ABSTRACT

**Aim:** The present study was carried out to evaluate the phytochemical composition and anticancer activities of leaf extract of *Aerides odorata* Lour., a widely distributed epiphytic herb found in the Eastern Ghats of Vizianagaram district.

**Methodology:** The solvents like n-hexane, ethyl acetate and methanol were used to extract dried leaf material of *A. odorata*. These extracts were analysed for phytochemical constituents by GC-MS analysis and *in vitro* anticancer activity was done against two cancer cell lines (*MCF-7* and *HeLa* cell line) by using MTT assay.

**Results:** Preliminary phytochemical analysis revealed the presence of alkaloids, coumarins, flavonoids, glycosides, phenols, and terpenoids. GC-MS analysis determines presence of 15 compounds in ethyl acetate and 14 compounds in methanol extracts respectively. Among two extracts a total 13 compounds have anticancer activity. Both the solvent extracts exhibit...
significant cancer cell growth inhibition with IC₅₀ value ranging between 26.211 µg/mL to 59.061 µg/mL.

**Conclusion:** Methanol about the best solvent and its activity. Our result showed A. odorata is a promising source of anticancer drugs.

**Keywords:** GC-MS analysis; anticancer; Aerides odorata.

### 1. INTRODUCTION

Orchids are one of the beautiful flowering plants and they are highly confined to ornamentation. In addition to ornamental, orchids have medicinal value in folklore and traditional systems [1,2]. Current ethnobotanical studies on orchids indicate that orchids have immense potential in the treatment of various diseases [3,4] and Chinese first described medicinal uses of orchids [5]. India is a harbour of orchids with 1331 species and 186 genera [6]. Among them 33 genera belonging to 66 species were distributed mainly in the hilly areas of Andhra Pradesh. About 10 species of orchids have been used ethnobotanically by tribals in different regions of Andhra Pradesh to treat various diseases [7,8]. A. odorata is widely distributed epiphytic herb found in the Eastern Ghats of Vizianagaram district. Ethnobotanically A. odorata used to treat various diseases such as chest pain and stomach disorder, skin disorders, tuberculosis, cuts and wounds, boils in ears and nose, pneumonia, inflammations etc. in various regions [2,9,10,11,12,13]. Many pharmacological activities of these ethnomedicinal plants are due to natural phytochemical composition. Phytochemical analysis of A. odorata may leads to explore of new bioactive compounds. Hence, the present study was carried out to determine the phytochemical analysis and anticancer efficiency of A. odorata leaf extracts.

### 2. METHODOLOGY

In present study fresh leaves of A. odorata were collected from Vizianagaram District, Andhra Pradesh. Plant was authenticated with voucher number of ANUBH01211 and preserved at the herbarium of department of Botany, Acharya Nagarjuna University, Guntur. The fresh healthy leaves of A. odorata were air-dried under shade at room temperature for fifteen days. The dried material pulverized into a coarse powder by means of electrical grinder. The dried leaf powder of (250g) was extracted with Soxhlet apparatus with n-hexane, ethyl acetate and methanol solvents for about 12-15hr at room temperature of 35-40°C. Finally, crude extracts of different solvents were concentrated in a vacuum rotary evaporator (Buchi Labortech Ag, model I, R-215) under reduced pressure. The concentrates of various solvent extracts were kept in the refrigerator at 4°C until use.

#### 2.1 Preliminary Phytochemical Screening

The dried extract of various solvents hexane, chloroform, ethyl acetate and methanol were preliminary screened by using standard procedures/tests [14,15,16,17].

#### 2.2 GC-MS Analysis

The GC-MS analysis of methanol and ethyl acetate solvent extracts was injected to Agilent 7890 A, GC system coupled with MS 5975. The operating conditions of GC-MS set for analysis were as follows: oven temperature was programmed from 50-150°C at 3°C/min s. An aliquot of 2 µL of the sample was injected and the carrier of inert helium gas at a constant flow rate of 1mL/1 min. The electron ionization of sample components was carried out with ionization energy 70eV. The total running time was 55.3 minutes. National Institute of Standard and Technology (NIST) Data Base Library 2.0 version searched to compare structure of the compounds. Compounds were identified based on the retention times and mass spectra of NIST library. The name, molecular weight and structure of the components of the test materials were ascertained.

