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Significance of the Microhabitat on the Distribution of Oribatid Mites in a Hornbeam-oak Mixed Forest*

By

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Abstract. This study analyzes the distribution of Oribatid mites in and outside earthworm burrows in a deciduous woodland. It was revealed that the burrows could be considered as suitable microhabitats for the Oribatids, especially Oppiidae, shown by their presence in great numbers and high frequencies in earthworm burrows.

It has been generally accepted that earthworms, particularly large-bodied species, play an important role in the process of soil industry (Zicsi, 1975, 1978). In doing this, earthworms make burrows, pulling organic matter into the soil. The present work aimed to investigate the significance of earthworm burrows, as a microhabitat, on the population dynamics of Oribatid mites. This work forms a part of a series of studies carried out in Hungarian deciduous woodlands since 1971 to investigate the zootic influences on the process of litter breakdown (Dózsa-Farkas, 1978; Loksa, 1978; Zicsi & Pobozsny, 1977; Zicsi, Pobozsny & Szlávecz, 1978).

Material and method

The study was conducted in a hornbeam-oak mixed forest located on Cserhát Mountain, about 50 km northeast of Budapest. The vegetations of the study area was described by Isépy (1974, 1977).

Monthly soil samples were taken on a random basis. Sampling began on November 1975 and lasted till November 1976. In January, however, it was impossible to sample the soil as it was frozen. Ten parallel soil samples were obtained on each sampling occasion from earthworm burrows, and another set of ten samples were taken just near the burrows. The soil sampler was a thin-walled steel cylinder of 20 cm^2 surface area and 5 cm deep. Oribatids were extracted

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using Berlese's apparatus with smooth perispane paper funnels, the extraction period lasted for one week at room temperature. The mites were counted and identified.

Results and discussion

A list of species of Oribatid mites occurring in the investigated area is presented in Table 1. 59 species were found to be accidental as they appeared only in few samples with a very small individual number. 25 species showed a relatively moderate number of individuals, and only 2 species, namely *Oppia obsoleta*, and *Oppia ornata*, were found with high frequency and dominancy during the whole experimental period.

Fig. 1.

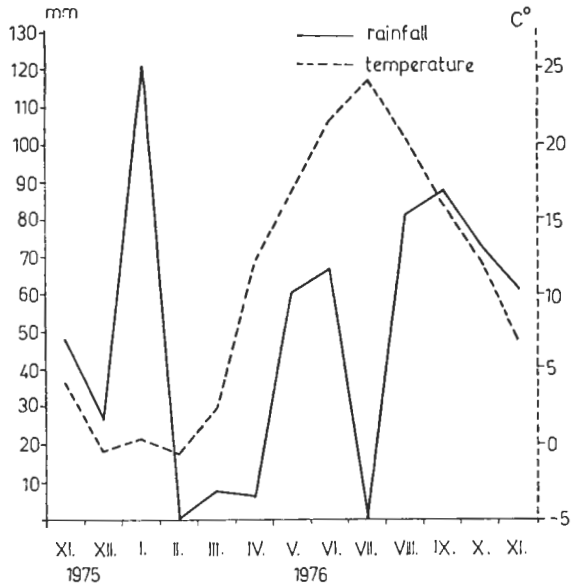

Fig. 1: Monthly rainfall and soil temperature at 5 cm depth

The total number of individuals monthly recovered from samples of earthworm burrows and those taken near it were subjected for analysis of significance using t-test, revealing no significant difference at 5% level of probability between all months, except for November 1975, July and September 1976 where the number of individuals in earthworm burrows was much higher than that in samples taken near the burrows.

It is clear from Fig. 2 that the total number of individuals recovered from samples of earthworm burrows, in addition to those taken near it reached a maximum is September 1976, while it showed a minimum in December 1975. This increase in the total number of individuals in September 1976 can be attributed to the fact that the litter, at that time, was in its later stage of decomposition due to the activity of soil macrofauna, mainly the earthworms.

