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Data Article

Data on GC-MS analysis, in vitro anti-oxidant and anti-microbial activity of the *Catharanthus roseus* and *Moringa oleifera* leaf extracts

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ABSTRACT

The article reports data on chemical profiling by gas chromatography-mass spectrometry (GC-MS) of aqueous and methanolic leaf extracts of Madagascar periwinkle (*Catharanthus roseus*) and drumstick tree (*Moringa oleifera*) and on their antioxidant and antibacterial effects against three clinical human pathogens. In total 105 compounds were tentatively identified; in which 65 in *Catharanthus roseus* and 40 in *Moringa oleifera* compounds. A large number of peaks with good area percentage was found in methanolic extract of *Catharanthus roseus* with core chemical constituents such as *trans*-squalene, n-hexadecanoic acid, Eicosyl acetate, stearin, 1H-Benz(G)indole-3-carboxylic acid. The corresponding constituents from *Moringa oleifera* include 9-Octadecenoic acid (z)-, Heptadecanoic acid and phytol acetate. The highest scavenging activity (87.7% at 200 μg/mL) was shown by DPPH aqueous leaf extract of *C. roseus*. Moreover, the methanolic scavenging of both plant extracts was in the order of FRAP>DPPH>NO> H_2O_2 with lowest antioxidant activity (51.4% at 200 μg/mL) exposed by *Catharanthus roseus* in comparison of all cases. Good antibacterial action was examined against three different organisms (*E.coli, B. subtilis* and *S. aureus*) of aqueous infusion of *Catharanthus roseus*.

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Specifications Table

Subject	Biology
Specific subject area	Medicinal plants and pharmacology
Type of data	Chromatogram figures, Tables, Figures, Text files
How data were acquired	Crude aqueous and methanolic leaf extracts of *C. roseus* and *M. oleifera* were isolated and analyzed by GC-MS, which was carried out on GC-MS QP2010 plus (Shimadzu, Japan) equipped with a flame ionization detector and GC 6890 model series. Several antioxidant activity *in-vitro* assays were performed with specified protocols. Antibacterial activities were determined using agar well diffusion method.
Data format	Raw, analyzed and expressed as mean ± SEM, One-way ANOVA analysis of variance.
Experimental factors	Aqueous and methanolic extracts of *Catharanthus roseus* and *Moringa oleifera* prepared to isolate secondary metabolites through GC-MS and tested in different *in-vitro* antioxidant assays and for antimicrobial activity.
Experimental features	Extraction and isolation of both plant crude extracts (Soxhlet, column chromatography, GC-MS analysis); *In-vitro* antioxidant assays (DPPH, FRAP, NO, H_2O_2.); Test microorganism (One Gram negative *Escherichia coli* (MTCC 443) and two Gram positive *Bacillus subtilis* (MTCC 441), *Staphylococcus aureus* (ATCC 259323).
Data source location	The fresh leaves of the two species of *Catharanthus roseus* and *Moringa oleifera* were gathered from campus of Yogi Vemana University and near Raychotighat, Kadapa, India, Department of Biotechnology and Bioinformatics, Yogi Vemana University, Kadapa, India.
Data accessibility	Provided data in this article
Related research article	Mehdi Soltani Howyzeh, Seyed Ahmad Sadat Noori, Vahid Shariati J (2018).Essential oil profiling of Ajowan (*Trachyspermum ammi*) industrial medicinal plant. *Industrial Crops and Products* 119, 255–259.

Value of the Data

- Madagascar periwinkle (*Catharanthus roseus*) and drumstick tree leaves (*Moringa oleifera*) have been used in traditional medicine and their influence in various biomedical areas include antioxidant effects, hypolipidemic, anti-inflammatory, immunomodulatory, anti-hyperglycemic (anti-diabetic), anti-carcinogenic, anti-ulcer, anti-bacterial and also to treat few diseases such as Ocular, Alzheimer's and Parkinson disease.
- Although quite a body of literature is available on Madagascar periwinkle and drumstick tree, the tentatively identified natural compounds with therapeutic potential may be exploited by the researchers for further investigations.
- These data add to a growing body of evidence on the biological activities of extracts from these plants. Compounds reported in our GC-MS profiling may be applied in treating Tuberculosis, Non-small-cell lung cancer and to design rationalized drugs.

