

Two New Species of Poecilostomatoid Copepods Associated with the Bivalve *Dosinella penicillata* in the Yellow Sea

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Key Words:

Copepoda
Poecilostomatoida
Myicola
Conchylurus
New species
Bivalvia
Yellow Sea

Two new species of poecilostomatoid copepods, each belonging to the genera *Myicola* (Myicolidae) and *Conchylurus* (Clausidiidae), are described, based on specimens taken from the mantle cavity of the bivalve *Dosinella penicillata* (Reeve). The host bivalve was collected from the intertidal mud flat near Incheon in the Yellow Sea.

Twenty-two species of copepods associated with mollusks have been recorded in Korean waters, including the most recent report on *Hersiliodes exiguus* by Kim and Stock (1996). In the present paper I report two more species, both new to science, of poecilostomatoid copepods each belonging to the genera *Myicola* and *Conchylurus* taken from the mantle cavity of the bivalve *Dosinella penicillata* (Reeve), the host collected from the intertidal mud flat in the Yellow Sea.

The species of *Myicola* Wright, 1885 and *Conchylurus* Bocquet and Stock, 1957, though they are of different families, are known to live in the mantle cavity of marine bivalve mollusks. While redescribing *Myicola metisiensis* Wright, 1885, the type species of the genus known from the Atlantic coast of North America, Humes (1986) removed the oriental species, *M. ostreae* Hoshina and Sugiura, 1953, from the genus *Myicola* and regarded it as a member of *Ostrincola*, a close relative genus. Since then, *Myicola* has remained as a monotypic genus until Ho and Kim (1992) re-defined the genus as it has, unlike *Ostrincola*, the multiseriate eggs in egg sac, a character shared by *M. ostreae*.

The genus *Conchylurus* had been known of nine nominal species, but Ho and Kim (1995) synonymized *C. fragilis* Reddiah, 1961 to *C. bombasticus* Reddiah, 1961. Therefore this genus is represented by eight described species at present. They are known throughout the Far East, Indian Ocean, West Africa, Europe and Mediterranean region.

The specimens on which the following descriptions are based were collected from the clam *Dosinella penicillata* (Reeve) in the intertidal mud flat at

Jakyakdo Island, off Incheon in the Yellow Sea. Freshly dug clams were fixed in 10% formalin for about a couple of hours, and then preserved in 70% ethanol. The copepods picked out from the mantle cavity of the host were examined in lactic acid. Measurements of body parts were made from the largest specimen.

Results

Family Myicolidae

Myicola intumidus n. sp. (Figs. 1-3)

Material examined: 8 ♀♀, 1 ♂ collected from the mantle cavity of *Dosinella penicillata* (Reeve) in the intertidal mud flat at Jakyakdo Island, off Incheon in the Yellow Sea, on 29 September 1996. Holotype (♀) and paratypes (6 ♀♀) will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Dissected allotype and paratype (1 ♀) are kept in the collection of the author.

Female: Body of ovigerous female (Fig. 1A) nearly *Ostrincola*-like, rather stocky but not very swollen, slightly arcuated, with distinguishable suture lines and distinct lateral indentation between somites. Length 2.03 mm. Greatest width 0.70 mm. Prosome 1.34 mm long, occupying 0.66 of body length, gradually narrowing toward posterior somites.

Urosome (Fig. 1B) relatively short, 5-segmented, with distinct segmentation. Fifth pedigerous somite 278 µm wide. Genital double-somite wider than long, 222 × 280 µm, as wide as fifth pedigerous somite, armed with 4 transverse groups of spinules on ventral surface, first 2 groups of them rather irregularly arranged. All abdominal somites much wider than long, each with a row of spinules near posteroventral border, 92 × 183, 61 × 156, and 78 × 131 µm, respec-

