救蛹

Pupa Rescue

兜蟲和鍬形蟲偶爾會化蛹失敗或是羽化失敗，造成輕則畸形，重則死亡的情形。其實悲劇是可以避免的。此章將探討如何給予遇到困難的前蛹和蛹協助，讓牠們能夠順利化蛹和羽化。

兜蟲和鍬形蟲的前蛹期和蛹期該怎麼照顧最妥當呢？針對這一點飼育界分成兩派。第一派的飼育家認為從造好蛹室的那一天開始，一直到羽化後數日都不要去干擾牠。也因此，第一派的飼育家不會將蛹室挖開觀察。反之，第二派的飼育家會在幼蟲失去活動能力後把蛹室挖開。我是屬於第二派的。

挖開或是不挖開都有優缺點。如果不將蛹室挖開，飼育者什麼都不用做，非常輕鬆。但缺點是萬一化蛹或是羽化時出了狀況，之前的努力可能都白費了。反之，如果之前有將蛹室挖開觀察，飼育者可以及時伸手援救。但將蛹室挖開也並不是沒有風險。挖開的過程要相當謹慎。如果不小心將蛹室挖壞了還要幫幼蟲做一個人工蛹室。

化蛹時最怕的就是前蛹無法順利脫皮。有兩種情形會導致化蛹時脫皮失敗。一是脫皮時舊頭殼沒有順利裂開(在正常的情況下，幼蟲脫皮時，舊頭殼會分裂成三瓣，讓蛹順利從舊表皮脫出)。二是幼蟲身體表面長有大黑斑。這些黑斑點直徑約3-4 mm，且摸起來感覺

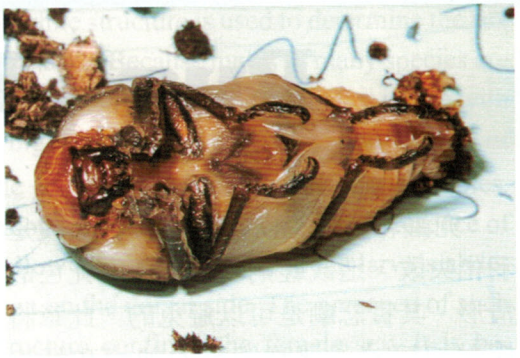
Rhinoceros and stag beetles occasionally fail to pupate or eclose properly, leading to situations such as deformity or death. However, disaster is avoidable. This chapter will discuss how to give assistance to pre-pupae and pupae in trouble.

What is the best way to care for a pre-pupa or pupa? The beetle breeding community has different opinions. Some believe the pre-pupa should be left alone until it becomes an adult and comes to the surface on its own. Others believe it's better to open the pupal cell after the pre-pupa becomes immobile and monitor the development of the pre-pupa.

If a pupal cell had not been dug open, and something goes wrong during pupation or eclosion, all previous efforts may be wasted. On the other hand, if a pupal cell had been dug open, and something goes wrong during pupation or elcosion, the hobbyist can intervene immediately. However, digging open a cell is not without risks. If the cell is overly damaged, the hobbyist would need to make an artificial pupal cell.

One of the conditions that cause pupation failure is the head capsule failing to split during pupation. Under normal circumstances, the head capsule splits in third, allowing the pupa to exit the old skin. Another condition is the presence of one or more

↗在正常的情況下，化蛹時幼蟲的舊頭殼會分成三瓣。日本大鍬。2000
Under normal circumstances, the larval head capsule splits into three to allow the pupa to escape the larval skin during pupation. ***Dorcus curvidens binodulosus***



↗ 化蛹時舊頭殼沒有分裂的巴布亞 (印尼) 金鍬雄蛹。這種情形發生時有些仍可羽化成大顎萎縮的個體。但在兜蟲中，死亡率幾乎是100%。2000
The larval head capsule of this ***Lamprima adolphinae*** failed to split during pupation. Although some stag beetle pupae with a larval head capsule attached can still eclose as adults with atrophied mandibles, rhinoceros beetle pupae with a larval head capsule attached always die.

↘第七氣孔處長有巨型黑斑的長戟大兜蟲前蛹。2001
D. h. trinidadensis pre-pupa with a huge black spot surrounding the seventh spiracle.

像是硬塑膠。在有大黑斑之處，幼蟲往往無法製造新表皮，導致化蛹時無法脫離舊表皮。以上的兩種情形發生時該怎麼辦呢？開刀；而且能開刀的時間相當有限，錯過了便什麼都無法挽回。

large black spots on the larva's body. They are usually 3-4 mm in diameter and have the touch of hard plastic. Where these spots occur, the pre-pupa is unable to generate new skin. As a result, the pupa is stuck to the old skin. The solution to the above two situations is surgery. But timing is extremely important.

