# 生物策略表

| 類別 | 生物策略 (Strategy) |
|---|---|
| 生物策略<br>STRATEGY | 裝載彈簧的花朵確保花粉傳播<br>(Spring-loaded flowers ensure pollen dispersal) |
| 生物系統<br>LIVING SYSTEM | 桑寄生科 Loranthaceae |
| 功能類別<br>FUNCTIONS | #散佈種子 #排出固體 #授粉 #在生物系統中感應觸覺及機械力 #機械能轉型<br>#Disperse seeds #Expel solids #Pollinate<br>#Sense touch and mechanical forces in a living system<br>#Transform mechanical energy |
| 作用機制標題 | 桑寄生的花朵使用貯存的機械能量來釋放花粉<br>(Flowers of the mistletoe use stored mechanical energy to release pollen.) |
| 生物系統/作用機制<br>示意圖 |  |

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

　　為了增加花粉的散播量，有數種桑寄生 (mistletoe) 發展出能爆裂綻開的「彈簧裝載」 (spring-loaded) 花朵，把花粉噴灑在訪花的傳粉者身上。

　　這些裝載彈簧的花朵以貯存機械能的方式產生張力。在花朵中的張力是透過內部的雄蕊（stamen，含有花粉的生殖器官）及外部花瓣生長速率不同而產生。這種差異性生長 (differentiate growth) 使花朵膨脹，直到花瓣最終互相裂開。這製造了花瓣之間的小開口，容許花朵能更進一步的向外膨脹，使張力增加。當花朵成熟時，傳粉者造成的力學干擾會觸發花瓣的張開。雄蕊首先垂直彈起，然後花藥（anthers，位於雄蕊頂端並含有花粉）水平方向外投，把花粉粒彈射到空氣中並落在傳粉者身上。

　　桑寄生花朵能以兩種不同的方法打開。鳥類能「拉開拉鏈」般從花瓣底部觸發花朵打開，使花粉灑在鳥類身上。鳥類也能抓住並拉開花瓣，同樣使花朵打開並散播花粉。花粉爆裂使花粉粒從花朵中心往上彈射出去。沒起疑心的傳粉者被披上花粉，並在花朵間穿梭時幫助與其他桑寄生植株異株授粉。沒灑落在鳥類身上的剩餘花粉仍然會投擲到空氣中（大約 20 公分高度），使花粉粒也能被風力所傳播。

這則策略是由 Christy Cael 及 Carol Gustafson 所提供。

In order to increase the amount of pollen they disperse, several varieties of mistletoe have developed "spring-loaded" flowers that burst open, showering pollen on visiting pollinators.

These spring-loaded flowers generate tension as stored mechanical energy. Tension is generated within the flower as the inner stamen (a reproductive organ containing pollen) and outer petals of the flower grow at different rates. This differential growth causes the flowers to bulge out until the petals eventually split from each other. This creates small openings between the petals, allowing the flower to bulge out further, which further increases tension. When the flowers are mature, mechanical disturbance from pollinators will trigger opening of the petals. The stamens first spring up vertically, then the anthers (which are located on the top of the stamen and contain pollen), move out horizontally, catapulting pollen grains up into the air and onto the pollinator.

Mistletoe flowers can be opened in two different ways. Birds can "unzip" the petals at their base, triggering flower opening and showering the birds in pollen. Birds can also grasp and pull the petals, also resulting in flower opening and pollen dispersal. The explosion of pollen catapults the pollen grains straight up and away from the flower's center. Unsuspecting pollinators are blanketed in pollen and help to cross-pollinate other mistletoe plants as they move between flowers. Residual pollen grains that don't land on the bird are still hurled high enough into the air (up to 20 centimeters) to allow for the grains to also be dispersed by the wind.

This strategy was contributed by Christy Cael and Carol Gustafson.

## 文獻引用 (REFERENCES)

一些非洲的桑寄生例如蛛花寄生屬 (*Erianthemum*)、星花寄生屬 (*Actinanthella*) 和垂枝腫萼寄生屬 (*Oedina*) 高度特化為鳥媒授粉。它們的花朵在成熟時轉變顏色，然後長管狀的花冠筒會沿著花瓣接縫處裂開成窗孔 (fenestrae)。這些開孔是由於雄蕊基部與花瓣窗孔下方的部分癒合，但上部則是自由可動，這樣的差異性生長產生張力而形成(Kirkup, 1998)。傳粉者太陽鳥會從窗孔伸入鳥喙，因此觸發花朵迅速打開，花絲向內卷曲，使花粉附著在鳥的頭上。(Vidal-Russell and Nickrent 2008: 1027)

同屬於桑寄生科的另一物種把花粉貯存在花朵的頂部。當鳥類降落時，其重量觸發腔室爆炸性的打開，使花粉噴灑在鳥類的前額。(Attenborough 1995: 117)

"Some African genera such as *Erianthemum*, *Actinanthella*, and *Oedina* are highly specialized for bird-pollination. Their flowers change color at maturation, and their tubular corollas split along the petal junctions to form window-like fenestrae. This fenestration results

from tension generated by differential growth of the stamens, which are fused to the petals below the fenestrae but free above (Kirkup, 1998). The pollinating sunbirds insert their beaks through the fenestrae, thus triggering rapid flower opening, inward coiling of the filaments, and deposition of pollen on the bird's head.". (Vidal-Russell and Nickrent 2008: 1027)

"Another species in the same family [of tropical mistletoe] stores its pollen in the roof of its flower. As a bird lands, its weight triggers the chamber so that it opens explosively and showers pollen all over the bird's forehead." (Attenborough 1995: 117)

| 參考文獻清單與連結 (REFERENCE LIST) |
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| 延伸閱讀 |
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| 生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S) |
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| https://en.wikipedia.org/wiki/Loranthaceae |

| 撰寫/翻譯/編修者與日期 |
| --- |
| 譚國鋆翻譯 (2021/03/22);王俊能編修 (2021/04/19) |

| **AskNature 原文連結** |
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| https://asknature.org/strategy/spring-loaded-flowers-ensure-pollen-dispersal/ |