



↑大齒型高砂深山锹形蟲。左78 mm右80 mm。1999
Major Lucanus maculifemoratus taiwanus.

深山锹形蟲

Lucanus Stag Beetles



↙台灣深山锹形蟲。67 mm。2005
Lucanus formosanus. Taiwan



「深山锹形蟲」這個名詞也是由日文直接翻譯而來的。顧名思義，深山锹形蟲是居住在「深山」的锹形蟲。雖然有些種類在海拔200公尺就會開始出現（姬深山锹形蟲：海拔200-2500公尺），但是大部分都要500公尺以上才會現身，有些種類更是要海拔1500公尺以上才會露面（黑腳深山锹形蟲：海拔1500-2600公尺）。中國甚至有分佈至海拔4000公尺以上的種類。根據氣象學，海拔每上升100公尺，溫度就會下降0.6度。在海拔500公尺的山區，溫度就會比平地低3度。在海拔1000公尺的高度，溫度就比平地低6度。換句話說，如果我們用26°C來飼育平地產的扁锹形蟲，那麼飼育深山锹形蟲就要用20°C。如果沒有適當的溫控系統，我們不建議飼育深山锹形蟲。若是強行用28°C的高溫飼育，成蟲很快就會死亡，更遑論產卵。深山锹形蟲非常耐寒，即使是5°C的低溫都不會死亡。最適合牠們成蟲和幼蟲的溫度是18-21度，26度算是中海拔深山锹形蟲的最高上限。

有些深山屬的個體會在飼養容器內不斷地爬行，因此一定要擺放足夠的攀爬物，尤其是在角落，以防止翻倒。飼育箱最好是用黑布完全地蓋起來，因為成蟲對光線很敏感，有些個體會往光源處不停地攀爬。深山锹形蟲喜愛水氣，因此可以每天往飼育容器內稍微地噴霧，但絕對不可過多，以免底部開始積水。

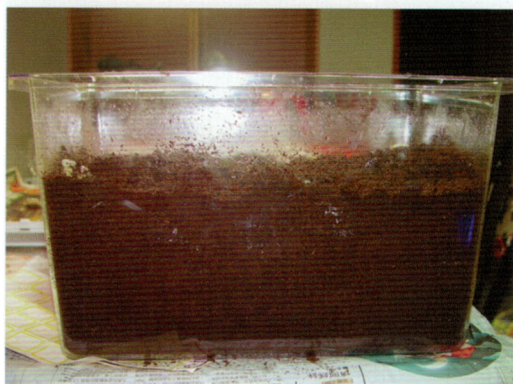
Stag beetles in the Genus *Lucanus* are called “deep-mountain stag beetles” in Japan and Taiwan because they tend to occur in higher elevations. Although some species begin to occur at 200 meters above sea level (*Lucanus swinhoei*: 200-2500 meters), most don't begin to appear until 500 meters above sea level. Some species don't begin to appear until 1500 meters above sea level (*Lucanus ogakii*: 1500-2600 meters). Some Chinese species dwell in elevations above 4000 meters. According to meteorology, for every 100 meters of elevation gain, the temperature drops 0.6°C. At 1000 meters above sea level, the temperature is 6°C lower than at zero elevation. In other words, if 26°C is used to rear *D. titanus* from zero elevation, then 20°C is required to rear *Lucanus* stag beetles. If the rearing environment lacks climate control, the rearing of *Lucanus* stag beetles should not be attempted. 28°C kills them quickly. On the other hand, *Lucanus* stag beetles are remarkably tolerant of extreme cold. Even 5°C does not harm them. The best temperature range for these beetles is 18-21°C. 26°C is the limit for *Lucanus* stag beetles from mid-elevations.

Some *Lucanus* individuals wander excessively in the tank. As a result, plenty of branches must be provided, especially at the corners, to prevent adults from flipping over. It's a good idea to cover the tank with a black cloth because *Lucanus* beetles are more sensitive to light. Some individuals walk relentlessly towards light. *Lucanus* stag beetles like humidity. The breeding tank can be misted slightly with a spray bottle ev-



↗高砂深山锹形蟲雌蟲。47 mm。1999
Female *L. maculifemoratus taiwanus*.

