

## On the Megalopae of Three Species of Crab (Crustacea: Decapoda: Brachyura: Calappidae, Matutidae) from Tungkang, Southwestern Taiwan

Wen-Jou Chen<sup>1</sup>, Jin-Hua Cheng<sup>2</sup>, and Keryea Soong<sup>1</sup>

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### ABSTRACT

From July 1993 to April 1995, crab megalopae were collected monthly from the coast of Tungkang, southwestern Taiwan. The crab megalopae of two genera and three species are described for the first time from Taiwan, viz. *Calappa philargius*, *C. lophos* (Calappidae); and *Matuta victor* (Matutidae). The morphological characteristics of these larvae are described in detail with text and figures.

**Key word:** crab larvae, megalopa, Calappidae, Matutidae, Brachyura, Tungkang, Taiwan.

### INTRODUCTION

Four genera of box crabs (Calappidae) and three genera of moon crabs (Matutidae) are currently known from Taiwan (Lin, 1949; Sakai, 1976; Dai and Yang, 1991; Ng and Huang, 1997; Tan *et al.*, 2000; Ng *et al.*, 2001). All these records are based on adult specimens. The larval stages, however, are not yet known. From July 1993 to April 1995, megalopal stages of two species of calappids (*Calappa philargius*, *C. lophos*) and one genus of matutid (*Matuta victor*) were obtained from off the coast of Tungkang in southwestern Taiwan. The morphology of these megalopae are here described in detail and figured for the first time.

### MATERIALS AND METHODS

From July 1993 to April 1995, crab megalopae were collected monthly from the coast of Tungkang area in southwestern part of Taiwan. They were transferred to laboratory, sorted and reared in 24 polystyrene cell wells until the second juvenile stage, changed to rear in larger aquarium. Water was changed daily, the crab megalopae were fed on recently hatched *Artemia nauplii* and the juvenile crab were fed little shrimp until they grew big enough to be identified. The undissected megalopae were preserved in 10% formalin and kept in Tungkang Marine laboratory, Tungkang, Pingtung, Taiwan, R.O.C.. The

<sup>1</sup>Institute of Marine Biology, National Sun Yat-sen University, Kaohsiung, Taiwan 804, R.O.C.

<sup>2</sup>Tungkang Marine Laboratory, Tungkang, Pingtung, Taiwan 928, R.O.C.

megalopal exuviae were collected for measurement, dissecting and to check the setation of appendages with Olympus ZSH10 dissecting microscope which equipped with camera lucida and drawing tube. All setae counts were proximal to distal and more 5 samples of every species were identified. The following abbreviations are used: CL = carapace length from frontal margin to posterior carapace border; CW = carapace width measured at the widest part of carapace; FW = frontal width measured at the widest part of frontal margin; P1-P5 = pereopods 1-5; PL1-PL5 = pleopods 1-5 (Wear and Fielder, 1985; Chen, 1995; Montu et al., 1996).

## RESULTS

### Main Morphological Characteristics of Megalopa

#### Family Calappidae De Haan, 1833

Carapace flattened; chelipeds prominently large, stout, longer than any other pereopods, which can cover all mouthparts; antenna 10-11 segmented; dactyl of P5 with long subterminal hooked setae. Sometimes with transparently oil droplets inside carapace when examined fresh.

#### Genus *Calappa* Weber, 1795

This genus contains 10 species in Taiwan (Lin, 1949; Ng *et al.*, 2001), but only *C. philargius* and *C. lophos* are collected as megalopae. The main morphological characteristics are: Body flattened, transparent; antenna 11-segmented; exopod of third maxilliped segmented; dactyls of P2-5 long, styliform, terminally tapering; chelipeds prominently large, stout, inner margin of dactyl with strongly granules or pyramidal process. Living specimens with body transparent, with big oil droplets internally when viewed dorsally.

**Carapace** (Fig.1. A, B): CL: 3.4mm; CW: 2.3mm.  $CL/CW=3/2$ ,  $FW/CW=0.46$ . Body flat, dorsal surfaces of carapace smooth without setae, spines and prominent tubercles; globose on posterior part, narrowing to frontal part, median region slightly depressed; rostrum short, directed anteroventrally, with slight median wrinkle; posterolateral margin of mesobranchial region granulated; posterior margin straight.

