


生物策略格式

KJC, 2019/10/21

類別	生物策略 (Strategy)	
生物策略 STRATEGY	藉著壓力從土壤吸收水分 (Pressure sucks moisture from soil)	
生物系統 LIVING SYSTEM	植物 (Plants)	
功能類別 FUNCTIONS	#獲取、吸收、或過濾液體 #Capture, absorb or filter liquids	
作用機制標題	沙漠植物的根部藉著負壓努力從土壤萃取以汲取水分 (The roots of desert plants extract hard to remove water from soil using negative pressure.)	
生物系統/作用機制示意圖		
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)		
<p>「又是植物，即使在沙漠中，在土表下方的土壤也含有液態水。它被稱為『毛細管水 (capillary water)』，它常常被認為是緊緊地附著在土壤粒子的表面。這種結合的物理性和化學性一樣強，且存在於土壤碎屑之間的微小凹陷處，在那裡能夠讓其與空氣的接觸面積最小化 (Rose 1966)。</p> <p>對於植物的根部來說，提取水分需要製造更多的表面積，為此需要非常大的拉力，這種壓力似乎是植物莖幹導管 (vessel) 中向上的一種附加 (負的) 分壓。目前植物中已知的最低 (最負) 壓力發生在沙漠植物的灌木叢，它們盡其所能的將土壤中的水完全吸收。我認為，記錄中最極端的值是減去 120 個大氣壓 (Schlessinger et al., 1982)。這將支撐超過 1,200 米 (4,000 英尺) 高的柱狀水。因此，使獲得土壤中所有的水所需的拉力可以超過保持水在導管中移動的拉力和抵消重力的拉力。」 (Vogel 2003: 113)</p> <p>“Plants again. Even in a desert the soil a little ways below the surface contains liquid water. It’s called ‘capillary water’ and is often thought of as firmly stuck to soil particles. The binding, though, is as much physical as chemical – the water in the soil interstices lie in tiny recesses</p>		
文獻引用 (REFERENCES)		

between soil crumbs where it has minimized its exposed interface with air (Rose 1966).

For the roots of a plant to extract the water requires making more surface, and thus it takes a very great pull, one that appears as an additional (negative) component of the pressure in the vessels running up a stem or trunk. The lowest (most negative) pressures known in plants occur in desert shrubs, which must suck really hard on the ground to get any water out. The most extreme value on record is, I think, minus 120 atmospheres (Schlessinger et al. 1982) – that would hold up a column water over 1,200 meters (4,000 feet) high. So the pull needed to get water free of soil can exceed both the pull that keeps water moving in the vessels and the pull that counteracts gravity.” (Vogel 2003: 113)

參考文獻清單與連結 (REFERENCE LIST)

Vogel, S. (2013). *Comparative biomechanics: life's physical world - second edition*. Princeton University Press.

Schlessinger, W. H., J. T. Gray, D. S. Gill and B. E. Mahall. 1982. *Ceanothus megacarpus* chaparral: A synthesis of ecosystem processes during development and annual growth. *The Botanical Review* 48: 71–117. (許秋容提供)

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/Plantae>

文章貢獻/編修者與日期:

賴建霖翻譯 (2019/04/10)；朱天愛編修 (2019/12/19)；吳皓編修 (2020/01/04)；
譚國銜編修 (2020/05/26)；許秋容編修 (2020/11/26)；紀凱容編修 (2020/11/26)

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