



Université  
de Strasbourg



# ➤ Interplay between a polerovirus (BChV) and a closterovirus (BYV)

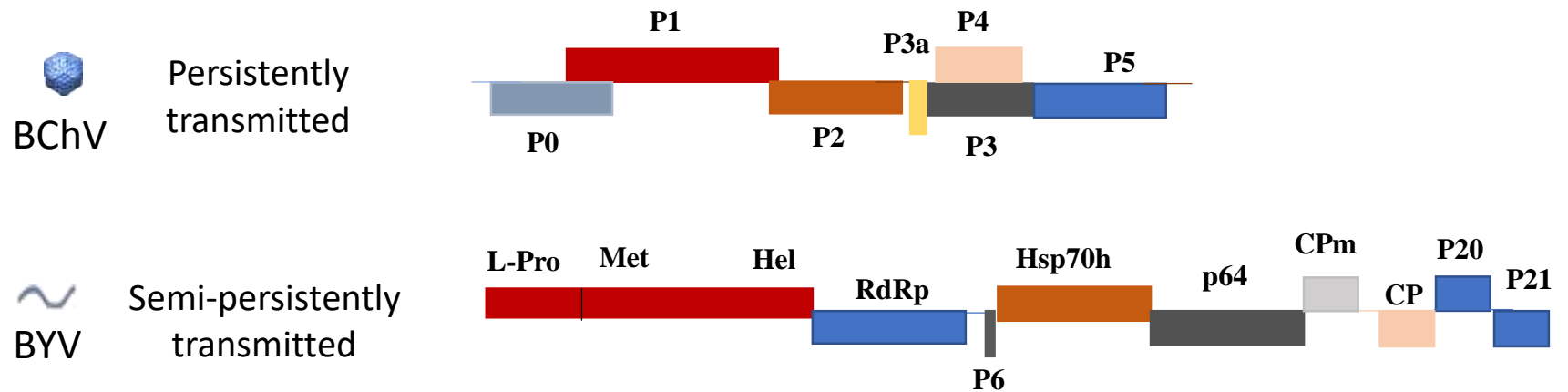
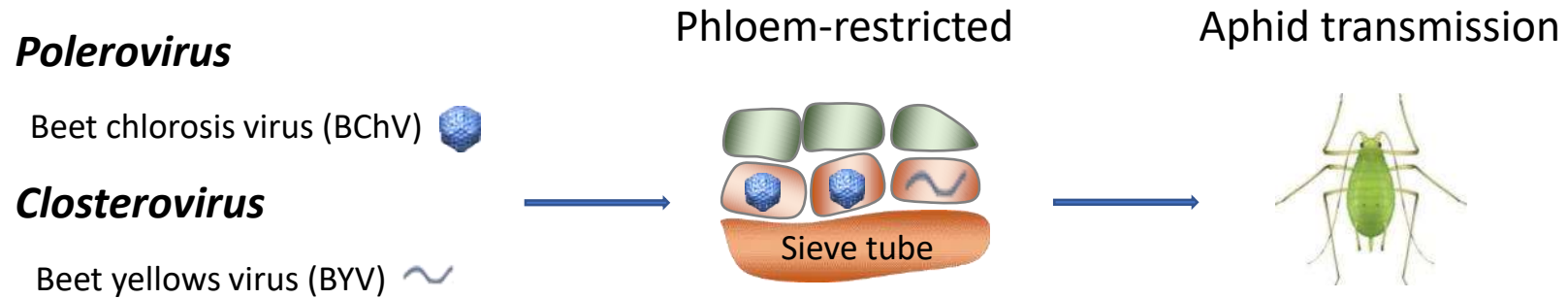
**Presented by: Souheyla Khechmar**

**Supervisor : Véronique Brault**

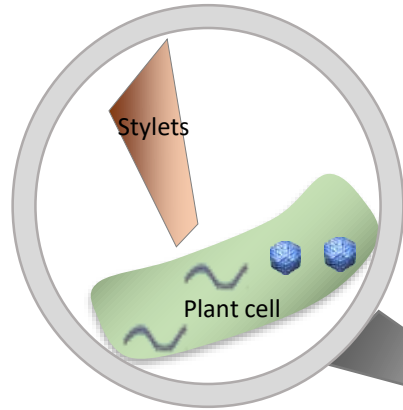
**Co-supervisor : Martin Drucker**



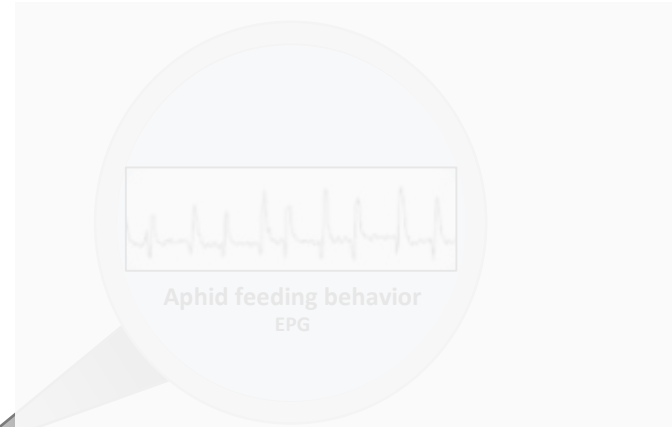
# ➤ Sugar beet viral co-infection



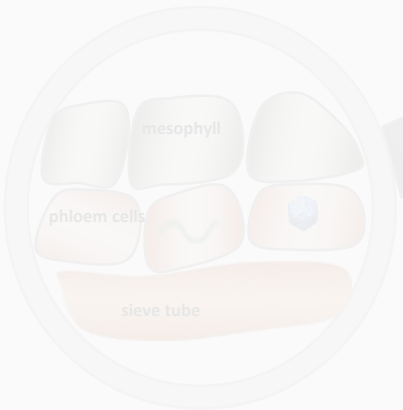
# ➤ Research questions



**Is there an effect of BChV/BYV co-infection on virus transmission by aphids?**



**2. Does BChV/BYV co-infection affect the aphid feeding behaviour?**



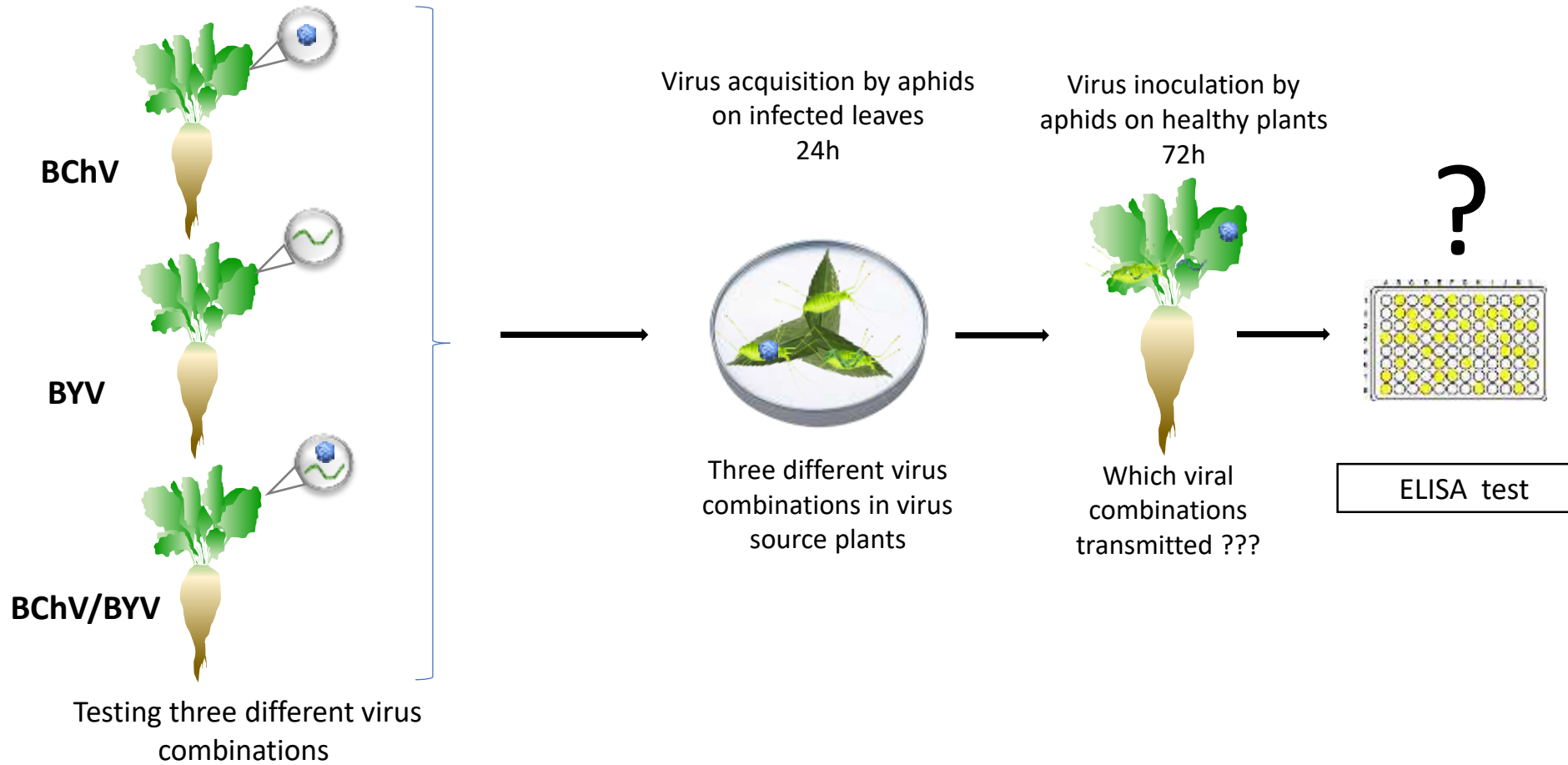
**1. Does BChV/BYV co-infection affect virus tissue tropism & cellular localization of the viruses?**