#### 2.3 Anticancer Activity by MTT Assay

The two solvent extracts (Ethyl acetate and Methanol) were tested for in vitro cytotoxicity using MCF-7 and HeLa cell lines by MTT (3, 4 5-Dimethylthiazol-2-yl)-2, 5-Diphenyltetrazolium Bromide) assay. 100 mL of diluted leaf extract was added to 100 mL of media followed by the addition of cell lines (6X10⁵) into 96 well micro-titer and incubated overnight at 37°C for 48 hrs. MTT was added after the incubation, precipitates were formed as a result of the reduction of the MTT salt to chromophore formazan crystals by the cells with metabolically active mitochondria. The optical density was measured at 570 nm on a microplate reader. Dose response curve was used to calculate IC₅₀ dose values [18].
3. RESULTS

3.1 Phytochemical Analysis

Preliminary phytochemical screening of the different solvent extracts like hexane, ethyl acetate and methanol extract of leaves in *A. odorata* revealed the presence of various secondary metabolites such as alkaloids, coumarins, flavonoids, glycosides, phenols, steroids and terpenoids (Table 1). Gas chromatography and mass spectroscopy is an important technological tool used to identify phytocompounds in plant species [19,20]. GC-MS analysis carried out based on the results of preliminary phytochemical analysis. Methanolic and ethyl acetate extracts of *A. odorata* used for the identification of bioactive compounds. GC-MS analysis of ethyl acetate leaf fraction of *A. odorata* revealed the presence of 12 bioactive compounds and 6 unknown compounds as shown in Table 2; Fig. 1. From the results of GC-MS spectra compounds found in the ethyl acetate extract are 2-Methyl-5-(1,2,2-Trimethylcyclopentyl)phenol (Fig. 2A), 1,3-Propanediol (Fig. 2B), 1,2,3-Propanetriol, 1-acetate (Fig. 2C), Butanamide (Fig. 2D), Phenyl(piperidin-3-yl)methanone (Fig. 2E), 4-Methyl-2-pentadecyl-1,3-dioxane (Fig. 2F), 3,7,11,15-Tetramethyl-2-hexadecen-1-ol (Fig. 2G), ß-Selinene (Fig. 2H), Longipinocarvone (Fig. 2I), (E)-5-Methylundec-4-ene (Fig. 2J), Methyl heptadecanoate (Fig. 2K), Hexadecan-1-ol (Fig. 2L), Methyl 14-methylpentadecanoate (Fig. 2M), 2-O-(2-Ethylhexyl) 1-O-pentadecyl oxalate (Fig. 2N), Squalene (Fig. 2O), and three unidentified compounds.

The methanol crude extracts isolated from the leaves of *A. odorata* analyzed by using GC-MS had led to the identification of 14 different organic compounds and 4 unidentified compounds shown in Table 3; Fig. 3. The compounds in the methanol extract are 2-Naphthalenemethanol, 1,2,3,4,4a,5,6,7-octahydro-a,α,4a,8-tetramethyl - (Fig. 4A), (2R-cis), 2-Propan-1-ol, -3(2,6,6-trimethyl-1-cyclohexen-1-yl) (Fig. 4B), 4-Methyl-2-pentadecyl-1,3-dioxane (Fig. 4C), Methyl (2E) - 3-phenyl -2-propeonate (Fig. 4D), 1,2,3-Propanetriol, diacetate (Fig. 4E), 5-Ethyl-2-methyl-2,3-dihydrofuran (Fig. 4F), cis-11-Eicosenoic acid (Fig. 4G), Ethyl α-D-glucopyranoside (Fig. 4H), 6-Isopropyl-3-methyl-1-cyclohex-2-enone (Fig. 4I), 3,7,11-Trimethyl-1,6,10-dodecatrien-3-ol (Fig. 4J), Erucic acid (Fig. 4K), (9Z,12Z)-Octadeca-9,12-dienoyl chloride (Fig. 4L), (2E,6E)-3,7,11-trimethyldeca-2,6,10-trien-1-ol (Fig. 4M) and 9,12,15-Octadecatrienoic acid, methyl ester (Fig. 4N).

