Bioactive Compounds Investigation From Methanol Bark Extract of *Pterocarpus marsupium* Using GC-MS Analysis

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**ABSTRACT**

Introduction: Medicinal plants still represent untapped sources of novel compounds with potential therapeutic effects for mitigating human maladies. *Pterocarpus marsupium*, commonly known as Bijasal, is a well-known drug in ayurvedic system of medicine. Materials and methods: The dried bark powder of *P. marsupium* was extracted by Soxhlet with methanol and analyzed by gas chromatography, while the mass spectra data of the compounds found in the extract was matched with the data available at National Institute of Standards and Technology (NIST) library. Results: The results of the GC-MS analysis provide different peaks determining the presence of 10 major phytocomponents, that are 1-Penten-3-one,1-(2,6,6-trimethyl-1-cyclohexen-1-yl); Geranyl isovalerate; 2-Pentadecanone,6, 10, 14-trimethyl; Cyclopropaneoctanonal, 2-ocetyl-; Octadecanoic acid; 10-Octadecanoic acid, methyl ester; Heptadecanoic acid, 16-methyl-,methyl ester; Phytol; 4,8,12,16-Tetramethyl heptadecan-4-olide; Dasyacarpian-1-methanol, acetate with different therapeutic activities. Conclusion: The presence of these bioactive compounds justifies that the *Pterocarpus marsupium* can offer a base for using this compound as herbal alternative for the synthesis and development of new drug to treat various infectious diseases. However, isolation of individual phytochemical constituents might be useful to formulate a new novel drug.

**Keywords:** *Pterocarpus marsupium*, GC-MS analysis, bioactive components, methanol extract, NIST Library.

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**INTRODUCTION**

Herbal medicines occupy distinct position right from the primitive period to present day due to their therapeutic potential, which signifies a major part of habitual treatments for different maladies1,2. Complementary medicine has a long history of serving people all over the world and has taken an important place especially in developing countries where limited health services are available3,4. The medicinal value of the plant lies in the bioactive phytochemical constituents that produce definite physiological effect on human body5. The most important bioactive secondary metabolites found in plants are alkaloids, flavonoids, tannins and phenolic compounds. There is growing awareness in correlating the phytochemical constituents of a medicinal plant with its pharmacological activity6. Therefore, the present study was aimed to identify the phytoconstituents which may have therapeutic value present in the *Pterocarpus marsupium* bark using GC-MS analysis. *Pterocarpus marsupium* (Fabaceae) is commonly known as Vijayasar is a large deciduous tree that is native to India, Sri Lanka and Nepal7. The heart wood, leaves, flowers and bark of the plant have useful medicinal properties. Traditionally, bark is useful in vitiated condition of kapha, pitta, elephantiasis, ereispelas, urethrorrhea, rectalgia, ophthalmopathy, hemorrhages, dysentery, cough, grayness of hair, urinary discharge and piles8. The powdered bark is mixed with *Schleicher oleosa* and taken with cold water to treat dysentery9. It has been scientifically reported for antihyperlipidaemic10, hepatoprotective11, anti-ulcer12, anti-inflammatory13 and anti-diabetic activity14. A variety of flavonoids and their derivatives have been isolated from various parts of the plant15. Methanol extract of bark has showed maximum activity against *Aspergillus niger*, *Salmonella typhi* and *Enterococcus faecalis*16. The selective COX-2 inhibitory activity of *P. marsupium* extract, attributed to its pterostilbene content has also been reported17. In recent years, Gas Chromatography - Mass Spectroscopy (GC-MS) studies are being increasingly applied for the analysis of medicinal plants as this technique will prove a valuable and important method in analyzing fatty acids, non-polar compounds, lipids, volatile essential oil and alkaloids18. Taking into consideration the medicinal importance of *Pterocarpus marsupium*, the methanol extract of the plant bark was analyzed for the first time using GC-MS.

**MATERIALS AND METHODS**

**Plant material**

The bark of *Pterocarpus marsupium* was collected from in and around Kalaburagi district, Karnataka, in the month of June, 2015. The plant was authenticated by Dr. Imran Baig, Professor, Botanical garden, UAS, GKVCK Campus,

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Bangalore and the voucher specimen (UASB: 4552) was deposited in the herbarium of GKVK botanical garden.

Preparation of plant extract
Freshly collected bark of *Pterocarpus marsupium* was washed thoroughly in running water, later with distilled water, shade dried and then powdered to required particle size. The bark powder (100g) was successively extracted by Hot Soxhlet extraction with polar solvent like methanol. The extract was heated at 30-40°C in hot air oven till the solvent got evaporated. Dried extract was kept in refrigerator at 4°C for future use.

