Transmission characteristics of *Xylella fastidiosa* subsp. pauca (ST53) by *Philaenus spumarius* and *Cicadella viridis*

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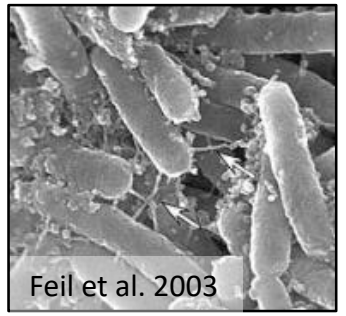
Introduction

Xylella fastidiosa is a xylem-limited bacterium (Wells 1987)



Vectors are xylem-sap feeders insects (Almeida et al 2005)

- **Cicadellidae: <u>Cicadellinae</u>**
  (Sharpshooters)
- **Cercopoidea → <u>Aphrophoridae</u>**
  (Spittlebugs)

Introduction

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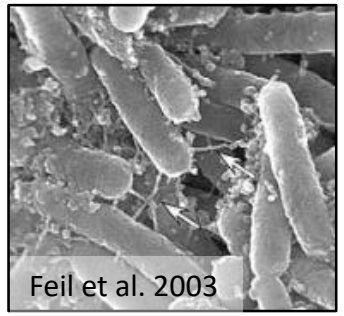

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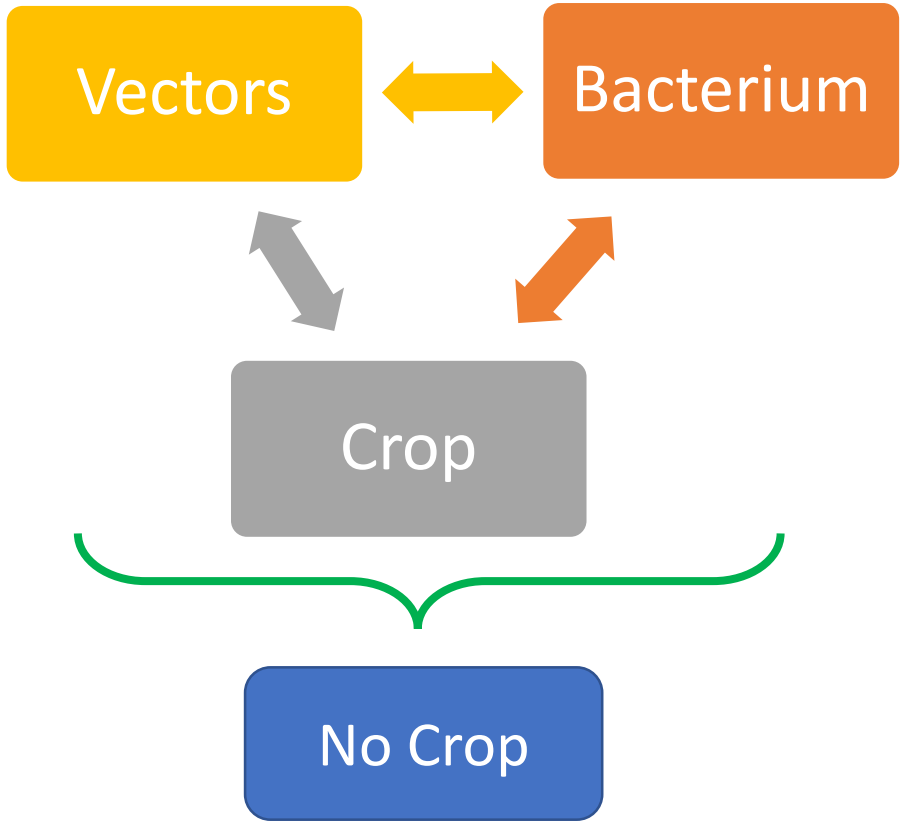


= Main characters of *Xf* pathosystems

well known in American agroecosystems

New introductions

Different subsp. *Xf* (eg. pauca ST53)

