

*SPONGIOCARIS HEXACTINELLICOLA*, A NEW SPECIES OF STENOPODIDEAN SHRIMP (DECAPODA: STENOPODIDAE) ASSOCIATED WITH HEXACTINELLID SPONGES FROM TARTAR BANK, BAHAMAS

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ABSTRACT

A new species of a bathyal stenopodid shrimp, *Spongiocaris hexactinellicola*, found off the Bahamas, associated with a hexactinellid sponge, *Euplectella jovis*, is described. The host and shrimp were collected by means of the *Johnson Sea Link II* submersible at a depth of 610 m. A comparison between the 3 species in the genus is provided and their distribution is discussed. A key for determination of the species of *Spongiocaris* is given.

The genus *Spongiocaris* Bruce and Baba (1973) has until now been represented by the two species for which the genus was established: *S. semiteres* Bruce and Baba, 1973, and *S. yaldwyni* Bruce and Baba, 1973. The geographical distribution of these two species does not include the western Atlantic. *Spongiocaris semiteres* is known from a depth of 400 m off Durban, South Africa, and *S. yaldwyni* is known from a depth of 600 m, north of New Zealand (Bruce and Baba, 1973). As pointed out by Bruce and Baba (1973) and Goy (1980), species of *Spongiocaris* seem to be intermediate between those of *Spongiocola* and *Spongicoloides*, and all three genera are known to have species living in the internal cavity of hexactinellid sponges.

The discovery of a new species of *Spongiocaris* in the Bahamas is the first occurrence in the western Atlantic for the genus and confirms the association of its species with hexactinellid sponges.

Knowledge of the association of species of *Spongiocaris* with sponges is most likely incomplete due to conventional sampling methods, since sponges are easily damaged during dredging or trawling. Consequently, it is impossible to say if the shrimps were living inside, on, or in the surroundings of the sponges. Sampling by the aid of submersibles, such as the *Johnson Sea Link II*, provides the opportunity of more delicate sampling of the host sponge and its associates (Bruce, 1986a, b; Berggren and Svane, 1989).

MATERIALS AND METHODS

The shrimps were found in the internal cavity of the hexactinellid sponge *Euplectella jovis* Schmidt, 1880.

The sponges were collected by the *Johnson Sea Link II* submersible at a depth of 606-610 m off Tartar Bank, Cat Island, Bahamas. The description is based on the holotype female, but the dissected mouth parts are from the paratype female and the male characteristics are based on the allotype male. Examination of the holotype of *Spongiocaris semiteres* was made possible through a loan from the Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (RMNH Crust D.27308), and allowed for a detailed comparison with the new species *Spongiocaris hexactinellicola*. The abbreviation CL is used for the postorbital carapace length (dorsal). Measurements were made on the mirror image from a stereomicroscope equipped with a drawing mirror, on a digitizing tablet connected to a computer. Specimens treated herein are deposited in the National Museum of Natural History (USNM), Washington, D.C., U.S.A.; the Nationaal Natuurhistorisch Museum (RMNH), Leiden, The Netherlands; and the Harbor Branch Oceanographic Museum (HBOM), Fort Pierce, Florida, U.S.A.

SYSTEMATICS

*Spongiocaris hexactinellicola*, new species  
Figs. 1-5

*Material examined.*—Bahamas: Tartar Bank, Cat Island, 24°30'N, 74°28'W, 606-610 m, *Johnson Sea Link II* dive no. 2826, 29 October 1990; bottom: silty sand with rock outcropping and boulders, with a slope of 30-60°; the shrimps were collected in pairs (male and female) from each sponge. Ovigerous ♀ holotype, CL 8.52 mm (USNM 252596), ♂ allotype, CL 6.08 mm (USNM 252597). One ♂ paratype, CL 5.75 mm (RMNH D 42021) and one ovigerous ♀ paratype, CL 7.56 mm (HBOM 089:07049).

*Diagnosis.*—Size small, with slender, not compressed or depressed body, generally glabrous; rostrum short, anterior two-thirds triangular in cross section, each ventrolateral ridge ending distally in tooth; carapace with antennal spine and produced pterygostomial angle; telson with 2 dorsal ridges with 8 or 9 spines on each, 3 posterior mar-

