

# Redescription of *Stenopus devaneyi* and *Stenopus earlei* from the Indo-West Pacific Region (Decapoda: Stenopodidae)

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## ABSTRACT

Preliminary diagnoses and color plates of 2 new species of *Stenopus* Latreille from the Indo-West Pacific region were presented by Goy & Randall (1984). Detailed redescription of the holotypes and morphological variations in the paratypes are presented. Specimens of *Stenopus devaneyi* Goy & Randall, 1984, were collected from the Marquesas Is and Sri Lanka and specimens of *Stenopus earlei* Goy & Randall, 1984, were collected from the Hawaiian Is and Grand Comoro I. These species are easily distinguished by differences in morphology and color pattern. A key to the 6 described species of *Stenopus* from the Indo-West Pacific is included.

## INTRODUCTION

Collections over several years in the Indo-West Pacific region have yielded numerous interesting specimens of new stenopodidean shrimps from deep and shallow water habitats. For the shallow water species in the family Stenopodidae, color pattern is an invaluable diagnostic field tool. Color patterns are highly consistent throughout the range of a given species; however, the shade and intensity of color may vary from locality to locality. The discovery of 2 new species in the genus *Stenopus* Latreille from the Indo-West Pacific region was facilitated by their distinctive color patterns. Preliminary diagnoses and color plates of these 2 new species were presented by Goy & Randall (1984). The present paper provides detailed redescriptions of the holotypes and morphological variations in the paratypes.

Specimens of *Stenopus devaneyi* Goy & Randall, 1984, have been collected from the Marquesas Is and Sri Lanka. Specimens of *Stenopus earlei* Goy & Randall, 1984, have been collected from the Hawaiian Is and Grand Comoro I in the Indian Ocean. The 2 species are closely related to *S. tenuirostris* DeMan, 1888, and *S. scutellatus* Rankin, 1898, respectively, but both are easily distinguished by numerous morphological differences as well as striking differences in coloration. A key to the 6 described species of *Stenopus* from the Indo-West Pacific is included below. Specimens treated herein are deposited in the Bernice P. Bishop Museum (BPBM), Honolulu, Hawai'i, the California Academy of Sciences (CAS), San Francisco, California, and the Senckenberg Museum (SMF), Frankfurt, West Germany. All redescribed material recorded below is from the type series.

## SYSTEMATICS

***Stenopus devaneyi* Goy & Randall, 1984: 117.**

Fig. 1-4

**Diagnosis.** Small stenopodid shrimp, body subcylindrical, densely covered with spinous processes; last 3 pairs of pereopods more robust than in other members of the genus;

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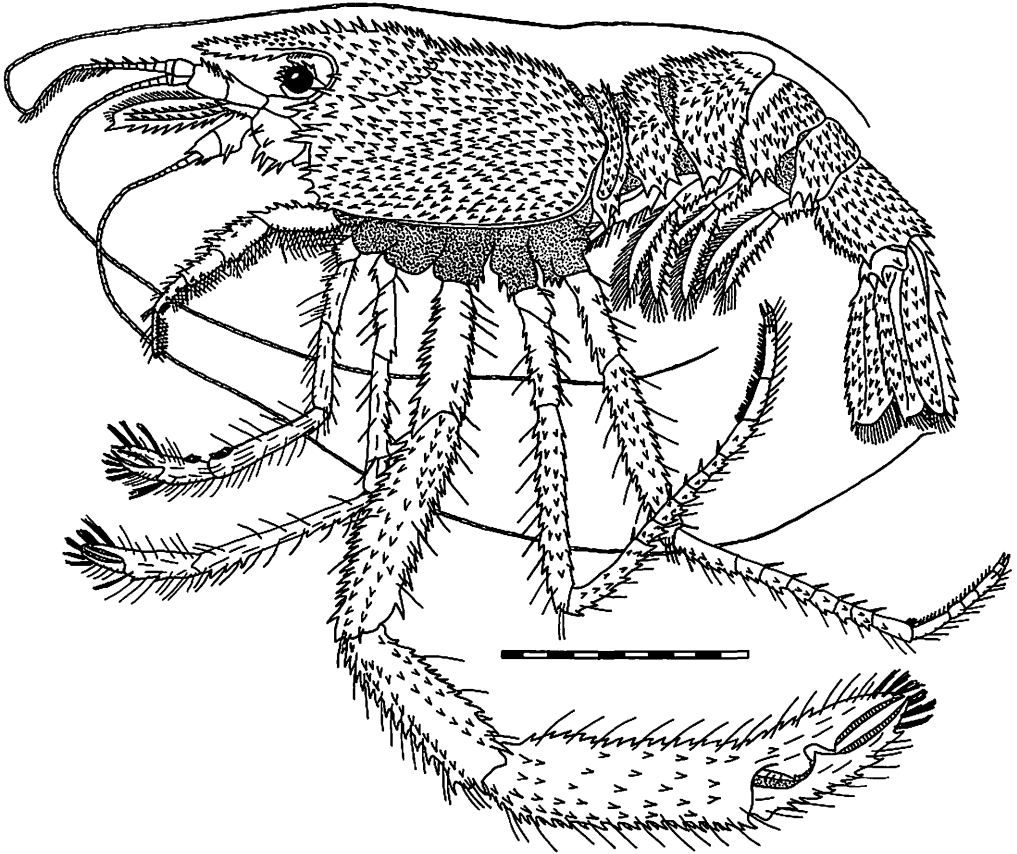


Fig. 1. *Stenopus devaneyi*, holotype, ♂. Increments of scale in mm.

distoventral extremity of 4th and 5th pereopod carpi with 2-6 acute movable spinules; uropodal exopodite with dorsal bifurcated median ridge; body generally whitish with bilobed bright red spot on sides of abdomen.

**Description.** Holotype (♂, BPBM S8045). Rostrum (Fig. 1) broad at base, tapering and compressed anteriorly; extending slightly past end of last antennular peduncle segment; dorsal margin with 13 spines, distal spine not reaching tip. Ventral margin with 6 spines in distal  $\frac{1}{2}$ , numerous proximal setae. Lateral margins with row of 6 spines in proximal  $\frac{1}{2}$ , directed obliquely upwards and forward; carinae fairly developed.

Carapace (Fig. 1, 2A) densely covered with spinules not noticeably elongated and not in distinct longitudinal rows. Cervical groove distinct with 9 spines. Orbit without supraorbital spine; inferior orbital angle bearing small anterior and larger posterior spines. Large antennal spine present; small hepatic spine at lower end of cervical groove. Branchiostegal spine preceded posterodorsally by 2 spines of equal length, followed by large spine slightly overlapping anterior edge of pterygostomial region and 4 smaller pterygostomial spines. Ventrolateral angle somewhat rounded, only slightly produced anteriorly while posterolateral angle of branchiostegite straight.

First 3 abdominal somites (Fig. 1, 2B) with forwardly directed spinules similar to those on carapace. Spinous region of 1st abdominal somite dorsally and laterally about  $\frac{1}{3}$  breadth of same region of 2nd somite. Pleura of 1st somite ending in 1 strong, 1 weak obliquely

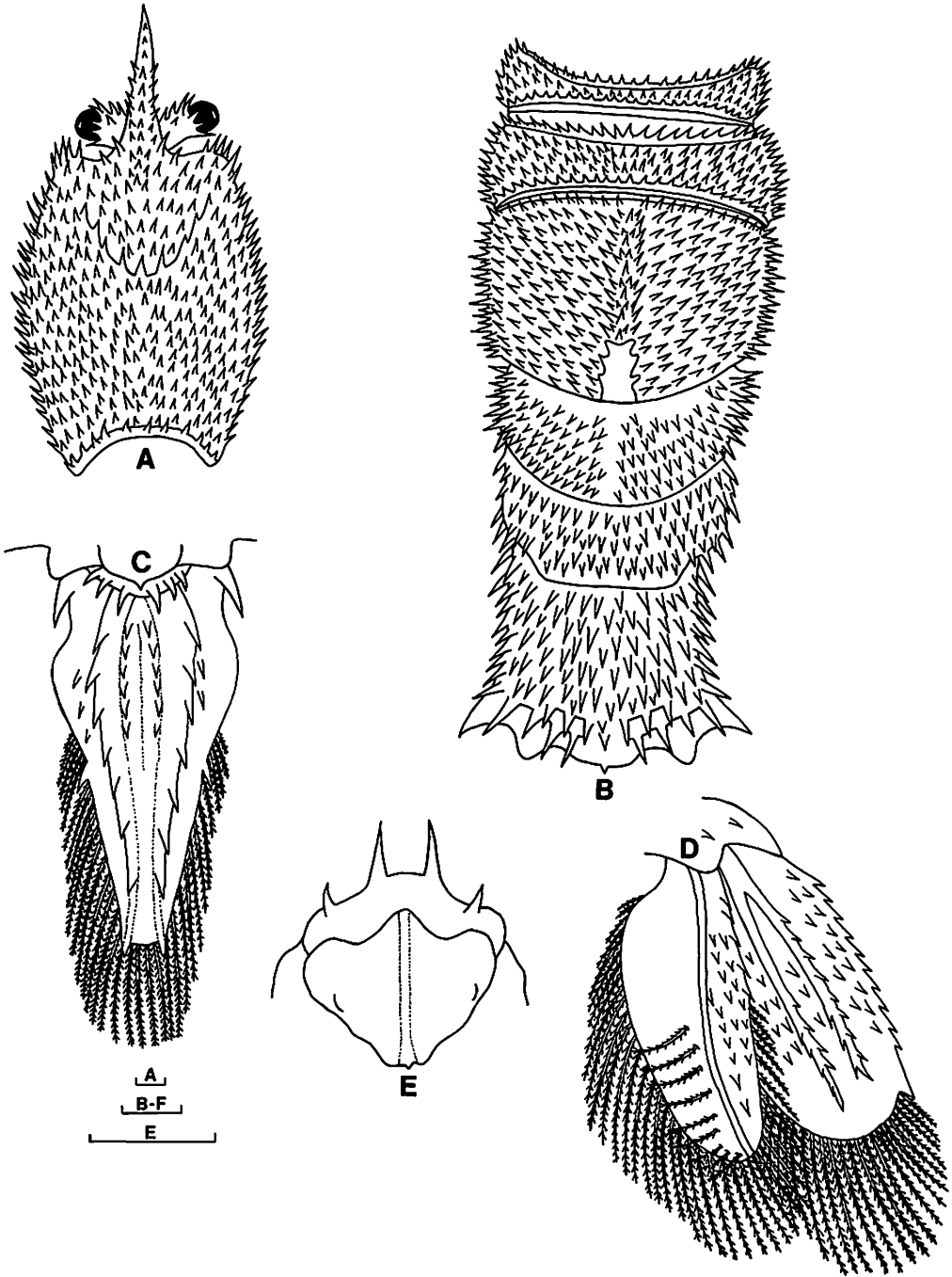


Fig. 2. *Stenopus devaneyi*, holotype, ♂: **A**, carapace, dorsal view; **B**, abdominal somites, dorsal view; **C**, telson; **D**, uropods; **E**, epistome and labrum, ventral view. Scale bars represent 1.0 mm.