1. Data

The current data pertains to GC–MS chromatogram of the methanolic and aqueous leaf extract of *C. roseus* (Figs. 1 and 2) and *M. oleifera* (Figs. 3 and 4) with their corresponding secondary metabolites as depicted in Tables 1 and 2 respectively. *In-vitro* antioxidant assays with percentage of inhibition as a parameter are presented in Figs. 5 and 6. Antimicrobial activity (in terms of inhibition zones) of *C. roseus* and *M. oleifera* leaves against selected bacterial strains was shown in Table 3.

2. Experimental design, materials and methods

2.1. Collection of plant material and preparation

The fresh leaves of *Catharanthusroseus* (Apocynaceae) and *Moringa oleifera* (Moringaceae) were gathered from campus of Yogi Vemana University, Kadapa and near Raychotighat, India respectively. The plant specimens were recognized and authenticated by Department of Botany at Yogi Vemana University, Kadapa, India. The leaves of both the plants were harvested at the vegetative phase.

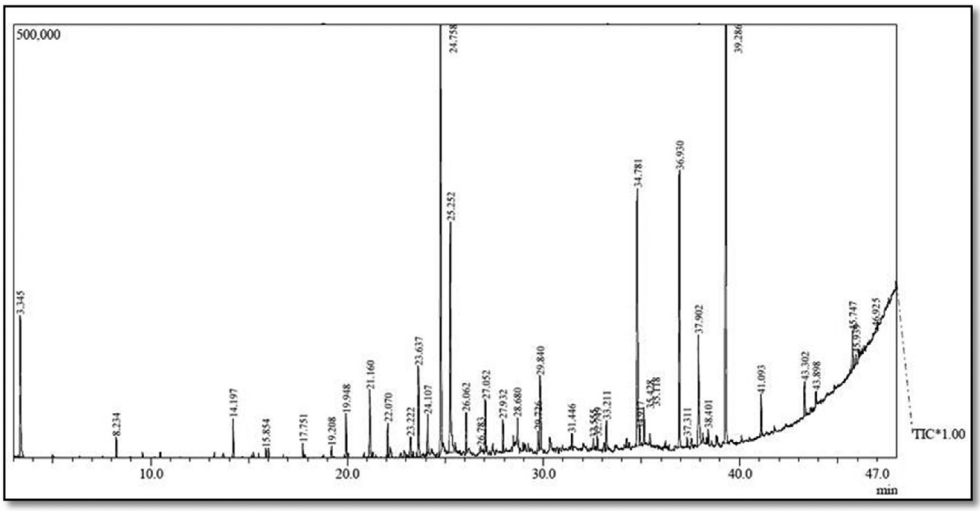

Fig. 1. GC-MS Chromatogram of methanolic *Catharanthus roseus* leaf extract.

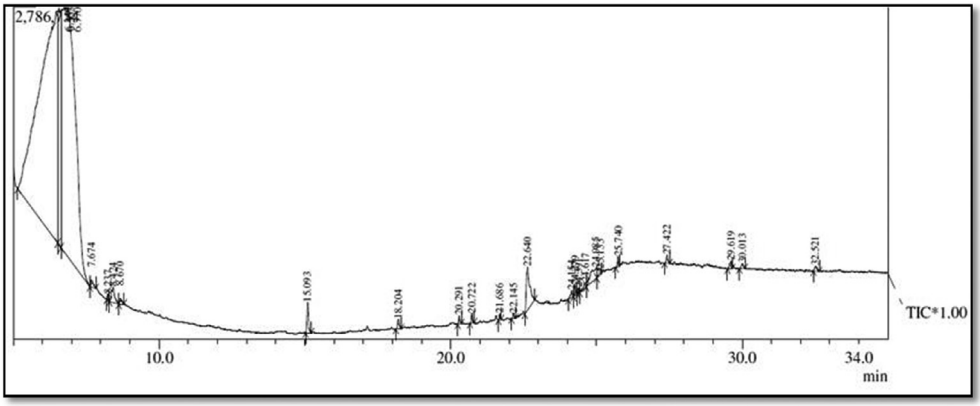

Fig. 2. GC-MS Chromatogram of aqueous *Catharanthus roseus* leaf extract.

