ABSTRACT
India is a rich source of Mangroves as it surrounded by Arabian Sea to Southwest, Bay of Bengal to Southeast and Indian Ocean to South. The methanolic extracts of outer bark of mangrove Aegiceras corniculatum (Fam. Primulaceae), was screened by GC-MS method. It was revealed that out of ten bioactive compounds, five are in higher concentration namely 7-Tridecanone, Glycerin, 2 Heptanone-3 methyl alpha-L-Galactopyranoside, methyl 6-deoxy- and 1,6-Anhydro-beta-D-glucopyranase (levoglucosan) while 2-Furan carboxaldehyde, 5 methyl, 4H-Pyran-4 –one, n-Hexadecanoic acid, Benzene, (2,2-dimethoxyethyl), Hexadecanoic acid methyl ester are found in lower concentrations. The antimicrobial properties of these secondary metabolites from other extracts have also been reported. The presence of these compounds in the methanol extracts could be used as antifungal, antibacterial and antioxidant agents. This mangrove can be used as wide range of bioresources that have rich source of photochemical.

Keywords: Aegiceras Corniculatum, Antimicrobial, Bark, GC-MS, Mangroves

INTRODUCTION
Mangroves are plants having salt-tolerant capacity. They are found in both tropical and subtropical intertidal regions of the world. The regions where these plants dominated named as ‘mangrove ecosystem’. Mangrove forest shows a tidal wetland tropical forest ecosystem with a very special association of flora and fauna that live in the intertidal zones. Mangroves are rich sources of variety of bioactive compounds.
Kokpol et al., (1990) and Bandaranayake (2002) observed that Mangroves have been used in folklore medicines and extracts displays well-known activities against human, animal and plant pathogens. Secondary metabolites like alkaloids, phenolics, steroids and terpenoids have been characterized from mangroves which have toxicological, pharmacological and ecological importance. Indian coastline is about 5,700 km long among them Maharashtra measures 840 kilometers in Arabian Sea commonly known as Konkan. Konkan is widely distributed by six districts namely, Thane, Greater Mumbai, Navi Mumbai, Raigad, Ratnagiri and Sindhudurg. Ratnagiri is a rich vegetation of mangrove Aegiceras corniculatum commonly known as black mangrove find in large scale in estuaries of Ratnagiri and Sindhudurg region (Jagtial et al., 1994; Bhosale, 2005) traditionally used for rheumatism, arthritis, inflammatory, diabetes and hepatoprotective actions (Roome et al., 2008). Therefore, present study was under takes to find out phytochemical compounds in the bark of stem of Mangrove Aegiceras corniculatum.

MATERIALS AND METHODS
Collection of Sample
The bark samples of mangroves of Aegiceras corniculatum from Family Primulaceae was collected from estuaries of Ratnagiri Districts in the month of December.
Preparation of Powder and Extract
Stem bark was shade dried, powdered and extracted with Methanol for 6-8 hours using Soxhlet apparatus. The extract was then filtered through muslin cloth, evaporated dried to get the viscous residue. The methanolic extracts of the plant was used for GC-MS analysis. 1µl of the methanolic bark extract of stem
was employed for GCMS analysis. The analysis of Mass spectra was done by retention time (RT) and library search of National Institute of Standards and Technology (NIST).

RESULTS AND DISCUSSION

The mass spectra of Aegiceras corniculatum exhibits ten important peaks out of which four peaks were having larger percent area (Table 1 and Figure 1) with 7-Tridecanone, Glycerine, 2-Heptonone-3 methyl, and α-L-Galactopyranoside methyl 6-deoxy- metabolites showing percent area 37.26%, 11.82%, 10.09% and 9.68% respectively. There are six peaks shows lower percent area 1,6-Anhydro-beta-D-glucopyranose (levoglucosan), 2-Furan carboxaldehyde, 5 methyl, 4H-Pyran-4 – one, n-Hexadecanoic acid, Benzene, (2,2-dimethoxyethyl) and Hexadecanoic acid methyl ester with percent area 8.33, 6.98, 5.51, 4.92, 3.42 and 2.00 respectively.

