# Multifunctional Bracts Enhance Plant Reproductive Fitness in Alpine Areas of Himalayas

A sample of Rheum nobile at its early flowering stage, growing in alpine areas of Himalayas. (Image by KIB)

Although alpine areas are generally characterized by low temperatures, high solar radiation, strong winds, cloudiness, frequent precipitation, and low levels of insect abundance and activity, it harbours high biodiversity. Thus, how these plants reproduce successfully in hostile environmental conditions is a topic of evolutionary biology. Plants in these areas frequently exhibit highly specialized structures to cope with various stresses, for example, greenhouse and snowball plants. However, the specific evolutionary adaptive mechanisms of these specialized structures are still unclear.

Recently, Ph.D student SONG Bo and Prof. SUN Hang, fromthe CAS Kunming Institute of Botany (KIB), investigated the evolutionary adaptive significances of large and showy bracts in *Rheum nobile*, a giant herb endemic to eastern high Himalayas. Bracts increase flower and fruit temperature on sunny days, greatly decrease the intensity of ultraviolet-B (UV-B) radiation reaching flowers and fruits, and prevent pollen grains being washed away by rain. Pollen germination experiments indicated that high temperature could promote pollen germination, while pollen grains exposed to rain and UV-B radiation at ambient levels were seriously damaged. Furthermore, bract removal decreased the number of pollinators visiting flowers. When bracts were removed before or after flowering, fecundity and progeny quality were adversely affected, but seed predation by larvae of pollinators decreased. A cost–benefit analysis demonstrated that the cost of bracts, i.e., increased seed predation, was modest. Based on these results, it is suggested that the bracts of *R. nobile* promote pollen germination, protect pollen grains from rain and intense UV-B radiation, enhance pollinator visitation during flowering, and facilitate the development of fertilized ovules during seed development. The scientists reached the conclusion that multifunctional bracts of *R. nobile* are an effective adaptive strategy in hostile alpine environments and might have been selected due to abiotic environmental conditions as well for enhancing pollination success. The results were published online in *Oecologia* in November, 2012.