Why at high latitudes trees should escape their relatives: maintaining high foliar phosphorous

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Résumé

All organisms need phosphorous (P). Across tree species, foliar P content increases towards higher latitudes, but it remains unclear whether this is due to higher availability of P, or higher demand for P, and whether the pattern across species also exists within species. Trees interact through competition and through enemies and mutualists shared among phylogenetically proximate trees. Such local interactions might increase access to P but also loss of P. It remains unclear whether interactions with phylogenetically proximate tree neighbours facilitate or hinder the maintenance of high foliar P at high latitudes. We used pan-European forest-plot databases to study nutrient contents of six late-successional tree species, each being represented in hundreds of plots. We inferred P availability from continental soil maps and P demand from climatic conditions constraining vegetation period and from high P resorption efficiency. Within five of the six species we found that trees show increased foliar P contents towards higher latitude – but only when growing in a phylogenetically distant neighbourhood. This pattern always reflected constraining climatic conditions increasing P demand, and occasionally the availability of P in the soil. We suggest that in order to maintain high P contents, trees may associate with distant relatives at high latitudes and with close relatives at low latitudes.

Mots-Clés: coexistence of close relatives, foliar phosphorous, trees, stoichiometry

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