2.2. Plant sample extraction and column chromatography

Dried powdered leaf samples were successively extracted by soxhlet apparatus, as described by Sadasivam and Manickam [1] and extracts were subjected to column chromatography over silica gel (60–120 mesh) and eluted with n-hexane, chloroform and methanol respectively. n-hexane and chloroform did not elute much of the compounds. Both aqueous and methanolic fractions of *Catharanthus roseus* and *Moringa oleifera* were kept under vacuum desiccators until used for gas chromatography/mass spectrometry (GC–MS) analysis.

2.3. Gas chromatography/mass spectroscopy (GC/MS) analysis

The GC-MS analysis was conducted on GC-MS QP2010 Plus (Shimadzu, Japan) equipped with a flame ionization detector and GC 6890 model series. The GC was equipped with a fused silica

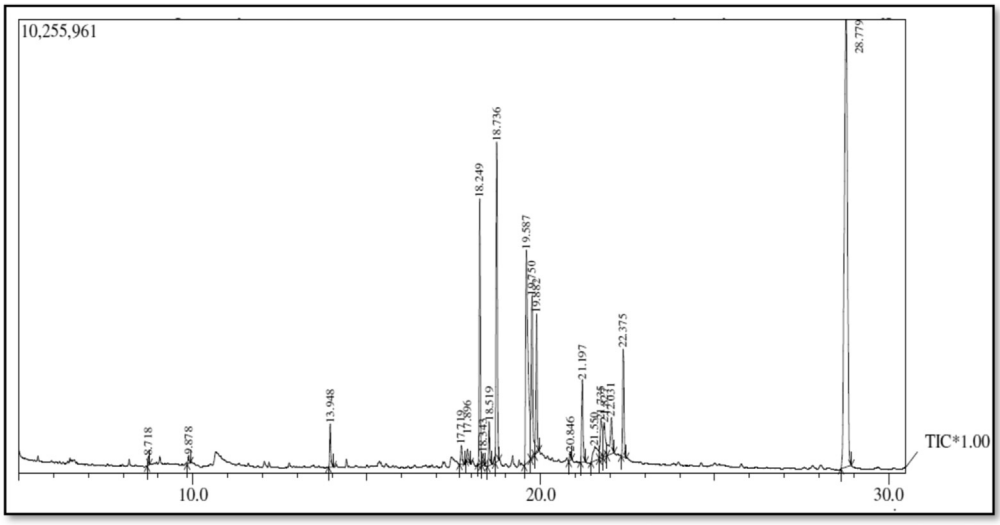

Fig. 3. GC-MS Chromatogram of methanolic *Moringa oleifera* leaf extract.

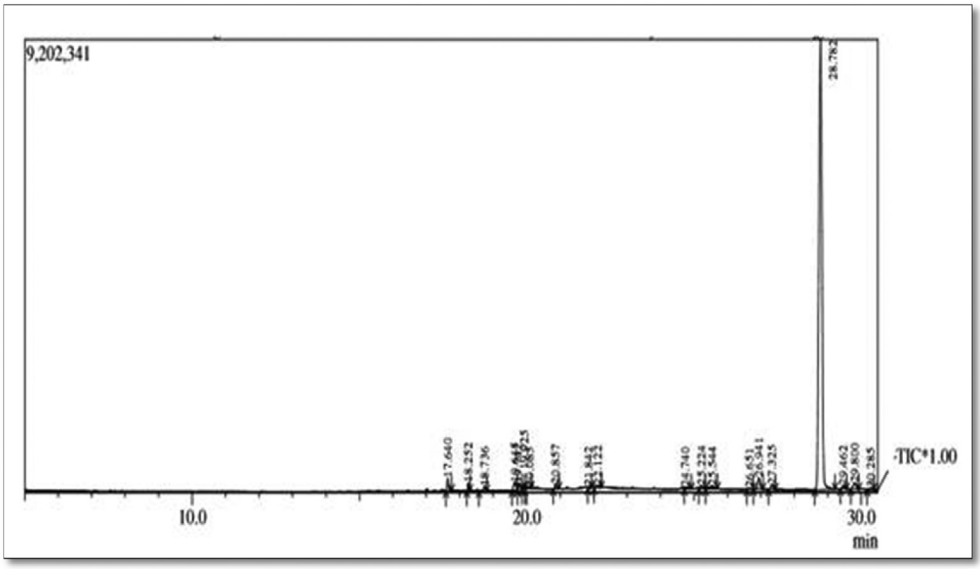

Fig. 4. GC-MS Chromatogram of aqueous *Moringa oleifera* leaf extract.

