



Insect vectors of grapevine phytoplasmas in Europe

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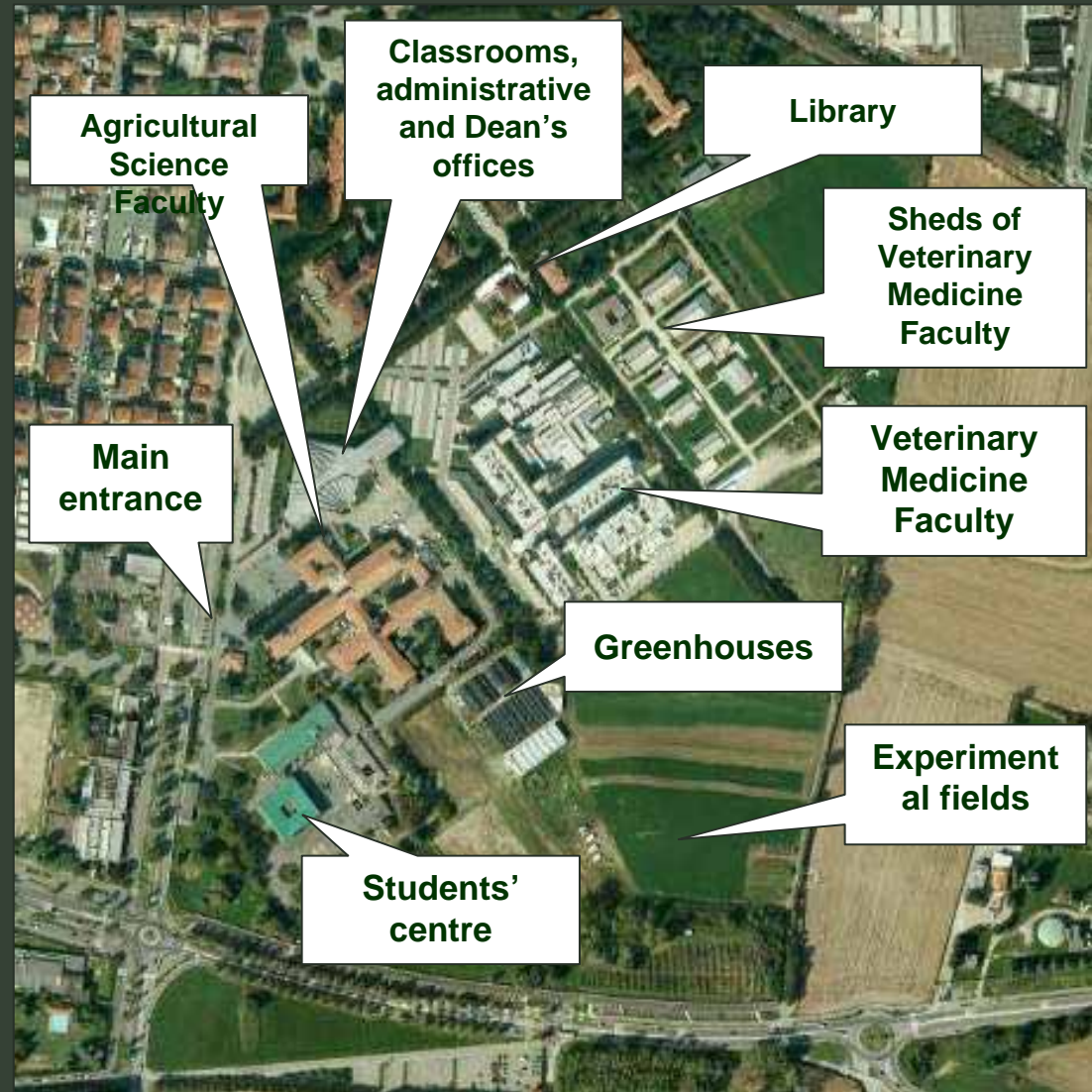
**Phytoplasmas and viruses management in Grapevine Collections for
Germplasm Conservation, Mobilization and Evaluation
8-9 May, 2012 , SOFIA - BULGARIA**

