

REDESCRIPTION OF THE HIPPOLYTID SHRIMP
TRACHYCARIS RUGOSA (BATE) (CRUSTACEA:
DECAPODA: CARIDEA) FROM THE WESTERN
ATLANTIC, WITH NOTES ON
SEXUAL DIMORPHISM

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Abstract.—*Trachycaris rugosa* (Bate, 1888) is redescribed and figured based on specimens from the western Atlantic. This species shows a remarkable sexual dimorphism in size, shape and length of the rostrum, abdominal pleura, ventromedian abdominal spines, and antennular peduncle. *Trachycaris rugosa* differs from the eastern Atlantic *Trachycaris restricta* (A. Milne Edwards, 1878) in the absence of a palp on the mandible, the presence of two spines on the basal antennal peduncle, and a two-segmented palp on the first maxilliped.

While examining material of *Trachycaris rugosa* (Bate, 1888) from the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM), to determine the identity of some specimens of *Trachycaris* collected in Santa Marta, Colombia, it was found that, with the exception of one specimen from Bermuda (USNM 351963), the USNM and Santa Marta specimens represent the same species. The specimens agree with the original description of *Trachycaris rugosa* (Bate, 1888), and differ from the eastern Atlantic *T. restricta* Holthuis (1949) in that in the former a palp is absent on the mandible, there are two spines on the antennal peduncle, and the palp of the first maxilliped is two-segmented. Also, considerable sexual dimorphism was found in the specimens of *T. rugosa*, especially reflected in size, shape of the rostrum, abdomen and antennular peduncles.

Total length (TL) of the specimens was measured from the anterior tip of the rostrum to the posterior median margin of the telson, and carapace length (CL) was measured from the tip of the rostrum to the posterior median margin of the carapace.

Although the *Trachycaris* species are typically designated as “*rugosus*” and “*restric-*

tus,” “*rugosa*” and “*restricta*” will be used in this paper to agree with the feminine *Trachycaris*.

Trachycaris rugosa (Bate, 1888)

Figs. 1-5

Platybema rugosus Bate, 1888:579, pl. 104, fig. 2. [type locality: off Culebra Island, Puerto Rico, depth 390 fm (713.3 m)].

Trachycaris rugosus: Calman, 1906:33.

Trachycaris restrictus: Holthuis, 1949:233, figs. 2-3 (in part, see remarks).

Material examined.—Colombia: 2 ♂, Isla de la Aguja ca. 11°18'N, 74°10'W, 25 m, 8 Aug 1987, on calcareous algae, coll.: B. Werding, USNM 252485; 1 ♀ ovig., Santa Marta, ca. 11°13'N, 74°9'W, 8 m, Feb 1980, sand, coll.: B. Werding, USNM 252485. Barbados: 1 ♀ ovig. Barbados-Antigua Exp., English Harbor 8, USNM 125144.

Virgin Islands: 1 ♀ juv. off St. Thomas, 20 ft (36.6 m), coral, Feb 1899, USNM 24691.

Puerto Rico: 2 ♀ ovig., off Culebra, R/V *Fish Hawk* 15 fm (27.4 m), coral sand, Feb 1899, USNM 24692, 24964; 2 ♀ ovig., off Jallabor Bay, July 1915, USNM 1135, 1179;

2 ♀, Mayaguez, on coral reef, 20 Jan 1899, USNM 24690.

Mexico: 1 ♀ ovig., Yucatan, off Cape Catoche, 22°18'N, 87°04'W, R/V *Albatross*, 24 fm (43.9 m), USNM 23308.

Cuba: 1 ♀, S. of Hicacos, Varadero, 2 Jan 1957, dredge haul, coll W. Schmitt, USNM 213537.

Belize: 1 ♀ ovig., Stann Creek District, Carrie Bow Cay, May 1981, on the alga *Rhizocephalus* sp., USNM 184510.

Gulf of Mexico: 1 ♀ ovig., off Charlotte Harbor 26°33'N, 83°10'W, 28 fm (51.2 m), 2 Apr 1901, sand, R/V *Fish Hawk*, USNM 24693; 2 ♀ ovig. 1 ♀ juv., between 29°14'30"N, 85°32'W and 29°16'N, 85°32'W, R/V *Albatross*, 24–27 fm (43.9–49.4 m), 30 Jan 1885, USNM 23770, 23771, 9599.

