Mechanisms of virus-vector interactions mediating disease transmission

Christiane Then, Fanny Bellegarde, Geoffrey Schivre, Tou Cheu Xiong, Martin Drucker, Stoyan Yordanov, Kaloian Koynov, Hans-Jürgen Butt, Jaclyn S Zhou, James C. K. Ng

To cite this version:

Christiane Then, Fanny Bellegarde, Geoffrey Schivre, Tou Cheu Xiong, Martin Drucker, et al.. Mechanisms of virus-vector interactions mediating disease transmission. 19. HFSP Awardees Meeting, Jul 2019, Tsukuba, Japan. 2019. hal-02947634

HAL Id: hal-02947634
https://hal.inrae.fr/hal-02947634
Submitted on 24 Sep 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Copyright
**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 affect the very first steps in virus-aphid interactions (transmission).

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

**Experimental system**

- Plant leaf expressing the calcium sensor YC3.6
- Calcium imaging by bright field microscopy
- Calcium imaging by fluorescence roimetry
- Temporal-spatial analysis

**Results**

- Analysis of calcium signal
  - Decreased signal duration and mean velocity for CaMV
  - Bimodal distribution for CaMV and TuMV, unimodal for TuYV and healthy

⇒ Viruses alter calcium signalling differently

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

**Model**

Viruses that retain in the foreguts 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**

- 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

**Results**

- Virus Retention Assays
  - Western Blot
  - TEM Analysis
  - Reverse transcription (RT) – PCR

- Virus retention data
  - B. rapa
    - Virus retention is significantly higher than B. napus
    - Virus retention increases with each generation
  - B. napus
    - Virus retention is significantly lower than B. rapa
    - Virus retention decreases with each generation

- **Acknowledgments:**
  - INRA Colmar (France): Christiane Then, Fanny Bellegarde, Géoffrey Schivre, Tou-Cheu Xiong, Martin Drucker
  - MPI Mainz (Germany): Stoyan Yordanov, Kaloian Koynov, Hans-Jürgen Butt
  - UC Riverside (USA): Jaclyn S. Zhou, James C.K. Ng