

**A new species of *Pseudostegias* Shiino, 1933
(Crustacea: Isopoda: Bopyridae: Athelginae)
parasitic on hermit crabs from Bali**

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Abstract.—A single male and female bopyrid pair was collected in Sanur, Bali, Indonesia in August 1997, from the abdomen of a hermit crab, *Calcinus gaimardii* (H. Milne Edwards). Examination of these specimens showed that they belong to the athelgine genus *Pseudostegias* Shiino, but cannot be placed into any described species. We describe this new species as *P. macdermotti* and compare it to *P. dulcilacuum* Markham, which it most closely resembles. This is the first record of a *Pseudostegias* from the genus *Calcinus*. A list and key of all described *Pseudostegias* species are provided.

Bopyrid isopods of the subfamily Athelginae are obligate parasites found on the abdomen of hermit crabs and lithodids (Decapoda: Paguroidea). The seven genera in this subfamily are defined primarily on the combination of lateral plates and pleopods on the pleomeres of the female. The genus *Pseudostegias* is distinguished by the presence of long uniramous lateral plates on pleomeres 1–4, and biramous pleopods. The lateral plates on pleomere 5 are reduced to a dorsally produced globular or bifurcated lobe.

One of us (JDW) collected a series of hermit crabs in Sanur, Bali, Indonesia during August 1997. One of these crabs was found to bear an immature female bopyrid with a male inside her brood plates. The specimens belong to the genus *Pseudostegias* and represent a new species most similar to *P. dulcilacuum* Markham, 1982. A list of the species of *Pseudostegias*, with their known localities and hosts, and a key to their identification are provided.

Methods

Hermit crabs inhabiting gastropod shells were collected intertidally in Sanur, Bali, Indonesia on 5–6 August 1997. Specimens were relaxed in 3% magnesium chloride, fixed in 10% formalin-seawater solution and stored in 70% ethanol. The shells were cracked using a hammer and pliers and the crabs removed and examined for parasites.

Camera lucida sketches made of specimens were scanned into a Macintosh[™] computer. Images were then prepared using the programs Adobe Photoshop[™] and Adobe Illustrator[™].

Shield length (SL) is provided as an indicator of size for the host crabs. Isopod size is given as total body length (anterior margin of head to posterior margin of pleotelson). Measurements were made to 0.01 mm using an ocular micrometer.

Specimens are deposited in the Department of Invertebrates, American Museum of Natural History, New York, U.S.A. (AMNH).

