

Three Species of Sea Lice (Copepoda: Caligidae) Parasitic on Marine Fishes of Taiwan

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(Received, September 10, 2003; Revised, November 1, 2003; Accepted, December 5, 2003)

ABSTRACT

Three species of sea lice belonging to three genera of the Caligidae (Siphonostomatoida) were recovered from three species of marine fishes landed at Da-Hsi Fishing Port located on the northeast coast of Taiwan. They are: *Anuretes quadrilaterus* Shiino, 1954 from *Zenopsis nebulosus* (Temminck & Schlegel); *Caligus digitatus* n. sp. from *Thyrsitoides marleyi* Fowler; and *Lepeophtheirus exilipes* n. sp. from *Caelorinchus japonicus* (Temminck & Schlegel). This report represents the second sighting of *A. quadrilaterus*. The new species *C. digitatus* is characteristic in having a relatively large genital complex and abdomen, spatula-like tines on the sternal furca, and 2-segmented exopod of leg 4 carrying a digital process at the base of each of the four outer spines. The other new species, *L. exilipes*, is distinguished by the possession of a broad genital complex with a small abdomen, a forked maxillule with equal size tines, and slender leg 4 with the 3-segmented exopod distinctly longer than the protopod.

Key words: sea lice, Caligidae, parasitic copepods, marine fishes, Taiwan.

INTRODUCTION

Although more than 100 fishing ports are known in Taiwan, not many of them harbor vessels equipped for catching deep-water fishes. Da-Hsi Fishing Port in I-Lan County located on the northeast coast of the island is one of the few such fishing ports where catches from deep-water fishing ground are landed almost daily. On our recent collecting trip to this fishing port, we found three species of sea lice parasitic, respectively, on three species of deep-water fishes: mirror dory [*Zenopsis nebulosus* (Temminck & Schlegel)], black snook (*Thyrsitoides marleyi* Fowler), and Japanese grenadier [*Caelorinchus japonicus* (Temminck & Schlegel)] caught from the deep water off the northeastern coast of

Taiwan.

In our past ten years of studies on the parasitic copepods of marine fishes of Taiwan, 44 species of sea lice (Caligidae, Siphonostomatoida) were recovered from 76 species of fish, but they were all epipelagic or shallow-water demersal fish. Thus, it is not surprising to find that the above-mentioned three species of sea lice from the deep-water fishes turned out to be new to Taiwan, with two of them also new to science. In this paper we report the results of our studies on these three species of sea lice.

MATERIALS AND METHODS

Host fishes landed at Da-Hsi Fishing Port of I-Lan County were purchased, kept in an icebox, and transported to the

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laboratory of the Crab Museum in the vicinity of the fishing port for examination of the copepod parasites. The parasites removed from the fish hosts were preserved in 70% ethanol. They were later cleared in 85% lactic acid for 1 to 2 hours before making dissection in a drop of lactic acid on a wooden slide under the dissection microscope (Humes and Gooding, 1964). The removed body parts and appendages were examined in a drop of lactic acid under the compound microscope with a series of magnification up to $\times 1,500$.

All drawings were made with the aid of a camera lucida. Measurements of the body and body parts were taken after the specimens were cleared in lactic acid. Identification of the fishes was based on the information provided in Shen (1993) and Shao (1996). Scientific names as well as the common names of the host fishes followed those adopted in Froese and Pauly (2002).

RESULTS

Order Siphonostomatoida Thorell, 1859 Family Caligidae Burmeister, 1934 Genus *Anuretes* Heller, 1865

Anuretes quadrilaterus Shiino, 1954
(Figs. 1-2)

Material examined: 2 ♀♀ on body surface by gill cavity of a mirror dory, *Zenopsis nebulosus* (Temminck & Schlegel), landed at Da-Hsi Fishing Port of I-Lan County on 27 June 2003.

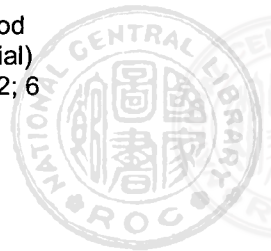
Female: Body (Fig. 1A) 5.62 (5.56-5.68) mm long, excluding setae on caudal rami. Cephalothoracic shield (Fig. 1A) suborbicular, 3.85 (3.80-3.90) \times 3.79 (3.78-3.80) mm, excluding frontal and lateral, hyaline membranes. Fourth pediger (Fig. 1A) narrow, 4.6 times wider than long, 0.2 \times 0.93 (0.92-0.94) mm. Genital complex (Fig. 1A) subrectangular, 1.47 (1.46-1.48) \times 2.15 (2.10-2.20) mm, distinctly wider than long and with rounded corners. Abdomen (Fig. 1A) small, 0.21 (0.20-0.22) \times 0.30 (0.29-0.31) mm, 1-segmented and wider than long. Caudal ramus (Fig. 1G) shaped

unusually, with narrow base and broad tip, measuring 0.14 \times 0.13 (broadest width) mm and equipped with usual number of 6 plumose setae. Egg sacs (Fig. 1A) broken, exact length and number of eggs unknown.

Antennule (Fig. 1B) 2-segmented; proximal segment with 1 tooth-like element on anterior margin proximal to the setae and 2 similar teeth on posterodistal corner, in addition to 25 pilose and 2 simple setae on anterodistal surface; distal segment slender, about 6.5 times longer than wide, and armed with 1 subterminal seta on posterior margin and 11 setae plus 2 aesthetascs on distal margin. Antenna (Fig. 1C) 3-segmented; proximal segment ring-like, with posteromedial corner protruded into a sharply pointed process; middle segment subrectangular and unarmed; distal segment a large claw with robust seta in basal region and slender seta in middle region. Basal part of postantennal process (Fig. 1C) carrying 2 papillae with each bearing 2 setules, another similar but isolated papilla on nearby sternum. Mandible as usual, 4-segmented and with 12 teeth on medial margin of distal blade. Maxillule (Fig. 1C) comprising sharply pointed dentiform process and basal papilla armed with 3 tiny and naked setae. Maxilla (Fig. 1D) 2-segmented and slender; proximal segment (lacertus) unarmed; distal segment (brachium) attenuated terminally and bearing subterminal hyaline membrane on outer edge and 2 unequal, terminal elements, short canna and long calamus. Maxilliped (Fig. 1E) with large, long, unarmed corpus; subchela about one-half length of corpus; terminal claw longer than shaft and bearing basal seta. Sternal furca (Fig. 1F) with divergent, bluntly pointed tines.

