Factors That Affect The Number Of Stoma On A Leaf.

Stomata are specialised pors on the epidermis of the leaves and stems of plants, which have the capability of opening and closing. The opening and closing of the stomata are contolled by a pair of modified epidermal cells called guard cells. The principle fuctions of stomata are gas exchange for photosynthesis and the evaporation of water as part of the transpiration stream.
The stomata open and close due to changes in turgor pressure within the guard cells. In the centre of each guard cell is a sap filled vacuole that can swell with increasing turgor pressure. Guard cells increase their turgor pressure by accumulating K^+ ions thus lowering their water potential allowing an osmotic flow of water into the cell. Because the inner cell was is thicker and less elastic than the outerwall the cell expnads unevenly. They bend and draw away from eachother. The result is the pore between them opens.

Many factors acount for the extent to which the stomata open.

- Light levels-open during the day but closed at night.
- Hot temperatures-means an increase in the maount of water lost through evaporation. If the water loss exceeds the water uptake the water content of the plant falls and the guard cells lose their turgor and close.
- High levels of CO_2-in this situation the plant rewquires very little CO_2 so the stomata close.

Similarly there are several factors that can affect the amount of stomata present on the epidermis of leaves, including:

- Humidity
- Light levels
- Rainfall
- Size of the leaf
- Species of the leaf.

In this investigation I will be determining the affect of light levels on the amount/density of stomata.

HYPOTHESIS:

I predict that the leaves taken from the outer area of the shrub will have a higher stomatal index than the leaves taken from the center of the shrub. Photosynthesis depends on the amount of light absorbed by the photosynthetic parts of a plant. When chloroplasts in the leaf's cell are exposed to light they synthesise ATP from ADP. Oxygen is produced as a by-product of the photosynthesis reaction. Therefore increasing the concentration of light will increase the amount of ATP being synthesised from ADP and so more oxygen will be released as a by-product. This increase in photosynthesis will mean that larger amounts of the other raw materials are needed, carbon dioxide and water. Carbon dioxide enters the plant via diffusion through the stomata. If the overall rate of photosynthesis is increased then a higher concentration of carbon dioxide must diffuse into the plant. In order for this to happen the plant was grow higher numbers of stomta (creating a larger surface area for CO_2 diffusion. Similarly the large amounts of oxygen being produced needs to be

excreted-this again occurs through the stomata. As the leafs from the outer area of the plant are exposed to higher intensities of light than the leafs in the center of the plant they will have higher numbers of stomata.

Higher intensities of light would also increase the temperature to which the surface of the plant is being exposed. The evaporation of water through the stomata has the affect of cooling the plant. So if the temperature is increased we can assume that the number of stomata will increase to enable more water to be evaporated, thus cooling the plant.

However there has to be a balance. If the number of stomata increase for gas exchange this can lead to increased water loss. The plant must grow the correct amount of stomata to create a balance between the amount of gas being exchanged and the amount of water being lost due to evaporation. For this reason I predict that the differnece between the stomatal index on the outer most leaves and the inner leaves will not be significantly large.

METHOD:

In total twenty leaves will be taken, all from the same shrub/bush. Ten leaves will be taken from the outer surface i.e the area most exposed to light, and ten from the centre of the bush where light levels are low. The fact that all the leaves will be atken from the same plant ensures fair testing, as there is a lot of diversity between different species of plants.

The lower epidermis only (where the great majority of the stomata are) of each leaf will be coated in a thin layer of nail polish. After the nail polish has been left to dry for a few minutes it will be peeled off and placed onto a clear microscope slide. The number of stomata and epidermal cells will then be counted under high power (400X). A stomatal index will be determined for the leaf. The Stomatal Index (I) =[S / (E+S)] * 100, where S is the number of stomata per unit area, and E is the number of epidermal cells per same unit area. The data form individual leaves will be combined and a mean will be calculated for each plant sampled.

The slide will be looked at from three other random fields of view and the amount of stomata present in each field counted. To successfully count the number of stomata in a field of view I will need to focus, using the fine adjustment, up and down to bring different planes into focus.

To ensure fair testing:

- All the leaves must be taken from the same plant/bush/shrub to ensure there is no diversity.
- All the leaves must be of approximately the same size although as I will determine the amount of stomata per this is not essential. Similarly the leaves must be of about the same age, as those that are older are likely to have more stomata than those that are younger, simply because they have been growing for a longer period of time.
- The same size area in which the stomatal index is calculated must be used for each leaf.