Supplementary Materials: Water, Rather than Temperature, Dominantly Impacts How Soil Fauna Affect Dissolved Carbon and Nitrogen Release from Fresh Litter during Early Litter Decomposition

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**Figure S1.** Water contents (±SE, *n* = 3) in the foliar litter with (white) and without (black) soil fauna at different sampling dates. (**a**) planted cypress; (**b**) native cypress; (**c**) fir; (**d**) shrub; (**e**) oak; (**f**) birch. Values with \*\* and \*\*\* are significantly different between the treatments at the *p* = 0.01 and 0.001 levels, respectively, based on a pairwise *t*-test.

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**Figure S2.** Concentrations of (**a**, **b**) dissolved organic carbon and (**c**, **d**) total dissolved nitrogen plotted against the carbon and nitrogen contents and the C/N ratios, respectively. The sample size, adjusted *R*2, and *p* value are shown in each panel.

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**Figure S3.** Concentrations of (a–e) dissolved organic carbon and (f–j) total dissolved nitrogen of the foliar litter plotted against the individual number and Shannon-Wiener, Simpson, Piolou and Margalef indexes of soil fauna. The Person’s *r* and *p* values of linear regression analyses are shown in each panel.

**Table S1.** Initial chemical composition of the foliar litter (concentration ±SE, *n* = 3).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Litter species** | **Carbon (%)** | **Nitrogen (%)** | **Phosphorus (%)** | **Cellulose (%)** | **Lignin (%)** | **C/N ratio** |
| Cypress | 51.6 ± 1.0 a | 1.3 ± 0.06 bc | 0.16 ± 0.001 ab | 20.2 ± 0.40 a | 16.7 ± 0.8 b | 39.0 ± 1.2 b |
| Shrub | 45.2 ± 1.0 b | 2.0 ± 0.05 a | 0.13 ± 0.004 ab | 12.9 ± 0.12 b | 18.9 ± 1.7 b | 23.1 ± 0.2 d |
| Oak | 50.3 ± 1.0 ab | 1.8 ± 0.09 ab | 0.18 ± 0.004 ab | 7.5 ± 0.70 c | 32.9 ± 0.3 a | 28.9 ± 1.1 c |
| Fir | 50.6 ± 1.7 a | 1.1 ± 0.03 c | 0.20 ± 0.037 a | 12.5 ± 0.59 b | 22.1 ± 3.6 b | 44.4 ± 0.5 a |
| Birch | 49.7 ± 0.8 ab | 1.6 ± 0.07 b | 0.10 ± 0.014 b | 13.6 ± 0.70 b | 36.9 ± 0.3 a | 31.9 ± 0.9 c |

Different lowercase letters in the same column indicate significant (*p* < 0.05) differences among the litter species.

**Table S2.** Mean litter surface temperature and frequency of freeze-thaw cycles at the experimental sites at different time periods.

|  |  |  |  |
| --- | --- | --- | --- |
| **Period** |  | **Mean litter surface temperature (°C)** | **Frequency of freeze-thaw cycle (time d−1)** |
| Winter | Arid valley | 7.6 | 0.73 |
|  | Ecotone | 2.4 | 0.82 |
|  | Subalpine forest | −1.4 | 0.94 |
| Growing season | Arid valley | 21.0 | 0 |
|  | Ecotone | 14.0 | 0 |
|  | Subalpine forest | 9.9 | 0.01 |

**Table S3.** Number of individuals (±SE, *n* = 3) and percentage (%) of soil fauna observed in the litterbag with 3 mm mesh size during the one-year decomposition period.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Arid valley** | | | | | | **Ecotone** | | | | | | **Subalpine forest** | | | | | |
| Planted cypress | | | Shrub | | | Native cypress | | | Oak | | | Fir | | | Birch | | |
| Fauna | No. | % | Fauna | No. | % | Fauna | No. | % | Fauna | No. | % | Fauna | No. | % | Fauna | No. | % |
| Prostigmata | 26 | 96 | Prostigmata | 10 ± 5 | 94 | Isotomidae | 37 ± 13 | 43 | Prostigmata | 40 ± 20 | 73 | Isotomidae | 39 ± 17 | 45 | Oribatida | 82 ± 39 | 61 |
| Isotomidae | 0.67 | 2.5 | Homoptera | 0.33 ± 0.17 | 3.1 | Prostigmata | 28 ± 14 | 33 | Oribatida | 7.7 ± 2.5 | 14 | Prostigmata | 26 ± 12 | 29 | Isotomidae | 26 ± 3.0 | 19 |
| Psocidae | 0.33 | 1.3 | Stenopirates | 0.33 ± 0.17 | 3.1 | Oribatida | 10 ± 5 | 12 | Isotomidae | 6.0 ± 1.7 | 11 | Oribatida | 16 ± 6.3 | 18 | Prostigmata | 23 ± 11 | 17 |
|  |  |  |  |  |  | Psocidae | 6.7 ± 3.3 | 7.9 | Phoridae | 0.67 ± 0.33 | 1.2 | Lithobiomorpha | 1.3 ± 0.67 | 1.5 | Scydmaenidae | 0.67 ± 0.33 | 0.50 |
|  |  |  |  |  |  | Geophilus | 2.0 ± 1.0 | 2.4 | Ctenizidae | 0.33 ± 0.17 | 0.61 | Acerentomata | 1.0 ± 0.5 | 1.1 | Caenorhabditis elegans | 0.33 ± 0.17 | 0.25 |
|  |  |  |  |  |  | Caenorhabditis elegans | 0.67 ± 0.33 | 0.79 | Geophilus | 0.33 ± 0.17 | 0.61 | Caenorhabditis elegans | 1.0 ± 0.5 | 1.1 | Geophilus | 0.33 ± 0.17 | 0.25 |
|  |  |  |  |  |  | Phoridae | 0.33 ± 0.17 | 0.39 |  |  |  | Staphylinidae | 1.0 ± 0.5 | 1.1 | Lithobiomorpha | 0.33 ± 0.17 | 0.25 |
|  |  |  |  |  |  | Ptilodactylidae | 0.33 ± 0.17 | 0.39 |  |  |  | Armadillidiidae | 0.67 ± 0.33 | 0.76 | Metriocampa | 0.33 ± 0.17 | 0.25 |
|  |  |  |  |  |  |  |  |  |  |  |  | Geophilus | 0.67 ± 0.33 | 0.76 | Phoridae | 0.33 ± 0.17 | 0.25 |
|  |  |  |  |  |  |  |  |  |  |  |  | Scydmaenidae | 0.67 ± 0.33 | 0.76 | Staphylinidae | 0.33 ± 0.17 | 0.25 |
|  |  |  |  |  |  |  |  |  |  |  |  | Phoridae | 0.33 ± 0.17 | 0.38 |  |  |  |
| Total | 27 ± 8.4 |  |  | 11 ± 3.2 |  |  | 85 ± 5.0 |  |  | 55 ± 6.3 |  |  | 88 ± 4.0 |  |  | 134 ± 8.3 |  |
| Group | 3 |  |  | 3 |  |  | 8 |  |  | 6 |  |  | 11 |  |  | 10 |  |

