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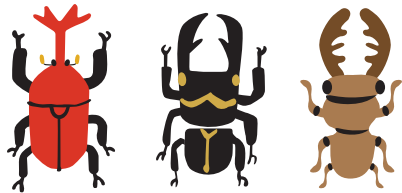
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蟲 新發現 我的節肢動物同學



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Bugs rediscovery — my arthropods schoolmates



活動資助 漁農自然護理署  
SUBVENTED BY  
AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT

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



# 節肢動物是甚麼？ What is arthropod?

現代節肢類動物包括  
昆蟲、甲殼類（如蝦蟹）、蜘蛛及蜈蚣。

Modern arthropods include  
insects, crustaceans (such as shrimps and crabs),  
spiders and centipedes.



多足類  
Myriapods



三葉蟲  
Trilobites  
(EXTINCTED)



螯肢亞門  
Chelicerates



甲殼動物  
Crustaceans



昆蟲  
Insects

共同祖先  
Common Ancestor

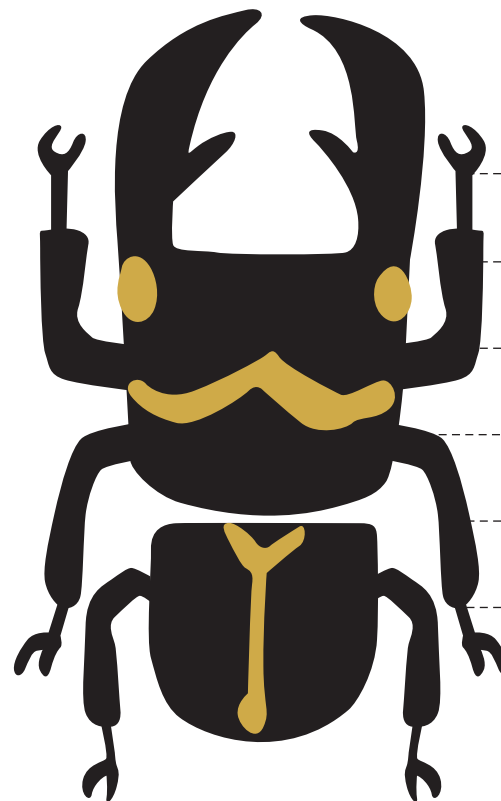
這進化樹反映新近數據，但牠們當中的關係仍在爭論中  
This tree reflects recent data, but the relationships Among major  
groups of arthropods are still being debated

資料來源 source: [https://evolution.berkeley.edu/evolibrary/article/0\\_0\\_0/](https://evolution.berkeley.edu/evolibrary/article/0_0_0/)

# 如何分辨節肢動物？ How to distinguish arthropods?

大部分節肢動物均具以下五項特徵

Most arthropods display  
all five of these characteristics



- 1 兩側對稱  
Bilateral (left/right) symmetry
- 2 身體分節  
Segmented body
- 3 堅硬的外骨骼  
Hard exoskeleton
- 4 足部有關節  
Jointed legs
- 5 有很多附肢  
Many pairs of limbs

## 序言

你有認識過一直在身邊的同學嗎？Have you ever get to know your schoolmates?

你有認識過一直在身邊的同學嗎？意思是，你身邊為數甚多，一直在旁走來走去，飛來飛去，跳來跳去的……節肢動物們。平常大家都以一個「蟲」字稱呼牠們。但你知道嗎，世界上已被發現的物種中，節肢動物佔了一百萬種，而科學家估計地球上尚有六百萬種節肢動物未被發現！How well do you know your schoolmates? There are plenty of them, always walking, flying, hopping around—they are the arthropods. We usually call them bugs. Did you know, arthropods make up 1 million of the discovered species on earth. Scientists have estimated that around 6 million of them are yet to be discovered!





