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Jumping-Droplet Condensation Drives Pathogen Transport on Wheat Leaves. SAURABH NATH, HOPE GRUSZEWSKI, STUTI BUDHIRAJA, FARZAD AHMADI, CAITLIN BISBANO, SUNGHWAN JUNG, DAVID SCHMALE III, JONATHAN BOREYKO, Virginia Tech — The classical viewpoint in phytopathology regarding how plant pathogens are liberated is based on active mechanisms such as shearing off spores via rain splash or wind. All of these mechanisms require some kind of impact on the surface. Here we show for the first time that there exists an entirely different mechanism in nature that drives pathogen transport on wheat leaves. Wheat leaves are inherently superhydrophobic, which enables microscopic dew droplets to spontaneously jump off the leaf surface during natural condensation cycles. We found that black rust (Puccinia graminis) spores often adhere to such coalescence-induced self-propelled dew droplets and subsequently get transported vertically as high as 5 mm. Once pathogens clear the quiescent boundary layer, typically of order 1 mm, they have the potential to be dispersed over large distances by the aid of atmospheric flows. A custom-made experimental setup was devised to simulate multiple one hour long natural dew cycles and how they affect spore dispersal. Spore liberation rates via jumping-droplet condensation were found to be as high 100 spores/cm2-hr. These findings reveal that on a sufficiently non-wetting surface humidity alone can liberate fungal spores, adding it as a third mechanism besides wind and rain.

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