

## A new genus and species of ghost shrimp from Tobago, West Indies (Crustacea: Decapoda: Callianassidae)

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*Abstract.*—The new genus *Pseudobiffarius* is the seventh genus of Callianassinae recognized from the Americas. This monotypic genus is based on its type species from Tobago, West Indies, *Pseudobiffarius caesari*, new species. It differs from all members of the subfamily in having a very short, stout upper flagellum on the A1 peduncle.

Collections of a very small callianassid were made on Tobago by two individuals at different times, Lois Nickell in 1989 and Richard Heard in 1992 and 1993. The species was initially identified as a member of *Biffarius* Manning & Felder, 1991, but closer examination after Heard's collections of 1993 revealed that it represented not only a new species but also a new genus as well. The new taxa are named here.

The types have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

Carapace length (cl) measured as post-orbital carapace length and total length (t1), measured on the midline in millimeters (mm). Other abbreviations: A1, antennule; A2, antenna; leg., collector; m, meter(s); Max1–2, maxillae 1–2; Mxp1–3, maxillipeds 1–3; P1–5, pereopods 1–5 (P1 and P2 are chelipeds, P3–5 walking legs); Plp1–5, pleopods 1–5.

Family Callianassidae Dana, 1852  
Subfamily Callianassinae Dana, 1852  
*Pseudobiffarius*, new genus

*Type species.*—*Pseudobiffarius caesari*, new species, by present designation and monotypy.

*Etymology.*—The generic name is formed by combining the Latin prefix *pseu-*

*do-*, false, with the generic name *Biffarius*, alluding to the resemblance of the present genus to the latter. The gender is masculine.

*Diagnosis.*—Size relatively small, t1 of adults less than 30 mm. Carapace with acute rostral projection, lacking rostral carina or spine. Cornea dorsal, subterminal, disk-shaped, corneal elements distinct. A1 peduncle longer than A2 peduncle; dorsal flagellum of A1 peduncle short and stout, shorter than peduncle. Mxp3 without exopod, ischium-merus operculiform; inner face of ischium with cristate ridge of strong teeth; merus projecting slightly beyond articulation with carpus; last 3 segments slender. Chelipeds unequal in male, equal in female, with meral hook. Plp1 uniramous in both sexes; Plp2 absent in male, biramous in female; Plp3–5 foliaceous, with stubby, projecting appendices internae in both sexes.

*Remarks.*—Manning & Felder (1991) recognized and named three American genera in this subfamily, *Biffarius*, *Neotrypaea*, and *Notiax*, and in 1992 added a fourth, *Gilvossius*. Rodrigues & Manning (1992) added a fifth, *Poti*. Heard & Manning (1998) added a sixth, *Necallianassa*. *Poti* and the type genus of the family, *Callianassa* Leach, 1814, differ from the remainder of these genera by having slender Mxp3, which are pediform rather than operculiform; *Poti* also differs from all other

genera in the subfamily by having an incomplete linea thalassinica on the carapace. Members of *Neotrypaea* and *Notiax* are known only from the eastern Pacific; members of the other genera are known only from the western Atlantic.

Members of *Pseudobiffarius* can be distinguished at once from the American genera with broad Mxp3 by the short, stout dorsal flagellum of A1. They further differ from both *Neotrypaea* and *Gilvossius* in having the appendix internae of the Plp3–5 embedded in the edge of the pleopod, whereas they are projecting in *Pseudobiffarius*, as in *Biffarius*, *Necallianassa* and *Notiax*. In *Notiax* the second male pleopod is present, whereas it is absent in *Pseudobiffarius*; members of *Notiax* also have a strong rostral spine extending almost beyond the cornea and a median distal spine on the telson. Members of *Biffarius* lack the strong ridge of teeth present on the inner margin of the Mxp3 in members of *Pseudobiffarius*.

*Pseudobiffarius caesari*, new species

Figs. 1, 2, 3a–k, n–o, 4, 5a

*Material*.—Tobago: Lover's Beach, northwest corner of Man O'War Bay [11°19'N, 60°34'W], protected beach and shallow reef, depth ca. 2 m, leg. R. Heard, sta 3, 6 Apr 1992: 1 male, cl 3.2 mm (paratype, USNM 260965).

