

分辨幼蟲性別

Larval Sex Determination

到底可不可以分辨出幼蟲的性別呢？可以，絕對可以。兜蟲和花金龜幼蟲的分辨率更是高達100%。我們先從兜蟲幼蟲開始。

1993年第一次飼養獨角仙幼蟲時，就一直想知道如何分辨幼蟲的性別，但當時就是連日本的飼育書籍都表示獨角仙幼蟲的性別無法分辨。當時雖然很努力地比較幼蟲，但怎麼看每一隻都沒有任何不一樣的部位。直到有一天，我發現所有的雄性前蛹腹部倒數第三節都有一粒微小的突起。但是這小突點只有在前蛹期才會出現，在還未要化蛹的幼蟲上並看不見。也就是說，除非幼蟲已要化蛹，否則還是無法分辨其性別。過一陣子後，我慢慢地放棄了尋找分辨獨角仙幼蟲性別的方法。但幾年後，在一個很偶然的情況下，我終於發現了如何百分之百分辨兜蟲幼蟲性別的方法。當時我正在觀察手上的三齡長戟大兜蟲幼蟲。正好目光掃到其腹部倒數第三節時，發現在一排剛毛前的中間位置有一橫向刻點，長度不到1 mm。(此刻點當長戟大兜蟲幼蟲還是三齡初期時，透過表皮可看見在其周圍有一小層白色物質。但三齡終期時由於身體不再透明，此白色物質完全消失；此時小刻點被原本沒有的一小點橘色色素包圍。但不管看不看得見表皮下的白色物質或是小橘點，重點是在表皮上的刻點。)由於此

Is it possible to determine the sex of a larva? Yes, and accuracy is one hundred percent. We will start with sex determination in rhinoceros beetle larvae.

Since I first reared *A. dichotoma* larvae in 1993, I had wanted to know how to sex them. However, even Japanese rearing books back then stated that it was not possible to do so. Although I scrutinized every part of the larvae I had, I was not able to discover any structural difference. But one day, I noticed each male pre-pupa had a small protrusion on the surface of the third-to-last segment on the ventral side. However, the small bump only appears during the pre-pupa stage. In other words, unless a larva was about to pupate, there was still no way that I could determine the sex of a rhinoceros beetle larva. Many years later, however, I finally discovered how to sex larvae with 100% accuracy. I was then holding a full-grown *D. hercules* larva. When my eyes came across the surface of the third-to-last segment on the ventral side, there was a small horizontal indentation at the center that was less than 1 mm in length. (In young L3 *D. hercules* male larvae, through the transparent skin a white mass can be seen surrounding the indentation. However, upon achieving maximum weight, the white mass disappears as larvae are no longer transparent. At this time, the indentation is sur-



小刻點的位置與獨角仙前蛹腹部的小突點的位置完全一樣，於是我馬上斷定這發現一定就是分辨性別的方法。接著我馬上把每一隻長戟大兜蟲的幼蟲翻過來看腹部是否有小刻點。後來化蛹時果然每一隻之前有小刻點的幼蟲都是雄性。除了長戟大兜蟲的幼蟲以外，所有兜蟲的幼蟲都可以用這個方法分辨性別。由於獨角仙並不是超大型的兜蟲，因此檢視時可將幼蟲放在燈光下稍微旋轉；當燈光照射的角度正確時，腹部的小刻點便會呈現於眼前。雖然刻點不大，但只要仔細看一定看得見。也正是此小刻點在獨角仙的前蛹期會稍微隆起，形成我之前看見的小突點（在長戟大兜蟲的前蛹上此小刻點並不會隆起）。在大型的種類中，例如長戟大兜蟲和戰神大兜蟲，

rounded by a dot of orange pigment instead. But whether it's the white mass or the orange coloration, the focus should be on the small horizontal indentation.) Because this small dent and the small lump on male *A. dichotoma* pre-pupae are both located on the third-to-last ventral segment, I immediately concluded that the indentation had to be the key to sex determination in rhinoceros beetle larvae. And indeed it is. The reason that I was not able to notice such a mark on *A. dichotoma* male larvae years ago is that it's much smaller than that of *D. hercules*. In fact, with the smaller species, the best way to see the indentation is to rotate a larva under a light bulb; when the light rays shine on the dent at the right angle, it becomes obvious. Although the indentation is difficult to see until third instar in smaller



♂雄性的兜蟲幼蟲腹部倒數第三節的中央部位有一個小刻點。圖為三齡長戟大兜蟲幼蟲。1999

Male rhinoceros beetle larvae have a small horizontal indentation on the third-to-last ventral segment. Pictured is a mature L3 *D. h. lichyi*.