directed posterior tooth; pleura of 2nd to 5th somites truncate, each ventrolateral margin with 3 equal teeth. Third somite broadly produced, posterior medial edge, without spines near entire edge; spines on this somite more or less laterally directed. Fourth somite with large area of anterior and medial regions lacking spinules. Last 3 somites with distolateral



Fig. 3. *Stenopus devaneyi*, holotype, ♂: A, right antennule and antennular peduncle, ventrolateral view; B, left antennular peduncle, dorsal view; C, antenna and scaphocerite, dorsal view; D, right mandible, ventral view; E, same, dorsal view; F, maxillule; G, maxilla; H, 1st maxilliped; I, 2nd maxilliped; J, 3rd maxilliped. Scale bars represent 1.0 mm.

spinules depressed and posterolaterally directed, arranged in somewhat transverse rows. Each abdominal somite except 6th bearing strong ventral median spine; that of 1st, 4th, and 5th somites posteriorly directed, latter somite flanked by a shorter spine on each side, that of 2nd and 3rd somites anteriorly directed; ventral surface of 6th somite also densely covered with short spinules.

Eyes well developed, with peduncle slightly longer than cornea. Ophthalmic peduncle dorsomedially with 3 short spinules and anteromedially with 2 longer spinules; 5 spinules

extending over cornea, 3 dorsally and 2 anterolaterally; proximodorsal side with 2 short spinules extending over cornea.

Telson (Fig. 2C) somewhat lanceolate, with median groove flanked by 2 distinct longitudinal carinae. Carinae with 8 strong, posteriorly directed spines, last spine overlapping rounded posterior telsonal margin. Base of telson with 4 pairs of spaced spines, lateral pair most strongly developed, middle pair weakest. Between each carinae and median groove, row of 6 small spinules; 2 or 3 spinules outside each carinae in anterior  $\frac{1}{2}$ . Lateral margins with strong spine about midway, provided with plumose setae along posterior  $\frac{2}{3}$ .

Uropods (Fig. 2D) well developed with endopodite not exceeding telsonal tip and slightly narrower and shorter than exopodite. Basal segment with 5 or 6 ventral spinules, 2 dorsomesial spinules. Exopodite bearing 10–11 acute teeth on outer margin, with distinct gap between penultimate and ultimate teeth. Dorsal surface bearing anterior median ridge that bifurcates longitudinally at about proximal  $\frac{1}{4}$  of its length, creating median groove. Two distinct rows of 5–6 and 9–10 spinules outside external longitudinal ridge; ridge bears 8–9 outer, 1–3 inner spinules. Three spinules midway on median groove; internal longitudinal ridge bears 3–4 inner, 4–5 outer spinules; 2 rows of 5–6 and 2–3 spinules outside internal ridge. Ventral surface with distinct longitudinal row of 13 spinules on outer portion, 23–24 spinules dispersed on inner portion. Outer proximal margin of endopodite bearing 5 teeth. Dorsal surface bearing distinct median ridge with 3 rows of 5–7 outer spinules, inner row of 9 plumose setae. Ventral surface without spinules. Unarmed margins of exopodites, endopodites with long plumose setae.

Epistome (Fig. 2E) triangular anteriorly with 2 stout submedian spines next to slightly rounded median area. Two smaller spines present laterally; labrum normally developed. Paragnath moderately bilobed, lobes separated by small median fissure, bordered by short setae. Thoracic sternites narrow with 2 submedian spinules on segments 4–6, 8 submedian spinules on segments 7–8.

Antennular peduncle (Fig. 3A,B) short, extending to less than  $\frac{1}{2}$  of scaphocerite. Basal, middle segments nearly same length, distal segment considerably shorter. Basal segment about  $2\times$  as long as wide with short rectangular process on inner proximodorsal margin; small, acute stylocerite on outer margin; outer distodorsal angle with scale bearing 3 spines, dorsomedially 2 small spines; interior ventral angle with 2 strong spines. Middle segment with 5 spines on ventral margin, 3 dorsal submesially, 5 large spines extending out dorsally. Distal segment with very weak ventral and strong dorsal spines. Upper flagellum well developed with proximal part bearing 39 aesthetascs beginning on 6th article and ending on 24th. From article 3 to 14, 8 dorsal spines; articles 2–5 with weak ventral spines. Lower flagellum not as strongly developed as upper.

Antenna (Fig. 3C) with strong basicerite bearing at least 10 spines on enlarged proximoventral portion, 6 small spinules on dorsoexternal side. Carpocerite with 6 small dorsomedial spinules, 1 large and 1 small dorsodistal spinule and 2 ventral spinules. Antennal flagellum well developed with dorsal spinules on segments 1 and 2, extending beyond tip of telson. Scaphocerite well developed, reaching more than  $\frac{1}{2}$  its length beyond tip of rostrum. Outer margin moderately concave proximally with 4 spines decreasing in size distally; distal part bearing 8–11 teeth, followed by short nonserrate distance to final small blunt tooth. Dorsal surface with 2 distinct longitudinal carinae, inner carina bearing row of 13 close-set spinules nearly to distal margin, outer carina with row of 8 spinules widely spaced, not extending as far distally. Inner margin with long plumose setae. Ventral surface with 2 longitudinal rows of spinules away from lateral margins; external row of 4–7 smaller and internal row of 15–18 larger curved spinules, latter extending further distally. Lamina only slightly tapering distally, its greatest width slightly proximal to  $\frac{1}{2}$  its length; narrowing to about  $\frac{1}{2}$  its maximum width proximally with convex median and concave outer sides.

Mandibles (Fig. 3D,E) robust with short, fused molar and incisor processes. Molar surface nearly smooth, incisor bearing 3 strong teeth medially, central one longest, 4 short lateral teeth. Palp well developed, 3-segmented. Proximal segment shortest; middle segment setose distolaterally and medially, broadest distally,  $2\times$  longer than proximal segment; distal segment broadest basally, tapering distally, densely setose laterally and distally.

Maxillule (Fig. 3F) with slender, undivided endopodite bearing 9 plumose setae mostly on distolateral border, a few mesiolaterally. Proximal endite broad, truncated distally with seta laterally, numerous compound spinose setae distally. Distal endite of equal size, rounded distally, bearing numerous plumose setae along most of its margins.

Maxilla (Fig. 3F) with following setation on coxal and basal endites; numerous plumose setae on both coxal lobes with fringe of setae below distal margins of lobes, forming double row together with marginal setae distally; proximal lobe  $2\times$  as broad as distal lobe; plumose setae along distal edge of both lobes of basal endite; proximal lobe about  $\frac{3}{4}$  breadth of distal lobe and slightly shorter. Endopodite not exceeding anterior margin of scaphognathite, slender, gradually narrowing distally, bearing 20 lateral, 10 distal, 9 inner marginal plumose setae. Scaphognathite long, narrow, about  $5\times$  longer than maximum breadth, with numerous plumose setae along margin.

First maxilliped (Fig. 3H) bearing 3-segmented endopodite. Proximal segment slightly longer than broad, with 10 long plumose setae laterally on outer margin, 9 shorter setae on inner margin. Middle segment about  $\frac{1}{2}$  length of proximal segment, with 15 long plumose lateral setae on outer margin, seta on inner margin. Distal segment slender, unarmed, less than  $\frac{1}{2}$  length of middle segment. Basipodite large, rounded anteriorly, slightly concave near middle, with outer border and area adjacent to this on both inner and outer sides proximally bearing dense fringe of long setae. Coxopodite lobed with numerous moderately long setae. Exopodite well developed, flagellum arising from complete peduncle, which bears 3 simple setae. Flagellum with 5 simple, 8 plumose long proximal setae, 20 longer plumose setae distolaterally. Large epipod with slender proximal and distal lobes approximately equal in length and slightly more than  $2\times$  as long as broad.

Second maxilliped (Fig. 3I) with 5-jointed endopodite. Dactylus suboval, about as long as broad, with dense fringe of comb setae along distodorsal margin, 3 short setae along distoventral margin with others scattered on inner surface, and 7 longer simple setae in rows on outer surface medially. Propodus equal to length of dactylus, comb setae in broad band dorsally and onto inner side, row of 6 longer setae dorsomedially, up to 10 setae near distal edge on outer side; 3 short setae on ventral margin. Carpus short, triangular, about  $\frac{1}{2}\times$  length of propodus, with numerous long and short simple setae on distal border; few very short setae on inner surface. Merus about  $2\times$  length of dactylus,  $2\frac{1}{2}\times$  longer than broad; inner border with 4 short, widely spaced distal simple setae; outer border slightly convex, with fringe of many long simple setae. Ischium and basis not fused, each with dense fringe of mesial setae as coxa; 4 short simple setae at inner proximal edge of ischium. Exopodite long, slender, undivided distal  $\frac{1}{2}$  bearing 18 long plumose setae. Small, elongate epipod present.

