1. Introduction

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This volume is devoted to biological soil crusts, a unique microecosystem composed mainly of microorganisms and non-vascular plants. Johnston (1997) provided the following characterization of a biological soil crust: *"Microbiotic crusts are formed by living organisms and their by-products, creating a surface crust of soil particles bound together by organic materials."* Biological soil crusts form an important part of dryland ecosystems (Evans & Johansen 1999; Belnap & Lange 2001; Bowker 2007). Usually, they are composed of cyanobacteria, algae, lichens, mosses and liverworts (Johnston 1997; Evans & Johansen 1999; Deines et al. 2007). Crusts are considered key components of arid ecosystems as they stabilize the soil surface thus reducing wind and water erosion (Evans & Johansen 1999; Belnap 2003) and they increase soil fertility by biotic nitrogen and carbon fixation (Johnston 1997; Hawkes & Flechtner 2002).

In temperate ecosystems of Central Europe biological soil crusts scarcely occur in natural habitats. The only small-scale exceptions are dynamic microhabitats with continuous mechanical disturbance that include e.g., the bases of sandstone cliffs or the slopes of erosion gorges in clay sediments. However, the most extensive areas in Central European landscape with biological soil crusts covering most of the substrate surface are the tree-less parts of abandoned ore and ash-slag sedimentation basins (Pohlová 2004). These toxic localities resist revitalization attempts and vascular plant diversity is usually extremely low (Vaňková & Kovář 2004). Sedimentation basins serve as disposal sites for sludge waste from industrial activity. Ash-slag deposits result from coal heating and power plant operation and ore-washery sedimentation basins are associated with ore mines. In the Czech Republic – a country with 150 years of industrial history – restoration of these habitats has been an important social and scientific issue (Prach 1987; Moldan & Schnoor 1992; Štýs & Braniš 1999; Kovář 2004). However, sedimentation basins with high concentrations of heavy metals also remain largely tree-less and unvegetated, even after decades of succession and repeated reforestation attempts (Figs. 1–6). In such localities, the substrate surface is mostly covered by biological soil crusts which are physiognomically quite similar to their counterparts in semiarid and desert ecosystems (Evans & Johansen 1999; Pohlová 2004). The natural crusts in semiarid ecosystems were found sensitive to mechanical disturbance that led to decrease in productivity and key eco-physiological parameters, as well as to a decrease in diversity (Johnston 1997; Evans & Johansen 1999).

This study is the first attempt to characterize composition, diversity and stability of biological soil crusts at the Central European ash and ore sedimentation basins. We chose five sedimentation basins in the Czech Republic with microbiotic crust cover and we conducted a two-year long investigation of their species composition and diversity. In addition, at the Chvaletice ore-waste sedimentary basin we did experimental mechanical disturbance of the crust cover to evaluate stability of species composition and eco-physiological features of the main organismal groups composing the crust.

Most of the work presented in this volume is a result of a three year project of the Ministry of the Environment of the Czech Republic (no. SM/2/90/05, 2005–2007). This project was primarily devoted to investigation of biodiversity and ecological dynamics of biological soil crusts on anthropogenic substrata of sedimentation basins. We mainly concentrated on four major organismal groups that constitute biological soil crusts as a whole – cyanobacteria and algae, lichens, fungi and mosses (Evans & Johansen 1999). In addition, the project aimed at the comparison of species composition and richness of man-made crust habitats, and several similar natural crust localities, in the temperate Central European landscape. Finally, the soil surfaces of two agricultural localities in Central Bohemia were incorporated into the project as examples of primarily non-crust microhabitats. Here, we specifically looked for possible presence of crust-like micro-communities in order to compare the eventual similarities in their species composition with natural and man-made crust ecosystems.

In individual chapters, we present data on species composition, data on principal abiotic factors and statistical interpretations in order to demonstrate the mutual affinities and differences between individual localities and most interesting species occurring on small-scale natural microbiotic crust localities and on the synanthropic ore-mine habitats.

Mechanical disturbance that distorts the compactness of a crust and enhances erosion is considered one of the most important external ecological factors that hampers or affects the crust development in semiarid habitats (Evans & Johansen 1999; Belnap & Lange 2001; Johansen et al. 2001; Belnap 2002). However, nothing was known on disturbance resistance of temperate crusts on toxic substrates. Therefore, we conducted investigation specifically aimed at the characterization of disturbance effect on diversity, abiotic parameters and ecophysiological properties of crusts in two localities in Czech Republic.

We believe that the presented volume will provide a source of information on diversity and ecology of biological soil crusts in Central European landscape for future studies of this interesting and remarkable microhabitat. In fact, we hope that our research will assist in promoting the future investigation of these habitats in temperate ecosystems.

Finally, we thank both referees of the project at the Ministry of the Environment of the Czech Republic, and the reviewers of mid-term drafts of the project for their valuable comments and recommendations.