Christophe Bressac & Frédéric Manas – Insect Biology Research Institute

Sperm storage reveals sexual conflict in Black Soldier Fly

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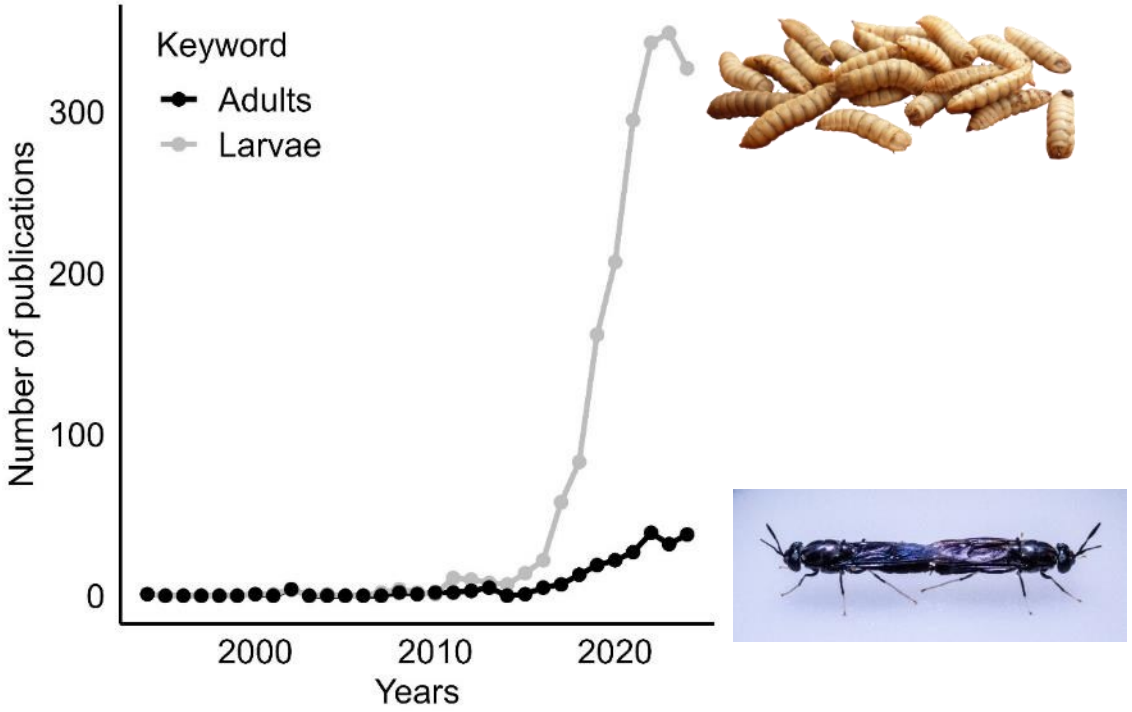
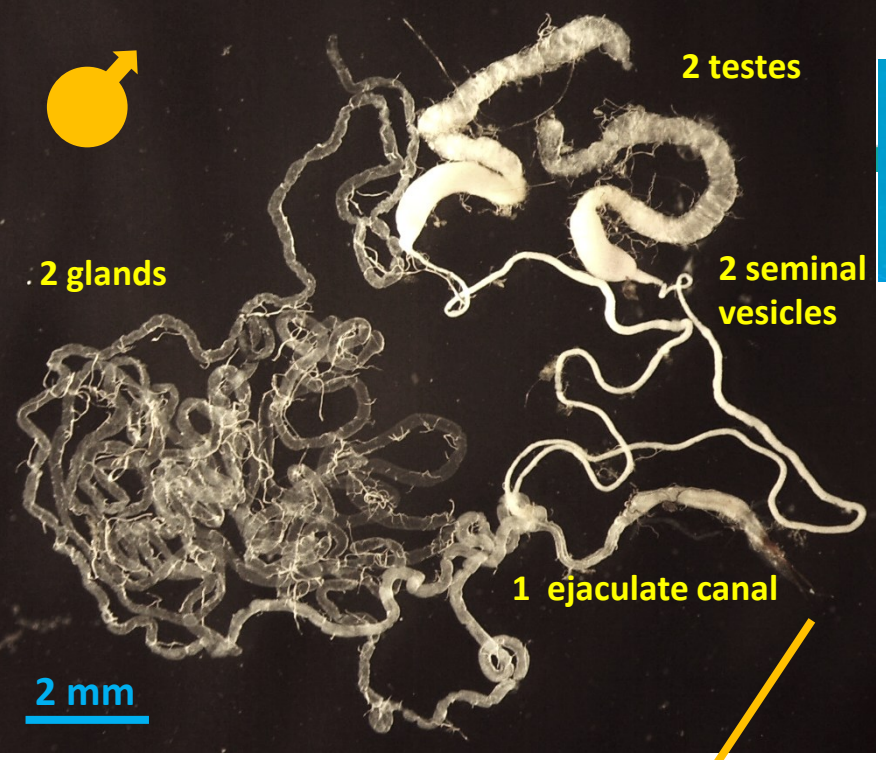
black soldier fly

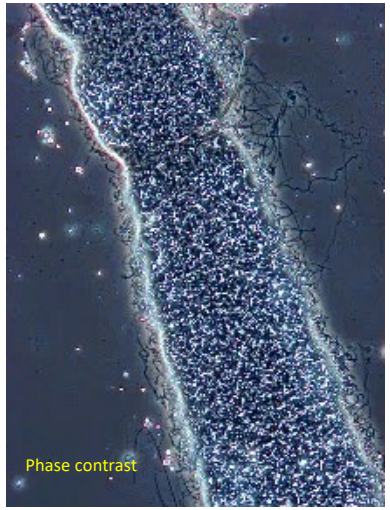
Bioconversion of organic wastes with **larvae**

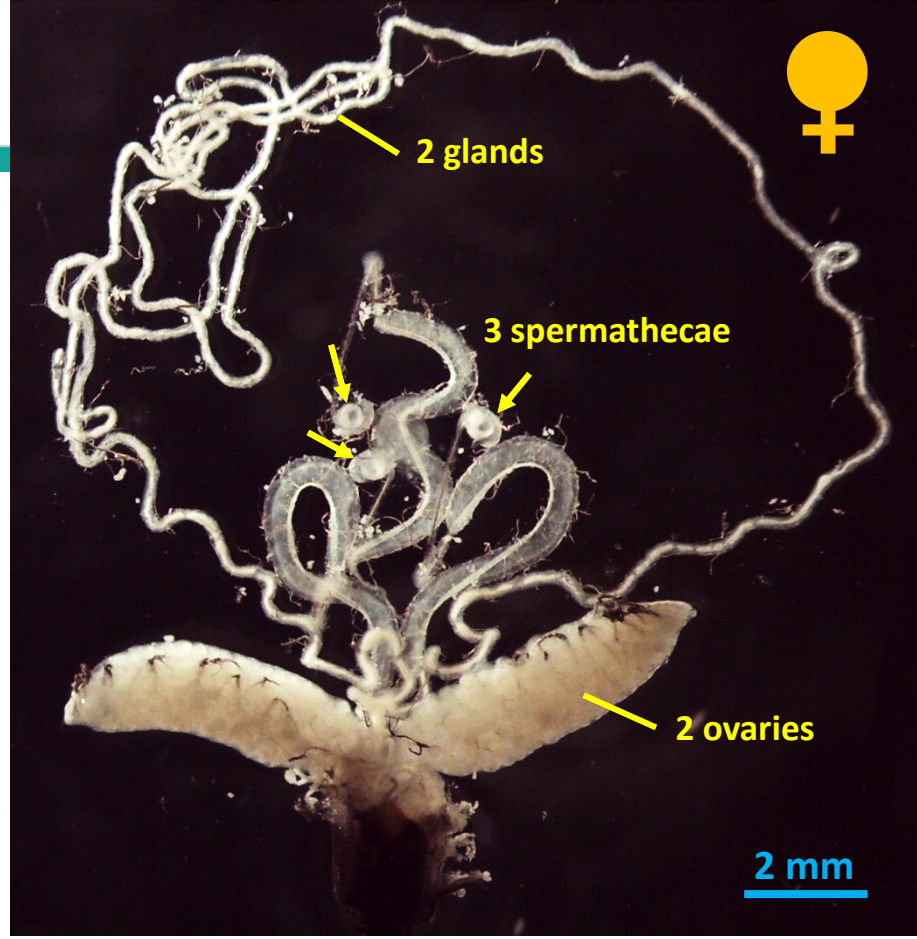
Source of proteins/lipids for animal feed

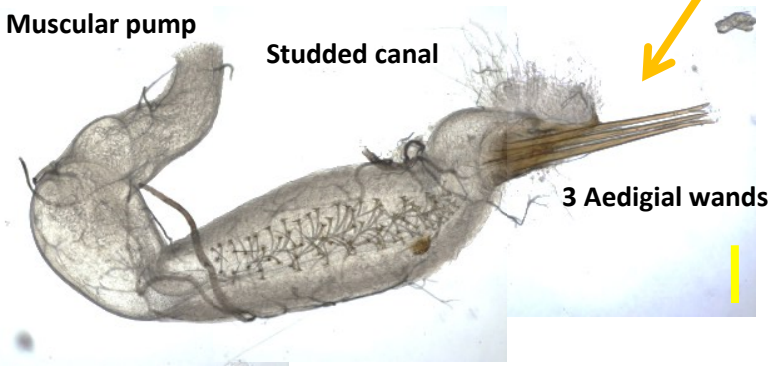


- A publication bias in favour of larvae
- A lack of knowledge about the adult stage
- Almost no information about pre-mating/post-mating **sexual selection**









Tracts are complex → Sexual Selection?

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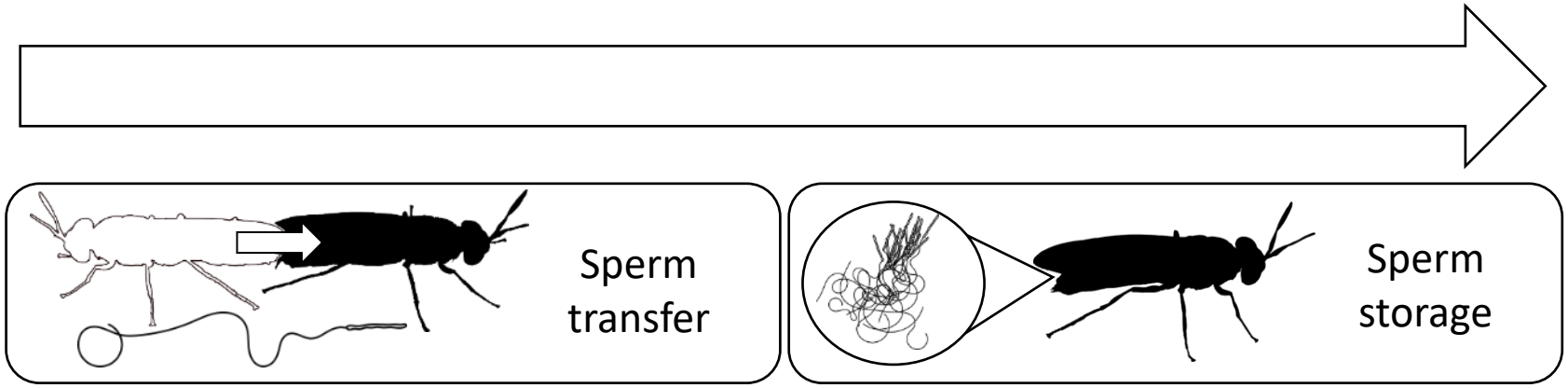
Post-mating sexual selection

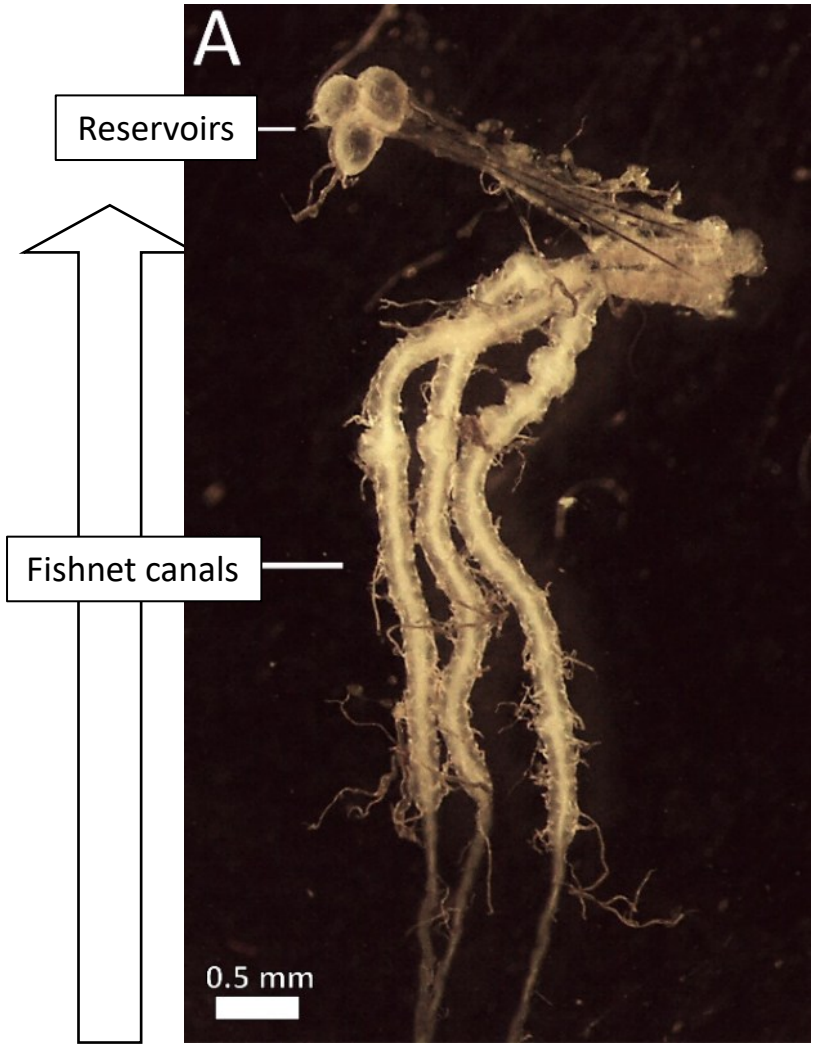
A good way to highlight Sperm competition/cryptic female choices **mechanisms**

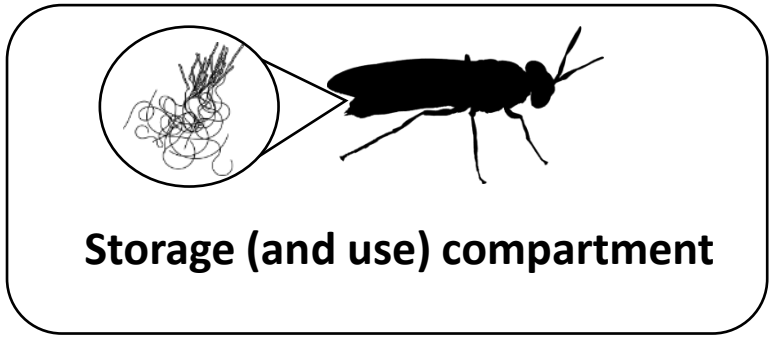
The dynamics of sperm transfer and storage

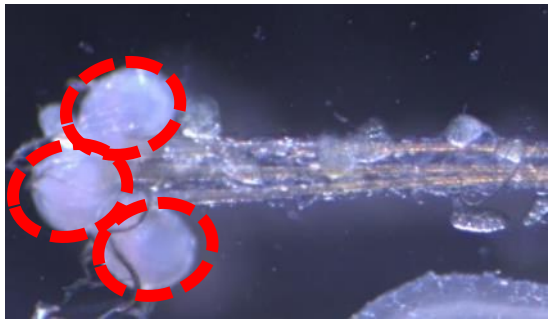
- Where are the spermatozoa over time?

