

四、馬陸，目 (Order) 的檢索表

- 1A** 體壁柔軟；背甲有一簇簇柔軟的網毛，在身體末端的2簇網毛較長；很小(體長不超過4mm)；步足絕不多過17對；廣泛分布於世界各地溫暖地區
 Body wall soft; tergites bearing tufts of feathery setae, with a pair of tufts formed by long setae (Fig. 8) at hind end of body; 11-13 rings; very small (less than 4 mm long), never more than 17 leg pairs; worldwide in warmer regions **Polyxenida**

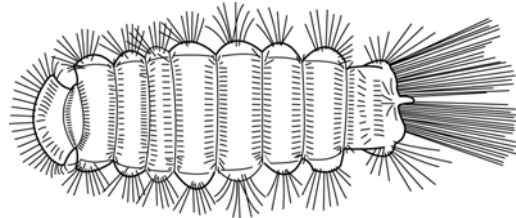


圖8- Polyxenida，全身,背面觀

- 1B** 體壁僵硬；背甲不一定有網毛，如有網毛，網毛並非一簇簇的排列；體節數超過11節；成體的步足數超過17對（不過部分的Glomerida除外）而且大部分種類的成體體長超過4mm
 Body wall hard and rigid; if setae are present on the tergites they are not arranged in tufts; more than 11 rings; adults with more than 17 leg pairs (except some female Glomerida); adults of most species longer than 4 mm..... **2**

- 2A** [1b] 體節數不超過22節
 [1b] Body with up to 22 body rings **3**

- 2B** 體節數超過22節
 Body with more than 22 body rings..... **4**

3 [2a]: Millipedes with up to 22 rings

- 3A** 從馬陸的背部計算，成體體節數有12節；頸板狹窄；第2體節的背甲非常寬（如圖4）；身體能捲成一球形（如圖5）；Tömösvary這一器官很大呈馬蹄形；如果有小眼則排成一行（如圖6）；分布於北半球及東南亞
 Body of adult with 12 rings, counted on the back of the animal, collum narrow, tergite of 2nd ring very broad (Fig. 9), body can roll into a ball (Fig. 10), large horseshoe-shaped Tömösvary's organ; ocelli, if present, in a row (Fig. 11), Northern Hemisphere and SE Asia **Glomerida**

提示： Glomerida 及 Sphaerotheriida

這兩目的頸板都非常小,如果馬陸捲起來便很難看到.但是第二體節的背甲則很大容易看見.找到第二片背甲,是為第二體節,繼續數到最後一節. Glomerida這一目僅有12節,第十一體節或許非常細長並且可以be ober looked. 雄性個體最後一對步足極度變形.

Tip/Hint: In Glomerida and Sphaerotheriida, the collum is very small. It may be difficult see when the animal is rolled up. The large 2nd tergite, however, is always easy to spot. Find the 2nd tergite and count it as 2, continue counting to the body end. The Glomerida have only 12 rings; the 11th ring may be very slim and can be overlooked. The last pairs of legs of males are strongly modified.

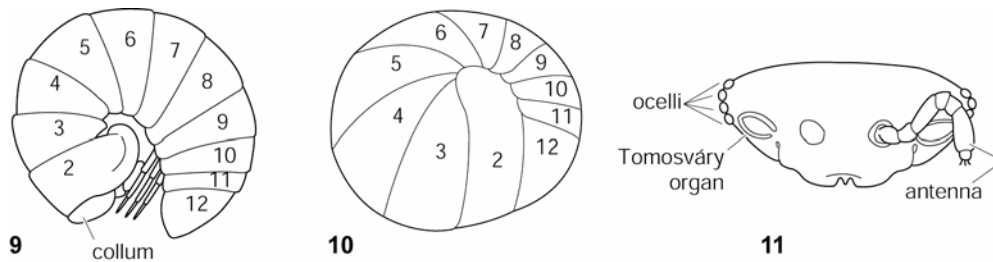


圖9- Glomerida，身體側面觀, 圖10, 11- Glomerida，捲成一球體

3B 從馬陸的背部計算，成體體節數有13節，從馬陸背部計算；頸板小且成橢圓，第2片背甲非常寬（圖12、13）；第13節的體節最寬；沒有臭腺孔；僅分布於印度東南亞澳洲紐西蘭非洲東部及西部及馬達加斯加島及Seychelles
 es Body of adult with 13 rings, counted on the back of the animal, collum small and oval, 2nd tergite very broad (Figs 12, 13); 13th ring the broadest; no ozopores; restricted to India, Sri Lanka, SE Asia, Australia, New Zealand, East and South Africa, Madagascar and Seychelles

