

An experiment to show how water loss in leaves can vary

Introduction

Transpiration is the movement of water from an area of high concentration to an area of low concentration in a leaf from out of the stomata. Mostly the stomata lie on the under side of the leaf but occasionally the stomata can lie on the top or on the stem of the leaf.

Factors that increase the rates of reaction are: windy conditions, hot conditions, humid conditions and the rate of water being absorbed through the roots being smaller than the rate it is transpired. A couple of ways that you could decrease or prevent transpiration could be keeping the leaf in an airtight container so the water evaporated does not escape and the conditions surrounding the leaf are humid so the rate of transpiration would not be as great, another way could be to cover the stomata with a substance such as Vaseline so the water is physically prevented from escaping. I have chosen this as my preferred method for this investigation.

Variables

- Leaf sizes can affect the rate of reaction in two different ways either by the leaves having varying surface area or varying thickness e.g. some leaves are fleshier than others.
- The petiole sizes can be different and the bigger the petiole, the bigger the water capacity the leaf can hold.
- Varying amounts of Vaseline means that some leaves have differing strengths of barriers preventing them from transpiring, also an even distribution of the Vaseline could result in some of the stomata being uncovered compared to others that do not.
- Drying the leaf is quite important because if you did it unequally, the leaf could absorb this so it has a greater water supply before the investigation has even started.
- Using different leaf types could result in an unfair test due to the same principles as the leaf sizes.

Prediction

I think that covering the underside of the leaf will be the most effective method of preventing transpiration because I am almost certain that the stomata will be there since the majority of leaves do. Also I think that using no Vaseline at all will be the least effective method of preventing transpiration because the leaf is free to evaporate on all sides of the leaf and no stomata will be covered although it will not be that different to using Vaseline on the top of the leaf, nevertheless it will probably have a small difference.

Method

Firstly I will take four similarly shaped leaves, all from the same plant, and then trace around the leaf so I can work out the surface area. after working out the surface area, I will measure the mass of each leaf then label each petiole with a number: 1, 2, 3 or 4. The leaf labelled number 1 will be the controlled experiment so I will leave the leaf to dry out naturally. Number 2 will have its underneath covered with Vaseline, number 3 will have the top of the leaf smeared with Vaseline and number 4 will have half of the top and half of the underside smeared with Vaseline. Finally the leaves will be left, hanging by some string off their petioles, this is done so that the air can access all areas of the leaf and they are not restricted to transpire. I am using Vaseline because it is reasonably good at preventing transpiration when used properly.

Results

leaf	Mass(g)	Area(cm ²)	Mass after 6 days(g)	Percentage change of mass (%) (negative change)
1	1.9	69	0.58	69.5
2	2.0	76	1.41	29.5
3	2.2	74	-----	-----
4	2.1	72	1.05	50

Analysis of data

There is no noticeable pattern that strikes you at first from looking at the data. Except for the obvious fact on the second graph that all of the leaves have less mass than before the six days. I have however noticed a very strong pattern that have all of the data following the rule and that is that the percentage changes all increase by roughly 20 % each time. Despite having such good results fro this pattern, I think it is actually a coincidence since had the missing result (number 3) been present then the pattern would have been broken.

Conclusion

The data I have collected has had some positive results in relation to my prediction, number 2 was the most effective method of preventing transpiration, it had Vaseline on the underside of the leaf. Number 1 was the least effective method of preventing transpiration; it had no Vaseline on it at all. these two followed my hypothesis but of course I cannot use this as evidence to back up my hypothesis because it cannot be proven without that third result since it could have been anywhere on the percentage change scale.

Evaluation

The data can not be used to prove anything due to the third leaf going missing also at least five results are required to have a decent experiment and have something of substance that will be able to show you a true pattern in the data. One reason why the leaf could have fallen off is that the petiole shrunk due to such a water loss that it fell out of the string tied around it. If I were to do the experiment again then I would use at least five examples of one leaf then five each with other types of leaf so you have a range of different leaf types. Also I would cut the leaves to a uniform size so they all have the same surface area but only using leaves of the same thickness. With the Vaseline, you could pre-weigh the amount and use that amount with all experiments then use a knife to spread it giving even distribution.

Method evaluation

This experiment has a lot of things to be aware of in order to make a fair test, so you need to think of all the possible variables that could alter the results. For instance, the amount of Vaseline applied to each leaf could vary greatly as it is quite hard to measure accurately. The Vaseline even with the same amounts on each leaf is not faultless, since Vaseline is a gel; it has a tendency to slide off the surface of the leaf. Also the conditions that the leaves are kept in, can have an effect on the rate of transpiration e.g. leaves left by the window or radiator would have different results than those that are not kept in these conditions. As you want to get the true results these are not helpful conditions to keep the leaves in. the size and type of leaf can have a big effect on the results as different leaf types can differ greatly, different plants can have more or less water capacity than others so this is an unfair test. Even if you have leaves from the same type of plant, if they are from different plants then there is a possibility that the two different plants were watered at differing times meaning that they have a greater amount of water absorbed into the cells. The leaves also need to be the same size in both surface area and thickness and have the same size petioles due to differing water capacities resulting again in impaired results. The way that the surface area was worked out was by estimating roughly how many cm^2 were on the leaf.

In conclusion I did not get completely accurate results but the showed generally what would happen to the rates of reaction.