



## Population responses of oribatid mites and collembolans after drought

N. Lindberg\*, J. Bengtsson

Department of Ecology and Crop Production Science, Swedish University of Agricultural Sciences,  
P.O. Box 7043, SE-750 07 Uppsala, Sweden

Received 7 April 2004; received in revised form 4 July 2004; accepted 9 July 2004

### Abstract

To compare the effects of a drought disturbance on species of Oribatida and Collembola, and subsequent recovery of their populations after the drought, we examined a Norway spruce, *Picea abies*, stand in south-western Sweden, where 6 years of experimentally induced summer droughts had resulted in major changes in the soil faunal communities. We followed the population densities during a 4-year period and sought correlations between the species' drought responses and their ecological characteristics. Data on depth preference, habitat choice and reproductive mode were collected from the literature. Surface-living species, which tended to have narrow habitat width, were less negatively affected by the drought. However, among species showing negative population responses to drought, species with large habitat widths tended to recover faster after the drought. Furthermore, parthenogenesis was more common among the oribatid species that showed a population recovery than among those that did not. Overall, collembolan species recovered faster than oribatids, and among the species that did not recover, Oribatida were over-represented. No general differences in characteristics between oribatids and collembolans were observed that could explain their different responses. Possibly, traits other than those examined were more important, such as differences in dispersal rates between the two groups.

© 2004 Elsevier B.V. All rights reserved.

**Keywords:** Collembola; Colonisation; Disturbance; Life history; Oribatida; Population recovery

### 1. Introduction

Many ecosystems are subject to disturbances of varying frequencies, such as fire, drought, flooding and, when under human management, events like

clear-cutting or tilling. To persist in such ecosystems, organisms either have to survive the disturbance, or recolonise disturbed patches from the surroundings. Hence, the traits that allow species to survive in dynamic landscapes are likely to be different from those allowing species to persist locally (Loreau et al., 2003) and may be related to the colonising ability of the species. In colonisation theory, life-history traits have often been used to explain colonisation patterns

\* Corresponding author. Tel.: +46 18 67 24 20;  
fax: +46 18 67 28 90.

E-mail address: [niklas.lindberg@evp.slu.se](mailto:niklas.lindberg@evp.slu.se) (N. Lindberg).

in plants and animals (Ebenhard, 1991). Good colonisers, sometimes equated with “*r*-selected species”, are often characterised by early age at first reproduction, short life span, large clutches and parthenogenesis, whereas the opposite has been suggested to be common among late colonisers, “*K*-selected species” (see, for instance, Baker, 1955; MacArthur and Wilson, 1967; Boyce, 1984; Grubb, 1987). However, the pattern is far from clear-cut, as landscape dynamics or traits such as dispersal ability and niche specialisation may also influence colonisation processes (Diamond, 1974; Simberloff, 1981; Baur and Bengtsson, 1987; Ebenhard, 1991; Ås et al., 1992; Ronce et al., 2000).

Post-disturbance colonisation and succession of soil fauna have received considerable interest over the years, and studies have focused, among others, on man-made habitats and the impact of pesticides, pollution and fire (e.g., Davis, 1986; Bengtsson and Rundgren, 1988; Hoy, 1990; Webb, 1994; Skubala, 1995; Wanner and Dunger, 2002). In soil microarthropods, dispersal behaviour, lifespan and reproductive strategies are probably key factors regulating survival and colonisation after disturbances (Norton, 1994; Petersen, 1995; Siepel, 1995; Shaw, 1997; St. John et al., 2002). It has also been suggested that the ability to survive in sheltered microsites is important (Tamm, 1984; Hopkin, 1997; Shaw, 1997). However, there have been few serious attempts to link the impact of disturbance and subsequent succession to the life-history traits and other characteristics of the species involved, probably because of a lack of data on many species (but see Siepel, 1996; Maraun and Scheu, 2000). Thus, general conclusions have often been drawn without proper tests.

Oribatid mites and collembolans share many similar features as they are mainly fungivorous, have similar body sizes, and are very numerous groups in the organic soil layers. However, the general life-history traits of Oribatida have been considered typical of *K*-selected species (Norton, 1994), whereas collembolan species exhibit wider variation in life-history traits (Norton, 1994; Hopkin, 1997). Therefore, the species-wise responses of Oribatida and Collembola after a disturbance probably differ. It has been argued that disturbances are the main structuring force for oribatid mite communities (Acari: Oribatida) (Maraun and Scheu, 2000). Also,

effects of disturbances on soil faunal communities are often stronger and more long-lived in oribatids than in collembolans (Strojan, 1978; Hutson, 1980; Lucarotti, 1981; Lindberg et al., 2002; Lindberg and Bengtsson, unpublished). This may be a result of general differences in life-history, or differences in dispersal ability and habitat specialisation between the groups.

To study the effects of a drought disturbance and the subsequent recovery of Oribatida and Collembola, we examined a forest site in south-western Sweden where experimentally induced long-term summer droughts had caused major changes in the soil faunal community (Lindberg et al., 2002). One advantage of the site was that the species pool consisted of many relatively well-known microarthropods. Our aim was to examine the extent to which a few life history and ecological characteristics could explain variations in the impact of drought on the soil fauna, and their recovery patterns after the disturbance. The main questions we addressed were:

- (1) Will the populations of collembolan species recover faster than oribatid species, as they are considered less *K*-selected (Norton, 1994)?
- (2) Will deep-living species recover faster than species living closer to the surface, as they are more likely to have survived the disturbance due to their ability to penetrate deeper into the soil during drought?
- (3) Will populations of parthenogenetic species recover faster than sexually reproducing ones, as suggested by *r*-selection theory?
- (4) Will generalist species recover faster than species with narrower habitat preferences, as suggested by e.g., Ås et al. (1992) for fragmented habitats in general?

## 2. Material and methods

### 2.1. Site description

The field study was carried out during 1996–1999 in a homogeneous Norway spruce (*Picea abies*) stand situated at Skogaby, south-western Sweden (56°33'N, 13°13'E), 16 km from the coast at an altitude of 95–115 m above sea level. The climate is maritime with a

Download English Version:

<https://daneshyari.com/en/article/9445236>

Download Persian Version:

<https://daneshyari.com/article/9445236>

[Daneshyari.com](https://daneshyari.com)