ABUNDANCE AND SPECIES DISTRIBUTION PECULIARITIES OF ORIBATID MITES (ACARI: ORIBATIDA) IN REGENERATING FOREST SOILS

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Abstract. The abundance, diversity and community structure of soil mites (Acari: Oribatida) in regenerating forest soils were investigated. The study of oribatid mites in soil of a 16-year-old pinewood showed that their abundance was 29.7 thousand ind. m^{-2} on average. Seven species of orbatid mites were detected. Analysis of the dominant structure of oribatid mites revealed a distinct eudominance of one species, *Oppiella nova*, which constituted 55.3% of the whole community of oribatid mites. *Tectocepheus velatus* and *Brachychthonius sp*. remain the dominant species. The study of oribatid mites in soil of a 40-year-old pinewood showed that their abundance was 60.5 thousand ind. m^{-2} on average; 35 species of orbatid mites were detected. *Oppiella nova*, constituting 44.0 % of all oribatid mites, is an eudominant species in soil. *Tectocepheus velatus*, *Suctobelba* sp., *Suctobelbella* sp., *Medioppia obsoleta*, and *Microppia minus* are subdominant species. Five species of oribatid mites new for Lithuania were identified in the investigated localities.

Key words: Oribatida, community structure, forest soil

Introduction

The study of soil microarthropods is particularly bewildering due to the peculiarities of the habitat and the diversity of its dwellers (Noti *et al*., 2003). One of the most important problems in ecology is to elucidate the factors that drive succession in ecosystems and thus influence the diversity of species in natural vegetation (De Deyn *et al*., 2003).

Traditional approaches to soil quality evaluation were based on the use of physical, chemical and microbiological indicators. Recently, new methods based on soil microarthropods have been proposed for soil quality evaluation. Mites are excellent subjects because they often constitute more than 80% of all arthropods living in soil (Peterson & Luxton, 1982); they are sensitive to soil conditions, and both their sampling methods and taxonomy are well developed. The morphologically highly diverse Oribatid mites constitute the order richest in species in the Acari subclass: by their very high number, both individual and specific, they are among the most important terricolous arthropod groups. Their activity might be of decisive importance in the life of soil and processes of energy turnover (Balogh & Mahunka, 1983).

Our research focused on one taxonomic group of mites – Oribatida. Oribatid mites participate in the decomposition of soil organic matter as saprophages and mycophages. By consuming plant and animal residues, grazing on soil fungi and bacteria, producing faecal pellets and dispersing microbial propagules, Oribatida promote the formation of

humus in the soil, assist in the microbial recolonization of litter material, stimulate microbial metabolism, and aid in maintaining soil structure and fertility (Maraun & Scheu, 2000).

The aim of this paper is to present data on the abundance and species diversity of oribatid mites (Acari: Oribatida) in forest soils of different regenerating age of Lithuania.

Material and Methods

The study was conducted in a 16-year-old naturally regenerating forest after long-term intensive land cultivation (Obelų Ragas, Švenčionys district, 55°17'12,0"N, 26°02'45,0"E) and in a 40-year-old planted forest (Verkšionys, Trakai district, 54°47'42,0"N, 24°54'40,0"E).

A 16-year-old forest soil is *albic luvisols*; a 40 years ago planted pine forest soil type is *arenosols*. Scots pine (*Pinus sylvestris*) is a dominant species in both of these areas.

Soil samples were taken five times from the top soil layer (0–5 cm) of each investigated sector with the aid of cenometer (5 × 5 × 5 cm) in accordance with standard methods (Giliarov & Striganova, 1987). Microarthropods were extracted from the soil with a modified Tullgren–Berlese light extractor. Abundance (n) (thousand ind. m^{-2}) and the number of oribatid mite species (*S*) were calculated for the analysis of the collected material. The structure of oribatid mite complexes was expressed in percentage. Species dominance was determined in accordance with H. Engelman (Engelmann, 1978). The nomenclature follows the Fauna Europaea database (Fauna Europaea Web Service, 2010).

Species new for the Lithuanian fauna are marked with an asterisk (*).