Sphaerotheriida

提示： Glomerida 及 Sphaerotheriida

這兩目的頸板都非常小如果馬陸捲起來便很難看到但是第二體節的背甲則相當大很容易認出來找到第二片背甲是為第二體節繼續數到最後一節。Sphaerotheriida目體節有13個體節跟 Glomerida目相反Sphaerotheriida目的眼睛很大且呈腎形是由數個小眼所構成雄性個體最後一對步足極度變形

Tip/Hint: In Glomerida and Sphaerotheriida, the collum is very small. It may be difficult see if the animal is rolled up. The large 2nd tergite, however, is always easy to spot. Find the 2nd tergite and count it as 2, continue counting to the body end. The Sphaerotheriida have 13 rings. In contrast to the Glomerida, the Sphaerotheriida always have large, kidney-shaped eyes with numerous ocelli. The last pairs of legs of males are strongly modified.

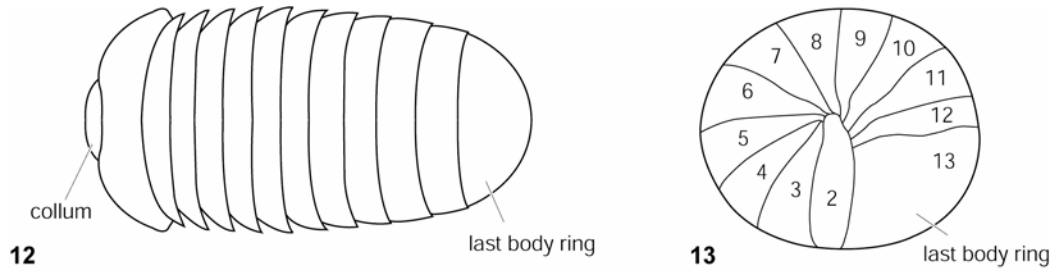


圖12- Sphaerotheriida，背面觀, 圖13- Sphaerotheriida，捲成球體

3C 成體體節數由19~21節，沒有眼睛也沒有小眼；有些種類背甲有側突有的沒有（圖14、15）；

雄性成體第7體節的兩對步足中的前面那一對變成生殖肢（圖16，與圖34相比較），而後面那一對步足仍為正常步足；廣泛分布於全世界

Body of adult with 19 to 21 rings, no eyes or ocelli; with or without paranota (Figs14, 15); in adult males anterior leg pair of 7th ring modified as gonopods (Fig. 16, compare with Fig. 34), posterior pair of 7th ring normal walking leg; worldwide

Polydesmida

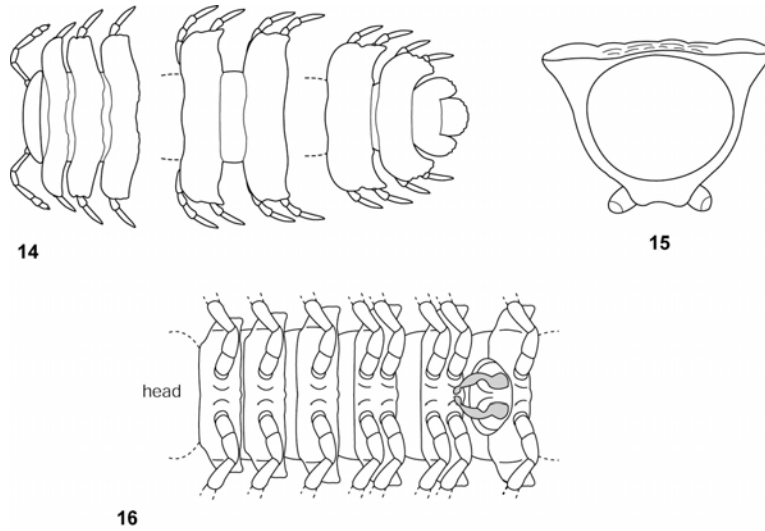


圖 14- Polydesmida，身體背面 圖15- *Polydesmus* (1985年, Blower之後)，身體橫切面 圖11-

Polydesmida雄性，腹面觀，只有一對生殖肢 (灰色)