Third maxilliped (Fig. 3J) endopodite strongly developed, well calcified, 5-segmented. Dactylus slender, tapering, about  $6\times$  longer than basal width, 4 simple setae on outer margin, numerous long simple setae mesially and on inner margin. Propodus slightly shorter than dactylus but about  $4\times$  longer than broad, bearing 1 acute spine, 7 long and short setae on distal margin; 2 spines submesiad; setiferous organ distally; numerous long simple setae on inner margin. Carpus equal in length to propodus, about  $3\times$  longer than broad, with 3 spines, 3 setae on outer margin; small spine proximally supramediad, 2 distal, 1 proximal submesiad spines; numerous long simple setae on inner margin. Merus robust, about  $\frac{1}{3}\times$

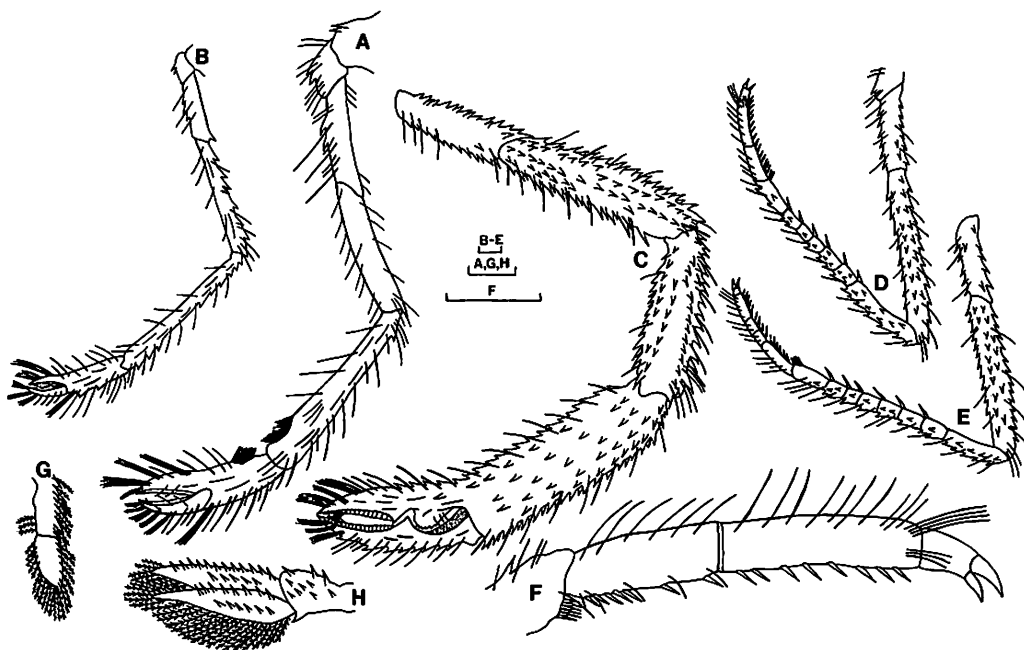


Fig. 4. *Stenopus devaneyi*, holotype, ♂: A, 1st pereiopod; B, 2nd pereiopod; C, 3rd pereiopod; D, 4th pereiopod; E, 5th pereiopod; F, dactylus and propodus of 4th pereiopod; G, 1st pleopod; H, 2nd pleopod. Scale bars represent 1.0 mm.

longer than carpus, with 7 large spines, 7 long setae on outer margin; 2 proximal supra-mesiad, 1 more distal mesiad spine; 2 acute large spines at distal extremity, long setae densely covering inner margin. Ischium robust, about  $\frac{1}{5} \times$  longer than merus, with 7 spines of various sizes on outer margin; small acute ventral spine at distal extremity; dense fringe of long setae on inner margin; row of shorter setae mesiad of inner marginal fringe on both dorsal and ventral sides. Basis short, rounded, with long setae on inner margin, laterally bearing well-developed exopodite  $\frac{1}{3} \times$  longer than ischium, with 26 plumose setae on distal  $\frac{1}{2}$ . Coxa short, with 4 short setae on inner margin, laterally bearing short, bluntly rounded epipod.

First pereiopod (Fig. 4A) small, slender, when stretched reaching just past scaphocerite, all segments generally glabrous. Palm of chela somewhat compressed, rounded dorsal and ventral sides about  $3\frac{1}{3} \times$  longer than deep. Dactylus less than  $\frac{1}{2}$  length of propodus. Fingers slightly compressed, having somewhat hooked tips. Cutting edges indistinct, both dactylus and propodus bearing chitinous ridges along inner margins. Dactylus covered with numerous, widely scattered, long simple setae; propodus covered with numerous short and long simple setae. Fingers and distodorsal extremity of palm bearing small tufts of long setae. Distoventral part of carpus and proximoventral part of propodus with setiferous organ. Carpus longest segment about  $\frac{1}{2} \times$  longer than propodus, narrowing slightly proximally, bearing widely scattered long and short simple setae, with small proximal spine on outer margin. Merus almost equal to carpal length, with acute spine at distal extremity of outer margin, few short simple setae. Ischium almost as long as merus, with 2 small proximal spines on inner margin, few long and short simple setae. Basis short, with 2 small spines and few simple setae on inner margin. Coxa stout, with 2 spines on inner margin, laterally small epipod.

Second pereiopod (Fig. 4B) built similarly to 1st, but longer, stronger. No setiferous organ present. Finger tips not as strongly hooked as those of 1st, cutting edges each with small rounded proximal tooth, larger dactylar tooth slightly in advance of one on propodus; edges bearing chitinous ridges. Fingers and distodorsal extremity of palm bearing small tufts of long setae; numerous scattered simple setae on propodus and dactylus; outer dactylar margin with 4 simple setae. Propodus with 1 or 2 minute spines on proximodorsal margin, surface covered with numerous short and long simple setae. Carpus about  $\frac{1}{2} \times$  longer than propodus, slightly longer than merus, bearing 6 proximal, 2 or 3 distal small dorsal spines, with only few scattered long simple setae on outer side, absent on inner side. Merus almost  $2 \times$  longer than ischium but shorter than carpus, with 8 small spines along dorsal margin, most distal at carpal-meral junction; small spine proximoventrally; few long setae on surface. Ischium with several long and short scattered setae, 3 recurved spines along ventral margin, 1 acute distodorsal spine. Basis short, with 2 small ventral spines. Coxa stout, with 3 distal spines; bearing small epipod.

Third pereiopod (Fig. 4C) strongest, robust, moderately calcified, slightly longer than entire length of body, extending beyond scaphocerite by length of carpus and chela. Palm of chela longest segment with 2 to 4 irregular rows of 16–18 forwardly directed robust spines, numerous blunt-tipped spines on both inner and outer surface in irregular rows, ventral surface with somewhat alternating row of 14 robust but blunt spines; few simple setae only adjacent to some spines. Ventral margin slightly concave at distal  $\frac{1}{3}$ , with row of 20 spines. Fingers elongate,  $\frac{2}{3} \times$  length of palm, with sharp hooked crossing tips. Dactylus with 8 dorsal acute spines; numerous long simple setae. Dactylar cutting edge bearing proximal large sharp tooth, distal row of stout, slightly posteriorly directed peglike teeth separated by rectangular chitinous lamellae. Cutting edge of propodus with proximal large rounded projection dorsally, with 6 denticles, followed by acute tooth merging into row of peglike teeth even with and separated by chitinous lamellae. Fingers distally bearing small tufts of long setae. Carpus about  $\frac{2}{3} \times$  length of propodus, narrowing proximally. Dorsal margin with 14 spines increasing in size distally, 2 rows of 4 and 9 spines dorsomesially, row of 3 medial spines; ventral margin with 11 spines, less distinct row of 4–5 small spines on outer border, 2 rows of 7 and 7 spines ventromesially. Between dorsal, ventral marginal spines, numerous long simple setae. Merus about  $\frac{1}{8} \times$  length of propodus, with 13 dorsal spines, 2 rows of 7 and 7 spines dorsomesially, indistinct row of 5 small inner border spines, 2 rows of 9 and 15 spines dorsomedially. Ventral margin with 11 large spines, 2 irregular rows of spines ventromesially. Numerous long setae interspaced between dorsal, ventral marginal spines. Ischium short, about  $\frac{1}{4} \times$  length of propodus, with 12 short dorsal spines, 5 spines dorsomesially; 12 short ventral spines, distal spine ventromesially, few long simple setae. Basis and coxa short, with coxa bearing 2 small spines on ventral margin, small epipod.

Fourth and 5th pereiopods (Fig. 4D,E,F) long, stout, very similar. Dactylus of 4th biunguiculate with unguis and accessory spine nearly of equal length, latter slightly shorter, both clearly separated from dactylar corpus. Propodus subdivided into 2 segments bearing 15 movable ventral spines, 12 dorsal long setae, various short setae dorsally and ventrally. Carpus straight, longest segment of pereiopod  $2\frac{7}{10} \times$  length of propodus, subdivided into 7 segments, proximal segment  $3 \times$ , distal segment  $2 \times$  longer than each of 5 middle segments; dorsal margin with 15 small acute recurved spines, 12 long setae, 2 rows of 12 and 4 small dorsomedial spines; each segment with acute distoventral movable spine, distoventral edge of most distal segment with group of 6 acute movable spines (Fig. 4F). Merus long,  $\frac{2}{3} \times$  length of carpus, stocky, with 10 small spines, 9 long setae dorsally, 2 rows of 8 and 9 dorsomesial spines, 8 small spines, 3 long setae ventrally. Ischium  $\frac{7}{10} \times$  length of merus, with 6 small spines, 2 long setae dorsally, 2 distal dorsomesial spines on each side, 6 small



spines, 4 long setae ventrally, 2 proximal ventromesial spines. Basis with small ventral spine, 4 long setae; coxa ventrally with 2 small spines. Fifth pereopod with dactylus similar to 4th. Propodus subdivided into 4 segments bearing 15 movable ventral spines, 14 long and short dorsal setae. Carpus  $2\frac{1}{2} \times$  length of propodus, subdivided into 8 segments, proximal segment slightly shorter than that of 4th pereopod and lacking distoventral movable spine; dorsal margin with 13 small, recurved spines, 16 long setae, irregular row of 13–15 dorsomesial spines, proximal 4 segments each with small ventromesial spine, each segment with acute distoventral movable spine, distoventral extremity of last segment with 5 acute movable spines. Merus  $\frac{7}{10} \times$  length of carpus, with 10 spines dorsally, irregular row of 13 and 7 spinules on each side dorsomesially, 9 slightly recurved spines ventrally, and irregular row of 7 spinules on one side, 3 on other side of ventral series. Ischium with 4 small dorsal spines, posterior 3 recurved, proximal and distal dorsomesial spines, proximal ventromesial spine, 5 small recurved spines, 3 long setae ventrally. Basis unarmed; coxa bearing 3 ventral spines.

First pleopod (Fig. 4G) uniramous, 2nd (Fig. 4H) to 5th biramous, all lacking appendices. First pleopod smallest, with exopodite equal in length to basipodite. External margin of basipodite with 4 spines, 2 proximal broader and larger than distal ones, with long plumose setae; dorsal margin with 3 distal long plumose setae. Exopodite lanceolate, with plumose marginal setae except in proximal region. Rami of 2nd pleopod more than  $2 \times$  length of basipodite. External margin of basipodite bearing 3 spines, 6 spinules on ventral surface, large acute spine on distal edge of internal margin. Ventral surface of exopodite bearing 2 rows of 5 and 12 elongate acute spines, numerous plumose marginal setae; that of endopodite with 2 rows of 7 and 8 elongate acute spines, numerous plumose marginal setae. Third to 5th pleopods generally similar, decreasing in size and spinulation posteriorly.