由於深山锹形蟲的原生產卵環境往往有厚厚的一層落葉和腐葉，因此在腐植土或是朽木屑中混入30-50%的腐葉土或是打成細小顆粒的枯葉能夠促進雌蟲產卵。打碎的枯葉使用前最好能夠先加水攪拌至一般飼養幼蟲時的溼度，然後放入戳有呼吸孔的容器1-3個月，以加深腐朽程度。要給深山锹形蟲產卵的朽木屑一定要夠腐爛（深褐色或是黑色）以及夠細膩。如果腐朽程度不夠，或是朽木屑的顆粒太大，雌蟲是一定不會產卵的。只要達到以上標準，即使朽木屑中沒有添加腐葉土或是打碎的枯葉，雌蟲



↗深山锹形蟲在腐植土裡頭產卵。2006
Lucanus oviposits in flake soil.

ery day. But make sure not to over-spray or the bottom of the tank will flood.

The natural breeding environment of *Lucanus* often contains thick layers of dead leaves and decayed leaves. As a result, mixing 30-50% of decayed leaf mulch or finely ground dead leaves into flakes soil or decayed wood flakes can encourage females to oviposit. However, ground dead leaves should be moistened to the humidity used to rear larvae and kept in a container with ventilation holes for 1-3 months before use to promote decay. For *Lucanus* females to oviposit, the substrate used must be adequately decayed (deep brown or black in color) and fine in texture. If these two conditions are met, how much decayed leaves are mixed into the substrate is not so important. Although *Lucanus* females almost only oviposit in flake soil, some individuals refuse to oviposit in substrate without solid decayed wood. This is because decayed wood are an important food source for *Lucanus* larvae. As previously mentioned, flake soil becomes nutritionless dirt after 4-6 months



↗艾克貝西亞納斯歐洲深山锹形蟲是極大型的種類。92 mm。2006
Lucanus cervus akbesianus is a giant species.



也幾乎都會產卵。雖然深山鍬形蟲幾乎只會把卵產在朽木屑裡，但是有些個體卻完全不願意在沒有添加產卵木的環境中產卵。這是因為朽木是幼蟲生長時重要的食物來源。之前提過，腐植土經過4-6個月的再腐化後將變成沒有營養的土壤（如果把溫度控在20度以下則可以延長到8-10個月）。如果在天然環境中缺少了朽木，幼蟲將在4-6個月後通通餓死。也因此，有些雌蟲拒絕在沒有朽木的環境中產卵。最理想的佈置方式為在飼育容器底部壓實約5 cm的朽木屑。接著在上面橫放1-2根偏軟的產卵木。最後再用朽木屑將產卵木埋沒。產卵環境的總深度至少要有15 cm。如果是飼育像是*Lucanus cervus judaicus*的大型種類，則深度至少要有20 cm。

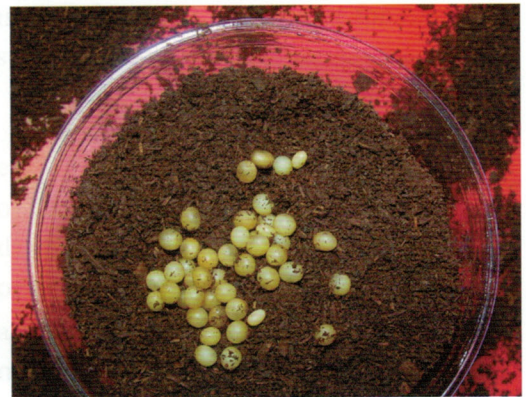
有些雄性個體會攻擊雌蟲，因此確認交配後雌雄分開飼養。如不確定是否交尾過，可先用包有塑膠膜的鐵線固定雄蟲的大顎，之後雌雄共養在產卵箱中

(8-10 months if the ambient temperature is below 20°C). If there was no decayed wood, larvae would starve to death in 4-6 months. As a result, some females refuse to oviposit in an environment without decayed wood. The ideal setup contains 5 cm of compressed flake soil at the bottom. Then one or two pieces of middle or soft decayed wood are placed on top. More flake soil is added until the logs are completely covered. The total depth should be at least 15 cm. If the species kept falls in the “large” category such as *Lucanus cervus judaicus*, then the total depth should be at least 20 cm.

