*KOREAN JOURNAL OF ZOOLOGY*
*Vol, 26. No, 2, 135-153 (1983)*

# Three Tube-Building Amphipods from Experimental Plates in Deukryang Bay in the Southern Coast of Korea

**Jai Sang Hong**
(Korea Ocean Research & Development Institute,
P.O. Box 17, Yeong Dong, Seoul, Korea)

# 韓國 南海岸 得粮灣에서 실시한 附着板實驗에서 大量發生했던 管棲 端脚類 三種의 分類 및 生態學的 硏究

洪 在 上
(韓國科學技術院 海洋硏究所)
(Received March 12, 1983)

**摘 要**

汚損生物 (fouling organisms)을 조사하기 위하여 1981년 1월부터 7월까지 한국 남해안에 위치하고 있는 得粮灣에서 附着板實驗을 실시한 결과 底棲性 端脚類가 優占動物群으로 나타났다. 그 중에서도 다음의 옆새우類 三種 (*Jassa falcata, Corophium acherusicum, Ericthonius brasiliensis*)은 부착판의 全 表面에 silty tubes를 형성하면서 附着生物의 群集 形成 초기단계가 괄목할만한 量的 增殖이 관찰되었는데 이들 3種의 형태적 특징과 生態에 관하여 기재하였다.

## INTRODUCTION

Systematic study of marine gammaridean amphipods in Korean waters has received little attention except that Iwasa (1939) and Stephensen (1944) have investigated some Korean materials.

Three tube-building amphipods are known in Deukryang Bay to pulluate on the submerged experimental blocks of cosmopolitan distribution in the temperate to tropical oceans and are considered as one of the most important taxonomic groups of fouling organisms. These organisms contribute abundantly to general fouling organisms in all parts of the world ocean, particularly with respect to installation of artificial structures in coastal areas, and to considerable damages upon hulls, cooling water conduits of industrial and power plants, and other submerged structures for mariculture.

The present study is to investigate fouling organisms in Deukryang Bay by means of the plastic and cement plates from January to July in 1981, and is focused on the des-

cription of these tubicolous amphipods and some of their ecological apects.

## MATERIALS AND METHODS

Deukryang Bay, located in the southern coast of Korea, is shallow and semienclosed embayment where a tidal current of mostly less than one knot flows in the north-east direction (Fig. 1). The study area is characterized by the typical conditions of the southern coastal embayments of Korea with relatively high standing crop of the phytoplankton as moderately eutropicated water with varying salinities (28.5-33.5‰) and suspended solids (0.8-14.2 mg/l). The mean monthly water temperature ranged from 2.4°C in January to 27.5°C in July with the annual mean of relatively warm 14.9°C (KORDI, 1981).

The sediments in the bay were largely dominated by the muddy fraction in the whole area of the bay, and the benthic fauna were somwhat diverse and rich in the number of species and individuals. The area seems to support relatively large and diverse fish populations, and serve as the spawning and nursery grounds for some of the resident fish species (KORDI, 1981).

A series of plastic and cement experimental plates have been installed in the waters of Deukryang Bay on January 22, 1981 and some of plates were recovered in March, May, and July 1981, and samples of fouling organisms were taken from these plates.

The experimental plates were made of plastic and cement, and measured 22×17×0.5 cm (=374 $cm^2$). The depth of the site was limited to only 8 m, and the plates were suspended at the depths of 1 m, 3 m and 5 m, as shown in Fig. 2, and reclaimed bimonthly in

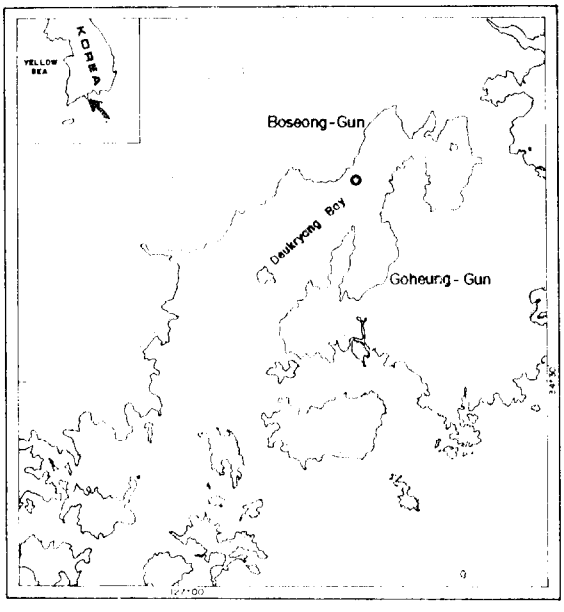


**Fig. 1.** Map of Deukryang Bay showing the experiment station(☆).

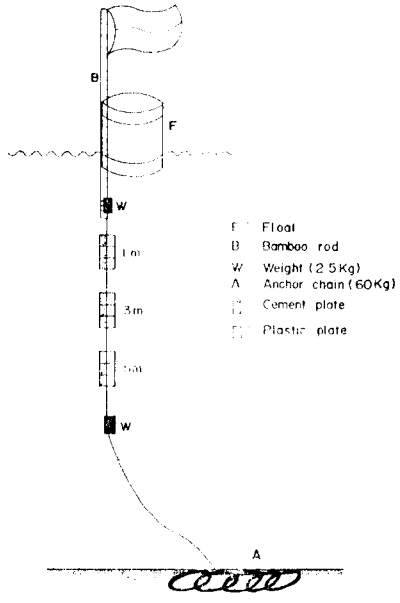


**Fig. 2.** *In situ* sampling design for the experimental plate studies.

order to study ecological succession of the biolgical assemblage formed on the artificial blocks.

## RESULTS AND DISCUSSION

During the initial colonization, the tube-building gammaridean amphipods showed the most remarkable numerical abundance together with certain caprellids such as *Caprella (Spinicephala) acanthogaster*, *C.(S.) californica*, and *C. (Rostrhicephala) eguilibra*. Three tubicolous gammaridean amphipods, *Jassa falcata*, *Corophium acherusicum*, and *Ericthonius brasiliensis* are described in the following and some ecological remarks are also noted.

### Genus *Jassa* Leach, 1814

### *Jassa falcata* (Montagu, 1808)

(figs. 3-5)

*Jassa falcata*: Chevreux & Fage, 1925, pp. 344-346, figs. 352-353; Barnard, K.H., 1932, pp. 241-242; Sexton & Reid, 1951, pp. 30-47, pls. 4-30; Nagata, 1965, p. 315; Barnard, J.L., 1969, pp, 155-159, figs, 38, 39; Culpepper, 1969, pp. 33-37; Bellan-Santini, 1971, pp. 259-260; Bellan-Santini & Ledoyer, 1972, pp. 916-917; Barnard, J, L., 1972, p. 135; Griffiths, 1974, p. 300; Relini & Pisano, 1977, p. 355; Lincoln, 1979, pp. 550-551, fig. 264

*Jassa dentex*: Chevreux & Fage, 1925, pp. 348-349, fig. 356; Irie, 1957, p. 2; Kajihara, 1964, p. 28

Material examined: fifty specimens selected from the artificial experimental plates in Deukryang Bay.

Description of male: Length up to 8~10 mm.