**Branchial formula** as follows:

	Maxillipeds			Pereiopods				
	I	II	III	I	II	III	IV	V
Pleurobranchs	–	–	1	1	1	1	1	1
Arthrobranchs	1	1	2	2	2	2	2	–
Podobranchs	–	1	–	–	–	–	–	–
Epipods	1	1	1	1	1	1	1	–
Exopods	1	1	1	–	–	–	–	–

**Measurements** (in mm). Postorbital carapace length, 8.6 (3.0, 9.4). Rostral carapace length, 13.9 (5.5, 14.2). Total length, ca. 32.9 (22.2, 34.8). Length of 3rd pereopod, 35.2 (25.1, 36.6). Numbers in parentheses represent measurements of paratypes.

**Coloration.** Carapace yellow-brown, eyestalks, antennular peduncle, antennal scale, rostrum, and 3rd maxillipeds faintly pale orangish to whitish. Antennal flagella, 1st, 2nd, 4th, and 5th pereopods all completely opaque white. Third pereopods banded as follows: basis, coxa, ischium opaque white; proximal  $\frac{2}{3}$  of merus opaque white, distal  $\frac{1}{3}$  with red-orange band distally becoming white; proximal  $\frac{1}{2}$  of carpus whitish, distal  $\frac{1}{2}$  red-orange; propodus with proximal and distal red-orange bands with white between; proximal band of propodus ending at white finger; dactylus white. Abdominal somites from 1st to middle of 5th whitish, with bilobed or trilobed bright red spots dorsolaterally on 2nd and proximal  $\frac{1}{2}$  of 3rd, distal  $\frac{1}{2}$  of 5th and all of 6th abdominal somites pale orangish. Telson, uropods also pale orangish. (See color plate IA,C,E.)

**Paratypes.** Male paratype collected in same area as holotype but from greater depth (22.9 m) shows considerable variation from holotype; generally, reduction in spination

probably attributable to smaller size. Rostrum long, extending well beyond end of last antennular peduncle segment and to end of scaphocerite, with 10 dorsal, 3 ventral widely spaced spines occurring on anterior  $\frac{1}{2}$  and row of 5–6 lateral spines on posterior  $\frac{1}{2}$ . Carapace less densely covered with spinules, with distinct cervical groove bearing 10 spinules; dorsal postrostral area with row of 5 pairs of forwardly curved spines, single spine posteriorly. Abdomen also less densely covered with spinules, shield-shaped area on dorsal side of 3rd abdominal somite bearing only 2 lobes on each side. Spination of telson similar except only 2 pairs of spines at base, only 7 carinal spines, only 2 intercarinal spinules anteriorly, none external to carina. Outer margin of uropodal exopodite and endopodite, respectively, bearing 12 and 3 spines, otherwise dorsal and ventral surfaces with fewer spines than holotype. Scaphocerite with only 1 large proximal, 1 smaller spine on outer margin distally; proximal portion with 9 nonoverlapping teeth followed by moderately long nonserrate portion to final distal tooth; dorsal surface with 2 rows of very short spines near center, 1 spine subdorsally; ventral surface also less spinous than that of holotype, with 1 row of spines centrally. Mouthparts show no major differences, except 3rd maxilliped bearing following spinulation: dactylus, propodus without spinules; merus with 3 dorsal spinules; carpus with 4 spinules subdorsally on external lateral surface; ischium with 3 dorsal, 1 ventral spinule. Spinule patterns for 1st to 3rd pereopods as follows. 1st: dactylus, propodus, carpus without spinules; distodorsal extremity of merus formed into acute spinule; ischium with 1 distodorsal spinule. 2nd: dactylus, propodus without spinules; 6 dorsal spinules on carpus; 5 dorsal spinules on merus; ischium with distodorsal spinule. 3rd (heavily calcified): dactylus without spines; propodus with dorsal row of 5 spines on proximal  $\frac{1}{2}$ , 1–3 smaller subdorsal spines on inner and outer sides proximally; carpus with 3 dorsal rows (2 dorsomedial) of 11–12 spines, mesial row of 7–8 spines, ventral and ventromesial rows of 4 spines; merus with 11 ventral spines, mesial row of 7–10 spines, dorsal and dorsomesial row of 7–10 spines; ischium with 6 dorsal, 6 ventral spines. Fourth pereopod with dactylar unguis and accessory spine unequal; propodus indistinctly subdivided into 4 segments with 14 movable ventral spinules; carpus indistinctly subdivided into 8 segments with 12 dorsal spinules (5,1,1,2,1,1,1,0 arrangement on proximal to distal subsegments), 6 movable ventral spinules, 2 acute movable spinules at distoventral extremity; merus with 7 short ventral, 8 dorsal spines plus 1 and 2 subdorsal spines on each side proximally; ischium with 7 ventral, 1 proximodorsal, 3 distodorsal spinules. Fifth pereopod with dactylar unguis and accessory spine subequal; propodus undivided, bearing 16 movable ventral spinules; carpus indistinctly subdivided into 9 segments with 12 dorsal spinules (3,0,2,1,2,1,1,1,1 arrangement on proximal to distal subsegments), 8 movable ventral spinules, cluster of 4 acute movable spinules at distodorsal extremity; merus with 9 dorsal spinules, 4 mediolateral spinules externally, 8 mediolateral spinules on internal side, 7 ventral spines; ischium bearing 5 ventral, 1 proximodorsal, 3 distodorsal spinules.

Paratype taken from Sri Lanka slightly larger than holotype but similar in body spination. Main differences as follows: rostrum with 10 dorsal, 4 ventral, row of 5 lateral spines on each side; telson median carinae with 7 spines; and outer margin of uropod with only 5 and 8 spines on left and right exopodites, respectively.

**Material examined.** FRENCH POLYNESIA: MARQUESAS IS: NUKA HIVA I: outer portion of Taiohae Baie, W side of islet, Sentinelle de l'Est, depth 6.2 m, 11.V.1971, Quinaldine poison (J.E. Randall) (BPBM S8045, ♂ holotype); W side of Sentinelle de l'Est, depth 22.9 m, 17.V.1971, Quinaldine poison (Randall & D. Cannoy) (BPBM S8496, ♂ paratype). SRI LANKA: donated by Hofmann (SMF 12200, ♂ paratype).

**Type-locality.** French Polynesia: Marquesas Is: Nuka Hiva I, outer portion of Taiohae Baie.

**Habitat.** The species is very retiring, having been observed only in recesses of the coral reef. It was found in close association with the moray eel *Gymnothorax breedeni* (see color plate IF) first observed at Vaitahu Baie, Tahuata (personal observation of Dennis M. Devaney, Nov. 1967). Other species of cleaner shrimp, including *Lyasmata amboinensis*, were often present with the new *Stenopus*.

**Etymology.** The specific name is in honor of Dr. Dennis M. Devaney, who contributed greatly to this paper and whose tragic death in 1983 is a major loss to the scientific community. His contributions to various taxocenes of the Pacific marine environment have been innumerable and invaluable.

***Stenopus earlei*** Goy & Randall, 1984: 117.

Fig. 5-8

**Diagnosis.** Small stenopodid shrimp, with slender, compressed body; moderately covered with spinous processes; abdominal somites with numerous squamous spinules, those of last 3 somites arranged in distinct transverse rows; 3rd somite with suboval bare medial posterior area encircled by small squamous spinules; ventral surface of 6th somite sparsely covered with spinules; background color of body white with lateral red stripes extending from posterior carapace along sides of abdomen converging at telson; 3rd pereopods reddish except tips of fingers.

**Description.** Holotype (♂, BPBM S10007). Rostrum (Fig. 5, 6A) long, extending to middle of last antennular peduncle segment. Dorsal margin with 6 spines, distal one little more than its length from tip, this space occupied by 4 stout hairs. Ventral margin slightly concave proximally, with 5 spines distally. Lateral margins without spines, carinae well developed.

Carapace (Fig. 5, 6A) densely covered with spinules placed in somewhat distinct longitudinal rows. Cervical groove distinct with 12 spines along upper margin. Orbit with both supraorbital and infraorbital spines. Large antennal spine present, moderate hepatic spine at lower end of cervical groove, large branchiostegal and pterygostomial spines also present. Ventrolateral angle somewhat rounded, only slightly produced anteriorly while posterolateral angle of branchiostegite slightly concave.

First 3 abdominal somites (Fig. 5, 6B) with forwardly directed spinules similar to those on carapace. First somite with 2 transverse rows of squamous spinules, anterior margin with small conical spine on distal  $\frac{1}{3}$ , pleuron ending in 3 stout spines. Second somite with 3 transverse rows of squamous spinules. Pleura of 2nd, 3rd, 4th, and 5th somites truncate, ventrolateral margins ending in 5, 4, 3, 3 strong spines, respectively. Third somite broadly produced, with posterior medial bare suboval area surrounded by 22 small squamous spinules. Last 3 somites with distodorsal squamous spinules with upturned tips arranged in distinct transverse rows. Anterior margins of 4th and 5th somites with articular knobs. Abdominal somites 1-5 bearing strong ventral median spine, those of 1-3 directed anteriorly, those of 4-5 directed posteriorly. Ventral surface of 6th somite smooth.

Eyes well developed, with peduncle slightly longer than cornea. Ophthalmic peduncle dorsally with 3-4 spinules, 2 mediodorsal and 1 proximodorsal spinules, some extending over cornea.

Telson (Fig. 6C) lanceolate, ca.  $2\times$  longer than 6th abdominal somite,  $2\frac{2}{5}\times$  longer than anterior (maximum) width, median groove flanked by 2 distinct longitudinal carinae. Outer margins of carinae with 6 strong, posteriorly directed spines, last spine overlapping rounded posterior margin of telson; inner margins with row of 3 weaker spines in anterior  $\frac{1}{2}$ , 1 sometimes 2, long setae at base of carinal spines. Base of telson with pair of lateral spines. Lateral margins with strong spine about anterior  $\frac{1}{3}$ ; also with plumose setae along posterior  $\frac{2}{3}$ .

