as showed in Table 7. α-Farnesene and spathulenol are the most abundant (20.27%), (22.276%), molecular formula of $C_{15}H_{24}$, $C_{15}H_{24}O$, retention time 14.082, 17.866 respectively. The fragment ions 133, 105 confirm the molecular mass of α-farnesene (204).

GC-MS result of ethyl acetate extract revealed seventeen compounds and these compounds were compared with standard library (pherobase). These compounds are γ-seliene (0.64%), caryophyllene (9.20%), α-trans-bergemotene (5.06), cis-β-farnesene (16.64%), γ-muurolene (1.03%), α-curcumene (2.29%), δ-cadiene (2.12%), trans nerolidol (1.52%), Cis-pinane (21.09%), 1,4- eicosadiene (2.93%), E-phytol (9.01%), phytol acetate (7.26%) [Table 6].

The fragments ions 82, 95 and 123 of most abundant compound in ethyl acetate extract, cis-pinane (% abundance, 21.09) correspond to molecular formula – C_6H_{10}, -C_7H_{11} and –C_9H_{15} , while cis-β-farnesene (% abundance, 16.64), which revealed fragment ions 120, 133 and 161 correspond to molecular formula – C_6H_9, -$C_{10}H_{13}$,-$C_{12}H_{17}$ [Table 8].

The result of the GC-MS of the methanol extract of the plant revealed twenty peaks indicating that a mixture of twenty compounds were present in the extract. Comparison of the peaks with a standard library confirms the presence of Coumaran (0.63%), 1,4 dihydroxybenzene (1.99%), 2-methoxylvinylphenol (7.96%), 2,6-dimethoxylphenol (0.92%), Eugenol (8.51%), Caryophyllene (3.99%), α-farnesene (1.55%), Cis-β-farnesene (6.72%), 4-epi-cubedol (1.18%), Nerolidyl acetate (0.87%), Spathulenol (11.02%), Cis- pinane (1.00%), Methyl palmitate (13.67%), methyl linoleate (1.91%), Methyl linolenate (11.69%), E-phytol (19.36%) as shown in table 7. The most abundant constituent, E-phytol (% abundance, 19.36) revealed the following fragment ions of the molecular formular –C_3H_3O (55 g/mol), -C_4H_7O (71 g/mol) and –$C_8H_{10}O$ (123 g/mol). Another major constituent of the extract, methyl palmitate (% abundance, 13.67) showed the following fragments of its molecular formular –$C_3H_6O_2$ (74 g/mol), -$C_4H_7O_2$ (87 g/mol), -$C_{10}H_{23}$ (143 g/mol) [Table9].

Table 7: GC-MS Analysis of N-hexane Extract of the Aerial Parts of *Conyza sumatrensis*

SN	Compound name	Formula	Peak area %	Molecular Weight (g/mol)	Retention time (min)
1	Caryophyllene	$C_{15}H_{24}$	8.94	204	13.025
2	α-Bergamotene	$C_{15}H_{24}$	4.30	204	13.450
3	β-Farnesene	$C_{15}H_{24}$	20.27	204	14.082
4	β-Cubebene	$C_{15}H_{24}$	5.04	204	14.882
5	α-Bisabolol	$C_{15}H_{26}O$	1.97	222	17.341
6	Spathulenol	$C_{15}H_{24}O$	22.28	220	17.886
7	Tricyclo-undecan-3-ol-trimethyl	$C_{15}H_{24}O$	2.09	220	20.881
8	3,7,11,15-tetramethyl-2-hexadecen-1-ol	$C_{20}H_{22}O$	19.10	278	24.716
9	Methyl Palmitate	$C_{16}H_{46}O_2$	1.76	270	26.924
10	Palmitic acid	$C_{16}H_{32}O_2$	5.88	256	28.275
11	Phytol	$C_{20}H_{38}O$	8.01	294	31.378

Table 8: GC-MS Analysis of Ethyl acetate Extract of the Aerial Parts of *Conyza sumatrensis*

S/N	Compound name	Peak area %	Molecular formula	MW g/mole	Retention time (min)
1	γ – seliene	0.64	$C_{15}H_{24}$	204.35	10.792
2	Caryophyllene	9.20	$C_{15}H_{24}$	204.35	13.069
3	α-trans-bergamotene	5.06	$C_{15}H_{24}$	204.35	13.488
4	Cis-β-farnesene	16.64	$C_{15}H_{24}$	204.35	14.138
5	γ-muurolene	1.03	$C_{15}H_{24}$	204.35	14.751
6	α-curcumene	2.29	$C_{15}H_{22}$	202.34	14.951
7	δ-cadinene	2.12	$C_{15}H_{24}$	204.35	16.140
8	Trans- nerolidol	1.52	$C_{15}H_{26}O$	222.37	17.378
9	Cis-pinane	21.09	$C_{10}H_{18}$	138.25	24.772
10	1,4- Eicosadiene	2.73	$C_{20}H_{38}$	278.82	25.848
11	E-phytol	9.01	$C_{20}H_{40}$	296.53	31.415
12	Phytol acetate	7.26	$C_{22}H_{42}O_2$	338.32	33.724

Table 9: GC-MS Analysis of Methanolic Extract of Aerial Parts of *Conyza sumatrensis*

S/N	Compound name	Peak area %	Molecula formula	Molecular Weight g/mole	Retention time (min)
1	Coumaran	0.63	C_8H_8O	120.15	7.614
2	1,4-dihydroxybenzene	1.99	$C_6H_6O_2$	110.11	9.374
3	2-methoxy-4-vinyl phenol	7.96	$C_9H_{10}O_2$	150.17	10.066
4	2,6- dimethoxyl phenol	0.92	$C_8H_{10}O_3$	154.16	11.148
5	Eugenol	8.51	$C_{10}H_{12}O_2$	164.2	11.323
6	Caryophyllene	3.99	$C_{15}H_{24}$	204.35	13.050
7	α-farnesene	1.55	$C_{15}H_{24}$	204.35	13.481
8	Cis – β – farnesene	6.72	$C_{15}H_{24}$	204.35	14.101
9	4 – epi –cubedol	1.18	$C_{15}H_{26}O$	222.27	14.958
10	Nerolidyl acetate	0.87	$C_{17}H_{28}O_2$	264.40	17.366
11	(-) – spathulenol	11.02	$C_{15}H_{24}O$	220.35	17.898
12	Cis-pinane	1.00	$C_{10}H_{18}$	138.25	24.741
13	Methyl palmitate	13.67	$C_{17}H_{35}O_2$	270.45	26.955
14	Methyl linoleate	1.91	$C_{19}H_{34}O_2$	294.45	30.909
15	Methyl linolenate	11.69	$C_{19}H_{34}O_2$	292.46	31.071
16	E-phytol	19.36	$C_{20}H_{40}O$	296.53	31.403

*Conclusion***:** The aerial parts of *Conyza sumatrensis* have been investigated in this research and preliminary phytochemical screening of the crude extracts shows the presence of bioactive compound of medicinal uses such as tannins, glycosides, flavonoids, saponin, phenolics and terpenoids. Antimicrobial activity of crude extracts from the plant against all the test bacteria and fungi was found to be very interesting and encouraging at moderate to high concentration which justify the uses of the plant traditionally for treating chickenpox, smallpox, sore throat, ringworm and other skin related diseases. The GC-MS reveals various peaks of bioactive compounds of which the activity of the plant against

bacteria and fungi may be attributed to the most prominent compound in synergistic effect with all the other compounds present in smaller quantities in the extract.

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