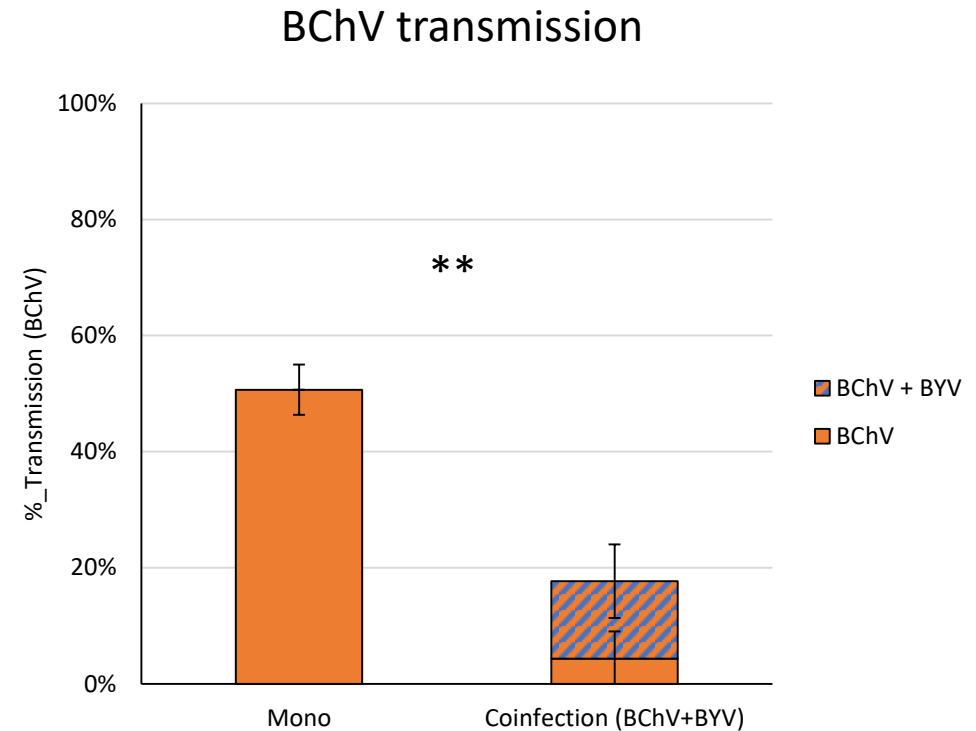
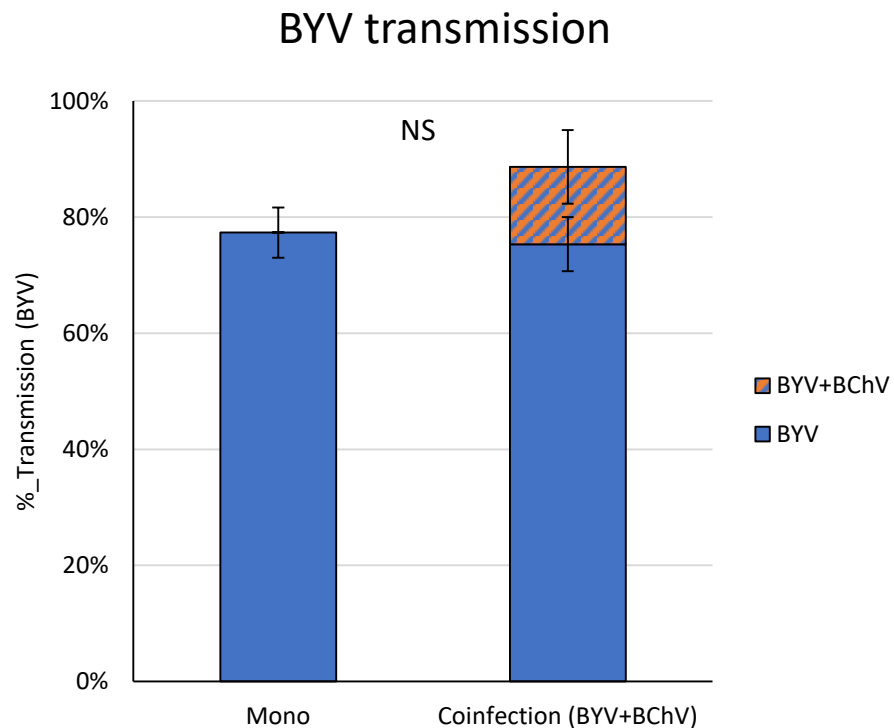
**3. Does BChV/BYV co-infection impact virus accumulation in plants?**

# ➤ Virus transmission

## Methodological approach for transmission

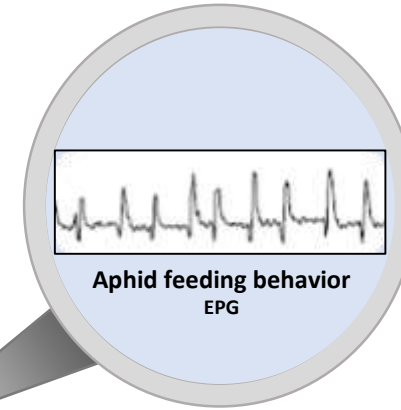
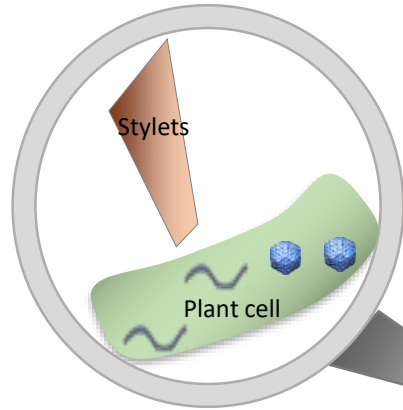


## ➤ BYV & BChV co-infection: Virus transmission



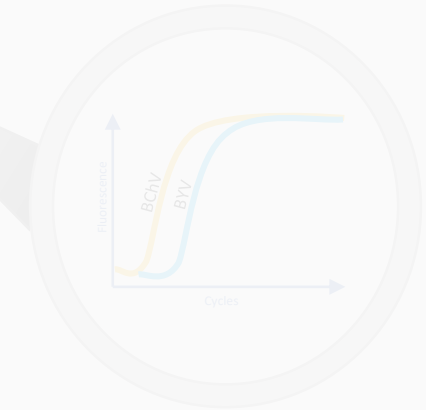
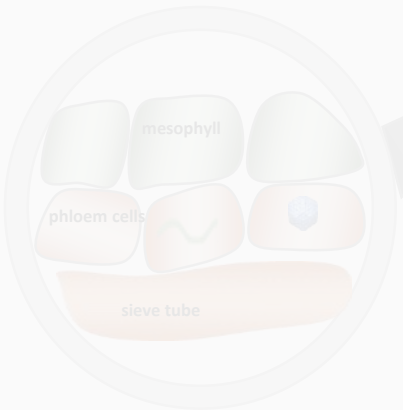
- ✓ Presence of BYV in BYV & BChV co-infected plants reduces transmission of BChV but has no impact on BYV transmission

# ➤ Research questions



**Is there an effect of BChV/BYV co-infection on virus transmission by aphids?**

**Does BChV/BYV co-infection affect the aphid feeding behaviour?**

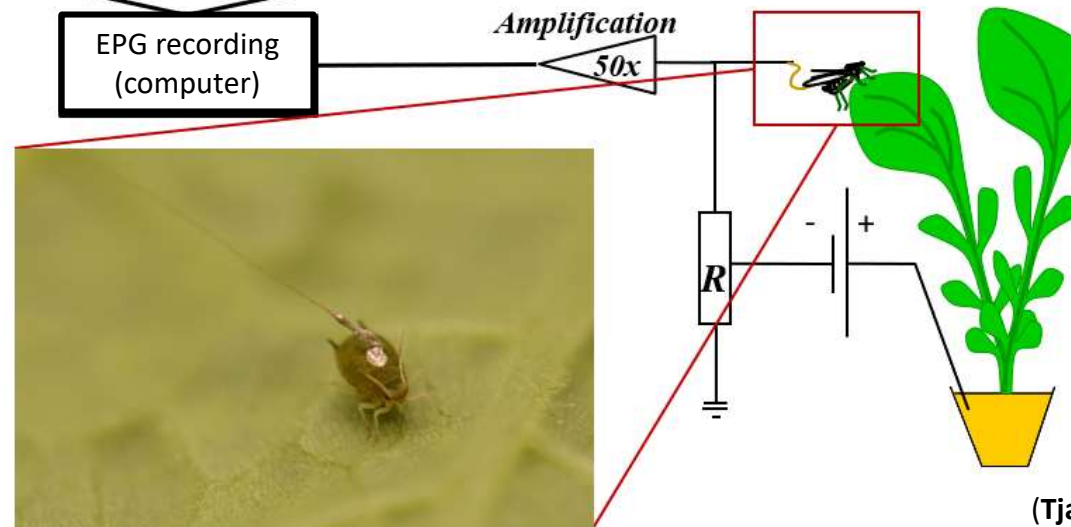
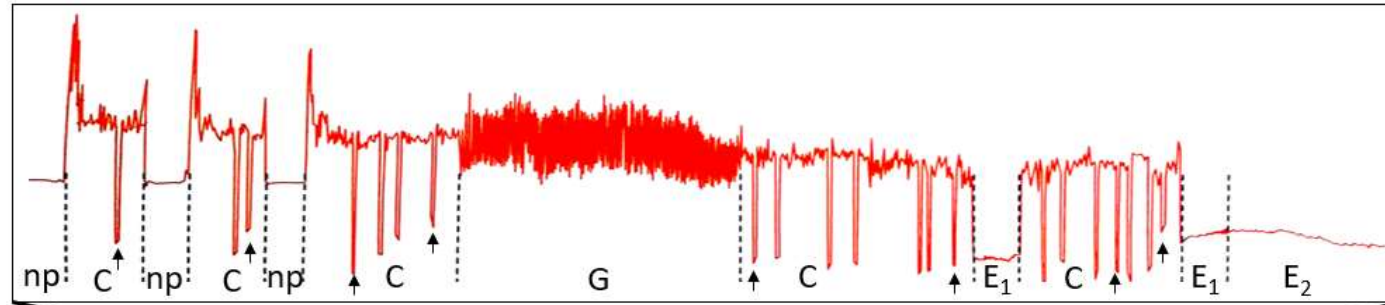


**1. Does BChV/BYV co-infection affect virus tissue tropism & cellular localization of the viruses?**

**3. Does BChV/BYV co-infection impact virus accumulation in plants?**

# ➤ Aphid feeding behaviour

Methodological approach: Electrical penetration graph technique (EPG)