Pirate's Cove, east side of Man O'War Bay, depth 2–3 m, leg. R. Heard, 12 Jan 1992: 3 females, 2 non-ovigerous, cl 2.6 and 3.8, 1 ovigerous, cl 4.1 (paratypes, USNM 260970).

Buccoo Reef [11°11'N, 60°49'W], back reef area with sand bottom, depth ca. 2 m, leg. R. Heard, sta 10A (1992 sta 2), 11 Jan 1993: 1 male, cl 4.7 mm (holotype, USNM 260966).

Coral Gardens, Buccoo Reef, depth 5 m, leg. Lois Nickell, 6 Jul 1989: 1 female, cl 3.6 mm (paratype, USNM 260968).—Coral Gardens, Buccoo Reef, depth 2 m, leg. Lois Nickell, 2 Aug 1989: 1 female, cl 6.0 mm, tl 26 mm (paratype, USNM 260969).

Pigeon Point [11°10'N, 60°51'W], depth 1 m, on sand, leg. R. Heard, 15 Jan 1993: 1 female, cl 4.4 mm (paratype, USNM 260967).

Lowlands Lagoon [= Petit Trou; 13°50'N, 61°05'W], leg. R. Heard, sta. 9, 7 Apr 1992: 1 male, cl 5.4 mm (paratype, USNM 260971).

*Diagnosis*.—Size very small, cl 6.0 mm or less and tl 30 mm or less in adults. Telson subrectangular, with small submarginal spines posteriorly and distinct median and posterolateral spines. Mxp3 ischium-merus operculiform, without exopod, inner surface of ischium with strong crest of teeth. Major cheliped not dimorphic in males; merus of both chelipeds with ventral hook. Male lacking Plp2. Uropods unarmed.

*Description*.—Carapace (Figs. 1, 4a–c) smooth, with dorsal oval, without cardiac prominence; cervical groove distinct; linea thalassinica distinct, parallel to longitudinal axis of body; rostrum short, acute, not produced into distinct spine; lateral frontal projections present, low, obtuse.

Abdominal somites (Figs. 1, 4a, d) smooth, somite 1 saddle-like, shortest; somite 2 longest, almost twice as long as somite 6, with small tuft of setae posterolaterally, set in submarginal longitudinal crease; somites 3–5 subequal in length, each with small lateral row of setae set in submarginal crease; somite 6 about as long as telson, with median carina. Telson (Fig. 4e, f) subrectangular, tapering posteriorly, slightly longer than wide, with anterior tuft of setae mid-dorsally and some isolated setae and small spinules dorsally, submarginal row of spinules present posteriorly; posterior margin setose, emarginate, with median spine and 2 pairs of posterolateral spines.

Eyes (Figs. 1, 4a–c, 5a) flattened, slightly convex, about as long as first segment of A1 peduncle, external margins moderately convergent, mesial margins parallel, tips pointed; cornea rounded, darkly pigmented, subterminal.