3.2 Anticancer Activity

Anticancer activity The MTT assay for cytotoxicity of ethyl acetate and methanol extracts of *A. odorata* was carried out at five different concentrations of 5, 10, 25, 50, 75 and 100 μg/mL on two different cell lines MCF-7 and HELa (Plates 1 and 2; Plates 3 and 4). The results of the cytotoxicity of *A. odorata* two solvent extracts on both the cell lines are shown in Tables 4, 5. The data suggest that the methanolic leaf extract of *A. odorata* showed more cytotoxicity as compared to the ethyl acetate extract on MCF-7 cell lines. The ethyl acetate extract of the *A. odorata* at the concentration 100 μg/mL showed the highest growth inhibition 61.128% on MCF-7 cell lines as compared to the methanol extract having 60.69%. The recorded IC50 (50% of growth inhibition) value for methanol extract was 26.211μg/mL and 41.094μg/mL in ethyl acetate extracts. It indicates that the methanol extract exhibit significant cytotoxicity effect on MCF-7 cell lines.

Table 1. Preliminary phytochemical screening of leaf extracts of *A. odorata*

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Phytochemicals</th>
<th>Test name</th>
<th>Hexane</th>
<th>Ethyl acetate</th>
<th>Methanol</th>
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<tr>
<td>1</td>
<td>Alkaloids</td>
<td>Dragendorff’s test</td>
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<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Coumarins</td>
<td>Sodium hydroxide test</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Flavonoids</td>
<td>Ferric chloride test</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>Glycosides</td>
<td>Anthrone test</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Phenolic compounds</td>
<td>Phenol test</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Quinones</td>
<td>H2SO4 test</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>Resins</td>
<td>Acetone H2O test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Saponins</td>
<td>Foam test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Tannins</td>
<td>Braemer’s test</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Steroids</td>
<td>Salkowski test</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Terpenoids</td>
<td>Salkowski test</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

(+): Positive (present); (-): Negative (absent)
<table>
<thead>
<tr>
<th>Sl. no</th>
<th>R.T (min)</th>
<th>Name of the compound</th>
<th>Molecular formula</th>
<th>Molecular Mass (gm/mol)</th>
<th>Peak area %</th>
<th>Biological activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.0167</td>
<td>2-Methyl-5-(1,2,2-Trimethycyclopentyl)phenol</td>
<td>C_{15}H_{25}O</td>
<td>218.34</td>
<td>0.56</td>
<td>Anticancer [21]</td>
</tr>
<tr>
<td>2</td>
<td>4.5167</td>
<td>1,3-Propanediol</td>
<td>C_{3}H_{8}O_{2}</td>
<td>76.095</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>5.8</td>
<td>1,2,3-Propanetriol, 1-acetate</td>
<td>C_{3}H_{10}O_{4}</td>
<td>134.131</td>
<td>1.74</td>
<td>Antibacterial [22]</td>
</tr>
<tr>
<td>4</td>
<td>6.1167</td>
<td>Butanamide</td>
<td>C_{4}H_{9}NO</td>
<td>87.122</td>
<td>6.58</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>9.2667</td>
<td>Pheny1(piperidin-3-yl)methanone</td>
<td>C_{12}H_{15}NO</td>
<td>189.258</td>
<td>4.76</td>
<td>Anticancer [23]</td>
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<tr>
<td>6</td>
<td>16.65</td>
<td>4-Methyl-2-pentadecyl-1,3-dioxane</td>
<td>C_{20}H_{40}O_{2}</td>
<td>312.538</td>
<td>0.64</td>
<td>Antibacterial and Antifungal [24]</td>
</tr>
<tr>
<td>7</td>
<td>19.99</td>
<td>3,7,11,15-Tetramethyl-2-hexadecen-1-ol (Phytol)</td>
<td>C_{20}H_{40}O</td>
<td>296.539</td>
<td>2.72</td>
<td>Anticancer [25], antihelmintic and anti-inflammatory [26]</td>
</tr>
<tr>
<td>8</td>
<td>20.0333</td>
<td>β-Selinene</td>
<td>C_{15}H_{24}</td>
<td>204.357</td>
<td>6.93</td>
<td>Antioxidant and anti-inflammatory [27]</td>
</tr>
<tr>
<td>9</td>
<td>22.9833</td>
<td>Longipinocarvone</td>
<td>C_{15}H_{22}O</td>
<td>218.34</td>
<td>2.03</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>31.2167</td>
<td>(E)-5-Methylundec-4-ene</td>
<td>C_{12}H_{24}</td>
<td>168.324</td>
<td>1.69</td>
<td>Anticancer and Antitumor [26]</td>
</tr>
<tr>
<td>11</td>
<td>41.4167</td>
<td>Methyl heptadecanoate</td>
<td>C_{18}H_{38}O_{2}</td>
<td>284.484</td>
<td>2.8</td>
<td>Catechol-O-Methyl-Transferase Inhibitor [26]</td>
</tr>
<tr>
<td>12</td>
<td>41.5003</td>
<td>Hexadecan-1-ol 1-</td>
<td>C_{16}H_{34}O</td>
<td>242.447</td>
<td>14.72</td>
<td>Skin diseases [28]</td>
</tr>
<tr>
<td>13</td>
<td>47.9833</td>
<td>Methyl 14-methylpentadecanoate</td>
<td>C_{17}H_{34}O_{2}</td>
<td>270.457</td>
<td>4.63</td>
<td>Methyl guanidine inhibitor [26]</td>
</tr>
<tr>
<td>14</td>
<td>50.0607</td>
<td>2-O-(2-Ethylhexyl) 1-O-pentadecyl oxalate</td>
<td>C_{25}H_{48}O_{4}</td>
<td>412.655</td>
<td>1.55</td>
<td>Anticancer, Antitumour and Inhibit production of tumour necrosis factor [26]</td>
</tr>
<tr>
<td>15</td>
<td>58.2667</td>
<td>Squalene</td>
<td>C_{30}H_{50}</td>
<td>410.73</td>
<td>2.15</td>
<td>Antibacterial, Antioxidant, pesticide, Antitumour, anti-cancer, preventive, Immunostimulent, Chemo preventive, Lipoxxygenase-inhibitor [29,30]</td>
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<tr>
<td>16</td>
<td>6.58</td>
<td>Unidentified compound 1</td>
<td>-</td>
<td>297.58</td>
<td>10.9500</td>
<td>-</td>
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<tr>
<td>17</td>
<td>4.76</td>
<td>Unidentified compound 2</td>
<td>-</td>
<td>344.08</td>
<td>14.4167</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>14.79</td>
<td>Unidentified compound 3</td>
<td>-</td>
<td>140.46</td>
<td>27.0667</td>
<td>-</td>
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</table>
Table 3. Bioactive compounds present in methanolic extract of *A. odarata* by using GC-MS analysis