製作好蛹室數日後，幼蟲腹部會漸漸縮小、變皺。腹部縮小是因為幼蟲慢慢地把體內所有的食物及糞便排除。此時幼蟲看起來稍微透明，但離化蛹還有一段時間。再經過一段時間後（依種類而定，小型種類數日，大型種類數十日），透過表皮可看見正在慢慢形成的蛹的背部花紋。此時離化蛹時間只有幾小時或幾天，依種類而定。當幼蟲很接近化蛹時，可清楚地透過舊表皮看見蛹的種種紋路。一旦開始化蛹，新蛹的腹部會很有規律地在舊表皮內收縮。經過一翻收縮後，在舊表皮內的新蛹會往舊表皮的頭部邁進。靠近仔細觀察將發現新蛹的氣孔慢慢地脫離舊的氣孔。新氣孔和舊氣孔之間還會有白色的氣管表皮。就是在這個時候要特別地注意。如果發現背部的裂痕裂至頭部時，頭殼沒有在5分鐘內開始分裂，就一定要用小攝子或牙籤很小心地將頭殼從分裂處繼續分開。只要頭殼一分裂，新蛹便可以很輕易地從舊表皮中脫出。如果是黑斑處卡

A few days after a larva has finished constructing its pupal cell, its abdomen begins to deflate and becomes wrinkled. The reason is that all the food and excrement are passed out. At this time, the larva looks somewhat transparent. After some more time (a few days for small species, a few weeks for large species), various marks on the developing pupa can be seen through the old skin. When a pre-pupa is very close to pupation, you can see every wrinkle of the pupa through the old skin. Once pupation begins, the pupa inside the old skin rhythmically contracts its abdomen to force itself towards the head region. At this time, new spiracles on the pupa can be seen moving away from the spiracles on the old skin, and between each old and new spiracle, tracheal skin can be seen. It is at this moment that the hobbyist has to pay close attention. As the pupa progresses towards the head of the old skin, the old skin on the dorsal side is forced to rupture. The rupture slowly extends to the head capsule, normally forcing it to split into three. If the head capsule does

↗此長戟大兜蟲的前蛹在第四、六、七氣孔處長有巨型黑斑，所幸化蛹時並無卡住。2001

The larval skin of this emerging ***D. hercules*** pupa has a large black patch near the fourth, sixth, and seventh spiracle. Luckily, they did not cause any trouble during pupation.

↗雖然成功地化了蛹，但第六、七氣孔處仍然長有黑疤。2001

Although the black patches on the larval skin did not cause trouble during pupation, two of them still carried over to the sixth and seventh spiracle of the pupa as large scabs.

住，則需要用到很鋒利的尖形小剪刀。第一是先確認新蛹的確有被黑斑處卡住於舊表皮內。如果新蛹腹部一直收縮但其氣孔卻無法越來越遠離舊氣孔，表示黑斑處有卡住的現象。發現卡住時必需在5分鐘內完成手術。最重要的是要膽大心細。手術時將剪刀伸入舊表皮，然後圍著黑斑剪一圈。如此一來新蛹與舊表皮便不再有連繫，可輕鬆脫皮完成化蛹。手術時可小心地將前蛹從蛹室中取出，之後再立即放回。

但是為什麼一定要在開始化蛹後的幾分鐘內開刀呢？這是因為只要化蛹時刻一到，幼蟲便一定要在特定的時間內脫出舊表皮，別無選擇。只要這個特定的時間一過，就算是新蛹還沒有脫出舊表皮，牠仍然會開始硬化。也就是說，如果沒有在開始化蛹後的幾分鐘內將卡在舊表皮內的新蛹救出來，之後再救出來的新蛹也已經完全硬化，將永遠是嚴重畸形的蛹。因此，如果有心要救蛹，別忘了時機是一切！

如果一隻辛苦養了整整3年的超大型亞克提恩大兜蟲，就只是因為一塊黑斑或是舊頭殼卡住而3年來的心血全部白費，心裡會有什麼感受呢？也因此，我都會把我特別喜歡的個體的蛹室挖開，親眼看著牠們化蛹，以防萬一。當然了，絕大部分的我們都要上課或是上班，不可能24小時盯著前蛹或是蛹看，但是多一分注意就少一分遺憾。

所以第一個需要將蛹室挖開觀察的原因是為了防止前蛹脫皮失敗。第二個原因是為了防止前蛹或蛹被活埋。雖然

not split within five minutes of the rupture reaching it, the hobbyist has to use a pair of toothpicks or forceps to split it. Once the head splits, the pupa can come out of the old sin. If it is a large black patch causing trouble, a pair of pointed and sharp scissors is needed. First make sure the pupa is indeed stuck to the old skin at the patched area. If a pupa contracts continuously but its spiracles do not move away from the old ones, it's most likely stuck. Surgery has to be done within five minutes. Cut around the large black patch on the old skin. Once the cut is made, the pupa is free and a successful molt follows. The pupa may be taken out of the pupal cell for surgery but put it back as soon as the surgery is done.

