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# GC–MS ANALYSIS OF ANTIOXIDANT COMPOUNDS PRESENT IN DIFFERENT EXTRACTS OF AN ENDEMIC PLANT *DILLENIA SCABRELLA* (DILLENIACEAE) LEAVES AND BARKS

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**Keywords:**

*Dllenia scabrella*, Antioxidant, Phytochemical tests, GC-MS analysis, Bioactive compounds

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**ABSTRACT:** The study aimed to investigate and characterize the antioxidant compounds from the leaves and barks of *Dillenia scabrella* (Dilleniaceae) (D. scabrella), an indigenous plant in the Northeast. The air-dried leaves and barks were powdered and subjected to selective sequential extraction using solvents of increasing polarity through percolation, namely, methanol, ethyl acetate + ethanol and water to obtain three different extracts. Further, the antioxidant potential of each of the extracts was checked by DPPH (1, 1-diphenyl, 2-picryl hydrazyl) assay. It was followed by preliminary phytochemical tests and gas chromatography-mass spectrometry to identify the anti-oxidant compound. All 4 crude extracts have shown significant antioxidant activity. The methanol extract of leaves (93%) at 500 µg/ml and bark (93.48% and 93.42%) at 500 µg/ml and 400 µg/ml showed free radical scavenging activity which was greater than the standard ascorbic acid (92.5%). In the phytochemical tests, phenolics were invariably present in all 4 extracts. Qualitative determination of the different biologically active compounds from crude extracts of *D. scabrella* using gas chromatography-mass spectrometry revealed different types of high and low molecular weight chemical entities with varying quantities present in each of the extracts. 16 bioactive compounds were identified in which 7 were reported for different biological activities. 3 compounds namely Cyclotrisiloxane Hexamethyl, 2, 4, 6-Cycloheptatrien-1, 3, 5-Bis-Trimethylsilyl, Trisiloxane- 1, 1, 1, 5, 5, 5-Hexamethyl-3, 3-Bis Trimethylsilyl are identified as compounds responsible for the above mentioned antioxidant property. Thus, identification of different biologically active compounds in the extracts of *D. scabrella* leaves and bark warrants further biological and pharmacological studies.

**INTRODUCTION:** *Dillenia scabrella* is a deciduous tree **Fig. 1** belonging to the family *Dilleniaceae*. There are about 100 species of Dillenia native to tropical and sub-tropical regions of Southern Asia, Australia and India [1]. However, to date, only a few *Dillenia* sp. namely *D. indica*, *D. pentagyna*, *D. papuana* and *D. suffruticosa* have been studied and reported to have pharmacological potential [2].

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Among these species, *D. indica* and *D. pentagyna* are the most studied ones. *D. indica* is well known for its properties like astringent, CNS depressant, antimicrobial and antioxidant [3]. *D. scabrella* is well known for its traditional uses and in India, this species is found in Meghalaya and some parts of Assam.

It is locally known as Agatchi among the Garo tribe of Meghalaya and Banji-ou among Assamese people. *Dillenia scabrella* fruits are eaten raw or as a pickle while the flowers are cooked with dry fish in Garo cuisines. The bark of this tree is traditionally used as an antidote for snake bites [4]. Though *D. scabrella* is well known for its uses no research data could be found on its chemical identity and pharmacological properties.

Thus, the objective of the study was to investigate the antioxidant property of *D. scabrella* and to identify the anti-oxidant compounds through GC-MS analysis.


**FIG. 1: *DILLENIA SCABRELLA* PLANT (A) AND DRIED COARSE POWDER OF LEAVES (B) AND BARK (C)**

## MATERIALS AND METHODS:

**Plant Sample:** The leaves and barks of *D. scabrella* were collected locally from West Garo Hills, District of Meghalaya on 17th January 2018 and authenticated in the Botanical Survey of India, in Shillong, Meghalaya (BSI/ERC/Tech./Plant Ident. /2018/734). The voucher specimen of *D. scabrella* was deposited in the herbarium.

**Extraction of Crude Extracts:** 25 gm of the dried coarsely powdered leaves and bark were subjected to selective sequential extraction using solvents of methanol, combined ethyl acetate +ethanol and water [5]. The extract was evaporated to dryness and the crude extracts were then collected and named as *D. scabrella* leaf methanol (DLM), *D. scabrella* leaf Ethyl acetate + Ethanol (DLEA+E), *D. scabrella* leaf Aqueous (DLA), *D. scabrella* bark methanol (DBM), *D. scabrella* bark ethyl acetate + ethanol (DBEA+E), and *D. scabrella* bark Aqueous (DBA). The extracts were then stored in a stoppered container at 20 ºC for further experiments.

**Phytochemical Screening:** The qualitative phytochemical screening of all the three extracts of both samples was performed according to the procedure described by [6]. The next experiments proceeded with methanolic and combined ethyl acetate +ethanol extracts of both leaves and bark. The aqueous extracts were not subjected to further analysis.

**Determination of Antioxidant Activity:** The antioxidant activity of *D. scabrella* leaves and barks extract were determined by the DPPH radical scavenging assay [7].

Different dilutions (100-500 µg) of the methanolic and combined ethyl acetate + ethanol extracts were prepared and mixed with (0.004% w/v) methanolic DPPH solution. The solution was incubated in the dark for 30 min and the absorbance was read at 515 nm using a UV-Visible spectrophotometer. Ascorbic acid was used as a standard. The percentage (%) of the DPPH radical scavenging ability of the sample was calculated with the help of the formula given below.

DPPH inhibition % = (Absorbance of control - Absorbance of sample) / (Absorbance of control) × 100

**Gas Chromatography-Mass Spectrometry:** Gas Chromatography-Mass Spectrometry analysis was carried out on methanol, ethyl acetate+ ethanol extracts of leaves and bark of *D. scabrella* by using Parkin Elmer in Biotech Park, IIT Guwahati. A DB-5MS column 60.0 m × 250 µm was used with oven program with an initial temperature of 50 °C for 2 min, ramp 5 °C/min to 300 °C, hold 8 min. The injector temperature was 250 °C. The carrier gas used was helium (He). A split injection with a ratio of 0:1 was used. The sample volume injected was 0 µl. The Solvent Delay was 8 min. The transfer temperature was 200 °C and the source temperature was 180 °C. The sample was scan at 40 to 600 Da.

