

## 生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	加壓的果實噴出種子 (Pressurized fruit ejects seeds)
生物系統 LIVING SYSTEM	噴瓜 <i>Ecballium elaterium</i> (Squirting cucumber)
功能類別 FUNCTIONS	#分配固體 #改變位置 #改變速度 #在氣體中移動 #Distribute solids #Modify position #Modify speed #Move in/through gases
作用機制標題	噴瓜的果實透過壓力噴發來散播種子 (The fruit of squirting cucumbers distribute seeds by ejecting them under 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>噴瓜 (squirting cucumber, <i>Ecballium elaterium</i>) 是一種葫蘆科 (Cucurbitaceae) 的植物，這個科也包括了甜瓜、南瓜及不會噴射的黃瓜。噴瓜原生於歐洲南部、北非以及亞洲部分地區。是一種植株低矮、匍匐 (creeping) 的植物，會長出細小而毛茸茸的綠色果實。果實帶有毒性，但也含有多種有醫藥特性的化合物。</p> <p>就像所有植物一樣，噴瓜也需要散播自己的種子，因此年幼的小苗才不會靠近母株與其競爭陽光及養分。其它葫蘆科的成員會長出可食用的果實，並依靠動物來傳播種子，而噴瓜使用的則是靜水壓力 (hydrostatic pressure)。</p> <p>噴瓜的果實在短小而朝上的莖上垂直地懸垂著。每顆果實中有一系列充滿著黏性汁液及種子的腔室。隨著果實成熟，腔室中充滿更多的汁液，壓力會到達大氣壓力的 27 倍。同時地，果實連接莖部的地方會發育出離層組織 (abscission tissue)。離層組織是一個脆弱的斷裂點，能使植物的某部分在該處斷裂掉落，而不會留下可能導致感染的開放性組織。當果實內的壓力超過莖部周圍離層組織的強度時，果實就會掉落，莖部原本連接果實之頂端處會留下一個小孔。當果實落下時，壓力使汁液連同種子一起，從頂端孔洞噴出。由於孔洞是朝上的，隨著果實掉落，種子以遠離母株的方向噴射出。</p> <p>The squirting cucumber (<i>Ecballium elaterium</i>) is a plant in the Cucurbitaceae family,</p>	

which also includes melons, squash and non-squirting cucumbers. It is native to Southern Europe, North Africa and some of Asia. It is a low growing, creeping plant with small hairy green fruit. The fruit is poisonous, but contains a number of compounds that may have medicinal properties.

Like all plants, the squirting cucumber needs to spread its seeds so that young seedlings are not competing with the parent for sunlight and nutrients. Whereas other members of the Cucurbitaceae produce edible fruit and rely on animals to spread their seeds, the squirting cucumber uses hydrostatic pressure.

The fruit of *Ecballium elaterium* hang down vertically from short, upright stems. Inside each fruit is a series of chambers filled with viscous sap and seeds. As the fruit ripens, the chambers fill with more and more sap, reaching pressures of about 27 atmospheres. Simultaneously, abscission tissue develops where the fruit is joined to the stem. Abscission tissue is a weak fracture point that allows parts of a plant to fall off without leaving open tissue that might get infected. When the pressure inside the fruit exceeds the strength of the abscission tissue around the stem, the fruit falls off, leaving a small hole at the top where the stem was attached. As it falls, the pressure forces the sap out of the hole at the top, carrying the seeds with it. Because the hole is pointing up, as the fruit falls, seeds are sprayed in a jet away from the parent plant.

#### 文獻引用 (REFERENCES)

「一個特有的種子遠距離傳播 (telechorous) 機制就是膨壓機制 (turgor mechanism)……這種機制是基於彈性組織會在某個方向被另一膨壓非常高的組織所拉扯撐開的現象……而產生巨大的張力。當張力超出臨界值時，果實會沿著果柄離層組織斷開而打開……結果，被拉扯的組織突然收縮，種子則因巨大的力量而噴射出。」(Fahn and Werker 1972: 195)

「隨著果實成熟而發育的離層組織，連接著嵌入果皮 (pericarp) 內部的果柄。當種子周圍的內部多汁組織所產生的壓力超過使離層細胞維持連接的力量時，果實就會從果柄上斷開脫落。同時果皮會瞬間收縮，尤其是白色的部分，而果實內含物，即是巨大多汁的細胞以及種子，會因巨大的力量，從深入的果柄脫落後形成的孔洞中噴出。」(Fahn and Werker 1972: 197)

“A solely telechorous mechanism of dispersal is the turgor mechanism... this mechanism is based on the fact that elastic tissue is stretched in a certain direction by another tissue with a very high turgor pressure... great tension develops. When tension exceeds a critical value, a barrier is removed by opening of the fruit along an abscission tissue... As a result, the stretched tissue suddenly contracts and the seeds are ejected with great force.” (Fahn and Werker 1972: 195)

“Abscission tissue develops as the fruit matures around the tissue which is continuous with the stalk within the pericarp. When the pressure which develops in the inner juicy tissue surrounding the seed exceeds that of the force keeping the cells of the separation layer together then the fruit becomes detached from the stalk. Simultaneously the pericarp, especially the white portion, contracts and the fruit contents – the large juicy cells together with the seeds – are ejected with great force through the hole produced by detachment of the ‘inserted stalk.’” (Fahn and Werker 1972: 197)

#### 參考文獻清單與連結 (REFERENCE LIST)

Fahn, A. and E. Werker. (1972). Anatomical mechanisms of seed dispersal in: seed biology importance, development, and germination. *Cambridge (MA): Academic Press*. 151-221. (<https://doi.org/10.1016/B978-0-12-424301-9.50010-3>)

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#### 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/ecballium\\_elaterium](https://en.wikipedia.org/wiki/ecballium_elaterium)

[https://www.onezoom.org/life/@ecballium\\_elaterium](https://www.onezoom.org/life/@ecballium_elaterium)

<https://eol.org/pages/487852>

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#### AskNature 原文連結

<https://asknature.org/strategy/pressurized-fruit-ejects-seeds/>