**Antennule** (Fig.1. C): Peduncle 3-segmented with 2 setae on second segment and 2 lateral spines on third segment. Exopod 4-segmented with numerous aesthetascs arranged in 3 tiers on segment 1,2, 3 respectively and 1 terminal and 1 subterminal setae on fourth segment; endopod 2-segmented with 2 terminal and 1 subterminal setae on second segment.

**Antenna** (Fig.1. D): 11-segmented, setation 4,1,0,0,0,2,0,3,1,2,4.

**Mandible** (Fig.1. E): Symmetrical, semicircular, incisor process inner margin divided faintly into 4 parts; palp 2-segmented, setation 7,13.

*Calappa philargius* (Linnaeus, 1758)  
(Fig.1 A-M)

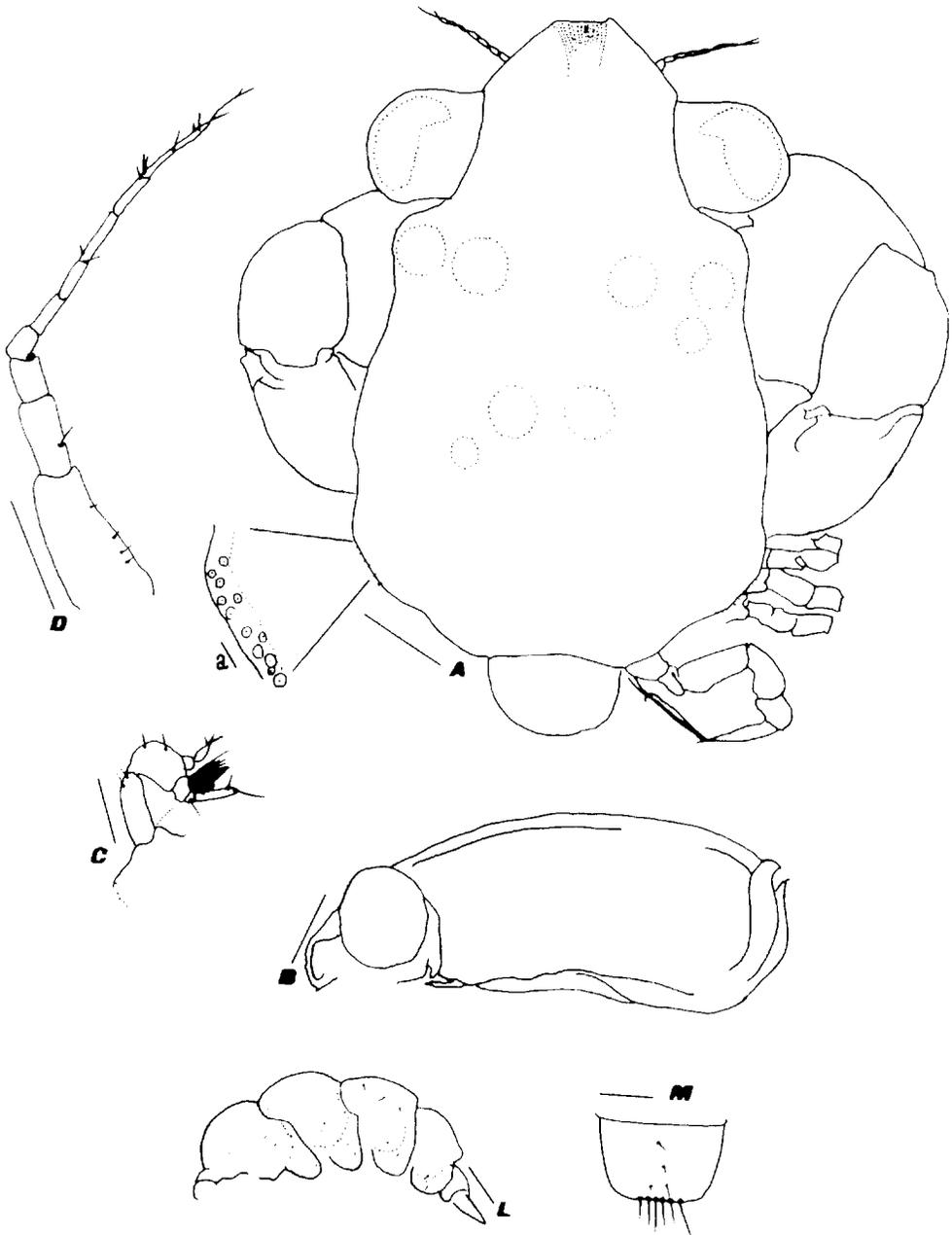


Figure 1a. *Calappa philargius* (Linnaeus, 1758), megalopa stage.

