The use of Collembola as bio-indicators

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@cjanion
What is a biological indicator?

“... a species or group of species that readily reflects:
1) the abiotic or biotic state of an environment;
2) represents the impact of environmental change on a habitat, community or ecosystem;
3) or is indicative of the diversity of a subset of taxa, or of wholesale diversity, within an area”

The selection, testing and application of terrestrial insects as bioindicators

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Biological indicators

Conservation and monitoring of invertebrates in terrestrial protected areas

J Insect Conserv

Terrestrial invertebrates as bioindicators: an overview of available taxonomic groups

Justin Gerlach · Michael Samways · James Pryke
Soil biota understudied, although soils are integral to agricultural productivity, biodiversity, and the maintenance of ecosystem services.

The use of soil fauna as bio-indicators restricted to a few well-known groups.
Soil biota as indicators

http://www.soilhealthlab.co.za/
Soil biota as indicators

Collembola
Diversity of Collembola in South Africa

About 8,200 species worldwide.

Deharveng (2004) *Pedobiologia*
Diversity of Collembola in South Africa

- Knowledge of Collembola in South Africa poor compared to other countries
- From the literature, 124 recorded species of which 75 endemic, 24 widespread and 25 introduced (Janion-Scheepers et al. 2015)
- Over 1000 species expected for SA

Updated list of Collembola species currently recorded from South Africa

Charlene Janion-Scheepers¹,³, Louis Deharveng², Anne Bedos², Steven L. Chown³
Barcoding of Collembola

DNA BARCODING
Coupling non-destructive DNA extraction and voucher retrieval for small soft-bodied Arthropods in a high-throughput context: the example of Collembola

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Barcoding of Collembola

A DNA-Based Registry for All Animal Species: The Barcode Index Number (BIN) System

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Unique BINs: 376; (1485 specimens)
Non-unique BINs – 59; (5880 specimens)

www.boldsystems.org
Collembola ecomorphological groups

Euedaphic

Epiedaphic

Atmobiotic
Collembola community structure can be used as a tool to assess land use effects on soil quality.

Not only the presence of certain Collembola species, but also the diversity of ecomorphological groups is important for soil processes.
Collembola as bio-indicators: habitat restoration

Liu et al. (2012) Pedobiologia
Collembola as bio-indicators: pollution

Folsomia candida (Collembola):
A “Standard” Soil Arthropod*

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Collembola as bio-indicators: fire

Collembola as bio-indicators: climate change and invasive species

Lab and field experiments found invasive springtails do better under warmer and drier conditions.

Soil biota as bio-indicators
Community level effect?
Soil biota as bio-indicators

(a) Collembola
(b) Oribatida
(c) Arachnida
(d) Pseudoscorpionida
Collembola x spider interaction
Summary

• The use of some terrestrial invertebrate bio-indicators are well developed in South Africa
• More groups of soil biota need to be included as bio-indicators
• For some groups, using morpho-species or functional groups is sufficient
• To use Collembola as bio-indicators, wider geographic sampling and expansion of barcoding library needed
• Building of taxonomic capacity of Collembola and other soil biota
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Prof. Schalk Louw

www.collembola.co.za
Thank you!
The role of physiology
Diet

- Saprophagous (decomposing/decaying plant material)
- Fungivorous (fungal hyphae)
- Phytophagous (pests include *Sminthurus viridis*, lucerne flea)
- Predatory (feed on nematodes, rotifers, and other Collembola)
Diet

Collembolan mouthparts: (A) typical mandible and (B) maxilla; (C) reduced mandible and (D) maxilla of Cyphoderidae; (E) piercing and sucking mandible and (F) maxilla of Neanura; (G-I) various mandibles of Neanuridae and (J-L) various maxillae of Neanuridae.