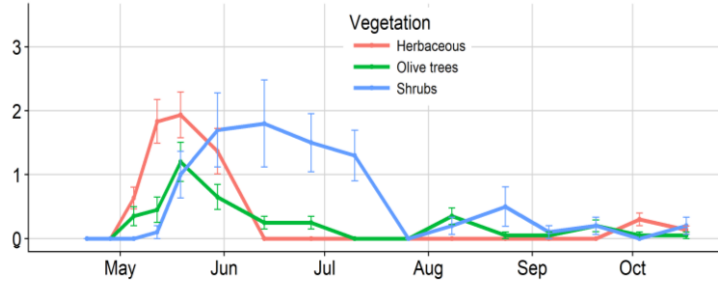
in Europe { Different agroecosystems

Transmission and epidemiology of *Xf* in Apulia and in Europe is not well known yet

Different Vectors → (Spittlebugs)

Philaenus spumarius main vector of *Xf* in Europe:

- efficient acquisition and transmission of *Xf* ST53 on olive (Saponari et al. 2014; Cornara et al. 2017a, 2017b)
- Abundant on olive and throughout olive agroecosystem
  (Ben Moussa 2016; Bodino et al. 2017; Dongiovanni et al. 2019)



Cicadella viridis

- Most common sharpshooter in Europe → Potential vector of *Xf* ?

Not on olives

Grapevine and other wild hosts

Incidence, **persistence** and **spread** of ***Xf*** in/by the vectors in Apulia and in Europe still poorly understood

Aims

Transmission biology of *Xylella fastidiosa* spp. pauca ST53 by *P. spumarius*

