

**TWO NEW LICHOMOLGID COPEPODS  
(CRUSTACEA: POECILOSTOMATOIDA)  
ASSOCIATED WITH ASTEROIDEA  
AT SINGAPORE AND SULAWESI**

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**ABSTRACT.** - Two copepods of the family Lichomolgidae associated with sea stars are described, *Stellicola antheanae*, new species, from *Antheana aspera* at Singapore, and *Synstellicola thromidiae*, new species, from *Thromidia catalai* at Pulau Bunaken, Manado, Sulawesi. Among characters useful for the distinction of these new species from congeners are the size of the body, the shape of the female genital double-somite, the size of the caudal ramus, the structure of the male maxilliped, and the shape and dimensions of leg 5.

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**INTRODUCTION**

Species of the two lichomolgid genera *Stellicola* and *Synstellicola* are common associates of Asteroidea in shallow waters throughout the Indo-Pacific, having been recorded from the Red Sea, Madagascar, India, the Moluccas, Japan, Korea, Palau, Enewetak Atoll, New Guinea, New Caledonia, Fiji and Hawaii (Kossmann, 1877; Stebbing, 1900; Thompson & A. Scott, 1903; Humes & Cressey, 1961; Ummerkutty, 1962; Humes & Ho, 1966, 1967; Humes, 1970; Sebastian, 1972; Humes & Stock, 1973; Humes, 1976a, b; Humes, 1980; Ho, 1982; Nair & Pillai, 1985; Humes, 1986; Kim, 1992). Species of these two genera, including the two new species described below, are associated with 24 species of sea stars in 17 genera. *Stellicola holothuriae* Ummerkutty, 1962, is exceptional in being associated with a holothurian, *Opheodesoma spectabilis* Fisher (see Humes, 1980; Ummerkutty, 1962). Except for members of the siphonostomatoid family Stellicomitidae, *Stellicola* and *Synstellicola* are among the copepods most frequently associated with asteroids.

This paper contains the descriptions of two copepod associates of shallow-water sea stars in the tropical western Pacific, *Stellicola antheanae*, new species, from *Antheana aspera* Döderlein at Singapore, and *Synstellicola thromidiae*, new species, from *Thromidia catalai* Pope & Rowe in Sulawesi.

DESCRIPTIVE PART

POECILOSTOMATOIDA THORELL, 1859

FAMILY LICHOMOLGIDAE KOSSMANN, 1877

*Stellicola* Kossmann, 1877

*Stellicola antheneae*, new species

(Figs. 1a-g, 2a-l, 3a-j)

**Type material examined.** - 12 females, 5 males, 7 copepodids from 2 sea stars (*Anthenea aspera* Döderlein, 1915), 15 m, dredged midway between Pulau Ubin and Pulau Tekong (off Changi), Singapore, 01°24'N, 104°00'30"E, coll. 26 Jan.1994. Holotype female (ZRC.1995.164), allotype male (ZRC.1995.165), and 6 paratypes (4 females, 1 male) (ZRC.1995.166) deposited in the Zoological Reference Collection, Department of Zoology, National University of Singapore, and 7 paratypes (5 females, 2 males) (USNM 268327) in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Remaining paratypes (dissected) and copepodids in the collection of the author.

**Description.** - Female: Body (Fig. 1a) with broad flattened prosome. Length 1.18 mm (1.11-1.26 mm) and greatest width 0.81 mm (0.77-0.86 mm), based on 10 specimens in lactic acid. Somite bearing leg 1 fused dorsally with cephalosome. Epimera of somites bearing legs 1-3 expanded and pointed posteriorly (Fig. 1b). Somite bearing leg 4, small, with rounded epimera, and covered in dorsal view by tergum of somite bearing leg 3 (Fig. 1a). Ratio of length to width of prosome 1.10:1. Ratio of length of prosome to that of urosome 2.83:1.

Somite bearing leg 5 (Fig. 1c) 115 x 230 µm. Genital double-somite broad, 110 x 230 µm, ratio of length to width 1:2. Genital areas located posteriorly, each area bearing 2 setae 16 µm and 23 µm. Three postgenital somites from anterior to posterior 26 x 100, 23 x 94, and 36 x 88 µm.

Caudal ramus (Fig. 1d) wider than long, 21 x 31 µm, ratio of length to width 0.68:1. Outer lateral seta 55 µm, dorsal seta 26 µm, outermost terminal seta 122 µm, innermost terminal seta 112 µm, and 2 median terminal setae 400 µm (outer) and 550 µm (inner). All setae smooth.

Body surface without visible sensilla except few on ventral surface of rostrum and adjacent areas (Fig. 1g).

Egg sac elongate, multiseriate, variable in form, 693 x 429 µm (Fig. 1e), 660 x 319 µm (Fig. 1f), each of many eggs 52-57 µm in diameter.

Rostrum (Fig. 1g) broad, linguiform. Antennule (Fig. 2a) 380 µm long. Lengths of its 7 segments (measured along their posterior nonsetiferous margins): 34 (60 µm along anterior side), 130, 57, 52, 47, 26, and 20 µm, respectively. Armature: 4, 13, 6, 3, 4+1 aesthete, 2+1 aesthete, and 7+1 aesthete. All setae smooth.

Antenna (Fig. 2b,c) 195 µm long, 3-segmented. Armature: 1, 1, and 3 and 1 terminal claw plus 3 setules. All setae smooth. Claw (Fig. 2d) 81 µm.