走廊  
In corridor

窗台  
Windowsill

花朵上  
On flowers

溫暖  
有陽光表面  
On warm and  
sunny surfaces


花盆底  
Under the pot

樹叢中  
In bushest

枯木及枯葉  
Logs and leaf litter

泥土  
Soil

## 節肢動物同學們會在哪？ Where are the arthropods schoolmates?

 翻動重物時要注意安全  
WATCH OUT WHEN LIFTING HEAVY  
OBJECTS LIKE POTS OR LOGS

代表大機會找到節肢動物的地方，天氣和暖時你可能比較容易看到牠們，天氣陰冷時可能需要加把勁。Places where arthropods are more likely to appear. When it is warm and sunny you have a higher chance to find them, when it is shady and cool, you may need to work a bit harder.



# 人類歷史上節肢動物從不缺席

## ARTHROPODS NEVER ABSENT FROM HUMAN HISTORY

### 過去 PAST

人類史上最早大型跨國貿易的推手

The operator of the most ancient international trade

數千年前人類已嘗試養蠶 (Bombyx mori)，吃桑葉的牠到結蛹時就會吐出珍貴的原料！  
People tried to keep silkworm thousands years ago. They glub down mulberry leaves and split the precious raw materials!

### 現在 PRESENT

你知道你在吃蟲嗎？

DO YOU KNOW YOU ARE EATING BUGS?

如果你在雪糕、乳酪、蟹柳、唇膏等……

包裝上見到 E120，中獎！胭脂蟲是一種吃仙人掌的介殼蟲，雌性以及若蟲為了防禦而製造胭脂紅酸，可提煉成安全的紅色色素。If you find the food addictive E120 on your ice-cream, yogurt, crab stick or lipsticks.....Bingo! Cochineal is a cactus eating scale insect, their female and nymph secrete carminic acid to deter predator. The red acid can make a safe colorant.

沒有蜜蜂，我們都餓死

WITHOUT BEES, WE WILL ALL STARVE.

蜜蜂為人類三分一的糧食傳粉，然而全球的蜜蜂都受到蜂群衰竭失調的威脅，即是族群內大量工蜂消失！科學家近年鎖定頭號疑犯為類尼古丁殺蟲劑，是一款全球廣泛使用的殺蟲藥。Honey bees pollinate 1/3 of the food we eat, but the bee around the world are threatened by colony collapse disorder, which means the majority of worker bees in a colony disappear! Scientists recently years proposed the top suspect, Neonicotinoid insecticide, which is used worldwide.

### 將來 FUTURE

救世者！糧食危機、廢物處理、超級物料都靠節肢動物了！SAVIOR! FOOD CRISIS, WASTE TREATMENT, SUPER MATERIALS, ALL RELY ON ARTHROPODS!

聯合國提倡昆蟲是優質蛋白質來源，而且如果人類只吃蟲不吃肉：可減少18%溫室氣體排放可恢復全球30%正在飼養牲畜的土地 大部份國家的糧食價格可下調33%。UN promote insects as an excellent source of protein, if human shift their diet to insect instead of meat: 18% of greenhouse gases emission will be cut down. 30% of earth's land occupied by livestock could be retrieved 33% of reduction of food price in most countries.

香港人每日丟棄48公噸發泡膠餐具。發泡膠自然分解需要一萬年，而史丹福大學的研究員發現，麵包蟲可以吃掉發泡膠並成功分解成二氧化碳！Everyday 48 tons of styrofoam are disposed IN HK, and it takes 10000 years for decoposition. Researcgers from Stanford discovered that mealworms can eat styrofoam and able to decompose it to CO2.

蜘蛛絲可以用作製作紡織品，助聽器，人造皮膚或防彈衣

Spider silk can be make textile, hearing aid, artificial skin or bullet approval armor.

