1 Biological Soil Crusts: Characteristics and Distribution

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1.1 Definition of Biological Soil Crusts

Biological soil crusts result from an intimate association between soil particles and cyanobacteria, algae, microfungi, lichens, and bryophytes (in different proportions) which live within, or immediately on top of, the uppermost millimeters of soil. Soil particles are aggregated through the presence and activity of these biota, and the resultant living crust covers the surface of the ground as a coherent layer (Fig. 1.1). This definition does not include communities where soil particles are not aggregated by these organisms (e.g., cyanobacterial/algal horizons in littoral sand and mudflats), where organisms are not in close contact with the soil surface (e.g., thick moss-lichen mats growing on top of decaying organic material, as in boreal regions), nor where the majority of the biomass is above the soil surface (e.g., large club-moss mats found in North American grasslands or dense stands of fruticose lichens, such as *Niebla* and *Teloschistes* species from the coastal fog deserts of California and of Namibia, respectively). However, the boundaries between the latter communities and biological soil crusts are fluid. In a similar fashion, there is no strict dividing line between the cyanobacterial, green algal, and fungal species that occur in soil-crust communities, yet are also found in a multitude of additional habitats (e.g., intertidal mates, tree trunks and leaves, rock faces).

Multiple names have been applied to biological soil crusts. These communities have been referred to as cryptogamic, cryptobiotic, microbiotic, microfloral, microphytic, or organogenic soil crusts (see Harper and Marble 1988; West 1990). Evans and Johansen (1999) discuss the implication of the different expressions. In this Volume, we use the term biological soil crusts because it is the broadest term which clearly states that these crusts are dependent on the activity of living organisms, in contrast to physical or chemical crusts (see Chap. 15). In addition, the term biological soil crust lacks taxonomic implications, and thus is broadly applicable to all soil crusts, regardless of their species composition.

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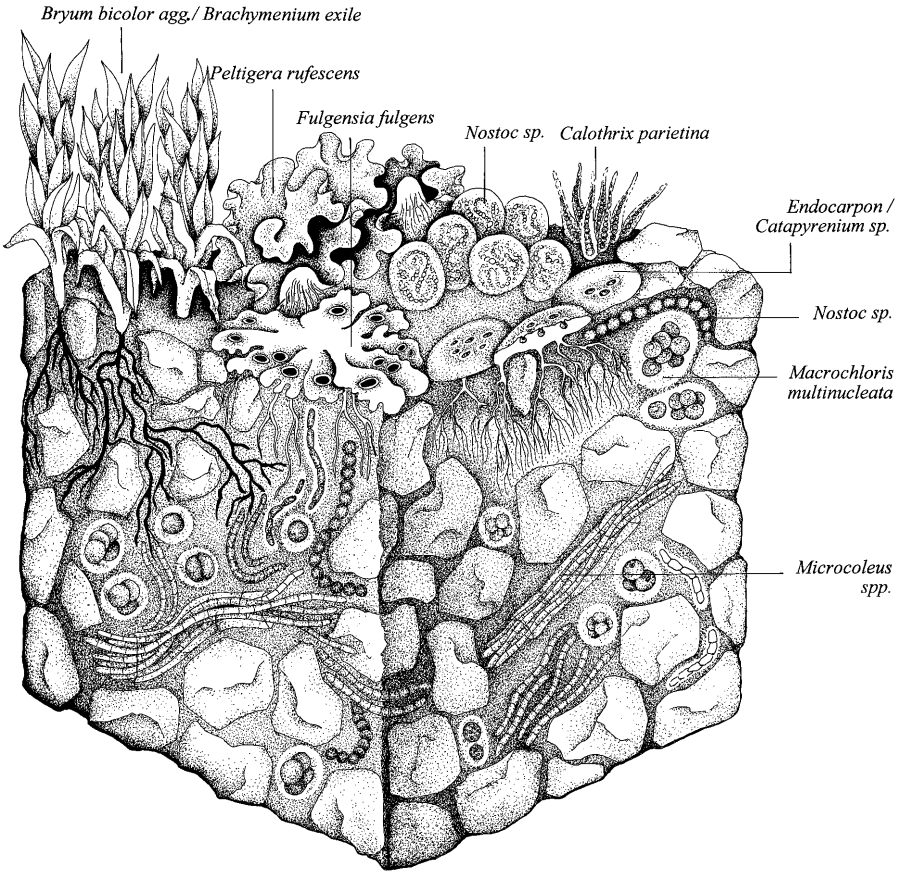
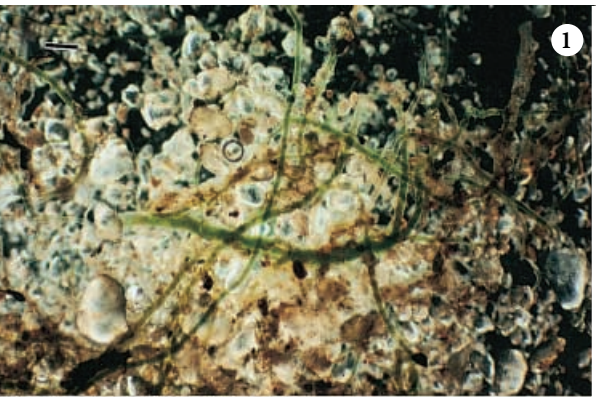