## RESULTS:

**Percentage Yield:** The moisture percentage of leaf and bark was observed as 79.76 and 83.26 respectively. The percentage yield is presented in **Table 1**. From three batches of approximately 25 gm of air-dried powdered leaves, mean percentage yields of 7.4% (SD = 1.56) of methanol extract,

6.44% (SD = 1.43) of combined ethyl acetate +ethanol extract and 7.08% (SD = 1.34) of water extract were obtained. The percentage yield was almost similar for all three solvents. In case of bark, mean percentage yields of 18% (SD = 2.17) of methanol extract, 24.80% (SD = 2.61) of combined ethyl acetate + ethanol extract and 7.12% (SD = 1.47) of water extract were obtained. The combined ethyl acetate + ethanol bark extract (DBEA+E) gave the highest percentage yield. Most of the constituents were polar in nature.

**TABLE 1: PERCENTAGE YIELD OF LEAF AND BARK EXTRACTS OF *D. SCABRELLA* IN DIFFERENT SOLVENT**

| Leaf | Methanol | EA+E | Aqueous |
|---|---|---|---|
| Dry wt | 25g | 25g | 25g |
| Yield % | 7.4 | 6.44 | 7.08 |
| Mean | 1.85 | 1.61 | 1.77 |
| SD | 1.56 | 1.43 | 1.34 |
| **Bark** | **Methanol** | **EA+E** | **Aqueous** |
| Dry wt | 25g | 25g | 25g |
| Yield % | 18% | 24.80% | 7.12% |
| Mean | 4.5 | 6.19 | 1.79 |
| SD | 2.17 | 2.61 | 1.47 |

**Physical Properties:** The different crude extracts from *D. scabrella* leaves possessed unique physical characteristics **Fig. 2**. The methanol extract (DLM) was dark green in color with agreeable odor; the pH was 6.79 in 10% aqueous solutions and specific gravity was 1.02. The combined ethyl acetate + ethanol extract (DLEA+E) was brown to dark brown in color with agreeable odor; the pH was 6.05 in 10% aqueous solutions and specific gravity were 1.03. The aqueous extract (DLA) was light yellow in color with sweetened agreeable odor; the pH was 7.03 in 10% aqueous solutions having a specific gravity of 2.4. The bark also has shown black to dark brown for methanol extract (DBM), dark brown for combined ethyl acetate + ethanol extract (DBE+E) and brown color for aqueous extracts (DBA). The pH was close to seven for all extracts, the odour was strong and agreeable, and specific gravity was near to 2.

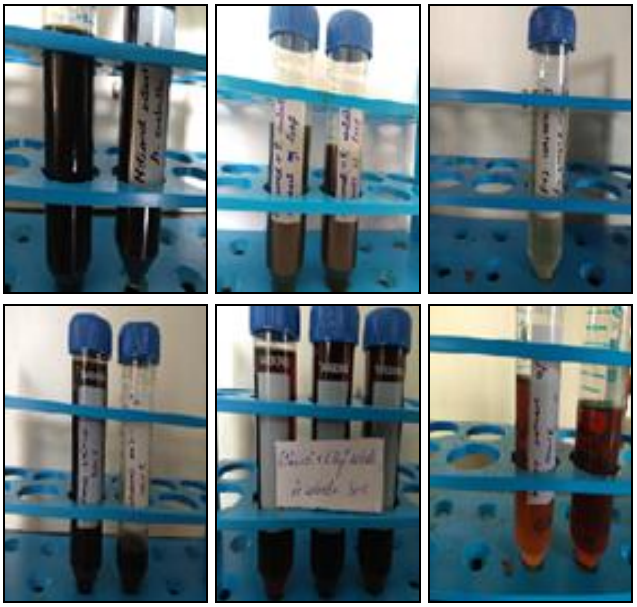


**FIG. 2: PHYSICAL PROPERTIES OF DIFFERENT EXTRACTS OF *D. SCABRELLA***

**TABLE 2: PHYTOCHEMICAL SCREENING OF LEAVES AND BARKS EXTRACTS OF *D. SCABRELLA***

| S. no. | Phytochemical test | Leaves extract | | | Bark extract | | |
|---|---|---|---|---|---|---|---|
| | | Methanol | Ethyl acetate + ethanol | Aqueous | Methanol | Ethyl acetate + ethanol | Aqueous |
| 1 | Alkaloids | + | + | + | + | + | + |
| 2 | Saponins | - | - | ++ | - | + | + |
| 3 | Phenolic compounds (Ferric Chloride test) | ++ | ++ | - | ++ | + | + |
| 4 | Gums | - | - | - | + | + | - |
| 5 | Flavonoids | - | - | + | - | - | - |
| 6 | Steroids (Salkowski test) | - | - | - | + | + | + |
| 7 | Tannins | + | + | | + | + | + |
| 8 | Proteins | - | - | - | - | - | - |
| 9 | Carbohydrates | + | + | + | ++ | + | ++ |

Presence (+), high concentration (++), absence (-) of phytochemicals

**Phytochemical Screening:** The preliminary phytochemical screening of the crude extracts of leaves and bark revealed the presence of alkaloids, saponins, phenolic compounds, tannins, gums and carbohydrates **Table 2**. The phenolics were sturdly present in all extracts.

**Antioxidant Activity of *D. Scabrella*:** The methanol leaf and bark extracts of *D. scabrella* (DLM, DBM) showed significant antioxidant activity in **Table 3**. The percentage of inhibition of DPPH radicals (93%, 93.48%), at 500 µg/ml of methanol leaf and bark and 93.42% at 400 µg/ml of methanol bark extract is significant than standard ascorbic acid (92.5%). The free radical scavenging activity showed by methanol leaf extracts was concentration-dependent while the combined ethyl acetate and ethanol extracts of leaves showed stable free radical scavenging activity (79-61%) from higher (500 µg/ml) to lower concentrations (100 µg/ml) **Table 3**. Similarly, the methanol extract (DBM, DBEA+E) of bark showed 93.4% and 93.32% of inhibition against free radicals at 500 and 400 µg/ml concentration. The reduction of inhibition was concentration-dependent and it was more significant than standard ascorbic acid. The combined ethyl acetate + ethanol extract has shown 84.23% inhibition at 500 µg/ml concentration but eventually, it decreased to 5% at 100 µg/ml.

