

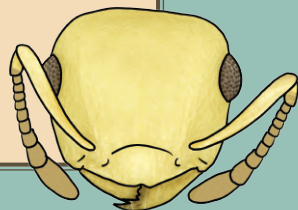
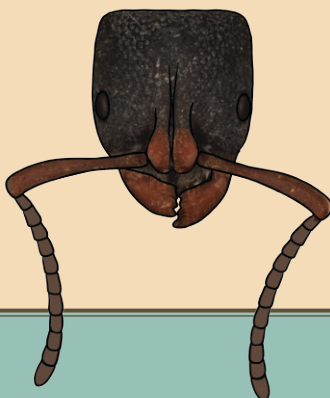
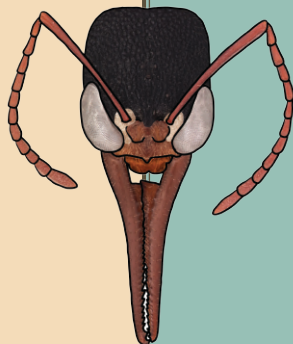
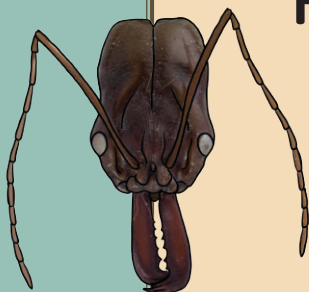
# 小螞蟻 · 大世界

香港螞蟻入門



## From Ants to the Nature World

An Introduction to Ants  
in Hong Kong



明愛陳震夏郊野學園  
Caritas Chan Chun Ha Field Studies Centre

## 目錄 Contents

簡介 Introduction	1
螞蟻的分類 Classification of Ants	2
螞蟻的階級 Castes of Ants	4
螞蟻的形態 Morphology of Ants	7
螞蟻的生活史 Life Cycle of Ants	8
螞蟻的生態位 Niches of Ants	10
採集螞蟻的方法 Sampling Methods of Ants	16
螞蟻的科學探究活動 Scientific Investigations about Ants	24
香港市區常見螞蟻 Common Ants in Urban Areas of Hong Kong	30



## 簡介 Introduction

螞蟻是大家日常生活中最常見的生物之一，但你了解牠們嗎？體型細小的螞蟻給人感覺毫不起眼，古人更以螞蟻與螻蛄比喻微不足道的人。事實上，螞蟻比人類早出現至少一億年，而且已成功演化成爲這「地表最強」、分佈最廣泛的生物之一！

除了南極洲和少數荒僻島嶼外，有陸地的地方就有螞蟻的蹤影，不論是市區還是郊區，戶外或室內，牠們都無處不在。螞蟻通常是熱帶雨林內數量最多的昆蟲之一。最近香港大學昆蟲生物多樣性與生物地理學實驗室的螞蟻普查發現，全球估計有至少 2 萬兆 ( $2 \times 10^{16}$ ) 隻螞蟻，其生物量超過所有野生雀鳥和哺乳類動物之總和！小小螞蟻經歷地球這麼長時間以來的環境變遷，仍能在**生態系統**中佔有如此重要份量，實在殊不簡單！

Ants are one of the commonest animals in our daily life but how much do you know about them? Ants have small body sizes so they are often neglected by humans. Ancient Chinese people used ants and mole crickets as a metaphor for insignificant people. In fact, ants appeared at least one hundred million years earlier than humans. They have evolved successfully into one of the most powerful and widely distributed organisms on Earth!

Except for Antarctica and a few remote islands, you can find ants on all lands, no matter in urban or rural areas, indoor or outdoor. Ants are ubiquitous! They are one of the most abundant insects in tropical forests. In a recent ant census conducted by researchers from the Insect Biodiversity and Biogeography Laboratory of The University of Hong Kong, the global ant population has been estimated to more than 20 quadrillion individuals. In terms of biomass, this outweighs the sum of all wild birds and mammals combined! It's amazing that ants could still take up such an important portion in the **ecosystem** although the environment on Earth has undergone lots of changes in its long history.



## 螞蟻的分類 Classification of Ants

### 林奈分類系統 Linnaean Classification System

層級 Classification level	共同特徵 Shared characteristics
界：動物界 Kingdom: Animalia	異養生物 Heterotrophs
門：節肢動物門 Phylum: Arthropoda	<ul style="list-style-type: none"> <li>無脊椎動物 Invertebrates</li> <li>含外骨骼 With exoskeleton</li> <li>身體分段 Segmented bodies</li> <li>足部成對而分節 Paired jointed appendages</li> </ul>
綱：昆蟲綱 Class: Insecta	<ul style="list-style-type: none"> <li>身體分為頭、胸、腹三部分 Three-part body (head, thorax and abdomen)</li> <li>具 6 隻腳 With 6 legs</li> </ul>
目：膜翅目 Order: Hymenoptera	<ul style="list-style-type: none"> <li>翅膀膜狀 Membranous wings</li> <li>具一排鉤來連接前後翅 With a series of hooks to connect forewings and hindwings</li> </ul>
科：蟻科 Family: Formicidae	<ul style="list-style-type: none"> <li>觸角呈膝狀彎曲 Elbowed antennae</li> <li>腹部具結節狀的腹柄節 Abdomen has petioles with nodes</li> </ul>

螞蟻與蜜蜂、大黃蜂和黃蜂同屬於膜翅目的昆蟲。目前全球已被命名的螞蟻共有 17 個亞科、337 個屬、接近 16,000 種，估計以上所述只佔所有蟻種的一半。而香港的螞蟻生物多樣性也相當高，已記錄到超過 300 種。這麼多螞蟻中，你又見過或認識多少呢？

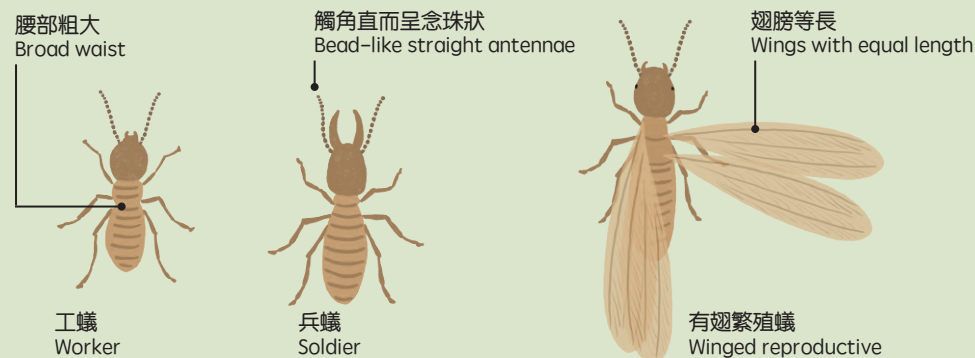
Ants, together with bees, bumblebees and wasps, belong to the Hymenoptera order, one of the four more diverse in insects. So far, nearly 16,000 **species** in 337 **genera** and 17 subfamilies of ants have been described globally. Scientists believed that represents just half of the total ant species. In Hong Kong, the ant diversity is considered as quite high — with over 300 species recorded. With so many ant species, how many have you seen or do you know?

## 小知識 —— 飛蟻 Fun Facts — “Flying Ants”



每年濕季，「飛蟻」入屋是香港常見的現象。你知道嗎？其實部分「飛蟻」並非真正的螞蟻，而是有翅膀且具生殖能力的雌性或雄性白蟻！雖然白蟻有「蟻」字，但牠們的近親是蟑螂，屬於蜚蠊目，大家不要混淆牠們喔！

In the wet season, it's common to find “flying ants” in our home. Do you know that some of those “flying ants” are not ants! They are actually the reproductive male or female termites with wings! Don't be cheated by its Chinese name, termites belong to Blattodea, who are closely related to cockroaches instead!



## 螞蟻資料庫 Ant Information Resources

- 螞蟻資料大全 Ant Wiki:  
<https://www.antwiki.org/>
- 高清的螞蟻標本相片 Photos of ant specimens in high resolution:  
<https://www.antweb.org/>
- 全球螞蟻分佈地圖 Global ant distribution maps:  
<https://antmaps.org/>
- 螞蟻研究學術論文 Journal articles of ant researches:  
<https://benoitguenard.wordpress.com/publications/>
- 霍德伯勒、威爾森著，蔡承志譯：《螞蟻·螞蟻：螞蟻大師威爾森與霍德伯勒的科學探索之旅》（台北：貓頭鷹出版，2019年）。  
Hölldobler, B. & Wilson, E.O. (1994). Journey to the Ants: A Story of Scientific Exploration. Harvard University Press.

## 螞蟻的階級 Castes of Ants

螞蟻在自然界其中一個致勝關鍵是牠們的真社會性。牠們會群居（形成蟻群），個體數量由十幾至過千萬不等（視乎蟻種）。一個蟻群裡同時會有至少兩代的成年個體，牠們當中只有部分個體具繁殖能力，而其他成員則會合作照顧後代，以及分擔覓食、建築、禦敵等其他工作。

能力的差異令蟻群內的螞蟻分成了三個階級，分別是雄蟻、蟻后和工蟻。

- 雄蟻是從未受精的卵孵化出來，一生只為與準蟻后交配，壽命只有數天至數星期，比由受精卵孵化的雌蟻短得多。牠們不會參與巢內的其他事務。
- 雌蟻中，蟻后通常是體型最巨大的。牠們專責產卵，是名副其實的生產機器，擔起蟻群發展的重任。一次交配所儲存的精子量已足夠蟻后的餘生使用（可長達將近30年），能生產數千個卵，有些甚至可在幾天內產下5萬個卵。而蟻群中的蟻后數量會視乎蟻種而定，有的只有一個，但許多都有多個蟻后生活在一起，有時可達數百個（例如紅火蟻）。
- 其他的雌蟻則是數量龐大的工蟻，牠們肩負著蟻群內一切大小事務，產卵除外。有些蟻種的工蟻會再細分兩個或以上的亞階級：雙態型螞蟻分為大工蟻（又稱為兵蟻）和小工蟻，多態型螞蟻則額外加上中工蟻、特大工蟻等。不同亞階級的體型和能力都有所差別，大工蟻通常體型較大，擁有更強而有力的大顎，使牠們在執行戰鬥、切割大型食物和搬運等粗活時更具優勢。大工蟻在保衛蟻巢上扮演著最重要的角色，所以牠們通常只會在蟻巢附近工作。而小工蟻則專注於建築、照顧幼體、清潔和到遠處覓食。通常情況下，越年輕的工蟻會留在蟻巢內負責越安全和輕鬆的工作（如育幼），而年老的工蟻則會外出進行較高風險的工作（如離巢覓食和防禦）。

One of the keys to ant's success is their eusociality. Ants live in colonies that are composed of a dozen up to over ten millions of individuals, depending on species. There are two or more generations of adults in a colony. Therein, only a few individuals are capable of **reproduction** while the others cooperate to take care of brood, forage, build nests, defence and perform other tasks.

The ability differences divide the ants in a colony into three castes — males, queens and workers.

- Males only hatch from unfertilized eggs. Their sole task is to mate with future queens (called “gynes”) and their lifespan is only a few days to a few weeks, much shorter than the females hatched from fertilized eggs. Males never help with the chores of the colony.

- In females, queens usually have the largest body sizes. They are the reproductive machines that are responsible for laying eggs, determining the development of colonies. The sperm storage after one mating is sufficient for a queen to use in her remaining lifetime which could be as long as nearly 30 years. A queen can lay thousands of eggs in her life, and some species can lay as much as 50,000 eggs in just a few days. The queen number in a colony varies among species — some include only one, but in many species, multiple queens could also live together, sometimes with hundreds of them (eg. Red Imported Fire Ants).
- The other females are the numerous workers. They take up all other work in the colonies but usually do not participate directly in the reproductive effort (laying eggs). In some species, the workers could be further divided into 2 or more subcastes: dimorphic species have major workers (majors or soldiers) and minor workers (minors); polymorphic species could have medium and/or supermajor workers on this basis. The sizes and abilities of different subcastes vary. Majors have larger size and more powerful mandibles which give them advantages in heavy duties like fighting, cutting and carrying large food. Majors play the most vital role in nest defence so they usually work near the nest. Meanwhile, minors focus more on nest building, brood caring, cleaning and foraging in far places. Usually, the younger workers would stay in the nests to do some safe and easy tasks (e.g. brood care) while older workers need to do the outdoor tasks with higher risks (e.g. forage outside and defence).



