# Example of aim: investigating the effects of environmental factors on transpirati...

Environment, Plants

# Introduction

Transpiration is the process involving the movement of water from the roots through the xylem to the atmosphere via the stomata. About 95% of the water absorbed by plants is transpired to the atmosphere. The plant uses the remaining 5% for its metabolic functions such as photosynthesis and respiration (Ahmadi and Baker, 259).

The movement of water in the vascular plant is as a result of the coordination among the three plant organs: the root, the stem, and the leaf. Roots have root hairs located toward its growing tip. The root hairs form extensions of the epidermal cells referred to as trichomes that provide sites for water absorption. The larger the number of root hairs, the more the water they absorbed and vice versa. The stem has a vascular bundle consisting of the xylem that provides the channel through which water moves up the plant to the leaves.

There are various forms of transpiration: stomatal transpiration, cuticular transpiration, and lenticular transpiration. Stomatal transpiration occurs through the stomata found on the leaf surface, tender stems, flowers, and fruits. It accounts for 80-95% of the water lost by the plant. Cuticular transpiration, on the other hand, occurs through the cuticle found on the surfaces of the plant body especially the aerial portions and accounts for 5-10% of the total water loss. Lastly, lenticular transpiration occurs through the lenticels of the plant.

This experiment sought to investigate the effects of environmental factors; heat, light, and wind, on the rate of transpiration in plants. The students compared the rates of transpiration for several plant species under different environmental conditions.

## Procedure

The first step involved investigating how light affects the rate of transpiration in plants. In this case, a sprig of one of the plants on the shelf was picked by clicking it. The sprig was then dragged and dropped near the photometer on the table so that in snaps into the photometer. The students then recorded the name of the selected plant that appeared on a note near the photometer. Next, the students clicked the clock to start the transpiration process. After one hour, the amount of water transpired by the plant in millilitres was shown in the digital readout near the photometer. The students recorded this data on the table.

Next, effects of wind on the rate of transpiration in plants were investigated. In this case, the students first clicked and dragged the fan from the lab bench to the table and dropped it near the photometer. The students proceeded with the experiment by following the steps outlined above for investigating the effects of light. The procedure was repeated until all the plant species, and appliances had been used.

## Results

The results obtained from the experiment are shown in table 1 shown below:

The rate of transpiration increased under wind and heat for all the plants tested. On the other hand, Zebra plant, weeping fig, rubber plant, and dieffenbachia recorded lower rates of transpiration when light was applied.

However, wind increased the rate of transpiration more than the other environmental factors. In addition, the rate of transpiration was higher when heat was induced than when light was induced.

## Discussion

In vascular plants, water moves from the root through the stem into the leaves. The movement of water is due to capillary action, a force that exists between water molecules and causes water to rise inside the xylem tube. Another force involved in the process is the shoot tension, negative pressure that results as water evaporates from the stomata. This process causes the steady and continuous flow of water up the plant (Ahmadi and Baker, 260). Shoot tension depends on the ability of water molecules to form hydrogen bonds with each other (cohesion) and other polar substances (adhesion) such as the xylem walls. These properties that enable water molecules to attract one another and to the xylem wall create thin water column in the xylem tube enabling it to move up the plant.

Wind increases the rate of transpiration by driving away water vapour close to the leaf surface. Consequently, the diffusion gradient between the air and the internal air spaces of the leaf increases, hence the high rate of transpiration. Heat raises the kinetic energy of water molecules. Consequently, the rate of diffusion of water through the leaf surface increases.

Among the tested plants, coleus plant had the highest rate of transpiration, followed by Geranium plant. The rate of transpiration differs among plant species with different morphologies and features which are due to selective pressures exerted by pollinators, climate, herbivores and other environmental factors.

Coating the leaf surface with petroleum jelly reduces the rate of transpiration because the stomatal pores, which are the main surface for water loss are blocked. This blockage, therefore, reduces the rate of water lose. However, it prevents carbon dioxide required for photosynthesis from diffusing into the leaf. On the other hand, the oxygen given off during respiration will not diffuse out of the leaf (Brodrib, Field, and Sack, 492).

Transpiration helps in the movement of minerals through the xylem, from the root up the plant and translocation of photosynthates throughout the plant (in the phloem). The process also helps in cooling the plant, due to loss of heat of vaporization. Transpiration also plays a role in maintaining turgor pressure of cells which makes the cells retain their shape and give them a competitive advantage in competing for sunlight (Blum, 22).

## Conclusion

In conclusion, the rate of transpiration is affected by the environmental factors such as heat, light, and wind and it also varies among plant species. Transpiration plays some pivotal role in maintaining cell turgidity, movement of mineral salts, and the cooling of plants.

## Works cited

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