On the delimitation of soil microarthropod coenoses in time and space

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In order to describe mean features of the structure of soil eco-sub-systems many authors deal with species lists of soil microarthropods, especially mites and Collembola. Because lists can hardly be compared, abundance and frequency of any single species may be quantified in different ways. By this, the significance of a species within the soil community is not pointed out sufficiently. Much more attention should be paid to the sociological behaviour of soil microarthropods. The few authors, who had tried to do so, do not agree about the method and the value of this procedure (for example Gisin, 1947; Cassagnau, 1961; Agrell, 1963; Davis, 1963; Dunger, 1968; Lebrun, 1971). This paper does not propose a new method, but compares some methods dealing with some experiments.

As in phytosociology, in the pedozoological literature four main concepts concerning the sociological treatment are discerned:

1. The continuum-concept presumes the co-existence of a undeterminate number of populations in a undeterminate correlation without objective discontinuities. In such a continuum only trends could be stated, and this renders the synbiological viewpoint more or less useless. In the experiments, the continuum-concept is disproved by discontinuities in the occurrence of species or species-groups in time and space, even if they are related.

2. The inventory-concept presumes the existence of a characteristic and homogeneous coenosis of soil microarthropods with the border of any unit of vegetation (phytocoenosis). The enumeration of the species-inventory of mites or Collembola is used to describe a soil taxocoenosis. The inventory-concept offers a real heuristic advantage for orientation in the field. However, it is applicable only under favourable circumstances.

3. The discontinuity-concept is trying to delimit coenoses of soil microarthropods by using discontinuities of their species combination. Negatively correlated, i.e., substitutive or vicarious species serve to determine the limits of a coenosis (differential species).
4. The affinity-concept aims at the contents-determination of the coenoses. It rests on positive interspecific correlations. If it can be proved that closely related species-combinations (recurrent groups) represent ecologically more or less specialized groups of species, then the affinity-concept enables an analysis of the coenoses "from the inside". This will increase essentially the indicatory significance of a described coenosis.

As a first step of sociological treatment of soil microarthropods, coenoses may be delimited by using characteristic substitutive species. This paper will be confined to methodical considerations and to some practical results of this procedure. This may be followed, as a second step, by the definition of the eco-sociological feature of the coenosis using the affinity-concept.

As to find out a "basal coenosis", the smallest sociological multispecific unit of soil microarthropods, the synusia, must be chosen. A synusia is to be defined as a mero- and/or strato-taxocoenosis. Constructing any kind of hierarchy of synusiae necessitates much more knowledge than is available up to date.

In obtaining and analysing the primary material the principle of maximal homogeneity must be observed: homogeneity of the area; observing minimal area, mosaic distribution etc., homogeneity of the structure unit and/or of the stratum; vegetation- and humus layer must be separated from the mineral soil; in poorly structured soils at least separation is to be made between soil-surface moving edaphon (caught by a pitfall technic) and soil-inhabiting edaphon (obtained by core sampling), homogeneity of the time aspect; analysing either complete year cycles or at least comparing identical aspects; considering development of synusiae in time.

Dominance and frequency of each species will be tabulated separately for each homogeneous plot. Series from different plots are than tested for discontinuities. Negatively correlated, relative or absolute substitutive species will be chosen as differential species, especially if autecological experiments justify it. Owing to such subjective judgement, synusiae delimited in this way are to be regarded as hypotheses based upon ecological and faunistic experiments. Therefore, synusiae should be delimited in order to form working hypotheses for further quantitative ecological analysis. The following examples illustrate both the advantage of synusia-formation using the discontinuity-concept and the necessity of exactly separating homogeneous synusiae in different strata or in point of temporal development.

An interesting object for study is the spatial succession of synusiae within a catena. Figure 1 shows a schematic profile through