University of Torino – Faculty of Agriculture



Grugliasco's campus

- about 30 ha
- deanship secretary's office
(Agricultural Science +
Veterinary Medicine)
- students secretariat
- classrooms
- laboratories
- offices and support
services to research and
teaching.
- departments



■ Invasive species

→ Bioethology

→ Development of biological and integrated control strategies

- *Neodryinus typhlocybae* against *Metcalfa pruinosa*
- *Torymus synensis* against *Dryocosmus kuriphilus*

■ Insect vectors of plant pathogens

(Grapevine, fruit trees, vegetables and ornamentals)

→ Bioethology and epidemiology



Development of innovative control strategies

- Biological and integrated control strategies
- Symbiotic control

→ Molecular tools for specific discrimination



Vectors

Grapevine phytoplasma diseases in Europe

■ Flavescence Dorée (FD)

- Epidemic
- Only 1 host plant and 1 insect vector

→ *Scaphoideus titanus*

- strictly dependent on grapevine



■ Bois Noir (BN)

- Endemic
- Multiple hosts and probably multiple insect vectors

→ *Hyalesthes obsoletus*

- feeds on different erbaceous plants, occasionally on grapevines



Life cycle of *Scaphoideus titanus* - FD

Jan. Feb. Mar. Apr. May. Jun. Jul. Aug. Sep. Oct. Nov. Dec.

