Summer School Soil and Water

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SOIL ZOOLOGY

Mini project

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CONTENTS

Figures

Introduction

Soil is one of the most diverse habitats on Earth and contains one of the most diverse assemblages of living organisms. Soil communities are extremely complex, with millions of species and billions of individual organisms being found within a single ecosystem, ranging from microscopic bacteria and fungi, through to larger organisms, such as earthworms, ants and moles. They have a major role in shaping aboveground biodiversity and the functioning of terrestrial ecosystems (Bardgett & Putten, 2014), such as decomposition of organic matter, which has for example beneficial impacts on soil structure and fertility (Wanner 2016a).

Species are commonly classified using taxonomic groups. But there are other criteria that can be used to assemble species, for example their principal food or their feeding mode (Brussaard 1998). According to these habits, they occupy different functions in the ecosystem. Hence, they can be categorized as different functional groups. Furthermore, there are differences in the appearance of differing species and thus in the abundance of members of different functional groups. Species do have various life-history tactics and occupy diverse microhabitats (Brussaard 1998). The conditions in the soil can vary a lot and form therefore several of these different habitats. Soil animals are adapted to their habitat and its conditions such as every other organism. Their distribution is influenced by environmental factors, biome type, above-ground diversity and latitude (Wu, 2011)

In our experiment we dedicated the present species to one of the following functional groups: predators, saprophages, fungivores and bacteriophages. Our aim was to examine two different locations concerning the population density of functional groups of soil meso- and macrofauna. We expected to find differences in the diversity of the appearing species and therefore differences in the abundance of members of the examined functional groups.

Material and Methods

The practical study of soil zoology is based on field sampling and laboratory procedures. In this experiment we examined the meso- and macrofauna of two vegetation types.

The experiment took place in Ceske Budejovice, Czech Republic during the Soil and Water Summer School from 7th to 13th of September 2016. On the first day (afternoon of 7th of September) two soil samples of a meadow were collected in a wetland near Trebon. Therefore we used a metallic cylinder and a shovel and put the samples into several plastic bags. Afterwards, we went to a place near Slavošovice where we collected three soil samples located under several trees.

The extraction and investigation of the animals in the soil samples took place in a laboratory of University of South Bohemia, Ceske Budejovice five days after collecting (12th of September). Therefore, we used two methods, the Berlese and Tullgren extraction.

To seperate the mesofauna from the soil we chose the Berlese method. We put the soil samples into various sieves which were inside a sinkhole. A testing tube was below the sinkhole which was filled with water. By putting a light bulb over the samples we created a gradient of dark/light and moisture/dry. The soil organisms followed this gradient, so they passed the pores of the sieve into the sinkhole.

The setup of the Berlese method is shown in Figure 1 (Wanner 2016b).

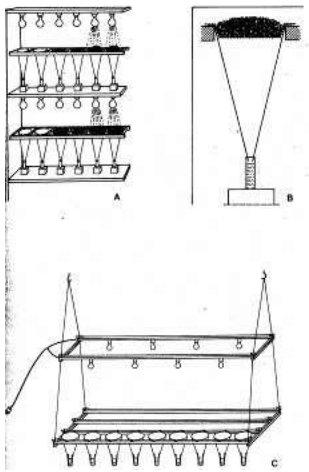

Figure 1. Method of Berlese/Tullgren extraction

The macrofauna was examined by the Tullgren method. We put the soil samples into a big sieve which was inside a bucket. The bucket was filled with water. We added some detergent to destroy the surface tension of the water, so the soil organisms could not come out of the bucket. As in the Berlese method, a light bulb above the samples created a gradient of dark/light and moisture/dry. The organisms went along the gradient and were collected in the water of the bucket.

For the investigation of the soil organisms we used binoculars. The samples of the sieves were put onto a Petri plate. Under the binocular we identified the individuals with a systematic key (Key to most common organisms in humus by Chomel – IMBE 2015) and counted them.

Results

As a result, in the wet meadow locality were dominant *oribatid mites* , among *gamasida* and other *acari species*, there were less numerous bacteriophages and saprophages for example *epigeic collembola*. The highest number of species was found on forest diversity, especially *endogeic collembola*, *oribatid mites* and *"other acari"* were very common. Also *epigeic collembola, gamasida, "insects", diptera, spiders, myriapoda, coleopteran larva, isopoda, hymenoptera, chilopoda* species were registered (Figure 3). In this study, our experiment showed differences with wet meadow, where fungivores are more abundant (49%), compared with the forest locality where bacteriophages (35) was the most common group (Figure 2).