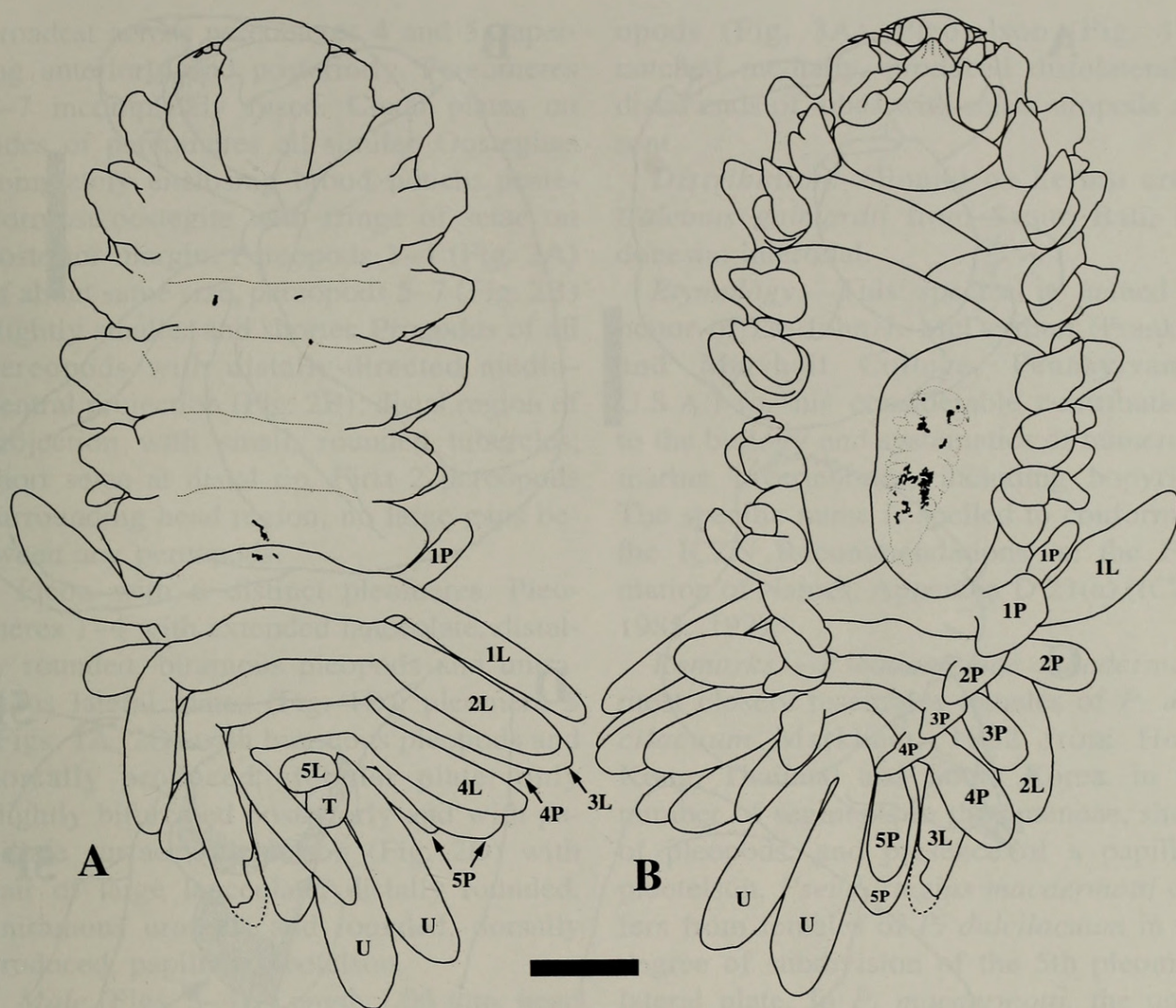


Fig. 1. *Pseudostegias macdermotti*, new species. Female, 3.6 mm, AMNH 17877, holotype. A, dorsal view; B, ventral view. L = lateral plate; P = pleopod; T = telson; U = uropod; numbers indicate pleon segment. Scale = 0.5 mm.

Family Bopyridae Rafinesque, 1815
Subfamily Athelginae Codreanu and
Codreanu, 1956

Genus *Pseudostegias* Shiino, 1933
Pseudostegias macdermotti, new species
Figs. 1–4

Material examined.—Holotype: female (3.6 mm), infesting male *Calcinus gaimardii* (H. Milne Edwards) (2.66 mm SL; AMNH 17879), inhabiting shell of *Drupella cornus* (Röding), 08°41'S, 115°15'E, Sanur, Bali, Indonesia, intertidal, coll. J. D. Williams, 6 Aug 1997 (AMNH 17877). Allotype: male (1.06 mm), same data as holotype (AMNH 17878).

Type locality.—Sanur, Bali, Indonesia, Pacific Ocean.

Description.—*Female* (Figs. 1–2). Body length 3.60 mm, maximal width 1.83 mm, head length 0.75 mm, head width 0.44 mm, pleon length 1.64 mm. Pereon not distorted due to immaturity; pleon deflected to the right. Body outline narrow and elongated. All body regions and most pereomeres distinctly segmented (Fig. 1A, B).

Head not produced due to immaturity. Eyes present approximately 1/4 distal from anterior margin. Antenna (Fig. 2C) of 7 articles; antennule (Fig. 2C) of 3 articles, distal margins of segments with setae. Maxilliped (Fig. 2E) with low rounded spur; palp absent; posterior margin setose. Barbula undeveloped.