Post-acquisition time

Season (summer/autumn)

1

Transmission dynamics of *Xf* in the olive-*P.spumarius* pathosystem

2

Acquisition | Persistence | Transmission

Spread model of *Xf* on olive

2017/2018

Insects infected

Olive infected

Aims

Transmission biology of *Xylella fastidiosa* spp. pauca ST53 by *C. viridis*

3

Time post-acquisition

***Xf-C. viridis* relationships**

Acquisition

Persistence

Transmission

Sharpshooter

Cicadella viridis

Periwinkle infected

1 Transmission dynamics of *Xf* in the olive-*P. spumarius* pathosystem

Season
(summer/autumn)

P. spumarius

Healthy adults

Acquisition (AAP)

- Olive
- Field (3 days)

- single olive plantlets
- climatic chamber (3 dd)

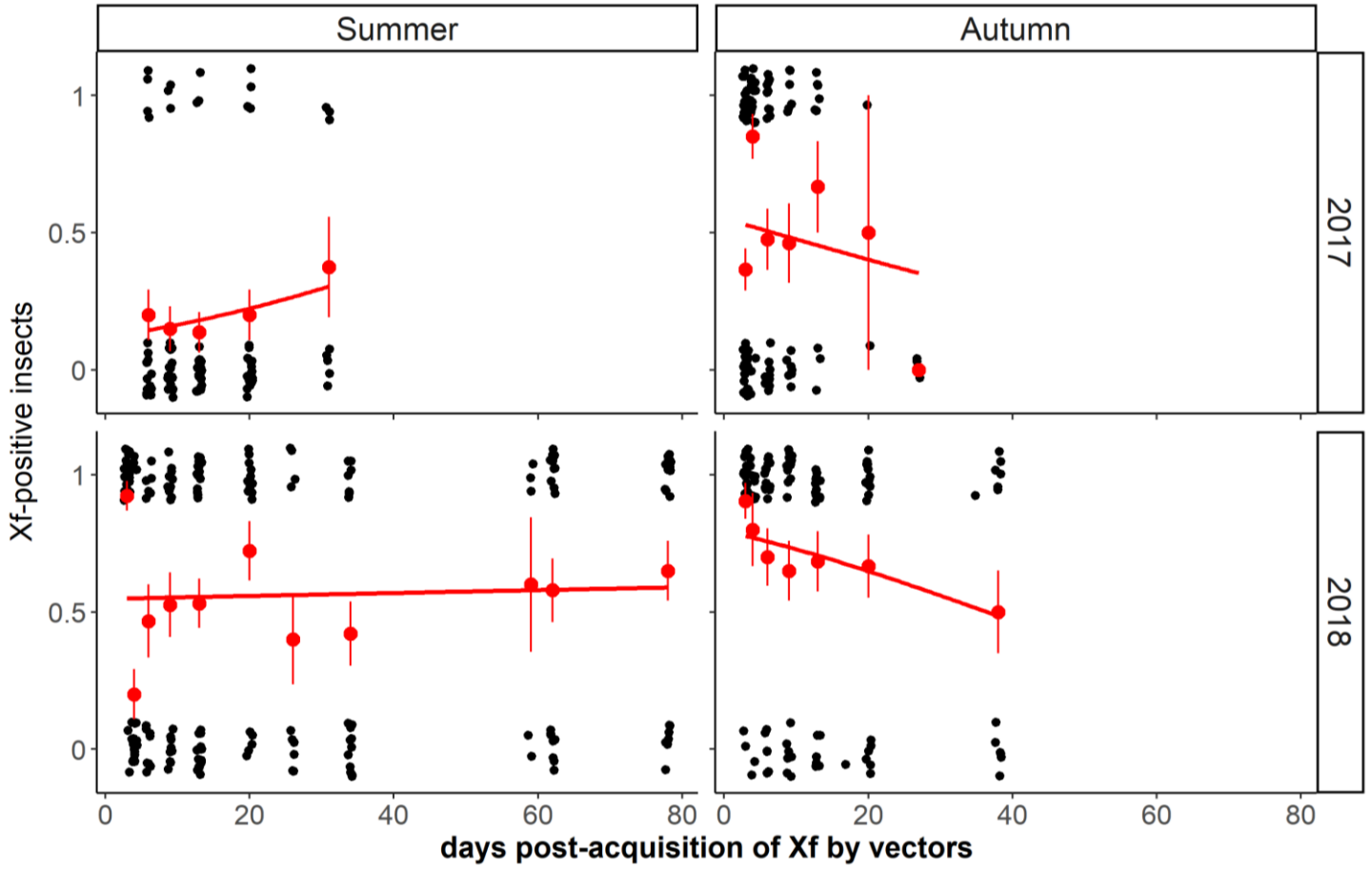
Inoculation (IAP)

