Christensen, B., Standen, V. (eds.): Proceedings of the 4th International Symposium on Enchytraeidae, Mols Laboratory, Denmark, 2-4 June 2000 (Newsletter on Enchytraeidae No. 7).
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The German long-term soil monitoring program and its implications for the knowledge of Enchytraeidae

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Introduction

Soil protection as a field of environmental policy has become of increasing importance during the past years. Within the scope of precautionary soil protection, 630 long-term soil-monitoring sites have been established in Germany as basis for the observation of soil quality and its changes in terms of biological, chemical and physical indicators. The biological investigations proposed for these sites by the LABO (Federal and State Panel for Soil Conservation) include the investigation of earthworms and enchytraeids as obligatory component (LABO 2000). In accordance with this proposal the basic inventories have been completed so far at all monitoring sites in Schleswig-Holstein, Hamburg and Nordrhein-Westfalen, covering a variety of soils and management types. This provides us with a broad database on the occurrence of species, their ecological amplitude and the typical species assemblages. In the following we will shortly present methods of the program and discuss its perspectives and possibilities.

Investigation of soil monitoring sites

Standard methods are used for soil sampling and extraction. Ten samples are taken at each monitoring site. Earthworm sampling is carried out by a combination of formalin extraction, hand sorting and Kempson extraction. Enchytraeid samples are extracted by a wet-funnel method without heating (for details see Graefe et al. 1998). The set of investigated parameters is given in table 1.

Perspectives

The systematic realisation of the soil zoological program at all monitoring sites would mean a considerable step forward in enchytraeology. Large data sets concerning the occurrence of species and species assemblages can be correlated with other parameters measured at the monitoring sites. Such informations are particular useful for the calibration of indicator values, strategy type and life form indices, which are the biological tools for classifying and assessing soil quality (Graefe & Schmelz 1999).

Soil quality evaluation needs some understanding about the normal formation of the soil community under different site and land use conditions (Fry et al. 1994). Hence, the data from soil monitoring sites serve as basic reference for the estimation of harmful or tolerable changes caused by air pollution and management practices. In this respect, earthworms and enchytraeids belong to the most sensitive indicators of soil changes (Beylich et al. 1995).

Parameter	**Indicator function**
Total abundance of enchytraeids (Ind./m²) Total abundance of earthworms (Ind./m²) Total biomass of earthworms (g/m²)	Indicators of soil faunal activity
Community structure: species composition, number, abundance, dominance and frequency of species	Indicators of soil biodiversity
Vertical distribution of enchytraeids: total and species level	Indicator of microhabitat quality and vertical extent of biological processes
Biomass and biomass dominance of earthworm species	Ecological significance of the species
Aggregated parameters: Strategy-type and life-form spectra Average indicator values Decomposer community type	Biological indicators of soil quality and the combined influence of environmental factors

Table 1: Investigated soil zoological parameters at long-term soil monitoring sites.

Biological soil monitoring with earthworms and enchytraeids as indicator groups is not confined to Germany. A quite similar program is performed in Austria (Bauer 2000). In the Netherlands an indicator system for life support functions of the soil has been presented by Schouten et al. (1997), which includes earthworms and enchytraeids. In other countries biological monitoring programs are restricted to earthworms and microorganisms so far. However, it has been proven useful to investigate enchytraeids as well as earthworms, as the two groups have an antagonistic relationship and enchytraeids predominate on sites where earthworms are

scarce or absent. A cross-border harmonisation of methods and investigated parameters is clearly recommended.

A prerequisite for using enchytraeids as indicators is the availability of systematic-taxonomic knowledge, of which Nielsen & Christensen (1959) laid the foundation with the critical revision of the Enchytraeidae. Subsequently this work stimulated a large number of taxonomical publications. So it becomes more and more difficult to survey all described species. A new systematic compilation is urgently needed.

References

Bauer, R., 2000: Biologische Bewertung von Böden: Erfassung der Regenwürmer und Kleinringelwürmer (Annelida; Oligochaeta: Lumbricidae und Enchytraeidae) auf den Dauerbeobachtungsflächen im Bundesland Salzburg. - Mitteilungen der Österreichischen Bodenkundlichen Gesellschaft 59: 39-41.

Beylich, A., H.-C. Fründ, U. Graefe, 1995: Environmental monitoring of ecosystems and bioindication by means of decomposer communities. - Newsletter on Enchytraeidae 4: 25-34.

Fry, P., C. Maurer-Troxler, A. Enggist, 1994: Einsatz bodenbiologicher Methoden in der langfristigen Bodenbeobachtung. - In: Alef, K., Fiedler, H., Hutzinger, O. (eds.): Umweltmonitoring und Bioindikation. ECOINFORMA'94, Bd. 5: 273-280.

Graefe, U., D.-C. Elsner, U. Necker, 1998: Monitoring auf Boden-Dauerbeobachtungsflächen: Bodenzoologische Parameter zur Kennzeichnung des biologischen Bodenzustandes. - Mitteilungen der Deutschen Bodenkundlichen Gesellschaft 87: 343-346.

Graefe, U., R. M. Schmelz, 1999: Indicator values, strategy types and life forms of terrestrial Enchytraeidae and other microannelids. - Newsletter on Enchytraeidae 6: 59-67.

LABO, 2000 (Ad-hoc-Arbeitsgruppe Boden-Dauerbeobachtung der Bund/Länder-Arbeitsgemeinschaft Bodenschutz): Boden-Dauerbeobachtung. Einrichtung und Betrieb von Boden-Dauerbeobachtungsflächen. - In: Rosenkranz, D., Bachmann, G., König, W., Einsele, G. (eds.): Bodenschutz. Kennziffer 9152, Erich Schmidt Verlag, Berlin.

Nielsen, C. O., B. Christensen, 1959: The Enchytraeidae, critical revision and taxonomy of European species. - Natura Jutlandica 8-9: 160 pp.

Schouten, A. J., L. Brussaard, P. C. de Ruiter, H. Siepel, N. M. van Straalen, 1997: Een indicatorsysteem voor life support functies van de bodem in relatie tot biodiversiteit. - RIVM, Bilthoven. Rapportnr. 712910005. 90 pp.