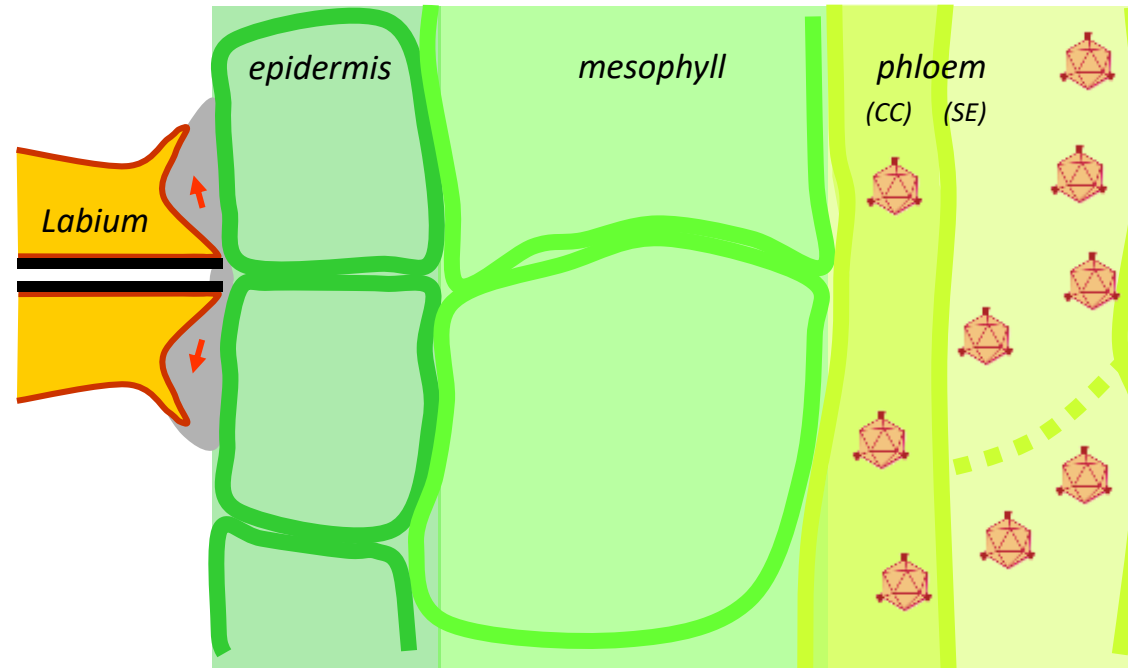


(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

## Methodological approach: Electrical penetration graph technique (EPG)

*Before penetration*



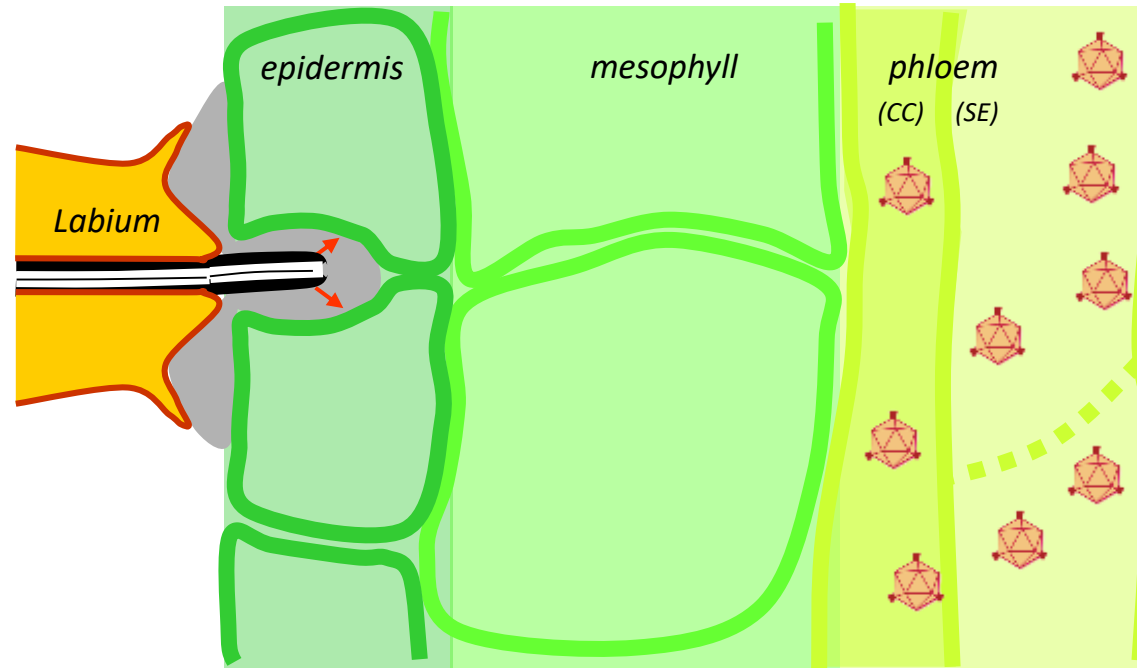
➔ salivation  
← ingestion

(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

Methodological approach: Electrical penetration graph technique (EPG)

*Pathway, intercellular*



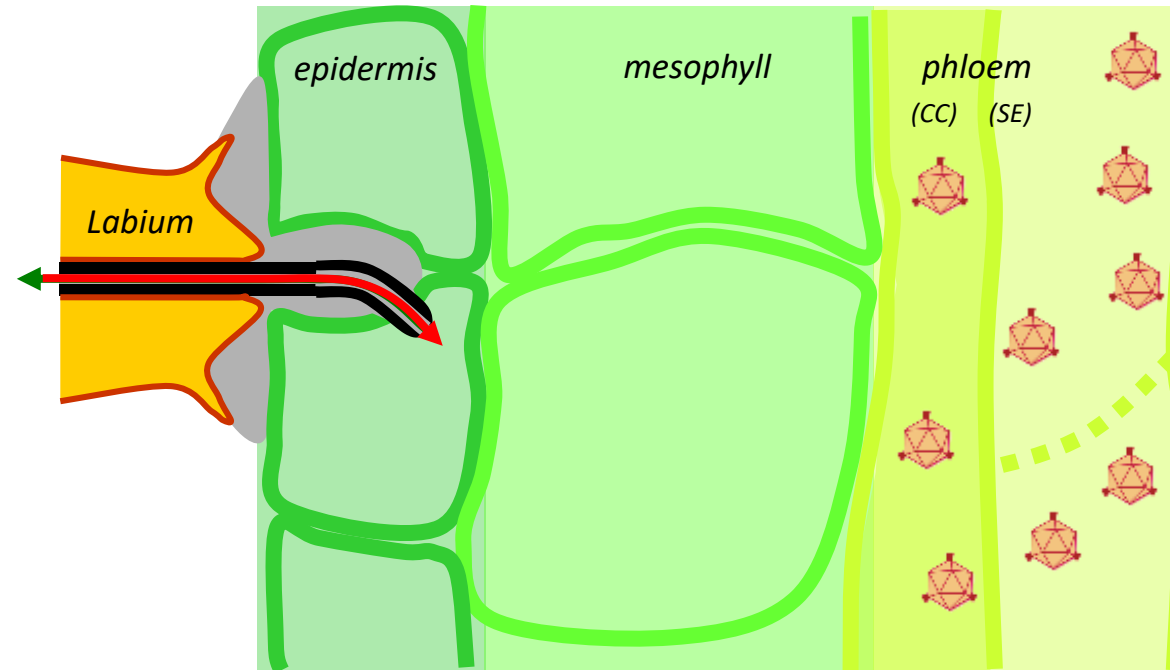
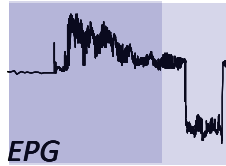
➔ salivation  
← ingestion

(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

Methodological approach: Electrical penetration graph technique (EPG)

Cell punctures



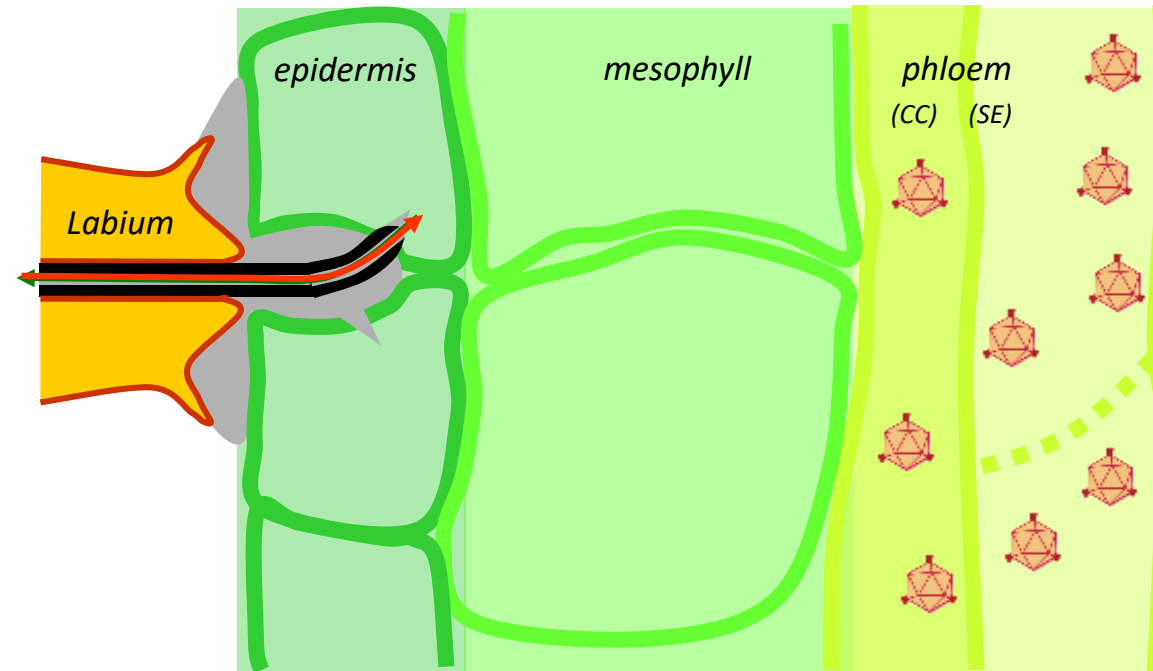
➔ salivation  
➤ ingestion

(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

Methodological approach: Electrical penetration graph technique (EPG)

*Cell punctures*



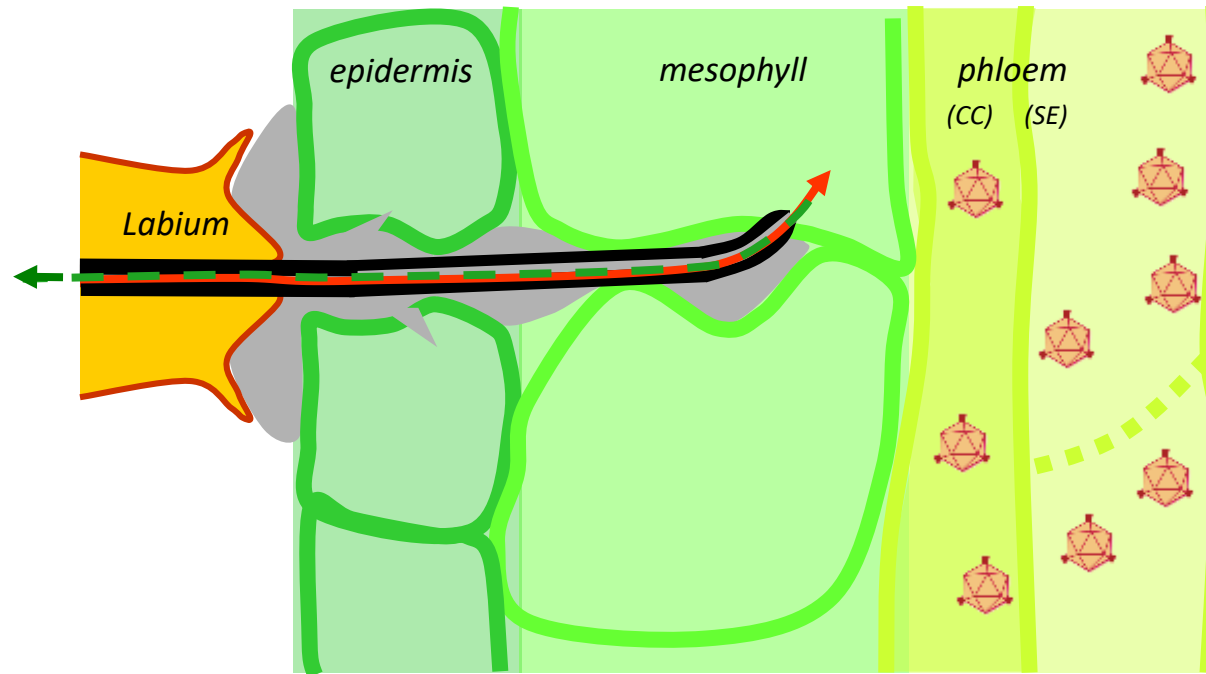
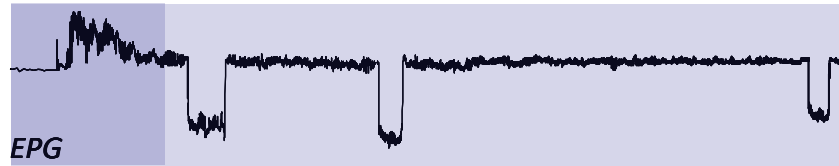
➔ salivation  
← ingestion

