

INDIVIDUAL PROJECT: MEASURING TANNIN LEVELS IN *PIPER* LEAVES

Aim

To measure tannin levels in Piper leaves in areas of different amounts of sunlight in the Tambopata jungle.

Hypothesis

The leaves in areas with lesser light will have more tannins than in leaves in direct sunlight.

The reasoning behind this hypothesis is the following. Tannins are bitter tasting chemicals produced by plants to make leaves less appetizing for leaf-eating insects. Plants in deeper areas of the forest compete heavily for light, because the **tall** trees in the upper canopy make light a scarce resource. Because the competition for light is so fierce, plants in shaded areas are forced to take more severe measures to protect their leaves from surrounding pests. That's why, according to the hypothesis, plants in areas with lesser light will have more tannins than leaves in direct sunlight.

Materials

- Piper Leaves
- Plastic Bags

Method

Piper plants from three different areas were studied in this experiment: the football pitch (where plants were in direct sunlight), the Middle Flood Plain Forest (where plants were in partial sunlight), and the Older Upper Flood Plain Forest (where plants were in complete shade).

Two leaves from two different plants in each of these areas were collected and placed in plastic bags to be carried back to the lodge. Once in the lodge, another person took the leaves and randomly gave me one leaf at a time to taste, so that the origin of the leaf was unknown to me upon tasting. After tasting a leaf, its bitterness was rated on a scale of lightly bitter, medium bitter, and very bitter. Once this was done, the leaf was spat out and I ate a cracker and drank some water to wash the taste out of my mouth. This process was repeated for each of the 12 leaves collected.

Results

Below is a table showing the comparative bitterness of the 12leaves tasted:

<u>Football Pitch</u>		
Plant	Leaf	Bitterness
Plant 1	A	<u>Lightly Bitter</u>
	B	<u>Very Bitter</u>
<u>Plant 2</u>	A	<u>Very Bitter</u>
	B	<u>Medium Bitter</u>
<u>Middle Flood Plain</u>		
Plant	Leaf	Bitterness
Plant 1	A	<u>Medium Bitter</u>
	B	<u>Very Bitter</u>
<u>Plant 2</u>	A	<u>Very Bitter</u>
	B	<u>Medium Bitter</u>
<u>Upper Older Flood Plain</u>		
Plant	Leaf	Bitterness
Plant 1	A	<u>Medium Bitter</u>
	B	<u>Very Bitter</u>
<u>Plant 2</u>	A	<u>Medium/Light Bitter</u>
	B	<u>Medium Bitter</u>

By using a bitterness scale of 1 to 5 (5 being very bitter, 3 medium bitter, and 1 lightly bitter, etc), these results can be averaged and shown in the table below:

Area	Average Bitterness Scale
<u>Football Pitch</u>	3.5
<u>Middle Flood Plain</u>	4
<u>Upper Older Flood Plain</u>	3.25

As can be seen from this table, the Middle Flood Plain was the area with the leaves with the average highest bitterness, with 4, followed by the Football Pitch, with 3.5, and the Upper Older Flood Plain, with 3.25. These results go against the expected results given by the hypothesis, that the Football Pitch would have the least bitter leaves, and the Upper Older Flood Plain the most bitter.

Conclusions

In conclusion, the data collected disproves the assumption of the hypothesis, that plants in direct sunlight have less tannins than plants in shaded areas of the forest. This result could have taken place for several reasons. The first of which being problems with using bitterness as a measure for tannin levels. It is possible that tannins aren't the only chemical which determine the bitterness of a leaf, so as such the results in bitterness could be completely unrelated to tannin levels of the leaves. In order to accurately measure tannin levels in this way, the accuracy of using bitterness of a method should have been further researched. Assuming that tannins were the only factor influencing the bitterness of the leaf, because only one person was used to taste the leaves, it's possible that the data could be mildly subjective according to the tastes of the tester. Measures like giving the leaves to the taster anonymously (with their origins unknown) were taken to reduce this subjectivity, however it's difficult to say if this really eliminated the possible vagueness of the results. For the tasting method to yield truly accurate results, many people should have been used as tasters, something which, unfortunately, time did not allow.

Ignoring these possible inconsistencies, there are many possible explanations for the results of this project. The first has to do with the reality of the piper plants in the football pitch. The football pitch is a relatively recently cleared area, meaning that though these plants were in direct sunlight, they may not have had time to adapt their tannin levels to the new situation of increased light. Following this idea, it could have been possible that these plants, in the past were in a much more shaded area than those in the Upper Flood Plain. This assumption has some evidence as given in the experiment measuring the horizontal/vertical ratio of piper plants. In this experiment, the results also hinted at the possibility that in the past, the Football Pitch was a heavily shaded area. Seeing how this conclusion came up in two separate experiments, it definitely holds some weight and should be considered.

Also, the plants in the football pitch grow in an area which the lodge uses for a compost pile. The decomposing organic waste attracts a large amount of insects, meaning that the piper plants in the football pitch, though in direct sunlight, still have a large need for protection against this massive potential insect threat. It should be noted as well that the piper plants in the football pitch were only partially in full sunlight, on the side facing the football pitch, whereas the other side of the plant was shaded. The continual presence of shade on one side of the plant could give it a greater need for tannins, leading to the results of this experiment.

In the end, though this individual project had its flaws, it gave me a good opportunity to test the scientific method in an experiment which I designed myself. Whatever ambiguities experienced in this experiment will only further my knowledge of controlling variables for accurate testing in the future. The results disproving my hypothesis created a need for me to look deeper into the situation for other possible influences on the bitterness, and as such the tannin levels of the leaves. For all these reasons, I consider this experiment to be a very useful individual project.