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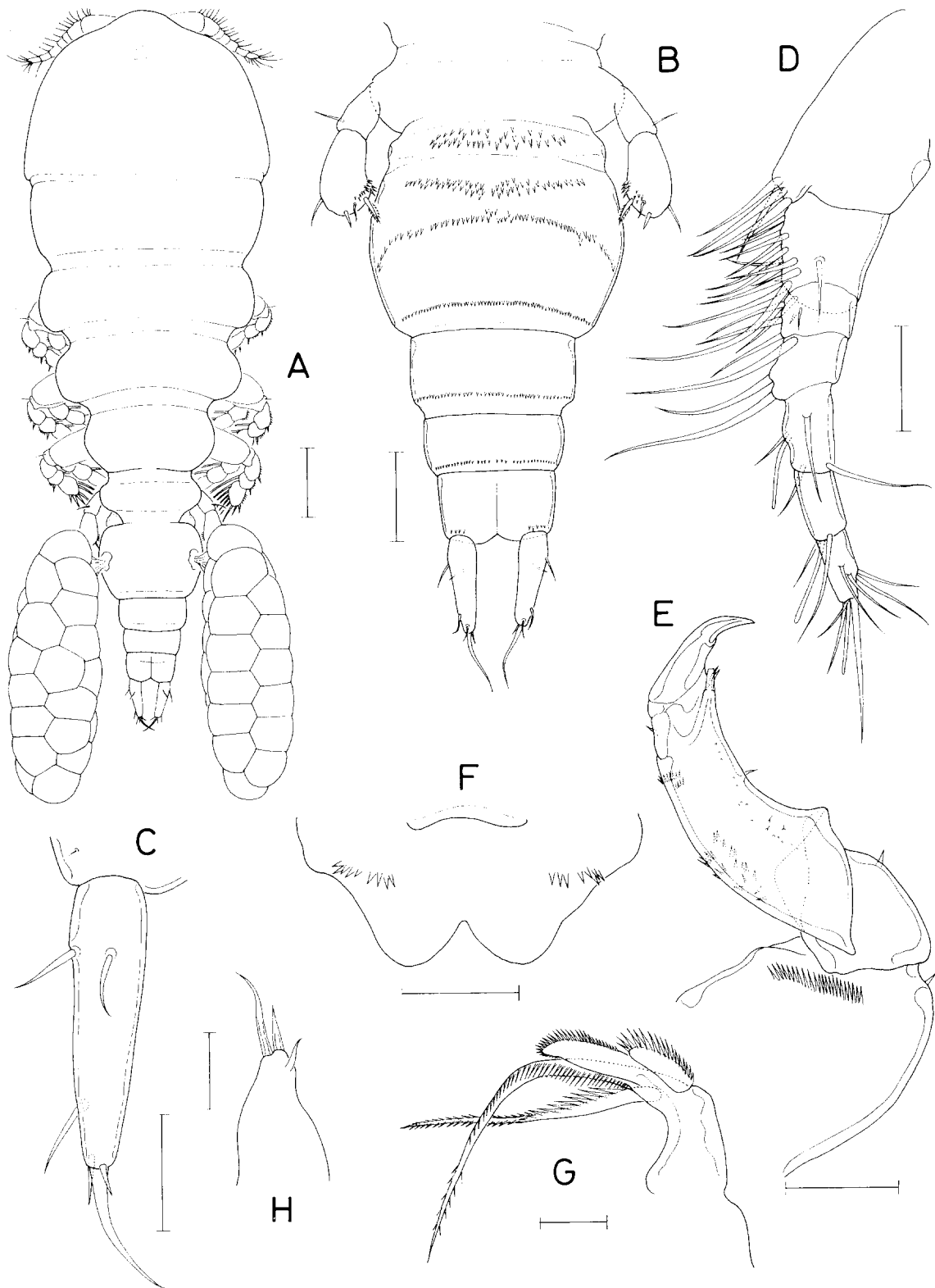


Fig. 1. *Myicola intumidus* n. sp., female. A, habitus, dorsal; B, urosome, ventral; C, left caudal ramus, dorsal; D, antennule; E, antenna; F, labrum; G, mandible; H, maxillule. Scales: A=0.2 mm; B, F=0.1 mm; C-E=0.05 mm; G, H=0.02 mm.