**Table S4.** Levels of significance from the two-way ANOVA for comparing the effects of season, litter species and their interaction on the group number, individual number and Shannon-Wiener, Simpson, Pielou and Margalef indexes of soil fauna.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **m** | ***df*** | **Group number** | | **Individual number** | | **Shannon-Wiener index** | | **Simpson index** | | **Pielou index** | | **Margalef index** | |
| *f* value | *p* value | *f* value | *p* value | *f* value | *p* value | *f* value | *p* value | *f* value | *p* value | *f* value | *p* value |
| Period | 1 | 122.9 | <0.001 | 44.9 | <0.001 | 26.4 | <0.001 | 79.8 | <0.001 | 6.7 | 0.016 | 18.4 | <0.001 |
| Litter species | 5 | 27.7 | <0.001 | 5.3 | 0.002 | 12.4 | <0.001 | 2.3 | 0.073 | 1.9 | 0.14 | 11.2 | <0.001 |
| Period × Litter species | 5 | 4.6 | 0.0047 | 2.6 | 0.050 | 0.8 | 0.58 | 7.9 | <0.001 | 16.3 | <0.001 | 0.4 | 0.88 |

**Table S5.** Shannon-Wiener, Simpson, Pielou and Margalef indexes (±SE, *n* = 3) of soil fauna observed in the litterbag with 3 mm mesh size.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Period** | **Arid valley** | | **Ecotone** | | Subalpine forest | |
| Planted cypress | Shrub | Native cypress | Oak | Fir | Birch |
| Shannon-Wiener index | | | | | | |
| Winter | N/A | 0 ± 0 aA | 0.46 ± 0.23 aA | 0.35 ± 0.20 aA | 0.52 ± 0.21 aA | 0.72 ± 0.09 bA |
| Growing season | 0.28 ± 0.19 B | 0.20 ± 0.12 aB | 0.89 ± 0.16 aAB | 1.03 ± 0.06 aA | 0.91 ± 0.14 aAB | 1.30 ± 0.08 aA |
| Simpson index | | | | | | |
| Winter | N/A | 0 ± 0 aA | −0.51 ± 0.25 bA | −0.92 ± 0.59 aA | −1.80 ± 0.99 aA | −0.71 ± 0.20 bA |
| Growing season | 0.20 ± 0.13 C | 0.14 ± 0.08 aC | 1.28 ± 0.18 aB | 1.50 ± 0.08 aB | 1.48 ± 0.10 aB | 2.66 ± 0.23 aA |
| Pielou index | | | | | | |
| Winter | N/A | 0 ± 0 b B | 0.67 ± 0.16 aA | 0.76 ± 0.15 aA | 0.69 ± 0.13 aA | 0.53 ± 0.03 aAB |
| Growing season | 0.82 ± 0.13 AB | 0.89 ± 0.07 aA | 0.53 ± 0.10 aAB | 0.44 ± 0.03 aB | 0.51 ± 0.11 aAB | 0.35 ± 0.04 bB |
| Margalef index | | | | | | |
| Winter | N/A | 0 ± 0 aA | 0.69 ± 0.42 aA | 0.26 ± 0.13 bA | 0.46 ± 0.13 aA | 0.93 ± 0.02 bA |
| Growing season | 0.40 ± 0.27 B | 0.28 ± 0.15 aB | 0.93 ± 0.09 aAB | 0.78 ± 0.09 aB | 0.98 ± 0.19 aAB | 1.53 ± 0.05 aA |

Different lowercase letters in the same column indicate significant (*p* < 0.05) difference between seasons for a certain litter species, and different capital letters in the same row indicate significant (*p* < 0.05) differences among litter species for a certain season.