Armature of rami of legs 1-4 as follows (Roman numerals indicating spines and Arabic numerals, setae):

| | Exopod | Endopod |
|-------|--------------------|-------------|
| Leg 1 | 1-0; III, 1, 3 | (vestigial) |
| Leg 2 | I-1; I-1; II, I, 5 | 0-1; 0-2; 6 |



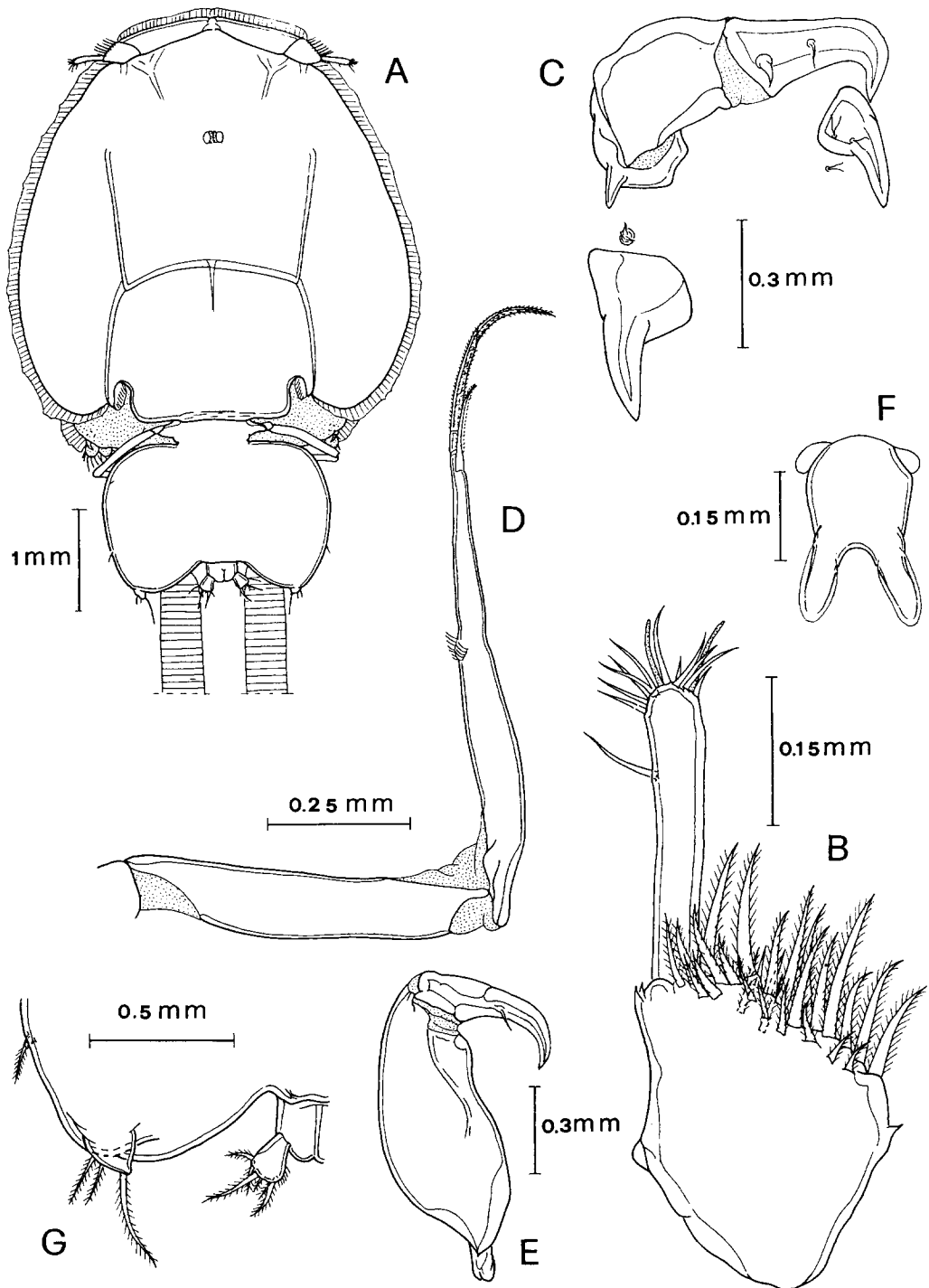
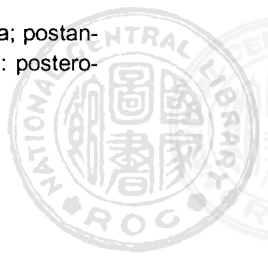


Fig. 1. *Anuretes quadrilaterus* Shiino, female. A: habitus, dorsal; B: antennule; C: antenna; postantennal process and maxillule, ventral; D: maxilla; E: maxilliped; F: sternal furca; G: postero-lateral area of genital complex showing leg 5, ventral.



| | | |
|-------|-----------|----------|
| Leg 3 | I-1; IV,5 | 0-0; 6 |
| Leg 4 | I-0; III | (absent) |

Leg 1 (Fig. 2A) protopod with short, outer plumose seta and another similar, inner, plumose seta; vestigial endopod bearing 1 subterminal and 2 terminal, minute setae; first segment of exopod with row of long setules on posterior edge and small, spiniform seta in anterodistal corner; inner 2 of 3 terminal elements on last segment of exopod with accessory process, plumose setiform element originated at base of innermost terminal element (Fig. 2B); 3 large plumose setae on posterior surface of this segment. Leg 2 (Fig. 2C) coxa small, with spinule bearing papilla on ventral surface and large, plumose inner seta on postero-outer margin; basis with small, naked outer seta in addition to a posterior, marginal setule on ventral surface and a long, narrow membrane on posterior margin; outer edges of both basis and first exopodal segment fringed with large marginal membrane; outer spine on middle segment of exopod bipectinate (see inserted drawing). Leg 3 (Fig. 2D) protopod (apron) armed with short, plumose, outer seta and long, plumose, inner seta in addition to a membrane on outer and another one on posterior edges; additionally, 2 marginal setules with each close to either end of posterior membrane. Outer margin of protopod proximal to marginal membrane corrugated. Leg 4 (Fig. 2E) slender; protopod with small, plumose outer seta; pectens on second exopodal segment at bases of each of 3 terminal spines. Leg 5 (Fig. 1G) represented by a small papilla and a small protrusion on posteroventral surface of genital complex, with the former tipped with 1 small, plumose seta and the latter, 2 short and 1 long setae.

Male: Not found.

Remarks: This species is so far known only from Japan parasitic on the same species of dory as in Taiwan. It has not been sighted since Shiino's (1954) original discovery. A close comparison with Shiino's (1954) description of *A.*

quadrilaterus revealed that the specimens from Taiwan differs from it in having accessory process on both terminal elements II and III on the exopod of leg 1. However, we consider the lack of an accessory process on the terminal element III (Shiino's Fig. 4B) is an over-look and not a genuine representation.

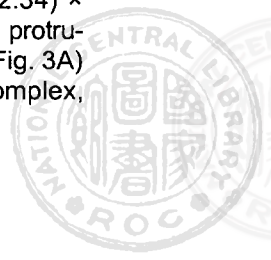
This is the third species of *Anuretes* known from Taiwan. It differs from *A. grandis* Ho & Lin, 2000, a parasite of painted sweetlips [*Diagramma pictum* (Thunberg)], in having the fourth pediger exposed in dorsal view (not covered by free margin of cephalothoracic shield), lacking a maxillary whip, long and slender distal segment of the antennule, and long and slender protopod and exopod on leg 4. It is also easily distinguished from the other species known from Taiwan (Lin and Ho, 2002), *A. branchialis* Rangnekar, 1953, a parasite of silver moony [*Monodactylus argenteus* (Linnaeus)], in having the fourth pediger exposed in dorsal view, a genital complex distinctly narrower than the cephalothoracic shield, a large postantennal process, 6 (instead of 2) setae on the terminal segment of the endopod of leg 3, and long and slender protopod and exopod on leg 4.