Labrum (Fig. 2e) with 2 diverging posteroventral lobes. Mandible (Fig. 2f) resembling that of congeners. Paragnath (Fig. 2g) small lobe. Maxillule (Fig. 2g) elongate slender lobe

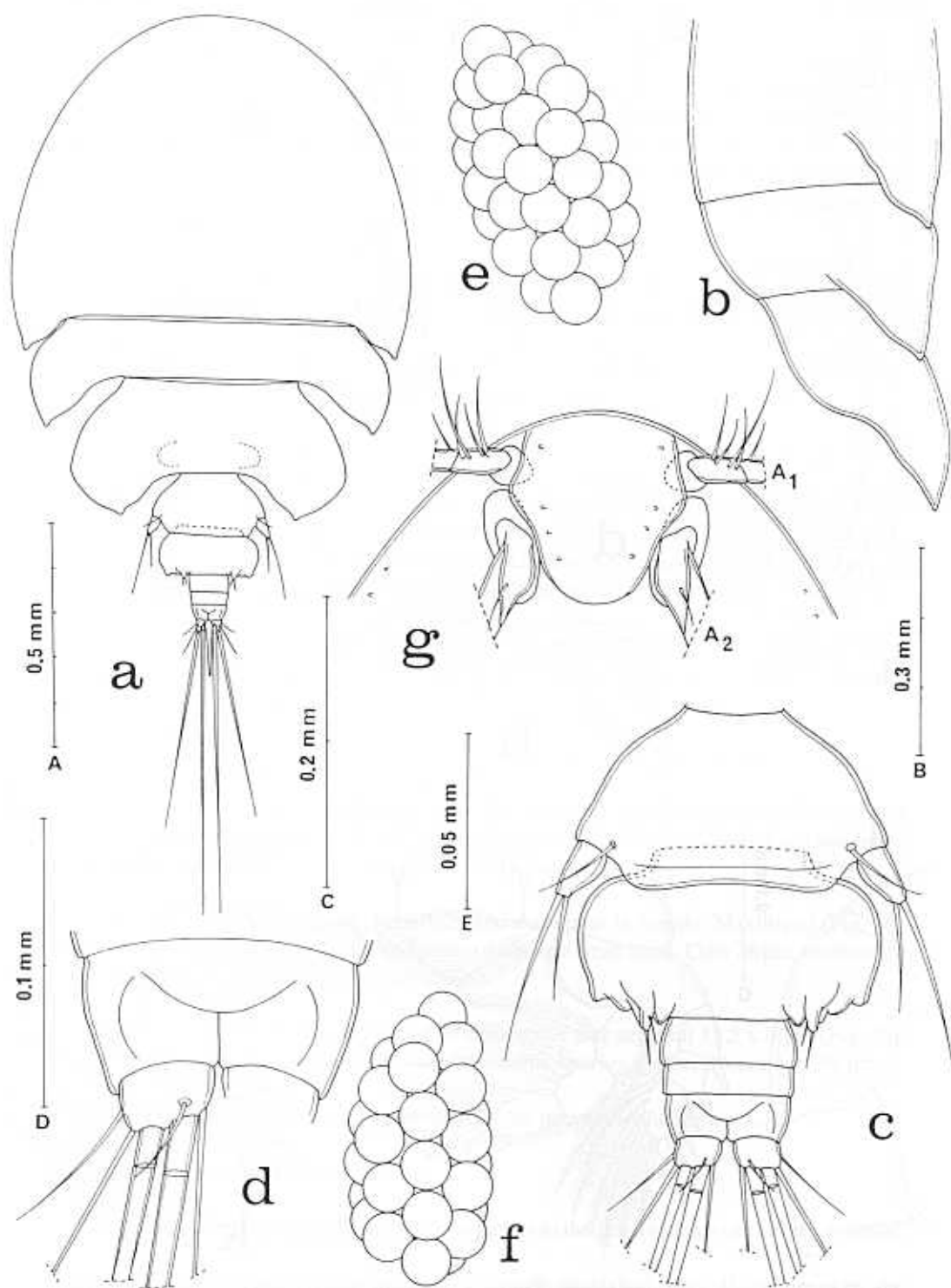


Fig. 1. *Stellicola antheneae*, new species. Female. a, dorsal (scale (A)); b, epimera of somites bearing legs 1-3, lateral (B); c, urosome, dorsal (C); d, anal somite and caudal ramus, dorsal (D); e, egg sac, right side, ventral (E); f, egg sac, left side, ventral (E); g, rostrum, ventral (B).

