Discrepancies of fungi and plants in the pattern of beta-diversity with environmental gradient imply a comprehensive community assembly rule

Shota Masumoto[1*], Ryo Kitagawa[2], Ryo Kaneko[3], Keita Nishizawa[4], Shunsuke Matsuoka[5], Masaki Uchida[3,6], Akira S. Mori[4]

[1] *Faculty of Life and Environmental Sciences, University of Tsukuba*

[2] *Kansai Research Center, Forestry and Forest Products Research Institute*

[3] *National Institute of Polar Research*

[4] *Research Center for Advanced Science and Technology, the University of Tokyo*

[5] *Field Science Education and Research Center, Kyoto University*

[6] *The Graduate University for Advanced Studies, School of Multidisciplinary Sciences*

Beta-diversity partitioning has been showed that the nestedness component develop with environmental stress in a variety of taxa (Ulrich et al 2012). However, soil fungal community may maintain its turnover components despite the development of plants' nestedness component, and the potential causes remain unclear.

To investigate the process of species turnover of soil fungi along stress gradient in the Arctic, we divided species turnover component into sub-components; βsim_hete and βsim_homo representing species turnover with or without a change in the guilds.

As the result, fungal community maintain its turnover component unlike plant community, but its βsim_hete increased under stressful (Fig. 1). Additionally, GDM analysis resulted in that βsim_hete were mainly explained by stress gradient and plant nestedness (Fig. 2), suggesting that functionality of soil fungi was ecologically filtered by environmental stress and plant community structure.

The discordant trend of beta-diversities between plant and fungi (i.e. development of plant nestedness and maintaining of fungal turnover) would be not caused by different assembly rules working parallelly on the two taxa, but according to an ecological rule that reflects plant-fungal interaction.

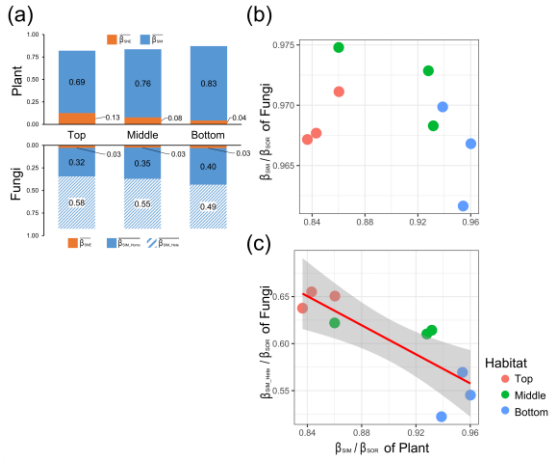

Figure 1. (a) Visualization of multi-site dissimilarity of plant and fungal communities. β_{SOR} is the Sørensen dissimilarity and β_{SIM} and β_{NES} are the turnover and nestedness components of dissimilarity, respectively. β_{SIM_Hete} and β_{SIM_Homo} are the turnover components with and without guild exchange, respectively. The correlations of the β_{SIM} to β_{SOR} ratios of soil fungi and plants (b) and (c) β_{SIM_Hete} to β_{SIM} ratio of soil fungi with the β_{SIM} to β_{SOR} ratio of plants. Red lines represent statistically significant ($P < 0.05$) linear model fits; the shaded area represents the corresponding 95% confidence intervals.

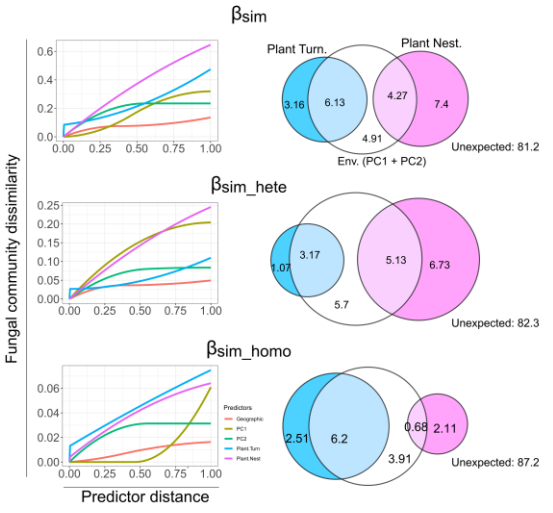

Figure 2. Predictors for soil fungal turnover components: β_{sim}, β_{sim_hete}, β_{sim_homo}. The left graphs show the effect of each predictor from the generalized dissimilarity modeling (GDM) analysis and Venn diagrams on the right show the relative importance of each predictor to the variation partitioning based on the GDM results.

References

Ulrich W, Almeida-Neto M. On the meanings of nestedness: Back to the basics. Ecography (Cop) 35, 865–71, 2012.