(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

## Methodological approach: Electrical penetration graph technique (EPG)

*Further pathway and punctures*



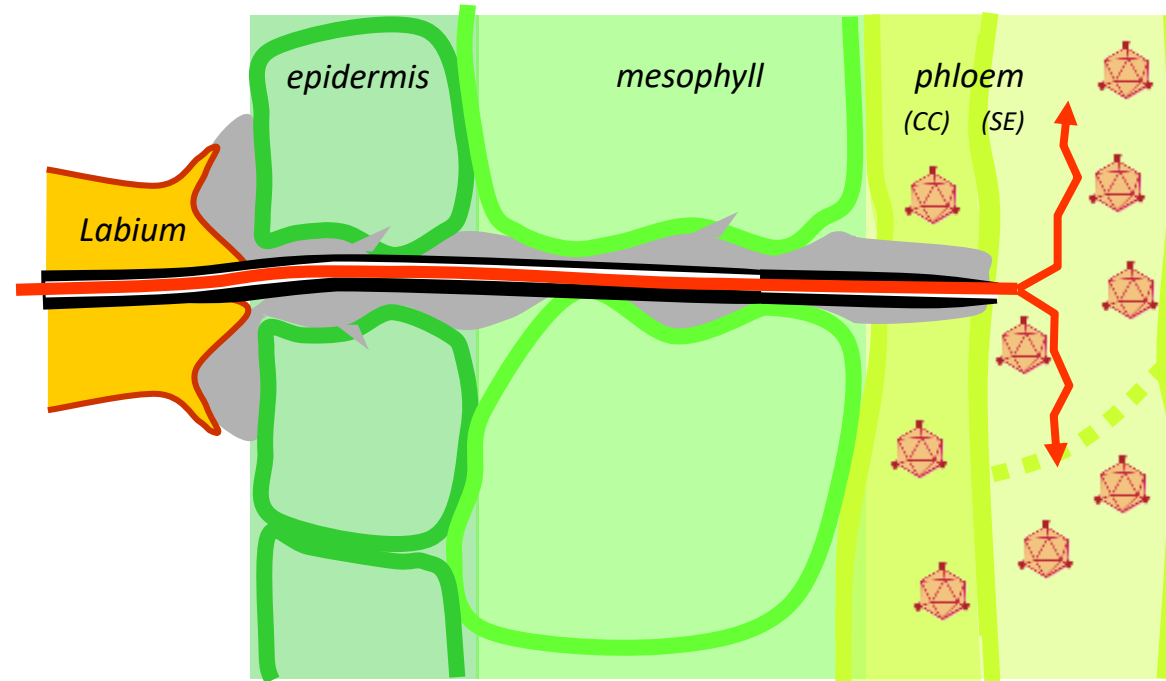
➔ salivation  
➔ ingestion

(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

## Methodological approach: Electrical penetration graph technique (EPG)

*Phloem salivation*



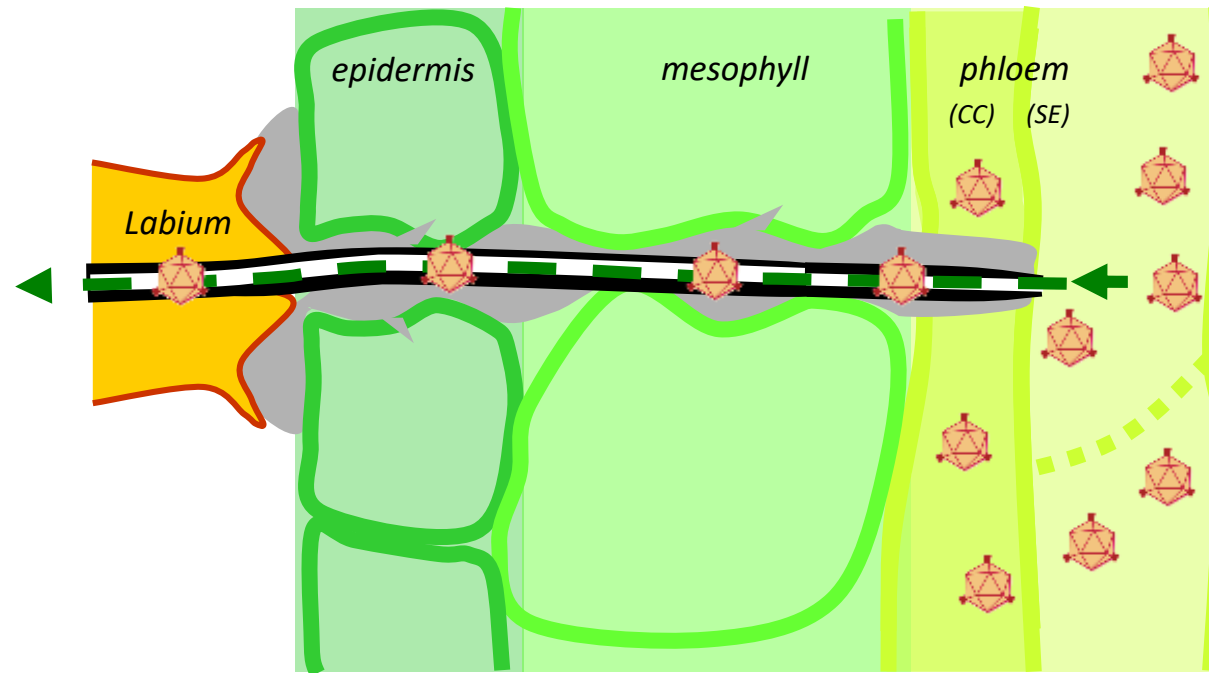
➔ salivation  
←••• ingestion

(Tjallingii 2017, adapted)

# ➤ Aphid feeding behaviour

## Methodological approach: Electrical penetration graph technique (EPG)

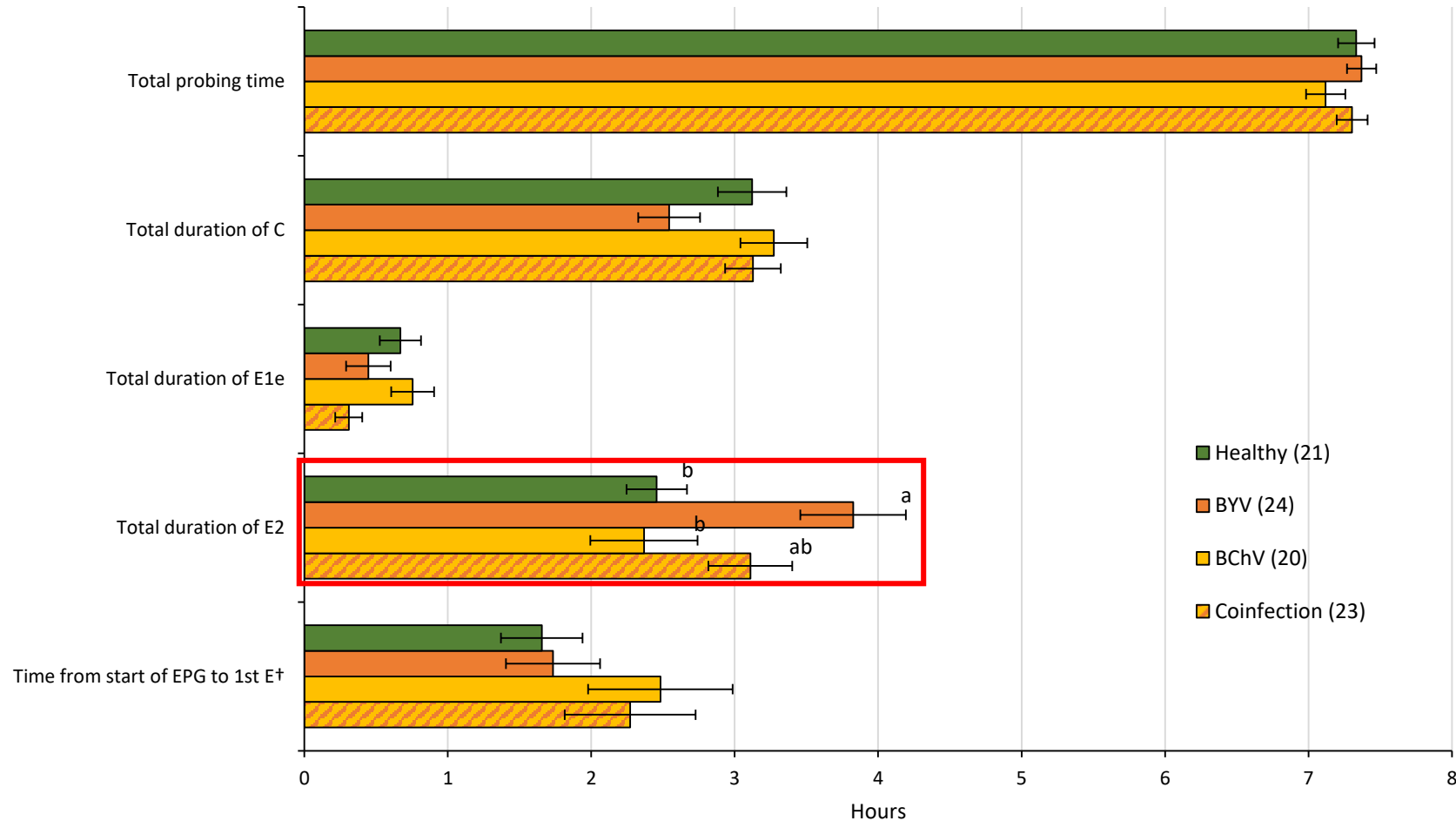
*Phloem ingestion*



→ salivation  
← ingestion

(Tjallingii 2017, adapted)

## ➤ BYV BChV co-infection: Aphid feeding behaviour



- ✓ In spite of the fact that aphids feed longer on co-infected plants, we have observed transmission of BChV drops → there is no correlation between transmission and aphid feeding

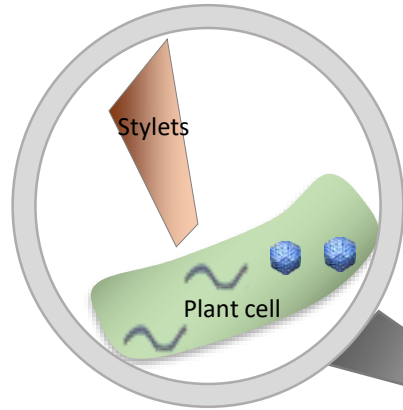
# ➤ Research questions



BChV

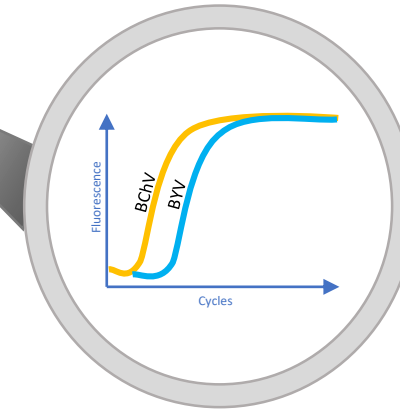
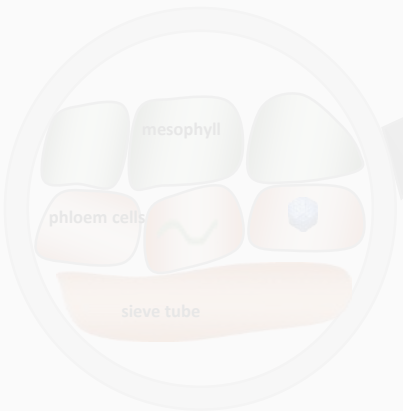
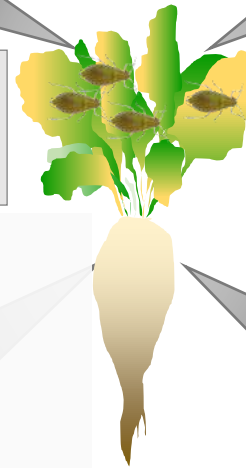


BYV



Is there an effect of BChV/BYV co-infection on virus transmission by aphids?

