The saprotrofic food chain in terrestrial ecosystems : Soil Biota

Impact of the introduction of the ant *Pheidole megacephala* on native invertebrates in a Australian rain forest

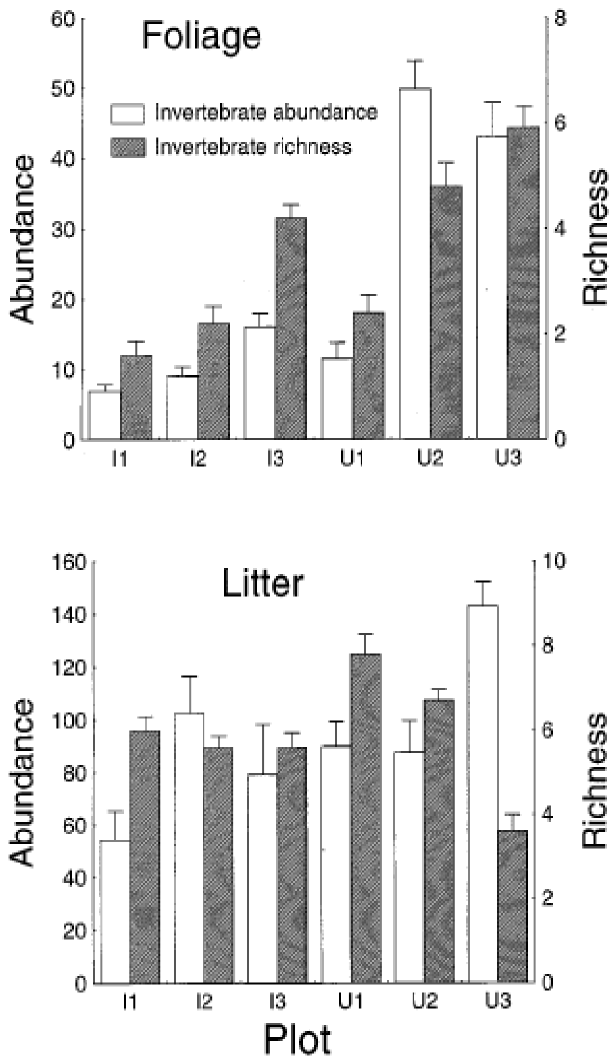

Fig. 3 Mean (+SE) of non-ant invertebrate abundance and ordinal richness within rain forest as found by 10 foliage beats and 10 litter samples at infested (*I1–3*) and uninfested plots (*U1–3*)

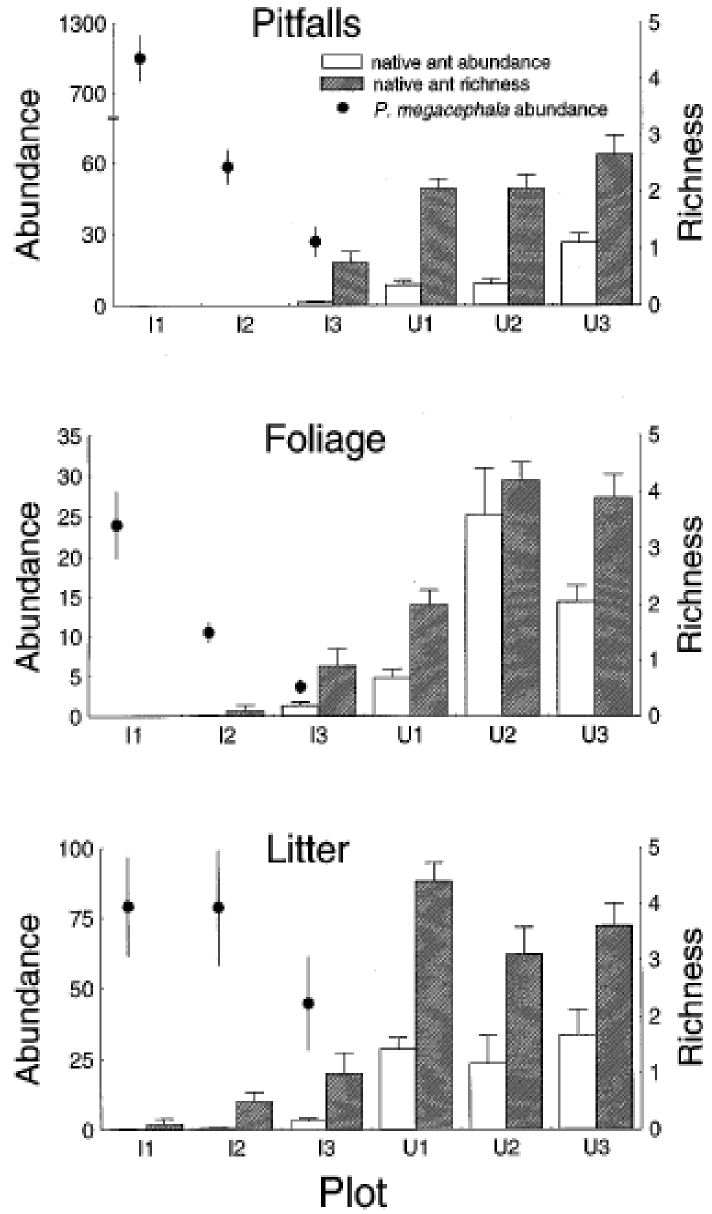

Fig. 1 Mean (+SE) *Pheidole megacephala* abundance and native ant abundance and richness per sample within the rain forest as found by 20 pitfall traps, 10 foliage beats and 10 litter samples at infested (*I1–3*) and uninfested plots (*U1–3*)

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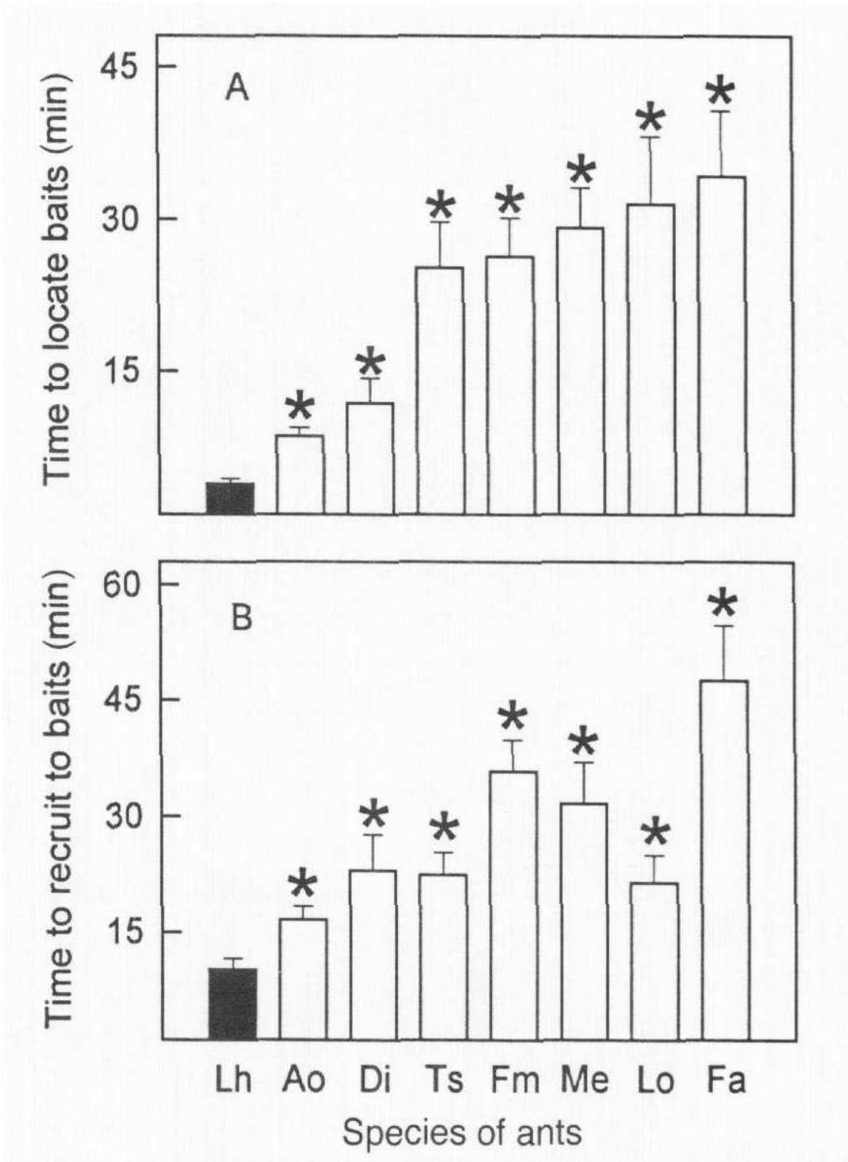
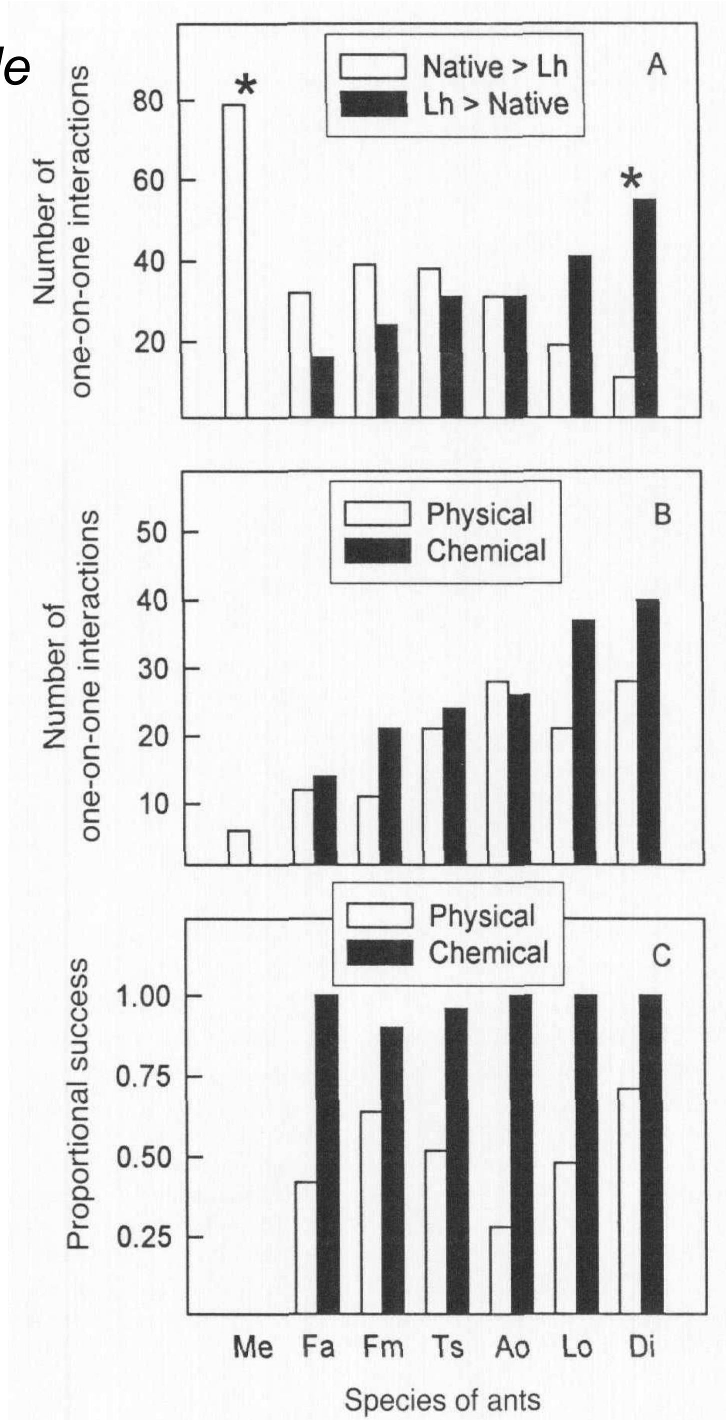
The invasive ant *Linepithema* (= *Iridiomyrmex*) *humile* in northern California (USA)



