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Changes in stomatal traits and the covariation with other leaf traits along an altitude transect

Ruili Wang (1,2), Guirui Yu (1), Nianpeng He (1), Jianping Ge (3), Qiufeng Wang (1), Ning Zhao (1,2), Zhiwei Xu (1,2)

(1) Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China , (2) University of Chinese Academy of Sciences, Beijing, China , (3) College of Life Sciences, Beijing Normal University, Beijing, China

Stomatal traits and their responses to the external environment have been intensively studied for individual plant species. However, little is known about general stomatal patterns along environmental gradients in a broad, interspecific context or about the relationship between stomatal traits and other leaf traits. Here, we measured the stomatal and leaf traits, including stomatal density (SD), stomatal length (SL), specific leaf area (SLA), leaf area (LA), leaf thickness (LT) and nitrogen concentration (mass- and area- base, Nmass and Narea) of 158 plant species along an altitudinal gradient on Changbai Mountain, China. Our results revealed that SD decreased and SL increased significantly with altitude for tree species, although no clear elevational trends were observed in SD and SL across species (including tree, shrub, and herbaceous plants). Plant growth forms (PGFs) were the most important driver of variation in SD and SL, and the contributions of the mean annual temperature, precipitation and soil water content were weak. In addition, a covarying relationship between stomatal and other leaf traits was observed, although this relationship changed with elevation. These findings reflect that the adaptive strategies of plant ecophysiological traits may be complex for alpine environmental gradients, combining the short-term plasticity to environmental changes and long-term convergent evolution.