# 認識同學們可先由 視察環境開始

## Start knowing your arthropod schoolmates by observing the environment



日期  
Date



天氣  
Weather



氣溫  
Temperature



相對濕度  
Relative humidity

### 小生境

Microhabitats

生境中的一分部分，提供其特有的資源

Part of a habitat that provide a particular resource

泥土  
Soil



枯葉  
Leaf litter



草叢  
In long grass



花上  
On flowers



枯枝  
Fallen dead  
branches or logs



花槽中  
Planted  
flower bed



盆栽或石底  
Under plant  
pots or rocks



其他  
Others





# 同學之間要好好相處—— 節肢動物同學和睦共處指南 Getting along with arthropods —— do's and don'ts

## 節肢動物安全守則 Safe fieldwork for arthropods



愛護你的同學，對牠們溫柔——即使有堅硬的外骨骼，牠們都很脆弱。多用眼睛觀察，有需要才拿起牠們，永遠記得你從那裡找到就放回那裡。如果把牠們放在容器中觀察，記得不要在陽光下直曬牠們，要盡快放回。  
Show your schoolmates some love and handle them gently —— even with exoskeleton, they are delicate. Always observe. Pick them up only when necessary and remember to put them back to where you found them. If you put them in a container to study it, be sure not to put them under direct sunlight and release them quickly.



遠離蜂類或蟻類同學們的巢，被打擾的他們可能會較具攻擊性。  
Stay away from the hives or nests of bees, wasps and ants. They may become aggressive when they are disturbed.



蛾寶寶、蜈蚣、某些蟻、蜘蛛等同學也不好惹，眼看手勿動。  
Don't mess with moth caterpillars, centipedes, some ants and spiders.

## 你的安全守則 Safe fieldwork for you



永遠與朋友一同進行考察。大家都要清楚緊急事故發生時的處理方法，有需要時需找人協助。  
Always work with  $\geq 3$  friends. Make sure all of you know what to do during emergency and call for help if necessary.



注意有刺或刺激性的植物，及尖利的物品。  
Look out for thorns or spines or irritating plants and also sharp objects.



切勿嘗試移動太大的石頭或木頭，翻動後緊記回復原狀。  
Don't try to turn over heavy rocks or logs. Put them back the way you found them.



考察完畢要徹底洗手  
Wash your hands thoroughly afterwards.

### 裳鳳蝶 *Troides helena spilotia*

受「野生動物保護條例」保護的昆蟲，如果你見到是很幸運的事，細細觀察，請勿捕捉！Common Birdwing is protected under the Wild Animals Protection Ordinance, it is very lucky of you to greet them, observe, don't catch!



# 來點名！Roll Call！ 常見節肢動物分類記錄表 Common terrestrial arthropod record sheet

腳的數目 Number of legs	種類 Type	數量 Number	小生境 Microhabitat
0	蝸牛 Snails*		
0	蛞蝓 Slugs*		
0	渦蟲 Land planarians*		
0	蚯蚓 Earthworms*		
6	石蛎目 Microcoryphia		
6	纓翅目 Thysanoptera		
6	蜻蜓目 Odonata		
6	蜚蠊目 Blattodea		
6	螳螂目 Mantodea		
6	蠍目 Phasmatodea		
6	直翅目 Orthoptera		
6	革翅目 Dermaptera		
6	鞘翅目 Coleoptera		
6	半翅目 Hemiptera		
6	雙翅目 Diptera		
6	膜翅目 Hymenoptera		
6	鱗翅目 Lepidoptera		
6	等翅目 Isoptera		
8	蜘蛛目 Araneae		
8	蜱蟎目 Acarina		
8	盲蛛目 Opiliones		
>8	土蠶 Woodlouse*		
>8	蜈蚣 centipede*		
>8	馬陸 millipede*		
Hard to tell	幼蟲 Insect larvae		
Hard to tell	其他 OTHERS		

\*非學名 not scientific name

\*記錄表粉紅色的都是非節肢類，然而常常與節肢動物一同出現。Those pink on the record sheet are NON ARTHROPODS. Yet they often accompany with arthropods.

(要明白生物間去演化關係，單就外型結構並不足夠，同時需要分子遺傳學上的證據。比如說你可能覺得螞蟻和白蟻是近親？然而螞蟻和蜂才是同一個目 (Order)，而白蟻與蜚蠊 (就是甲由) 才是近親！To understand the evolutionary relationship, its not simply by the morphology, but with evidence from molecular genetic data. For example you may think ants and termites are closely related? However ants are in the same order with bees! Yet, termites are closely related to cockroach! Surprise?!)