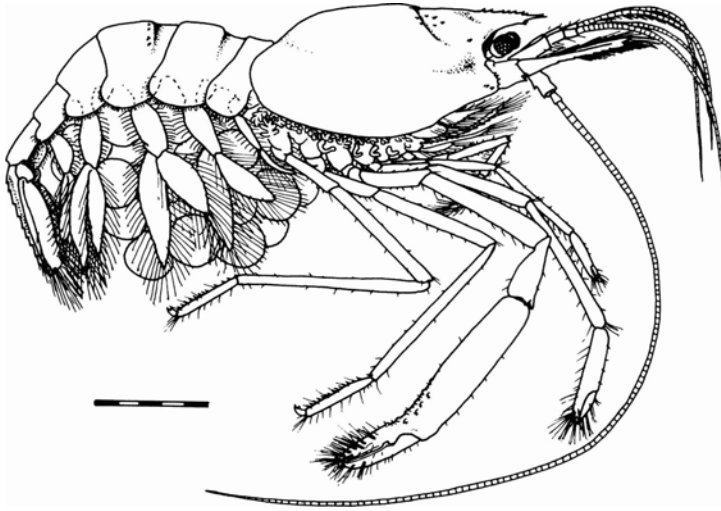


Fig. 1. *Spongiocaris hexactinellicola*, new species, holotype female, Tartar Bank, Bahama Islands, CL 8.52 mm (USNM 252596). Scale bar = 5.0 mm.

ginal teeth and 6–9 lateral teeth; fingerlike epipods on pereiopods I–III, small blunt accessory teeth at base of inner main tooth of biunguiculate dactyli, and small ventral terminal spine on carpus of pereiopods IV and V.

*Description.*—Slender shrimp, not compressed or depressed in body form (Fig. 1).

Carapace (Figs. 1, 2A–C) glabrous with distinct upper cervical groove. Posterior border of cervical groove with 2 spines, on large animals (females) 3 or 4 small spines anterior to cervical groove. Postorbital region with 1 small spine on large animals (females). Weak hepatic groove present, without hepatic spine. Orbit feebly developed, inferior orbital angle weakly produced. Antennal spine present. Pterygostomial angle rounded, produced, 4 or 5 marginal and 1 or 2 postmarginal spines.

Rostrum (Fig. 2A–C) short, straight, with acute tip; reaching end of first antennular segment; 4–7 dorsal teeth more or less in pairs, all anterior to orbit, 1 subterminal tooth. Proximal two-thirds of rostrum becoming gradually triangular in cross section, with small tooth distally on each ventrolateral ridge, distal third compressed, no ventral tooth.

Abdominal segments (Fig. 1) glabrous without carinae. Nonarticulated portion of tergum of third segment with 4 small (2 pairs) ventrally directed spines at anterior margin and 2 small (paired) dorsally di-

rected spines (Fig. 5L). Pleura of second to fifth segments posteriorly produced, in ovigerous females setose on ventral margin, in males nonsetose. Posterior ventral angle of fifth segment with small acute tooth (Fig. 5K). Ventral and lateral posterior angles of sixth segment weakly produced, dorsal posterior margin with 3 small teeth (Fig. 2D).

Telson (Fig. 2D) 2.2 times longer than broad, widest near end of proximal third, tapering slightly towards broadly rounded posterior margin. Lateral margin with 6 acute teeth on right side and 9 on left, posterior margin with 3 teeth of same size as lateral. Two dorsal ridges, with 9 spines on right and 8 on left, proximal dorsal pre-marginal tooth on each side. Distal two-fifths with dense marginal setae.

Uropods (Fig. 2D) subequal to telson in length. Protopod short, robust with small blunt posterolateral tooth. Exopod broader than endopod, slightly convex lateral border with 13 acute denticles, few short setae, and slightly larger posterior lateral tooth; 2 weak dorsal longitudinal ridges on outer half; posterior margin with long plumose setae. Endopod with long plumose setae marginally, single longitudinal weak ridge middorsally.

Eye (Fig. 2G) well developed on short stalk; cornea globular with rather large ommatidia, ocular peduncle glabrous.

Antennule (Fig. 2E) normal, basal segment without statocyst, bluntly pointed stylocerite, ventral spine medially. Mesial lat-

