

ANNA KARENINA AS A PROMOTER OF MICROBIAL DIVERSITY IN A TEPHRITID AGRICULTURAL PEST (DIPTERA, TEPHRITIDAE)

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Study system

This research compares the gut microbiome of 64 *Zeugodacus cucurbitae* larvae collected from infested cucumber and watermelon. The crops were grown under either agroecological or conventional farming practices in the Uluguru mountains (~1000m) and the plains (~500m) of the Morogoro area in Tanzania. Using 16S metabarcoding the microbial composition of the larvae was investigated.



Agroecological farming vs conventional farming

- | | |
|-----------------------|-------------------------------|
| - No chemical control | - Insecticides and fungicides |
| - Organic manure | - Chemical fertilizer |
| - Mulching | - No mulching |
| - Intercropping | - No intercropping |

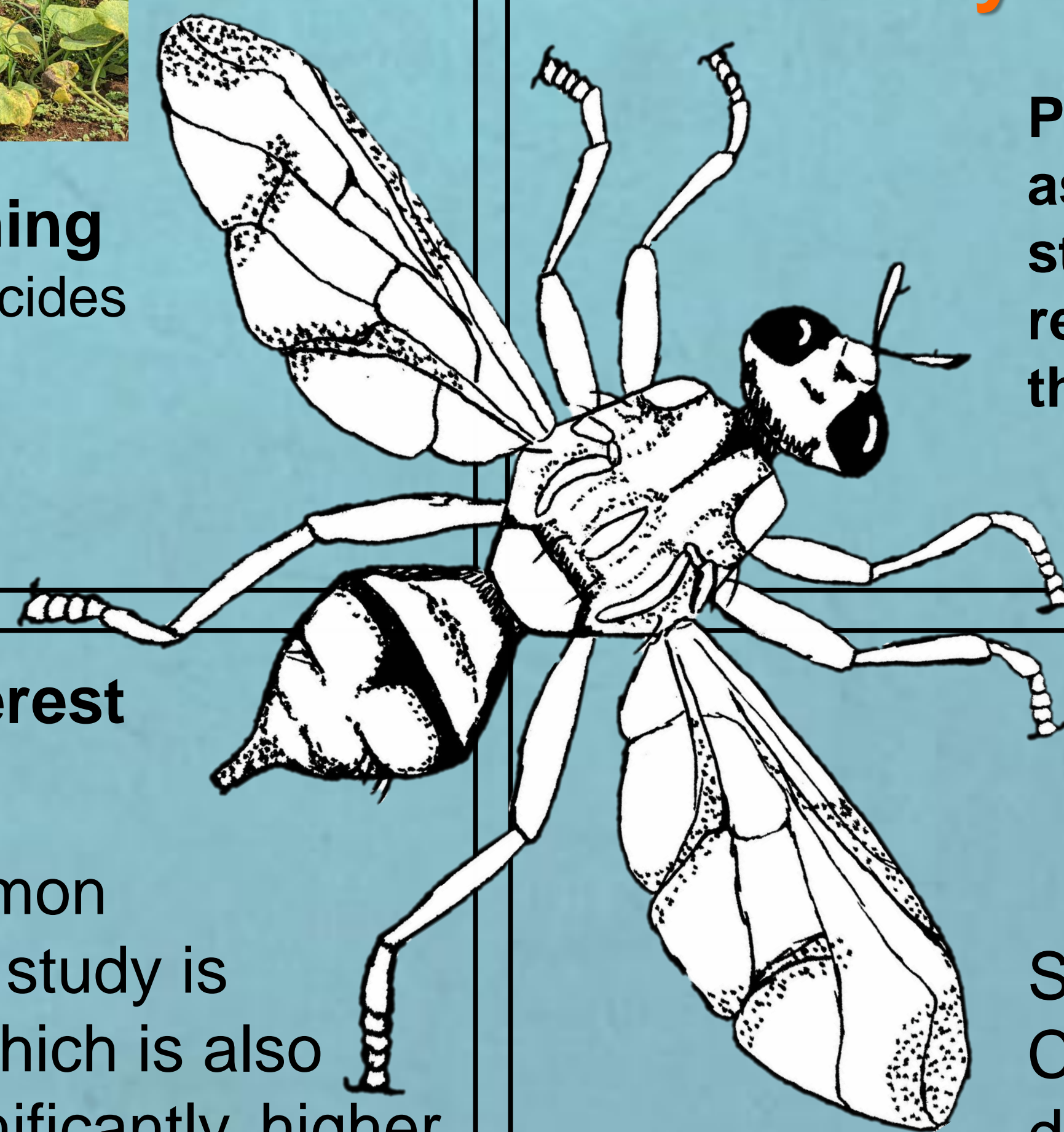
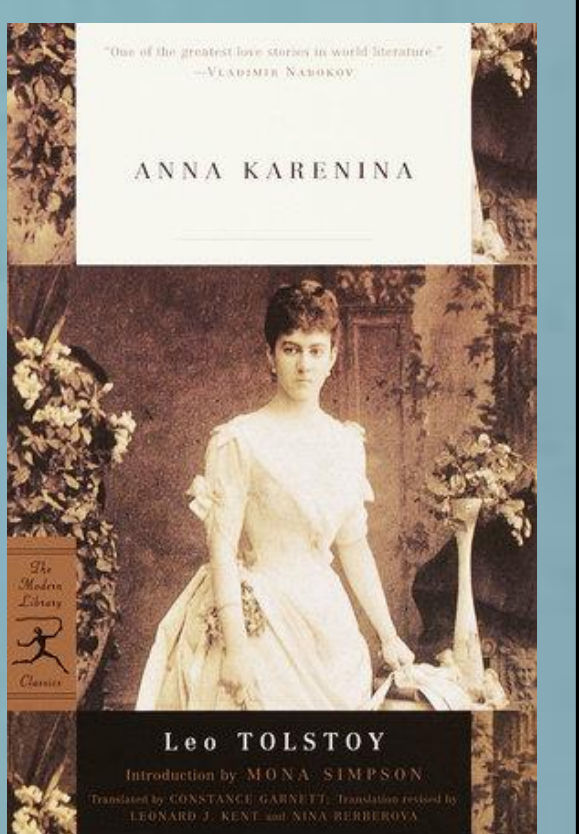
Findings