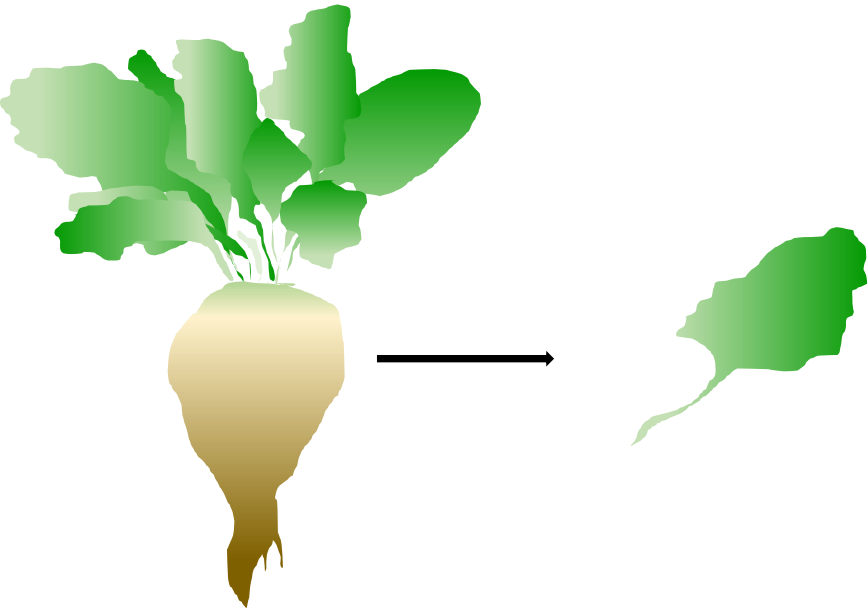
Does BChV/BYV co-infection affect the aphid feeding behaviour?



1. Does BChV/BYV co-infection affect virus tissue tropism & cellular localization of the viruses?

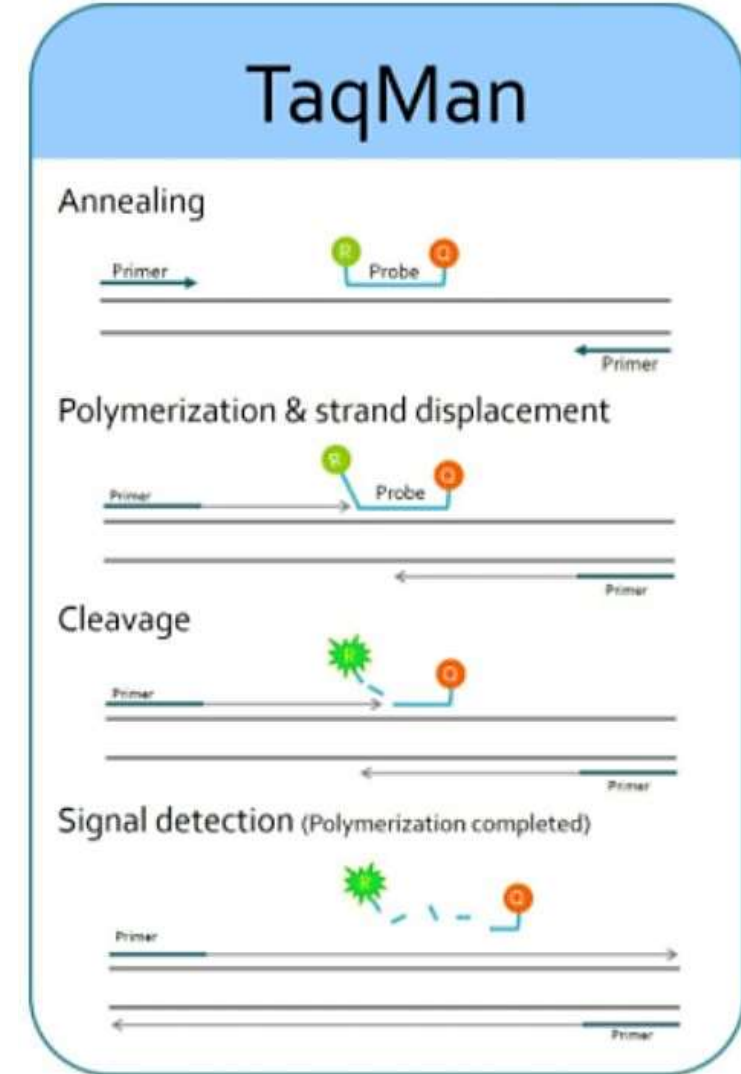
3. Does BChV/BYV co-infection impact virus accumulation in plants?

# ➤ Virus accumulation by multiplex TaqMan RT-qPCR

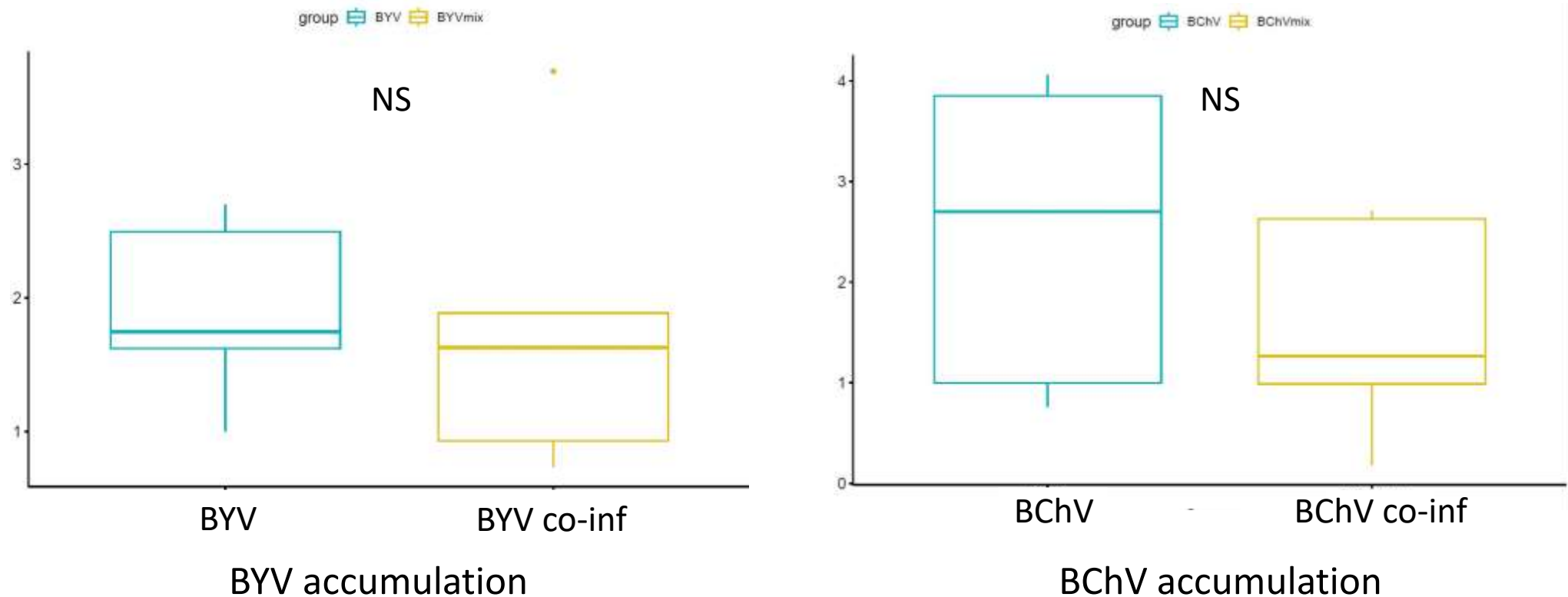


We selected the third upper leaf of each source plant

RNA extraction



## ➤ Virus accumulation by multiplex TaqMan RT-qPCR



- ✓ BChV & BYV accumulation did not change significantly between mono- and co-infected plants

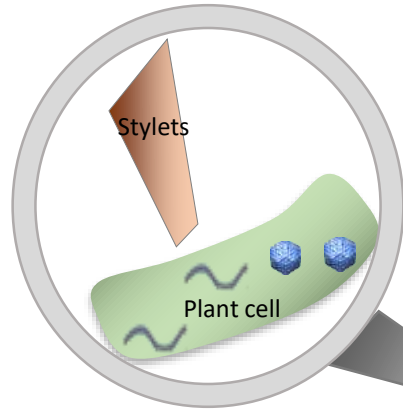
# ➤ Research questions



BChV



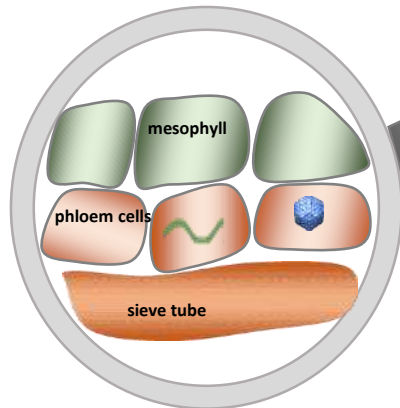
BYV



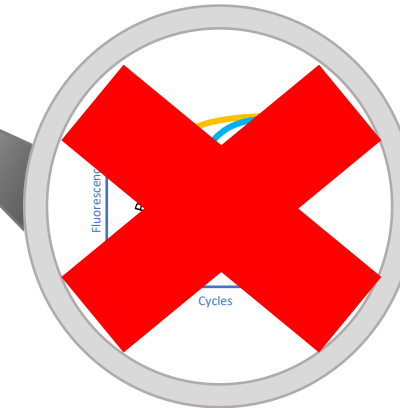
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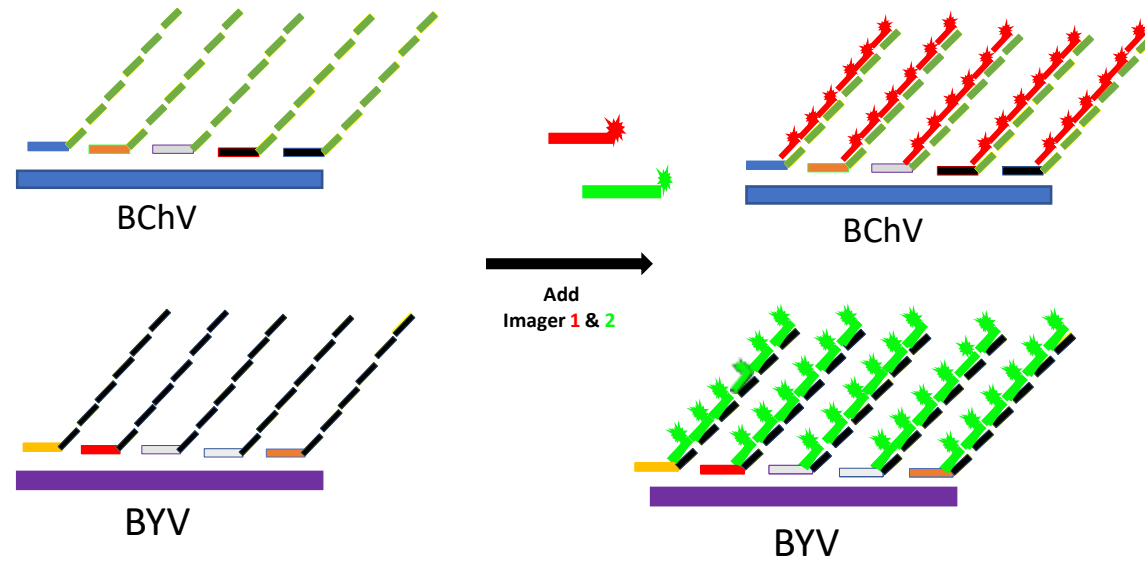
Does BChV/BYV co-infection affect virus tissue tropism & cellular localization of the viruses?