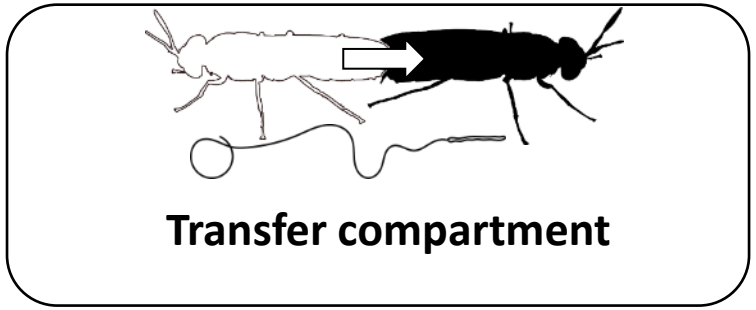


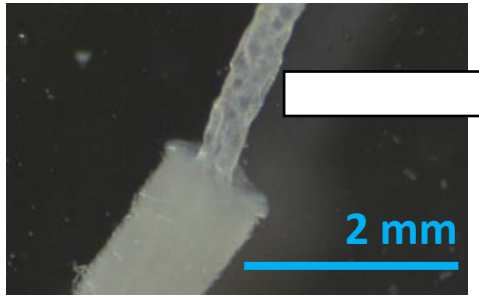
Post-mating sexual selection

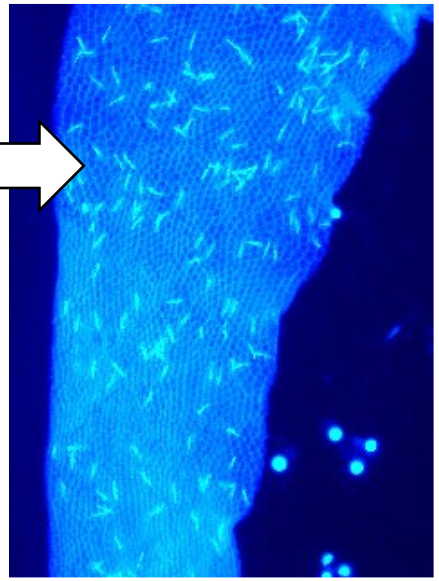




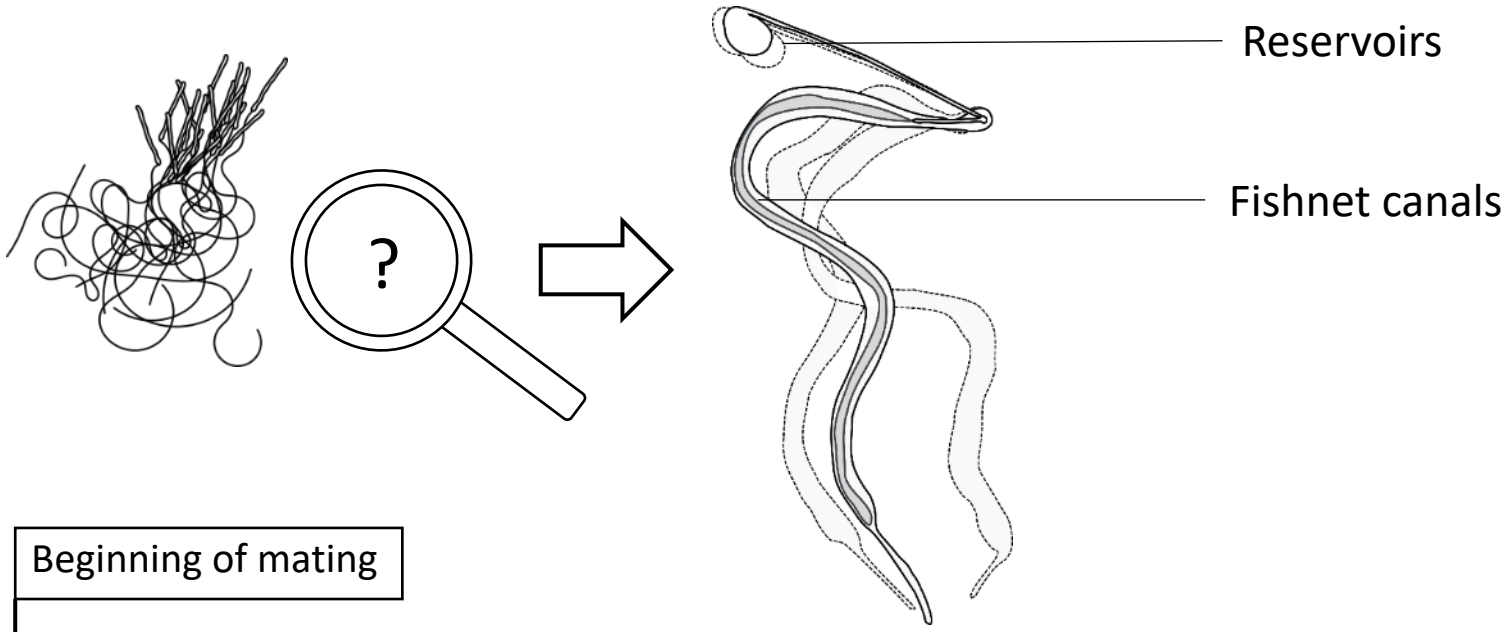




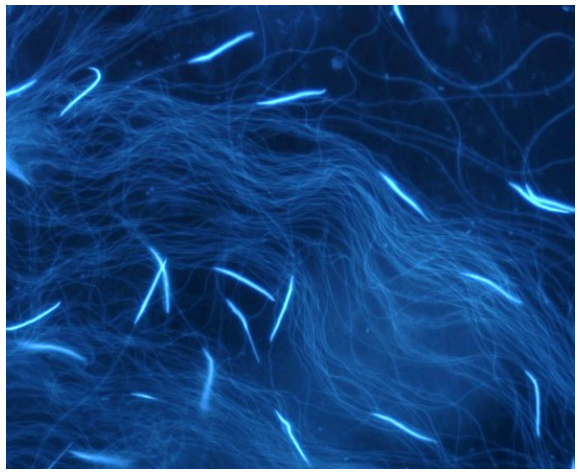


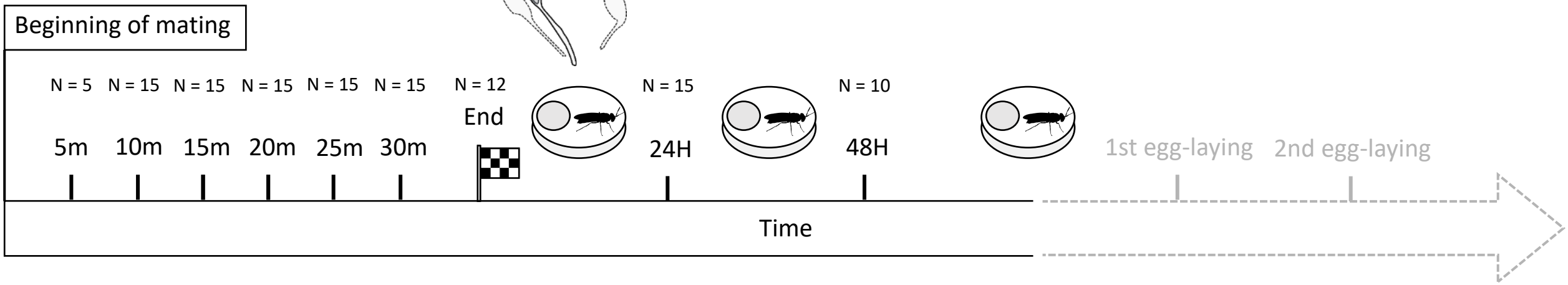


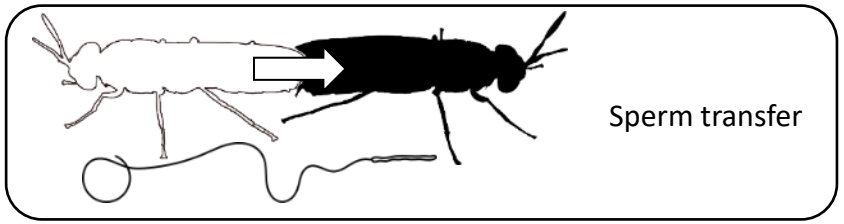
Spatio-temporal dynamics of sperm storage