A1 peduncle (Figs. 4a, b, 5a) extending beyond A2 peduncle; segment 3 more than



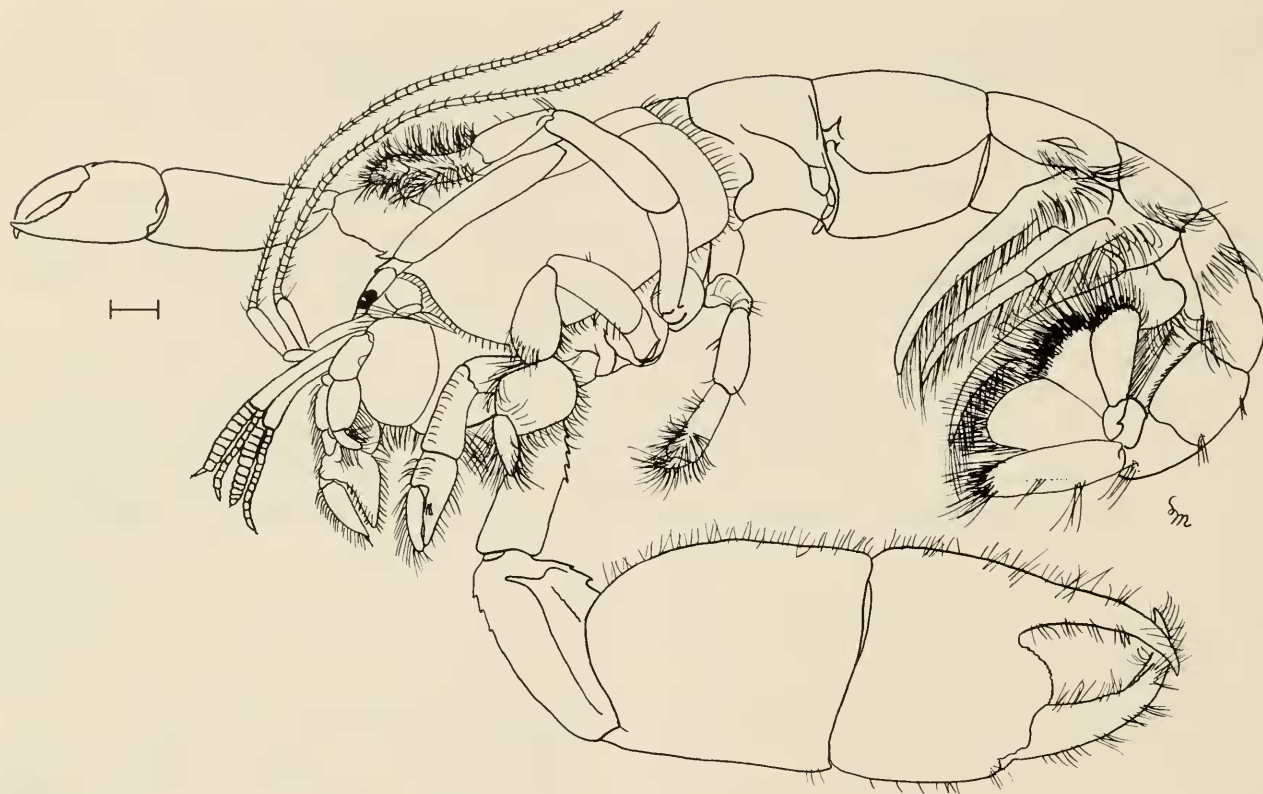


Fig. 1. *Pseudobiffarius caesari*, new genus and species, male holotype (USNM 260966), cl 4.7 mm, Buccoo Reef. Lateral view. Scale = 1 mm.

twice as long as segment 2, segment 1 subequal to segment 2; upper flagellum stout, much shorter than distal segment of peduncle. A2 peduncle (Figs. 4a, b, 5a) with segment 4 slightly shorter than segment 3 and as long as segment 1 and 2 together; antennal scale not evident; flagellum much longer than peduncle.

Mandible (Fig. 3a, b) with numerous small teeth on incisor process; molar process unarmed; palp 3-segmented, segment 3 elongate, longer than segments 1 and 2 combined, tapering distally. Max1 (Fig. 3c) with broad basal endite, distal lobe almost forming right angle; coxal endite elongate, triangular; palp slender, with curved tip. Max2 (Fig. 3d) with protopodal endites bilobed, distalmost lobe elongate, triangular; palp slender; exopod broad, with crenulated margins. Mxp1 (Fig. 3e) with protopodal endites very slender, bilobed; palp very small but distinct, longer than wide; exopod bilobed, mesial margin densely setose with short, spatulate setae (Fig. 3f); epipod subrectangular, elongate. Mxp2 (Fig. 3g) with

5-segmented endopod, terminal segment short, spatulate; exopod unsegmented, shorter than endopodal merus; protopod with small setose epipod, apparently lacking arthrobranch. Mxp3 (Fig. 3h-k) ischium-merus sub-operculiform; ischium about as wide as long, mesial surface with dentate crest of large teeth; merus more than 1.5 times wider than long, almost 4 times wider than carpus and propodus, distal margin of outer face projecting beyond articulation with carpus; propodus much longer than wide, tapering distally, only slightly wider than digitiform dactylus.