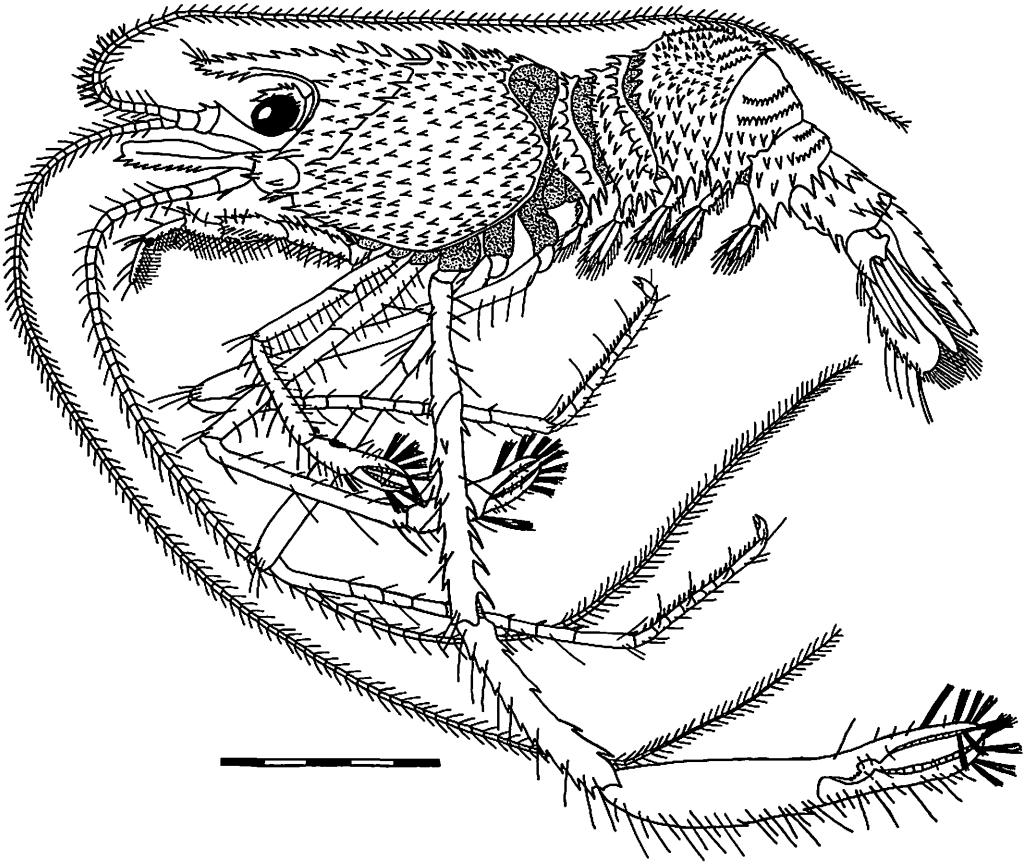
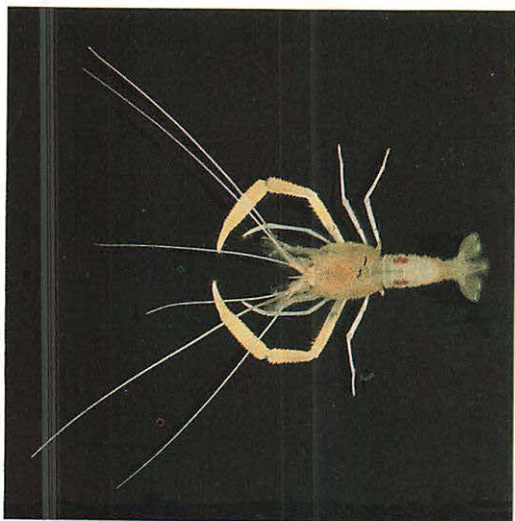


Fig. 5. *Stenopus earlei*, holotype, ♂. Increments of scale in mm.

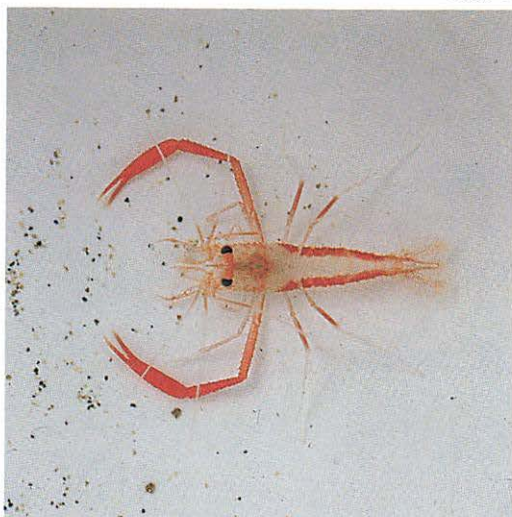
Uropods (Fig. 6D) well developed with endopodite equal to telson length and narrower but slightly longer than exopodite. Basal segment with medial central spinous process. Exopodite bearing 6 equally spaced teeth on distal  $\frac{2}{3}$  of outer margin, 7 long plumose setae; dorsal surface bearing 2 longitudinal carinae, 1 extending slightly past midlength; ventral surface unarmed. Outer proximal margin of endopodite bearing 2 teeth, 5 long plumose setae. Dorsal surface bearing distinct median ridge; ventral surface unarmed. Unarmed margins of exopodites, endopodites with long plumose setae.

Epistome (Fig. 6E) triangular anteriorly, with 2 submedian spines, 2 smaller spines present laterally; labrum normally developed. Paragnath (Fig. 6F) moderately bilobed, lobes separated by median fissure. Thoracic sternites narrow, 2 submedian spinules on segments 4-6, 6 submedian spinules on segments 7-8.

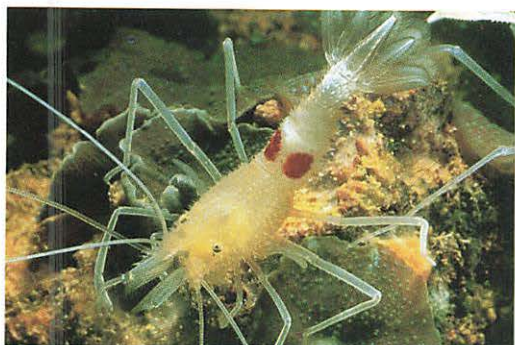
Antennular peduncle (Fig. 7A,B) short, extending to middle of scaphocerite. Basal segment almost  $2\times$  as long as wide, short rectangular process bearing small median knob on inner proximodorsal margin; small, elongate stylocerite on outer margin; dorsomedially 2 small spines, 5 plumose setae; distodorsally with appressed rounded process bearing small conical marginal spines. Middle segment with 2 strong spines at distodorsal angle; 2 spines anteriorly mesiad; 3 small spines dorsomedially. Distal segment with strong spine at distodorsal angle. Upper flagellum well developed, proximal part bearing 14 groups of aesthetae beginning on 6th article ending on 14th. Lower flagellum not as strongly developed



A. Holotype of *Stenopus devaneyi*, Nuku Hiva, Marquesas Islands. Photo by John E. Randall.



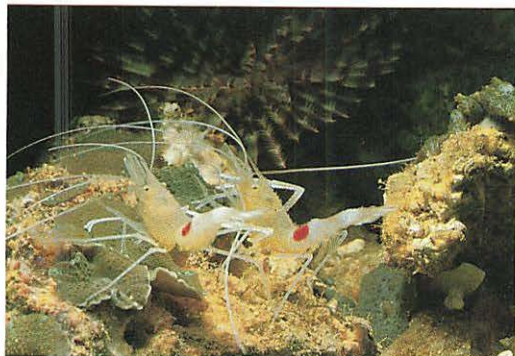
B. Holotype of *Stenopus earlei*, O'ahu, Hawaiian Islands. Photo by John L. Earle.



C. *Stenopus devaneyi*, Sri Lanka. Aquarium photo by Helmut Debelius.



D. *Stenopus earlei*, O'ahu, Hawaiian Islands. Underwater photo at night by Scott Johnson.



E. A pair of *Stenopus devaneyi*, Sri Lanka. Aquarium photo by Helmut Debelius.



F. *Stenopus devaneyi* and the moray *Gymnothorax breedeni*, Tahuata, Marquesas Islands. Underwater photo by John E. Randall.

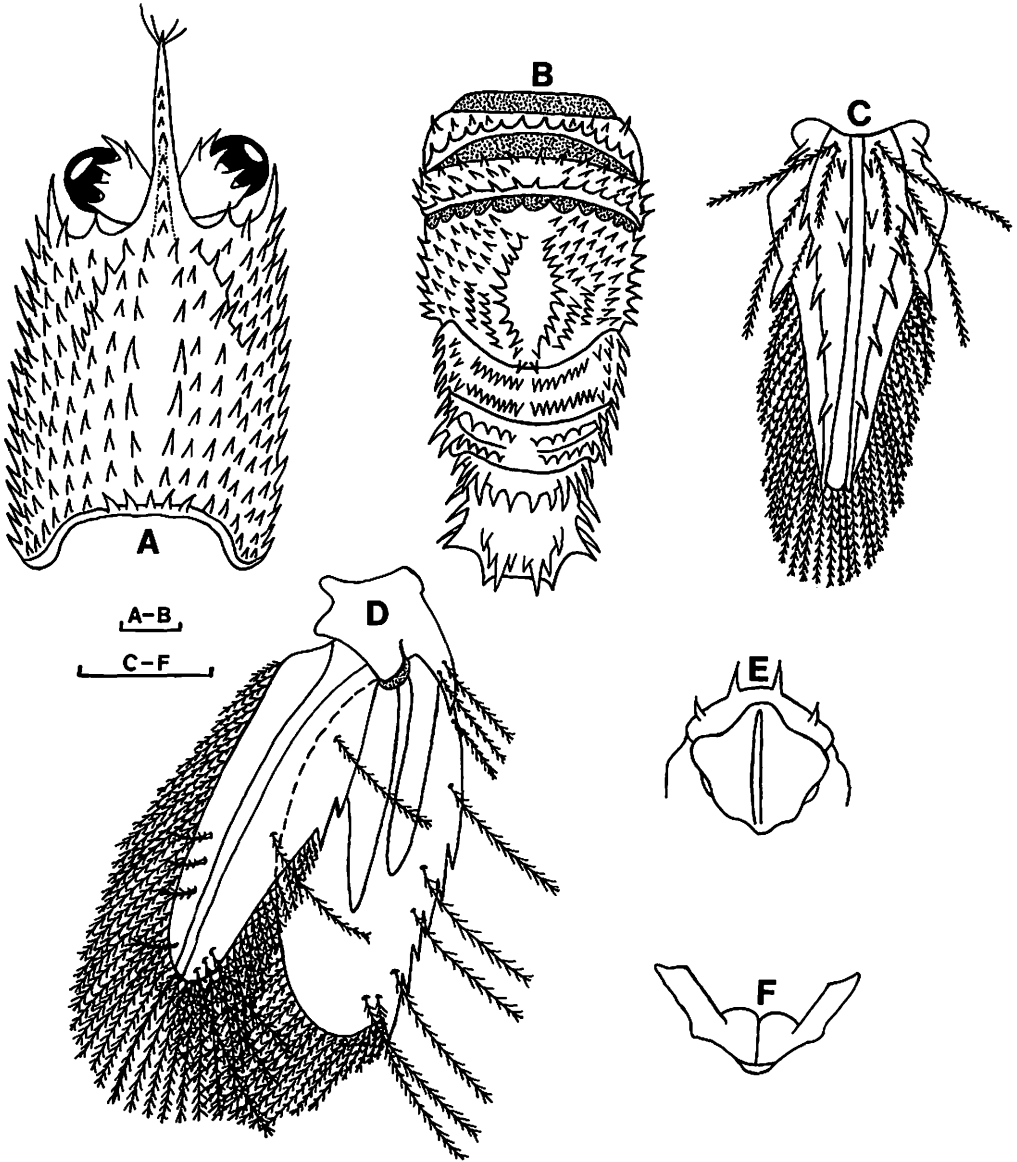


Fig. 6. *Stenopus earlei*, holotype, ♂: A, carapace, dorsal view; B, abdominal somites, dorsal view; C, telson; D, uropods; E, epistome and labrum, ventral view; F, paragnath. Scale bars represent 1.0 mm.

as upper. Articles of both flagella with delicate short setae placed on all sides along entire length.