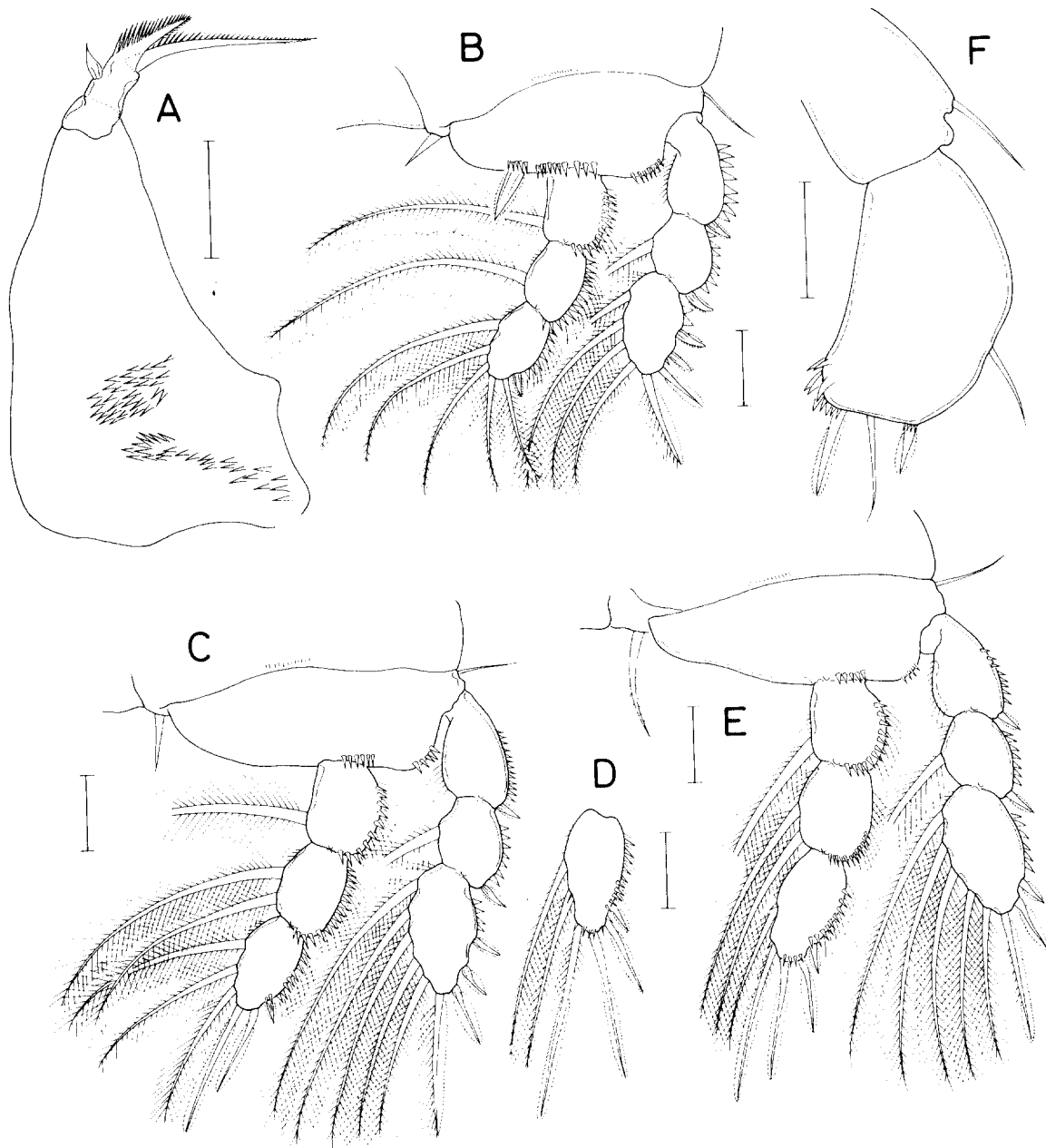


Fig. 2. *Myicola intumidus* n. sp., female. A, maxilla; B, leg 1; C, leg 2; E, leg 4; D, third endopodal segment of leg 3; E, leg 4; F, leg 5. Scales: 0.05 mm for all.

tively.

Caudal rami widely separated from each other by a distance of about 1.5 times of their width, weakly convergent or parallel. Each ramus (Fig. 1C) weakly tapering, $125 \times 32 \mu\text{m}$ (length/width=3.91 : 1), armed with 6 setae: 2 proximal, 1 subterminal, and 3 terminal ones. Outer lateral seta located at proximal 0.26 length of ramus. Subterminal seta located at distal 0.22 length of ramus. Median terminal seta prominently larger than other setae, curved, and $60 \mu\text{m}$ long. All caudal setae smooth.

Egg sac $790 \times 260 \mu\text{m}$ (length/width=3.14 : 1), with multiseriate eggs (Fig. 1A).

Rostrum not distinguished. Antennule (Fig. 1D) 7-segmented, gradually narrowing toward tip, with formula for armature: 4, 15, 5, 3, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc. All setae smooth. Antenna (Fig. 1E) 3-segmented. First segment (=coxobasis) inflated, armed distally with a transverse row of spinules and 1 small inner distal seta. Second segment (=first endopodal segment) with 1 small inner seta. Third segment about 2.2 times as

