Antimicrobial activities of *Aerva javanica* and *Paeonia emodi* plants

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**Abstract:** *Aerva javanica* and *Paeonia emodi* plants extracts were studied for antibacterial activity against *Escherichia coli* (NCTC 10418), *Klebsiella pneumoniae* (ATCC 700603), *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Salmonella typhi*, *Staphylococcus epidermidis* (NCTC 11047) and *Methicillin Resistant Staphylococcus Aureus* (MRSA) (NCTC 13143) and antifungal activity against *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger* and *Fusarium solani*. Extracts were obtained by using methanol, n-hexane, chloroform, ethyl acetate and aqueous fraction. The extracts of *Paeonia emodi* and *Aerva javanica* showed significant antibacterial activity but only *Salmonella typhi* was resistant to *Aerva javanica*. Moreover, the antifungal activity of *Aerva javanica* was very poor but the fractions of *Paeonia emodi* showed sufficient inhibition against fungal strains.

**Keywords:** *Aerva javanica*, *Paeonia emodi*, antibacterial, antifungal.

**INTRODUCTION**

Many ancient nations have awoken to the importance of herbal medicine (Ashur, 1986). Many countries of the world have traditional medicines as a source of first aid treatment. The existence and use of plants to treat human diseases, is as old as man (Sangawan & Alhaji Sangawan, 2010).

The plant *Aerva javanica* belongs to family Amaranthaceae. It is a perennial herb, native to Africa, Asia and extensively scattered in the far away areas of the world (Judd et al., 2008). This plant has got lot of application for example, this herb is used as diabetic demulcent, diuretic, the resultant liquid of plant is used to get rid of swellings. Powder of the plant is used to cure ulcers of domestic animals. Furthermore the seeds are used to mitigate headache and also used in rheumatism. Srinivas Reddy et al in 2009 had analyzed the presence of carbohydrates, flavonoids steriods and triterpenoids.

Another plant investigated was the *Paeonia emodi*, of family Paeoniaceae, it is largely scattered in Northern Pakistan, North West India, China and West Nepal (Deyuan, 2004). It is a vertical perennial herb having long, glabrous, binate or ternate leaves, pale lamina, solitary flowers of axillary (Kirtikar, 1918). Monoterpene glycosides, paeoniflorin, lactiflorin and oxypaeoflorine are among the compounds that have been reported in this plant (Muhammad et al., 1999). *Paeonia emodi* is applied in indigenous medical system. The rhizomes and roots are curative agents in backache, headache, dizziness, vomiting, oedema and epilepsy, also as an energizer, emetic, therapeutic, blood cleanser, helps in pregnancy and bellyache while the seeds are used as laxative (Shinwari et al., 2003, Ahmad & Sher, 2004).

The current study was undertaken to authenticate antimicrobial activities of methanol extracts of both plants.

**MATERIALS AND METHODS**

The study was conducted in the Institute of Pharmaceutical Sciences (IPS) and Department of Biotechnology & Genetic Engineering, Kohat University of Science and Technology, Kohat, from October 2010 to December 2010.

**Collection and identification of plants**
The plants materials were collected from hills of Village Teri, Kashmir and from the backside mountains of Kohat University and were identified by Dr. Zafar Iqbal in the department of Plant Sciences, Kohat University of Science and Technology, Kohat.

**Preparation of crude extract and fractions**
Plants were dried by keeping in between old newspapers in the room. The shade dried plants were crushed into grinded coarse powder with the help of grinder. Obtained powder (15 Kg) of each plant were macerated in methanol by shaking at intervals at room temperature (Allen and Ansel, 2006) for 14 days for extraction. After 14 days maceration, methanol soluble fractions were filtered off. Filtrates were concentrated under vacuum at low temperature (37°C) with the help of a rotary evaporator. A crude extract (150 gm) of each plant was extracted from both filtrates. The crude extract (130 gm) of each plant was suspended in distilled water (500 ml) and consecutively portioned with n-hexane (3 x 500 ml), chloroform (3 x 500 ml) and ethyl acetate (3 x 500 ml), to give the n-hexane (40 gm), chloroform (30 gm), and ethyl acetate (25 gm) and aqueous fractions (35 gm).
respectively. These crude extracts and fractions obtained were firmly packed and kept in refrigerator at 4°C.

**Antibacterial assay**

Antibacterial activity of both plant extracts were determined by using well assay method of Perez et al. (1990). Seven bacterial strains *Escherichia coli* (NCTC 10418), *Klebsiella pneumoniae* (ATCC 700603), *Pseudomonas aeruginosa*, *Salmonella typhi*, *Staphylococcus epidermidis* (NCTC 11047) and *Methicillin Resistant Staphylococcus Aureus* (MRSA) (NCTC 13143) were used in this assay. Muller Hinton agar (Oxoid, UK) media was prepared in conical flask. Properly sterilized media and equipments were used to carry out the experiment.

The culture of bacterial strains equivalent to 10⁶ colony forming unit was inoculated upon the solidified media. Then, 6 mm wells were dug in the medium with the help of sterilized metallic borer. Stock solutions of crude extract and fractions dissolved in Dimethylsulfoxide (DMSO) at concentration of 10 mg/ml were prepared and 200 ul from each stock solution was supplemented into corresponding wells. The zones of inhibition were measured after incubating at 37°C for 24 hours.