3D 成體體節數22節 (或許不易計算) ，越到身體末端的體節越細；最後一對步足細小，朝身體末端突出去很像尾器 (cerci) (如圖17、18) ；即使即將成熟的馬陸每一體節都有步足；在觸角基部的後方有

Tömösváry

器官，很大且呈橢圓形 (圖19) ；沒有小眼；雌性成體具長且呈管的產卵器，位於第二對步足的兩個基節 (coxa) 後方 (圖20) ；分布於東南亞、西印度、墨西哥、南美洲的北方

Body of adult with 22 rings (may be difficult to count), body tapering to the end; last leg pair slender, extending beyond the body end and resembling 'cerci' (Figs 17, 18); subadult specimens with legs on all rings; large, oval, Tömösváry's organ behind antenna sockets (Fig. 19), no ocelli; adult females with long tubular ovipositor on each coxa of 2nd leg pair (Fig. 20); SE Asia, West Indies, Mexico, northern South America.....

Glomeridesmida

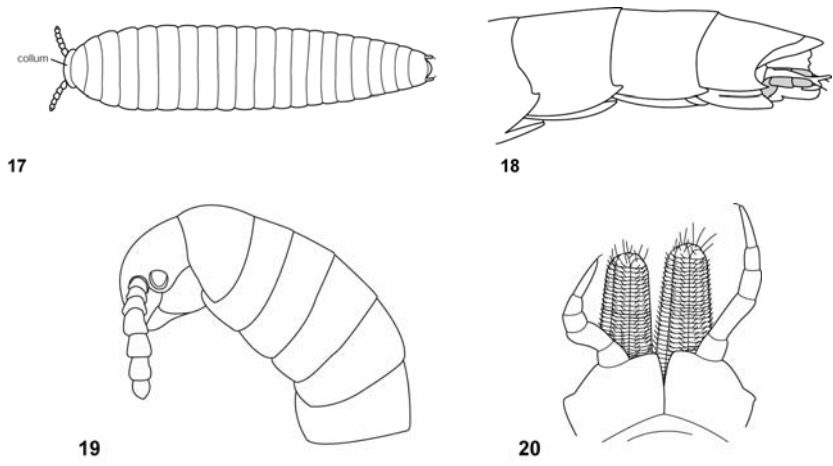


圖17- Glomeridesmida ， 整個軀體 ， 背面觀，圖18- 身體末端，擴大 (1980年Mauriès 之後)
 圖19- Glomeridesmida ， 頭部側面觀 ， 有Tömösváry n 器官 (1980年Mauriès 之後)
 圖20- Glomeridesmida ， 雌性生殖器位於第二對步足處 (1922年，Chamberlin之後)

4 [2b]: Millipedes with more than 22 rings

4A 背甲的背面有一條明顯的縱溝將背甲分開，

這條縱溝有時會看成2條從頭部到尾部的縱線，沒有色素(圖21、26、27)

Tergites dorsally divided by a distinct longitudinal groove, the groove may appear as two longitudinal lines, usually without pigments..... **5**

4B 背部沒有縱溝，但有一條由色素成殿而形成的中間線，有時是一條淺色線，隱約可見

Animals without a longitudinal dorsal groove, a single pigmented midline or a thin, pale suture line may be visible **10**

注意：4A、4B這兩項對初學者言或許有些困難如果讀者不能肯定您的馬陸是否確實有背部的中間線且無法做到正確的鑑定請試另一選項並往以下的檢索步驟繼續鑑定

Warning: This couplet may be difficult for the beginner. If you are in doubt about the dorsal midline of your particular animal and you do not reach a satisfying identification, take the alternative step at this point and continue.