Antenna (Fig. 7C) with strong basal segment bearing 2 strong ventral, 1 ventrolateral spines. Scaphocerite well developed, reaching about  $\frac{1}{2} \times$  beyond tip of rostrum. Outer margin moderately concave proximally with 2 small spines; distal part bearing 9 stronger teeth equally spaced to tip. Dorsal surface with 2 distinct longitudinal carinae, without spinulation. Inner margin with long plumose setae. Ventral surface without spinules but with widely spaced long setae. Antennal flagellum well developed, extending beyond tip

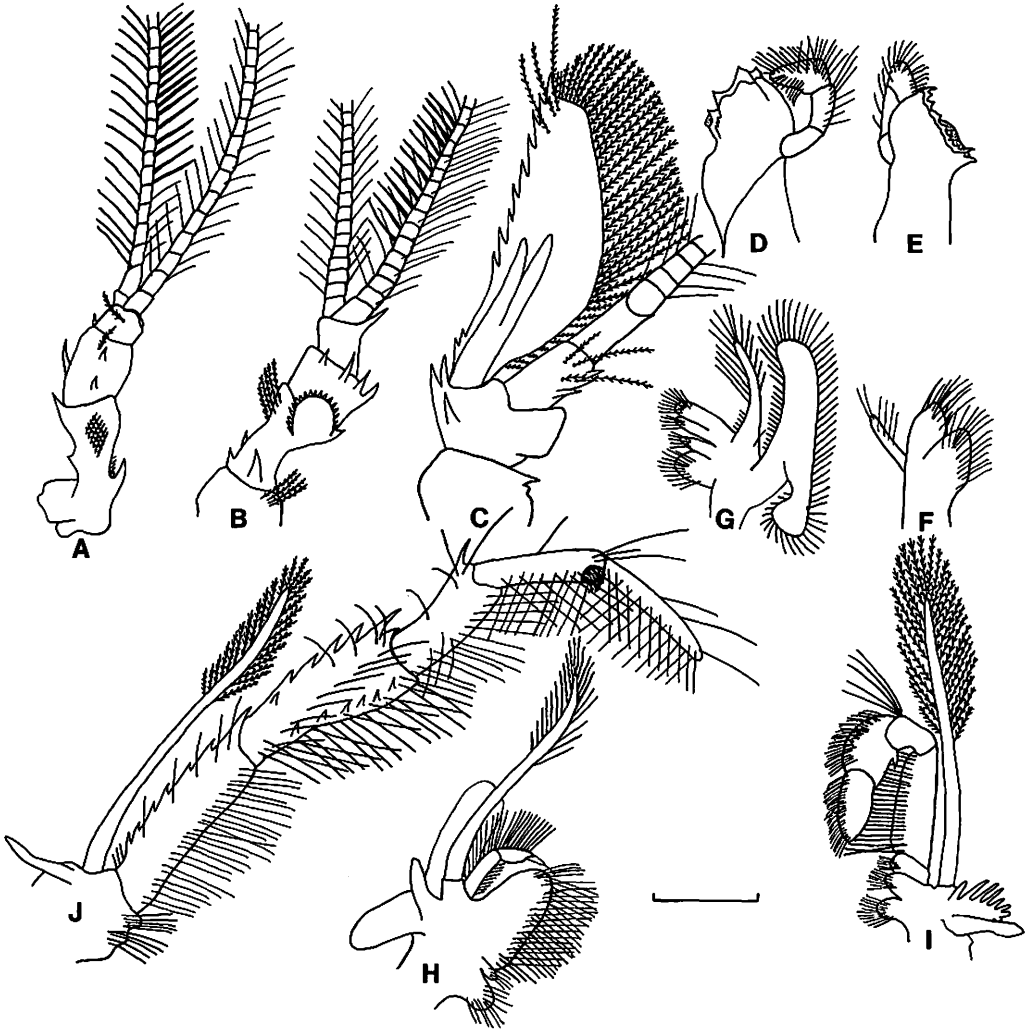


Fig. 7. *Stenopus earlei*, holotype, ♂: A, left antennule and antennular peduncle, dorsal view; B, right antennule and antennular peduncle, ventral view; C, antenna and scaphocerite, dorsal view; D, right mandible, ventral view; E, left mandible, dorsal view; F, maxillule; G, maxilla; H, 1st maxilliped; I, 2nd maxilliped; J, 3rd maxilliped. Scale bar represents 1.0 mm. Setules on some plumose setae not shown for clarity.

of telson; basal segment with 3 dorsal spines, 1 larger spine distoventrally; all flagellar articles with delicate setae around entire length of flagellum.

Mandibles (Fig. 7D,E) robust with short, fused molar and incisor processes. Molar surface nearly smooth, incisor bearing 10 minute medial teeth. Palp well developed, 3-segmented; proximal segment lacking setae; middle segment more than  $2\times$  as broad as proximal segment, setose on outer surface; distal segment broad, flattened, setose along edges and outer surface.

Maxillule (Fig. 7F) with slender, undivided endopodite bearing 4 plumose setae laterally, 2 distally. Proximal endite moderately broad, slightly broader distally than proximally with 1 slender seta laterally, about 15 robust simple setae in more than 1 row distally, fringing

slender setae on inner edge. Distal endite slightly broader, tapering distally, simple setae dense.

Maxilla (Fig. 7G) with following setation on coxal and basal endites: 11 on proximal lobe, 5 on distal lobe of coxal endite; 5 on proximal lobe, 9 on distal lobe of basal endite. Endopodite long, slender, exceeding anterior margin of scaphognathite, with 5 small simple setae on basal portion of inner margin, 15 long plumose setae around distal  $\frac{1}{2}$ . Scaphognathite long, narrow, little more than  $4\times$  longer than breadth at center with plumose setae along margin.

First maxilliped (Fig. 7H) with 3-segmented endopodite. Proximal segment longer than broad, with 10 long plumose setae laterally along outer margin, 9 shorter setae on inner margin. Middle segment about  $\frac{1}{2}$  length of proximal segment, with 11 long plumose setae along outer margin. Distal segment slender, tapering, slightly less than  $\frac{1}{2}$  length of middle segment, with minute simple terminal seta. Basipodite large, auriculiform, with straight outer border bearing dense fringe of long simple setae. Coxopodite bilobed, each lobe bearing numerous short setae. Exopodite well developed, flagellum with 22 long plumose distolateral setae. Large epipod with proximal lobe distinctly longer, larger than distal lobe.

Second maxilliped (Fig. 7I) with 5-jointed endopodite. Dactylus suboval,  $1\frac{2}{3}\times$  longer than greatest breadth, dense fringe of short setae along distodorsal margin. Propodus equal to length of dactylus but broader, densely setose on dorsal margin, ventral margin bearing stout proximal tooth. Carpus short, almost as long as propodus, with 5 long simple setae at distodorsal angle, several shorter setae on upper surface. Merus about  $2\times$  length of dactylus,  $2\frac{1}{2}\times$  longer than broad; outer border compressed, slightly convex, with many long simple setae. Ischium and basis not fused, each with dense fringe of mesial setae as for coxa, ventral aspect of ischio-basis bearing small setose knob. Exopodite long, slender, undivided in distal  $\frac{1}{2}$ , bearing 28 long plumose setae. Small, elongate epipod present; arthrobranch and podobranch also present.

Third maxilliped (Fig. 7J) endopodite strongly developed, 5-segmented, with coxa and basis fused. Dactylus slender, tapering, about  $6\frac{1}{2}\times$  longer than basal width, with 3 simple setae on outer margin, 10–11 simple setae in mesial row and 11 along inner margin. Propodus same length as dactylus but about  $5\times$  longer than broad, with 4 simple setae on outer margin; setiferous organ reduced to 10 stout short setae distally, row of 8 long simple setae mesially and row of 6 on inner margin. Carpus slightly shorter than propodus, about  $4\times$  longer than broad, with large distodorsal spine, 4 setae on outer margin; numerous long setae mesially on inner margin. Merus long, slightly robust distally, about  $1\frac{1}{3}\times$  longer than carpus, with 6 dorsal spines increasing in size distally, 4 simple setae on outer margin; row of 6 low, curved, small spines subdorsally along proximal  $\frac{3}{4}$  of segment, above numerous long simple setae medially and mesially on inner margin. Ischium long, slender, about  $\frac{1}{3}\times$  longer than merus, with 7 spines, 8 setae on outer margin; dense fringe of long setae on inner margin and row of simple setae on central part of medial side together with some scattered setae.