**TABLE 3: ANTI-OXIDANT ACTIVITY OF *D. SCABRELLA* LEAVES AND BARK EXTRACTS AT DIFFERENT CONCENTRATIONS**

| Dilutions (µg/ml) | % Inhibition of DLM | % Inhibition of DLEAE | % Inhibition of DBM | % Inhibition of DBEAE | % Inhibition of Ascorbic acid |
|---|---|---|---|---|---|
| 500 | 93 | 79 | 93.48 | 84.23 | 92.5 |
| 400 | 84 | 73.7 | 93.32 | 50.57 | 92.5 |
| 300 | 49 | 71.2 | 84.48 | 32.88 | 69 |
| 200 | 35 | 63.08 | 78.29 | 21.34 | 49 |
| 100 | 12 | 61.1 | 51.60 | 5 | 42 |

**GC-MS Analysis of *D. Scabrella* Leaves and Barks Extract:** The result of GC-MS analysis was carried out on four crude extracts of leaves and bark (DLM, DLEA+E, DBM and DBEA+E) is given in **Fig. 3-10**. The library data of major peaks found in each chromatogram is extracted by using database NIST (National Institute of Standard and Technology), and their reported bioactivity is shown in **Table 4-7**. Several peaks with different retention time (RT) were detected in the chromatograph **Fig. 3, 5, 7, 9**. The major peaks were subjected to analysis for further information on the molecular weight **Table 4-7**. The molecular weight and molecular formula were deduced from the spectra **Fig. 4, 6, 8, 10**.

The compounds detected were identified through existing databases with their structure and reported activity in **Table 4-7**. 5 major bioactive compounds are detected from *D. scabrella* leaf methanol, ethyl acetate + ethanol and bark methanol extracts (cyclotrisiloxane hexamethyl, silicic acid diethyl bis (trimethylsilyl) ester, cyclotetrasiloxane octamethyl, 1, 2-bis (trimethylsilyl) benzene and tetrasiloxane decamethyl). However, the hexasiloxane 1, 1, 3, 3, 5, 5, 7, 7, 9, 9, 11, 11-dodecamethyl found in leaf methanol, ethyl acetate + ethanol, and bark ethyl acetate + ethanol extracts accordingly. The leaf methanol and ethyl acetate + ethanol extracts have shown 3 compounds, namely 1, 2-benzisothiazol-3-amine TBDMS, hepta-siloxane 1, 1, 3, 3, 5, 5, 7, 7, 9, 9, 11, 11, 13, 13 – tetradecam and methyl tris (trimethylsiloxy) silane. The octasiloxane 1, 1, 3, 3, 5, 5, 7, 7, 9, 9, 11, 11, 13, 13, 15, 15-hexadec is uniformly present in all four extracts. 6 compounds were detected exclusively in specific extracts like 2, 4, 6-cycloheptatrien-1, 3,5-bis-trimethylsilyl found only in leaf methanol extract and 3-Ethoxy-1, 1, 1, 5, 5, 5-hexamethyL-3-(trimethylsiloxy) tri found in bark methanol extract alone. In addition that 3-butoxy-1, 1, 1, 7, 7, 7-hexamethyl-3, 5, 5-tris trimethylsilyl, 3-isopropoxy-1, 1, 1, 7, 7, 7-hexamethyL-3, 5, 5-tris trimethyl, cyclo-heptasiloxane tetradecamethyl and trisiloxane 1, 1, 1, 5, 5, 5-hexamethyl-3, 3-bis trimethylsilyl were detected only in bark ethyl acetate + ethanol extract exclusively.