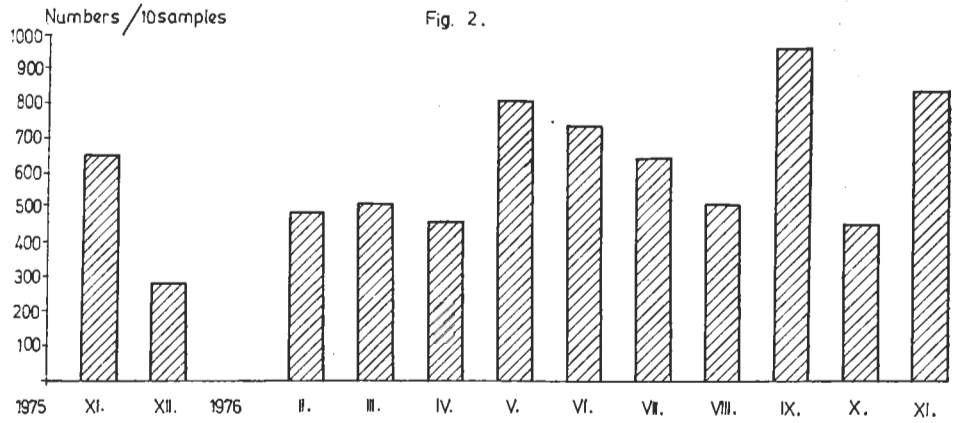

Fig. 2: Distribution pattern of the total numbers of Oribatids

Ten species were selected for analysis of variance, as they appeared regularly every month. The results obtained (Table 2) showed that the number of individuals of *Oppia obsoleta* was highly significant, i.e. it is the most abundant species, followed by *Oppia ornata*. However, there was no significant difference between the numbers of individuals of the following species: *Xenillus tegeocranus*, *Liacarus coracinus*, *Chamobates voigtsi*, *Hermanniella punctulata*, *Tectocepheus sarekensis* and *Tectocephus velatus*. The numbers of individuals of *Oribatula tibialis* and *Hermannia gibba* were found to be significantly equal.

Oppia obsoleta (Fig. 4a): This was found to be the most abundant one. Generally, it appeared in high percentages in earthworm burrows. Only in February 1976 its percentage decreased which could be attributed to the fact that earth-