Gas Chromatography-Mass Spectrum Analysis
2μl of methanol bark extract from *Pterocarpus marsupium* was used for GC-MS analysis\(^9\). This extract was dissolved

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**Figure 1: GC-MS Chromatogram of the methanol extract of *Pterocarpus marsupium* bark.**

**Table 1: Bioactive compounds detected in methanol extract of *Pterocarpus marsupium* bark.**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>RT</th>
<th>Compound Name</th>
<th>Compound nature</th>
<th>Molecular formula</th>
<th>Molecular weight</th>
<th>Biological activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.6</td>
<td>1-Penten-3-one,1-(2,6,6-trimethyl-1-cyclohexen-1-yl)-alkane</td>
<td>C(<em>{13})H(</em>{22})O</td>
<td>206.32</td>
<td>-</td>
<td>Anti-inflammatory, antioxidiant and anti-viral activities</td>
</tr>
<tr>
<td>2</td>
<td>14.92</td>
<td>Geranyl isovalerate</td>
<td>Monoterpene</td>
<td>C(<em>{15})H(</em>{26})O(_2)</td>
<td>238.37</td>
<td>Anti-inflammatory, antioxidiant and anti-viral activities</td>
</tr>
<tr>
<td>3</td>
<td>16.22</td>
<td>2-Pentadecanone,6,10,14-trimethyl diterpenoids</td>
<td>Diterpenoids</td>
<td>C(<em>{18})H(</em>{36})O</td>
<td>268.48</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>17.02</td>
<td>Cyclopropanooctanal,2-octyl-</td>
<td></td>
<td>C(<em>{19})H(</em>{36})O</td>
<td>280.49</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>18.1</td>
<td>Octadecanoic acid</td>
<td>Stearic acid</td>
<td>C(<em>{18})H(</em>{36})O</td>
<td>284.48</td>
<td>Antibacterial, antiviral, anti-inflammatory, soap lubricant, cosmetics</td>
</tr>
<tr>
<td>6</td>
<td>18.8</td>
<td>10-Octadecanoic acid, methyl ester</td>
<td>Unsaturated fatty Acid methyl ester</td>
<td>C(<em>{19})H(</em>{38})O</td>
<td>296.49</td>
<td>Antibacterial, antifungal, antioxidant, decrease blood cholesterol</td>
</tr>
<tr>
<td>7</td>
<td>19.03</td>
<td>Heptadecanoic acid,16-methyl,16-methyl ester</td>
<td>Stearic acid</td>
<td>C(<em>{18})H(</em>{36})O</td>
<td>298.50</td>
<td>Used against skin cancer protein.</td>
</tr>
<tr>
<td>8</td>
<td>19.88</td>
<td>Phytol</td>
<td>Triterpene</td>
<td>C(<em>{20})H(</em>{40})O</td>
<td>296</td>
<td>Antimicrobial,anticancer,anti inflammatory,diuretic,imm unostimulatory,antidi-abetic</td>
</tr>
<tr>
<td>9</td>
<td>21.18</td>
<td>4,8,12,16-Tetramethylheptadecan-4-olide</td>
<td>Isoprenoid</td>
<td>C(<em>{21})H(</em>{38})O</td>
<td>324.54</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>23.17</td>
<td>Dasycarpidan-1-methanol,acetate</td>
<td>Ester</td>
<td>C(<em>{20})H(</em>{38})N(_2)O(_2)</td>
<td>326.44</td>
<td>-</td>
</tr>
</tbody>
</table>
in HPLC grade methanol and subjected to GC and MS. GC mate equipped with secondary electron multiplier, JEOL GCMATE II GC-MS (Agilent Technologies 6890N Network GC system for gas chromatography). The column (HP5) was fused with silica 50m x 0.25mm I.D. Analysis conditions were 20 minutes.

Figure 2: Mass spectrum and structure of 1-Penten-3-one, 1-(2,6,6-trimethyl-1-cyclohexen-1-yl).

Figure 3: Mass spectrum and structure of Geranyl isovalerate.

Figure 4: Mass spectrum and structure of 2-Pentadecanone,6,10,14-trimethyl.
Figure 5: Mass spectrum and structure of Cyclopropaneoctanal, 2-octyl.

Figure 6: Mass spectrum and structure of Octadecanoic acid.

Figure 7: Mass spectrum and structure of 10-Octadecanoic acid, methyl ester.
Figure 8: Mass spectrum and structure of Heptadecanoic acid, 16-methyl-,methyl ester.

Figure 9: Mass spectrum and structure of Phytol.

Figure 10: Mass spectrum and structure of 4,8,12,16-Tetramethylheptadecan-4-olide.
RESULTS AND DISCUSSION

GC-MS is a combined technique which is used to identify different substances within the sample. It works on separation of the individual compound by GC according to their RT and the separated compounds were further analyzed at a molecular level by MS. The active principles with their Retention Time (RT), molecular formula, molecular weight and their biological activities obtained through Dr. Duke’s Phytochemical and Ethnobotanical Databases are presented in Table-1. The mass spectrometer analyzes the compounds eluted at different times to identify the nature and structure of the compounds. The large compound fragments into small compounds giving rise to appearance of peaks at different m/z ratios. These mass spectra are fingerprint of that compound which can be identified from the data library. This report is the first of its kind to analyze the chemical constituents of *P. marsupium* methanol bark extract using GC-MS. The mass spectra and structures of identified bioactive compounds are presented in Figures 2-11. The presence of various bioactive compounds confirms the application of *P. marsupium* for various ailments by traditional practitioners.

CONCLUSION

In developing countries, providing modern healthcare facilities is still in infancy. Due to economic constraint, it is prudent to look for options in herbal medicines. *Pterocarpus marsupium* carried out an importance from the ancient times to cure mankind against various disease conditions. The medicinal applications of this plant are countless and more investigations must be carried out to evaluate the mechanism of action of active principles so that its potential can be fully utilized. By the isolation of various phytochemicals it enables to exploit its therapeutic value which plays a major role in modern system of medicine.

REFERENCES

6. Turker AU, Usta C. Biological screening of some Turkish medicinal plant extracts for antimicrobial and

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Figure 11: Mass spectrum and structure of Dasycarpidan-1-methanol, acetate.