

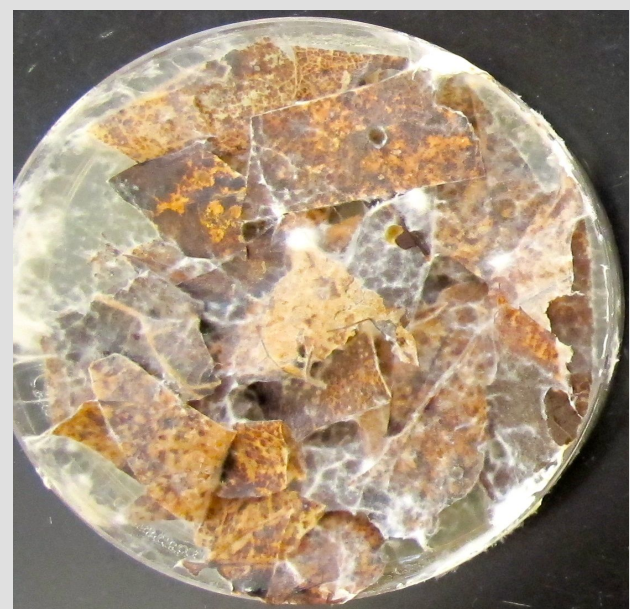
Fungal carbon use efficiency – effects of temperature and functional guild

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Background

Increased temperatures are generally expected to decrease microbial carbon use efficiency (CUE), but empirical observations and theory suggest that microbial CUE may acclimate to warming over long time periods. One mechanism underlying potential acclimation is a shift in microbial community composition, wherein increased temperatures favor microbes with a lower Q10 of CUE. Fungi are the primary decomposers of leaf litter, and different species specialize on different types of litter compounds, but potential differences in the CUE of these functional guilds and their responses to temperature are largely unknown.



Basidiomycete
lignin decomposer



Ascomycete
cellulose decomposer

Objectives

- Determine whether CUE of fungi is reduced by increased temperature.
- Determine whether CUE is stratified by functional guilds represented by litter decomposing fungi in the Ascomycota and Basidiomycota.
- Describe how temperature responses of growth rate and CUE *in vitro* relate to *in situ* relative abundance.
- Describe potential for acclimation of community CUE to temperature through shifts in community composition.