Lateral cephalic lobe coniform, ventral margin of lobe sinuous, eyes large and clear; accessory flagellum 2-articulate, article 1 elongate, article 2 obsolescent; antenna 1 approxi mately as long as the peduncle of antenna 2, antenna 2 much longer, more robust, thicker than antenna 1 especilly in male, second joint of the peduncle in antenna 1 and 5th joint in antenna 2 the longest, each joint of the peduncle carried on the posterior margin by a row of stiff and lightly curved bristles, sparsely feathered and graduated in length from rather short proximally to a little long distally, spines present at the distal posterior angle of antenna 2, flagellum possessing a series of feathered bristles inset in clusters generally at the distal posterior angle of each joint but the first joint of flagellum carried by several clusters; mandibular palp article 3 more or less clavate and 2-3 articles with plumose setae, molarial flake present; maxilliped palp article 4 stout, the inner and outer plates having some ventral tooth and plumose setae; coxa 1 more than three-quarters length of coxa 2, coxae 5-6 emarginate posteriorly but coxa 5 much larger than coxa 6; gnathopods 1 and 2 propodus very large with numerous plumose setae usually in clusters along a palmar ventral margin; gnathopod 1 of both

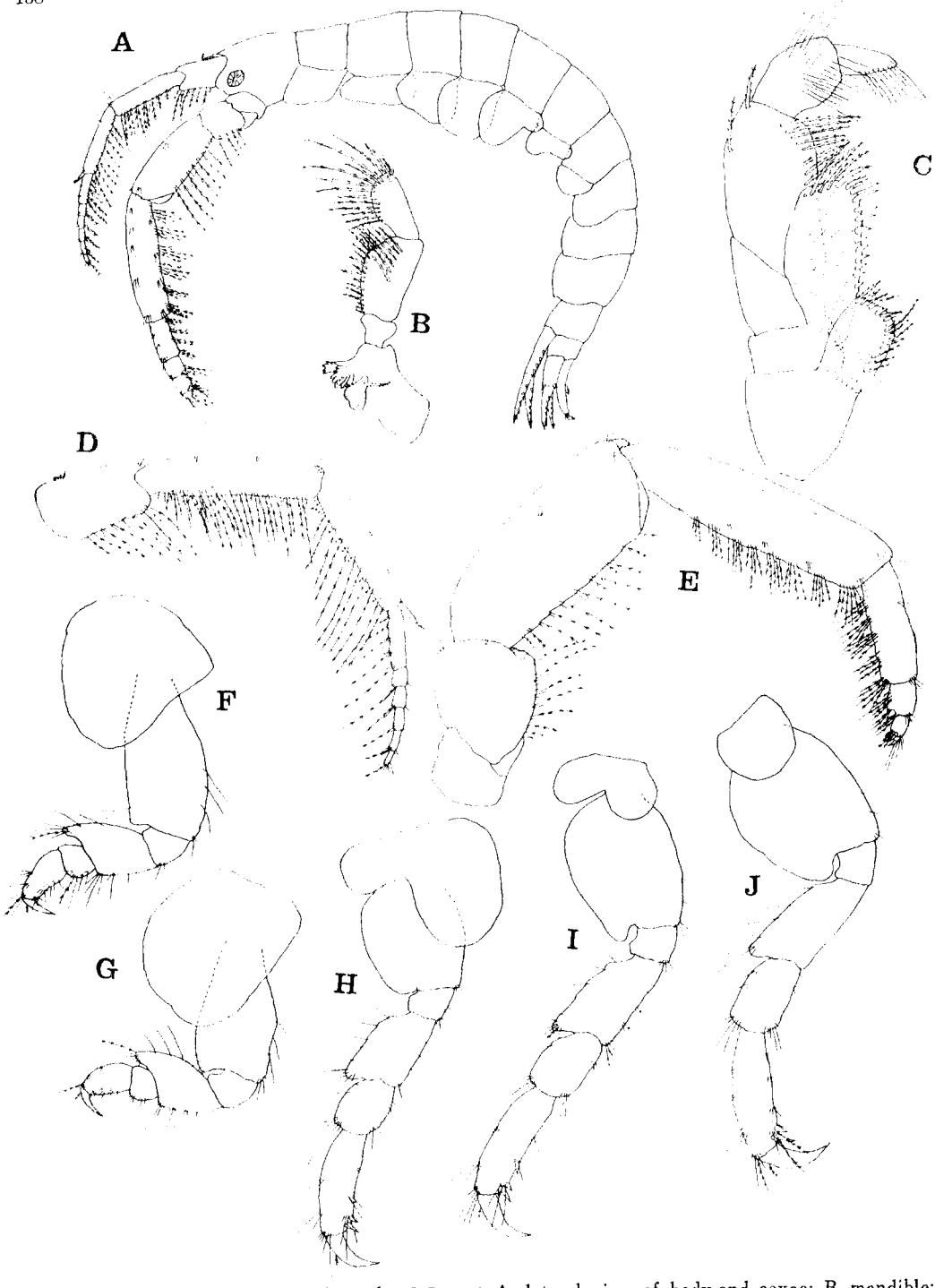


**Fig.** 3. *Jassa falcata* (Montagu), male, 6.5 mm: A, lateral view of body and coxae: B, mandible; C, maxilliped; D, antenna 1; E, antenna 2; F,G.H.I,J, pereopods 1, 2, 3, 4, 5.

sexes very similar, article 5 cup-shaped and smaller than 6, latter propodus somewhat ovate narrowing distally, palm strongly oblique, straight or weakly concave delimited by 2-3 small spines, dactyls with inner margin serrate and facial comb; gnathopod 2 extremely large and robust, development variable, basis more or less elongate with several long setae on anterior margin which shows slight crenulation, propodus often oval in young specimens with small proximal process but in adult specimens propodus form various, certain propodus elongate with enormous proximal bifid projection but other form with a proximal process not developed bearing sometimes midpalmar tooth; pereopods moderately setose without distinguished morphological differences in both sexes; pereopods 1-2 with anterior margin of basis bearing long setae, merus broad with

