



長戟大兜蟲各亞種典型雌蟲
Typical Female *Dynastes hercules* of Various Subspecies

註：雌蟲外觀變異大，非典型個體普遍存在。
 Note: illustrated are typical females. However, variations exist within each subspecies.

利奇氏長戟大兜蟲雌蟲
Dynastes hercules lichi

● 特徵 Characteristics :
 小楯片通常只有上半部出現刻點。色帶通常黃色到橘褐色。腹部末端體毛通常偏黃。
 usually only upper region of scutellum covered with indentations. Rear elytral color usually yellow to orange brown. Terminal abdominal hair usually yellow.



✓↓ 利奇氏長戟大兜蟲。厄瓜多爾多種源。幼蟲頭幅15.9 mm。幼蟲最高體重78 g。幼蟲期16個月。72 mm。2007
Dynastes hercules lichi. Ecuador origin. Larval head capsule 15.9 mm. Maximum larval weight 78 g. Larval duration 16 months. 72 mm. 2007

赫克力士原名亞種長戟大兜蟲雌蟲
Dynastes hercules hercules

● 特徵 Characteristics :
 小楯片通常只有上半部出現刻點。色帶通常綠色到墨綠色，但也有灰白色。
 usually only upper region of scutellum covered with indentations. Rear elytral color usually green to olive green, occasionally white grey.



✓↓ 赫克力士長戟大兜蟲。幼蟲頭幅15.0 mm。幼蟲最高體重68 g。幼蟲期12個月。68 mm。2007
Dynastes hercules hercules. Larval head capsule 15.0 mm. Maximum larval weight 68 g. Larval duration 12 months. 68 mm. 2007



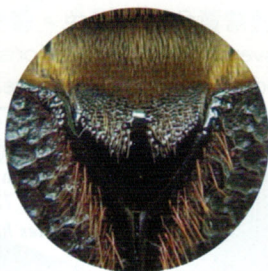
瑞德氏長戟大兜蟲雌蟲

Dynastes hercules reidi

● 特徵 Characteristics :

小盾片刻點通常延伸到下半部。色帶通常黃綠色到暗黃色。

indentations usually extend to lower half of scutellum. Rear elytral color usually yellow green to dim yellow.



✓↓ 瑞德氏型瑞德氏長戟大兜蟲。47 mm。2008。標本李柏濤提供

Dynastes hercules reidi, reidi type. 47 mm. 2008. Dried specimen provided by Lee Buo-hao



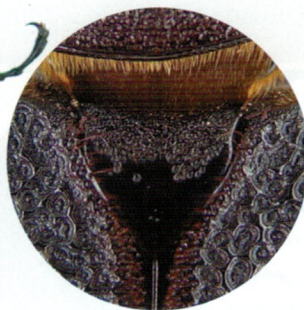
厄瓜多長戟大兜蟲雌蟲

Dynastes hercules ecuatorianus

● 特徵 Characteristics :

小盾片刻點通常延伸到下半部。色帶通常黃綠色到暗黃色。

indentations usually extend to lower half of scutellum. Rear elytral color usually yellow green to dim yellow.



✓↓ 厄瓜多長戟大兜蟲。厄瓜多種源。幼蟲頭幅15.8 mm。幼蟲最高體重77 g。幼蟲期13個月。69 mm。2007

Dynastes hercules ecuatorianus. Ecuador origin. Larval head capsule 15.8 mm. Maximum larval weight 77 g. Larval duration 13 months. 69 mm. 2007





北方長戟大兜蟲雌蟲
Dynastes hercules septentrionalis

● 特徵 Characteristics :

小盾片刻點通常延伸到下半部。色帶通常暗黃色到橘褐色。
indentations usually extend to lower half of scutellum. Rear elytral color usually dim yellow to orange brown.



✓ ↓ 北方長戟大兜蟲。宏都拉斯種源。66 mm。2008。活體蟲磨坊提供
Dynastes hercules septentrionalis. Honduras origin. 66 mm. 2008. Live specimen provided by Insect Mall

西方長戟大兜蟲雌蟲
Dynastes hercules occidentalis

● 特徵 Characteristics :

小盾片刻點通常延伸到下半部。色帶通常黃色到橘褐色。腹部末端體毛通常偏橘紅。
indentations usually extend to lower half of scutellum. Rear elytral color usually yellow to orange brown. Terminal abdominal hair usually reddish orange.



✓ ↓ 西方長戟大兜蟲。厄瓜多種源。野生蟲。76 mm。2002
Dynastes hercules occidentalis. Ecuador origin. Wild specimen。76 mm。2002



帕斯可長戟大兜蟲雌蟲 *Dynastes hercules paschoali*

● 特徵 Characteristics :

小盾片刻點通常延伸到下半部。色帶通常暗黃色到橘褐色。

indentations usually extend to lower half of scutellum. Rear elytral color usually dim yellow to orange brown.



✓ ↓ 帕斯可長戟大兜蟲。巴西。野生蟲。副模式標本。71 mm。海拔150 m。1989六月。帕斯可·格羅希博士攝

Dynastes hercules paschoali. Brazil. Wild specimen. Paratype. 71 mm. Elevation 150 m. June, 1989. Photo by Dr. Paschoal Grossi



千里達長戟大兜蟲雌蟲 *Dynastes hercules trinidadensis*

● 特徵 Characteristics :

約半數個體小盾片刻點出現於上半部、半數個體刻點延伸至下半部。色帶通常黃色到墨綠色。

about half of individuals with scutellum indentations on upper region, half with indentations extended to lower region. Rear elytral color usually yellow to olive green.



✓ ↓ 千里達長戟大兜蟲。千里達島。野生蟲。67 mm。1978

Dynastes hercules trinidadensis. Trinidad island. Wild specimen. 67 mm. 1978





布魯森氏長戟大兜蟲雌蟲

Dynastes hercules bleuzeni

● 特徵 Characteristics :

約半數個體小盾片刻點出現於上半部、半數個體刻點延伸至下半部。色帶通常黃色到墨綠色。

about half of individuals with scutellum indentations on upper region, half with indentations extended to lower region. Rear elytral color usually yellow to olive green.