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>R.T (min)</th>
<th>Name of the compound</th>
<th>Molecular formula</th>
<th>Molecular Mass (gm/mol)</th>
<th>Peak area %</th>
<th>Biological activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.15</td>
<td>2-Naphthalenemethanol, 1,2,3,4,4a,5,6,7-octahydro-α,α,4a,8-tetramethyl-(2R-cis)-</td>
<td>C₁₅H₂₈O</td>
<td>222.372</td>
<td>6.9167</td>
<td>Antimicrobial [31]</td>
</tr>
<tr>
<td>2</td>
<td>2.41</td>
<td>2-Propen-1-ol, 3-(2,6,6-trimethyl-1-cyclohexen-1-yl)-m-Tolualdehyde</td>
<td>C₁₂H₂₀O</td>
<td>180.291</td>
<td>8.15</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>2.3</td>
<td>Methyl (2E)-3-phenyl-2-propionate</td>
<td>C₁₀H₅DO₂</td>
<td>162.188</td>
<td>15.4833</td>
<td>Anticancer, antitumour and Cytochrome-P450-2E1-Inhibitor [26]</td>
</tr>
<tr>
<td>4</td>
<td>4.44</td>
<td>1,2,3-Propanetriol, diacetate</td>
<td>C₇H₁₂O₅</td>
<td>176.168</td>
<td>22.6667</td>
<td>Cellular narcotic and fragrance agent [32, 33]</td>
</tr>
<tr>
<td>5</td>
<td>4.17</td>
<td>5-Ethyl-2-methyl-2,3-dihydrofuran</td>
<td>C₁₇H₃₄O₂</td>
<td>270.45</td>
<td>12.6667</td>
<td>Methyl guanidine inhibitor [26]</td>
</tr>
<tr>
<td>6</td>
<td>4.77</td>
<td>Ethyl α-D-glucopyranoside</td>
<td>C₈H₁₆O₆</td>
<td>208.21</td>
<td>34.8833</td>
<td>Hepatic and skin moisturizing effect [35]; Anticancer and alcohol dehydrogenase inhibitor [26]</td>
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<tr>
<td>7</td>
<td>4.17</td>
<td>6-Isopropyl-3-methyl-1-cyclohex-2-enone (piperitone)</td>
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<td>152.237</td>
<td>35.3137</td>
<td>Antibacterial [36]</td>
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<td>4.45</td>
<td>3,7,11-Trimethyl-1,6,10-dodecatrien-3-ol (Nerolidol)</td>
<td>C₁₅H₂₈O</td>
<td>222.372</td>
<td>38.75</td>
<td>Antimicrobial, antioxidant, anti-nociceptive, anti-inflammatory and anticancer [37]</td>
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<tr>
<td>9</td>
<td>4.53</td>
<td>Erucic acid (9Z,12Z)-Octadeca-9,12-dienoyl chloride (Linoleyl chloride)</td>
<td>C₂₂H₄₂O₂</td>
<td>338.576</td>
<td>40.4167</td>
<td>Antibacterial [38]</td>
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<td>(9Z,12Z)-Octadeca-9,12-dienoyl chloride (Linoleyl chloride)</td>
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<td>298.895</td>
<td>43.15</td>
<td>Antimicrobial [26]</td>
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<td>11</td>
<td>12.32</td>
<td>9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)</td>
<td>C₁₉H₃₂O₂</td>
<td>292.463</td>
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<td>Antifungal [39]; Anticancer and antitumour [26]</td>
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Table 4. Cytotoxic properties of ethyl acetate extract of A. odorata on MCF-7 and HeLa cell lines