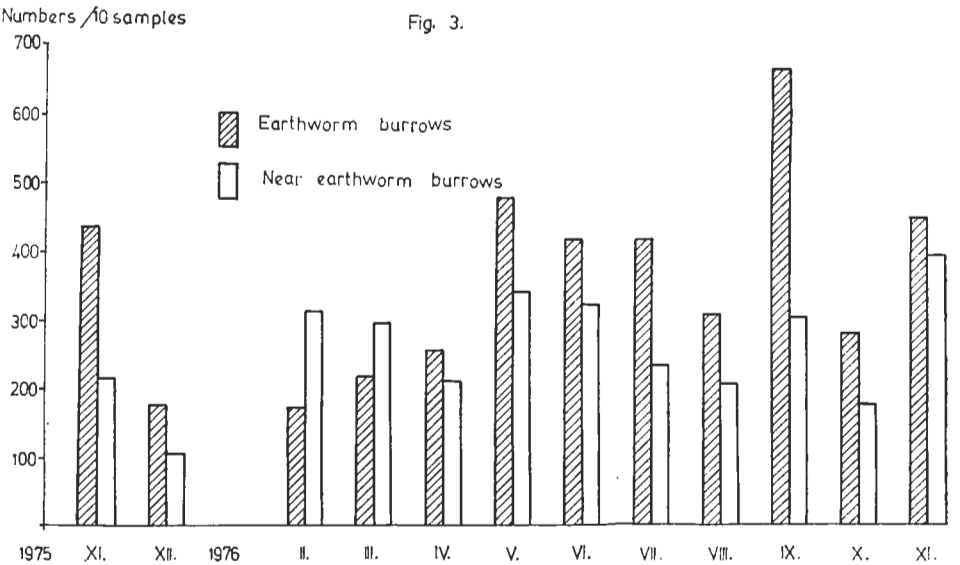

Fig. 3: Distribution pattern of Oribatids in earthworm burrows and near it

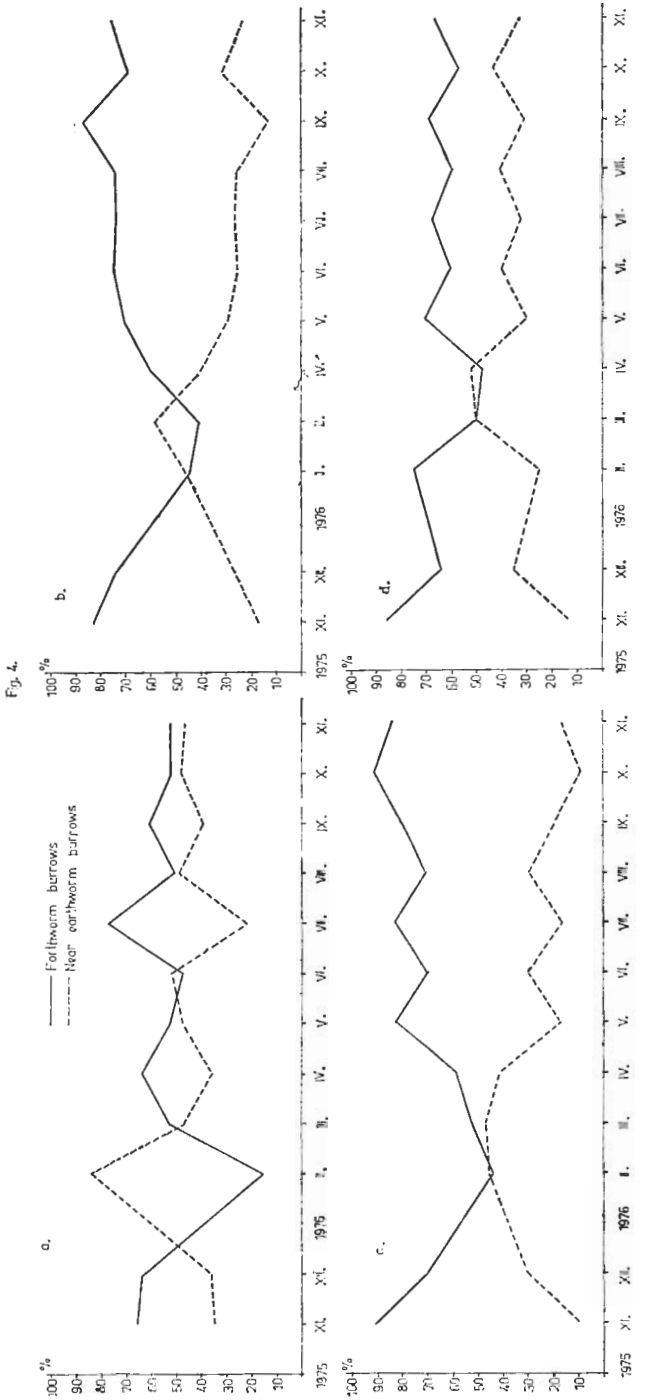

Fig. 4: Frequancy distributions for five species: (a) *Oppia obsoleta*, (b) *Oppia ornata*, (c) *Hermannia gibba*, (d) *Oribatula tibialis*, and (e) *Liacarus coracinus*

worms become less active during winter, as the accumulated litter is still in an early stage of decomposition. It is worthy to note that in July 1976 the percentage of individual numbers of this species in earthworm burrows highly exceeded that in samples near burrows. This is, perhaps because the earthworm burrow, at that time of the year, furnishes a suitable microclimate for the occurence of this species.

Oppia ornata (Fig. 4b): From the figure it can be seen that the percentages of the number of individuals of this species found in earthworm burrows exceed that in samples near it during the whole period of study, except in February, May and April 1976 where the case is reversed. It showed a maximum in earthworm burrows in September 1976.

Hermannia gibba (Fig. 4c): The distribution pattern of this species is very similar in its general trend to that of *Oppia ornata*.