**Antifungal assay**

Antifungal activity of the extracts was evaluated by the method of agar tube dilution. Four fungal strains *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger* and *Fusarium solani* were used in this assay. Each corresponding fraction was prepared in 5 ml DMSO. These were incorporated into the sabourad dextrose agar media at 45°C and poured in sterilized test tubes. Very small part of already refresh grown fungus was placed in each test tube and kept at 25°C for 5 days in incubator. After 5 days, each tube was observed for presence or absence of fungal growth and results were recorded. A negative control (without any fungi) and a positive control (with only fungal) strain were used in the assay to correlate the results.

**RESULTS**

**Antibacterial activity**

In the present work, the zones of inhibition of bacterial growth on agar plate were determined after treatment with different fractions of *Aerva javanica* and *Paeonia emodi*. All the plant fractions showed good antibacterial activity against the pathogenic bacteria. The zones of inhibition formed by the different fractions of these plants are listed in the following table 1 and 2.

Every fraction of *Aerva javanica* showed good activity against the tested pathogens except the *S. typhi* which resisted all the fractions significantly. While *Paeonia emodi* was almost equally active against all the seven pathogens included in this study. Thus, *Paeonia emodi* exhibits excellent antibacterial activity as observed upon treated microbes.

**Antifungal activity**

The results shown by different fractions of plants i.e., *Aerva javanica* and *Paeonia emodi* are given in table 3

### Table 1: Antibacterial activity of *Aerva javanica*

<table>
<thead>
<tr>
<th>Microorganisms</th>
<th>Zone of inhibition (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ethyl acetate</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>10</td>
</tr>
<tr>
<td><em>P. Aeruginosa</em></td>
<td>14</td>
</tr>
<tr>
<td><em>K. Pneumoniae</em></td>
<td>10</td>
</tr>
<tr>
<td><em>MRSA</em></td>
<td>12</td>
</tr>
<tr>
<td><em>S. Aureus</em></td>
<td>16</td>
</tr>
<tr>
<td><em>S. Epidermidis</em></td>
<td>8</td>
</tr>
<tr>
<td><em>S. Typhi</em></td>
<td>6</td>
</tr>
</tbody>
</table>

### Table 2: Antibacterial activity of *Paeonia emodi*

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Zone of inhibition (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n-Hexane</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>14</td>
</tr>
<tr>
<td><em>P. aeruginosa</em></td>
<td>20</td>
</tr>
<tr>
<td><em>K. pneumoniae</em></td>
<td>10</td>
</tr>
<tr>
<td><em>MRSA</em></td>
<td>12</td>
</tr>
<tr>
<td><em>S. Aureus</em></td>
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<td><em>S. Typhi</em></td>
<td>8</td>
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</tbody>
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DISCUSSION

Biochemical components present in plants are used as curative agents for different diseases. These components are checked for there various activities like antibacterial, antifungal and other activities of beneficial interests throughout the world which play an important role in finding innovative compounds as herbal remedies designed for diagnosis and treatment of a range of diseases (Urzua et al., 2008). The local people of Teri, Karak, Kohat and Kashmir have good knowledge of plants and they use plants for curing various ailments.

Majority of microbes have developed resistance to the present day antibiotics and hence pharmaceutical companies are using different plants to get effective antimicrobial agents and come over the problem of resistance breaking strains of microorganisms (Ullah et al., 2009; Rafie et al., 2010; Angeh et al., 2007). Our study showed that Aerva javanica and Paeonia emodi possesses antibacterial and antifungal activities. The MRSA is referred as superbug usually in the media and in general has multi drug resistance (Dettenkofer et al., 2008). Such disease causing agents produces infections of skin and soft tissues, ear, respiratory tract, blood and urinary tract (Furukawa et al., 2008; Gould, 2009; Hawser, 2009; Pereira et al., 2009).

Our outcomes are consistent with the antibacterial activity shown by other species of the genus Aerva. Vijayan et al. (2010) enclosed report of antibacterial and antifungal activity of Aerva lanata. It was effective against all bacterial species except Klebsiella. Earlier researches showed that ethyl acetate and methanol extracts of Aerva lanata have some interesting antimicrobial properties (Choudhary, 2004).

In our present study both plants showed significant activity against S. epidermidis. The crude and other fractions exhibited good activity next to P. aeruginosa. The plant Aerva javanica also have activity against Staphylococcus aureus and plant Paeonia emodi inhibited growth of Klebsiella pneumoniae, Salmonella typhi and Pseudomonas auroginosa.

Fungi cause multiples infections e.g. infection of blood, liver, lungs and mouth etc (Fung, 2002; Ker et al., 2002; Danziger-Isakov et al., 2008). In most of the cases they cause skin problems in humans and other animals (Sogair et al., 1991). Aspergillus niger typically cause infectivity in lungs and has also been detected on skin of burnt injuries (Singhal et al., 2005). Aspergillus fumigatus, Aspergillus flavus and Fusarium solani have been found to be engaged in lungs and eye infections (Kang et al., 2008). Our observations showed that both plants are inactive against fungal strains and thus exhibit very poor activity.

CONCLUSION

Both plants Aerva javanica and Paeonia emodi showed significant antibacterial activity and thus they are capable to be used in cure of infectious diseases caused by E. coli, P. aeruginosa, S. aureus, K. pneumonia, S. epidermidis, S. typhi, and MRSA bacteria. On other hand the plants fractions did not show any significant antifungal activity.
against *F. solani*, *A. niger*, *A. flavus* and *A. fumigatus*. The presence of phytoconstituents like steroids, terpenoids, flavonoids and phenolics are likely to be responsible for the observed antimicrobial activity.

**Future prospects**

1. Identification of antibacterial and antifungal compounds.
2. Screening of medicinal plants of surrounding area for antimicrobial activities.
4. Search for new drugs effective against severe diseases.

**REFERENCES**


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