

A redescription of *Pseudodiaptomus salinus* (Giesbrecht, 1896) and a new species from the Arabian Sea (Copepoda, Calanoida, Pseudodiaptomidae)

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Abstract

Many species of *Pseudodiaptomus* are known from the Indian Ocean. However, only two species have been reported from the Red and Arabian Seas. A review of *P. salinus* (Giesbrecht) from collections near Kuwait and Pakistan in the Arabian Sea revealed differences from Red Sea material. Further study proved the existence of a new species *Pseudodiaptomus arabicus* n.sp.

Keywords: Calanoida; Pseudodiaptomus; taxonomy; Arabian Sea; Red Sea; Copepoda

1. Introduction

The species of *Pseudodiaptomus* Herrick from Africa and India are numerous. The African taxa are represented by four species (*batillipes* Brehm, *hessei* (Mrazek), *pauliani* Brehm, *stuhlmanni* (Poppe and Mrazek)) from the Improcerus species group, two species (*salinus*, *serricaudatus* (Scott) from the Ramosus group ('serricaudatus-subgroup') and one species (*heterothrix* Brehm) from an unassigned species group as defined by Walter (1986a). There are more Indian than African species; however, they will not be listed here. Most of the African and

Indian species are found in fresh or brackish water estuarine environment. Only two species have been reported from the region between Africa and India: *P. salinus* and *P. serricaudatus*. These species prefer a more marine habitat, though given the euryhaline nature of the genus, they can be found in reduced saline conditions at various times. No representatives of the genus have yet been confirmed from the Mediterranean Sea.

Giesbrecht (1896) described the species *P. salinus* from the Red Sea based on only two females; the males were not known until described by Thompson and Scott (1903) from material collected near the type locality in the Red Sea and Suez Canal. The new species in this paper is from the Arabian Sea and was thought of by me as *P. salinus*, when I first encountered it in 1983. However, after comparison to material from the Natural History Museum,

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London, I was able to reevaluate its status and determine that it is a new species.

2. General description of the species

Abbreviations used throughout the paper are as follows: USNM = United States National Museum; BM = The Natural History Museum, London; Pr = prosome; Ur = urosome; Pdg1–5 = pedigerous somites 1–5; Ur1–5 = urosomites 1–5; A1 = antennule; P1–5 = swimming legs 1–5; CR = caudal rami; B1–B2 = basipods 1–2; Re = exopod; Ri = endopod; Se = outer spine; St = terminal spine. All measurements were done with a calibrated ocular micrometer in millimeters. Pr and Ur lengths were measured dorsally from anterior margin of head to posterior end of Pdg5 and from the anterior margin of Ur1 insertion into Pdg5 to distal tip of CR. Because Pdg5 corners usually overlap Ur, total length may be less than combined lengths of Pr and Ur. Mouthparts and P1–4 are not drawn here as they do not differ from those reported by Reddy and Radhakrishna (1982) and Walter (1986a).

The following characteristics are common to both species and will not be repeated in the descriptions. Female A1 and left male A1 with 22 segments, segment 20 with barbed modified seta. Male right A1 with 21 segments. Head separate from Pdg1, Pdg5 with pointed posterior corners in both sexes. Female Ur with 4 segments, Ur1 with paired genital flaps, posterior scale rows variable and egg sac single. Male with Ur1–5, Ur2 with ventral paired spinule rows, Ur2–4 with posterior scale rows. Female P5 symmetrical, both legs with B1–2 and Re1–3. Posterior view, B1 with proximal fine spinules, B2 with a large and small surface seta. Re1 and Re2 with distolateral Se and small surface seta. Re3 elongate with small proximomedial process and plumose. Male P5 asymmetrical with B1–2, Re of right leg 3-segmented and left leg 2-segmented and both legs with Ri. Posterior view, B1 with fine surface spinule row and distomedial corners acute. B2 with one large and two small setae, right Ri bifid, anteriorly inserted and proximal spinule patch at base of Ri; left Ri simple and elongate. Right Re1 with small surface knob at base of medial fine spinule patch and distolateral corner elongate. Re2

with Se and two surface setae, Re3 simple, curved, plumose, with two proximal surface setae. Left Re1 with Se and two small surface setae. Re2 large, medial margin basically straight with small distomedial spine, lateral margin convex, Se at mid-length, St at apex, and eight surface setae. Anterior view, B1 with proximal surface spinule row, B2 lateral spinule row continues onto surface at mid-length. Left Re2 with proximal groove lined with fine spinules and hairs.