The composition of the gut microbiome of *Z. cucurbitae* larvae is influenced by the interaction of altitude and farming practices; only at high altitude do we see a significant impact of the farming practices.

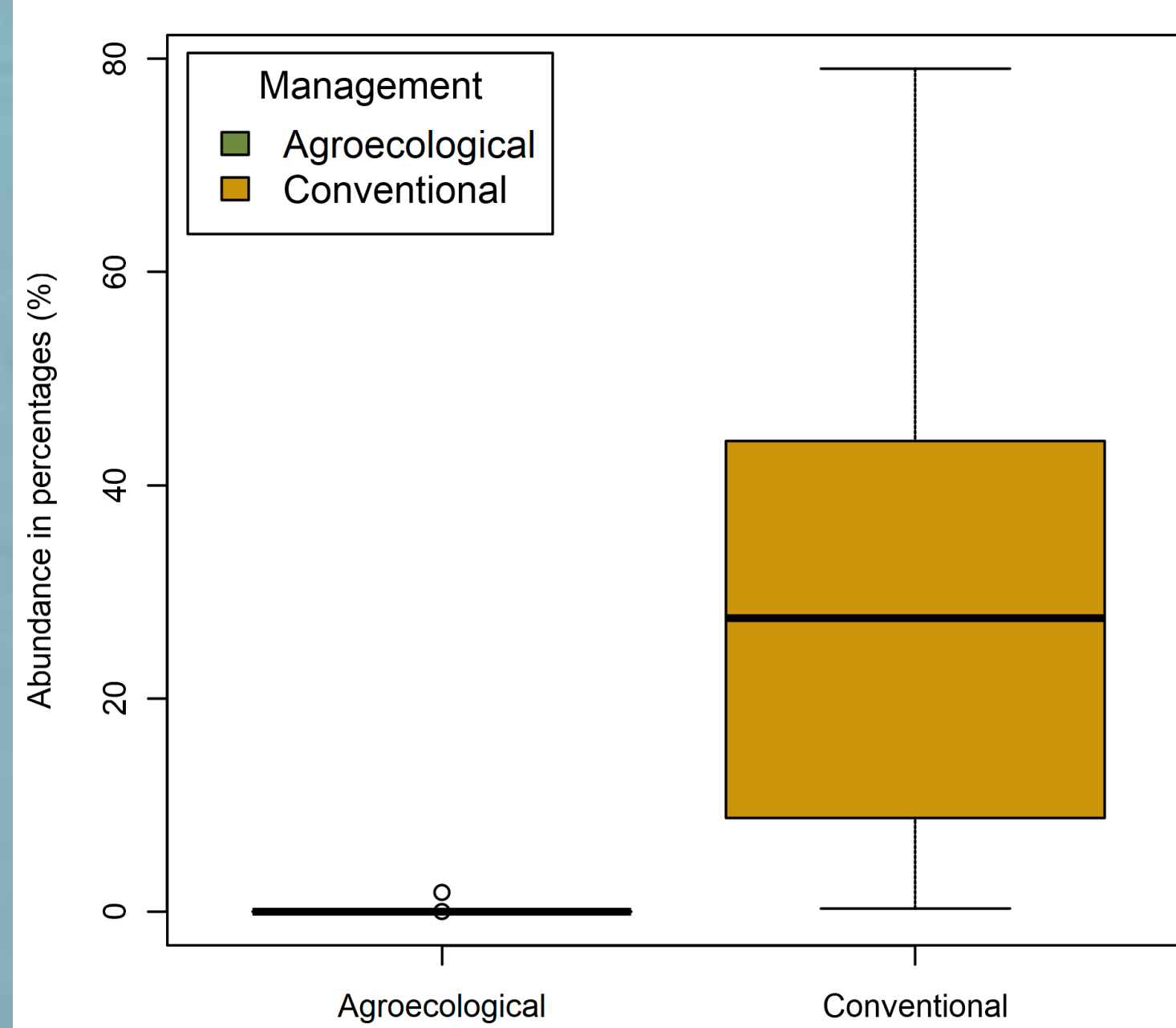
High altitudes are a suboptimal living condition for *Z. cucurbitae*, and the combination with conventional farming results in stress following the expectations made by the Anna Karenina principle.