Results of fixed-distance ant-baiting experiment: bait in 1 m distance from nest entrance; * - significant difference of *L. humile* to native ant species.



Short-term introduction experiment with *L. humile*: interaction with other ant species

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The effect of the soil-dwelling ant *Lasius flavus* on soil properties and below-ground plant biomass in Slovakian grasslands

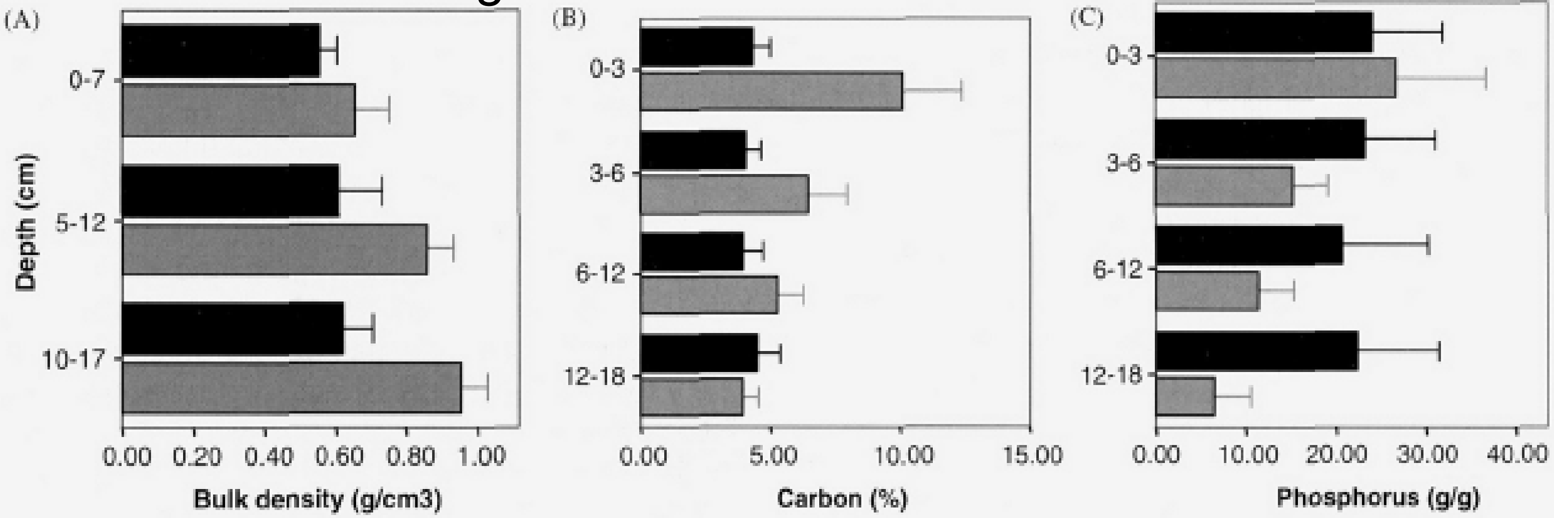

Fig. 1. (A) Bulk density, (B) carbon concentration, and (C) available phosphorus concentration (means ± SD) in mounds (black bars) and control plots (gray bars) sampled at three and four depths, respectively.

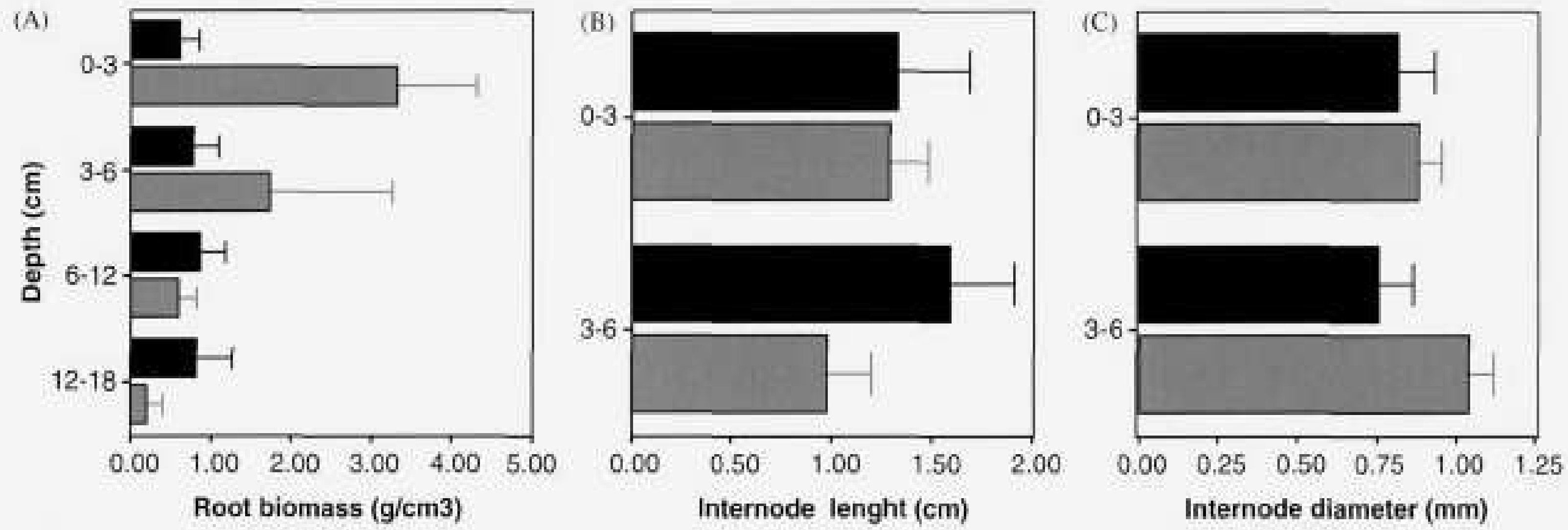

Fig. 2. (A) Root biomass, (B), internode length, and (C) internode diameter (means ± SD) in ant mounds (black bars) and control plots (gray bars) sampled at four and two depths, respectively.