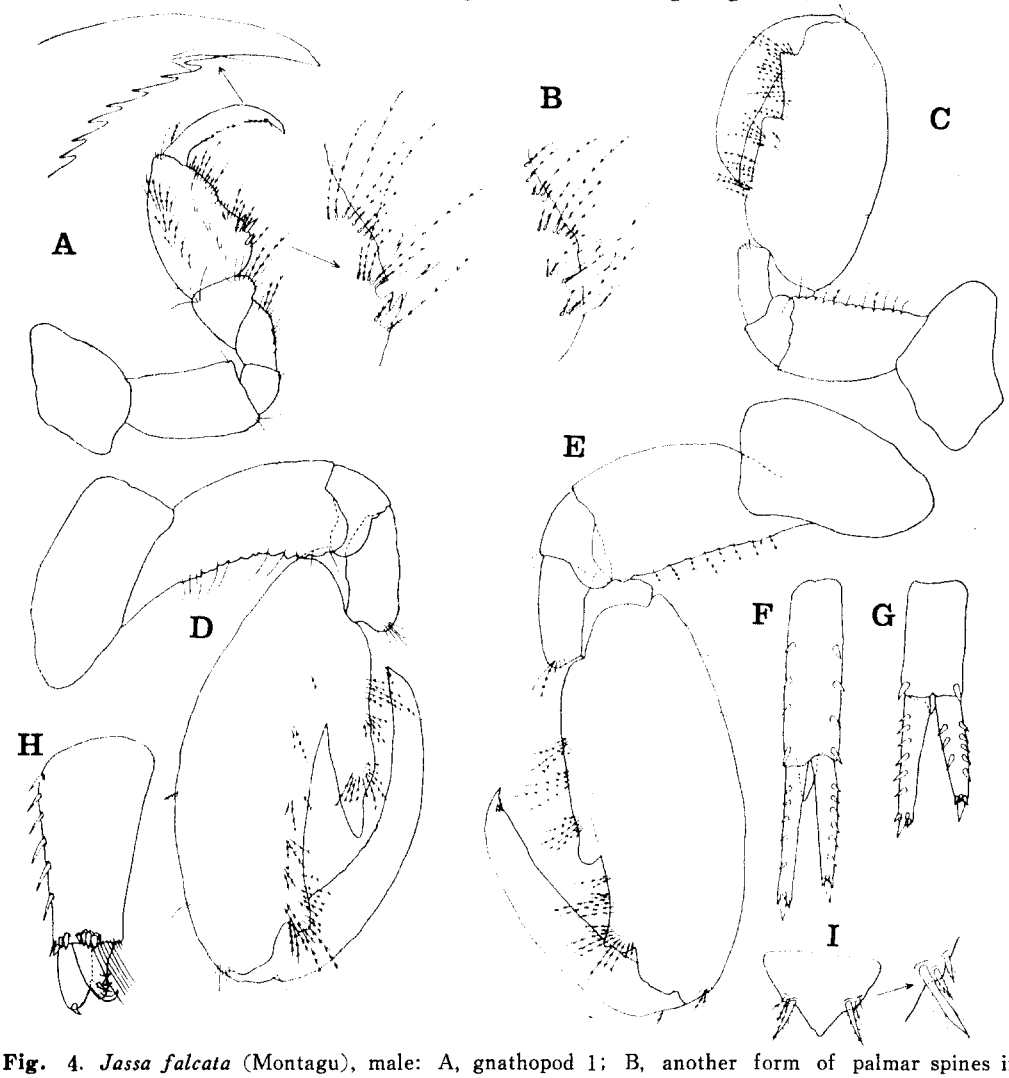


**Fig. 4.** *Jassa falcata* (Montagu), male: A, gnathopod 1; B, another form of palmar spines in gnathopod 1; C,D,E, various forms of gnathopod 2; F,G,H, uropods 1, 2, 3; I, telson.

numerous long setae, anterodistal angle produced and overlapping small carpus; pereopod 3 basis expanded, merus broad; pereopods 4-5 robust, basis moderately expanded and its posterodistal angle strongly produced and narrowly rounded; pereopods 3-5 with anterior margin of article 6 bearing 3-4 spines; dactyls of pereopods all bearing facial comb; uropods 1-2 outer ramus little shorter than inner, a long apical spine around three small ones in the distal end of inner and outer rami; a long process in the ventrodistal end of the first uropodal peduncle; uropod 1 with a series of spines along outer margin of peduncles and rami; uropod 2 peduncle with only a pair of distal spine; uroprd 3 inner ramus straight and flat bearing a single, stout, distal spine; uropod 3 outer ramus with a long, curved, basally immersed distal spine and two sharp, flattened accessory cusps proximal to the spine, which are large and slightly reverted proximally; posterior outer margin of uropod 3 outer ramus sometimes minutely serrate; telson triangular with a pair of subdistal plumose spines and two pairs of setules.

Female: Above all, the female is very different from male in shape and size of the second gnathopod; gnathopod 2 of female much larger than 1 and similar to ganthopod 1 of both sexes, basis with several long setae on anterior margin as in the gnathopod 2 of male but without the crenulation on anterior margin, propodus large and slightly narrowing distally, palm defined by 1-2 small spines, palmar margin concave, dactyl with several inner nail-shaped sculpture and facial comb; other characters are generally similar to those of male.

Discussion: Since the type specimen of this species was first described in 1808 by Montagu under the name of *Cancer* (*Gammarus*) *falcatus*, (*In* Sexton & Reid, 1951), many authors have published voluminous and often conflicting reports on the morphology of this species. Thus, it has been described under no less than 13 genera and 40 specific names. A major contribution to the clarification of the morphology of this species was made by Sexton & Reid (1951), who reported a comprehensive review of the previous literature along with illustrations of the various forms hitherto described.

Sexton & Reid (1951) carried out extensive breeding and rearing experiments with this species and were able to relate certain forms and particular growth stages to a number of species previously considered as distinct. They divided the species into three primary categories designated as "the broad form", "the narrow form", and "the large polar form". The division of the first two is based primarily on the thickness of the antenna and the second gnathopod. In addition to the three major forms, a number of minor forms were designated. The "cut-across stage" refers to a certain growth stage development of young males which cause them to resemble females. The "intersexes" are functional males but exhibit certain secondary female characteristics. The "intermediates" are small forms which conform largely to one or the other major categories, but show unusual configuration of the second gnathopod. The intermediate forms were divided into a number of sub-categories based largely on differences in the second gnathopod, particulary the