↙ 布魯森氏長戟大兜蟲。委內瑞拉。野生蟲。65 mm。海拔1400 m。2006九月。帕斯可·格羅希博士攝

Dynastes hercules bleuzeni. Venezuela, Edo. Bolivar, La Escalera. Wild specimen. 65 mm. Elevation 1400 m. September, 2006. Photo by Dr. Paschoal Grossi



森島氏長戟大兜蟲雌蟲

Dynastes hercules morishimai

● 特徵 Characteristics :

小盾片刻點通常延伸到下半部。色帶通常黃色。

indentations usually extend to lower half of scutellum. Rear elytral color usually yellow



↙ 森島氏長戟大兜蟲。玻利維亞種源。幼蟲頭幅15.2 mm。幼蟲最高體重64 g。幼蟲期10個月。61 mm。2007

Dynastes hercules morishimai. Bolivia origin. Larval head capsule 15.2 mm. Maximum larval weight 64 g. Larval duration 10 months. 61 mm. 2007



除了瑞德氏亞種和杜克斯拉斯亞種以外，所有的亞種都有機會長到150 mm的驚人體長，而利奇氏亞種更可以突破170 mm，但是絕大部分的長戟大兜蟲個體都不超過140 mm，一般野外所採集個體大約都在120 mm左右。超過140 mm的個體就算是大型個體了。150 mm以上的長戟大兜蟲就是連原名亞種都不多見。至於160 mm以上的個體，一個人一生中應該見不到幾隻。超過170 mm的巨物我也只在照片中見過1隻，為利奇氏亞種。那180 mm的個體呢？曾聽過許多180 mm長戟大兜蟲的傳聞，但我沒見過任何證據。至於200 mm者，大家似乎都同意這世上並不存在。如果哪一天真的有190 mm的長戟大兜蟲問世，或許便會有人相信長戟大兜蟲可以突破200 mm。長戟大兜蟲的量法是從胸角的末端量到翅鞘的末端（不是腹部末端，因為腹部會收縮）。

飼養長戟大兜蟲時，務必落實一個容器只有一隻雄蟲，使用的容器也一定要有充足的空間。原因有三。一是此種的雄蟲有強烈的地域性。二是許多個體相當神經質。只要有任何的風吹草動，便會馬上摩擦腹部和翅鞘，擦發出嘶嘶的警告聲，並且忽左忽右地晃動。此時任何東西靠進，包括雌蟲，都會被鬥得七暈八素的。三是長戟大兜蟲特殊的犄角構造。由於長戟大兜蟲的犄角長度以及弧度都夠，因此很容易便可以將另一隻個體牢牢地卡住於胸角與頭角之間。接著只要再用有角突的頭角狠狠地往上

Other than *D. h. reidi* and *D. h. tuxtlaensis*, all subspecies can grow over 150 mm, with *D. h. lichyi* capable of exceeding 170 mm. However, most wild-caught specimens do not exceed 120 mm. Individuals over 140 mm are considered major specimens. Specimens over 150 mm are rare, even in *D. h. hercules*. Even the most serious hobbyist is not likely to see more than a few specimens in the 160-mm range. I have only seen a picture of a specimen over 170 mm and it was a *D. h. lichyi*. People talk about individuals over 180 mm, but there has been no evidence of its existence. People generally agree that 200-mm individuals do not exist. The length of a rhinoceros beetle is measured from the tip of the thoracic horn to the end of the elytra (not the abdomen, because it contracts).

When keeping *D. hercules*, make sure there is only one male per container. The container should be spacious too. There are three reasons. One, males are extremely territorial. Two, they are easily provoked. When spooked, they hiss by rubbing their abdomen against elytra and attack anything that approaches, including a female. Three, males have specialized horns capable of holding and puncturing their rivals. I have seen females dismembered by males. In addition to a spacious container, where to situate the container is equally important. Males tend to behave when the air inside its tank is calm. However, when a gust of wind suddenly enters the tank, the male becomes agitated. If a female happens to be by his



一頂，不幸的受害者身上馬上就會被打出洞來。我曾親眼見過兩隻被雄蟲犄角分屍的雌蟲。以上的組合讓長角型的長戟大兜蟲成為極具破壞力的戰士。除了飼育環境要夠大以外，飼育箱的擺放地點也很重要。根據經驗，只要飼育箱內空氣流動不強烈，雄蟲便會很安穩。但如果讓一陣風吹入飼育容器，原本平靜的雄蟲就很有可能變得神經兮兮的。此時若剛好有雌蟲在旁邊則很有可能被喪失理智的雄蟲攻擊。因此飼育箱切記要擺置於通風，但沒有強風的陰暗處。除此之外，掀開飼育箱的蓋子時也務必要緩慢小心。若開得太快，導至一股氣流湧入飼育箱，或是震動到飼育箱，都很有可能讓神經質的雄蟲發瘋。總之，盡一切可能不要驚嚇到長戟大兜蟲的雄蟲。讓長戟大兜蟲交配最好的方法是讓雄蟲在又寬闊又安靜的飼育箱內自己尋找雌蟲。雖然飼育者可以把雌蟲直接放在溫馴的種類的雄蟲面前，但千萬不要直接把雌蟲放在長戟大兜蟲雄蟲的面前。有時雄蟲不但不青睞還會攻擊雌蟲呢！

要讓野生個體產卵並不困難。不只長戟大兜蟲，大部分的兜蟲產卵時，對腐植物並不會很挑剔。但是這一點都不代表幼蟲對於腐植物也不挑剔。白兜蟲和長戟大兜蟲都是這一類的例子。剛開始時並不曉得長戟大兜蟲和美西白兜蟲的幼蟲對腐植物相當挑剔。看著雌蟲在園藝店隨便買的帶有沙子顆粒的土壤中大量產卵時，心想原來美西白兜蟲如此地好飼育。一直到幼蟲孵化後才知道，

side, she may get attacked. Therefore, it is important to keep the tank in an area with only gentle currents of air. Be especially careful when lifting the lid of the container. If it's done too fast, the gust of air may spook the male. The safest way for mating to occur is allowing the male to find the female himself in a spacious container. Never place a female directly in front of a male. If the male is spooked, he could hurt the female.