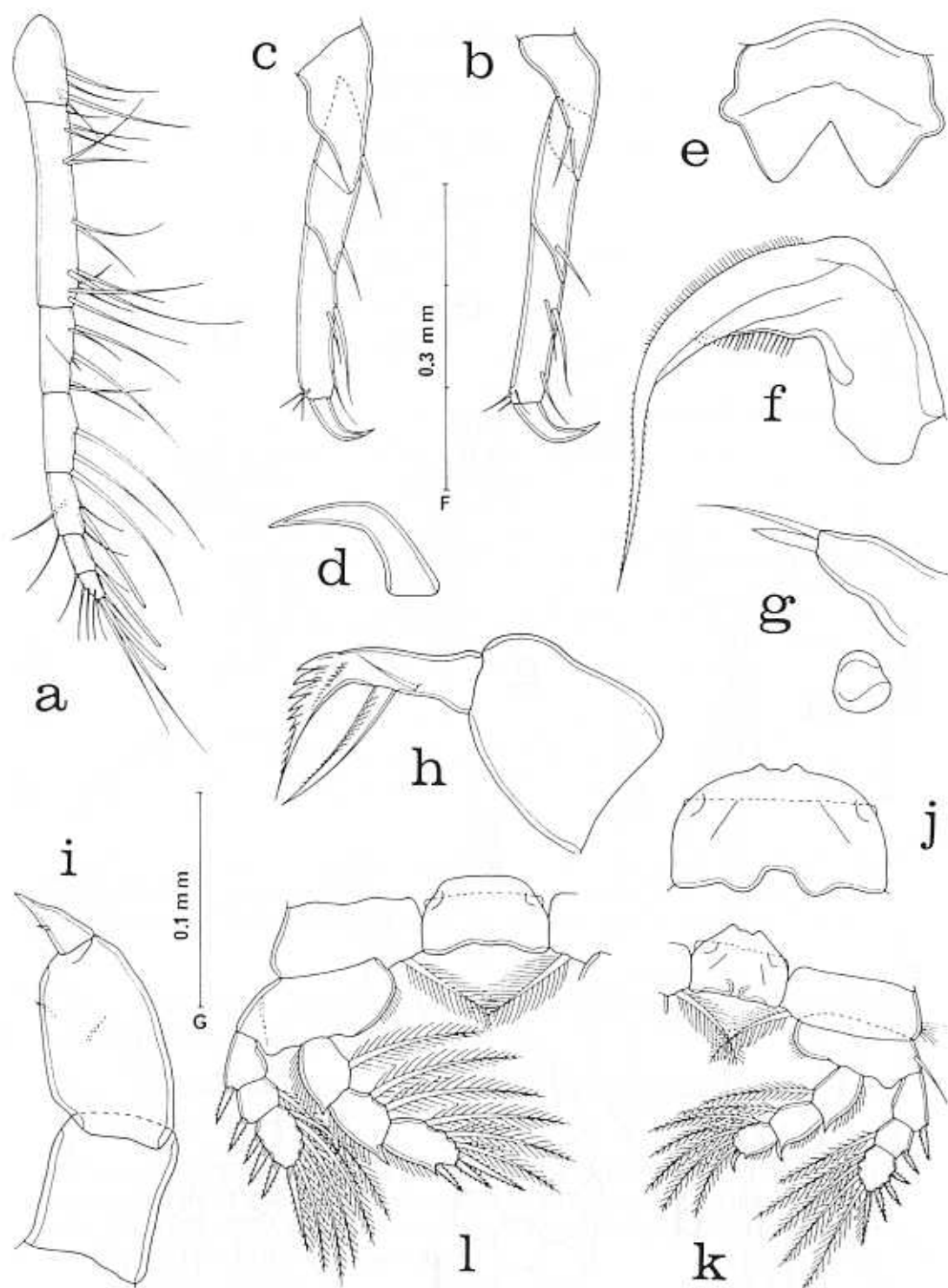


Fig. 2. *Stellicola antheneae*, new species. Female. a, antennule, dorsal (scale C); b, antenna, slightly anterior (F); c, antenna, posterior (F); d, claw of antenna, anterior (G); e, labrum, ventral (C); f, mandible, anterior (D); g, maxillule and paragnath, ventral (D); h, maxilla, posterior (D); i, maxilliped, anterior (D); j, intercoxal plate of leg 1, anterior (G); k, leg 1 and intercoxal plate, posterior (F); l, leg 2 and intercoxal plate, anterior (F).

bearing 2 unequal terminal setae. Maxilla (Fig. 2h) and maxilliped (Fig. 2i) similar to those of congeners.

Legs 1-4 (Figs. 2k,l, 3a,b) segmented and armed as in congeners. Leg 1 with intercoxal plate having 2 marginal lobes (Fig. 2j), and with spine on third segment of endopod recurved (Fig. 2k). Coxa of leg 1 with outer tuft of slender setules. Leg 4 (Fig. 3b) with inner coxal seta minute, 6  $\mu\text{m}$ . Endopod (Fig. 3c) with first segment 33 x 19  $\mu\text{m}$ , inner smooth seta 44  $\mu\text{m}$ ; second segment 41 x 17  $\mu\text{m}$ , its 3 setae from outer to inner 34  $\mu\text{m}$  and smooth, and 90  $\mu\text{m}$  and 117  $\mu\text{m}$ , both plumose.

Leg 5 (Fig. 3d) with free segment broader proximally than distally, greatest dimensions 44 x 26  $\mu\text{m}$ , its 2 terminal setae 125  $\mu\text{m}$  (outer) and 73  $\mu\text{m}$  (inner). Adjacent dorsal seta 33  $\mu\text{m}$ . All setae smooth.

Leg 6 represented by 2 setae on genital area (Fig. 1c).

Color of living specimens unknown.

Male: Body (Fig. 3e) with prosome resembling that of female. Length 0.67 mm (0.66-0.68 mm) and greatest width 0.36 mm (0.34-0.40 mm), based on 5 specimens in lactic acid. Tergum of somite bearing leg 4 not covered dorsally by preceding tergum. Ratio of length to width of prosome 1.31:1. Ratio of length of prosome to that of urosome 2.44:1.

As in congeners, somite bearing leg 5 fused with genital somite (Fig. 3f), combined somite being 117 x 109  $\mu\text{m}$ . Four postgenital somites from anterior to posterior 18 x 52, 18 x 49, 13 x 47, and 17 x 44  $\mu\text{m}$ .

Caudal ramus (Fig. 3f) similar to that of female but smaller, 18 x 8  $\mu\text{m}$ .

Rostrum and antennule like those of female. Antenna (Fig. 3g) showing sexual dimorphism in having setae on segments 1, 2, and 3 much longer than in female. Claw 68  $\mu\text{m}$  and more slender than in female.

