NUTRITIONAL SYMBIONTS CONFER STRUCTURAL DEFENCE AGAINST PREDATION AND FUNGAL INFECTION IN A GRAIN PEST BEETLE

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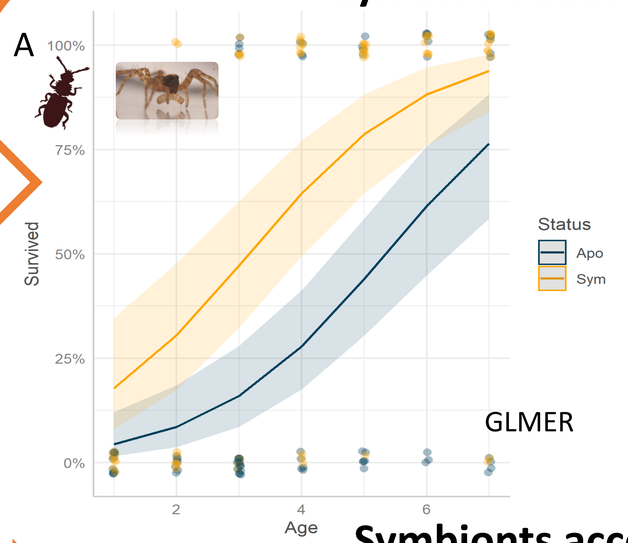
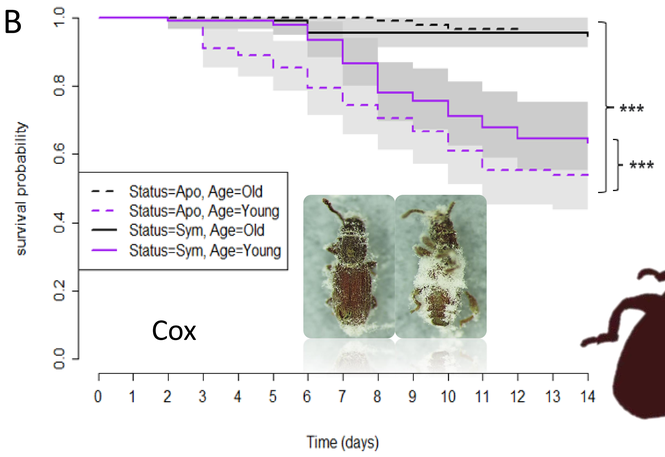
Nutritional symbioses are common in insects and play a pivotal role in shaping the ecology and evolution of their hosts. Supplementation of essential nutrients, degradation and detoxification of toxic compounds[1] are some known examples of how nutritional symbionts enable their hosts to better deal with difficult diets[2]. The grain pest beetle, *Oryzaephilus surinamensis* engages in such a symbiosis with microbes of the Bacteroidetes group[3]. The symbionts supplement the beetle with the tyrosine precursor prephenate, which the beetle uses to form a strongly sclerotized and melanised cuticle[4]. Through their contribution to cuticle formation, the symbionts have been shown to enhance desiccation resistance[3]**. This study aimed to investigate if the cuticle-enhancing nutritional symbiosis of the saw-toothed grain beetle *Oryzaephilus surinamensis* confers protection against predation and fungal infection.**

Methods

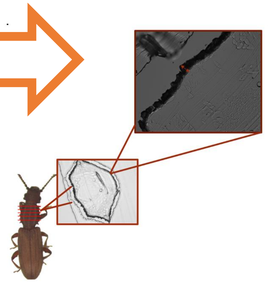
- Predation assays: age defined symbiotic and aposymbiotic beetles exposed to field collected wolf spiders.
- Fungal Bioassays: Age defined beetles exposed to *Beauveria bassiana* for 14 days
- Cuticle thickness: epicuticle measured on semi-thin sections
- Melanisation: standardised photos of age-defined beetles taken. Cuticle redness quantified

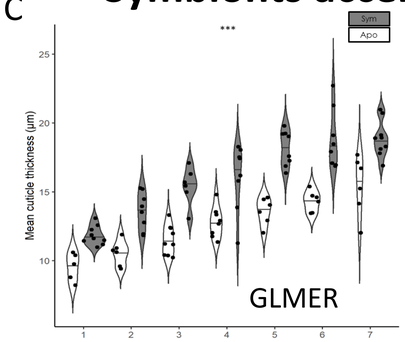
Symbiotic beetles have higher survival probability

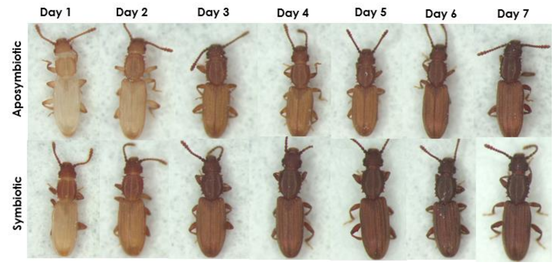




Symbionts accelerate cuticle development



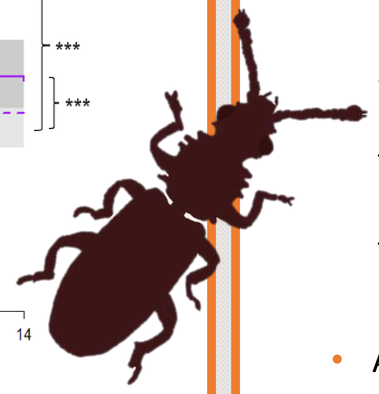




A) : Impact *of Oryzaephilus surinamensis* symbiont status and age on adult defence against predatory wolf spiders. B) Survival probability of young (purple lines) and old (black lines) symbiotic (solid lines) and aposymbiotic (dashed lines) beetles exposed to *B. bassiana* spores. C) Cuticle thickness and D) melanisation progression in age defined beetles

Conclusions

- Aposymbiotic beetles are susceptible to predation and fungal infection for a longer period than symbiotic beetles
- Accelerated symbiont-mediated cuticle development allows symbiotic beetles to escape vulnerability to natural enemies faster.



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References:: 1.Salem et al.,2017. Drastic genome reduction in an herbivore's pectinolytic symbiont. Cell, . 2. Itoh et al., 2018. Detoxifying symbiosis: microbe-mediated detoxification of phytotoxins and pesticides in insects. Natural product reports, 3. Engl, et al., 2018. Ancient symbiosis confers desiccation resistance to stored grain pest beetles. Molecular ecology,, 4. Kiefer et al., 2021. Inhibition of a nutritional endosymbiont by glyphosate abolishes mutualistic benefit on cuticle synthesis in Oryzaephilus surinamensis. Communications biology,