5A 成體體節一數26~32節每一節背甲有一排網毛為3 + 3排列 (圖21) 小眼散佈成堆 (圖23) 身體末端變細；有些種類有側板，有些沒有
 雄性成體的生殖肢由第七對體節的兩對步足組成；廣泛分布於全世界

但非洲薩哈拉沙漠以南 (馬達加斯加群島有) 及南美熱帶地區除外

Body of adult with 26 to 32 rings, each tergite with a transverse row of 3+3 setae (Fig. 21); ocelli in a loose cluster (Fig. 23); body tapering at end (Fig. 22); with or without paranota; in adult males gonopods comprised of the anterior and posterior pair of the 7th ring; worldwide except for sub-Saharan Africa (present on Madagascar) and tropical South America

Chordeumatida

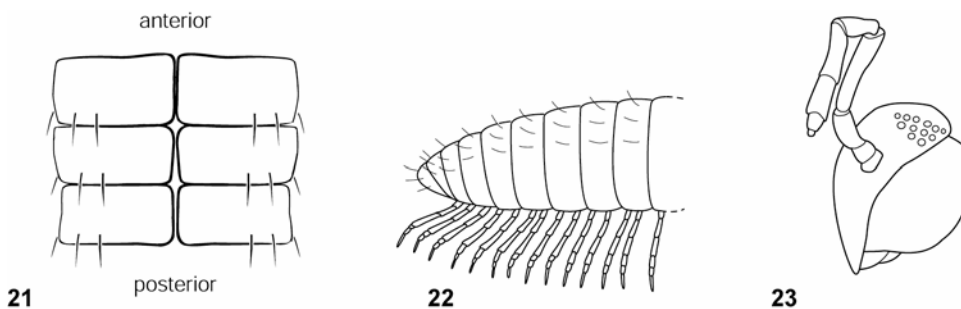


圖 21- Chordeumatida, 背面觀, 3 + 3排列的網毛, 圖22- Chordeumatida頭部, 側面觀, 圖23-

Chordeumatida身體末端, 側面觀

註：Chordeumatida這目的綱毛比較長,容易看出綱毛是擺向身體末端.

由上往下看馬陸的背部可看到一條細而明顯的縱溝,

此時每排僅可清楚的看到兩根綱毛,而第3根綱毛通常是位於體側因此僅可看到它的尖端.

Note: The setae are longer and hence easier to see towards the end of the body. In dorsal view, looking onto the thin but distinct dorsal longitudinal groove, only two setae may be clearly visible from above. The third setae of every row often inserts on the lateral side of the animal, with only the tip of the setae visible from above.

5B 成體體節數超過32節 Body of adult with more than 32 rings **6**

6A 有眼睛或小眼 Ocelli or eyes present..... **7**

6B 眼睛、小眼沒有，頭部則在觸角窩上方有一突起 (圖24、25)；有明顯的側板；體節數多於35節 (圖26、27)；
 雄性成體的生殖肢前面有8對步足；
 分布於中美洲及北美洲、歐洲日本及東南亞

Eyes or ocelli absent, head with bulges above antenna sockets (Figs 24, 25); with distinct lateral paranota (Figs 26, 27), more than 35 rings; adult males with eight pairs of walking legs anterior to the gonopods (Fig. 34); North and Central America, Europe, Japan, SE Asia.....

