Intra- and interspecific variations of leaf Si concentration in broad-leaved trees
（広葉樹の葉のケイ素濃度の種内および種間の変異）

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Silicon (Si) is a beneficial element for plants because it enhances the tolerance against biotic and abiotic stresses. Leaf Si concentration varies 1000-fold among species, reflecting how plants absorb Si from the soil. In some crop species, but not in woody plants, intraspecific variations of leaf Si concentration with the cumulative water consumption through the leaf had been reported. In the present study, I aimed to clarify for broadleaf tree species with moderate levels of Si accumulation, 1) how the intraspecific variation of leaf Si accumulation rate relates to the environmental factors, and 2) whether there are any physiological or ecological tradeoffs existing in association with silicon accumulation. In Chapter 2, I found that Si in the leaves of three taxa of broad-leaved trees is localized in the leaf lamina, whereas petioles and veins contained negligible amounts of Si. In Chapter 3, I found that leaf Si accumulation rate correlated positively with shoot-level light availability in *Broussonetia papyrifera*, which was an expected pattern if shoots transporting more water under greater light availability accumulate more Si in their leaves. In Chapter 4, in a manipulative experiment, I found that the effect of soil Si availability on leaf Si accumulation rate is small in *Ficus erecta.* In Chapter 5, I quantified leaf mechanical properties with a tear test and examined their relationship with the Si concentration of the leaves of 33 broadleaved woody species. The results show that Si enhances stiffness (= modulus of elasticity) but not strength (= fracture resistance). These data suggest that 1) leaf Si accumulation rate in broad-leaved trees shows intraspecific variation in relation to shoot-level light availability and that 2) leaf mechanical properties and their correlation with Si and cell wall fiber concentrations suggest an interspecific pattern of tradeoff in association with silicon accumulation.