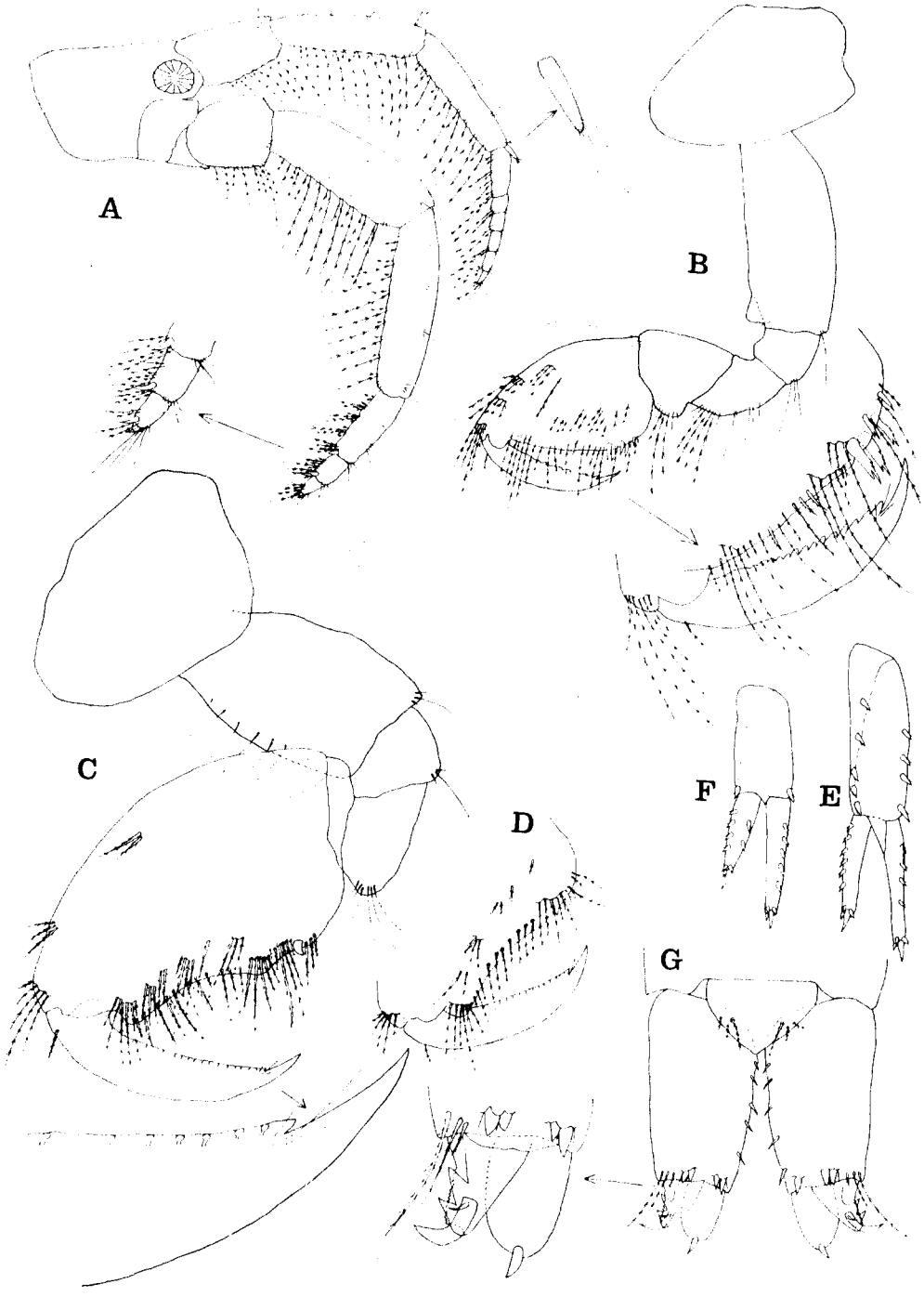


**Fig.** 5. *Jassa falcata* (Montagu), ovigerous female, 5.0 mm: A, lateral view of head and antennae 1, 2; B, gnthopod 1; C, gnathopod 2; D, palmar spinal variation of gnathopod 2; E,F, uropods 1, 2; G, uropod 3 and telson.

thumb of the propodus.

Besides several of the numerous forms, Barnard (1969) described another forms from the Californian populations, thin-bodied form and thick-bodied form. The thin-bodied form is distinct from all others by the shorter anterior coxae, the more slender body, and the poorly retained body pigment. The male first coxae are rounded at their anteroventral corners and are not pointed as in the typical thick-bodied forms; the second gnathopods are very slender and the posterior tooth of article 6, which varies so much in other forms of the species, is consistently short and armed with 2 stout spines. Article 2 of the accessory flagellum is obsolescent. The ventrodistal end of the first uropodal peduncle lacks any but a vestige of the long process observed in thick-bodied forms.

The *Jassa falcata* found on the artificial experimental plates in Deukryang Bay in the southern coast of Korea are closely related to Barnard's thick-bodied form (1969) by the male first coxae pointed at their anteroventral corners; male gnathopod 2 propodus with palm delimited by large bifid proximal process; ventrodistal end of the first uropodal peduncle bearing a long process. However, it is noteworthy that another forms of male gnathopod 2 were observed and they differ from others in bearing propodus elongate oval, palm with proximal process not developed with or without 2 stout spines. In addition, there are some specimens bearing the outer margin of outer ramus of uropod 3 characterized by the continuation of the small size of the denticles, which is rather characteristic in the genus *Ischyrocerus*.

Ecology: This species is an important fouling organism but also not infrequent in the photophilic algal community. The animal constructs tubes amongst littoral algae or hydroid growths, or preferably on artificial solid surfaces such as pilings, buoys, rafts or the hulls of ships. Their nests constructed after attachment to any floating object collect soon the mud and sand held in suspension by the water, afford fresh foothold for more algae and hydroids, and the dense shelter thus provided enables the *Jassa falcata* colonies to increase in immense numbers. Abundant populations have been observed in the milieu of harbors as fouling organisms (Barnard, J.L., 1958; Leung Tack, 1972) and also in Japanese waters this species is quantitatively important on the artificial experimental plates amongst Gammaridean amphipods in Sasebo Bay, western Kyushu (Kajihara, 1964). The reproduction occurs all the year round (Nair & Anger, 1980), and this species is also well adapted to fairly strong currents (Perkins, 1974) and hence *Jassa falcata* is a superior competitor in biotopes exposed to turbulent waters (Daro, 1970).

*Jassa falcata* were abundantly collected from the facies of brown alga *Cystoselra stricta* and *Mytilus galloprovincialis*, which belong to the biocoenoses of photophilic algae in the North western Mediterranean, and it has been referred to the species of hard substrates with a wide ecological distribution (Bellan-Santini, 1971). The colonies or silty tubes in mass may become very large and sometimes can cause congestion of

water pipes and ducts which run into the sea from coastal industrial installations. They can also inflict considerable damage, for example in other submerged structures to be used for mariculture fisheries. However, it is interesting to note that this species have been found in nocturnal plankton samples in the Gulf of Marseille (Macquart-Moulin, 1968).

The experimental plate study on the fouling organisms in Deukryang Bay during January to July 1981, showed that the artificial plates were completely colonized by the tube-building amphipods in the initial phase, particularly by this species *Jassa falcata* (Montagu).

Distriubution: Cosmopolitan in temperate, warm-temperate, and tropical waters and it has been recorded nearly from all parts of the world; widespread and frequently recorded in Atlantic, Pacific and Indian Oceans, both north and south of the equator. Reported from most coastal regions, especially frequent in bays and harbors, and often locally abundant. Bellan-Santini & Ledoyer (1972) reported also the specimens referable to the "Large Polar Form" described by Sexton & Reid (1951) from Antarctic Kerguelen.

## Genus *Corophium* Latreille, 1806

### *Corophium acherusicum* Costa, 1857

(figs. 6-8)

*Corophium acherusicum*: Chevreux & Fage, 1925, p. 368, fig. 376; Shoemaker, 1934, pp. 24-25; Barnard, J.L., 1954, p. 36; Barnard, J.L., 1955, p. 37; Irie, 1957; pp. 5-6, fig. 6; Nagata, 1960, p. 177; Barnard, J.L., 1964, p. 111; Nagata, 1965, p. 317; Barnard, J.L., 1971, p. 59; Bellan-Santini, 1971, pp. 260-261; Bellan-Santini & Ledoyer, 1972, p. 908; Barnard, J.L., 1972, p. 48; Griffiths, 1974, p. 281; Relini & Pisano, 1977, p. 355; Lincoln, 1979, p. 532, fig. 255 a-f

Material examined: 30 specimens taken from the artificial experimental blocks in Deukryang Bay.

Description of Female: Length up to 5 mm.