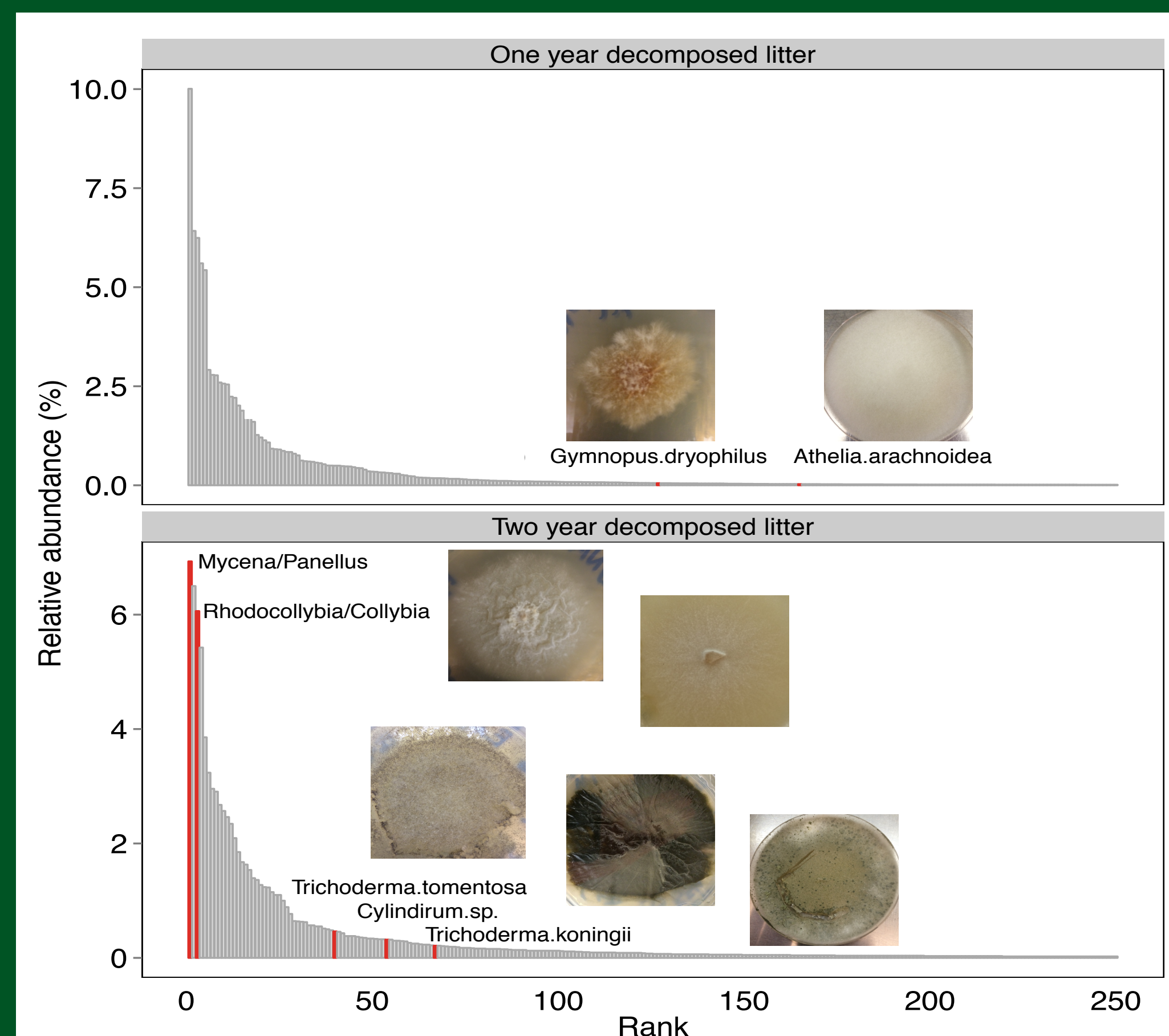
Methods

- Fungi were isolated from decomposing leaf litter at the Harvard Forest LTER, Massachusetts, USA.
- A long-term experimental soil warming study at Harvard Forest was used to identify species of interest. Meta-barcoding data were generated from leaf litter decomposed for one or two years. Fungal isolates were compared to these data.