Eggs



Nymphs



Adults

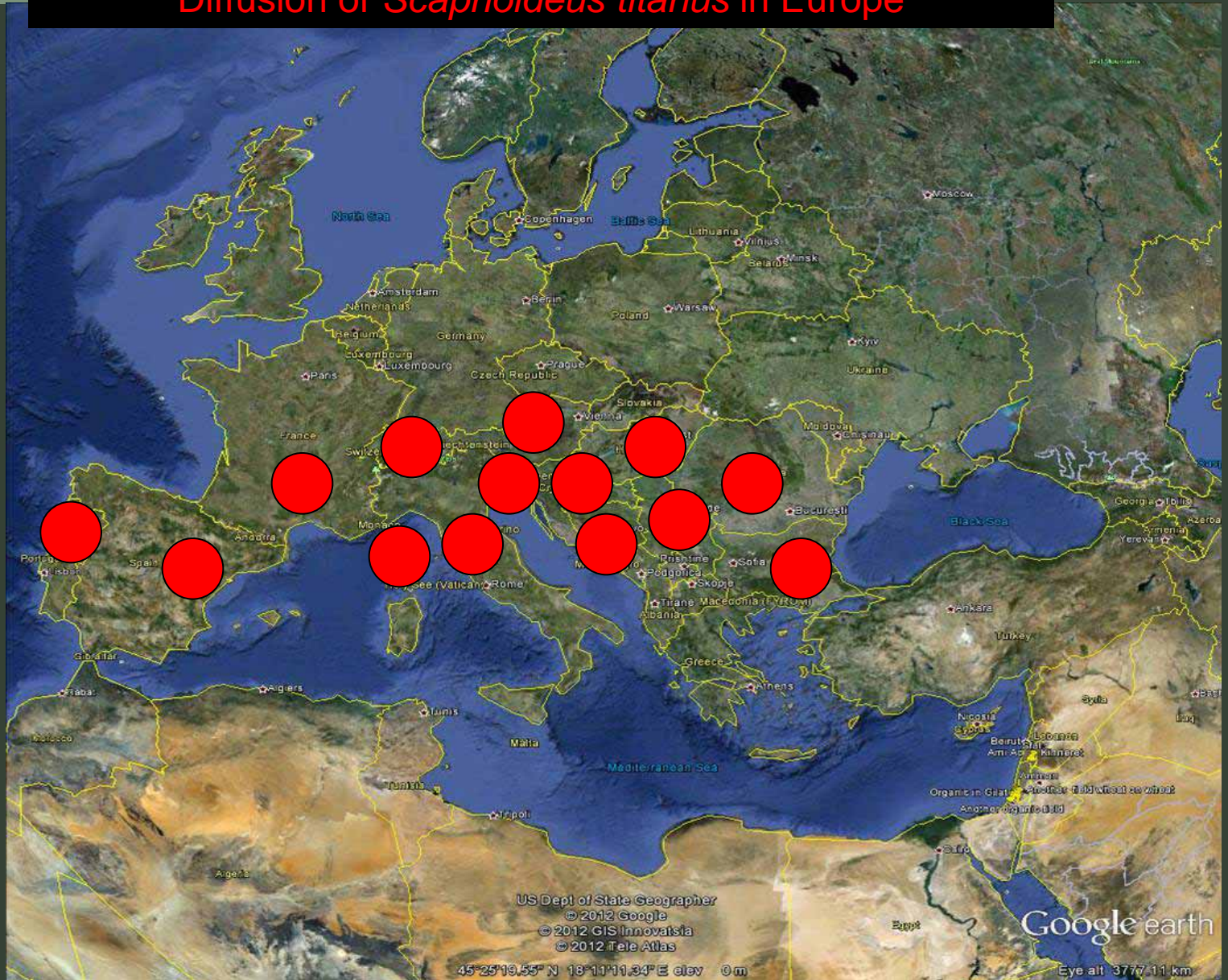


Eggs



Diffusion of *Scaphoideus titanus* in Europe

POR.
SPAIN
FRANCE
ITALY
CORSICA
SWITZ.
AUSTRIA
SLOVENIA
CROATIA
B.H.
SERBIA
HUNGARY
ROMANIA
BULGARIA



Life cycle of *Hyalesthes obsoletus* - BN

Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.

