Materials and Methods

- The Bacillus species investigated in this study include B. thuringiensis, B. atrophaeus, B. pumilus (American Type Culture Collection strain #700614 – this strain does not produce an antibacterial agent), and B. pumilus (environmental isolate – this strain is known to produce an antibacterial compound).
- Seeds of Brassica rapa were surface sterilized and soaked in each of the four bacterial broths prior to planting in sterile soil. Control, untreated seeds were also planted.
- Ten four-inch pots containing three seeds each were used for each group.
- Plants were watered daily, and insect repellants and fertilizers were not used. After 6 weeks, the plants were evaluated for growth characteristics including:
  - total wet length
  - wet and dry weight
- Analysis of variance (ANOVA) was conducted to compare bacterial treatments.

Results

While plants treated with B. thuringiensis did demonstrate greater length and higher weights compared with other treatments or controls, these differences were not statistically significant.

Table 1. Average plant growth characteristics. The power of ANOVA was 0.284 for wet weight and 0.65 for wet length.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Wet weight (g)</th>
<th>Dry weight (g)</th>
<th>Wet length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. atrophaeus</td>
<td>1.90</td>
<td>0.14</td>
<td>14.9</td>
</tr>
<tr>
<td>B. thuringiensis</td>
<td>1.77</td>
<td>0.13</td>
<td>17.05</td>
</tr>
<tr>
<td>B. pumilus ATCC</td>
<td>1.04</td>
<td>0.16</td>
<td>16.2</td>
</tr>
<tr>
<td>B. pumilus isolate</td>
<td>1.48</td>
<td>0.27</td>
<td>15.65</td>
</tr>
<tr>
<td>Control</td>
<td>1.12</td>
<td>0.17</td>
<td>15.68</td>
</tr>
</tbody>
</table>

Discussion

- No statistically significant differences were found between treatment groups for wet weight or length. This may be attributed to the small sample sizes and high variability in the data.
- Visual differences were observed, however, for plants inoculated with B. atrophaeus and B. thuringiensis. Bacillus atrophaeus treatment group had the lowest survival of plants, and they were smaller with less flowering. Endophytes are often host specific, promoting growth in one plant but not another. This may be the case with B. atrophaeus and Brassica rapa. In contrast, all plants in the B. thuringiensis treatment group were larger and looked healthier than the other treatments.
- Bacillus thuringiensis has been well-documented for "biological control" by causing the death of harmful insects, although no insect pests caused damage to the plants in this study.
- Future studies will use in vitro microbiological techniques to assess possible mechanisms used by B. atrophaeus and B. thuringiensis to affect plant growth. The sample size for the greenhouse experiment will be larger and dry above-ground biomass will be used for statistics.

Literature Cited


Acknowledgements

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