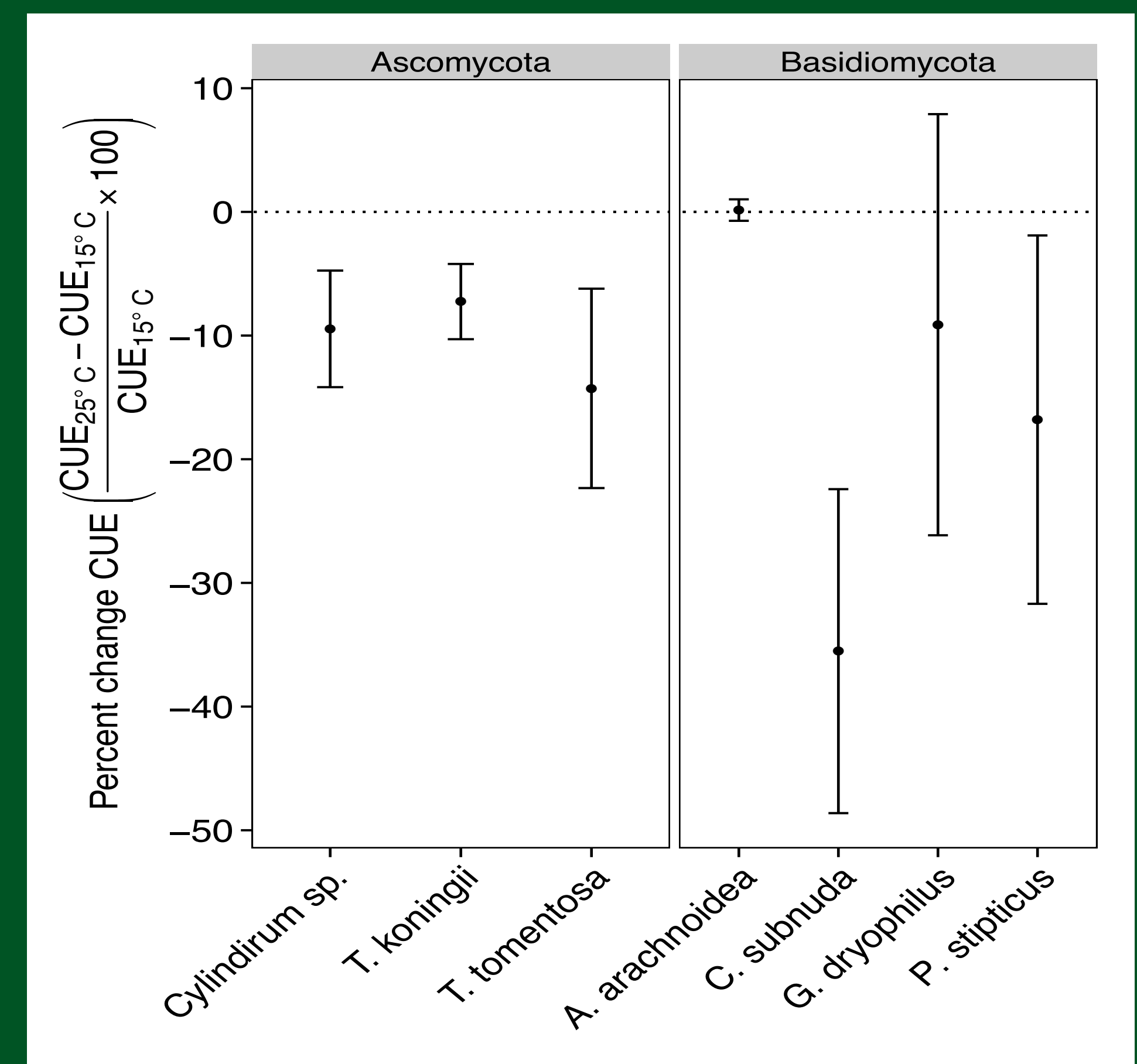
- Fungi were grown in liquid culture (potato dextrose broth) at 15 or 25°C.
- Specific growth rate and mass specific respiration rate were calculated and used to determine CUE.