被雄蟲攔腰斬的雌蟲。利奇氏亞種。2007
Female decapitated by male. *Dynastes hercules lichyi*

It's not difficult to get wild females to oviposit. Most rhinoceros beetle females aren't very picky about the substrate. However, this does not mean their larvae won't be picky about the substrate. Both *D. hercules* and *D. granti* are good examples. When I first saw *D. granti* ovipositing in poor quality sandy potting soil from a garden shop, I thought this species would be a breeze to culture. It wasn't until hatching that I realized the larvae would not eat the potting soil. A friend in Europe experienced the same situation with his *D. hercules*. This doesn't make sense. In the wild, females know in



雖然雌蟲肯在此土壤中產卵，但其幼蟲卻根本就不吃它。長戟大兜蟲也是如此。有一位住歐洲的朋友也是發現，雌蟲雖然肯在劣質介質中大量產卵，可是幼蟲孵化後並不肯進食。仔細想想，以上的情形實在沒有道理。在野外，雌蟲都知道應該在那一種腐植物中產卵。既然雌蟲願意在園藝店所購買的土壤中產卵，為什麼幼蟲會不肯進食呢？我的猜想是，只要雌蟲接近生命終期便會不選擇地產卵。記得歐洲那位朋友的雌蟲，前兩個月一粒卵都不肯產。而我當時養的白兜蟲也是到快十一月份了才大量產卵。

1998年剛開始飼養長戟大兜蟲的幼蟲時真的是困難重重。最起先是從朋友送的三齡幼蟲開始飼養。剛收到時6隻幼蟲都才剛脫皮不久，最重的一隻也只有20公克。一開始我心想，長戟大兜蟲跟獨角仙均屬兜蟲，因此幼蟲的養法應該與獨角仙相同。於是我便餵這6隻幼蟲自然朽木屑；之後這些幼蟲也都有進食與增重。但是1個月以後，我突然發現有幾隻幼蟲開始變輕。很快地，其他幼蟲也都開始變瘦。大約3個星期後，原本曾經重到48公克的幼蟲一隻一隻像消了氣的氣球一樣變得又扁又皺。此時再換任何的腐植物都已無濟於事。就這樣，第一次所養的6隻幼蟲全軍覆沒。

幾個月以後又有一個朋友讓出3隻二齡幼蟲，於是我再一次地挑戰飼養長戟大兜蟲幼蟲。這3隻幼蟲吃的當然不再是自然朽木屑，而是精心用麵粉發酵

what substrate to oviposit. If they are willing to oviposit in sandy potting soil, why won't their larvae eat it? This phenomenon seems to be related to the age of the female. His *D. hercules* didn't oviposit for the first two months and my *D. granti* didn't oviposit until November.



圖中的雄蟲每天都有果凍吃。羽化9個月後不但沒有斷腳，還能夠交配。

This male is fed beetle jelly every day. Nine months after eclosion, it hasn't lost any leg parts and can still mate. 2007

When I first attempted rearing *D. hercules* in 1998, I was faced with many obstacles. I started with six larvae that had just become third instar. The heaviest one was only 20 grams. At first I thought *D. hercules* could be treated just like *A. dichotoma*. I fed them natural decayed wood flakes. The larvae fed and gained weight. However, a month later, a few of them started to



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成的腐植土。由於這次所用的是能夠養出超大型美西白兜蟲的腐植物，心想一切應該是可以一帆風順了。剛開始時的確一切都很順利。可是萬萬沒想到突然間又有狀況了。這3隻幼蟲脫皮為三齡以後，成長速度一天比一天慢。到了24公克以後便再也長不上去。再一次的，長戟大兜蟲的幼蟲我又養失敗了。此時我已束手無策了，決定以後再也不養長戟大兜蟲的幼蟲了。真的是怎麼養怎麼死，讓我灰心不已。不只是我，當時住在歐洲的一個同好也是遇到幼蟲養不大便夭折的情形。難道長戟大兜蟲的幼蟲真的那麼難養？我們到底忽略了什麼呢？

但是以上的遭遇即將永遠改變。就在此時馬克馬尼格先生也開始飼養長戟大兜蟲的幼蟲。當時我打電話警告他，長戟大兜蟲的幼蟲每次都會莫名其妙變輕，然後死亡的情形。但是他卻只是若無其事的說一句「餵狗食」。狗食？開玩笑嗎？怎麼可能？飼育過多代獨角仙和其他兜蟲以後，我的結論是，只要是沒有腐朽過的東西幼蟲根本碰都不碰。記得以前經驗不足時曾餵過獨角仙幼蟲生木屑。結果當然是每一隻幼蟲都爬至



↗二齡中期的利奇氏亞種幼蟲。1998
Second instar *D. h. lichyi* larva.

lose weight. Soon, the rest started to lose weight. Three more weeks later, all of them had shrunk and died. Just like that, my first attempt failed miserably.

A few months later, I had another opportunity to work with three second instar *D. hercules*. This time I didn't feed them natural decayed wood flakes. I fed them flake soil produced via flour fermentation. This substrate had been proven to work for *D. granti* and should work for *D. hercules*. It did in the beginning. However, the larvae failed to gain weight after becoming third instar, with a top weight of only 24

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→正在吃食狗食的三齡原名亞種幼蟲。幼蟲頭部前方的白色絲條為長在狗食上的菌絲，其左側角落的一小塊米色物為咬下的狗食碎片。1999

Third instar *D. h. hercules* larva feeding on dog food. The whitish substances in front of the larva are fungi growing on the dog food. The small yellowish piece to the larva's left is a fragment of dog food.