Body subcylindrical, depressed; head with small triangular rostrum; antennae setose; ventral margin of first peduncular article of antenna 1 with 6 long spines, proximal spine curved, and inner margin with 5 spines and several long distal setae; ovigerous specimens bearing 7 spines on peduncular article 4 of antenna 2, arranged 2, 2, 2, 1, but peduncular article 3 with 2 spines on ventrodistal margin and fifth joint bearing two equally spaced spines on lower margin; gnathopod 1 propodus with palm slightly oblique and convex, finely serrate throughout, armed on outer edge with 2-3 submarginal spines and several short spines on palmar margin; gnathopod 2 grossly setose; dactyl of gnathopod 2 with 3 accessory teeth on inner margin but the third tooth vestigial; pereopods 1-4 basis scarcely setose; pereopods 3-4 carpus with 2 rows of teeth on the dorsal surface, 5 stout spines on upper distal margin and 3-4 spines on central region; pereopods 3-5 propodus armed with one short spine on central region; pereopods 3-5

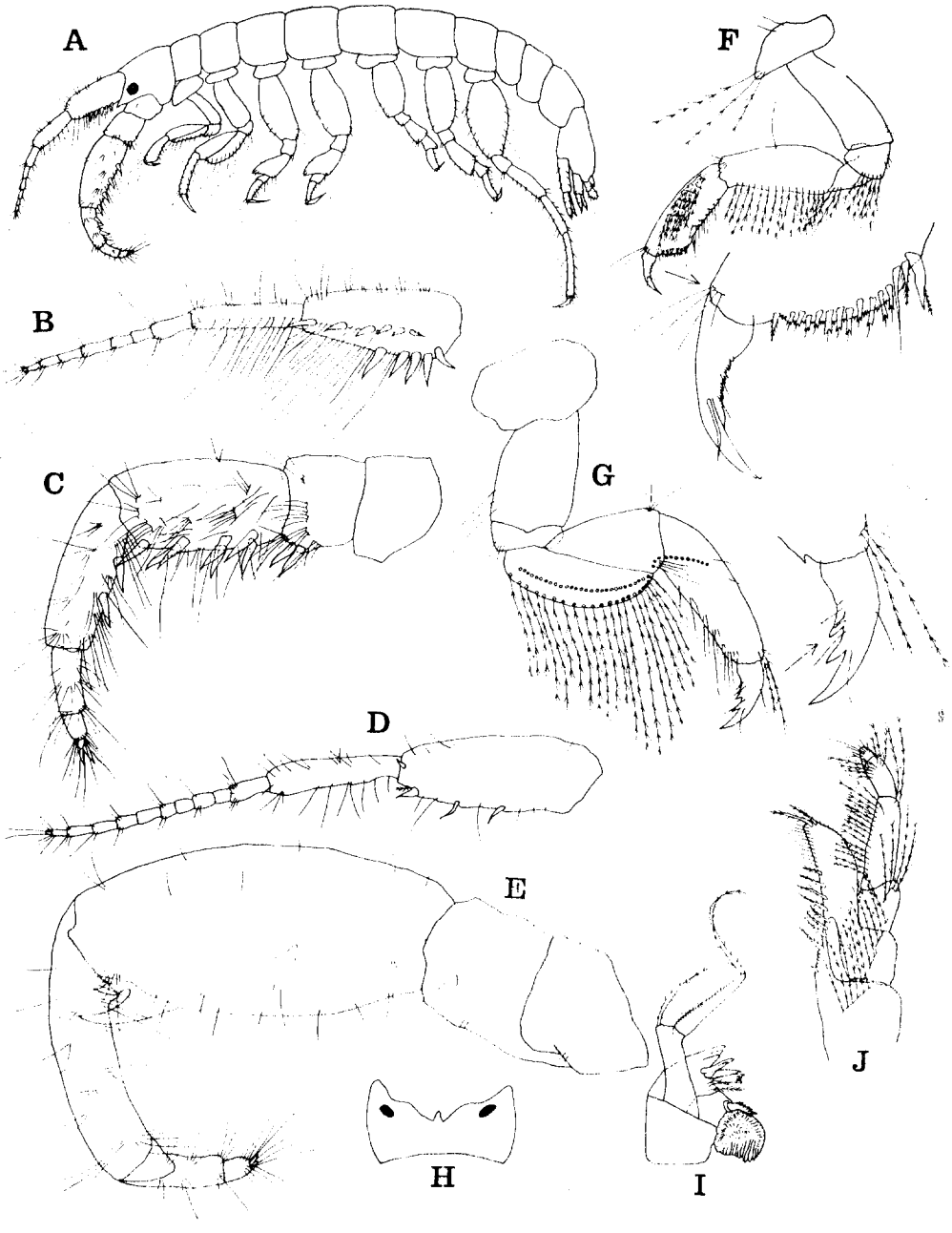


**Fig.** 6. *Corophium acherusicum* Costa: A, lateral view of an ovigerous female except pleopods, 5.0 mm; B,C, antenna 1, 2, of ovigerous female; F,G, female gnathopods 1, 2; H, upper view of head of adult male; I, male mandible; J, male maxilliped.

propodus armed with one short spine on anteroterminal end; pereopod 5 carpus without the swelling of the center of the front margin or row of short spinules; urosome segments depressed and coalesced; uropod 1 peduncle with triangular distal lobe, outer margin with 7-9 spines, inner margin with 3-5 spines; uropod 1 outer ramus with 4 spines on outer margin and none on inner margin, inner ramus with 5-6 spines and none on inner margin uropod 2 inner margin of peduncle with one distal spine and none on outer margin; uropod 2 outer ramus with 1-2 spines on outer margin and none on inner margin, inner ramus with 2-3 spines on outer margin and none on inner margin; uropod 3 pedundle and ramus flattened and broad, ramus a little longer than peduncle, and armed distally with several long and small slender spinules; telson softly triangular armed with 3-4 pairs of small plumose setae on dorsolateral side and 2 rows of several short spines forming quadrangular structure in terminal margin.

Male: Length up to about 4 mm. Male rostrum short; antennae scarcely setose; ventral margin of peduncle article of antenna 1 provided with 3 short spines, inner margin without spines; antenna 2 reaching nearly half of body length, article 4 sparsely setose, distal ventrolateral angle with one large and one small acute process, article 5 with a small process near the base and a large blunt process terminally; mandible with well developed molar, 2-articulate, palp with first joint somewhat produced distally and bearing the customary plumose seta, the second joint articulated obliquely to the first and provided with the plumose seta; maxilliped outer plate large, palp elongate, 4-articulate with long plumose setae; gnathopods, pereopods, urosome, and uropods largely much like the female except the following characters. Pereopod 5 carpus having the center of the front margin somewhat protruding and above this swelling a row of very short straight spinules present, uropods 1 and 2 less spinose.

Discussion: The arrangement of spines on the antennae of ovigerous females is more or less variable but distinctive for the indentification. However, 7 spines on peduncular article 4 of antenna 2 are largely specific, and arranged in 3 pairs and a single terminal.

Male antenna 2 article 4 very large and sparsely setose bears one large and one small acute tooth in distal ventrolateral angle. However, these characters are sometimes confusing amongst certain related taxa such as *C. insidiosum* Crawford, *C. baconi* Shoemaker, and *C. bonelli* (Milne-Edwards), because the number of these antennal spines, and of accessory teeth on the dactyl of gnathopod 2 in the female increase with age and in the male there is a progressive deterioration of spines in number and size, and an appearance of small basal and large terminal processes on the article 5 of antenna 2 (Crawford, 1937).

