南極コケ層における微小菌類の菌糸量・種多様性・遷移と化学変化

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Abundance, richness, and succession of microfungi in relation to chemical changes in Antarctic moss profiles

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Mosses are major components of terrestrial ecosystems of Antarctica and account for the crucial budgets of carbon and nutrients via primary production and concomitant decomposition and accumulation of moss tissues in soil. However, little is known about the patterns of abundance, diversity, and succession of microfungi within moss profiles consisting of live, senescent, and dead tissues in different stages of decomposition in Antarctica. In the present study, vertical patterns of the hyphal length and the diversity of culturable microfungi, and their relationship with chemical compositions, were examined within colonies of *Bryum pseudotrichetrum/B. archangelicum* complex collected from coastal outcrops at five locations in the Lützow-Holm Bay area, East Antarctica. At each site, five moss blocks (each 2 × 2 cm, approximately 6 to 10 cm below the surface) were collected during JARE51 from December 2009 to January 2010, making a total of 25 moss blocks. The blocks were divided into 4 layers (denoted as layers G, R, B, and BT from upper to lower) according to color and texture, making a total of 100 samples, and used for hyphal length estimation, fungal isolation, and chemical analyses. Total and darkly pigmented hyphal length increased with the depth of moss blocks. A total of 72 fungal isolates were obtained from 53 (53%) out of the 100 moss samples, zero to three isolates (0.7 isolates on average) per sample. These isolates were classified into 18 molecular operational taxonomic units (MOTUs). The MOTU richness of microfungi and the occurrence of major MOTUs (*Phoma herbarum* and *Geomyces pannorum*) increased with the depth of moss blocks. The content of organic chemical components (acid-unhydrolyzable residues, total carbohydrates, and extractives) and nitrogen in moss tissues decreased, whereas ash content increased with the depth of moss blocks. Relative amounts of acid-unhydrolyzable residues (recalcitrant compounds) and total carbohydrates did not differ significantly among the vertical layers. The increase with depth of the microfungal richness and occurrence in the Antractic moss blocks without MOTU replacement was consistent with the directional-nonreplacement model of succession (Svoboda and Henry 1987), indicative of the high environmental resistance which represents the sum of the adverse factors hindering the success of species establishment. This contrasted with the fungal succession in arctic moss profiles (Osono et al. 2012), which supported the directional-replacement model, in which species replacement takes place due to competition. The contrasting patterns of fungal succession suggest that more hostile environmental conditions in continental Antarctica than in the Arctic characterized the pattern of succession in decomposing moss tissues and limited the roles of microfungi in the decomposition processes. To our knowledge, the present study is the first to reveal a detailed picture of the vertical pattern of fungal occurrence across moss blocks (i.e., across the bryosphere) of continental Antarctica, with reference to hyphal length and culturable fungal assemblages in relation to chemical changes in decomposing moss tissues. Our dataset provides useful insights into the abundance and diversity of fungi, potential factors affecting the abundance and diversity, and possible roles of fungi in chemical changes in moss profiles in continental Antarctica.

References

Svoboda J, Henry GHR (1987) Succession in marginal arctic environments. Arc Alp Res 19: 373-384.
Osono T., Ueno T., Uchida M. & Kanda H. (2012) Abundance and diversity of fungi in relation to chemical changes in arctic moss profiles. Polar Science 6: 121-131.