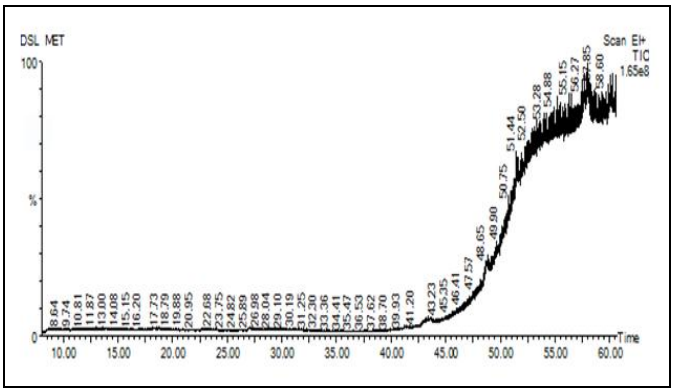



**FIG. 3: A CHROMATOGRAM OF THE BIOACTIVE COMPOUNDS PRESENT IN METHANOL EXTRACT OF *D. SCABRELLA* LEAVES (DLM)**

**TABLE 4: COMPOUNDS IDENTIFIED FROM METHANOL EXTRACTS OF LEAVES OF *D. SCABRELLA* (DLM)**

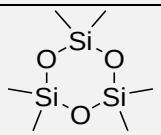
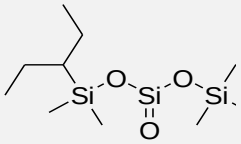
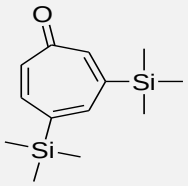
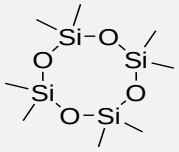
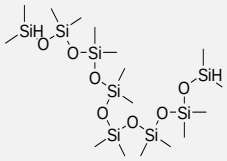
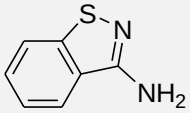
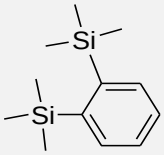
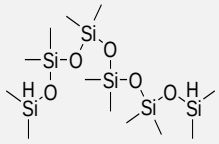
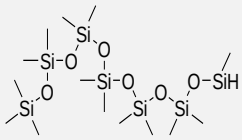
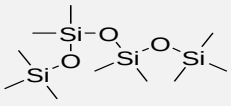
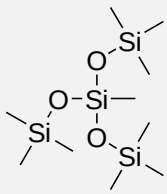
| Name of the compound | RT | M.W | Peak area % | Molecular formula | CAS | Structure | Biological activity | References |
|---|---|---|---|---|---|---|---|---|
| Cyclotrisiloxane-Hexamethyl | 57.993/ 60.049 | 222 | 0.721/ 1.033 | $C_6H_{18}0_3Si_3$ | 541-05-9 |  | Antibacterial activity, antioxidant | 8,9 |
| Silicic acid, Diethyl Bis (Trimethylsilyl) Ester | 57.993/ 60.049 | 296 | 0.721/ 1.033 | $C_{10}H_{28}O_4Si_3$ | 3555-45-1 |  | Antibacterial activity | 9 |
| 2,4,6-Cycloheptatrien-1, 3,5-Bis-Trimethylsilyl | 57.993/ 60.049 | 250 | 0.721/ 1.033 | $C_{13}H_{22}OSi_2$ | 900161-21-8 |  | Antioxidant activity | 10 |
| Cyclotetrasiloxane, Octamethyl | 57.993/ 60.049 | 296 | 0.721/ 1.033 | $C_8H_{24}O_4Si_4$ | 556-67-2 |  | Anti-microbial, antiseptic, hair conditioning agent, skin conditioning agent- emollient | 11 |
| Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-Hexadec | 57.993/ 60.049 | 578 | 0.721/ 1.033 | $C_{16}H_{50}0_7Si_8$ | 19095-24-0 |  | Anti-microbial | 12, 13,14 |
| 1,2-Benzisothiazol-3-Amine TBDMS | 57.993/ 60.049 | 264 | 0.721/ 1.033 | $C_7H_6N_2S$ | 900332-57-2 |  | | |
| 1,2-Bis (Trimethylsilyl) Benzene | 57.993/ 60.049 | 222 | 0.721/ 1.033 | $C_6H_{18}0_3Si_3$ | 17151-09-6 |  | | |
| Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-Dodecamethyl | 57.993/ 60.049 | 430 | 0.721/ 1.033 | $C_{12}H_{36}O_5Si_6$ | 995-82-4 |  | Anti-microbial, antibacterial, anti-septic, hair conditioning agent, emollient | 15,16,11 |
| Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13 - Tetradecam | 57.993/ 60.049 | 504 | 0.721/ 1.033 | $C_{14}H_{44}$ | 19095-23-9 |  | | |
| Tetrasiloxane, Decamethyl | 57.993/ 60.049 | 310 | 0.721/ 1.033 | $C_{10}H_{30}O_3Si_4$ | 141-62-8 |  | | |
| Methyl Tris (Trimethylsiloxy) Silane | 57.993/ 60.049 | 310 | 0.721/ 1.033 | $C_{10}H_{30}O_3Si_4$ | 17928-28-8 |  | | |

**TABLE 5: COMPOUNDS IDENTIFIED FROM ETHYL ACETATE + ETHANOL EXTRACTS OF LEAVES OF *D. SCABRELLA* (DLEA+E)**

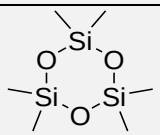
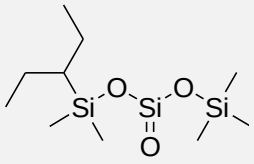
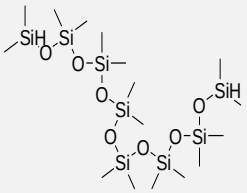
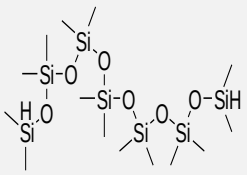
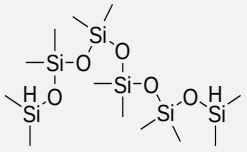
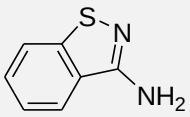
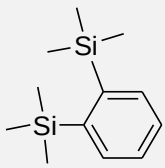
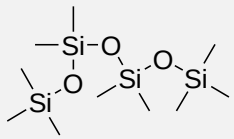
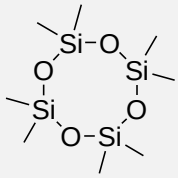
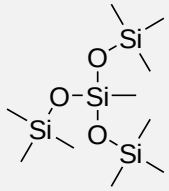
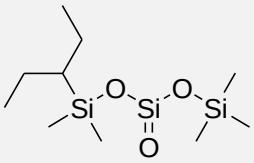
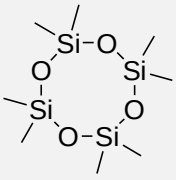
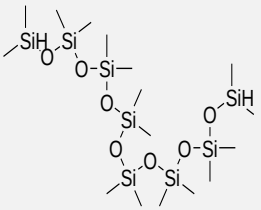
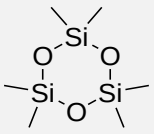
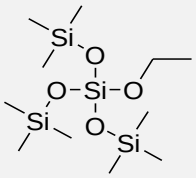
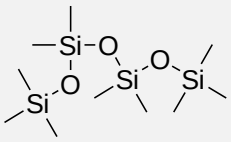
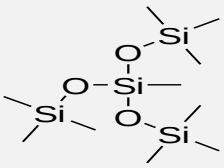
| Name of the compound | RT | M.W | Peak area % | Molecular formula | CAS | Structure | Biological activity | References |
|---|---|---|---|---|---|---|---|---|
| Cyclotrisiloxane, Hexamethyl | 59.669/ 60.004 | 222 | 0.616/ 0.791 | $C_6H_{18}O_3Si_3$ | 541-05-9 |  | Antibacterial activity, antioxidant | 8,9 |
| Silicic acid, Diethyl Bis (Trimethylsilyl) Ester | 59.669/ 60.004 | 296 | 0.616/ 0.791 | $C_{10}H_{28}0_4Si_3$ | 3555-45-1 |  | Antibacterial activity | 9 |
| Octasiloxane, 1,1,3,3,5,5,7,7,9,9, 11,11,13,13,15,15-Hexadec | 59.669/ 60.004 | 578 | 0.616/ 0.791 | $C_{16}H_{50}0_7Si_8$ | 19095-24-0 |  | Antimicrobial | 12,13,14 |
| Heptasiloxane, 1,1,3,3,5,5,7,7,9,9, 11,11,13,13-Tetradecam | 59.669/ 60.004 | 504 | 0.616/ 0.791 | $C_{14}H_{44}$ | 19095-23-9 |  | | |
| Hexasiloxane, 1,1,3,3,5,5,7,7,9,9, 11,11-Dodecamethyl | 59.669/ 60.004 | 430 | 0.616/ 0.791 | $C_{12}H_{36}O_5Si_6$ | 995-82-4 |  | Antimicrobial, antibacterial, antiseptic, hair conditioning agent, emollient | 15,16,11 |
| 1,2-Benzisothiazol-3-Amine TBDMS | 59.669/ 60.004 | 264 | 0.616/ 0.791 | $C_7H_6N_2S$ | 900332-57-2 |  | | |
| 1, 2-Bis (Trimethylsilyl) Benzene | 59.669/ 60.004 | 222 | 0.616/ 0.791 | $C_{12}H_{22}Si_2$ | 17151-09-6 |  | | |
| Tetrasiloxane, Decamethyl | 59.669/ 60.004 | 310 | 0.616/ 0.791 | $C_{10}H_{30}O_3Si_4$ | 141-62-8 |  | | |
| Cyclotetrasiloxane, Octamethyl | 59.669/ 60.004 | 296 | 0.616/ 0.791 | $C_8H_{24}O_4Si_4$ | 556-67-2 |  | Antimicrobial, antiseptic, hair conditioning agent, skin conditioning agent-emollient | 11 |
| Methyl Tris (Trimethylsiloxy) Silane | 59.669/ 60.004 | 310 | 0.616/ 0.791 | $C_{10}H_{30}O_3Si_4$ | 17928-28-8 |  | | |

