Aust. J. Mar. Freshw. Res., 1987, **38**, 363–96

Review of the Taxonomy and Distribution of the Demersal Copepod Genus *Pseudodiaptomus* (Calanoida : Pseudodiaptomidae) from Southern Indo-West Pacific Waters

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Abstract

The coastal demersal copepod *Pseudodiaptomus* has been repeatedly reported from Australian and surrounding southern Indo-West Pacific waters. At present, 13 species are known from this region, five of which are new: *P. australiensis*, *P. griggae*, *P. hypersalinus*, *P. inflexus* and *P. occidentalus*. These 13 species are representative of four species groups. Several of these species have been previously misidentified and are herein synonymized with the new species. The zoogeography of these species is discussed and a key is presented.

Introduction

Several taxonomic studies dealing with coastal calanoid copepods from Australia have reported the occurrence of *Pseudodiaptomus* (Nicholls 1944; Bayly 1966; Grigg 1972; Greenwood 1977). These and several ecological studies (Bayly 1965, 1975; Robertson and Howard 1978; Greenwood 1981, 1982) have contributed to understanding the distribution and systematics of these demersal copepods. Demersal copepods remain near, on, or in the bottom substrates during the day, but emerge to swim freely between dusk and dawn or even on heavily overcast days.

Typically, pseudodiaptomids are found in shallow coastal waters (0·5–15 m) over sand or grass flats, coral reefs and rubble, and mud bottoms of river mouths. Given their coastal distribution they are very euryhaline, with species worldwide found in fresh, brackish, marine or hypersaline waters.

Traditional plankton tows typically underestimate the relative abundance and importance of demersal copepods in coastal waters. Recent plankton studies around coral reefs using light traps, emergence traps and diver-towed nets at night have produced new information on the abundance and distribution of these copepods (Sale *et al.* 1976, 1978; Alldredge and King 1977; McWilliam *et al.* 1981; Ohlhorst 1982; Walter *et al.* 1982; Alldredge 1985). The shallow-water demersal nature of *Pseudodiaptomus* and the extensive island network throughout the Indo-Pacific region are conducive to geographical isolation of species. This isolation tends to limit the distribution of species and makes study of these animals difficult.

The genus *Pseudodiaptomus* presently consists of 72 species, including the five new species described here. These have been divided by Walter (1986*a*, 1986*b*) into seven species groups, eight subgroups and one unassigned group of species. These species groups were

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determined primarily on the structure of the male and female P5,* and are supported by other morphological features and geographical distributions. As discussed by Walter (1986*b*) numerous attempts have been made by researchers to divide this genus into species groups, most recently by Pillai (1980) and Grindley (1984).

Structure Features

The first antennae of pseudodiaptomids belong to one of two basic types (Fig. 1). Several species groups (Hyalinus, Americanus and Lobus) possess the type (Figs 1*A*, 1*B*) which has female A1 with 21 segments, right male A1 geniculate with 20 segments (terminal 2 fused) and left male A1 with 22 segments. The other A1 type, which has female and left

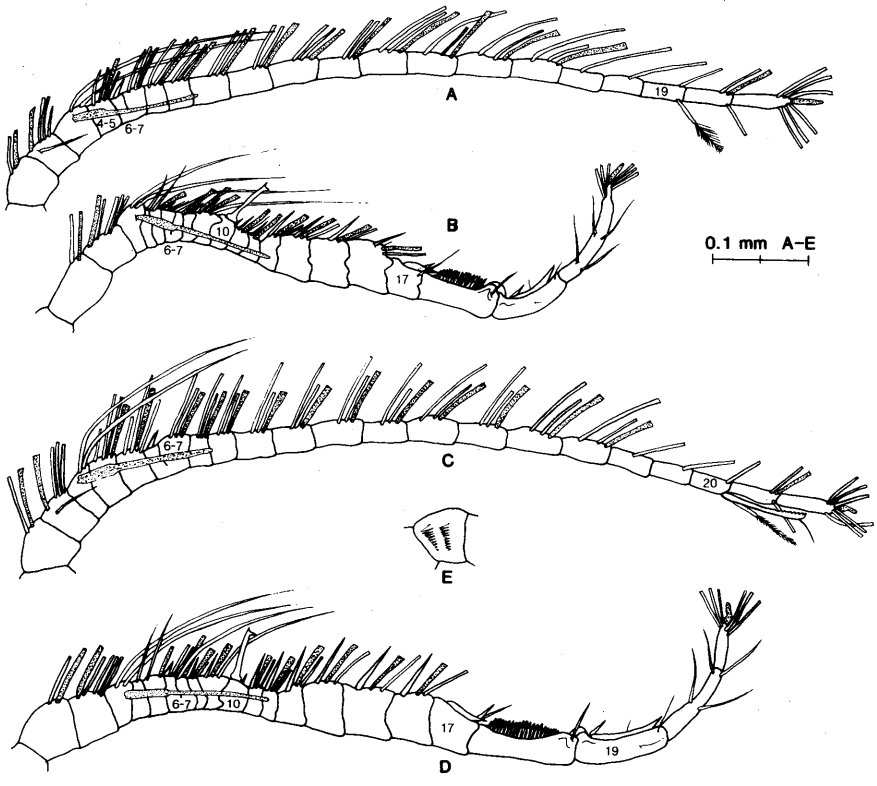

Fig. 1. General segmentation of A1 for *Pseudodiaptomus*. *A*, female A1 with 21 segments; *B*, male A1 with 20 segments; *C*, female A1 with 22 segments; *D*, male A1 with 21 segments; *E*, ventral surface of segment 1 showing spinules.

male A1 with 22 segments and right male A1 with 21 segments (Figs 1*C*, 1*D*), is found in the Improcerus, Nudus, Ramosus and Burckhardti groups. The latter species groups possess a modified barbed seta on the antepenultimate segment of female and left male A1, while this seta is lacking in the former groups and *P. gracilis* of the Nudus group.

**Abbreviations:* A1 = first antenna; P1–P5 = first-fifth swimming legs; Pdg1–5 = pedigers 1–5; Pr = prosome; Ur = urosome; Ur1–5 = urosome segments 1–5; CR = caudal ramus; B1–B2 = basipods 1–2; Re = exopod; Ri = endopod; Se = outer spine; St = terminal spine; Hyp = hyaline plate; Sp = spermatophore; USNM = United States National Museum; AMS = Australian Museum, Sydney; SAM = South Australian Museum.

The rest of the mouthparts and swimming legs of pseudodiaptomids are basically identical among the members of the genus, and were reviewed by Walter (1984, 1986*b*). The following P5 characters are common for all males and females studied and will not be repeated in the descriptions.

Female P5, posterior view. Both legs (3 Re segments): B1 usually with 1 very small surface seta. B2 with 1 large and 1 small surface seta. Rel with distal Se and 2 surface setae. Re2 with 1 surface seta, medially produced into a spiniform process, and plumose or spinulose along both margins of process; Se small, naked or plumose. Re3 with small proximomedial spiniform process, distally produced and pointed with both margins hirsute, and usually equal in length to or longer than Re2 spiniform process.

Male P5, posterior view. Right leg (3 Re segments): B1 with 1–3 spinule rows. B2 with 1 large plumose seta and at least 1 small surface seta. Rel–Re3 each with at least 1 small surface seta; Rel and Re2 with variably shaped Se, and Re3 proximally thickened with medial basal swelling or process, concavely produced, and medial margin hirsute. Left leg (2 Re segments): B1 same; B2 same with or without Ri. Rel with at least 1 surface seta and variably shaped Se. Re2 with several surface setae, usually with Se near midlength, and typically with a St. *Anterior view.* Right leg: B1 with hair or spinule row. B2 with lateral spinule row that continues onto surface at midlength, and usually with Ri. Left leg: B1 and B2 with same spinule ornamentation.

Lengths of prosome and urosome were taken dorsally from anterior margin of head to posterior end of Pdg5, and from anterior margin of Ur1 to distal tip of CR. Measurements are in millimetres. Since Pdg5 usually overlaps Ur, total length may be less than combined lengths of Pr and Ur. Female Ur1–3 with posterodorsal spine rows that extend partly laterad. Ventral surface of Ur1 usually with fringe of spinules anterior to genital boss, genital opening protected by a pair of spines, flaps, or valves. The male Ur2–4 typically with spine rows that are complete; in some species a partial spine row is present on Ur1. There are 6 terminal setae on each CR; 1 placed laterally, 4 posteriorly, and 1 small seta mediodorsally. In the female the second medial CR seta is usually twice the length of the other setae; in the male the third medial CR seta is usually the longest.

Species Groups

Pseudodiaptomids from Australian and southern Indo-West Pacific waters are representative of four species groups: Nudus, Lobus, Hyalinus and Ramosus (Table 1). Characteristics of these four groups are: Nudus, male P5 lacks left and right Ri; Lobus, male P5 with simple right Ri and large medial projection on left B2; Hyalinus, male P5 with only right Ri and hyaline plate on left Re2; Ramosus, male P5 with left and right Ri, the right Ri variably branched. The following key is for the identification of the 13 species of *Pseudodiaptomus* known from Australia, Papua New Guinea and eastern Indonesia.

Key to Species of the Genus *Pseudodiaptomus* from Australia, Papua New Guinea and Indonesia

1. Male P5 left Ri absent 2
   Male P5 left Ri present 6
2. Male P5 right Ri absent; female P5 B2 with pair of spines on distomedial corner ... *P. clevei*
   Male P5 right Ri variably forked and left Re2 with hyaline plate; female P5 B2 and Rel usually with rows of spinules on lateral margins 3
3. Pdg4–5 partly fused ..... *P. mertoni*
   Pdg4–5 completely fused 4
4. Male P5 right Ri with 2 points 5
   Male P5 right Ri with 3 points ..... *P. occidentalus*
5. Male P5 right Rel with 4 spiniform processes, left Re2 hyaline plate complete ..... *P. griggae*
   Male P5 right Rel with 2 spiniform processes, left Re2 hyaline plate incised ..... *P. baylyi*

6. Male and female Pdg5 corners rounded and lacking wings; female Ur1 with pair of large lateral spines ..... *P. annandalei*
   Male and female Pdg5 with wings; female Ur1 without lateral spines 7
7. Pdg1 with posterodorsal pair of fleshy knobs 8
   Pdg1 without posterodorsal knobs 9
8. Male P5 left Ri lobate and reduced, right Ri medial branch incised at apex, with lateral branch digitiform ..... *P. galleti*
   Male P5 left Ri elongate, right Ri medial branch with pointed apex, and equal in length to lateral branch ..... *P. cornutus*
   Male P5 left Ri elongate, right Ri medial branch with blunt apex, and 2× longer than lateral branch ..... *P. pacificus*
9. Male P5 right Re1 Se bifid; female P5 B2 with few spinules at distolateral corner 10
   Male P5 right Re1 Se not bifid; female P5 B2 without distolateral spinules 11
10. Male P5 right Ri lateral branch apex with 4 stout toothlike points ..... *P. australiensis*
    Male P5 right Ri lateral branch apex with pair of small, fine bifid points separated by a gap ..... *P. hypersalinus*
11. Male P5 right Rel Se bent medially 90° at midlength, left Ri strongly curved, with bifid and sclerotized apex ..... *P. inflexus*
    Male P5 right Rel Se straight with slight medial curve near apex, left Ri elongate, slightly curved with simple pointed apex ..... *P. colefaxi*

The five new species *P. griggae*, *P. occidentalus*, *P. australiensis*, *P. hypersalinus*, and *P. inflexus* presented here correspond to *Pseudodiaptomus* spp. 1–5 respectively, as presented in Walter (1986*b*, Table 1). In addition, the Ramosus species group (Table 1) is amended to reflect a change in subgroup names. The *hickmani* (7A) and *serricaudatus* (7B) subgroups were previously reported as the *serricaudatus* and *salinus* subgroups, respectively (Walter 1986*a*, 1986*b*). This change is subgroup names is needed as I unfortunately had not previously examined *P. serricaudatus* and erronously placed it in the 7A subgroup. For the sake of convenience and to provide a standard reference, the most senior member of each subgroup provides the subgroup name.