Florida Keys: 3 ♀ ovig., 1 ♀ juv., Dry Tortugas, 27 fm (49.4 m), Jan 1925, coll. W. L. Longley, USNM 144662, 127956, 127957, 127958, 2 ♀, S. of Cape San Blas, 29°11'18"N, 85°29'32"W, R/V *Albatross*, 25–27 fm (45.7–49.4 m), 7 Feb 1885, USNM 23769, 2374.

South Carolina: 7 ♂, off S. Carolina, between 31°31'54"N, 78°39'42"W, and 32°49'18"N, 78°49'18"W, between 33–68 m, Aug 1981, suction sampler, USNM 224965, 224966, 224967, 22070, 22071, 224989.

Redescription.—Carapace varying considerably with size and sex (Figs. 1a, b; 2a, b). Rostrum of adult females strongly compressed laterally, approximately as long as high, tip truncated with 5–6 small teeth; lower margin with 3 large teeth, upper margin with 6 or 7 teeth (Fig. 1b). Dorsomedian ridge of carapace sloping sharply down to rostrum, with several teeth distinctly larger than those of rostrum, unequal in size. Adult males with elongate rostrum, approximately twice as long as high, ending in 2 apical teeth, tip truncated with 3–4 small teeth; lower margin with 3 rather large teeth; upper margin with 6 teeth, continuing in relatively straight line to dorsomedian ridge (Fig. 2b). Juveniles of both sexes with car-

apace similar, different from adults (Figs. 1a, 2a); dorsal ridge rising behind eye and sloping down to rostrum, more pronounced with size in females, tending to be flat in males (Figs. 1b, 2b). Carapace with several tubercles ending in anteriorly directed spines variable in size and location but with following general pattern: behind cervical groove a row of 3–4 spinules, and another 3 or 4 forward (absent in juveniles); row of 4–5 tubercles beginning behind antennal spine and running along lateral surface; under this row another 3–6 tubercles near lateral margin of carapace; near highest point of dorsal ridge there is another group of tubercles variable in number. Adult females with additional group of tubercles near posterolateral margin of carapace. Juveniles with fewer and smaller tubercles. Upper margin of orbit with distinct supraorbital spine, lower angle ending in sharp pterygostomial spine; anterior margin with a strong antennal spine, below which are 3 other small spines on anterolateral angle of carapace (Figs. 1a, b; 2a, b).

Antennular peduncle with basal segment with distinct, large stylocerite, ending in 2 processes. Proximal process tapering into sharp anteriorly directed tip, the other rounded but with distinct spine at the top. Between 2 processes a deep, rounded notch. Ventral surface with strong curved spine directed to outside of peduncle. In males, second segment robust and short about $\frac{1}{3}$ length of third. Flagella short, consisting of about 6 articles (Fig. 2d). In females, second segment slightly longer than third, flagella consisting of approximately 8 articles (Fig. 1d).

Antennal scale overreaching antennular peduncle by about $\frac{1}{3}$ of its length, about twice as long as broad; outer margin ending in distinct terminal tooth overreaching the lamella. Antennal peduncle bearing 1 small dorsal spine and 2 large ventral spines, largest located near base of scaphocerite, smallest near distal border. Antennal flagellum consisting of 15 or 16 articles (Fig. 3g).