**TABLE 6: COMPOUNDS IDENTIFIED OF METHANOL EXTRACTS OF BARK OF *D. SCABRELLA* (DBM)**

| Name of the compound | RT | M.W | Peak area % | Molecular formula | CAS | Structure | Biological activity | References |
|---|---|---|---|---|---|---|---|---|
| Silicic acid, Diethyl Bis (Trimethylsilyl) Ester | 55.007 | 296 | 0.762 | $C_{10}H_{28}O_4Si_3$ | 3555-45-1 |  | Antibacterial activity | 9 |
| Cyclotetrasiloxane, Octamethyl | 55.007 | 296 | 0.762 | $C_8H_{24}O_4Si_3$ | 556-67-2 |  | Antimicrobial, antiseptic, hair conditioning agent, skin conditioning agent-emollient | 11 |
| Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-Hexadec | 55.007 | 578 | 0.762 | $C_{16}H_{50}O_7Si_8$ | 19095-24-0 |  | Antimicrobial | 12,13,14 |
| Cyclotrisiloxane, Hexamethyl | 55.007 | 222 | 0.762 | $C_6H_{18}O_3Si_3$ | 19095-23-9 |  | Antibacterial activity, antioxidant | 8,9 |
| 3-Ethoxy-1,1,1,5,5,5-HexamethyL-3-(Trimethylsiloxy) Tri | 55.007 | 340 | 0.762 | $C_{11}H_{32}O_4Si_4$ | 18030-67-6 |  | | |
| Tetrasiloxane, Decamethyl | 55.007 | 310 | 0.762 | $C_{10}H_{30}O_3Si_4$ | 141-62-8 |  | | |
| 1,2-Bis (Trimethylsilyl) Benzene | 55.007 | 222 | 0.762 | $C_{12}H_{22}Si_2$ | 17151-09-6 |  | | |

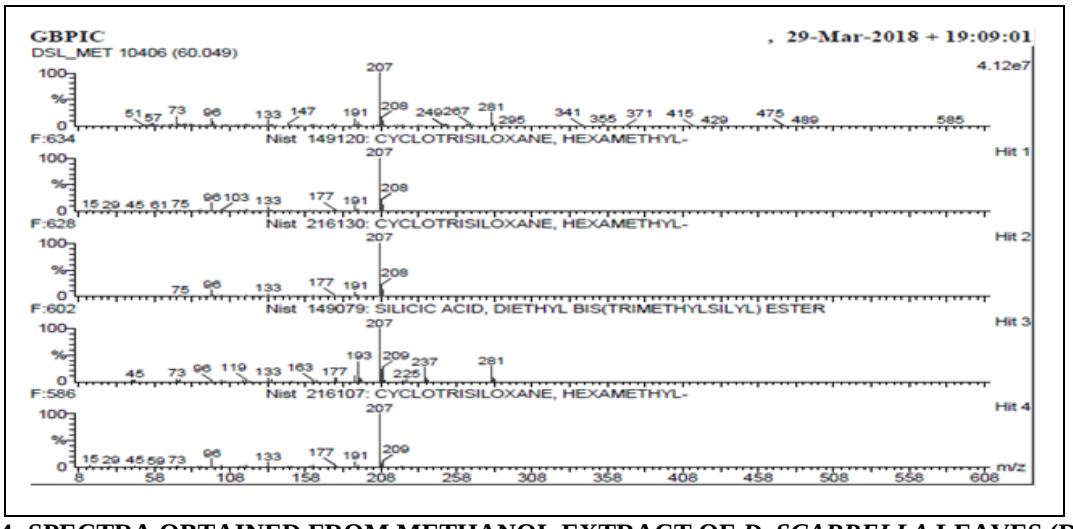
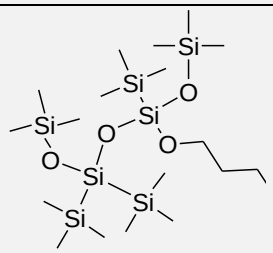
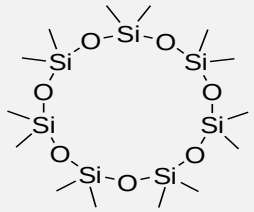
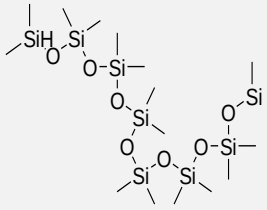
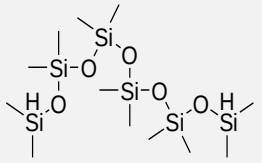
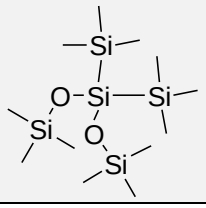