Table 1. *Pseudodiaptomus* species groups and species subgroups assemblages
IP, Indo-Pacific species; A, African species; B, North and/or South American species; F, reported from freshwater habitats; S, *Schmackeria* according to Marsh (1933); U, specimens deposited at USNM; X, previously reported only once in literature; O, only female reported in the literature

Groups, subgroups and species	IP	A	B	F	S	U	X	O
(1) Nudus group								
(1) *P. clevei* Scott, 1909	+	–	–	–	–	+	–	–
(2) *P. gracilis* (Dahl, 1894)	–	–	+	+	–	+	–	–
(2) Americanus group								
(A) '*acutus*-subgroup'								
(3) *P. acutus* (Dahl, 1894)	–	–	+	–	–	+	–	–
(4) *P. acutus leptopus* Loeffler, 1963	–	–	+	–	–	–	–	–
(5) *P. galapagensis* Grice, 1964	–	–	+	–	–	+	–	–
(6) *P. richardi* (Dahl, 1894)	–	–	+	+	–	+	–	–
(7) *P. richardi inequalis* (Brian, 1926)	–	–	+	+	–	–	+	–
(8) *P. wrighti* Johnson, 1964	–	–	+	–	–	+	+	–
(B) '*pelagicus*-group'								
(9) *P. americanus* Wright, 1937	–	–	+	–	–	–	+	–
(10) *P. cokeri* Gonzalez & Bowman, 1965	–	–	+	–	–	+	–	–
(11) *P. cristobalensis* Marsh, 1913	–	–	+	–	–	–	–	–
(12) *P. culebrensis* Marsh, 1913	–	–	+	–	–	–	–	–
(13) *P. euryhalinus* Johnson, 1939	–	–	+	–	–	+	–	–
(14) *P. marshi* Wright, 1936	–	–	+	–	–	+	+	–
(15) *P. pelagicus* Herrick, 1884 [=*P. coronatus* Williams, 1906]	–	–	+	–	–	+	+	–

Table 1 (*continued*)

Groups, subgroups and species	IP	A	B	F	S	U	X	O
(3) Burckhardti group								
(16) *P. burckhardti* Sewell, 1932	+	–	–	–	–	+	–	–
(4) Improcerus group								
(17) *P. andamanensis* Pillai, 1980	+	–	–	–	–	–	–	–
(18) *P. batillipes* Brehm, 1954	–	+	–	–	–	–	+	–
(19) *P. hessei* (Mrazek, 1894)	–	+	–	–	–	+	–	–
(20) *P. ornatus* (Rose, 1957)	+	–	–	–	–	+	–	+
(21) *P. pauliani* Brehm, 1951	–	+	–	–	–	–	+	–
(22) *P. stuhlmanni* (Poppe & Mrazek, 1895) [=*P. charteri* Grindley, 1963]	–	+	–	–	–	+	+	–
(23) *P. trispinosus* Walter, 1986	+	–	–	–	–	+	–	–
(5) Lobus group								
(A) '*forbesi*-subgroup'								
(24) *P. annandalei* Sewell, 1919	+	–	–	+	+	+	–	–
(25) *P. binghami* Sewell, 1912	+	–	–	+	+	+	–	–
(26) *P. binghami malayalus* Wellershaus, 1969	+	–	–	+	–	+	–	–
(27) *P. brehmi* Keifer, 1938	+	–	–	+	–	–	+	–
(28) *P. bulbosus* (Shen & Tai, 1964)	+	–	–	+	–	–	+	–
(29) *P. forbesi* (Poppe & Richard, 1890)	+	–	–	+	+	+	–	–
(30) *P. inflatus* (Shen & Tai, 1964)	+	–	–	+	–	–	+	–
(31) *P. inopinus* Burckhardt, 1913	+	–	–	+	+	–	–	–
(32) *P. inopinus saccupodus* (Shen & Tai, 1962)	+	–	–	+	–	+	+	–
(33) *P. lobipes* Gurney, 1907	+	–	–	+	+	–	–	–
(34) *P. poplesia* (Shen, 1955)	+	–	–	+	–	+	–	–
(35) *P. spatulatus* (Shen & Tai, 1964)	+	–	–	+	–	–	+	–
(B) '*poppei*-subgroup'								
(36) *P. poppei* Stingelin, 1900	+	–	–	+	+	–	+	–
(37) *P. smithi* Wright, 1928	+	–	–	+	+	+	+	–
(38) *P. tollingerae* Sewell, 1919	+	–	–	+	+	+	–	–
(6) Hyalinus group								
(A) '*aurivilli*-subgroup'								
(39) *P. aurivilli* Cleve, 1901	+	–	–	–	–	+	–	–
(40) *P. bowmani* Walter, 1984	+	–	–	–	–	+	–	–
(41) *P. compactus* Walter, 1984[B]	+	–	–	–	–	–	–	–
(42) *P. mertoni* Früchtl, 1923[A]	+	–	–	–	–	+	–	–
(B) '*trihamatus*-subgroup'								
(43) *P. baylyi* Walter, 1984[A]	+	–	–	–	–	+	–	–
(44) *P. bispinosus* Walter, 1984	+	–	–	–	–	+	–	–
(45) *P. dauglishi* Sewell, 1932 [=*P. beieri* Brehm, 1951]	+	–	–	+	–	+	–	–
(46) *P. griggae*, sp. nov.[A]	+	–	–	–	–	+	–	–
(47) *P. incisus* Shen & Lee, 1963	+	–	–	–	–	–	+	–
(48) *P. occidentalus*, sp. nov.[A]	+	–	–	–	–	+	–	–
(49) *P. sewelli* Walter, 1984[B]	+	–	–	–	–	+	–	–
(50) *P. trihamatus* Wright, 1937	+	–	–	–	–	+	–	–
(7) Ramosus group								
(A) '*hickmani*-subgroup'								
(51) *P. ardjuna* Brehm, 1953	+	–	–	–	–	+	–	–
(52) *P. australiensis*, sp. nov.	+	–	–	–	–	+	–	–
(53) *P. hickmani* Sewell, 1912	+	–	–	+	–	+	–	–
(54) *P. hypersalinus*, sp. nov.[A]	+	–	–	–	–	+	–	–
(55) *P. ishigakiensis* Nishida, 1985	+	–	–	–	–	+	–	–
(56) *P. jonesi* Pillai, 1970	+	–	–	–	–	+	–	–
(57) *P. marinus* Sato, 1913	+	–	–	–	–	+	–	–
(58) *P. philippinensis* Walter, 1986	+	–	–	–	–	+	–	–

Table 1 (*continued*)

Groups, subgroups and species	IP	A	B	F	S	U	X	O
(B) '*serricaudatus*-subgroup'								
(59) *P. caritus* Walter, 1986	+	–	–	–	–	+	–	–
(60) *P. colefaxi* Bayly, 1966[A]	+	–	–	–	–	+	–	–
(61) *P. cornutus* Nicholls, 1944[A]	+	–	–	–	–	+	–	–
(62) *P. diadelus* Walter, 1986	+	–	–	–	–	+	–	–
(63) *P. galleti* (Rose, 1957)[A]	+	–	–	–	–	+	–	–
(64) *P. inflexus*, sp. nov.[A]	+	–	–	–	–	+	–	–
(65) *P. nihonkaiensis* Hirakawa, 1983	+	–	–	–	–	+	–	–
(66) *P. pacificus* Walter, 1986[A]	+	–	–	–	–	+	–	–
(67) *P. salinus* (Giesbrecht, 1896)	+	–	–	–	–	+	–	–
(68) *P. serricaudatus* (T. Scott, 1894) [=*P. nudus* Tanaka, 1960]	+	–	–	–	+	+	–	–
(8) Unassigned species								
(69) *P. bulbiferus* (Rose, 1957)	+	–	–	–	–	–	–	+
(70) *P. heterothrix* Brehm, 1953	+	–	–	–	–	–	+	–
(71) *P. masoni* Sewell, 1932	+	–	–	–	–	–	–	+
(72) *P. nankauriensis* Roy, 1977	+	–	–	–	–	–	–	+

[A] Deposited at the Australian Museum, Sydney.
[B] Deposited at the University of Kiel.

Taxonomy

Pseudodiaptomus mertoni Früchtl

(Fig. 2*A–H*)

Pseudodiaptomus mertoni Früchtl, 1923, pp. 455–6, pl. 26, figs 23–4; 1924, pp. 49–53, figs 31–6. Brehm 1934, pp. 88, 93, fig. 1*a–b*. Bayly 1966, pp. 55–6, figs 2*g–i*, 3*e–f*; 1975, table 1. Grigg 1972, pp. 82–3, figs 31*c–d*, 33*a–e*. Greenwood 1977, p. 66; 1981, pp. 591–5; 1982, p. 58. Walter 1984*a*, pp. 374–5, fig. 3*A*.
Pseudodiaptomus sp. 3. Bayly 1965, pp. 327–8.
[?]*Pseudodiaptomus aurivilli*. Scott 1909, p. 116.
[?]*Pseudodiaptomus mertoni*. Goswami 1983, pp. 254–7.

Material Examined

Queensland: Calliope River estuary, Port Curtis, 23°51'S., 3.iii.1983, oblique plankton tow, 11 males, 7 females, USNM 213267; 1 male, 1 female, AMS P35506; coll. by J. G. Greenwood.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	8	1·10–1·30	1·18	0·84	0·43	2·0 : 1
Male	12	0·91–0·93	0·92	0·66	0·34	1·9 : 1

Description

Female (Fig. 2*A–C*). Head and Pdg1 fused, posterodorsal margin of Pdg1 thickened. Pdg4–5 partly fused; wings very divergent. P1 B2 with lateral spinule row. Ur1 dorsally indented near midlength with fine anterolateral spinule patch; genital boss small with very small genital flaps (not spines). CR about 6× longer than wide. Ur segments and CR in the proportions 26 : 14 : 16 : 10 : 34 = 100. A1 with 21 segments, lacking modified barbed seta on antepenultimate segment (Fig. 1*A*). P5 (Fig. 2*C*): B2 with flared proximomedial corners. B2 and Re1 with spinule rows on lateral margins. Re2 with proximomedial tuft of hairs. Re3 more than twice length of Re2.

Male (Fig. 2*D–H*). Head and Pdg1 fused. Pdg4–5 partly fused. Ur2 with ventral spinule row. CR 2·5× longer than wide. Ur segments and CR in the proportions 14 : 21 : 21 : 16 : 12 : 16 = 100. Right A1 with 20 segments (Fig. 1*B*). P5 posterior view (Fig. 2*F*): right leg, B1 distomedial corner bifid, medial point longer than lateral. B2 with seta at distolateral corner. Re1 laterally produced into 2 processes, the more lateral with seta at