Genus *Caligus* Müller, 1785

Caligus digitatus n. sp.
(Figs. 3-4)

Material examined: 2 ♀♀ in oral-gill cavities of a black snoek, *Thyrsitoides marleyi* Fowler, landed at Da-Hsi Fishing Port of I-Lan County on 26 June 2003.

Female: Body (Fig. 3A) large, 7.21 (7.08-7.34) mm long, excluding setae on caudal rami. Cephalothoracic shield (Fig. 3A) suborbicular, 3.85 (3.80-3.90) × 3.33 (3.32-3.34) mm, excluding frontal and lateral, hyaline membranes. Fourth pediger (Fig. 3A) wider than long, 0.37 (0.36-0.38) × 1.03 (1.00-1.06) mm. Genital complex (Fig. 3A) subquadrate, 2.10 (1.86-2.34) × 2.05 (1.78-2.32) mm, with posterior protrusion on both corners. Abdomen (Fig. 3A) nearly one-half size of genital complex,



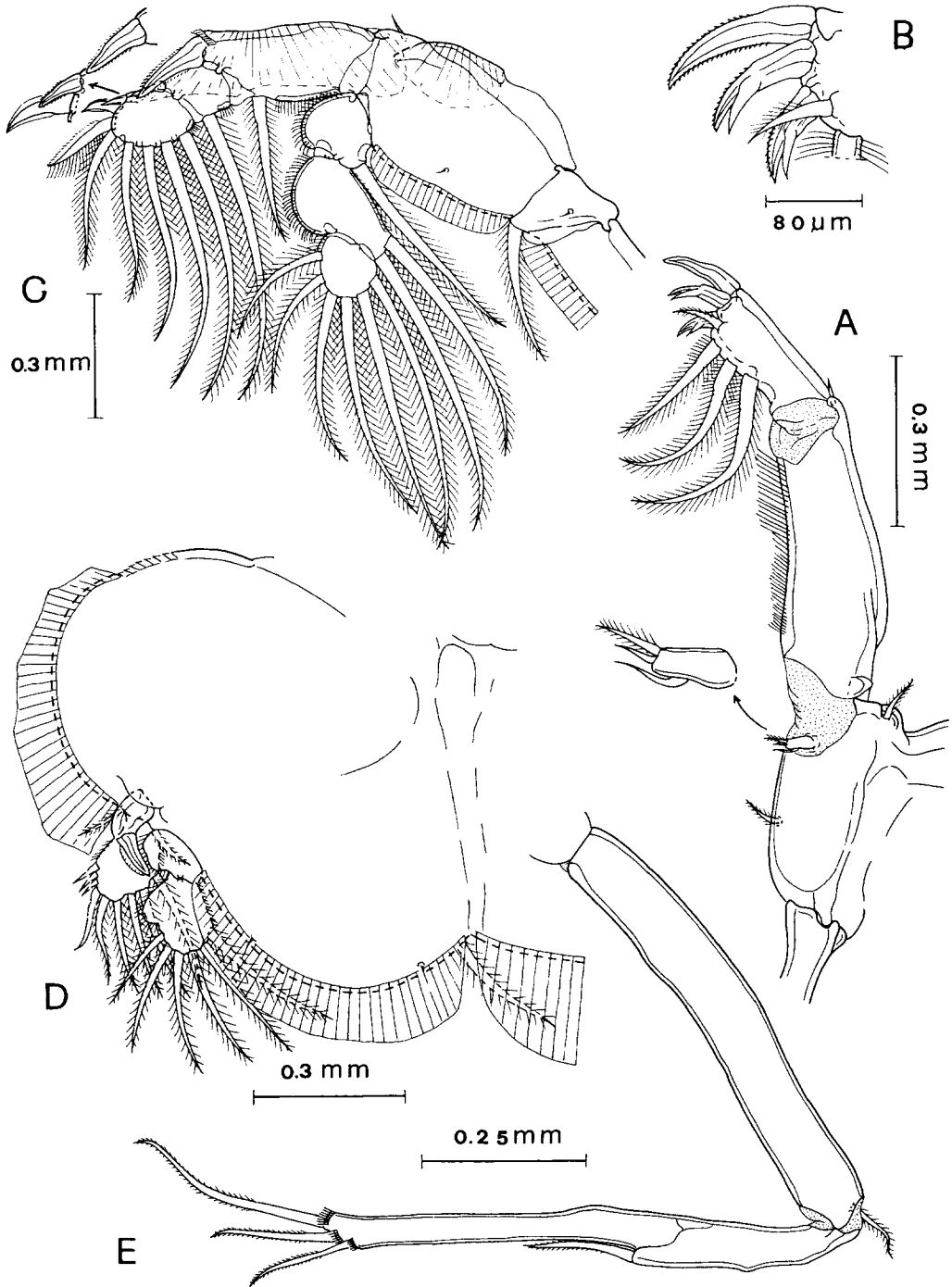


Fig. 2. *Anuretes quadrilaterus* Shiino, female. A: leg 1; B: tip of exopod of leg 1; C: leg 2; D: leg 3; E: leg 4.