Nymphs



Adults



Eggs



Nymphs



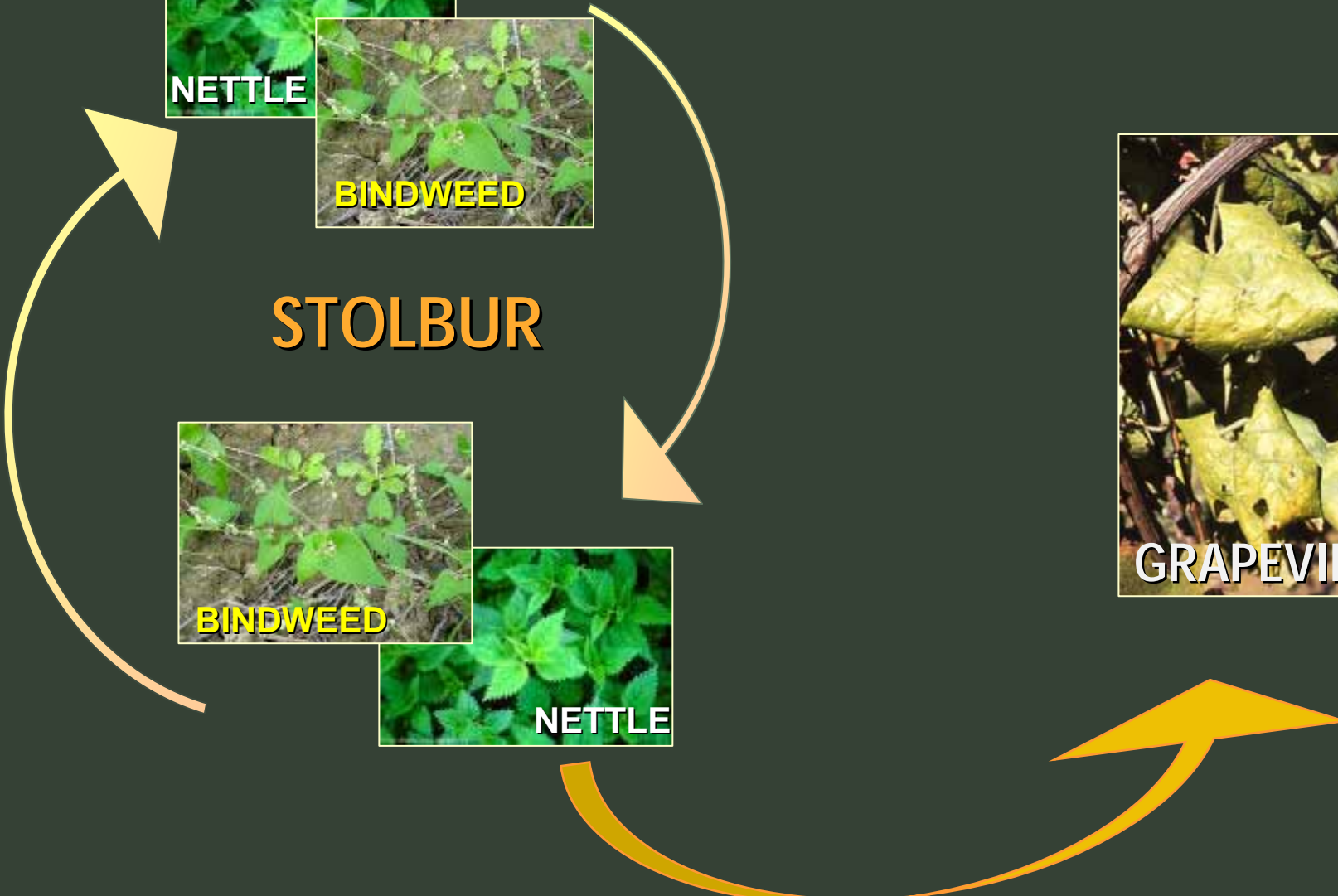
Diffusion of *Hyalesthes obsoletus* in Europe



"Open cycle "



STOLBUR





New potential vectors

New vectors?

■ New vectors of FD: open cycle?



- *Dictyophara europaea*: present on *Clematis vitalba* and other weeds within the vineyards
- transmission of 16SrV phytoplasmas from *C. vitalba* to grapevine is possible

Filippin *et al.*, 2009



- *Orientus ishidae*: commonly found in vineyards, lives on many trees
- positive to 16SrV phytoplasmas, source unknown

Mehle *et al.*, 2010, 2011
Gaffuri *et al.*, 2011

New vectors?

Unknown host plants



Open cycle FD

O. ishidae (?), 16SrV- D



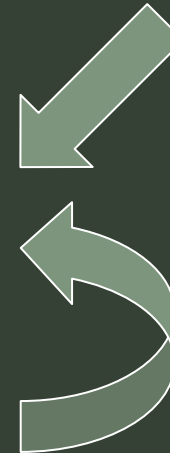
grapevine



Clematis vitalba



D. europaea (?), 16SrV-C



S. titanus

Closed cycle FD

New vectors?

■ New vectors of BN



Hyalesthes luteipes



Hyalesthes scotti




Reptalus spp.