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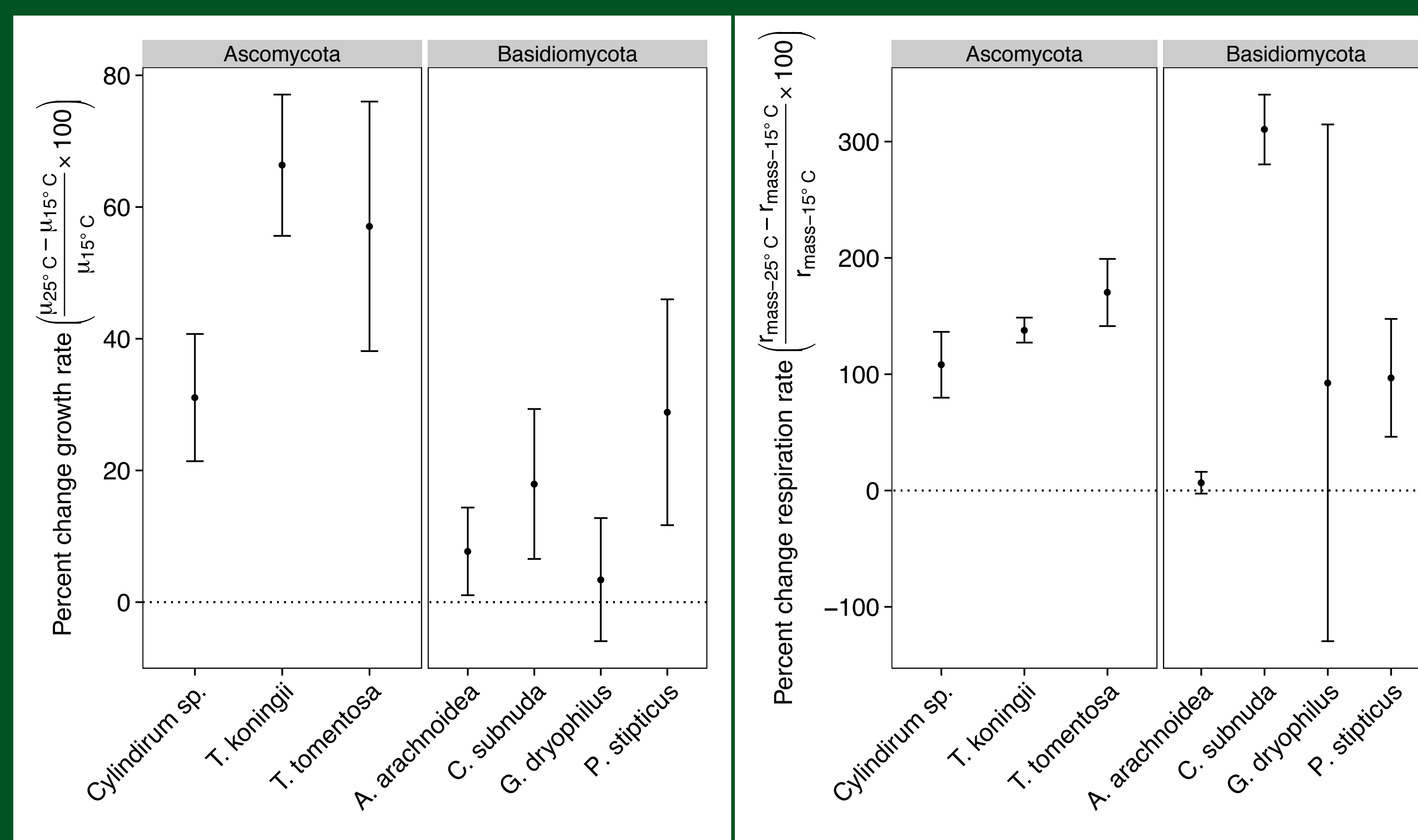
Results



Species were identified that were either highly abundant or responsive to temperature *in situ*.



