Antibacterial Activity of
*Pandanus tectorius*

Taoba Mwemwenikeaki

Mentor: Roger Goodwill
Bio.493
Abstract

This study was done to determine the possible antibacterial activity of *Pandanus tectorius*. The Kirby Bauer Assay was used to test for the antibacterial activity of the extracted solution of *P. tectorius* roots against *Escherichia coli*, *Bacillus subtilis*, *Candida albicans*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*. The dosage of both concentrations (100% and 80%) of *P. tectorius* extract was 30μL. The antibacterial activity of *P. tectorius* was determined by the diameter of the zones of inhibition formed. Among the five microorganisms *E. coli*, *B. subtilis*, *C. albicans*, *P. aeruginosa*, and *S. aureus*, only two of them had zones of inhibition, *B. subtilis* and *S. aureus*. However *S. aureus* is not significantly (p<0.05) different from the negative control.

Introduction

According to the World Health Organization (WHO), 80% of the world’s populations rely on traditional medicines (Adamu et al. 2004). The practice of herbal medicine is common in rural areas where western medicines are too expensive or not available (Adamu et al. 2004). Commonly used medicines among the Pacific Islands include extracts from the leaves of *Morinda lucida*, which are used for malaria and for the treatment of fever (Madureira et al. 2001), extracts of *Bauhinia refescens*, which are used for eye infections, and *Guiera senegalensis*, leaves which are used for cough, syphilis, diarrhea, leprosy, and impotence (Adamu et al. 2004).

*Pandanus tectorius* is also widely used for medicine in the Pacific. *Pandanus tectorius* originated in Northern Australia. It belongs to the family Pandanaceae, and grows to a height of 5-8 meters (25 feet) with sharp to blunt spikes along the trunk (Whistler 1996). The tree is supported by sword-like aerial roots (Whistler 1992b). According to Walter (2000), *P. tectorius* is used as a food and medicine in the Marshalls, Yap, Hawaii, Tonga, and Tahiti. In these cultures, the aerial root is used to relieve several internal diseases including stomachache, food poisoning, and urinary tract problems (Whistler (1992a, b, 1996).

Etera (pers. comm.) also reports the use of *P. tectorius* extracts in Kiribati. Krauss
(1979), noted that Hawaiians used *P. tectorius* for medicine. Whistler (1992a), and Peungvicha et al. (1998) reported that *P. tectorius* was used for internal ailments, inflammation, sores, relieving stomach aches, and food poisoning. Peungvicha et al. (1998b) stated that the root extraction of *Pandanus odoratus* played a role in increasing glucose consumption in rats. A constituent of *P. odoratus*, 4-Hydroxybenzoic acid, made this possible. In Kosrae, Federated States of Micronesia, the fruit, which contains a high level of provitamin A, is usually taken to promote dental health and to create wellbeing in the sick. (Englberger et al. 2003). The purpose of this study was to examine the root extracts of *P. tectorius* for possible antibacterial activity.

**Methods:**

Two aerial roots of *P. tectorius* were collected from trees at the Polynesian Cultural Center (Oahu, Hawaii). The roots were cleaned with tap water and dried. The outer bark was removed and discarded. The phloem was collected and sap was hand squeezed into a sterile beaker. The extract was used at full strength (100%) and in an 80% dilution, with distilled water. The extracted solutions (100% and 80% ) of *P. tectorius* were then used to test for antibacterial activity against *E. coli, Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus subtilis* and *Candida albicans* using the Kirby Bauer Assay (Bauer et al.1996). A dosage of 30µL was used for each treatment and control. Petri dishes (with LB agar) were inoculated with 30µL of culture and then divided into five sections. In each Petri dish, five 6mm disks were placed containing agar. 1) antibiotic 2) 30µL of 100% extract 3) blank disk with 30µL of 80% *P. tectorius* 4) blank disk and 5) blank disk with 30µL of distilled filtered water. The inoculated Petri dishes were replicated five times and incubated at 37º Celsius for 24 hours. Antibacterial activity was determined by the diameter of the observed zone of inhibition measured in millimeters. Zones measured included the 6mm diameter filter-paper disk; therefore, a 6 mm diameter zone of
inhibition represents no antimicrobial activity. The negative controls that were used for this study were blank disks and water. The positive controls were: tetracycline for both *Bacillus subtilis* and *Escherichia coli*, vancomycin for *Staphylococcus aureus*, piperacillin for *Pseudomonas aeruginosa*, tolnaftate solution for *Candida albicans*.