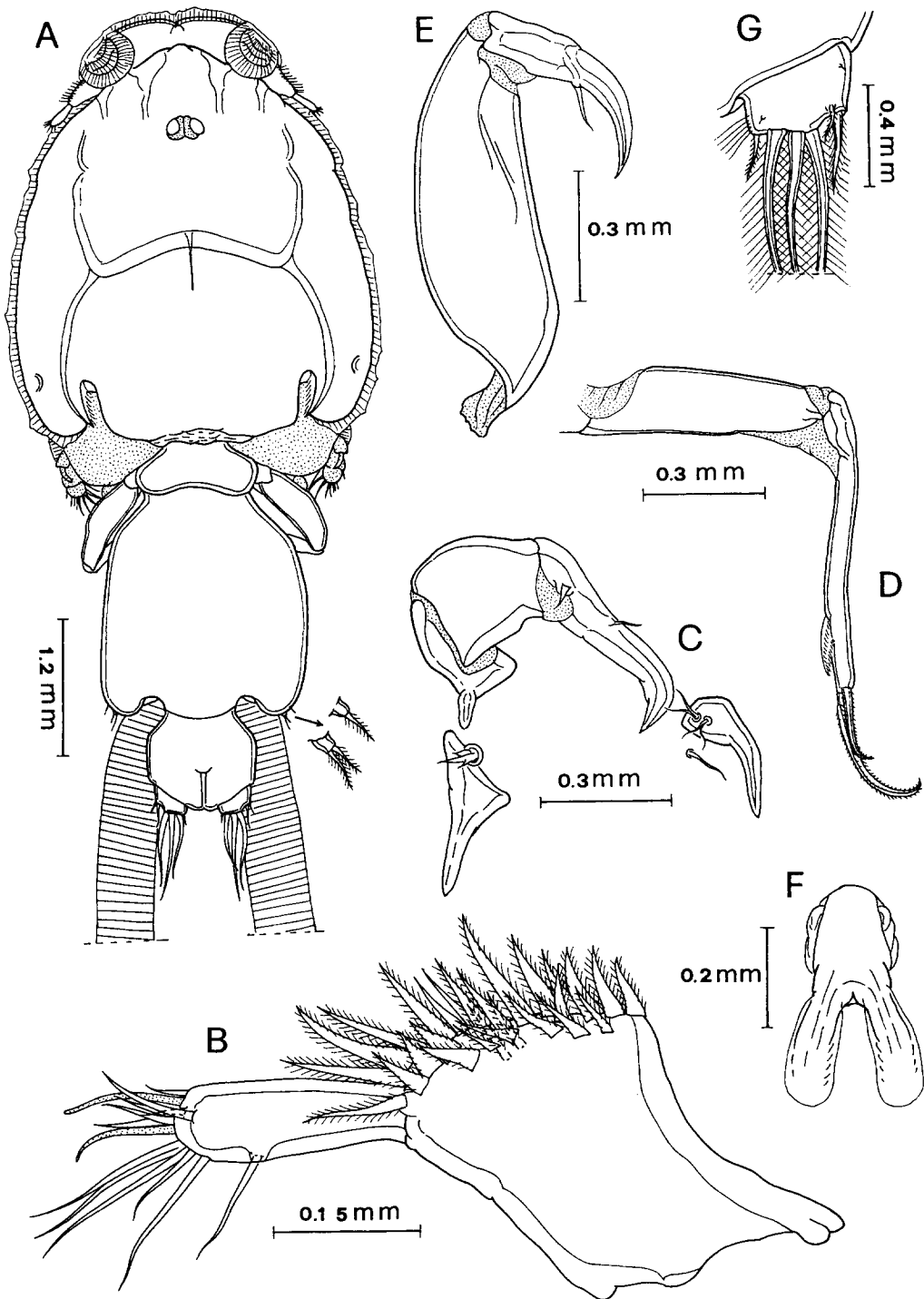


Fig. 3. *Caligus digitatus* n. sp., female. A: habitus, dorsal; B: antennule; C: antenna; postantennal process and maxillule, ventral; D: maxilla; E: maxilliped; F: sternal furca; G: caudal ramus, ventral.

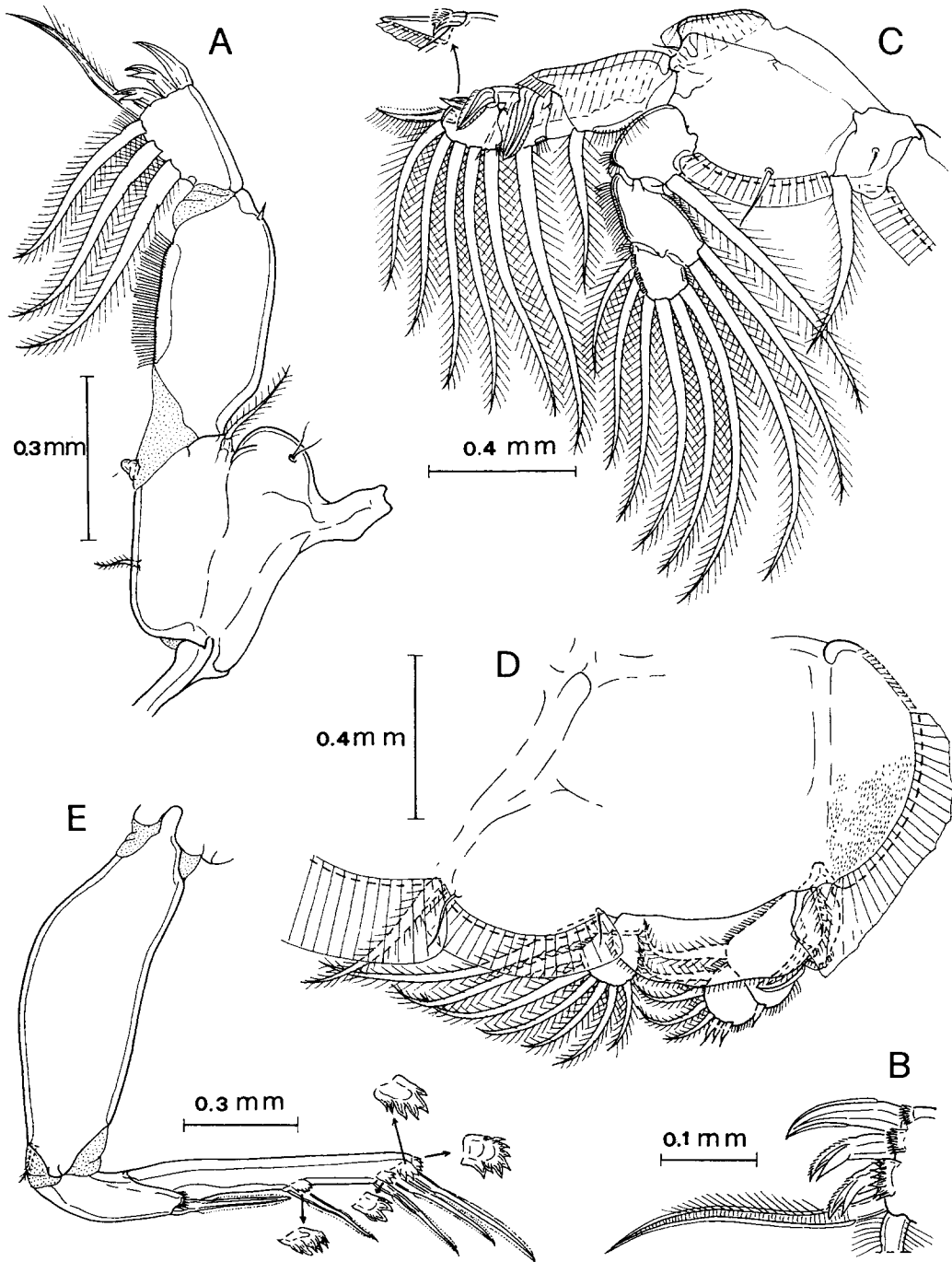


Fig. 4. *Caligus digitatus* n. sp., female. A: leg 1; B: tip of exopod of leg 1; C: leg 2; D: leg 3; E: leg 4.



1.03 (1.02-1.04) × 0.91 (0.90-0.92) mm, 1-segmented and slightly longer than wide. Caudal ramus (Fig. 3G) attached obliquely to abdomen, about as long as wide (0.25 × 0.26 mm), and armed with 3 short and 3 long plumose setae. Egg sac (Fig. 1A) slightly longer than body, 7.4 mm long and containing 118 eggs.