Males with very unequal chelipeds. In larger cheliped of male (Figs. 1, 2a, b): ischium with ventral margin spinulose in largest of 3 males; merus with dorsal margin spinulose in proximal fourth, smooth distally, posterior margin with spinules proximal to distally-directed hook, with distal portion serrated; carpus distinctly longer than wide, smooth dorsally and ventrally, broadly rounded proximally; palm shorter than carpus, length less than height; fingers

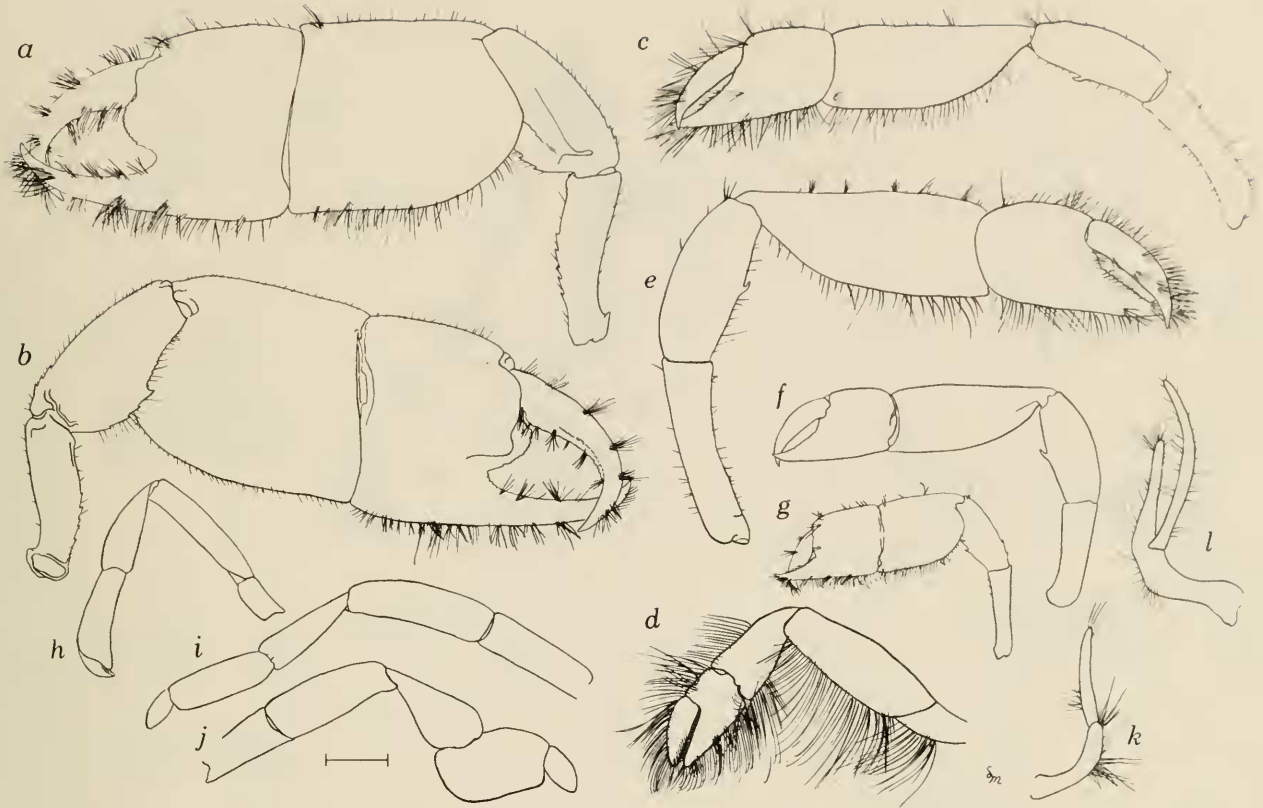


Fig. 2. *Pseudobiffarius caesari*, new genus and species. a, Male major P1, outer aspect; b, Male major P1, inner aspect; c, Female P2; d, Male P2; e, Male minor P1; f, Juvenile male minor P1, setae omitted; g, Juvenile male major P1; h, Male P3; i, Female P4; j, Female P5; k, Female Plp1; l, Female Plp2. a, b, d, male holotype (USNM 260966), cl 4.7 mm, Buccoo Reef; c, g, h, k, l, female paratype (USNM 260967), cl 4.4 mm, Pigeon Point; e, f, juvenile male paratype (USNM 260965), cl 3.2 mm, Lover's Beach. Scale: a-j, 0.5 mm; k, l, 1.0 mm.

about as long as palm, gaping, tips acutely pointed, crossing; cutting edge of movable finger minutely serrated; gape conspicuous, base with dorsal convex lobe, edge serrate, above smoother, deep invagination in distal border of propodus.