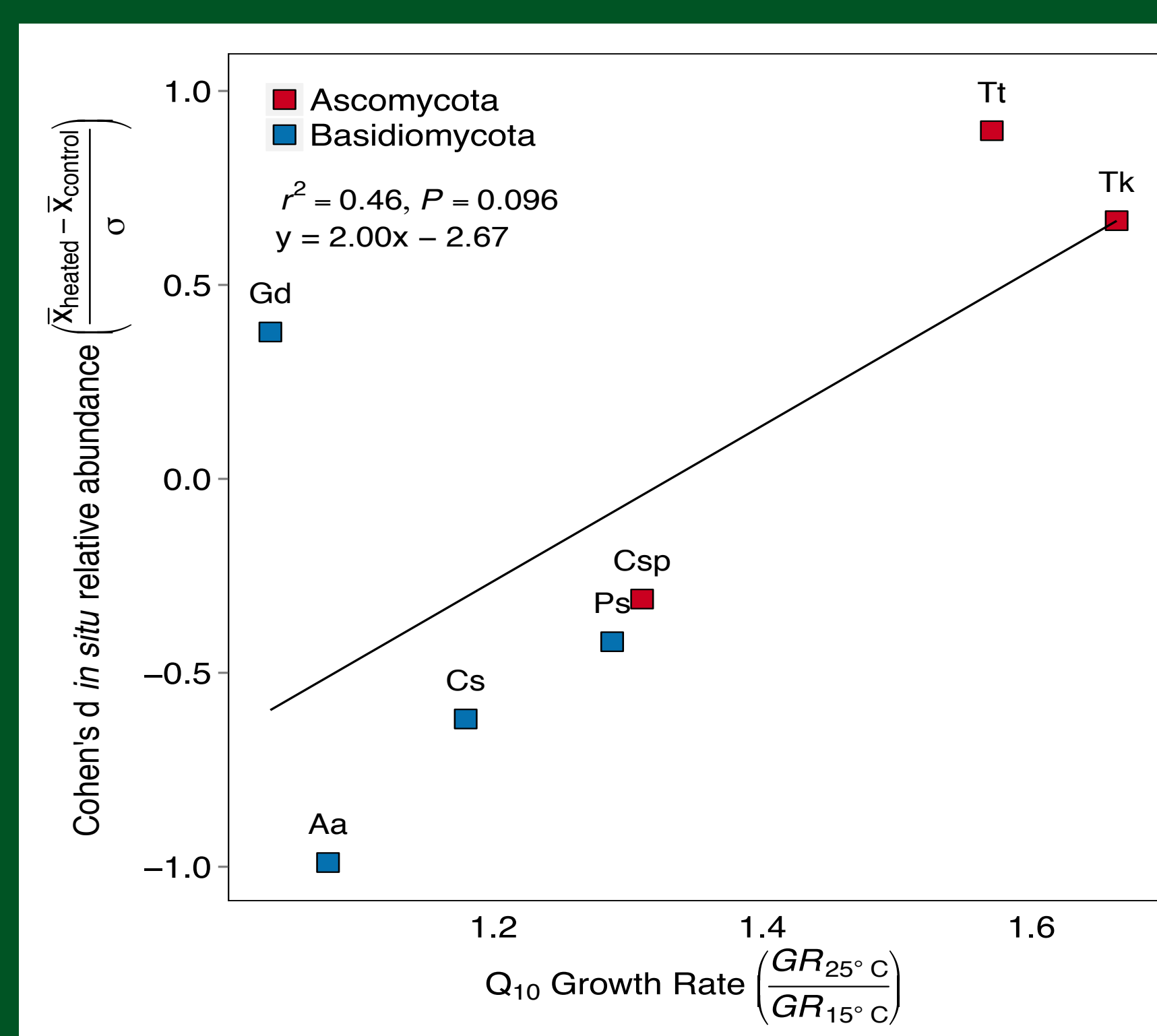
CUE was reduced by temperature, but was not stratified by functional guilds indicated by phyla.



Both growth rates and respiration rates increased with temperature.

Ascomycetes had a higher Q10 of growth rate than basidiomycetes and also had higher growth rates overall.

Responses of respiration rates to temperature were not stratified by phylum.



Growth rate Q10 was a good predictor of relative abundance responses to temperature *in situ*.