Antennule (Fig. 3B) 2-segmented; proximal segment with 25 pilose and 2 naked setae on anterodistal surface; distal segment with 1 subterminal seta on posterior margin and 11 setae plus 2 aesthetascs on distal margin. Antenna (Fig. 3C) 3-segmented; proximal segment smallest, with short, blunt posteromedial process; middle segment subrectangular and unarmed; distal segment sharply pointed, bent claw bearing 1 seta in proximal region and another one in middle region. Postantennal process (Fig. 3C) moderately long and sharply pointed, carrying 2 basal papillae with each bearing 2 setules; another papilla located nearby on sternum bearing a single setule. Mandible as usual with 4 joints and 12 teeth on medial margin of distal blade. Maxillule (Fig. 3C) comprising large dentiform process and basal papilla with 3 short setae. Maxilla (Fig. 3D) 2-segmented; proximal segment (lacertus) large and unarmed; slender, distal segment (brachium) carrying small, subterminal, hyaline membrane on outer edge, terminal calamus longer than subterminal canna. Maxilliped (Fig. 3E) 3-segmented; proximal segment (corpus) largest but unarmed; middle (shaft) and distal (claw) segments about equally long and fused to form subchela, claw with barbell at basal, medial margin. Sternal furca (Fig. 3F) with large, subrectangular box bearing large, straight, spatula-like tines.

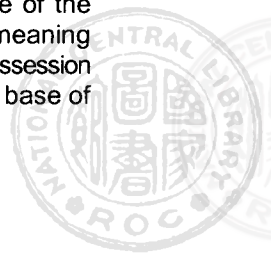
Armature on rami of legs 1-4 as follows (Roman numerals indicating spines and Arabic numerals, setae):

| | Exopod | Endopod |
|-------|--------------------|-------------|
| Leg 1 | 1-0; III, 1, 3 | (vestigial) |
| Leg 2 | I-1; I-1; II, I, 5 | 0-1; 0-2; 6 |
| Leg 3 | I-0; I-1; III, 4 | 0-1; 6 |
| Leg 4 | I-0; I, III | (absent) |

Leg 1 (Fig. 4A) protopod with long, plumose outer seta and another small, plumose inner seta, in addition to a papilla bearing 2 setules on outer margin of coxa; vestigial endopod a small, inconspicuous process; first segment of exopod with row of setules on posterior edge and small spiniform seta on outer distal corner; middle 2 of 4 terminal elements on last segment of exopod with accessory process, element 4 about twice length of element 1 and plumose only on outer margin (Fig. 4B); furthermore, pecten on terminal segment of exopod at base of each outer 3 terminal elements (Fig. 4B). Leg 2 (Fig. 4C) coxa small, with large, plumose, inner seta on posterior edge and setule-bearing papilla on ventral surface; basis carrying small seta on outer edge and narrow membrane along posterior margin in addition to setule-bearing papilla on ventral surface close to base of posterior marginal membrane; anterodistal surface of basis and first segment of exopod with large marginal membrane; proximal 2 spines on outer margin of terminal segment of exopod with hyaline membrane on one side only (see inserted drawing). Leg 3 (Fig. 4D) protopod (apron) with small, plumose, outer seta and long, plumose inner seta in addition to an outer and a posterior marginal membrane; outer margin anterior to hyaline membrane corrugated, setule-bearing papilla on ventral surface close to outer and inner ends of latter membrane; velum well developed and fringed with setules. Leg 4 (Fig. 4E) protopod with plumose seta at outerdistal corner; pecten on proximal segment of exopod at base of outer spine, but being replaced with digital process on remaining 4 spines on distal segment of exopod. Leg 5 (Fig. 3A) represented by 2 small papillae on posterolateral margin of genital complex, 1 tipped with small plumose seta and the other, 2 similar setae.

Male: Not found.

Etymology: The specific name of the parasite, *digitatus*, is a Latin meaning "having fingers." It alludes to the possession of having finger-like process at the base of



each of the four outer spines on the terminal segment of leg 4 exopod (see Fig. 4E).

Remarks: The most characteristic feature of this new species is the possession of a large abdomen, which is nearly one-half of the size of the genital complex. Among more than 250 species of *Caligus*, there are only two species share with *C. digitatus* with this unusual feature. They are *C. berychis* Wilson, 1936 and *C. kirtii* Prabha and Pillai, 1986. The latter species can be easily distinguished from the new species in lacking the digital processes on the terminal segment of leg 4 exopod and possession of a postmaxillary process in oral area.

Caligus berychis is so far known only from the Gulf of Mexico and Caribbean Sea (Wilson, 1936; Cressey, 1991). Although it is like the present new species in having a digital process at the base of each of the four outer spines on the terminal segment of leg 4 exopod, there are some obvious distinctions between the two species. The occidental species, *C. berychis*, differs from the oriental *C. digitatus* in having a pair of slender tines on the sternal furca, an accessory process on terminal element I of leg 1 exopod, and a caudal ramus which is not about as long as wide.

It is interesting to note that in his redescription of *C. berychis*, Cressey (1991) pointed out that "The host (*Beryx decadactylus* Cuvier and Valenciennes) is a relatively deep-water form and, as such, is unusual as a host for *Caligus* species, more commonly found on inshore, shallow-water fishes." Our discovery of *C. digitatus* from the deep-water fish off Taiwan echoes this statement.

Genus *Lepeophtheirus* Nordmanni, 1832

Lepeophtheirus exilipes n. sp.
(Figs. 5-7)

Material examined: 2 ♀♀ on body surface underneath scales and 1 ♂ in gill cavity of Japanese grenadier, *Caelorinchus japonicus* (Temminck & Schlegel), landed

at Da-Hsi Fishing Port on 26 June 2003.

Female: Body (Fig. 5A) 4.24 (3.98-4.50) mm long, excluding setae on caudal rami. Cephalothoracic shield (Fig. 5A) suborbicular, 2.74 (2.58-2.90) × 2.62 (2.46-2.78) mm, excluding lateral, hyaline membrane. Fourth pediger (Fig. 5A) wider than long, 0.25 (0.24-0.26) × 0.72 (0.68-0.76) mm. Genital complex (Fig. 5A) subrectangular and wider than long, 1.04 (0.98-1.10) × 1.49 (1.36-1.62) mm, with broadly expanded posterior corners. Abdomen (Fig. 5A) small, 225 (219-231) × 280 (251-308) μm, and 1-segmented. Caudal ramus (Fig. 5G) attached obliquely to abdomen, longer than wide, 113 (105-122) × 81 μm, and armed with two ventral papillae bearing long setule and a row of setules on medial margin in addition to 3 short and 3 long plumose setae on distal margin.