Pereon composed of 7 pereomeres,

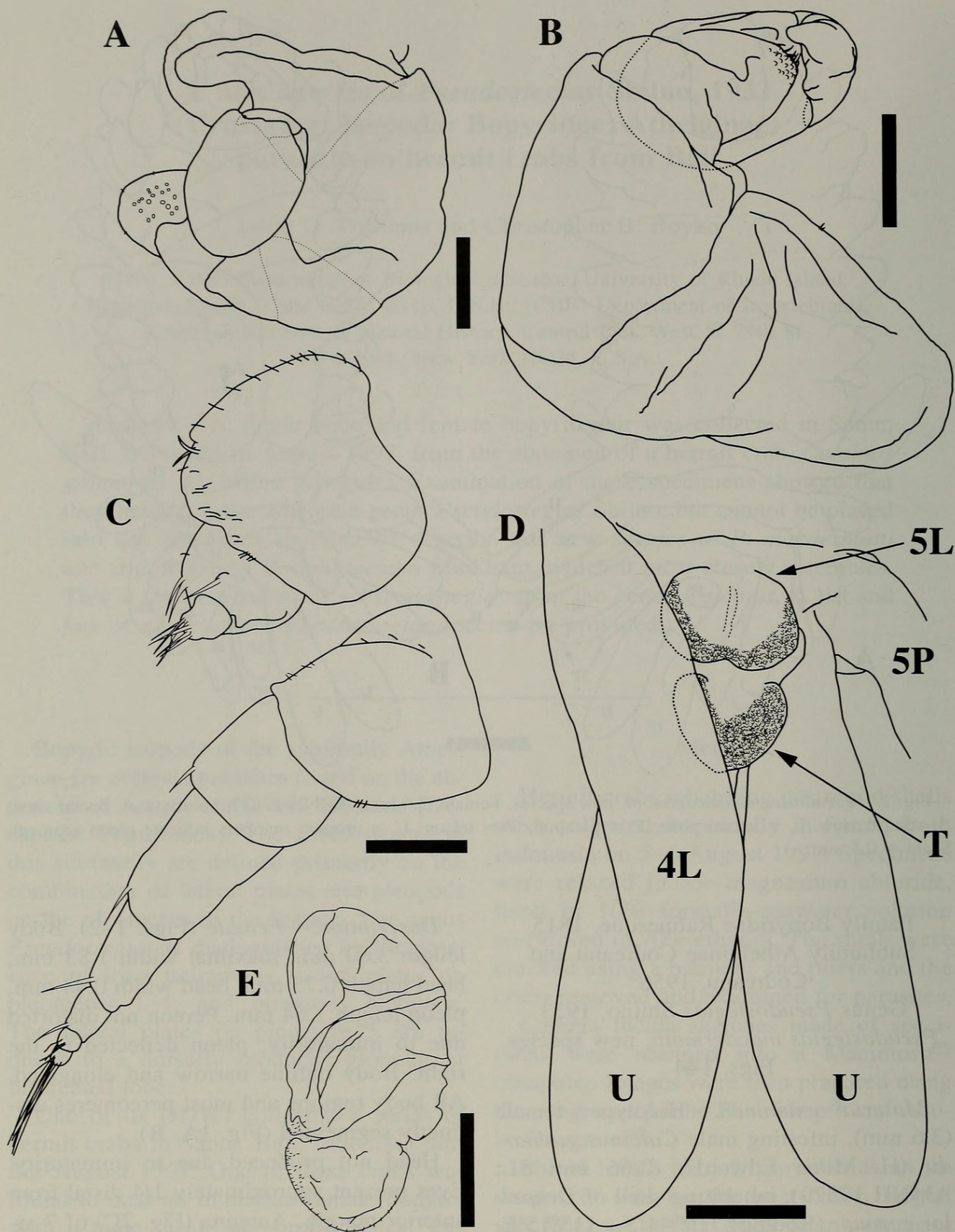


Fig. 2. *Pseudostegias macdermotti*, new species. Female, 3.6 mm, AMNH 17877, holotype. A, right pereopod 1; B, left pereopod 7; C, right antenna and antennule; D, dorsal view of fifth lateral plates, pleotelson, and uropods (L = lateral plate; P = pleopod; T = telson; U = uropod; numbers indicate pleon segment); E, left maxilliped. Scale = 0.1 mm (A, B, D), 0.05 mm (C), and 0.02 mm (E).

broadest across pereomeres 4 and 5, tapering anteriorly and posteriorly. Pereomeres 2–7 incompletely fused. Coxal plates on sides of pereomeres all similar. Oostegites completely enclosing brood pouch; posteriormost oostegite with fringe of setae on posterior margin. Pereopods 1–4 (Fig. 2A) of about same size, pereopods 5–7 (Fig. 2B) slightly smaller and shorter. Propodus of all pereopods with distally-directed medioventral projection (Fig. 2B); distal region of projection with small, rounded tubercles; short setae at distal tip. First 2 pereopods surrounding head region; no large gaps between any pereopods.