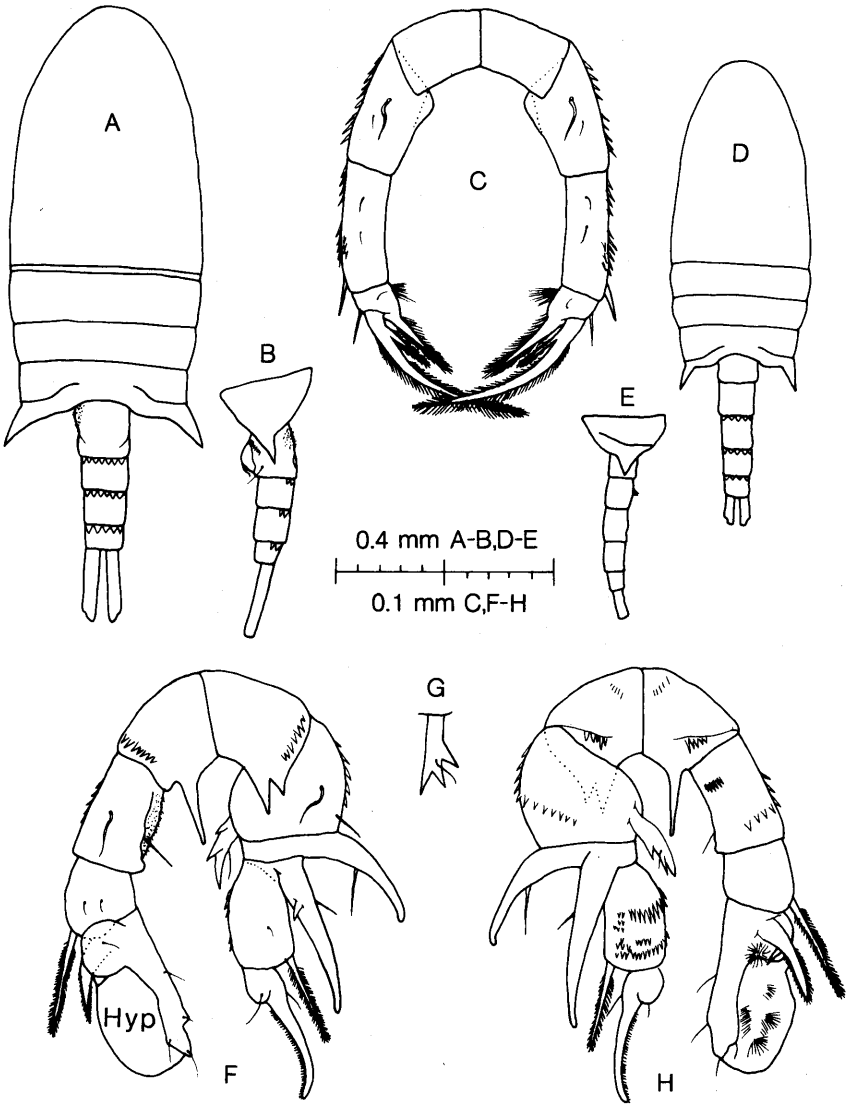

Fig. 2. *Pseudodiaptomus mertoni* Früchtl. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Ur left side; *C*, posterior view of P5. *D–H*, adult male: *D*, dorsal view; *E*, lateral view of Ur right side; *F*, posterior view of P5; *G*, lateral view of right Ri; *H*, anterior view of P5.

midlength, the more medial longer with small seta and proximomedial spine. Re2 with plumose Se. Re3 with small rounded basal knob. Left leg, B1 distomedial corner with long spiniform process. B2 with medial raised surface, fine hairs lining groove and one large setae. Re1 with 2 surface setae and long plumose Se. Re2 proximolateral corner swollen and

circular, hyaline plate rounded along lateral margin and 5 surface setae. Anterior view (Fig. 2*H*): right leg, B1 with surface spinules. B2 Ri laterally compressed with 3 points, 1 at midlength and 2 at apex (Fig. 2*G*). Re2 with surface spinule arrangement that extends to medial margin. Left leg, B1 same. B2 with short spinule row near proximomedial corner. Re2 with scattered fine hairs on hyaline process, small circular patch of hairs near 2 proximolateral spines; 1 long, hirsute and posterolaterally directed, the other short and medially directed.

Remarks

A recent study on *Pseudodiaptomus* (Walter 1984*a*) attempted to clarify the status of *P. mertoni* and *P. aurivilli*. These two closely related species, plus *P. trihamatus* and five new species, were incorporated into the Hyalinus species group. Unfortunately, no specimens of *P. mertoni* were available for comparison at the time of that study and conclusions about this species were drawn from the literature. Früchtl (1924) differentiated his new species *P. mertoni* from *P. aurivilli* based on (*a*) the absence of ventral spines at female genital opening, (*b*) long spiniform process on left B1 of male P5, and (*c*) length of CR setae. Since Früchtl's study, Walter (1984*a*) determined that the CR setae length and female P5 have proved ineffective in accurately determining species within this genus.

The present material agrees with Früchtl's description and illustrations of *P. mertoni* with the following amendments: (1) Pdg4–5 are partly fused; (2) female Ur1 possesses a posterodorsal spine row; and (3) the dense goatee of felt-like hair on female genital boss actually represents the genital flaps. At present, of all the members in the Hyalinus species group only *P. mertoni* lacks the pair of ventral spines on female Ur1. I mistakenly reported (Walter 1984, p. 375) that the absence of ventral spines effectively eliminated assigning this female to the Hyalinus group and that therefore Früchtl's male and female could not be conspecific. However, examination of the present material has convinced me that Früchtl's association of the pair was correct.

P. mertoni, originally collected by Früchtl (1923) from the Aru Archipelago between Wokam and Udjir Islands (Fig. 15), was reported later from the Australian coast (Bayly 1966; Greenwood 1977). The closely related species *P. aurivilli* has been reported from the Malay Archipelago (Cleve 1901), Sri Lanka (Thompson and Scott 1903), Philippines (Walter 1984) and China (Walter, unpublished data). In addition, *P. aurivilli* was reported from several localities along the Indonesian Archipelago (Scott 1909) from Kangean to Seram (Fig. 15). Regrettably, Scott did not provide figures or an adequate description of the species, and based on locality I feel that Scott more likely had *P. mertoni* than *P. aurivilli*. Both species have been erroneously reported along the coasts of India. It is now known that *P. mertoni* is replaced on the Indian subcontinent by *P. compactus* and *P. bowmani* (Walter 1984).

From this study it now appears that *P. mertoni* is confined to the eastern regions of Indonesia, Papua New Guinea and northern Australia. Within Australian waters the known range is from Townsville south to Brisbane, Queensland. Further studies are needed to determine if *P. mertoni* and *P. aurivilli* co-occur along the Indonesian Archipelago.

Pseudodiaptomus baylyi Walter

(Fig. 3*A–I*)

Pseudodiaptomus baylyi Walter 1984, pp. 387–9, fig. 8*A–J*.
Pseudodiaptomus cf. *P. aurivilli*. Bayly 1966, pp. 54–5, figs 2*d–f*, 3*c–d*.
Pseudodiaptomus aurivilli. Grigg 1972, pp. 80–2, fig. 31*a–b*, 32*a–e*. Bayly 1975, table 1. Greenwood 1977, pp. 64–5.
Pseudodiaptomus sp. 2. Bayly 1965, pp. 325, 327.

Material Examined

Northern Territory: East Point, Darwin, 22.viii.1982, algal washings, 1 male holotype (P5 on slide) USNM 210669, 1 female allotype (P5 on slide) USNM 210670; coll. by J. L. Barnard. **Queensland:**

Townsville, Alligator Creek, 18.ix.1982, epidemersal sled in mangrove estuary, 3 males, 40 females, USNM 216771; 2 males, 2 females, AMS P35505; coll. by R. Hartwick. Calliope River Estuary, Port Curtis, 23°15'S., 3.iii.1983, oblique plankton tow, 10 males, 11 females, USNM 213266; coll. by J. G. Greenwood.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	20	1·15–1·20	1·18	0·82	0·45	1·8 : 1
Male	11	0·93–0·95	0·95	0·65	0·35	1·9 : 1

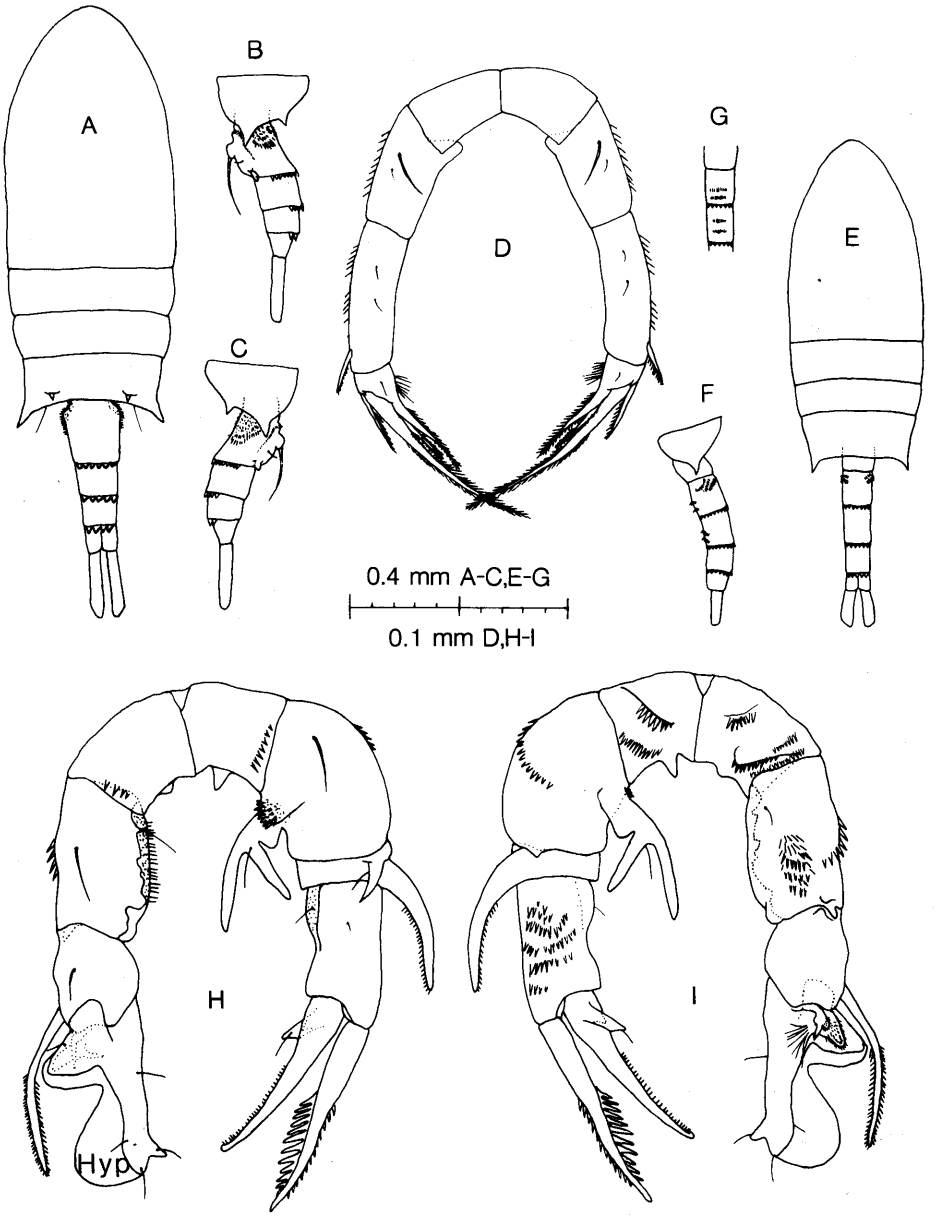

Fig. 3. *Pseudodiaptomus baylyi* Walter. *A–D*, adult female: *A*, dorsal view; *B*, lateral view of Ur left side; *C*, lateral view of Ur right side; *D*, posterior view of P5. *E–I*, adult male: *E*, dorsal view; *F*, lateral view of Ur left side; *G*, ventral view of Ur1–3; *H*, posterior view of P5; *I*, anterior view of P5.

Description

The following are salient diagnostic features of *P. baylyi*; for a complete description of the species see Walter (1984).

Female (Fig. 3*A–D*). Head and Pdg1 fused. Pdg4–5 fused with additional pair of small posterodorsal spines. P1 B2 with lateral spinule row. Ur1 with small process on each posteroventral corner and genital boss guarded by pair of long stout spines. CR about 6 times longer than wide. Ur segments and CR in proportions 30 : 14 : 14 : 12 : 30 = 100. A1 with 21 segments (Fig. 1*A*). P5 (Fig. 3*D*): B2 and Re1 with lateral spinule rows. Re2 more than half length of Re3 with medial tuft of fine hairs.

Male (Fig. 3*E–I*). Head and Pdg1 fused. Pdg4–5 fused. CR 3 times longer than wide. Ur segments and CR in proportions 13 : 20 : 22 : 15 : 8 : 22 = 100. Right A1 with 20 segments (Fig. 1*B*). P5 posterior view (Fig. 2*H*): right leg, B1 with small medial projection. Re1 produced into 2 spiniform processes; the smaller medially directed process with seta is shorter than the medially hirsute distolateral process. Re2 with large Se strongly serrate on medial margin and weakly serrate on lateral. Left leg, B2 medially sculptured with fine hairs along groove. Re2 proximolateral lobe overlaps Re1, lateral hyaline plate deeply incised. P5 anterior view (Fig. 3*I*): right leg, Ri of B2 with small triangular knob, distally bifid at midlength, with terminal point the longest. Left leg, Re2 with irregularly shaped hirsute spiniform process at proximolateral corner.