All happy families are alike; each unhappy family is unhappy in its own way

Patterns of dispersion of microbial assemblages increase under stressful conditions as stress reduces a host's ability to regulate their own microbiome



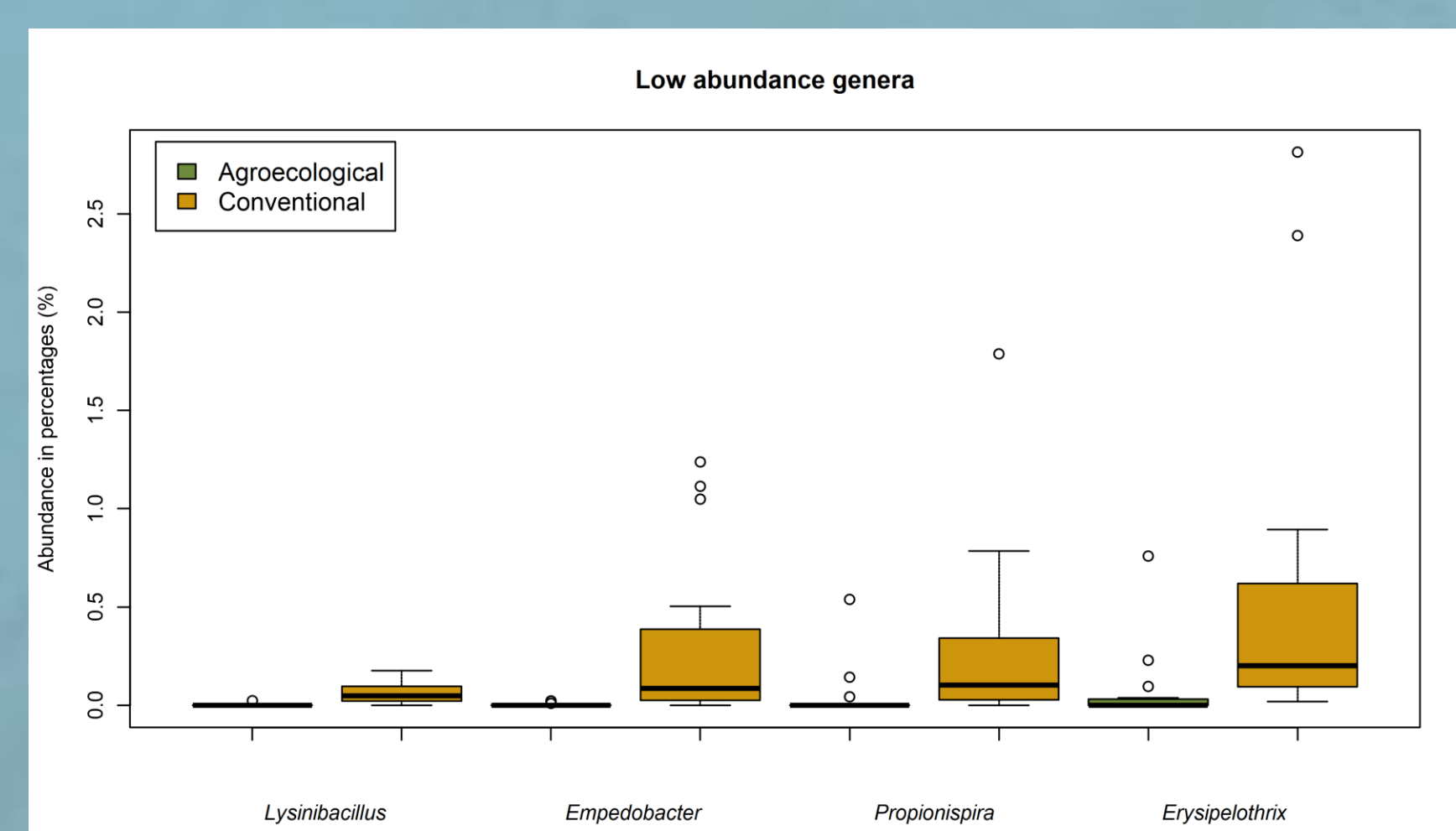
Differential abundance of the genus *Romboutsia*