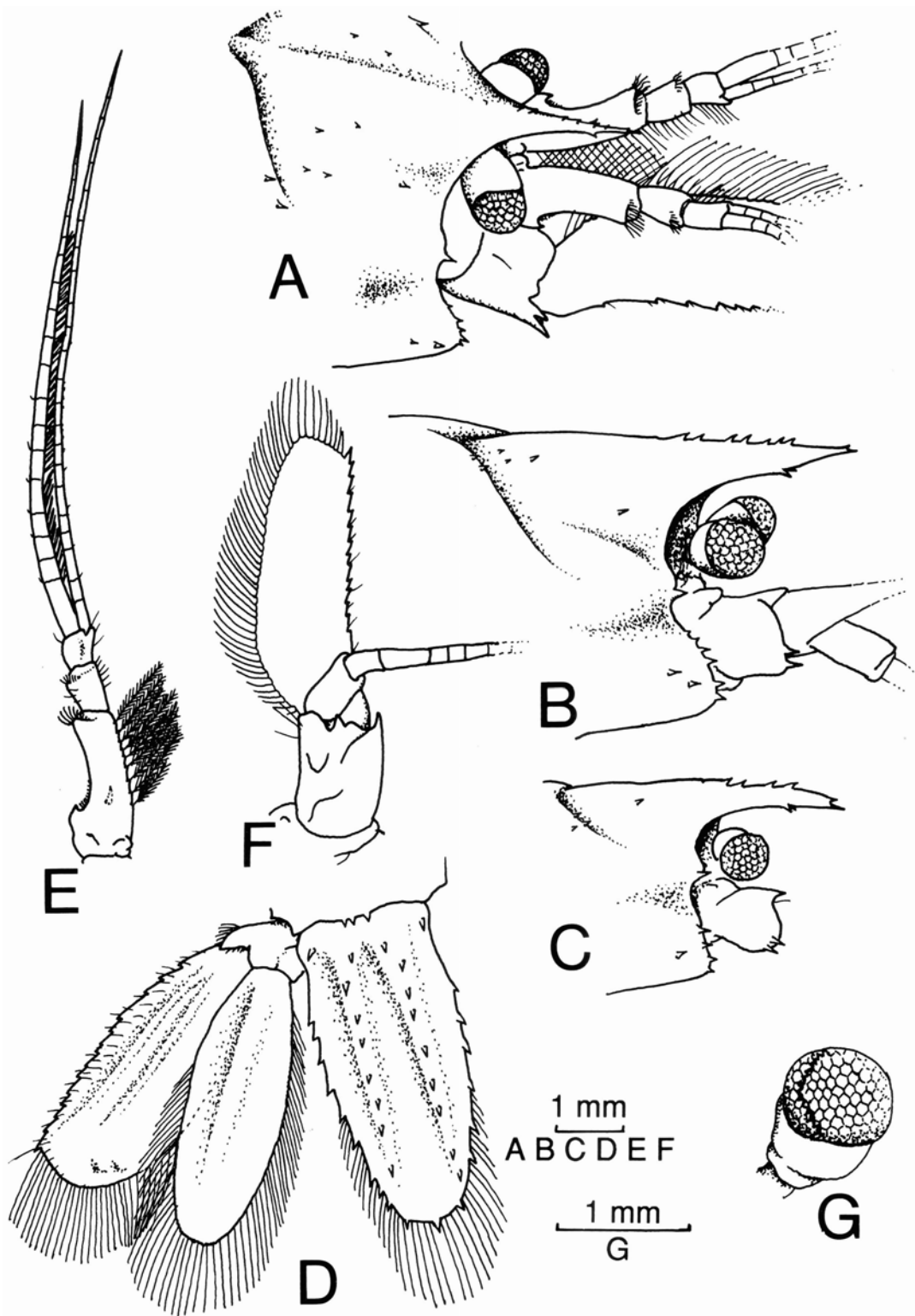


Fig. 2. *Spongiocaris hexactinellicola*, new species: A, B, D, holotype female (USNM 252596); C, allotype male (USNM 252597); E, F, G, paratype female (HBOM 089:07049). A, anterior carapace, rostrum, and cephalic appendages, dorsolateral view; B, anterior carapace and rostrum, lateral view; C, anterior carapace and rostrum, lateral view; D, left uropod and telson, dorsal view; E, antennule, dorsal view; F, antenna, peduncle, ventral view; G, eye.

eral border feebly convex, with dense plumose setae. Second segment slightly longer and broader than third, both unarmed. Upper flagellum with 21 segments, with aesthetascs on first 14, lower flagellum more slender, with 23 segments.

Antenna with robust basicerite, 2 stout spines on lateral margin (Fig. 2A–C). Carpocerite short, not exceeding intermediate segment of antennular peduncle. Flagellum long and slender, reaching beyond telson, about 1.1 times total length (tip of rostrum to end of telson). Scaphocerite (Fig. 2F) 3.2 times longer than wide, lateral margin feebly concave, with 13 small teeth on distal two-thirds, terminal tooth slightly larger. Anterior margin rounded, overreaching distolateral tooth.

Mandible (Fig. 3A–C) with well-developed 3-segmented palp, terminal segment with numerous setae and equal to or little longer than second segment; first segment short and broad, situated beneath and between incisor and molar processes. Molar and incisor processes fused. Incisor process with 2 teeth anteriorly, with row of 5 small, irregularly shaped teeth. Molar process with 3 blunt teeth on masticatory surface.