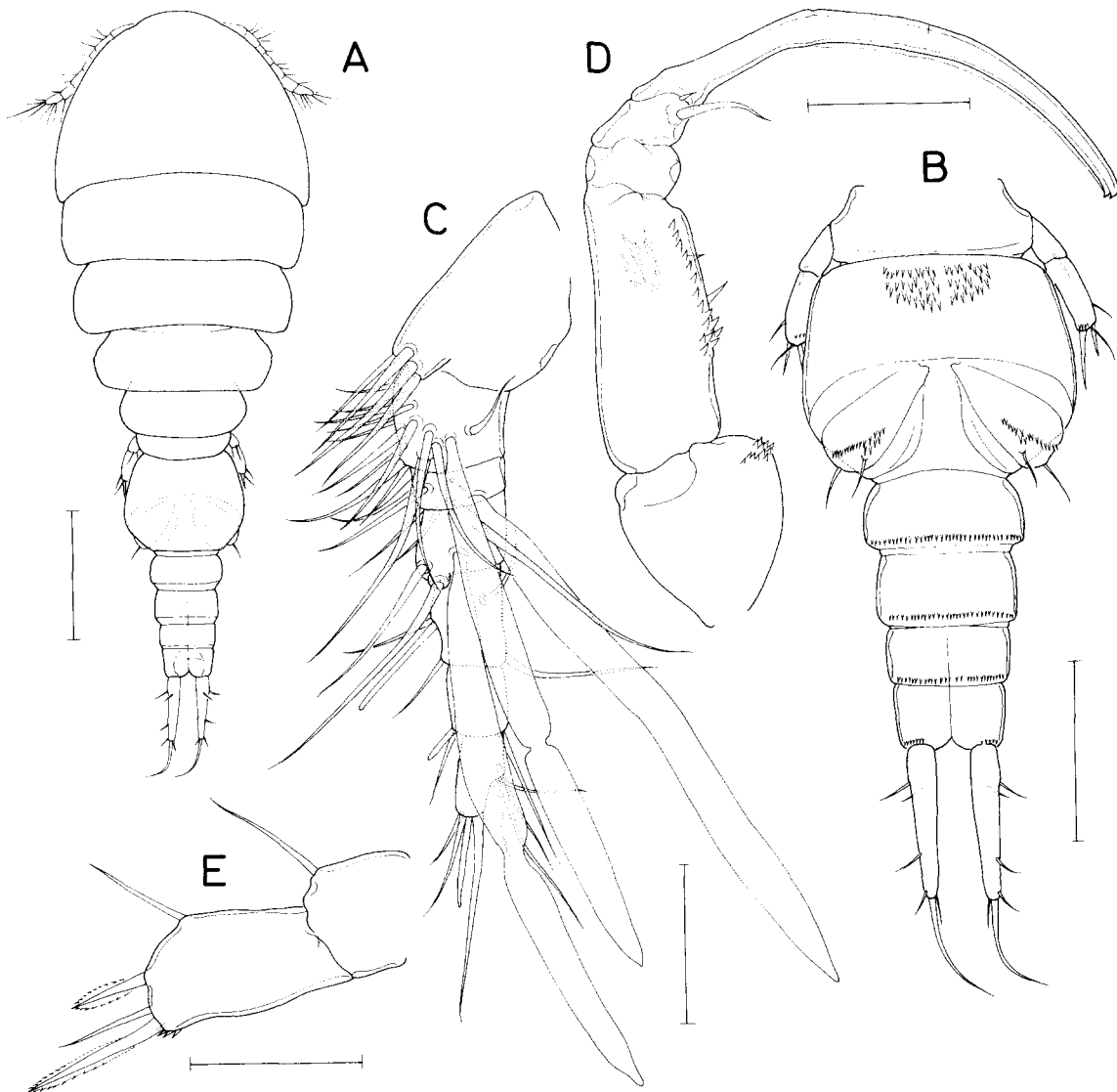


Fig. 3. *Myicola intumidus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, maxilliped; E, leg 5. Scales: A=0.2 mm; B-E=0.05 mm.

long as wide, armed with 1 median seta on inner surface, 3 inner distal setae (one of them being thick and truncate), 1 outer distal seta, and a number of spinules on outer surface. Terminal claw strong but rather short and acutely pointed.

Labrum (Fig. 1F) posteriorly narrowed, with 2 round posterior lobes and 8 or 9 spinules on each side. Mandible (Fig. 1G) with 4 elements, 2 of them plate-like and remaining 2 very long (1 of latter being main shaft of mandible); all elements spinulated. Maxillule (Fig. 1H) with 2 terminal setae of unequal length and 1 subterminal smaller seta. Maxilla (Fig. 2A) 2-segmented. First segment inflated basally and narrowed distally, with 2 groups of spinules in basal half. Terminal segment small, terminated in setiform spinulated process, with 1 small lateral seta and 1

very long terminal seta, the latter longer than twice the length of process. Maxilliped lacking, without any rudiment.

Legs 1-4 with 3-segmented rami. Formula for armature of these legs as follows (Roman numerals indicating spines, and Arabic numerals representing setae):

- P1: coxa 0-1; basis 1-I; exp I-0; I-1; III, I, 4
 enp 0-1; 0-1; I, 5
 P2: coxa 0-1; basis 1-0; exp I-0; I-1; III, I, 5
 enp 0-1; 0-2; II, I, 3
 P3: coxa 0-1; basis 1-0; exp I-0; I-1; II, I, 5
 enp 0-1; 0-2; II, II, 2
 P4: coxa 0-1; basis 1-0; exp I-0; I-1; II, I, 5
 enp 0-1; 0-2; II, II, 1

All biramous legs with spinules on distal margin of basis and on outer margins of segments of both rami (Figs. 2B-E). Endopodal segment of all legs with hairs on outer margin in addition to spinules. Spine on basis of leg 1 very thick but shorter than endopodal first segment. Outermost spine of endopodal terminal segment of legs 3 and 4 basally plumose and distally lamellate.

Leg 5 (Fig. 2F) 2-segmented. Basal segment about $67 \times 51 \mu\text{m}$, with 1 outer seta. Distal segment $100 \times 59 \mu\text{m}$ (length/width=1.69 : 1), broadened medially, slightly arcuate, with spinules near inner distal corner, 2 terminal spines, and 1 terminal and 1 outer setae. Outer margin strongly convex. Inner margin slightly concave. Distal margin truncate. Outer seta $32 \mu\text{m}$. Terminal seta $39 \mu\text{m}$. Terminal outer spine $19 \mu\text{m}$. Terminal inner spine $35 \mu\text{m}$.

Male: Body (Fig. 3A) as in female but less inflated. Body length 1.14 mm and greatest width 0.39 mm. Prosomal somites gradually narrowing toward posterior one. Urosome (Fig. 3B) 6-segmented. Fifth pedigerous somite $145 \mu\text{m}$. Genital somite $150 \times 188 \mu\text{m}$, with 2 patches of spinules on mid-ventral surface of proximal portion, and row of spinules and 2 setae on each genital flap. All abdominal somites with posteroventral border fringed with spinules, each somite from anterior one 52×110 , 50×97 , 38×87 , and $45 \times 78 \mu\text{m}$. Caudal ramus distinctly more elongated than that of female, $110 \times 20 \mu\text{m}$ (length/width=5.50 : 1).

Antennule (Fig. 3C) differs from that of female in armament, with its formula for armature: 4, 14+1 aesthetasc, 6+1 aesthetasc, 2+1 aesthetasc, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc. Segmentations obscure between second and third, and third and fourth segments. Three aesthetascs each on second, third, and fourth segments greatly enlarged and distally tapering, those of second and fourth segments distinctly constricted near middle.

Antenna with 1 more added seta (thus 4) at inner distal corner of third segment.

Labrum, mandible, maxillule, and maxilla not differ from those of female. Maxilliped (Fig. 3D) 4-segmented. First segment rather short but inflated distally, with spinules near inner distal corner. Second segment with 2 small setae, each located medially and at distal fourth, spinules on inner margin, and a patch of spinules in distal third of one lateral surface. Third segment unarmed. Fourth segment with 2 setae, distal one very small. Claw arched and nearly as long as 4 segments combined.