A, whole megalopa from dorsal aspect; B, carapace from lateral aspect; C, antennule;

D, antenna; L, abdomen from lateral aspect; M, telson.

Scale: A, B=0.5mm C, D, L, M 0.25mm a=0.05mm.

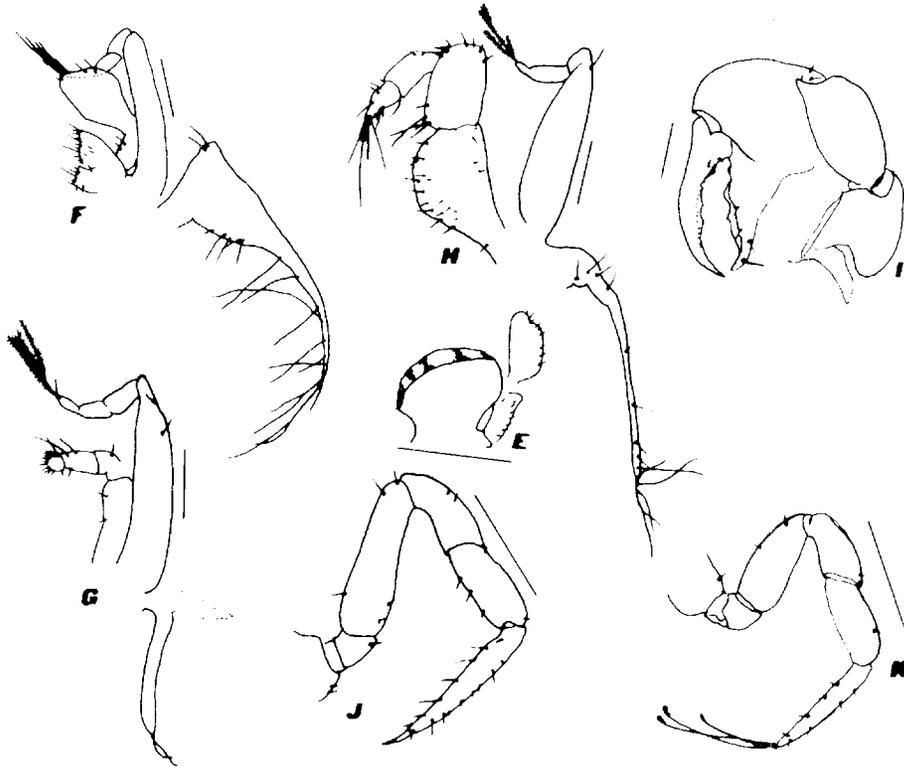


Figure 1b. *Calappa philargius* (Linnaeus, 1758), megalopa stage.

E, mandible; F, first maxilliped, G, second maxilliped; H, third maxilliped; I, cheliped; J, perciopod 2; K, perciopod 5.

Scale: E, F, G, H, J, K =0.25mm I=0.5mm.

**Maxillule:** Protopod with 2 simple setae; basal endite with 20 spines.

**Maxilla:** Endopod with 3 simple setae; basal endite bilobed with 4,9 spines/setae; coxal endite bilobed with 6,3 spines/setae; scaphognathite with 90 plumose setae.

**Maxilliped 1** (Fig.1. F): Exopod 3-segmented, setation 0,0,6; endopod unsegmented with 2 lateral and 4 terminal setae; basal endite with 22 setae; coxal endite with 7 setae; epipod triangular with 15 long setae; protopod covered with 2 long setae.

**Maxilliped 2** (Fig.1. G): Exopod 3-segmented, setation 1,0,6; endopod 4-segmented, setation 2,1,8,9; epipod with 5 long setae.

**Maxilliped 3** (Fig.1. H): Exopod 3-segmented, setation 1,0,6. Endopod 5-segmented, quadrangular-like merus inner margin with 5 setae, outer terminal upper margin with 7 setae; ischium subterminal inner margin broadly with 12 setae, proximal narrowing remarkably some smaller simple setae; epipod with 10 long setae; protopod covered with 5 sparsely plumose setae.