Fig. 1.1. Schematic block diagram of a biological soil crust with typical colonizers. Thickness of the layer about 3 mm, organisms not drawn to scale. (Illustration Renate Klein-Rödder)

1.2 Taxonomic Components of Soil-Crust Communities (Photos 1–28)

Cyanobacteria, and in particular species of the genus *Microcoleus* (Photos 1, 2), provide most of the cohesive quality of the biological soil crusts in arid and semiarid lands. As discussed in detail in Chapter 15, bundles of *Microcoleus* filaments are surrounded by extracellular sheaths which wind throughout the uppermost soil layers. When wet, the filaments glide out of their sheaths, and in a phototactic reaction, move up towards the soil surface. Upon drying, the filaments leave the surface, and the exposed filaments secrete new sheaths. The result of this frequent movement is copious sheath material dispersed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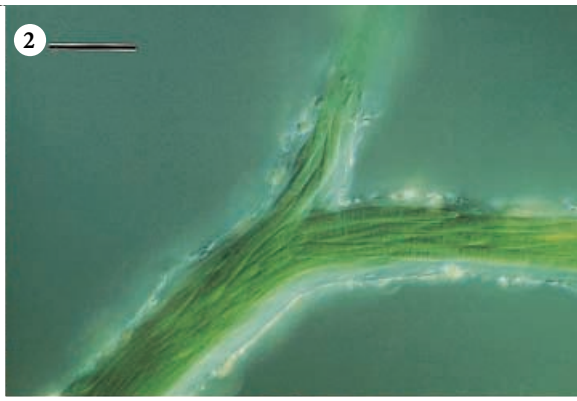
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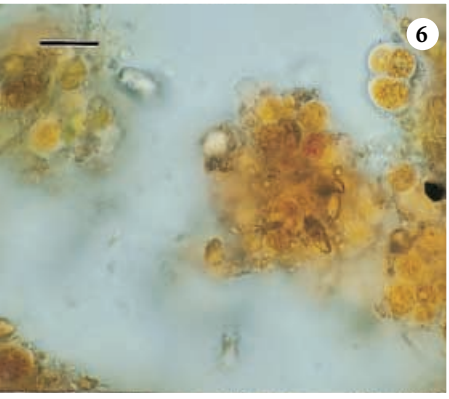
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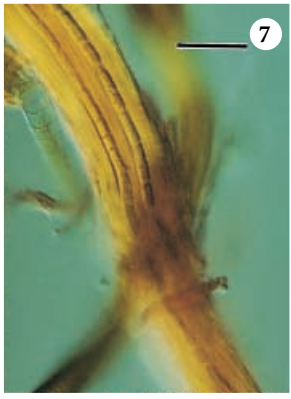
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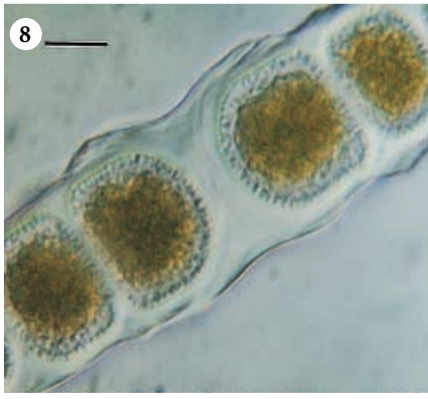
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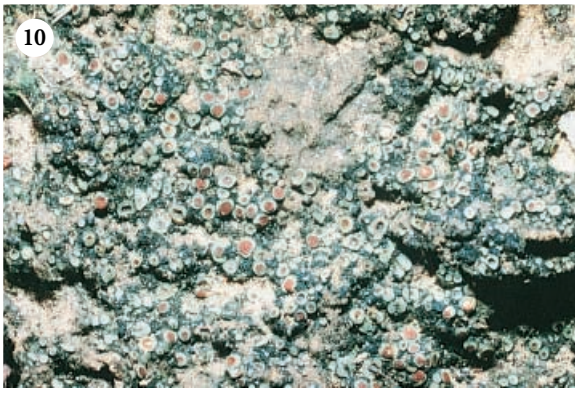
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