Labrum, mandible, paragnath, maxillule, and maxilla as in female. Maxilliped (Fig. 3h) with second segment having 2 setae and group of adjacent small setae. Claw 36  $\mu\text{m}$ , moderately stout but with abruptly attenuated tip.

Legs 1-4 as in female. Leg 5 with small rectangular free segment 15.5 x 8  $\mu\text{m}$  (Fig. 3f). Leg 6 (Fig. 3i) posteroventral flap on genital somite bearing 2 setae 16  $\mu\text{m}$  and 39  $\mu\text{m}$ .

Spermatophore (Fig. 3j) elongate oval, 82 x 36  $\mu\text{m}$ , not including neck.

Color of living specimens unknown.

**Etymology.** - The specific name *anthenae* refers to the generic name of the host asteroid.

**Remarks.** - The male of *S. anthenae* may be distinguished from all congeners by the unusually long setae on the antenna (Fig. 3g), with the seta on the first segment exceeding the length of the second segment.

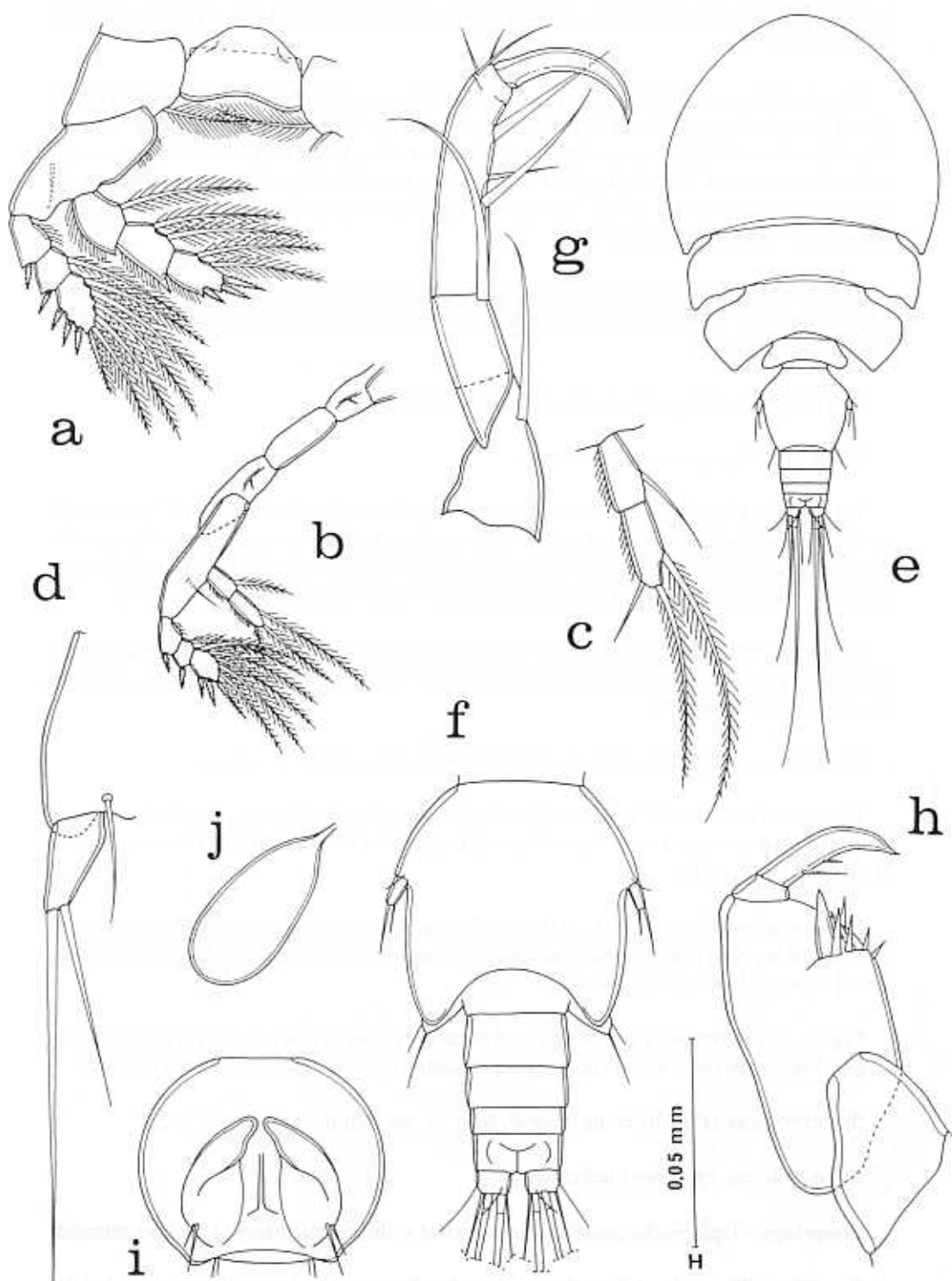


Fig. 3. *Stellicola antheneae*, new species. Female. a, leg 3 and intercoxal plate (scale F); b, leg 4 and intercoxal plate, anterior (F); c, endopod of leg 4, anterior (C); d, leg 5, dorsal (G). Male. e, dorsal (B); f, urosome, dorsal (C); g, antenna, anterior (G); h, maxilliped, postero-inner (H); i, genital somite, ventral (G); j, spermatophore, attached to female, ventral (G).

The female of *S. antheanae* may be separated from congeners by its intermediate length (average 1.18 mm, extremes 1.11-1.26 mm) and its broad genital double-somite (ratio 2.09:1), 20% wider than that of congeners.

Two features of the male maxilliped in the new species are unique in the genus: the relatively short claw with an abruptly attenuated tip and the cluster of small setae around the two usual setae on the second segment, together with the absence of two rows of spinules.