**Pereiopods** (Fig. 1. I, J, K): Chelipeds symmetrical, large, movable finger tapering, proximal inner margin with one remarkably protuberant teeth, one simple setae; immovable finger inner margin with 4 pyramidal teeth, special the second is largest, stout, the terminal outer margin with 1 long simple setae. P2-P4 are similar, covered with setae; dactyl with 6 ventral spines, 3 dorsal spines and 1 terminal spine. P5 styliiform; dactyl with one terminal sharp spine, 3 long subterminally hooked setae, 4 dorsal simple setae, 4 ventral spines, 2 simple setae.

**Abdomen** (Fig. 1. L): 6 somites, all with sparse setae. Segments 2-5 with posterolateral margin roundly; segment 6 narrower than others.

**Pleopods:** 5 pairs, exopod of PL1-4 setations 21-24; endopods with 2-4 hooked setae. PL5 2-segmented, exopod with 16 plumose setae, outer margin of protopod with 1 plumose seta; without endopod.

**Telson** (Fig. 1 M): Subquadrate, broader than long, angles rounded, with 4 dorsal setae and 6 setae on posterior margin.

*Calappa lophos* (Herbst, 1782)  
(Fig.2. A-M)

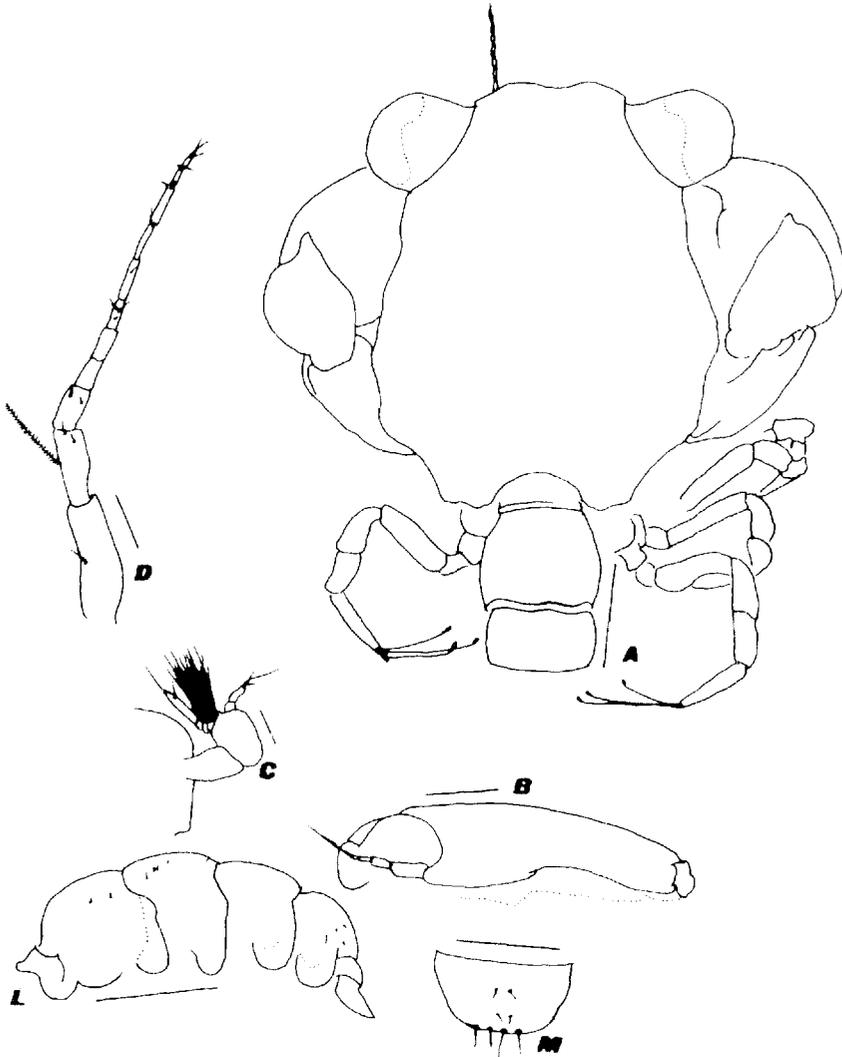


Figure 2a. *Calappa lophos* (Herbst, 1782), megalopa stage.