The saprotrofic food chain in terrestrial ecosystems : Soil Biota

Sampling of soil animals

Small soil corer (mesofauna)

Large soil corer (macrofauna)

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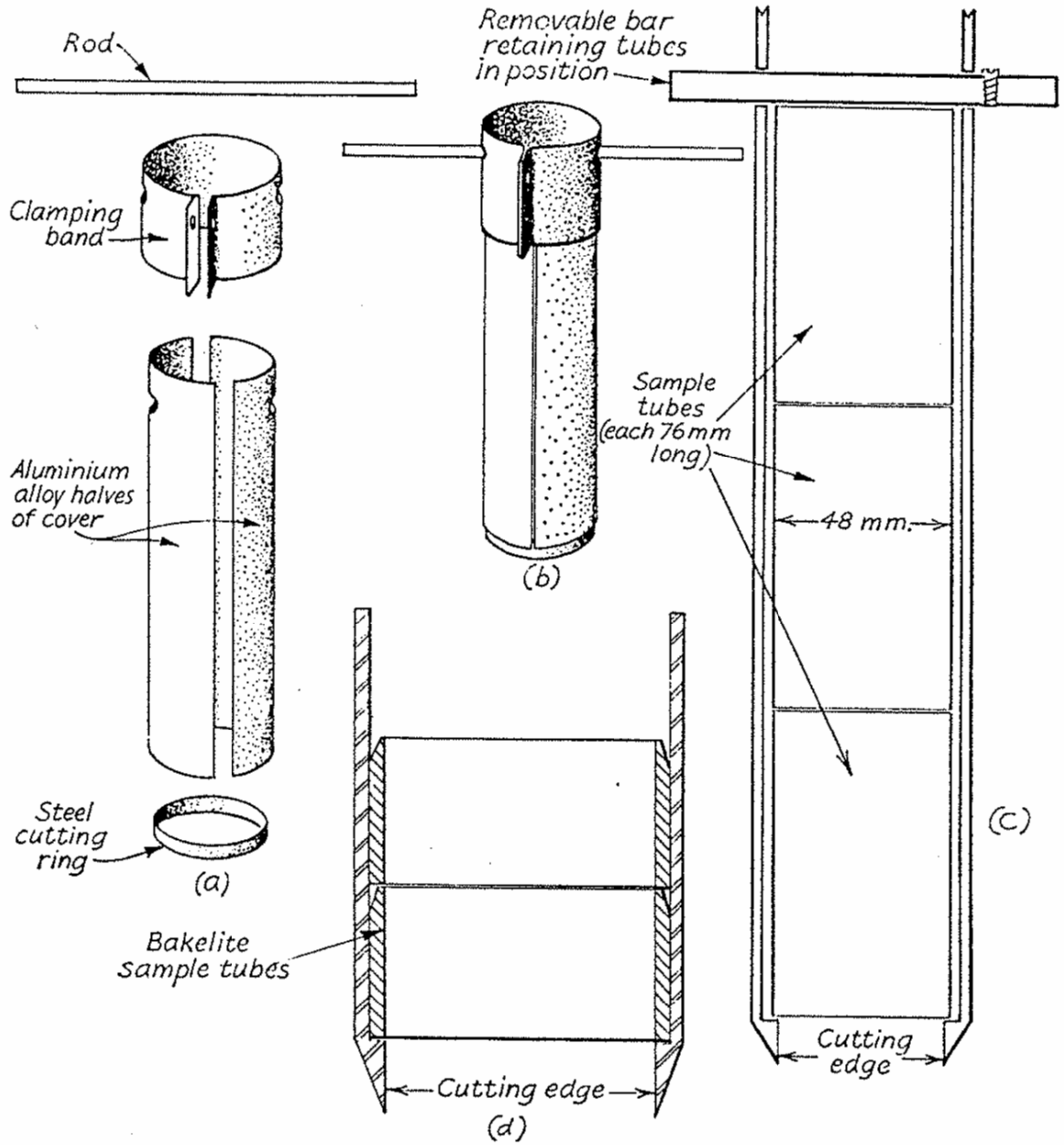

Fig. 28. Soil corers. *a* and *b*. The O'Connor split corer: *a*. showing compartments (after O'Connor, 1957); *b*. assembled. *c*. Soil corer with sample tubes (after Dhillon & Gibson, 1962). *d*. Soil corer for the canister extractor (after Macfadyen, 1961).

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Sampling of soil animals

Electro-octet method for the extraction of earthworms in the field

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Sampling of soil animals

Ground photoeclectors (emergence traps)

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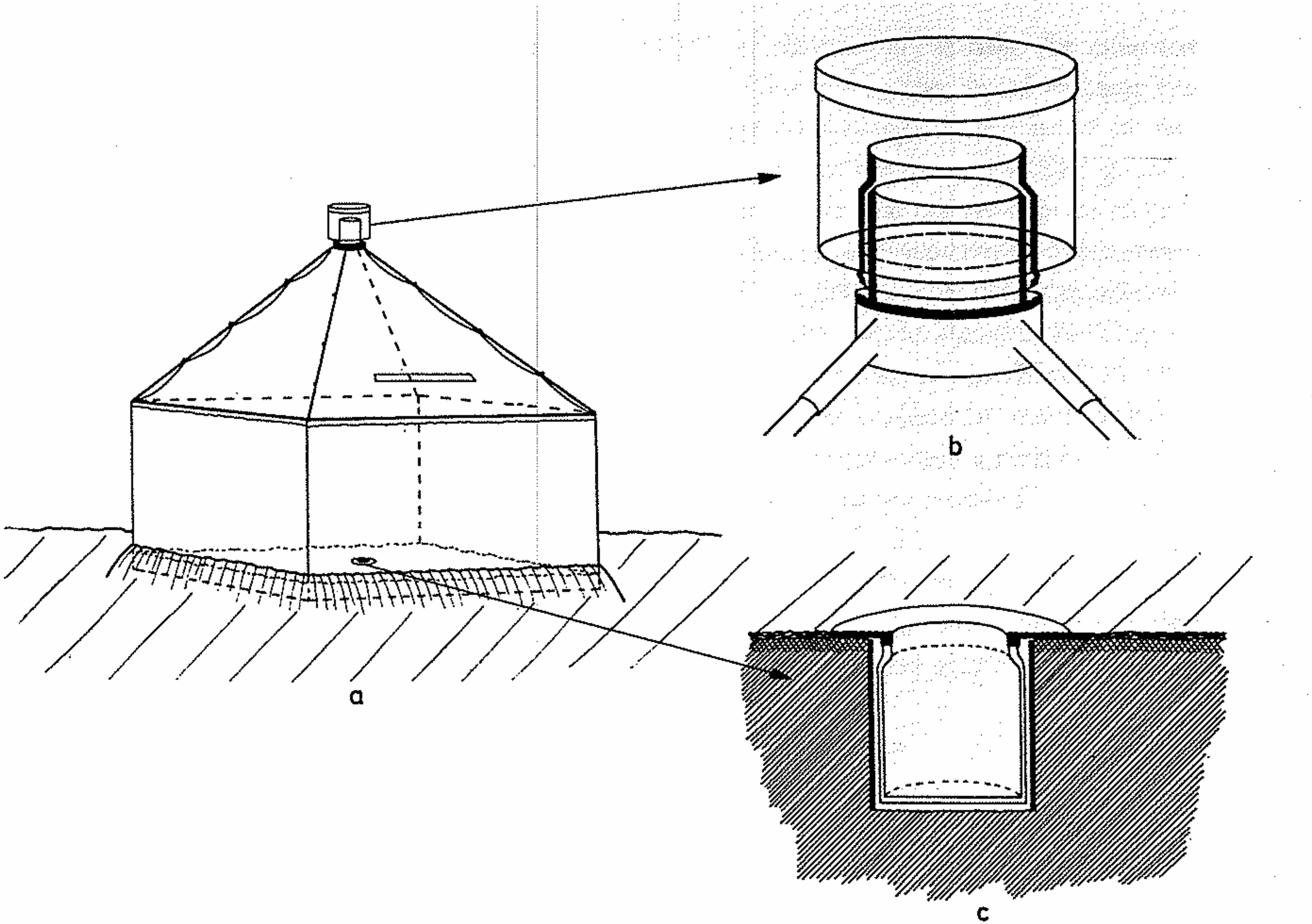
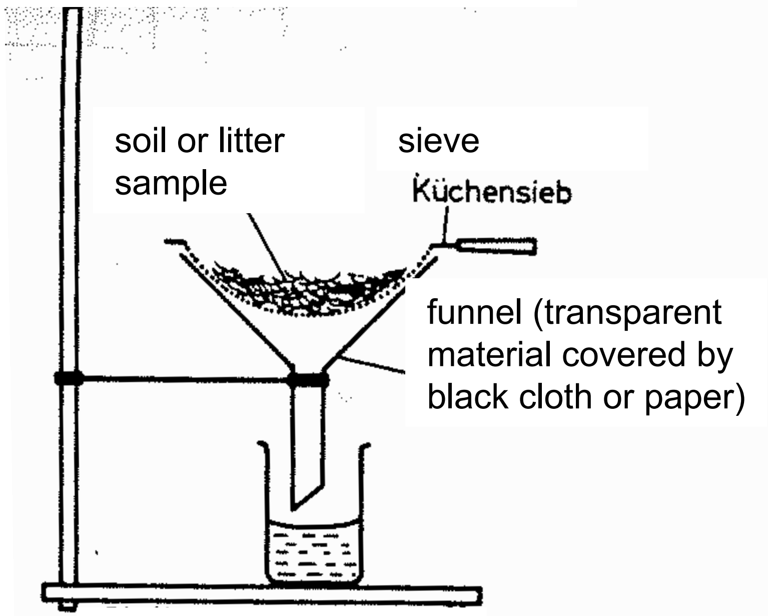


