NITROGEN ECOPHYSIOLOGY OF AN AUSTRALIAN MONTANE RAINFOREST: A GONDWANAN APPROACH

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INTRODUÇÃO

Most of the literature on tree physiology is still based on a carbon (C) centric view of the world, but in fact, tree growth is seldom limited by the availability of C, and the plant C status is not the most important aspect of their physiology to understand, rather there is a growing body of evidence for the importance of nitrogen (N) storage and remobilization for tree growth (Millard & Grelet 2010). Also, it is being reported that nutrient availability limits tree growth, particularly N (Rennenberg *et al.*, 2009) and its physiologic mechanisms limit primary production in most terrestrial systems (Chapin *et al.*, 2002). In addition, plants exert a major influence over soil N cycling via unique N attainment strategies and therefore influence their own fitness (Chapman *et al.*, 2006). Thus, plants depend on and drive N relations in their habitat, and competition for N has resulted in the evolution of diverse strategies for acquisition and use of N as shown by Schmidt *et al.*, (1998) in an Australian forest community. It has also been shown that plants in late sucessional stages seasonally change transport and acquisition of N (Aidar *et al.*, 2003). With exception of these few studies sufficiently overrated above, still, the majority of the quantitative studies that have addressed N storage and remobilization have used young trees or seedlings growing in artificial conditions (e.g. Vizoso *et al.*, 2008), there is now a need to describe and quantify these processes for adult trees in situ where most root N uptake might occur via ectomycorrhizal partners (Millard & Grelet 2010). The approach of studying interactions between N and C allocation in trees and associated mycorrhizal partners, are likely to be crucial in regulating the response of trees to many aspects of global environmental change. Given that N cycling is likely to ultimately regulate ecosystem scale responses, this is potentially a major gap in our understanding of how trees respond to elevated CO_2 (Millard & Grelet 2010).

OBJETIVOS

Because of the importance of N for plant growth and ecosystem processes and the limited knowledge on how climate change will affect tropical and subtropical forests, there is an urgent necessity to obtain more information about nitrogen relations, including physiological and ecological mechanisms that regulate the plant growth in plant communities. Storage, assimilation capacity and transport of N in plants are fundamental characteristics that provide insight into plant function. Then, an improved knowledge of assimilation, transport, stock and recycling of N are essential for a better understanding of these processes and mechanisms in subtropical rainforest communities. Studies of N dynamics and the processes of internal cycling and plant species ecophysiology traits would improve the comprehension about functionality of the N cycle in these ecosystems. We tested whether the forest studied here have similar behaviour in relation to N use and transport in species sucessional stages to Brazilian tropical forests, considering the gondwanic link between them regarding their formation and developing. Such knowledge will be useful for conservation and management in these sensitive areas before global warming threat.

MATERIAL E MÉTODOS

Study area The study site was a Montane Rainforest of Lamington National Park, located in Southern Queensland State (28°13'S, 153°07'E), QLD/Australia, at an altitude of 900m. The region is formed from Tertiary volcanic rocks that are primarily basaltic, and receives an average annual rainfall of 1660mm.

Experimental design In a sample of 40 species, 3 - 4 individuals of each species were collected in summer and winter of 2010. In order to verify the assimilation and stock of nitrate (NO_3^-) by the plants, leaf tissue was submitted to the *in vivo* nitrate reductase activity (NRA) analysis, leaf NO_3^- content, stable isotope ratio (CN) and leaf areameasurements.The transport and recycling of N compounds as ammonium (NH_4^+), NO_3^- and free amino acids (aa) was determined measuring their amount in xylem sap extracts using an UPLC. Nodules, mycorrhizal colonization and communities of arbuscular mycorrhizal fungi spores were verified in the soil. The aa content was also measured in the soil as well as the availability of$NH_4^+$and NO_3^-, estimated through ion exchange resin bags, kept within 5 cm of soilduring sampling week. For statistical analysis we used ORIGIN 5·0, WINSTAT (R. Fitch Software, Cambridge, MA/USA) and FITOPAC 2.0 (Shepherd, Unicamp 2010).

RESULTADOS

Pioneer species assimilate especially nitrate and transport mainly asparagine in the xylem fluid. In contrast, late secondary species had not NRA activity, showing that they use no nitrate as a main N source, but rather recycle N internally by transporting arginine in the xylem sap. Early secondary species exhibited a less uniform behaviour. The data presents a validation of a model for nitrogen use along succession in Australian Montane Rainforest trees, introduced first for Atlantic Forest trees by Aidar *et al.*, (2003).Plants in late sucessional stages seasonally changed transport and acquisition of N by remobilizing N from N storage pools in the dry season as indicated by the prevalence of arginine as the main xylem sap N form, and transporting amides (glutamine/asparagine) which dominate the xylem sap content during times of active acquisition of N.

CONCLUSÃO

The data indicates that nitrogen use along succession in Australian Montane Rainforest trees is similar to the proposed model for Atlantic Forest trees by Aidar *et al.*, (2003). It is an interesting evidence of that the actual composition and functioning of Brazilian and Australian tropical forests have common origins,because both had their roots on the Cretaceous in the super continent of Gondwana. Raven and Andrews (2010) presented evidence that nitrate assimilation was probably the first source of nitrogen for plants that have conquered the terrestrial environment, this is also an important source in the early evolution of tree species. This vision of theangiospermsevolution suggests that theecophysiologicalstrategies of N use we see in today's tropical forests were established early in the development of flowering plants in the Tertiary period. This aspect favors the realization of pan - tropical comparisons through the use of standard methods that will provide greater knowledge about the ecology and functioning of tropical forests, and assist in identifying conservation strategies that are appropriate to regional conditions.

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