表面拒絕進食。白兜蟲則更誇張，對牠們的幼蟲而言，低腐朽度的木屑都已經不行了，更不用提未腐朽的木屑。不要說狗食不是腐質物了，它就是連植物都不是。真的能用狗食來養長戟大兜蟲的幼蟲？

由於當時自己的長戟大兜蟲幼蟲已死光，而且也沒有飼養其他兜蟲的幼蟲，因此無法立刻試探狗食的可行性。不過腦筋轉了一下以後，想到一位當時有飼養獨角仙幼蟲的朋友。於是立刻打電話過去叫他餵一些乾燥的狗食顆粒給幼蟲吃吃看。當時我也不知道要餵多少或要埋多深，只是抱著相當懷疑的心態叫他餵餵看。接著不可思議的事情就這樣發生了。

但在說出到底發生了什麼事之前，我想先淺談一下兜蟲幼蟲的習性。基本上，幼蟲這種蛋白質含量高、行動又緩慢的生物有相當多的天敵，從地鼠到鳥類到野豬都包括在內。但是幼蟲並沒有任何的反抗能力。雖然有一對大顎，但是大型的掠食者根本不把它們放在眼裡。對於小型的天敵而言，例如寄生蜂和寄生菌，幼蟲的大顎也是完全無用武之地。在這種完全沒有自衛能力的情況下，幼蟲唯一的避敵方式就是躲藏。除非遇到淹水或是有什麼天災，否則幼蟲是絕對不會離開地底的。

究竟發生了什麼驚人的事呢？隔天朋友打電話過來叫我猜一猜那些獨角仙幼蟲對狗食的反應。我叫他不要賣關子

grams. My second attempt to rear *D. hercules* failed. At one point I thought about giving up. I was devastatingly disappointed. Another friend in Europe faced the same situation. Could *D. hercules* larvae really be this difficult? What did we miss?

But things were about to take a surprising turn. Not long after the death of my larvae, Mr. McMonigle started rearing *D. hercules* larvae as well. I called to warn him about the difficulty I had faced. But he simply told me over the phone without the slightest worry, "just give them some dog food." Dog food? Was he kidding? My conclusion at the time was rhinoceros beetle larvae would only accept decayed vegetation. I had once fed *A. dichotoma* larvae fresh sawdust and they all climbed to the surface refusing to feed. First of all, dog food has not been decayed. Secondly, it's not even vegetative matter. How could this stuff be fed to rhinoceros beetle larvae?

Because I wasn't at the time keeping any rhinoceros beetle larvae, I couldn't experiment with dog food. However, I thought of a friend who was at the time keeping *A. dichotoma* larvae. I called and asked him to feed his larvae some dog food. I didn't know how much to feed or where to place it. I was very suspicious of its usability. But then amazing things happened.

But before revealing what the surprises were, I would like to briefly talk about the behavior of rhinoceros beetle larvae. Because they are rich in protein and slow-moving, they have countless predators.



趕快直接告訴我。接著他叫我聽了後別被嚇到。他說：「我就只是把一些狗食撒在腐植物表面。但是第二天有好幾隻獨角仙幼蟲竟然就直接平躺在腐植物表面啃食那些狗食！」聽了之後真的是一時說不出話來。為什麼狗食這種完全出乎意料的非腐朽食物幼蟲不但肯吃，而且還停留在表面上慢慢啃食呢？之後多次的使用狗食後發現，沒有任何一種兜蟲、鍬形蟲、或是花金龜的幼蟲是不喜愛狗食的。有些種類的幼蟲，例如大王花金龜，如果沒有狗食或是蛋白質補充品是完全養不活的！

在得知狗食這個秘方以後，本來再也不想養長戟大兜蟲幼蟲的心又燃燒了起來。經過一陣等待後，終於又有機會和長戟大兜蟲的幼蟲見面。這一次是5隻剛孵化的一齡幼蟲。雖然一想到以前的狀況就相當害怕悲劇會再重演，不過這次有狗食的助陣所以感到安心不少。狗食果然不負期望。這幾隻只有火柴頭大小的小不點在狗食的助長下快速地成長。當時我把每一隻幼蟲各自養在底片盒裡頭。這麼做是因為小的空間能夠讓幼蟲在最短的時間內找到狗食。經過這幾年來的觀察，兜蟲的幼蟲都喜歡比較新鮮的狗食。放入飼養容器內的狗食一定都會在3天內開始發霉。起先霉菌都是白色的。此時幼蟲還願意啃食。但再經過幾天，當霉菌是灰色、土色、綠色、或是黑色時，幼蟲便不再有興趣。也就是說，如果狗食在發霉之前沒有被發現就等於白餵了。因此，狗食飼

However, larvae are powerless against them. Although they are equipped with a pair of mandibles, they are too small for large predators such as wild boars and too big for small predators such as parasitic wasps. Larvae's only option is hiding. Unless there is a flood, a larva will not leave the safety of underground. With that said, what were the surprises?

My friend called back the next day and asked me to guess how his *A. dichotoma* larvae responded to dog food. I didn't want to guess. I impatiently told him to tell me at once. He said he had only tossed some dog food into the rearing container and the next day some larvae were on the surface feeding on the dog food. I was shocked. Not only did the larvae accept dog food, they stayed on the surface eating it. It was later discovered that all rhinoceros, stag, and flower beetle larvae would accept dog food. Some species, such as the Goliath beetle, simply cannot be cultured without it or similar protein supplements.