Platydesmida

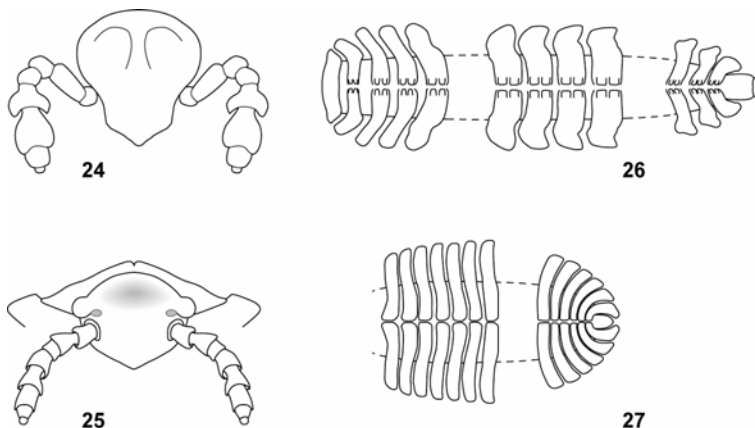


圖24.- Platydesmida頭部, 正面觀, 觸角窩上方凸起的情形； Andrognathidae科, Gosodesmus 屬, 圖25.- Platydesmida頭部,

正面觀, 觸角窩上方凸起的情形; Platydesmidae科, 圖26.- Platydesmida, 部分軀體, 背面觀Andrognathidae科, *Gosodesmus*屬, 圖27.-

7A [6a] 頭部兩側各有數個小眼 Numerous ocelli at both sides of the head..... **8**

7B 頭部兩側各有1~2幾個小眼 One or two ocelli at both sides of the head..... **9**

8A 軀體通常有縱crests 及

ridges(圖.28) (只有一屬沒有: 義大利的*Callipodella*屬, "former Yugoslavia" and

Bulgaria) ; 上唇中央沒有縫合線 (圖.42) 成體體節數40~60節; 眼睛由很多個小眼組成, 小眼緊密排列眼睛呈三角形有明顯的邊緣 (圖.29、30) ; 雄性成體的生殖肢由第7體節的前面那一對步足形成, 生殖肢部分構造凹陷於體內, 後面那對步足為正常步足; 分布於北美、歐洲、西亞、中國大陸南部及東南亞

[7a] body frequently with longitudinal crests and ridges (Fig. 28) (absent only in species of the genus *Callipodella* from Italy, 'former Yugoslavia' and Bulgaria); labrum **without** a distinct median suture line (see Fig. 42); 40-60 rings in adults; eyes with many, closely packed ocelli; eyes triangular with distinct borders (Figs 29, 30); in adult males gonopods comprised of anterior leg pair of 7th ring, withdrawn in body cavity, with just the distal parts visible; posterior leg of 7th ring normal walking leg; North America, Europe and west Asia, southern China and SE Asia.....

Callipodida

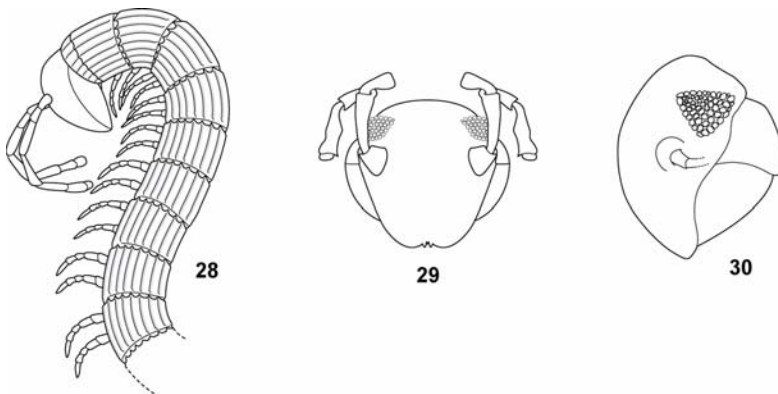


圖.28- Callipodida,部分, 圖.29- Callipodida頭部, 圖.30- Callipodida頭部

8B 軀體平滑,沒有**或任何的***,上唇中央有一條明顯的縫合線如圖41 ; 成體體節數40~60節 ; 眼睛由很多小眼組 ; 沿著背部中央線最多只有一條很細且淺色的縫合線,雄性第七體節的生殖肢凹陷於體內 ; 分布於西半球、非洲薩哈拉以南、東南亞、澳大利亞

Body smooth, without longitudinal crests or ridges; labrum with distinct median suture line as in Fig. 41; 40 to 60 rings in adults; eyes with many ocelli; at most a fine pale suture line along the dorsal midline of the body; Western hemisphere, sub-Saharan Africa, SE Asia, Australia

Spirobolida

註 : Spirobolida背甲背部並沒有縱溝. 然而有些標本可能有一條縫合線會被誤認為一條溝.