Pseudodiaptomus salinus (Giesbrecht, 1896) (Fig. 1) *Schmackeria salinus* Giesbrecht, 1896, 322–323, pl. 6, figs. 23–28 (female only).

Pseudodiaptomus salinus (Giesbrecht, 1896), Giesbrecht and Schmeil, 1898, p. 65; Thompson and Scott, 1903, p. 248, pl. 2, figs. 21–23; Sewell, 1932, p. 235; Sewell, 1947, p. 164; Sewell, 1948, pp. 323, 431, 433, 439; Marsh, 1933, p. 39, pl. 20, figs. 4, 5; Dussart, 1989, pp. 10–11, fig. 6. non *Pseudodiaptomus salinus* (Giesbrecht, 1896), Michel et al., 1986a, p. 21; Michel et al., 1986b, p. 65; Walter, 1986b, pp. 504–505.

Material examined. Indian Ocean, Red Sea, Suez Canal, Port Taubiq, 5♂, 5♀, Sep. 1920, BM 1926.2.16.42–43 (see Table 1).

Female. Additions to Giesbrecht's description are as follows. Pdg5 posterior margin lined with fine setae, one long seta on each side of Ur insertion, and posterior corners directed slightly laterally (Fig. 1A). Ur1 asymmetrical, swollen medially, right proximolateral surface produced into acute posteriorly directed hook-like process and dense spinule patch, three surface spinule rows extending laterally and two posterior surface setae. Dorsally, posterior margin lacks scale row and is replaced with thickened margin (Fig. 1A,B). Ur2 lacks posterior scale row and is much shorter than Ur3. Ur3 with scale row. Ur1–4 and CR in proportions of 25:13:20:18:24. P5 posterior view (Fig. 1E): B1 with few large anterior surface spinules; B2 distolateral corners with 4 to 5 fine spinules.

Male. Pdg5 posterior corners small and directed slightly laterally (Fig. 1C). Ur1–5 and CR in proportions of 10:22:17:18:13:20. P5 posterior view (Fig. 1F). Right leg: Re1 distolateral corner produced