The various phytochemicals which contributes to the pharmaceutical activity of the plant Aegiceras corniculatum showed in Table 2, the phyto-constituents like 2-Furan carboxaldehyde, 5 methyl and 4H-Pyran-4 – one shows antimicrobial and anti-inflammatory potentials, n-Hexadecanoic acid and Hexadecanoic acid methyl ester are known for their Antioxidant, Hypocholesterolemic, Nematicide, Pesticide, Lubricant, Flavor. Glycerin was common to pharmaceutical and cosmetic industry as it used as base material.

Mangrove plants have been used in folklore medicines and extracts from mangrove species have verified activity against human, animal and plant pathogens. Mangroves are the rich sources of variety of bioactive compounds. Mangroves are growing in stress conditions so secondary metabolites like alkaloids, phenolics, steroids and terpenoids have been reported from mangrove and have toxicological, medicinal and biological importance (Bandaranayake, 2002 and Kokpol et al., 1990). Several reports prove that mangroves have antimicrobial properties associated with isothiocyanates (Dornberger et al., 1975 and Iwu et al., 1991), thiosulfimates (Tada et al., 1988) and glycosides (Murakami et al., 1993; Rucker et al., 1992). Polyacetylenes also have special attention due to organic polymer with repeating unit. Estevez-Braun et al., (1994) isolated C17 polyacetylene compounds form Bapleurum salicifolium a plant native to the canary Islands. The compound 8S-Heptadeca-2(z), 9(z) diene-4, 6-diyn-1, 8-diol, was inhibitory to Gram negative bacteria, Staphylococcus aureas and Bacillus subtilis but not to gram positive bacteria and Yeasts.

The mature leaves of A. marina (Abeysinghe and Wanigatunge, 2006) and Aegiceras corniculatum (Poompzhil and Kumarasamy, 2014) contain alkaloids, steroids, triterpenoids and flavonoids. The bark of A. corniculatum is also rich in Polyphenols, flavonoids and tannins (Powar and Gaikwad, 2014).

Phytochemical investigation of Rhizophora stylosa Griff. (Rhizophoraceae) showed one new acetylated flavanol, 3, 7, 0-diacetyl (-) epicatechin (Anjaneyulu et al., 2002).

The bark of A. corniculatum have very good antifungal and antibacterial activities against various strains of fungi, Alternaria alternata and Fusarium moniliforme (Powar et al., 2011) and bacteria, Bacillus megaterium, Staphylococcus aureus, Erwinia carotovora and Xanthomonas citri (Powar et al., 2009). This activity of A. corniculatum might be due to presence of antimicrobial compounds like 2-Furan carboxaldehyde, 5 methyl and 4H-Pyran-4 – one.

The main chemical compounds isolated from the bark of Bauhinia variegata are quercitroside, isoquercitroside, rutoside, myrciyl glycoside and kamferoglycoside (Gupta et al., 1980). Gupta et al., (1978) isolated 5, 7-dihydroxyflavanone 4′-02-1 rhamnopyanosyl-β-D-glucopyranoside (I) from the stem. The stem is rich source of β-sitosterol, lupeol, Kempferol-3-glucoside and 5, 7-dimethyl ether 4′ rhamnoglucoside. The stem barks of Bauhinia variegata yields four substances viz. Hentriacontane, Octacosanol, β-sitosterol and Sigmasterol (Anandaprabhak, 1978). Glycerin in combinations with other phytochemicals dimethicone, petrolatum, antioxidants, fatty acids, lecithin are useful in healing of skin and cures dermatitis (Lorancini et al., 2014).

Phytochemical analysis of the methanolic bark extract of mangrove A. corniculatum revealed that presence of variety of phytoconstituents Glycerine, 2-Furan carboxaldehyde, 5 methyl, 4H-Pyran-4 – one, n-Hexadecanoic acid and Hexadecanoic acid methyl ester. These active chemical constituents have good
Research Article

antimicrobial, anti-inflammatory, antiallergic and antioxidant properties. These secondary metabolites from other plants parts have also been reported earlier. It could be concluded that the presence of these compounds in the methanolic bark extract of *Aegiceras corniculatum* might be contents the antifungal, antioxidant, anti-inflammatory pesticide and nematocidal bioactive phytochemicals. Further study is essential to isolate individual phytochemical constituents and subjecting it to the biological activity will give productive results. This plant may be used as one of the good sources of pharmaceutical industry. This mangrove can be used as wide range of bioresources that have rich source of phytochemicals. Thus, the barks of this plant can be successfully used for the synthesis of anti-inflammatory, antimicrobial, analgesic drugs with further careful investigations and it will also enhances knowledge about use of traditional medicine.

