Single-cell transcript profiling of barley attacked by the powdery mildew fungus

In many plant-pathogen interactions, there are several possible outcomes for simultaneous attacks on the same leaf. For instance, an attack by the powdery mildew fungus on one barley leaf epidermal cell may succeed in infection and formation of a functional haustorium, whereas a neighboring cell attacked at the same time may resist fungal penetration. To date, the mixed cellular responses seen even in susceptible host leaves have made it difficult to relate induced changes in gene expression to resistance or susceptibility in bulk leaf samples. By microextraction of cell-specific mRNA and subsequent cDNA array analysis, we have successfully obtained separate gene expression profiles for specific mildew-resistant and -infected barley cells. Thus, for the first time, it is possible to identify genes that are specifically regulated in infected cells and, presumably, involved in fungal establishment. Further, although much is understood about the genetic basis of effective papilla resistance associated with mutant mlo barley, we provide here the first evidence for gene regulation associated with effective papilla-based nonspecific resistance expressed in nominally "susceptible" wild-type barley.

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