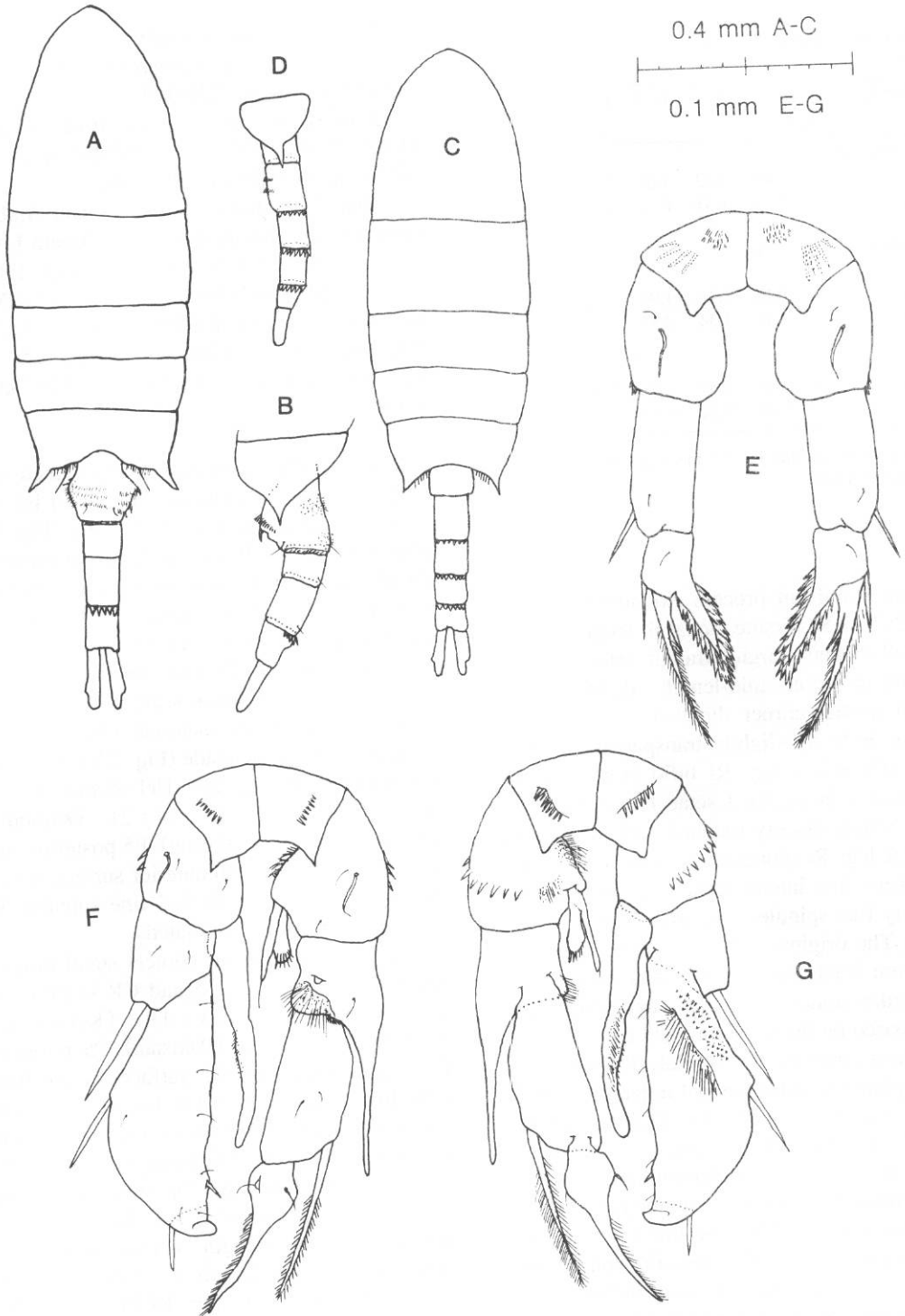


Fig. 1. *Pseudodiaptomus salinus* (Giesbrecht) A, B, E, adult female: (A) dorsal view complete habitus; (B) left lateral view Pdg5 and urosome; (E) P5 posterior view, B1 with dotted lines show anterior spinules. C, D, F, G, adult male: (C) dorsal view complete habitus; (D) left lateral view Pdg5 and urosome; (F) P5 posterior view; (G) P5 anterior view.

Table 1
A comparison of *Pseudodiaptomus* species from the Red and Arabian seas

Sex	Number	Length (mm)	\bar{x}	Pr \bar{x}	Ur \bar{x}	Pr:Ur
<i>Pseudodiaptomus salinus</i>						
Female	5	1.40–1.45	1.42	1.01	0.50	2.0:1
Male	5	1.29–1.34	1.31	0.94	0.44	2.1:1
<i>Pseudodiaptomus arabicus</i> n.sp.						
Kuwait:						
Female	20	1.39–1.48	1.44	1.04	0.54	1.9:1
Male	20	1.31–1.37	1.34	0.94	0.46	2.0:1
Pakistan:						
Female	11	1.40–1.50	1.45	1.05	0.54	1.9:1
Male	6	1.32–1.37	1.34	0.93	0.45	2.0:1

\bar{x} = mean total body length; Pr \bar{x} = mean prosome length; Ur \bar{x} = mean urosome length.

into elongate spiniform process extending to distal edge of Re2; Re2 Se hirsute, equal in length to Re3. Left leg: Re2 medial margin straight, lateral margin strongly convex after mid-length, distal margin curved with medial corner directed medially, area from base of St to tip slightly transparent. Anterior view (Fig. 1G). Right leg: Ri bifid both branches simple, medial with terminal setae longer than lateral, lateral branch distally rounded with 4 to 5 fine spinules. Left leg: Ri elongate, tapering to rounded point with very fine lateral spinules at mid-length; Re2 with very fine spinules proximal to groove.

Remarks. The original descriptions of the female and male were brief and the drawings incomplete. The above redescription allows for easy species determination based on the following. (1) Female Ur1–2 lack posterior scale rows. (2) Male P5 right Re1 distolateral spiniform process equal in length to Re2. (3) Male P5 right Re2 Se equal in length to Re3. (4) Male right Ri lateral branch with only 4 to 5 spinules at apex. Sewell (1932), after examining collections in the Indian Museum, Calcutta from the R/V Investigator (station number 616), reported *P. salinus* from the Nicobar Islands. His identification of that material was incorrect and the distribution of *P. salinus* is restricted to the Red Sea region and possibly the Mediterranean Sea, though it is not yet confirmed from the latter locality.