蝸牛和蛞蝓都是軟體動物  
Both snails and slugs are molluscs

## 非節肢動物 Non-arthropods



### 蝸牛 Snails

- ◆ 軟而黏的身體，有硬的碳酸鈣殼  
Soft slimy body with hard calcium carbonate shell



### 蛞蝓 Slugs

- ◆ 軟而黏的身體，沒有殼  
Soft slimy body without shell



### 蚯蚓 Earthworms

- ◆ 長而幼的環節狀身體  
Long thin body divided into segments



### 陸生渦蟲 Land planarian

- ◆ 長而扁平的身體，通常有扇形的頭部。外表軟綿綿卻是一名殺手，很多無脊椎動物都在牠菜單上，牠會分泌消化液把獵物進行體外消化。  
Long flatten body, very often with a fan-shaped head. They look soft but they are actually predator. Many invertebrates are on its menu, they will secrete digestive enzyme to digest its prey externally.



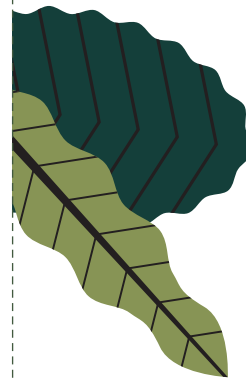
## 石蛎目 Microcoryphia



- ◆ 三條鬚，中間較長  
tip of abdomen with 1 long medial filament and 2 shorter lateral cerci
- ◆ 多生活在野外的落葉堆或石縫中，以腐植質為食  
Mostly found in the wild, living in litter or crevices, feeding on plant debris
- ◆ 善跳躍  
Excellent Jumper



石蛎目 Microcoryphia



## 縷翅目 Thysanoptera

- ◆ 蕪馬小而長，約1mm左右，黑色，經常在捲起的葉片中中發現  
Thrips, thin and long, black in colour, very often live in rolled leaves.
- ◆ 若蟲與成蟲住在一起  
Nymphs and adults live together.

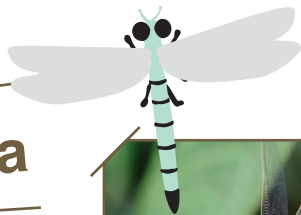


縷翅目 Thysanopter



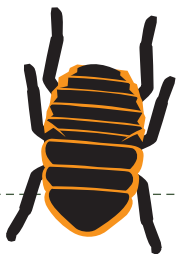
## 蜻蜓目 Odonata

- ◆ 從小吃肉吃到大，小時住水中，長大就會飛  
Carnivorous since little, born in water, fly when grow up
- ◆ 蜻蜓，停棲時翅膀平展  
Dragonfly, wings flat lay when they stop
- ◆ 豆娘停棲時很多種類都疊上翅膀  
Damselfly, wings closed when they stop (for many species)



## 蜚蠊目 Blattodea

- ◆ 除了大家都很熟悉的家居蟑螂，其實香港也有較可愛的品種，如金邊土蠊  
Apart from the most familiar domestic species, there are some more cute ones (comparatively...), such as oriental cockroach



## 螳螂目 Mantodea

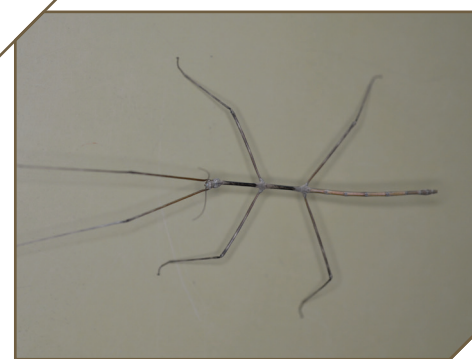
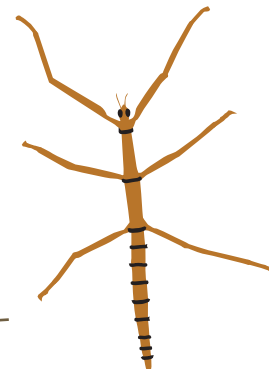
- ◆ 前肢發達有力呈鐮刀狀  
Strong sickle shaped front legs
- ◆ 英文名praying mantis，明顯地描述牠折合前肢並舉起的捕獵姿態  
The name, praying mantis, obviously describing how their front legs are bended and hold when they are actually preying!