Does BChV/BYV co-infection impact virus accumulation in plants?

# > Virus localization

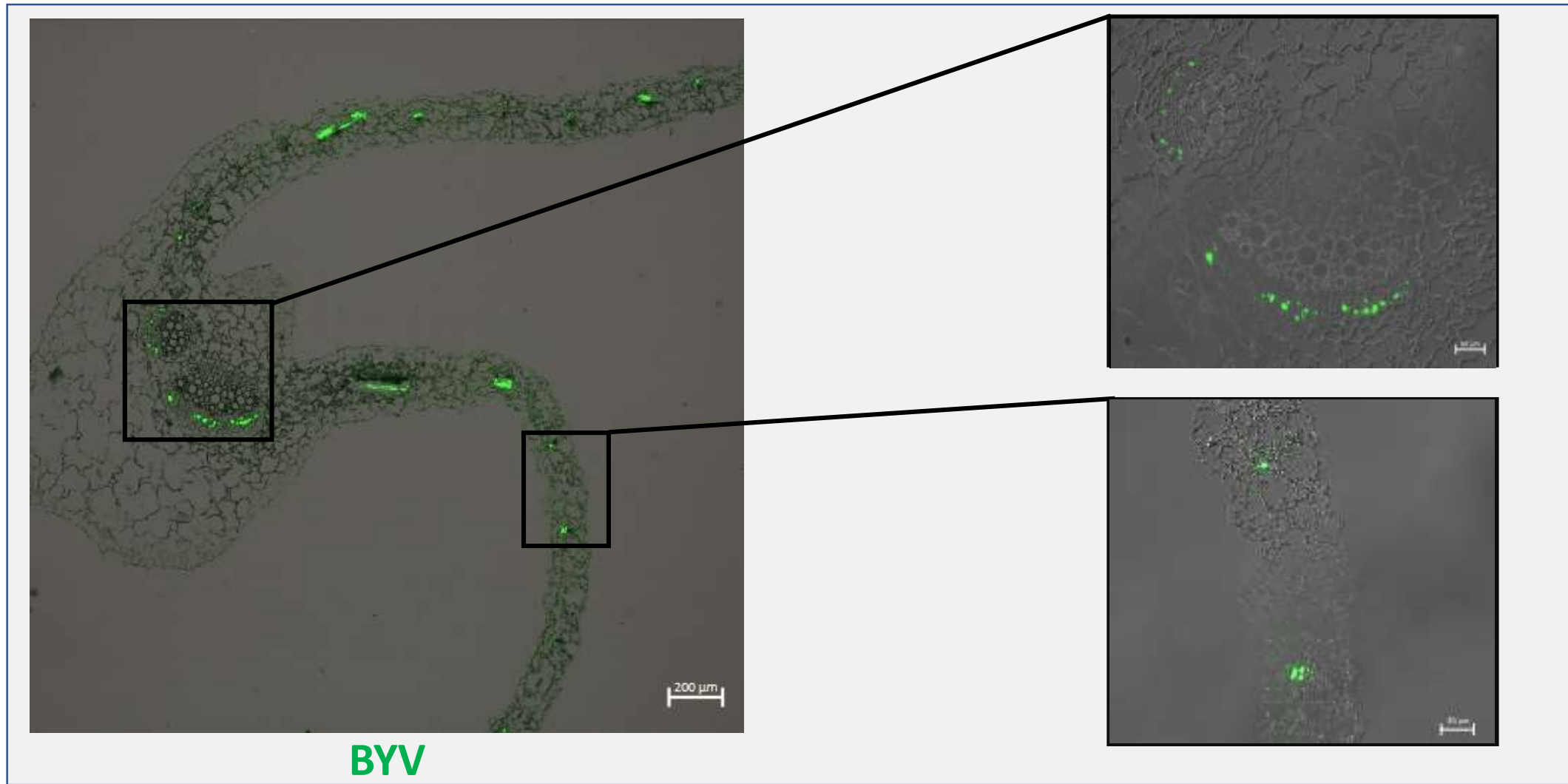
## Methodological approach: Multiplex FISH with SABER



Hybridize BChV & BYV probes on the targets

Reveal targets with fluorescent imagers

## ➤ BYV mono-infection: Virus localization



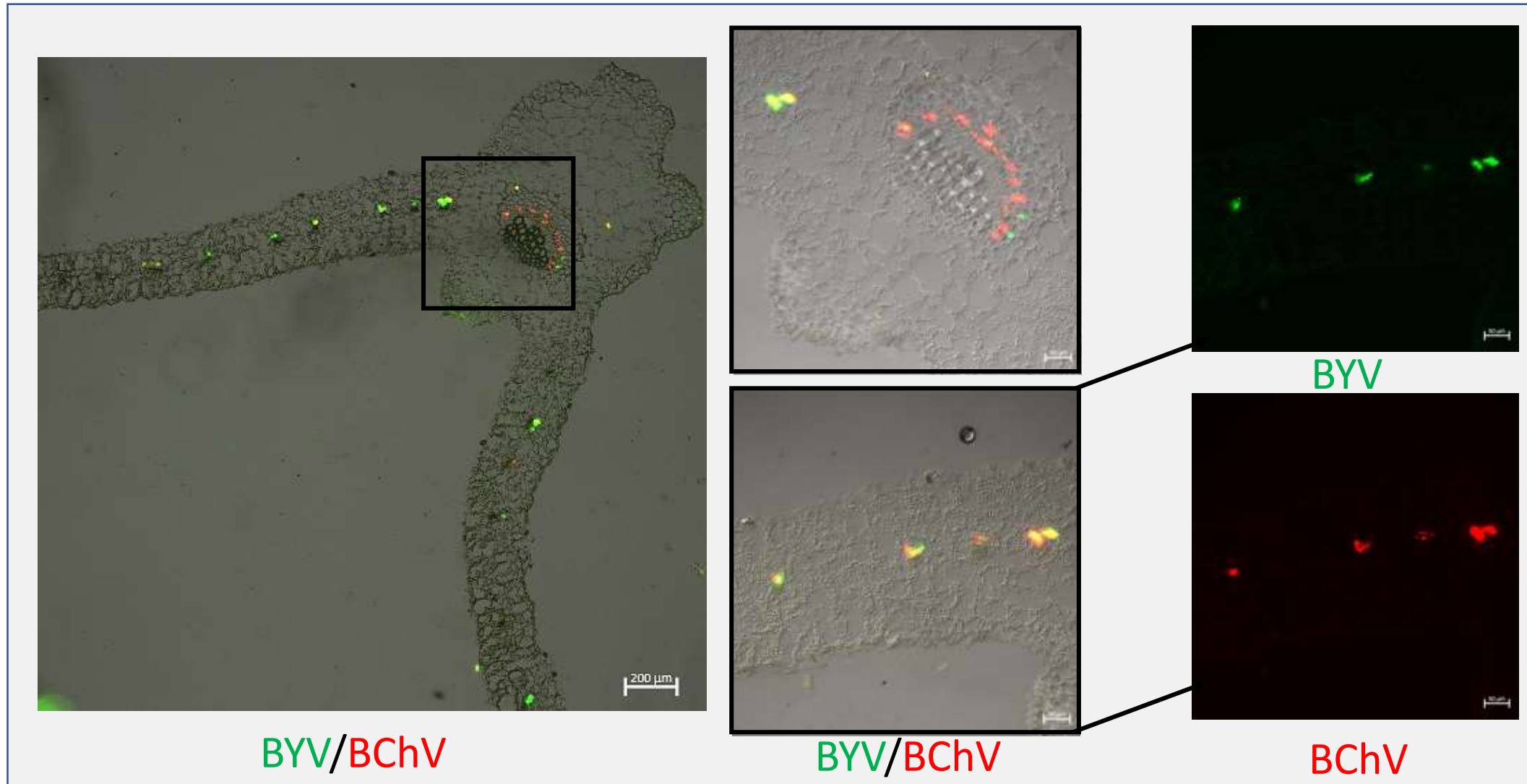
✓ BYV localizes in the phloem of primary & secondary vessels in infected leaves

## ➤ BChV mono-infection: Virus localization



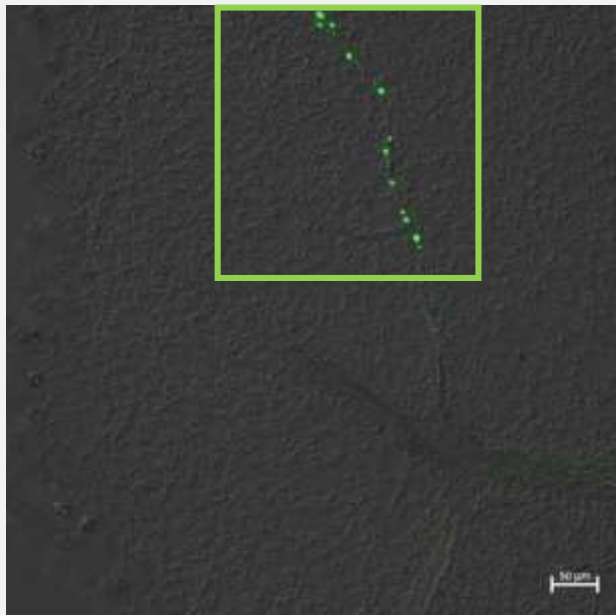
INRAE ✓ BChV localizes mostly in the phloem of secondary vessels in infected leaves

## ➤ BYV & BChV co-infection: Virus localization

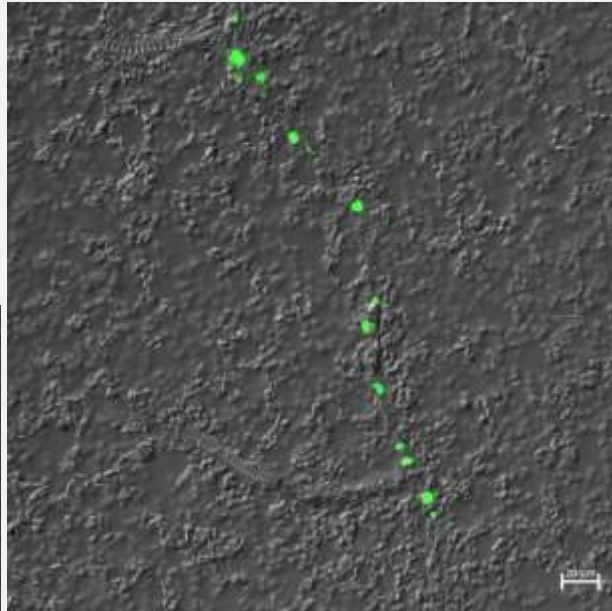


- INRAE ✓ BChV and BYV co-localize in the phloem of secondary vessels in infected leaves  
✓ BChV accumulates mainly in the midrib phloem

