Experimental *Sodalis* infection eliminates ancient insect symbiont

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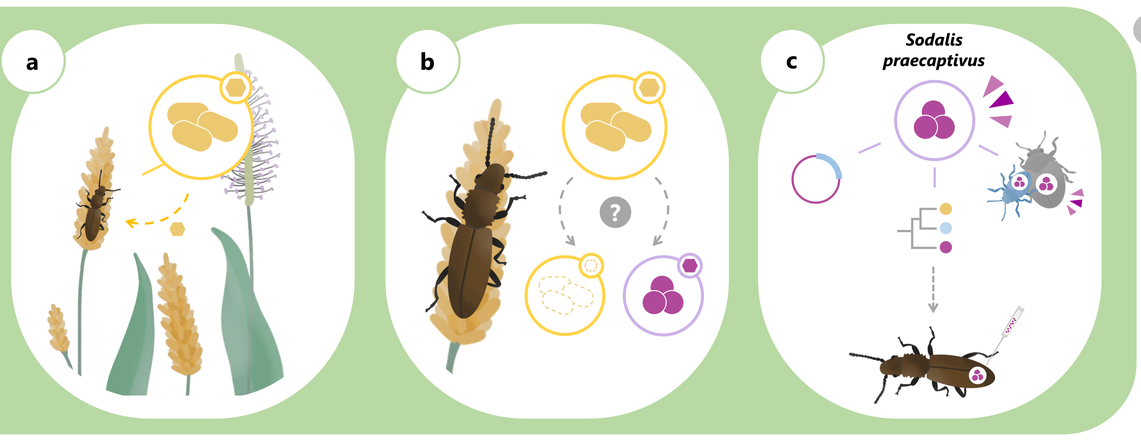


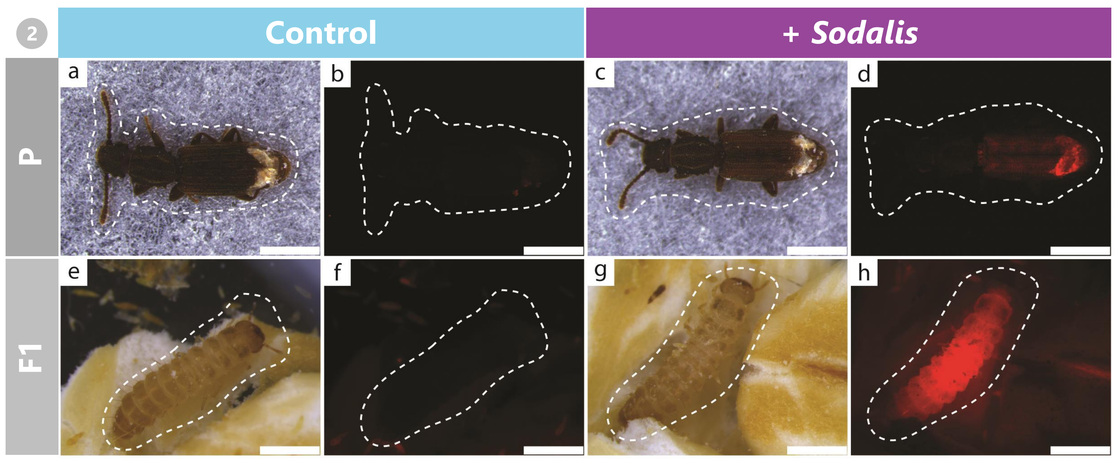
BACKGROUND

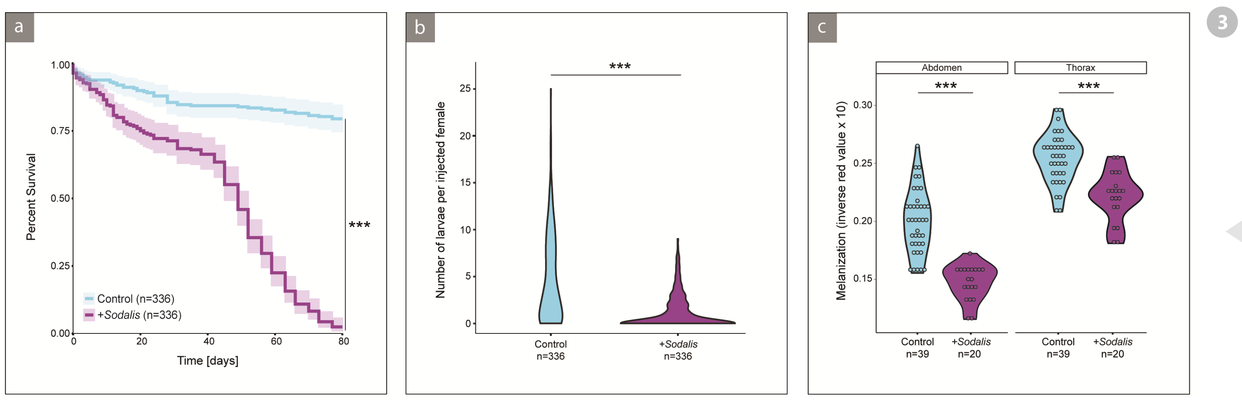
- **Intracellular symbionts** contribute to the ecological success of many insects[1] (1a)
- Those symbionts can be lost or replaced by other microbes. The **intractability** of ancient symbionts makes it hard to study these **loss and replacement events**[2] (1b) although they have important **impact on host ecology and evolution**
- Creating a **tractable symbiosis** would allow to address these questions[3,4] (1c)
- ***Sodalis praecaptivus*** as a tractable symbiont, closely related to insect symbionts, that can infect insect hosts[5] (1c) and potentially **replace ancient symbionts**