上：熱帶火蟻（雙態型）  
Above: Tropical Fire Ant (*Pheidole megacephala*) (Dimorphic)

下：多態型盲切葉蟻的特大工蟻和小工蟻  
Below: Supermajor and minor workers of polymorphic Marauder Ant (*Carebara* sp.)

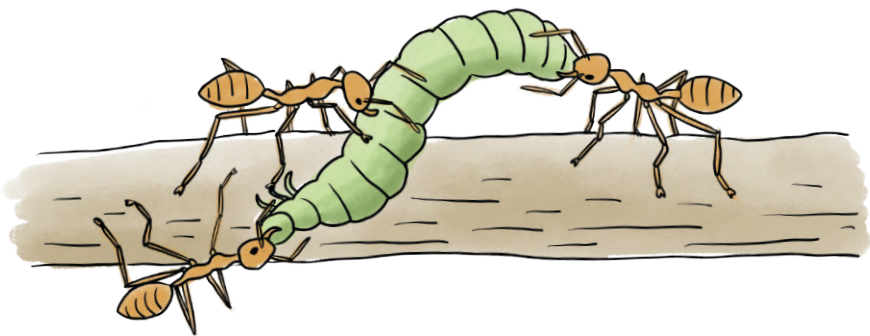


## 小知識 —— 工蟻中的偷懶者？ Fun Facts — Free Riders in Workers?



螞蟻和蜜蜂經常被稱讚為勤勞工作的榜樣，但前幾年的一項研究顛覆了大家對螞蟻的認知——原來蟻群內約有 4 成的螞蟻總在發呆，終日無所事事。研究人員發現懶惰是這些螞蟻的職責，牠們保留實力，為蟻群提供最好的勞動力儲備。當失去了最優秀的活躍螞蟻時，原本懶惰的螞蟻就會開工，以平衡勞動力，維持蟻群的發展。

Ants and bees are often considered as role models of diligence. A few years ago, a study changed people's views by showing that 40% of the ants in a colony were found inactive and idle all day. Researchers found being lazy is a kind of duty so that these ants could retain their power to make them a good labour reserve for the colony. When the most outstanding active ants are lost, the lazy ants would start to work, in order to balance the labour force ratio and maintain the development of the colony.



## 小知識 —— 香港螞蟻體型大比拼 Fun Facts — Size Contest of Hong Kong Ants



最大 Largest : (~ 15 mm)

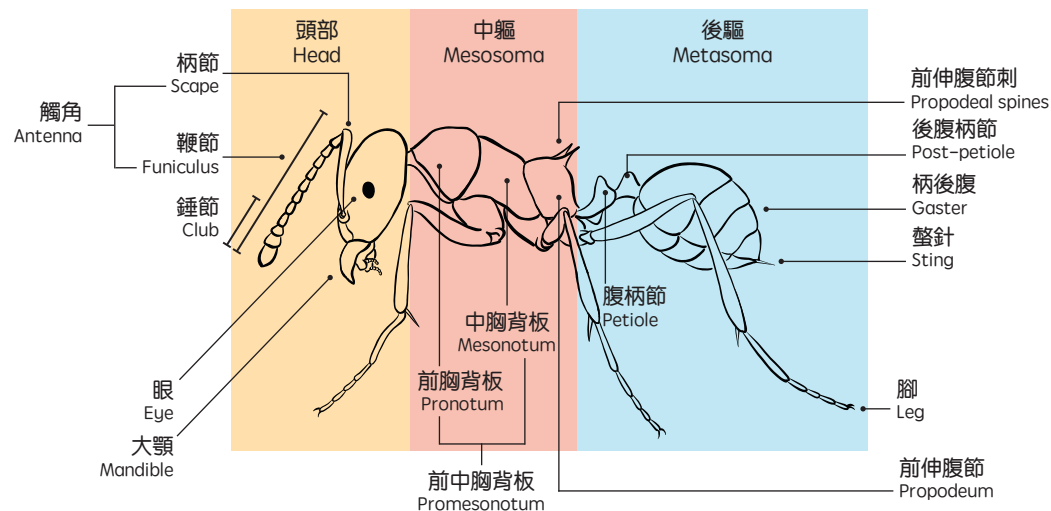
紅足穴猛蟻  
Foamy Ants  
(*Pseudoneoponera rufipes*)

最小 Smallest : (< 1 mm)

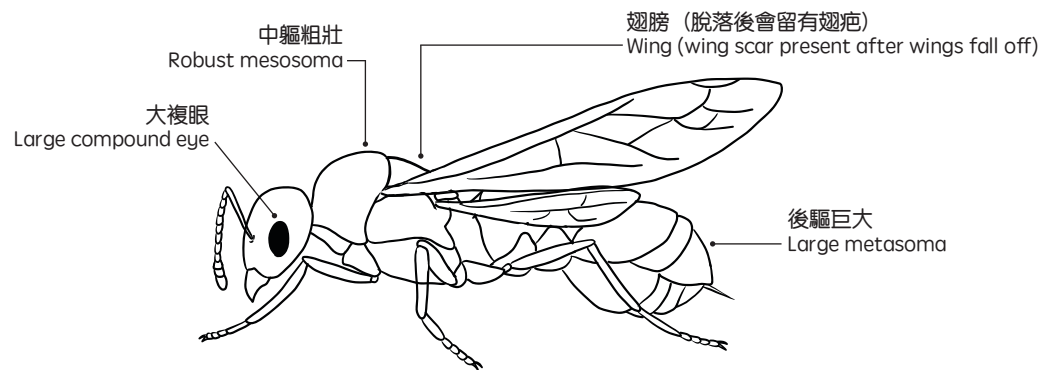
部分盲切葉蟻 (e.g. 惠勒盲切葉蟻) 的小工蟻  
The minor workers of some Marauder Ants  
(*Carebara* sp., e.g. *Carebara wheeleri*)

## 螞蟻的形態 Morphology of Ants

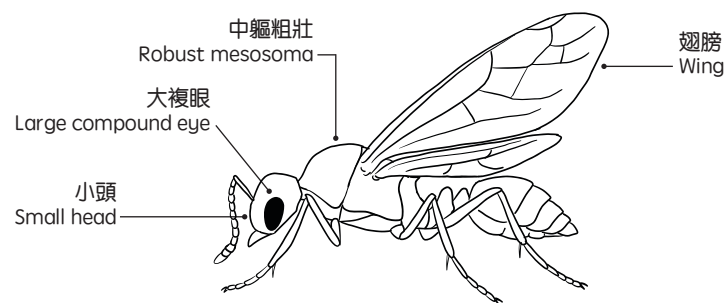
### 工蟻身體結構 Body Structure of a Worker Ant



### 蟻后身體結構 Body Structure of a Queen Ant



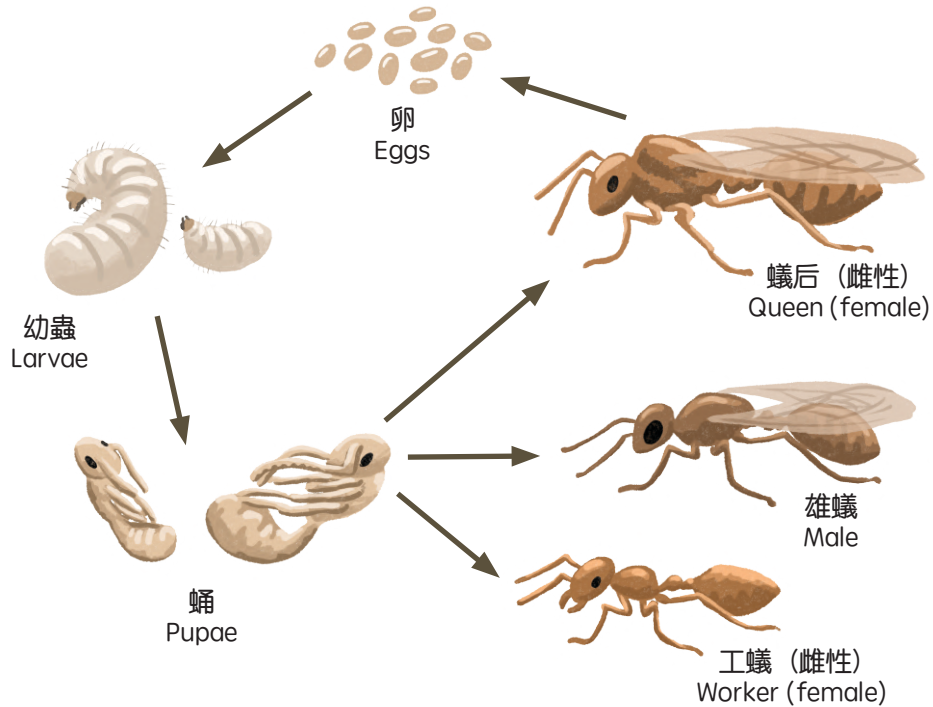
### 雄蟻身體結構 Body Structure of a Male Ant



## 螞蟻的生活史 Life Cycle of Ants

螞蟻是**完全變態的昆蟲**，即包含**卵**、**幼蟲**、**蛹**（有時會作繭）和成蟲階段。

Ants are insects with **complete metamorphosis**. They go through **egg, larva, pupa** (sometimes with production of a cocoon) and adult stages as they grow up.



螞蟻幼體發育時需要舒適的溫度，因此工蟻需要經常將牠們搬來搬去，讓牠們長期處於合適的生長環境。有別於其他昆蟲，螞蟻的幼蟲通常沒有活動能力，需由工蟻餵食。工蟻覓食時會先吃下液態食物，待回巢後再吐出來餵給幼蟲。成蟲之間也會以此交換食物（此行為稱作「交哺」）。然而，幼蟲對蟻群亦有貢獻：終齡幼蟲可將固體食物分解，再透過交哺反饋回工蟻；部分蟻種的幼蟲亦會分擔築巢工作，例如黃猄蟻的巢就是用幼蟲所吐的絲來把葉片縫起來而成。

一隻螞蟻屬於哪個階級在牠成熟前多數已有定論。階級類別取決於卵的受精狀況，以及在幼蟲和蛹階段的營養有多豐富。雄蟻是單倍體，由未受精的卵孵化出來。受精卵會發展成為雌性，是雙倍體。若雌蟻在幼體時期被餵食高營養的食物，則多數會成為蟻后。另外，溫濕度等非生物因子和蟻群成員的比例等其他因素也會影響部分蟻種的分級情況。

Immature ants develop only in suitable temperatures, which means workers need to keep moving them to provide them with a good environment. Unlike other insects, ant larvae could not move on their own and rely on workers to feed them. During foraging, workers would ingest fluid food first and spit out to feed larvae after they come back to the nest. Adults would exchange food in this way as well, which is called trophallaxis. Nevertheless, larvae also contribute to the colony: the final-instar larvae could break down the solid food and feed workers back through trophallaxis; larvae of some ant species also take up the nest building job. For example, the silk secreted by the larvae of Weaver Ants is a vital material to sew the leaves together to construct the nest.

An ant belongs to which caste is determined before they mature, mainly based on the fertilization of eggs and how good quality of the nutrition is fed in larval and pupa stages. Males are haploids that hatched from unfertilized eggs. Fertilized eggs would develop into female diploids. Female larvae who are fed with highly nutritious food will most likely become the queens. Besides, abiotic factors (like temperature and humidity) and ratio of ant castes in the colony and other factors would affect the caste differentiation of some species.



