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

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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; $\beta_{\text{sim\_hete}}$ and $\beta_{\text{sim\_homo}}$ 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 $\beta_{\text{sim\_hete}}$ increased under stressful (Fig. 1). Additionally, GDM analysis resulted in that $\beta_{\text{sim\_hete}}$ 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 parallely 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. $\beta_{\text{SOR}}$ is the Sørensen dissimilarity and $\beta_{\text{SIM}}$ and $\beta_{\text{NES}}$ are the turnover and nestedness components of dissimilarity, respectively. $\beta_{\text{SIM\_Hete}}$ and $\beta_{\text{SIM\_Homo}}$ are the turnover components with and without guild exchange, respectively. The correlations of the $\beta_{\text{SIM}}$ to $\beta_{\text{SOR}}$ ratios of soil fungi and plants (b) and (c) $\beta_{\text{SIM\_Hete}}$ to $\beta_{\text{SIM}}$ ratio of soil fungi with the $\beta_{\text{SIM}}$ to $\beta_{\text{SOR}}$ 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: $\beta_{\text{sim}}, \beta_{\text{sim\_hete}}, \beta_{\text{sim\_homo}}$. 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**