Influence of Nutrient Recharges on Oribatid Mites (Acari: Oribatei)

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The aim of the present study was to determine the influence of mineral fertilization on oribatid mites belonging to the mesofauna of the soil. These mites have a soil forming function of decomposing the litter so it is not indifferent how they react to fertilization.

According to HEUGENS and VAN DAELE /1981/ mineral fertilizers do not immediately act as a source of nutrition but increase, as soon as applied, the salt concentration of the soil. Populations of some Oribatid mite species decreased in number with the increase of salt concentration. By adding nitrogen to the soil RONDE /1959/ observed an increase in the mite population, with the exception of the Oribatei. MOURSI /1962/ realized that ammonia was toxic to mites. CAREY et al. /1971/ found that potash fertilizer was favourable for Oribatei mites. HAUSSER et al. /1969/ noted that phosphorus acted in the same way. A shock effect was recorded by HUHTA et al. /1967/ aftér application of NPK and lime to soil under Norway spruce. While BEHAN et al. /1978/ found that after nitrogen fertilization there was an initial decrease in Acarina population density which increased rapidly later.

Materials and methods

A 17-year-old Scotch pine /Pinus silvestris/ stand was studied near Bögöte village under an acid non-podzolic brown forest soil with pH/H_2O/ 3.9-4.6 and pH/KCl/ 3.0-3.6. The territory belongs to a hornbeam-oak climatic zonal forest association, with a mean annual precipitation of 680 mm.

Previously, Robinia Pseudo-Acacia was planted on the former arable land and 17 years ago, after cutting the Robinia stand, the land was afforested with Scotch pine.

In the summer of 1987 mineral fertilization experiments were set up with 8 different combinations of fertilizers /N,P,K/ in random blocks in 3 replicates, including the control /Table 1/. 270 kg/ha ammonium-nitrate, 90 kg/ha P_2O_5 and 180 kg/ha K_2O were added to the study plots of 0.1 ha area. Only data of two replicates are reported here. The various doses of fertilizers were calculated on the basis of the estimated nutrient content of the needle mass, the total N content of the soil, the easily soluble P-content /AL-P/ and K-content /AL-K/ of the soil.

Table 1
Fertilization experiment in random blocks in 3 replicates /I, II, III/

I.	N, P, K	∅
	N, P, K/2	N/2, P, K
	N, K	N, P
	N, P/2, K	P, K
II.	N, P	N, K
	∅	P, K
	N, P/2, K	N, P, K
	N/2, P, K	N, P, K/2
III.	N, P, K/2	N, P/2, K
	N, P, K	N, K
	N/2, P, K	P, K
	N, P	∅

∅: untreated control; N: 270 kg NH_4NO_3/ha;
P: 90 kg P_2O_5/ha; K: 180 kg K_2O/ha.
Study plot: 0.1 ha.

The fertilizer doses were dug in holes spaced at 2x2 m. The plots were treated, with P and K in the late summer of 1987 and with N in the early spring of 1988.

Two samples were taken from the top 10 cm layer of the soil covered with litter from each plot twice in 1988. The first sampling was in late May, when the soil temperature /at 10 cm depth/ was 25.3 °C and soil moisture content 23-32%. The second sampling was in early October at 13.3 °C soil temperature and 14-23% soil moisture content. The large amount of gravel /15-17%/ and thick roots made the sampling difficult. Soil animals were extracted by Balogh's paper funnel extractor /BALOGH, 1962/ into isopropanol at room temperature for four weeks. Mites were separated into groups and counted under binocular microscope /100x/. Adults of Oribatid mites were identified to species under high power microscope.

Results and discussion

Low density of Oribatid mites and generally few species featured all the experimental plots. There were 27 species altogether in 64 samples. Adults of 19 species were counted. The occurrence of the other 8 species were so rare that they were not counted. Table 2 lists the 27 species. The number of the individuals in the different plots varied from 101 to 770/500 cm^3. There were only few nymphs in the samples on both occasions. Unfavourable soil conditions as well as former agricultural cultivation and subsequent change of the tree species may have resulted in the low number of mite species. There was no relationship between the species occurring in the plots or the numbers of their individuals and the fertilization treatments. Several factors could be the cause of the fact that the mite population did not change appreciably in the first year after fertilization. Among others the form of the fertilizers - powder or granulated - and the way of fertilization - in holes spaced at 2x2 m - may make absorption slow. In addition a relatively long dry period followed the treatment.