Mandible lacking palp. Molar process with

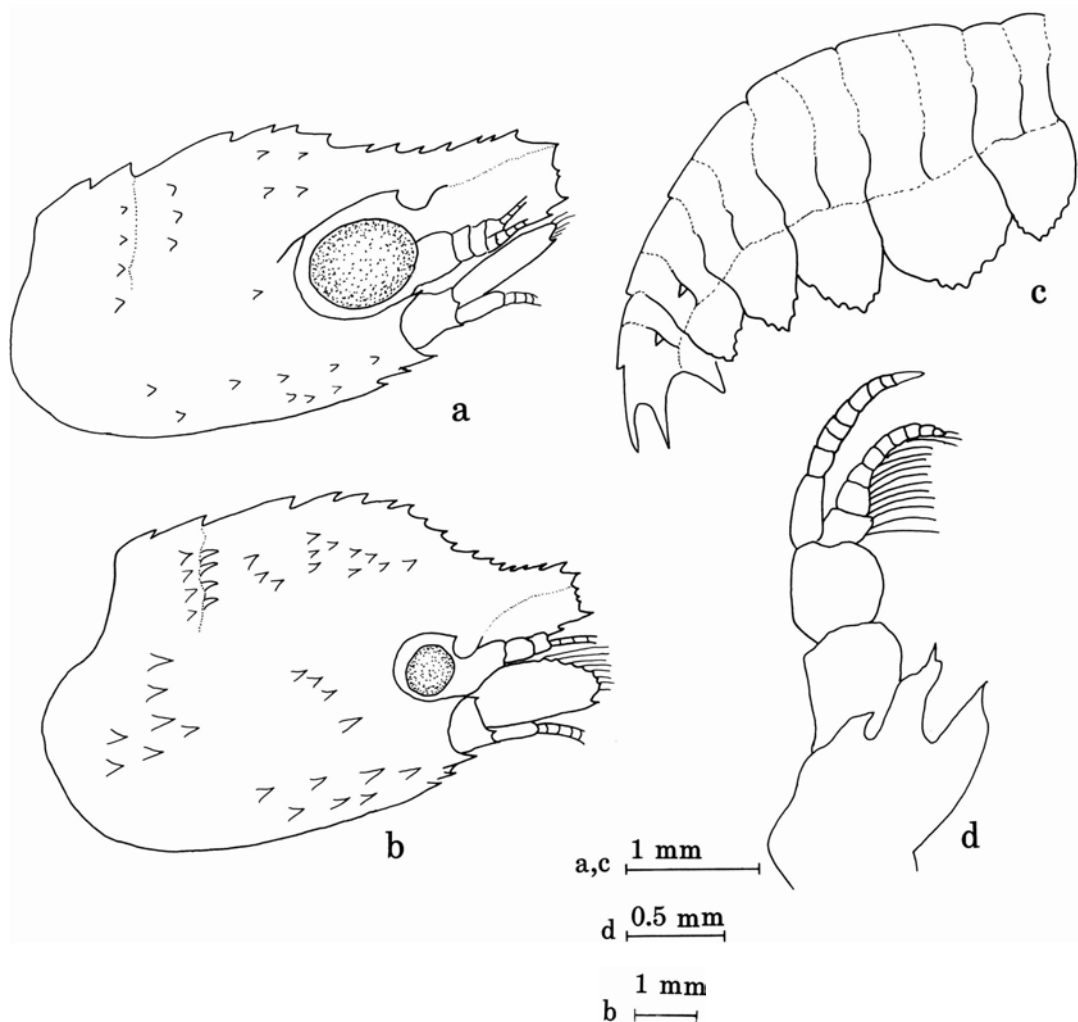


Fig. 1. *Trachycaris rugosa* Bate, females from Puerto Rico (USNM 24691, 1135). a, carapace of juvenile female; b, carapace of adult female; c, abdomen of juvenile female, ventrolateral view; d, antennular peduncle of female, ventral view.

strong conical tooth medially, and series of small serrate teeth (Fig. 3a).

Maxillule with slender bilobed endopodite; upper lacinia broad, distal margin with about 25 small spines; lower lacinia with few long distal setae (Fig. 3b).

Maxilla with setose distal endite distinctly cleft, proximal endite setose with single lobe; palp short, thumblike, scaphognathite well developed (Fig. 3c).

Maxillipeds each provided with well de-

veloped exopod. First maxilliped with 2 endites separated by distinct notch. Palp distinctly segmented, provided near the base with accessory lobe. Epipod slender, distinctly bilobed (Fig. 3d).

Second maxilliped with 5-segmented endopodite. Dactylus short, as long as broad, with dense fringe of setae along dorsodistal margin. Propodus slightly shorter than carpus, also bearing numerous long simple setae (Fig. 3e).