## ➤ BYV & BChV mono-infection: Virus intra-cellular distribution



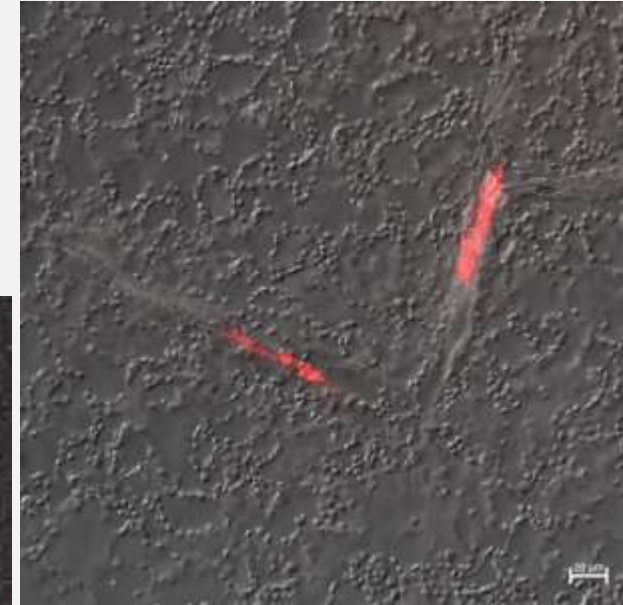
BYV



BYV

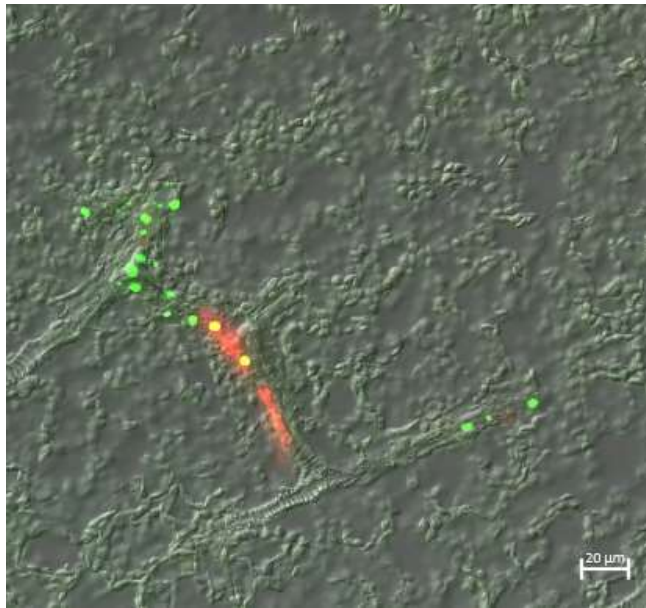


BChV

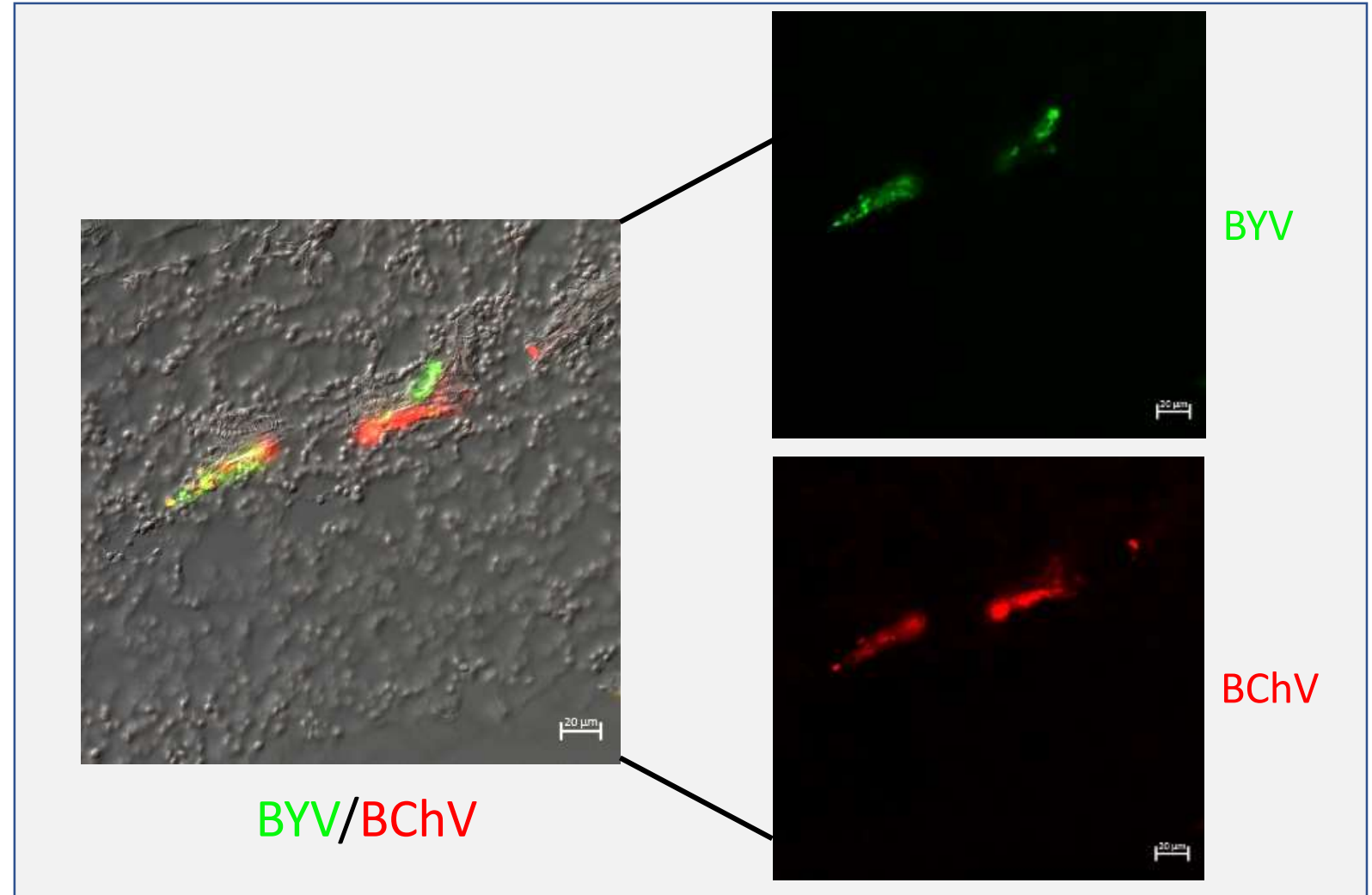


BChV

## ➤ BYV & BChV co-infection: Virus intra-cellular distribution



BYV/BChV

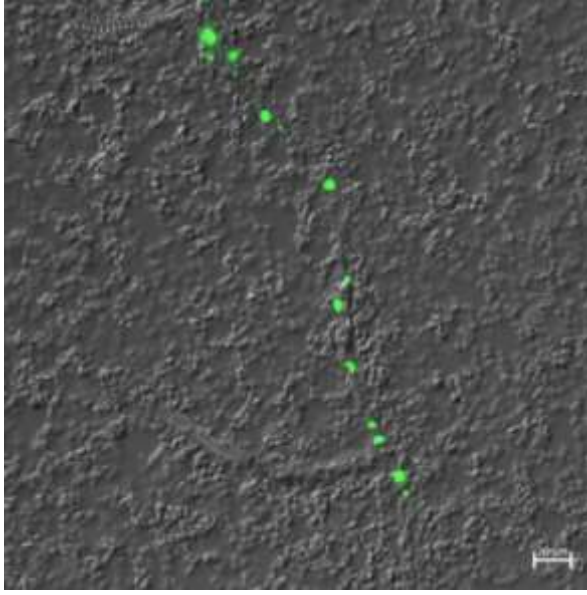
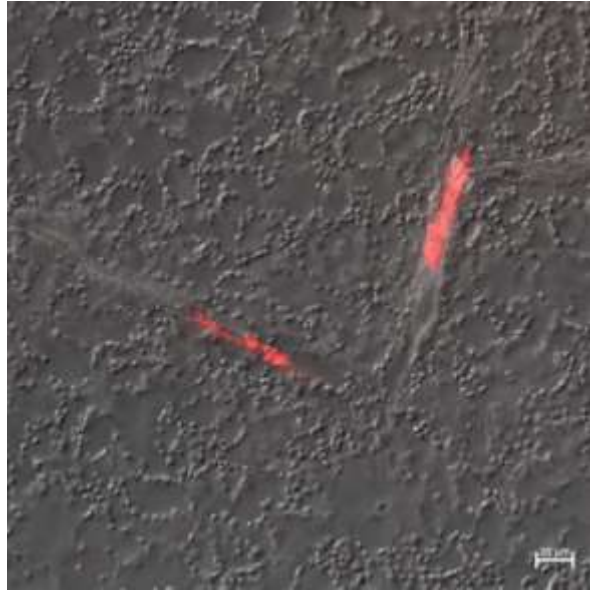


BYV/BChV

BYV

BChV

INRAE ✓ BChV and BYV co-localize in the same phloem cells of infected leaves changing BYV intracellular distribution



## ➤ Take-home message

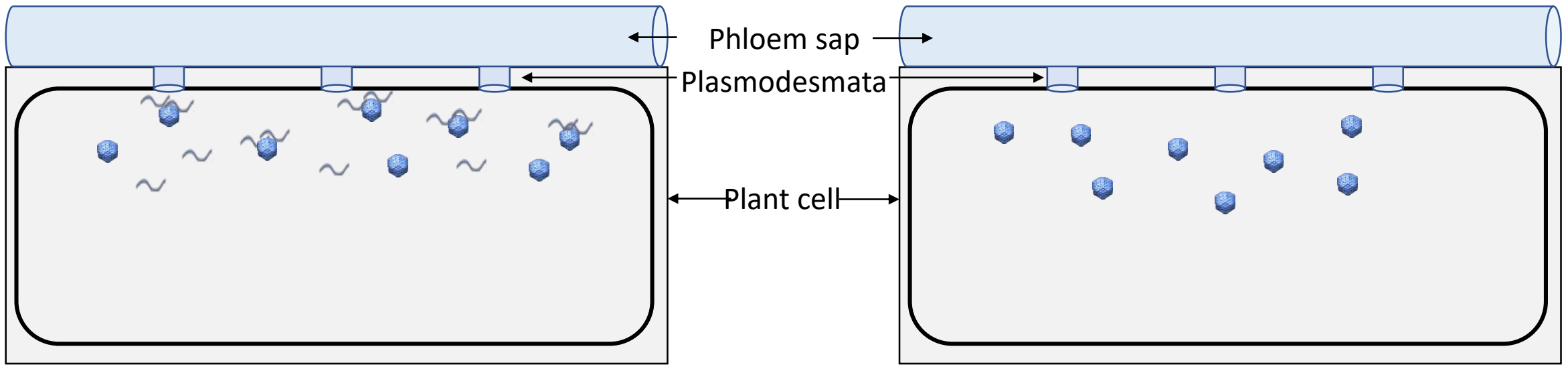
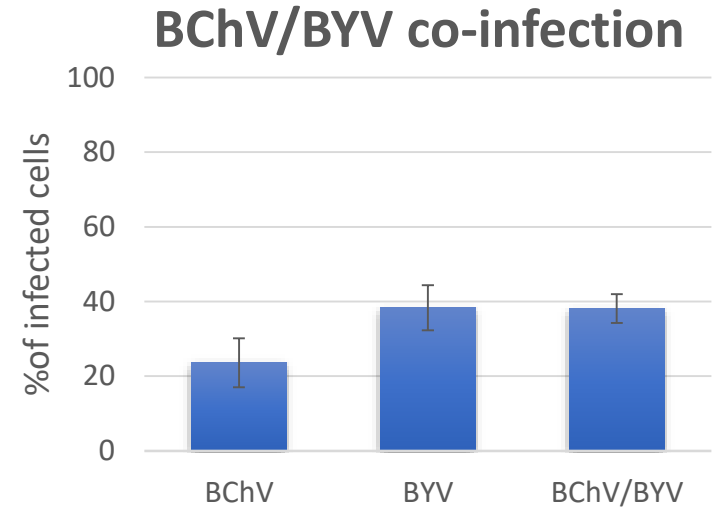