Fig. 1a—c. Ground photo-eclector (emergence trap). a) total view; b) sampling box (light trap) with pipes and upper metal construction; c) pitfall trap (sectional diagram); particulars see text

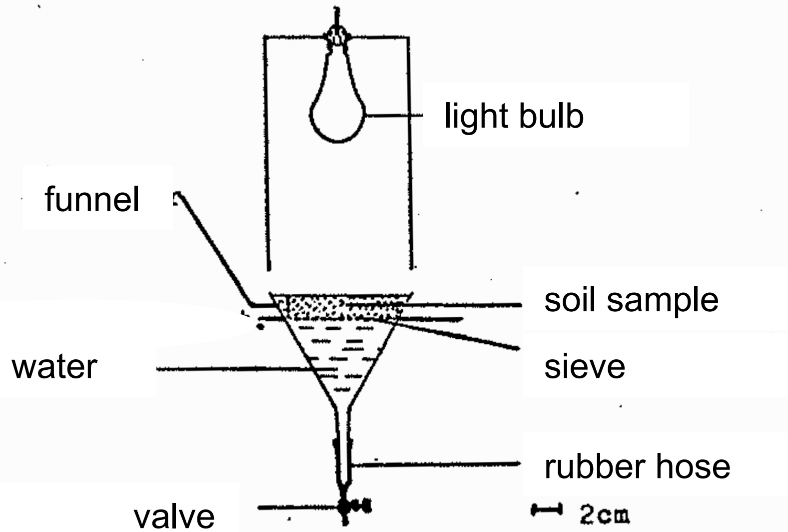
Funke, W., 1977: Food and energy turnover of leaf-eating insects and their influence on primary production. In: Ellenberg, H. (ed.) Integrated Experimental Ecology

The saprotrofic food chain in terrestrial ecosystems : Soil Biota

Extraction of soil (litter) samples (dry / wet)



Tullgren Funnel



Baermann Funnel

- Macrofauna
- Microarthropods
- Heating from above possible
- Cooling from below possible

- Wet Funnel Extraction (not necessarily with heating from above, cooling from below possible)
- Nematoda (Beamann)
- Enchytraeidae (O'Connor)
- other semiaquatic fauna

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Wet extraction of soil (litter) samples

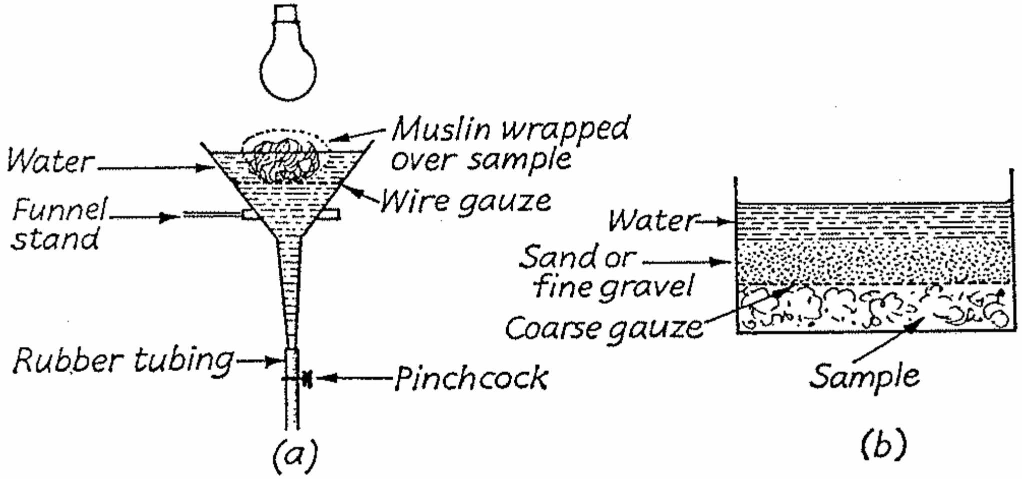

Fig. 36. *a*. Simple heated Baermann funnel. *b*. Sand extractor.

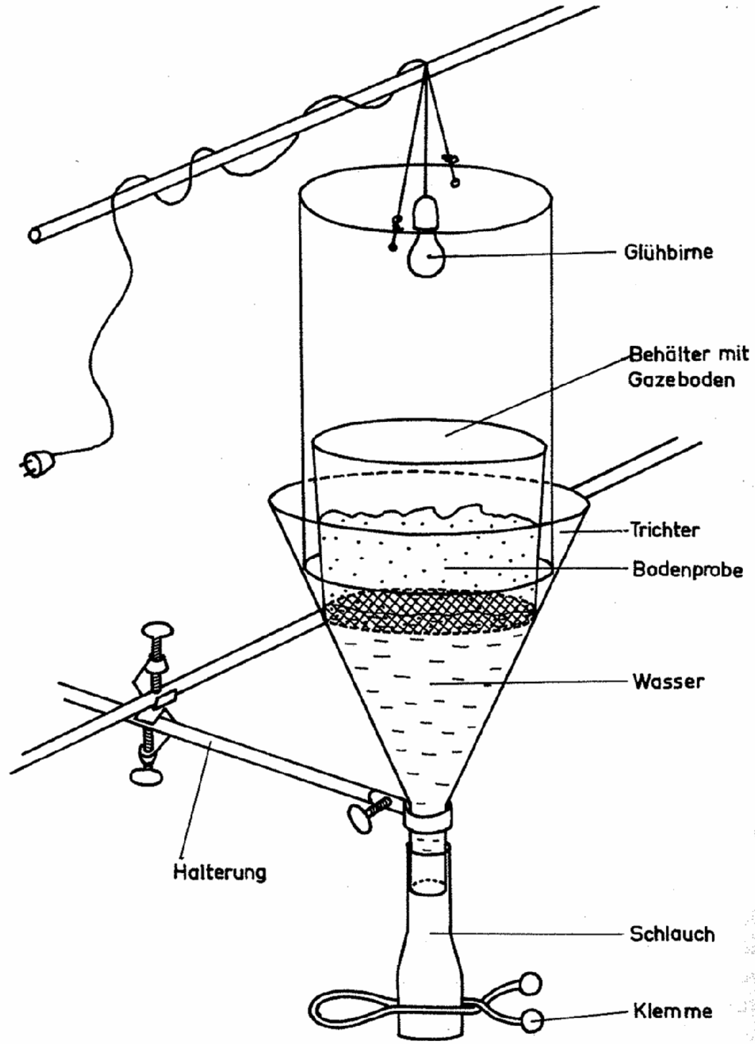

Abb. 83: Einfacher BAERMANN-Trichter zur Nematoden-Extraktion.

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Dry extraction of soil (litter) samples