Smaller cheliped of male (Fig. 2d, e) and both chelipeds of female (Fig. 2c) similar in size (chelipeds symmetrical in female): ischium smooth, unarmed, about as long as merus; merus with small, acute hook at mid-length of ventral margin; carpus longer than

other joints, length about 2.5 times height; palm less than half as long as merus, length and height subequal; fingers subequal, curved, slightly longer than palm, sharply pointed, with some serrations on cutting edge of fixed finger, tip of fingers crossing.

P2 (Fig. 2c, d) with fingers not gaping, cutting edges straight, smooth. P3 (Fig. 2h) with ischium and merus of about same width, merus longer than ischium; carpus broadening distally; propodus wider than carpus, anterior and posterior margins convex, posterior margin much longer than anterior; dactylus as long as wide, spatulate. P4 (Fig. 2j) lacking subchelar projection. P5 (Fig. 2i) distinctly chelate, fingers small, tips curved.

Branchial formula, differing from normal callianassid formula in complete absence of arthrobranch on Mxp2, as shown in Table 1.

Plp1 of male uniramous, 2-segmented. Male lacking Plp2. Plp1 of female (Fig. 2k) uniramous, 2-segmented, proximal segment

Table 1.—Gill formula of *Pseudobiffarius caesari*, new genus and species.

	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	—	—	—	—
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	—	—	—	—	—	—
Epipods	1	1	—	—	—	—	—	—
Exopods	1	1	—	—	—	—	—	—