Details of the maxilliped, the armature of the third segment of the exopod of leg 3, and the size and form of leg 5 are useful features in distinguishing the various species of *Stellicola*.

Several species referred to *Stellicola* are insufficiently described, thus making comparisons with the new species difficult. Points of differences, however, may be noted as follows: in *S. pleurobranchi* Kossmann, 1877, the caudal rami are longer than wide and the epimera of the somite bearing leg 3 are slightly bifid; in *S. thorelli* Kossmann, 1877, the length of the female is 0.91 mm, shorter than in the new species; in *S. curticaudatus* (Thompson & A. Scott, 1903) the ratio of length to width of the genital double-somite is 0.65:1 and the relative lengths of the setae on the endopod of leg 4 are different from those in the new species; and in *S. longicaudatus* (Thompson & A. Scott, 1903) the genital double-somite is large and tumid with rounded lateral margins. In all four of these species males remain unknown. Two species of *Stellicola*, *S. alabatensis* Kossmann, 1877, and *S. semperi* Kossmann, 1877, are so incompletely described that a reliable comparison with the new species is not possible.

Sexual dimorphism in the antenna of *S. antheanae* is seen also in two congeners, *S. novaecaledoniae* Humes, 1986, and *S. pollex* Humes & Ho, 1967. In *S. parvulipes* Humes, 1976 there is only a slight difference in the dimensions of segment 3 of the antenna. The remaining congeners show no sexual dimorphism in the antenna, as far as known.

### *Synstellicola* Humes & Stock, 1972

#### *Synstellicola thromidiae*, new species

(Figs. 4a-f, 5a-k, 6a-i)

**Type material examined.** - 50 females, 32 males from *Thromidia catalai* Pope & Rowe, 1977, Pulau Bunaken, Manado, Sulawesi, 01°38'N, 124°45'E, coll. 19 Apr. 1994. Holotype female (ZRC.1995.161), allotype male (ZRC.1995.162), and 40 paratypes (23 females, 17 males) (ZRC.1995.163) deposited in the Zoological Reference Collection, Department of Zoology, National University of Singapore, and 20 females, 10 males (USNM 268328) in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Remaining paratypes in the collection of the author.

**Description.** - Female: Body (Fig. 4a) with moderately slender prosome. Average length 1.06 (1.02-1.14 mm) and greatest width 0.47 mm (0.44-0.50 mm), based on 9 specimens. Greatest dorsoventral thickness 0.43 mm. Somite bearing leg 1 clearly separated from head by dorsal transverse suture. Additional such suture between this suture and somite bearing leg 2. Somite bearing leg 2 with pointed epimera. Epimera of other metasomal somites rounded. Ratio of length to width of prosome 1.63:1. Ratio of length of prosome to that of urosome 1.90:1.

Somite bearing leg 5 (Fig. 4b) 90 x 130  $\mu$ m. Genital double-somite elongate, 185 x 143  $\mu$ m, ratio 1.29:1, slightly protruding ventrally (Fig. 4c). Genital areas located dorsolaterally