Pleon with 6 distinct pleomeres. Pleomeres 1–4 with extended lanceolate, distally rounded, biramous pleopods and uniramous lateral plates (Fig. 1B); pleomere 5 (Figs. 1A, 2D) with biramous pleopods and dorsally produced globular plate, only slightly bifurcated posteriorly and with papillate surface; pleotelson (Fig. 2D) with pair of large lanceolate, distally rounded, uniramous uropods and rounded, dorsally produced, papillate pleotelson.

Male (Figs. 3–4). Length 1.06 mm, head length 0.09 mm, head width 0.21 mm, pleon length 0.33 mm. Occurring under oostegites of female (Fig. 1B); directed anteroposteriorly.

Head suboval, widest posteriorly, incompletely fused with 1st segment of pereon. Large eyes near posterolateral margin. Antenna (Fig. 4C) of 7 articles, distally setose; extending posterolaterally from head; antennule of 3 articles (Fig. 4C).

Pereomeres 2–6 broadest, tapering anteriorly and posteriorly. Pereomeres 1–4 directed laterally; 5–7 directed posterolaterally. All segments of body except for head with irregular dark pigmentation pattern. All pereopods (Fig. 4A, B) of equal size, all articles distinctly separated.

Pleon tapering posteriorly, pleomeres directed laterally and fringed with setae. First segment incompletely fused to 2nd segment; all other segments fused. No midventral tubercles; 5 pairs of tuberculiform ple-

opods (Fig. 3A). Pleotelson (Fig. 4D) notched medially, produced distolaterally, distal ends of lobes with setae; uropods absent.

Distribution.—Found on hermit crab, *Calcinus gaimardii* from Sanur, Bali, Indonesia; intertidal.

Etymology.—This species is named in honor of Dr. John J. McDermott (Franklin and Marshall College, Pennsylvania, U.S.A.) for his considerable contributions to the biology and systematics of numerous marine invertebrates, including bopyrids. The specific name is spelled to conform to the ICZN Recommendations on the Formation of Names, Appendix D 21(a) (ICZN 1985: 197).

Remarks.—*Pseudostegias macdermotti* most closely resembles females of *P. dulcillacuum* Markham, 1982 from Hong Kong, Thailand and South Korea, in the number of segments in the antennae, shape of pleopods, and presence of a papillate pleotelson. *Pseudostegias macdermotti* differs from females of *P. dulcillacuum* in the degree of subdivision of the 5th pleomere lateral plate. In *P. macdermotti*, the undivided globular 5th pleomere lateral plate has only a hint of a medial seam, while *P. dulcillacuum* has a strongly bifurcated 5th pleomere lateral plate. The only other species in the genus which has an undivided 5th pleomere lateral plate is *P. otagoensis* Page, 1985, from New Zealand. *Pseudostegias otagoensis* differs from *P. macdermotti* in both the shape of its 5th pleomere lateral plate, which is extended anteroposteriorly rather than mesiolaterally as in *P. macdermotti*, and in the distally pointed shape of the pleopods which are rounded in *P. macdermotti*. Some authors (Shiino 1933, Lemos de Castro 1965) have incorrectly described species of *Pseudostegias* as lacking 5th pleomere lateral plates, although all species in this genus possess such plates (Markham 1982). We consider the shape of the 5th pleomere lateral plate to be diagnostic in species of *Pseudostegias*, since it has been shown to be constant