Legs 1-4 with armature formula identical to that of female, but inner coxal seta of these legs plumose and longer than in female.

Distal segment of leg 5 not arcuate, more slender (Fig. 3E), $54 \times 32 \mu\text{m}$ (1.75 : 1). Leg 6 represented by 2 setae on genital flap (Fig. 3B).

Etymology: The specific name *intumidus* is from the Latin *in-* (not) and *tumidus* (swollen). It is named so because of its non-inflated body.

Remarks: This is the third known species of *Mycicola*, with its previously recorded congeners of *M. metisiensis* Wright, 1885 from the northwest Atlantic, 1885 and *M. ostreae* Hoshina and Sugiura, 1953 from the Far East.

Mycicola intumidus n. sp. is easily distinguished from the other two congeners by the non-inflated body of ovigerous female. Besides the body form, other morphological features differentiates the new species from the congeners. *Mycicola intumidus* differs from the West Atlantic species *M. metisiensis* in bearing smaller body (2.03 mm in the new species, compared to 2.94-3.17 mm of *M. metisiensis*, according to Humes, 1986), broader distal segment of leg 5 (length/width=1.69, against 3.66 in *M. metisiensis*, according to Humes, 1986), and fewer number of eggs in the egg sac, from *M. ostreae* by the more slender caudal rami (length/width=3.91 in *M. intumidus*, against 4.95 in *M. ostreae*, according to Ho & Kim, 1991) and the different shape of the distal segment of leg 5.

Except for the bearing multiseriate eggs in the egg sac as defined by Ho and Kim (1992) as the diagnostic character, the ovigerous females of the genus *Mycicola* has the body size larger than in *Ostrincola*, as noted by Humes (1986). The largest measurement of body length of *Ostrincola* is, as far as I am aware, 1.32 mm for *Ostrincola portonoviensis* Reddiah, 1962 recorded in the redescription by Ho and Kim (1995). In contrast, the smallest measurement of *Mycicola* is 1.40 mm long for *M. ostreae* recorded in the original description of Hoshina and Sugiura (1953). However, the specimens measured by Hoshina and Sugiura (1953) may contain young adults, judging from the Ho and Kim's (1991) record as 1.65 mm for the smallest ovigerous female of this species from the same species of host. In addition to the body size, the slenderness of caudal rami differs also between the two genera. The broadest caudal rami of *Ostrincola* is observable in *O. humesi* described by Ho and Yoosukh (1994) in which the ratio of length to width of caudal rami is 5.25. This dimension is contrasted to 4.95 (as recorded by Ho and Kim, 1991) in *M. ostreae*, the species bearing the most slender caudal rami among *Mycicola*.

Family Clausidiidae

Conchylurus inchonensis n. sp. (Figs. 4-6)

Material examined: 3 ♀♀, 1 ♂, and 1 copepodid V collected together with *Mycicola intumidus* n. sp. from the mantle cavity of the clam *Dosinella penicillata*