Time post AAP

- **0-3-7-14-21-28-56-72 dd**
- 5 reps × 5 insects each

Year (2017/2018)

1 Transmission dynamics of *Xf* in the olive-*P. spumarius* pathosystem

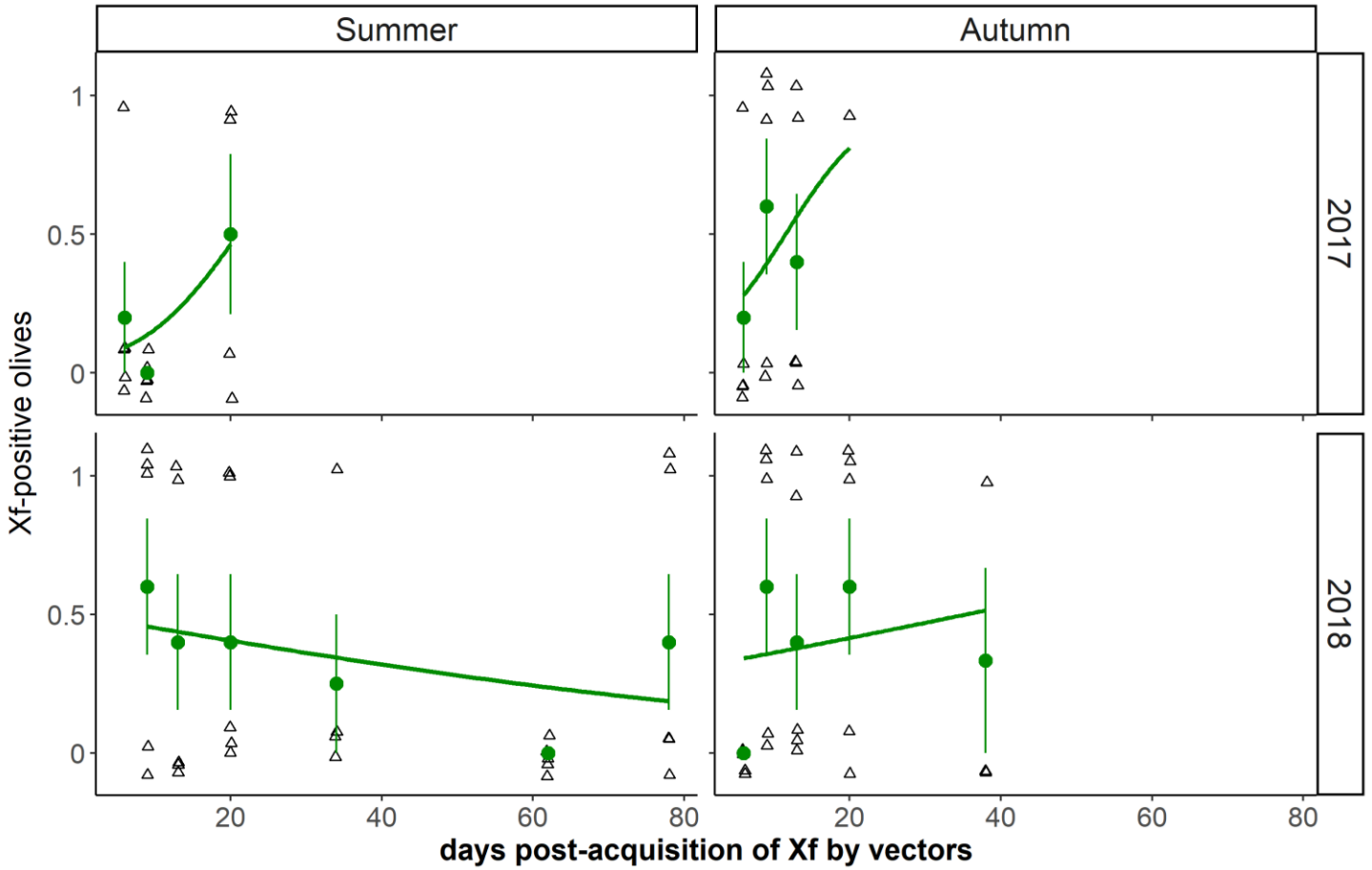


? Shorter longevity of insects infected by *Xf* ?

Philaenus spumarius

- infective and infectious immediately after end of acquisition
- infected adult life-long
- **Seasonal effect:**
  - higher proportion of infective insects at beginning of post-AAP in **autumn**
  - Proportion of infective individuals decreases slightly during time in **autumn**

1 Transmission dynamics of *Xf* in the olive-*P. spumarius* pathosystem



Olive

- Transmission quite constant during time post-acquisition and among seasons
  - **range 30-60% infected**

2 Spread model of *Xf* on olive

Season
(summer/autumn)

Year (2017/2018)

P. spumarius

Healthy adults

Acquisition (AAP)

- Olive
- Field (3 days)

16 olive plantlets/cage

Outdoor

Indoor

Inoculation (IAP)