## 蝽目 Phasmatodea

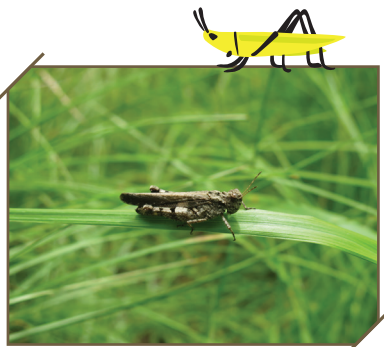
蝽讀音同「收」

- ◆ 你只會看不牠，很難不認得牠，蟲如其名就似竹節或樹枝  
Unless you can't see him, you can hardly misidentify it, it looks exactly like its name: stick bug
- ◆ 對牠們的擬態及保護色充滿信心，動作很緩慢……  
They are so confident in their mimicry and camouflage that they move very slowly...



## 直翅目 Orthoptera

- 蚱蜢、蟋蟀、蝗蟲、螞斯  
GRASSHOPPERS, CRICKETS, Locusts, katydid
- 後腿特別發達善於跳躍  
Hindlegs enlarged for jumping



## 革翅目 Dermaptera

- 串珠狀的觸角，尾鬚成巨大鉗狀，所以有名為剪刀蟲  
bead-like antennae, and are easily recognized by the pair of large pincers (cerci) at the tip of the abdomen
- 少數具有育幼行為的昆蟲  
One of the very few insects which take care of their young



## 鞘翅目 Coleoptera

- 已知的物種中甲蟲數目最為豐富，約佔所有物種的22%  
Beetles count for 22% of all the described species, is the most abundant species on earth
- 前翅硬化（所以叫鞘翅）覆蓋後翅  
Hard forewing cases call elytra
- 吃草的吃蟲（泛指無脊椎動物）的吃真菌的吃落葉的吃木的吃糞的……都有  
plant-eating, flesh (of other invertebrates) eating, fungi-eating, litter eating, wood-eating, dung-eating... all sorts of diet



## 半翅目 Hemiptera

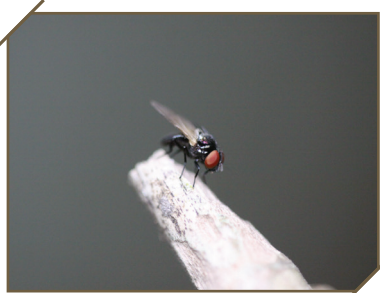
- 與甲蟲不同的是半翅目只有前翅的前端革質化，後面仍是膜質  
Wing cases different from beetles, only front part of their forewing are hardened, the back part is still membrane like
- 刺吸式的口器，方便吸吮汁液，草食的吸植物汁，肉食的進行體外消化把獵物『溶解』成『肉汁』  
With tube-like proboscis to feed on liquid, herbivore feed on plant sap while carnivore digest their prey externally and feed on their "melt tissue"





## 雙翅目 Diptera

- 蚊、蠅、虻都屬此類  
Mosquitoes, flies, horseflies are in this group
- 雙翅目的昆蟲只有一對翅膀。  
其後翅演化成平衡棒  
use only a single pair of wings to fly,  
the hindwings evolved to halteres