此雄性幼蟲才有的小刻點，當幼蟲還是二齡時便看得見了。雖然有些飼育家用幼蟲的大小來分辨性別，但可靠度並不是百分之百，因為有許多種類雌雄體重相差不多，以及有很多雄性幼蟲因飼養不當而體型比雌蟲小。腹部有無小刻點是百分之百可靠的性別分辨方法。(註：在中、小型的兜蟲種類中，此小刻點並沒有顏色。)

分辨锹形蟲幼蟲的性別時，主要是看頭幅或是幼蟲體內是否有黃色或白色

species, in giant species such as *D. hercules* and *M. actaeon* such mark can be seen in L2. Although some breeders use the size of larvae to determine the sex, with larger larvae being males, it's not always reliable. In many species both males and females are approximately the same size. Furthermore, if a male larva is poorly fed it can be lighter than a female.

For stag beetle larvae, either the size of the head capsule or the presence of yellow



↗三齡安達佑實大锹形蟲幼蟲。左邊是雄性個體，因為身體和頭部都比較大。

L3 *Dorcus antaeus* larvae. Male on left, with larger body and larger head. 2008

→雌性锹形蟲幼蟲的腹部長有黃色或是白色的構造。2006
Female stag beetle larvae possess yellow or white structure in the abdomen.



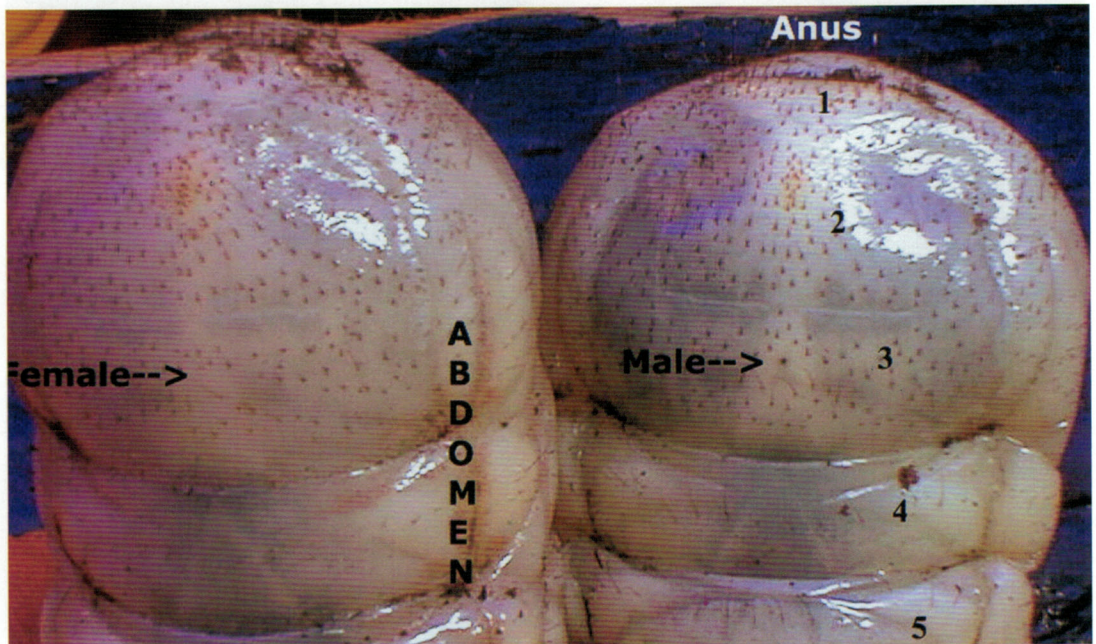


的結構體。由於許多種類的雄蟲都比雌蟲大出許多，因此頭幅大的一定都是雄性。細身赤屬的锹形蟲便是很好的例子。此屬的雄性三齡幼蟲頭幅都明顯地比雌性的大出許多。另外一個方式是透過幼蟲的腹部背面尋找黃色或是白色的構造。如果有，幼蟲便是雌性的。據說此結構日後會發育成雌蟲的卵巢。此方法當幼蟲還是二齡時便可以用了。

分辨花金龜幼蟲性別的方式和分辨兜蟲幼蟲的一樣。唯一的不同是，花金龜的雄性幼蟲擁有的是一圓形小黑點，而非橫向小刻點。由於大部分的花金龜幼蟲體型都不大，分辨時最好是用放大鏡。大王花金龜的小黑點在三齡雄性幼蟲上相當地明顯，無需放大鏡。

or white structure is used to determine the sex of a larva. Because males of many species are considerably bigger than females, larvae with a big head capsule are males. Stag beetles of the genus *Cyclommatus* are great examples. Another method is to look for the presence of yellow or white structure in the larva's abdomen on the dorsal side. The presence of such structure confirms the female sex. It is believed that such structure develops to become the ovaries.

Flower beetle larvae are sexed in the same way that rhinoceros beetle larvae are. The only difference is the horizontal indentation is replaced with a small dot. Since most flower beetle larvae are smaller than those of rhinoceros beetles, a magnifying glass may be helpful.



♂雄性花金龜幼蟲腹部倒數第三節的中央部位有一小黑點。圖為三齡波麗菲夢斯花金龜幼蟲。馬克馬尼格攝
Male flower beetle larvae have a small black dot on the third-to-last ventral segment. Pictured are L3 *Chelorrhina polyphemus*. Photo by McMonigle