Abstract

Mountains serve as exceptional natural laboratories for studying biodiversity due to their heterogeneous landforms and climatic zones. The Himalaya, a global biodiversity hotspot, hosts rich endemic flora, supports vital ecosystem functions, and offers a unique window into multifaceted plant diversity patterns. This review synthesizes research on Himalayan plant diversity, including species, phylogenetic, functional, and genetic dimensions, highlighting knowledge gaps and solutions. Research on Himalayan plant diversity has developed significantly. However, gaps remain, especially in studies on phylogenetic and functional diversity. The region's vegetation ranges from tropical rainforests to alpine ecosystems, with species richness typically following a hump-shaped distribution along elevation gradients. The eastern Himalaya exhibits higher plant diversity than the central and western regions. Low-elevation communities were found to be more functionally diverse, whereas high-elevation communities displayed greater ecological specialization. Communities at mid-elevations tend to show greater phylogenetic diversity than those at higher and lower elevations. The eastern and western flanks of the Himalaya retain high levels of genetic diversity and serve as glacial refugia, whereas the central region acts as a hybrid zone for closely related species. Himalayan plant diversity is shaped by historical, climatic, ecological and anthropogenic factors across space and time. However, this rich biodiversity is increasingly threatened by environmental change and growing anthropogenic pressures. Unfortunately, research efforts are constrained by spatial biases and the lack of transnational initiatives and collaborative studies, which could significantly benefit from interdisciplinary approaches, and other coordinated actions. These efforts are vital to safeguarding the Himalayan natural heritage.