### 小知識 —— 婚飛 Fun Facts — Nuptial Flight



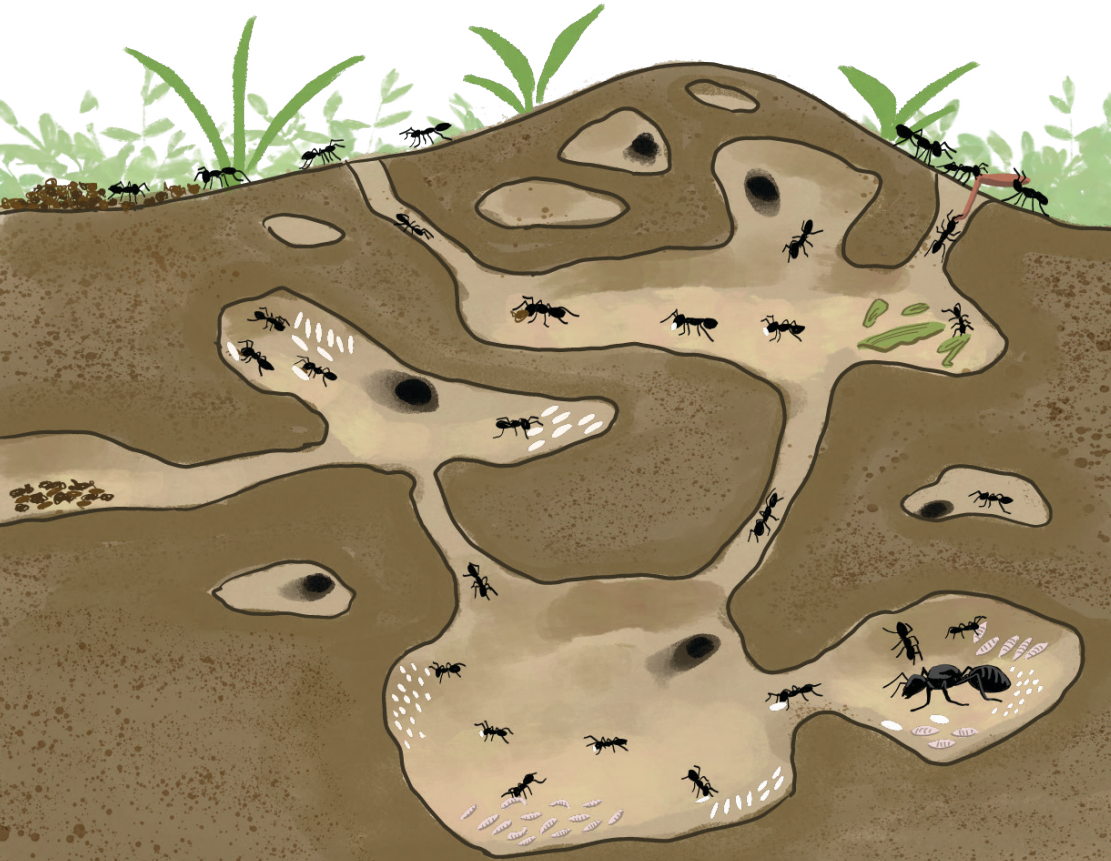
「飛蟻」會大群飛入屋，其實是與被稱為「婚飛」的群體繁殖行為有關。雌雄白蟻會相約在雨後黃昏一起飛出巢外，落地後翅膀脫落，在地上交配，以完成傳宗接代的使命。螞蟻也有類似的婚飛行為，不同的是牠們會在空中**交配**。交配後，雄蟻不久就會死去，而蟻后一旦找到適合建立牠的新巢之地，其翅膀就會脫落。

The reason why a swarm of “flying ants” would appear in houses is related to a collective reproduction behaviour called “nuptial flight”. The male and female termites would fly out from the nests in rainy dusk. Their wings would fall off after they land and then they mate on the ground. Ants have nuptial flight behaviour as well but they **mate** in flight. The males would die soon after mating. The wings of the queens will fall off after the queens have found their new nesting places.

## 螞蟻的生態位 Niches of Ants

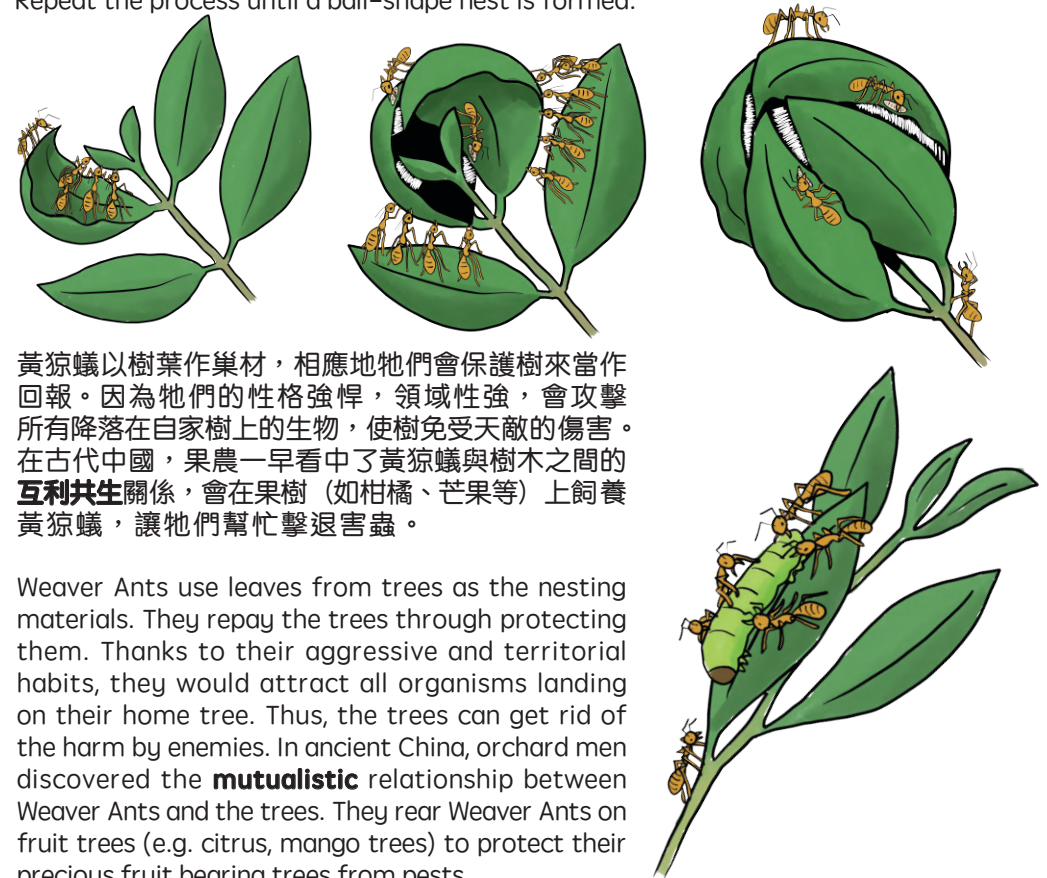
螞蟻雖小，在大自然中卻扮演著舉足輕重的角色。例如，螞蟻被稱為生態工程師。有些螞蟻（如橫紋齒猛蟻）會在泥土中築巢、興建隧道，過程中泥土會被移位和改變形狀。這有助改善地底的通風狀況和養分循環。有學者甚至認為，螞蟻在疏鬆泥土方面做得比蚯蚓更為出色。而愛整潔的螞蟻亦會把巢內的垃圾，包括同伴的屍體和食物殘渣，堆在一起，這亦令那些位置附近的營養含量更高，提升土壤的**肥力**，間接促進植物的生長。

Although ants are small, they play important roles in nature. For instance, ants are considered ecological engineers. Some ants (e.g. *Odontoponera denticulata*) would nest and build tunnels in soil. In this process, soil would be moved and changed shape, which improves aeration and nutrient cycling in the soil. Some researchers even thought that ants do better jobs than earthworms in terms of soil turnover. Ants like tidying and they gather the refuse together, such as dead bodies of their companions and food leftovers. This increases the nutrient content and soil **fertility** near the refuse points, and facilitates plant growth indirectly.



有些螞蟻會在樹皮下、樹枝內或樹冠層等植物位置上建造安樂窩。黃猄蟻就是當中的表表者。牠們的巢是由工蟻和幼蟲合力建成。找到合適的築巢地點後，工蟻們就會善用自己身體修長的優勢，大顎咬住一塊樹葉的一邊，後腳鉤著相鄰樹葉的一邊，拉近兩塊葉之間的距離。若兩葉相距較遠，牠們就會咬著前面同伴的腰部組成「蟻鏈」，頭尾的工蟻成功著陸兩葉後，大家就會出盡力拉合兩葉。隨後，部分工蟻則叨著幼蟲遊走在葉片間，用幼蟲所吐出的絲把葉片縫在一起，不斷重複，直至建成球形的巢。

Some ants build their homes under tree bark, inside twigs or in the canopy level. One typical example is Weaver Ants (*Oecophylla smaragdina*). Their nests are built by workers and larvae. Once they found a suitable nesting site, workers would make good use of their slender body. They bite a leaf margin with their mandibles while hook the adjacent leaf with hind legs, and then pull the two leaves closer. If the distance between two leaves is far away, they would form “ant chains” by biting the waist of the ants in front of them. After the workers at both ends land on leaves, all ants in the chain would pull the leaves together. Then, some workers carry the larvae and move among leaves to sew the leaves together using the silk secreted by larvae. Repeat the process until a ball-shape nest is formed.



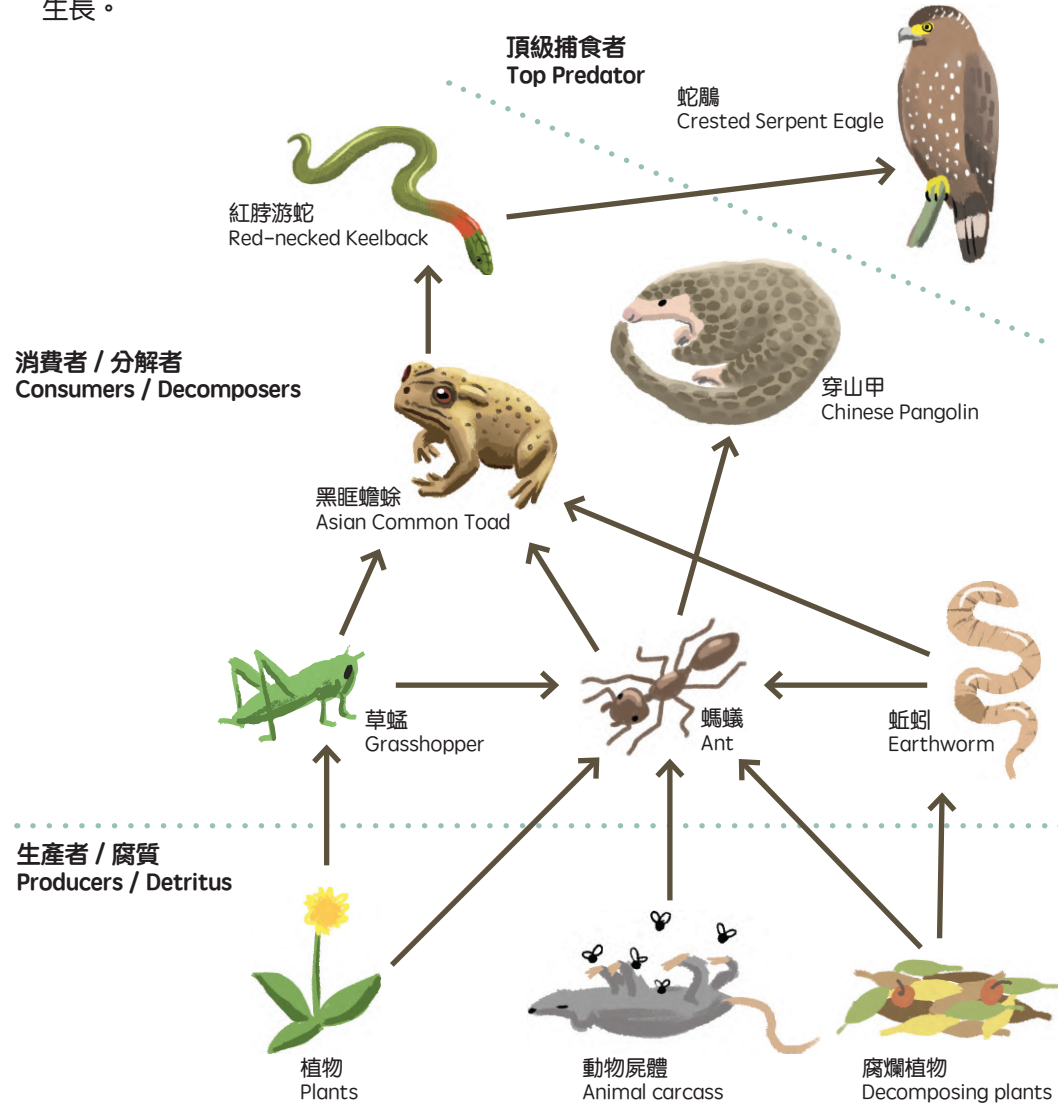
黃猄蟻以樹葉作巢材，相應地牠們會保護樹來當作回報。因為牠們的性格強悍，領域性強，會攻擊所有降落在自家樹上的生物，使樹免受天敵的傷害。在古代中國，果農一早看中了黃猄蟻與樹木之間的**互利共生**關係，會在果樹（如柑橘、芒果等）上飼養黃猄蟻，讓牠們幫忙擊退害蟲。

Weaver Ants use leaves from trees as the nesting materials. They repay the trees through protecting them. Thanks to their aggressive and territorial habits, they would attract all organisms landing on their home tree. Thus, the trees can get rid of the harm by enemies. In ancient China, orchard men discovered the **mutualistic** relationship between Weaver Ants and the trees. They rear Weaver Ants on fruit trees (e.g. citrus, mango trees) to protect their precious fruit bearing trees from pests.

