Antibacterial activities of genetic variants of \textit{Mirabilis jalapa}

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\begin{abstract}

The aqueous and ethanolic extract derived from the leaves of an indigenous medicinal plant \textit{Mirabilis jalapa L.} (white, cream, yellow and pink, flowered plants) were screened for antibacterial activities against \textit{Staphylococcus aureus}. Aqueous extracts did not display any inhibition to the tested bacteria. However, the ethanolic extract of only white flowered plant showed good antibacterial activity against \textit{S. aureus} i.e. 54\%. While other three colors i.e. cream, yellow, and pink flowered plants extract didn’t show any zone of inhibition against the tested bacteria. The growth inhibitions (\%) were calculated with reference to the activities of tetracycline which was taken as a standard (100\%). The research clear cut indicates the effectiveness of white flowered plant of \textit{M. jalapa} against \textit{S. aureus}. Which is responsible for causing diseases like skin infections, pneumonia, and food poisoning etc.

\textbf{Keywords:} \textit{Mirabilis jalapa}, antibacterial activity, white, cream, yellow and pink flowered plants.

\textbf{Editor:} Dr. Srisailam Keshetti, Phcog.Net

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\end{abstract}

\textbf{INTRODUCTION}

The plant \textit{Mirabilis jalapa} (Nyctaginaceae) is a tall herbaceous climbing plant with opposite leaves, large showy flowers, coriaceous obovoid fruits and prominent tuberous roots, planted as an ornamental plant throughout the country [1]. A special quality of this plant is that, flowers of different colors can be found simultaneously on the same plant, i.e. several colors of flower are available i.e. white, yellow, cream and pink, etc or an individual flower can be splashed with different colors. Another interesting thing is a color-changing phenomenon. For example, in the yellow flower, as the plant matures, it changes to a pink color. Similarly white flowers can change to light violet, which shows phenotype change.

\textit{M. jalapa} has been used in traditional medicine. It is extensively used for treatment of dysentery, diarrhea, conjunctivitis, edema, inflammation, swellings, muscular pain, swelling and abdominal colic, also used as a laxative by people from different countries [2-6]. The extract of \textit{M. jalapa} have also been reported to possess various bioactivities including antibacterial, antiviral, antifungal, protein synthesis inhibition, antimicrobial, antinociceptive, and antigonorrhoeal antispasmodic, diuretic, carminative, cathartic, hydragouses, purgative, stomachic, tonic and vermifuge properties [2, 7–15].

Several constituents have been isolated from the root and aerial parts of this plant including some rotenoids, an isoquinoline derivate, terpenoids, steroids, phenolic compounds, d-glucoside, ursolic acid, mirabalisoic acid, trigonellin, an antiviral protein, alanine, alphaamyrins, arabinose, beta amyrins, campesterol, daucosterol and dopamine [7, 16–23].

The medicinal properties of \textit{M. jalapa} have been well characterized in several studies. A protein purified from the root tubers of \textit{M. jalapa} was confirmed to be an antiviral protein. This has been shown to inhibit the mechanical transmission of tomato mosaic virus (TMV) in tobacco, tomato, and pepper plants, and cucumber green mottle mosaic virus in cucumber plants [24–29]. While the protein has also an inhibitory effect on cell-free protein synthesis and an antiproliferative effect on tumor cells, it inhibits in vitro protein synthesis of prokaryotes and eukaryotes [30–32].

In the current study, we present the results of antibacterial activity of \textit{M. jalapa} according to the flower colors. This study was designed with a view to explore antibacterial action of \textit{M. jalapa} due to flower...
colors, and to find the most effective type of M. jalapa against *Staphylococcus aureus*, which is gram positive cocci responsible for causing diseases like skin infections, pneumonia, and food poisoning etc, in such a large variety of flowers. Therefore, four different flower colors of *M. jalapa* were screened for antibacterial activities.

**MATERIAL AND METHODS**

**Plant Material**

The plant *M. jalapa* of various flower colors (fresh leaves) were collected from Abbottabad, Pakistan in the month of October. The specimens were identified through herbarium Hazara University Mansehra Pakistan.

**Preparation of extracts**

The shade-dried plant material was chopped into small pieces and then pulverized into fine powder (100gms each) and was soaked (each flower color plant) in water and ethanol separately for about 4 weeks. Both the extracts of each flower colors were separately filtered and evaporated under reduced pressure to yield a gum (8-13gms aqueous and 4-7gms ethanolic).