(30 m × 0.25 mm ID × 0.25 μm) capillary column. Injection temperature was maintained at 250 °C by employing helium (99.995%) as a carrier gas at a constant flow rate of 1.5 ml/min. 1 mg/1 ml absolute alcohol at a split ratio of 1: 10 was injected. The instrument was set to an initial temperature of 50 °C for 2 min. At the end of this period the oven temperature was arisen up to 300 °C, at the rate of 12 hold/40 min. The mass spectra of compounds in samples were obtained by electron ionization (EI) at 70 eV, and the data was evaluated using total ion count (TIC) for compound identification and quantification. The MS start and end time (3 and 32 min.) was performed at a scan speed of 2000. The spectrum of the

Table 1
Phytochemicals tentatively identified based on retention time (RT) matching in the methanolic (Left) and aqueous (Right) extracts of *Catharanthus roseus* leaf extract by GC-MS.

Sl. No	RT (min.)	NIST DATABASE/Wiley 2007/FAME ID/ *(Methanolic)*	RT (min.)	NIST DATABASE/Wiley 2007/FAME ID/*(Aqueous)*
1.	3.34	2-Hydroxy-2-methyl-4-pentanone (diacetone)	6.46	R (-)-2-Amino-1-butanol
2.	8.23	4-Penten-2-Ol, 3-methyl-	6.55	Phenethylamine, alpha-ethyl-
3.	14.17	Quinoline, 1,2-dihydro-2,2,4-trimethyl-	6.77	1-Butanol, 2-amino-
4.	15.85	Hexathiane	7.67	2,4(1H,3H)-Pyrimidinedione
5.	17.75	Pentadecane	8.23	Naphthalene
6.	19.20	2(3H)-Benzothiazolone	8.42	2,2,5,5-Tetramethylhex-3-ene, 3,4-dideutero
7.	19.94	Octadecane	8.67	4-Pyrimidinamine, 2,6-dimethyl
8.	21.16	Tetradecanoic Acid	15.09	Phenol, 2,4-Bis(1,1-dimethylethyl
9.	22.07	Tetracosane	18.20	Cyclooctasiloxane, hexadecamethyl
10.	23.22	Octadecanoic Acid	20.29	1,3-Diphenyl-1,3,5,5-tetramethyl-
11.	23.63	3-(2-Chloroethyl)-1,3-benzothiazol-2(3H)-one	20.72	1,1,3,3,5,5,7,7,9,9,11,11,13,13-Tetradeca
12.	24.10	Tetracosane	21.68	Phosphine Oxide, bis(Pentamethylphenyl)-
13.	24.75	2-(1,3-Benzothiazol-2-ylsulfanyl)ethanol	22.14	Hexadecanoic Acid, methyl ester
14.	25.25	n-Hexadecanoic acid	22.64	n-Hexadecanoic Acid
15.	26.06	Tetracosane	24.15	9-Octadecenoic acid, Methyl ester, (E)-
16.	26.78	Dodecane, 1,1′-oxybis-	24.27	Cyclododecasiloxane, tetracosamethyl
17.	27.05	Octathiocane	24.39	Hexacosanoic acid, Methyl Ester
18	27.93	Tetracosane	24.61	1,5,9,9-Tetramethyl-2-oxatricyclo [6.4.0.0 (4,8)
19.	28.68	Urea	24.98	2-Furanpentanoic acid, tetrahydro-5-nonyl-, methyl
20.	29.72	Spiro [Cyclopentane-1,2′ (1′h)-quinoxaline], 3′-(4-morpholinyl)-6′,8′-dinitro-	25.13	(2-Methyl-1-phenyl-2-propenyl)Be
21.	29.63	Eicosyl Acetate	25.74	Cyclononasiloxane, Octadecamethyl-
22.	31.44	Tetracosane	27.42	1H-Purin-6-Amine, [(2-fluorophenyl
23.	32.55	Stannane, Tributyl (2,5-dimethyl-1-phenyl-4-hexenyl)-, (R*,R*)-(.+-.)-	29.61	Heptasiloxane, Hexadecamethyl-
24.	32.74	Methyl 6,7-dideoxy-6-C-methyl-2,3-di-o-methyl-.alpha.-D-gluco-oct-6-eno-1,5-pyranosid)Urono-8,4-lactone	30.01	1,2-Benzenedicarboxylic acid
25.	33.21	Tricosyl acetate	32.52	Cyclononasiloxane, octadecamethyl-
26.	34.78	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester		
27.	34.91	1,4-Cyclooctanedione		
28.	35.42	1,2-Benzenedicarboxylic acid		
29.	35.11	Pyrrolo [3,4-C]pyrrole-1-carboxylic Acid, 3-cyclopropyloctahydro-4,6-dioxo-1,5-diphenyl-, methyl ester		
30.	36.93	4,4′((phenylene)diisopropylidene)diphenol		
31.	37.31	1H-indole-3-ethanamine		
32.	37.90	Octadecanoic acid, 2,3-dihydroxypropyl ester		
33.	38.40	Heptacyclo [6.6.0.0(2,6).0(3,13).0(4,11).0(5,9).0(10,14)] Tetradecanone		
34.	39.28	2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-Hexamethyl-		
35.	41.09	1H-Benz [G]indole-3-carboxylic acid, 1-(2,2-dimethoxyethyl)-5-methoxy-2-methyl-, ethyl Ester		
36.	43.30	Cholest-5-en-3-ol (3.Beta.)-		
37.	43.89	6-Methoxy-2,8-dimethyl-(4′,8′-dimethyl-3′,7′-nonadienyl)-3,4-dihydro-2H-1-Benzopyran		
38.	45.74	Beta.-Sitosterol		
39.	45.93	Ethanone, 1,1′-[3,3′-biisoxazole]-5,5′-diylbis-		
40.	46.92	3-Butoxy-1,1,1,5,5,5-hexamethyl-3-(Trimethylsiloxy)trisiloxane		