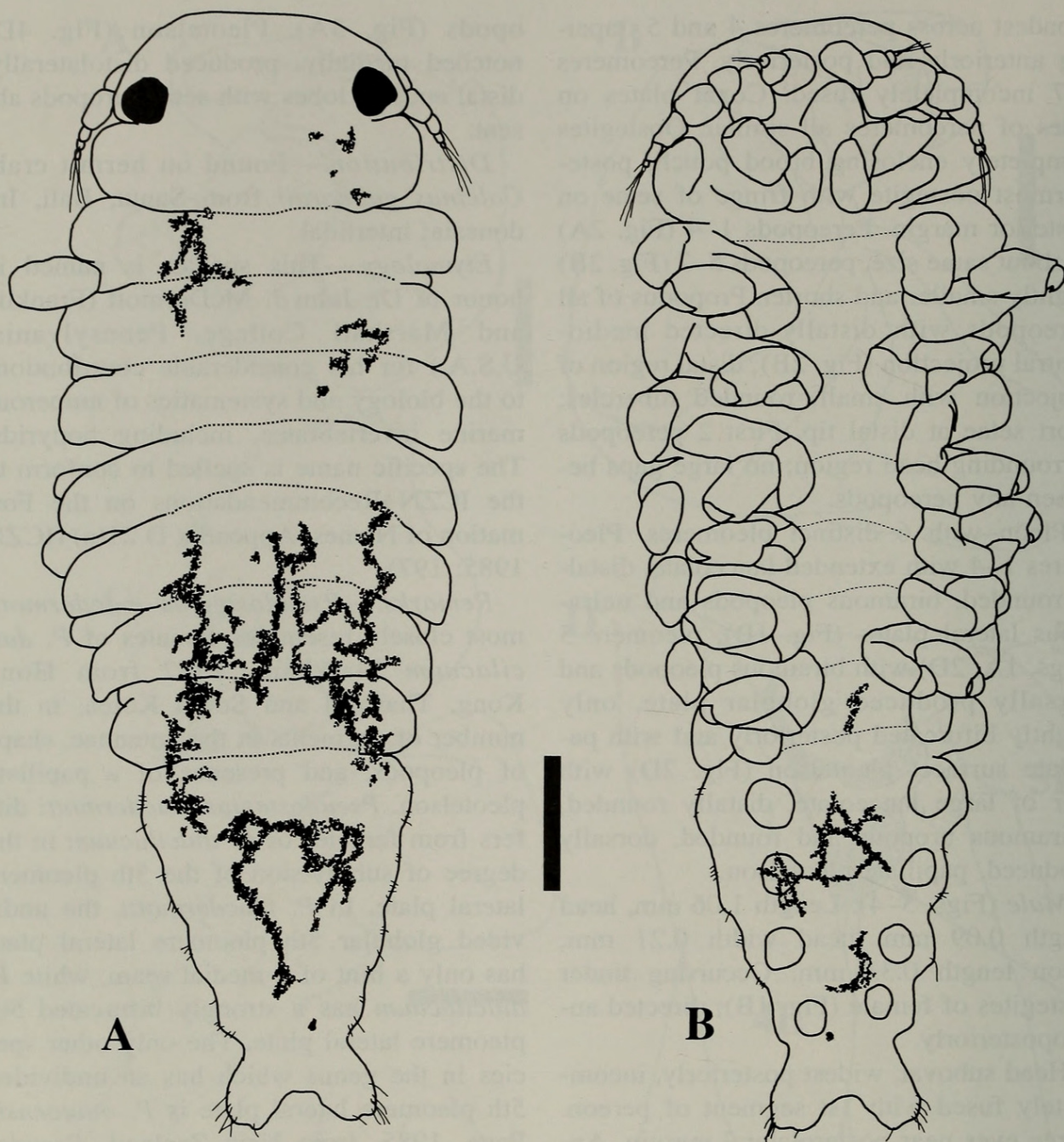


Fig. 3. *Pseudostegias macdermotti*, new species. Male, 1.06 mm, AMNH 17878, allotype. A, dorsal view; B, ventral view. Scale = 0.1 mm.

within species, including *P. dulcilacuum*, between juveniles and adults (Lemos de Castro 1965: figs. 2–4, Markham 1985: figs. 26–27). The key given below provides additional characters for separating the species of *Pseudostegias* based on females.