Antennule (Fig. 5B) 2-segmented; proximal segment with 25 pilose and 2 naked setae on anterodistal surface, distal segment with 1 subterminal seta on posterior margin and 11 setae plus 2 aesthetascs on distal margin; posterodistal corner of proximal segment with 2 unequal protrusions. Antenna (Fig. 5C) 3-segmented; proximal armed with pointed posteromedial process fringed with narrow membrane; middle segment largest and unarmed; distal segment strongly bent claw bearing large seta in proximal region and thin seta in middle region. Postantennal process (Fig. 5C) sharply pointed process carrying 2 basal papillae with each bearing 5-8 setules; another similar papilla located nearby on sternum. Mandible 4-segmented; with 12 teeth on medial margin of distal blade. Maxillule (Fig. 5C) comprising massive, bifurcate, dentiform process and small basal papilla tipped with 3 short setae. Maxilla (Fig. 5D) 2-segmented; proximal segment (lacertus) unarmed; slender, longer, distal segment (brachium) carrying long, marginal membrane on outer edge; distal canna about one-half length of calamus. Maxilliped (Fig. 5E) 3-segmented; proximal segment (corpus) long but unarmed; subchela short, about

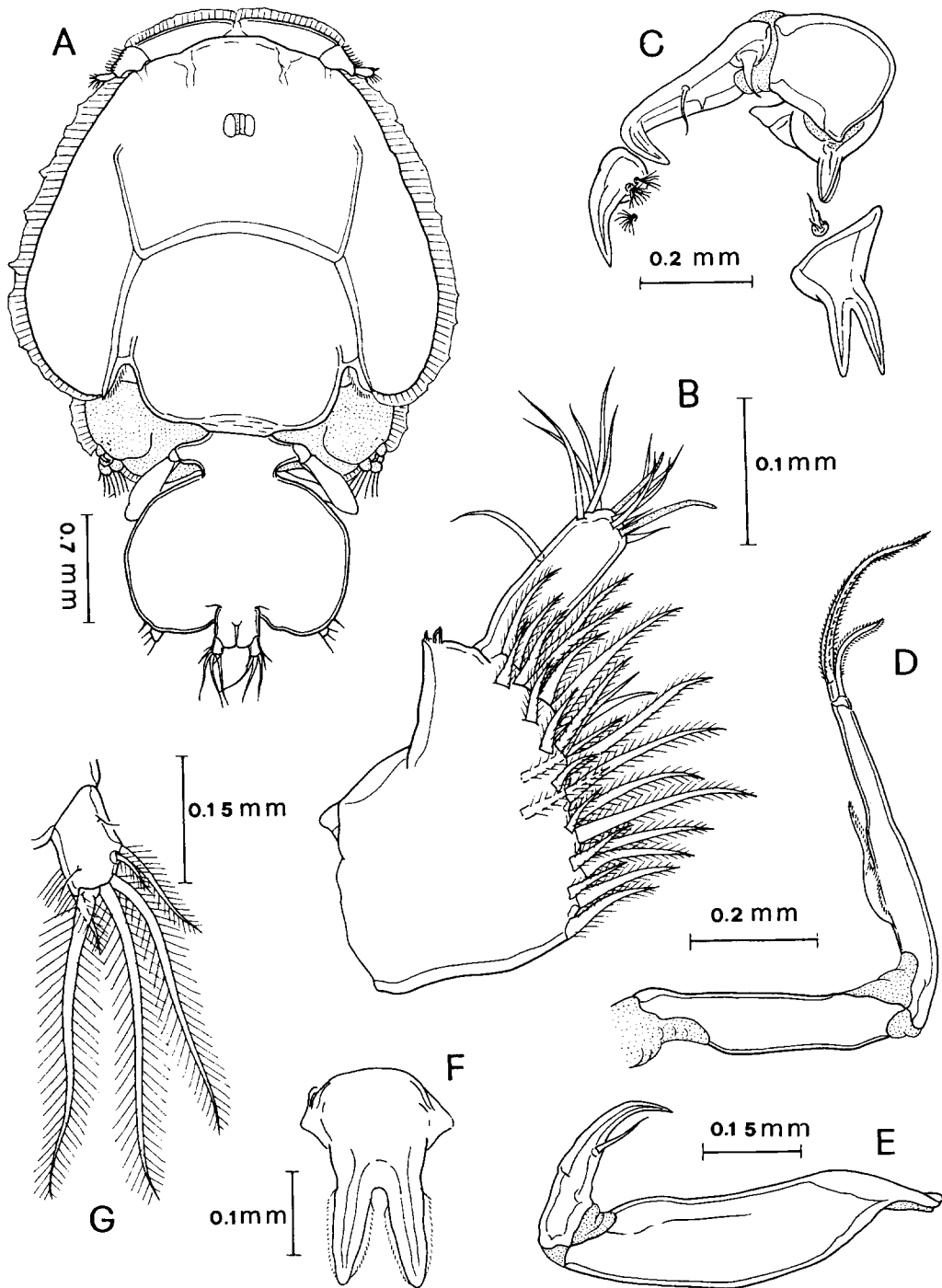


Fig. 5. *Lepeophtheirus exilipes* n. sp., female. A: habitus, dorsal; B: antenna; postantennal process and maxillule, ventral; D: maxilla; E: maxilliped; F: sternal furca; G: caudal ramus, ventral.