螞蟻與許多生物都有著各式各樣的互動關係。牠們是**陸地生境**內無脊椎動物最主要的**捕食者**之一，包括昆蟲、蚯蚓、彈尾蟲、蜘蛛等等。與此同時，螞蟻亦是兩棲爬行類、鳥類、哺乳類等生物的重要食糧。香港有研究發現，從一隻年幼穿山甲消化道找到的**獵物**殘骸中，有97%都是螞蟻（超過25,000隻）。可見，螞蟻在食物網中極其重要，螞蟻數量下降或會引致生態系統內的重大轉變。

其實許多螞蟻是**雜食性**的，基本上甚麼都吃。如有動物死去，牠們通常最快找到屍體。因此被認為是森林裡最有效率的**食腐動物**，是其他生物難以取替的。

而螞蟻在覓食過程中也輔助了不少植物的繁殖：採花蜜的螞蟻會遊走在不同花之間，有助**傳粉**；採集種子的螞蟻把種子帶回地下蟻巢時，裡面的環境有利於植物的發芽與生長。



Ants have various interactions with other organisms, and are one of the main **predators** of invertebrates (e.g. insects, earthworms, collembola, spiders, etc) in **terrestrial habitats**. Meanwhile, ants also serve as food for many organisms like herps, birds and mammals. A study in Hong Kong found that 97% of the **prey** items found in the gut content of a juvenile Chinese Pangolin are ants (over 25,000 individuals). Thus, ants play a very crucial role in the food webs. An decrease in ant population may lead to substantial changes in the ecosystem.

Actually, many ant species are **omnivores**. They eat everything basically. If an animal dies, ants are the first ones to find the dead body. They are thought to be the most efficient **scavengers** in the forest, which is irreplaceable by other organisms.

The foraging process of ants also facilitates the reproduction of many plants: nectar-feeding ants helps with **pollination** when they walk from flowers to flowers; when seed-collecting ants bring seeds back to the nests, the environment inside is good for the sprouting and growth of plants.

### 小知識 —— 螞蟻的殺手鐮 Fun Facts — Trump Cards of Ants

很多螞蟻都有強而有力的大顎，是牠們對付獵物和敵人的強大武器。也有些螞蟻（如猛蟻亞科）與蜂類一樣，後軀有螫針，可把毒液注入獵物體內，以降低獵物的抵抗程度。在香港，最為人熟知的可能是入侵紅火蟻的螫咬，會引起人類不同程度的過敏反應。此外，有些螞蟻沒有螫針，但可從後軀的分泌孔噴射蟻酸來制服對手。

Many ants possess strong mandibles, which are powerful weapons against prey and enemies. Same as wasps, some ants (eg. Ponerinae) have stings in metasoma to inject venom into the prey bodies, reducing the resistance. In Hong Kong, the Red Imported Fire Ants are well known for their stinging bites that would cause allergies to different extents in humans. Besides, some ants don't have stings. Instead, they can secrete formic acids from their acidopores in metasoma to subdue prey.



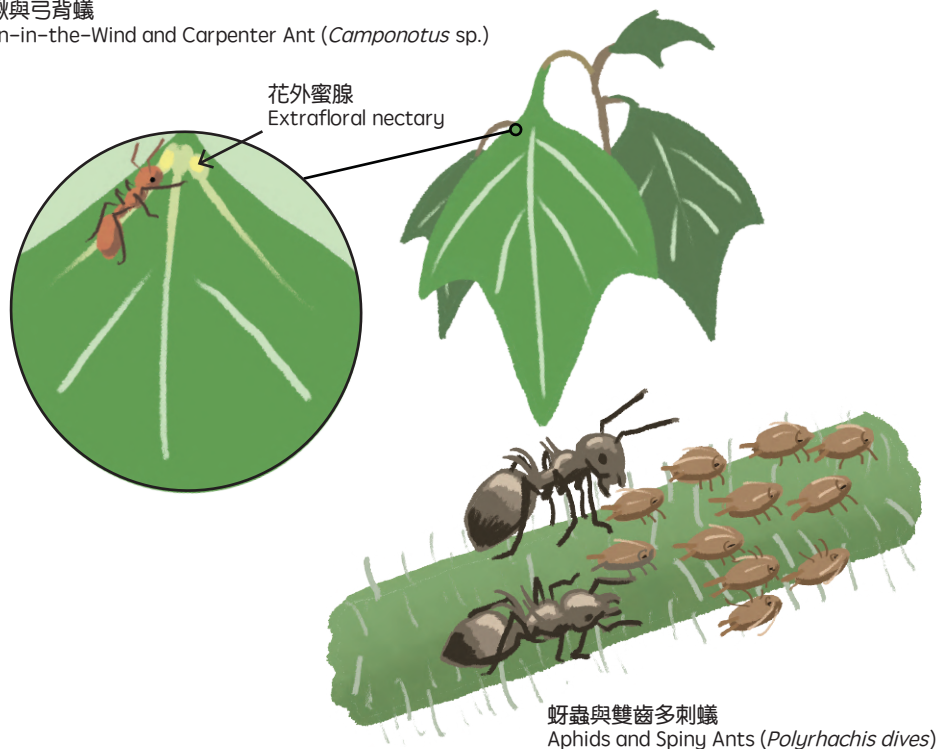
山大齒猛蟻  
Trap-jaw Ant  
*Odontomachus monticola*



大自然中適者生存，某些相對弱勢的生物就各出奇謀來求生，其中一個方法就是找「神隊友」相助，而天性兇猛的螞蟻就是個不錯的選擇。大戟科、薔薇科等植物具有**花外蜜腺**分泌**蜜露**，半翅目的昆蟲（如蚜蟲、介殼蟲）亦會排出體內多餘的蜜露，這都會吸引螞蟻前來取食。然後螞蟻會保護牠們的蜜露供應者，形成互利共生的雙贏局面。螞蟻照顧、保護著牠們的資源供應者，活像農夫一樣。科學家還發現，美洲的切葉蟻更會在巢中培植真菌，採收後用來餵食幼蟲，是幼蟲唯一的食物來源。這類真菌若失去了切葉蟻的照顧，就不能存活，所以與切葉蟻是相依為命的好拍檔。

Only the fittest can survive better in nature. Some relatively weak organisms have evolved all kinds of mechanisms and tactics for survival. One way is to find strong teammates and ants are a good option. Plants in Euphorbiaceae, Rosaceae and so on produce **extrafloral nectaries** that secrete **nectar**, and hemipterans like aphids and scale insects would expel extra honeydew from their bodies. These attract ants to forage and then ants would provide protection for their food suppliers, forming a mutualistic win-win situation. Ants work like farmers that they take care of and protect their resource suppliers. Leafcutter ants, a group of species found in the New World, cultivate fungi in their nests and feed their larvae after harvesting. If this kind of fungi lacks the care from leafcutter ants, they can't survive anymore, while the fungi are the only food source for the ant larvae. Therefore, the fungi and leafcutter ants depend on each other for survival.

白楸與弓背蟻  
Turn-in-the-Wind and Carpenter Ant (*Camponotus* sp.)



在另一方面，也有些生物只會佔便宜而不付出。例如部分衣魚、隱翅蟲等會生活在蟻巢中，偷食蟻巢中的食物碎屑（**偏利共棲**），有些甚至會捕食螞蟻的幼蟲和卵（**寄生**）。有些生物會從外貌、行為或化學信號上模仿螞蟻，以此矇騙螞蟻，待成功進入蟻巢後，就會伺機捕食幼體。例如某些灰蝶幼蟲會散發與螞蟻相同的氣味，使螞蟻誤以為是自己的幼蟲而帶回巢，然後灰蝶幼蟲就可捕食螞蟻幼蟲了。

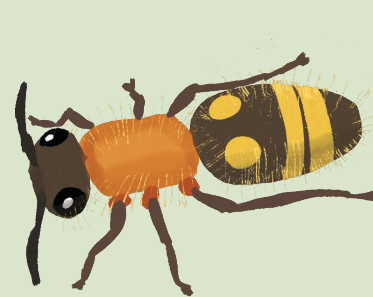
On the other hand, some organisms benefit from ants without reciprocity. For example, some silverfish and rove beetles live in ant nests to steal the food residues inside (**commensalism**), and some of them even prey on ant larvae and eggs (**parasitism**). Some organisms would mimic ants from appearance, behaviours or chemical signals to deceive ants. When they enter the ant nests successfully, they would prey on the ant brood. For instance, the larvae of some Lycaenidae butterflies can release smell like ants, making ants to consider them as their own larvae and thus bring back to the nests, resulting in the predation on the ant larvae.

### 小知識 —— 螞蟻扮演者 Fun Facts — Ant Imitators



螞蟻合作性高、防禦能力強，許多捕食者都對牠們避之則吉。因此不少節肢動物（如蟻蜂、蟻蛛）的外形或行為會模仿螞蟻，以此來逃避捕食者。

Ants have strong cooperation and defence abilities, making many predators avoid them if possible. Thus, some arthropods (e.g. Mutillids and Ant-mimicking Jumpers) would mimic ants on appearance or behaviours so as to escape from predators.



絨蟻蜂  
Velvet Ant  
*Wallacidia oculata*



臺灣蟻蛛  
Ant-mimicking Jumper  
*Myrmarachne formosana*

## 採集螞蟻的方法 Sampling Methods of Ants

螞蟻作為陸地生境的優勢物種，一直以來都是受生態學家關注的研究對象。螞蟻的**習性**、棲息地多變，因此並沒有一種共通的方法可以同時採集到所有螞蟻種。

如果想調查特定螞蟻種，就需要事前了解其習性，例如活躍的季節、時間、出沒的地點、**小生境**等，然後選用合適的方法和工具，在適當的時間和地點採集。一般來說，大部分螞蟻在寒冷或酷熱的環境中會變得不活躍，因此應避免在那些情況進行採集。

Ants are the dominant animals in terrestrial habitats, thus they are the research targets of ecologists for a long time. However, no single method could collect all species of ants at the same time due to the diversity of their **habits** and habitats.

If you would like to survey certain ant species, you need to know about their habits in advance, for example, their active seasons, time, locations and **microhabitats**. Then, you can choose suitable methods and tools and collect the ants at proper times and places. Generally speaking, a majority of ants would become inactive in cold or very hot environments, so you should avoid sampling under those situations.