Why must surgery be done within five minutes of the beginning of pupation? The reason is the pupa begins to harden just minutes after the beginning of pupation, even if the pupa is still in the old skin. In other words, if you get a trapped pupa out of the old skin after it's hardened, it's permanently deformed. If a stuck pupa is to be saved, timing is everything.

How would you feel if an extra-major ***M. actaeon*** that you have had for the past three years dies simply because its head capsule failed to split? As a result, for those individuals that I especially like, I open their pupal cell to monitor their development. Of course, most of us have to go to school or work. It would be impossible to keep an eye on them twenty four seven. But I do what I can.

發生的機率不大，但有時候因為種種因素，蛹室突然倒塌，導致化蛹或是羽化失敗。

挖開蛹室之前最好是能夠將飼養容器朝蛹室的側面傾90度，如此挖開時才不會讓腐植物的屑屑落入蛹室中。如果不小心讓一些屑屑掉落進去，可將前蛹小心取出，將內部清乾淨後再放回。挖開蛹室時最多只能挖到露出前蛹的前半段。若挖到整隻前蛹都露出來，表示幾乎一半的蛹室都被挖掉了，蛹將無法利用腹部周圍的牆壁翻身。除非在適當時刻有人為的幫助，否則自己無法翻身的蛹一定會羽化成畸形個體。如果在挖開蛹室的過程中不小心將整個蛹室給挖壞了，唯一的選擇就是替前蛹或蛹造人工蛹室。

製造人工蛹室最好的材料是聚集力強的泥土。這一類的泥土好定型，不易

↗人工蛹室。製作時長度、弧度都越像原來的越好。
Artificial pupal cell. When making one, make it as identical to the original one as possible.

↗因為蛹室坍塌而化蛹失敗的蛹。2007
Pupation failure due to collapsed cell.

The first reason for opening a cell is to make sure molting goes smoothly. The second reason is to prevent a pre-pupa or pupa from being buried by a collapsed cell. Although the chance of it happening is slim, pupal cells occasionally collapse and cause the pre-pupa or pupa to become deformed.

It's best to tilt the rearing container 90 degrees to the side of the pupal cell before opening it. This prevents substrate from falling into the pupal cell. If some do get in, remove the pre-pupa and clean the inside. When digging open a cell, expose no more than the upper half of the pre-pupa or pupa. If the entire pupa is exposed, it may not be able to turn over by rubbing its abdomen against the surrounding walls. A pupa that cannot turn over will become a deformed adult. If the pupal cell is accidentally destroyed during the digging process, the only option is to build an artificial one for the pre-pupa or pupa.

破碎，很適合裝會扭的前蛹或蛹。(兜蟲和鍬蟲的蛹室有一點不同。兜蟲的蛹室通常傾斜至少20度，獨角仙和姬兜蟲的蛹室更是幾乎垂直的；鍬形蟲的則幾乎是水平的。以上的不同是因為兜蟲蛹的構造適合尾部來承擔地吸引力的壓力；鍬形蟲蛹的構造適合背部承擔地吸引力的壓力。傾斜20度的蛹室能夠讓兜蟲蛹斜躺，將壓力分散於尾部。反之，水平的蛹室能夠將壓力集中於背部，防止裸露在尾部的生殖器遭折損。因此，製作人工蛹室時兩者的斜度必需注意。) 先是準備一個裝有泥土的容器。接著在泥土內用手指頭壓出一個大小、形狀都與幼蟲原來蛹室差不多的半橢圓形。在這裡一定要強調，人工蛹室的底部一定要有弧度。如果是平的，大型種類一定會變成畸形的蛹。由於前蛹很怕乾燥，因此不管是使用人工蛹室還是原蛹室，都必需在開口輕輕蓋上一張戳有數個小洞的保鮮膜。如果介質看起來有些乾燥，則在蛹室周圍淋少許的水。由於人工蛹室的弧度和原本的蛹室多少會有一些誤差，因此有些蛹在羽化時無法自己翻身、讓頭部朝下。躺著羽化的大型兜鍬蛹必定羽化失敗。飼育者最好能夠在羽化的前一天先將蛹調整到趴著的體位。羽化的前一天，蛹的表皮會明顯凹陷，並且蛹會變得很柔軟，此時是翻身的好時機。由於人工蛹室是開放式的，為了防止剛羽化的個體亂跑翻倒，導致翅鞘壓損，可在蛹室開口壓一小片厚紙板。