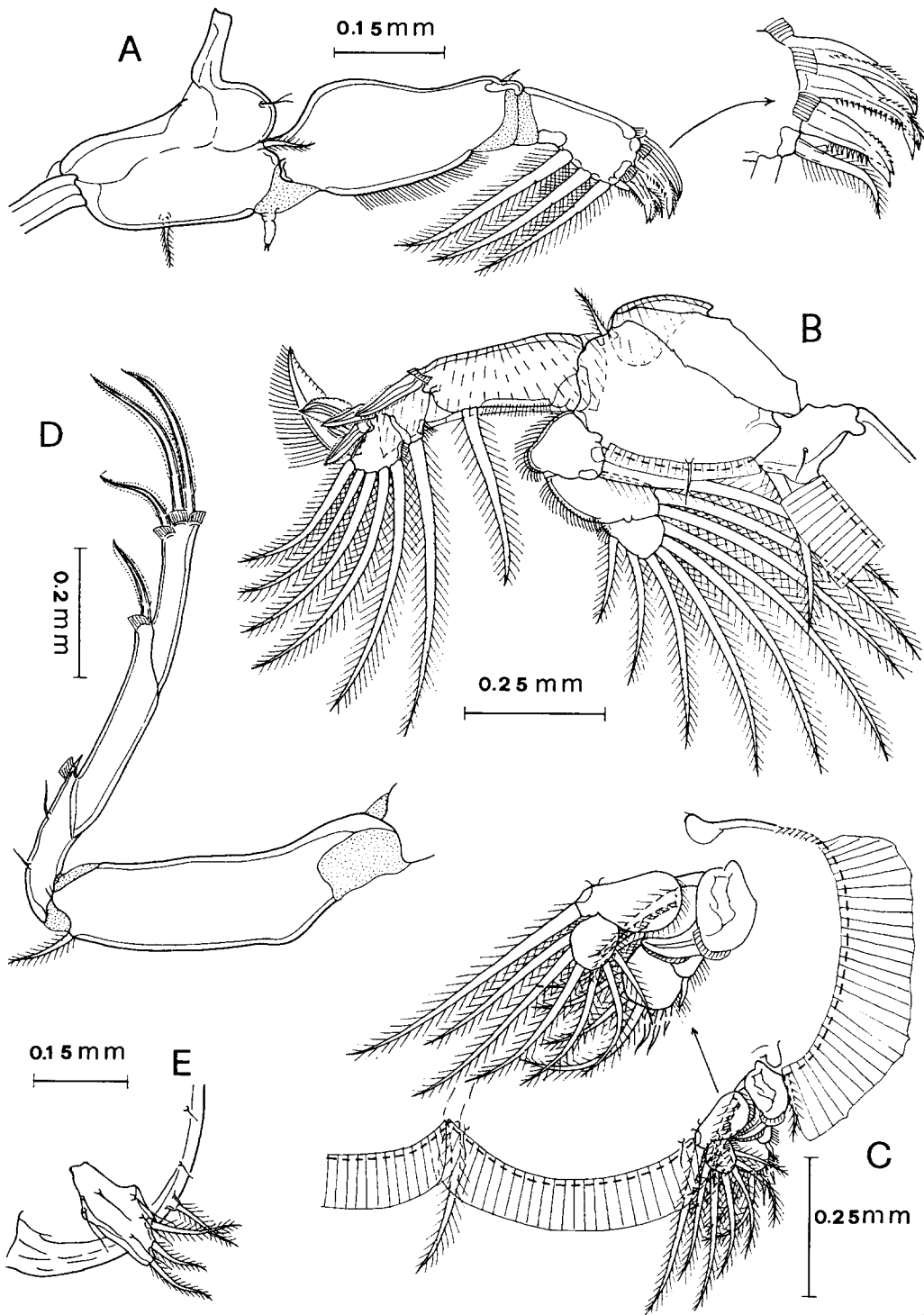


Fig. 6. *Lepeophtheirus exilipes* n. sp., female. A: leg 1; B: leg 2; C: leg 3; D: leg 4; E: leg 5.



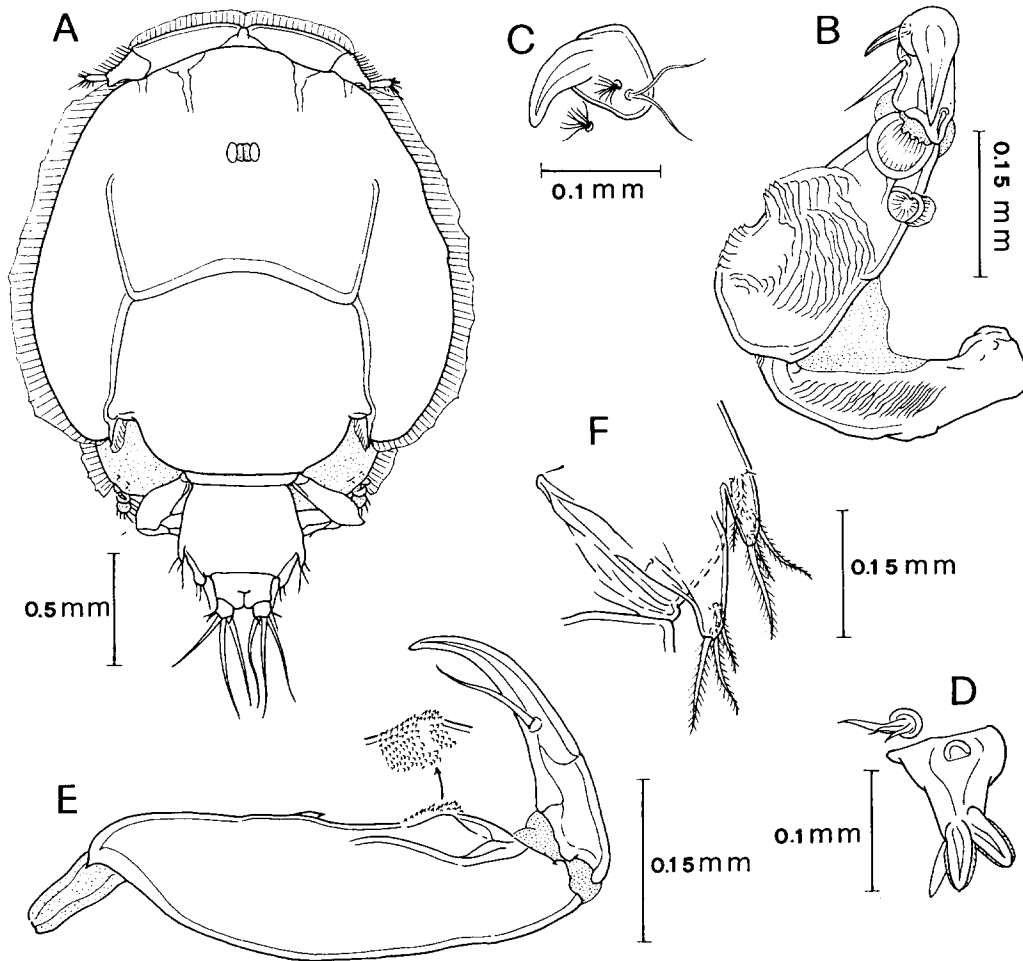


Fig. 7. *Lepeophtheirus exilipes* n. sp., male. A: habitus, dorsal; B: antenna; C: postantennal process; D: maxillule; E: maxilliped; F: posterolateral area of genital complex showing leg 5 and leg 6, ventral.

one-half length of corpus and armed with long barbell in mid-region. Box of sternal furca (Fig. 5F) with ear-like outgrowth at base, tines bluntly pointed and fringed with narrow membrane on both sides.

Armature on rami of legs 1-4 as follows (Roman numerals indicating spines and Arabic numerals, setae):

| | Exopod | Endopod |
|-------|--------------------|-------------|
| Leg 1 | I-0; III, 1, 3 | (vestigial) |
| Leg 2 | I-1; I-1; II, I, 5 | 0-1; 0-2; 6 |
| Leg 3 | I-1; I-1; III, 4 | 0-1; 6 |
| Leg 4 | I-0; I-0; III | (absent) |

Leg 1 (Fig. 6A) protopod with plumose outer and inner seta; vestigial endopod tipped with 2 tiny setae; first segment of exopod with row of spinules on posterior edge and short spiniform seta at outer distal corner; middle 2 of 4 terminal elements on last segment of exopod bilaterally serrated and with accessory process (Fig. 6A). Leg 2 (Fig. 6B) coxa small, with setule-bearing papilla on anterior surface and large, plumose, inner seta on posterior edge; basis with small, plumose, outer seta; posterior margin of basis with long, narrow membrane and a setule-

bearing papilla on the base in the middle region of this membrane; anterodistal surface of coxa and first segment of exopod with outer marginal membrane. Leg 3 (Fig. 6C) with small rami; protopod (apron) with small, outer and large, inner plumose seta, outer and posterior edge fringed with marginal membrane; short, corrugated margin anterior to outer membrane, setule-bearing papilla near both ends of posterior membrane; proximal segment of exopod protruded and fringed with hyaline membrane; proximal segment of endopod protruded even more and fringed with a row of setules. Leg 4 (Fig. 6D) protopod with plumose seta at outerdistal corner; proximal segment of exopod with 2 setule-bearing papillae on outer margin; pecten at base of each outer spine on exopod. Leg 5 (Fig. 6E) represented by a rod-like process bearing 3 plumose setae and an isolated papilla bearing 1 plumose seta located at posteroventral corner of genital complex; 6 papillae on this process tipped with a long setule.

