STUDY OF THE DIVERSITY OF SOIL ANIMALS COMMUNITY IN THE SONGNEN PLAIN GRASSLAND OF CHINA

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Abstract

This paper dealt with the diversity in eight habitat soil animals communities in Songnen plain grassland. The results showed the better habitat condition the higher diversity index of soil animals, and vice-versa. The diversity of soil animals communities correlated positively with soil organic matter, total nitrogen, and negatively with soil pH; there was a poor correlation with soil water content and total soil phosphorus. The diversity of soil animals communities decreased with increasing depth of soil layer and has surface-collection.

Keywords: China, Songnen plain, grassland, soil animals, diversity

Introduction

The ecological study of soil animals has a history of fifty years. China has studied it since 1970, but the study of soil animals in grassland is not well known (Dongmei, 1984; Xiuqin et al, 1993), and the diversity study of soil animals communities has not been reported. The paper makes a study of diversity of soil animals communities in Songnen plain grassland

(Yingqian and Keping, 1994), so as to know about the distribution and condition of soil animals diversity and the relation between diversity and ecological factors. It shows status and function of soil animals in the ecological system and provides a scientific basis for the protection and sustained use of biodiversity.

Material and Methods

In Changling country in Songnen plain grassland we sampled eight typical habitats of *Ulmus* sparse woods sandy dune (I), *Stipa grandis* sandy land (II), *Calamagrostis epigeios* flat land (III), *Leymus chinensis* flat land (IV), *Heleocharis intersita* lower wet land (V), *Hemarthria japonica* lower wet land (VI), *Suaeda corniculata* lower alkali land (VII) and *Puccinellia tenuiflora* lower alkali land (VIII). Four sites were located in each habitat and soil samples were taken at 5 layers depth (0-5cm, 5-10cm,10-15cm,15-20cm and 20-30cm) at each site. In this way total sample number was 160. The sample area of the large, middle and small soil animals, and wet habitat soil animals were 50cm×50cm, 10cmx10cm and 5cmx5cm, respectively. Animals were separated from soil by hand-picking using Tullger and Baermann funnels (Aoky,1973). Species identifications on number were recorded and soil water content, pH value and soil nutrient content at each layer. The differences of soil animals groups number in eight habitats were calculated using the Shannon-Wiener formula of diversity index. Through analyzing the different ecological factors step by step the correlation between soil animals and different ecological factors was estimated by least square method.

Results and Discussion

The constitution of species groups and numbers of soil animals. A total of 6603 soil animals and 86 groups in 8 habitats were obtained, belonging to 4 phyla, 6 classes, 27 orders and 64 families. Large-scale soil animals are represented by 55 groups; middle and

small soil animals make 52 groups and wet soil animals make 8 groups. The groups constitute the main body of soil animals in Songene plain grassland.

The diversity distribution of soil animals groups in different habitats. There are certain differences of soil animals structure and function in different habitats, these differences determine the species (groups) constitution. Table 1 displays the higher equal degree in I, II, III and IV habitats as compared to the equal degree in V, VI, VII and VIII habitats. The diversity index is high and it demonstrates that the first four habitats are better than the latter four habitats. The VIII habitat is the worst of all, with the lowest diversity index and equal degree, but dominant degree is the highest. It shows the unequal distribution in soil animals. In Table 1, the diversity index, equal degree and dominant degree clearly display the difference of soil animals groups between species constitution and communities organization level in Songnen plain grassland.

The relation between the diversity of soil animals communities and ecological factors. The distribution of soil animals is influenced by several ecological factors whose effects differ greatly. The paper emphasizes the relationship between group number of soil animals with the soil water content, organic matter, total phosphorus, total nitrogen and pH value. From Figure 1 we can see these factors have different demonstration in different habitats.

Soil animals group number correlated positively with % soil organic matter: $y = 3.97 + 16.50x$; $r = 0.74$; % total nitrogen: $y = 10.3 + 226.7x$; $r = 0.57$; and negatively with soil pH: $y = 156 - 13.46x$; $r = -0.69$ but did not correlate with soil water ($r = -0.4$) and total soil phosphorus ($r = 0.37$). So soil organic matter and soil pH are the ecological factors playing the main role. The effect of main factors varies with habitats.