Paragnath (Fig. 3D) bilobed, with well-separated lobes.

Maxillula (Fig. 3E) with moderately broad upper lacinia, 6 compound spinose setae and dense simple setae distally, lower lacinia subequal in length, numerous simple setae distally. Palp simple and slender, 2 terminal and 2 subterminal simple setae.

Maxilla (Fig. 3F) with long tapering palp, long simple setae dorsally and along mesial border, 3 setae proximolaterally. Basal and coxal endites deeply bilobed with numerous simple setae distally, plumose setae ventrally on lower lobe of coxal endite. Scaphognathite well developed with large anterior and smaller posterior lobes, with plumose setae.

First maxilliped (Fig. 3G) with stout 3-segmented palp, first and second segments with long plumose setae marginally. Terminal segment small, 0.2 times length of tapering second and second 0.65 times length of first segment. Basal endite divided into small, slender proximal lobe and large, broad, distal lobe, both with dense simple setae. Coxal endite rounded, small, with row of simple setae distally. Exopod long, slen-

der, 9 plumose setae distally, 6 long and some short simple setae on obsolescent caridean lobe. Epipod large, bilobed with rounded lobes.

Second maxilliped (Fig. 3H) with long, rather slender endopod. Dactylus and propodus subequal in length, with dense band of simple setae on mesial border, propodus also with few long setae proximally. Carpus shorter than propodus, cup-shaped with few setae. Merus 4.5 times longer than wide, subequal to length of dactylus and propodus together, simple setae along medial border. Ischium incompletely fused to basis, both with long simple setae medially, basis with long slender exopod having 9 terminal plumose setae. Coxa with sparsely setose median lobe. Epipod simple with small podobranch.

Third maxilliped (Fig. 3I) slender with tapering segments, exceeding carpocerite by half length of carpus, length ratios of dactylus-propodus-carpus-merus-ischium-basis: 6, 13, 17, 24, 23, and 4. Merus with small spine distally, all segments sparsely setose externally, thickly setose internally, from merus to dactylus in double row. Coxa with feebly developed median lobe with few setae, finger-shaped epipod.

Pereiopods I–III chelate (Fig. 4A–D), successively larger and longer from I to III, all pairs subequal in shape, pereiopods IV and V (Fig. 4E, F) normal, ambulatory.

Pereiopod I (Fig. 4A) exceeding scaphocerite by tip of carpus; fingers of chela 0.36 times length of palm, cutting edges on both fingers entire. Tip of chela with long setae. Carpus greatest width 10.6 times length, length of carpus 1.83 times length of chela. Coxa with fingerlike epipod.

Pereiopod II (Fig. 4B) similar to first but longer, length of fingers 0.45 times palm, cutting edges on both fingers entire. Fingers with long setae distally. Carpus greatest width 10 times length, length 1.38 times length of chela. Coxa with fingerlike epipod.

Pereiopod III (Fig. 4C) more robust and longer than anterior pereiopods. Fingers 0.47 times length of palm, slightly turned inward, both fingers with dense patches of setae (over distal third on movable finger, distal two-thirds on immovable finger). Width of palm 4.2 times length. Movable finger with stout tooth on proximal third of cutting edge, immovable finger with fossa for tooth of dac-