Male: Body (Fig. 7A) 2.74 mm long, excluding setae on caudal rami. Cephalothoracic shield (Fig. 7A) suborbicular, 2.00×1.92 mm, excluding frontal and lateral, hyaline membranes. Fourth pediger (Fig. 7A) wider than long, 0.16×0.44 mm. Genital complex (Fig. 7A) small, subrectangular and wider than long, 0.42×0.52 mm. Abdomen (Fig. 7A) small, 1-segmented, and distinctly wider than long, 154×243 μm . Caudal ramus (Fig. 7A) longer than wide (138×81 μm), and armed as in female.

Antenna (Fig. 7B) 3-segmented; with various size of corrugated, adhesion pads on first 2 segments; terminal segment a large, strongly bent claw with slender, auxiliary tine and 2 unequal, basal setae. Postantennal process (Fig. 7C) with one basal papilla carrying 2 long setules. Dentiform process of maxillule (Fig. 7D) tipped with 2 tines and 1 stubby seta. Myxal area of corpus of maxilliped (Fig. 7E) slightly protruded and armed with 2 patches of denticles. Leg 5 (Fig. 7F) on posterolateral margin of genital complex

and constructed generally as in female. Leg 6 (Fig. 7F) represented by a process larger than that of leg 5 and also armed with 3 plumose setae.

Etymology: The species name *exilipes* is a combination of Latin words *exilis* (thin, slender, meager, weak) and *pes* (foot). It alludes to the possession of a long and slender leg 4.

Remarks: The new species is characteristic in having in the female a genital complex distinctly wider than long; a small, 1-segmented abdomen; a maxillule with two equally long tines on the dentiform process; and slender leg 4 with its exopod distinctly longer than the protopod. As far as we are aware, 109 species of caligids are known in the genus *Lepeophtheirus* (Lin *et al.*, 1996). A close comparison with them revealed that the following five species are like the present new species in sharing with it the above mentioned four features. They are: *L. atypicus* Lin, Ho, and Chen, 1996; *L. erecsoni* Thomsen, 1890; *L. furcatus* (Capart, 1953); *L. goniistii* Yamaguti, 1936; *L. lagocephali* Pillai, 1963; and *L. rotundipes* Dojiri, 1979.

Based on the original description of *L. atypicus* given by Lin *et al.* (1996), it can be distinguished from the new species in the fine structure of the canna (serrated and bearing a sharp, outer, basal tooth) on the maxilla; of the tines on the sternal furca (bluntly tipped); of the terminal elements II and III (lacking accessory process) on the exopod of leg 1; and of the exopod spine (subterminally located) on the basal segment of leg 3. According to Boxshall and Bellwood's (1981) redescription of *L. erecsoni*, it can be distinguished from *L. exilipes* in the fine structure of the canna (with a recurved, outer, basal tooth), ornamentation on the terminal elements II and III (with naked tip) of the exopod of leg 1; relative length of the middle, terminal spine (shorter than the inner spine) on the exopod of leg 4; and armature on the corpus of the maxilliped (a dactiliform process with a bifurcate tip). Capart's (1953) "*Anuretes furcatus* sp. nov." has not been found again since its discovery



on a devil ray [*Mobula rochebrunei* (Vaillant)] caught off Gorée, Senegal. It was transferred to *Lepeophtheirus* by Ho and Lin (2000). Although not much differences can be mentioned here between *L. furcatus* and *L. exilipes*, due to incomplete description of the original work, Caprt's (1953) Fig. 2E shows that it differs from *L. exilipes* in having the inner-most terminal spine as the longest terminal elements on the exopod of leg 4.

Lepeophtheirus goniistii was found parasitic on a morwong [*Goniistius zonatus* (Cuvier)] caught off Japan by Yamaguti (1936). It was found again by Shiino (1952) on three species of Japanese fishes other than the morwong. The major distinction between *L. goniistii* and the present new species is its possession of a large, forked, outer spine on the proximal segment of the exopod of leg 4 in female. Based on Pillai's (1963) original description, the Indian species, *L. lagocephali*, differs from *L. exilipes* in the possession of simple (without accessory process), terminal elements on the exopod of leg 1; short, middle, terminal spine at the tip of leg 4 exopod; and a hooklet (instead of an auxiliary tooth) on the terminal claw of antenna in male. The Californian *L. rotundipes*, according to Dojiri (1979), is distinguishable from *L. exilipes* in the structure (short and broad) of leg 5 in the female and the armature of 3 claws and a straight tine at the tip of the antenna in the male.

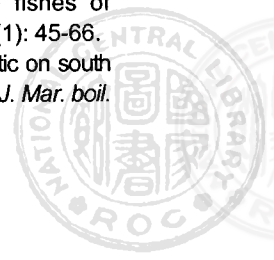
ACKNOWLEDGEMENTS

We would like to thank Mr. Jenn-Yuh Chang for arranging for us to purchase the deep-water fishes landed at Da-Hsi Fishing Port and the Manager of the Crab Museum in Da-Hsi, Mr. Tung-Hsing Lee, for allowing us to use the museum facilities for examination of the purchased fishes for copepod parasites. The students of the National Chiayi University, Yuh-Ying Chiang, Yu-Rong Cheng, Meng-Ta Yu, Mei-Jun Shi, I-Chia Ho, and Su-Shen Hwang assisted us in transportation and examina-

tion of the purchased fishes. The field and laboratory works of this project were made possible through the grants (NSC 91-2313-B-415-010) from the National Science Council of Taiwan to Ching-Long Lin. Completion of this manuscript was aided by another grant from the Paramitas Foundation to Ju-shey Ho.

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三種寄生在台灣海水魚體上的海水魚虱 (橈足亞綱：魚虱科)

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(2003年9月10日收件；2003年11月1日修正；2003年12月5日接受)

從台灣大溪漁港採到的三種海水魚體上鑑定出三種分屬三個不同屬的魚虱(魚虱科，吸管口目)。此三種魚虱分別為：寄生在雨印鯛 [*Zenopsis nebulosus* (Temminck & Schlegel)] 上的 *Anuretes quadrilaterus* Shiino, 1954；寄生在尖身鯪(*Thyrsitoides marleyi* Fowler) 上的 *Caligus digitatus* n. sp.；寄生在日本鬚鱈 [*Caelorinchus japonicus* (Temminck & Schlegel)] 上的 *Lepeophtheirus exilipes* n. sp.。本報告為 *A. quadrilaterus* 的第二次被發現的報導。新種 *C. digitatus* 的特徵為具一相當大的生殖節及腹部，匙狀的胸叉，第四對胸腳的外肢(exopod)只有 2 節，具四支棘，而棘的基部均具指狀突起。另一新種 *L. exilipes* 的特徵為具寬大生殖節，腹部小，第一小顎(maxillule)呈等二叉狀，第四胸腳狹長，其外肢為 3 分節，外肢遠長於原節(protopod)。

關鍵詞：海水魚虱，魚虱屬，寄生橈足類，海水魚，台灣。

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