**Results:**

Only two of these five microorganisms *B. subtilis and S. aureus* that were inhibited by the *P. tectorius* extract. However, *S. aureus, P. aeruginosa, E. coli, C. albicans* are not significantly (p<0.05) different.

*Staphylococcus aureus*

The mean Zones of inhibition for 100% and 80% root extraction of *Pandanus tectorius* against *Staphylococcus aureus*, were 7.8mm and 7.4mm respectively (Table 1). Between the two different concentrations (100% and 80%), there was no significant dosage effect difference (p<0.05)(Table 2). However, when comparing both of the concentrations with the positive control, Vancomycin, there was a significant (p<0.05) difference between them. Comparing the two different concentrations of *P. tectorius* with the negative controls (blank disk and water), there were small differences, but the differences were not significant (p<0.05) (Table 2).

| Table 1. The mean and standard deviation of zones of inhibition (mm) of 100% and 80% *Pandanus tectorius* extracts against *Staphylococcus aureus* |
|---|---|---|---|---|---|
| Replicate | Vancomycin | 100% Ext.Juice | 80%Ext.Juice | Water | Blank |
Table 2. ANNOVA Values for differences between treatments and controls using S. aureus
**Bacillus subtilis**

The mean Zones of inhibition for 100% and 80% root extraction of *Pandanus tectorius* against *Bacillus subtilis* were 11mm and 8.6mm (Table 3). The two different concentrations of *P. tectorius*, 100% and 80%, had a significant (p<0.05) dosage effect (Table 4). When comparing both of the different concentrations with the positive control, tetracycline, both were significant (p<0.05) different than the control. Comparing the negative controls (blank and water) with the 100% concentration, there were significant (p<0.05) differences.

<table>
<thead>
<tr>
<th>Replicates</th>
<th>Tetracycline</th>
<th>100%</th>
<th>80%</th>
<th>Water</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>11</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>12</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>11</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>11</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Mean</td>
<td>29.8</td>
<td>11</td>
<td>8.6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 3. The mean and standard deviation of zones of inhibition (mm)

*Of 100%* Pandanus tectorius, 80%*Pandanus tectorius* Against *B. subtilis*
St.Dev | 1.095 | 0.707 | 1.342 | 0 | 0

Fig 2. Zones of inhibition for *B. subtilis* exposed to Tetracycline, two concentration of *P. tectorius* root extract and two negative controls.

Table 4 . ANNOVA Value for *B. subtilis*

Critical q (p=.05) → 4.29
50.25*  56.66*  63.61*  63.61*  6.40*  13.36*  13.36*  6.95*  6.95*  0

* difference are significantly different (p<0.05)
1 = Tetracycline
2 = 100% extract
3 = 80% dilution extract
4 = distilled water
5 = blank filter paper disc

Conclusion:
The results indicate that the *P. tectorius* have antibacterial effect on *B. subtilis*, but not on *E. coli*, *P. aeruginosa*, *C. albicans*, or *S. aureus*. There is an indication that it has an effect on gram-positive rod.

Acknowledgement:
I would like to take this time to give thanks to Roger Goodwill for his time, support, ideas and encouragement. Robert Winget for his help, on some information on the particular plant, and his time. R.Shane Gold for his assistance in computer graphics, and all the Biology staff, Phil Bruner and Randy Day for their time and insights.

Works cited:


