生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	多樣性飲食使得蜜蜂保持健康 (Diverse Food Sources Keep Honeybees Healthy)
生物系統 LIVING SYSTEM	蜜蜂 (*Apis mellifera*)
功能類別 FUNCTIONS	#捕獲、吸收或過濾固體 #貯存固體 #分配固體 #調節細胞過程 #保護免受微生物傷害 #Capture, Absorb, or Filter Solids #Store Solids #Distribute Solids #Regulate Cellular Processes #Protect From Microbes
作用機制標題	蜜蜂的免疫系統是透過飲食來維持，缺乏多樣的蛋白質會降低免疫系統運行的能力。 (The honeybee's immune system is maintained through diet and that a lack of diverse protein sources reduces the ability of its immune system to function.)
生物系統/作用機制示意圖 (確認版權、註明出處；畫質)	 https://1d59b73swr1f1swu2v451xcx-wpengine.netdna-ssl.com/wp-content/uploads/2021/12/Picture7-514x720.jpg
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	

多方面飲食於蜜蜂免疫力的影響可透過它的血球濃度、脂肪體內容物、酚氧化酶活性和葡萄糖氧化酶 glucose oxidase (GOX) 活性得知。

前三個指標和個體免疫系統功能有關。血球濃度和酚氧化酶活性測量蜜蜂分辨、限制、去除寄生蟲的能力。脂肪體是抗菌的多肽製造處。

第四個指標有關於整個群體。葡萄糖氧化酶使得一個群體得以透過生產過氧化氫來消毒，具有防腐劑的特性。這些防腐劑產物被分泌至蜂蜜以及其他幼蟲的食物

實驗指出蜜蜂飲食中蛋白質的量增加並不會顯著的改善它的免疫力，但是增加蜜蜂飲食的多樣性卻可以。

(The impact of a diverse diet on the honeybee's immunity can be measured through its blood cell concentration, fat body content, phenoloxidase activity and glucose oxidase (GOX) activity.

The first three measures relate to the immune function of individuals. Blood cell concentration and phenoloxidase activity measure a bee's ability to identify, trap, and remove parasites. Fat bodies are where antimicrobial peptides are made.

The fourth measure relates to the colony as a whole. GOX allows a colony to be sterilized through the production of hydrogen peroxide, which has antiseptic properties. These antiseptic products are secreted into honey and other larval food.

Experimentally, it has been shown that increasing the amount of protein in a honeybee's diet did not significantly improve its immunity, but increasing the diversity of the honeybee's diet did.)

文獻引用 (REFERENCES)

"蛋白質飲食調整了個體與社會性免疫能力，但是飲食中蛋白質含量的增加並不會增強免疫能力。然而，飲食多樣性能提升免疫能力級別。尤其是多種花的飲食，與單一花種的飲食相比，更能促進更高的葡萄糖氧化酶活性，這些結果指出蛋白質營養和蜜蜂的免疫力的關係，強調資源可用性對傳粉者健康的關鍵作用"（Alaux 等人 2010:562）

"如同社會有機體，蜜蜂不僅僅依靠個體免疫力，同時依靠蜂巢的整體運作。因此，我們也研究葡萄糖氧化酶的活性，作為社會性免疫的範圍。主要呈現於 HPGs（Ohashi 等人 1999），葡萄糖氧化酶催化 b-D-葡萄糖的氧化，產生葡萄糖酸和過氧化氫，後者具有抗菌的特性。抗菌的產物被分泌至幼蟲的食物以及蜂蜜，促成群體食物消毒（White 等人 1963），因此，預防了群體層面的疾病感染"（Alaux 等人 2010:562）

"Protein feeding modified both individual and social IC [immunocompetence] but increases in dietary protein quantity did not enhance IC. However, diet diversity increased IC levels. In particular, polyfloral diets induced higher GOX [glucose oxidase] activity compared with monofloral diets, including protein-richer diets. These results suggest a link between protein nutrition and immunity in honeybees and underscore the critical role of resource availability on pollinator health." (Alaux et al. 2010:562)

"As social organisms, honeybees depend not only on individual immunity, but also on the overall functioning of the hive. So, we also analysed glucose oxidase (GOX) activity as a parameter of social immunity. Mainly expressed in the HPGs (Ohashi et al. 1999), GOX catalyses the oxidation of b-D-glucose to gluconic acid and hydrogen peroxide, the latter having

antiseptic properties. The antiseptic products are secreted into larval food and honey, which contributes to colony-food sterilization (White et al. 1963), and hence, to the prevention of disease contamination at the group level." (Alaux et al. 2010:562)
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AskNature 原文連結
https://asknature.org/strategy/the-honey-bee-maintains-immune-function/#introduction

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