Once again I was filled with desire to rear *D. hercules* larvae. A few more months later, I had another opportunity to work with five first instar larvae. The concern that tragedy would strike again was constantly there. But with dog food, I crossed my fingers and hoped for the best. And things worked out. These larvae grew quickly. In the beginning, I kept them in five separate film containers. I used such a small container because I wanted them to be able to find the dog food. After years of observation, it was concluded



養法的關鍵就在如何讓幼蟲在最短的時間內發現狗食。

我用狗食餵養長戟大兜蟲幼蟲的方法如下：先將1隻一齡幼蟲放入已用清水洗淨的透明底片盒(之所以用透明的因為方便觀察)。接著用麵粉發酵成的腐植土將底片盒稍微拖壓地填滿。最後在表面放一粒乾燥狗食，然後用戳過小洞的蓋子蓋起來。一切就緒後把底片盒橫放，因為兜蟲的幼蟲移動時喜歡左右移動，不像鍬形蟲的幼蟲喜歡上下移動。接著每星期清除一次糞便。清除方式為將幼蟲和腐植物倒到報紙上，然後把糞便和剩餘的狗食挑出丟棄。

that larvae like fresh dog food. Dog food becomes moldy within three days of being placed into the substrate. In the beginning, the mold is white. Larvae still accept dog food with white mold. However, when the mold becomes grey, brown, green, or black after a few days, larvae tend to lose interest. As a result, the key to dog food is how to let larvae find it in the shortest time.

For first instar larvae, this is what I do. Each larva is placed into a pre-washed film container. Flake soil produced via flour fermentation is packed with slight pressure into the container. A pellet of dog food is placed on the top. The lid with ventilation holes is put back. The container is kept horizontally as rhinoceros beetle larvae tend to move horizontally. The substrate is cleaned once a week. Fecal pellets and old dog food are discarded.



↗飼養長戟大兜蟲幼蟲的各種大小容器。右下角的容器內有一隻正在啃食狗食的幼蟲。1999
Containers of various sizes for rearing *D. hercules* larvae. The lower right container has a third instar *D. h. hercules* feeding on dog food.



當一齡幼蟲變成二齡時，底片盒當然就無法繼續容納牠。此時將幼蟲換到體積更大的塑膠容器內。由於1隻幼蟲的最高體重會是剛出生時的好幾百倍，因此從出生到老熟，1隻幼蟲需要4個不同尺寸的容器。一齡幼蟲養於底片盒中。二齡幼蟲養在大約5 cm長 × 5 cm寬 × 6 cm高的塑膠盒。三齡初期到中期養在大約10 cm長 × 7 cm寬 × 6 cm高的塑膠盒。雌性幼蟲三齡後期至羽化養在大約14 cm長 × 10 cm寬 × 7 cm高的塑膠容器內。由於大型雄蟲完全無法於14 × 10 × 7 cm的容器中化蛹，因此顏色變黃後便需要從以上的容器轉移至大約20 cm長 × 12 cm寬 × 10 cm高的容器。接著照常餵予狗食直到開始製造蛹室。

平常飼養幼蟲時，腐植物的深度應要有幼蟲厚度的5倍深。若腐植物的深度不足，幼蟲將會為了尋找更深的地方而不進食地四處亂鑽。以1隻4 cm厚的老熟長戟大兜蟲幼蟲而言，腐植物最好能夠有15 cm深。但是以上的塑膠盒子最多只能裝7 cm深的腐植物。這麼淺的深度幼蟲受得了嗎？答案是如果沒有加蓋，幼蟲鐵定會不停地亂鑽。但是只要於容器內裝滿腐植物並且加蓋，所產生的壓力將足夠讓幼蟲認為週遭環境的深度是相當足夠的。至於狗食的用量，二齡幼蟲一次餵2粒（1粒1公克）。三齡幼蟲一次則餵5粒。狗食的擺放位置為容器的底部；每星期一次將沒吃完的狗食及糞便清除。以上便是我讓長戟大

When a first instar larva becomes second instar, it needs to be moved to a bigger container. Since a mature larva is a few hundred times bigger than a hatchling, four different containers are needed to raise a hatchling to adulthood. A first instar larva is kept in a film container. A second instar larva is kept in a 5 by 5 by 6 cm container. A young third instar larva is kept in a 10 by 7 by 6 cm container. A full-grown female larva is kept in a 14 by 10 by 7 cm container until eclosion. Since a large male larva cannot pupate successfully in a 14 by 10 by 7 cm container, it is kept in a 20 by 12 by 10 cm container.



♀雌性幼蟲在14 × 10 × 7的容器中有足夠的空間化蛹。圖中雌蟲採容器短邊造蛹室，但一般都採用長邊。1999

Female larvae are able to pupate successfully in 14 × 10 × 7 containers. The female pictured uses the width of the container to construct her pupal cell. Most females use the length.

It was mentioned in chapter three that the depth of the substrate should be at least five times the thickness of the larva. Otherwise, the larva burrows endlessly in search of deeper substrate. A larva in this state will



兜蟲幼蟲在最短的時間內吃掉最多的狗食的方法。適合長戟大兜蟲幼蟲的溫度為22至24°C。高於28°C幼蟲完全無法養肥，最後羽化成小型個體。



▲除完糞便、剛被放回容器的三齡幼蟲。右下角可見新放的狗食。1999

The container has just been cleaned; the larva is placed back. At the lower right corner are newly placed dog food pellets.

自從餵予狗食以後，之前遇到的困難都煙消雲散了。馬克馬尼格先生的發現真的是不可思議。又有誰會想到，以肉類為主原料的狗食，竟然會是每一種幼蟲都喜愛的呢？馬克馬尼格的發現在日本也造成了轟動。有幾位日本朋友起先認為他們民族十幾年來所研發的養殖技術已是十全十美，但後來也不得不佩服狗食的威力。如今馬克馬尼格所發明的狗食飼養法已被網路大力傳開。他對我開玩笑地說，如果早知道反應會這麼地熱烈，當時應該把狗食當做秘密。

not gain weight and eventually die. For a full-grown larva of 4 cm thickness, the depth of the substrate should be at least 15 cm. But the above-mentioned containers can hold a maximum of only 7 cm. Isn't this too shallow? It is, if no lid is used. However, if a container is completely filled and pushed down slightly with a lid, the pressure created is sufficient to make the larva think that it's in deep substrate. As far as dog food goes, two pellets for second instar and five pellets for third instar (each pellet being 1 gram). The location is the bottom of the container. Fecal pellets and old dog food are discarded weekly. The best temperature range for *D. hercules* is 22-24°C. Larvae do not gain weight in temperature higher than 28°C.