Remarks

P. baylyi was recognized as new by Bayly (1965) but not given full species status until Walter (1984) placed it in the Hyalinus species group and the *trihamatus* subgroup. Amendments to the original description (Walter 1984, fig. *I–J*) of the male P5 of *P. baylyi* are: (*a*) posterior surface with small curved medial spine arising from right Re1 not B2 and (*b*) anterior surface of B1 with additional spinulation. *P. baylyi* is most similar to *P. trihamatus* and *P. occidentalus*, sp. nov. It is distinguished from the former by (*a*) male P5 right Ri has 2 subequal branches and lacks palmate spinule cluster at base; (*b*) right Re2 has coarsely serrate Se; (*c*) left B1 and B2 distomedial corners without spiniform processes; (*d*) female Ur1 lacks large posterodorsal pair of spines. The main difference between the present species and *P. occidentalus* is that in the latter the male P5 right Ri possesses 2 rather than 3 points.

Distribution of *P. baylyi* appears to be confined to the north-eastern coasts of Australia from Northern Territory south to Moreton Bay, Qld. It would not be surprising if the range of this species extends to Papua New Guinea.

Pseudodiaptomus colefaxi Bayly

(Fig. 4*A–G*)

Pseudodiaptomus colefaxi Bayly 1966, pp. 49–54, figs 1*a–f*, 2*a–c*; 1975, table 1. Greenwood 1977, p. 65; 1981, pp. 591–5; 1982, pp. 56–7.
Pseudodiaptomus sp. 1. Bayly 1965, pp. 325, 327.
Pseudodiaptomus hickmani Sewell (Sydney variety). Dakin and Colefax 1940, p. 89, fig. 107*a–f*.

Material Examined

Queensland: Brisbane River, July 1960, surface plankton tow, 9 males, 9 females, USNM 213980; coll. by I. A. E. Bayly. **New South Wales:** Hunter River, collector and date unknown, 8 males, 8 females, paratypes, AMS P15024–5. **Victoria:** Rhyll, Westernport Bay, 5.x.1983, surface plankton tow, 14 males, 16 females, USNM 213982; coll. by D. McKinnon.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	12	1·28–1·30	1·29	0·90	0·49	1·8 : 1
Male	12	1·12–1·15	1·14	0·78	0·40	1·9 : 1

Description

Bayly (1966) provides a complete description of the species; the following are amendments to his description (Fig. 4*A–G*).

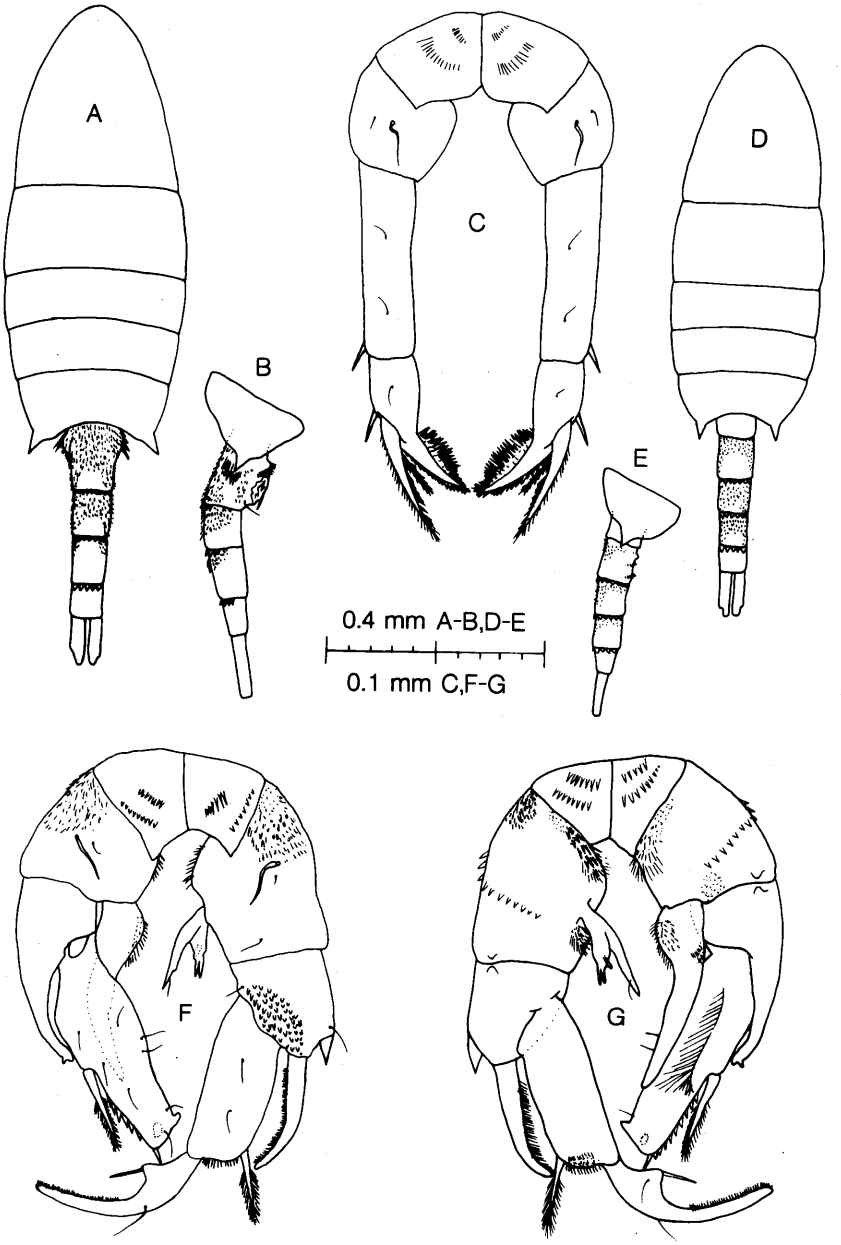

Fig. 4. *Pseudodiaptomus colefaxi* Bayly. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Ur right side; *C*, posterior view of P5. *D–G*, adult male: *D*, dorsal view; *E*, lateral view of Ur right side; *F*, posterior view of P5; *G*, anterior view of P5.

Female Ur1–3 and male Ur2–4 with large areas of fine spinules on dorsal and lateral surfaces. Female Ur3 longer than Ur2 or 4. Female A1 and left male A1 with spinules on ventral surface of segment 1 (Fig. 1*C–E*). P5 Re2 slightly longer than Re3 (Fig. 4*C*).

Male Ur2 with small anteroventral knob and 2 ventral rows of fine spinules. Male P5 posterior view (Fig. 4*F*): right leg, B2 with proximolateral hair patch. Rel distomedial corner heavily scaled. Left leg, B2 with proximolateral spinule patch. Rel distolaterally produced with small lateral projection at apex and small bulbous medial process. Re2 with 8 surface setae and row of spinules between plumose Se and naked St. Anterior view (Fig. 4*G*): right leg, B1 with 2 spinule rows. B2 with proximomedial spinule patch and few hairs distal to bifid Ri; shorter lateral branch of Ri with 2 apical points and 1 point (not easily seen in posterior view) near midlength, medial branch simple, slightly longer and pointed. Left leg, B2 with proximomedial hairs and small, circular, distal fine hair patch; Ri slightly curved and proximally hirsute.

Remarks

This species is a member of the Ramosus species group and the *serricaudatus* subgroup (Table 1) since the right Rel Se of the male P5 is not bifid, as in the *hickmani* subgroup. However, two morphological features present in *P. colefaxi* link it to several members of the latter subgroup (i.e. *P. australiensis*) in that: (*a*) A1 segment 1 has spinules on ventral surface; and (*b*) female Ur3 is longer than Ur2 or 4. When the male P5 is compared to other members of the *serricaudatus* group, this species stands out in that (i) left Ri is medially curved and pointed, (ii) right Ri with pointed branches and (iii) left Rel is produced distally into strong spiniform process.

At present, the known range of *P. colefaxi* appears confined to south-eastern Australia from the Brisbane River, Qld, south to Westernport Bay, Vic.

Pseudodiaptomus galleti (Rose)

(Fig. 5*A–J*)

Mazellina galleti Rose 1957, pp. 235–45, figs 1–6.

Pseudodiaptomus galleti (Rose). Walter 1984, pp. 380–3; 1986*b*, pp. 136–8, fig. 3*A–M*. Kimmerer *et al.* 1985, pp. 426–7.

Material Examined

Western Australia: Shark Bay, surface plankton tow, 17.vi.1983, 2 males, 8 females, USNM 216855; 3 males, 3 females, AMS P35635; slide male P5, AMS P35511; coll. by D. McKinnon.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	2	1·22–1·30	1·24	0·88	0·40	2·2 : 1
Male	8	1·00–1·10	1·04	0·74	0·33	2·3 : 1

Description

The following are the important diagnostic features of *P. galleti*; for a complete description see Walter (1986*b*).

Female (Fig. 5*A–D*). Head and Pdg1 not fused; head with dorsal hump and Pdg1 with posterodorsal fleshy protuberances. Ur1 with a few hairs and spinules on right lateral margin. A1 with 22 segments (Fig. 1*C*). P5 (Fig. 5*D*): with fine spinules along lateral margin of Rel. Re2 slightly shorter than Re3.

Male (Fig. 5*E–J*). Head with dorsal hump and very small Pdg1 protuberances. A1 with 21 segments (Fig. 1*D*). P5 posterior view (Fig. 5*I*): right leg, Rel with proximomedial projection covered with fine hairs, Se stout and medially recurved. Left leg, B2 with small rounded Ri. Re2 with 9 surface setae, stout Se and St. Anterior view (Fig. 5*J*): right leg, B2 with large Ri; elongate medial branch bifid at apex, lateral branch simple and distally hirsute.

Remarks

P. galleti originally collected from Viet Nam (Rose 1957) was recently redescribed by Walter (1986*b*) from material collected in the Philippines. This species, like *P. colefaxi*, is