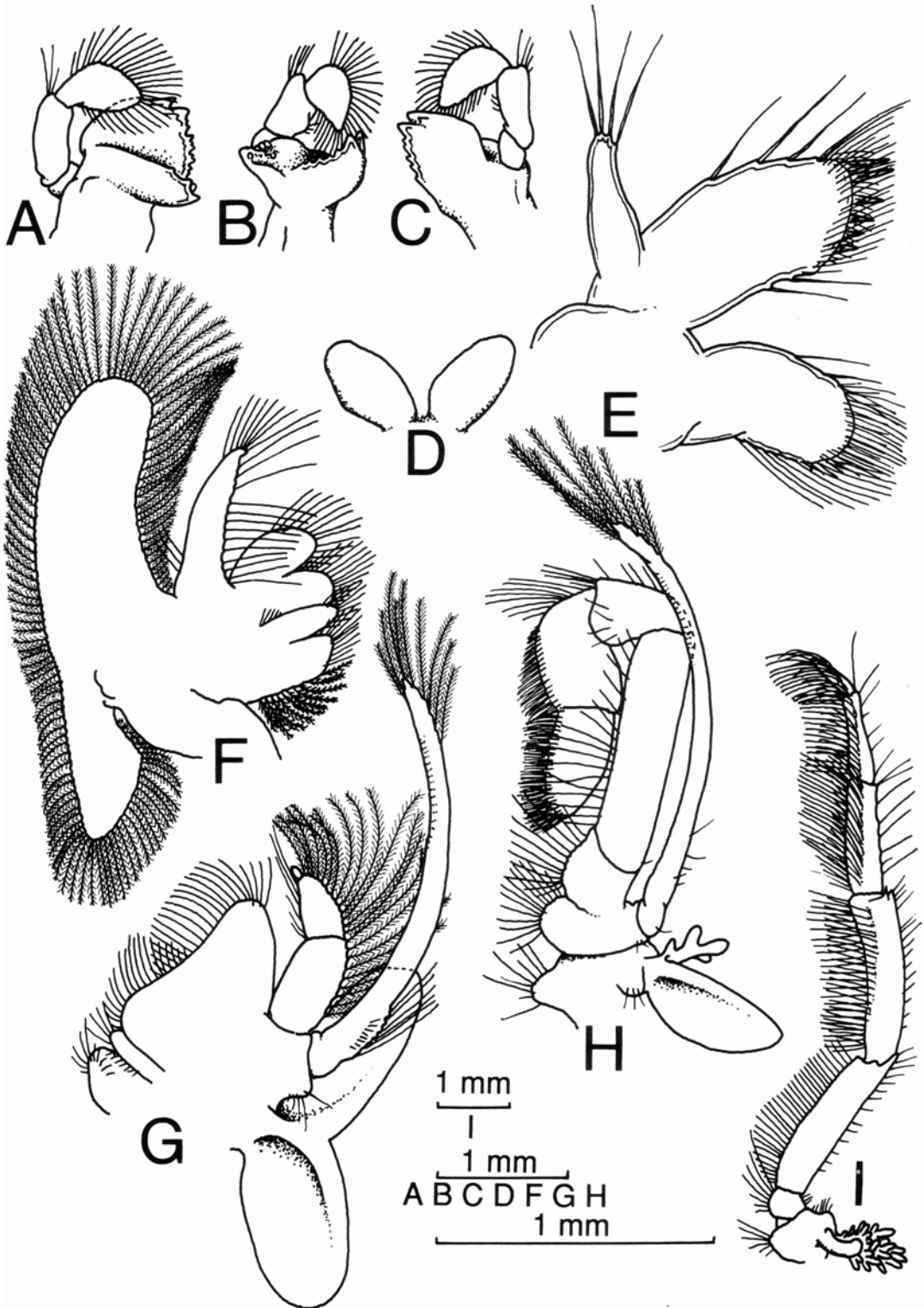


Fig. 3. *Spongiocaris hexactinellicola*, new species: paratype female (HBOM 089:07049), mouthparts, left side. A-C, mandible; D, paragnaths; E, maxillule; F, maxilla; G, first maxilliped; H, second maxilliped; I, third maxilliped.

