UV and blue light enhance tree litter decomposition in a temperate forest by accelerating the decomposition rate.

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Abstract

Sunlight, alongside warm temperatures and high humidity, can accelerate litter decomposition by direct breakdown of organic matter through photodegradation. This process is mainly driven by radiation at the high-energy short-wavelength end of the solar spectrum: UV radiation and blue light. Although this process is widely studied in arid environments, few studies have been done in temperate forets.
This study aims to test how sunlight, and particularly UV-B, UV-A, and blue light, affects litter decomposition of different tree species under a temperate forest canopy. Litter mass loss and C:N ratio of: European ash (*Fraxinus excelsior*), European beech (*Fagus sylvatica*) and pedunculate oak (*Quercus robur*), differing in their leaf traits and consequently decomposition rate, were analysed over 7-10 months in litterbags made using filters attenuating different regions of the solar spectrum. We expected less mass loss and higher C content when UV and blue light were excluded, due to the lower photodegradation.

Over the entire period, mass loss was smallest in the absence of UV and blue light and this litter had the lowest C:N ratio. The filter treatment had a greater effect on decomposition than the biotic community composition as controlled through mesh size. The three litter type responded differently to the filter treatments, suggesting the magnitude of photodegradation to be dependent on litter quality and especially on the initial C:N, known to affect decomposition rate.
This study shows that even under the reduced irradiance found in the understorey of a temperate forest UV radiation remains important in accelerating decomposition, increasing mass loss and thus C released into the atmosphere. Blue light was also revealed to make an important contribution to these decomposition processes. Knowing the role of UV and blue light in decomposition is crucial to estimate the contribution of temperate forests to carbon cycling under a scenario of climate.

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