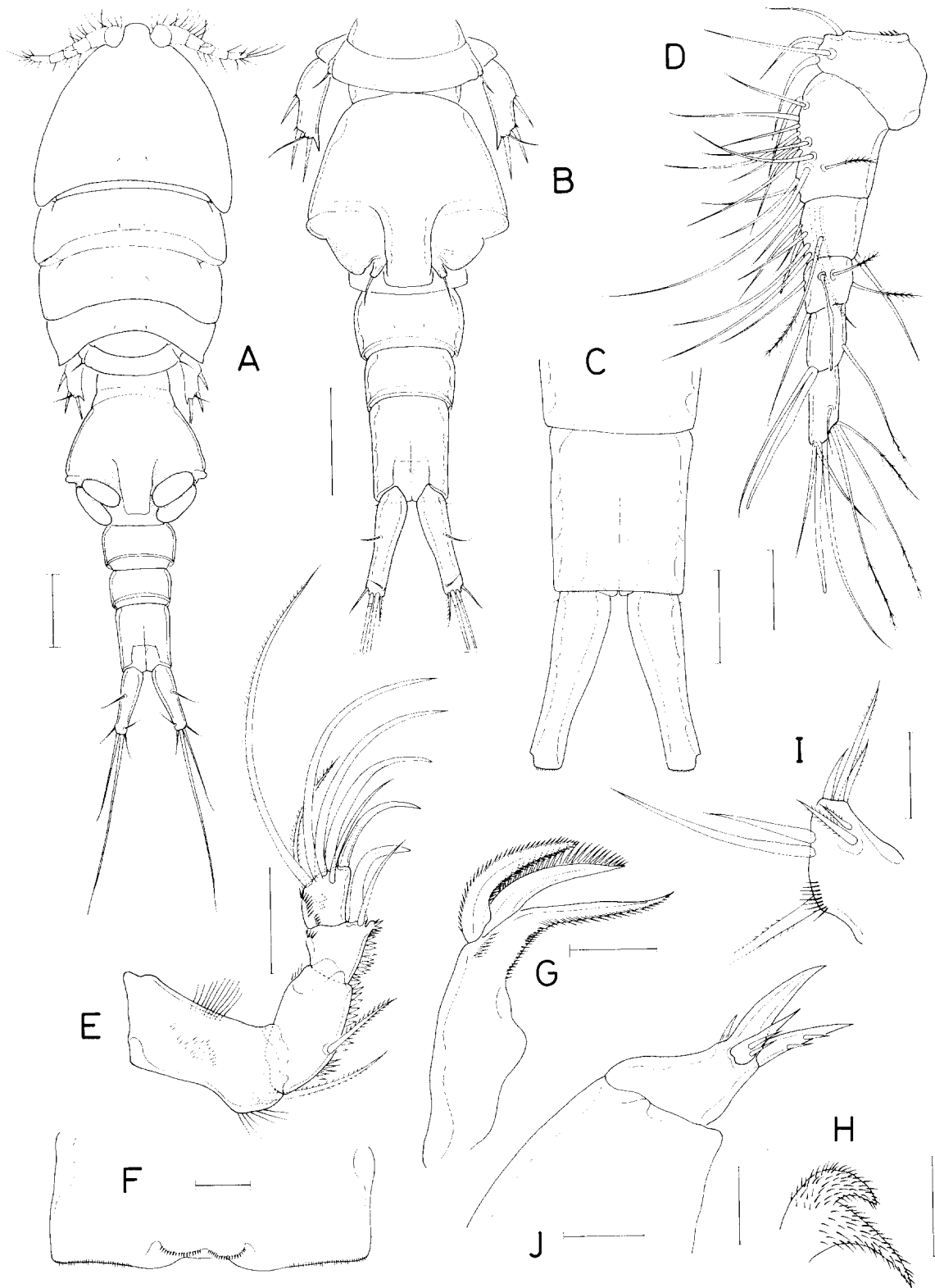


Fig. 4. *Conchylurus inchonensis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, anal somite and caudal rami, ventral; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule; J, maxilla. Scales: A, B=0.2 mm; C=0.1 mm; D, E=0.05 mm; F-J=0.02 mm.

(Reeve) in the intertidal mud flat at Jakyakdo Island located off Incheon in the Yellow Sea, on 29 September 1996. Holotype (♀), allotype (one of maxillipeds dissected out), and 2 paratypes (1 ♀ abdomen broken off, and 1 copepodid V) will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Dissected paratype (1 ♀) is kept in the collection of the author.

Female: Body (Fig. 4A) flattened dorsoventrally, 1.94 mm long, with maximum width 0.58 mm. Prosoma narrow, elliptical, 1.74 times as long as wide. Rostrum produced forward, quadrate in dorsal view. Fourth pedigerous somite with pointed posterolateral corners.

Urosome (Fig. 4B) 5-segmented. Fifth pedigerous somite 289 µm wide. Genital double somite as long as wide (375 × 375 µm), roughly hexagonal, widest at 2/3 length of somite, with distinct genital lobe (=dorsomedian ridge). Genital area covered with dark sticky material. Spermatophore oval, paired on each side, and obliquely attached. Three abdominal somites 130 × 202, 103 × 167, and 173 × 150 µm, respectively. Ventral surface of anal somite unarmed, only with minute spinules along posterior border (Fig. 4C). Caudal ramus tapering, 192 × 55 µm (length/width = 3.49 : 1), 1.1 times as long as anal somite, with 6 setae, innermost terminal one of them plumose on medial side.

Egg sac unknown. Antennule (Fig. 4D) 6-segmented, 950 µm long, narrowing toward end, with armature formula: 4, 15, 10, 4+1 aesthetasc, 2+1 aesthetasc, and 7+1 aesthetasc. First segment with spinules on proximal anterior surface. All setae smooth except for 1 on each second and third segments, 2 on fourth, 1 on fifth, and 3 on last.

Antenna (Fig. 4E) 4-segmented. First segment (=coxobasis) with 1 distal seta and hairs on surface. Second segment (=first endopodal segment) with 1 seta on the middle of inner side; inner margin crenate. Third segment armed distally with 1 thick, strongly curved calyx and 1 seta, and small inner distal process; inner margin densely crenate. Terminal segment slightly longer than wide, with 7 elements, 4 of them claw-like.

Labrum (Fig. 4F) with 2 crenate lobes near mid-posterior margin; both sides of posterior margin finely crenate. Mandible (Fig. 4G) distally with thick, lash-like process and 2 broad elements. Paragnath (Fig. 4H) bifurcate as 2 spinulated lobes. Maxillule (Fig. 4I) as a lobe armed with 8 setae. Maxilla (Fig. 4J) 2-segmented. First segment (=syncoxa) unarmed. Second segment (=basis) terminated in a long claw-like process, and armed with 2 lateral elements (one of them smaller and setiform, another one being a spine bearing 2 spinules) and 1 dorsal spine bearing 2 spinules near middle. Maxilliped (Fig. 5A) 2-segmented. First segment thick, with 1 seta on dorso-

distal corner and spinules on ventral and lateral surfaces. Second segment forming a strong hook, with 2 denticles each on both sides.

Leg 1 (Fig. 5B), leg 2 (Fig. 5C), leg 3, and leg 4 (Fig. 5D) with 3-segmented rami. Armature formula of legs 1-4 as follows (Roman numerals indicating spines, and Arabic numerals representing setae):

- P1: coxa 0-1; basis 1-I; exp. I-0; I-1; III, I, 4
 enp. 0-1; 0-1; II, 4
 P2: coxa 0-I; basis 1-0; exp. I-0; I-1; III, I, 5
 enp. 0-1; 0-2; III, 3
 P3: coxa 0-I; basis 1-0; exp. I-0; I-1; III, I, 5
 enp. 0-1; 0-2; IV, 2
 P4: coxa 0-I; basis 1-0; exp. I-0; I-1; III, I, 5
 enp. 0-1; 0-2; IV, 1

Median posterior margin of legs 1-4 and outer margin of first exopodal segment of leg 1 crenate. Inner coxal spine of leg 1 long, extending beyond distal margin of second endopodal segment. Outer margin of all endopodal segments of leg 1 crenate. Hairs on outer margin of endopods of legs 2-4.