Another character also useful for the indentification of this species is the morphology of the carpus of male pereopod 5, which is characterized by the possession of the center of the front margin somewhat protruding and the presence of a row of very short straight spinules above this swelling. In females or even younger males, however, this

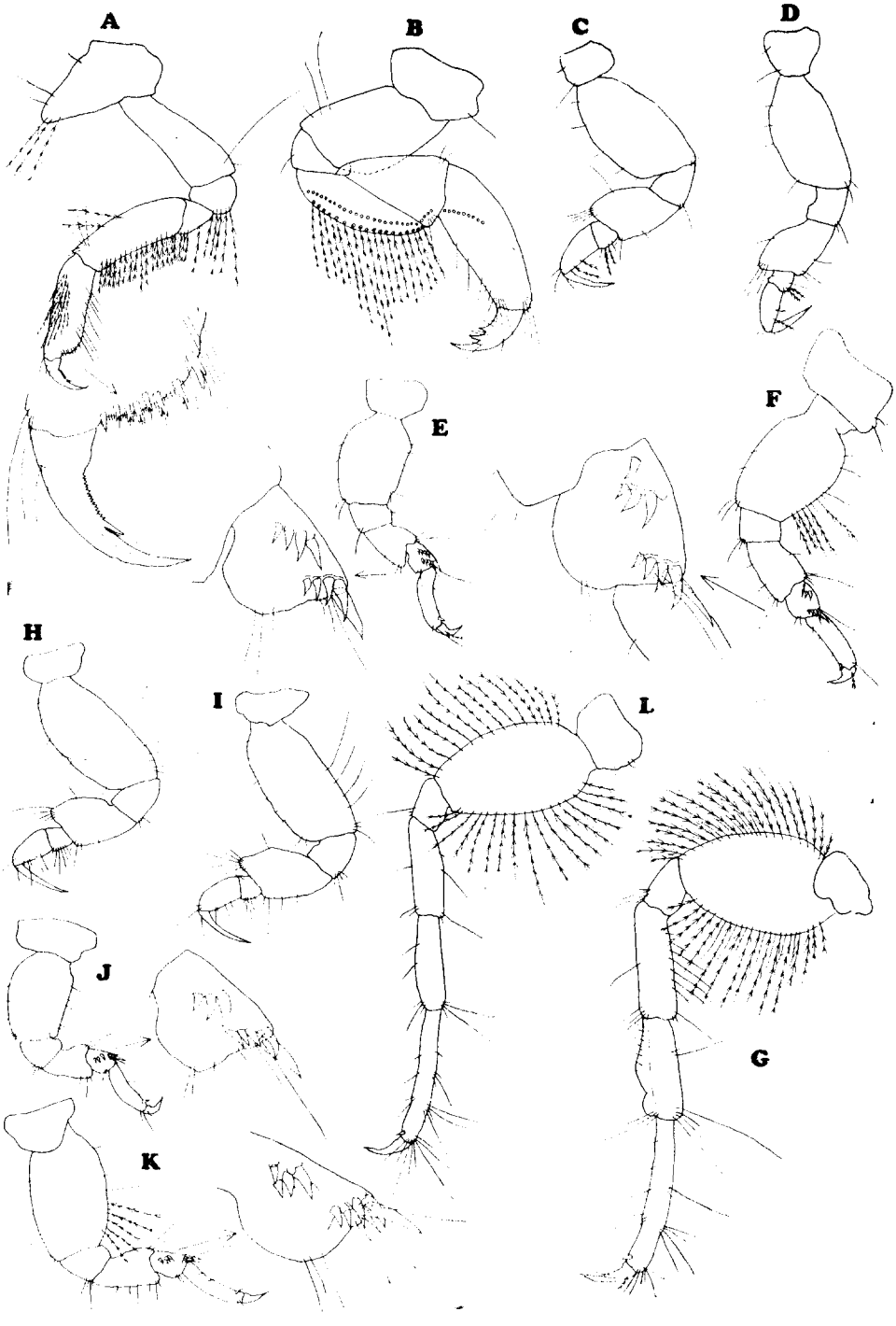


**Fig. 7.** *Corophium acherusicum* Costa: A,B, male gnathopods 1, 2; C,D,E,F,G, male pereopods 1, 2, 3, 4, 5; H,I,J,K,L, female pereopods 1, 2, 3, 4, 5.

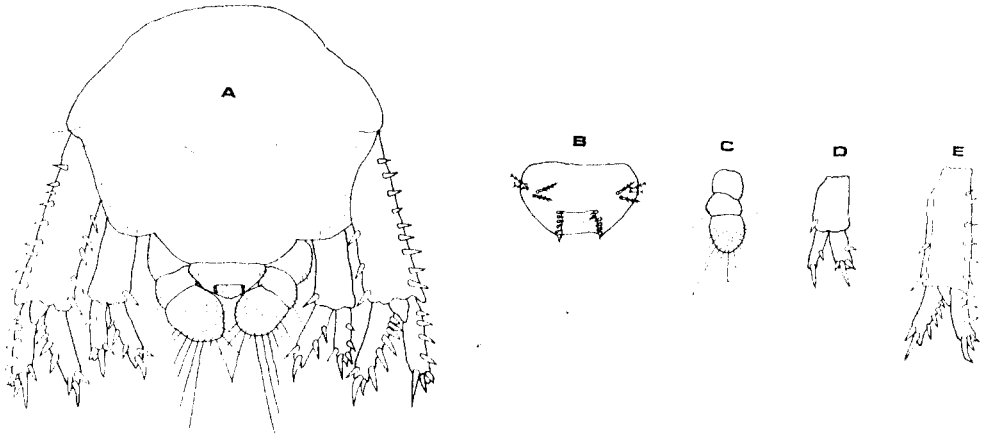


**Fig.** 8. *Corophium acherusicum* Costa: A, urosome, uropods, uropods, and telson of an ovigerous female; B, male telson; C, uropod 3; D, uropod 2; E, uropod 1.

article does not bear these characters.

Ecology: Like *Jassa falcata* (Montagu, 1808), *Corophium acherusicum* forms tubes on weed and hydroids in shallow waters, usually in harbors, and especially on floating objects such as buoys, rafts, and other submerged artificial structures. Barnard, J.L. (1958) demonstrated from an experimental study of a series of wooden test blocks installed in the waters of Los Angeles-Long Beach Harbors that this species was quantitatively most important fouler. From the amphipodological study of Marseille Harbor, Bellan-Santini (1971) suggested that the presence of *C. acherusicum* may be due to euryhaline condition or marked hypersedimentation on hard substrates.

This species has been also recorded as a major inhabitant on artificial reef submerged at a depth of 6 m in Marseille waters (Coustalin, 1971) and on artificial panel test in Sasebo Bay, western Kyushu (Kajihara, 1964). The experimental plate studies carried out in Deukryang Bay showed a non-negligible density during the initial phase of submergence.

Distribution: Cosmopolitan in the temperate and tropical coastal waters; North Atlantic, American and European coasts; Mediterranean; North Sea; Black Sea; Indian Ocean, south and east Africa; Pacific Ocean, Australia, New Zealand, Hong Kong, Japan, China, western coast of North America.