Pseudodiaptomus arabicus n.sp. Fig. 2

Pseudodiaptomus marinus Sato, 1913, Michel and Herring, 1984, pp. 328–329.

Pseudodiaptomus salinus (Giesbrecht, 1896), Michel et al., 1986a, p. 21; Michel et al., 1986b, p. 65; Walter, 1986b, pp. 504–505.

Material examined. Indian Ocean, Arabian Gulf, Persian Gulf, Kuwait Bay, R/V Oloum I, Cr. Nr. 8, Sta. Nr. 10, 29°25'N, 047°50'E, Aug. 1980. Holotype USNM 264694 (male), Allotype USNM 283101 (female), Paratypes USNM 233620, 100♂, 100♀; Pakistan, Karachi, Manora Channel, 6♂, 11♀, 18 Dec. 1969, coll. by R. Richman, BM 1970.9.4.1 (see Table 1).

Female. Pdg5 posterior margin lined with fine setae, one long seta on each side of Ur insertion and posterior corners directed posteriorly (Fig. 2A). Ur1 asymmetrical, swollen medially, right proximolateral slightly larger with dense spinule patch, three surface spinule rows extending laterally and two posterior dorsal setae, posterior margin with incomplete dorsal scale row (Fig. 2A–C). Ur2 almost equal in length to Ur3 with posterior dorsal scale row. Ur3 with dorsal scale row, Pakistan material with proximolateral spinule patch on each side (Fig. 2A,C) not present in Kuwait material (Fig. 2B). Ur1–4 and CR in proportions of 25 : 20 : 20 : 14 : 21 (Kuwait), and 24 : 19 : 22 : 14 : 21 (Pakistan). P5 posterior view (Fig. 2F): B1 with few small anterior surface spinules; B2 distolateral corners with 5–8 fine spinules, Re1 lateral surface heavily spinulated.

Male. Pdg5 posterior corners small directed posteriorly (Fig. 2D). Ur1–5 and CR in proportions of 11 : 21 : 19 : 17 : 13 : 19 (Kuwait), and 11 : 22 : 18 : 18 : 11 : 20 (Pakistan). P5 posterior view (Fig. 2G). Right leg: B2 surface groove lined with very fine spinules; Re1 distolateral corner produced into short spiniform process approximate one-third the length of Re2; Re2 Se hirsute, one-half the length of Re3. Left leg: Re1 Se small extending only halfway to base of Re2 Se; Re2 medial margin notched near mid-length, lateral margin gradually narrows from mid-length to distal apex. Anterior view (Fig. 2H). Right leg: Ri bifid, both branches simple, medial with terminal setae longer than lateral, lateral branch distally rounded and heavily spinulated. Left leg: Ri elongate, slightly swollen after

