Soil Biology and Biochemistry 119 (2018) 59–62

Contents lists available at ScienceDirect

Soil Biology and Biochemistry

journal homepage: www.elsevier.com/locate/soilbio

Short Communication

Drought in spring increases microbial carbon loss through respiration in a Mediterranean pine forest

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ARTICLE INFO

Keywords:
Decomposition
Climate change
Legacy effects of drought
Pinus brutia
Soil carbon

ABSTRACT

We investigated the effect of drought in spring (earlier onset of summer drought) on litter decomposition in a Mediterranean pine forest, in Greece. We exposed litterbags filled with decomposed or fresh pine litter in the forest floor from January to November and simulated drought from April to May (season with usually high activity in soil). The drought treatment resulted in a significant increase of microbial respiration and litter weight loss and a decrease of microbial C. Both litter types were similarly affected by drought, but differed in parameters related to decomposer community succession (Collembola and Acari abundances, organic C and N, microbial N). Our results indicate that drought during the highly biologically active season might have significant implications for soil Carbon sequestration/storage.

Decomposition is fundamental for ecosystem functioning and plays a key role in nutrient cycling (e.g. Hättenschwiler et al., 2005; Gessner et al., 2010). Climatic factors, litter quality and soil community composition and activity are the main factors influencing the decomposition process (Swift et al., 1979; Bradford et al., 2002, 2015; Handa et al., 2014). Longer and extremely dry periods are predicted to become more frequent in Europe, especially during the late spring and summer season (Christensen and Christensen, 2007; IPCC, 2007; Aiguo, 2013). These predictions also include the Mediterranean region where water is one of the limiting factors (Sardans and Peñuelas, 2007). We investigated the legacy effect of drought during spring (earlier onset of summer drought) on litter decomposition in a *Pinus brutia* Mediterranean pine forest. We hypothesized that drought during spring (i.e. highly biologically active season in Mediterranean systems) would affect litter decomposition patterns in the longer term (i.e. after several months), but that there might be differences among litters of different decomposition stage (corresponding to the different forest litter layers).

We carried our experiment out on Mt. Holomon (470 m a.s.l.) in N. Greece (see also Tsiafouli et al., 2005). The climate is Mediterranean with dry summers, cold and wet winters. Seasons of spring and autumn are relatively warm and wet (Fig. 1). We collected freshly fallen *P. brutia* needles from the study area by traps, 6 months before using them for the litterbags. Half of the material was air-dried (fresh) and the other half was aged (aged) in the laboratory. For aging, the litter was inoculated with a suspension containing fungi from the experimental area, incubated in darkness for 3.5 months at 20 °C, and regularly

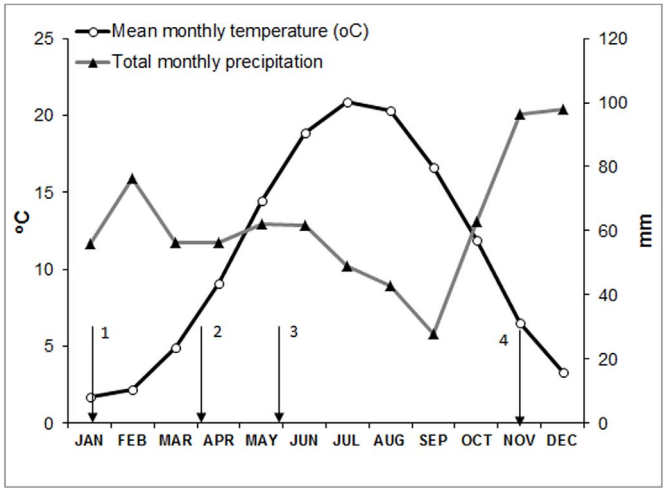

Fig. 1. Diagram of temperature and precipitation of the study area (Mt. Holomon, Greece) and experimental manipulation. The arrows depict stages of the experimental manipulation in the field: 1. Placing of litterbags on the forest layer, 2. Placing of roofs on top of the litterbags (drought plots), 3. Removal of roofs, and 4. Sampling of litterbags.