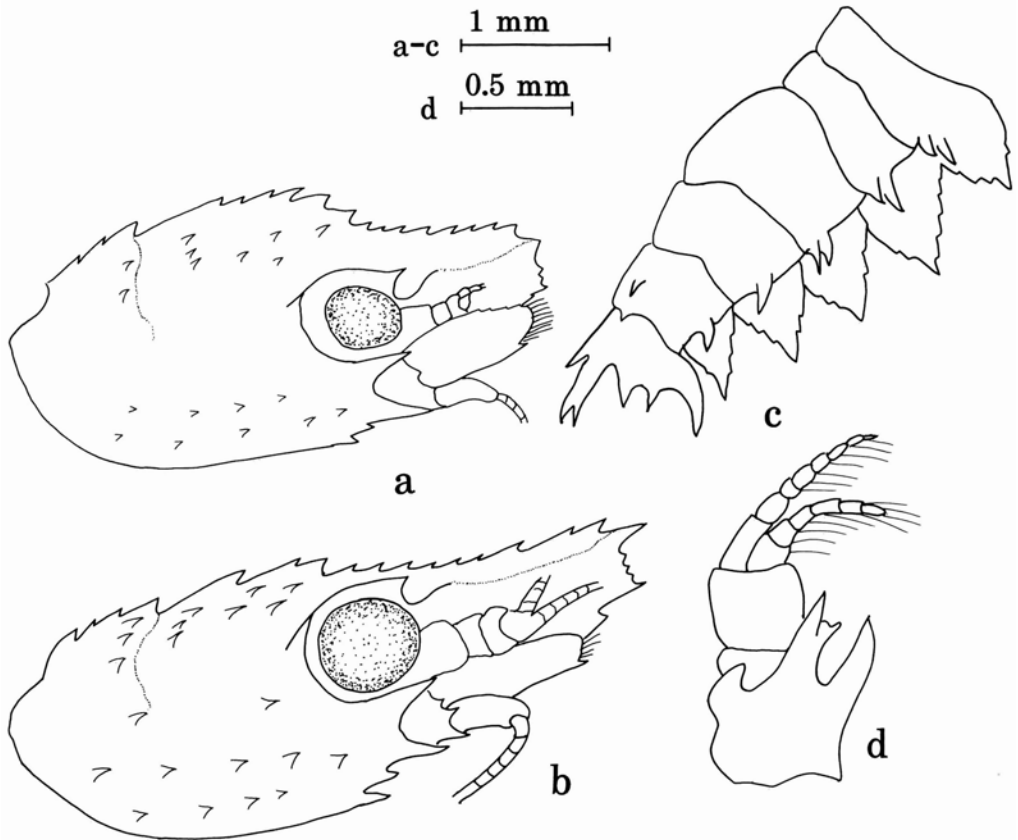


Fig. 2. *Trachycaris rugosa* Bate, males from South Carolina (USNM 224966) and Colombia (USNM 252485). a, carapace of juvenile; b, carapace of adult; c, abdomen of adult, ventrolateral view; d, antennular peduncle of adult, ventral view.

Third maxilliped robust, exceeding antennular peduncle by tip of ultimate segment, endopodite well developed, 4-segmented. Ultimate segment about twice as long as penultimate segment, bearing 7 strong dark spines. Penultimate segment slightly shorter than antepenultimate; on dorsal surface bearing 3 rows of terminal spines variable in number (first row 6–8, second 8–10, third 10–18). Antepenultimate segment bearing large spine on outer anterolateral angle and 2 rows of setae on dorsal surface (first row 2–10, second 6–8). Exopod long, slender, reaching anterolateral spine of antepenultimate segment (Fig. 3f).

First pereiopods small, rather heavy, reaching middle of merus of third maxilli-

peds. Finger acute, about $\frac{3}{5}$ as long as palm, fixed finger ending in 2 black claws. Palm somewhat swollen, produced posterior to articulation with carpus. Carpus short, slightly longer than broad, about $\frac{2}{3}$ the length of the chela. Merus and ischium slightly longer than carpus (Fig. 4a).

Second pereiopods equal and slender. Finger nearly $\frac{1}{3}$ as long as palm. Carpus about 1.5 times as long as chela, consisting of 2 joints of equal length. Merus slightly longer than chela (Fig. 4b).

Last 3 legs robust, short. Third pereiopod exceeding antennular peduncle by entire length of carpus. Posterior margin of dactylus with 3–5 teeth, distal one largest; propodus nearly twice as long as dactylus, posterior margin

