

生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	植物讓毛蟲餓肚子 (Plants starve caterpillars)
生物系統 LIVING SYSTEM	番茄 <i>Solanum lycopersicum</i> (Tomato)
功能類別 FUNCTIONS	#催化化學物質分解 #保護免受動物危害 #Catalyze chemical breakdown #Protect from animals
作用機制標題	番茄的葉子會分泌一種酵素來避免毛毛蟲，這種酵素可以破壞毛蟲腸道內的關鍵營養素。 (Leaves of tomatoes ward off parasitic caterpillars by secreting an enzyme that breaks down a key nutrient in the caterpillar larvae's gut.)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>沒有任何一個餐廳老闆會希望在自家餐廳吃飯的人吃到生病，但是番茄卻要依靠這種策略才能存活。當草食性的蝴蝶或是飛蛾幼蟲開始咀嚼番茄的葉片時，常見於番茄葉中的蘇胺酸脫氨酶 (threonine deaminase)，會改變型式使其能夠在鱗翅目惡劣的腸道環境下作用。事實上，這種酵素就像超人 (Clark Kent) 一樣，在鱗翅目腸道的惡劣環境下變成超級英雄分子，破壞蘇氨酸的鍵，也就是鱗翅目幼蟲生存的必需胺基酸。此外，它也可以藉由分解另一種氨基酸，L-絲氨酸 (L-serine)，來產生有毒的氨氣，為毛毛蟲的棺材再多釘上幾根釘子。</p> <p>While it would be business suicide for any restaurateur to go out of their way to sicken those who eat on its premises, tomato plants depend on such a strategy for their very survival. When the larvae of herbivorous butterflies or moths begin to chew on tomato plant leaves, threonine deaminase, an enzyme commonly found in tomato leaves, changes to a form that enables it to survive the harsh conditions of the lepidopteran gut. In fact, it's the conditions of the gut that activate this Clark Kent of an enzyme into a superhero molecule that breaks the bonds of threonine, an amino acid essential for the lepidopteran larvae's survival. It may also add nails to the lepidopteran larvae's coffin by degrading another amino acid, L-serine, and by producing toxic ammonia.</p>	
文獻引用 (REFERENCES)	

「草食性昆蟲的生長與發育依靠牠們消化植物蛋白獲得必需胺基酸的能力。在此我們描述了番茄利用營養脆弱性的防禦相關 TD2 (蘇氨酸脫氨酶旁系同源物) 同功型 (isoform) 的生化和結構特徵。TD2 通過分解草食昆蟲腸道內的蘇氨酸來減少草食生物的攝食，蘇氨酸是鱗翅目幼蟲生長所必須和限制性的營養素 (11)。」 (Gonzales-Vigil et al. : 5897)

The growth and development of insect herbivores depend on their ability to acquire essential amino acids by digestion of plant protein. Here, we describe the biochemical and structural features of the defense-related TD2 [threonine deaminase paralog] isoform from tomato that exploits this nutritional vulnerability. TD2 appears to reduce herbivory by acting in the insect gut to degrade Threonine, which is an essential and limiting nutrient for the growth of lepidopteran larvae (11).” (Gonzales-Vigil et al. : 5897)

參考文獻清單與連結 (REFERENCE LIST)

Gonzales-Vigil, E., C. M. Bianchetti, G. N. Phillips, and G. A. Howe. (2011). Adaptive evolution of threonine deaminase in plant defense against insect herbivores. *PNAS* 108: 5897-5902. (<https://doi.org/10.1073/pnas.1016157108>)

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/Lycopersicon>

撰寫/翻譯/編修者與日期

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AskNature 原文連結

<https://asknature.org/strategy/plants-starve-caterpillars-2/>