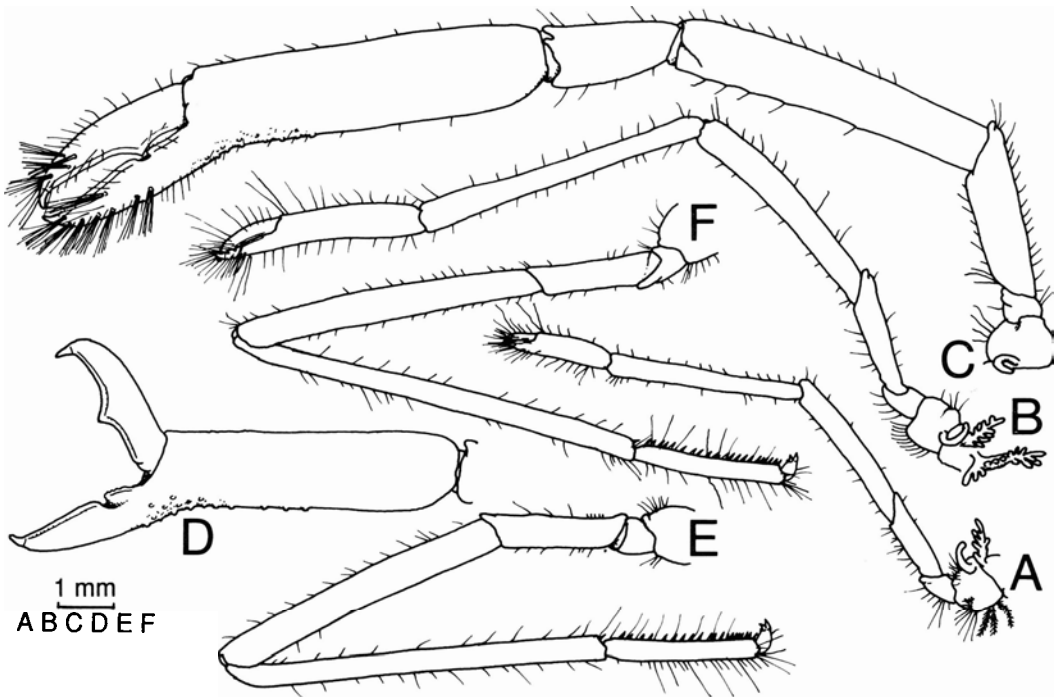


Fig. 4. *Spongiocaris hexactinellicola*, new species, left side: A–C, E, F, paratype female (HBOM 089:07049); D, allotype male (USNM 252597). A, pereopod I; B, pereopod II; C, pereopod III; D, chela of pereopod III, setae omitted; E, pereopod IV; F, pereopod V.

tylus, deep notch in cutting edge at proximal third, cutting edge posterior to notch serrated. Chela subcylindrical, smooth with some small blunt denticles distoventrally at beginning of immovable finger. Carpus greatest width 2.2 times length, length 0.24 times length of chela, with 2 blunt teeth distomedially. Coxa with fingerlike epipod.

Male chela of pereopod III (Fig. 4D) slightly more robust, nearly same proportions as females, palm 3.8 times as wide as long, with more denticles than in female.

Ambulatory pereopods (IV and V) long and slender, with small distoventral spine on carpus; merus, ischium, coxa, and basis without spines, sparsely setose.

Pereopod IV (Fig. 4E) with carpus 14.7 times longer than wide, with small ventral terminal spine. Propodus width 8.6 times length, 20 spines on ventral margin. Length of propodus 0.43 of carpus. Dactylus (Fig. 5A) biunguiculate, 0.2 times length of propodus; several small blunt accessory teeth at base of inner main tooth, with serrated area ventrally. Pereopod V (Fig. 4F) with carpus 17.7 times longer than wide, with small ventral terminal spine, propodus

width 8.4 times length, 21 spines on ventral margin. Length of propodus 0.37 of carpus. Dactylus (Fig. 5B) same as in pereopod IV.

Total length proportions among pereopods I–V (measured from beginning of coxa to tip of dactylus) 1.00:1.56:3.55:1.77:1.97 (using pereopod I as 1.00).

Pleopods well developed, third largest and longest; first (Fig. 5I) with single ramus, second to fifth biramous, without appendix interna; basis in male without or with very few setae (Fig. 5J), with many long setae in ovigerous females; endopod and exopod with plumose setae in both sexes.

The branchial formula is as follows:

|              | Maxil-lipeds |    |     | Pereopods |    |     |    |   |
|--------------|--------------|----|-----|-----------|----|-----|----|---|
|              | I            | II | III | I         | II | III | IV | V |
| Pleurobranch | 0            | 0  | 1   | 1         | 1  | 1   | 1  | 1 |
| Arthrobranch | 1            | 1  | 2   | 2         | 2  | 2   | 2  | 0 |
| Podobranch   | 0            | 1  | 0   | 0         | 0  | 0   | 0  | 0 |
| Epipod       | 1            | 1  | 1   | 1         | 1  | 1   | 0  | 0 |
| Exopod       | 1            | 1  | 0   | 0         | 0  | 0   | 0  | 0 |

*Coloration.*—In life, yellowish white.