<table>
<thead>
<tr>
<th>Cell line</th>
<th>Concentration (µg/mL)</th>
<th>Absorbance at 570nm</th>
<th>Average</th>
<th>Average-Blank</th>
<th>% Viability</th>
<th>IC50 (µg/mL)</th>
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<tr>
<td>MCF-7</td>
<td>100</td>
<td>0.792</td>
<td>0.794</td>
<td>0.794</td>
<td>0.787</td>
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<td>75</td>
<td>0.889</td>
<td>0.893</td>
<td>0.891</td>
<td>0.884</td>
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<td>HeLa</td>
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<td>0.893</td>
<td>0.893</td>
<td>0.888</td>
<td>46.54</td>
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In the present study growth inhibition of HeLa cell lines increase with a rise in concentration of A. odorata leaf extract. The viability percentage of HeLa cell lines of ethyl acetate and methanol leaf extracts at concentration 100 µg/mL reduced from 100% to 41.92% and 41.29% respectively. The reported IC50 (50% of growth inhibition) value for methanol extract was 52.167µg/mL and 59.061µg/ml in ethyl acetate extracts. Cytotoxic effect of ethyl acetate and methanol leaf extract on MCF-7 and HeLa cell lines were shown in Figs. 5A and 5B; 6A and 6B.

![Fig. 1. GC-MS chromatogram of ethyl acetate leaf extract of A. odorata](image-url)
Fig. 2(A-D). Phytocompounds identified in ethyl acetate leaf extract of *A. odorata*
Fig. 2(E-H). Phytocompounds identified in ethyl acetate leaf extract of A. odorata
Fig. 2(I-L). Phytocompounds identified in ethyl acetate leaf extract of *A. odorata*
Fig. 2(M-O). Phytocompounds identified in ethyl acetate leaf extract of *A. odorata*

Table 5. Cytotoxic properties of methanolic leaf extract of *A. odorata* on MCF-7 and HeLa cell lines

<table>
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<tr>
<th>Cell line</th>
<th>Concentration (μg/mL)</th>
<th>Absorbance at 570 nm</th>
<th>Average</th>
<th>Average-Blank</th>
<th>% Viability</th>
<th>IC&lt;sub&gt;50&lt;/sub&gt; (μg/mL)</th>
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Fig. 3. GC-MS chromatogram of methanol leaf extract of *A. odorata*

