

Preface

This volume contains papers presented at a British Ecological Society meeting held in York from 16 to 18 April 1984. The meeting brought together researchers on all aspects of the soil biota, from the roots through the various microbial groups to the soil fauna. There have been several meetings recently on interactions between parts of this complex, for example on root-fungus interactions (particularly mycorrhizas) and on animal-microbial interactions. Our aim was to link together all these studies so that, for example, groups working on decomposition could talk to those interested in root production or in grazing interactions; in particular we hoped to provide an opportunity to discuss higher-order interactions, in which producer, grazer and predator, for example, interact in the soil environment. We also wished to provide an opportunity to bring together workers in agricultural and natural ecosystems.

These thoughts dictated the order and selection of papers, and the arrangement in this volume progresses from studies on roots alone, to root-microbial, animal-microbial and finally more complex interactions. In both the planning and delivery stages the meeting served to highlight several areas where little information was available or where, excitingly, the data are now beginning to appear.

One impression that stands out strongly is of the need to forge links between above-ground and below-ground ecological studies. Both in quantification and in the development of theory, 'above-ground' ecologists seem to have outstripped their 'subterranean' colleagues. It is clear, though, that we are at last beginning to put numbers to our diagrams. In the opening paper, Coleman points to the complexity of below-ground food webs, with up to seven possible links in a chain. Does this imply a greater complexity than is found in above-ground webs or simply that there are more alternative pathways? Without numbers it is difficult to answer such questions, and it may be that the application of above-ground theory to below-ground events is not a simple matter, as suggested by Heal & Dighton and Usher. It is certain, though, that invertebrates have a profound effect on microbial populations (Visser) and on microbially-mediated processes (Anderson *et al.*). The consequences of such interactions may be unexpected, as for example, the 'priming' effect suggested by Clarholm, and greatly influence plant growth, above- and below-ground. The essential connectedness of the above- and below-ground subsystems is emphasized by Miles.

Production estimates are another area where quantification seems now to be possible. Fogel shows that in many natural communities, the greater part of net primary production goes underground, in striking contrast to the agricultural communities that have been the models for much theoretical development. The idea that above-ground food chains are mainly grazer-initiated, whereas those below-ground are based on decomposers, is widely held, and highlights our lack of knowledge of below-ground herbivory, discussed here by Brown. Of course, much

of this production may go straight into mycorrhizal hyphae, and we need to know much more of the consequences of mycorrhizal grazing (Finlay and Shaw) in parallel with studies of grazing on soil fungi in general.

It is increasingly realized that the mycorrhizal condition is the norm in natural vegetation, and the implications of this, particularly in terms of nutrient transport through interplant connections, discussed here by Read, must be profound. Since colonization of roots by hyphae already attached to other roots seems widespread, and since plant uptake of P and, at least for ectomycorrhizas, of N and even water occurs through hyphae, we must re-examine concepts of competition between roots based on the soil model, which are themselves recent in origin. It could even be that the resource competed for is the mycorrhizal hyphae.

The growth, distribution and activity of roots in soil has been strangely neglected in studies of the soil ecosystem. They are considered here at two levels (soil profile and individual root system) by Atkinson and Fitter. Until recently the rhizosphere was viewed as a site of intense microbial (and hence, presumably but not demonstrably, faunal) activity. One strong theme to emerge from the meeting was of the relative inactivity of the rhizosphere populations, and even the significance of rhizosphere dinitrogen fixation, a process recently felt to have exciting agricultural potential, is questioned in a critical review by Giller & Day. The importance of the dead root as an energy source for soil microbes was stressed by Newman, leaving open the question of the importance of grazing on living roots. The relative quantitative significance of above- and below-ground grazing, particularly in the light of the new production estimates, remains unclear. It may be that it is the root-fungal complex that should be viewed as the grazing resource.

As any good meeting should, the symposium on which this volume is based raised new questions in the minds of the participants. As editors, we hope the volume serves the same purpose to its readers. In putting it together we have tried to represent the flavour of the meeting by including both the spoken papers and many of the posters. The latter have been written on a more economical scale, explaining the great range of lengths of paper presented here. We have nevertheless mixed them in with the other papers, both invited and offered, to create what we hope is a coherent order. All the papers were refereed and in most cases these comments were given to authors before the meeting, the final versions being accepted a few weeks later, giving authors a chance to take discussions and comments from participants into account.

Finally we would like to thank the anonymous referees who read and commented on manuscripts, both rapidly and effectively; Roger Booth, Peter Shaw and Maureen Chapman who helped with the organization at the meeting; and Avril Harrison, who, single-handed and with unfailing good humour, handled all the bookings and correspondence.

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