Table 2
Phytochemicals tentatively identified based on retention time (RT) matching in the methanolic (Left) and aqueous (Right) extracts of *Moringa oleifera* leaf extract by GC-MS.

Sl. No	RT (min.)	NIST DATABASE/Wiley 2007/ FAME ID/*(Methanolic)*	RT (min.)	NIST DATABASE/Wiley 2007/ FAME ID/*(Aqueous)*
1.	8.718	1,1-Diethoxy-2-ethylhexane	17.640	Benzene, 1,1′-(1,2-cyclobutanediyl
2.	9.878	Azulene	18.252	3,7,11,15-Tetramethyl-2-hexadecen-1-ol
3.	13.948	2,6-Di-butyl-2,5-cyclohexadiene-1	18.736	pentadecanal-
4.	17.719	9-Octadecenoic acid, ethyl ester	19.645	9-Octadecenoic acid (z)-
5.	17.896	2(4H)-Benzofuranone, 5,6,7,7a tetrahydro	19.742	1,2-Benzenedicarboxylic acid, diheptyl ester
6.	18.249	2,6,10-Trimethyl,14-ethylene-14-pe	19.925	2,5-Pyrrolidinedione, 1-hydroxy-
7.	18.343	2-Pentadecanone, 6,10,14-trimethyl-	20.085	Cyclopropanetetradecanoic acid, 2-octyl-, methyl
8.	18.519	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	20.857	Phosphonic acid, dioctadecyl ester
9.	18.736	Phthalic acid, isobutyl undec-2-en-1-yl ester	21.842	Dimethylaminato [4-methyl-2-(e)
10.	19.587	l-(+)-Ascorbicacid2,6-dihexadecanoate	22.122	Tetradecanamide
11.	19.750	Dibutyl phthalate	24.740	Heptadecanoic acid, ethyl ester
12.	19.882	Hexadecanoic acid, ethyl ester	25.224	Hexanedioic acid, mono (2-ethylhexyl)ester
13.	20.846	Behenic alcohol	25.544	Tetracosyl acetate
14.	21.197	2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-,	26.651	borneol, Pentamethyldisilanyl ether
15.	21.550	9,12-Octadecadienoic acid (z,z)-	26.941	7-Propyl-1,3,5-cycloheptatriene
16.	21.735	(r)-(-)-14-Methyl-8-hexadecyn-1-ol	27.325	Octane, 1,1′-oxybis-
17.	21.827	9,12,15-Octadecatrienoic acid, (z,z,z)-	28.782	Bis(2-ethylhexyl) phthalate
18.	22.031	Heptadecanoic acid, ethyl ester	29.462	(2,3-Diphenylcyclopropyl) methyl phenyl sulfoxide,
19.	22.375	Phytol, acetate	29.800	1,2-Diphenyl-1-isocyanoethane
20.	28.779	Bis(2-ethylhexyl) phthalate	30.285	7-(Isobut-1-yl)cyclohepta-1,3,5-tr

