The morphological phenotyping of hooked hairs in Phaseolus Vulgaris

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[1]Plant Biology
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Abstract

We quantify the shape of hooked hairs which is a newly observed phenotype of epidermal cell extensions [1] in the common bean genotype L88-57 (Phaseolus vulgaris). The hooked hairs emerge below-ground before the root hairs and have a distinct 'hooking' morphology. We generated a dataset capturing their full distribution under the microscope within 3-5 days of germination. We quantify their shape by a novel computational pipeline that can automatically phenotype morphology. Our phenotyping pipeline quantifies traits like length, curvature, perimeter, area, and 'hooking.' Our objective is to quantify their response to nutrient stress to determine the function of hooked hairs in common bean during early development. We used the pipeline for analyzing our dataset of hydroponically grown beans and observed statistically significant responses compared to the control for length, curvature, perimeter, and area to nitrogen ($p < 0.001$**) and phosphorus ($p < 0.001$**) stress treatments. The calculation of 'hooking' for our dataset is still ongoing. We are simultaneously developing a landmark-free method for the two-dimensional shape analysis of our dataset and believe that our phenotyping efforts will enable the high-throughput analysis of morphological root hair traits for any plant species.

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[1] A. Roy, A. Bucksch. Root Hairs vs. Trichomes: Not everyone is straight! Current Opinion in Plant Biology, 2021 (under revision)

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