CAN SYMBIONT LOSSES AND REPLACEMENTS BE EXPERIMENTALLY RECAPITULATED IN REAL TIME?

SODALIS ESTABLISHES IN THE NEW HOST

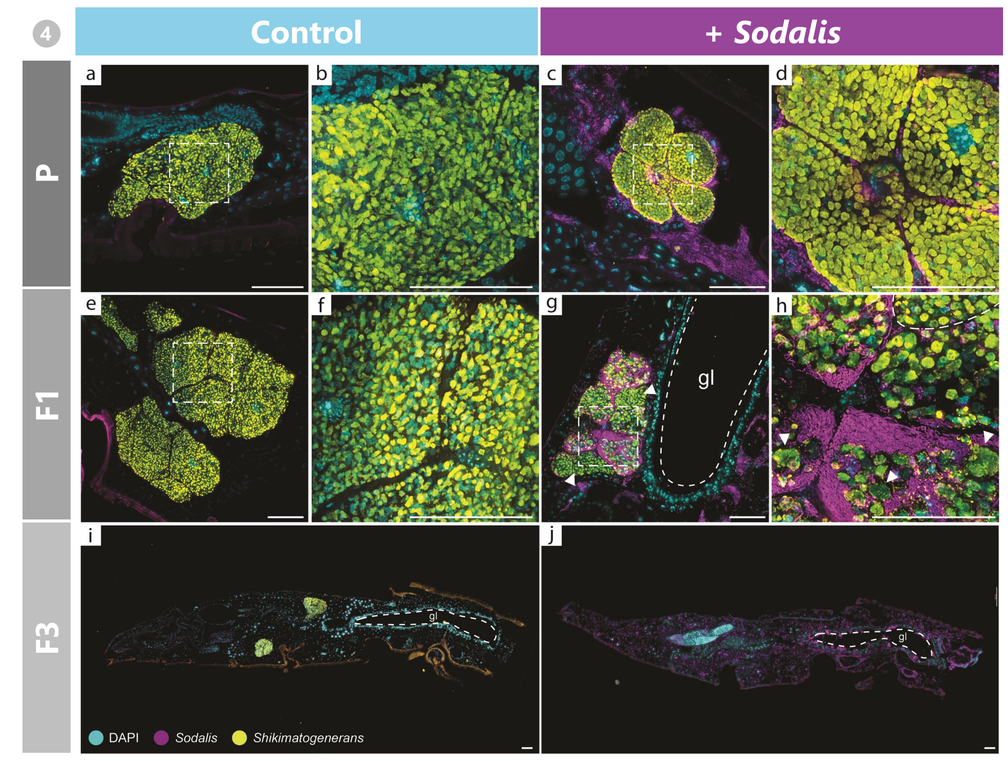
- **Live imaging** of beetles: *Oryzaephilus surinamensis* beetles harboring *S. praecaptivus* glow due to mCherry (2)
- *S. praecaptivus* establishes **systemic infections** in the parental generation, 7 days after injection (2a - 2d)
- Female beetles **vertically transmit** *S. praecaptivus* to their offspring (2e - 2h)





