

# 生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	蟻群對食物分配的反應迅速 (Ant Colonies Respond Quickly to Distribute Food)
生物系統 LIVING SYSTEM	螞蟻 <i>Temnothorax albipennis</i> (Rock Ant)
功能類別 FUNCTIONS	#分配固體 #分配液體 #透過自我組織維持群落協調 #Distribute Solids #Distribute Liquids #Coordinate by Self-Organization
作用機制標題	蟻群在饑荒後利用去中心化而有效且安全地快速分配食物 (Ant colonies distribute food effectively and safely after famine using a decentralized response to quickly spread food.)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p><b>介紹</b></p> <p>一個中心化 (centralized) 的群體 (society) 通常由單一個體或一群個體形成「控制中心」(control center)。這個控制中心擁有權力進行策劃及控制群體的工作方式。牠們首先作出決定，然後分配這些資訊到群體中的其他成員。然而，這個系統需要時間來做群體決策及指派任務。</p> <p>另一方面，去中心化 (decentralized) 的群體通常沒有控制中心。取而代之的是個體或小群體獨自做決定。這允許個體更加迅速地動作，因為資訊不需要先經過控制中心。</p> <p><b>策略</b></p> <p>蟻群 (ant colony) 就是去中心化的群體。一隻螞蟻可以與鄰近個體進行互動，或從當地環境中取得線索來做決定。這種去中心化的反應使螞蟻能迅速行動並容許有復原力</p>	

(resiliency)，這是忍耐干擾 (distress) 並從中恢復的能力。螞蟻對食物短缺或飢荒的反應就是復原力的一個例子。

當飢荒中的螞蟻找到食物時，牠們迅速將食物分發給生活在同一巢穴中的其他螞蟻。當饑荒發生時，螞蟻能移動到巢穴中的任何地方來幫助分發食物。為了快速餵養所有螞蟻，覓食者 (forager) (收集食物的螞蟻) 更深入地進入巢穴，以將食物傳遞給更多個體。照顧幼蟲的螞蟻通常生活在巢穴深處。在飢荒時期，牠們會移動到巢穴的邊緣，以更快地從覓食者那裡取得食物。

由於螞蟻在飢荒期間需要快速找到並分發食物，因此牠們往往會退而求其次選擇較低品質的食物，這些食物有時可能含有有害的化學物質。螞蟻平常不會進食這些食物，減少攝取有害食物機會的一種方法是擁有多個食物來源。多隻覓食螞蟻在飢荒期間會從巢穴以不同的方向出外尋找不同的食物來源。擁有多個食物來源能稀釋來自一種特定來源的有害化學物質。另一種解決方案是使用活體「穀倉」(living silo)，即一隻螞蟻可以儲存和測試食物來源中是否含有有害化學物質。該隻螞蟻可能會死亡，但族群卻可以從有害的食物來源中活下來。這些都是一隻螞蟻快速而協調的去中心化反應。總括來說，這些行動能幫助群落渡過飢荒。

### **Introduction**

A centralized society consists of a single individual or group of individuals that function as a type of “control center.” This control center has the power to plan and control how the society works. They make decisions first and then they distribute this information to other members of the society. However, in this system it takes time to make group decisions and assign tasks.

On the other hand, a decentralized society does not have a control center. Instead, individuals make decisions independently or in small groups. This allows individuals to act more quickly because information does not have to go through a centralized group first.

### **The Strategy**

Ant colonies are an example of a decentralized society. An ant can have interactions with nearby individuals, or take cues from the local environment to help make its decisions. This decentralized response enables ants to act quickly and allows for resiliency, which is the ability to endure and recover from distress. An ant’s response to food shortages or famine is an example of resiliency.

When ants in a famine find food, they quickly spread it to other ants living in the same nest. When a famine occurs, the ants can move anywhere in the nest to help spread food. In order to feed everyone quickly, foragers (the ants who collect food) move deeper into the nest to pass food to more individuals. Ants that take care of the young usually live deep in the nest. In times of famine, they move to the edges of the nest to receive food from foragers more quickly.

Because ants need to find and spread food quickly during a famine, they often settle for a lower quality of food, which sometimes may contain harmful chemicals. Ants normally wouldn’t eat these foods, but one way to reduce the chances of eating harmful food is to have multiple food sources. Multiple foragers will travel out in different directions from the nest to find different food sources during a famine. Having multiple food sources dilutes harmful chemicals coming from one particular source. Another solution is to use living “silos” where an individual ant stores and tests a food source for harmful chemicals. The ant may die, but the colony would be saved from a food source that was harmful. All of these are quick and

coordinated decentralized responses by individual ants. Together, these actions help a colony survive famine.

## 文獻引用 (REFERENCES)

「我們發現群落在饑荒緩解期間對毒物的易受害性 (vulnerability) 可以透過以下方式減輕：(1) 透過混合來稀釋同一來源的食物；(2) 位於群落中心與群落周圍中間位置的工作螞蟻之食物濃度；以及(3) 「穀倉」的存在。後者是消耗性的覓食者，牠們在飢荒緩解期間留在巢穴中並儲存食物，因此可作為潛在的可拋棄性食物毒性測試儀。」 (Sendova 2010: 473)

「覓食螞蟻在輕度飢餓時所無視的一些營養物質，會在長期饑荒後被收集起來並在群落中分發。這揭示了高度飢餓螞蟻的食品質量接受性較低。」 (Bles 2018: 221)

「去中心化可以說是社會昆蟲群落中最大的復原力來源之一。在社會性昆蟲群落中沒有領導者也沒有規劃藍圖 (blueprint)。每個個體主要是根據當地資訊做決定。甚至負責繁殖的女王 (queen) 也是可替換的。例如，在蜂后 (queen) 死亡的情況下，蜜蜂可以很快地培養出新的應急蜂后 (emergency queen)。」 (Middleton 2016: 13)

“We discovered that colony vulnerability to poisons during famine relief might be mitigated by: (1) the dilution of food from the same source through mixing, (2) the concentration of food in workers positioned midway between the colony centre and its periphery and (3) the existence of living ‘silos’. The latter are expendable foragers, who stay inside the nest and store food during famine relief, thus acting as potential disposable testers for food toxicity.” (Sendova 2010: 473)

“Some nutrients that are ignored by foragers at low levels of starvation are collected and distributed within colonies after a lengthy period of starvation. This reveals a lower food quality acceptability threshold of highly starved ants.” (Bles 2018: 221)

“Decentralization is arguably one of the greatest sources of resilience in social insect colonies. In social insect societies, there is no leader and no blueprint; each individual makes decisions based primarily on local information. Even the queen, who is responsible for reproduction, is replaceable. In the event of queen death, honeybees, for example, can rear emergency queens, and do so very quickly.” (Middleton 2016: 13)

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