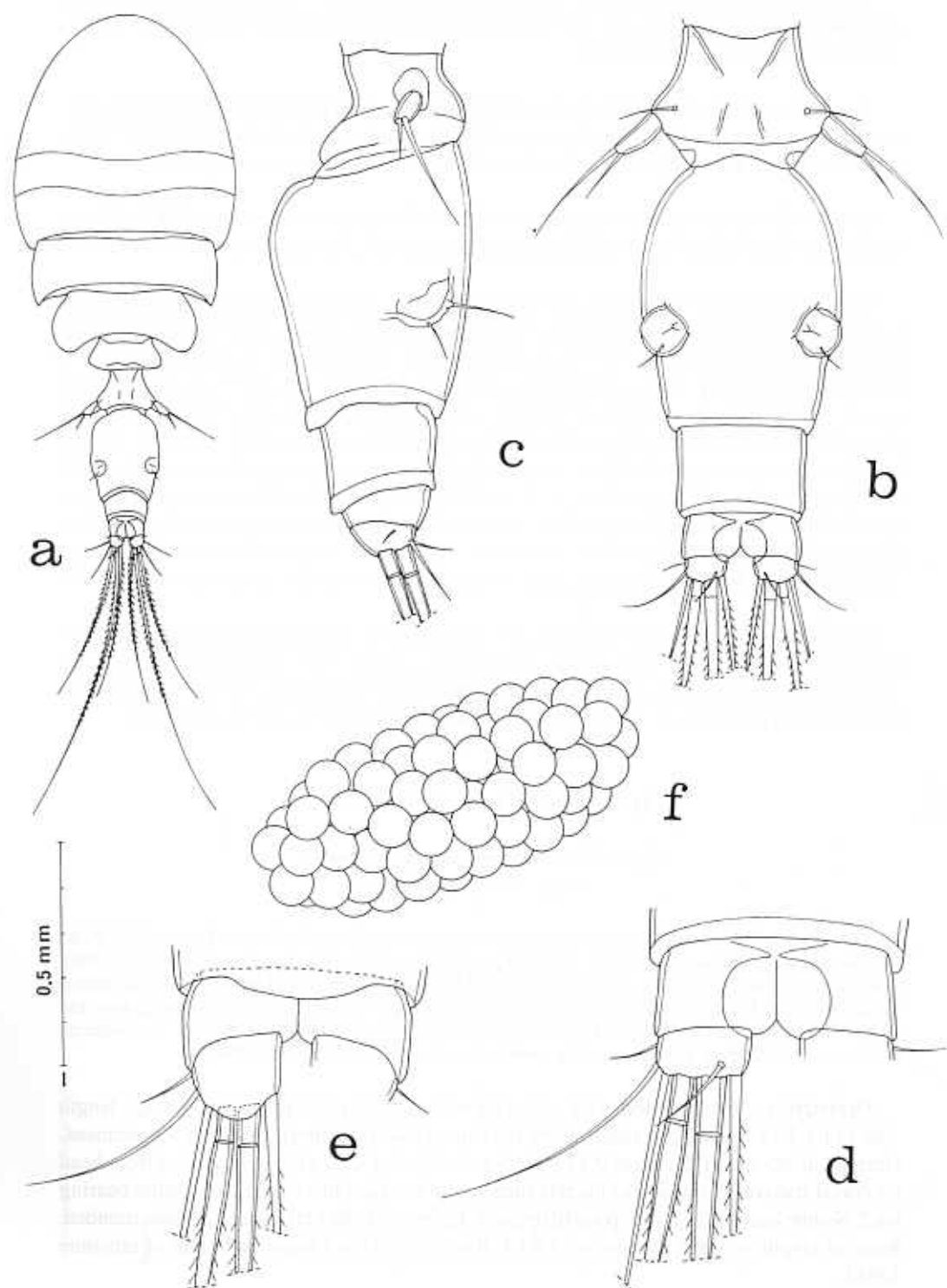


Fig. 4. *Synstellicola thromidiae*, new species. Female. a, dorsal (scale 1); b, urosome, dorsal (C); c, urosome, lateral (C); d, anal somite and caudal ramus, dorsal (D); e, anal somite and caudal ramus, ventral (D); f, egg sac, separated from female (B).



near junction of middle and posterior thirds of somite. Each area bearing 2 setae 21  $\mu\text{m}$  and 9  $\mu\text{m}$  (Fig. 3). Two postgenital somites in dorsal view from anterior to posterior 52 x 91  $\mu\text{m}$  and 31 x 83  $\mu\text{m}$ .

Caudal ramus (Fig. 4d,e) short, wider than long, 21 x 30  $\mu\text{m}$  in dorsal view, ratio 0.7:1, 29 x 29  $\mu\text{m}$  in ventral view including slight ventral terminal lamella (Fig. 4e). Outer lateral seta 90  $\mu\text{m}$ , dorsal seta 31  $\mu\text{m}$ , and outermost terminal seta 120  $\mu\text{m}$ , all smooth. Innermost terminal seta 360  $\mu\text{m}$ , 2 median terminal setae 370  $\mu\text{m}$  (outer) and 500  $\mu\text{m}$  (inner), all with delicate lateral setules. Small setule, 22  $\mu\text{m}$ , on outer proximal margin of ramus.

Dorsal surface of body smooth, without visible sensilla.

Egg sac (Fig. 4f) elongate, 560 x 240  $\mu\text{m}$ , egg diameter approximately 52-57  $\mu\text{m}$ .

Rostrum (Fig. 5a) linguiform. Antennule (Fig. 5b) 7-segmented, 300  $\mu\text{m}$  long. Lengths of segments: 52 (49  $\mu\text{m}$  along anterior margin), 79, 26, 52, 47, 23, and 7  $\mu\text{m}$ , respectively. Armature: 4, 13, 6, 3, 4+1 aesthete, 2+1 aesthete, and 7+1 aesthete. All setae smooth. Antenna (Fig. 5c) 245  $\mu\text{m}$  long, including claw. Formula: 1, 1, 3, and 1 claw plus 4 setae. First segment ornamented with row of slender setules and bearing long seta as long as second segment. Second segment bearing 1 much shorter seta. Third segment with 1 seta in group of 3 sinuous. Claw long and slender, 68  $\mu\text{m}$ .

Labrum (Fig. 5d) with 2 rounded posteroventral lobes slightly flaring outward. Mandible (Fig. 5e) with inner row of spinules and outer row of much smaller spinules; lash slender. Maxillule (Fig. 5f) small lobe with 3 terminal setae, one of them stout and barbed, and 1 subterminal seta. Maxilla (Fig. 5g) with second segment bearing 2 inner setae, one short and slender, other stout, much larger and barbed. Lash with 2 large outer spines proximally followed by shorter spines on both sides. Maxilliped (Fig. 5h) of usual form, as illustrated.

Ventral area between maxillipeds and first pair of legs (Fig. 5i) only slightly protruding.

Legs 1-4 (Figs. 5j,k, 6a,b) segmented and armed as in congeners. Leg 4 with inner seta on coxa 21  $\mu\text{m}$  and smooth. Exopod 140  $\mu\text{m}$ . Endopod with first segment 31 x 23  $\mu\text{m}$ , its inner seta 60  $\mu\text{m}$ ; second segment 65 x 26  $\mu\text{m}$ , its inner seta 68  $\mu\text{m}$  and its 2 terminal spines 52  $\mu\text{m}$  and 44  $\mu\text{m}$ .

Leg 5 (Fig. 6c) with free segment 34 x 13  $\mu\text{m}$ , ratio 2.6:1. Two terminal setae very unequal, 96  $\mu\text{m}$  and 29  $\mu\text{m}$ . Dorsal seta on body held erect and not measurable with accuracy.

Leg 6 represented by 2 setae on genital area (Fig. 4c).

Color of living specimens unknown.

Male: Body (Fig. 6d) with prosome similar to that of female. Length 0.70 mm (0.67-0.72 mm) and greatest width 0.24 mm (0.23-0.24 mm), based on 7 specimens. Greatest dorsoventral thickness 0.22 mm. Ratio of length to width of prosome 1.69:1. Ratio of length of prosome to that of urosome 1.51:1.