**FIG. 4: SPECTRA OBTAINED FROM METHANOL EXTRACT OF *D. SCABRELLA* LEAVES (DLM)**

**TABLE 7: COMPOUNDS IDENTIFIED FROM ETHYL ACETATE + ETHANOL EXTRACT OF BARK (DBEA+E)**

| Name of the compound | RT | M.W | Peak area % | Molecular formula | CAS | Structure | Biological activity | Reference |
|---|---|---|---|---|---|---|---|---|
| 3-Butoxy-1,1,1,7,7,7-Hexamethyl-3,5,5-Tris Trimethylsilyl | 27.216 | 590 | 7.686 | $C_{19}H_{54}O_7Si_7$ | 72439-84-0 |  | | |
| 3-Isopropoxy-1,1,1,7,7,7-HexamethyL-3,5,5-Tris Trimethyl | 27.216 | 576 | 7.686 | $C_{18}H_{52}O_7Si_7$ | 71579-69-6 | | | |
| Cycloheptasiloxane, Tetradecamethyl | 27.216 | 518 | 7.686 | $C_{14}H_{42}O_7Si_7$ | 107-50-6 |  | | |
| Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-Hexadec | 27.216 | 578 | 7.616 | $C_{16}H_{50}O_7Si_8$ | 19095-24-0 |  | Antimicrobial | 12,13, 14 |
| Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-Dodecamethyl | 27.216 | 430 | 7.616 | $C_{12}H_{38}O_5Si_6$ | 995-82-4 |  | Antimicrobial, antibacterial, antiseptic, hair conditioning agent, emollient | 15,16, 11 |
| Trisiloxane, 1,1,1,5,5,5-Hexamethyl-3,3-Bis Trimethylsilyl | 27.216 | 384 | 7.616 | $C_{12}H_{36}O_4Si_5$ | 3555-47-3 |  | Antioxidant activity | 17 |