IAP time

2017

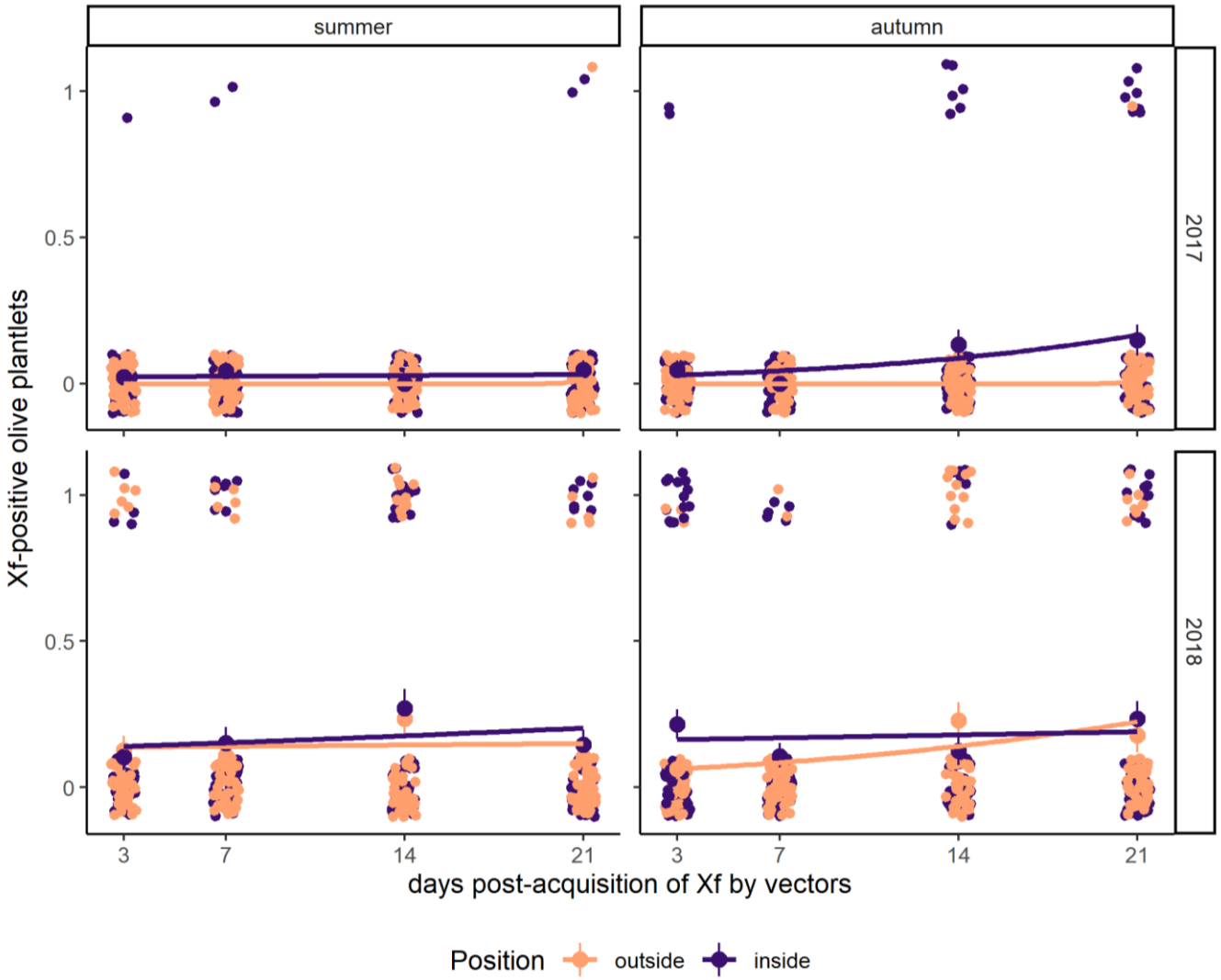
- **3-7-14-21 dd**
- 3 reps × 16 insects each

2018

- **3-7-14-21 dd**
- 3 reps × 32 insects each

2 Spread model of *Xf* on olive

- **Proportion of infected plar inoculum time**



Olive

- **Inoculum time poorly affected the transmission success**
  - **up to 22-27% after 14-21 days**
  - we observed high prevalence ***Xf*-infected plants after only 3 days inoculum**
- Higher transmission efficiency under controlled conditions (indoor *vs* outdoor)
- No differences between seasons

3 *Xf*-*Cicadella viridis* relationships

Season
(summer/autumn)

C. viridis

P. spumarius

Acquisition (AAP)

- Periwinkle
- **Artificial diet**
  - Xfm
  - PD3 (10^7 CFU/ml)