Sistematically positive to BN

- *Reptalus quinquecostatus* can transmit to a feeding medium
- *Anaceratagallia ribauti* collected in vineyards can transmit BN to broadbeans



Thank you



Symbiotic control

Symbiotic control strategies

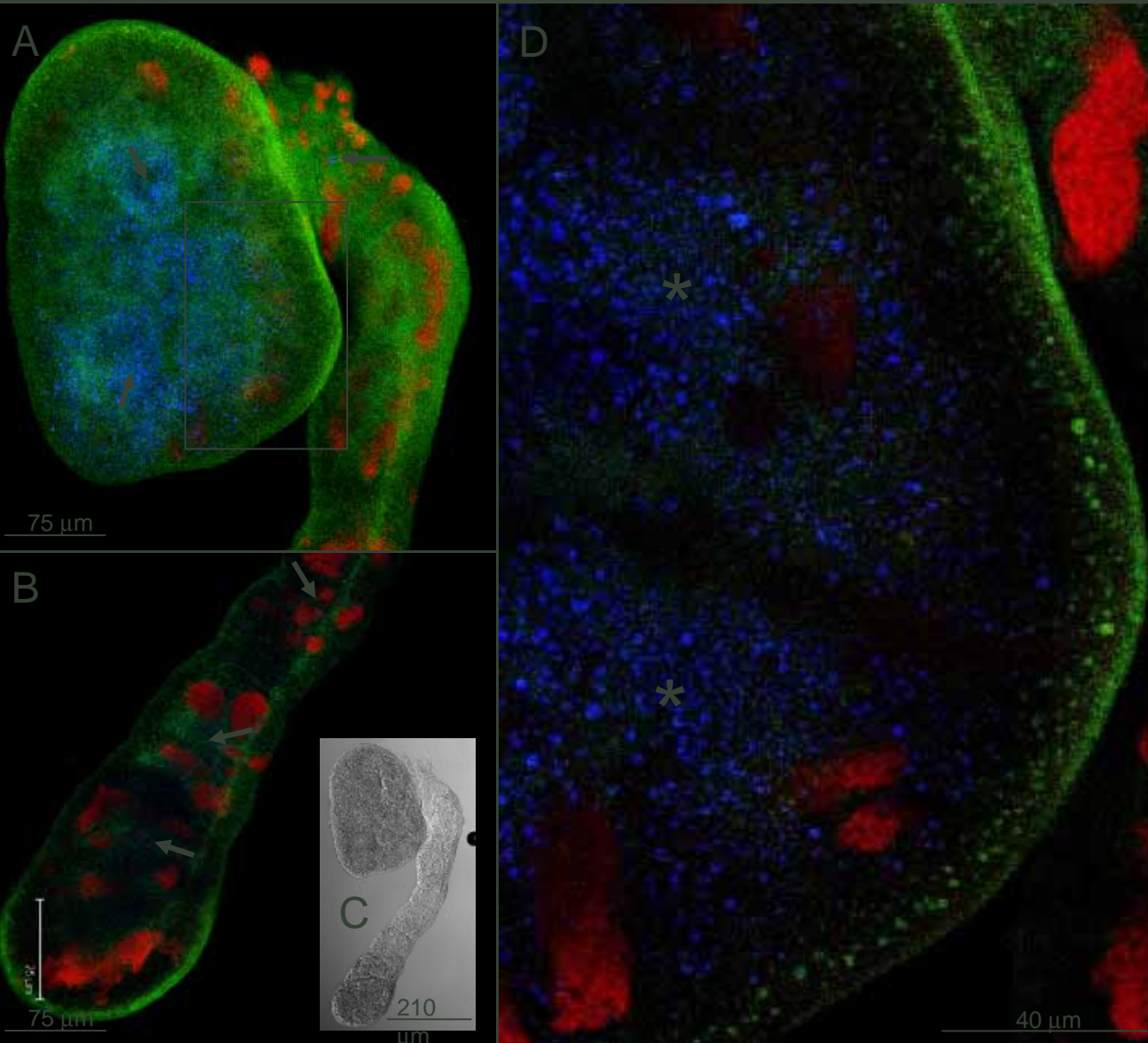
- Direct arthropod control: unbalancing the host's sex ratio and disturbing the population development
- Control of insect-borne pathogens: antagonistic activity blocking vector-mediated pathogen transmission