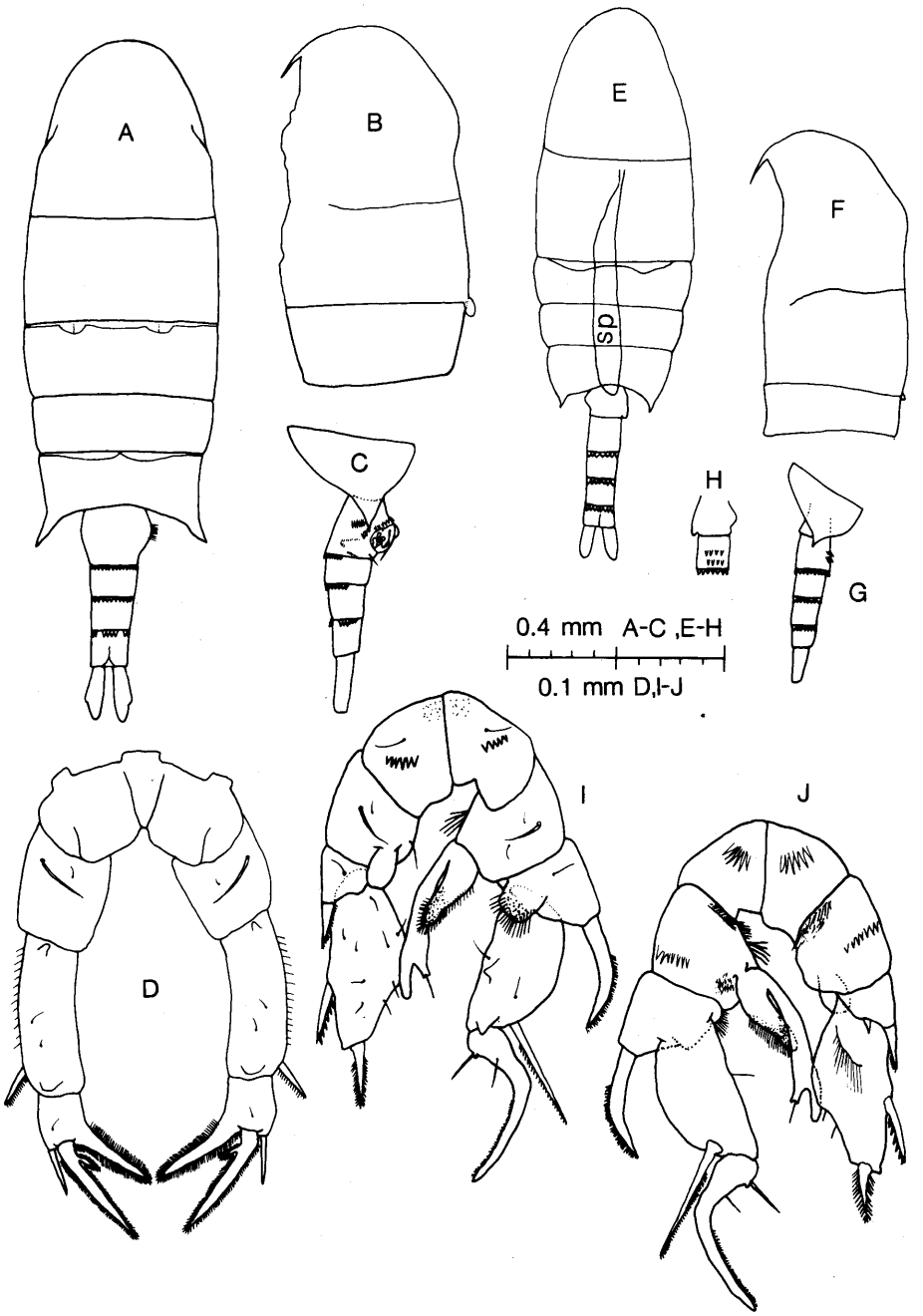

Fig. 5. *Pseudodiaptomus galleti* (Rose). *A–D*, adult female: *A*, dorsal view; *B*, lateral view of Pdg1–2; *C*, lateral view of Ur right side; *D*, posterior view of P5. *E–J*, adult male: *E*, dorsal view; *F*, lateral view of Pdg1–2; *G*, lateral view of Ur right side; *H*, ventral view of Ur1–2; *I*, posterior view of P5; *J*, anterior view of P5.

a member of the Ramosus species group and the *serricaudatus* subgroup. The known range of *P. galleti* extends from Japan, South China Sea, and the Philippines south to Australia where it has so far only been reported from the hypersaline Shark Bay, W.A.

Pseudodiaptomus cornutus Nicholls

(Fig. 6*A–H*)

Pseudodiaptomus cornutus Nicholls 1944, pp. 8–10, fig. 3. Bayly 1975, table 1. McWilliam *et al.* 1981, p. 190, table 4. Walter 1986*b*, p. 155, fig. 11*K–L*.

Material Examined

Victoria: Rhyll, Westernport Bay, 5.x.1983, surface plankton tow, 25 males, 25 females, USNM 213981; 5 males, 5 females, AMS P35507; coll. by D. McKinnon. **Southern Australia:** Blanche Harbour, SAM holotype–allotype slide C3957, paratypes slide, C3958, non-type slides C3959–60; coll. by A. G. Nicholls.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	20	1·13–1·20	1·16	0·88	0·39	2·2 : 1
Male	20	1·05–1·10	1·08	0·78	0·35	2·2 : 1

Description

Female (Fig. 6*A–D*). Head and Pdg1 not fused, head with slight dorsal hump (Fig. 6*B*) and posterodorsal margin of Pdg1 with 2 large fleshy processes (knobs). Pdg4–5 fused with large Pdg5 wings. Ur1 with few surface hairs, small left distolateral knob, right lateral surface with 2 sets of spinules, and small genital flaps. CR 4 times longer than wide. Ur segments and CR in proportions 31 : 15 : 15 : 13 : 26 = 100. A1 with 22 segments (Fig. 1*C*). P5 (Fig. 6*D*): B1 with row of fine surface hairs. Re2 with serrate medial and plumose lateral margins. Re3 longer than Re2.

Male (Fig. 6*E–H*). Head and Pdg1 not fused, head with slight dorsal hump and very small Pdg1 dorsal processes. Pdg4–5 fused with hairs lining posteromedial margin. Ur2 with 2 ventral spinule rows. CR 3 times longer than wide. Ur segments and CR in proportions 16 : 19 : 17 : 17 : 12 : 19 = 100. Right A1 with 21 segments (Fig. 1*D*). P5 posterior view (Fig. 6*G*): right leg, B1 with fine surface spinules, pointed distomedial corner and small medial hump lined with spinules. B2 with distomedial spinule row. Re1 with distomedial cluster of large spinules, 1 large triangular spine, 2 setae, and plumose Se. Re2 with 2 surface setae, plumose Se, and fine marginal hairs between Se and Re3. Left leg, B2 with proximomedial hairs and large, elongate Ri hirsute distal to midlength. Re1 with very short Se. Re2 elongate with 5 surface setae, Se slightly curved and medially serrate, fine medial spinules between Se and small naked St. Anterior view (fig. 6*H*): right leg, B2 with proximomedial hairs and 2 rows of fine surface spinules. Ri bifid; apex of short truncate lateral branch covered with fine scales, medial branch pointed and almost equal in length with seta near apex. Left leg, B2 with proximomedial tuft to hairs.

Remarks

This species is a member of the Ramosus species group and the *serricaudatus* subgroup. It is closely related to *P. pacificus*, *P. nihonkaiensis* (Japan) and *P. salinus* (Red Sea) with regards to possession of Pdg1 posterodorsal knobs (except for *P. salinus*) and the male P5 right Ri which have small, generally rounded lateral and longer pointed medial branches. *P. cornutus* is most similar to *P. pacificus*; however, in *P. cornutus* (*a*) female Pdg5 wings are larger, more laterally directed and the P5 Re3 is longer than Re2, (*b*) male Ur2 has 2 ventral spinule rows and (*c*) male P5 right Ri has medial branch approximately equal in

length to truncate lateral branch, right Re2 lacks small medial plate-like spine, and left Re2 Se is slightly curved.

This is the most southern representative of Australian pseudodiaptomids; its range is confined to the cooler waters from Victoria east to South Australia.

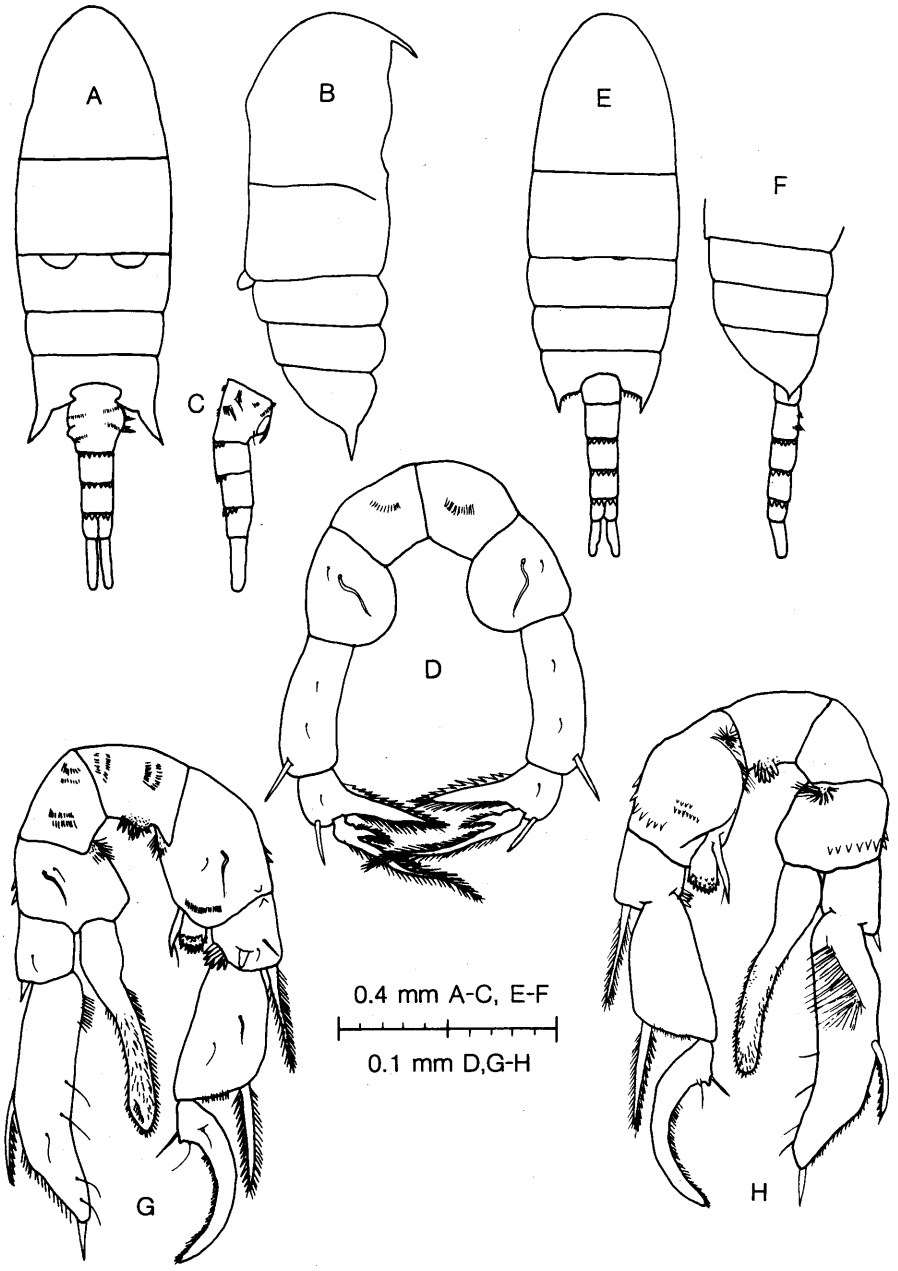

Fig. 6. *Pseudodiaptomus cornutus* Nicholls. *A–D*, adult female: *A*, dorsal view; *B*, lateral view; *C*, lateral view of Ur right side; *D*, posterior view of P5. *E–H*, adult male: *E*, dorsal view; *F*, lateral view of Pdg2–5 and Ur; *G*, posterior view of P5; *H*, anterior view of P5.

Pseudodiaptomus pacificus Walter
(Fig. 7*A–I*)

Pseudodiaptomus pacificus Walter 1986*b*, pp. 153–5, fig. 11*A–J*.