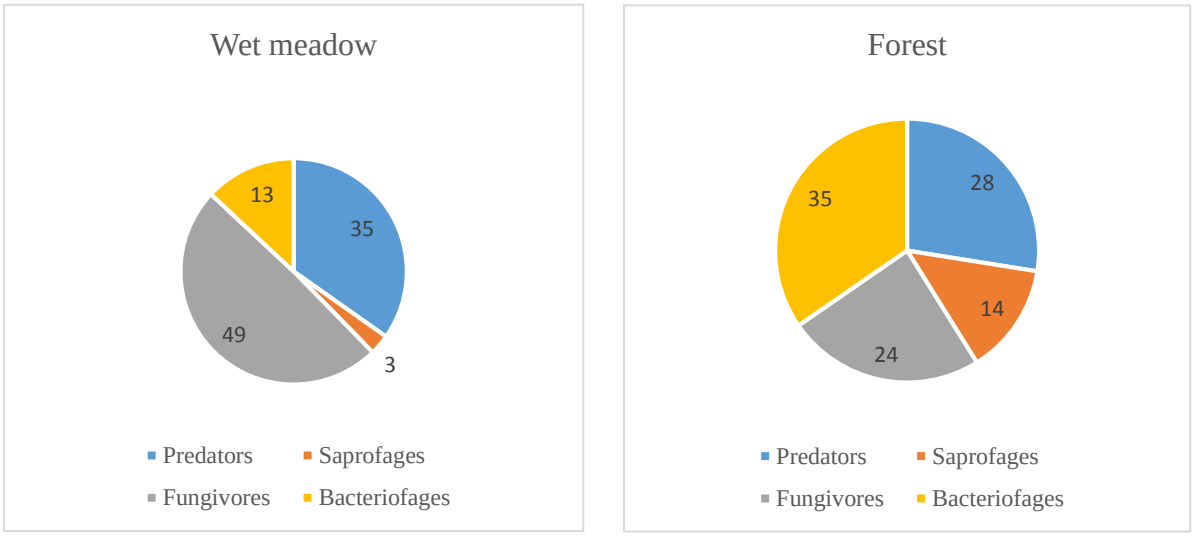

Figure 2. Diagram with different proportion of taxonomical groups from wet meadow and forest localities.

By means of statistical analysis on R, we compared the diversity from wet meadow and forest habitat. It´s summarizing the numbers of species, which is showing that in forest locality there are more different soil animals (Figure 3).

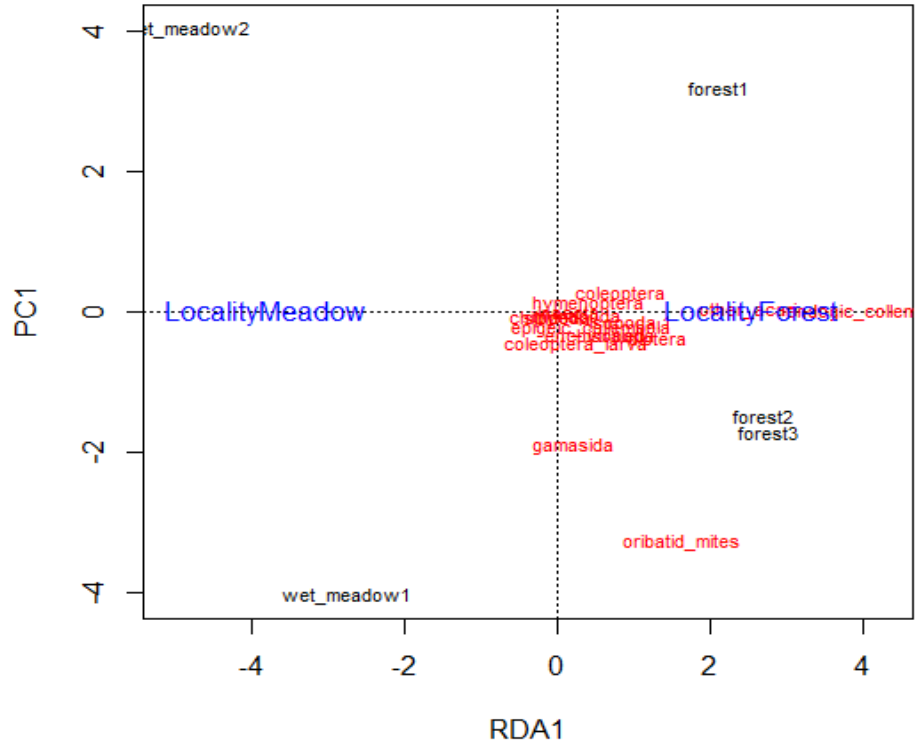

Figure 3. Ordination diagram with different proportion of species from meadow and forest diversity.