Male *P. macdermotti* differ from those of *P. dulcilacuum* in having a fused head with the first pereon segment and in pleotelson shape. The pleotelson of the male *P. macdermotti* is notched medially and produced

distolaterally while *P. dulcilacuum* possesses a pleotelson which tapers to a blunt point. Male *P. macdermotti* differ from those of *P. otagoensis* in possessing eyes and in pleotelson shape. *Pseudostegias otagoensis* lacks eyes and has a tapered, pointed pleotelson. The location of the male inside the brood plates of the female is consistent with other reports for this genus (Shiino 1933, Markham 1982), although the male of *P. hapalogasteri* was found outside

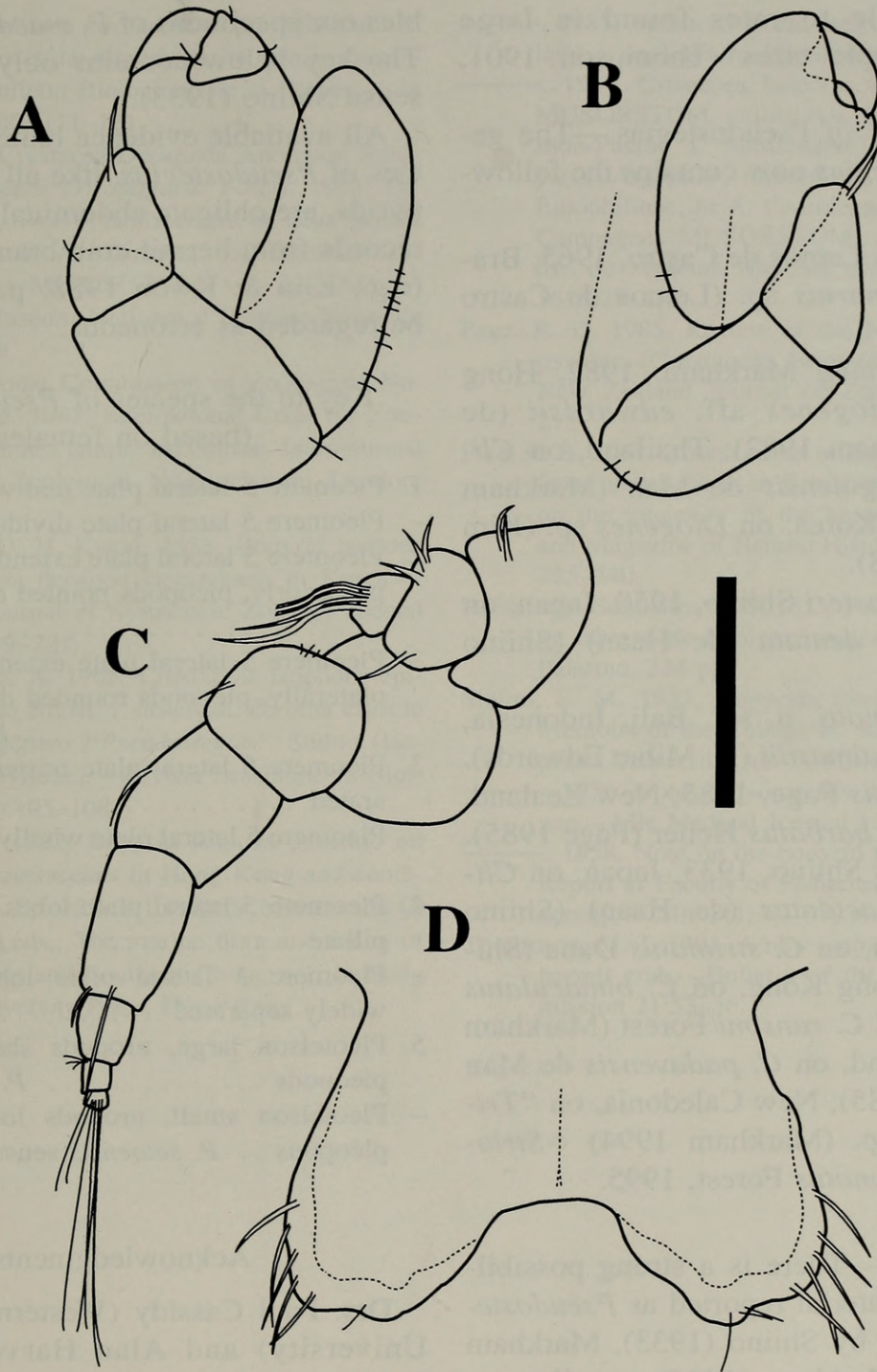


Fig. 4. *Pseudostegias macdermotti*, new species. Male, 1.06 mm, AMNH 17878, allotype. A, left pereopod 1; B, left pereopod 7; C, right antenna and antennule; D, Dorsal view of pleon. Scale = 0.05 mm.

the brood plates on the posterior end of the female (Shiino 1950).