A, whole megalopa from dorsal aspect; B, carapace from lateral aspect; C, antennule;  
D, antenna; L, abdomen from lateral aspect; M, telson.

Scale: A, B, L=0.5mm C, D=0.01mm M=0.25mm.

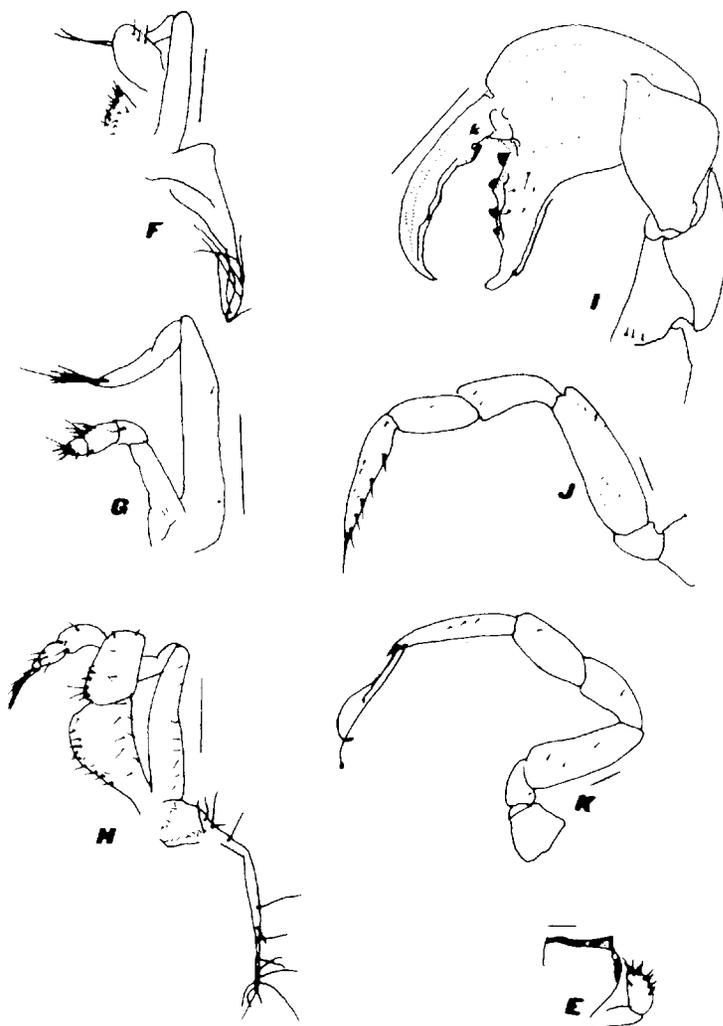


Figure 2b. *Calappa lophos* (Herbst, 1782), megalopa stage.

E, mandible; F, first maxilliped; G, second maxilliped; H, third maxilliped; I, cheliped; J, pereopod 2; K, pereopod 5.

Scale: E=0.05mm, F, G, H=0.25mm I=0.5mm J, K=0.01mm.

**Carapace** (Fig.2. A, B): CL: 1.9mm; CW: 1.7mm. CL/CW=1.11; FW/CW=0.42. Body flat, dorsal surfaces smooth, without prominent tubercles; median part of frontal region slightly concave; rostrum short, directed anteroventrally; postero-medial margin of intestinal region depressed; outer margin of mesobranchial region relatively broader.

**Antennule** (Fig.2. C): Peduncle 3-segmented, glabrous; exopod 4-segmented with numerous aesthetascs arranged in 3 tiers on segment 1,2,3 respectively and 1 terminal and 1 subtermi-

nal setae on fourth segment; endopod 2-segmented with 3 terminal and 1 subterminal simple setae on second segment.

**Antenna** (Fig.2. D): 11-segmented, setation 1,3,2,0,0,3,1,2,2,2,3; especially segment 2 with 1 long plumose seta.

**Mandible** (Fig.2. E): Symmetrical, subquadrate, incisor process with inner margin divided faintly 4 parts, terminal part pyramidal; palp 2-segmented, setation 0,10.

**Maxillule**: Endopod bald; basal and coxal endite with 23,13 spines respectively.

**Maxilla**: Endopod finger-like, glabrous; basal endite bilobed with 5,9 spines/setae; coxal endite bilobed with 5,2 spines/setae; scaphognathite with 76 plumose setae.

