

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	膨大的儲藏性地下部容許再生 (Underground storage swelling enables regeneration)
生物系統 LIVING SYSTEM	桉樹 (<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>) (Jarrah)
功能類別 FUNCTIONS	#物理性組成結構 #保護免受火危害 #保護免受動物危害 #貯存化學物質 #Physically assemble structure #Protect from animals #Protect from fire #Store chemical entities
作用機制標題	桉樹的木質塊莖透過儲存能量儲備及潛在的芽體形成位置，容許其在被破壞後再生 (The lignotuber of <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> allows it to regenerate after being destroyed by storing energy reserves and potential bud-forming sites.)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>當喬木或灌木被砍下，或是遭受其他生物或毀滅性自然力量如火災所破壞時，植株通常都會死亡。然而對桉樹 (<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>) 來說並非如此。利用一種在大部分植物中沒有，稱為木質塊莖 (lignotuber) 的特殊根部適應性，這個物種能夠在地上部被破壞後再生。</p> <p>木質塊莖是植物根系頂端一種特殊的膨大構造 (根系通常都埋藏在土表之下)。木質塊莖含有澱粉、醣類、養分，以及「分生組織聚集點 meristematic foci」。這些內容物使植物能重新長出芽體。然而，這個過程的關鍵在於分生組織聚集點。類似細小的疙瘩，分生組織聚集點與幹細胞 (stem cells) 相似，帶有未分化 (undifferentiated) 的細胞及組織，最終能長成及轉變為新芽。</p> <p>然而，分生組織聚集點並不能獨自運作，它是木質塊莖中澱粉、醣類以及養分發揮作用的場所。養分及醣類被植物分解用來生長與再生。澱粉被用在呼吸作用，就如同它們在葉子遭受破壞之前被植物使用的方式一樣。呼吸作用產生二氧化碳，這是植物功能運作所必需的，就像人類需要氧氣一樣。</p>	

為了增加植物可用作芽體再生的能量，桉樹脫去大部分的根系。透過脫去不必要的根部，只留下需要固定植株的結構性根部，原本用來維持大量根系的能量可用於地上部的再生。因此，桉樹的木質塊莖幾乎就像植物的種子，含有受傷植物重新生長必需的所
有細胞、組織和能量儲備。

此篇策略是由 Thomas McAuley-Biasi 所提供。

When a tree or shrub is cut down or destroyed by either another organism or a destructive natural force, such as fire, the plant itself is usually killed. For *Eucalyptus kochii* subsp. *plenissima*, however, this is not the case. Due to a special root adaption called a lignotuber, absent in most other plants, this species can regenerate after the aboveground part is destroyed.

A lignotuber is a special swelling at the top of the plant's root system (which sits mostly submerged below ground). It contains starch, sugars, nutrients, and "meristematic foci" (read on for more about this). These contents enable the plant to regrow its shoots. The key to the process, however, lies in the meristematic foci. Resembling little pimples, meristematic foci are similar to stem cells, with undifferentiated cells and tissue that ultimately grow and change into new shoots.

The meristematic foci, however, cannot act alone, and this is where the starch, sugars, and nutrients within the lignotuber come into play. The nutrients and sugars are broken down and used by the plant to grow and regenerate. The starch is used for respiration, just as it was used by the plant before the leaves were destroyed. Respiration brings in carbon dioxide, which is necessary for the plant to function, just as humans need oxygen.

To increase the energy available to the plant for shoot regeneration, *Eucalyptus kochii* subsp. *plenissima* sheds most of its root system. By shedding unnecessary roots and leaving only the structural roots needed to anchor the plant, the energy previously used to maintain the extensive root system is made available to regenerate the parts above ground. Thus, the lignotuber of *Eucalyptus kochii* subsp. *plenissima* acts almost like a plant seed, containing all of the necessary cells, tissue, and energy reserves needed to regrow the damaged plant.

This summary was contributed by Thomas McAuley-Biasi.

文獻引用 (REFERENCES)

「『矮叢』桉樹 [例如 *Eucalyptus kochii* subsp. *plenissima*] 的特徵是它們可以由地下的木質塊莖長出許多木質莖幹。」 (Wildy and Pate, 2002: 185)

「木質塊莖通常含有數千個「分生組織聚集點」 (Noble, 2001)，每一個分生組織聚集點都可以長出許多獨立的枝條。」 (Wildy and Pate, 2002: 185)

「不論是何種生活型與萌芽形態，芽體萌發的早期生長，在某程度上都和以往累積的儲備養分、澱粉、醣類及其它可溶性與不可溶性能量儲備的運移有關。」 (Wildy and Pate, 2002: 185)

「桉樹的木質塊莖主要不是作為澱粉儲存器官，而是作為在去頂 (decapitation) 後提供替代的芽體分生組織。」 (Wildy and Pate, 2002: 193)

「大部分觀察到從根系流失的澱粉，可能之後被用於呼吸作用，而不是導致萌芽更新(coppice) 芽體的乾物質 (dry matter) 增加。」 (Wildy and Pate, 2002: 195)

“Mallee’ eucalyptus [such as the *Eucalyptus kochii* subsp. *plenissima*] are characterized by multiple woody stems arising from an underground lignotuber.” (Wildy and Pate, 2002: 185)

“A lignotuber typically contains several thousand of such ‘meristematic foci’ (Noble, 2001), each of which is capable of producing several individual shoots.” (Wildy and Pate, 2002: 185)

“Regardless of life form and sprouting morphology, early growth of shoot sprouts is associated with some degree of mobilization of previously accumulated reserves of nutrients, starch, sugars and other soluble and insoluble energy reserves.” (Wildy and Pate, 2002: 185)

“Lignotubers of *E. kochii* appear less important as starch storage organs than they are as providers of replacement shoot meristems after decapitation.” (Wildy and Pate, 2002: 193)

“Much of the observed loss of starch from root systems might then be committed to respiration rather than contributing to dry matter gain of new coppice shoots.” (Wildy and Pate, 2002: 195)

參考文獻清單與連結 (REFERENCE LIST)

Wildy, D. T. and J. S. Pate. (2002). Quantifying above- and below-ground growth responses of the Western Australian oil mallee, *Eucalyptus kochii* subsp. *plenissima*, to contrasting decapitation regimes. *Annals of Botany* 90: 185-197. (<https://doi.org/10.1093/aob/mcf166>)

Dawson, J. (2005). *The nature of plants: habitats, challenges, and adaptations*. Timber Press, Incorporated.

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/eucalyptus_marginata
https://www.onezoom.org/life/@eucalyptus_marginata
<https://eol.org/pages/301399>

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