Natural Healing: Regeneration of Epicuticular Waxes on Leaf Surfaces

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The surface of plant leaves plays a major role in the interaction between plants and their environment as it fulfills important functions, such as protection against water loss due to transpiration or resistance against mechanical stress. For this purpose, epicuticular waxes are present on plant surfaces. In order to maintain the structure and functionality of such waxes, plants have to reproduce wax-structures to replace damaged wax and to fill up voids. Using atomic force microscopy (AFM), I studied the process of wax regeneration in dependence of environmental conditions on leaf surfaces of different plants. Waxes were removed from the leaves still attached to the plant by applying a small drop of glue on the surface and removing it, after it has hardened. Measurements were taken continuously in order to observe and quantify the creation of new waxes by the plant. Furthermore, the structure of the wax layers was studied using data from the AFM-images and mass spectroscopy (Maldi-Tof) measurements. Varying wax-structures on different plants and the ability of a few plants to renew them after destruction were observed. Significant changes in the speed of regeneration due to changes in illumination and irrigation could be shown: The higher the intensity of light and the less the irrigation, the faster the wax-layers were repaired. The differences in wax production due to different environmental conditions show that the wax layers play an important role in adjustment processes. Findings of the investigation can be useful for technical applications such as the development of new surfaces with self-repairing properties.

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