這步驟可能有人會誤判 請注意1844年從新幾內亞所採集到的標本*Acanthiulus*

Gervais屬就有很明顯的****但仍將歸為Spirobolida這一目因為牠的上顎中間有明顯的縫合線.

Note: Spirobolida do not possess a longitudinal dorsal groove on the tergites. However, some specimens may have a suture line that may be mistaken as a groove. This step here captures this possible misidentification.

9A [7b]頭部很大有幾一個或二個小眼如果是有兩個小眼其中一個很明顯的比另一個大的多 (如圖31) ; 體節數從39~60節 ; 雄性成體第一對步足變大 , 生殖肢由第7體節的前一對步足形成 , 後一對步足則萎縮 , 但仍可看見其痕跡 ; 分布於中美洲、西印度及南美的熱帶地區、中非洲、南印度和斯里蘭卡、新英格蘭

[7b] Head large with one or two ocelli on each side, if two are present one is distinctly larger (Fig. 31); 39 to 60 rings; in adult males 1st pair of legs enlarged, gonopods comprised of anterior legs of 7th ring, remnants of posterior legs of 7th ring present; Central America, West Indies and tropical South America, central Africa, southern India and Sri Lanka, New Guinea.....

Stemmiulida

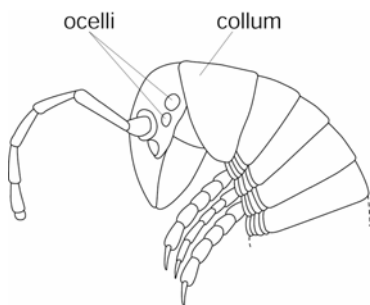


圖31-Stemmiulida頭部，側面觀

9B 頭部小，呈三角形，在觸角窩上方有兩黑洞，每一凹洞內各有2對的小眼
 (圖28) 雄性成體在生殖肢前有8對步足 (圖27) ; 雄性成體的第七體節
 的後一對步足和第八體節的前一對步足有變形 ; 分布於蘇門達臘、

Malacca, Canary and Madeira Islands

Head small, triangular, with 2 pairs ocelli in two black pits above each antenna socket (Fig. 33); adult males with eight pairs walking legs anterior to the gonopods (Fig. 34); posterior legs of 7th ring and anterior legs of 8th ring modified in adult males; Sumatra, Malacca, Canary and Madeira Islands

Siphonocryptida

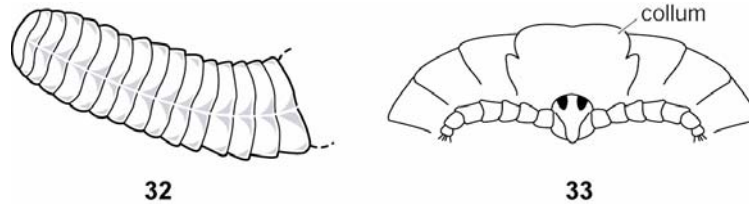


圖32-*Hirudicryptops*,部分體節 (1995, Enghoff& Golovatch之後) 圖33- Siphonocryptida頭部 (1995, Enghoff& Golovatch之後)

10A [4b]頭部前方逐漸變細整個頭呈三角形頭部看起來有點像鳥嘴 (圖33、34、37、38、39) ; 雄性成體在生殖肢前有8對步足 (圖34)

Front of head tapered and triangular to beak-shaped (Figs 33, 34, 37, 38, 39); adult males with eight pairs of walking legs anterior to the gonopods (Fig. 34), two pairs of leg-like gonopods directed forward

11

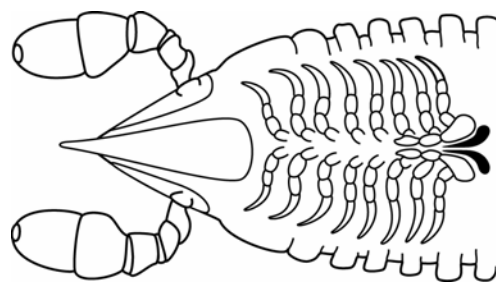


圖34- 雄性成體生殖肢前有8對步足

10B 頭部不像鳥嘴(圖29、41、42) Front of head not beak-shaped (Figs 29, 41, 42)..... **13**