Ecology.—A total of 43 hermit crabs were collected from Sanur, Bali on Aug. 5–6, 1997. The majority were *Calcinus gaimardii* (34 specimens) and only a single specimen of this crab was found with a bopyrid parasite (3% prevalence). This is the

first report of a species of *Pseudostegias* on a species of *Calcinus*. The other crabs collected were *Calcinus latens* (Randall) (4 specimens), *Clibanarius* sp. (1 specimen), *Dardanus* sp. (2 specimens), and 2 unidentified hermits. No specimens of any of these other species were parasitized. The overall rate of bopyrid occurrence was 2.3%, which

is comparable to rates found in large (1000+) sample sizes (Thompson 1901, Pike 1961).

The species of Pseudostegias.—The genus *Pseudostegias* now contains the following six species:

P. atlantica Lemos de Castro, 1965, Brazil, on *Clibanarius* sp. (Lemos de Castro 1965).

P. dulcilacuum Markham, 1982, Hong Kong, on *Diogenes* aff. *edwardsii* (de Haan) (Markham 1982); Thailand, on *Clibanarius merguiensis* de Man (Markham 1985); South Korea, on *Diogenes* sp. (Kim & Kwon 1988).

P. hapalogasteri Shiino, 1950, Japan, on *Hapalogaster dentata* (de Haan) (Shiino 1950).

P. macdermotti, n. sp., Bali, Indonesia, on *Calcinus gaimardii* (H. Milne Edwards).

P. otagoensis Page, 1985, New Zealand, on *Paguristes barbatus* Heller (Page 1985).

P. setoensis Shiino, 1933, Japan, on *Clibanarius bimaculatus* (de Haan) (Shiino 1933); Taiwan, on *C. striolatus* Dana (Shiino 1958); Hong Kong, on *C. bimaculatus* (de Haan) and *C. ransonii* Forest (Markham 1982); Thailand, on *C. padavensis* de Man (Markham 1985); New Caledonia, on "*Trizopagurus*" sp. (Markham 1994) = *Strizopagurus boreonotus* Forest, 1995.

Discussion.—There is a strong possibility that the material reported as *Pseudostegias setoensis* by Shiino (1933), Markham (1985), and Markham (1994) actually represents three distinct species. Based on the published illustrations and descriptions, the 5th pleomere lateral plates on each specimen are quite different, the number of pereopods found overlapping the head region is not identical, and the shape of the pleopods is more variable than has been demonstrated for other athelgine species. Specimens would need to be examined to make a final determination on their status. However, neither *P. setoensis* sensu Markham (1985) or Markham (1994) closely resem-

bles our specimens of *P. macdermotti* n. sp. The key below contains only *P. setoensis* sensu Shiino (1933).

All available evidence indicates that species of *Pseudostegias*, like all athelgine bopyrids, are obligate abdominal parasites and records from hermit crab branchial cavities (e.g., Kim & Kwon 1988: p. 215) should be regarded as erroneous.

Key to the species of *Pseudostegias* (based on females)

1. Pleomere 5 lateral plate undivided 2
- Pleomere 5 lateral plate divided 3
2. Pleomere 5 lateral plate extended antero-posteriorly, pleopods pointed distally *P. otagoensis*
- Pleomere 5 lateral plate extended mesiolaterally, pleopods rounded distally *P. macdermotti*
3. Pleomere 5 lateral plate posteriorly separated *P. atlantica*
- Pleomere 5 lateral plate wholly separated 4
4. Pleomere 5 lateral plate lobes large, papillate *P. dulcilacuum*
- Pleomere 5 lateral plate lobes small, widely separated 5
5. Pleotelson large, uropods shorter than pleopods *P. hapalogasteri*
- Pleotelson small, uropods longer than pleopods *P. setoensis* sensu Shiino, 1933

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