Leg 5 (Fig. 5E) 2-segmented. Basal segment short and fused to somite, with 1 seta. Distal segment 141 × 58 (length/width = 2.43), with pronounced inner distal process, 3 spines (57, 63, and 77 µm, respectively from outer one) and 1 plumose seta. Both inner and outer margins smooth but areas near basis of spines with spinules. Leg 6 represented by a dorsal process tipped by seta in posterior portion of each genital area (Fig. 4B).

Male: Body shape as in female. Body length not examined. Urosome (Fig. 5F) 6-segmented. Fifth pedigerous somite 217 µm wide. Genital somite 220 × 262 µm, broadened distally, with pronounced, acute posterolateral processes. Four abdominal somites unarmed, each 132 × 184, 117 × 162, 97 × 138, and 170 × 125 µm. Caudal ramus shorter than anal somite, 153 × 50 (length/width = 3.06).

Antennule and antenna as those of female. All mouth organs as those of female as well, except for maxilliped. Maxilliped (Fig. 6B) 4-segmented. First segment (=syncoxa) unarmed, with bulged inner margin but without inner process. Second segment (=basis) armed with 1 long distal seta and medially 1 short oblique row of spinules near base of seta and another longer longitudinal row of spinules (Fig. 6C). Third segment (=first endopodal segment) short and unarmed. Terminal segment forming a long claw bearing bifid tip, armed basally with 1 small, process-like element and 2 setae of unequal length.

Legs 1-5 not differ from those of female. Distal segment of leg 5 103 × 44 µm. Leg 6 represented as 1 seta in genital area (Fig. 6A).