11A [10a]沒有眼睛也沒有小眼此種馬陸體型細長像蠕蟲 (如蚯蚓) ; 體節沒有變大 ; 步足短
 Eyes or ocelli absent; animals slender and worm-like; collum not enlarged; legs short... **12**

11B 頭的兩側各有2~3個黑色眼點或小眼 (圖35、36) ; 此種馬陸背部隆起，腹部平坦或如圖36 ; 頭如圖37 ; 雄性成體在第二對步足的基節處或基節後方有成對的陰莖

2 dark eye spots present (Fig. 37), animals much wider than thick (Figs 35, 36), dorsal side convex, the ventral side flat or as in Fig. 36; head as in Fig. 37; adult males with paired penes on or behind the coxae of 2nd leg pair; Europe, North America, Caribbean, Indian Ocean islands, SE Asia.....

Polyzoniida目

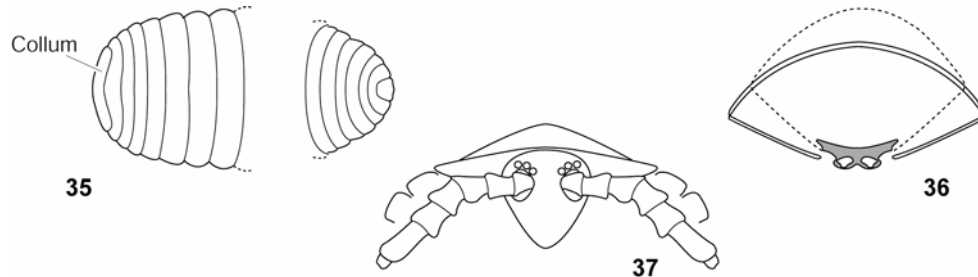


圖35.- Polyzoniida，部分軀體, 圖36.- Polyzoniida，身體橫切面的剖面圖 (1995, Hoffman * * 之後)

12A [11a]此種馬陸身體的橫切面呈半圓型,腹部則是扁平 ; 有細小的網毛緊密覆蓋軀體 ; 觸角的末端數節變大且加厚,頭如圖38所示 ; 分布於美洲的北部、中部及南部**、南非及東南亞、澳大利亞及紐西蘭

Cross section of animal forms a half circle, the ventral side of the animal is flat; animal densely covered with fine setae; distal segments of antennae enlarged and thickened (Fig. 38); the Americas, Caribbean, South Africa; SE Asia, Australia and New Zealand.....

Siphonophorida

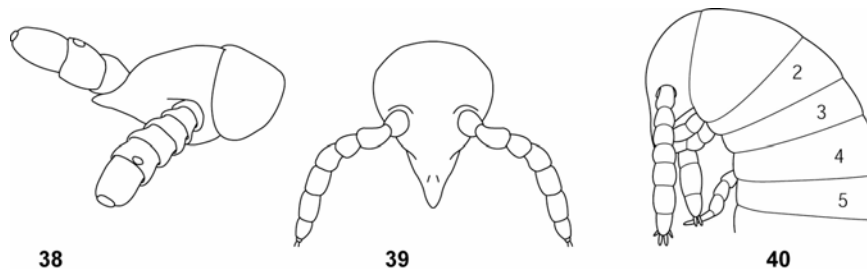


圖38.- Siphonophorida，頭部,未畫出網毛 (1990, Hoffman之後) , 圖39.- Siphoniulida，頭部 (1979,Hoffman之後, 圖40.- Siphoniulida，前面軀體，側面觀 (1979, Hoffman之後)

12B 此種馬陸身體的橫切面是一個圓；身體
 表面光滑且無毛；體型上明顯的比Siphonophorida小；觸角末
 端數節變細 (圖39) ；第三體節沒有步足 (圖40) ；目前僅知
 分布於****及墨西哥

Cross section of animal forms a perfect circle; body surface very smooth and glabrous; small, up to 10mm in length; distal segments of antennae slender (Fig. 39); legs of 3rd ring appear missing (Fig. 40); currently known only from Sumatra and Mexico.....