Oribatula tibialis (Fig. 4d): This species also has a similar distribution pattern as that of *Oppia ornata* and *Hermannia gibba*.

Liacarus coracinus (Fig. 4e): Its percentage was found to be very high in samples of earthworm burrows, reaching 100% during the first two months of the experiment as well as in June, July and August 1976. However, it disappeared completely from samples of earthworm burrows in April 1976.

Xenillus tegeocranus (Fig. 5a): The percentages of numbers of individues of this species in earthworm burrows showed higher values than in samples near the burrows, except in November 1975 and March 1976.

Chamobates voigtsi (Fig. 5b): During the first six months of the experiment the percentages of numbers of individuals in earthworm burrows were found to be much lower than that in samples taken near the burrows. From May 1976 onwards, the percentages of numbers of individuals of this species showed higher values in earthworm burrows,

Hermanniella punctulata (Fig. 5c): The percentages of the numbers of individuals appeared from earthworm burrows samples highly exceeded that from samples near it, except in February 1976.

Tectocepheus sarekensis (Fig. 5d): This species appeared in samples taken near earthworm burrows in higher percentages than those of earthworm burrows during the period March – June 1976, reaching 100% in April.

Tectocepheus velatus (Fig. 5e): This species was the only species found to have higher percentages of its number of individuals in samples taken near earthworm burrows than those of the burrows, with the exception of December 1975.