## Genus *Ericthonius* Milne-Edwards, 1830

### *Ericthonius brasiliensis* (Dana, 1853)

(figs. 9-10)

*Ericthonius brasiliensis*: Chevreux & Fage, 1925, pp. 353-354, figs. 360-361; Barnard, K. H., 1937, p. 173; Barnard, J.L., 1955, pp. 37-38; Irie, 1957, pp. 4-5, figs. 5-1, 5-2; Culpepper, 1969, pp. 26-30; Barnard, J.L., 1969, p. 102, fig. 24 f-i; Barnard, J.L., 1971, p. 61; Bellan-Santini, 1971, p. 260; Bellan-Santini & Ledoyer, 1972, pp. 908-909;

Ledoyer, 1973, pp. 28-29, pl. 2; Griffiths, 1974, pp. 281-282; Ledoyer 1979a, pp. 91-93; Ledoyer, 1979b, p. 166; Lincoln, 1979, p. 560, fig. 269 a-e; Barnard, J.L., 1979, pp. 24-25

Material examined: 30 specimens selected from the samples for experimental blocks in Deukryang Bay.

Description of male: Length up to 8.5 mm.

Body especially depressed in male; cephalic lobes apically acute; eyes very large, protruding, and rounded; coxal plates contiguous except for plate 2, coxae 4-5 emarginate posteriorly; epimeral plate 3 distal margin rounded, minutely crenulate; antennae little over half body length, peduncle articles elongate, setose; antenna 1 flagellum about 11-articulate, lower distal end of the first peduncular article with a spinal process, terminal article of flagellum bearing two serrate spinal setae on distal margin; antenna 2 peduncular article 5 little longer than 4, flagellum about 10-articulate, terminal article of flagellum with 2 spines and several setae on distal margin; gnathopod 1 carpochelate, propodus smaller than carpus, both triangular, setose, palm oblique defined by several spines and plumose long setae on the margin, palmar margin minutely serrate: gnathopod 2 merus and ischium very small, carpus very large and robust, posterodistal angle with a long acute process and an accessory tooth on inner margin, propodus much smaller with low distal tubercle, dactyl broad and slightly curved proximally; mandible with large triturative molar, palp 3-articulate, palp articles 2-3 broad and setose; maxilliped inner and outer plates with several spines and plumose setae, palp slender and setose; maxillae well developed; lower lip with inner lobes well developed; pereopods 1-2 basis broadly rounded, pereopods 4-5 generally longer than 1-3, pereopods 4-5 basis moderately expanded, propodus with 2 spines on ventrodistal corner, dactyl serrate on inner margin and two hooks present on outer margin, pereopod 3 basis with inferoposteriorly slight extension, propodus with 2 spines on ventrodistal margin, dactyl with 2 hooks on outer margin; uropods 1-3 peduncles spinose on the outer and inner margins, uropods 1-2 ramus subequal, weakly spinose, margins minutely serrate; uropod 3 peduncle elongate, ramus very short, curved with terminal short hooks and spinules; telson short and broad, and covered with a pair of several tiny hooks and setae.

Female: Length up to 5 mm for ovigerous females. Largely like the male except in the following characters:

Coxal plates generally more setose and with plumose setae along anterior margin; peduncular article 1 of antenna 1 without a spinal process on lower distal end, terminal article of flagellum bearing 2 spines and several setae like that of antenna 2; gnathopod 1 much like that of male but more setose in propodus and carpus; gnathopod 2 carpus with narrow setose posterior lobe, propodus oval, palm convex delimited by 3 small spines, posterior palmar margin armed with several tiny spines; pereopods largely similar to those of males except for pereopod 3, of which the basis is moderately expanded like

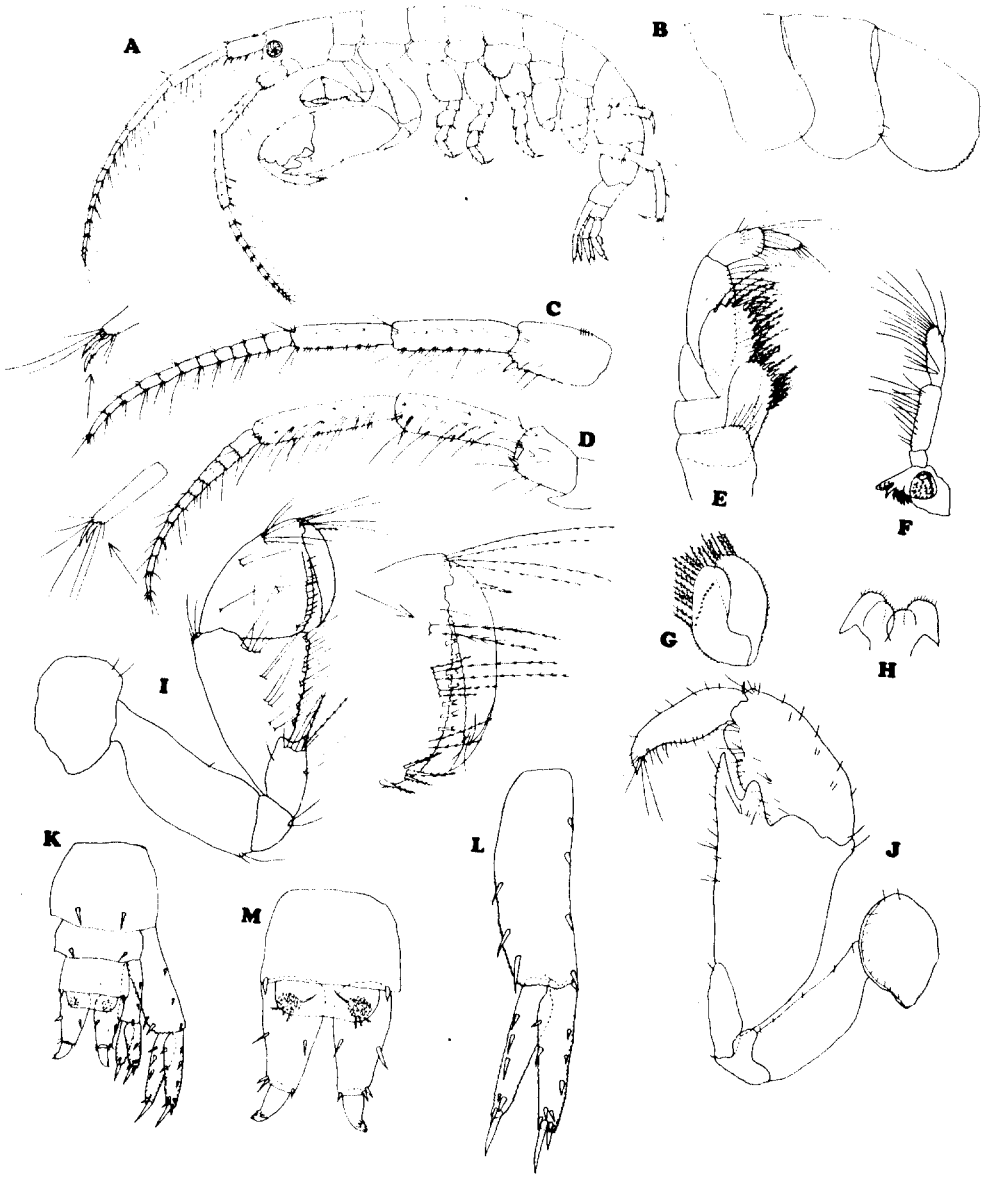


**Fig. 9.** *Ericthonius brasiliensis* (Dana), male, 8.0 mm: A, lateral view of adult male except pleopods; B, epimeron; C,D, antennae 1, 2; E, maxilliped; F, mandible; G, maxilla 2; H, lower lip; I,J, gnathopods 1, 2; K, urosome, uropods, and telson; L, uropod 1; M, uropod 3 and telson.