Genera of interest

The most common bacteria in this study is *Romboutsia*, which is also present in significantly higher abundances in larvae from conventional fields at high altitude. *Romboutsia* has been linked to the presence of agrochemicals.

It is possible that the increase of microbiome diversity (promoted by the Anna Karenina effect) might help explain at least part of the impressive adaptive potential of polyphagous fruit flies

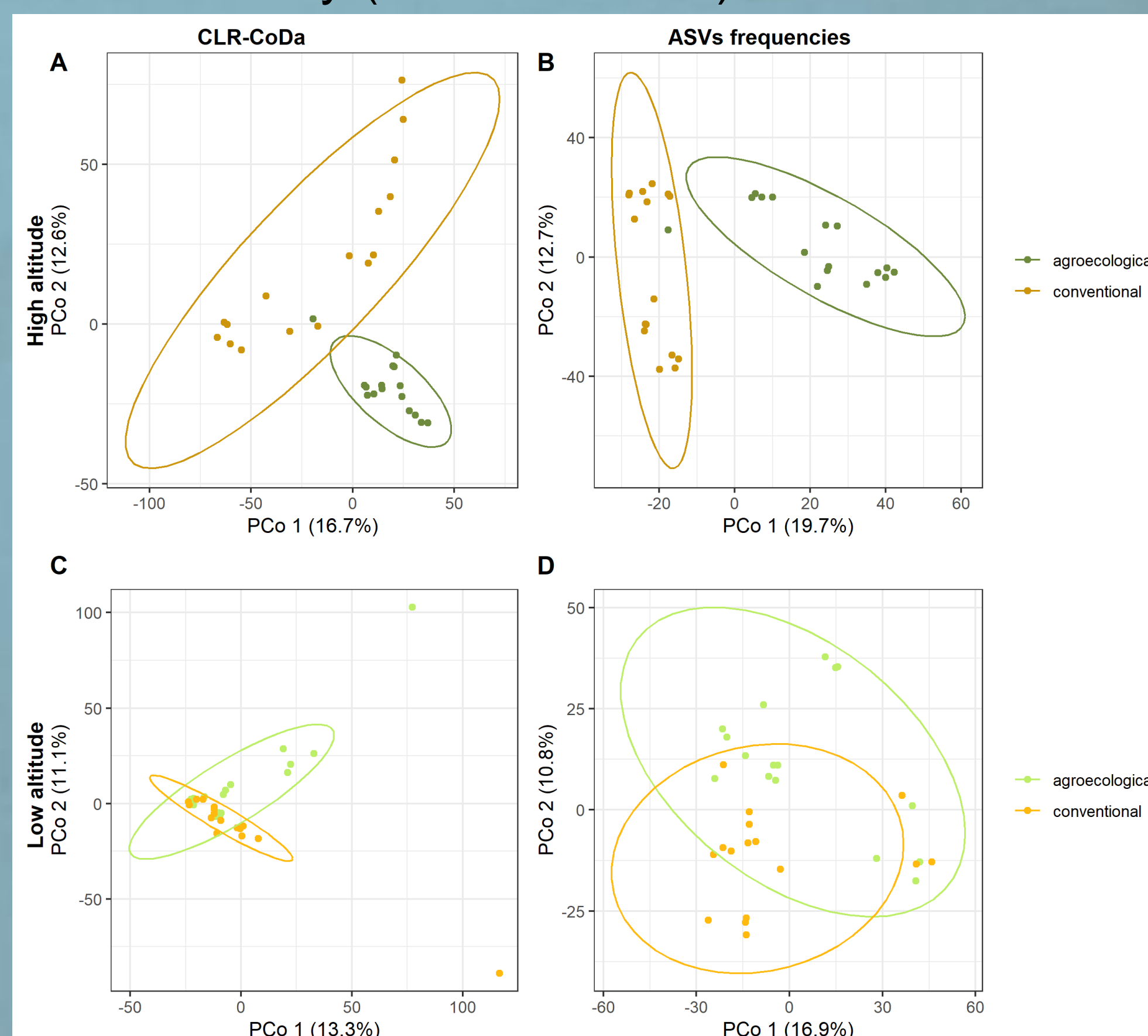


Four other genera are present in higher abundances under high altitude and conventional farming