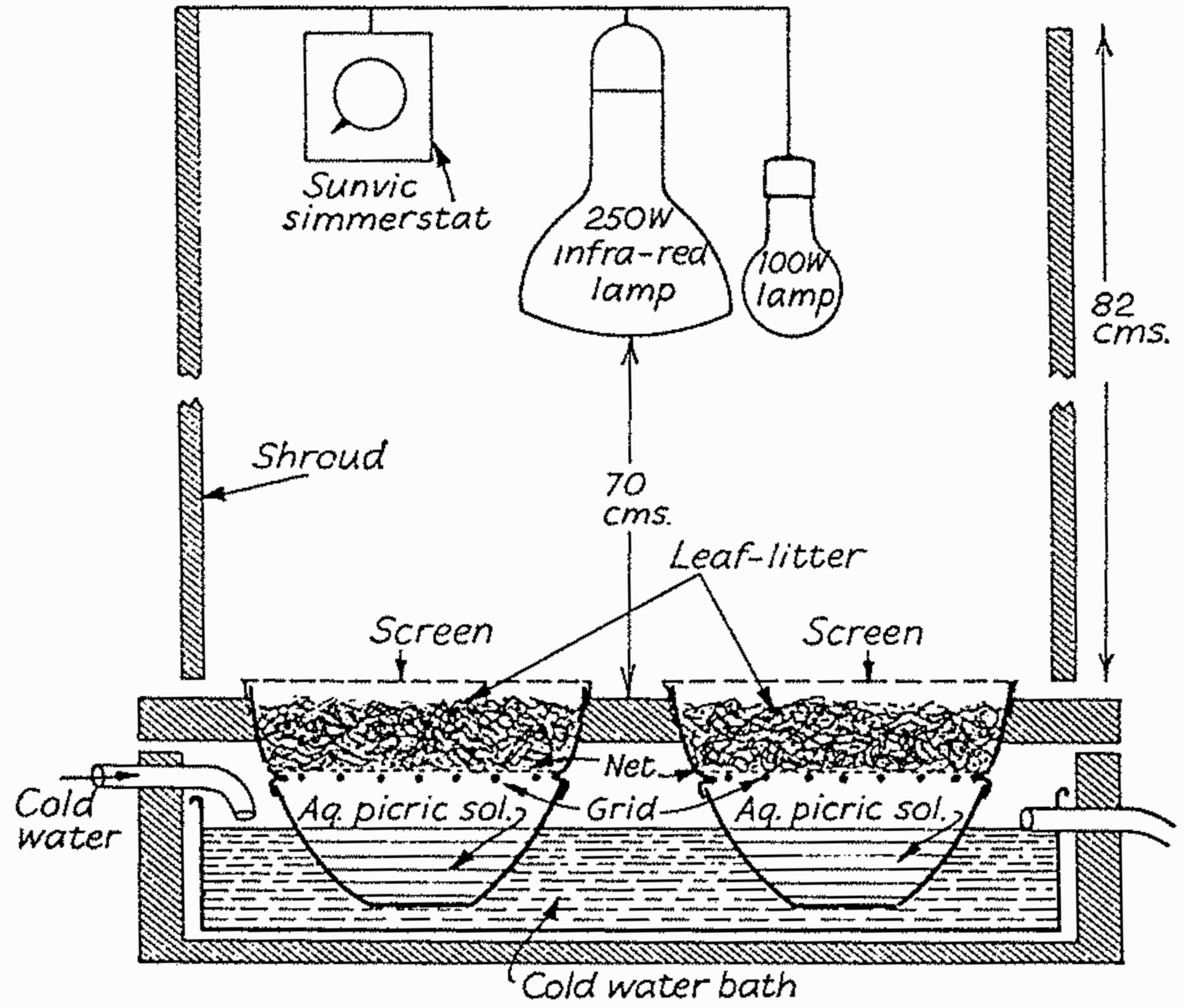

Fig. 35. Kempson bowl extractor (after Kempson, Lloyd & Ghelardi, 1963).

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Dry extraction of soil (litter) samples

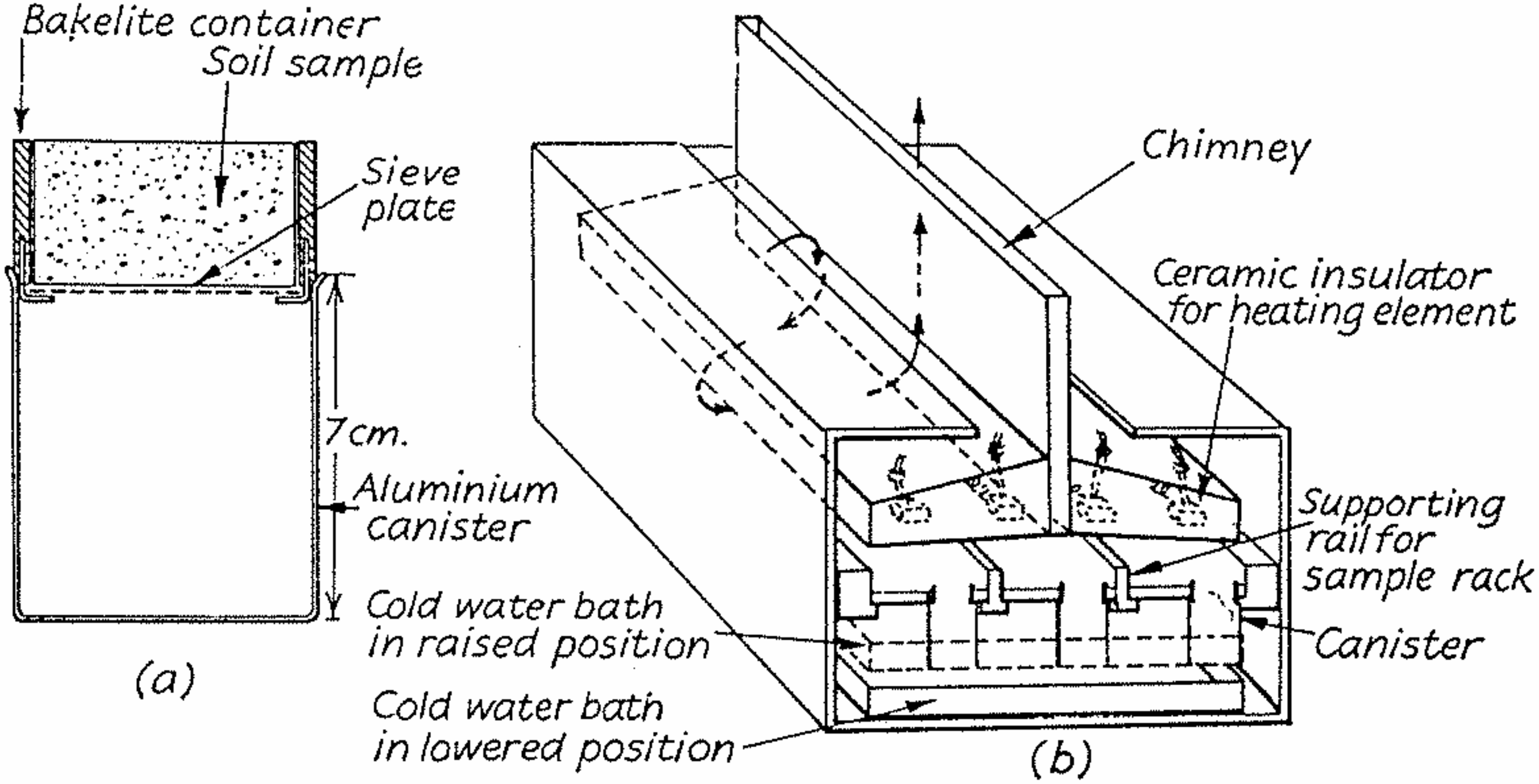

Fig. 34. Multiple canister extractor (after Macfayden, 1961): *a*. canister, core and sieve plate; *b*. whole apparatus.

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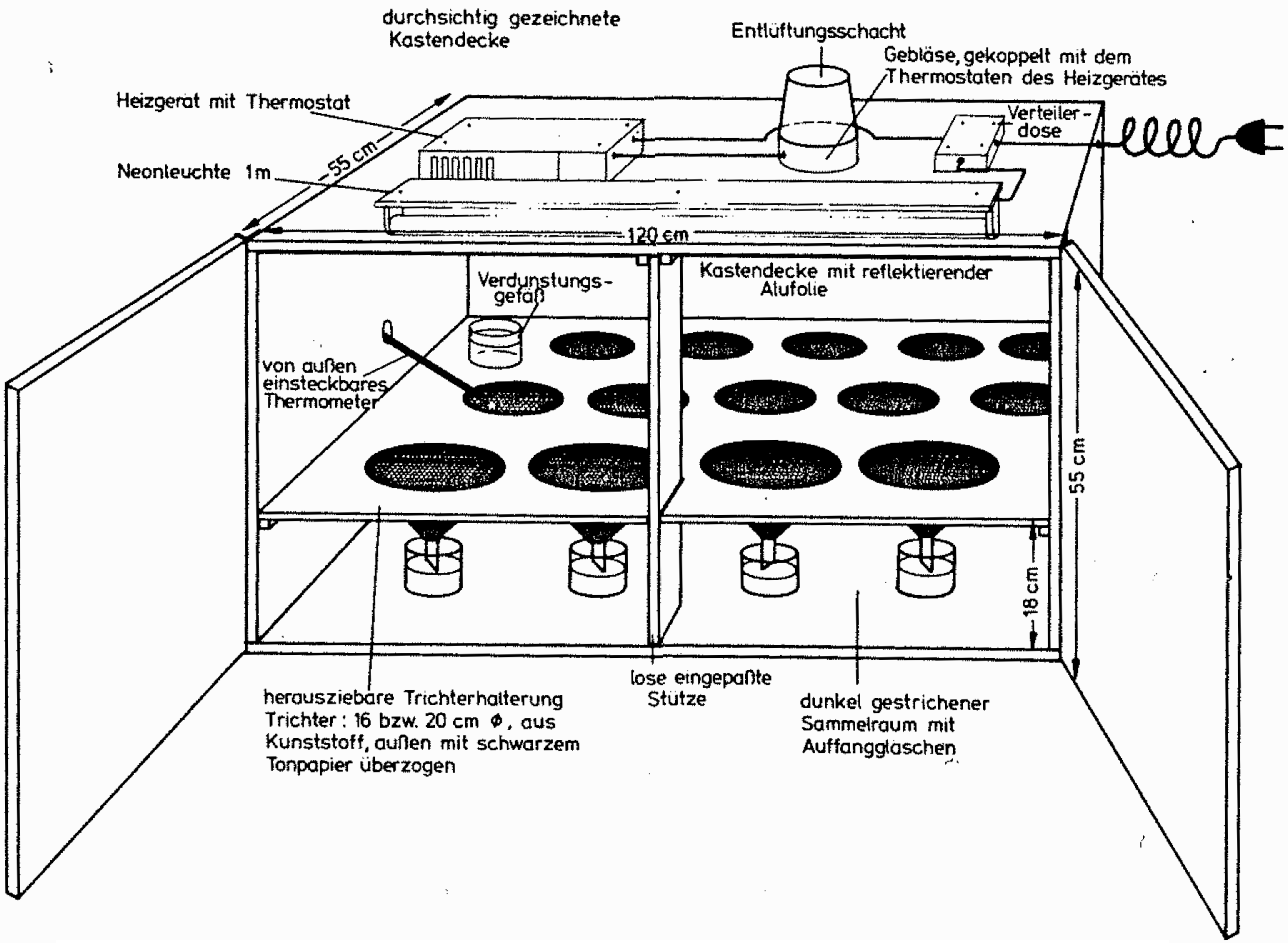
Extraction of soil (litter) samples