After the addition of dog food, problems I encountered before never reoccurred. Mr. McMonigle's discovery was simply astounding. Who would have thought something made out of meat would be crucial to herbivorous beetle larvae? Mr. McMonigle's discovery also stirred up quite a storm in the Japanese beetle breeding community. They had come to believe their breeding techniques had already achieved perfection, but in the end had to agree that dog food deserves applause. Today, dog food is widely used in the international beetle community.



↑ 用狗食養得很肥胖的老熟原名亞種幼蟲。中間為美西白兜蟲，右為美東白兜蟲。1999

Full-grown *D. h. hercules* larva fed with dog food. To the middle is *D. granti* and to the right is *D. tityus*.

長戟大兜蟲的卵期在20至25°C之間大約是1個月。一齡幼蟲期22-25天。二齡幼蟲期約50天。三齡初期到最高體重所需的時間依幼蟲性別而異。由於只要給予充足的食物，雄性的長戟大兜蟲幼蟲老熟時，都一定比雌性重，因此雄性幼蟲需要比雌蟲更多的時間達到最高體重。我的雌蟲都在孵化後的6-7個月達到最高體重。而雄蟲則需8-9個月的時間。以上的記錄都是來自於吃狗食長大的幼蟲。我發現也只有我和馬克馬尼格的長戟大兜蟲幼蟲長得如此快速。雖然許多發表以及網路上的資料都顯示長戟大兜蟲從孵化至化蛹需要16個月的時間，而有些資料更指出有些個體需要36個月的時間，但我和馬克馬尼格的長戟大兜蟲全部都在12個月以內化蛹！有些幼蟲（兩性皆有）更是9個月大時便化蛹，令我們感到相當驕傲。而這一切當然都要歸功於狗食。

D. hercules eggs kept between 20-25°C hatch in about 30 days. L1 stage lasts 22-25 days. L2 stage lasts about 50 days. Early L3 to maximum weight depends on the sex of the larva. Since well-fed male larvae are always heavier than female larvae, males require more time than females do to achieve maximum weight. My females reach maximum weight about 7 months after hatching. Males take about 9 months. The above record comes from larvae supplemented with dog food. It seems only larvae supplemented with dog food achieve such growth rate. Data from breeders who don't supplement their larvae with dog food shows that larvae take 16 months from hatching to pupation. Some even take up to 36 months. My larvae pupate within 12 months of hatching. Some only take 9 months. It appears dog food expedites growth.



↗114公克的老熟利奇氏亞種幼蟲與0.2公克的一齡初期利奇氏亞種幼蟲。2000
114 g full-grown *D. h. lichi* larva. To the right is a 0.2 g first instar *D. h. lichi*. The full-grown larva is more than 500 times bigger!

長戟大兜蟲的雌性前蛹期大約是20天，雄性前蛹期大約是28天。若是想要將前蛹從蛹室內取出觀察化蛹過程，務必等到造好蛹室15天後。太早從蛹室取出的幼蟲會因為還沒失去活動能力而四處爬行，嚴重延後化蛹日期。我有一次太早將幼蟲從蛹室中取出，結果幼蟲不但慢了十幾天化蛹還瘦了近10公克。長戟大兜蟲的蛹期不一，越大型的個體蛹期越長。一般在20-25°C之間，雌蟲蛹期大約45天，大型雄蟲45-60天。若是溫度在15-18°C之間，蛹期將長達90天。羽化之後的新成蟲會在蛹室中蟄伏40天後才開始進食。一旦開始活動，成蟲可活至少8個月。雌蟲可產200粒以上的卵。新成蟲進食1個月後再配對。當個體的跗節開始脫落，或是腳爪失去活動能力時，就表示個體已經開始老化。但只要繼續餵食，通常都能夠再活幾個月。*Dynastes*屬的翅鞘有個奇特的現象，那就是環境溼度高時，翅鞘會變成深褐色。有些年紀大的個體，翅鞘也會因為身體出油而慢慢地變暗。



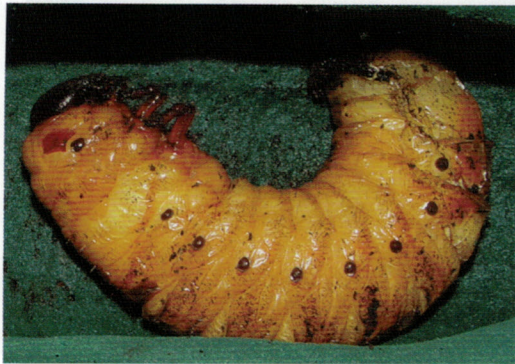
↗剛過蟄伏的成蟲先餵食1個月再配對。2007
Allow new adults to feed for a month before mating.

The pre-pupa period for females is about 20 days and 28 days for males. If a pre-pupa is to be taken out of the pupal cell to have the pupation process observed, wait at least 15 days after the construction of the pupal cell. If a larva is removed too early, it will still be mobile and pupation will be delayed. I once took out a larva too soon and not only was pupation delayed by 10 days, the larva also lost ten grams. The pupa period depends on the size of the beetle. The larger a beetle, the longer the pupa duration. When kept between 20-25°C, the pupa period is about 45 days for females and 45-60 days for males. If kept between 15-18°C, the pupa period could last 90 days. Feeding begins about 40 days after eclosion. Once active, adults can live at least 8 months. Females oviposit up to 200 eggs. Let the adults feed for a month before mating. When an individual starts to lose tarsi or control of claws, it has reached the terminal phase of its life. However, as long as food is supplied, it can live a few more months. In the Genus *Dynastes*, elytra become dark when



