VIDEO: Plants use raindrops to spread seeds

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Incredible high-speed video shows how 'splash-cup' plants use raindrops to spread their seeds.

Splash-cup plants use raindrops to spread their seeds. (Credit: Tim Nowack)

NEW FOOTAGE REVEALS HOW plants harness the energy of raindrops to extend the spread of their seeds.

Plants with cone-shaped flowers or fruit, sometimes called ‘splash-cups’, disperse their seeds using splashes of falling water. They capture rainwater in their cup-shaped flowers and use the impact of subsequent raindrops to splash out the seed-filled liquid.

For the first time, researchers have captured high-speed footage that shows how these plants have adapted to maximise the distance a splash – and therefore their seeds – will travel.

Cone-shaped plants use raindrops to spread seed

The conical shape of the flowers or fruit, coupled with the location of the raindrop’s impact to concentrate the splash in one direction, extends the reach of the plants’ seeds. “The combination of both of these effects creates a fast water jet that entrains the seeds and carries them a distance of up to 10 times the height of the mother plant,” says one of the study’s key researchers, Guillermo Amador, from the Georgia Institute of Technology in the US. “The advantage of this is that the plants can harness 'free' energy from falling rain in order to spread their seeds.”

For their study, published this week in the *Journal of the Royal Society Interface*, the research team used a 3D printer to replicate the flowers of an average-sized splash-cup plant. They released water droplets from a syringe held 35cm above the replica flowers to simulate raindrops travelling at terminal velocity. They varied the angle of the flowers’ sides and the location of the water droplets’ impacts, to see how these factors affect seed distribution.

Using high-speed video cameras, they visualised the splash profiles. “This is the first time high-speed film has been used to study these plants,” says Guillermo. “The splash of a liquid drop onto a surface takes all of 2-3 milliseconds, so in order to carefully study this event, we had to shoot the videos at about 10,000 frames per second.”

Distinct water patterns aid splash-cup plants

Two distinct splash patterns were observed. When a droplet landed in the centre of the flower, the resulting splash was symmetrical and not far-reaching. If it landed off-centre, however, the splash jetted off in one distinct direction, travelled up to five times further than an on-centre splash.

The shape of the flowers enhanced the splash. “We found that the conical geometry of the fruiting body was responsible for the great dispersal distances,” says Guillermo. He explains that the angle and curvature of the cone’s walls led to a spout-like effect. This amplifies the speed of the splash, causing it to be up to five times greater than the speed of the falling droplet.

“We were completely surprised when we observed the seeds travelling at speeds five times greater than the incoming water-drop speed,” says Guillermo. “This was the equivalent of seeing a car travelling at 8m/s and then, within the span of 1 millisecond, seeing it speed up to 40m/s as it travelled around a turn.”

Researchers believe splash-cup plants evolved from species that use wind to disperse their seeds. Because of their short stature – splash-cup plants don’t grow higher than 35cm and their average height is only 12cm – their exposure to wind is limited. This could explain why they rely on rainfall for seed distribution.

“There has been little investigation into these splash-cup species in the past, and before our study, no-one had been able to explain how these short-statured plants achieved such great seed dispersal distances with the use of rain,” says Guillermo.

Splash-cup species in Australia

Plant biologist Dr Peter Prentis, from the Queensland University of Technology, says interdisciplinary studies such as this one, which combines physics and biology, can provide important insights into plant behaviour. “This research is extremely significant as it shows that interdisciplinary research can elucidate the actual mechanism behind specific adaptations,” he says.

“This type of adaptation could occur in Australian plants, in fact some species from the genus *Mazus* are found in Australia and New Zealand,” he adds, commenting that although splash-cup plants are not overly common in Australia, this method of seed dispersal could be important for some species.

Guillermo agrees. “The fungal species called bird's nest fungus is one example that exists in Australia,” he says. These conical mushrooms grow on rotting trees and rely on falling water for seed dispersal. “The list of splash-cup plant species is still growing,” says Guillermo, “and there is a lot more work left to do to identify them.”

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