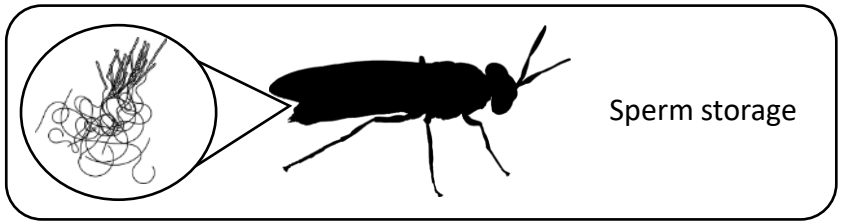


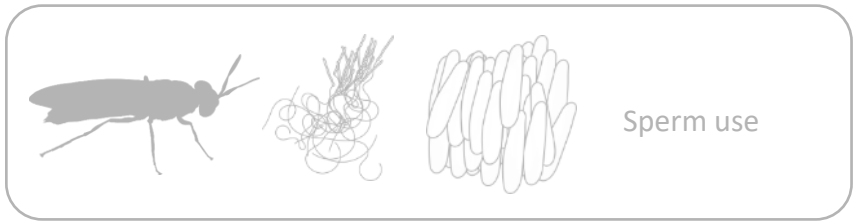
DAPI staining

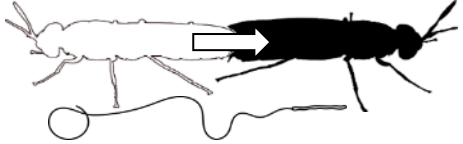




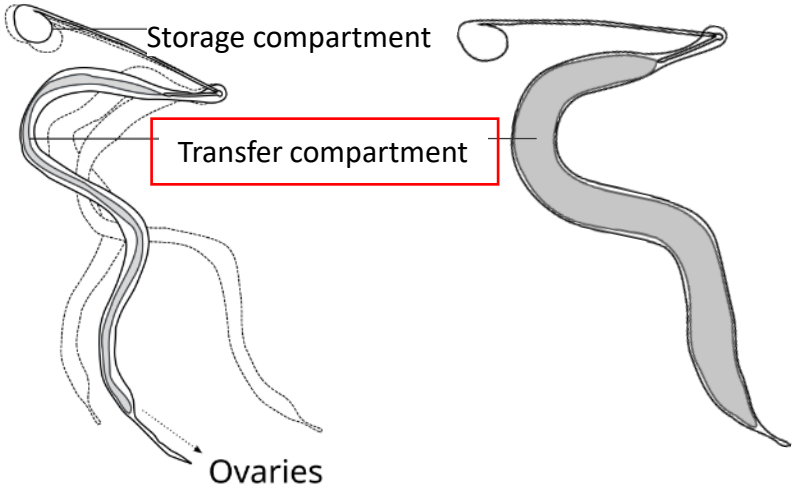


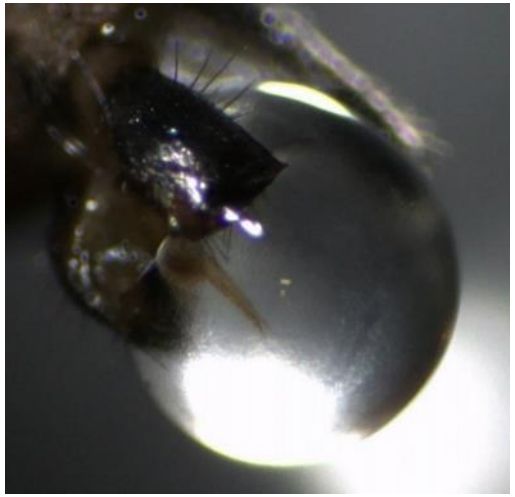




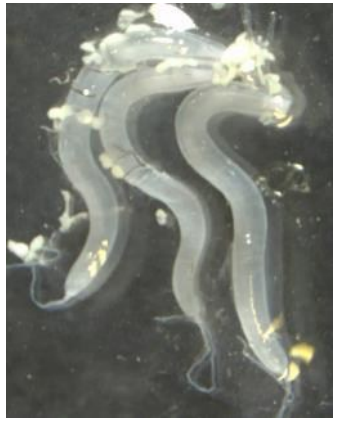


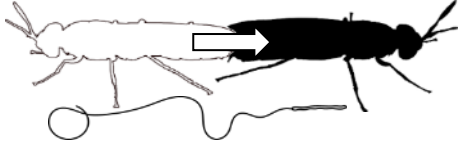
Sperm transfer



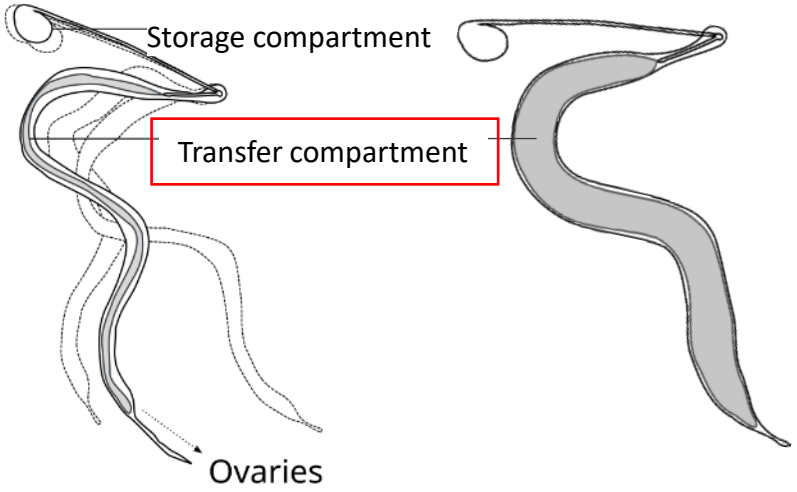


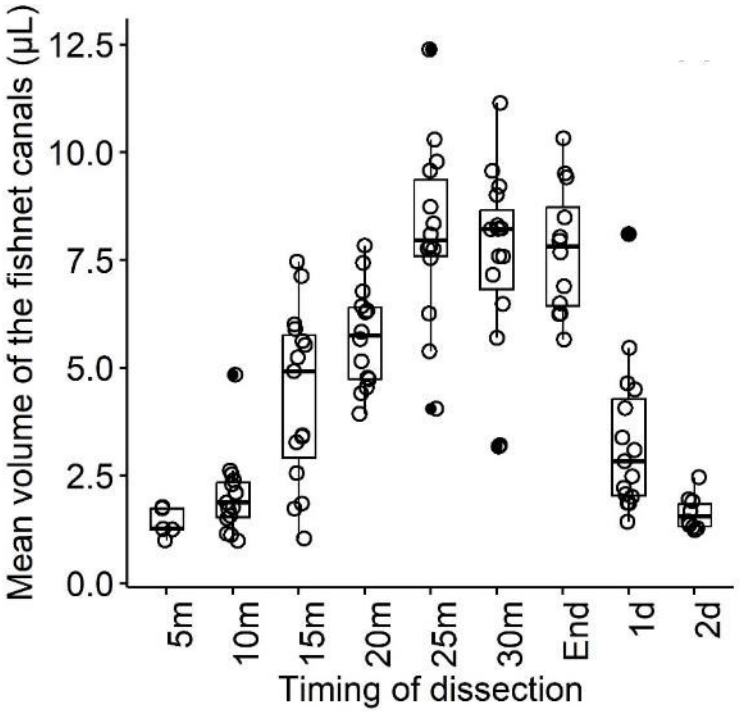
Seminal fluid transfer



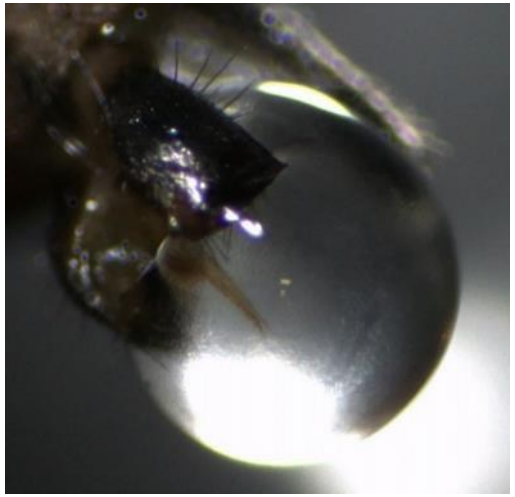


Sperm transfer

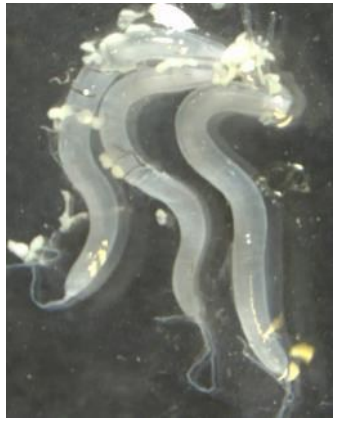


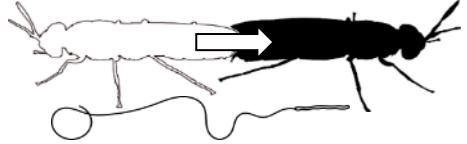


A loss of seminal fluid after mating

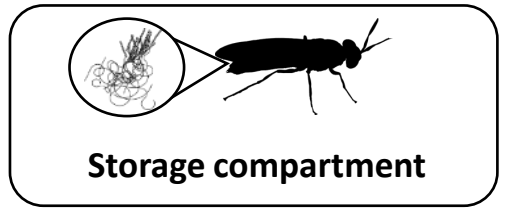


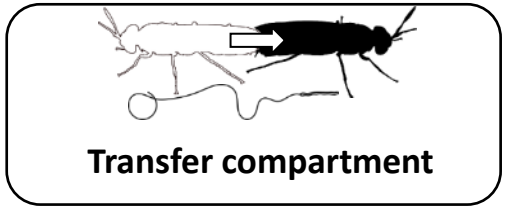
Seminal fluid transfer

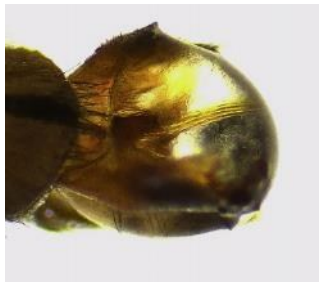


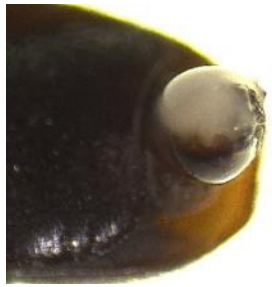


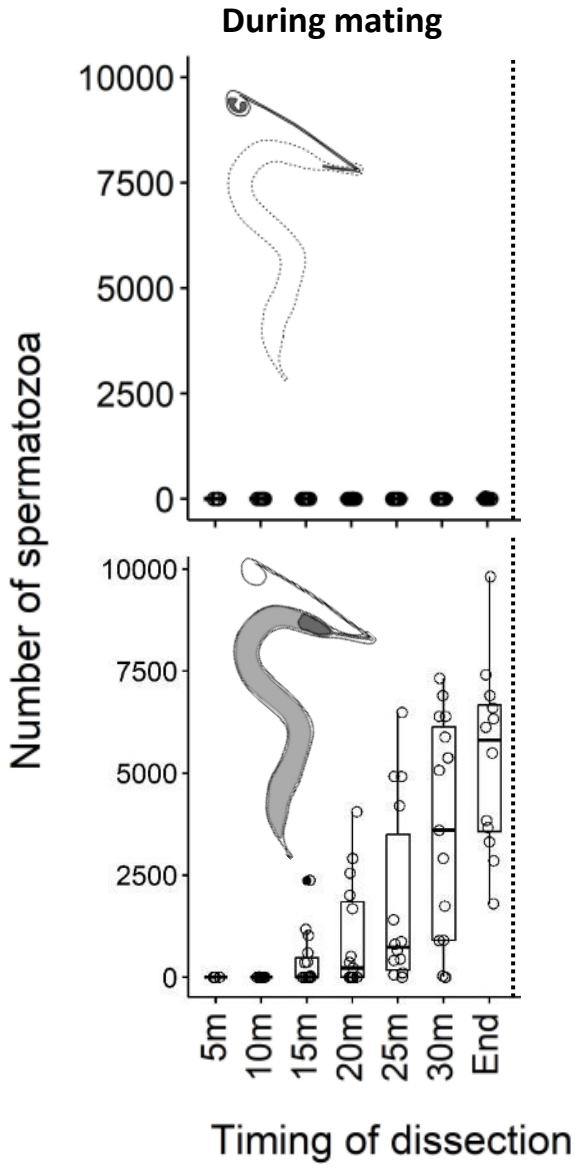
Sperm transfer

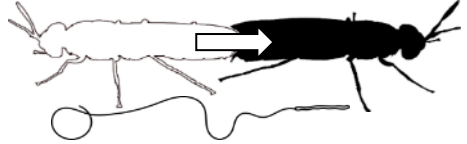




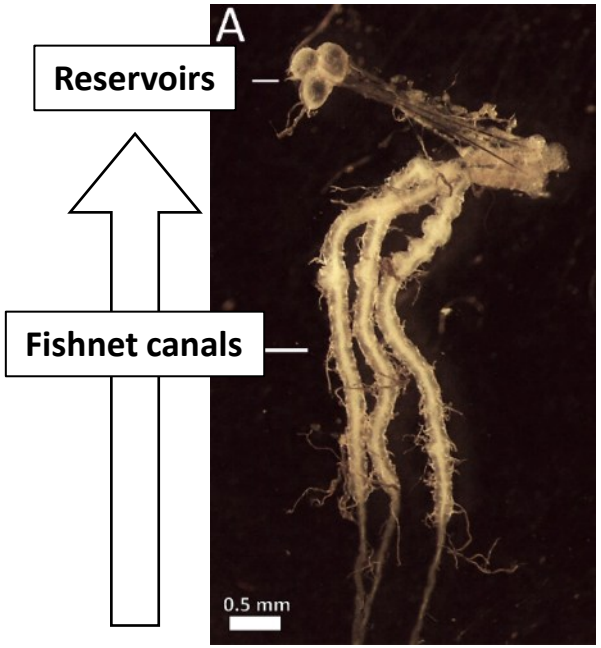


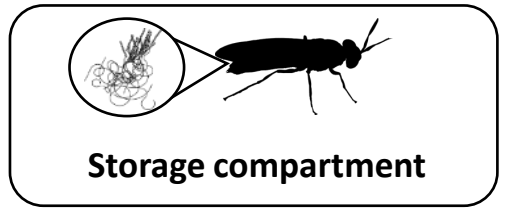


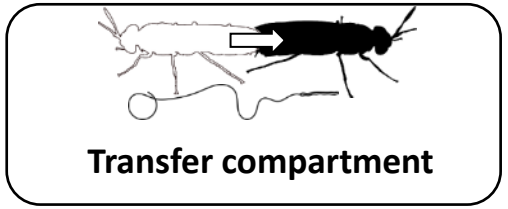


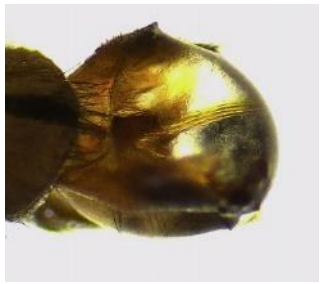


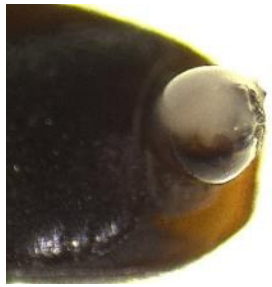
Sperm transfer

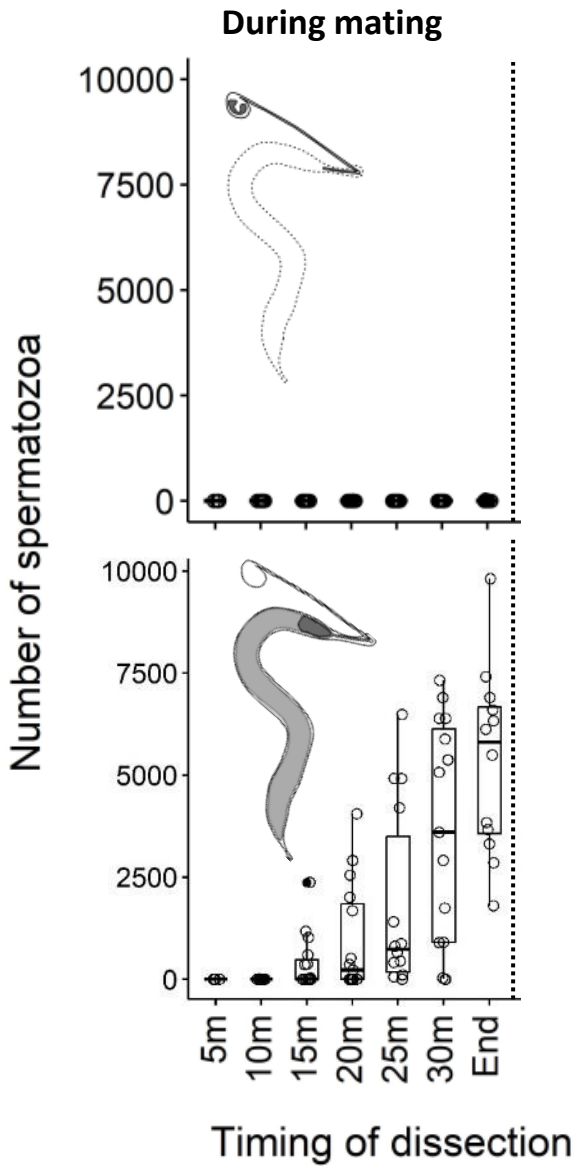


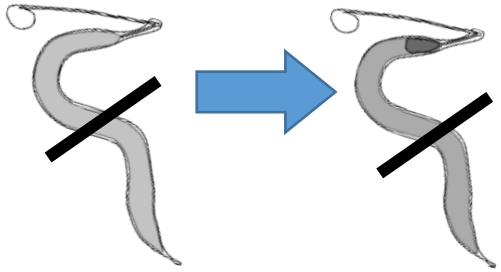








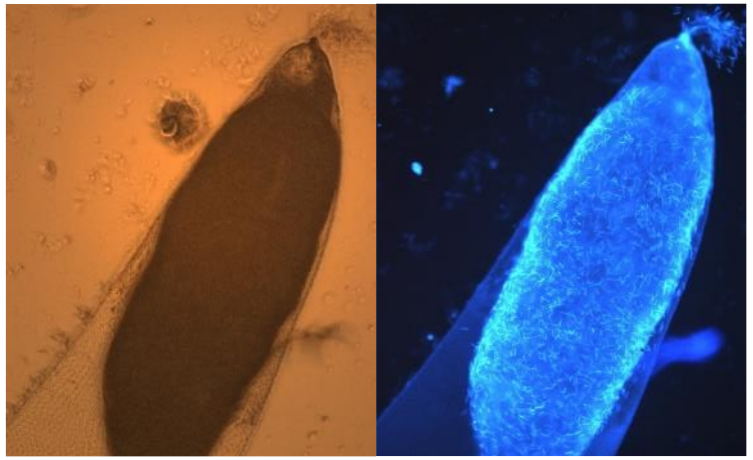




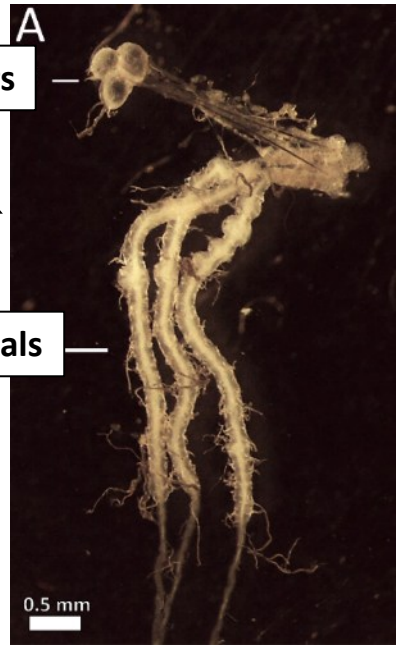
92 ± 11 % of the spermatozoa located in the second half of the fishnet canals

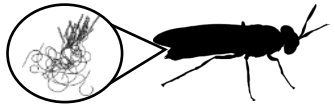
Most of the spermatozoa form a mass at the end of the fishnet canals

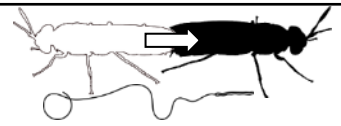
Sperm plug ?

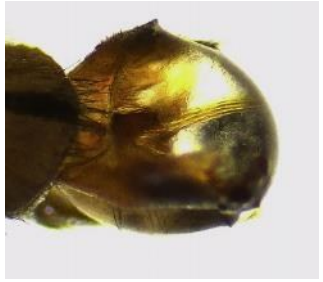


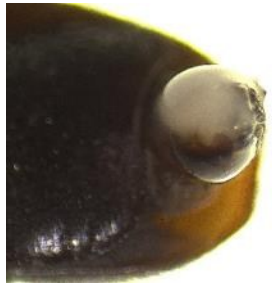
Sperm storage

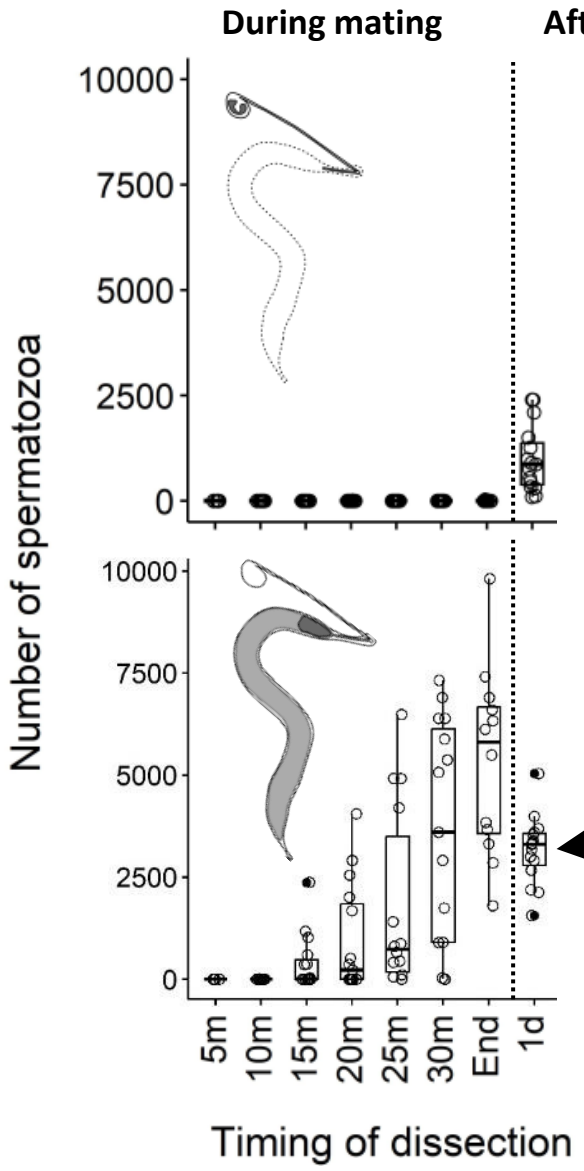




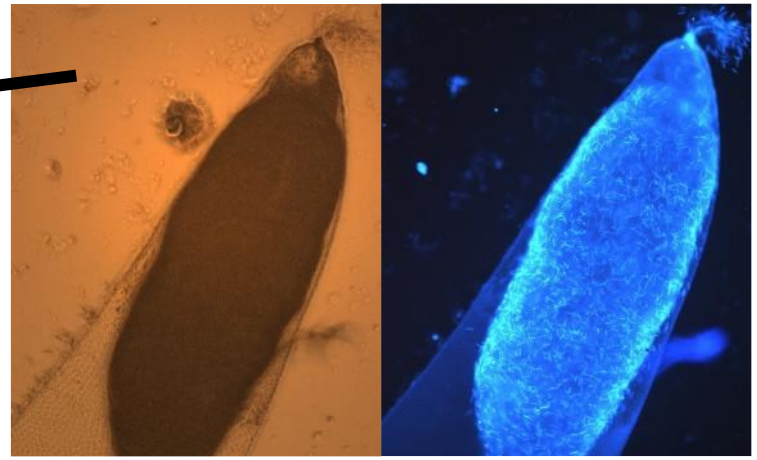




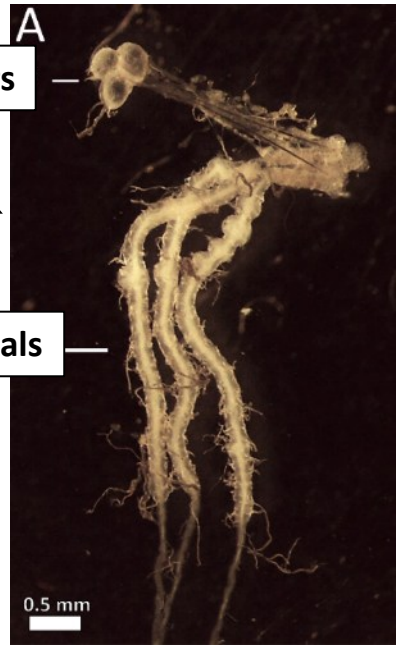


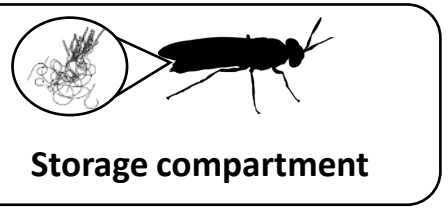


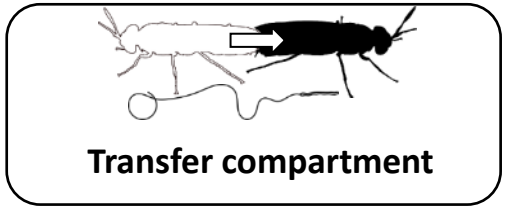
Sperm plug ?