Comparing the the functional groups results with different proportion of species (Figure 3) then it´s confirming the same, also more taxonomical groups (fungivores, predators, saprophages, bacteriophages) are in forest localities (Figure 4).

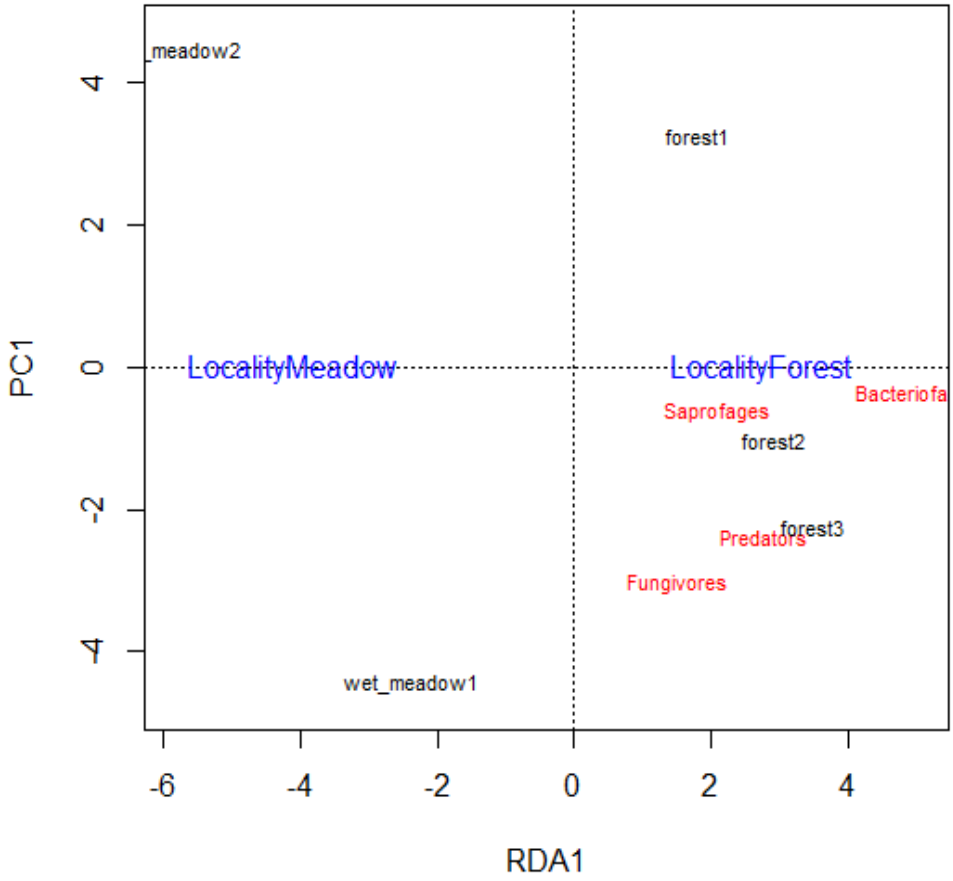

Figure 4. Ordination diagram with different proportion of taxonomical groups from meadow and forest diversity.

Discussion

The examined samples showed that most of the functional groups were present at the investigated plots. There were predators (*gamasina mites*), saprophages (*epigeic colembola*), fungivores (*oribatid mites*) and bacteriophages (*endogeic colembola*). A significant difference in the local meso- and macrofauna could be explained by two different types of vegetation and their carbon/nitrogen-ratio (C/N-ratio). The high C/N-ratio in wetlands leads to difficulties in decomposition for most soil organisms. Only fungi are able to decompose under such conditions and therefore more fungivores are living in wetlands. Furthermore, the higher water level compared to forest soil puts soil fauna under water stress and leads to a hostile environment for soil animals. So in forest soil are more functional groups compared to the soil of wet meadows.

To make a statement about the biodiversity further studies which include the amount of local species are required.

Conclusion

The soil fauna is very important to study because different species of soil animals are living there, responsible for many important processes. There are several possible factors influences the soil animal distribution. Our experiments indicate that there are significant differences between wet meadow and forest localities which are representing different species of soil animals. We confirm that forest soil diversity is a more functional group-, compared to the soil of wet meadows, which could explained by two different types of vegetation and their carbon/nitrogen-ratio (C/N-ratio).

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