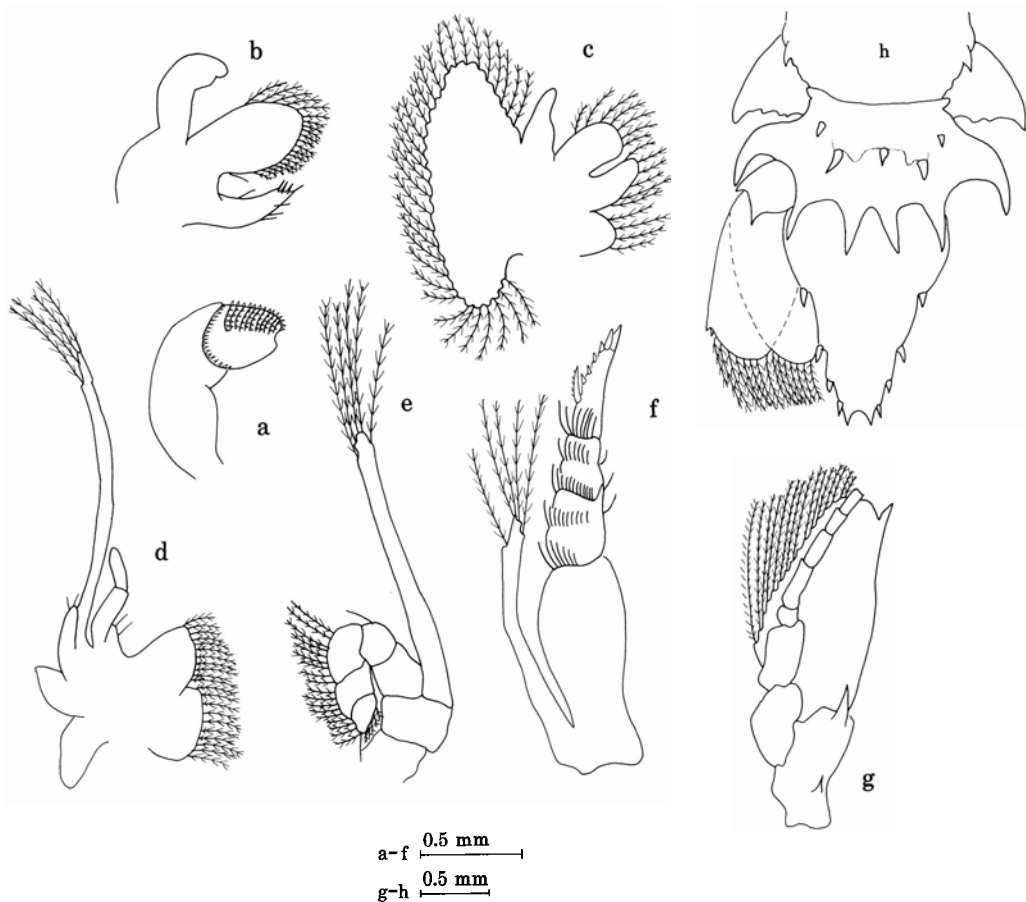


Fig. 3. *Trachycaris rugosa* Bate, male from Colombia (USNM 252485). a-f, mouth parts, right external view: a, mandible; b, maxillula; c, maxilla; d, first maxilliped; e, second maxilliped; f, third maxilliped, dorsal view; g, antenna, ventral view; h, telson and sixth abdominal somite.

bearing 4 spinules; carpus about half length of merus, bearing 4 or 5 strong spines on dorsal surface, ventral margin with strong spine at anterior point (Fig. 4c, d); dorsal surface of merus with 2 spines on inner margin, and 2 spines near middle. Fourth and fifth pereiopods similar to third (Fig. 4e, f).

Abdomen having anterior 2 somites with lateral, short grooves, third to sixth somites smooth. Males with abdominal pleura large, narrow (Fig. 2c). Apexes of first to fifth pleura ending in marginal teeth with minute denticles (generally 2 or 3). First to third abdominal somites armed with 2 strong ventromedian abdominal spines, fourth and

fifth somites bearing only 1 ventromedian spine. Females with pleura broadly rounded, also with minute denticles (generally 3 or 4). Juvenile females armed on first to third somite with 2 small ventromedian abdominal spines, fourth and fifth with a single spine. Immature females (LT \leq 11.5 mm) still having 1 ventromedian spine on both fourth and fifth somite (Fig. 1c). Oviparous females lacking all ventromedian abdominal spines. Fifth abdominal somite in females and males with large spine on lateral surface of pleura. Sixth somite with very narrow pleura ending in strong posterior spine without minute denticles and bearing