**Maxilliped 1** (Fig.2. F): Epipod triangular, with 14 long setae; exopod 2-segmented, setation 0,4; endopod unsegmented, terminal remarkably broad with 3 setae; basal endite with 24 setae.

**Maxilliped 2** (Fig.2. G): Exopod 3-segmented, but segment 2-3 poorly indicated, setation 2,0,5; endopod 4-segmented, setation 4,1,8,8.

**Maxilliped 3** (Fig.2. H): Exopod 3-segmented, terminal segment with 4 long setae, outer margin of proximal segment with a tier of 11 simple setae. Endopod 5-segmented, merus quadrangular-like, inner margin with 7 setae, outer terminal upper margin with 3 setae; ischium medial region with 2 tiers of simple setae, subterminal inner margin broad, with 14 setae, proximal part narrowing prominently; epipod with 11 long setae; protopod covered with many tiers of setae.

**Pereiopods** (Fig.2. I, J, K): P1-P5 all covered with sparse short setae. Chelipeds unsymmetrical, right bigger than left; right cheliped big and strong. Movable finger hook-like, inner margin with 3 globose teeth, special proximal one larger; immovable finger inner margin with 2-3 simple setae, 4 globose teeth, first and second especially larger and stouter. P2 - P4 similar, dactyl with 5-6 ventral spines and 1 distal spine. P5 styliform, dactyl with 1 terminal sharp spine, 3 long subterminally hooked setae.

**Abdomen** (Fig.2. L): 6 somites, with sparse short setae. Segments 2-5 with posterolateral margin roundly; segment 2 prominently bigger than the other.

**Pleopods**: 5 pairs, exopod of PL1-4 setose 18-20; endopod with 3 hooked setae. PL5 2-segmented, exopod with 14 plumose setae, outer margin of protopod with 1 plumose seta; without endopod.

**Telson** (Fig.2. M): Rounded, with 4 dorsal setae and 4 setae on posterior margin.

### Family Matutidae De Haan, 1833

#### Genus *Matuta* Weber, 1795

This genus contains two species in Taiwan (Lin, 1949; Ng *et al.*, 2001), but only *M. victor* has collected as megalopa. The main morphological characteristics are: Body pigmented in life, hepatic region with lateral margin convex; antenna 10-segmented; exopod of third maxilliped unsegmented;

dactyls of second pereiopods blade-like. Chelipeds are prominently large, stout, inner margin of dactyl with strongly pyramidal processes; inner margin of merus with granule.

***Matuta victor* (Fabricius, 1781)**

(Fig.3. A-N)