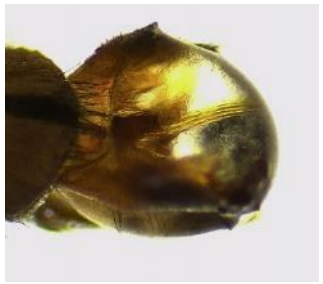


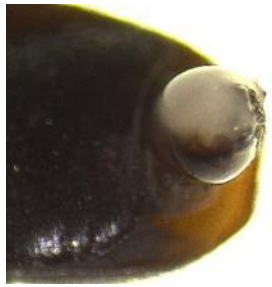
Sperm storage

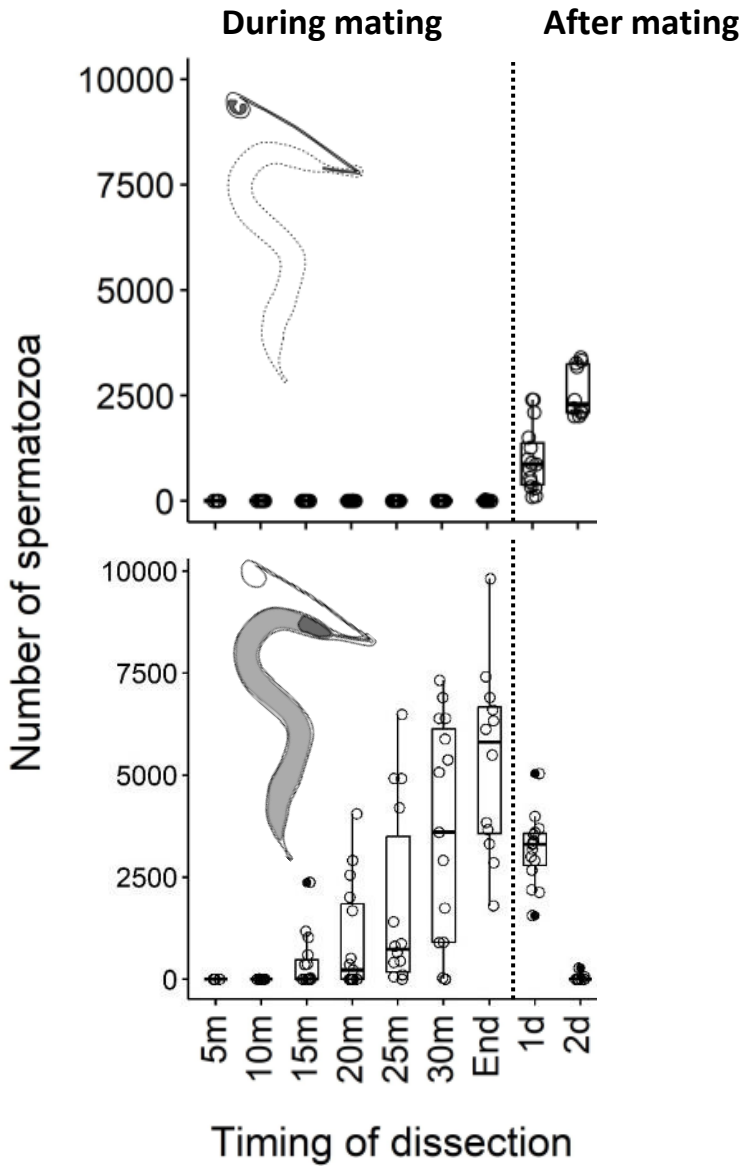




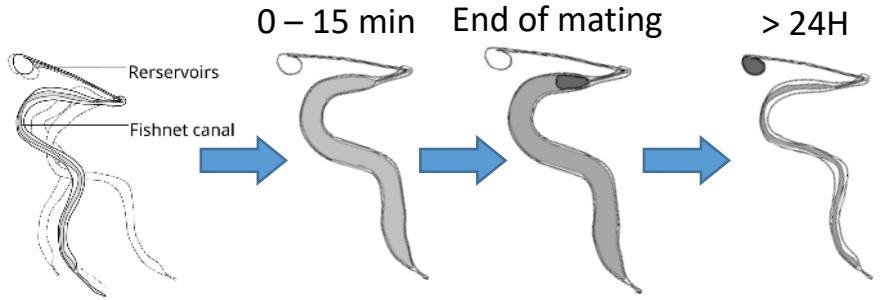


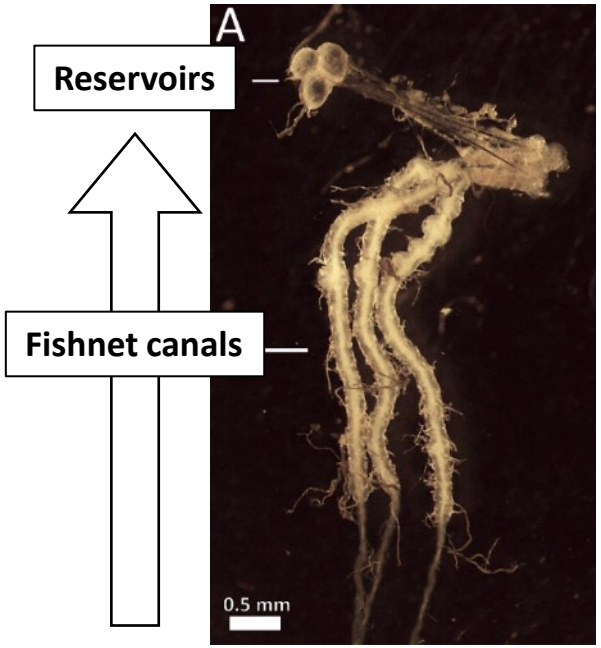


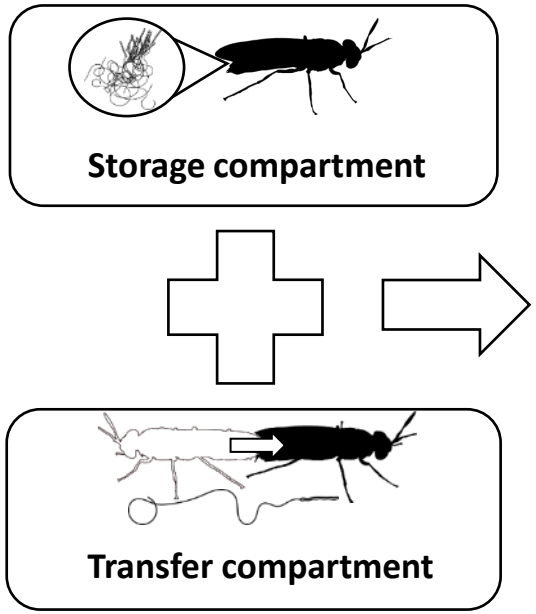


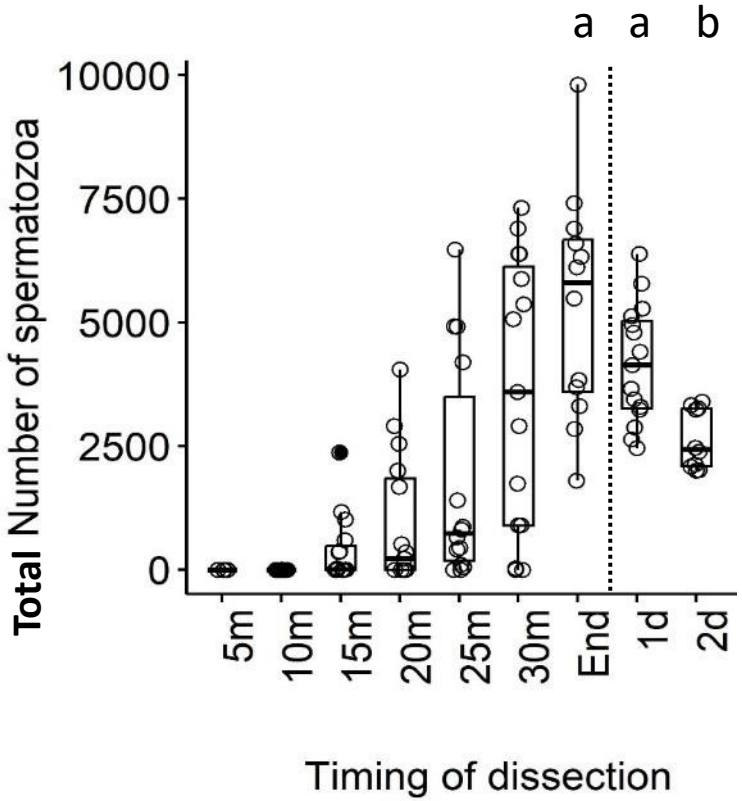


Sperm storage

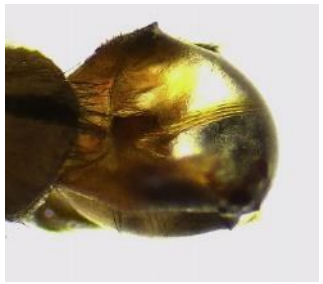


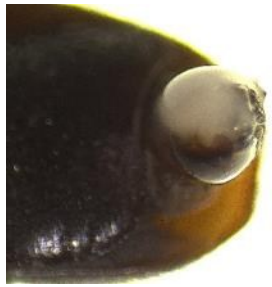




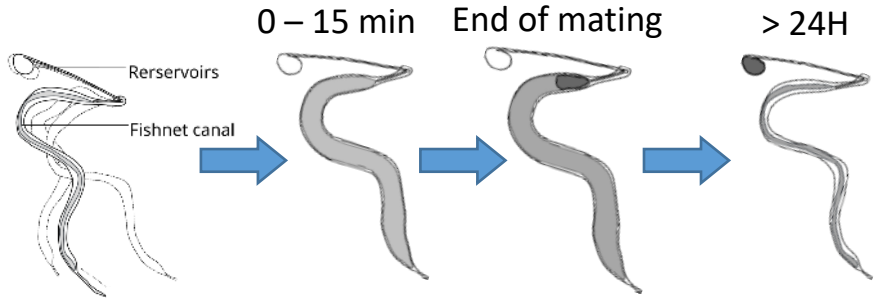


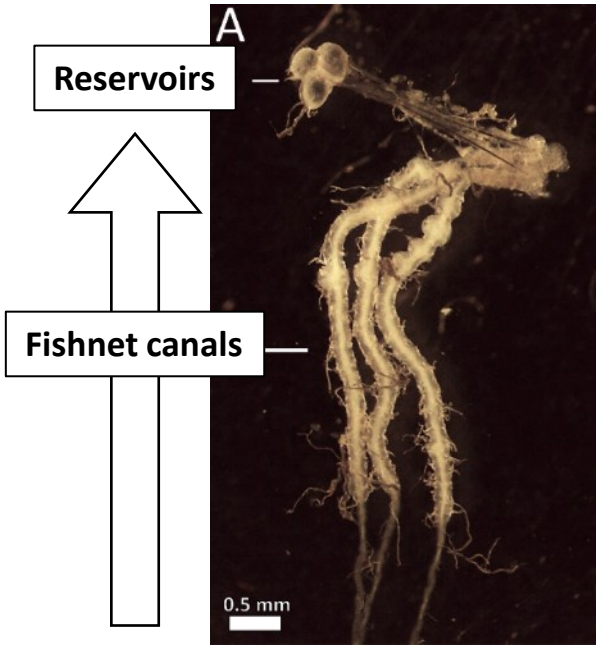
Pairwise wilcoxon tests with a false discovery rate correction P < 0,05

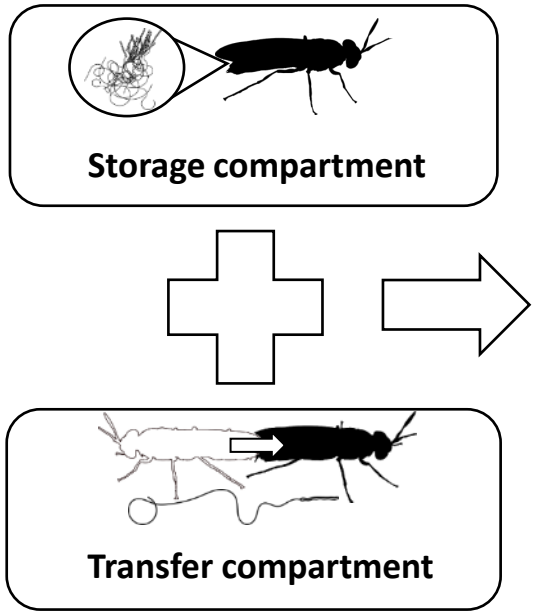


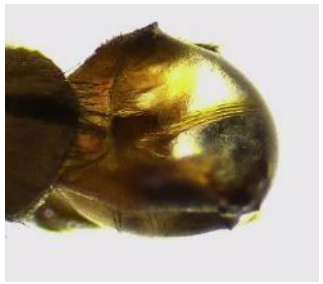


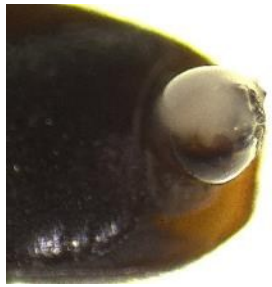
Sperm storage

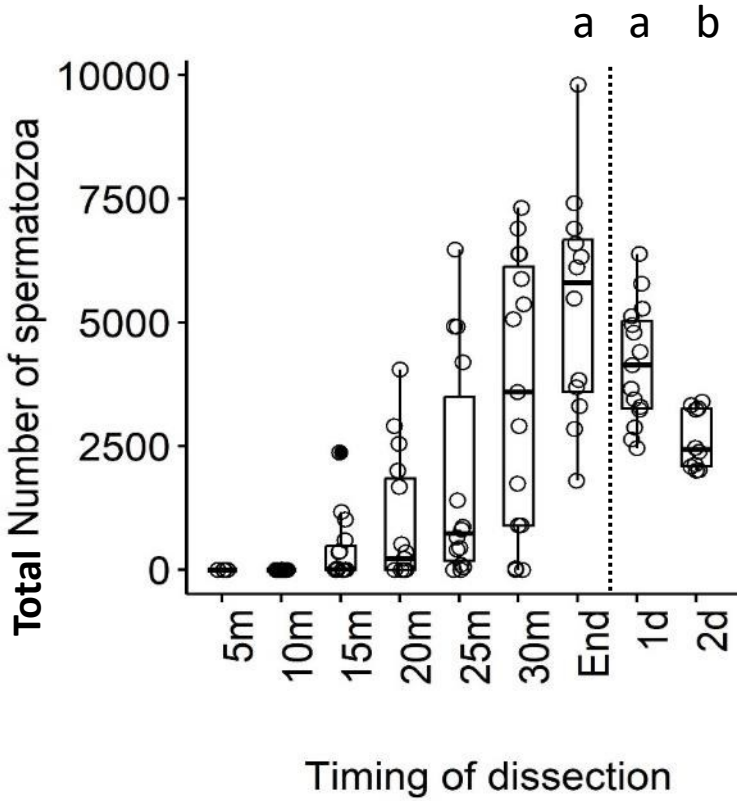












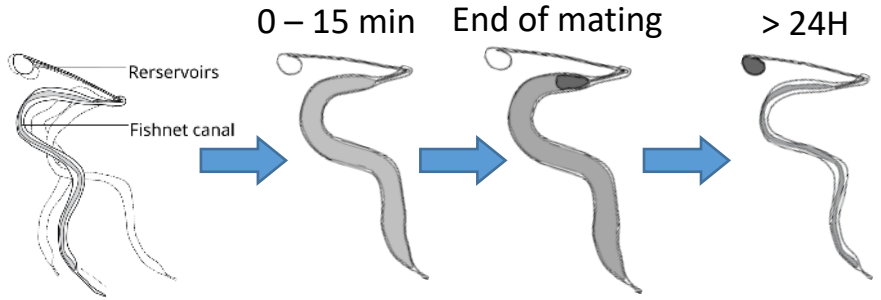
Pairwise wilcoxon tests with a false discovery rate correction $P < 0,05$

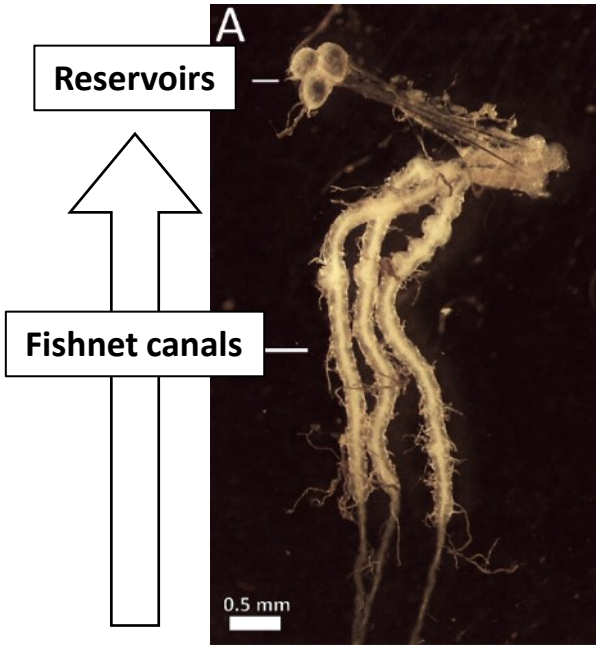
~ 5000 **transferred** spermatozoa
~ 2500 **stored** spermatozoa