Extraction apparatus for dry extraction of sample series (Kempson, Macfadyen)

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Dry extraction of soil (litter) samples

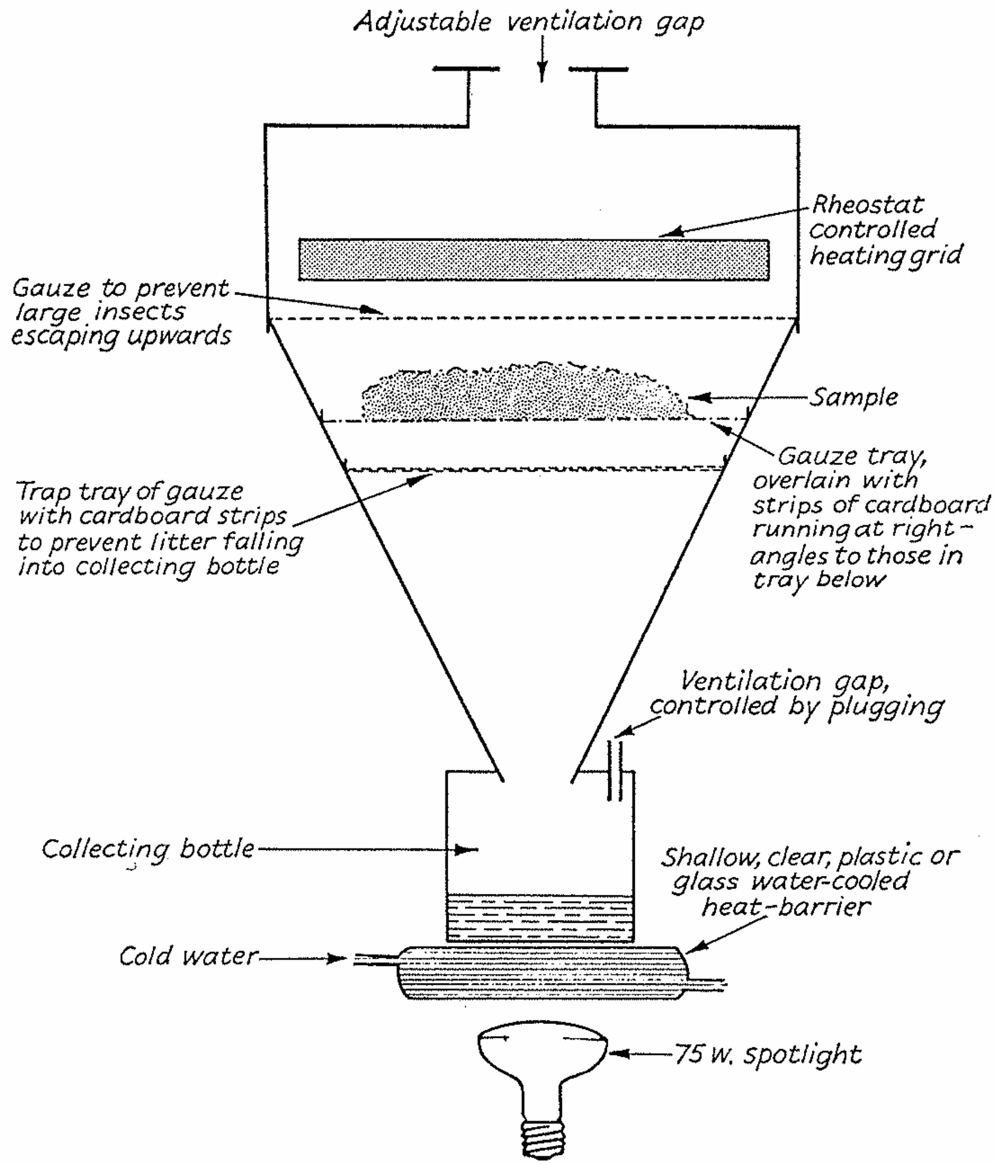

Fig. 32. A large Berlese funnel with modification.

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Extraction of soil (litter) samples: washing of soil through sieves

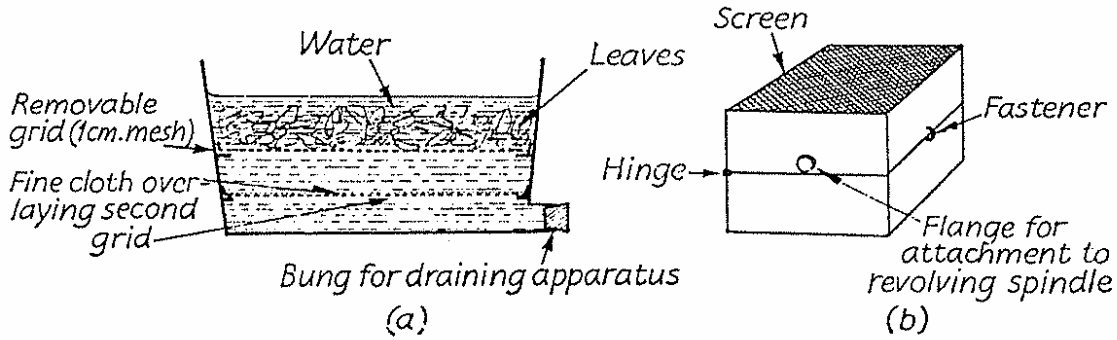

Fig. 29. *a*. Tank for the separation of molluscs from fallen leaves by wet sieving, based on Williamson's design. *b*. Simple sieve box for wet sieving sawfly cocoons, based on McLeod's design.

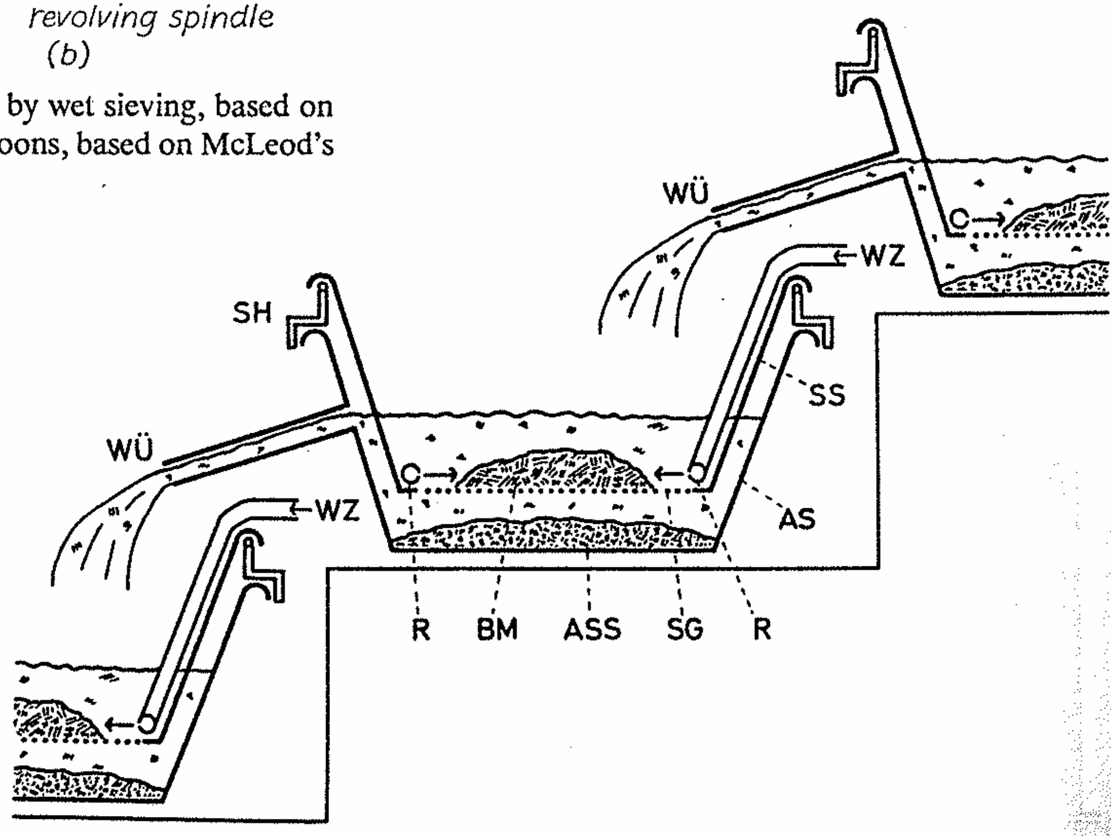

Abb. 82: Siebflotationsmethode. – Funktionsschema der Siebkaskade. (Aus Behre 1987.) – AS – Auffangschale, ASS – Auffangschalensediment, BM – Bodenmaterial, R – Wasserzulaufring, SG – Siebgaze, SH – Siebhalterung, SS – Siebschale, WÜ – Wasserüberlauf, WZ – Wasserzulauf.