unknown components were compared with spectrum of known components stored both in the "NIST-MS Library 05", "Wiley GC-MS Library 2007" as well as FAME with more patterns.

2.4. In-vitro anti-oxidant assays

2.4.1. DPPH free radical scavenging assay

The DPPH radical-scavenging activity of the test extracts was examined using the modified method by Brand-Williams et al. [2]. Leaf extracts of different concentrations (50–200 μg/mL) were mixed with an equal volume of methanolic solution of DPPH (Sigma Aldrich). The mixture was allowed to react at room temperature in dark for 30 min. Ascorbic acid (1 mg/mL (50–200 μg/mL)) was used as positive control. After 30 min the absorbance was measured at 517 nm and converted into percentage of antioxidant activity using the following equation.

$$\% \text{ of inhibition} = [A_0\text{-}A_1/A_0] *100$$

where A_0 = Absorbance of control.
A_1 = Absorbance of test.

2.4.2. Hydrogen peroxide scavenging assay

The H_2O_2 scavenging activities for both the leaf extracts were assayed by the modified method [3]. Different concentrations of plant leaf extracts (50–200 μg/mL) and ascorbic acid at different concentrations (50–200 μg/mL) of (1 mg/mL) were added to 40 mM H_2O_2 solution prepared in phosphate buffer. The absorbance of H_2O_2 at 230 nm was determined after 10 min. The percentage of H_2O_2 scavenging by the extracts and standard (H_2O_2) was calculated as follows.

$$\% \text{ of scavenged } [H_2O_2] = [A_0\text{-}A_1/A_0] *100$$

where A_0 = Absorbance of control.