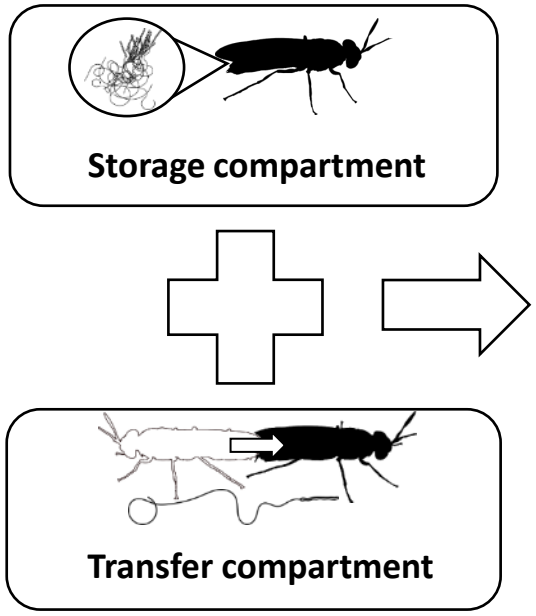
A loss of spermatozoa that are not stored in the reservoirs

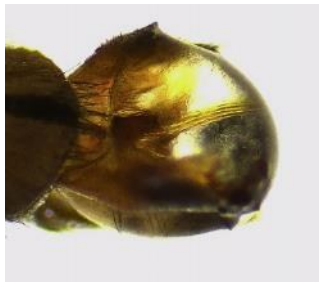
No sperm dumping

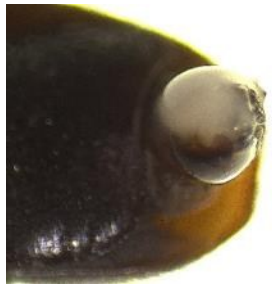
Sperm storage

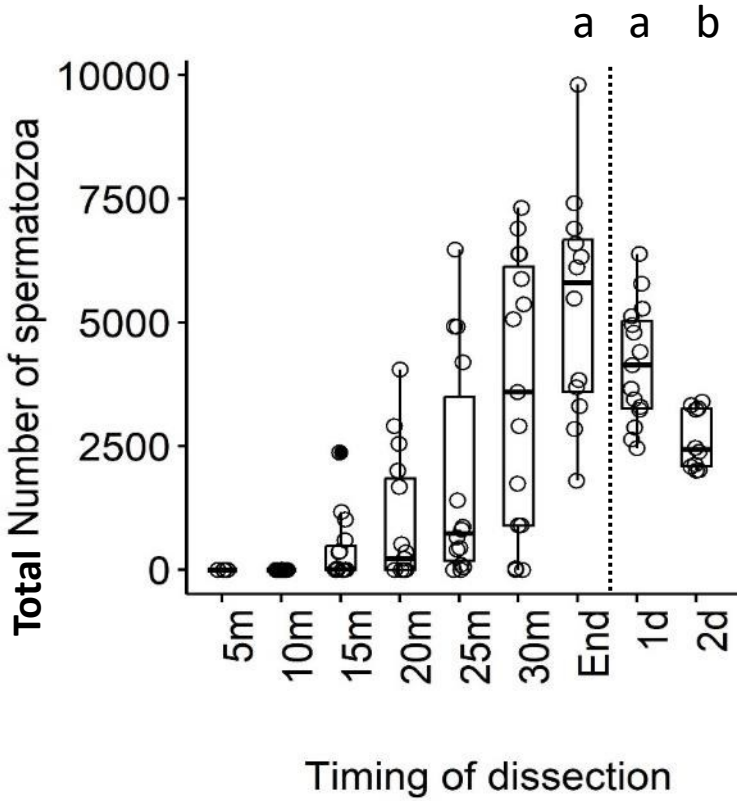












Pairwise wilcoxon tests with a false discovery rate correction $P < 0,05$

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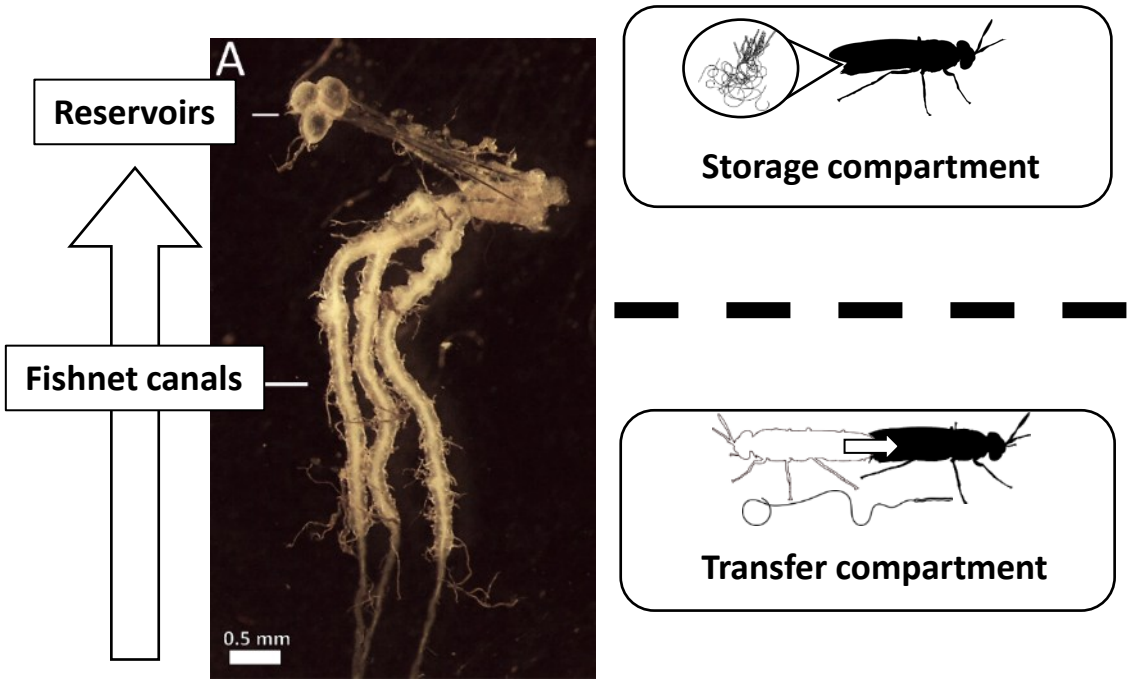
~ 2500 **stored** spermatozoa

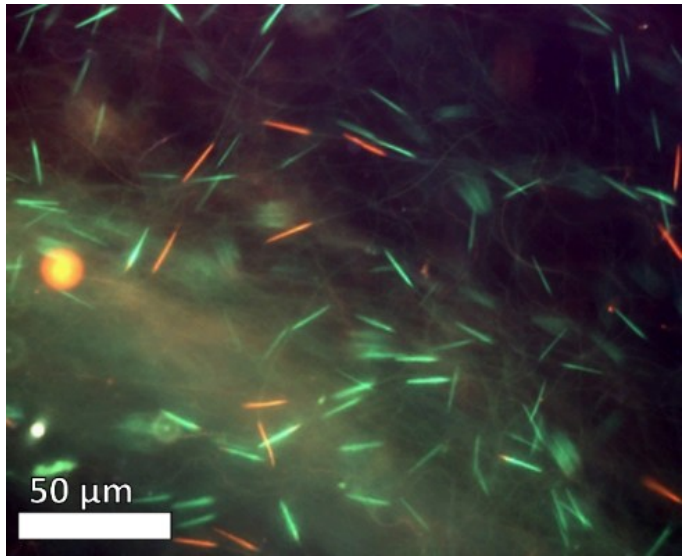
A loss of spermatozoa that are not stored in the réservoirs

No sperm dumping

Harjoko et al., 2023
Mated females live longer than virgin

Sperm digestion?

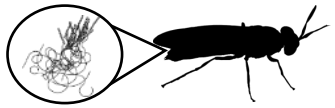




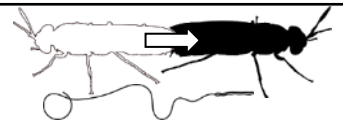
SYBR-14 and Propidium iodide

Green → viable « live » spermatozoa
Red → unviable « dead » spermatozoa

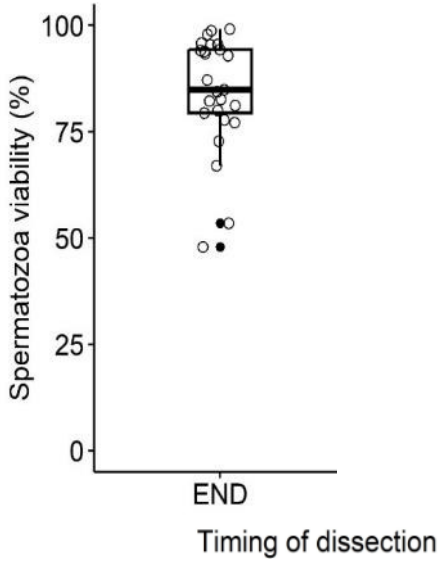
Sperm digestion?

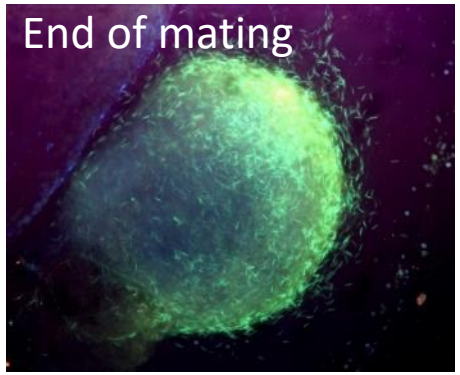


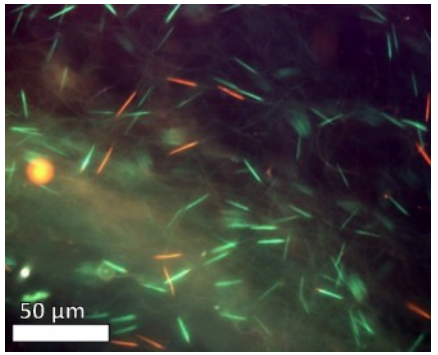
Storage compartment



Transfer compartment

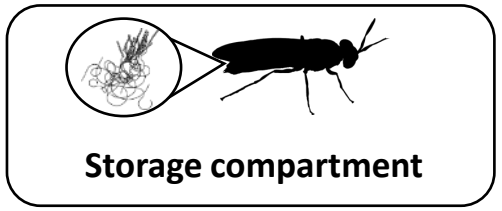


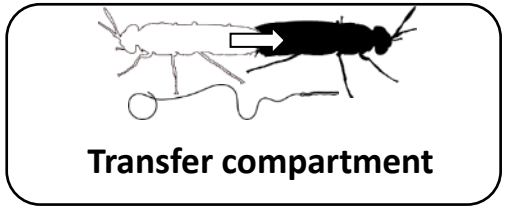


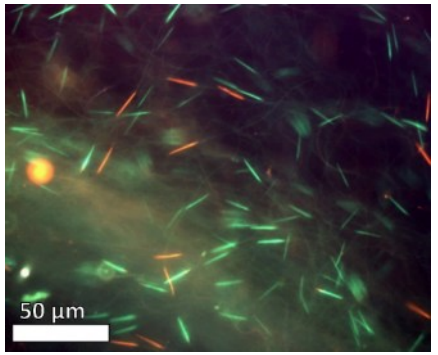


SYBR-14 and Propidium iodide

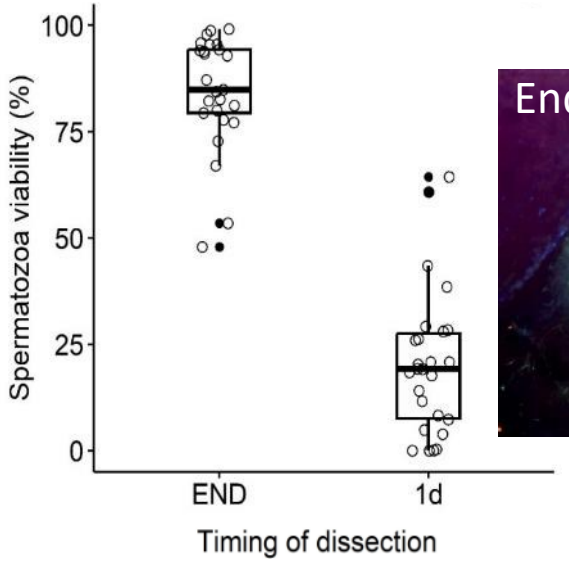
Sperm digestion?

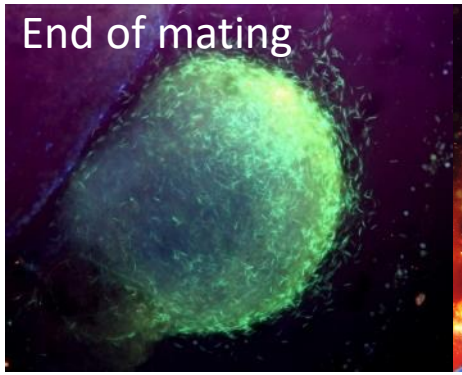


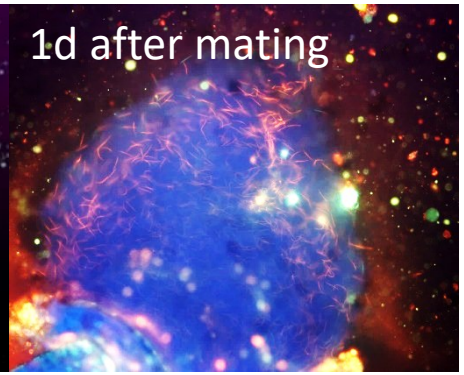




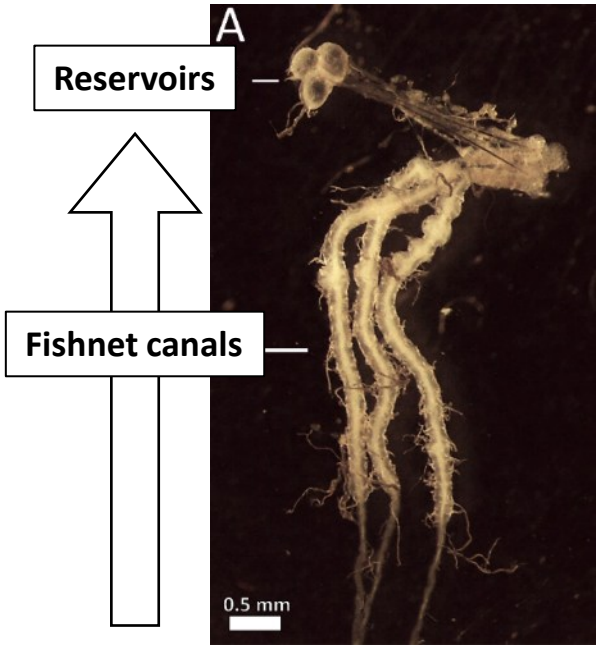
SYBR-14 and Propidium iodide

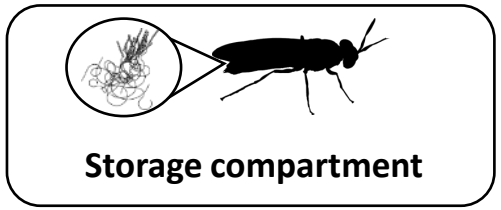


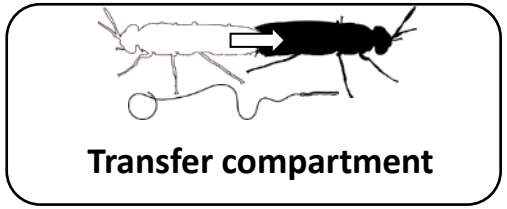


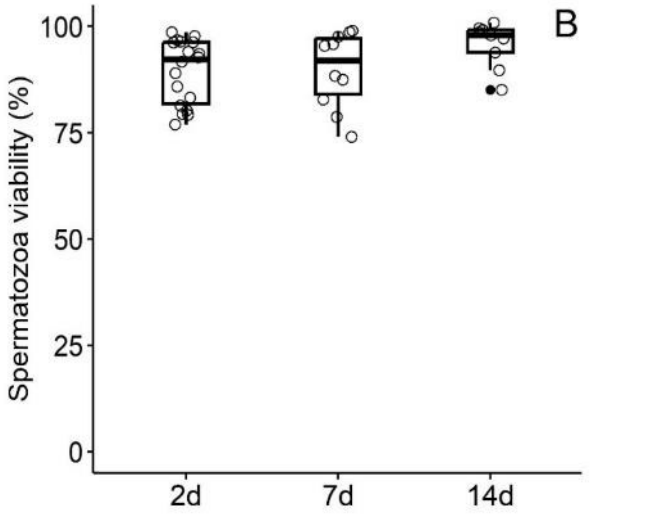


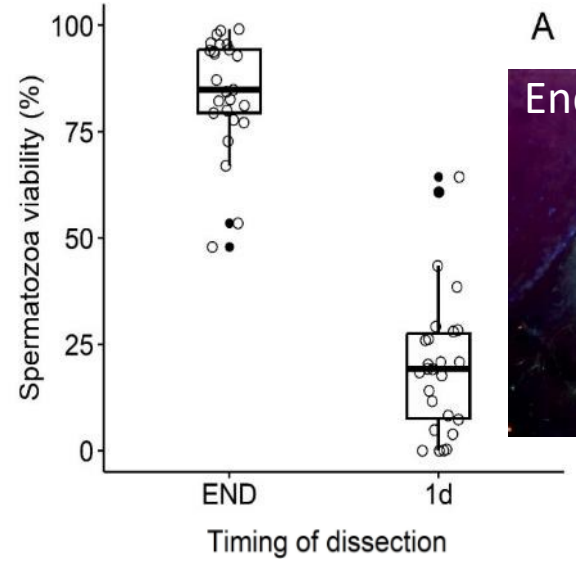
Sperm digestion?