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Extraction of soil (litter) samples: flotation

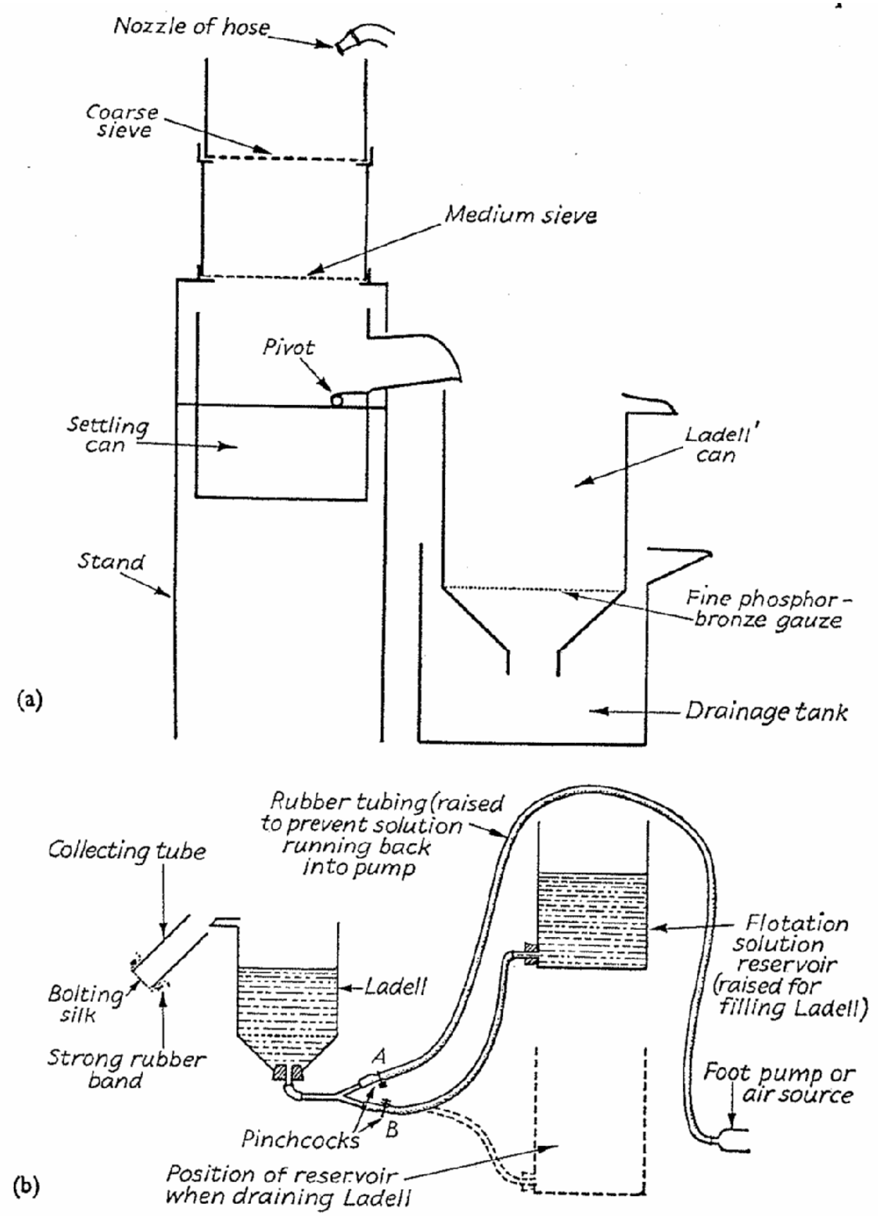
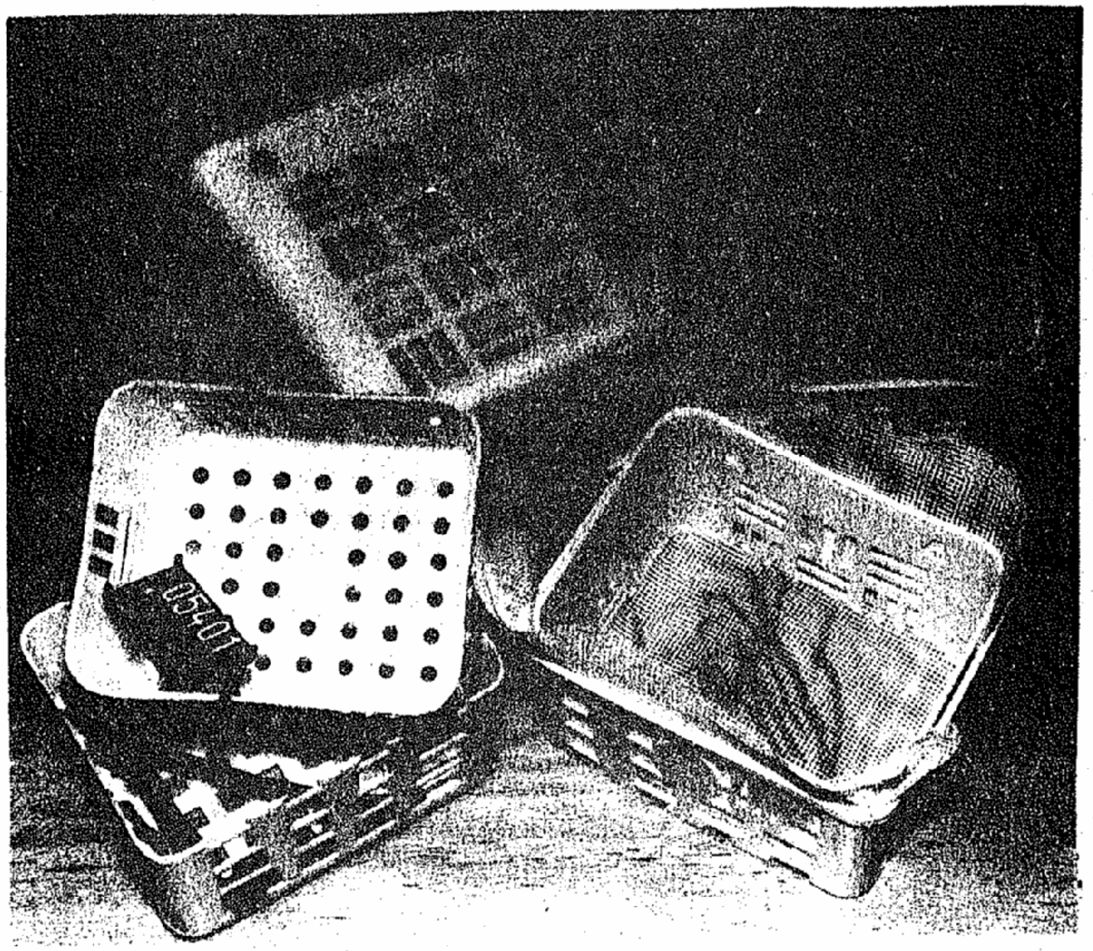
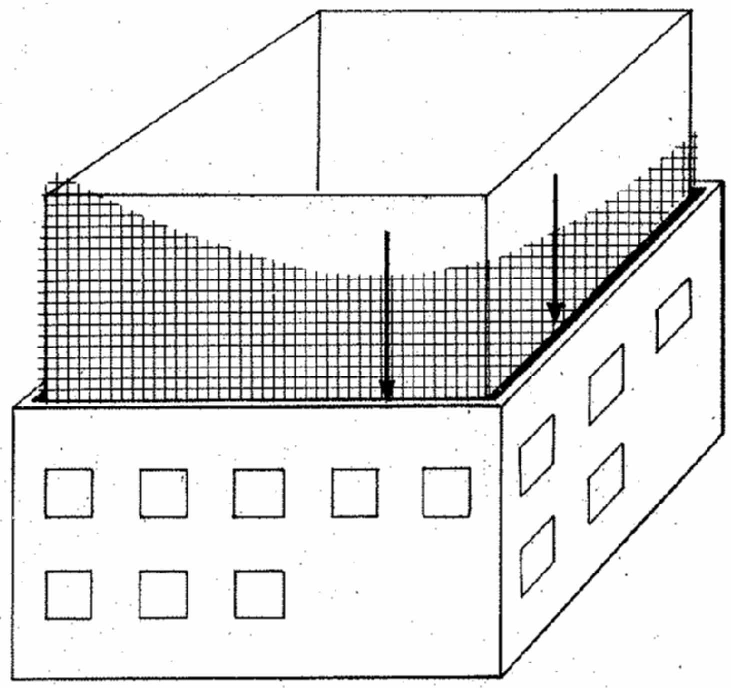


Fig. 30. *a.* Soil washing apparatus (modified from Salt & Hollick, 1944). *b.* Ladell can and associated equipment during the air agitation phase of flotation (diagrammatic).