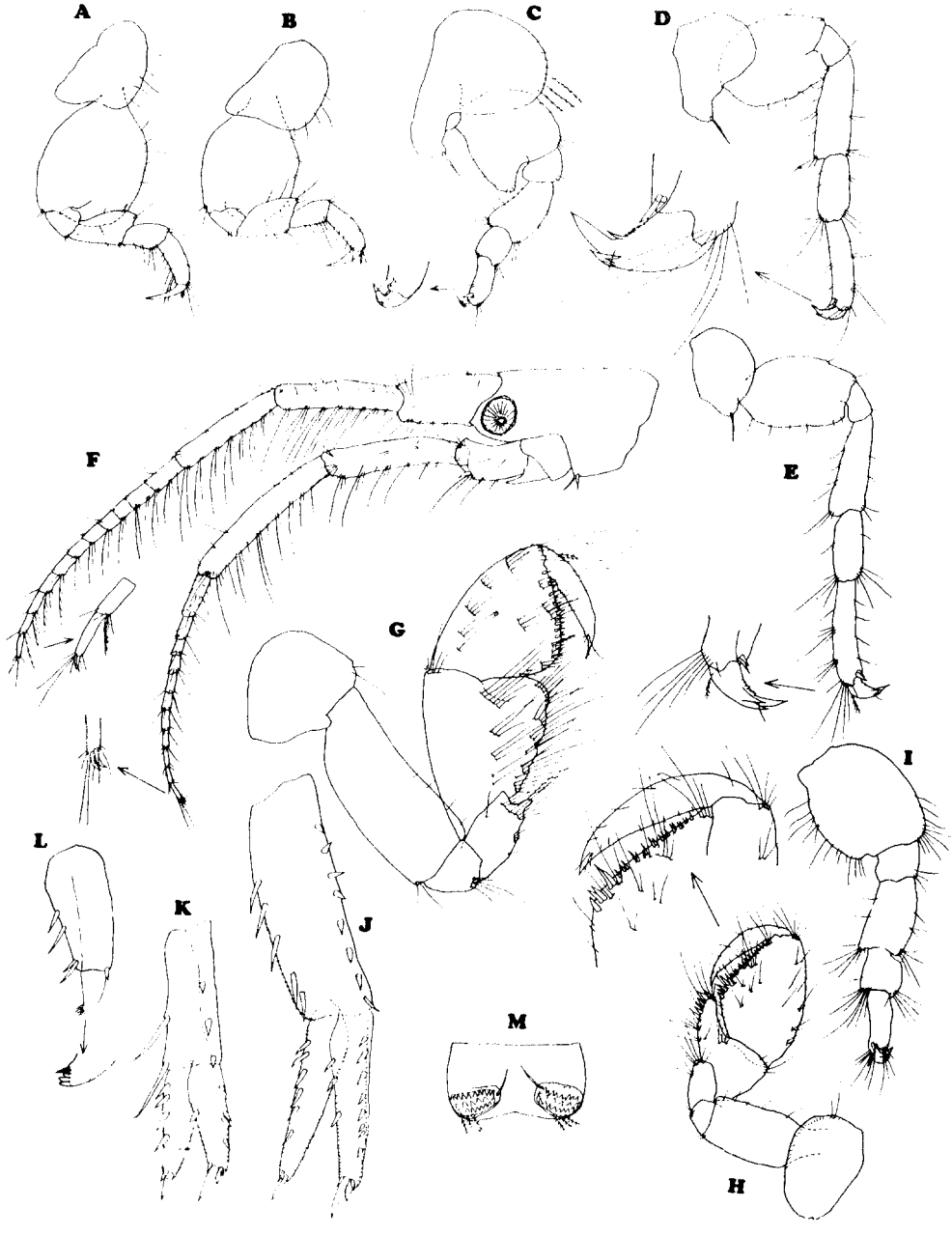


**Fig. 10.** *Ericthonius brasiliensis* (Dana): A,B,C,D,E, male pereopods 1, 2, 3, 4, 5; F, lateral view of head and antennae, ovigerous female, 5.0 mm; G,H, female gnathopods 1, 2; I, female pereopod 3; J,K,L, female uropods 1, 2, 3; M, female telson.

pereopods 4-5.

Discussion: The separation of the species has been based generally on the morphology of the second male gnathopod, the famales being almost impossible to distinguish. However, certain problem can be caused in this species, since the structure of male gnathopod 2 is variable with size of specimen; propodus ovate and carpus bidentate in small specimens, but often in large individuals propodus narrowly rectangular, carpal process very elongate with secondary tooth reduced to small ridge (Lincoln, 1979).

*E. brasiliensis* is very closely related to *E. pugnax* Dana in the morphological structure of male gnathopod 2 (Nagata, 1960). Therefore the identification of *E. brasiliensis* can be made, for the moment, only by the male pereopod 3 of which the basis bears the inferoposterior lobe much less developed than in *E. pugnax* Dana, and by the uropods 1-2 ramus which are denticulate (Ledoyer, 1973, 1979b).

Ecology: This species forms great masses of silty tubes attached to piles, docks in harbors, but inhabits sparsely the open sea to depths of at least 30 m, usually in algal communities. In the waters of Los Angles-Long Beach Harbors this species was shown as a major foulng organism from the survey conducted by wooden test blocks (Barnard J.L. 1958). Ecological study of amphipods collected in the Marseille Harbor demostrated that *E. brasiliensis* was very tolerant of certain pollution and its distribution might rely on the sedimentation of the possibility of easy capture for muddy particles in suspension (Bellan-Santini, 1971). In Simabara Peninsula, facing to Ariake Kai, Japan, Irie (1957) observed marked quantitative abundance in relation to the presence of mud on the substrates. The experimental plate survey in Deukryang Bay did not show high density for the initial phase of benthic colonization.

Distribution: Cosmopolitan in temperate and tropical seas; widespread in Atlantic, Pacific and Indian Oceans; European coasts from northern Norway to Mediterranean; east coast of America, Hawaii, notheastern Gulf of Mexico, Simabara Peninsula (Japan).

## SUMMARY

Studies of fouling organisms in Deukryang Bay in 1981 showed that amphipod crustaceans comprised the most abundant zoological group. Three tubicolous gammaridean amphipods, *Jassa falcata* (Montagu, 1808) *Corophium acherusicum* (Costa, 1857) and *Ericthonius brasiliensis* (Dana, 1853) were described. They formed great masses of silty tubes attached to plastic and cement experimental plates. The ecological aspects of these fouling organisms have been also discussed.

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