- Periwinkle

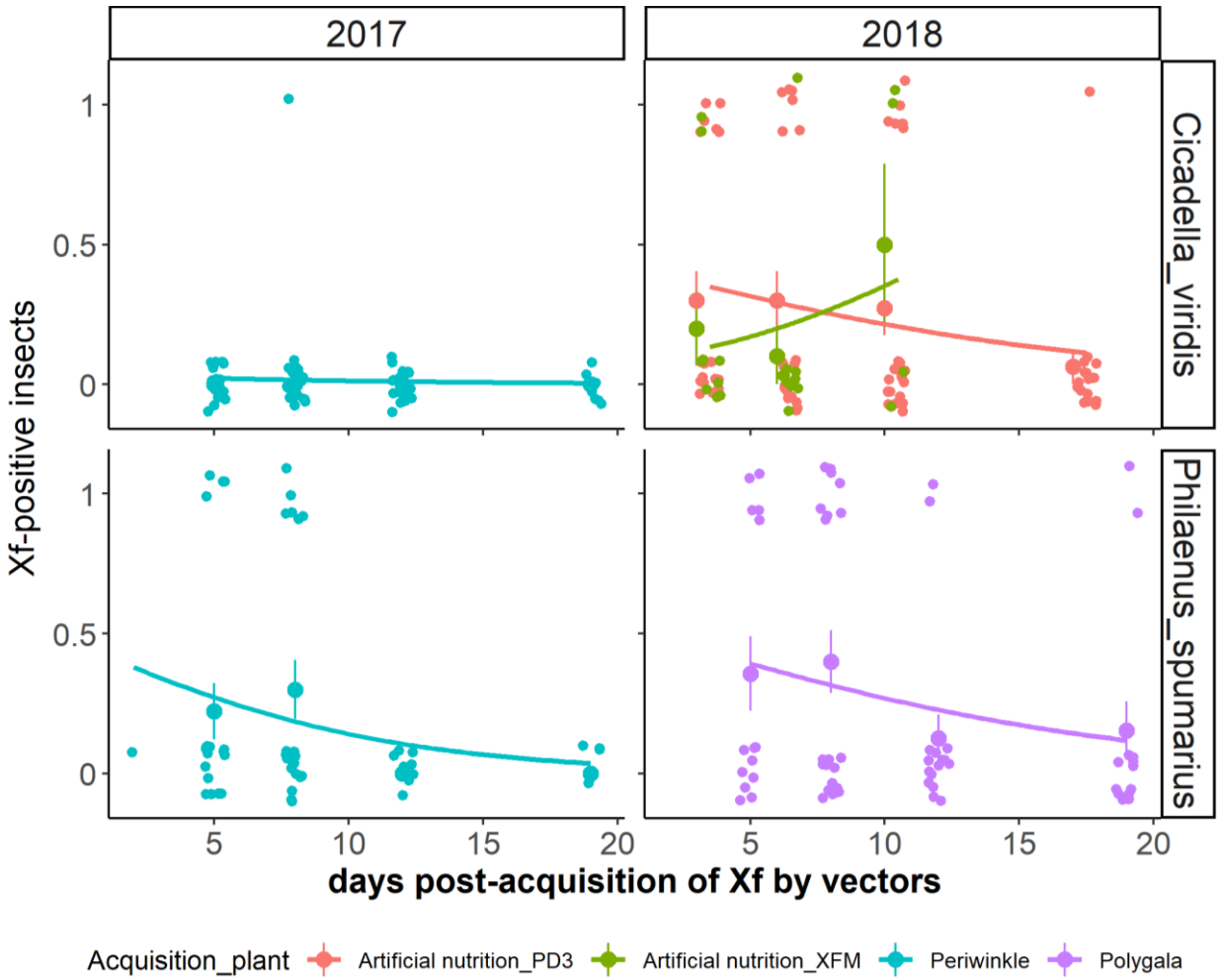
- single periwinkle plants
- climatic chamber (3 dd)

Inoculation (IAP)