Table 1: Relative Percentage Composition of Bark Extract of Mangrove *Aegiceras Corniculatum*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Retention Time (Min.)</th>
<th>Constituents</th>
<th>Molecular Formula</th>
<th>Molecular Formula</th>
<th>Concentration %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.227</td>
<td>7- Tridecanone</td>
<td>C_{13}H_{26}O</td>
<td>198</td>
<td>37.26</td>
</tr>
<tr>
<td>2</td>
<td>9.739</td>
<td>Glycerin</td>
<td>C_{3}H_{8}O</td>
<td>92</td>
<td>11.82</td>
</tr>
<tr>
<td>3</td>
<td>12.400</td>
<td>2 Heptanone-3 methyl</td>
<td>C_{8}H_{16}O</td>
<td>128</td>
<td>10.09</td>
</tr>
<tr>
<td>4</td>
<td>19.698</td>
<td>alpha-L-Galactopyranoside, methyl 6-deoxy-</td>
<td>C_{7}H_{14}O_5</td>
<td>178</td>
<td>9.68</td>
</tr>
<tr>
<td>5</td>
<td>23.589</td>
<td>1,6-Anhydro-beta-D-glucopyranase (levoglucosan)</td>
<td>C_{6}H_{10}O_5</td>
<td>162</td>
<td>8.33</td>
</tr>
<tr>
<td>6</td>
<td>9.390</td>
<td>2-Furan carboxaldehyde, methyl</td>
<td>C_{6}H_{32}O_2</td>
<td>110</td>
<td>6.98</td>
</tr>
<tr>
<td>7</td>
<td>14.038</td>
<td>4H-Pyran-4-one</td>
<td>C_{6}H_{14}O_4</td>
<td>144</td>
<td>5.51</td>
</tr>
<tr>
<td>8</td>
<td>31.283</td>
<td>n-Hexadecanoic acid</td>
<td>C_{16}H_{32}O_2</td>
<td>256</td>
<td>4.92</td>
</tr>
<tr>
<td>9</td>
<td>15.916</td>
<td>Benzene,(2,2-dimethoxyethyl )</td>
<td>C_{10}H_{14}O_2</td>
<td>166</td>
<td>3.42</td>
</tr>
<tr>
<td>10</td>
<td>30.827</td>
<td>Hexadecanoic acid methyl ester</td>
<td>C_{17}H_{32}O_2</td>
<td>270</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Table 2: Activity of Phyto-Components Identified in the Methanolic Extracts of the Bark of *Aegiceras Corniculatum* by GC-MS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Compounds</th>
<th>Compound Nature</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Glycerin</td>
<td>Polyol compound</td>
<td>Skin healing, cures dermatitis (Lorançini et al., 2014)</td>
</tr>
<tr>
<td>2</td>
<td>2-Furan carboxaldehyde, methyl</td>
<td>Aldehyde compound</td>
<td>**Antimicrobial, Preservative (Ravikumar et al., 2012)</td>
</tr>
<tr>
<td>3</td>
<td>4H-Pyran-4-one</td>
<td>Flavonoid fraction</td>
<td>**Antimicrobial, Anti inflammatory</td>
</tr>
<tr>
<td>4</td>
<td>n-Hexadecanoic acid</td>
<td>Palmitic acid</td>
<td>Antioxidant, Hypcholesterolemic, Nematicide, Pesticide, Lubricant, Flavor, Hemolytic 5-Alpha reductase inhibitor (Rajeswari et al., 2013)</td>
</tr>
<tr>
<td>5</td>
<td>Hexadecanoic acid methyl ester</td>
<td>Palmitic acid</td>
<td>Antioxidant, Hypcholesterolemic, Nematicide, Pesticide, Lubricant, Flavor, Hemolytic 5-Alpha reductase inhibitor (Rajeswari et al., 2013)</td>
</tr>
</tbody>
</table>

**Source:** Dr. Duke's phytochemical and ethnobotanical databases [Online database].
ACKNOWLEDGEMENT

One of the authors is very much thanking to head department of Botany and CFC department Shivaji University, Kolhapur, MH – India for providing all needful things for this piece of research work.

REFERENCES


Research Article