The relation between diversity of soil animals communities with soil layer depth. The distribution of soil animal groups in different soil layers in eight habitats obeys obvious

law. The diversity of soil animal groups in the surface soil is abundant and decreases with the increasing depth of soil layer, related to soil nutrient content and pH value. In general soil animals groups and individual number have positive relation with soil nutrient content. Soil nutrient level decreases with the increasing depth of soil, and the number of soil animals also decreases. The groups number of soil animals and individual number have negative relation with pH value, meaning that the high pH value has a restriction to soil animals.

From above it shows the better habitat condition the higher the diversity index of soil animals and the worse habitat condition, the lower the diversity index of soil animals. The diversity index of 8 habitats is IV>II>III>I>VI>VII>V>VIII. The diversity of soil animals communities have positive relation with soil organic matter and total nitrogen, and have negative relation with pH value, and have no obvious relation with soil water content and total phosphorus. The diversity of soil animals communities in different soil layer depth decreases with the increasing depth of soil layer and has obvious surface-collection.

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Table 1 - Diversity index, equal degree and dominant degree of soil animals in different habitats.

Habitat	Group Number	Individual Number	Diversity Index	Equal Degree	Dominant Degree
I	40	1652	2.0426	0.4586	0.2166
II	35	1209	2.2992	0.5162	0.1503
III	41	1462	2.0708	0.4649	0.2164
IV	36	579	2.3226	0.5214	0.1999
V	16	395	1.5605	0.3503	0.2784
VI	25	326	1.8107	0.4065	0.2778
VII	20	523	1.7116	0.3842	0.2853
VIII	13	457	0.8856	0.1988	0.5519
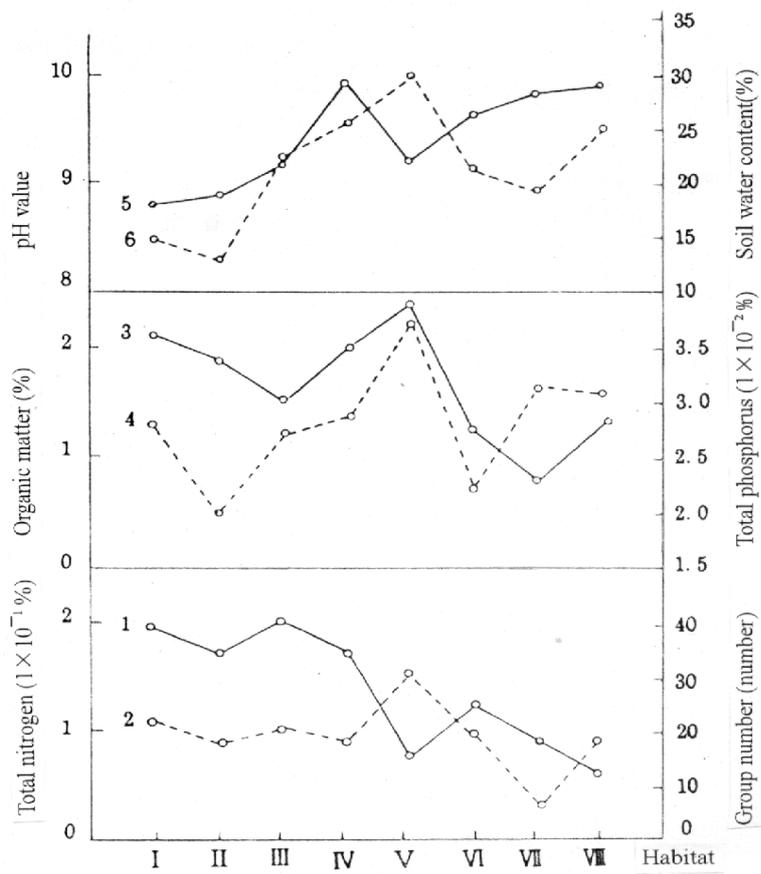
1. Group number   4. Total phosphorus
2. Total nitrogen   5. pH value
3. Organic matter   6. Soil water content

Figure 1 - The relationship between soil animals groups and ecological factors in different habitats