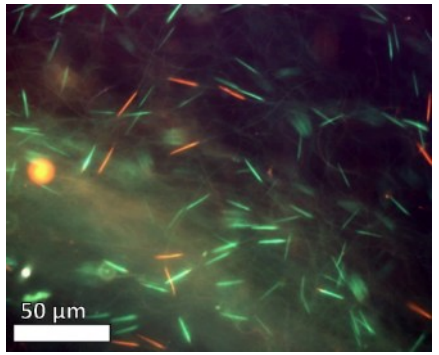




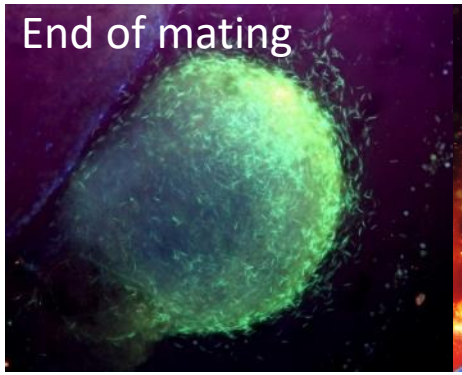


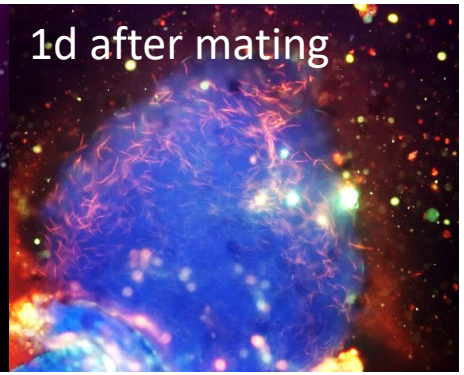






SYBR-14 and Propidium iodide



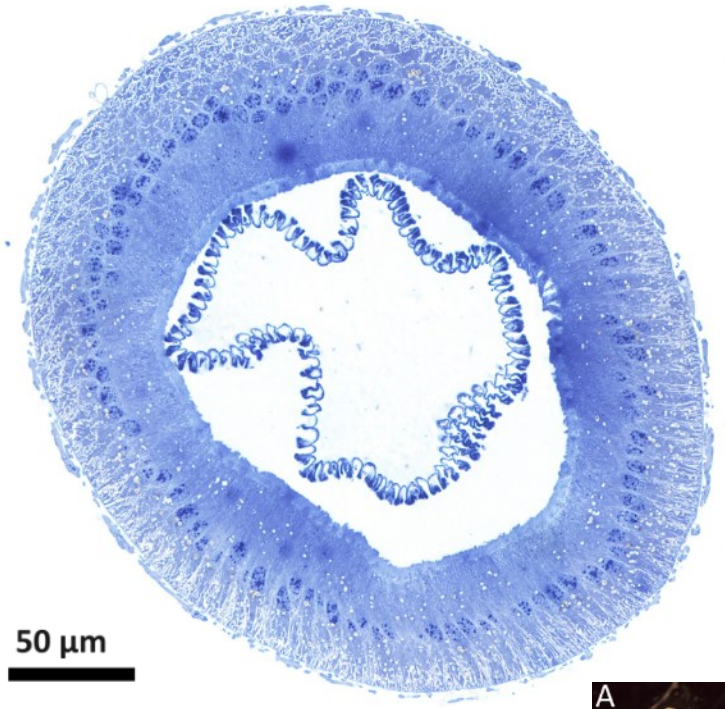


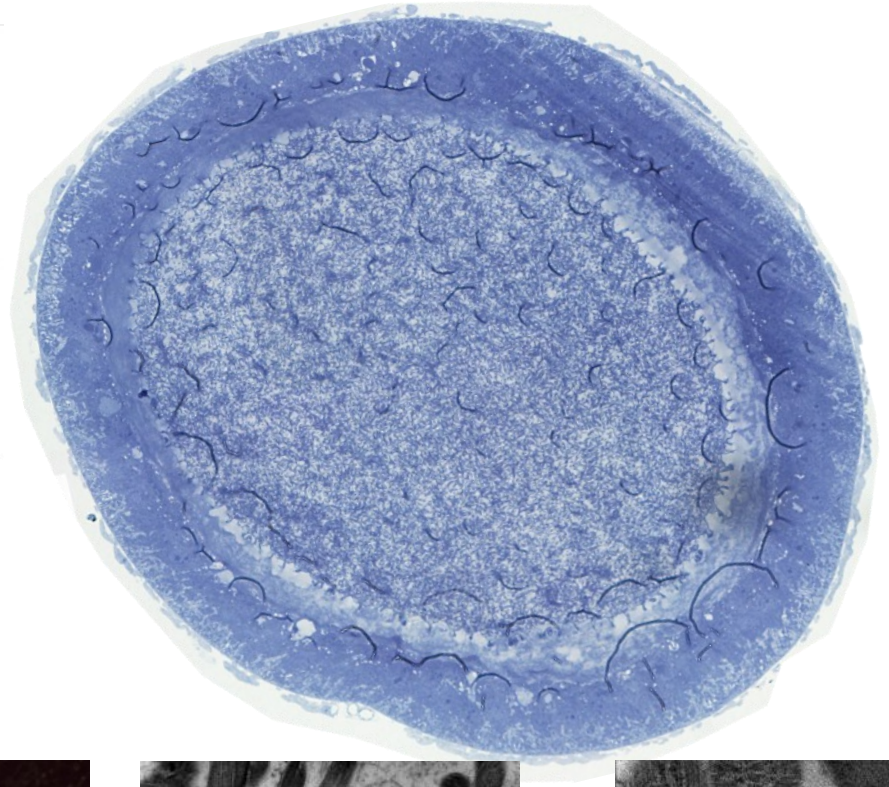
Sperm digestion?

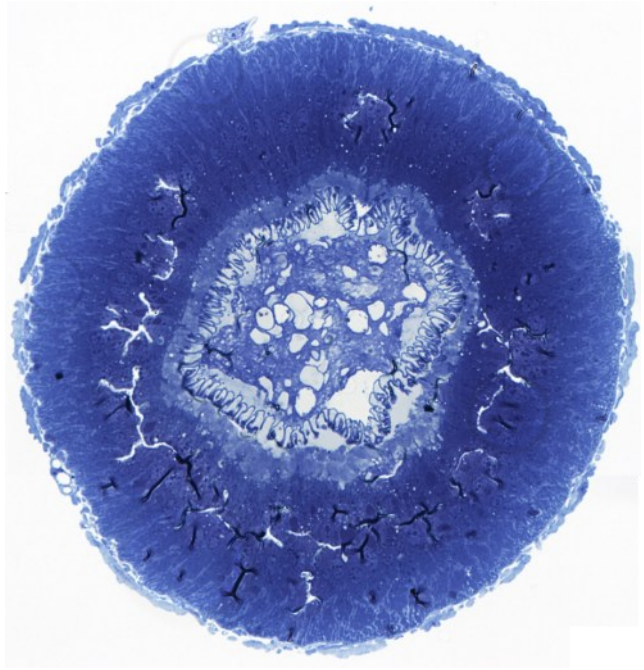
Before mating

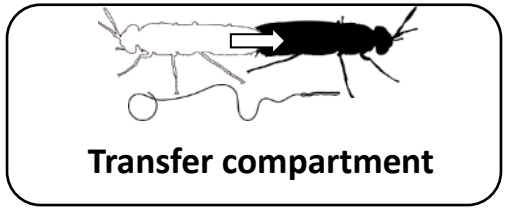
Just after mating

2 days after mating

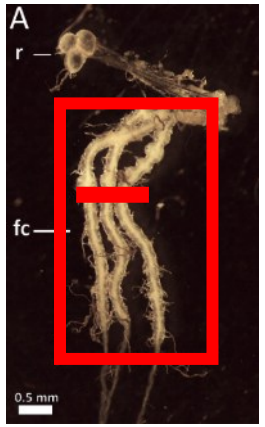


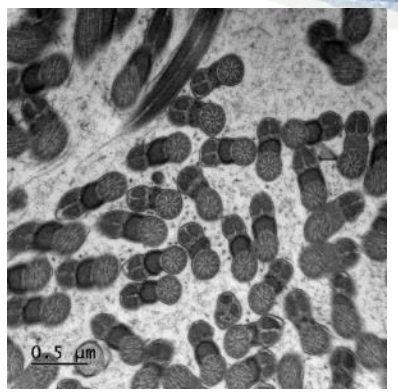


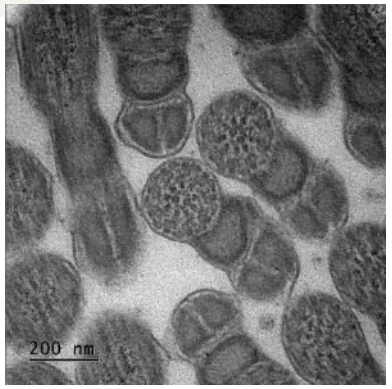




Transfer compartment

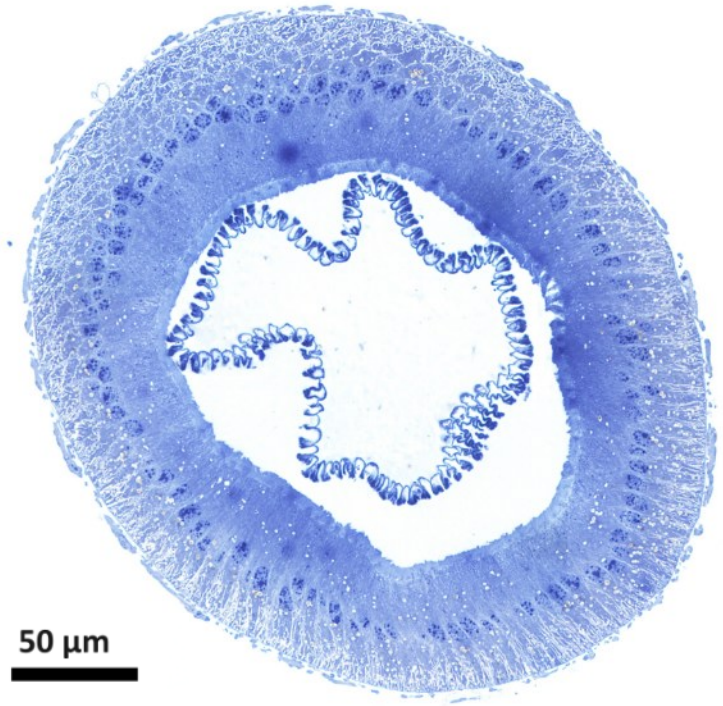


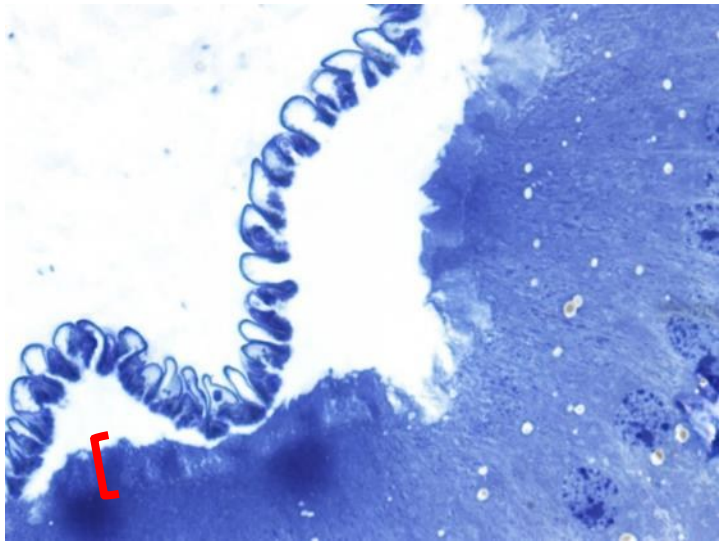


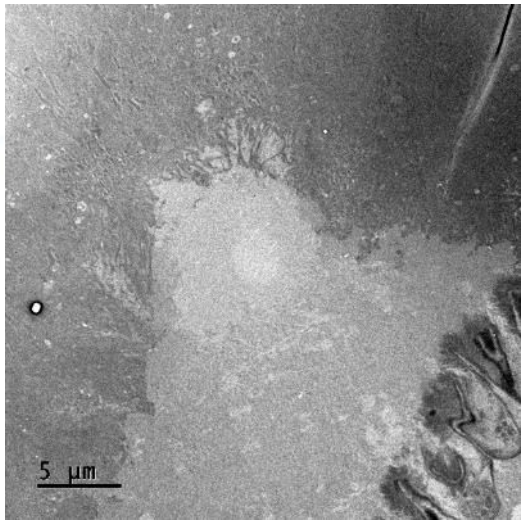


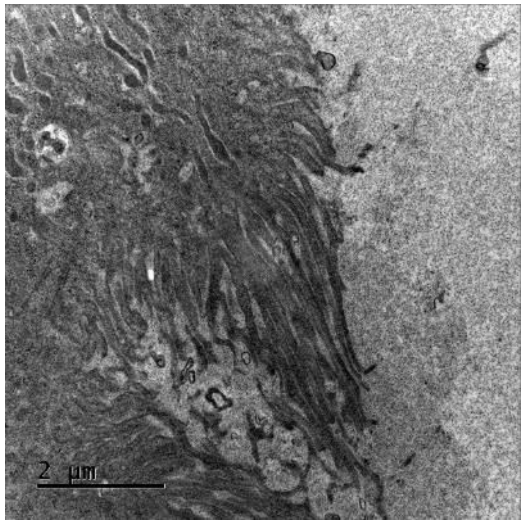
Sperm digestion?

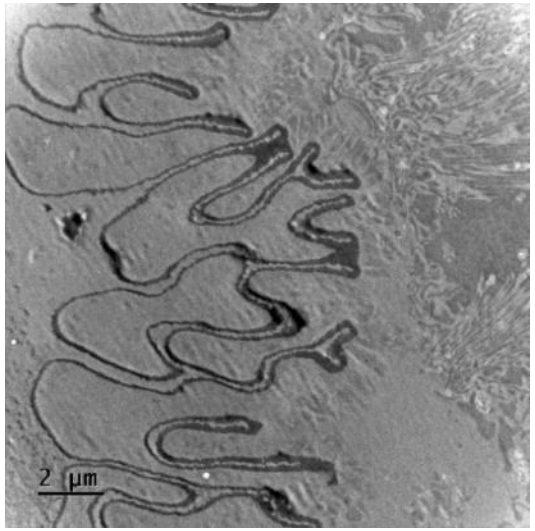
Loss of spermatozoa/seminal fluid, damaged spermatozoa in the transfer compartment + **ultrastructure**









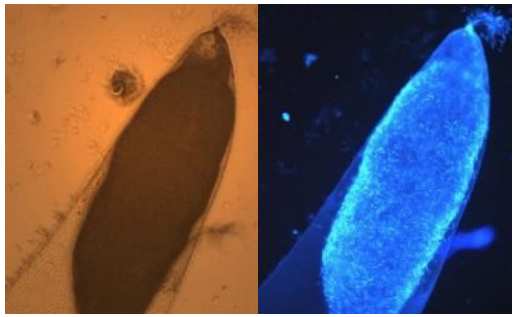


Apical layer full of Microvilli

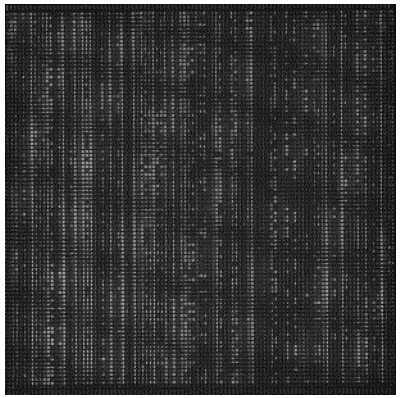
⇩

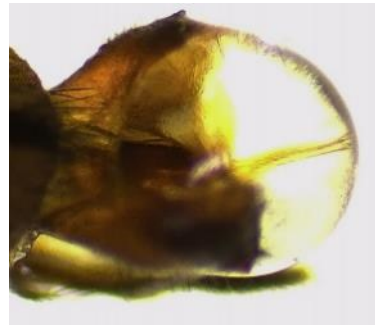
Absorptive/secretory functions

Implications for post-mating sexual selection



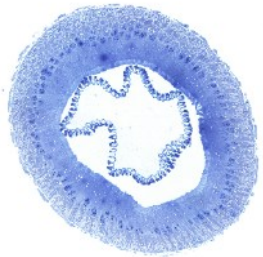
Sperm plug?
→ *sperm precedence?*
Paternity tests