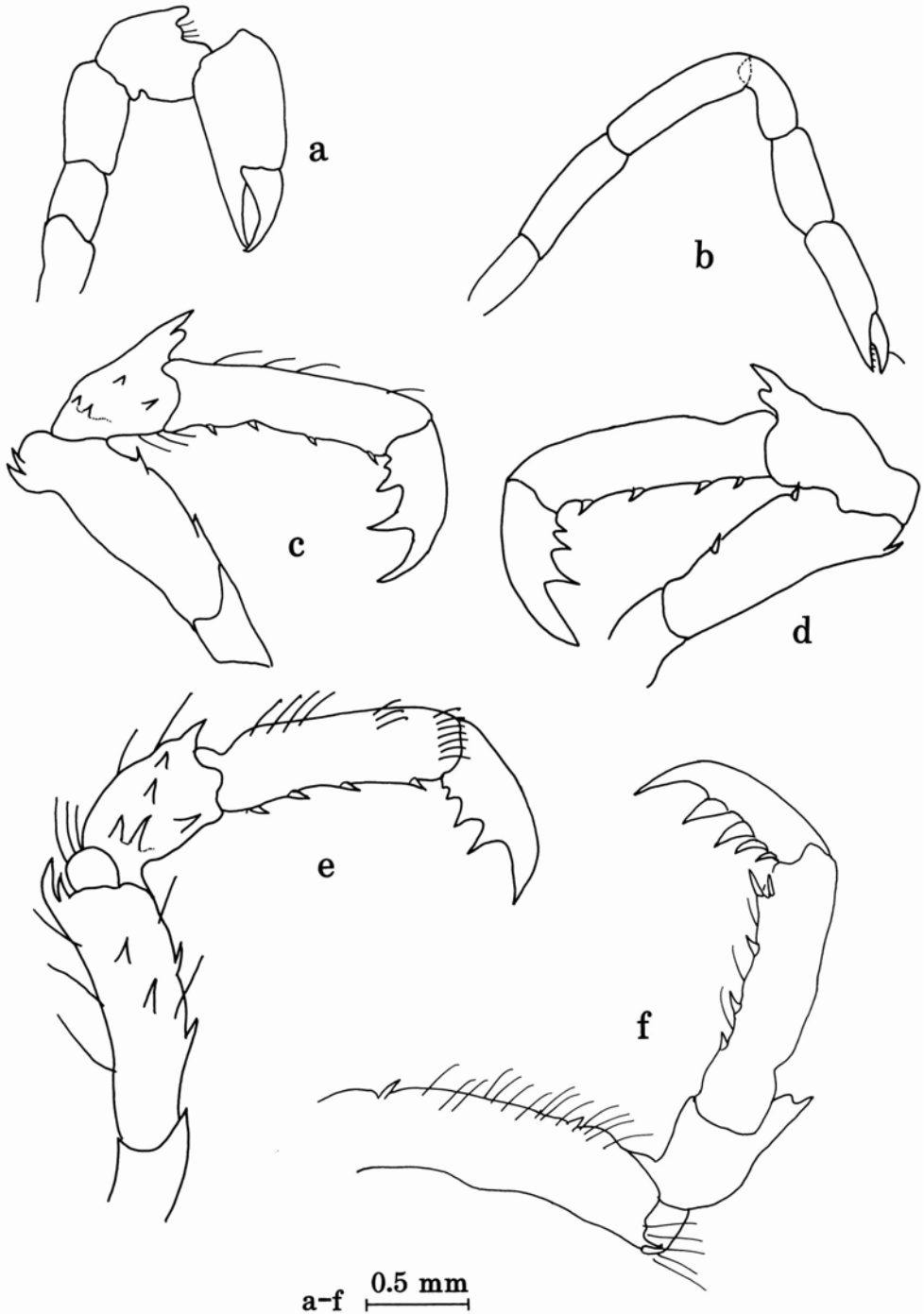


Fig. 4. *Trachycaris rugosa* Bate, male from Colombia (USNM 252485) and female from Puerto Rico (USNM 1135). a, first pereiopod of male; b, second pereiopod of male; c, third pereiopod of male, dorsal view; d, third pereiopod of male, ventral view; e, fourth pereiopod of female, dorsal view; f, fourth pereiopod of female, ventral view.