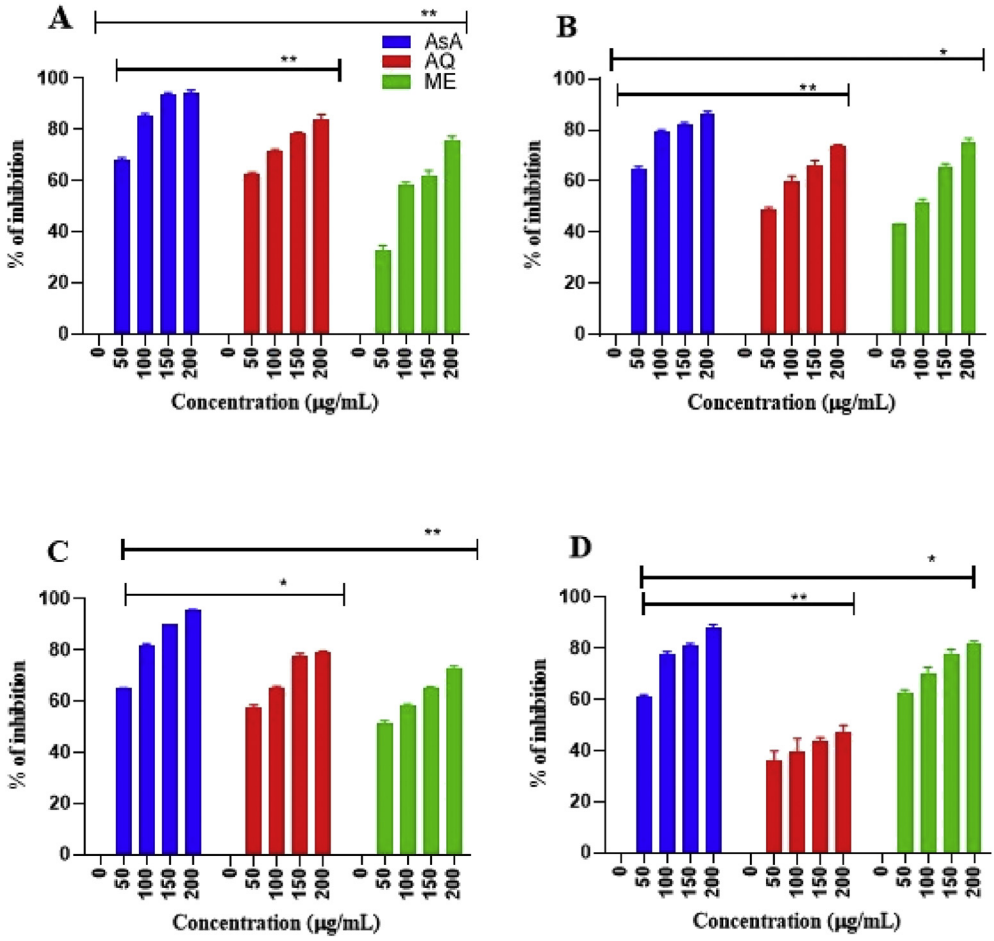

Fig. 5. *In-vitro* antioxidant activity of aqueous and methanolic leaf extracts of *Catharanthus roseus.* (A) DPPH scavenging activity (B) H_2O_2 scavenging activity (C) Nitric oxide scavenging activity (D) FRAP assay. Values are expressed as Mean ± SEM (n = 3). One-way ANOVA followed by Dunnett's test was employed to compare each concentration with positive control. *Statistical significance at $p < 0.05$; ** statistical significance at $p < 0.01$. AsA-Ascorbic acid (Positive control); AQ - Aqueous; ME-MeOH.

A_1 = Absorbance of test.

2.4.3. Nitric oxide radical scavenging assay

The nitric oxide (NO) scavenging activity was determined using the method described by Parul et al. [4].10 mM sodium nitroprusside was incubated with 100 µL leaf extract for 60 min at 30 °C. After incubation, 100 µL of griess reagent was added. The absorbance of the chromatophore formed during the diazotization of nitrite with sulphanilamide and subsequent coupling with naphthylehylendiamine was measured at 562 nm. Ascorbic acid (1 mg/mL) was at the same concentration was taken as standard.

% NO scavenged = $[A_0\text{-}A_1/A_0]$ *100

where A_0 = Absorbance of control.

A_1 = Absorbance of test.