✓ 距離化蛹只有幾個小時的原名亞種雄性前蛹。透過舊表皮可非常清楚地看見許多皺紋，為被壓縮著的前胸背板角。2000

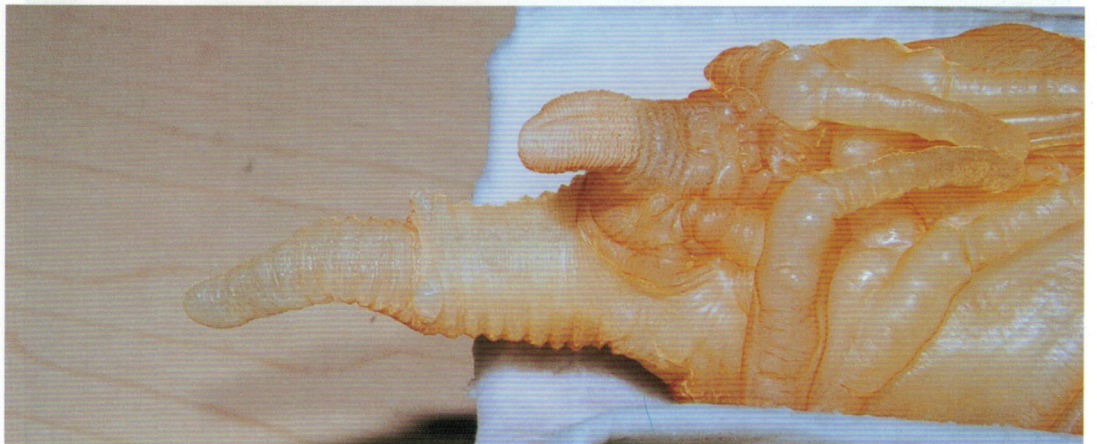
D. h. hercules pre-pupa only hours before pupation. A lot of wrinkles can be seen through the larval skin. They are the wrinkles of the compressed thoracic horn.



✓ 06/08/2006 14:35



✓ 幼蟲頭殼分裂成三瓣。2001
Larval head capsule splits into three.



✓ 剛脫離舊表皮不到10分鐘的新蛹，可看見犄角一開始時像是被壓縮著的彈簧，經血液充灌以後才開始膨脹。2000
A very rare scene! The pupa emerged just a few minutes before. You can see that his horns are like highly compressed springs. They only expand after blood is pumped into them.



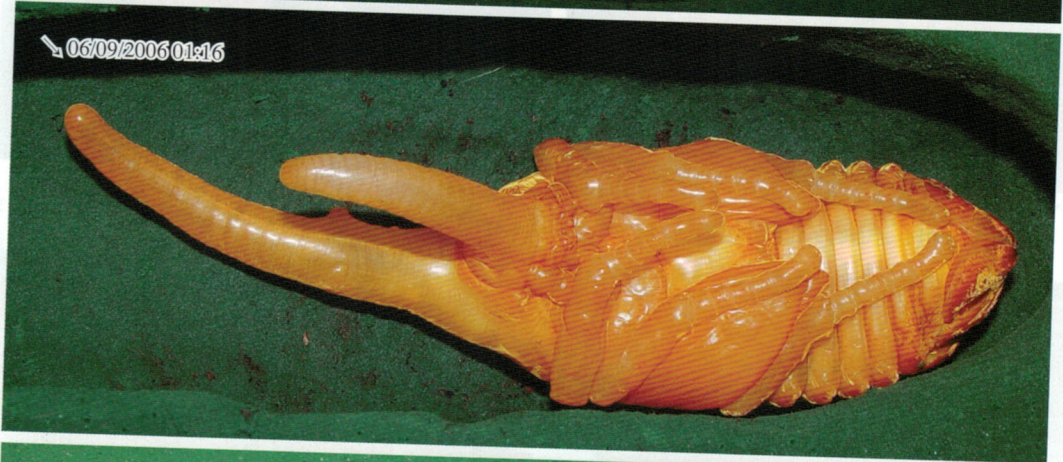
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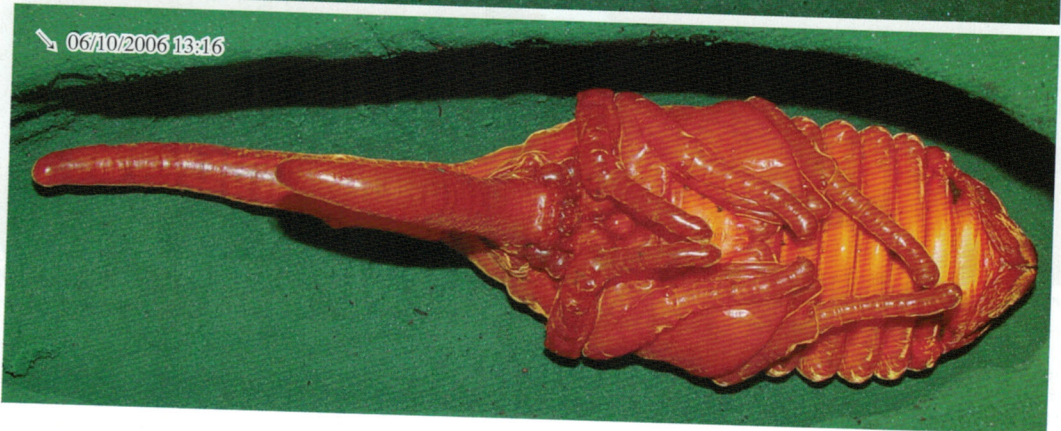
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06/09/2006 01:16



06/10/2006 13:16





\拿在手上重量十足的長戟大兜蟲蛹。全世界又有幾種昆蟲可以讓你拿在手上然後說道「嗯，蠻重的！」？
 A handful pupa. How often can you hold an insect in your hand and say, "hum, it is pretty heavy!"?



↑原名亞種蛹的背面。2000
 Back view of a male *D. h. hercules* pupa.

\中角型西方亞種蛹。2003
 Medium *D. h. o.* pupa.