Results

During the period of three-year studies, a total of 60 soil samples were taken, and 42 species of oribatid mites (Acari: Oribatida) were identified. Five new for Lithuania species of oribatid mites were recorded in the studied sites: *Moritzoppia unicarinata* (Paoli, 1908), *Lauroppia maritima* (Willmann, 1929), *Sphaerozetes tricuspidatus* Willmann, 1923, *Diapterobates oblongus* (C. L. Koch, 1879), *Chamobates pusillus* (Berlese, 1895)

The abundance of oribatid mites in soil of a naturally regenerating 16-year-old pinewood was 29.7 thousand ind. m^{-2} on average. Seven species of oribatid mites were detected. Analysis of the community structure of this most widespread group of microarthropods in a naturally regenerating soil in accordance with H. D. Engelman's (1978) species dominance classification revealed a distinct eudominance of one species, *Oppiella nova* (Oudemans, 1902), which constituted 55.3% of the whole community. *Tectocepheus velatus* (Michael, 1880) and *Brachychthonius* sp. made up 23.5 and 13.5%, respectively, representing dominant species. Subrecedent species (*Latilamellobates incisellus* (Kramer, 1897), *Scutovertex minutus* (C. L. Koch, 1836), and *Scheloribates latipes* (C. L. Koch, 1844)) were not numerous. Their abundance was found to range from 0.02 to 1.0 thousand ind. m^{-2} on average.

The abundance of oribatid mite community in soil of the planted 40-year-old pinewood was 60.5 thousand ind. m^{-2} on average. Orbatid mites of 35 species were recorded. *Oppiella nova*, representing 44.0% of all mites, was an eudominant species of

the community. *Tectocepheus velatus*, *Suctobelba* sp., *Suctobelbella* sp., *Medioppia obsoleta* (Paoli, 1908), and *Microppia minus* (Paoli, 1908) constituting 4.0 to 10.0% of all Oribatida were subdominant species. Recedent (4) and subrecedent (25) species formed the remainder of the community.

List of species

Oribatida species in 16-year-old forest (Obelų Ragas)

BRACHYCHTHONIIDAE
***Brachychthonius* sp.**
TECTOCEPHEIDAE
***Tectocepheus velatus* (Michael, 1880)**
OPPIIDAE
***Oppiella nova* (Oudemans, 1902)**
SUCTOBELBIDAE
***Suctobelbella* sp.**
SCUTOVERTICIDAE
***Scutovertex minutus* (C. L. Koch, 1836)**
SCHELORIBATIDAE
***Scheloribates latipes* (C. L. Koch, 1844)**
CERATOZETIDAE
***Latilamellobates incisellus* (Kramer, 1897)**

Oribatida species in 40-year-old forest (Verkšionys)

BRACHYCHTHONIIDAE
***Brachychthonius* sp.**
PHTHIRACARIDAE
***Phthiracarus borealis* (Trägardh, 1910)**
***Phthiracarus* sp**.
NOTHRIDAE
***Nothrus silvestris* Nicolet, 1855**
CAMISIIDAE
***Heminothrus peltifer* (C. L. Koch, 1839)**
TRHYPOCHTHONIIDAE
***Trhypochthoniellus badius* (Berlese, 1905)**
DAMAEIDAE
***Epidamaeus* sp.**
BELBIDAE
***Metabelba* sp.**
LIACARIDAE
***Adoristes poppei* (Oudemans, 1906)**
TECTOCEPHEIDAE
***Tectocepheus velatus* (Michael, 1880)**
OPPIIDAE
****Moritzoppia unicarinata* (Paoli, 1908)**