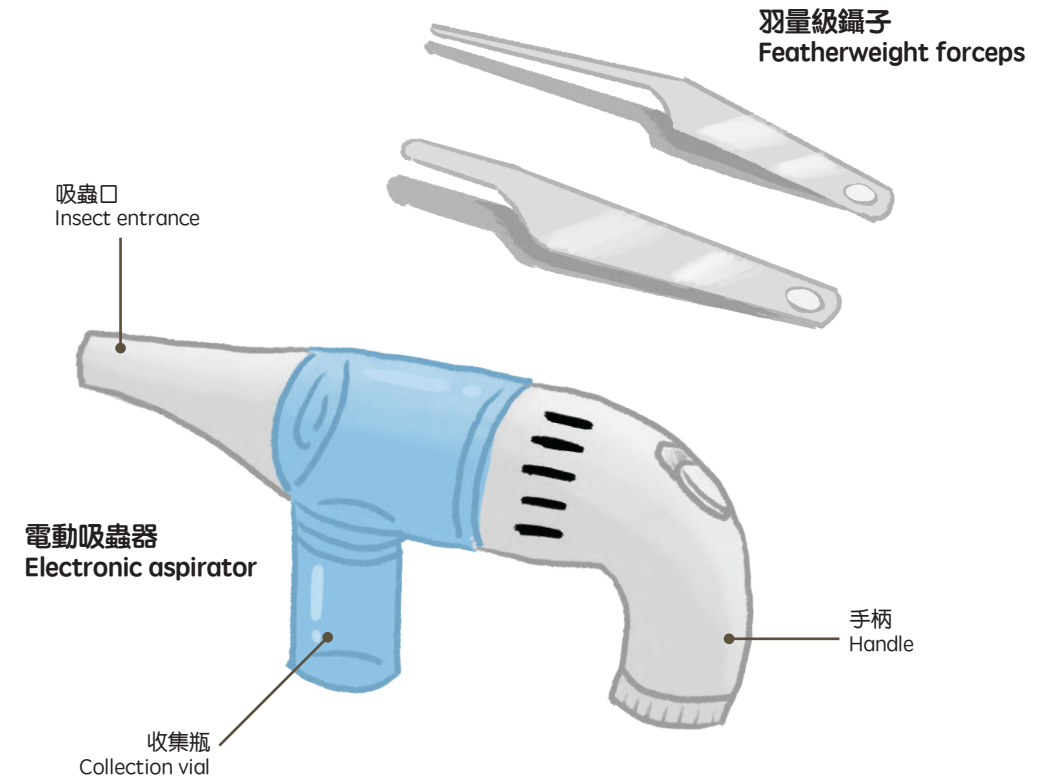
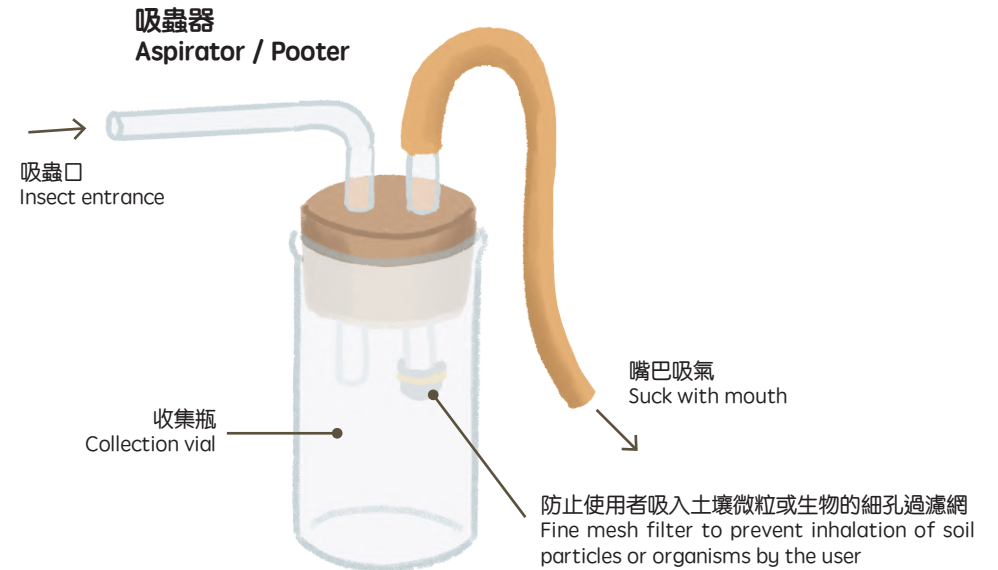
以下簡介幾種採集螞蟻常用的方法：

Here are several common methods of collecting ants:

### 用手採集 Hand Collecting

當找到螞蟻後，最簡單的可用鑷子直接捕捉螞蟻，然後放進收集瓶中。建議使用柔軟的羽量級鑷子，以減少採集過程中螞蟻的傷亡。捉細小昆蟲專用的吸蟲器也是個不錯的工具——透過嘴巴或電製造吸力，把螞蟻吸入收集瓶內。注意，部分螞蟻種有螫針，因此處理螞蟻時要格外小心，記得用這些工具來輔助採集。用手採集的靈活性較大，適用於不同的小生境，可採集到多類螞蟻，便於建立螞蟻名錄。

When you find ants, you can simply catch them with forceps and then put them into collection vials. The soft featherweight forceps are recommended to reduce injuries and deaths of ants. You can also use aspirators (/pooters) specialized to catch small insects. Through creating air suction with your mouth or electric power, ants would be sucked into the vials. Note, however, that some species of ants have a sting so you should be very careful when manipulating ants and don't hesitate to use these hand collecting tools as aids. Hand collecting has great flexibility to collect different groups of ants in various microhabitats, which facilitates building an ant species list.



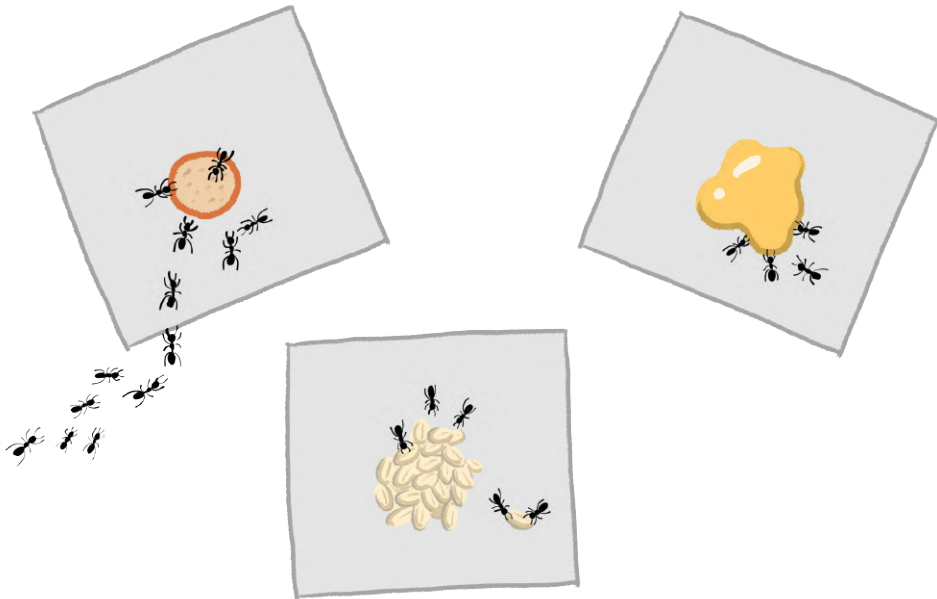
## 誘餌陷阱 Baiting Trap

通過提供食物，我們可吸引螞蟻前來覓食，從而採集到附近的螞蟻以及研究牠們的活動和行為。不同螞蟻種喜愛吃不同的食物，可以根據其食性來投其所好，或者提供含有多種營養成分的食物（如香腸）來同時吸引各類螞蟻。為了方便觀察和採集螞蟻，可用統一的容器來盛載食物，可以是試管、過膠卡紙、膠碟等等。

放置誘餌後，多數情況下螞蟻的數量會隨時間而增加。通常數分鐘至 15 分鐘會開始有螞蟻到達誘餌，30 分鐘時覓食隊內大約 50 - 70% 的螞蟻會出現，直到約 90 分鐘後螞蟻數量開始趨平。可視乎研究的目的和資源來決定放置的時間長度，一般建議放置至少一小時。

Through providing food, we could attract ants to forage. Then, we can collect ants nearby and study their activities and behaviours. Different ants prefer different food. You can cater to their pleasure according to their feeding habits. Or, you can provide food with multiple nutrients (e.g. sausages) to attract different groups of ants. To facilitate observation and collection, you can use standardized containers to carry the food, such as test tubes, laminated card paper, plastic plates and so on.

The number of ants would increase with time in most cases after baiting starts. Usually, some ants would reach the bait at several minutes to 15 minutes. 50 - 70 % of the foraging population would appear at 30 minutes and the ant abundance would begin to level off at around 90 minutes. The duration of the baiting depends on the objectives and resources available of the study, but the recommended duration is at least one hour.



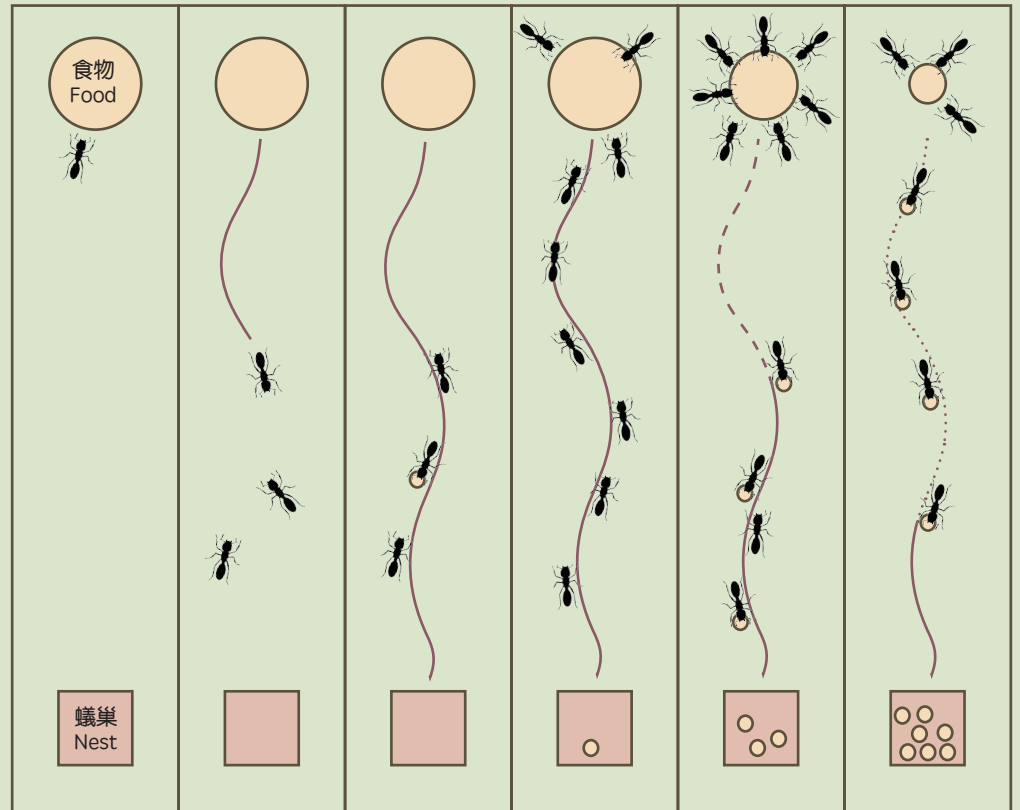
## 小知識 —— 螞蟻之間的摩斯密碼

### Fun Facts — Morse Code among Ants



螞蟻主要透過**信息素**來傳遞訊息和溝通。信息素是牠們散發出來的化學氣味，不同化學物質比例所組成的信息素代表著不同的意思。當一隻螞蟻偵察員找到食物時，牠在回巢時會沿途放下信息素記號，引導同伴前來幫忙搬運食物。當越來越多同伴成功搬運到食物回巢時，信息素就會不斷加強，直至食物被搬運完畢。此外，有些螞蟻有時也會利用輕拍、撫摸身體等肢體語言和發聲來輔助信息素溝通。

Ants deliver messages and communicate mainly through **pheromones**. Pheromones are the chemical scent the ants release. Pheromones with different chemical substance composition represent different meanings. When a scout ant finds a food source, it would leave pheromone signs along its way back to the nest, guiding its nestmates for help. When more and more ants carry food back to the nests successfully, the pheromones are strengthened until the food is depleted. Besides, some ants would use body languages (eg. tapping and touching) and calls to assist pheromones for communication.