*Egg measurements.*—Eggs in prehatching

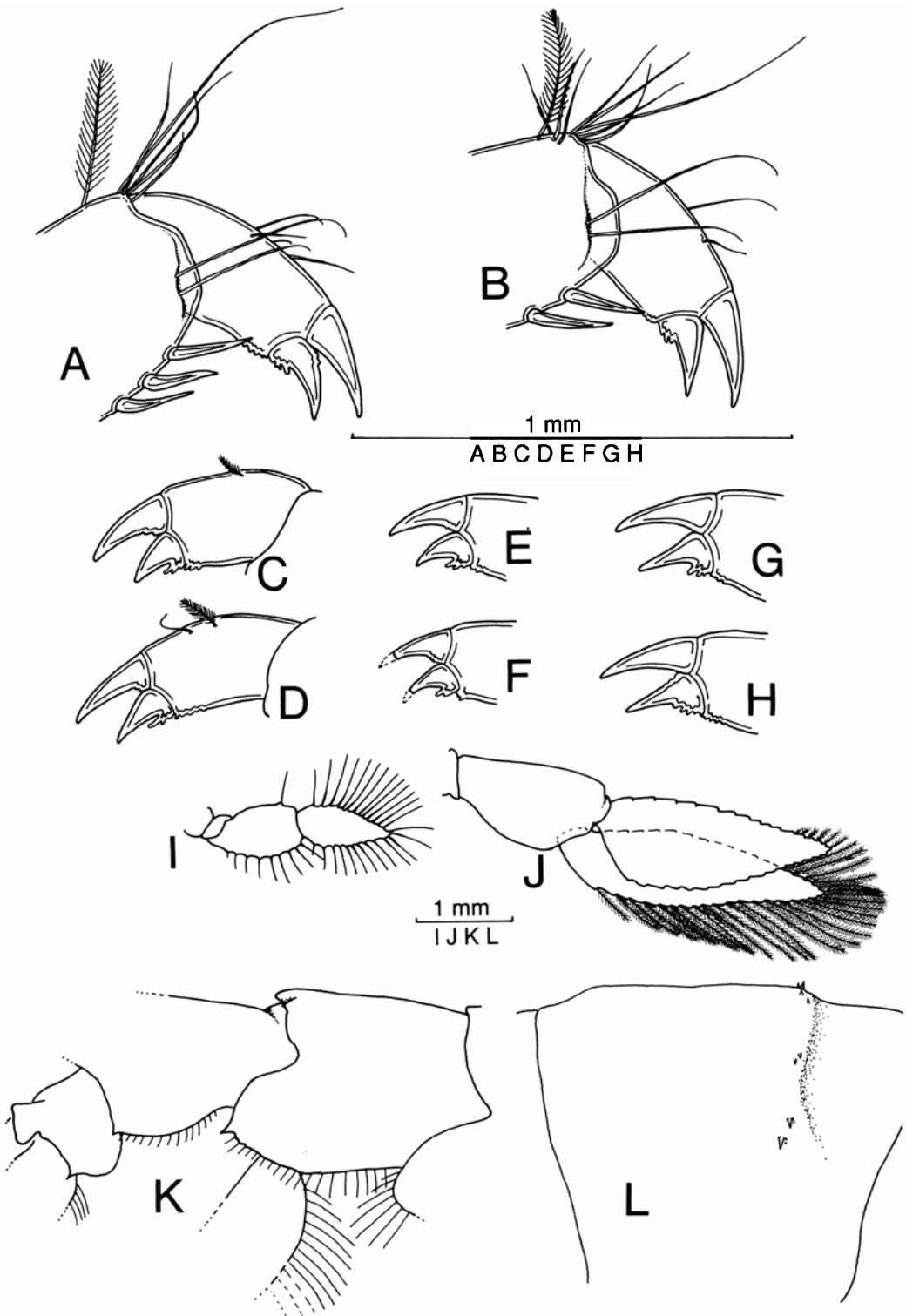


Fig. 5. *Spongiocaris hexactinellicola*, new species. Left appendages: A, B, K, L, holotype female (USNM 252596); C, D, I, J, allotype male (USNM 252597); G, H, paratype female (HBOM 089:07049); E, F, paratype male (RMNH D 42021). A, dactylus of pereopod IV; B, dactylus of pereopod V; C, dactylus of pereopod IV; D, dactylus of pereopod V; E, pereopod IV, tip of dactylus; F, pereopod V, tip of dactylus; G, pereopod IV, tip of dactylus; H, pereopod V, tip of dactylus; I, pleopod I; J, pleopod II (setae omitted from exopod); K, fifth abdominal segment (right lateral view); L, dorsal part of third abdominal segment (right lateral view).

Table 1. Character differences in the three species of *Spongiocaris* (+ = present, - = absent).

| Characteristics   | Species             |                    |                            |
|---|---------------------|--------------------|----------------------------|
|   | <i>S. semiteres</i> | <i>S. yaldwyni</i> | <i>S. hexactinellicola</i> |
| Rostrum overreaching second segment of antennular peduncle  | -                   | +                  | -                          |
| At least proximal half of rostrum triangular in cross section with teeth on each ventrolateral ridge    | -                   | +                  | +                          |
| Rostrum with ventral teeth on compressed section  | +                   | +                  | -                          |
| Antennal spine  | -                   | +                  | +                          |
| Produced pterygostomial angle   | -                   | -                  | +                          |
| Epipod on third maxilliped  | +                   | -                  | +                          |
| Telson with median posterior marginal tooth   | -                   | +                  | +                          |
| Spines, denticles, or tubercles on chela of pereopod III  | -                   | +                  | +                          |
| Carpus of pereopods IV and V with small ventral terminal spine  | -                   | -                  | +                          |
| Small blunt accessory teeth at base of inner main tooth of biunguiculate dactylus on pereopods IV and V | -                   | -                  | +                          |

stage, length = 2.5 mm, width = 2.0 mm, number of eggs = 33 in holotype female,  $\approx$  30 in paratype female (some lost in handling).