Segment bearing leg 5 (Fig. 6e) 44 x 74  $\mu\text{m}$ . Genital somite 112 x 96  $\mu\text{m}$ , ratio 1.17:1. Three postgenital somites from anterior to posterior 52 x 70, 39 x 57, and 20 x 52  $\mu\text{m}$ .

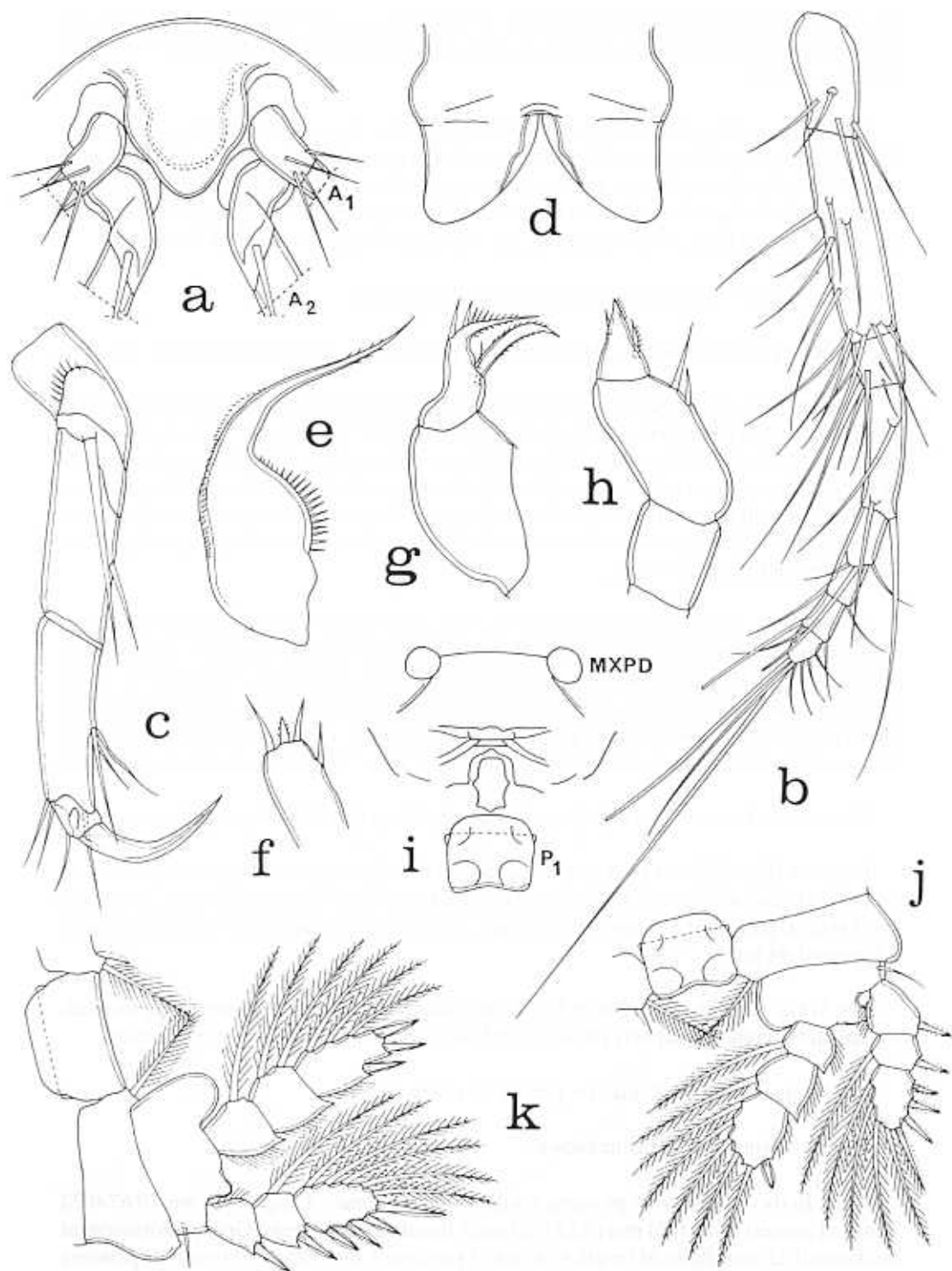


Fig. 5. *Synstellicola thromidiae*, new species. Female. a, rostrum, ventral (scale C); b, antennule, anterodorsal (G); c, antenna, anterior (G); d, labrum, ventral (D); e, mandible, anterior (H); f, maxillule, anterior (H); g, maxilla, anterior (D); h, maxilliped, posterior (D); i, area between maxillipeds and first pair of legs, ventral (C); j, leg 1 and intercoxal plate, posterior (C); k, leg 2 and intercoxal plate, anterior (C).