First pereopod (Fig. 8A) small, when stretched almost reaching past scaphocerite, all segments glabrous. Dactylus equal to  $\frac{1}{2}$  length of propodus. Fingers slightly compressed, having somewhat hooked tips. Cutting edges distinct, both propodus and dactylus bearing small, stout, peglike teeth separated by rectangular chitinous lamellae. Dactylus with few scattered simple setae, tufts of longer setae around distal part; propodus with few scattered short simple setae, pair of long setae (branched towards their tips) on distodorsal extremity, tufts of long setae around distoventral area. Distoventral part of carpus and proximoventral part of propodus with setiferous organ. Carpus longest segment about  $2\times$  longer than palm, narrowing slightly proximally, bearing scattered long and short simple setae. Merus



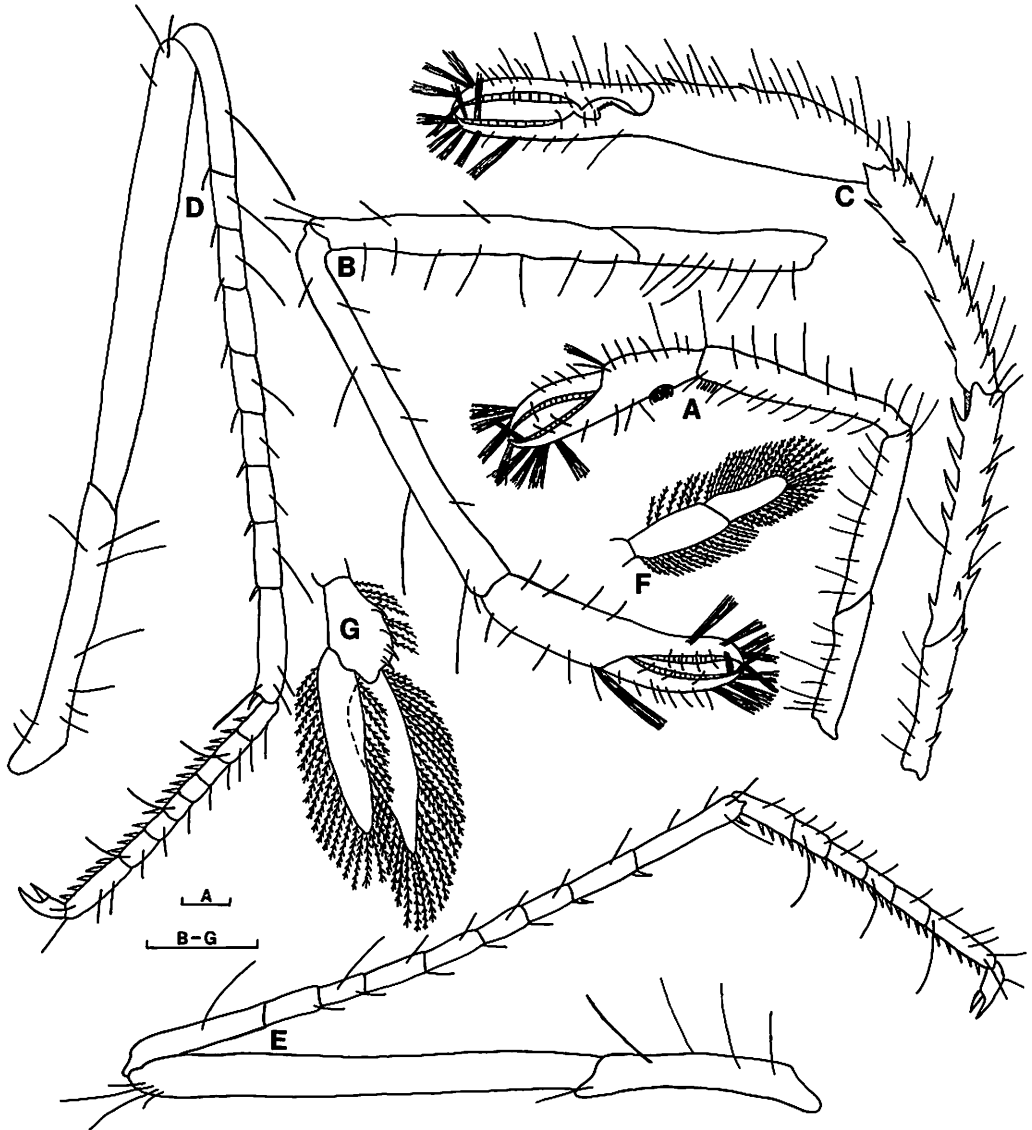


Fig. 8. *Stenopus earlei*, holotype, ♂: A, 1st pereopod; B, 2nd pereopod; C, 3rd pereopod; D, 4th pereopod; E, 5th pereopod; F, 1st pleopod; G, 2nd pleopod. Scale bars represent 1.0 mm.

almost equal to carpal length, with numerous long and short simple setae, especially on ventral margin. Ischium about  $\frac{1}{3}$  shorter than merus, with few long simple setae on ventral margin. Basis short, with few simple setae on inner margin. Coxa short, with few simple setae on inner margin, laterally small epipod.

Second pereopod (Fig. 8B) built similarly to 1st but longer, stronger, all segments glabrous. No setiferous organ present. Finger tips more strongly hooked than those of 1st, cutting edges with small, stout, peglike teeth separated by rectangular chitinous lamellae. Fingers and distodorsal extremity of palm bearing small tufts of long setae; outer dactylar margin with 8 simple setae. Widely scattered short to medium simple setae over surface of palm, pair of long fused setae at distodorsal extremity. Carpus longest segment just over

3× longer than palm, with several long and short simple setae on margins. Merus about 2× longer than ischium, with few long and short simple setae, especially on ventral margin. Basis and coxa unarmed, coxa with small epipod.

Third pereopod (Fig. 8C) largest, strongest, longer than entire length of body, extending beyond scaphocerite by length of carpus and chela. Palm of chela equal in length to carpus, with 2 small spines centrally on outer dorsal surface together with long simple setae along dorsal margin of entire propodus. Fingers elongate, with sharp hooked crossing tips. Dactylus with numerous long and short dorsal simple setae; cutting edge bearing proximal large sharp tooth, distal row of 10 stout peglike teeth separated by rectangular chitinous lamellae. Cutting edge of propodus with proximal large rounded projection dorsally, with 4 denticles followed by acute tooth merging into row of 10 stout peglike teeth separated by chitinous lamellae. Fingers distally bearing small tufts of long setae. Carpus about ½ length of propodus. Dorsal margin with 10 forwardly directed spines increasing in size proximally, 9 long simple setae; ventral margin with 4–6 smaller spines; dorsomesial edge produced into blunt spinelike process. Merus equal to length of carpus; 5 small spines, 5 long simple setae on dorsal margin; distomesial edge produced into large rounded knob; ventral margin with 5–6 spines increasing in size distally. Ischium about ½× shorter than merus, with 2 or 3 curved dorsal marginal spines along proximal ½ of segment, most proximal spine largest, 0–1 smaller spine and scattered simple setae on ventral margin. Basis and coxa short, coxa bearing few simple setae, small epipod.

Fourth and 5th pereopods (Fig. 8D,E) long, slender, very similar. Dactylus of 4th biunguiculate with unguis long, curved, not clearly separated from dactylar corpus; accessory spine about ⅓ length of unguis. Propodus subdivided into 8 segments bearing 20 movable spines, 3 long setae ventrally; numerous shorter dorsal setae, except only 1 long seta at distodorsal extremity. Carpus slender, straight, longest segment of pereopod slightly more than 2× meral length, subdivided into 9 smaller segments with 4 small spines on distoventral margin of distal 4 segments, other 5 segments bearing short simple seta distoventrally; dorsal margin with 9 long simple setae. Merus slender, elongate, about ½× length of carpus, unarmed except for 3 long simple setae distodorsally. Ischium, basis, coxa unarmed except for few long setae. Fifth pereopod with dactylus similar to 4th, slightly more slender. Propodus subdivided into 6 segments bearing 23 movable spines; 3 long setae ventrally; 13 shorter dorsal setae and several on inner margin. Carpus slightly more than 2× propodal length, subdivided into 9 segments, all other segments except proximal bearing short simple seta distoventrally; dorsal margin with 9 long simple setae. Merus slender, ⅓× length of carpus, unarmed except for 4 long simple setae distoventrally. Ischium, basis, coxa unarmed except for few long setae.

First pleopod (Fig. 8F) uniramous, 2nd (Fig. 8G) to 5th biramous, all lacking appendices. First pleopod smallest, with exopodite slightly shorter than basipodite. Ventral margin of basipodite with long plumose setae; dorsal margin with 6 long plumose setae; exopodite with plumose marginal setae. Ventral margin of 2nd pleopod basipodite bearing 4 spines, 8 plumose setae; dorsal margin unarmed; rami lanceolate, about 2× length of basipodite. Exopodite and endopodite with plumose marginal setae. Third to 5th pleopods generally similar, except 3rd with only 3 spines on ventral margin, decreasing in size, setation posteriorly.

**Branchial formula.** Same as for *S. devaneyi* given above.

**Measurements.** Measurements of the holotype are included in Table 1 and compared with other specimens examined.

**Coloration.** Dorsal and lateral surfaces of carapace with numerous tiny, diffuse, reddish-

Table 1. Meristic data and comparison between carapace, 3rd pereopod, and total length in *Stenopus earlei* (measurements in mm).

Lengths	Specimen					
	BPBM S10012a	BPBM S10012b	BPBM S10007 (holotype)	CAS 030069	CAS 031662	BPBM S8573
Total (T)	15.7	16.5	17.2	19.2	20.2	22.5
Rostral carapace (RC)	6.0	5.8	7.1	8.6	8.2	8.7
Postorbital carapace (PC)	4.2	4.0	4.0	4.8	4.7	5.3
Chela of 3rd pereopod (C)	5.0	5.4	8.1	—	—	10.0
3rd pereopod (P)	14.3	14.0	18.5	—	—	27.0
Ratios P/PC	3.4:1	3.5:1	4.6:1	—	—	5.1:1
P/RC	2.4:1	2.4:1	2.6:1	—	—	3.1:1
P/T	0.9:1	0.8:1	1.1:1	—	—	1.2:1
T/RC	2.6:1	2.8:1	2.4:1	2.2:1	2.5:1	2.6:1

orange chromatophores; many spines in this area red from base to tip; concentrated dark red spot at posteriolateral edge of carapace; anterior to this and medially, clear area with spines unpigmented. Rostrum, eyestalks light red. Edges of antennal and antennular peduncle, scaphocerite, ischium and merus of 3rd maxillipeds outlined in red. Carpus, propodus, dactylus of 3rd maxillipeds reddish. Flagella of antennule, antenna reddish proximally but white for greater part of their length. Lateral red stripe on each side of abdomen converging and narrowing distally, merging at telson, but abdominal pleura and dorsal region mainly white. First and 2nd pereopods with light reddish ischia, meri, and carpi; chelae white. Third pereopods reddish except tips of chelae white. Fourth and 5th pereopods with red meri and reddish ischia; carpi, propodi, and dactyli white. Pleopods with reddish basipodites, rami outlined in light red. Telson reddish, only central area somewhat lighter anteriorly. Uropods with endopodite outlined in red becoming more diffuse centrally; exopodite reddish on outer edge, clear elsewhere. (See color plate IB.) Paratypes similar in coloration of holotype, except carpi, propodi and dactyli of 3rd pereopods whitish. (See color plate ID.)

