生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	氣生根迅速吸收水分及養分 (Aerial roots rapidly absorb water and nutrients)
生物系統 LIVING SYSTEM	蘭科植物 Orchidaceae (Orchids)
功能類別 FUNCTIONS	#獲得、吸收、或過濾液體 #Capture, absorb, or filter liquids
作用機制標題	蘭花的氣生根迅速吸收水分及養分 (Aerial roots on orchids rapidly absorb water and nutrients)
生物系統/作用機制示意圖	 

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

蘭花是具有多樣性的植物家族，包括適應生活在潮濕雨林中高處的物種。這些蘭花是生長在其它植物上的附生植物 (epiphytes)。為了收集水分，某些蘭花會將它們的根懸掛在空氣中，直接從大氣、雨水，以及滴落在上方植物的水滴中吸收水分。而其它種類則在樹木枝幹表面擴展它們的根部，收集流過枝幹表面的水分。

此篇策略是由 EcoRise Youth Innovations 共同提供。

Orchids are a diverse family of plants that includes species adapted to life high above the ground in humid rainforests. These orchids are epiphytes that grow on other plants. To collect water, some epiphytic orchids dangle their roots in the air and absorb moisture directly from the atmosphere, from rain, and from water that drips off vegetation above it. Others spread their roots over the surfaces of tree branches and collect water as it trickles over the tree's surfaces.

This strategy was co-contributed by EcoRise Youth Innovations.

文獻引用 (REFERENCES)

「根被組織 (velamen radicum) 為海綿狀，通常是根部的多層表皮，在成熟時由死亡的細胞所組成，經常被描述為附生性蘭花重要的環境適應手段…我們測試了最初由 Went

在 1940 年提出的見解，根被讓植物獲取並留住降雨時最先流下的溶液，這些溶液含有最多的養分…首先，我們證實了大多數蘭花物種的根被能在數秒中攝取溶液，但溶液要從根被中蒸發則需要數小時。帶電荷的離子可能因為細胞壁的正、負電荷而被保留在根被中，不帶電荷的化合物則流失到外部介質 (external medium) 中。最後，我們證實了養分吸收是以在低外界濃度下的高效率主動運輸 (active transport) 系統遵循雙相動力反應理論 (biphasic kinetics)。因此，我們的結果對 Went 的假說提供了強力的支持：根被在附生環境中擔任吸收養分的重要功能。」(Zotz and Winkler 2013: 733)

「很多種蘭花都採取這種在高處的生活。它們缺乏鳳梨科植物 (bromeliads) 維持生命的貯水池，所以它們必須以其它方式收集所需的養分。部分物種的根部在空中懸掛著，從潮濕的大氣中吸收水氣，並仰賴可能溶解在從森林植被落下的水分中的微量養分。其它物種則在樹枝上擴展根部，並收集從樹葉或枝幹上滴落的水分，從中獲得少量的養分。」 (Attenborough 1995: 166)

"The velamen radicum, a spongy, usually multiple epidermis of the roots, which at maturity consists of dead cells, is frequently described as an important adaptation of epiphytic orchids…We tested the notion originally put forward by Went in 1940 that the velamen allows plants to capture and immobilize the first solutions arriving in a rainfall, which are the most heavily charged with nutrients…First, we show that the velamen of a large number of orchid species takes up solutions within seconds, while evaporation from the velamen takes several hours. Charged ions are retained in the velamen probably due to positive and negative charges in the cell walls, while uncharged compounds are lost to the external medium. Finally, we demonstrate that nutrient uptake follows biphasic kinetics with a highly efficient, active transport system at low external concentrations. Thus, our results lend strong support to Went's hypothesis: the velamen fulfills an important function in nutrient uptake in the epiphytic habitat." (Zotz and Winkler 2013: 733)

"Orchids of many kinds have also adopted this high life. They lack the ponds that sustain the bromeliads, so they must collect their nourishment in other ways. Some dangle their roots in the air, absorbing moisture from the humid atmosphere and rely on the tiny amount of nutriments it might have dissolved on its descent through the forest vegetation. Others spread their roots over the surface of the branches and collect the water that has trickled through the leaves and dripped from branch to branch, gathering a little nutriment on the way." (Attenborough 1995: 166)

參考文獻清單與連結 (REFERENCE LIST)

Zotz, G. and U. Winkler. (2013). Aerial roots of epiphytic orchids: the velamen radicum and its role in water and nutrient uptake. *Oecologia*, 171: 733-741. (https://doi.org/10.1007/s00442-012-2575-6)

Attenborough, D. (1995) *The private life of plants*. Princeton University Press.

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/orchidaceae https://www.onezoom.org/life/@orchidaceae https://eol.org/pages/8156
撰寫/翻譯/編修者與日期
譚國鎏翻譯 (2021/03/22)；洪麗分編修 (2021/04/10)
AskNature 原文連結
https://asknature.org/strategy/aerial-roots-rapidly-absorb-water-and-nutrients/