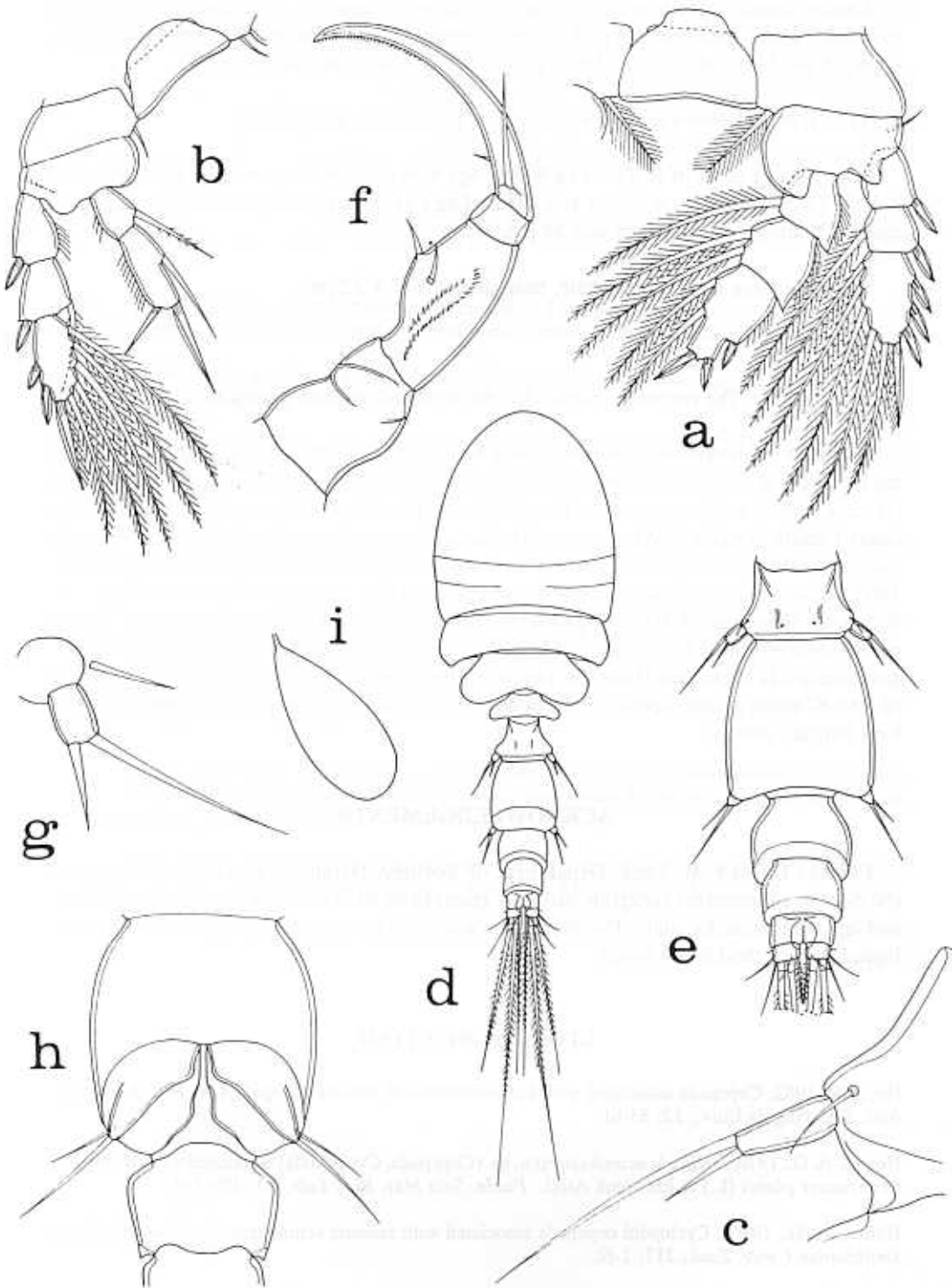


Fig. 6. *Synstellicola thromidiae*, new species. Female. a, leg 3 and intercoxal plate, anterior (C); b, leg 4 and intercoxal plate, anterior (C); c, leg 5, dorsal (D). Male. d, dorsal (B); e, urosome, dorsal (C); f, maxilliped, posterior (D); g, leg 5, lateral (H); h, genital somite with sixth pair of legs and postgenital somite, ventral (G); i, spermatophore, ventral (C).

## Humes: New copepods associated with *Asteroidea*

Caudal ramus, rostrum, antennule, antenna, labrum, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 6f) with second segment bearing 2 setae and 2 rows of spinules. Claw 95  $\mu\text{m}$  long, rather stout, bearing proximally 2 very unequal setae.

Ventral area between maxillipeds and first pair of legs as in female.

Legs 1-4 like those of female. Leg 5 (Fig. 6g) with small free segment 14 x 9.5  $\mu\text{m}$ , ratio 1.47:1. Two terminal setae 65  $\mu\text{m}$  and 20  $\mu\text{m}$ . Leg 6 (Fig. 6h) posteroventral flap on genital somite, bearing 2 setae 55  $\mu\text{m}$  and 34  $\mu\text{m}$ .

Spermatophore (Fig. 6i) elongate, pear-shaped 117 x 52  $\mu\text{m}$ .

Color unknown.

**Etymology.** - The species is named for the genus of the host asteroid.

**Remarks.** - *Synstellicola thromidiae* may be differentiated from its several congeners by the following selected characters. In *S. longicauda* Ho, 1982, *S. similis* Humes, 1982, *S. carens* (Humes, 1986), and *S. paracarens* Kim, 1992, the female caudal ramus is elongate, with a ratio of length to width 1.59:1 or greater. In *S. acanthasteris* Humes, 1970, the average female body length is 1.89 mm, much greater than in the new species. In *S. longiseta* Humes & Ho, 1967, the seta on the first segment of the antenna and one of the terminal setae on leg 5 are very long, 165  $\mu\text{m}$  and 170  $\mu\text{m}$ , respectively. In *S. kossmanni* Humes & Ho, 1967, the female genital double-somite has anterior "shoulders", instead of being smoothly tapered as in the new species. In *S. pichoni* Humes & Ho, 1967, the average female body length is 0.79 mm (0.70-0.87 mm), shorter than in *S. thromidiae*, and the anterior surface of antenna has many long hairlike setules.

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