Plate 1. Cytotoxic Properties of ethyl acetate extract on *HeLa* Cell Line
Fig. 4(A-D). Phytocompounds identified in Methanol leaf extract of A. odorata
Fig. 4(E-H). Phytocompounds identified in Methanol leaf extract of *A. odorata*
Fig. 4(I-L). Phytocompounds identified in Methanol leaf extract of A. odorata
Fig. 4(M-N). Phytocompounds identified in Methanol leaf extract of *A. odorata*

Plate 2. Cytotoxic Properties of Methanol extract on *HeLa* Cell Line
4. DISCUSSION

The documentary evidences on orchid metabolites and extracts proved their efficiency over number of human ailments [42,43,44,45,46,47,48,49]. They also have a significant role in prevention of cancer and its treatment [50,51,52]. Phytochemical analysis of different organic extracts of A. odorata contains fatty acids, secondary alcohols, diketones, esters and phenols. These secondary metabolites may be for various biological activities of medicinal plants [53,54]. Most of the compounds identified in ethyl acetate and methanol extracts of the plant are biologically active (Tables 2 and 3). In the present study a total of seven phytocompounds in ethyl acetate and six compounds in methanol extracts have anticancer activity. 2-Methyl-5-(1,2,2-Trimethyl cyclopentyl) phenol is also known as Xanthorrhizol. It has biological activities such as anticancer, antimicrobial, anti-inflammatory, antioxidant and anti hypertensive [21]. 3,7,11,15-Tetramethyl-2-hexadecen-1-ol (phytol) is an unsaturated acyclic diterpenoid alkene alcohol and act as precursor of vitamin E. This compound has acute oral cytotoxicity LD50 in rats > 5 g/kg [55]. 9,12,15-octadecatrienoic acid methyl ester is an unsaturated fatty acid ester which has been shown to possess anticancer, hypcholesterolemic, antimicrobial and antioxidant activities [40,41]. Apart from this other compounds reported in the present study such as Phenyl(piperidin-3-yl) methanone, β-Selinene, (E)-5-Methyldodec-4-ene, 2-O-(2-Ethylexyl) 1-O-pentadecyl oxalate, Squalene, m-Toluylaldehyde, Methylene (2E) - 3-phenyl - 2-propeonate, Ethyl α-D-glucopyranoside, 3,7,11-Trimethyl-1,6,10-dodecatrien-3-ol, (2E,6E)-3,7,11-trimethyldecene-2,6,10-trien-1-ol also posses anticancer properties. Squalene acts as a defence agent against certain pathogens causing human and animal diseases along with its anticancer activity [56].
Plate 3. Cytotoxic Properties of ethyl acetate extract on MCF-7 Cell Line

Plate 4. Cytotoxic Properties of Methanol extract on MCF-7 Cell Line
Some compounds like 1,3 propanediol has a wide range of applications. It is used as adhesive, lubricant, antifreeze and medicine [57, 58,59,60]. Hexadecan-1-ol is a fatty alcohol more commonly used as an emulsifier agent in skin creams and lotions [28]. Longipinocarvone is sesquiterpenes compound, and also reported in essential oil of *Boswellia dalzielii* leaves [61]. The results of anticancer study reveal a death rate of MCF-7 and HeLa cell lines increase with a rise in concentration of *A. odorata* leaf extract. IC₅₀ value is greater than 1000µg/mL in crude plant extract is non toxic, while toxic if it is less than 1000 µg/mL [62]. The lowest IC₅₀ value 26.211µg/mL observed for methanolic leaf extract on MCF-7 cell lines. It indicates that the methanol extract shows significant inhibitory effect. The present results in agreement with previous reports of anticancer studies on orchids [63,64]. Hence, the findings of this study proved that leaf extract of *A. odorata* have anticancer effect and this species could be acts good source to develop anticancer drugs.

5. CONCLUSION

Phytochemical analysis of epiphytic orchid *A. odorata* confirmed the presence of bioactive compounds. The ethyl acetate and methanol solvent extracts has proved in vitro anticancer activity on MCF-7 and HeLa cell lines. Many of the compounds reported have anticancer properties. Hence, solvent extracts of this plant act as good source of anticancer drugs.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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55. Opdyke DLJ, Letizia C. Fragrance raw materials monographs, Food and Chemical Toxicology. 1982;20(6):637-852. ISSN: 0278-6915. doi.org/10.1016/S0015-7628(82)80217-4