New control strategies

- Symbiotic control: use of microbial symbionts

- Complex microbiotas are associated to insects, including phytoplasma vectors
- Some of microbial symbionts are predominant in insect microbial communities
- They are located in organs and tissues that are fundamental for pathogen's life cycle (co-localization)
- Symbionts can undergo different transmission routes (vertical / horizontal)

The microbiota of *Hyalesthes obsoletus*



PROPIDIUM IODIDE staining

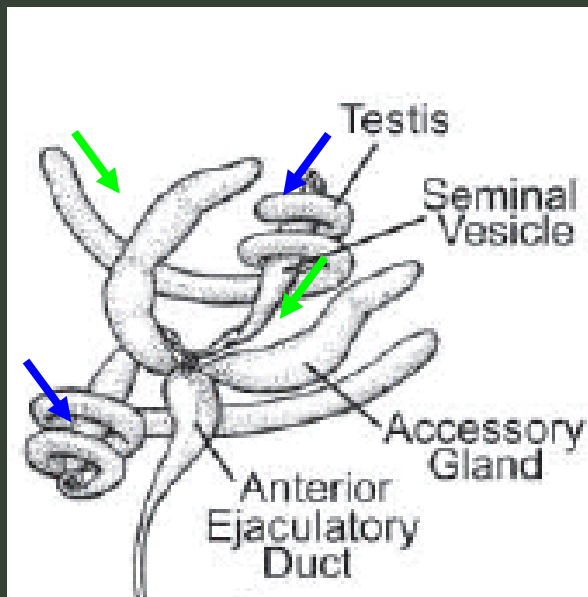
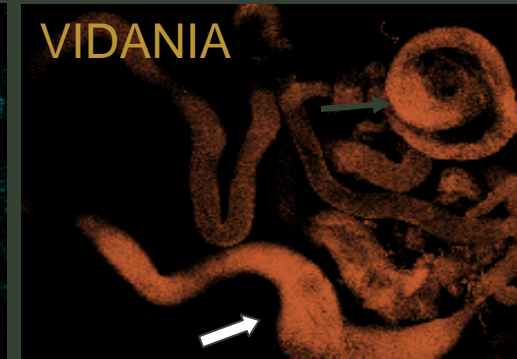
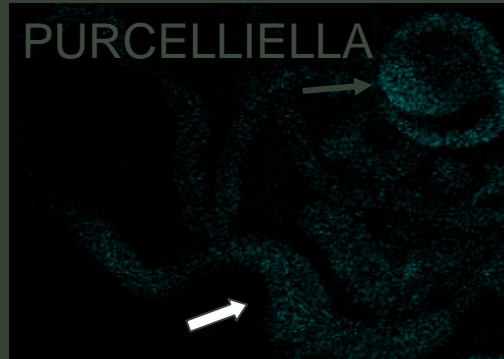
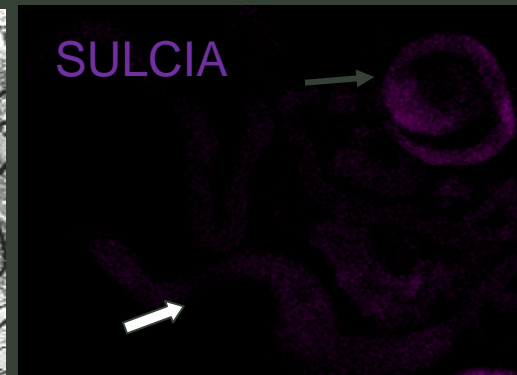
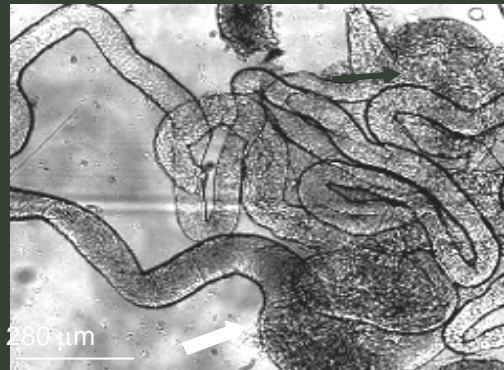
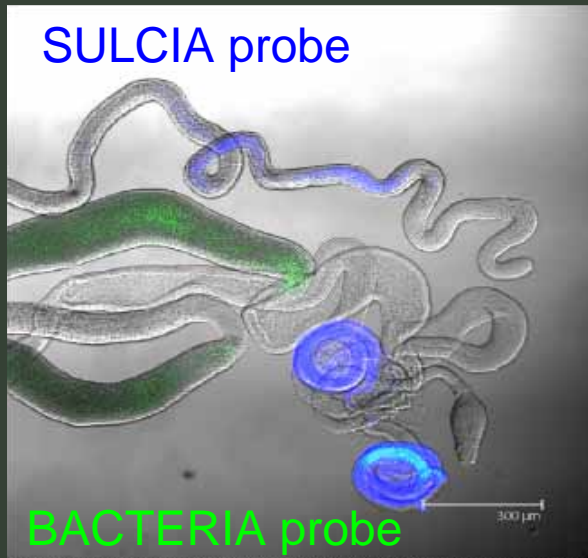
BACTEROIDETES probe