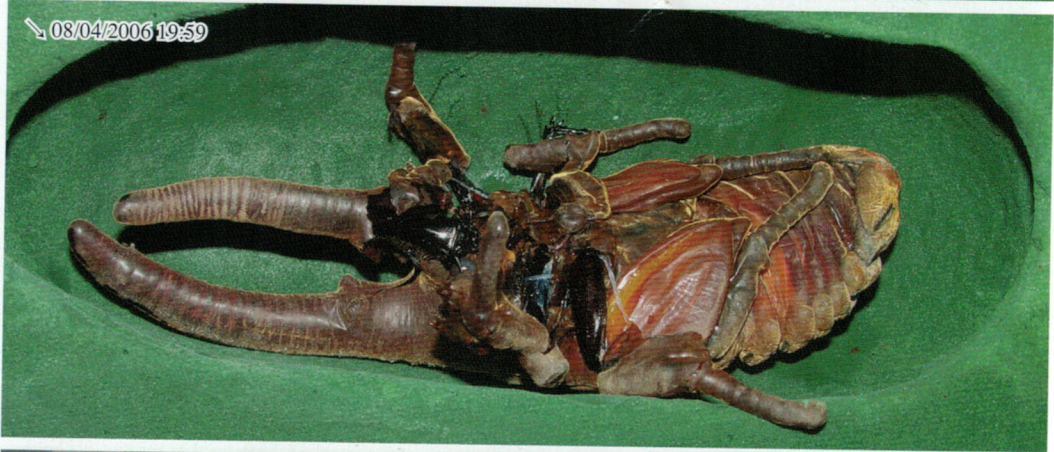
\利奇氏亞種雌蛹。2000
 Female *D. h. litchyi* pupa.



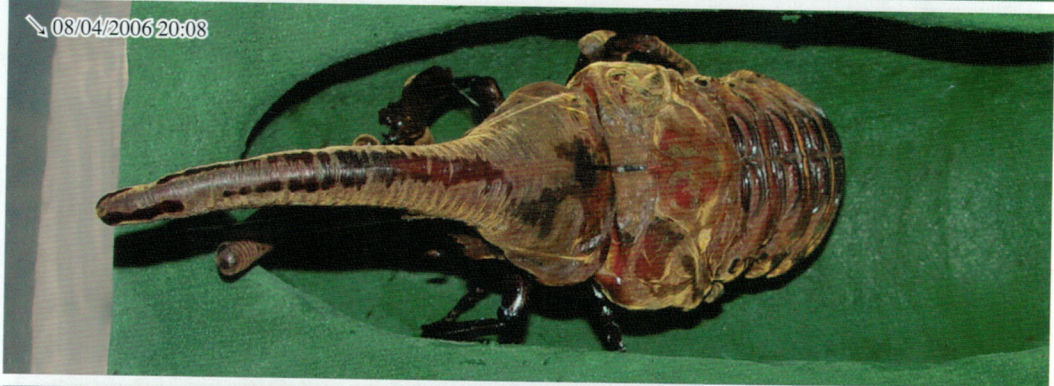
距離羽化只有數小時的蛹。可看見頭角部位的蛹皮已經失壓凹陷。
A few hours away from eclosion. Cephalic pupal skin has deflated.



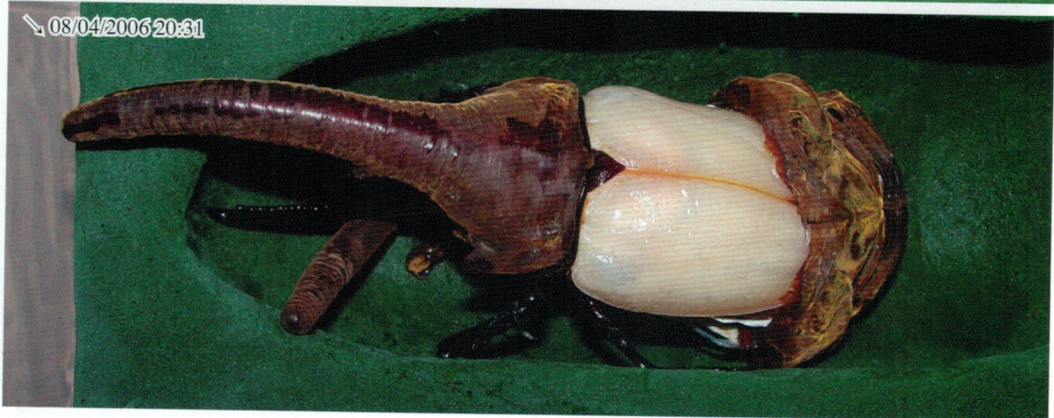
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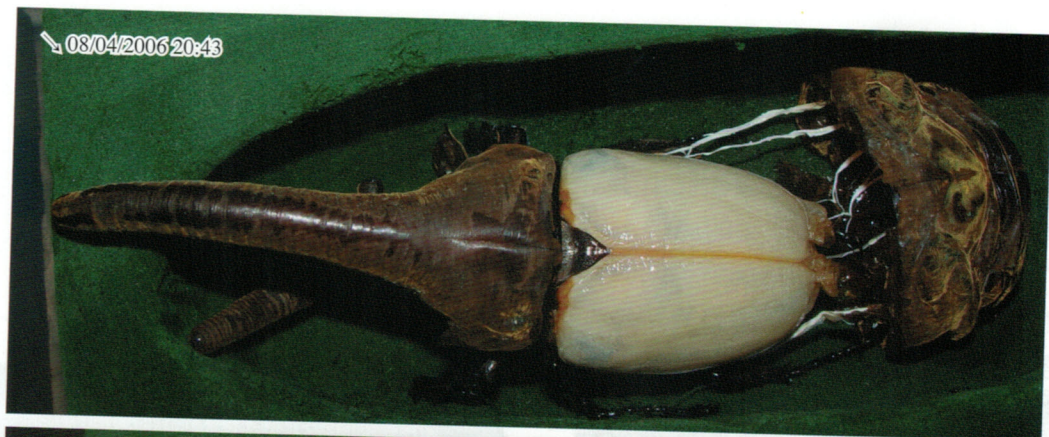


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→ 羽化2個星期後，一半以上的翅鞘已為成熟的顏色。2000
Two weeks after eclosion. More than half of the elytra are of the mature color.