Etymology: The specific name *incheonensis* is originat-

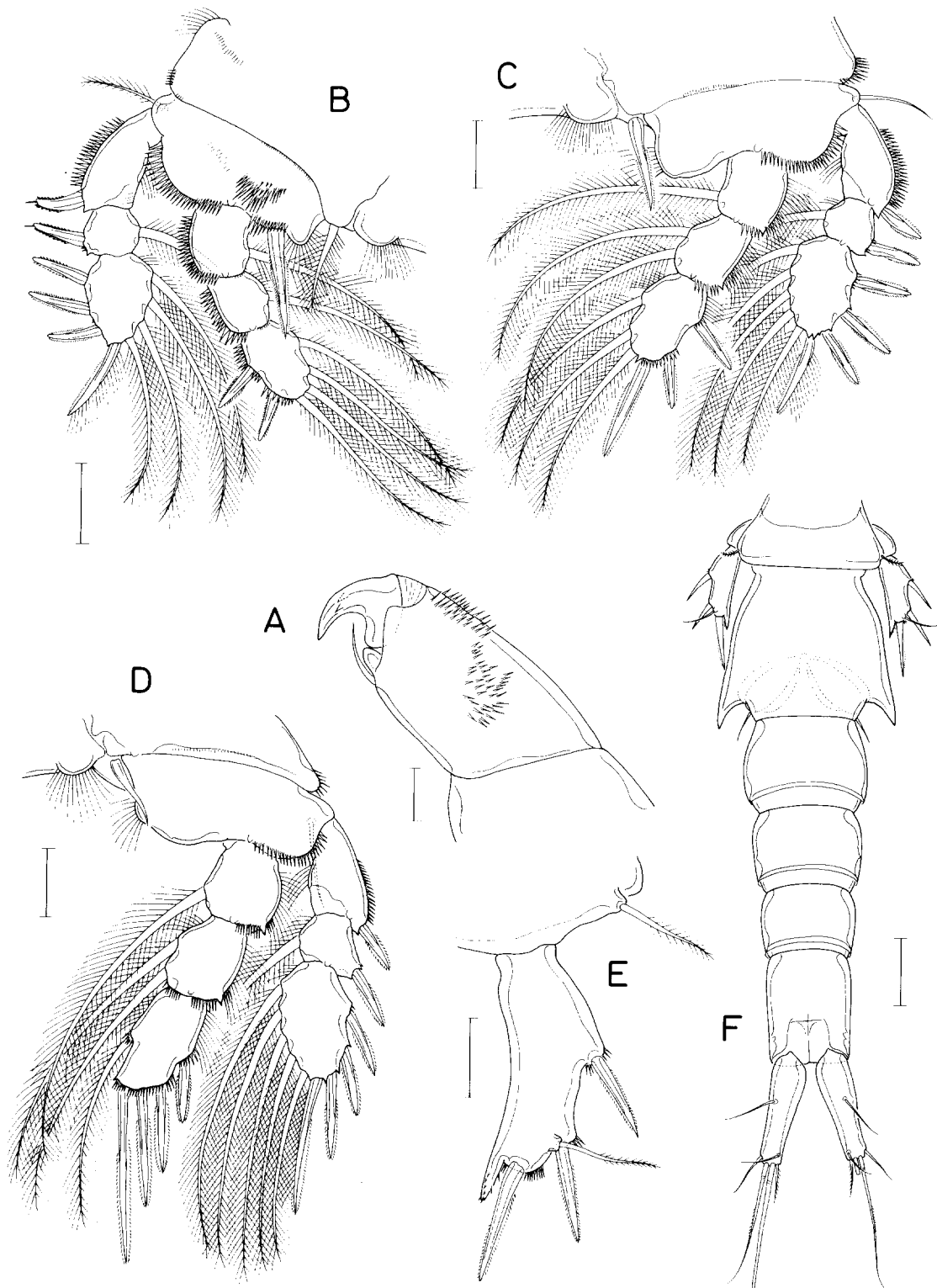


Fig. 5. *Conchyliliurus inchonensis* n. sp. Female: maxilliped; B, leg 1; C, leg 2; D, leg 4; E, leg 5. Male: F, urosome, dorsal. Scales: A=0.02 mm; B-E=0.05 mm; F=0.1 mm.

ed from Incheon, the city neighboring the type locality, Jakyakdo Island.
Remarks: Eight known species of *Conchyliliurus* are

quite uniform in morphology. The prosomal legs, antennule, antenna, and almost all the mouth organs reveal no species-specific character. However, the

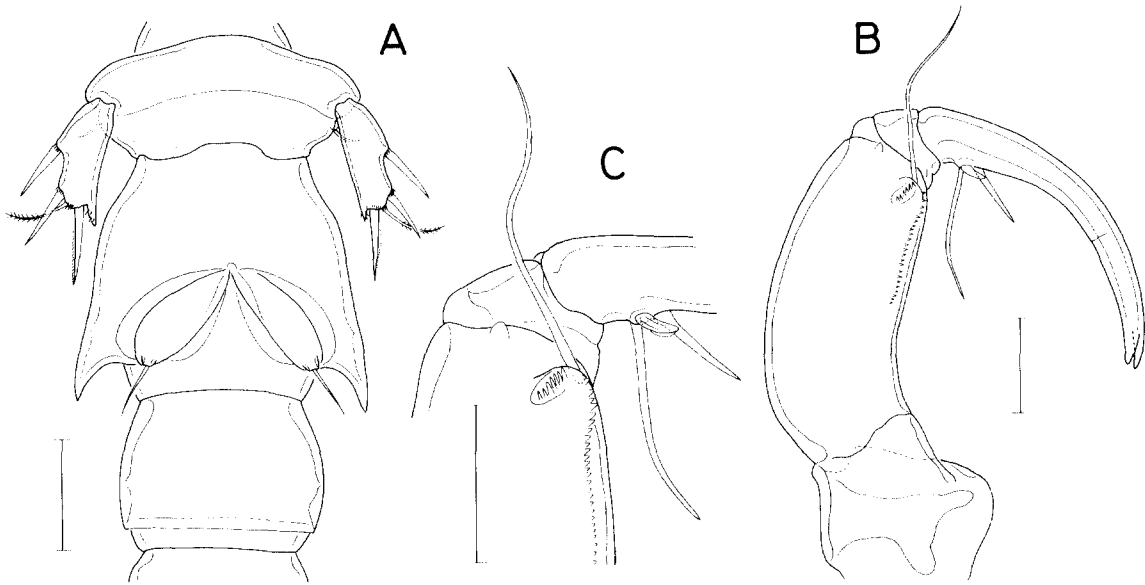


Fig. 6. *Conchyliliurus inchonensis* n. sp., male. A, anterior somites of urosome, ventral; B, maxilliped; C, area of third segment of maxilliped. Scales: A=0.1 mm; B, C=0.05 mm.

urosome offers some characteristic features usable in differentiating species.

As did Gooding (1963), species of this genus can be divided artificially into two groups on the basis of the presence or absence of the proximo-ventral spinules on anal somite. The first group bearing these spinules contains *Conchyliliurus cardii* Gooding, 1957, *C. lobatus* Humes and Cressey, 1958, *C. torosus* Humes and Cressey, 1958, *C. quintus* Tanaka, 1961, and *C. mactrae* Avdeev, 1977. Another group, to which *Conchyliliurus inchonensis* n. sp. belongs, bearing no such spinules contains *C. solenis* Bocquet and Stock, 1957, *C. maximus* Reddiah, 1961, and *C. bombasticus* Reddiah, 1961. *Conchyliliurus inchonensis* can be distinguished from the latter three species by the following ways:

Unlike the new species, *C. solenis*, the European species, has, according to Bocquet and Stock (1957), the caudal rami which is shorter than the anal somite, the distal segment of leg 5 bearing short inner distal process, the maxillule bearing only seven elements (instead of 8), and the male genital double-somite bearing no posterolateral processes.

Conchyliliurus maximus, an incompletely described species from the Indian Ocean, has an exceptionally large body size, 2.3-2.8 mm long in female (Reddiah, 1961), and the caudal rami which are very long and slender.

Conchyliliurus bombasticus, another species known from the Indian Ocean, was redescribed recently by Ho & Kim (1995). Based on this redescription, the female of this species has no genital lobe on the genital double-somite, the shorter caudal rami in which the ratio of length to width is 2.79 in contrast to 3.49 in the Korean species, and the smaller inner distal process of leg 5.

Acknowledgements

The field work for this study was made possible through the support from the Korea Science and Engineering Foundation (95-0401-04-01-3).

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[Received December 2, 1996; accepted February 17, 1997]