Material Examined

Queensland: One Tree Island Lagoon, Great Barrier Reef, 23°30'S.,153°06'E. emergence trap, 24.xi.1978, 6 males, 5 females, USNM 216328; 5 males, 7 females, AMS P35509; coll. by P. S. McWilliam.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	5	1·20–1·25	1·23	0·88	0·40	2·2 : 1
Male	6	0·96–0·98	0·97	0·69	0·33	2·1 : 1

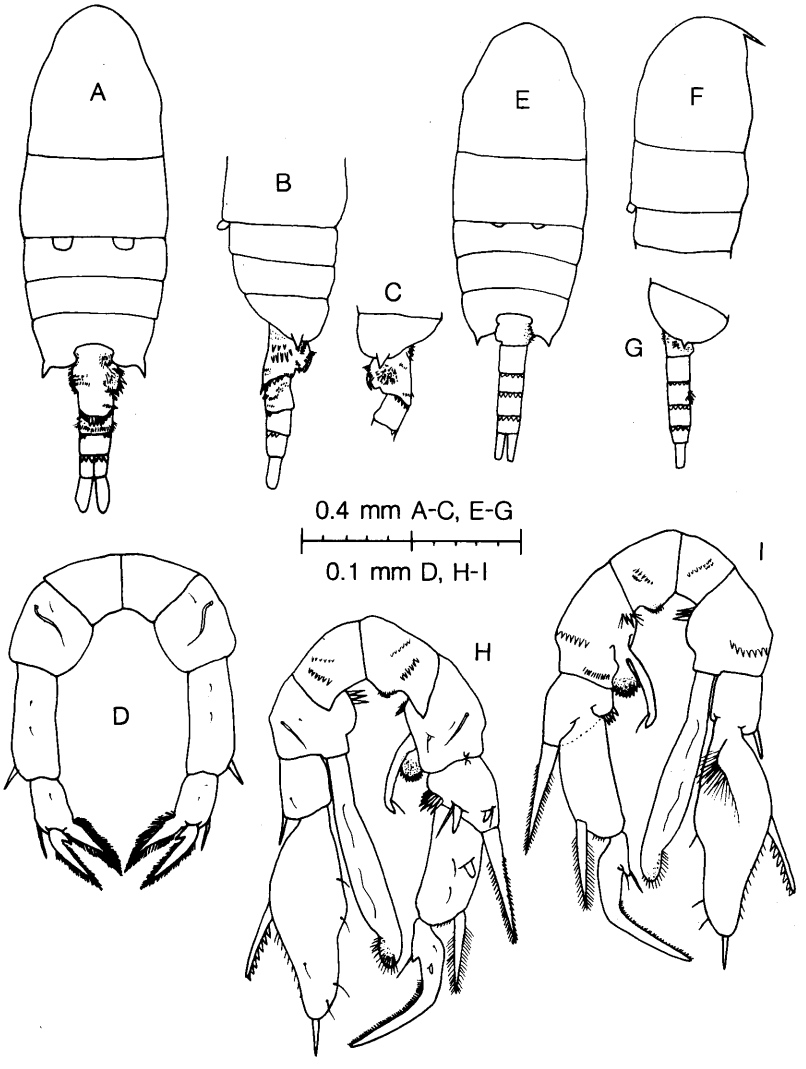

Fig. 7. *Pseudodiaptomus pacificus* Walter. *A–D*, adult female: *A*, dorsal view; *B*, lateral view of Pdg2–5 and Ur; *C*, lateral view of Ur1–2 left side; *D*, posterior view of P5. *E–I*, adult male: *E*, dorsal view; *F*, lateral view of Pdg1–2; *G*, lateral view of Ur right side; *H*, posterior view of P5; *I*, anterior view of P5.

Description

The following salient diagnostic features are presented; for a complete description of *P. pacificus*, refer to Walter (1986*b*).

Female (Fig. 7*A–D*): Pdg1 with large pair of posterodorsal fleshy protuberances (knobs). Ur1 right lateral margin with ridge and spinule cluster at midlength and posterodorsal spine row with larger central spines; ventrally, genital boss with very small genital valves. CR 3 times longer than wide. Ur segments and CR with proportions 41 : 12 : 12 : 14 : 21 = 100. A1 with 22 segments (Fig. 1*C*). P5 (Fig. 7*D*): Re2 with plumose spiniform process about equal in length to plumose Re3.

Male (Fig. 7*E–I*): Pdg1 with small pair of posterodorsal fleshy protuberances. Ur1 with right anterolateral hair patch. Ur3 with ventral spinule row. CR about 3 times longer than wide. Ur segments and CR with proportions 21 : 21 : 13 : 16 : 11 : 18 = 100. Right A1 with 21 segments (Fig. 1*D*). P5 posterior view (Fig. 7*H*): right leg, B1 with pointed distomedial corner, surface spinules and small medial hump lined with very fine hairs. Re1 with 2 pairs of a triangular surface spine and seta, a medial spinule cluster, and large plumose Se. Re2 with spatulate surface spine. Left leg, B2 with marginal row of 3 large proximomedial spinules; Ri elongate with hirsute apex. Re1 with small naked Se. Re2 with coarsely serrate Se and small naked St. Anterior view (Fig. 7*I*): right leg, B2 with bifid Ri; lateral branch round and covered with small spinules, medial branch simple and 2 times longer.

Remarks

P. pacificus, *P. cornutus*, and *P. galleti* are the only three Australian species which possess Pdg1 dorsal knobs and all are members of the Ramosus species group and *serricaudatus* subgroup. *P. pacificus* is most closely related to *P. cornutus* but differs in that, in the female, (*a*) Ur1 has several large spines on the posterodorsal spine row and (*b*) P5 Re2 is equal in length to Re3. In the male, (*a*) Ur3 has ventral spinule row; (*b*) P5 right Ri medial branch is twice as long as the rounded lateral branch; (*c*) P5 right Re1 Se is slightly stouter; (*d*) P5 left Re2 Se is straight not curved; and (*e*) P5 right Re2 has surface spatulate spine.

This species was collected from Heron Island and One Tree Island Lagoon, Queensland with emergence traps (McWilliam *et al.* 1981), and probably ranges north to the Darwin region and Papua New Guinea. At present, *P. pacificus* is one of the most widely distributed Indo-Pacific pseudodiaptomids in that it has been reported from China, Palau, Tonga and now Australia (Walter 1986*b*).

Pseudodiaptomus australiensis, sp. nov.

(Fig. 8*A–H*)

Pseudodiaptomus marinus Sato. Grigg 1972, pp. 77–8, figs 27*a–b*, 28*a–f*. Greenwood 1977, pp. 65–6, figs 5*e–g*.

Material Examined

Northern Territory: Darwin, Channel Island, algal washings, 21.viii.1982, 1 male, holotype (P5 male on slide), USNM 213443; 1 female, allotype (P5 female on slide), USNM 213444; 3 females, paratypes, USNM 213445; coll. by J. L. Barnard.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	4	1·20–1·27	1·25	0·85	0·44	1·9 : 1
Male	2	1·04–1·06	1·05	0·76	0·37	2·0 : 1

Description

Female (Fig. 8*A–D*). Head and Pdg1 not fused. Pdg5 wings small. Ur1 with swellings near midlength on right and left sides and patches of fine spinules on posterolateral surfaces.

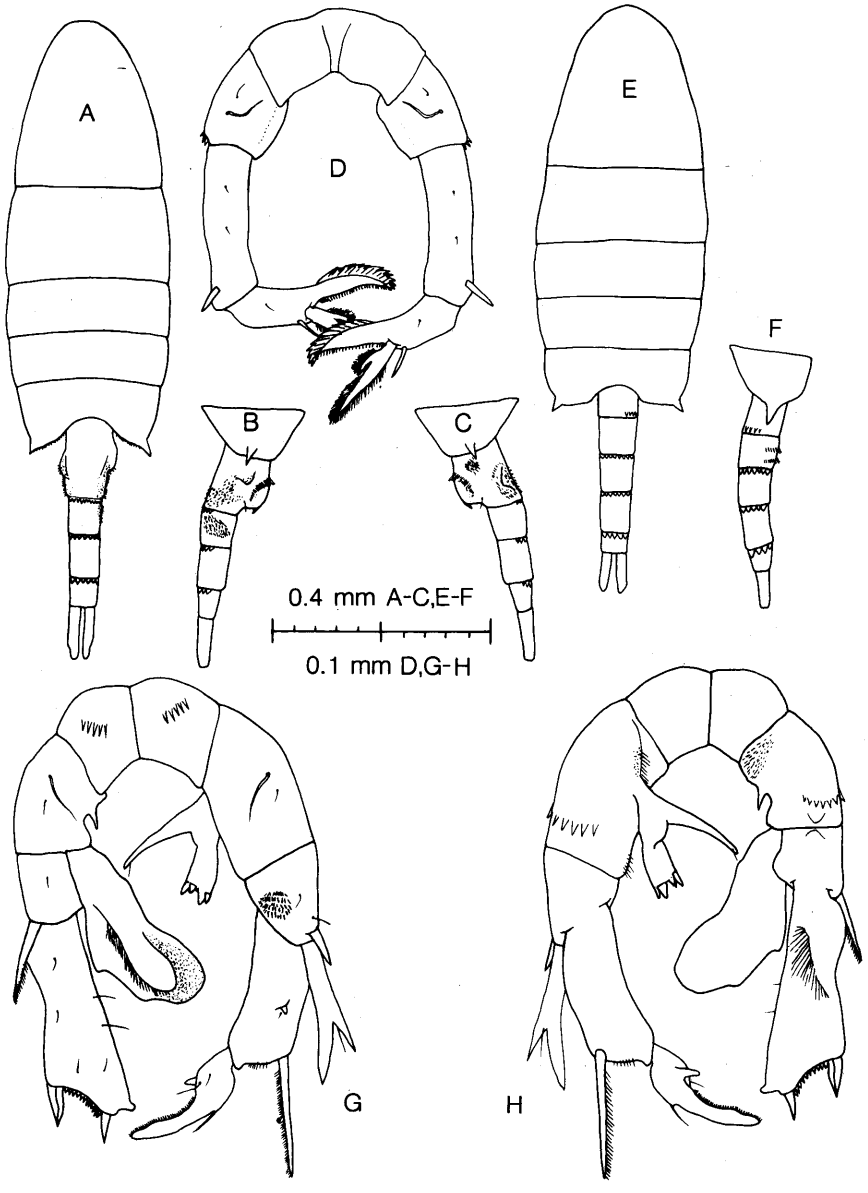

Fig. 8. *Pseudodiaptomus australiensis*, sp. nov. *A–D*, adult female: *A*, dorsal view; *B*, lateral view of Ur right side; *C*, lateral view of Ur left side; *D*, posterior view of P5. *E–H*, adult male: *E*, dorsal view; *F*, lateral view of Ur right side; *G*, posterior view of P5; *H*, anterior view of P5.

Genital boss with pair of small genital flaps at opening. Ur2 with anterolateral patch of fine spinules on right surface. Ur3 longer than Ur2 or 4. CR 4·5 times longer than wide. Ur segments and CR in the proportions 33 : 14 : 19 : 12 : 22 = 100. A1 with 22 segments

and fine spinules on ventral surface of segment 1 (Fig. 1*C*, *E*). P5 (Fig. 8*D*): B2 distolateral corners with a few small spinules. Re2 spiniform process short, medial margin strongly curved, serrate; laterally plumose. Re3 plumose, equal in length to Re2 process.

Male (Fig. 8*E–H*). Head and Pdg1 not fused. Pdg5 with small wings. Ur1 right side with few posterodorsal spines. Ur2 with 2 ventral rows of fine hairs. CR 3 times longer than wide. Ur segments and CR with proportions 22 : 17 : 15 : 19 : 10 : 17 = 100. Right A1 with 21 segments (Fig. 1*D*). P5 posterior view (Fig. 8*G*): right leg, B1 with surface spinule row. Re1 with medial spinule patch, Se bifid beyond midlength with unequal branches, outer fork shorter with seta at base; smaller distolateral spine at Se base. Re2 with small triangular surface spine at midlength. Re3 short with small lateral spine at midlength. Left leg, B1 same. B2 medial margin incised with distally directed point; Ri large, clavate with raised surface and lining of fine hairs. Re1 with medially plumose Se. Re2 distally expanded with 6 setae, 1 flanged Se, lateral spinule row between Se and naked St, and distomedial corner medially produced. Anterior view (Fig. 8*H*): right leg, B2 with fine hair patch at base of Ri; Ri bifid, lateral branch truncate with 4 prominent tooth-like projections at apex, medial branch simple, slightly longer with seta at apex. Re2 with plumose Se. Left leg, B2 with proximomedial hair patch.

The specific name *australiensis* refers to the continent where the specimens were collected.

Remarks

This species is a member of the Ramosus species group, *hickmani* subgroup, and is similar to *P. marinus* (USNM 216773), *P. ishigakiensis* (USNM 213187), *P.* cf. *marinus* (USNM 216774–216777), *P. philippinensis* (USNM 210654) and *P. hypersalinus*, sp. nov., in that male and female A1 bear fine spinules on the ventral surface of segment 1 (Walter 1986*b*). *P. colefaxi* also possesses these spinules on A1 but is not a member of the *hickmani* subgroup. In these species, all females have in common: small Pdg5 wings, small genital flaps, Ur3 longer than Ur2 or 4 and, except for *P. colefaxi*, P5 with small distolateral spinules on B2. Males of *P. australiensis*, *P. philippinensis* and *P. hypersalinus*, sp. nov. possess common characters: (*a*) spine row on Ur1, (*b*) P5 left B2 with incised medial margin and (*c*) right Re3 small when compared with the genus as a whole.