- Presence of BYV in BYV&BChV co-infected plants reduces transmission of BChV
- Lower BChV transmission from co-infected plants can not be attributed to differences in feeding behavior
- BChV & BYV accumulation did not change significantly between mono and co-infected plants therefore does not explain the drop of BChV transmission
- Differential intra-cellular distribution might be responsible for difference in virus transmission

# > Hypothesis

 BChV

 BYV



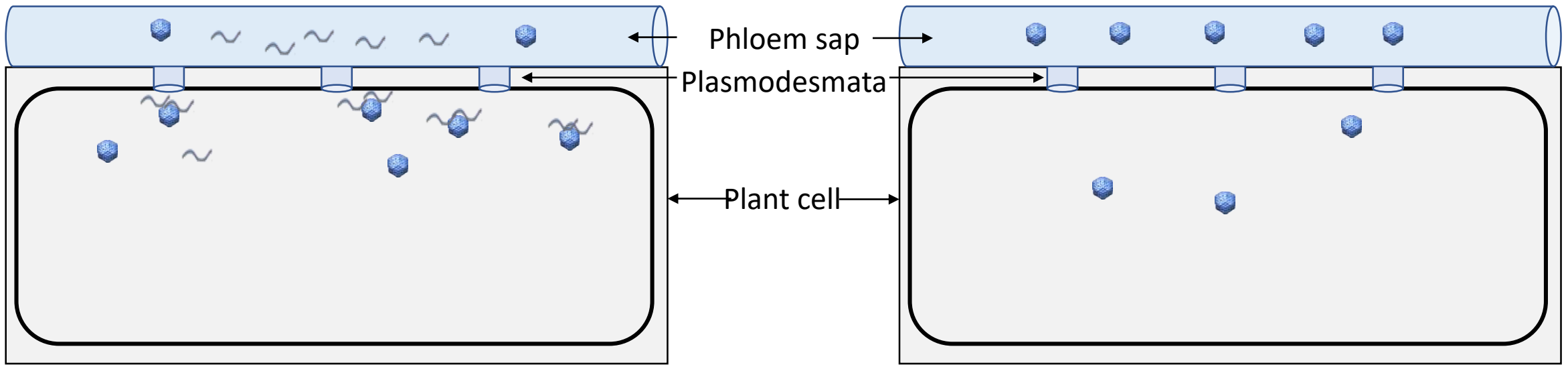
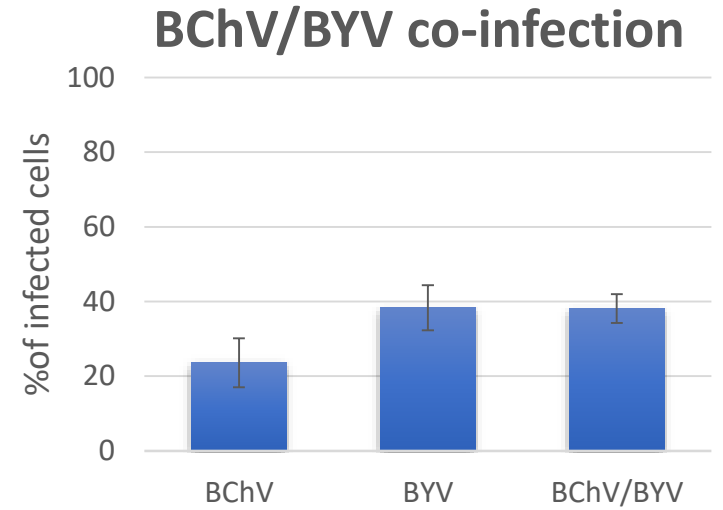
BChV/BYV co-infected cell

BChV mono-infected cell

# > Hypothesis

 BChV

 BYV

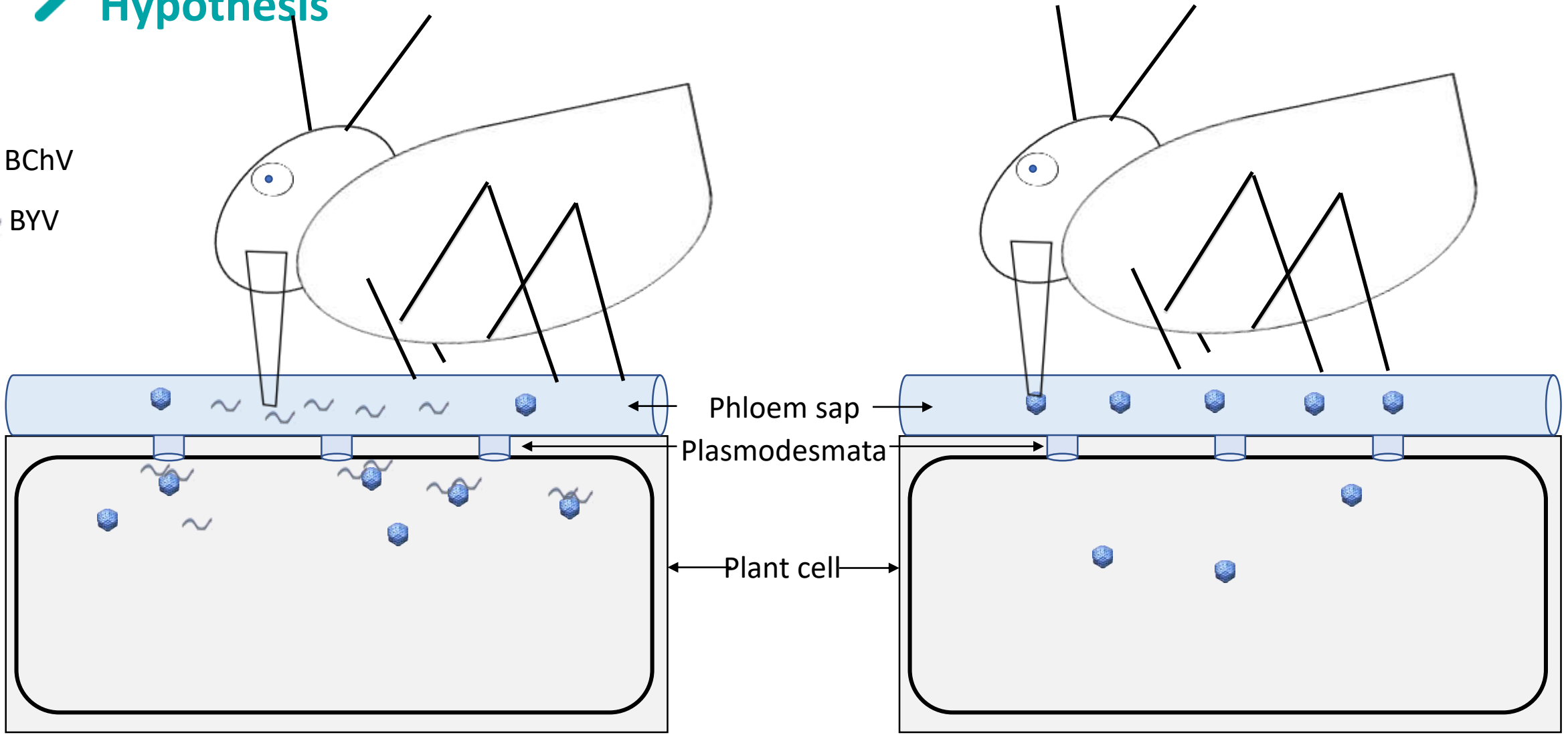


BChV/BYV Co-infected cell

BChV mono-infected cell

# > Hypothesis

● BChV  
~ BYV

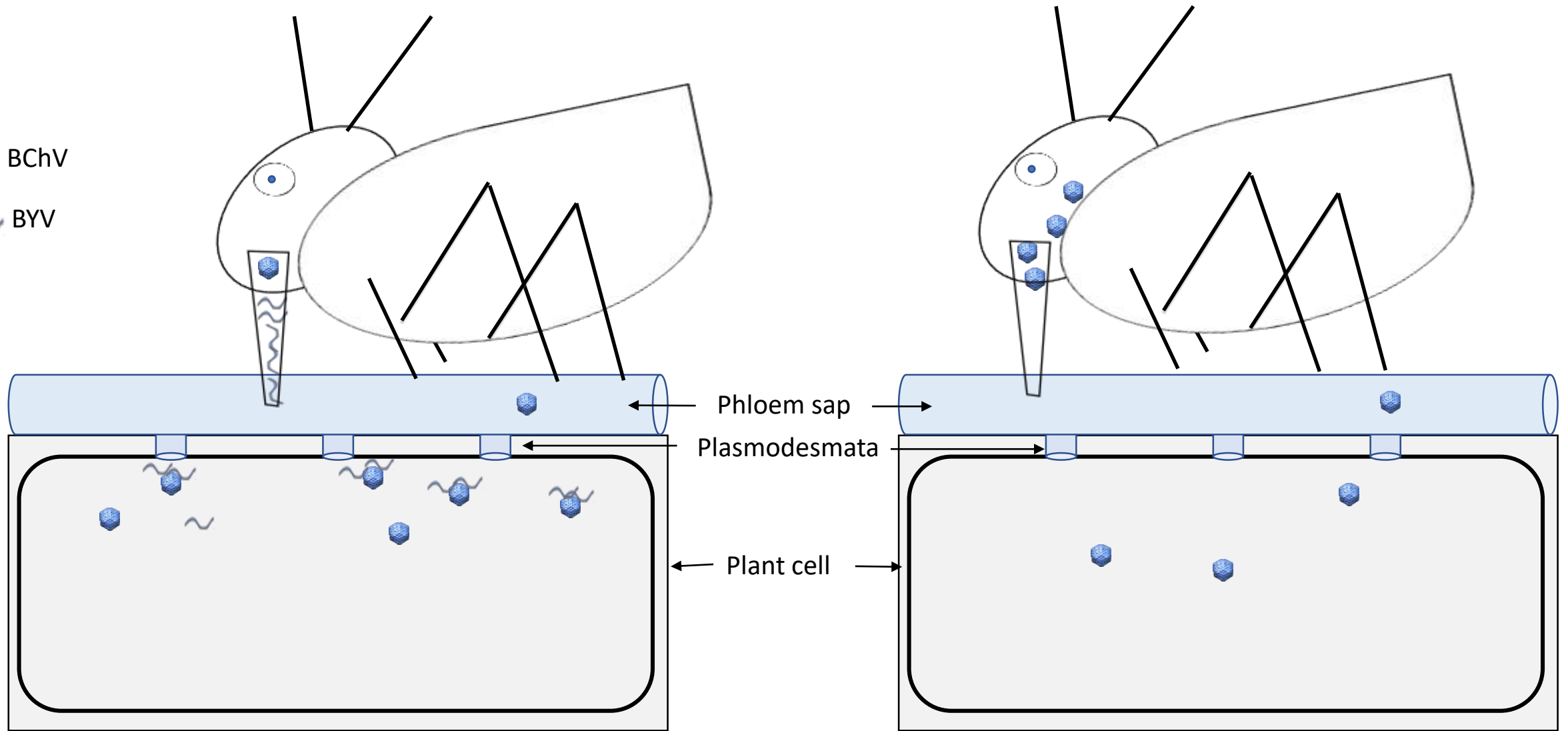


BChV/ByV Co-infected cell

BChV mono-infected cell

BChV

BYV



BYV co-infected cell

BChV mono-infected cell

➤ Thank you for your attention