## 掉落式陷阱 Pitfall Trap

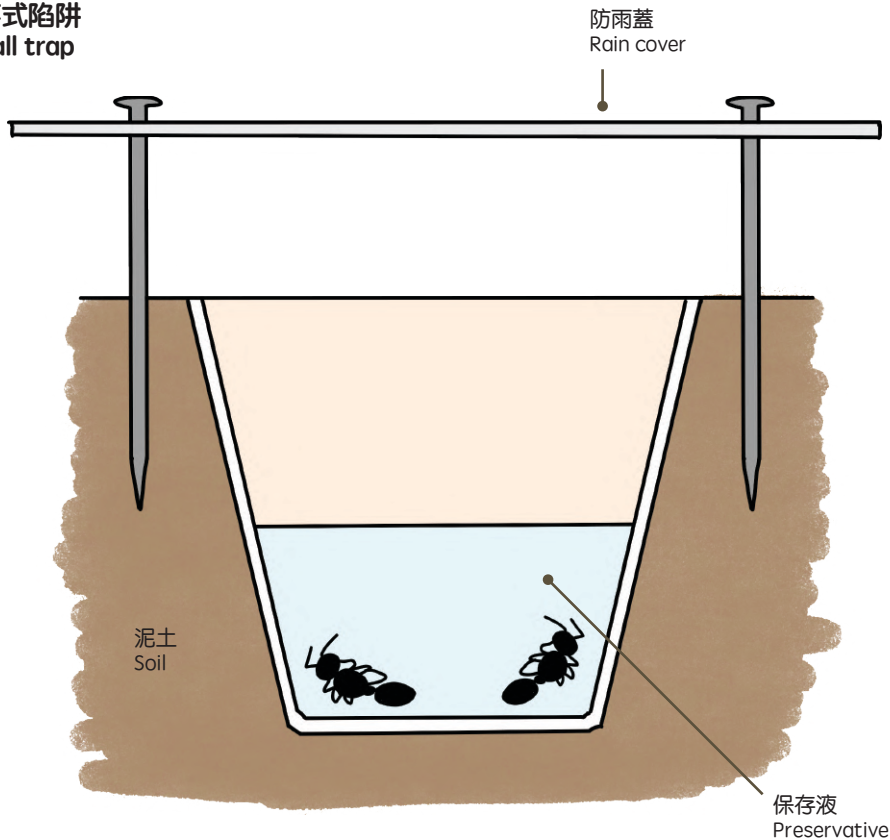
最簡單的掉落式陷阱是把寬口的樣本杯埋在泥裡，杯口與地面同高，加入 75% 酒精或肥皂水（份量需為大約一半至全滿，視乎放置的時間長度），待幾小時至一兩天後收回。杯口上可添加防雨蓋，以避免雨水影響採集結果。當螞蟻途經陷阱時，或會失足跌下去。這類陷阱通常可採集到在地面活動性較高的螞蟻。如果放過夜，亦有機會收集到夜間活躍的螞蟻。

進階版是結合誘餌來設置地下陷阱：在離心管外圍鑽幾個小孔，讓誘餌的氣味更易散發出來。然後加入酒精在底部和誘餌在上方，合上蓋子後埋在地下。這可採集到活躍於地表下的螞蟻，牠們甚少或從不到地面活動。

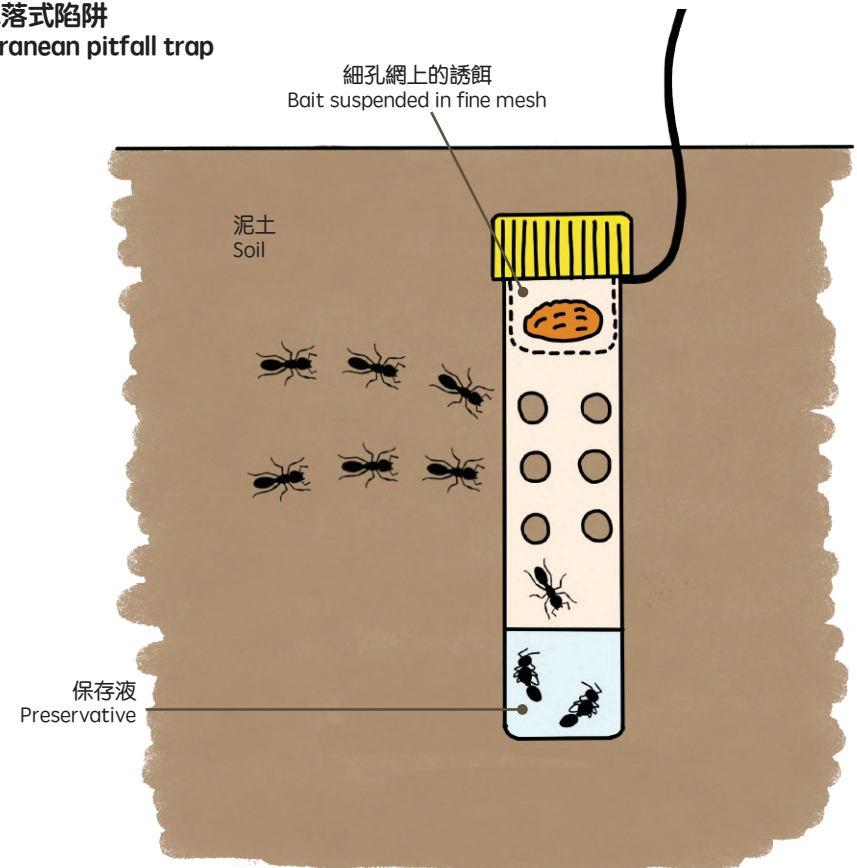
A simple pitfall trap could be a sample cup with a wide opening buried in the soil, and the opening should be at the same level with the ground. Fill half of the cup with 75% alcohol or soapy water (volume depending on the experiment duration). Collect after a few hours or 1 – 2 days. You can add a rain cover above the pitfall trap to prevent the effects of rain. When ants pass by, they may fall into the trap. This kind of trap could usually collect ants active above the ground. If the trap stays overnight, then it's possible to collect nocturnal ants — as some species are only or mainly active at night.

The advanced version is a subterranean pitfall trap that combines baiting and pitfall trap together. Drill some holes on a centrifuge tube to allow the smell of baits to come out. Add alcohol at the bottom and baits near the top, and then bury it underneath the ground with the lid closed. This method could collect subterranean ants; those species that rarely or never come above ground.

掉落式陷阱  
Pitfall trap



地下掉落式陷阱  
Subterranean pitfall trap



## 其他方法 Other Methods

### 擊落法 Beating

用棍敲打樹枝並在下面用大白布（或雨傘）接住由樹枝跌落來的螞蟻，然後用手採集樹上的螞蟻。

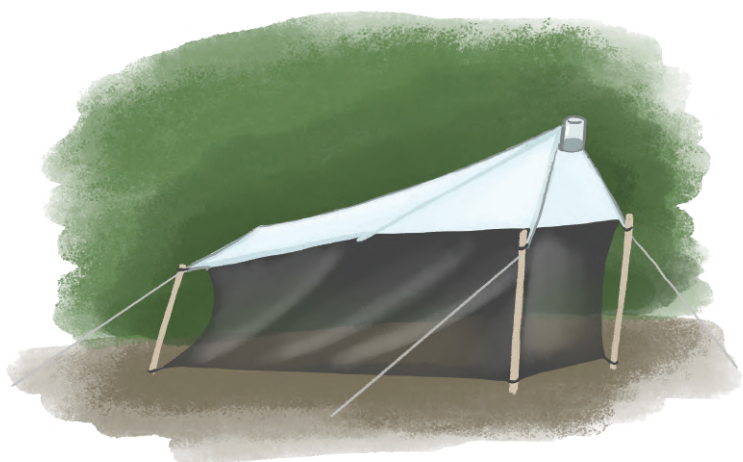
Hit tree branches with a stick and gather the fallen ants with a big white sheet (or an umbrella) underneath, and then use hand collecting methods to collect arboreal ants.



### 馬氏網 Malaise Traps

把馬氏網懸掛起來幾日，在頂部放酒精樣本瓶來收集有翅膀的螞蟻。

Hang up the Malaise trap for a few days. Insert a sample cup with alcohol to collect ants with wings.



螞蟻採集方法短片  
Videos about different  
sampling methods :  
<https://bit.ly/3DHeehZ>



## 落葉袋收集法 Winkler Extraction

收集 1 m<sup>2</sup> 範圍內地面的枯枝落葉，搖動篩濾袋把腐殖質和生物篩到袋的底部。回實驗室後轉移到落葉袋的內篩網中，懸掛起來，底部放上裝有酒精的樣本杯，數日後收回。過程中，在落葉袋內的螞蟻在走動時就會跌落到樣本杯內。這可收集到活躍於落葉層的螞蟻。

Gather the twigs and leaf litter in 1 m<sup>2</sup> area into the Winkler sifter. Shake the sifter to extract humus and organisms at the bottom. Transfer the mixture into the mesh sack in the Winkler bag. Hang up the bag and put a sample cup with alcohol at the bottom. Collect the samples a few days later. In the process, ants moving in the bag will drop to the cup. This method could collect ants active in the leaf litter layer.



## 螞蟻的科學探究活動

### Scientific Investigations about Ants

螞蟻隨處可見、數量多，又是**生物指示者**，是很好的生態研究對象。而誘餌陷阱所需的用具和操作都很簡單，因此老師可在校園內利用誘餌陷阱來與學生設計和進行各種**科學探究**活動。透過觀察和比較螞蟻在不同設置下的覓食行為，既可以認識螞蟻的習性，亦可了解不同的非生物因子會如何影響螞蟻的活動。

Ants are ubiquitous, abundant and **biological indicators**, so they are good targets of ecological research. Baiting needs simple equipment and has simple procedures, thus teachers can use baiting to design and conduct **scientific investigations** with students at schools. Through observing and comparing the foraging behaviours of ants under different setups, you can learn about habits of ants, and know how various abiotic factors would affect ants' activities.

#### 香腸誘餌陷阱

#### Sausage Bait Traps

下面簡介兩個以香腸作為誘餌的活動，以供參考。每個誘餌站的基本設置為：

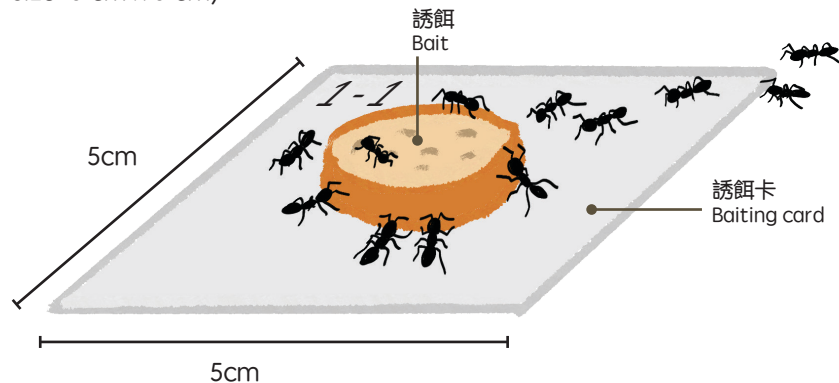
誘餌：一塊香腸（約 5 mm 厚）

誘餌平台：一張已過膠及附有編號或標籤的白紙（白紙尺寸為 5 cm x 5 cm）

Here, 2 activities using sausages as baits are introduced for your reference.  
Basic setup of each bait station:

Bait: A slice of sausage with ~5 mm thick

Baiting platform: A piece of laminated white paper with a code/label  
(paper size: 5 cm x 5 cm)



## 1. 校園螞蟻大搜查

### School Ant Survey

老師可帶領同學在校園的不同地方放置誘餌站，等待至少一小時後，拍攝記錄誘餌站的情況，並用鑷子把誘餌站連螞蟻放進密實袋中，帶回實驗室觀察和嘗試辨認螞蟻。如果螞蟻太活躍，在觀察前可把牠們放進冰櫃 10 - 15 分鐘。由此可整理出螞蟻名單，了解校園螞蟻的多樣性。

Teachers can lead students to set up bait stations in different places at school. After one hour or later, take photos of the bait stations. Then, use forceps to put the bait stations and ants into ziplock bags, and bring them back to the lab to observe and try to identify the ants. If the ants move too much, you can place them in a freezer for 10 - 15 minutes before conducting the observations. Through this, you can get an ant species list and know about the ant diversity at your school.