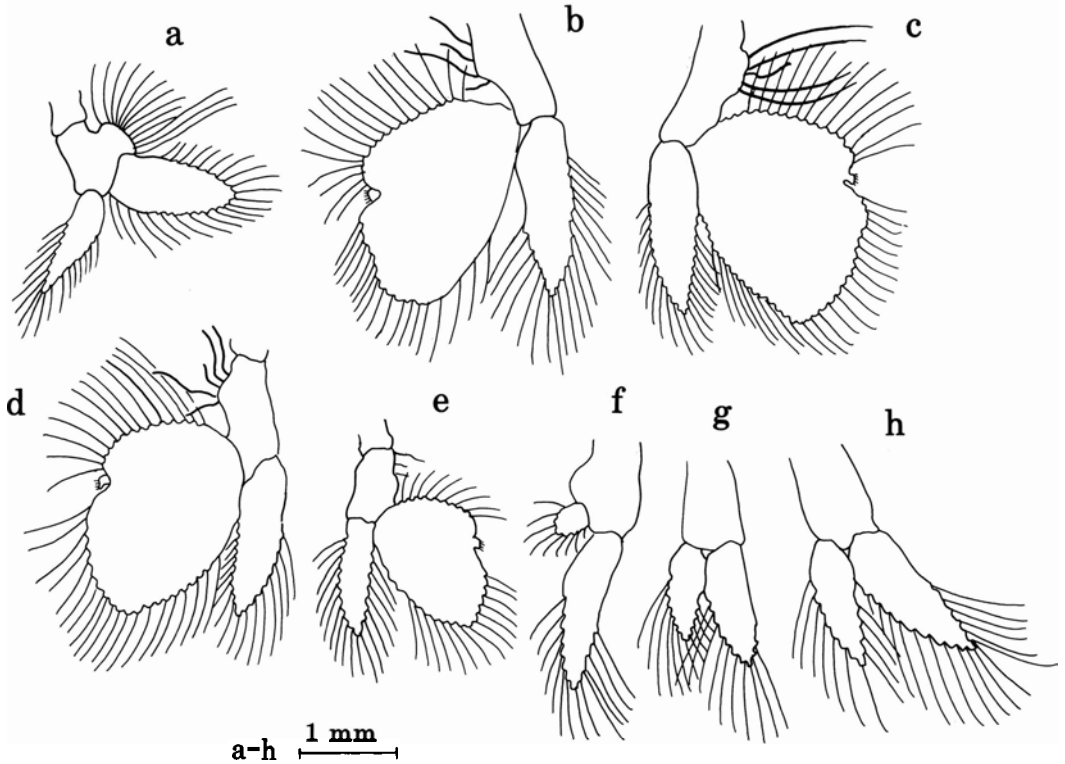


Fig. 5. *Trachycaris rugosa* Bate, female from Puerto Rico (USNM 1135) and male from Colombia (USNM 252485). a, first pleopod of female; b, second pleopod of female; c, third pleopod of female; d, fourth pleopod of female; e, fifth pleopod of female; f, first pleopod of male; g, second pleopod of male; h, third pleopod of male.

4 large, strong terminal spines similar in size; another 3 large spines are on dorsal surface alternately placed between 4 terminal spines (Fig. 3h).

Telson broadly oval, with blunt apex. Lateral margin each bearing 4 movable spines. Anterior pair of spines located anterior to middle of telson, second pair placed midway between first spine and posterior end of telson (Fig. 3h). Two posterior pairs smaller, similar in size near the apex.

Uropods well developed. Exopodite distinctly broad with outer margin slightly rounded and ending in tooth; inner side bearing movable spine often difficult to observe in juveniles. Endopodite narrowly ovate, fringed with plumose setae (Fig. 3h).

Pleopods biramous, first pleopods small-

est in females, with narrow endopodite twice as long as basipodite and longer than endopodite. First pleopods lacking appendix interna (Fig. 5a). Second to fifth pleopods bearing a very small rounded appendix interne ending in tiny curved hairs. Second pleopods with broad discoidal endopod about 1.3 times longer than wide, exopodite narrow (Fig. 5b). Second to fifth pleopods generally similar, third pleopod largest, decreasing in size posteriorly (Fig. 5b-e). In males, first to fifth pleopods biramous, all lacking appendices. First pleopods with very small and rounded endopodite and large and narrow exopodite. Second to fifth pleopods similar in shape and size (Fig. 5f-g).

Measurements.—♀ ovig. TL = 11.12–29.3 mm, CL = 5.7–12.5 mm; ♀ non-breeding

LT = 5.4–11.12 mm, LC = 2.57–5.70 mm.
♂ LT = 6.96–11.32 mm, LC = 3.03–5.65 mm.