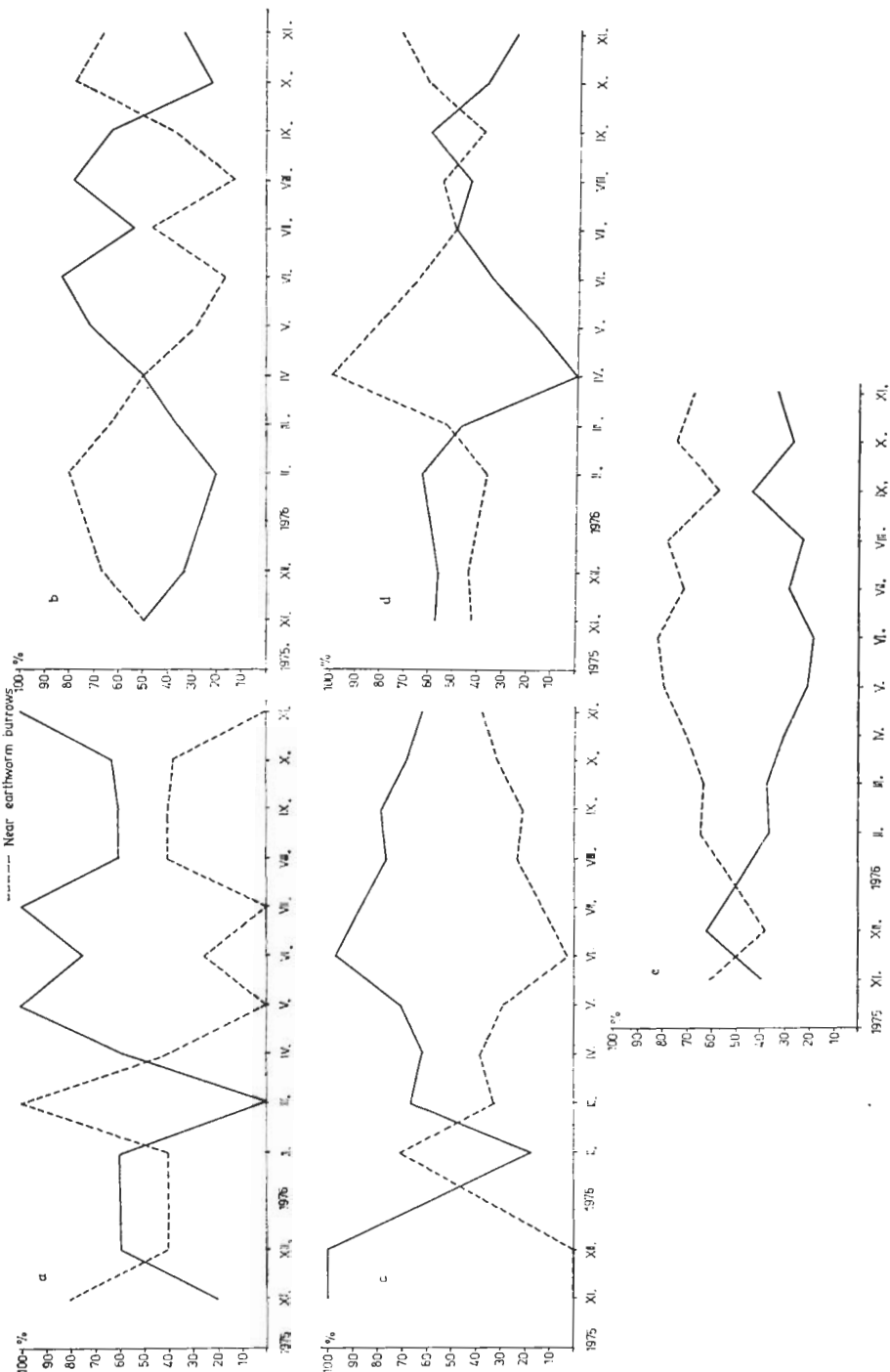

Fig. 5: Frequancy distributions for five species: a) *Xenillus tegeocranus*, (b) *Chamobates voigtsi*, (c) *Hermanniella punctulata*, (d) *Tectocepheus sarekensis*, and (e) *Tectocepheus velatus*

Conclusion

The obtained results show that the earthworm burrows may act as good microhabitats for the Oribatid mites, especially small-sized species as Oppiidae. However, further studies are in need to investigate the significance of the different microhabitats, in different ecosystems, on the population dynamics and activity of Oribatids.

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Table 1. List of Oribatid species found at the investigated area

No.	Species
1.	*Achipteria coleoptrata* (L., 1758)
2.	*Achipteria nitens* (Nic., 1855)
3.	*Amerus troisii* (Berl., 1883)
4.	*Astegistes pilosus* (C. L. Koch, 1840)
5.	*Autogneta longilamellata* (Mich., 1888)
6.	Belboidea
7.	*Brachychochthonius cricoides* (Weis-Fogh, 1948)
8.	*Brachychochthonius immaculatus* (Forssl., 1942)
9.	*Brachychthonius berlesei* Willm., 1928
10.	*Carabodes areolatus* Berl., 1916
11.	*Carabodes coriaceus* C. L. Koch, 1836
12.	*Cepheus cepheiformis* (Nic., 1855)
13.	*Cepheus dentatus* (Mich., 1888)
14.	*Ceratoppia bipilis* (Herm., 1804)
15.	*Ceratoppia quadridentata* (Haller, 1880)
16.	*Ceratozetes gracilis* (Mich., 1884)
17.	*Chamobates borealis* (Träg., 1902)
18.	*Chamobates cuspidatus* (Mich., 1884)
19.	*Chamobates subglobulus* (Oudms., 1900)
20.	*Chamobates voigtsi* (Oudms., 1902)
21.	*Cultroribula bicultrata* Berl., 1908
22.	*Eremaeus hepaticus* C. L. Koch, 1836
23.	*Eulohmannia ribagai* (Berl., 1910)
24.	*Eupelops acromios* (Herm., 1804)
25.	*Eupelops auritus* (C. L. Koch, 1840)
26.	*Eupelops hirtus* (Berl., 1916)
27.	*Euphthiracarus monodactylus* (Willm., 1916)
28.	*Fosseremus laciniatus* (Berl., 1905)
29.	*Furcoribula furcillata* (Nord., 1901)
30.	*Galumna lanceata* Oudms., 1900
31.	*Gustavia microcephala* (Nic., 1855)
32.	*Gymnodamaeus bicostatus* (C. L. Koch, 1840)
33.	*Hermannia gibba* C. L. Koch, 1839
34.	*Hermanniella punctulata* Berl., 1908
35.	*Hypochthoniella minutissima* (Berl., 1904)
36	*Hypochthonius luteus* Oudms., 1913
37.	*Liacarus coracinus* (C. L. Koch, 1840)
38.	*Liacarus subterraneus* (C. L. Koch, 1841)
39.	*Licnodamaeus pulcherrimus* (Paoli, 1908)
40.	*Liochthonius sellnicki* (Thorr, 1930)
41.	*Liochthonius simplex* (Forssl., 1942)
42.	*Liochthonius strenzkei* Forssl., 1963
43.	*Liodes* sp.
44.	*Micreremus gracilior* Willm., 1931
45.	*Minunthozetes pseudofusiger* (Schweizer, 1922)
46.	*Nahermannia elegantula* Berl., 1913
47.	*Neoribates aurantiacus* (Oudms., 1914)
48.	*Nothrus biciliatus* C. L. Koch, 1844
49.	*Nothrus silvestris* Nic., 1855
50.	*Oppia bicarinata* (Paoli, 1908)
51.	*Oppia clavipectinata* (Mich., 1885)
52.	*Oppia concolor* (C. L. Koch, 1844)
53.	*Oppia insculpta* (Paoli, 1908)
54.	*Oppia obsoleta* (Paoli, 1908)
55.	*Oppia ornata* (Oudms., 1900)

