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Axial and radial pressures by earthworms measured in lab

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Movement of earthworms in soil

Besides ingesting and egesting soil, earthworms move through soil by displacing soil aside with their muscular strength. The coelomic fluid in the segments of earthworms is incompressible and functions as an internal hydrostatic skeleton. The alternating contraction of circular and longitudinal muscles results in successive waves of circular and longitudinal compression called peristaltic locomotion. Earthworms generate axial pressures when contracting the circular muscles and radial pressures when contracting the longitudinal muscles. The formation of the compacted drilosphere is a process of soil aggregation; the formation of open macropores a process of soil segregation.

Axial and radial pressures of earthworms

Experimental equipment was developed to measure axial and radial pressures of 8 earthworm species (2 anecic, 4 endogeic, 2 epigeic) (details in KEUDEL & SCHRADER 1999).
The maximum axial pressures recorded for each functional group of earthworms were in the order: anecic (91-116 kPa), endogeic (64-70 kPa) and epigeic (43-50 kPa). For the maximum radial pressures the following order was found: endogeic (79-295 kPa), anecic (136-177 kPa) and epigeic (82-126 kPa).

Outcome and conclusions

- Radial pressures are generally much higher than axial pressures
- Radial pressures are generated by the first 15 segments of an earthworm
- Endogeic earthworms generate highest radial pressures
- Anecic earthworms generate highest axial pressures
- The radial pressure results in the break up of the soil in front of the earthworm; this mechanically weakened soil structure is then axially penetrated
- Radial pressures from plant seedlings are several times higher compared to those recorded for earthworms

Literature

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Further reading

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