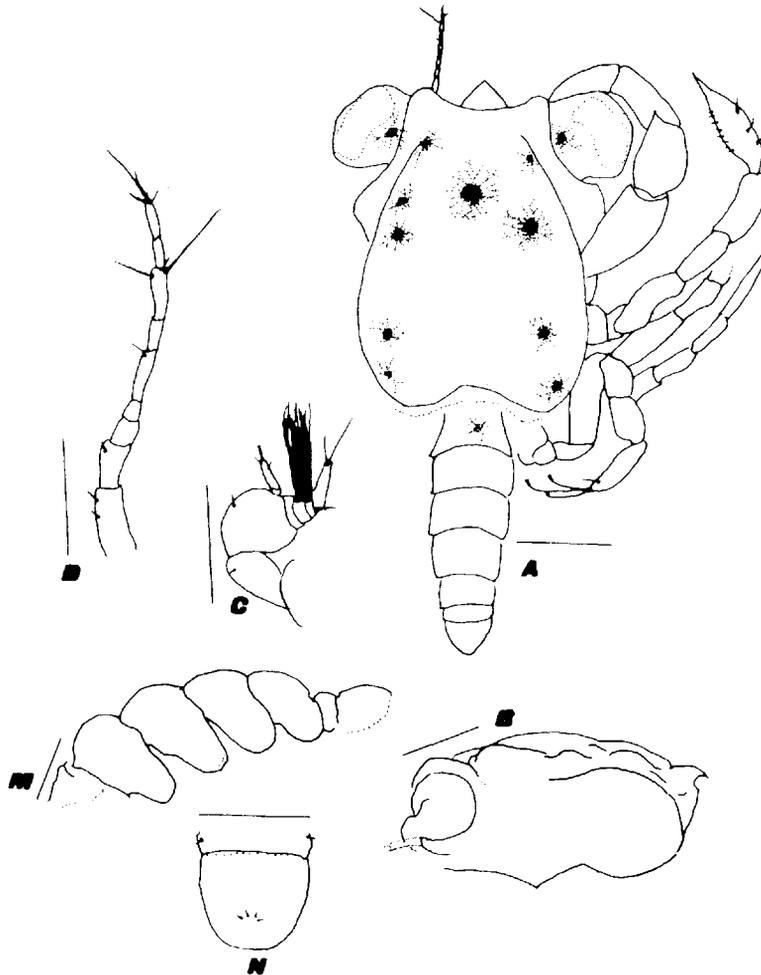


Figure 3a. *Matuta victor* (Fabricius, 1781), megalopa stage.

A, whole megalopa from dorsal aspect; B, carapace from lateral aspect; C, antennule;  
D, antenna; M, abdomen from lateral aspect; N, telson.

Scale: A, B 0.5mm C, D, M, N=0.25mm.

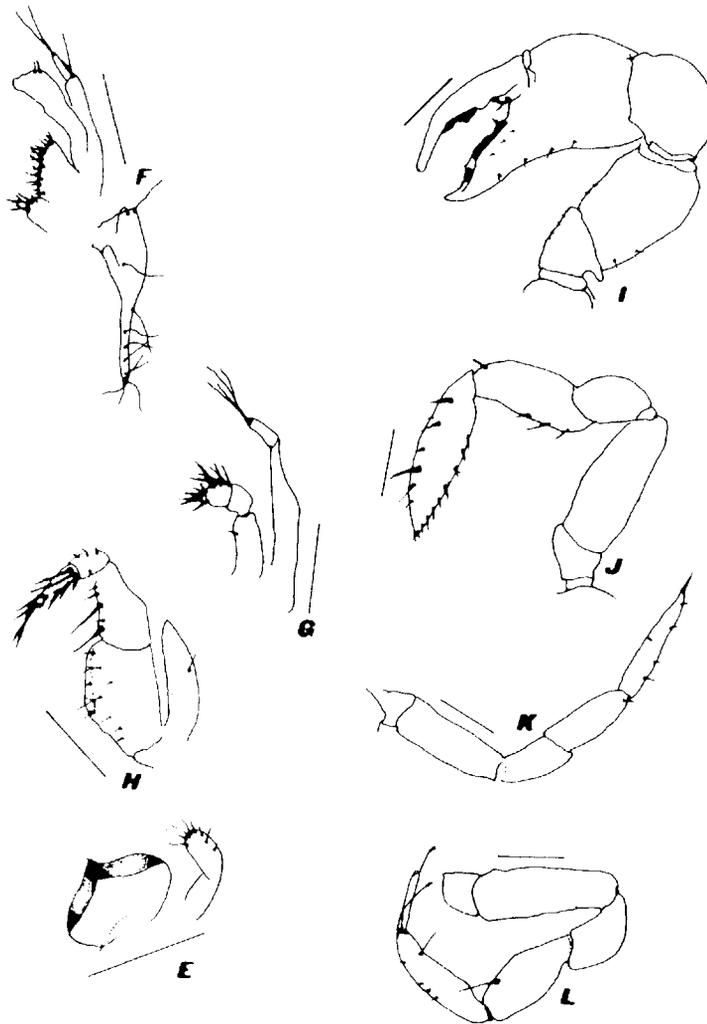


Figure 3b. *Matuta victor* (Fabricius, 1781), megalopa stage.

E, mandible; F, first maxilliped; G, second maxilliped; H, third maxilliped; I, cheliped;

J, perciopod 2; K, perciopod 4; L, perciopod 5.

Scale: E-L=0.25mm.

**Carapace** (Fig.3. A, B): CL: 1.7mm; CW: 1.4mm; CL/CW=1.21; FW/CW=0.5. Surfaces of carapace uneven, with lateral and median undulations; median part of frontal region rounded, slightly depressed; rostrum short, triangular bent; postero-medial margin of intestinal region rounded, depressed; frontal part of carapace star-shaped in dorsal aspect; outer margin of mesobranchial region smooth, rounded.

