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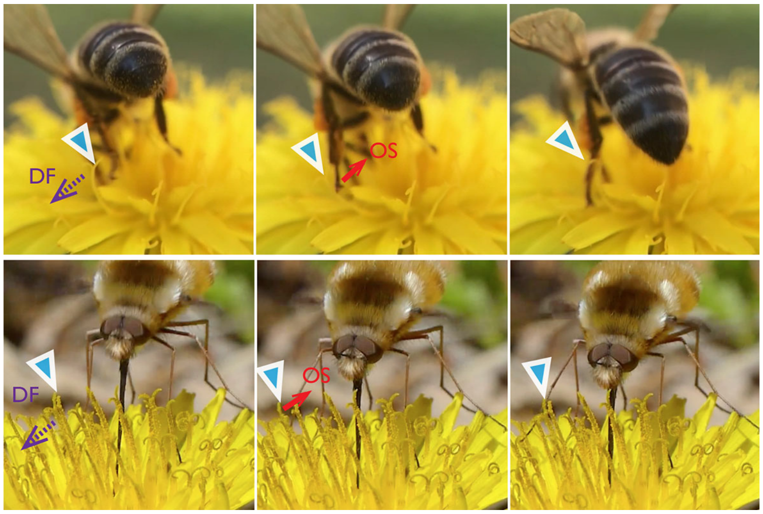
INSIDE JEB

Flatweed catapults pollen to ensure it gets a lift



Top: a bee deflecting a flatweed filament, indicated with a blue triangle [arrows show direction of deflection (DF) and oscillation after release (OS)]. Bottom: deflection of a filament by a bee fly.

Insects often leave the luscious flowers they frequent dusted in a coat of pollen, which they bear to the next bloom; insects and plants have struck a mutually beneficial bargain. But some insects have reneged on the deal, sipping nectar from on high using elongated mouthparts to avoid carrying undue weight when pollen attaches to their bodies and limbs – which has driven some flowers to develop long pollen-bearing styles, protruding beyond the anther, to brush against their benefactors. Yet, even those cannot always reach the most aloof insects, which prompted Shuto Ito, Hamed Rajabi and Stanislav Gorb from the University of Kiel, Germany, to ask how these resourceful plants transfer pollen to their couriers.

Ito and his young family went for walks around local parks in Kiel, looking for the dandelion-like flowers of the flatweed (*Hypochaeris radicata*) – part of the daisy family, which depends exclusively on insects for pollination – filming insects feeding on the blooms with an iPhone to find out how the flowers pass on their pollen. Back in the lab, Ito and Rajabi noticed that pollen rubbed off on an insect's flanks when it inadvertently pulled the style toward itself, ready to be transferred to the pollen basket. But after the insect brushed past the style, deflecting it away from the body, the style suddenly snaped back like a catapult. Could it be launching clumps of pollen into the air to pepper the flower and insect?

Intrigued by the filament's ballistic manoeuvre, Ito and Rajabi gathered newly opened florets and returned with them to the lab where they measured the force required to bend the structures to find out how springy they were. The filaments that anchor the floret to the flower head were very elastic, allowing the filament to tip over, while the anther tube was relatively rigid – like the rigid cantilever of a catapult – and the style at the end was floppy, allowing it to flex. But how would the filament's segmented assembly impact pollen dispersal as the structure flicked back?

This time, Ito and Rajabi deflected the filament sideways with a needle, forcing it to bend initially at the base and eventually deflecting the style until the needle slipped off the filament tip. Filming the instant when the filament hurtled forward, at 5000 frames s^{-1}, the team saw the flexible style flick forward and straighten reaching accelerations of up to 6000 $m\ s^{-2}$ at the tip before the anther catapulted the entire assembly forward, launching pollen from the style, before returning upright and gently oscillating to and fro until it finally came to rest.

The duo then calculated how far the filament could hurl pollen grain clumps, revealing that the majority fell within the circumference of the flower, enabling the precious grains either to become safely lodged on the insect's body for transport to another flower, or to be retained on the flower head, ready to be picked up by the next unsuspecting insect visitor, 'minimising the waste of dispersed pollen', says Ito.

Daisies and other members of the Asteraceae family of plants are notoriously efficient, invading many regions of the planet, and the team suspects that their ballistic pollen dispersal strategy could be one of the secrets to their success, allowing them to distribute pollen efficiently even if it doesn't land a lift first time.

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