*Habitat.*—In the internal cavity of a hexactinellid sponge (*Euplectella jovis* Schmidt, 1880).

*Etymology.*—The name is derived from the Latin for glass sponges (*Hexactinellidea*), the preferred habitat, and *-cola*, dweller or inhabitant; it is a noun in apposition.

#### DISCUSSION

Of the three species described in the genus *Spongiocaris*, *S. hexactinellicola* is the first found in the Atlantic and the northern hemisphere. This finding gives the genus a very peculiar distribution, with one species from north of New Zealand, one off South Africa, and one off the Bahamas. All were found living inside hexactinellid sponges at depth of about 500–600 m. Lack of sampling at these depths in areas between these sites makes it difficult to determine at this time whether the species are endemic, patchily distributed, or have a continuous distribution between the collection sites with

intermediate forms. *Euplectella jovis*, the host sponge for *S. hexactinellicola*, has a depth range of 1,000–1,400 m and is normally found in the Bahamas, Caribbean Sea, and Gulf of Mexico (Dr. O. Tendal, personal communication). The finding of this sponge at 610 m seems to be the shallowest record for this species.

When living in pairs, locked in the internal cavity of a deep-water hexactinellid sponge, it would appear that the only means for the species to disperse geographically is through larval stages. The larvae would then have to find a suitable unoccupied sponge habitat. From the large size of the ova it is possible that the larval stages may be abbreviated. According to Dr. J. W. Goy, Texas A&M University, material at the National Museum of Natural History, Washington, fits the description of *S. hexactinellicola*, collected from the Dry Tortugas in 1932 (USNM 11985) and from Puerto Rico in 1933 (USNM 124263). One ovigerous female had eggs in the process of hatching to a postlarval (decapodid) stage (Dr. J. W. Goy, personal communication). Consequently, this species lacks pelagic larval dispersal and is probably endemic to a limited area.

It is to be expected that species that are geographically isolated from each other but utilizing the same type of habitat will develop small morphological changes in the speciation process (Futuyama, 1979). This holds true for the species of *Spongiocaris*. The new species, *S. hexactinellicola*, closely resembles the other two species in the genus, all found in deep-water hexactinellid sponges. The small differences among the species are distinct on the basis of the specimens thus far found (Table 1). The shape of the rostrum is clearly different in the three species. *Spongiocaris yaldwyni* is only one of the three species that has a rostrum overreaching the antennular peduncle. In *S. hexactinellicola*, the rostrum is triangular in cross section for the proximal two-thirds, ending with a small tooth on each ventrolateral ridge, the remaining distal third being normally compressed and without ventral spines; the antennal spine is easily seen; and the distinct fingerlike epipods are present on the first three pereopods but none on the ambulatory pereopods. In *S. semiteres*, the whole rostrum is compressed with



two small teeth distoventrally; there is no trace of an antennal spine; the epipods of pereopods I–IV are rudimentary; and pereopod V lacks an epipod. The paragnaths on *S. semiteres* are more closely set than in *S. hexactinellicola* and taper distally. An important characteristic of *S. hexactinellicola* is the small blunt accessory teeth at the base of the inner main tooth and the serrated ventral area on the dactyli beneath the accessory teeth of pereopods IV and V. There are individual differences in the serrated area and accessory teeth on the ventral main tooth of the dactylus in *S. hexactinellicola* (Fig. 5A–H) but none possess the simple accessory tooth found in *S. semiteres*.

As a whole, *S. hexactinellicola* appears to be more elongated and slenderer than *S. semiteres*, especially the pereopods; the ratio between the palm width versus the length of the chela of the third pereopod is 4.2 (holotype female) and 3.8 (allotype male) compared to 3.3 on *S. semiteres* (holotype female).

A key for the determination of the species is given below.

#### KEY TO THE KNOWN SPECIES OF *SPONGIOCARIS*

1. Rostrum overreaching end of antennular peduncle; third maxilliped lacking epipod ..... *S. yaldwyni*
- Rostrum not overreaching end of second segment of antennular peduncle; third maxilliped with epipod ..... 2
2. Whole rostrum compressed, with 2 ventral teeth distally; antennal spine absent; telson without median marginal posterior tooth ..... *S. semiteres*
- Distal third of rostrum compressed, without ventral tooth, proximal two-thirds triangular in cross section, with distal spine on each ventrolateral ridge; antennal spine present; telson with median posterior marginal tooth ..... *S. hexactinellicola*

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