## 地面溫度對螞蟻覓食的影響

### Effects of Ground Surface Temperature on Foraging of Ants

不同物種都有特定範圍的耐熱值。例如，矮大頭蟻是香港最常見的螞蟻之一，其臨界熱最大值 ( $CT_{max}$ ) (即出現雜亂動作的溫度上限) 只有不足  $45^{\circ}\text{C}$ 。螞蟻體型細小，相比起空氣溫度，地面溫度對牠們的影響更大。當地面溫度接近或高於螞蟻的  $CT_{max}$  時，螞蟻就會失去控制肌肉的能力，最終死亡。

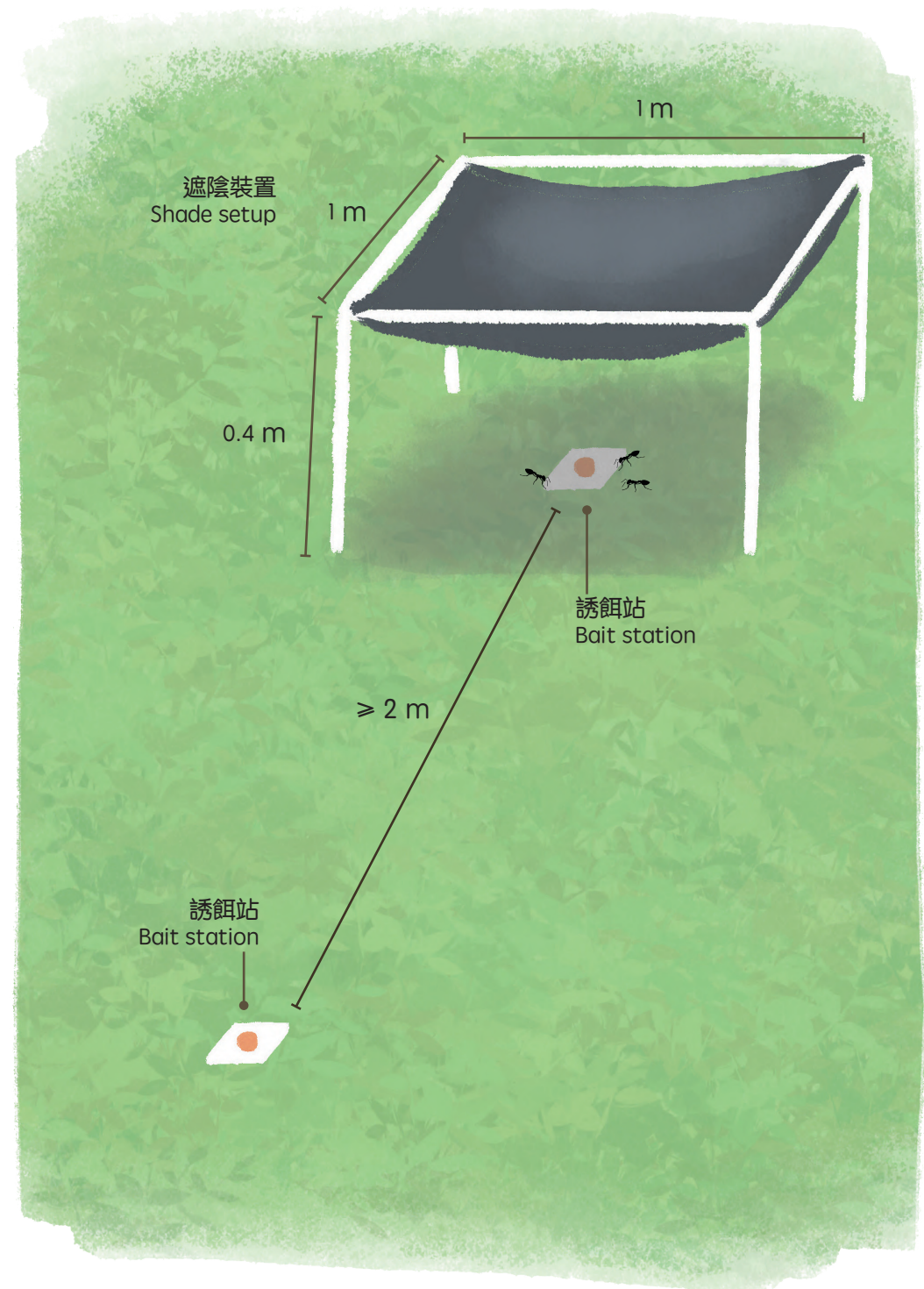
老師可選擇在晴天與同學探究地面溫度對螞蟻活動的影響。用  $1\text{ m} \times 1\text{ m}$  的遮光網和 PVC 膠管製作大約  $0.4\text{ m}$  高的遮陰裝置，放置在實驗地點至少半小時後，在其陰影的中央擺放誘餌站。同時，在同類型地面基質並距離遮陰裝置  $\geq 2\text{ m}$  的地方擺放另一個誘餌站。待至少一小時後記錄並收集誘餌站的螞蟻，以及用紅外線探熱器量度每個誘餌站附近的平均地面溫度，與螞蟻數量進行比較。

若校園內有樹冠濃密的地方，也可直接用樹蔭取代遮陰裝置。在同樣情況下，不同地面基質 (如草地、泥地、石屎地、紅磚地、瓷磚地) 的溫度也有所不同，溫差可超過  $15^{\circ}\text{C}$ 。因此，也可選擇同時在不同地面基質上擺放誘餌站進行另一個實驗。

Different species have their own specific heat tolerance. For example, *Pheidole parva* is one of the commonest ant in Hong Kong and its Critical Thermal Maximum ( $CT_{max}$ ) (i.e. the upper limit of temperature with unorganized locomotion) is a bit lower than  $45^{\circ}\text{C}$  only. Ants are small in size, compared to air temperature, ground surface temperature (GST) has larger effects on them. When the GST is near or higher than the  $CT_{max}$ , the ants will lose muscle control and die eventually.

Teachers could lead students to investigate the effects of GST on ant activities on sunny days. You can make a  $0.4\text{ m}$  tall shade setup with a shade net ( $1\text{ m} \times 1\text{ m}$ ) and PVC pipes. After putting it in the study site for at least half an hour, place the bait station at the centre of its shade. Meanwhile, set up another bait station on the same ground substrate at a distance of  $\geq 2\text{ m}$  away from the shade setup. Record and collect the ants at bait stations after  $\geq 1\text{ hour}$ . Measure the mean GST near each bait station with an infrared thermometer and compare the data with ant abundance.

If there are trees with dense canopy, you can replace the shade setup with tree shades. Under the same circumstances, the temperatures on different ground substrate (eg. grassland, mud, concrete, bricks, tiles) are different that the differences could be over  $15^{\circ}\text{C}$ . Thus, you can also put bait stations on different ground substrates at the same time for another type of experiment.



## 螞蟻的覓食偏好 Food Preferences of Ants

除了用香腸外，你也可使用以下食物來測試螞蟻的覓食偏好：

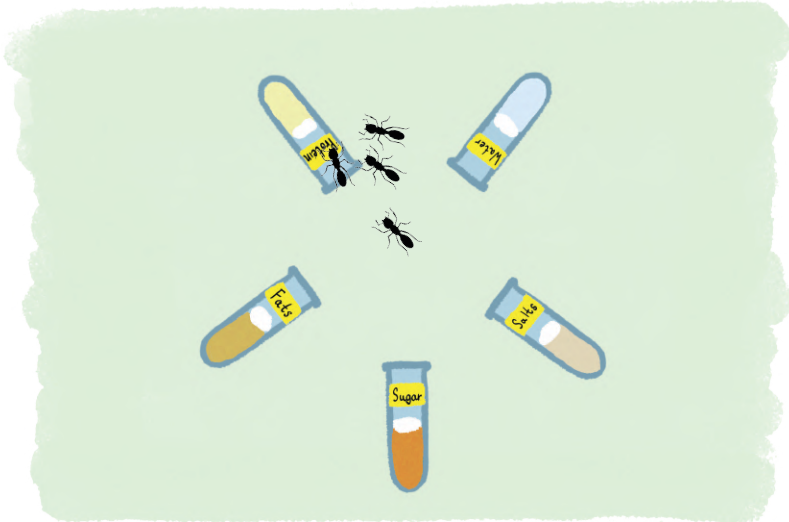
- 蛋白質：蛋白水（容量 1:1）
- 脂肪：花生油
- 糖分：20% 糖水
- 鹽：1% 鹽水
- 水：蒸餾水

液體誘餌可使用試管盛載，加至半滿後加入棉花球（以免誘餌流走），並把試管圍圈排列，試管之間最好相距幾厘米，試管開口向內。觀察和記錄哪種營養成分最受螞蟻歡迎，或不同螞蟻種的選擇會否相同。

Except for sausages, you can use the food below to test the food preferences of ants:

- Protein: Egg white mixed with water in 1:1 ratio in volume
- Fats: Peanut oil
- Sugar: Sugary water (20% by mass)
- Salts: Salty water (1% by mass)
- Water: Distilled water

Test tubes could be the containers of the fluid baits. Halfly fill the test tubes with baits and add cotton balls inside to prevent leakage. Arrange the test tubes in a circle and keep several centimeters among test tubes. The opening of test tubes should direct inwards. Observe and record which nutrient is the most popular among ants or whether different ant species would have the same food choices.

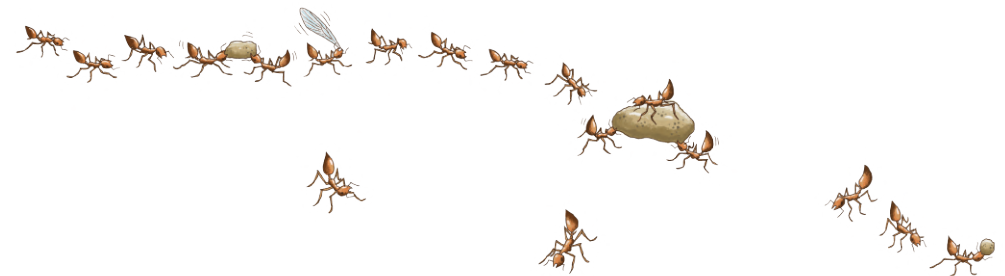


注意事項：

- 螞蟻的最遠覓食距離通常只有數米，因此建議把誘餌站放在附近有植物或泥土的地方。
- 如時間許可，實驗過程中可鼓勵同學每隔 5/10/15 分鐘查看、拍照並記錄誘餌站的變化，包括螞蟻的豐度和多度。由此亦可了解到不同螞蟻種的徵募行為，以及觀察到不同生物之間的互動。
- 螞蟻物種的辨認比較困難，可選擇只辨認至屬或形態種（即根據外觀不同而區分的種）。
- 建議活動後把螞蟻放生回採集地附近，以減少對螞蟻群的影響。

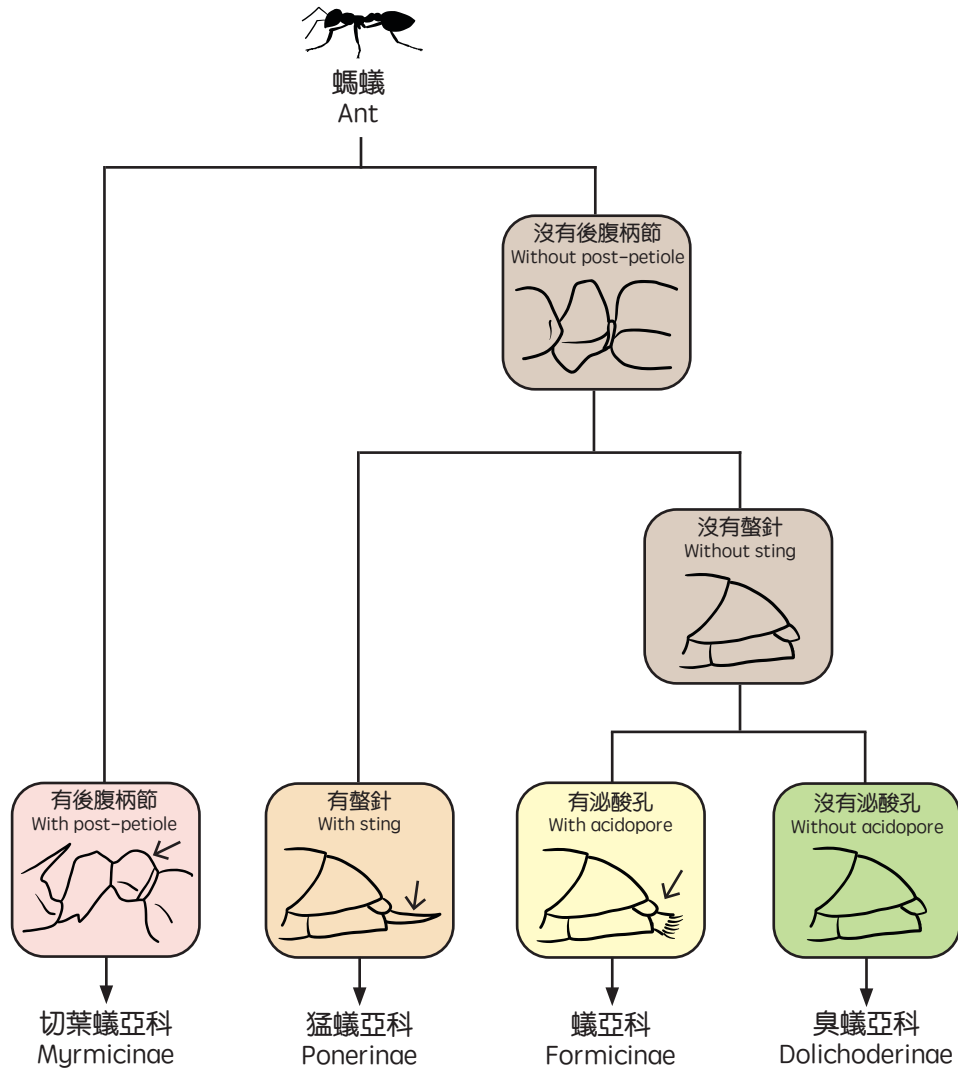
Remarks:

- The furthest foraging distance of ants usually is several meters only, so you'd better put bait stations near places with plants or soil.
- If time is allowed, you can encourage students to check, take photos and record the changes of the bait stations (including abundance and diversity of ants) every 5/10/15 minutes during the experiments. Therefore they can learn the recruitment behaviours of different ants and observe the interactions among organisms.
- It's hard to identify ant species. You can identify to genus level or just morphospecies (ie. a taxonomic species based wholly on morphology).
- You are advised to release the ants back to the collection points after the activities to reduce the effects on ant colonies.