IAP time after acquisition

- **5-8-12-19 dd**
- 5 reps × 10 insects each

3 *Xf*-*Cicadella viridis* relationships



Acquisition

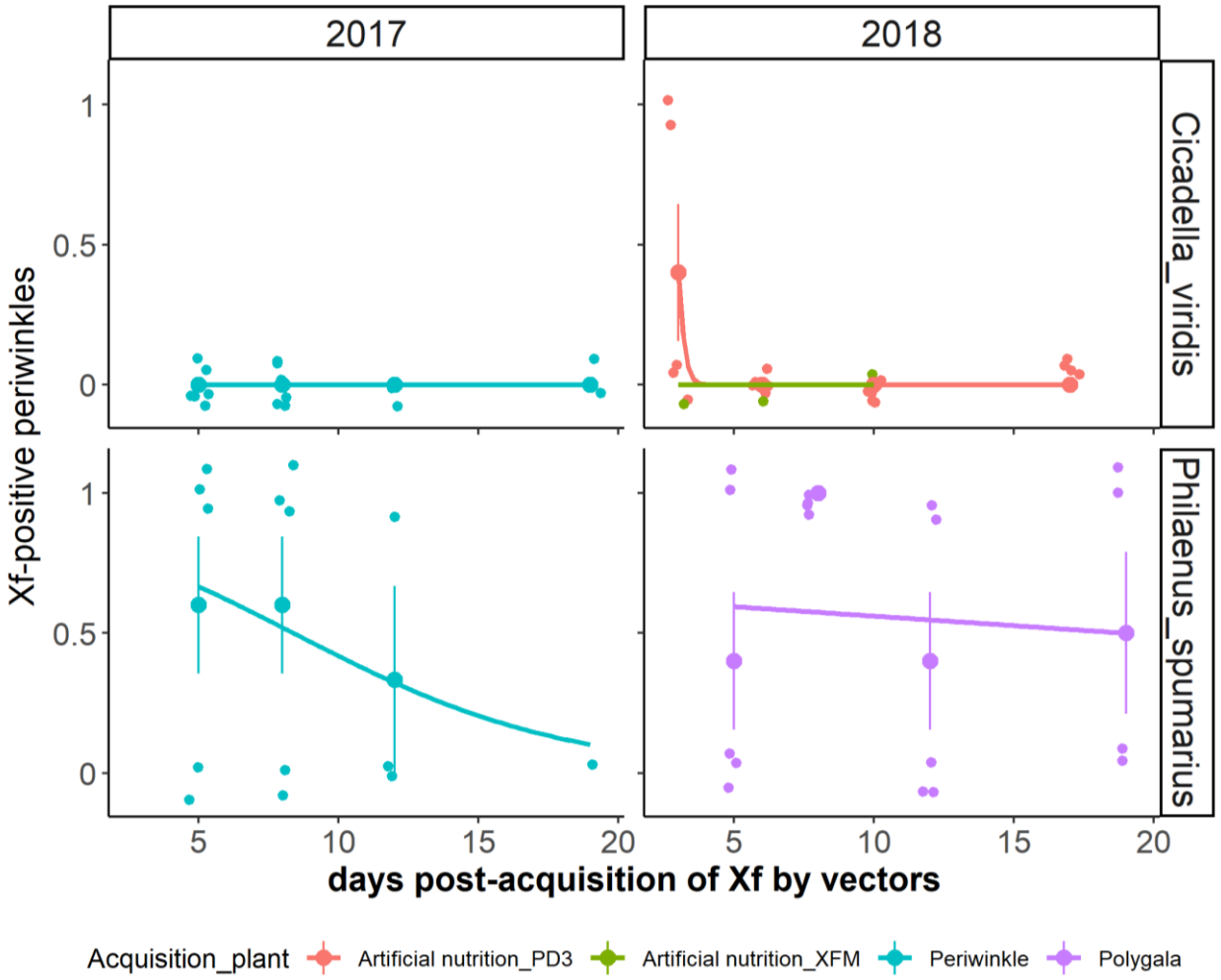
C. viridis

- acquisition from artificial nutrition (both diets)
  - **up to 30-50% individuals infected**
- Only one insect acquired from periwinkle

P. spumarius (Control)

- acquisition from both periwinkle and polygala, although with lower efficiency than from olive

3 *Xf-Cicadella viridis* relationships



Transmission to plants

C. viridis

- very low transmission to periwinkle from artificial diet PD3 only (2 plants infected)
- No transmission from periwinkle to periwinkle

***P. spumarius* (Control)**

- transmission to periwinkle from both periwinkle and polygala

Conclusions

Philaenus spumarius

- can acquire and transmit persistently ***Xf*** ST53 on olive throughout the year (June – November)
- Proportion of infected olives increases with time of inoculation
  → however high transmission rate can occur also after 3 days of inoculation
- No clear seasonal effect on efficiency of *Xf* transmission to olive

Cicadella viridis

- acquires and transmits ST53 from artificial diet only, very low efficiency

No olive/periwinkle

No evidence of a role as vector of *Xf* (ST53)

Conclusioni

Philaenus spumarius

- can acquire and transmit persistently ***Xf*** ST53 on olive throughout the year (June – November)

Population dynamic of *P. spumarius* important to understand *Xf* epidemic

Control perspective

Apulia

P. spumarius abundant on olive trees in May-June

Time period at higher risk — **lower *Xf* load in olive**

Suppress *P. spumarius* adults on olive trees during «key» period

Conclusioni

Philaenus spumarius

- can acquire and transmit persistently ***Xf*** ST53 on olive throughout the year (June – November)

Population dynamic of *P. spumarius* important to understand *Xf* epidemic

Risk assessment

North Italy

P. spumarius abundant on olive trees throughout summer (May-September)

Long time period at risk

More difficult to protect olives from *P. spumarius* adults throughout summer

Control of nymphal stages within and outside olive groves essential to prevent epidemics

Thanks for your attention

Acknowledgements:

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