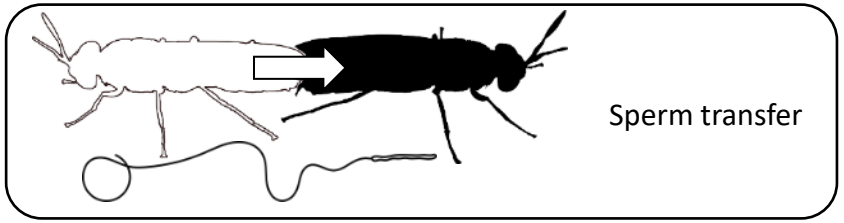
Seminal fluid transfer
→ *Post-mating responses*
Proteomics
and injections

- Induction of egg-laying
- **Decrease of sexual receptivity (Drosophila)**



Sperm digestion?
→ *A nuptial gift?*
→ *sexual conflicts?*

Enzymatic assays



ROYAL SOCIETY OPEN SCIENCE

Gone but not forgotten: dynamics of sperm storage and potential ejaculate digestion in the black soldier fly *Hermetia illucens*

Frédéric Manas, Harmony Piterois, Carole Labrousse, Laureen Beaugeard, Rustem Uzbekov and Christophe Bressac

Published: 30 October 2024 https://doi.org/10.1098/rsos.241205

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Paul Munsch-Masset, Carole Labrousse, Laureen Beaugeard, Christophe Bressac

First published: 07 August 2023 | https://doi.org/10.1111/eea.13358 | Citations: 2

Frédéric Manas

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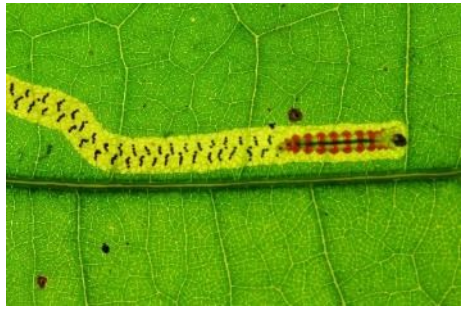


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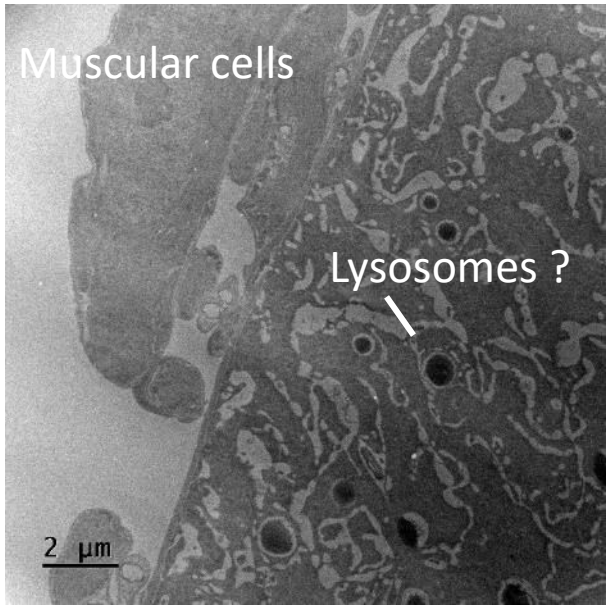
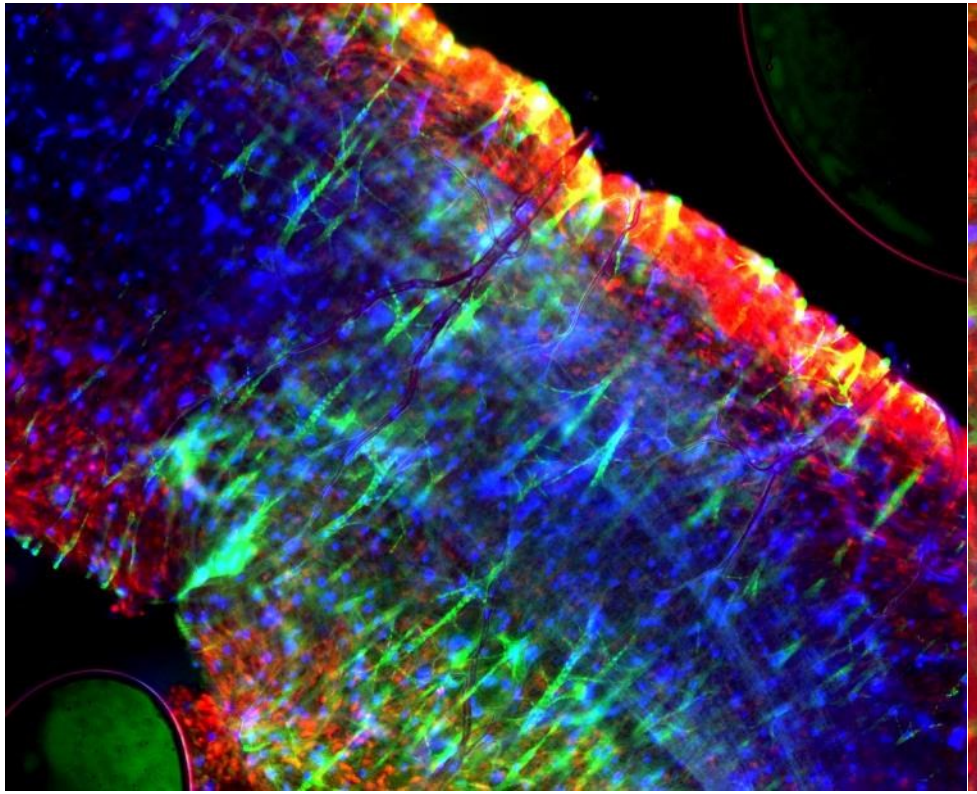
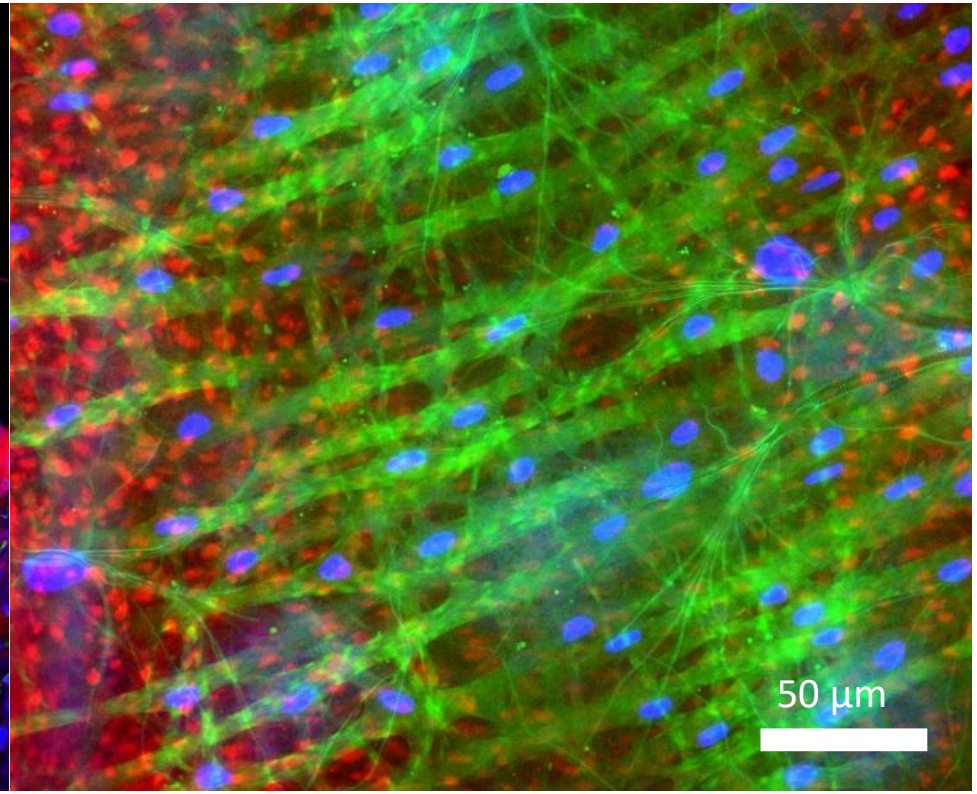
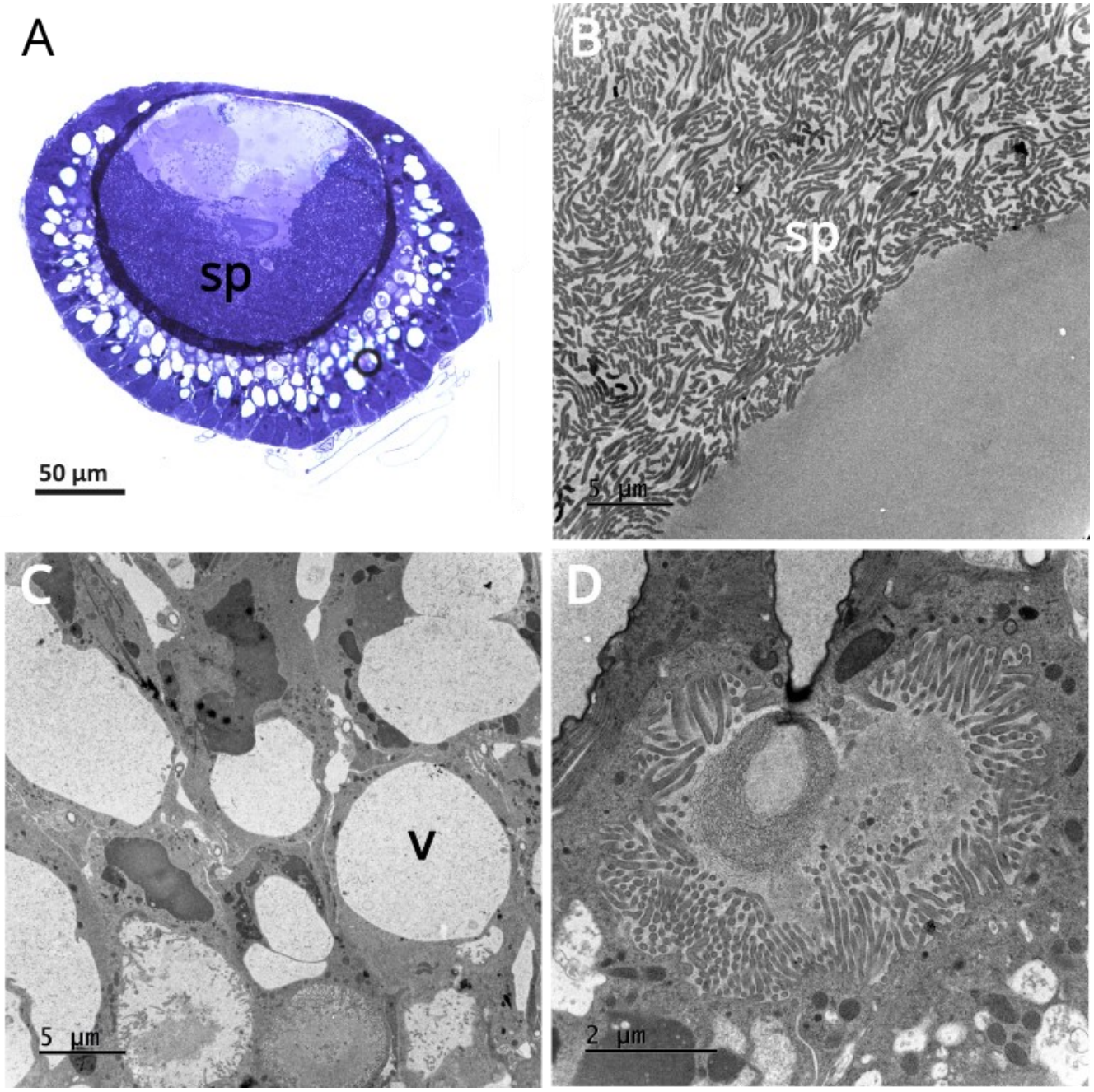
Sperm digestion?

