Biological diversity in a mutualistic world

Biological diversity on Earth is currently rapidly declining. The losses are likely to have major consequences for the functioning and stability of terrestrial ecosystems. In order to sustain diversity the mechanisms which contribute to its conservation must be understood. Recently we showed that the diversity of one group of symbiotic and mutualistic microorganisms, the arbuscular mycorrhizal fungi, greatly enhanced plant diversity in grassland ecosystems (Nature 396: 69-72). This breakthrough in the study of the regulation of plant diversity may be the starting point of a new series of exciting discoveries. Here it is proposed to build upon that study by investigating how ecosystem functioning and biodiversity depends on the interactive effects of three important groups of microbial symbionts. These are the nitrogen fixing rhizobial symbionts of legumes, the ectomycorrhizal fungal associates of shrubs and trees and the arbuscular mycorrhizal fungal symbionts of many grasses and forbs. It is hypothesized that each group of microbial symbionts plays a key role in maintaining diversity in the selected ecosystems. It is further hypothesized that the co-occurrence of different symbionts stimulates ecosystem functioning (e.g. enhances nutrient capture and productivity) since they can act synergistically and supply different types of limiting nutrients to the plants. To test these hypotheses semi-natural ecosystems will be constructed under controlled conditions and the presence, composition and diversity of the different groups of mutualistic symbionts will be manipulated, and their effects upon plant diversity and ecosystem functioning will be investigated.

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