Climbing to new heights in the forest canopy: Questions remain after Darwin's own interest (w/ Video)

August 6 2009

With summer in full swing, many plants are at their peak bloom and climbing plants, like clematis, morning glories, and sweet peas, are especially remarkable. Not only are these plants beautiful, but their ability to climb walls and trellises is an impressive feat of biological engineering that has taken millions of years to accomplish.

A recent article by Dr. Sandrine Isnard and Dr. Wendy Silk in the July issue of the American Journal of Botany explores the logistics of this incredible ability. Climbing plants have fascinated biologists, including Charles Darwin, who wrote a provocative essay on the subject in 1865; however, many questions remain to be answered.

Climbing plants vary in their mode of attachment to their supporting structures. They have traditionally been classified into five categories based on their mode of attachment: twining plants like morning glories, leaf-climbers like clematis, tendril-bearers like grapevines, root-climbers like English ivy, and hook-climbers like cats claw.

Climbing plants in the first three categories exhibit a type of motion where the plant grows by revolving in large arcs, known as circumnutation, giving them the greatest likelihood of encountering a support. Exactly what allows the plants to circumnutate is still poorly-understood and is a topic of much ongoing research involving biophysics. After contacting a support, the stem of twining plants winds and forms a helix around the supporting structure. In leaf-climbers, the leaves bend and clasp the supporting structure; while in tendril-bearing plants, the tendrils coil around a support, and form a basipetal spring-like structure which draws the stem closer to its source of support.

Root-climbers and other clinging climbers often adhere to a supporting structure through viscous secretions, allowing them to crawl up very large tree trunks. Hook-climbers are rather less sophisticated. They use their hooks to lean on their source of support without firmly attaching to it, a notable difference from the other types of climbers.

Although it is possible to observe the superficial differences among the vines in their climbing methods, it is more difficult to observe structural traits of the stems that play an integral role in the plants' climbing ability. Because climbing plants rely on their other supportive structures as they reach toward the sky, they do not need to invest their energy into building huge tree trunks to support heavy branches. Not only are they able to be flexible, but flexibility is an asset that makes a vine less prone to mechanical stresses while detaching from support or during fall of the support itself. Many anatomical traits of vines, such as the significant development of parenchyma and high frequency of wide water transport vessels, allow them to maintain this flexibility and withstand breakage while still effectively transporting water and nutrients throughout the plant.

Recent research in Amazonian forests has suggested that the abundance of woody vines is increasing relative to tree species, possibly as a result of human-induced climate change, such as increasing carbon dioxide concentration and increasing forest fragmentation. A greater knowledge of these fascinating plants is warranted as we begin to understand the important ecological role they play in forest dynamics, structure, and composition.

More information: www.amjbot.org/cgi/content/full/96/6/1075

Source: American Journal of Botany