**Antennule** (Fig.3. C): Peduncle 3-segmented, setation 0,1,1; exopod 4-segmented with many aesthetascs

arranged in 3 tiers on segment 1,2,3 respectively, 1 terminal and 1 subterminal setae on fourth segment, 1 terminal seta on third segment; endopod 2-segmented with 2 terminal and 2 subterminal simple setae on second segment.

**Antenna** (Fig.3. D): 10-segmented, setation 2,1,0,0,1,0,3,0,3,2; specially segment 5,7,10 with 1 long simple seta.

**Mandible** (Fig.3. E): Symmetrical, incisor process median part pyramidal; palp 2-segmented, setation 0,8.

**Maxilla**: Endopod 2-segmented but not distinct, proximal part broad, with 3 setae; basal endite bilobed with 7,7 spines/setae; coxal endite bilobed with 8,2 spines/setae; scaphognathite with 49 plumose setae.

**Maxilliped 1** (Fig.3. F): Epipod similarly triangular, with 12 long setae; exopod 2-segmented, setation 2, 2; endopod unsegmented, terminal remarkably broad with 2 setae; basal and coxal endites with 21, 7 setae respectively.

**Maxilliped 2** (Fig.3. G): Epipod with 4 long setae; exopod 2-segmented, setation 0,4; endopod 4-segmented, setation 1,1,5,7.

**Maxilliped 3** (Fig.3. H): Exopod unsegmented, outer margin a small simple seta. Endopod 5-segmented, merus inner margin with 5 setae, outer terminal margin declined glabrous; ischium inner region with 11 spines/setae, outer margin smooth baldly; dactyl, propodus and carpus with numerous long spines/setae; epipod with 4 long setae.

**Pereiopods** (Fig.3. I, J, K, L): Chelipeds symmetrical, large, strong; ischium with 1 ischial spine, 3 granule, 2 simple setae; inner margin of merus with 2 granule, 2 small setae; movable finger tapering, inner margin with uneven teeth; immovable finger inner margin with some setae and 3 uneven teeth, median especially larger, stouter; the joint of fingers with a bundle of setae; inner margin of propodus with a row of setae. P2-P3 similar, dactyl blade-like, with 9 ventral spines, 3 small simple setae and 3 dorsal long setae, 4 small setae, 1 distal spine; inner margin of propodus with 3 spines. P4 dactyl styliform, with 1 terminal sharp spine, 2 ventral setae 4 dorsal setae. P5 dactyl long-finger type, with 3 long subterminally hooked setae, 1 long setae and 4 dorsal setae; medial inner margin of propodus broadly, nearing dactyl with 1 long seta.

**Abdomen** (Fig.3. M): 6 somites; segments 2-5 smooth, glabrous, posterolateral margin rounded.

**Pleopods**: 5 pairs, exopod of PL1-4 setations 15-18; endopods with 3-4 hooked setae. PL5 2-segmented, exopod with 10 plumose setae, outer margin of protopod with 1 plumose seta; without endopod.

**Telson** (Fig.3. N): Semi-rounded, with 4 dorsal setae, no setae on posterior margin.

**Colour**: Body blackish-yellow, cardio-metagastric region distinctly yellow, appendages dark red.

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## 臺灣西南部東港沿岸三種蟹類之大眼幼體之記錄

陳溫柔<sup>1</sup>、鄭金華<sup>2</sup>、宋克義<sup>3</sup>

<sup>1</sup>高雄縣立大灣國中

<sup>2</sup>行政院農委會水產試所東港分所

<sup>3</sup>國立中山大學海洋生物研究所

### 摘 要

從1993年7月到1995年4月，於臺灣西南方，東港沿岸，進行蟹類大眼幼體定期撈捕、室內飼養、鑑定。其中饅頭蟹科 Calappidae 有二種之大眼幼體，即饅頭蟹屬 *Calappa* 的逍遙饅頭蟹 *C. philargius*、卷折饅頭蟹 *C. lophos* 和另一種之大眼幼體為黎明蟹科 Matutidae 的頑強黎明蟹 *M. victor* 被記錄。這些種類之大眼幼體最大特徵乃個體扁平、螯足粗大如成蟹般，顯著大於各步足。本篇報告亦描述了科、屬特徵，也繪製外表輪廓圖供參考。

**關鍵字：**蟹苗、大眼幼體、饅頭蟹科、黎明蟹科、甲殼類、東港鎮、臺灣沿海。