
Determinant factors of decomposition process in São Paulo state forests

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Abstract

Composition is an important indicator of functional patterns of ecosystems, as it controls basic processes related to the availability of nutrients and to ecosystem productivity. Climatic and edaphic conditions and the quality of the litter and soil fauna as determining factors are of particular importance in the process of decomposition. The significance of each one of these varies with spatial and temporal scale. The objective of this work was to evaluate the importance of certain determining factors of decomposition in sites representing the main forest ecosystems of the state of São Paulo, Brazil. To accomplish this, two independent experiments were conducted.

The first, denoted here as the “Exotics” experiment, was to examine the effects of the type of forest and the soil fauna on the decomposition of leaves of an exotic species (*Laurus nobilis* L.) in two humid forests (Restinga Forest of the Parque Estadual da Ilha do Cardoso e Atlantic Forest of the Parque Estadual Carlos Botelho) and a seasonal forest (Semideciduous Forest of the Estação Ecológica de Caetetus). The effects of these factors were tested above and belowground, to simulate the environment of decomposition among leaves and roots respectively. The type of forest had a significant effect over fauna above the surface, while below the surface, only fauna had significant effect. These results indicate that the hierarchy of determining factors in decomposition differs between leaves and roots. If on the one hand decomposition in leaves is much more susceptible to variation in climate than are roots, on the other hand changes in the soil fauna affect decomposition in both environments. Above the surface, fauna had a significant effect only in the Atlantic Forest, emphasizing the difference between two humid forests. Under the surface, and in the absence of fauna, the percentage of remaining biomass was very similar in the three forests. Notwithstanding differences in the forests, the presence of fauna was apparent, suggesting that there is a specific contribution of fauna in decomposition among roots in these forests. The Restinga Forest produced the most pronounced effect of fauna below the soil surface. These results indicate that fauna is a factor of notable importance in the decomposition of roots, especially in humid sandy tropical forests.

The other experiment, here called the “Native” experiment, was developed to evaluate the effects of the substrate and the forest type on the decomposition of leaves of four native species in sites of the four major forest types in São Paulo state. The experiment

was conducted in the same three forest sites as the “Exotics” experiment, including the Cerradão da Estação Ecológica de Assis. A tree species was chosen in each forest type, the leaves of which were used as substrate for the litter bags. The type of forest and the substrate demonstrated a significantly greater effect on the quantity of remaining mass throughout the experiment. The majority of the species suffered greater losses in the Atlantic Forest, followed by the Restinga Forest, the Semideciduous Forest, and the Cerradão. These results suggest that the total associated precipitation and its distribution are important determinants in the process of decomposition. As such, the two most humid forests show, on average, decomposition rates twice as great as the two seasonal forests. The rest of the differences encountered between forest types can be explained by edaphic and biotic factors. With respect to the effect of the species, the greatest biomass losses were observed in *Esenbeckia leiocarpa* Engl., followed by *Copaifera langsdorfii* Desf., *Guapira opposita* Vell. and *Calophyllum brasiliensis* Camb. Chemical parameters only show significant negative correlation with decomposition rates when *G. opposita* is excluded from the analysis. In this case the percentage of lignin was the parameter that showed the greatest correlation ($r^2=0,59$). In spite of the general patterns presented above, the interaction between forest type and substrate showed some variation, principally related to the loss of mass of *C. langsdorfii* in its native habitat, the Cerradão. Comparing decomposition rates (k) found in the Semideciduous Forest and Cerradão, *C. langsdorfii* shows a decrease of 40% more in the Cerradão, while the other species show, on average rates 28% lower in the Cerradão than in the Semideciduous Forest. These results suggest a strict correlation between the decomposition community and the local litter.

Understanding processes of decomposition, is of fundamental importance and includes recognizing the determining factors and the variation in the importance of these factors under different environmental conditions, as presented in this study. This is true not only for our understanding of the forest ecosystems of São Paulo, but also for management planning, restoration, and conservation.

Key-words: leaf litter, litter bags, litter quality, climate control on decomposition, soil fauna