***Lauroppia maritima* (Willmann, 1929)**
***Lauroppia neerlandica* (Oudemans, 1900)**
***Medioppia obsoleta* (Paoli, 1908)**
***Microppia minus* (Paoli, 1908)**
***Oppia* sp.**
***Oppiella nova* (Oudemans, 1902)**
QUADROPPIIDAE
***Quadroppia quadricarinata* (Michael, 1885)**
SUCTOBELBIDAE
***Suctobelba* sp.**
***Suctobelbella* sp.**
MICREREMIDAE
***Micreremus brevipes* (Michael, 1888)**
ORIBATULIDAE
***Oribatula tibialis* (Nicolet, 1855)**
PROTORIBATIDAE
***Liebstadia humerata* Sellnick, 1928**
SCHELORIBATIDAE
***Scheloribates latipes* (C. L. Koch, 1844)**
CERATOZETIDAE
***Ceratozetes* sp.**
***Sphaerozetes tricuspidatus* Willmann, 1923**
***Trichoribates trimaculatus* (C. L. Koch, 1836)**
***Diapterobates oblongus* (C. L. Koch, 1879)**
***Diapterobates numerosus* (Sellnick, 1924)**
CHAMOBATIDAE
***Chamobates pusillus* (Berlese, 1895)**
***Chamobates* sp.**
PHENOPELOPIDAE
***Eupelops duplex* (Berlese, 1916)**
***Eupelops occultus* (C. L. Koch, 1836)**
***Eupelops* sp.**
GALUMNIDAE
***Galumna* sp.**

Discussion

Each type of soil and habitats are characterized by a distinctive group of organisms of the soil composition and the functional relationships between them. Activity of microarthropods in different habitats is often associated with changes in environmental conditions and substrate quality. J. M. Anderson and H. Hall (1977), R. A. Hansen and D. C. Coleman (1998), and R. A. Hansen (2000) found that oribatid richness positively correlated with microhabitat heterogeneity. Oribatid mites are inhabitants of weakly acid and acid soil.

It is possible to assert that even after 16 years just the initial properties characteristic of natural ecosystems are observed in the process of oribatid mite community formation: the change of core species, a decrease of dominants, and a gradual increase in recedent

species. Eudominance of a single species (*Oppiella nova)* in the dominant group of microarthropods (Oribatida) demonstrates that the succession of this soil ecosystem has not yet reached the level of a stable and self-regulating system. Moreover, it is characterized by properties of cultivated land cenoses.

Oribatid mite communities in the soil of a naturally regenerating 16-years-old pinewood demonstrated a lower species diversity than did 40-year-old planted pinewood communities.

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Oribatidinių erkių (Acari: Oribatida) gausumo ir rūšių pasiskirstymo ypatumai atsikuriančių miškų dirvožemiuose

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Santrauka

Tirti dirvožemio erkių (Acari: Oribatida) gausumo ir rūšių pasiskirstymo ypatumai skirtinguose atsikuriančių miškų dirvožemiuose.

Tyrimai parodė, kad oribatidinių erkių gausumas 16 metų pušyno dirvožemyje siekia vidutiniškai 29,7 tūkst. ind. m^{-2}. Aptiktos 7 oribatidinių erkių rūšys. Analizuojant oribatidinių erkių dominantinę struktūrą pagal H. D. Engelmano (Engelmann, 1978) rūšių dominavimo klasifikaciją, pastebėta, kad ryškus eudominantas yra viena rūšis, *Oppiella nova*, kuri sudaro 55,3% visų erkių. *Tectocepheus velatus* and *Brachychthonius* sp. sudaro atitinkamai 23,5 ir 13,5% ir lieka dominantų lygyje. Labai retų rūšių negausu. Prieš 40 metų sodinto miško dirvožemyje vidutinis oribatidinių erkių gausumas 60,5 tūkst. ind. m^{-2}. Aptiktos 35 oribatidinių erkių rūšys. Eudominantas yra *Oppiella nova*, kuri sudaro 44,0% visų oribatidinių erkių. Subdominantai – *Tectocepheus velatus*, *Suctobelba* sp., *Suctobelbella* sp., *Medioppia obsoleta* ir *Microppia minus* – sudaro nuo 4,0 iki 10,0%. Likusią oribatidinių erkių bendrijos dalį sudaro retos ir labai retos rūšys. Šiame 40 metų sodinto miško dirvožemyje aptiktos 5 naujos Lietuvos faunos oribatidinių erkių rūšys.

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