**Antibacterial activities**

The extracts were screened against human pathogen *S. aureus* by agar well diffusion method. Nutrient agar plates were swabbed with a 2-8 h broth culture of respective bacteria. Wells (6 mm diameter) were cut in the medium in each of these plates using a sterile metallic borer with centers at least 24 mm apart. Samples (100 mg/ml) and standard Tetracycline (100mcg/ml) were then added in their respective wells using sterilized dropping pipettes. The antibacterial activity of each flower color of *M. jalapa* extract against the selected bacteria were compared to tetracycline, which was taken as a standard (100%). All the growth inhibitions (%) were calculated with reference to the activities of tetracycline by using the formula,

\[
\% \text{Inhibition} = \left( 1 - \frac{\text{zone of inhibition of the sample (mm)}}{\text{zone of inhibition of the Std (mm)}} \right) \times 100
\]

**RESULTS AND DISCUSSION**

Antibacterial activities of *Mirabilis jalapa* plant (flower color variants) has been evaluated in vitro against *S. aureus*. The antibacterial activity of the extracts both water and ethanolic and their potency was assessed by the presence or absence of inhibition zone as displayed in Table 1. Aqueous extracts did not display any inhibition to the tested bacteria. However, the ethanolic extract of only white flowered plant showed good antibacterial activity against *S. aureus* i.e. 54%. While other three colors i.e. cream, yellow, and pink flowered plants extract didn’t show any zone of inhibition against the tested bacteria. The growth inhibitions (%) were calculated with reference to the activities of tetracycline which was taken as a standard (100%).

From this research the effective type of plant in large variety of *M. jalapa* (flower color variants) against *S. aureus* has been identified. Only the white flower ethanolic extract gave best result by inhibiting the selected bacteria. Which is gram positive coccus responsible for causing diseases like skin infections, pneumonia, food poisoning etc. While the other three colors cream, yellow, and pink was not able to produce good result by inhibiting *S. aureus*. The research clear cut indicates that the *M. jalapa* is a beneficial medicinal plant have a powerful action against wide range of microorganisms as described [33].

The antimicrobial activity of *M. jalapa* was known from the varying past [2, 7, 8, 9, 10, 12] but a range of flower colors are available, in which four colors were checked for antibacterial screening. The result shows that each flower color plant have change in its action against microorganisms, i.e. only white color plant is effective against *S. aureus*.

The antimicrobial activities measured by M. Kola Oladunnmoyo [33], as the ethanolic extract of the leaf of *M. jalapa* was tested for antimicrobial activity against five pathogenic bacterial strains: *E. coli, S. aureus, S. typhi, B. cereus* and *K. pneumoniae*. The highest zone of inhibition of leaf extract was 13.0 mm and the least 4.0 mm, but in the case of current study it has found that only white flower plant have inhibitory activity against *S. aureus*. However other colors didn’t show any zone of inhibition against the

<table>
<thead>
<tr>
<th>Extration base</th>
<th>Bacteria</th>
<th>White color flower</th>
<th>Cream color flower</th>
<th>Yellow color flower</th>
<th>Pink color flower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td><em>S. aureus</em></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ethanol</td>
<td><em>S. aureus</em></td>
<td>54</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1.
tested pathogen. The aqueous extracts were also not able to inhibit any of the tested bacteria. It may be because of the antimicrobial peptides, which may not be soluble in water. So by this way we can also say that *M. jalapa* is a broad spectrum antibiotic for certain microorganisms [8, 12]. The research is beneficial as it provides us the proper use of each plant (flower color) of *M. jalapa* in a large number of variants. From the above results it can be concluded that plant extracts have great potential as antibacterial compounds against microorganism and that they (specific color) can be used in the treatment of infectious diseases caused by these microorganism.

It was also reported that neither aqueous nor methanolic extracts of *M. jalapa* were able to inhibit any of the tested bacterial strains, i.e. *Ps. testosteroni*, *K. pneumoniae*, *M. flavus*, *P. morganii*, *B. subtilis* and *S. epidermidis* [34]. Same was the case in the current study for aqueous extracts which doesn’t show any inhibitory activity, while the ethanolic extract of white flower was found to inhibit the tested bacteria.

It was also reported that *M. jalapa* have an antibacterial activities [33], but in the current study it was noted that only the White flower plant showed antibacterial activity against *S. aureus* and therefore only this plant can be used

**Figure 1:**

White Flowered plant collected from shaikh-ul-bandi Abbottabad, Pakistan. While the other three colors Cream, Yellow and Pink flowered plants collected from Araam-Bagh Abbottabad Pakistan.
to discover bioactive natural products that may serve as leads for the development of new pharmaceuticals against disease’s caused by S. aureus. Other wise if we use Cream, Yellow or Pink against S. aureus it will be useless, have no activity. Such screening of various natural organic compounds and identifying active agents and the most effective form is the need of the hour. By the result of this research we can increase the efficacy of anti microbial agents obtained from M. jalapa by using the most effective type of selected flower color plant against required pathogen.

In this research as it has found the change of action on microorganism because of color variation. It is so beneficial experiment, because we have a lot of plants which have variation of flower colors. For example Catharanthus rosea (Vinca) etc. Then after this we can also apply the same experiment to other plants too. And can find (select) the most beneficial and effective variety in these plants. With out the wasting of time and money in such a medicine which is useless or having less effectiveness, means appropriate use of drug would be prepared now onward from Mirabilis jalapa, if we use the most effective flower color plant whose effect we have required. And it would be given in Table 1.

REFERENCES:


