Antibacterial Activity of Crude Extracts of *Aerva javanica*

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Abstract: The current study was carried out to evaluate the antibacterial activities of methanolic extract and various fractions of *A. javanica*. The fractions of *A. javanica* (Burm. f.) Juss. ex Schult., were evaluated against six bacterial strain, *Escherichia coli*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Shigella flexenari* and *Salmonella typhi*. Some of the solvent extracts of the plant showed significant activity against some bacteria as compared to standard drug used. The observed antibacterial activities may be due to the presence of some secondary metabolites such as tannins, alkaloids and flavonoids etc. The results are very significant in delivering safe and cheap use of the plant in the treatment of wounds healings and for the control of dysentery and diarrhea.

Key words: *Aerva javanica* - Methanolic extract - Antibacterial activity

INTRODUCTION

*Aerva javanica* (Burm. f.) Juss. ex Schult. belongs to the family Amaranthaceae. It is a small perennial herb commonly found over a broad range of sandy sediments at different altitudes. It is native to the region of North Africa to South West Asia [1]. In Pakistan, it grows in the sandy habitat and dry surrounding mountainous areas. There are six species normally found in Bannu, Karak, Western Himalya, Kurram, Tirrah, Bahawalpur, Cholistan, lower parts of Sindh and Kashmir [2].

Its erect pale stiff branching can rise to a height of 1.6 m. The stem is often light greenish in color and covered with pale green 20-40 mm long leaves. The leaves are alternate, lanceolate, oblong ovate or sub-orbicular, sub sessile or shortly petiolate and have a covering of matted hairs, upper surface with a grayish appearance. In the axils appear very small dense round clusters of flowers in the form of white tomentose [3].

In Ayurvedic medicines it is used as one of the best remedies for bladder and kidney stones [4]. *A. javanica* is used in diarrhea and dysentery [5]. The infructescence and seeds are used in case of diarrhea and haematuria in cattle [6]. The plant is also used as a remedy for toothache [7, 8]. The *Aerva javanica* plant has anti-inflammatory, anticalculus and insecticidal activity [9]. The bunches and flowers of *A. javanica* are traditionally claimed for the wound healing activity [10].

This current work was therefore undertaken to authenticate the plant’s antibacterial potentials.

MATERIALS AND METHODS

Collection of Plant Materials: *Aerva javanica* plant was collected from District Bannu (Pakistan) during the March 2009. It was identified by Prof. Abdur Rehman, Chairman Department of Botany, G.P.G.C. Bannu. The whole plant was shade dried for two weeks, chopped and grinded mechanically of mesh size 1 mm.

Preparation of the Extract: The shade-dried whole plant (20 kg) was mechanically grinded and extracted with 80% MeOH at room temperature (3 × 50 L). The combined methanolic extract was filtered and evaporated under
vacuum to afford (700 g) of a thick gummy mass which was farther fractionated into n-hexane (F-1), chloroform (F-2), ethyl acetate (F-3) and water (F-4) fractions. All these fractions were evaluated for antibacterial activities.

**Bacterial Strains:** The six bacterial strains; *Escherichia coli, Bacillus subtilis, Shigella flexenari, Staphylococcus aureus, Pseudomonas aeruginosa* and *Salmonella typhi* were used for antibacterial activities.

**Antibacterial Activities:** Antibacterial activities of different fractions were evaluated by using agar well diffusion method. In this method, a loop full of a 24 h old broth culture containing each of the bacterium used on the surface of Muller-Hinton agar plates. Wells were dug in the agar with the help of sterile borer. Stock solution containing test samples (F1-F4) in the concentration of 0.1mg/ml were prepared in DMSO and of each dilution was added in the respective wells [11].

**RESULTS AND DISCUSSION**

**Antibacterial Assay:** Antibacterial activities of crude methanolic extracts of *A. javanica* and fractions were investigated against the six common bacterial strains; *Escherichia coli, Bacillus subtilis, Shigella flexenari, Staphylococcus aureus, Pseudomonas aeruginosa* and *Salmonella typhi*.

The minimum inhibitory concentration of various fractions (F1-F4) of *A. javanica* was evaluated for antibacterial activity in the concentration of (1, 3 and 5 mg/ml in DMSO) of the plant extract of *A. javanica* against gram +ve and gram –ve strains as shown in Table 1. The data showed that the fraction F2 and F3 were significant, exhibiting high activity where as F1 and F4 showed no activity and moderate activity respectively in killing the six bacterial strains. The data showed that the chloroform (F-2) and ethyl acetate (F-3) fractions have the same significant value and are found to be most effective showing higher activity. The hexane fraction showed no activity in killing the bacterial strains (Table 1).

The various crude extracts tested in this study were complex mixtures of primary and secondary metabolites. Some of these may be nutrients and, as a consequence, may attract motile bacteria [12]. It is possible that the increased settlement of bacteria on *A. javanica* extracts is due to attraction of bacteria to a nutritionally favorable environment, although it has been shown that there is no correlation between metabolic value of a substrate and its ability to attract bacteria [12].

The antibacterial result obtained in this study incorporates the traditional uses of *A. javanica*. As this plant is used in the treatment of diarrhea and dysentery [13, 14, 15]. The large zone inhibition by F2 and F3 fractions signify its traditional uses in diarrhea. These fractions showed high activity against *E. coli, Shigella flexenari* and *Salmonella typhi*. According to WHO, *E. coli* causes diarrhea in the developing countries and is the most common agent in traveler’s diarrhea and other infections in human [16]. The use of such medicinal plants in curing the various diseases minimizes the cost of ever rising prices of the medicines in the health care system [16] (Singleton, 1999). The inability of the hexane fraction (F1) to inhibit the most of the bacterial strains may be due to the presence of some secondary metabolites which may possess a mechanism for detoxifying it. This fraction totally ineffective, which showed no activity due to the resistance.

All the extracts of the plant tested showed varying degree of antibacterial activities against the test bacterial species (Table 1).

<table>
<thead>
<tr>
<th>Name of bacteria</th>
<th>n-Hexane (F1) 1ml</th>
<th>CHCl3 (F2) 1ml</th>
<th>EIOAc (F3) 1ml</th>
<th>Aquas Fraction (F4)</th>
<th>Std. drug 1 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus subtilis</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
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<tr>
<td>Escherichia coli</td>
<td>+</td>
<td>+++</td>
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<td>+++</td>
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<tr>
<td>Pseudomonas aeruginosa</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
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<tr>
<td>Salmonella typhi</td>
<td>+</td>
<td>+</td>
<td>++</td>
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<td>+++</td>
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<tr>
<td>Shigella flexenari</td>
<td>-</td>
<td>+</td>
<td>++</td>
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<td>+++</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>-</td>
<td>+</td>
<td>+</td>
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</tbody>
</table>

Key: +++ = high activity; ++ = moderate activity; + = low activity; - = no activity

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CONCLUSION

The tested plant fractions of A. javanica showed the activity against certain bacteria strains, indicating that these plants are good source of antibiotics for the treatment of certain bacterial diseases especially in case of diarrhea. However, further experimental and research efforts on this plant and their extracts are needed to be able to specify the pharmacological implication. Other details needed will include tests using other solvents, infrared spectrometry, MS and NMR of the constituents of the extracts.

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REFERENCES