P. australiensis can be distinguished from *P. marinus* in that, in the male P5 of the latter, the lateral branch of the right Ri has 3 points at apex, rather than 4 tooth-like points as in the former. The present species is also similar in appearance to *P. ishigakiensis*, but differs as follows: female, Pdg5 wings are smaller, P5 with distolateral spinules on B2; male, Pdg5 wings more laterally directed, Ur1 with partial spine row, and Ur2 with 2 ventral rows of hairs. In addition, the male P5 right Ri of *P. ishigakiensis* has 5 points on the lateral branch and the right Re2 Se is bifurcate proximal to its midlength.

P. australiensis is most closely related to *P. hypersalinus* from Shark Bay, W.A. The differences between these two species are discussed in the section dealing with the latter species.

The reports of *P. marinus* with a 4-point Ri and the right B2 Se bifurcation above midlength (Grigg 1972; Greenwood 1977) from Moreton Bay, Qld, are now assignable to *P. australiensis*. The known range of this species is from Darwin, N.T., south to Moreton Bay, Qld.

Pseudodiaptomus griggae, sp. nov.

(Fig. 9*A–H*)

Pseudodiaptomus difalcatus. Grigg 1972, pp. 83–4, figs 34*c–d*, 35*a–e*.
Pseudodiaptomus sp. nov. Bayly 1980, pp. 9–10.

Material Examined

Papua New Guinea: Varoi River mouth, Purari estuary, 26.vii.1979, surface plankton tow, 1 male holotype USNM 216765, 1 female allotype USNM 216766; 3 males, 4 females, paratypes, USNM 216767; dissected male and female on 2 slides, paratypes, AMS P35510; coll. by T. Petr.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	5	1·00–1·10	1·04	0·72	0·36	2·0–1
Male	4	0·84–0·85	0·85	0·56	0·30	1·9 : 1

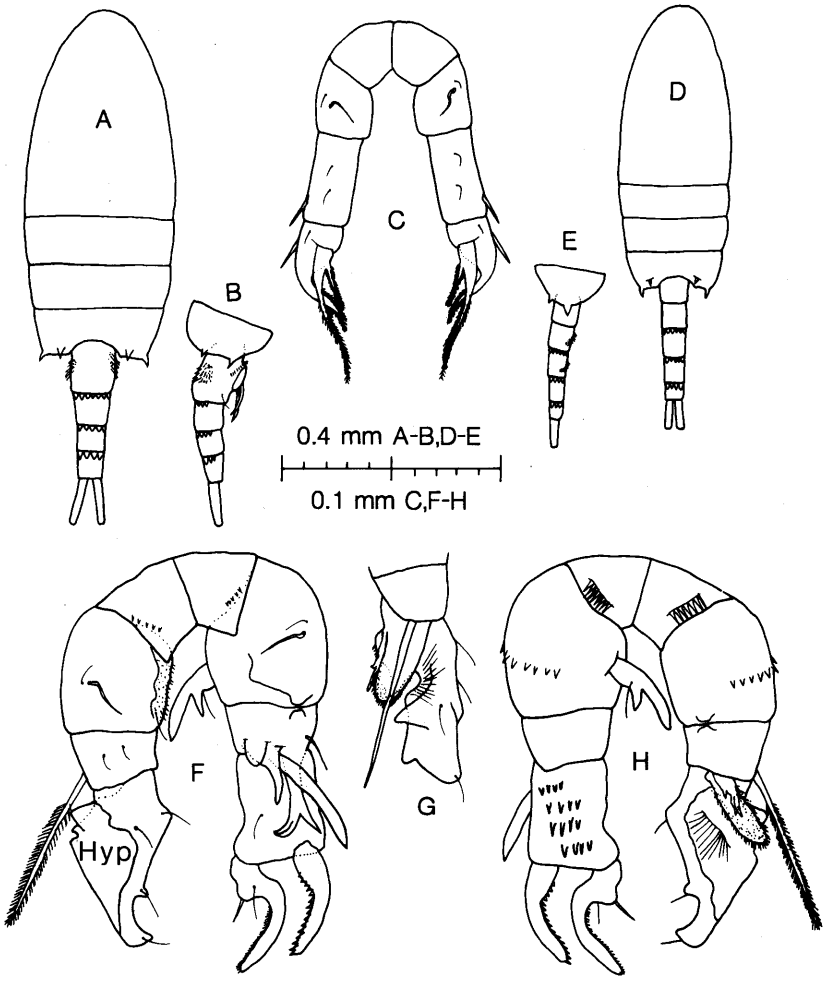

Fig. 9. *Pseudodiaptomus griggae*, sp. nov. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Ur right side; *C*, posterior view of P5. *D–H*, adult male: *D*, dorsal view; *E*, lateral view of Ur right side; *F*, posterior view of P5; *G*, lateral view of left Re2; *H*, anterior view of P5.

Description

Female (Fig. 9*A–C*). Head and Pdg1 fused. Pdg4–5 fused with small wings and additional pair of small posterodorsal spines. P1 B2 with lateral spinule row. Ur1 with left and right lateral patches of fine spinules; ventrally, genital boss insignificant with pair of strong spines guarding opening. CR 6 times longer than wide. Ur segments and CR in the proportions 29 : 15 : 15 : 17 : 24 = 100. A1 with 21 segments (Fig. 1*A*), lacking modified barbed seta

on antepenultimate segment. P5 (Fig. 9*C*): compact in appearance with B2 and Re1 lacking lateral spinule rows. Re2 plumose, strongly curved. Re3 plumose and twice as long as Re2.

Male (Fig. 9*D–H*). Head and Pdg1 fused. Pdg4–5 fused with additional pair of small posterodorsal spines. Ur2 and 3 with ventral spinule row. CR 3 times longer than wide. Ur segments and CR in proportions 15 : 18 : 20 : 18 : 9 : 20 = 100. Right A1 with 20 segments (Fig. 1*B*). P5 posterior view (Fig. 9*F*): right leg, B1 with oblique row of surface spinules. B2 with distal ridge and knob. Re1 with small proximal knob opposite B2 knob, small rounded distomedial process, distolateral seta and 3 spines; medial spine small slightly curved, second spine longest simple and directed distolaterally, lateral spine distally bifid with medial branch medially curved. Re2 with robust medially serrate Se. Re3 with small medial seta, equal in length to Re2 Se. Left leg, B1 same. B2 with medial ridge, fine spinules and hairs and 1 seta. Re1 with long thin plumose Se. Re2 distomedially incised with 4 surface setae and indistinct lateral hyaline plate. Anterior view (Fig. 9*H*): right leg, B1 with submarginal spinule row. B2 with unequally bifid Ri, lateral fork smaller with seta at base. Left leg, B1 same. Re2 with irregularly shaped and pointed process anterior to hirsute blunt lateral process.

This species is named for Helen Grigg, who first collected and reported it.

Remarks

The fused head and Pdg1, lack of barbed setae on antepenultimate A1 segment, long ventral spines at female Ur1 and fifth legs of both the male and female show that this is a member of the Hyalinus species group. The female of *P. griggae* is the only member of this group that lacks the typical lateral spinule rows on B2 and Re1 of the P5. I have placed *P. griggae* in the *trihamatus* subgroup, although it differs from the other members of this group in several unusual features of the male P5. The following differences in the male P5 easily distinguish *P. griggae* from *P. baylyi*, *P. occidentalus*, sp. nov. and *P. trihamatus* to which it is most similar: right leg—Ri is small with only 2 points, Re1 with 3 spiniform processes, Se of Re2 simple and curved; left leg—hyaline plate of Re2 not incised. In addition, the male of *P. griggae* has a set of dorsal Pdg5 spines unique to this group.

This species was first observed and reported by Grigg (1972) as *P. difalcatus*, nom. nud. The present range of *P. griggae* is from the estuarine waters of Papua New Guinea south to several estuaries along the coast of Queensland.

Pseudodiaptomus hypersalinus, sp. nov.
(Fig. 10*A–H*)

Pseudodiaptomus sp. nov. Bayly 1975, pp. 46–7, table 1.
Pseudodiaptomus sp. Kimmerer *et al.* 1985, pp. 426–7.

Material Examined

Western Australia: Shark Bay, Useless Inlet, surface plankton tow, 21.viii.1973, salinity = 49·7 g/l, 1 male holotype USNM 216292, 1 female allotype USNM 216293; 6 males, 6 females, paratypes, USNM 216294; 2 males, 2 females, paratypes, AMS P35508; coll. by I. A. E. Bayly.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	6	1·30–1·37	1·36	0·92	0·48	1·9 : 1
Male	6	1·05–1·08	1·07	0·76	0·38	2·0 : 1

Description

Female (Fig. 10*A–C*). Head and Pdg1 not fused. Pdg4–5 fused with fine hairs along medial margin. Ur1 with dorsal and lateral fine spinule and hair patches; ventrally, genital boss prominent with small genital flaps at opening. Ur3 longer than Ur2 or 4. CR 3·5

times longer than wide. Ur segments and CR in proportions 30 : 16 : 24 : 11 : 19 = 100. A1 with 22 segments and spinules on inner margin of segment 1 (Fig. 1*C*, *E*). P5 (Fig. 10*C*): B1 with few proximal fine hairs. B2 distomedial corner with 3–5 spinules. Re2 medially serrate and equal in length to plumose Re3.

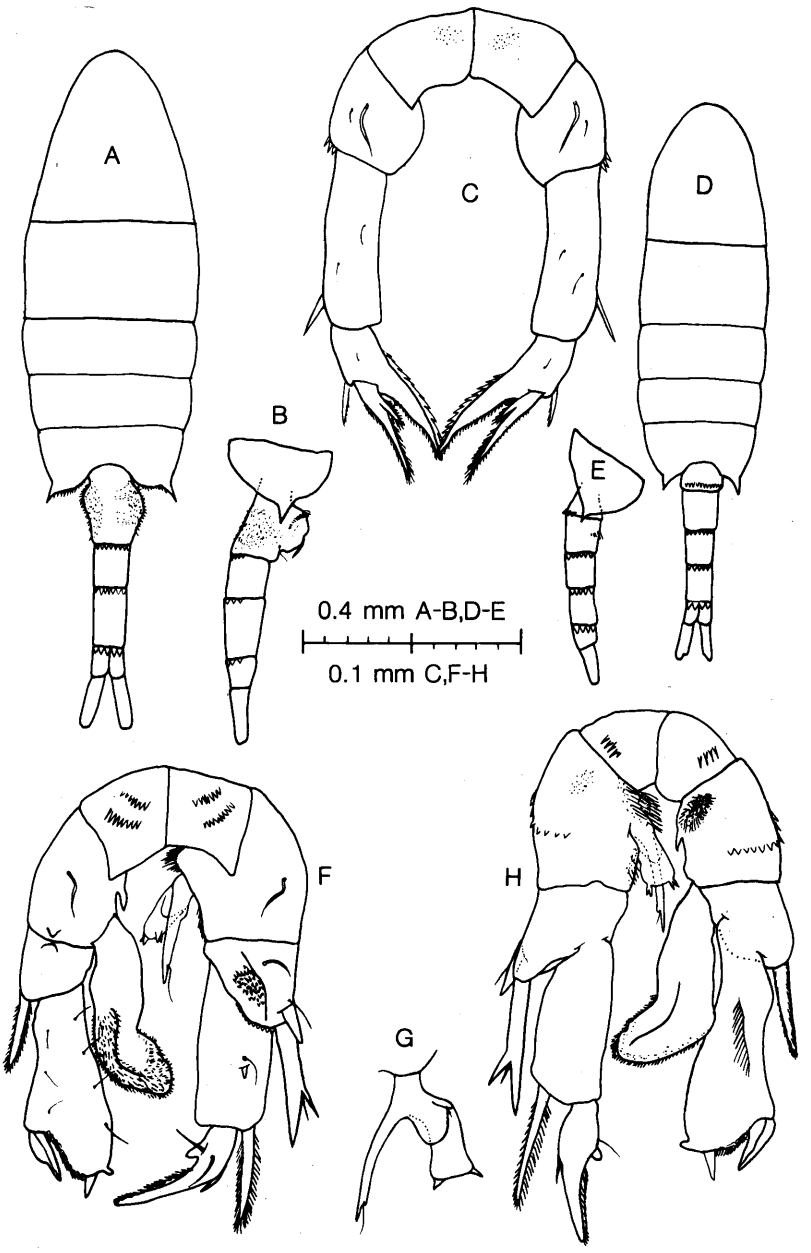

Fig. 10. *Pseudodiaptomus hypersalinus*, sp. nov. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Ur right side; *C*, posterior view of P5. *D–H*, adult male: *D*, dorsal view; *E*, lateral view of Ur right side; *F*, posterior view of P5; *G*, lateral view of right Ri; *H*, anterior view of P5.