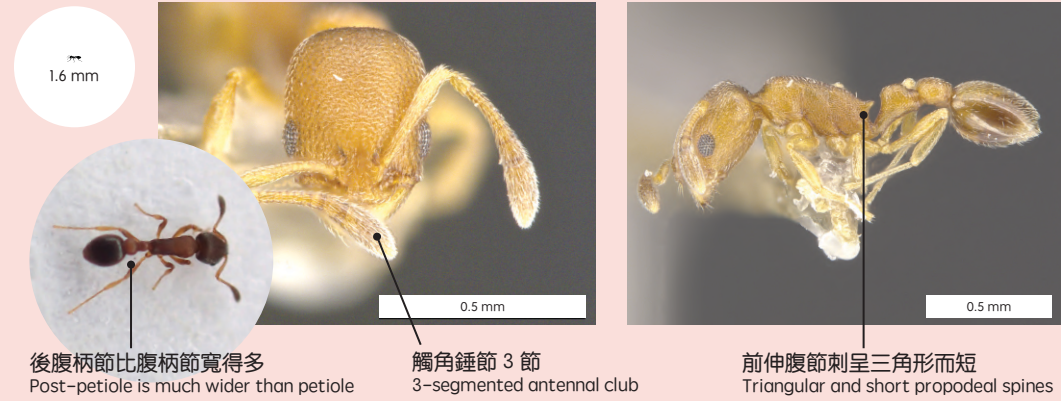
二叉式檢索表  
Dichotomous Key



(只適用於這份圖鑑，並不包括所有亞科)  
(Only applicable to this field guide that not all subfamilies are represented here)

切葉蟻亞科 Myrmicinae

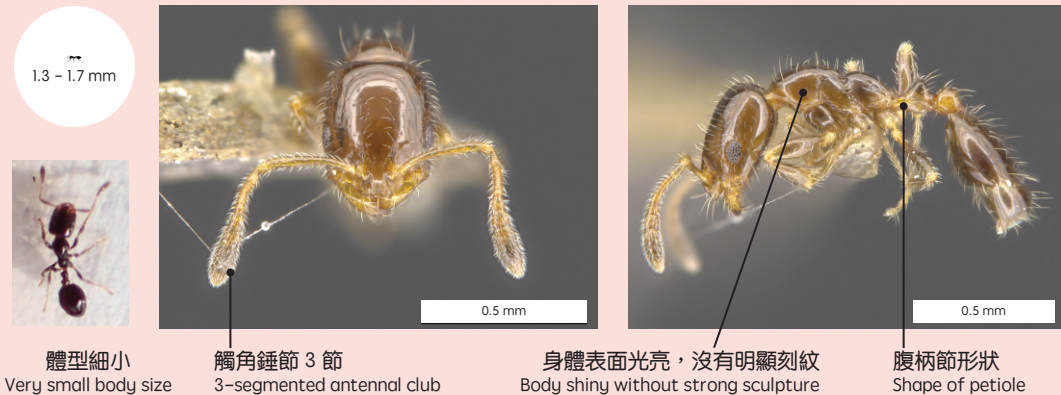
心結蟻屬 (*Cardiocondyla*) | eg. 小心結蟻 Lesser Sneaking Ant (*Cardiocondyla minutior*)



盾胸切葉蟻屬 (*Meranoplus*) | eg. 二色盾胸切葉蟻 Bicolored Shield Ant (*Meranoplus bicolor*)



小家蟻屬 (*Monomorium*) | eg. 中華小家蟻 *Monomorium chinense*



大頭蟻屬 (*Pheidole*) | eg. 矮大頭蟻 Big-headed Ant (*Pheidole parva*)



雙態型 (2 個亞階級)  
Dimorphic (2 subcastes)

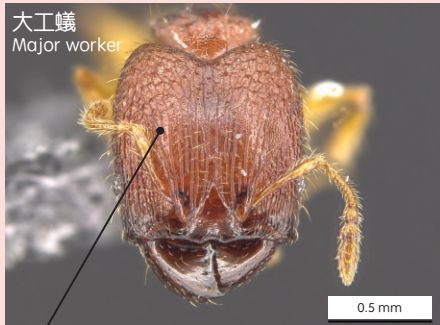


小工蟻  
Minor worker

觸角錘節 3 節  
3-segmented antennal club



水滴形大眼  
Large eyes in droplet shape



大工蟻  
Major worker

頭部巨大 (大工蟻特別明顯)  
Large heads (obvious in major workers)



呈圓弧形  
Dome-like  
前伸腹節刺  
Propodeal spines

火蟻屬 (*Solenopsis*) | eg. 入侵紅火蟻 Red Imported Fire Ant (*Solenopsis invicta*)



多態型 (>6 個亞階級)  
Highly polymorphic (> 6 subcastes)



觸角錘節 2 節  
2-segmented antennal club



身體表面光亮，中軀 / 前伸腹節有刻紋  
Body shiny and with sculいたure limited to the mesosoma/propodeum area

鋪道蟻屬 (*Tetramorium*) | eg. 雙隆骨鋪道蟻 Guinea Ant (*Tetramorium bicarinatum*)



中軀背部有大量中型直立毛  
Numerous medium-sized erect hairs on mesosoma dorsum



觸角錘節 3 節  
3-segmented antennal club  
大眼  
Large eyes  
方形頭有網狀刻紋  
Square head with grid-like sculいたure



前伸腹節刺  
Propodeal spines  
方形  
Square-shaped

## 猛蟻亞科 Ponerinae

### 雙刺猛蟻屬 Queenless Ant (*Diacamma*)



體型非常大  
Very large size

腹柄節有 2 條後傾的刺  
2 spines inclined backwards  
visible on petiole

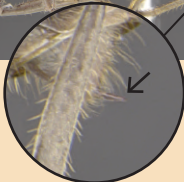
螺旋刻紋  
Spiral sculpture



大眼  
Large eyes

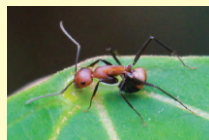
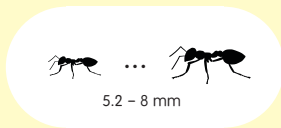


螫針可見  
Sting present and visible



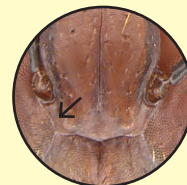
## 蟻亞科 Formicinae

### 弓背蟻屬 (*Camponotus*) | eg. 尼科巴弓背蟻 Carpenter Ant (*Camponotus nicobarensis*)



多態型 (3 個亞階級)  
Polymorphic (3 subcastes)

呈弓形  
Arched



觸角窩與唇基後緣不相接  
Antennal insertion not touching  
the posterior clypeal margin



## 臭蟻亞科 Dolichoderinae

### 酸臭蟻屬 Ghost Ant (*Tapinoma*)



體型細小  
Small size

腹柄節扁平或已退化  
Petiole flattened or reduced

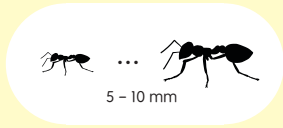
沒有直立毛  
No erect hairs



大眼  
Large eyes



編織蟻屬 (*Oecophylla*) | eg. 黃猄蟻 Weaver Ant (*Oecophylla smaragdina*)



多態型  
Polymorphic

中胸背板狹窄  
Narrow mesonotum  
腹柄節幼長  
Slender petiole



長觸角柄節  
Long antennal scape  
頭呈三角形  
Triangular head



大眼  
Large eyes  
瘦長的腳  
Long and skinny legs

立毛蟻屬 (*Paratrechina*) | eg. 長角立毛蟻 Longhorn Crazy Ant (*Paratrechina longicornis*)



披滿白色、直立的長剛毛 (前伸腹節除外)  
Full of long whitish erect setae (except on propodeum)

腹柄節扁平  
Flattened petiole



卵形頭  
Head ovaloid  
長觸角柄節  
Long antennal scape



大眼  
Large eyes  
長腳  
Long legs

小蟻 · 大世界  
香港蟻入門

From Ants to the Nature World  
An Introduction to Ants in Hong Kong

作者 Author

明愛陳震夏郊野學園  
Caritas Chan Chun Ha Field Studies Centre  
| 葉婉明老師 Ms. Louisa Yip

顧問 Consultants

香港大學香港生物多樣性博物館  
Hong Kong Biodiversity Museum, The University of Hong Kong  
香港大學昆蟲生物多樣性與生物地理學實驗室  
Insect Biodiversity & Biogeography Laboratory, The University of Hong Kong  
| Dr. Benoit Guénard, Mr. Matthew Hamer & Mr. Wilfred Tang

相片提供 Photographers

明愛陳震夏郊野學園  
Caritas Chan Chun Ha Field Studies Centre  
| 葉婉明老師 Ms. Louisa Yip

香港大學香港生物多樣性博物館  
Hong Kong Biodiversity Museum, The University of Hong Kong  
| Ms. Aline Oliveira

設計 Designer

鳴鴉自然教室 Project CROW

出版 Publisher



2022 年 12 月初版 First print in December 2022

© 明愛陳震夏郊野學園 版權所有 不得翻印  
All rights reserved. Copyright © Caritas Chan Chun Ha Field Studies Centre

此刊物由漁農自然護理署資助。  
在此刊物上 / 項目活動內表達的任何意見、研究成果、結論或建議，並不一定反映香港特別行政區政府的觀點。  
Subvented by the Agriculture, Fisheries and Conservation Department  
Any opinions, findings, conclusions or recommendations expressed in this material / event do not necessarily reflect the views of the Government of the Hong Kong Special Administrative Region.



● **大嶼山瘤顎蟻 Lantau Miniature Trap-jaw Ant (*Strumigenys lantau*)**

2019 年命名的香港特有種，會利用特化的大顎來捕獵  
New endemic species described in 2019, hunting with specialized mandibles



● **平截平頭蟻 Gate-keeper Ant (*Colobopsis nipponica*)**

兵蟻的頭部可用來堵塞木頭內的蟻巢口  
Heads of soldiers could plug nest entrances in wood



● **台灣雙節行軍蟻 Army Ant (*Aenictus formosensis*)**

流浪階段會組成軍隊掃食沿途的生物（包括螞蟻）  
Form armies to hunt animals (including ants) along the way during nomadic phase



● **山大齒猛蟻 Trap-jaw Ant (*Odontomachus monticola*)**

地球上攻擊速度第二快的動物  
With the second fastest attack speed on Earth



● **獵鎌猛蟻 Asian Jumping Ant (*Harpegnathos venator*)**

捕獵時會突然跳起，用鎌刀狀的大顎夾住獵物  
Jump suddenly and grab prey with sickle mandibles when hunting



● **金樹蟻 / 紫荊花細腰家蟻 Golden Tree Ant (*Paratopula bauhinia*)**

2016 年在香港發現的夜行性樹棲蟻  
Nocturnal arboreal species found in Hong Kong in 2016



● **紅足穴猛蟻 Foamy Ant (*Pseudoneoponera rufipes*)**

會分泌泡沫作防禦工具  
Produce foam as a defensive strategy



● **比羅舉腹蟻 Acrobat Ant (*Crematogaster biro*)**

受驚擾時會舉起柄後腹，螫針指向前方自衛  
Raise gasters and point stings forward as defence if disturbed

0 5 10 15 20 (mm)

比例尺  
Scale bar