56. *Oppia subpectinata* (OUDMS., 1901
57. *Oppia* sp.
58. *Oppiella nova* (OUDMS., 1902)
59. *Oribatella berlesei* MICH., 1898
60. *Oribatula tibialis* (NIC., 1855)
61. *Oribell cavatica* KUNST, 1962
62. *Parachiptera willmanni* v.d. HAMMEN, 1952
63. *Pergalumna myrmophila* (BERL., 1913)
64. *Phthiracarus lentulus* (C. L. KOCH, 1841)
65. *Phthiracarus nitens* (NIC., 1855)
66. *Phthiracarus* sp.
67. *Platynothrus peltifer* (C. L. KOCH, 1839)
68. *Poecilochthonius italicus* (BERL., 1910)
69. *Poroliodes farinosus* (C. L. KOCH, 1840)
70. *Punctoribates punctum*(C. L. KOCH, 1939)
71. *Quadroppia quadricarinata* (MICH., 1885)
72. *Scheloribates laevigatus* (C. L. KOCH, 1836)
73. *Suctobelba trigona* (MICH., 1888)
74. *Suctobelba arcana* MORITZ, 1970
75. *Suctobelbella subcornigera* (FORSSL., 1941)
76. *Suctobelbella subtrigona* (OUDMS-, 1916)
77. *Suctobelbela* sp.
78. *Synchthonius crenulatus* (JACOT, 1938)
79. *Tectocepheus sarekensis* (TRÄG., 1910)
80. *Tectocepheus velatus* (MICH., 1884)
81. *Tropacarus carinatus* (C. L. KOCH, 1841)
82. *Tropacarus pulcherrimus* (BERL., 1887)
83. *Xenillus tegeocranus* (HERM., 1804)
84. *Xylobates badensis* (SELLN., 1928)
85. *Zetorchestes micronychus* (BERL., 1883)
86. *Zygoribatula cognata* (OUDMS., 1902)
87. *Zygoribatula* sp.

Table 2. Analysis of variance of selected species

Sourse of variation	d.f.	SS	M.S.	F	Ftables
Time	12	33 307,6	2 775,6	4,89	2,29 3,17
Species	10	114 055,6	11 405,6	20,1	1,65 2,03
Error	120	68 080,4	567,3	–	–
Total	**142**	215 443,6	14 748,5		

L. S. D. 1% for species = 25.46
Means: *Xenillus tegeocranus* 5.91 (a), *Liacarus coracinus* 6.66 (a), *Chamobates voigtsi* 8.58 (a), *Hermanniella punctulata* 19.58 (ab), *Tectocepheus sarekensis* 23.91 (ab), *Tectocepheus velatus* 27.41 (ab), *Oribatula tibialis* 37.75 (b) *Hermannia gibba* 39.25 (b), *Oppia ornata* 69.08 (c), *Oppia obsoleta* 116.25 (d).