The Antibacterial Properties of Hawaiian Lichens
Clayton L. Martin Jr.
Mentor: Dr. Colby Weeks
Byu-Hawaii 55-220 Kulanui St Laie, HI 96762

Abstract
In this study the methanol extract of two lichens Parmotrema tinctorum and Teloschistes flavicans were taken. These were tested against the Gram positive bacteria Bacillus subtilis and Staphylococcus aureus as well as the Gram negative bacteria Escherichia coli. This was done using a Kirby Bauer Disc Diffusion Susceptibility Test. While the extracts had no effect on Gram negative growth they did prove powerful inhibitors of Gram positive growth. S. aureus was inhibited at ranges between 17.75±433mm and 12.25±.829 mm and B. subtilis was inhibited to the ranges of 19.25±1.48mm and 14.25±2.17mm. T. flavicans was the stronger inhibitor in both cases. These results were significant when compared to controls and warrant further research to identify and purify the causative agent.

Methods

Methanol extraction. Each lichen was frozen with liquid nitrogen then ground up in a mortar and pestle to a fine dust. Methanol was added and an extraction was performed. The solution of extract was evaporated at low heat and pressure. The extracts were later resuspended and refilter. The solutions were evaporated again and then resuspended to a concentration of 50mg/mL.

Antimicrobial assays. The Kirby-Bauer disk diffusion susceptibility test was performed. Mueller-Hinton agar plates were inoculated with 100μL of broth with 1 x 10^8 bacteria/mL for each microorganism and 10 mm paper disks infused with the extract were then placed the plates. The cultures were grown at 37°C for 24 hours. A paper disc soaked only with sterile methanol was used as a negative control. Paper discs loaded with Ampicillin (50mg/mL) were used as the positive control for gram positive bacteria and kanamycin (50mg/mL) was used against gram-negative bacteria. After the 24 hour incubation the zones of inhibition were measured for each disk.

Results

The extract of both lichens demonstrated significant antibacterial activity against the Gram -positive organisms Bacillus subtilis and Staphylococcus aureus. The Gram -negative bacteria Escherichia coli had no observable inhibition at concentrations up to 50mg/mL. T. flavicans and P. tinctorum cause inhibition zones of 19.25±1.48mm and 14.25±2.17mm, respectively, against B. subtilis and 17.75±433mm and 12.25±.829 mm against S. aureus. The disks with ampicillin showed expected activity against Gram-positive bacteria with a zone of inhibition of 33.25±2.86mm against B. subtilis and 50.25±.861mm against S. aureus. The methanol loaded disks used as negative control did not cause any observable inhibition.

Discussion

The lichens demonstrated a potent capacity to inhibit the growth of Gram-positive bacteria. Since activity was only seen against Gram-positive bacteria it is possible that the causative agent effects peptidoglycan. Similar activities by orsellinates and lichenic acids have been reported (Lauterwein 1995).

While the extracts were less potent than their positive control they were a mixture of compounds. If the active agent could be purified then this activity could increase dramatically. However, many compounds in extracts have been found to be potentiating and synergistic with one another meaning that isolation of causative agents will not necessarily lead to greater activity.

The extracts of T. flavicans and P. tinctorum warrant further studies to identify the active agent or agents and measure their antibacterial activity.

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