SULCIA probe

Large cells typical of '*Ca. Sulcia muelleri*' massively colonize the intestine together with other Bacteroidetes

The microbiota of *Hyalesthes obsoletus*

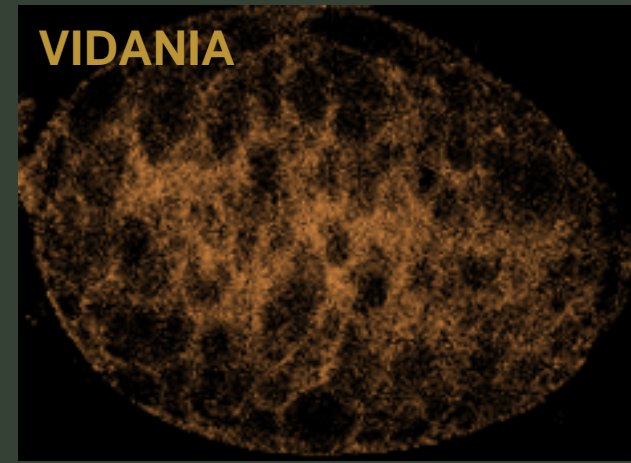
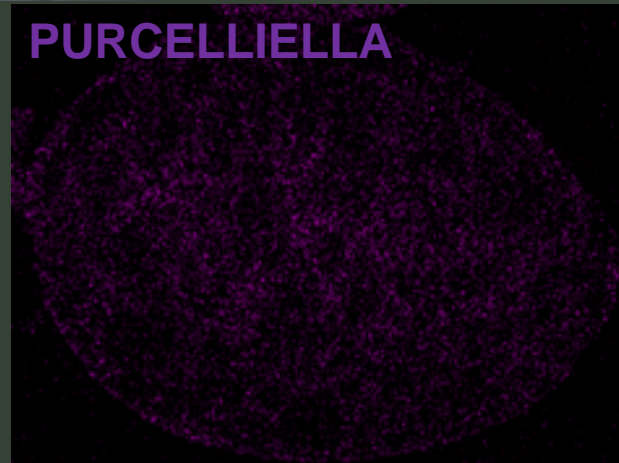
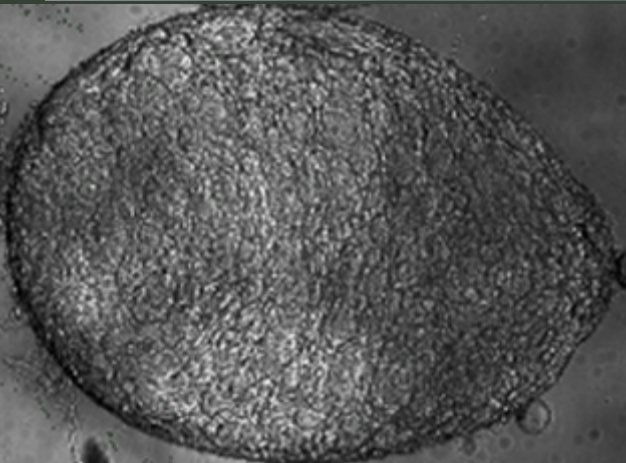
■ Symbiont localization