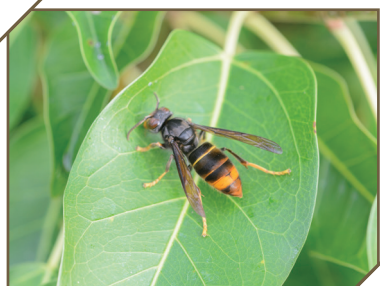


雙翅目 Diptera



## 膜翅目 Hymenoptera

- 包括蜂和螞蟻  
Include bees, wasps and ants
- 如有翅膀，都很薄和透明  
if they have wings, they are very thin and see-through
- 通常都有很幼的腰  
normally have a narrow waist
- 很多成員都高度社會化，如很多蜂和蟻，但也有獨居的蜂，和寄生蜂  
Many members are highly socialized like many bees, wasps and ants, but here are also solitary wasps and parasitoids



膜翅目 Hymenoptera



## 等翅目 Isoptera

- 白蟻有串珠狀的觸角，眼睛退化  
Termites have bead-like antennae and reduced eyes. They can digest lignin because they have symbiotic microbes
- 工蟻：數量最多  
Workers: most abundant
- 兵蟻：顎部發達  
Soldiers: with strong jaws



等翅目 Isoptera

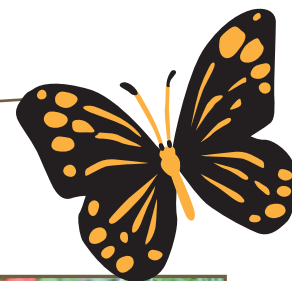


## 鱗翅目 Lepidoptera

- 翅膀上的鱗粉令牠們帶有不同的顏色和花紋  
with scales to cover their wings to give them different colour and pattern
- 蝴蝶：觸角前端突起（有點像火柴頭的形狀）  
Butterfly: have lumps on the end of their antennae
- 蛾：觸角有不同的形狀（例如尖型或羽毛狀）  
Moths: different shapes of antennae (pointed or feathery)



鱗翅目 Lepidoptera



## 蜘蛛目，盲蛛目，蜱蟎目 Araneae, Opiliones, Acarina

- 蜘蛛：身體分成兩部份，頭胸部及腹部，一般有8隻單眼，有些6隻或更少

Araneae (spiders): Body divided to 2 parts, the cephalothorax and abdomen; normally with 8 eyes, some have 6, and some fewer

- 盲蛛：只有一節身體，兩隻單眼或無眼，長幼腿

Opiliones: One body part only, two eyes or without eyes, long thin legs

- 蜱蟎：頭胸部及腹部看上去像一體，非常小，最大的也只有1cm左右，通稱需以顯微鏡觀察

Acarina: cephalothorax and abdomen looks fused, maximum size is like~1cm, mostly microscopic



## 蜈蚣，馬陸 Centipede, Millipede

- 蜈蚣：每節一對腳

Centipede: 1 pair of legs on each segment

- 蚰蜒：15對又長又幼的腳

House centipede: 15 pairs of long thin legs

- 馬陸：每節兩對腳，有些品種會捲成一個球

Millipede: 2 pairs of legs on each segment, some species can roll to a ball

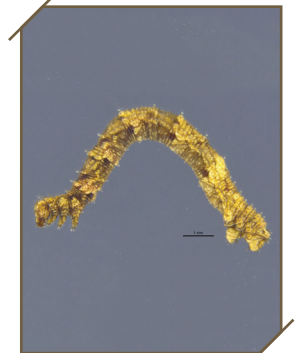


## 土蠶 Woodlouse

- 身體分很多節  
Body is divided to many segment
- 七對腳  
7 pairs of legs
- 有些品種會捲成一個球  
Some species roll themselves to a ball
- 枯葉中很常見  
Commonly found in leaf litter
- 很多人說牠長得像瀨尿蝦而沒錯  
牠們都是甲殼類  
Some said that they look like mantis shrimp and yes they are both crustacean



## 幼蟲 Larvae



- 與成蟲完全不一樣，牠們長中會結蛹，經過徹底的改變以成體破蛹而出。  
Look very different from adult. They turn to pupa and undergo a complete change and hatch as adult.