**Paratypes.** The new species is variable in the number of body and appendage spines. Rostrum with 5–7 dorsal, 1–5 ventral spines. Scaphocerite with 1–2 proximal spines, 7–9 distal spines on outer margin. Ischium of 3rd maxilliped with 2–7 dorsal spines; merus with 4–6 dorsal spines. One specimen with 5 dorsal meral spines, 6 dorsal carpal spines on 2nd pereopod. Spination on 3rd pereopod very variable: ischium bearing 4–5 dorsal spines; merus with 5–10 dorsal, 5–7 ventral spines; carpus with 10–14 dorsal, 1–5 dorsomesial, and 4–8 ventral spines; and propodus bearing 2–13 dorsal spines. Ventral surface of 6th abdominal somite sparsely covered with spinules in some specimens. Outer margin of uropodal endopodite with 2–3 teeth; outer margin of uropodal exopodite with 6–10 teeth. We could not find any correlation between the number of spines and the size or sex of the animals, but some of these differences may reflect allometric growth changes and normal variation in the species.

**Material examined.** HAWAIIAN IS: O'AHU I: off Mākua, depth 36.5 m, 12.IV.1981 (John Earle) (BPBM S10007, ♂ holotype); off Mākua, depth 39.6 m, under flat slab nr reef dropoff, VII.1979 (Earle) (BPBM S8573, ♀ paratype); KAUA'I I: off Lāwa'i, depth 15.2 m, under *Porites* slab, 4.X.1981 (Earle) (BPBM S10012, ♂, ♀ paratypes). INDIAN OCEAN: GRAND COMORO I: Mozambique Channel, N of Hotel Itsandra in front of Coelacanth Grotto, depth 20–30 m, 20.II.1975 (McCosker et al.) (CAS 031662, ♀ paratype; CAS 030069, ♂ paratype).

**Type-locality.** Hawaiian Is: O'ahu I, off Mākuā.

**Habitat.** Most of the specimens were taken under ledges on well-developed coral reef systems in depths greater than 20 m. The new species has long, prominent, white antennal flagella, and even though it was not found in association with any fishes, it may enter into cleaning symbiosis with cooperating fishes, much like its congeners in the genus *Stenopus*.

**Etymology.** This new species is named for Mr. John Earle, who first drew our attention to the animal. He not only provided the holotype and some of the paratypes but also provided color slides of these specimens. This enabled us to give an extensive morphological, as well as color, description of the species.

### Key to the Described Indo-West Pacific Species of *Stenopus*

1. Lateral marginal spines absent on telson; carapace and abdomen white in life; antennal flagella white; abdominal somites with broad middorsal red stripe ..... *S. pyrsonotus* Goy & Devaney, 1980  
Lateral marginal spine present on telson; abdominal somites otherwise pigmented ..... 2
2. Rostrum not exceeding middle segment of antennular peduncle in length; without ventral spines; with 1 or more lateral spines ..... 3  
Rostrum exceeding middle segment of antennular peduncle; with 1 to 5 ventral spines, but no lateral spines ..... 4
3. Third abdominal somite without bare area posterodorsally; carapace white in life; antennal flagella white; abdomen with red transverse bands on 3rd and 6th somites ..... *S. hispidus* (Olivier, 1811)  
Third abdominal somite with bare area posterodorsally; carapace golden yellow in life; antennal flagella red; abdomen with oval red patches on sides of 2nd and 5th somites ..... *S. zanzibaricus* Bruce, 1976
4. Outer margin of scaphocerite serrate up to final (terminal) tooth; carapace reddish white in life; antennal flagella white; lateral red stripes extending from posterior of carapace along sides of abdomen, converging at telson; 3rd pereopods reddish white except finger tips ..... *S. earlei* Goy & Randall, 1984  
Outer margin of scaphocerite with considerable nonserrate space before final (terminal) tooth; rostrum exceeding antennular peduncle, with both ventral and lateral spines; carapace and abdomen otherwise pigmented; 3rd pereopods banded in red, white, and orange ..... 5
5. Distoventral carpal extremity of 4th and 5th pereopods with 2 to 6 acute movable spines; carapace yellow-brown in life; antennal flagella white; abdomen with bilobed red spot on 2nd and 3rd somites ..... *S. devaneyi* Goy & Randall, 1984  
Distoventral carpal extremity of 4th and 5th pereopods without movable spines; carapace purplish blue in life; antennal flagella white; abdomen with red transverse bands on 3rd and 5th somites ..... *S. tenuirostris* DeMan, 1888

### DISCUSSION

Both *Stenopus devaneyi* and *S. earlei* closely follow the definition of the genus *Stenopus* given by Holthuis (1946). *Stenopus devaneyi* is generally more robust than other members of the genus, especially in having stouter appendages. In this regard, it is most closely related to *S. tenuirostris*, but differs in color and in being less spinous on the carapace, abdomen, and appendages. *Stenopus earlei* has squamous spinules on the abdominal somites in contrast to the usually erect spinules in other members of the genus. It is most closely related to *S. scutellatus* from the Western Atlantic, but differs in color and in the spination of the rostrum, scaphocerite, and 3rd maxilliped.

The only stenopodidean shrimp collected from the Marquesas Is is *S. devaneyi*, but *S. tenuirostris* has been photographed at Nuka Hiva I (BPBM photo #188, D.M. Devaney).

Also, both *S. hispidus* (Olivier, 1811) and *S. tenuirostris* have been recorded from other islands of French Polynesia (Holthuis 1946). *Stenopus hispidus* has been the only stenopodid besides *S. devaneyi* reported from Sri Lanka (Müller 1887).

Four species of stenopodidean shrimps have been reported from the Hawaiian Is: *Stenopus hispidus* (Rathbun 1906; McNeil & Ward 1930; Edmondson 1946; Tinker 1965; Hobson & Chave 1972; Titcomb 1979); *Spongiicola henshawi* (Rathbun 1906); *Stenopus pyrsonotus* (Goy & Devaney 1980); and *Spongiocoloides hawaiiensis* (Baba 1983). *Stenopus earlei* becomes the 5th stenopodid species collected in the Hawaiian Is. It is also reported herein from Grand Comoro I in the Indian Ocean. *Stenopus hispidus* collected from Grand Comoro I has been examined by one of us (JWG) (CAS 03-0067, CAS 030070, CAS 030071, and CAS 030073). A large (70.7 mm total length) *Stenopus pyrsonotus* (CAS 030068) also was found from Grand Comoro I. *Stenopus earlei* was photographed near Kilifi, Kenya, under a boulder inside a cave at a depth of 16 m (H. Debelius, IKAN photograph collection).

The Indo-West Pacific region occupies a large geographic area extending longitudinally more than halfway around the world and latitudinally through about 60° (Briggs 1974). In the east, this region's farthest outposts are the Hawaiian Is, the Marquesas Is, and the Tuamotu Archipelago, while in the west, the east coast of Africa provides a natural boundary (Ekman 1953). It is very interesting zoogeographically that 3 recently discovered species in the genus *Stenopus* (*S. pyrsonotus*, *S. devaneyi*, and *S. earlei*) have been found in these outposts. More extensive sampling in the Indo-West Pacific region will probably lead to records of these species and other stenopodidean shrimps from other localities throughout this tropical marine region.

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#### LITERATURE CITED

- Baba, K. 1983. *Spongiocoloides hawaiiensis*, a new species of shrimp (Decapoda: Stenopodidea) from the Hawaiian Islands. *J. Crustacean Biol.* 3(3): 477-81, fig. 1-2.
- Briggs, J.C. 1974. *Marine zoogeography*. McGraw-Hill, New York.
- Bruce, A.J. 1976. Studies on Indo-West Pacific Stenopodidea. 1. *Stenopus zanzibaricus* sp. nov., a new species from East Africa. *Crustaceana (Leiden)* 31(1): 90-102, fig. 1-5.
- Edmondson, C.H. 1946. Reef and shore fauna of Hawaii. *Bernice P. Bishop Mus. Spec. Publ.* 22. 381 p., 223 fig.
- Ekman, S. 1953. *Zoogeography of the sea*. Sidgwick & Jackson, London.
- Goy, J.W. & D.M. Devaney. 1980. *Stenopus pyrsonotus*, a new species of stenopodidean shrimp from the Indo-West Pacific region (Crustacea: Decapoda). *Proc. Biol. Soc. Wash.* 93(3): 781-96, fig. 1-6.
- Goy, J.W. & J.E. Randall. 1984. Diagnosis of three new *Stenopus* species. p. 116-17. In: H. Debelius, *Armoured knights of the sea*. Alfred Kern Verlag, Essen.
- Hobson, E. & E.H. Chave. 1972. *Hawaiian reef animals*. University Press of Hawaii, Honolulu.
- Holthuis, L.K. 1946. The Decapoda Macrura of the Snellius Expedition. I. The Stenopodidae, Nephropsidae, Scyllaridae and Palinuridae (Biological results of the Snellius Expedition XIV). *Temminckia* 7: 1-178, fig. 1-2, pl. 1-11.

- Man, J.E. De.** 1888. Bericht über die von Herrn Dr. J. Brock im indischen Archipel gesammelten Decapoden und Stomatopoden. Arch. Naturgesch. 53(1): 215-600, pl. 7-222a.
- McNeil, F.A. & M. Ward.** 1930. Carcinological notes. No. I. Rec. Aust. Mus. 17(9): 357-83, fig. 1, pl. 59-61.
- Müller, F.** 1887. Zur Crustaceenfauna von Trincomali. Verh. Naturforsch. Ges. Basel 8: 470-85, pl. 4-5.
- Olivier, A.G.** 1811. Palémon. Palaemon. p. 652-67. In: A.G. Olivier, Insectes. Encycl. Méth. Hist. Nat. 8.
- Rankin, W.M.** 1898. The Northrop collection of Crustacea from the Bahamas. Ann. N.Y. Acad. Sci. 11(12): 225-58, pl. 29-30.
- Rathbun, M.J.** 1906. The Brachyura and Macrura of the Hawaiian Islands. Bull. U.S. Fish. Comm. 23(3): 827-930, fig. 1-79, pl. 3-24.
- Tinker, S.W.** 1965. Pacific Crustacea. Charles E. Tuttle, Rutland, Vt.
- Titcomb, M.** 1979. Native use of marine invertebrates in old Hawaii. Pac. Sci. 32(4): 325-86, fig. 1-34.