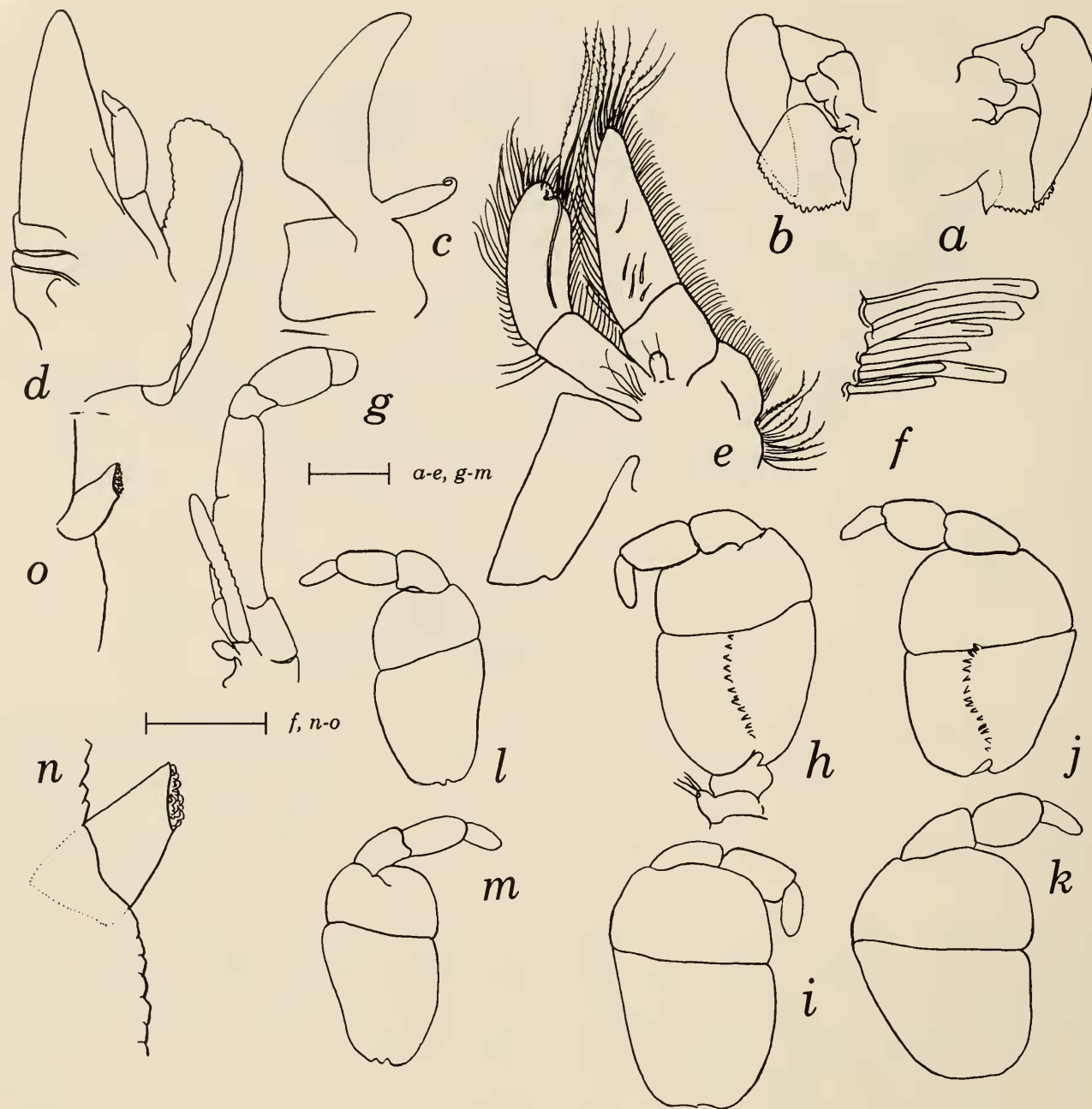


Fig. 3. *Pseudobiffarius caesari*, new genus and species: a-k, n, o, male holotype (USNM 260966), cl 4.7 mm, Buccoo Reef. *Pseudobiffarius caesari*, new genus and species: h, i, female paratype (USNM 260968), cl 3.6 mm, Buccoo Reef.—*Biffarius biformis* (Biffar, 1971): l, m, male (USNM 266071), cl 5.5 mm, Fort Pierce, Florida (USNM 266071): a-b, Mandible; c, Max1; d, Max2, e, Mxp1; f, Marginal setae of Mxp1, enlarged; g, Mxp2; h, Mxp3, inner face; i, Mxp3, outer face; j, Mxp3, inner face; l, Mxp3, outer face; m, Mxp3, inner face; n, o, Plp3 appendix interna. Upper scale, a-e, g-m = 0.5 mm; lower scale, f, n, o, = 1.0 mm.

with subterminal and terminal patch of short setae; distal joint about as long as proximal, with a patch of small setae at midlength and 4 spiniform apical setae. Plp2 of female (Fig. 2l) biramous; endopod straight, with long terminal setae and a few setae scattered along its length; exopod similar to endopod but curved and lacking longer apical setae. Plp3-5 with stubby, projecting appendices internae (Fig. 3n, o) in both sexes.

Uropodal endopod (Fig. 4a, e) slightly longer than wide, margins densely setose; exopod slightly longer than and much wider than endopod, upper plate more than half as wide as lower.

*Size*.—cl of males ( $n = 3$ ), 3.2 to 5.4 mm; tl of largest male, 20 mm; cl of females ( $n = 6$ ), 2.6 to 6.0 mm, of ovigerous female, 4.1 mm; tl of largest female, 26 mm.

