The morphology and phosphorus concentration drive the leaf carbon capture and economic trait variations in subtropical bamboo forest

Jun Sun[1], Jinlong Li[2], koyama kohei[3], Dandan Hu[2], Quan-ling Zhong[2], and Dongliang Cheng[2]

[1]Anqing Normal University
[2]Fujian Normal University
[3]Hokkaido University of Education - Asahikawa Campus

December 28, 2022

Abstract

Carbon absorption capability and morphological traits are crucial for plant leaf function performance. Here, we investigated the five bamboos at different elevations to clarify how the leaf trait responds to the elevational gradient, and drive the photosynthetic capacity variations. We selected five bamboo species located along different elevations in Wuyi Mountain, southeastern China. The Standardized Major Axis Regression (SMA) analyses and the Structural Equation Model (SEM) are applied to identify how the bamboo leaf trait, including the ratio of leaf length to width (W/L), leaf mass per area (LMA), photosynthesis rates (Pn), leaf nitrogen, and phosphorus concentration (Nmass and Pmass) response to elevation environment, and the driving mechanism of Pn changes. Across the five bamboo species, our results revealed the Pmass of Phyllostachys edulis and Oligostachyum oedogonatum decreased with increasing elevation, but the Nmass, and LMA of Indocalamus tessellatus increased. Besides, the Pmass scaled isometrically with respect to W/L, the Nmass scaled allometrically as the 0.80-power of Pmass, and Nmass and Pmass scaled allometrically to Pn, with the exponents of 0.58 and 0.73, respectively. The SEM result showed altitude, morphological trait (W/L and LMA), and physiological trait (Nmass and Pmass) could together explain the 44% variations of Pn, with a standard total effect value of 70.0%, 38.5%, 23.6% to Pmass, Nmass, and W/L, respectively. The five bamboo species along the different elevational share an isometric scaling relationship between their Pmass and W/L, providing partial support for the general rule and operating between morphological and physiological traits. The scaling relationship between Pmass and W/L is insensitive to elevation and species. Further, the leaf W/L and Pmass as the main trait that affects leaf area and P utilization in growth and thus drives bamboo leaf photosynthetic capacity variations in different elevations.

Hosted file

`The bamboo leaf economic trait.doc` available at https://authorea.com/users/312642/articles/616193-the-morphology-and-phosphorus-concentration-drive-the-leaf-carbon-capture-and-economic-trait-variations-in-subtropical-bamboo-forest