The epithelium

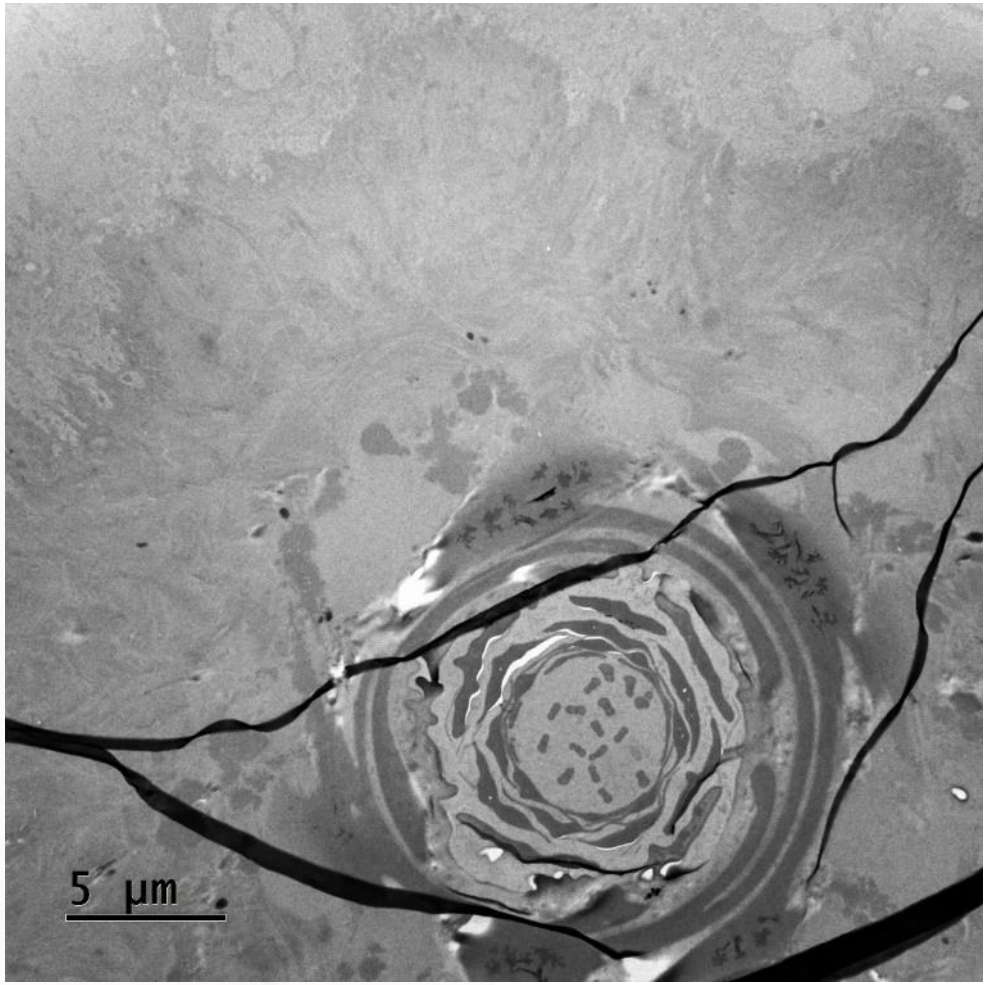


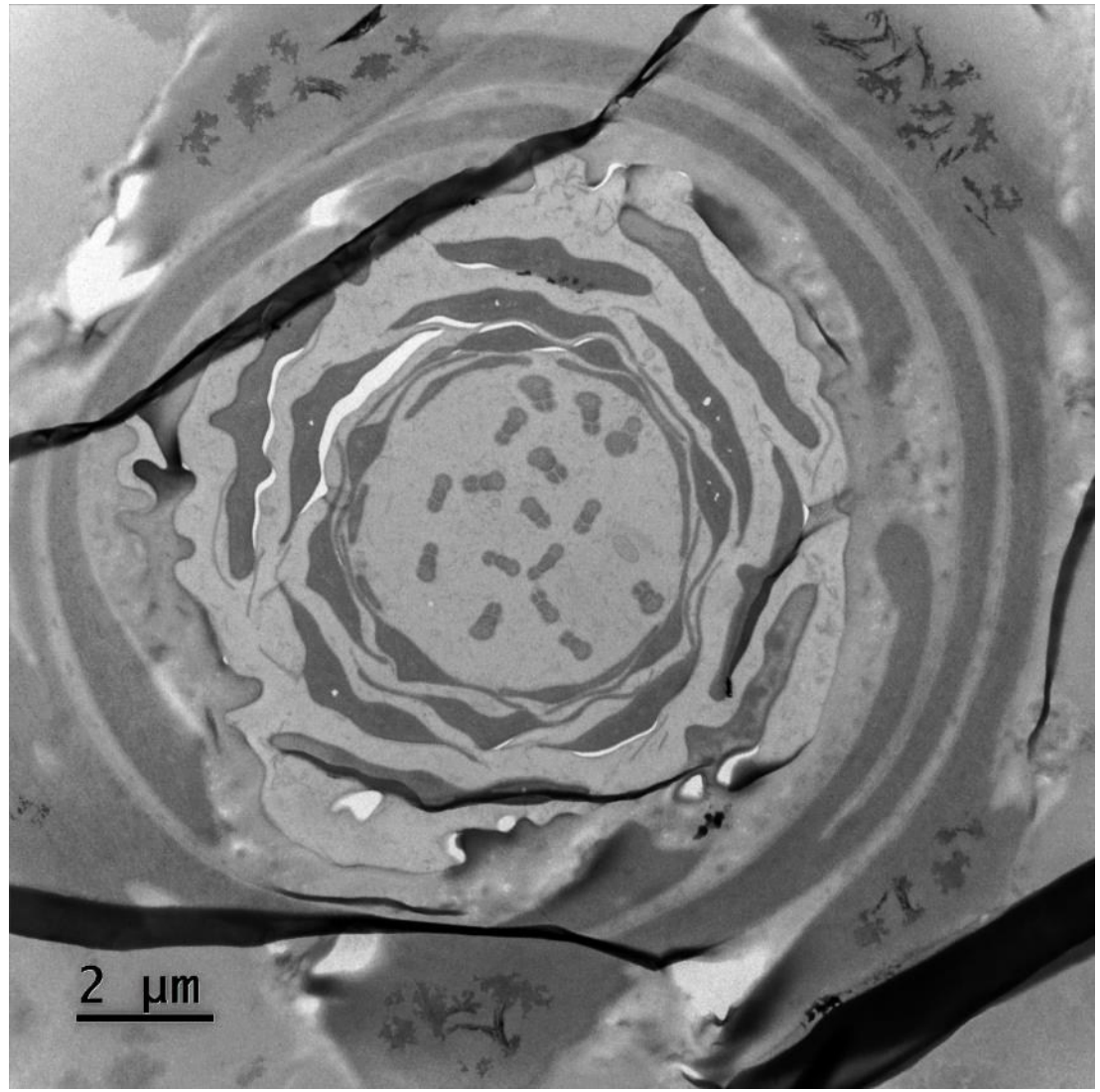


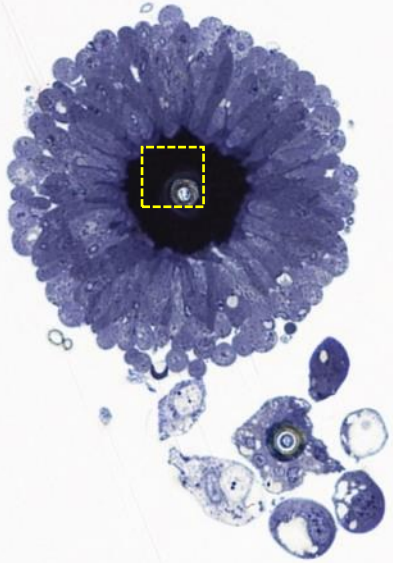


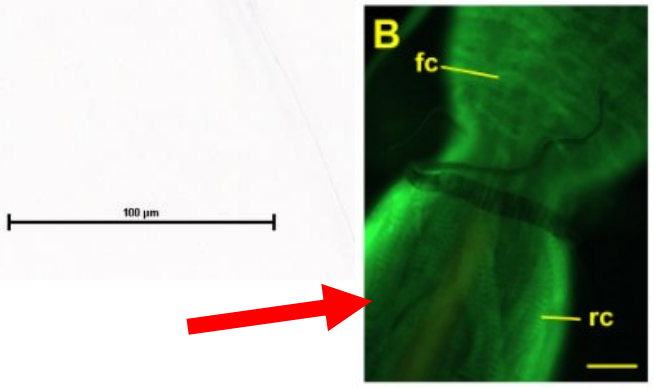

A
sp
50 µm
B
sp
5 µm
C
v
5 µm
D
2 µm


200 µm


5 µm

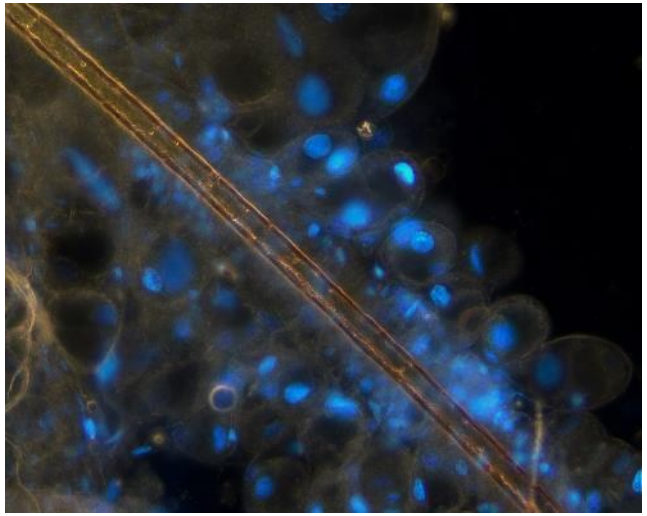

2 µm

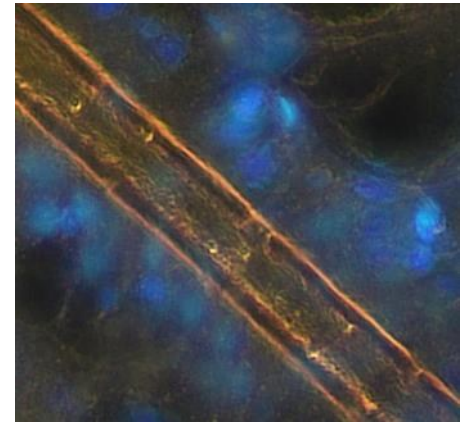


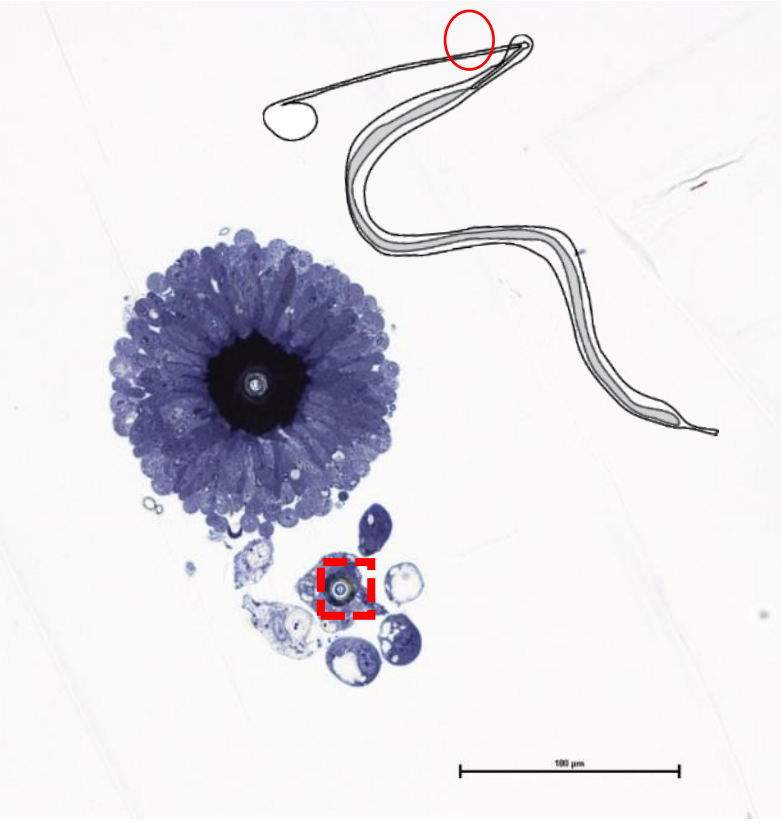

100 µm

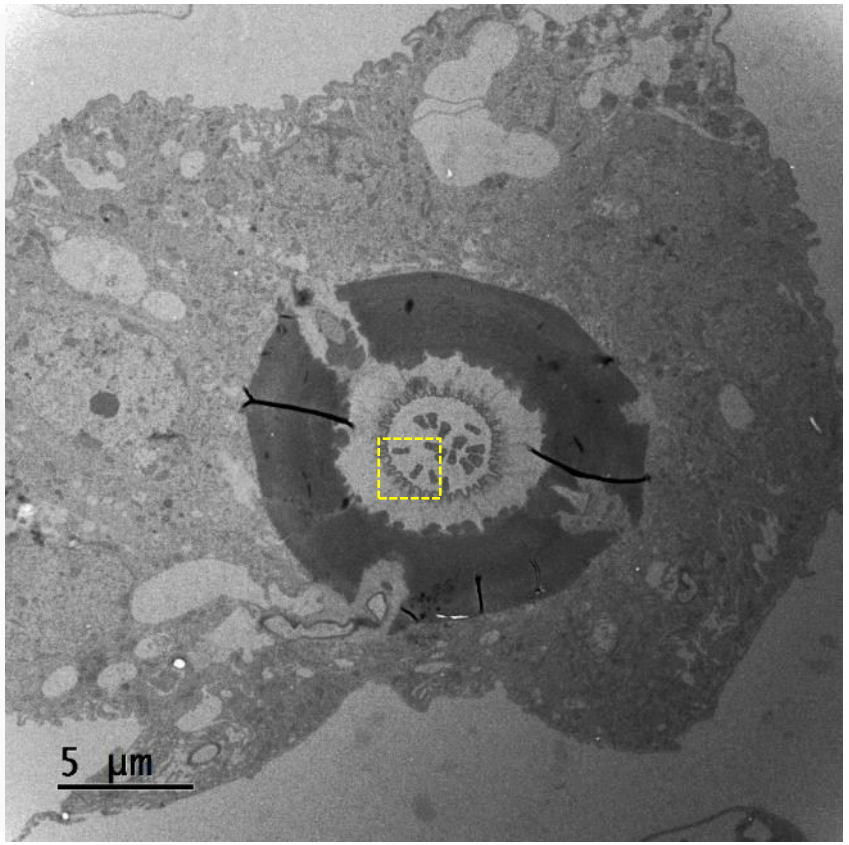
B
fc
rc

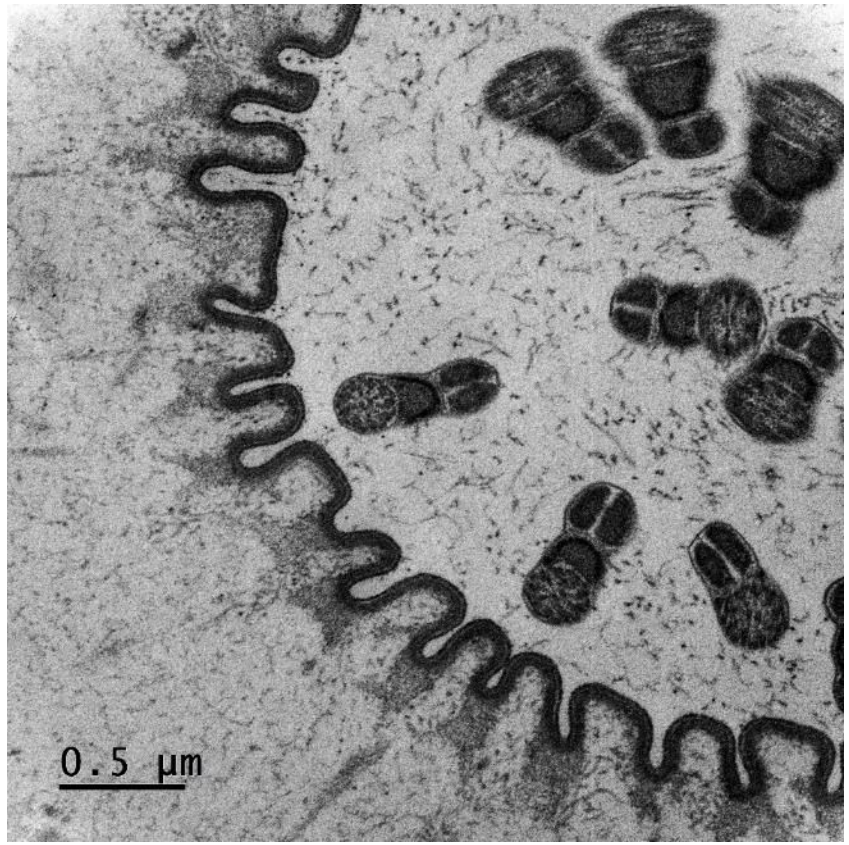

200 µm



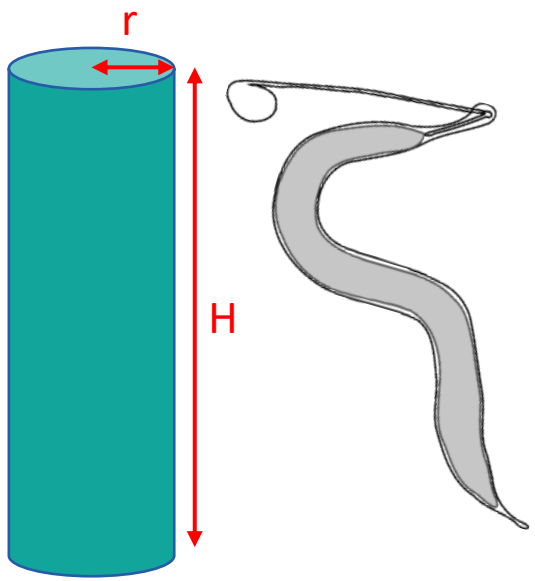




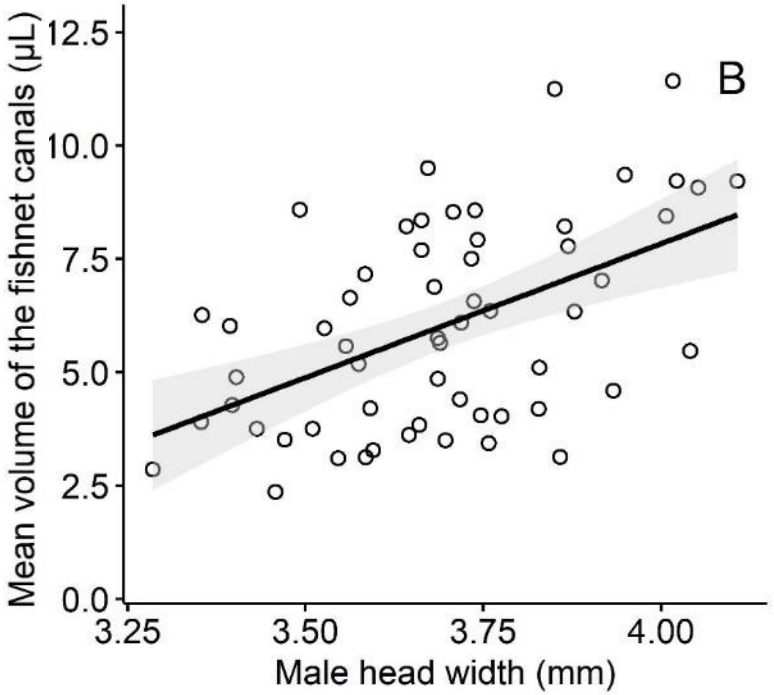

5 µm

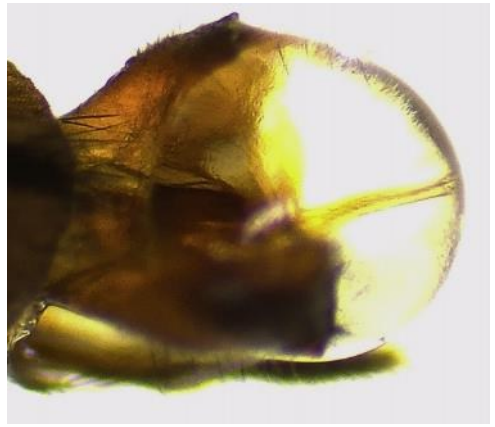

0.5 µm

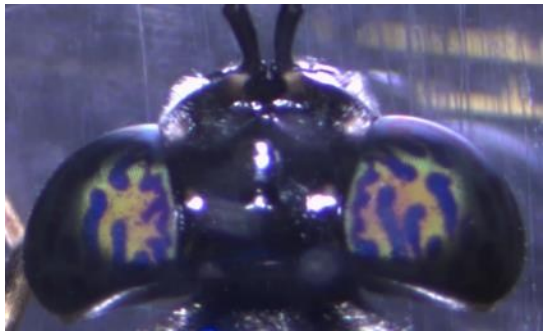
First step : seminal fluid transfer



$V = \pi \times r^2 \times H$







Multiple regression: N = 47, F = 26.70, P < 0.001

Fluid transfer is condition-dependant ?