*Remarks*.—Although this species superfi-



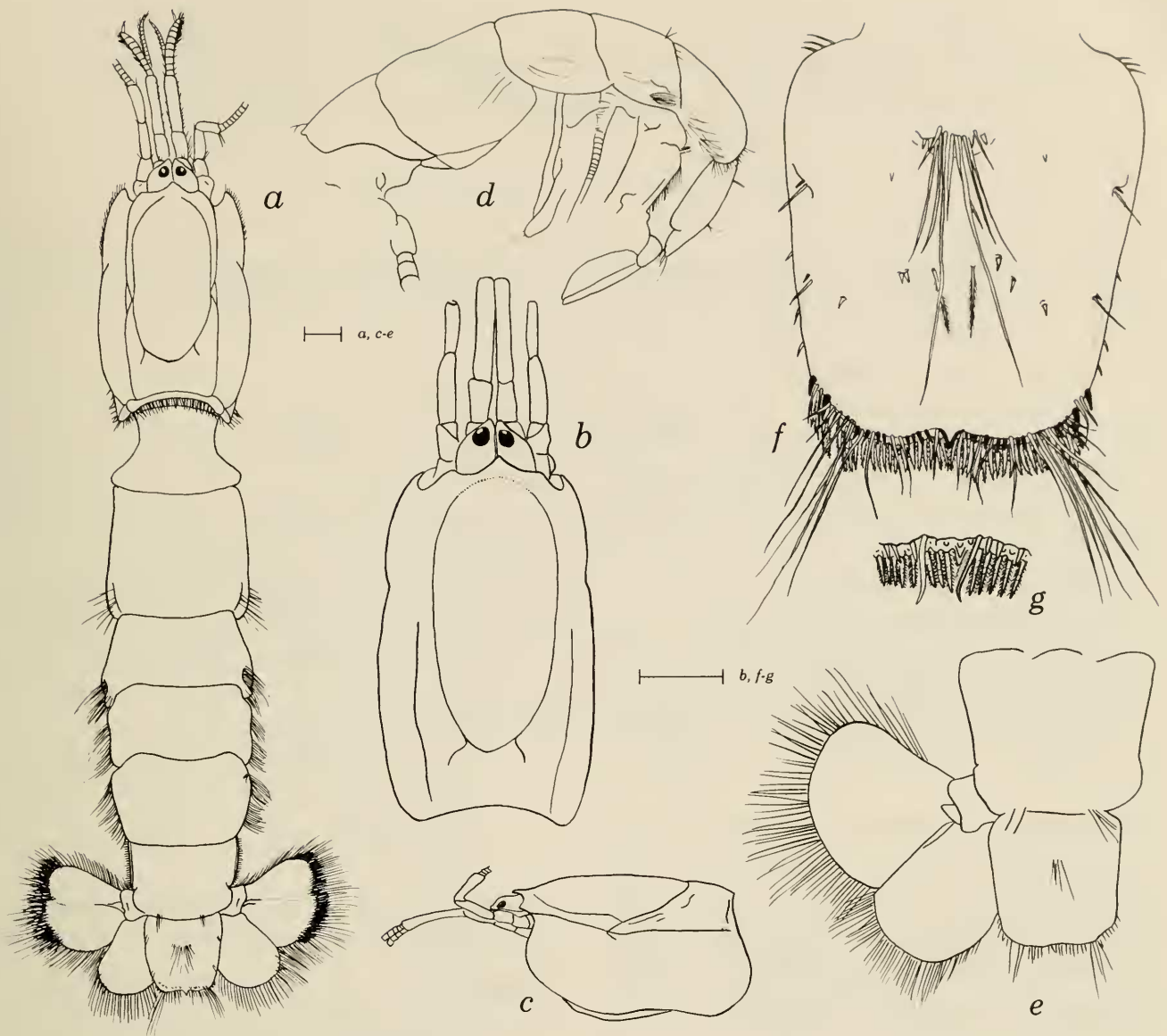


Fig. 4. *Pseudobiffarius caesari*, n. gen., n. sp. a, Dorsal view (pereopods omitted); b, Carapace and anterior appendages, dorsal view; c, Carapace and anterior appendages, lateral view; d, Abdomen, lateral view; e, Sixth abdominal somite, telson, and left uropod, dorsal view; f, Telson, dorsal view, enlarged; g, Details of telson margin, enlarged. a–d, f–g, female paratype (USNM 260967), cl 4.4 mm, Pigeon Point; e, female paratype (USNM 260968), cl 3.6 mm, Buccoo Reef. Scale: a, c–e, 2 mm; b, f, 1 mm; g, 0.5 mm.