Siphoniulida

13A [10b]成體的體節決不超過32個體節此種馬陸體型非常小；背甲
 背部有網毛呈3 + 3的排列；背部有一縱列凹溝較小的標本此一
 凹溝較不易看見

Adults never with more than 32 body rings; animals very small; 3+3 setae dorsally on the tergites (Fig. 21); with a longitudinal dorsal groove, which may be difficult to see in small specimens.....

Chordeumatida

註：所有的Chordeumatida背部都有一縱溝.

一些小的標本在顯微鏡下不易看見此一縱列凹溝.請小心這一步驟可能會誤判

Note: All Chordeumatida possess a longitudinal dorsal groove. In some small specimens, the groove may be difficult to see under the light microscope. This step will hopefully capture a possible misidentification.

13B 馬陸體節數超過32節 Animals with more than 32 body rings..... **14**

14A [13b]中央縫合線從上唇往上沿伸 (如圖41) ；第5體節僅一對步足
 ,雄性成體第7體節可能變大,生殖肢凹陷於外骨骼內；分布於西半
 球,非洲薩哈拉以南,東南亞及澳洲

Median suture line extending upward from labrum (Fig. 41), 5th ring with one pair of legs, in adult males 7th ring may be enlarged, gonopods carried inside; Western Hemisphere, sub-Saharan Africa, SE Asia, Australia

Spirobolida



圖41. Spirobolida頭部,正面觀 (1960,Keeton之後), 圖42. Julida頭部, 正面觀

14B 上唇沒有中間縫合線
 Median suture line on front of head not extending to labrum Fig. 42..... **15**

15A [14b]顎唇板的側片分開 (圖44) ; 雄性成體, 第一對步足不似勾狀; 生殖肢位於第七體節凹陷於外骨骼內; 分布於西方半球, 非洲薩哈拉以南, 亞洲分布於喜馬拉亞雅山以南, 澳洲
 Side pieces of gnathochilarium separated (Fig. 44); in adult males, first pair of legs not hook-like; Western Hemisphere, Australia Africa, Asia south of the Himalayas..... **Spirostreptida**

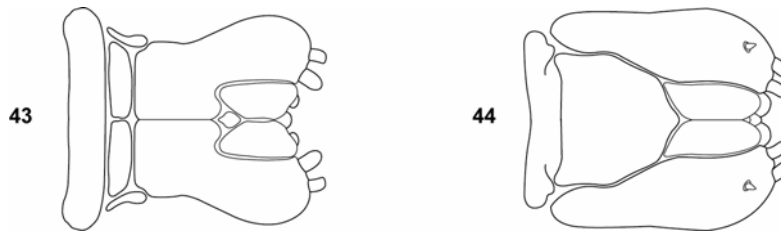


圖. -,43 Julida顎唇板 (1930,Attems之後). 圖.44.- Spirostreptida,顎唇板 (1930,Attems之後)

15B 顎唇板的側片在中間線相接 (圖39) ; 可能需要將頭部從軀幹上拔下來才容易看 (詳見引言部分) ; 雄性成體第一對步足短且呈勾狀 (如圖1) , 或是變得很大作為抱合器; 生殖肢凹陷於第七體節外骨骼內; 新的標本在體節最末端的邊緣有一輪的剛毛; 分布於北美洲到巴拿馬, 歐洲,****, 亞洲則分布於喜馬拉亞雅山以北, 東南亞
 Side pieces of gnathochilarium meet at midline (Fig. 43); it may be necessary to detach the head from the trunk, see introduction); first pairs of legs in males short and hook-like (Fig. 6), or enormously enlarged as claspers; fresh specimens with 'whorl or fringe of setae' (Fig. 6) at the hind margins of body rings; North America to Panama, Europe, Asia north of the Himalayas, SE Asia..... **Julida**