Mechanisms of virus-vector interactions mediating disease transmission

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Mechanisms of virus-vector interactions mediating disease transmission

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Do plant viruses perceive the presence of aphid vectors?

Model

Aphid punctures trigger instant calcium elevations at the puncture site. They might be the first step in establishment of plant defense responses against these predators (see model above).

Many plant viruses are transmitted by aphids. There is evidence that viruses modify plant defenses, for example, to modify interactions of plants with virus-transmitting aphids.

Such modifications could effect the very first steps in virus-aphid interactions (transmission).

Therefore, we tested whether virus infection interferes with local calcium elevations.

Experimental system

Method:
Recording of aphid activity by bright field microscopy
Recording of calcium concentration by fluorescence-radiometry
Tempo-spatial analysis

Results

Analysis of calcium signal

Bi-modal distribution for CaMV and TuMV, unimodal for TuYV and healthy.

Viruses alter calcium signaling differently

Can a plant virus perceive the presence of a plant while being retained in its insect vector?

Model

Viruses that retain in the foregut of whitefly vectors must be released and inoculated into the plant in order to achieve transmission.

Many whitefly-transmitted viruses are emerging viral pathogens of important food and fiber plants.

Although whitefly feeding (on plants) contributes to the inoculation of foregut borne viruses, nothing is yet known about the role(s) that plants play, if at all, in virus inoculation.

Therefore, we conducted studies to test the hypothesis that the inoculation of a foregut borne virus can be mediated by a plant trigger.

Experimental system

Whole-mount, widefield fluorescence microscopy of whiteflies (heads)

Results

Establish virus host (B. rapa) and non-host (B. napus)

Plant-to-plant transmission of lettuce infectious yellows virus (LIYV) to B. rapa or B. napus

Virus Retention Assays

B. rapa

Transmitted light
Widefield fluorescence
B. napus

Transmitted light
Widefield fluorescence

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