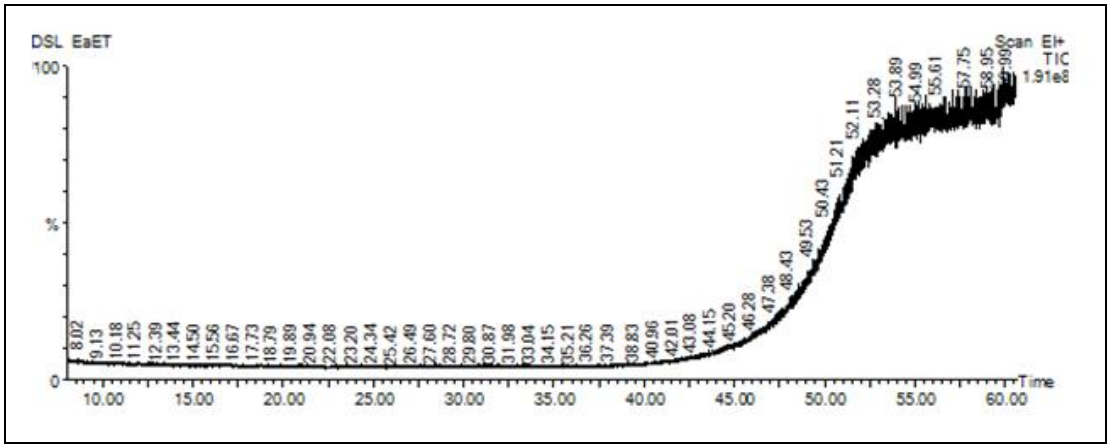



**FIG. 5: A CHROMATOGRAM OF THE BIOACTIVE COMPOUNDS PRESENT IN ETHYL ACETATE + ETHANOL LEAVES EXTRACT (DLEA+E)**

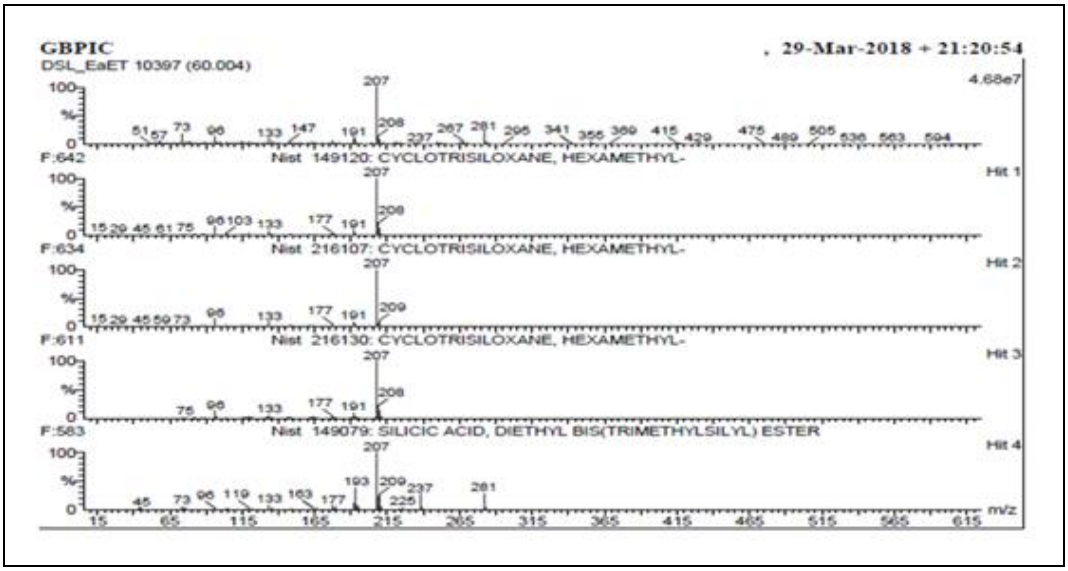



**FIG. 6: SPECTRA OBTAINED FROM ETHYL ACETATE + ETHANOL EXTRACT OF LEAVES (DLEA+E**

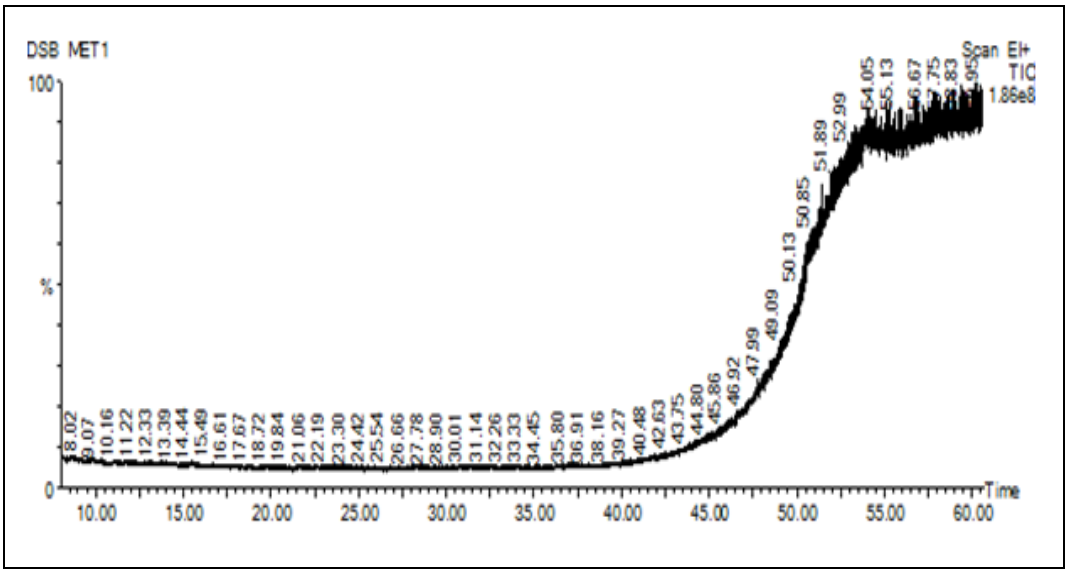



**FIG. 7: A CHROMATOGRAM OF THE BIOACTIVE COMPOUNDS PRESENT IN METHANOL EXTRACT OF BARK (DBM)**

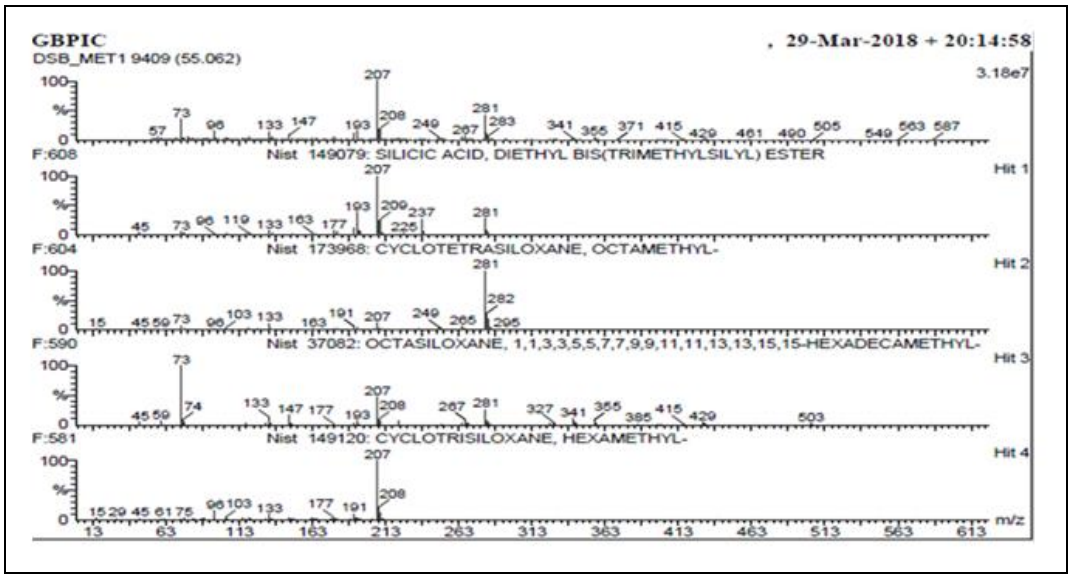



**FIG. 8: SPECTRA OBTAINED FROM METHANOL EXTRACT OF *D. SCABRELLA* BARK (DBM)**

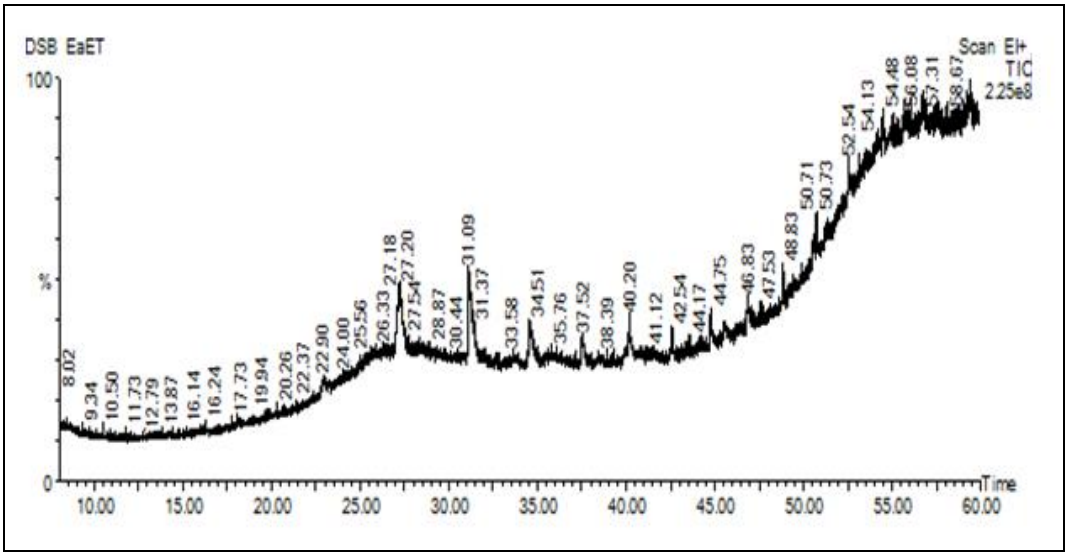



**FIG. 9: A CHROMATOGRAM OF THE BIOACTIVE COMPOUNDS PRESENT IN ETHYL ACETATE + ETHANOL EXTRACT OF BARK (DBEA+E)**

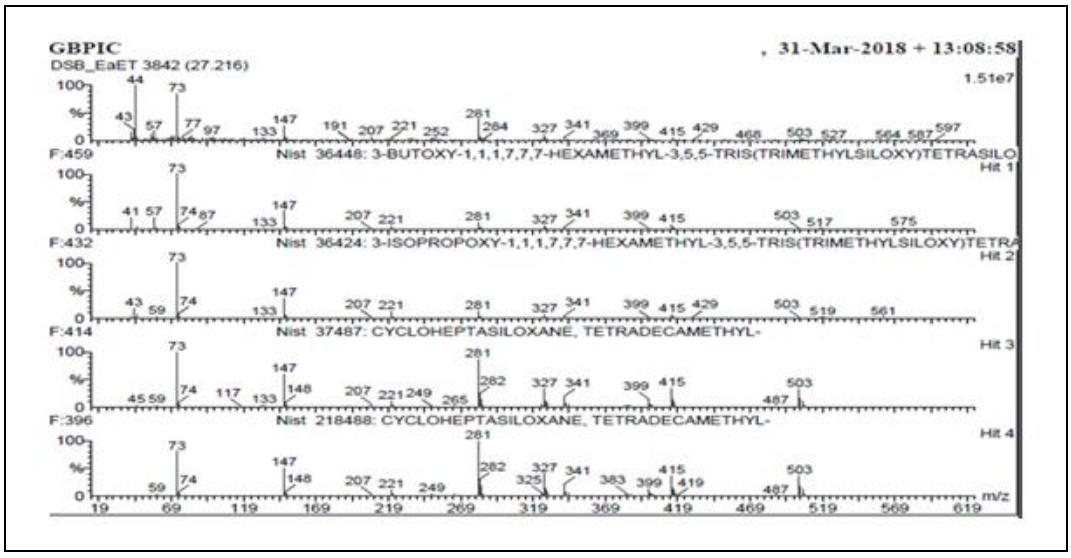



**FIG. 10: SPECTRA OBTAINED FROM ETHYL ACETATE+ETHANOL EXTRACT OF *D. SCABRELLA* BARK (DBEA+E)**

**DISCUSSION:** *D. scabrella* is a novel plant material to the research community. The present study shows the efficiency of the leaves and barks in reducing the free radical power of DPPH. The DPPH assay of two extracts of leaf and two extracts of bark showed a significant free radical scavenging activity. *D. scabrella* leaf and bark methanol extract (DLM, DBM) showed 93% inhibition (of DPPH free radicals at concentration 500 µg/ml as compared to ascorbic acid which showed 92.5% inhibition **Table 3** The combined ethyl acetate and ethanol extract of leaf and bark also showed considerable free radical scavenging activity with 79% and 83.23% inhibition of free radical at 500 µg/ml. The result is corresponding with the research reported in *D. indica* [7]. The antioxidant molecules of *D. indica* contribute an active role in the reported anti-leukemic activity [18]. The present result on the free radical scavenging property of *D. scabrella* is very promising for their antioxidant molecules which were higher than standard ascorbic acid. The phytochemical screening of the extracts displayed **Table 2** the presence of alkaloids, saponins, phenolics, gums, flavonoids, steroids, tannins and carbohydrates. However, the above-mentioned phytochemicals were not present in all 6 extracts homogenously except phenolics which were present invariably. Phenolics were present intensely in DLM, DLEA+E and DBM and this result is analogous to the consistent free radical scavenging property they exhibited. This study present phenolics might be providing the antioxidant property.

