# Adaptation to dry and hot environmental conditions of grassland springtails (Collembola)

**Shakiba Salehian, Lynda Beladjal and Johan Mertens**

**Ghent University, Department of Biology, Terrestrial Ecology Unit, K.L. Ledeganckstraat 35, B-9000 Ghent, Belgium**

## Introduction:

Springtails (Collembola) are extremely widespread, representing a major part of the pedofauna. They play an important role in the decomposition of litter and in maintaining of the soil structure.

Most springtails have no adaptation to desiccation of the environment, although some species have well known strategies for coping with dry conditions. Prominent among these strategies is the production of dormant eggs which can hatch when humidity increases.

Some springtails not only survive extreme long dry periods as dormant eggs. We hypothesize that they tolerate very high temperatures too.

## Material and methods:

- *Sphaeridia pumilis* specimens were collected from a lawn in the Botanical Garden of Ghent University using a vacuum cleaner.
- After isolation, they were stocked in glass tubes filled with a mixture of plaster and charcoal (9/1) (Fig. 1) at the bottom and fed with yeast (*Saccharomyces cervisiae*). The top of the tube was covered with parafilm.
- Eggs were laid on the wall of the glass tubes.
- After air dried, eggs were incubated for 3 days over silica gel in a desiccator before the heating experiments.
- Samples were slowly heated at 110°, 120°, 130°, 140°C , 150°C and essayed at once.
- The probe of a wire thermocouple (connected to a data logger, Testo 175-T3) was placed directly in the sample holder, in order to measuring the actual temperatures of the examined eggs.

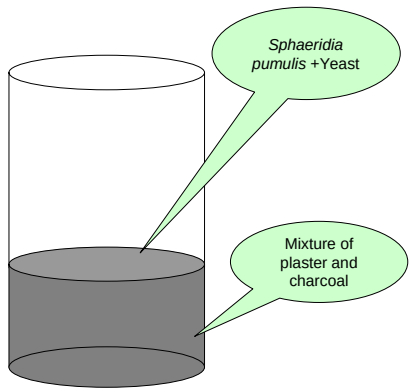


**Figure 1:** Schematic design of glass container filled by plaster and charcoal

**Figure 2:** *Sphaeridia pumilis* female

***Figure 3:*** *Sphaeridia* egg on a glass tube wall

## Results:

The hatching of *S. pumilis* eggs after slow heating to 110°, 120°, 130°, 140°C and 150°C is summarized in Table 1 and Fig. 4.

| Replication | control | 110°C | 120°C | 130°C | 140°C | 150°C |
|---|---|---|---|---|---|---|
| | juveniles % | juvenile % | juvenile % | juvenile % | juvenile % | juvenile % |
| 1 | 68 | 32,5 | 0 | 7,5 | 2,85 | 0 |
| 2 | 11,11 | 0 | 0 | 0 | 0 | 0 |
| 3 | 7,14 | 7,01 | 14,28 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 34,28 | 0 | 0 |
| 5 | 33,3 | 0 | 0 | 0 | 0 | 0 |
| Average % | 23, 91 | 7, 90 | 2, 85 | 8. 35 | 0, 57 | 0 |

**Table 1**: Hatching of *Sphaeridia pumilis* eggs after slow heating at different temperatures

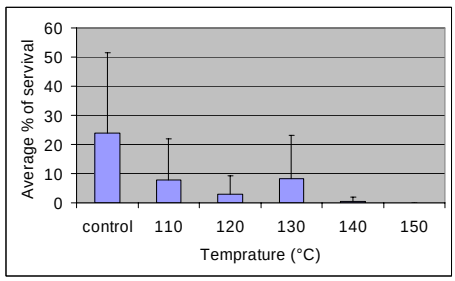


**Figure 4**: Hatching of *Sphaeridia pumilis* eggs after slow heating at different temperatures

## Discussion

Eggs of *S. pumilis* survive temperatures far above those they experience in nature. These observations suggest, albeit speculatively, the possibility that thermal resistance to extreme temperatures could have arisen very early in the evolution of these organisms, but retained thereafter. Their abilities are not so much the result of recent adaptation, but rather reflect capabilities that were achieved during their early evolutionary history and have been maintained subsequently (Mertens *et al.* 2008).

## References

Mertens J., Beladjal L., Alcantara A., Fougnies L., Van Der Straeten D., Clegg J.S. 2008 Survival of dried eukaryotes (anhydrobiotes) after exposure to extremely high temperatures. Biological Journal of the Linnean Society 93: 15-22.