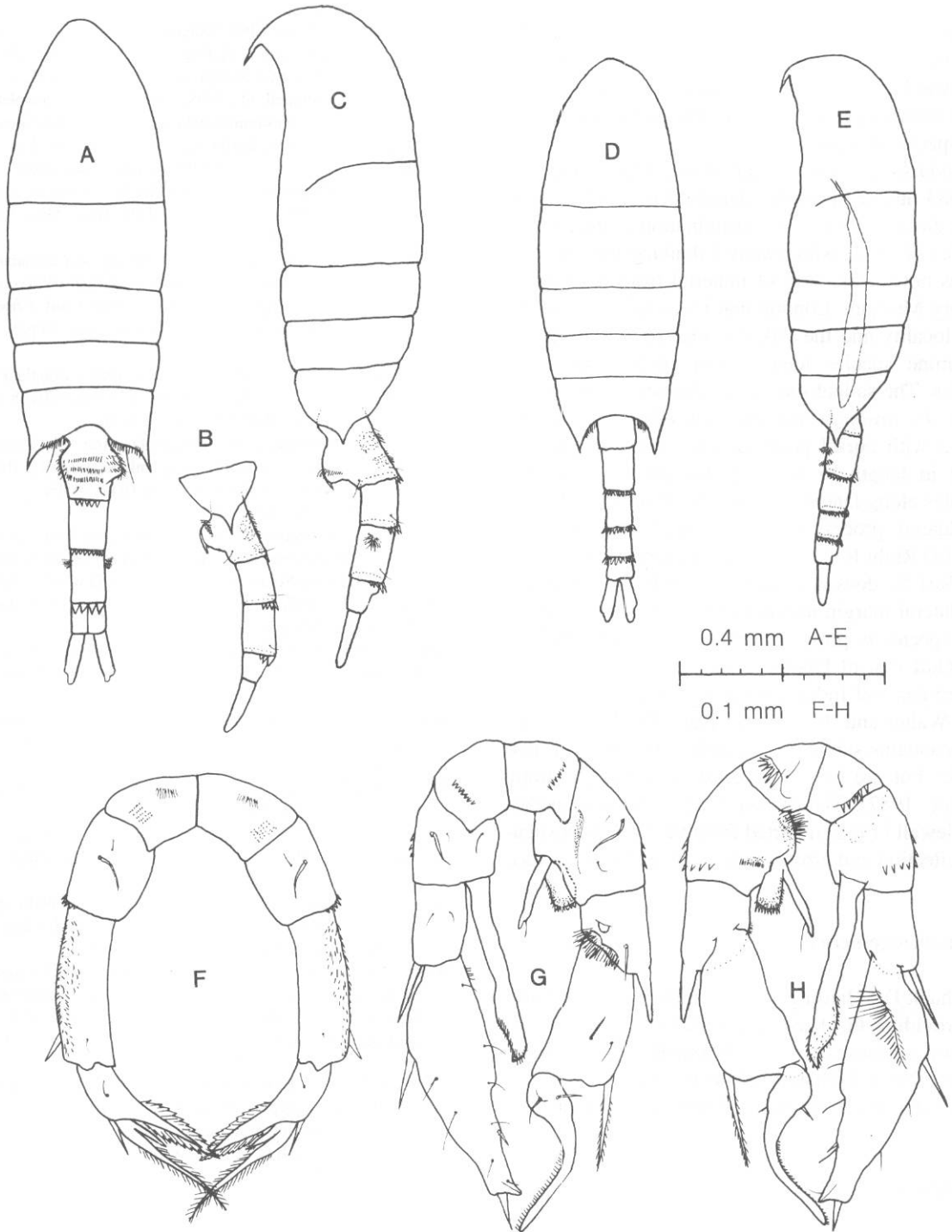


Fig. 2. *Pseudodiaptomus arabicus* n.sp. A, B, C, F, adult female: (A) Pakistan material, dorsal view complete habitus; (B) Kuwait material, left lateral view Pdg5 and urosome; (C) Pakistan material, left lateral view complete habitus; (F) P5 posterior view, B1 with dotted lines indicate anterior spinules. D, E, G, H, adult male: (D) dorsal view complete habitus; (E) left lateral view complete habitus; (G) P5 posterior view; (H) P5 anterior view.

mid-length with distal tip curved slightly laterally with very fine lateral spinules.

Etymology. The specific name *arabicus* is derived from Latin, and refers to the Arabian Sea where this species was found.

Remarks. I examined the above Kuwait material in 1983 and erroneously identified it as *P. salinus*. Later during a review and examination of the African species of *Pseudodiaptomus* I doubted this identity. It was not till the loan of material from the Natural History Museum, London that I was able to compare type locality and the Pakistan material to accurately determine species identity and confirm this new species. The salient diagnostic characters that distinguish *P. arabicus* are the following. (1) Female Ur1–2 with dorsal posterior scale row, Ur2 almost equal in length to Re3. (2) Female P5 Re1 with spinules along lateral margins. (3) Male P5 right Re1 distolateral process short, one-third the length of Re2. (4) Right Re2 Se one-half the length of Re3. (5) Left Re1 Se does not reach base of Re2 Se. (6) Left Re2 lateral margin narrows after mid-length to apex. This species is presently known only from the Persian Gulf east of Pakistan, but probably reaches the eastern coast of India. Two other congeners *P. pacificus* Walter and *P. cornutus* Nicholls also from the ‘serricaudatus-subgroup’ resemble the present two species but are from Southeast Asia and Australia (Walter, 1987). The former is probably the species that Sewell (1932) reported from the R/V Investigator collection and erroneously assigned to *P. salinus*.

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