The GC–MS analysis of four extracts (DLM, DLEA+E, DBM, DBEA+E) *D. scabrella* leaves and bark revealed the presence of 16 compounds and some of them are repeatedly present in various extracts, therefore, the total compounds analyzed from all extracts is 34. The structural identity is elucidated with molecular formula **Table 4-7**. 6 compounds were present in all three extracts (DLM, DLEA+E, DBM). Octasiloxane, 1, 1, 3, 3, 5, 5, 7, 7, 9, 9, 11, 11, 13, 13, 15, 15-hexadec was present in all four extracts. The leaf extracts (DLM, DLEA+E) have shown a maximum number of compounds (11) as compared to bark. 2, 4, 6-cycloheptatrien-1, 3, 5-bis- trimethylsilyl is present only in methanol leaf extract remaining 10 compounds were common in both leaf extracts. The extracts of bark (DBM, DBEA+E) have revealed 5 compounds that were absent in the leaf.

Out of 16 compounds detected in GC-MS 7 are reported by various researchers for biological activities **Table 4-7**. The reported seven compounds possessing biological activities like antioxidant, antibacterial, antiseptic and antimicrobial. The three compounds namely cyclotrisiloxane hexamethyl, 2, 4, 6-cycloheptatrien- 1, 3, 5- bis- trimethylsilyl, trisiloxane- 1, 1, 1, 5, 5, 5-hexamethyl-3, 3-Bis trimethylsilyl are identified as compounds responsible for the above mentioned antioxidant property. 9 compounds are not reported so far for any biological activity from any natural products. cyclotrisiloxane hexamethyl, which was detected in all three extracts (DLM, DLEA+E and DBM) holding high antioxidant properties. The 2, 4, 6-cycloheptatrien-1, 3, 5-bis-trimethylsilyl was only present in leaf methanol extract (DLM). Trisiloxane- 1, 1, 1, 5, 5, 5-hexamethyl-3, 3-bis trimethylsilyl was present in combined ethyl acetate and ethanol extract (DBEA+E) of bark.

**CONCLUSION:** In conclusion, *D. scabrellais* a good antioxidant source which may be due to the presence of above mentioned antioxidant compounds. Identification of these compounds in the plant serves as the basis in determining the possible health benefits of the plant leading to further biologic and pharmacologic studies.

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**CONFLICTS OF INTEREST:** We declare that we have no conflict of interest

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