Some male individuals attack females. Males and females should be kept separately once mating is confirmed. If no mating is sighted, the male’s mandibles can be cuffed and kept with the female for three days in the breeding tank. *Lucanus* females oviposit 30-50 eggs. However, large species like *Lucanus cervus judaicus* can oviposit over 100 eggs. Larvae can be harvested two months after the female was placed in the



↗ 剛生下的黑栗色深山鍬形蟲卵。2002
Newly deposited *Lucanus kanoi piceus* egg.



↗ 接近成熟的朱戴克斯歐洲深山鍬形蟲卵。卵直徑 5.44 mm。2006
Near-mature *Lucanus cervus judaicus* eggs. Egg diameter 5.44 mm.



大約3天。深山锹形蟲一般可產30-50粒卵，不過像是*Lucanus cervus judaicus*等的大型種類可以生超過100粒卵。雌蟲放入產卵箱2個月後便可以收成幼蟲。飼養幼蟲的容器不能只裝原產卵木屑，因為產卵木屑的腐朽程度已經相當地高，幾個月後幼蟲很有可能餓死。應該先在容器內壓實70%的發酵木屑，然後再壓實30%的舊木屑，最後再挖個小洞放入一隻幼蟲。容器內部也可埋放軟朽木塊供幼蟲啃食。幫幼蟲換飼料時一樣先在容器底部壓實70%的發酵木屑，之後再壓實30%的舊木屑。

由於深山锹形蟲都是有一定海拔的種類，因此牠們的一生都會經歷分明的四季。這一點讓飼育深山锹形蟲充滿了挑戰性。要讓一對野生成蟲產卵並把牠們的幼蟲養成成蟲並不是一件難事。最大的困難是如何再讓新成蟲繁殖下去。這可以說是深山锹形蟲飼育的精髓所在。不像生長在熱帶的長戟大兜，一個溫度就可以把卵期、幼蟲期、蛹期、蟄

tank. The rearing container cannot only contain substrate larvae were found in because it is already too decayed. The rearing container should contain 70% compressed fermented decayed wood flakes at the bottom and 30% compressed old substrate on the top. The substrate may also include a small piece of soft decayed wood at the bottom. During substrate change, discard only about 70% of the old substrate and transfer the remaining 30% to the top of the new substrate.

Because the vast majority of *Lucanus* stag beetles dwell in high elevation mountains, their life cycles experience distinct seasonal changes. This makes culturing *Lucanus* full of challenges. Getting a wild-caught *Lucanus* female to oviposit and raise her offspring to adulthood is not difficult. However, getting the new adults to reproduce is where all the challenges lie. Unlike rhinoceros beetles from the tropics, where one temperature can take care of all the egg, larval, pupal, teneral, and adult stages, if *Lucanus* stag beetles don't experience winter in their life cycle, chances are



↗ 黑栗色深山锹形蟲的三齡中期幼蟲。2005
Middle L3 *Lucanus kanoi piceus* larvae.



↗ 高砂深山锹形蟲三齡中期幼蟲。2003
L3 *Lucanus maculifemoratus taiwanus* larva.

伏期、成蟲期全部包下來，深山鍬形蟲如果沒有經歷明顯的冬天，就很有可能斷種。飼育深山鍬形蟲時必須模擬其原生棲地的溫度變化。在野外，深山鍬形蟲羽化後至少會經歷6個月的低溫期，也就是十月份到隔年的三月份。如果羽化後還是持續養在20度以上的溫度中，新成蟲大約3個月後就會開始活動。提早開始活動的新成蟲一生都不會產卵，或是只產幾顆不會孵化的卵。有些個體甚至靜靜地在木屑中死去。也因此，新成蟲羽化2個月後便一定要放入溫控在5-14°C的冰箱（海拔越高的種類就要越低溫）。這裡選擇2個月後，而不是羽化幾天後，是因為在野外幼蟲不會在寒冬中羽化（在低溫環境中昆蟲雖然不會死亡，但生理卻會呈現停滯狀態）。既然在野外幼蟲不會在冬天羽化，把剛羽化的人工個體立刻丟入嚴冬環境是不符常理的。新成蟲羽化2個月後就大約完成了初步的器官成熟，此時便可以進入冰箱。（如果從來都沒有把新成蟲挖出來過，可直接將飼養容器放入冰箱。如果之前有把蛹移到人工蛹室，可將新成蟲再埋回原來的飼養容器中。新成蟲低溫蟄伏時的木屑不能是乾燥的。）在接下來的6個月中，新成蟲會慢慢地在低溫環境中達到完全成熟。從冰箱拿出來以後，新成蟲不一定會立即爬出木屑活動。此時只要把飼養容器放置在20度的環境中，靜靜地等待新成蟲開始活動即可。新成蟲開始活動以後可以活3-5個月。

