Antimicrobial activity of *Momordica cymbalaria* Fenzl aerial parts extracts

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Extracts of *Momordica cymbalaria* Fenzl (Cucurbitaceae) were screened for their *in vitro* antimicrobial activity by agar diffusion method in comparison with standard antibiotics, Ampicillin, Tetracycline, Streptomycin and Gentamycin. The antimicrobial activity of petroleum ether, chloroform, ethanol and aqueous extract of aerial parts of the plant were studied using *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa* (Clinical isolate, Bacteria) and *Aspergillus niger* (Fungi) as test organisms. All the extracts were effective against all the four microorganisms. The result reveals that the plant extract has very good inhibitory activity against Gram negative organism when compared to standard antibiotics. The ethanol and aqueous extracts of plant has shown significant activity against *K. pneumoniae*, *E. coli*, *P. aeruginosa* and *S. aureus*. Similarly the chloroform extract of plant has shown good inhibitory activity against *A. niger*. While all standard antibiotics had a zone of inhibition less than the extracts of *M. cymbalaria* indicating that the plant can fight these organisms effectively and it could be a better alternative to the modern medicine.


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**Introduction**

The increasing prevalence of multidrug resistant strains of bacteria and the recent appearance of strains with reduced susceptibility to antibiotics raises the spectra of untreatable bacterial infections and adds urgency to the search for new infection fighting strategies. Plants provide a valuable material base for the discovery and development of new drugs of natural origin. Contrary to the synthetic drugs, antimicrobials of plant origin are not associated with many side effects and have an enormous therapeutic potential to heal many infectious diseases¹. In this regard, one such plant which has number of traditional uses is *Momordica cymbalaria* Fenzl (Family — Cucurbitaceae). It is a perennial herb distributed over tropical parts of Western peninsular, India and well known as *Karchikayee*. It is also found in the states of Karnataka and Andhra Pradesh in India. It is traditionally used as abortifacient². Ethanol extract is reported to have anti-ovulatory, abortifacient and anti-implantation activity³⁻⁴. The extracts and the dried form of fruit and leaves were shown to have antidiabetic, hypolipidemic and anti-hyperglycemic activities⁵⁻⁷. Since there is no report on the antimicrobial activity of *M. cymbalaria*, an attempt was made to evaluate its petroleum ether, chloroform, ethanol and aqueous extracts by agar diffusion method using *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa* (Clinical isolate, Bacteria) and *Aspergillus niger* (fungi) as test organism.

**Materials and Methods**

**Plant material**

*M. cymbalaria* (stem, leaves and fruits; Plate 1) were collected from Gulbarga district, Karnataka and authenticated by Central Council for Research in Ayurveda and Siddha, Bangalore. A voucher specimen has been preserved in Department of Pharmacognosy, The Oxford College of Pharmacy, Bangalore.

**Extraction procedure**

Shade dried plant parts such as stem, leaves and fruits (470 g) were coarsely powdered and subjected to successive solvent extraction using petroleum ether, chloroform, ethanol and water by continuous hot extraction (Soxhlet). Each time, the marc (exhausted plant material) was air dried and later extracted with other solvents. All the extracts were
concentrated by distilling the solvent in a rotary flash evaporator. The yield was found to be 3.36, 1.06, 6.67 and 11.26% w/w with reference to the air dried plant. The dried extracts were dissolved in dimethyl sulphoxide (DMSO) at a concentration of 5 mg/ml.

Microorganisms and Media

Various microorganisms used in the study were: Gram positive bacteria: *Staphylococcus aureus*; Gram negative bacteria: *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae* and Fungi: *Aspergillus niger*.

Bacterial isolates were the clinical isolates obtained from samples collected from the patients under treatment at The Bangalore Institute of Oncology, Bangalore. The fungal culture was obtained from Department of Microbiology, The Oxford College of Science, Bangalore. The bacterial and fungal stock cultures were maintained on Muller Hinton agar and Martin Rose Bengal agar and stored at 4°C.

Antimicrobial activity

The extracts obtained above were screened for their antimicrobial activity in comparison with standard antibiotics, viz. Ampicillin, Tetracycline, Streptomycin and Gentamycin *in vitro* by disc diffusion method by using *S. aureus, K. pneumoniae, E. coli* and *P. aeruginosa* (Clinical isolate, Bacteria) and *Aspergillus niger* (Fungi) as test organism. Muller Hinton agar and Martin Rose Bengal agar were prepared, sterilized and poured into petriplates up to a depth of 3 mm. The organisms were suspended in saline and 0.1 ml of organisms (10^10 colony forming units per ml) were spread on these plates on which wells were made using an 8 mm cork borer. To each well, 100 µl of each extracts were added and plates were incubated at 37°C for 24 h for bacteria and at room temperature for 48 h for fungi. After incubating for 24 and 48 h, the results were recorded by measuring the diameter of zone of inhibition surrounding the well. For standard, antibiotic test-disc method was employed. Standard antibiotic discs of 6 mm diameter (Hi-Media) for different antibiotics such as Ampicillin, Tetracycline, Streptomycin and Gentamycin were used. The experiments were done in triplicate.

Result and Discussion

The results of antimicrobial activities are given in Tables 1 and 2. From Table 1 and Fig. 1, it is very clear that all the extracts have shown antimicrobial activity.

