3 scopes with 1 scope: long-term live imaging of viruses in plants

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Abstract

Growth and organogenesis in plants originate from meristems, groups of undifferentiated and rather inaccessible cells that are found in the tips of shoots or roots.

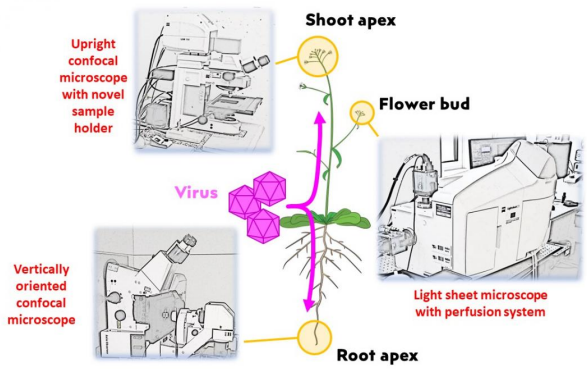
Meristems are also of special interest in plant virology, as it is well-documented that most viruses do not enter meristematic cells even in systemically infected plants. Apical meristems generate flower buds that can be infected to various degrees.

To follow infection dynamics, imaging techniques are necessary that allow long-term observation in living tissue kept under physiological conditions.

We will present a triad of imaging strategies that involves usage of confocal as well as light sheet microscopy in order to follow spreading of viruses across the living plant over a week.

We manufactured an ad hoc workstation and plant holder coupled with an upright confocal microscope devoid of condenser for long-term live imaging of the shoot tip (of a whole plant in a pot with soil!). We adopted light sheet microscopy with perfusion system for long term live imaging to follow virus movement in flower organs. We used a vertically oriented microscope coupled with custom-made plates to track virus presence in roots.

The combination of multiple microscopy techniques and innovative set-ups for plant live imaging represents extraordinary tools to study virus infection in above- and below-ground organs, pushing the frontiers of plant live imaging and pathogen infection.



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