生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	虹光薄層提供光保護作用 (Iridescent thin layer provides photoprotection)
生物系統 LIVING SYSTEM	雙蓋蕨屬 *Diplazium*、孔雀秋海棠 *Begonia pavonina*、圓葉錦香草 *Phyllagathis rotundifolia* （後兩種許秋容加入）
功能類別 FUNCTIONS	#獲得、吸收、或過濾能量 #保護免受光危害 #調節細胞代謝 #Capture, absorb, or filter energy #Protect from light #Regulate cellular process
作用機制標題	熱帶雨林底層植物以藍色虹光保護免受過多陽光損害 (Leaves of tropical rainforest understory plants are protected from excess sun by blue iridescence.)
生物系統/作用機制示意圖	

作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)

文獻引用 (REFERENCES)

「葉片帶有藍色虹光 (iridescence) 的植物生長在熱帶雨林中最陰暗及受保護的微氣候 (microclimates) 中。對於虹光現象可能的適應性意義有眾多推測，但還沒有任何有效的解釋，這種虹光現象實際上降低了葉片在這些有限光線環境中的光吸收。我們的假說是 460-485 nm 波長的建設性干涉現象 (constructive interference) 可能透過減少在上述波長的吸收來保護葉片免受光抑制 (photoinhibition) 及損害，而其它物種的葉片則是以花青素 (anthocyanins) 及葉黃素循環 (xanthophyll cycle) 的變化型來達到保護效果。我們觀察了馬來西亞三種具藍色虹光多形性 (polymorphism) 林下植物的光保護效果 (photoprotection)：孔雀秋海棠（*Begonia pavonina*，秋海棠科）、絨毛雙蓋蕨（*Diplazium tomentosum*，蹄蓋蕨科）及圓葉錦香草（*Phyllagathis rotundifolia*，野牡丹科）。我們在黎明前於武吉蘭樟森林保護區 (Bukit Lanjan Forest Reserve) 的植株上收集了暗馴化的葉片。我們測試了藍色及綠色葉片的質量、葉綠素及養分含量差異，透過 30 分鐘的高光照射 (~1000 µmol m^{-2} s^{-1}, 400–700 nm) 兩種葉片，以及在 90 分鐘內每 5 分鐘間隔測量其瞬態螢光反應 (transient fluorescence, *Fv/Fm*)，來測試藍色葉片中增加的光保護作用。所有的葉片，特別是孔雀秋海棠在固定單位面積中有相對較低的質量、葉綠素及氮含量。在孔雀秋海棠及圓葉錦香草中，藍色葉片相比綠葉在照射高光後明顯有較快速的回復力，

但在絨毛雙蓋蕨中則無顯著差異。這三種林下中的兩種植物提供了這些極陰性植物以藍色虹光對抗瞬間曝露在光斑 (light flecks) 時提供光保護的證明。」

"Iridescent blue-leaved plants grow in the most shady and protected microclimates of tropical rainforests. Much speculation on the possible adaptive significance of iridescence has not led to any viable explanations, as such iridescence actually reduces leaf absorption in these light-limited environments. We hypothesize that constructive interference in the wavelengths of 460-485 nm may protect against photoinhibition and damage via reduced light absorption at those wavelengths, where other leaves are protected by anthocyanins and variants of the xanthophyll cycle. We looked for such photoprotection in three Malaysian understory species polymorphic for blue iridescence: *Begonia pavonina* Ridl. (Begoniaceae), *Diplazium tomentosum* Bl. (Athyriaceae), and *Phyllagathis rotundifolia* (Melastomataceae). We collected dark-acclimated leaves before dawn from plants in Bukit Lanjan Forest Reserve. We tested for differences in leaf mass, chlorophyll and nutrients in green and blue leaves, and for increased photoprotection in blue leaves by subjecting both to 30 min of high irradiance (~1000 µmol m-2 s-1, 400-700 nm) and testing for differences in transient fluorescence as *Fv/Fm* for 90 min at 5 min intervals. All leaves, particularly in *B. pavonina* had relatively low mass, chlorophyll and N per unit area. In *B. pavonina* and *P. rotundifolia*, blue leaves recovered significantly more rapidly from light exposure than green ones, but the differences for *D. tomentosum* were not significant. Two of the three understory species thus provide evidence for a photoprotective function by blue iridescence against transient exposures to light flecks in these extreme-shade plants." (Lee et al. 2008)

參考文獻清單與連結 (REFERENCE LIST)

Lee, D., J. Kelley, and J. H. Richards. (2008). Blue leaf iridescence as a by-product of photoprotection in tropical rainforest understory plants. *Vancouver, Canada: Botanical Society of America*. (http://www.2008.botanyconference.org/engine/search/index.php?func=detail&aid=343)

Thomas, K. R., M. Kolle, H. M. Whitney, B. J. Glover, and U. Steiner. (2010). Function of blue iridescence in tropical understorey plants. *Journal of The Royal Society Interface* 7: 1699-1707. (https://doi.org/10.1098/rsif.2010.0201)

Gould. K. S. and D. W. Lee. (1996). Physical and ultrastructural basis of blue leaf iridescence in four Malaysian understory plants. *American Journal of Botany* 83: 45-50. (https://doi.org/10.2307/2445952) (許秋容加入)

延伸閱讀

生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)

https://en.wikipedia.org/wiki/diplazium
https://www.onezoom.org/life/@diplazium
https://eol.org/pages/6083993

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AskNature 原文連結

https://asknature.org/strategy/iridescent-thin-layer-provides-photoprotection/