The Oribatid mite fauna of the control plots did not essentially differ from that of the treated ones. All of the 27 species were present on the

Table 2
List of all oribatid mite species recorded at the study site

Oribatid mite species	%	
Phthiracarus longulus /C. L. KOCH, 1841/	+	0.90
Hypochthonius rufulus /C. L. KOCH, 1836/	+	0.03
Hypochthonius luteus /OUDEMANS, 1917/		
Hypochthoniella minutissima /BERLESE, 1904/	+	0.62
Nothrus borussicus /SELLNICK, 1929/	+	0.04
Camisia spinifer /C. L. KOCH, 1836/	+	0.35
Platynothrus peltifer /C. L. KOCH, 1840/	+	4.05
Trhypochthonius tectorum /BERLESE, 1896/	+	0.14
Damaeus onustus /C. L. KOCH, 1844/	+	2.37
Adoristes ovatus /C. L. KOCH, 1840/	+	7.93
Xenillus tegeocranus /HERMANN, 1804/	+	0.59
Ceratoppia quadridentata /HALLER, 1880/	+	3.12
Carabodes coriaceus /C. L. KOCH, 1836/	+	0.32
Tectocepheus sarekensis /TRAGARDH, 1910/	+	4.21
Oppia ornata /OUDEMANS, 1900/	+	51.30
Oppia subpectinata /OUDEMANS, 1901/		
Oppiella nova /OUDEMANS, 1902/		
Quadroppia quadricarinata /MICHAEL, 1885/		
Suctobelba subcornigera /FORSSLUND, 1941/		
Suctobelba falcata /FORSSLUND, 1941/		
Scheloribates laevigatus /C. L. KOCH, 1836/	+	8,21
Protoribates badensis /SELLNICK, 1928/	+	0.02
Xylobates lophotricus /BERLESE, 1904/	+	11.42
Ceratozetes minutissimus /WILLMANN, 1951 /spn//	+	0.02
Trichoribates trimaculatus /C. L. KOCH, 1836/		
Oribatella reticulata /BERLESE, 1916/		
Achipteria coleoptrata /LINNÉ, 1758/	+	0.60

+: counted

control plots, 11 of them in great numbers, and all 27 species occurred in the treated plots, too. They belong to the decomposers of the litter so their importance is great. As regards the whole study site, Oppia ornata accounted for more than half /51%/ of the total Oribatei population. They were dominant on all of the plots, including the controls.

While the distribution of small Oppia ornata was quite uniform, large Xylobates lophotricus was observed in discrete spots. Large mites are known to live in "aggregates" in the soil /BALOGH, 1953, SCHENKER, 1986/. Xylobates l. also seemed to do so. While they lived in extremely high density on one of the control plots /57%/ and on the neighbouring plot treated with N/2,K,P /45%/ they were absent on some parts of the area. Since the study area seemed to be homogeneous this kind of localization of the Xylobates l. groups cannot be explained. It is not indifferent - in case the mites appear in aggreates - which part of the experimental plot the sample has been taken from.

For example 305 and 21 individuals of Xylobates l. species were present in the spring while in the autumn 4 and 101 individuals of Xylobates l. were present on the two replicate sampling points of the same untreated plots. Scheloribates leavigatus /8%/ were found everywhere, apart from two

neighbouring plots, with relatively high density in the autumn. The quite common Adoristes ovatus represents 8% of the total Oribatei fauna. Significant increase in their numbers was observed on all the treated and untreated plots in the autumn compared to the spring numbers. Ceratoppia quadridentata also showed an increase in density, although to a lesser extent, in the autumn. In contrast with them, the number of the individuals of Tectocepheus sarekensis was higher in spring than in autumn. While they were present in great numbers on some plots /119/500 cm^3/ they were totally absent from others. Platynothrus peltifer populations were large in the spring but represented only a small proportion of Oribatei population on the same sampling site in autumn.

Conclusions

In the first year after fertilization no significant changes occurred in the Oribatei population either in number or in composition.

The statistical analysis has not been performed in lack of sufficient data. The influence of nutrient recharges will be studied further for 4 years. Only frequent analyses can reveal the long-term effects of these treatments.

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