Color.—In life, abdomen and carapace bright red with some white spots in distal part of rostrum, orbit of eye, telson and outer edge of pleura. Pereiopods with transverse irregular white and red bands, except on the second pair. This color pattern appears to be mimicry, as the specimens were found living on calcareous algae of a similar red-pinkish color. Color of preserved material is variable, some specimens keeping a dark brown color, while in others the color disappears entirely.

Distribution.—Western Atlantic from South Carolina through Gulf of Mexico and Caribbean Sea to Santa Marta, Colombia.

Remarks.—The genus *Trachycaris* Calman (1906) was founded to receive *Platybema rugosus* Bate, 1888, a species that until 1940 was known only from the western Atlantic (Gurney 1940). Holthuis (1949) compared material of *T. rugosa* from the Canary Islands and a single *T. rugosa* specimen from Curaçao with material of *T. restricta* A. Milne Edwards from the Cape Verde Islands, and concluded that the eastern and western Atlantic forms should be one species, *T. restricta*. The Curaçao and Canary Island specimens differed in several significant details from Bate's figures, leading Holthuis to conclude that Bate's drawings of the western Atlantic specimen were inaccurate, and that both forms should be considered as one species. Although Holthuis accurately described and compared the specimens he observed, he may have wrongly assumed that Bate's descriptions of the mandible were inaccurate.

Noteworthy variations in morphology were found among the specimens of *T. restricta* in the USNM collection, due in part to sexual dimorphism and age. In addition, significant differences were found between the ovigerous females in the USNM collection and Holthuis's description of an ovig-

erous female of *T. restricta*. The main differences are: lack of a palp on the mandible; two spines on the basal antennal peduncle instead of three; two-segmented palp of the first maxilliped; lower endite of the maxilla present; ventral surface of the antennular peduncle with a large curved spine; and several rows of spines on the third maxilliped.

These characteristics were shared by all but one of the 19 females in the USNM collection. The sole exception, a female from Bermuda, showed the mandible, the antennal peduncle, and the first maxilliped as in Holthuis's (1949) description of *T. restricta*. The other differences between Holthuis's description and the characteristics observed in the USNM material may be due to inaccuracies in the description, because these structures appear different when viewed from ventral and dorsal perspectives. Until it is possible to compare greater number of specimens from the eastern and western Atlantic to determine the extent of variation of this species, it is best to separate the east Atlantic species, *T. restricta*, from the west Atlantic species, *T. rugosa*.

Kemp (1914) described variation in the proportional lengths of the third maxillipeds and first pereiopods of males of the hippolytids *Saron marmoratus* and *Alope australis* from young adulthood to senility. In addition, females and males of *Latreutes mucronatus* exhibited a remarkable diversity in the form of the rostrum as well as the proportions of the antennal scale and the spinulation of the anterolateral margin of the carapace. Sexual dimorphism in other hippolytids has been reported in *Lebbeus polaris*, *Spirontocaris liljeborgii* and *S. phippsii*, with differences found mainly in the shape and length of the rostrum, which become more pronounced with increasing age (Greve 1963, Squires 1965). Chace (1972) reported a large difference in size between males and females of *Thor dobkini*. Although some hippolytids, like *Spirontocaris* spp., possess ventral abdominal spines

(Greve 1963), they are not considered to be an indication of sexual dimorphism. Sexual dimorphism in the hippolytid *Trachycaris rugosa* is based mainly on the presence of ventromedian abdominal spines in the males, lack of appendices in all the pleopods in the males, more rounded abdominal pleura in females, different proportion of segments in the antennular peduncle, and different spination and shape of the carapace. Similar features were reported by Goy & Felder (1988) in the stenopodid *Microprosthema manningi*.

Males of *T. rugosa* of the USNM collection, which are smaller and less abundant, come from only two different localities: South Carolina (U.S.A.) and Isla de Aguja (Colombia). The South Carolina specimens were collected by suction sampler between 33–68 m in depth, and the Colombian specimens were collected by hand in 25 m among calcareous algae. Females examined were collected in different parts of the Caribbean, Gulf of Mexico and Bermuda, in depths between 8–20 m, on sand or coral. Based on this information, it is reasonable to conclude that males are more cryptic and live in deeper water than females, and that these differences in habitats could possibly account for morphological differentiation.

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