Shedding Light on Mobile tRNA in Plant Biotic Stress

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As plants lack an adaptive immune system, they are reliant on the innate immunity of cells and systemic signaling mechanisms from infected cells. Plant immunity research demonstrates the complexity and diversity of these signaling pathways. The field of tRNA biology is quickly expanding as new evidence demonstrates that tRNA-derived fragments (tRF's) are involved in regulation of gene expression and protein synthesis —beyond their traditional role in protein translation. Through attachment to fluorescent tag molecules (6-FAM,) tRFS can be imaged with fluorescence. In this project, a novel, ultra-pure fluorescent light has been engineered that functions with an EM-CCD camera system to irradiate these tagged tRF molecules. With the use of the light, time-course experiments were conducted using Col-0 of A. thaliana and inoculation of solution containing FAM-tagged tRFs, buffer, and suspended P. syringae (both avirulent and virulent.) Images were captured each hour over 48 hours. Images were qualitatively analyzed with videos showing the tRF movement over time and were quantitatively analyzed through the change in mean grey value of systemic and infiltrated leaves. On both accounts, it is apparent there is systemic tRF movement in infected plants (particularly avirulent) in comparison to proper controls. Therefore, the GLU^TTC tRF analyzed is implicated in systemic pathogen defense induction. Furthermore, this novel system allows for high throughput assessment of vital functional fluorescently-tagged molecules in plants. With a more detailed understanding of the biochemical pathways of plants, agricultural and plant scientists are far more aptly suited to improve crop production for food, fibers, and biofuel.

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