# Bract Monopteron

The seed needs to be carried away as far as possible from the tree, so that it doesn't land in its shadow or on its roots, where it would be starved of nutrients. The wind is fickle, you can't schedule a gust, the only variable the tree can control is the time. When you drop a rock from 30 meters it hits the ground in around 2,5 seconds. The seed needs to fall as slow as possible.

There is tumbling and autorotation. Tumbling is chaotic movement where gravity wins quickly. Autorotation is steady, stable rotating motion around the vertical axis - the wing is generating lift, turning the fall into a glide. Autorotation cuts the descend speed in half. Doubling the dispersed range is in evolutionary terms superpower.

The length of the stalk matters, when it falls from the tree it doesn't start spinning immediately, it tumbles for a split second. Then it has to self-correct and lock into the spin. The stalk is what makes this correction possible. The movement of the seed creates torque through the stalk, which pulls the wing back into the correct orientation. Shorter stalk would result in less torque, and there would be no correction, and no gliding.

Ω 1 cm U $\vec{g}$ X Z

R_s

L_{wing}

l_{wing}

l

L
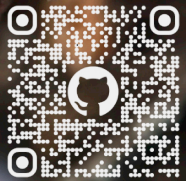
Tilia x europaea

A mature tree typically grows to a height of approximately 30 meters. Its crown begins roughly two to five meters above the ground.

Tumbling

Autorotation

10 cm

$L = 3.75$ cm $L = 2.75$ cm $L = 2.5$ cm $L = 2.25$ cm
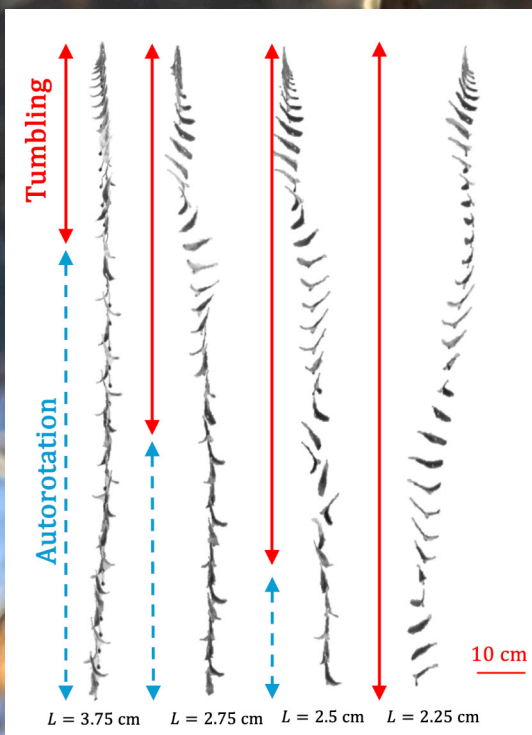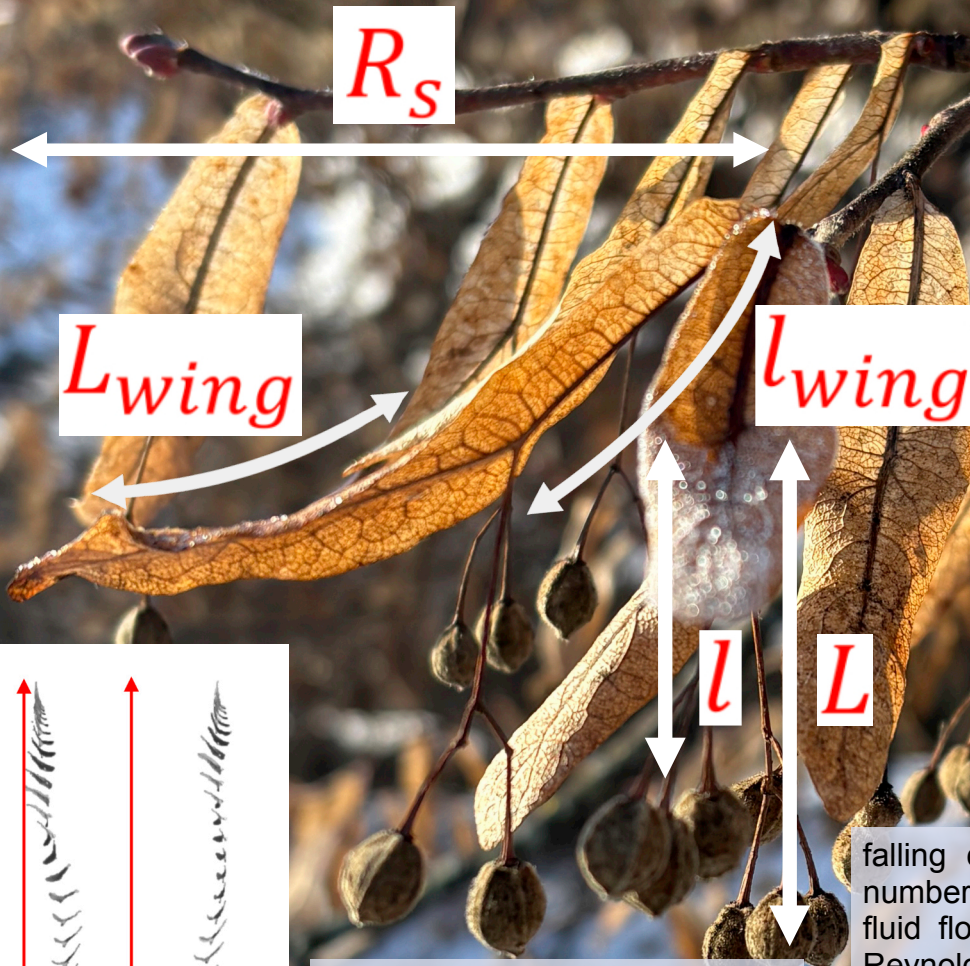
Scientists 3D printed perfect replicas of the linden seeds, took a tank of water and filled it with tiny glittering particles, to be able to see the water moving, by shining a laser at the water.

The only difference between air and water is density and viscosity. Adjusting the scale of the model and the speed of falling can match Reynolds number. It describes how a fluid flows, so matching the Reynolds number of water and air gives the same descend in both fluids.

The curvature of the wing pushes the vortex outward. The curve makes the spin stronger. Flatter wing wouldn't need as long stalk, shorter stalk would make the curved wing tumble. Beautiful holistic system.