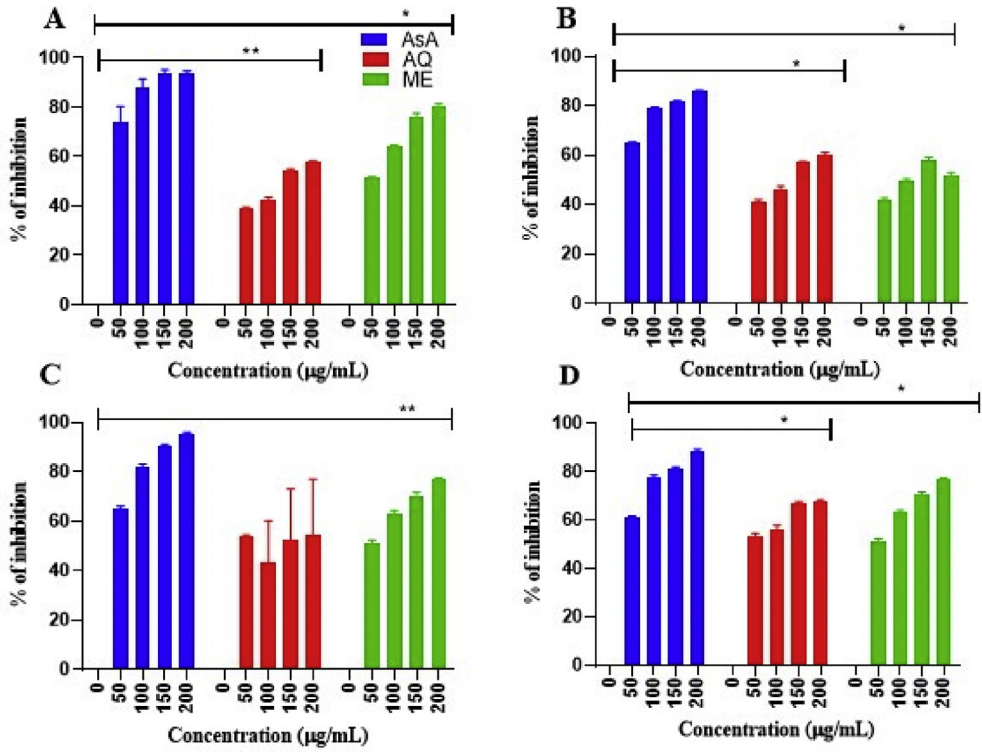

Fig. 6. *In-vitro* antioxidant activity of aqueous and methanolic leaf extracts of *Moringa oleifera.* (A) DPPH scavenging activity (B) H_2O_2 scavenging activity (C) Nitric oxide scavenging activity (D) FRAP assay. Values are expressed as Mean ± SEM (n = 3). One-way ANOVA followed by Dunnett's test was employed to compare each concentration with positive control. *Statistical significance at $p < 0.05$; ** statistical significance at $p < 0.01$. AsA-Ascorbic acid (Positive control); AQ-Aqueous; ME-MeOH.

Table 3
Antimicrobial activity of aqueous and methanolic leaf extracts of *Catharanthus roseus* and *Moringa oleifera* against selected bacterial strains.

Leaf Extracts (50 µg/mL)	Zone of inhibition (mm)		
	B. subtilis	*S. aureus*	*E. coli*
C. roseus			
Aqueous	22 ± 0.33	23 ± 0.18**	25 ± 0.25
Methanolic	23 ± 0.23	23 ± 0.44**	20 ± 0.41
M. oleifera			
Aqueous	23 ± 0.23*	20 ± 0.25	18 ± 0.41
Methanolic	23 ± 0.65*	24 ± 0.44	16 ± 0.23
Tetracycline (1 µg/mL)	29 ± 0.25	36 ± 0.33	28 ± 0.46

*Statistical significance at $p < 0.05$; ** statistical significance at $p < 0.01$.

2.4.4. Ferric reducing power (FRAP) assay

The reducing power was determined by Benzie and Strain [5] with slight modifications. Various concentrations of plant leaf extracts (50–200 µg/mL) were mixed with phosphate buffer and 2 mM potassium ferricyanide. The mixture was incubated at 50 °C for 20 min. TCA was added to the mixture which was then centrifuged at 3000 rpm for 10 min. The upper layer of solution was mixed with distilled water and freshly prepared $Fecl_3$ solution (0.5 mL) and the absorbance was recorded at 700 nm

using UV-Visible spectrophotometer (Thermo scientific evolution -201 series). Ascorbic acid (50–200 μg/mL) was used as positive control. Reducing capacity was calculated as follows:

% increase in reducing power = $[A_{test}/A_{blank}\text{-}1]*100$

Where A_{test} = Absorbance of test solution.
A_{blank} = Absorbance of blank.

2.5. Antimicrobial assay

2.5.1. Test microorganism

One Gram negative *Escherichia coli* (MTCC 443) and two Gram positive *Bacillus subtilis* (MTCC 441), *Staphylococcus aureus* (ATCC 259323) were used as bacterial test organism. The bacterial strains were cultured overnight at 37 °C in Luria-Bertani (LB) medium.

2.5.2. Agar well diffusion method

Antibacterial activities of two plants extract (*Catharanthus roseus* and *Moringa oleifera*) was determined using Agar well diffusion method [6]. The bacterial suspensions containing 7×10^5 cells/mL were incubated overnight and used for inoculation. 20 ml of molten nutrient agar was poured into the Petri dishes and cooled. All the bacterial suspension was swapped over the medium and 3 wells of 0.5 cm deep were made by using a sterile tip. Each 50 μL of aqueous, methanolic leaf extracts were added to respective wells one with tetracycline (1 μg/mL, Sigma) was added as positive control and other with distilled water as negative control. Tetracycline (antibiotic) was used as positive control. The antimicrobial behavior was determined by measuring Zone of inhibition around the holes in diameter (mm) after incubation.

2.6. Statistical analysis

All assays were performed in triplicate. Mean and standard deviation (SD) was examined for all assays. The results were expressed as mean ± SEM of three experiments. One way ANOVA with Dunnett's test was followed to compare each concentration with positive control to analyze level of statistical significance. $P < 0.05$ were considered statistically significant using Graph pad PRISM v.8.0.

Acknowledgments

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2020.105258.

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