### Table 1 — Antimicrobial activity of different extracts of *Momordica cymbalaria* against microorganisms

<table>
<thead>
<tr>
<th>Test organisms</th>
<th>P.E</th>
<th>C.E</th>
<th>E.E</th>
<th>A.E</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>13</td>
<td>15</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>16</td>
<td>16</td>
<td>19.5</td>
<td>19</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>14</td>
<td>19</td>
<td>18</td>
<td>19.5</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>12.5</td>
<td>14.5</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td><em>Aspergillus niger</em></td>
<td>21</td>
<td>37</td>
<td>24.5</td>
<td>34</td>
</tr>
</tbody>
</table>

P.E = Petroleum ether extract; C.E = Chloroform extract; E.E = Ethanol extract; A.E = Aqueous extract. Values are average of three determinations.

### Table 2 — Antimicrobial effect of standard antibiotics on tested pathogens

<table>
<thead>
<tr>
<th>Test Organisms</th>
<th>Zone of Inhibition in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ampicillin</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>17</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>13</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>11</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>12</td>
</tr>
<tr>
<td><em>Aspergillus niger</em></td>
<td>14</td>
</tr>
</tbody>
</table>
activity against all tested organisms. The ethanol and aqueous extracts of plant has shown significant activity against *K. pneumoniae* (18mm; 19.5mm), *E. coli* (17 mm; 17 mm), *P. aeruginosa* (19.5 mm; 19 mm) and *S. aureus* (15 mm; 17mm). Similarly chloroform extract of the plant has shown good inhibitory (37 mm) activity against *A. niger*. The antimicrobial activity of different extracts against test organisms are given below:

**Escherichia coli**: Ethanol and aqueous extracts showed maximum zone of inhibition (17 mm) followed by chloroform extract (15 mm), while petroleum ether extract showed less zone of inhibition (13 mm).

**Pseudomonas aeruginosa**: Ethanol and aqueous extracts showed maximum zone of inhibition (19 mm). While petroleum ether and chloroform extracts showed less zone of inhibition (16 mm) but equal to that of standard antibiotics (Tetracycline:16 mm).

**Klebsiella pneumoniae**: Aqueous (19.5 mm) and chloroform extracts (19 mm) showed maximum zone of inhibition followed by ethanol extract (18 mm), while petroleum ether extract showed less zone of inhibition (14 mm).

**Staphylococcus aureus**: Aqueous extract showed maximum zone of inhibition (17 mm) followed by ethanol extract (15 mm), while chloroform (14.5 mm) and petroleum ether extracts (12.5 mm) showed less zone of inhibition.

**Aspergillus niger**: Chloroform (37 mm) and aqueous extracts (34 mm) showed maximum zone of inhibition followed by ethanol extract (24.5 mm), while petroleum ether extract showed less zone of inhibition (21 mm).

Susceptibility test of these test organisms to traditional antibiotics was done using standard antibiotics such as Ampicillin, Tetracycline, Streptomycin and Gentamycin. The zone of inhibition of the standard antibiotics against the test organism was measured and the results are given in Table 2 and Fig. 2.

**Escherichia coli**: Standard antibiotic Ampicillin showed maximum zone of inhibition (17 mm) followed by Streptomycin (13 mm), while Tetracycline (9 mm) and Gentamycin (7 mm) showed less zone of inhibition.

**Pseudomonas aeruginosa**: Standard antibiotic Tetracycline showed maximum zone of inhibition (16 mm) followed by Ampicillin (13 mm) and Gentamycin (12 mm), while Streptomycin showed less zone of inhibition (11 mm).

**Klebsiella pneumoniae**: Standard antibiotic Tetracycline showed maximum zone of inhibition (17 mm) followed by Gentamycin (16 mm) and Streptomycin (14 mm), while Ampicillin showed less zone of inhibition (11 mm).

**Staphylococcus aureus**: Standard antibiotic Streptomycin showed maximum zone of inhibition (13 mm) followed by Ampicillin (12 mm) and Tetracycline (11 mm), while Gentamycin showed less zone of inhibition (9 mm).

**Aspergillus niger**: Standard antibiotic Gentamycin showed maximum zone of inhibition (22 mm), while
Streptomycin (17 mm), Tetracycline (16 mm) and Ampicillin (14 mm) showed less zone of inhibition.

**Conclusion**

It can be concluded from the results that *M. cymbalaria* plant extracts possess antimicrobial activity against various test organisms used. Some of the extracts (ethanol and aqueous) were more effective than traditional antibiotics to combat the pathogenic microorganisms studied. This possibly means that the compound responsible for the antimicrobial activity is present in each extract at different concentrations. The chance to find antimicrobial activity was more apparent in ethanol and aqueous extracts than in petroleum ether and chloroform extracts. The extracts were found to be effective against Gram negative (*E.coli, K.pneumoniae, P. aeruginosa*) pathogens when compared to Gram positive (*S.aureus*) pathogen. Chloroform and aqueous extracts were found to be very effective against *A.niger*. The phytoconstituents present in the extracts may be responsible for the antimicrobial activity. The mechanism, is yet to be identified.

The *in vitro* study of antimicrobial and antifungal activity of *M. cymbalaria* on various test organisms may help to discover new class of antibiotic substances that could serve as selective agents for infectious chemotherapy and control. This approach has opened up the possibility of the use of this plant in drug development for human consumption for future use.

Further work is needed to isolate the secondary metabolites from the extracts studied in order to test specific antimicrobial activity. This *in vitro* study demonstrated that folk medicine can be as effective as modern medicine to combat pathogenic microorganisms. The millenarian use of these plants in folk medicine suggests that they represent an economic and safe alternative to treat diseases.

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**References**

