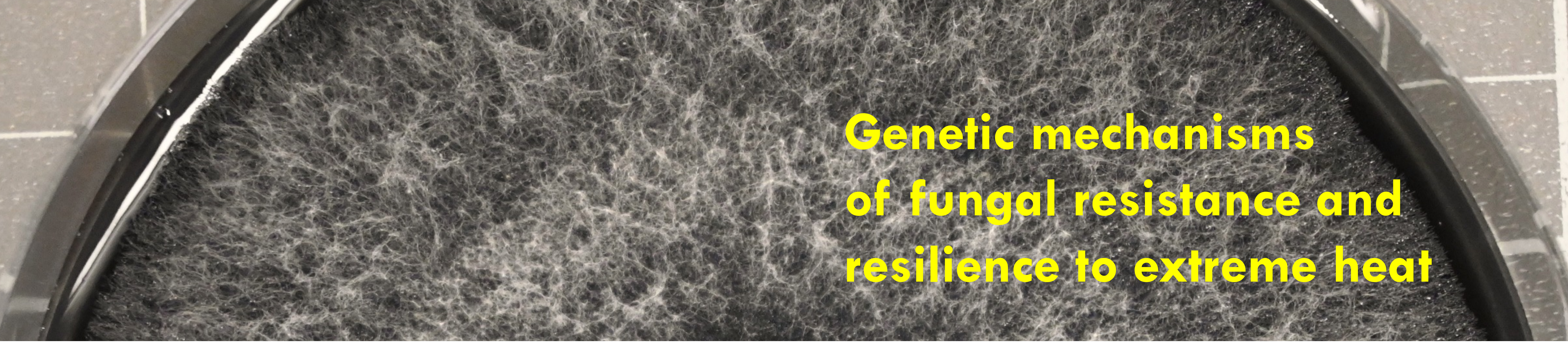

Genetic mechanisms of fungal resistance and resilience to extreme heat

Background:

Saprotrophic fungi are recyclers that put nutrients back into the soil. As the climate warms, extreme heat events will impact nutrient cycling and the composition of soil communities. We can better predict how soil communities will be impacted by climate change by understanding the molecular mechanisms underlying the response and recovery of different saprotrophic fungal species to extreme heat events. Heat shock proteins are often the first genes whose expression is impacted by high temperature stress; yet species differ in timing, duration, and presence of gene expression changes. This research will help us understand how different saprotrophic fungi manage heat stress, potentially influencing their entire terrestrial community.

Key questions:

- How does the expression of heat shock proteins (Hsp70) in response to heat stress differ between slow-growing, heat-resistant fungi and fast-growing, heat-resilient fungi?
- Are differences in Hsp70 expression correlated with the resistance and/or recovery of slow- and fast-growing fungal species to heat stress?

Methodology:

We will culture several different slow and fast-growing saprotrophic fungal species (Morchella and Trichoderma) with previously established different resistance and resilience to extreme heat events. Each species will be grown in monoculture on solid potato media. Experimental replicates will be exposed to a 30°C heat shock treatment for 2 days and then allowed to recover at 20°C for 2 days. Samples from each replicate will be snap-frozen in liquid nitrogen at five time points (0, 0.5, 1, 3, and 4 days). Then, we will extract RNA from these samples and use quantitative reverse transcription polymerase chain reaction (RT-qPCR) to determine the change in relative gene expression of Hsp70 over time.

Key readings:

Waldvogel, A. M., Feldmeyer, B., Rolshausen, G., Exposito-Alonso, M., Rellstab, C., Kofler, R., Mock, T., Schmid, K., Schmitt, I., Bataillon, T., et al. (2020). Evolutionary genomics can improve prediction of species' responses to climate change. Evolution Letters, *4(1), 4-18. doi: 10.1002/evl3.154*

Chen, B., Feder, M. E., Kang, L. (2018). Evolution of heat-shock protein expression underlying adaptive responses to environmental stress. Molecular Ecology, *27(15), 3040-3054. doi: 10.1111/mec.14769*

Mota, T. M., Oshiquiri, L. H., Lopes, E. C. V., Filho, J. R. B., Ulhoa, C. J., & Georg, R. C. (2019). Hsp genes are differentially expressed during Trichoderma asperellum *self-recognition, mycoparasitism and thermal stress.* Microbiological Research, *227(2019), 126296. doi: 10.1016/j.micres.2019.126296*

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