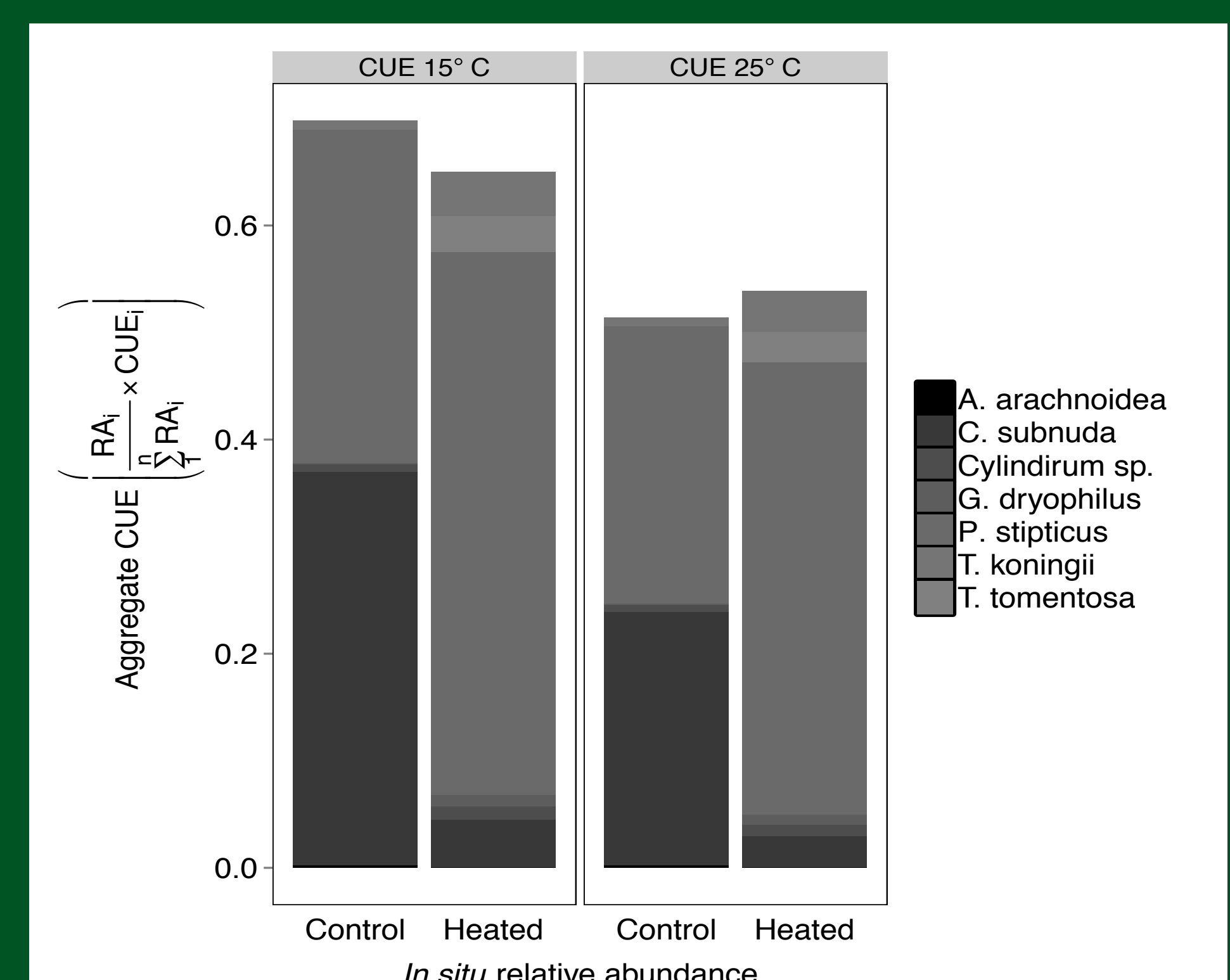
Discussion

CUE generally decreased with increasing temperature, but was not stratified by functional guild.

However, Q10 of growth rate was higher for ascomycetes and was a good predictor of *in situ* responses of relative abundance to temperature increases.

Shifts in community composition may allow acclimation of CUE to increased temperatures.

A shift towards ascomycetes with warming may favor cellulose decomposition over lignin decomposition.



An aggregate CUE metric created by scaling the CUE of each species by its *in situ* relative abundance suggests acclimation of CUE may occur through changes in community composition.