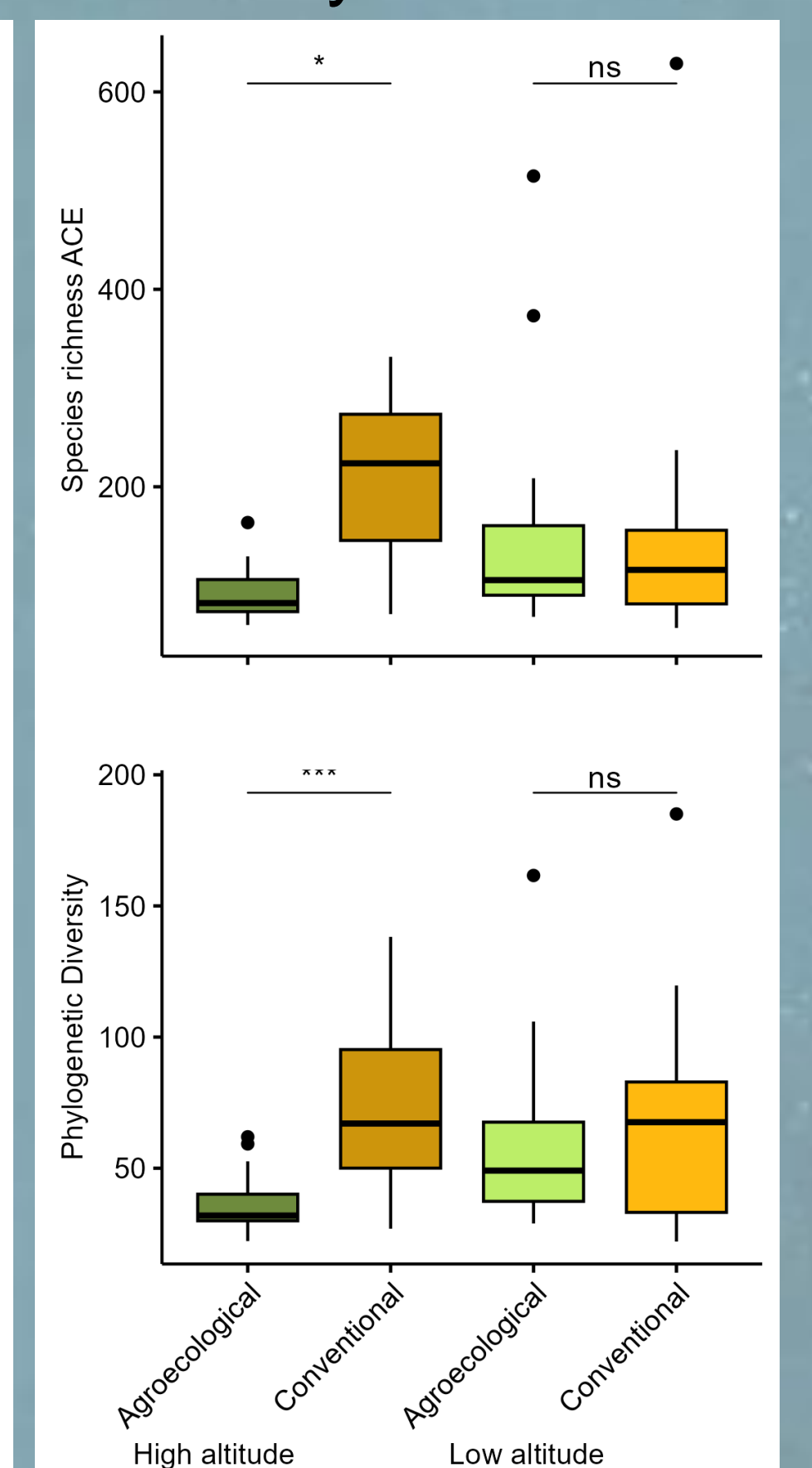
Increased microbial diversity at high altitude when exposed to conventional farming practices:

Species richness (Abundance-based Coverage Estimator ACE), phylogenetic diversity and dispersion are elevated, differences in beta diversity are found

PCoA: Increased dispersion and difference in beta diversity (PERMANOVA):



Differential alpha diversity:



References

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