大約在2000年的時候有人發現了花店的插花海綿可以用來製作人工蛹室。

The best material to make an artificial pupal cell is clay-like soil. Such soil is easy to mold and resistant to the pre-pupa or pupa's wiggling movements. (Rhinoceros and stag beetle pupal cells differ in one respect. Those of rhinoceros beetles are inclined at least 20 degrees, with ***A. dichotoma*** and ***X. gideon***'s being almost vertical, whereas those of stag beetles are horizontal. This is because rhinoceros beetle pupae are designed to have their abdomen absorb the gravitational pressure while stag beetle pupae are designed to have their back absorb the pressure. Inclined pupal cells allow the pupa to rest slanted, placing pressure on the abdomen. Horizontal pupal cells exert pressure on the back of the pupa, preventing the exposed sexual organ from being damaged. Inclination must be taken into account when making an artificial pupal cell.) Prepare a container filled with soil. Use thumb to make a cell whose shape, size, and inclination are as similar to the original cell as possible. The artificial cell must be arched. If it's flat, large species will become deformed pupae. Because pre-pupae are prone to dehydration, the opening should be covered with a kitchen wrap poked with small holes. Because artificial cells differ somewhat from the original in shape and size, the pupa may not be able to turn over during eclosion, resulting in eclosion failure. It's best to position a pupa on its underside one day before eclosion. A day before eclosion, the pupal skin deflates and the pupa becomes very soft. Since an artificial pupal cell is topless, it is best to cover the opening with a piece of cardboard and small weight to prevent the new adult from climbing out and hurting itself.

這可能是兜鍬飼育史上最重大的發現之一。這種材料容易取得、便宜、好雕塑、效果絕佳。現在可以說是無人不用。只要用尺或是刀子先將插花海綿切割成適合的大小，再用湯匙挖出蛹室的形狀，人工蛹室就大功告成了。吸水吸到飽和後就可以放入前蛹或是蛹了。插花海綿蛹室可以整個用戳有小洞的保鮮膜包起來，或是放入飼育箱內，然後蓋上戳有數個小洞的蓋子。容器的蓋子最好能夠貼住人工蛹室的開口，如此便不怕新成蟲羽化後爬出蛹室摔跤。蓋子上的透氣孔儘量不要戳得太大，否則濕氣的蒸發速度會過快。若人工蛹室過於乾燥應適量補充水分。

Somebody discovered in 2000 that artificial sponges used by floral shops make great artificial pupal cells. Today, they are widely used by beetle breeders around the world. Cut a block with a ruler or knife into appropriate size and dig out a cell with a spoon. Saturate it with water and the prepupa can be placed in it. The artificial pupal cell can be wrapped in kitchen wrap poked with holes, or placed in a rearing container with lid. It's best to have the lid close to the opening of the pupal cell to prevent the new adult from climbing out. Avoid making too many holes on the lid or water evaporates too quickly. Add water to the block should it appear dry.

↗把插花海綿切割成適合的大小。2003
Cut sponge into appropriate size.

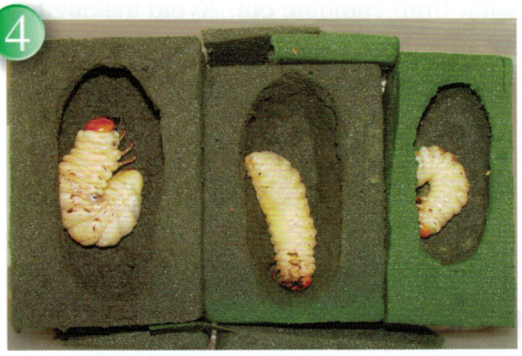
2

↗用湯匙挖出人工蛹室。2003
Dig out cell with spoon.

3

↗完成的人工蛹室。2003
Finished cell.

4



↗放入幼蟲。2003
Put in larvae.

A

↗由於人工蛹室是開放式的，新成蟲很容易爬出受傷。2007
Because artificial cells are topless, new adults are prone to climbing out and getting hurt.

B

↗把人工蛹室放入飼養箱內。
Put cell in rearing container.

C

↗蓋上蓋子。
Cover with lid.