they won't reproduce. It is therefore of utmost importance to re-create winter for *Lucanus* stag beetles in captivity. In the wild, newly eclosed *Lucanus* adults experience at least 6 months of cool to cold weather, usually from October to March. If new adults are kept at 20°C or above, they will become active in about three months or die silently in the substrate without ever becoming active at all. New adults that become active too soon never oviposit or oviposit only unhatchable eggs. As a result, two months after eclosion, new adults must be transferred to an environment 5-14°C. The time frame chosen here is 2 months (not a few days after eclosion) because larvae do not eclose in winter. Although insects don't die in cold weather, their metabolism virtually stops. If larvae do not eclose in winter, it makes no sense to immediately transfer newly eclosed adults to a cold environment. In about 2 month's time, new adults will have completed the first stage of organ maturing and can now be transferred to a cold environment. (If the new adults were never removed from their rearing containers, simply store the containers in a cold environment. If they were removed to artificial pupal cells as prepupae or pupae, they can now be returned to their original containers and buried in moist wood flakes.) In the next 6 months, the new adults will reach full maturity in a cold environment. After they are taken out of the refrigerator, they won't necessarily climb out immediately. Simply leave their containers in a 20°C environment and wait for them to become active. Once active, adults live 3-5 months.



雌蟲的幼蟲期8-24個月，但大部分的幼蟲會在12個月大時化蛹。雄蟲的幼蟲期12-36個月，但大部分的幼蟲會在18個月大時化蛹。也就是說，大部分的雌蟲和雄蟲不會同時羽化。這是飼育深山锹形蟲另外一個令人頭痛的地方。這個問題可用兩種方式克服。一是同時飼養至少10隻雌性幼蟲、10隻雄性幼蟲。這樣應該有機會遇到至少1對或是2對差不多同時羽化的成蟲。另外一個方式就是拉長雌蟲的蟄伏期。如果把雌蟲的低溫蟄伏期從原來的6個月拉長到9個月並不會有負面影響。但是極限在哪裡？雌蟲能不能被強制蟄伏2年或甚至3年並且之後還能夠正常繁殖？這就需要更多實驗了。

Larval duration for females is 8-24 months, with most pupating at around 12 months of age. Larval duration for males is 12-36 months, with most pupating at around 18 months of age. In other words, most males and females don't eclose at the same time. This is another challenge for the propagation of *Lucanus* stag beetles. There are two ways to solve this problem. One is to rear at least ten female and ten male larvae at the same time. This should be enough to produce one or two pairs. The other way is to prolong the females' hibernation from 6 months to 9 months. This will have no negative effects on the females' reproductive ability. However, where is the limit? Can females be forced to hibernate for as long as two or even three years and still be able to reproduce? This will require more experiments.



↗ 黑栗色深山锹形蟲前蛹。2006
Pre-pupae of *Lucanus kanoi piceus*.



↗ 黑栗色深山锹形蟲的雌蛹。2006
Female pupa of *Lucanus kanoi piceus*.



↗ 美國(鹿)深山锹形蟲的雄蛹。52 mm。2006。馬克馬尼格攝
Male pupa of *Lucanus elaphus*. Photo by McMognle



↗ 美國馬薩馬深山锹形蟲的雄蛹。28 mm。2006。馬克馬尼格攝
Male pupa of *Lucanus mazama*. Photo by McMognle