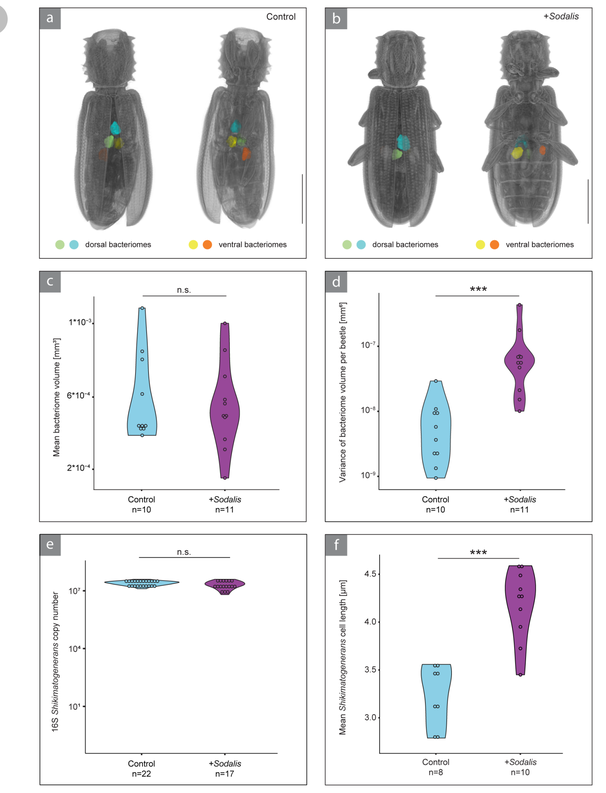
SODALIS IS COSTLY FOR THE HOST

- Observation of beetle survival over 80 days: *S. praecaptivus* **negatively affects** host **survival** (3a) and leads to a **decrease in offspring production** (3b)
- Also affects first offspring generation: Infection with *S. praecaptivus* leads to a **reduction in cuticle melanization** (3c)



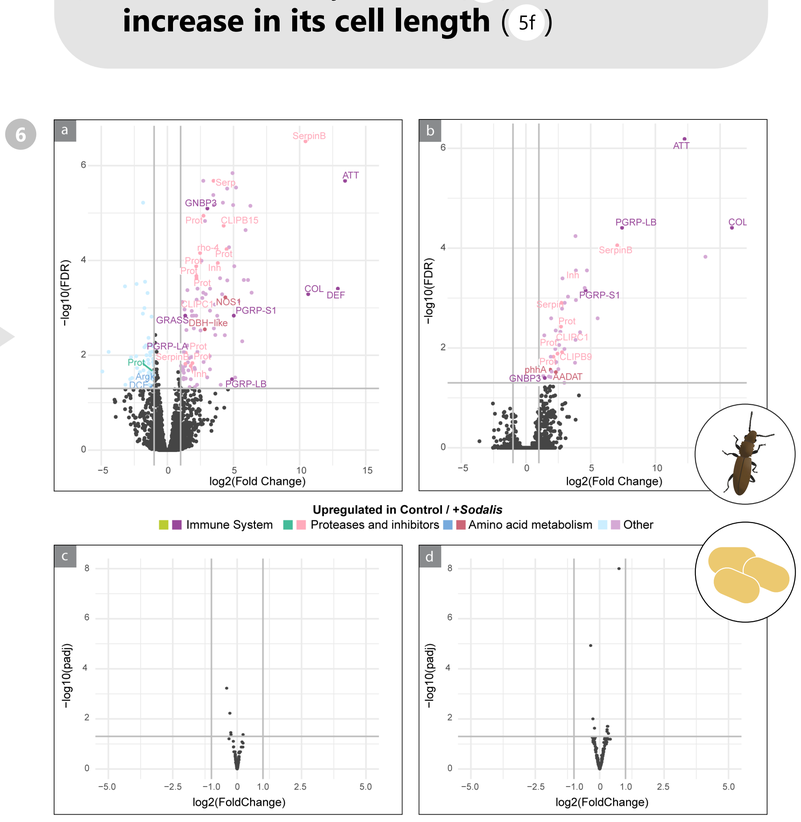
SODALIS ELIMINATES NATIVE SYMBIONT

- *S. praecaptivus* present across beetle hemolymph and **in bacteriomes** (4)
- **Abundance increases in F1** bacteriomes and affects morphology of native symbiont (4g - 4h)
- **F3** beetles harboring *S. praecaptivus* **lack bacteriomes** (4i - 4j)



SODALIS AFFECTS HOST BUT NOT SYMBIONT GENE EXPRESSION

- Significant **upregulation of host immune system genes** in **bacteriomes** of beetles infected with *S. praecaptivus* (6a - 6b) e.g. **antimicrobial peptides** and **serine protease inhibitors**
- *S. praecaptivus* likely resists host's efforts to clear infection
- Host issues **tyrosine starvation response** upon *S. praecaptivus* infection via upregulation of **tyrosine hydroxylase** (6a - 6b, nutrient depletion by *S. praecaptivus*)
- Native symbiont **incapable of mounting transcriptional response** to invading *S. praecaptivus* (6c - 6d)



CONCLUSION

- **Novel symbionts** can **drive** (rapid) **losses** of **host-beneficial symbionts**
- Crucial **step towards** functional **symbiont replacement**
- Tractable system to **study evolution and maintenance** of host-beneficial symbioses **in real time**

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