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https://doi.org/10.1016/j.soilbio.2018.01.010
Received 3 October 2017; Received in revised form 9 January 2018; Accepted 15 January 2018

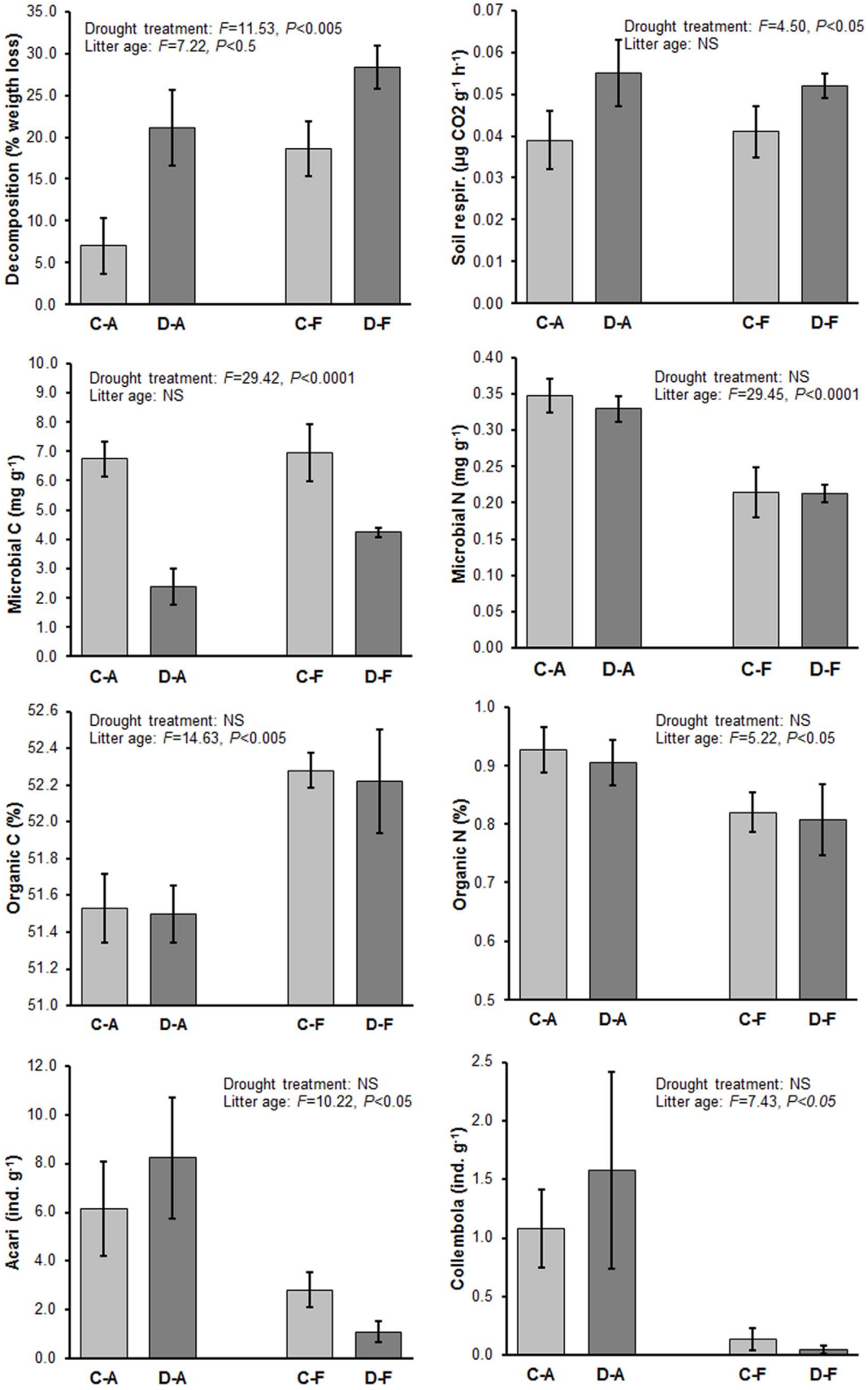

Fig. 2. Mean values of measured parameters, along with the effect of drought treatment and litter age as indicated by two-way ANOVA. The interactive effect of the independent factors was non-significant for all parameters, i.e. the effect of drought was similar for both litter types, and therefore is not shown in the graphs. Bars above columns indicate standard errors. Codes: the first letter and the color refer to the treatment (C, light grey: control; D, dark grey: drought). The second letter refers to the litter decomposition stage (A: aged, F: fresh). NS: non-significant.