cially resembles the type species of *Biffarius*, *B. biformis* (Biffar 1971), it differs in many features. In contrast to *B. biformis*, males have only one type of cheliped rather than two types, as reported by Biffar (1971) in *B. biformis*. *Pseudobiffarius caesari* also differs from *B. biformis* in having the A2 peduncle shorter than the A1 peduncle, the upper A1 flagellum much shorter, stouter, and with 9 or 10 rather than 18 to 20 segments. In *B. biformis* the inner face of the ischium of Mxp3 (Fig. 3m) lacks spinules, whereas there is a line of strong spinules on the inner surface of Mxp3 (Fig. 3h, j) in *P. caesari*.

Examination of the telson under high magnification (Fig. 4f, g) yielded a very different picture of its marginal ornamentation than can be obtained under the magnification available from a dissecting microscope. In addition to being lined with short, plumose setae and some much longer ones, especially laterally, the posterior margin of the telson has a distinct median spine and a series of small, thick marginal spines and shorter submarginal spines, with two larger spines posterolaterally.

The shore fauna of Tobago is very rich in species of burrowing decapods. Among

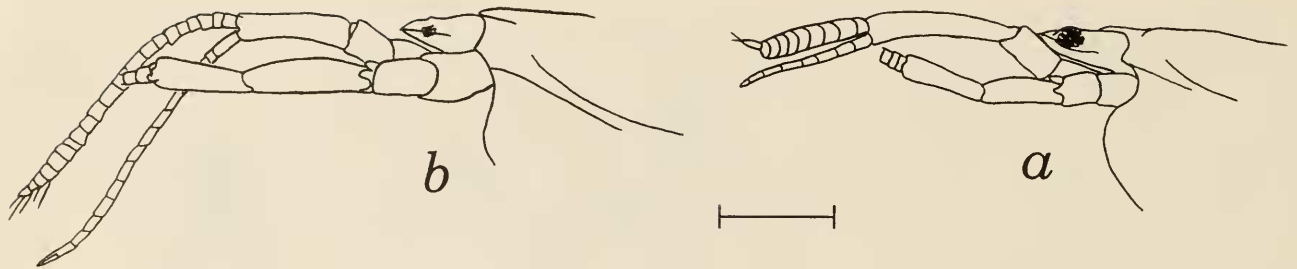


Fig. 5. Carapace and anterior appendages in lateral view. a, *Pseudobiffarius caesari*, new genus and species, female paratype (USNM 260967), cl 4.4 mm, Pigeon Point; b, *Biffarius biformis* (Biffar 1971), male, (USNM 266071, cl 5.5 mm, Fort Pierce, Florida. Scale = 1 mm.

the new species discovered by us (RH) are another callianassid, *Neocallichirus nickellae* Manning, 1993 and the commensal pinnotherid crab, *Austinixa hardyi* Heard & Manning, 1997.

We are pleased to acknowledge our respect for our late colleague, Austin B. Williams, by being able to publish this report in a volume of the Proceedings of the Biological Society of Washington dedicated to him.

*Etymology*.—Named for Errol Caesar of the Fisheries Division, Ministry of Agriculture, Land, and Marine Resources, Tobago. His enthusiastic support and interest in Heard's fieldwork on Tobago materially improved collecting opportunities.

#### Acknowledgments

We thank both Errol Caesar and J. David Hardy for their support of Heard's investigations on Tobago; Lois Nickell, then with the University Marine Biological Station, Millport, Scotland, for the gift of her collections; and Lilly King Manning for preparing the figures. Manning's studies on callianassid systematics are supported by the Smithsonian Marine Station at Fort Pierce; this is contribution no. 455 from that facility.

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