The male reproductive system hosts *Sulcia*, *Purcelliella* and *Vidania*

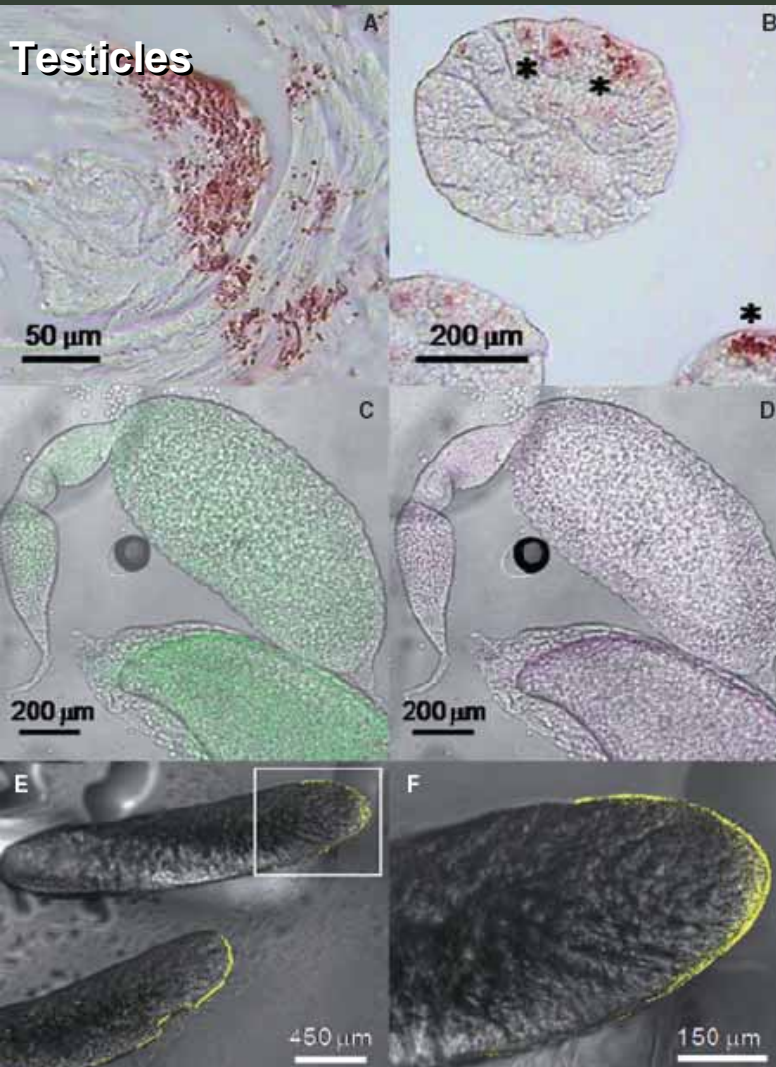
The microbiota of *Hyalesthes obsoletus*

- Vertical transmission to the progeny



The microbiota associated to *Scaphoideus titanus*

■ The acetic acid bacterium *Asaia* in *S. titanus*



Malpighian tubules

Ovaries

Asaia lives in the gonoducts of leafhoppers and can be vertically transmitted by egg smearing



The microbiota associated to *Scaphoideus titanus*

■ Breaking the infection triangle