<u>The saprotrofic food chain in terrestrial ecosystems : Soil Biota</u>

Litter bag experiments
– course of decomposition and the effect of soil biota





One advanced design of litter bags:

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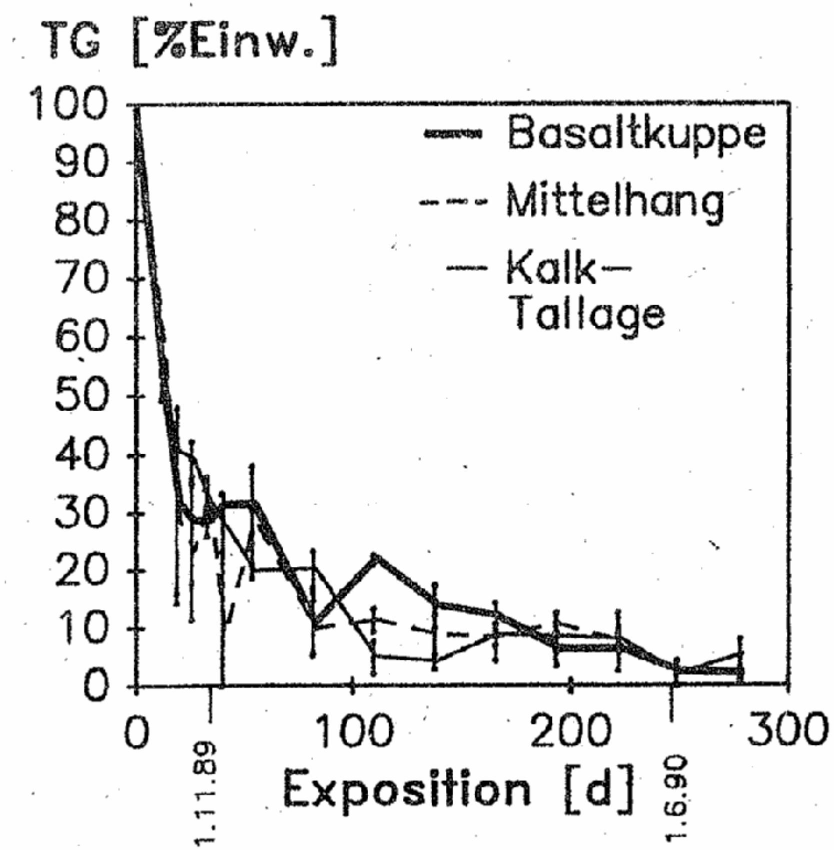
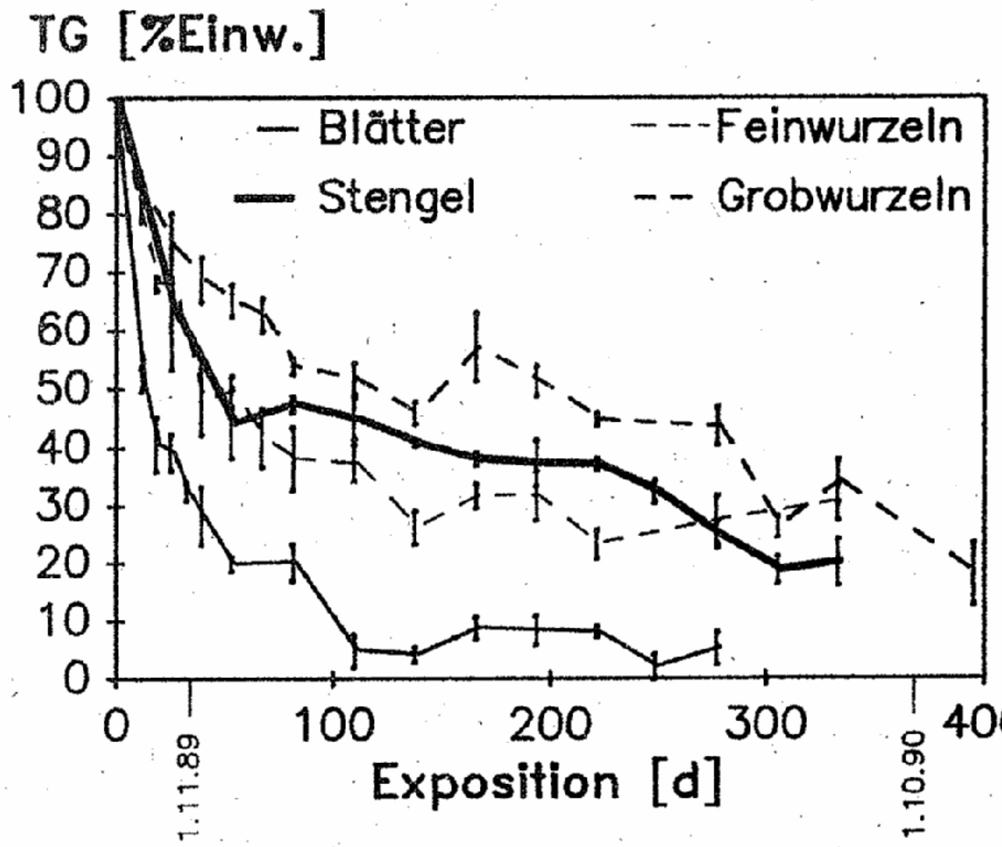
Litter bag experiments
– course of decomposition and the effect of soil biota



Decomposition of nettle leaves in various positions along a pH transect on the slope of a basalt hill: basalt top, middle slope, foot of hill (limestone), in % of initial dry weight; coarsest mesh width



Decomposition of various types of nettle litter on the foot of the hill (limestone): leaves, stems, fine roots, coarse roots, in % of initial dry weight; coarsest mesh width

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What controles the community / food web structure?

Top-down or bottom-up?

(predation or availability of food resources)

- Litter enrichment experiments (food, habitat structure, moisture)

- Predator exclosure experiments

- Mesocosm experiments, e.g. enriching the soil by food sources as glucose to stimulate microbial growth (respiration)

What exactly is the trophic position of a given organism?

- Food preference experiments (choice)
- Analysis of gut content
- Direct observation
- Labelling of potential food with ^{14}C (radioactive isotope)

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Using stable isotopes (C, N) to estimate trophic position

- ^{15}N / ^{14}N ratio ($\delta\ ^{15}N$)
- Enrichment in ^{15}N per trophic level in organisms (on average by 3.4 ‰)
- Range of ^{15}N / ^{14}N ratios in given community indicates number of trophic levels
- ^{15}N / ^{14}N increases with soil depth (thus species collonizing deeper soil layers might contain higher ^{15}N concentrations despite belonging to lower trophic level)

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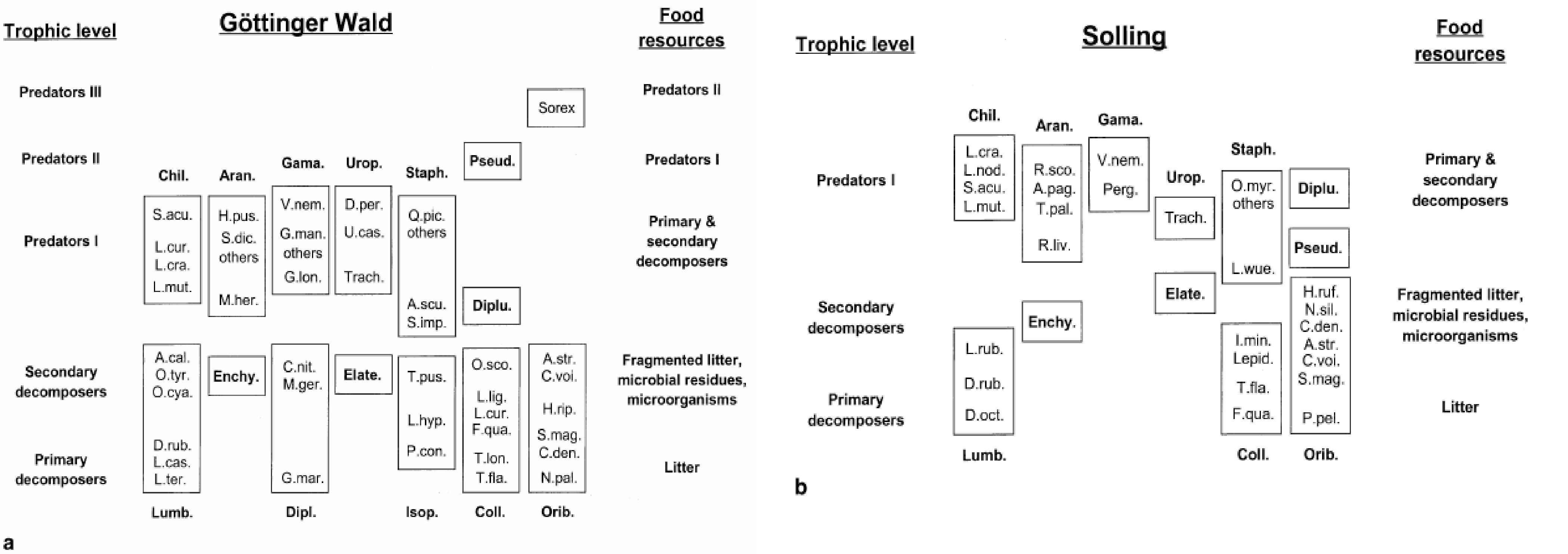
Using stable isotopes to estimate trophic position



Trophic position and food resources of the soil animal community in two beech forests (Göttinger Wald – on limestone, mull humus, Solling – on acidic sandstone, raw humus)