Male (Fig. 10*D–H*). Head and Pdg1 not fused. Pdg4–5 fused. Ur1 with incomplete posterodorsal spine row. Ur2 with ventral spinule row. CR 3 times longer than wide. Ur segments and CR in proportions 14 : 21 : 18 : 18 : 11 : 18 = 100. Right A1 with 21 segments (Fig. 1*D*). P5 posterior view (Fig. 10*F*): right leg, B1 with 2 spinule rows. Re1 with groove at midwidth lateral to spinule patch, small spinules along distolateral margin, stout Se bifid well distal to midlength, medial branch thick and longer, seta at base of fork, and small spine and seta at Se base. Re2 with small triangular spine at midlength and plumose Se. Re3 small with small lateral spine, and small proximal knob with seta. Left leg, B1 same. B2 with proximomedial margin incised distal to pointed process: Ri large clavate, distally hirsute. Re1 with plumose Se. Re2 with 7 surface setae, flanged Se, spinules between Se and short naked St, and distomedial corner with medially directed knob. Anterior view (Fig. 10*H*): right leg, B1 with submarginal spinule row. B2 with proximomedial spinules and few hairs distal to bifid Ri; lateral branch with basal knob and pair of small points at each apical corner (these paired points appear as only single points in lateral view, Fig. 10*G*), medial branch simple and longer with seta near apex. Left leg, B1 same. B2 with proximomedial spinules.

The specific name *hypersalinus* refers to hypersaline waters from which these specimens were collected; this does not imply that the species is restricted to high salinity waters.

Remarks

This species is a member of the Ramosus species group and the *hickmani* subgroup and was brought to my attention by Dr I. A. E. Bayly, who kindly provided me with specimens and preliminary drawings. *P. hypersalinus* has features in common with several other species, and is most closely related to *P. australiensis*. Differences between these two species are minor and confined to the male P5. The following morphological features of *P. hypersalinus* distinguish it from *P. australiensis*: (*a*) right Ri lateral branch with 2 pairs of small points separated by a gap (not tooth-like) at apex; (*b*) right Re2 Se slightly stouter; and (*c*) left Ri noticeably bent medially at midlength.

At present this species has only been reported from Shark Bay, W.A., though future studies may show a more extensive range.

Pseudodiaptomus inflexus, sp. nov.

(Fig. 11*A–H*)

Pseudodiaptomus inflexus. Grigg 1972, pp. 78–9, figs 27*c–e*, 29*a–e*, 30*a–c*.

Material Examined

Queensland: Townsville, Alligator Creek, epidemersal sled, 18.ix.1982, 1 male holotype USNM 216762; 1 female allotype USNM 216763; 48 males, 91 females, paratypes, USNM 216764; 7 males, 8 females, paratypes, AMS P35634; coll. by R. Hartwick.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	25	1·20–1·25	1·23	0·83	0·43	1·9 : 1
Male	25	1·01–1·03	1·02	0·70	0·34	2·0 : 1

Description

Female (Fig. 11*A–C*). Head and Pdg1 not fused. Pdg4–5 fused. Ur1 with anterodorsal oblique spinule rows, anterolateral hair-spinule patches, and incised right posterodorsal margin; ventrally, genital boss with inconspicuous genital flaps, small anterior knob and 2 spines. CR 3 times longer than wide. Ur segments and CR in proportions 35 : 15 : 18 : 12 : 20 = 100. A1 with 22 segments (Fig. 1*C*). P5 (Fig. 11*C*): B1 with 2 fine spinule rows. Re2 serrate, almost equal in length to plumose Re3.

Male (Fig. 11*D–H*). Head and Pdg1 not fused. Pdg4–5 fused. Ur2 with 2 ventral spinule rows. CR twice longer than wide. Ur segments and CR in proportions 20 : 18 : 16 : 16 : 12 : 18 = 100. Right A1 with 21 segments (Fig. 1*D*). P5 posterior view (Fig. 11*F*): right leg, B1 with 3 proximal spinule rows. B2 with large distomedial seta. Re1 with 1 large

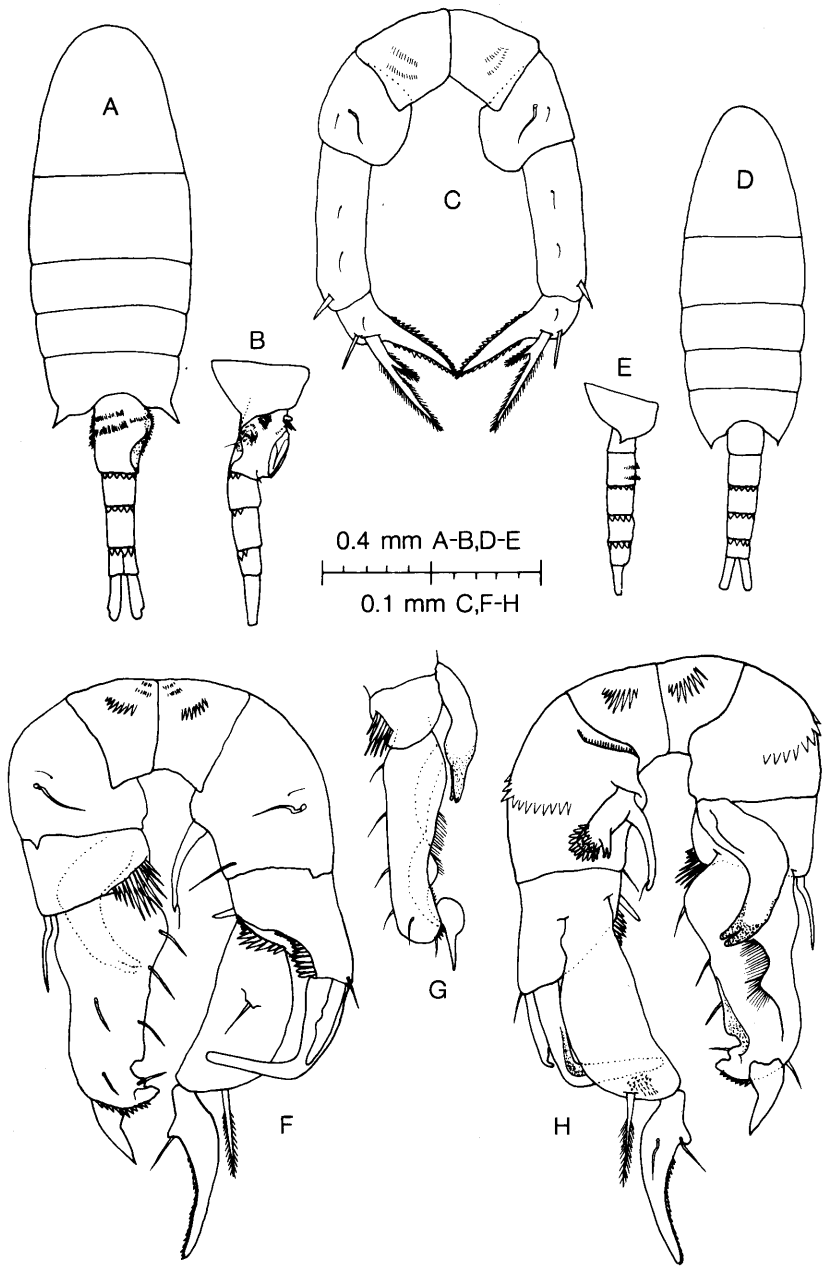

Fig. 11. *Pseudodiaptomus inflexus*, sp. nov. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Ur right side; *C*, posterior view of P5. *D–H*, adult male: *D*, dorsal view; *E*, lateral view of Ur right side; *F*, posterior view of P5; *G*, lateral view of left Re2; *H*, anterior view of P5.

spinule and 2 spinule rows on medial margin, distolateral seta, large Se bent medially at right angle near midlength and large spine that overlies Se posteriorly. Re2 with surface seta inserted on papilla, and small thin plumose Se. Re3 with small basal knob. Left leg, B1 same. Re1 with longer slender medial spines and thin Se slightly bent proximally. Re2 with 6 surface setae, distal incision on medial margin, and distal spinule row. Anterior view (Fig. 11*H*): right leg, B1 with large proximal spinules. B2 with proximomedial spinules and bifid Ri; medial branch simple, pointed and slightly longer, lateral branch clavate with small bifid medial sub-branch and heavily scaled apex. Re2 with fine distal spinules. Left leg, B1 same. B2 with strongly curved Ri, apex bifid and sclerotized. Re2 with large distal spine (Fig. 11*G*).

The specific name *inflexus* means bend in: from Latin *in*, in, into, and *flexus*, bend. The name was originally given to this species by Grigg (1972) as a nomen nudum in her thesis. This name is most appropriate, as it describes the appearance of the male P5 with the strong, medially bent, right Re1 Se and left Ri. Therefore, it is maintained and validated herein.

Remarks

This species is a member of the Ramosus species group and *serricaudatus* subgroup with the most closely related species appearing to be *P. colefaxi*. The Re1 Se and left Ri of *P. inflexus* are more strongly curved than in *P. colefaxi*, and the right Ri lateral branch is simple and not heavily scaled in the latter. Grigg (1972) illustrated a variant form of this species, but I did not see any variations in the material I had.

This species is known from the Ross River, Endeavour, Annan and Daintree estuaries, Townsville, Qld.

Pseudodiaptomus occidentalus, sp. nov.

(Fig. 12*A–H*)

Pseudodiaptomus baylyi Walter. Kimmerer *et al.* 1985, pp. 426–7.

Material Examined

Western Australia: Shark Bay, Hamelin Pool, surface plankton tow, 17.vi.1983, 1 male holotype USNM 216856, 1 female allotype USNM 216857, 4 males, 13 females, paratypes USNM 216858; 1 male and 1 female on 2 slides, paratypes, AMS P35512; coll. by D. McKinnon.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	10	1·23–1·26	1·24	0·84	0·43	1·9 : 1
Male	5	1·00–1·04	1·02	0·70	0·35	2·0 : 1

Description

Female (Fig. 12*A–D*). Head and Pdg1 fused. Pdg4–5 fused with additional pair of dorsal spines. P1 B2 with lateral spinule row. Ur1 with dorsal and anterolateral spinule rows; ventrally, genital boss insignificant with pair of strong spines at opening, left and right posterior corners with hirsute knobs. CR 5 times longer than wide. Ur segments and CR in proportions 30 : 18 : 11 : 9 : 32 = 100. A1 with 21 segments, lacking modified barbed seta on antepenultimate segment (Fig. 1*A*). P5 (Fig. 12*D*): B1 with fine surface spinules. B2 with lateral spinules; proximomedial corners produced into triangular lobes. Re1 with small surface and lateral spinules. Re3 plumose, about 2·5 times longer than plumose Re2.

Male (Fig. 12*E–H*). Head and Pdg1 fused. Pdg4–5 fused. Ur1 with lateral fine spinules. Ur2 with anterodorsal fine spinules. Ur2 and 3 each with 2 ventral spinule rows. CR 3 times longer than wide. Ur segments and CR in proportions 14 : 20 : 18 : 16 : 12 : 20 = 100. Right A1 with 20 segments (Fig. 1*B*). P5 posterior view (Fig. 12*G*): right leg, B1 with small

medial projection and fine surface spinules. B2 with proximolateral spinule patch, distolateral seta, and proximomedial knob covered with spinules. Re1 with 2 small spiniform processes; short laterally curved proximomedial process with seta and slightly longer medially curved and plumose distal process. Re2 with medial seta and large heavily serrate Se equal

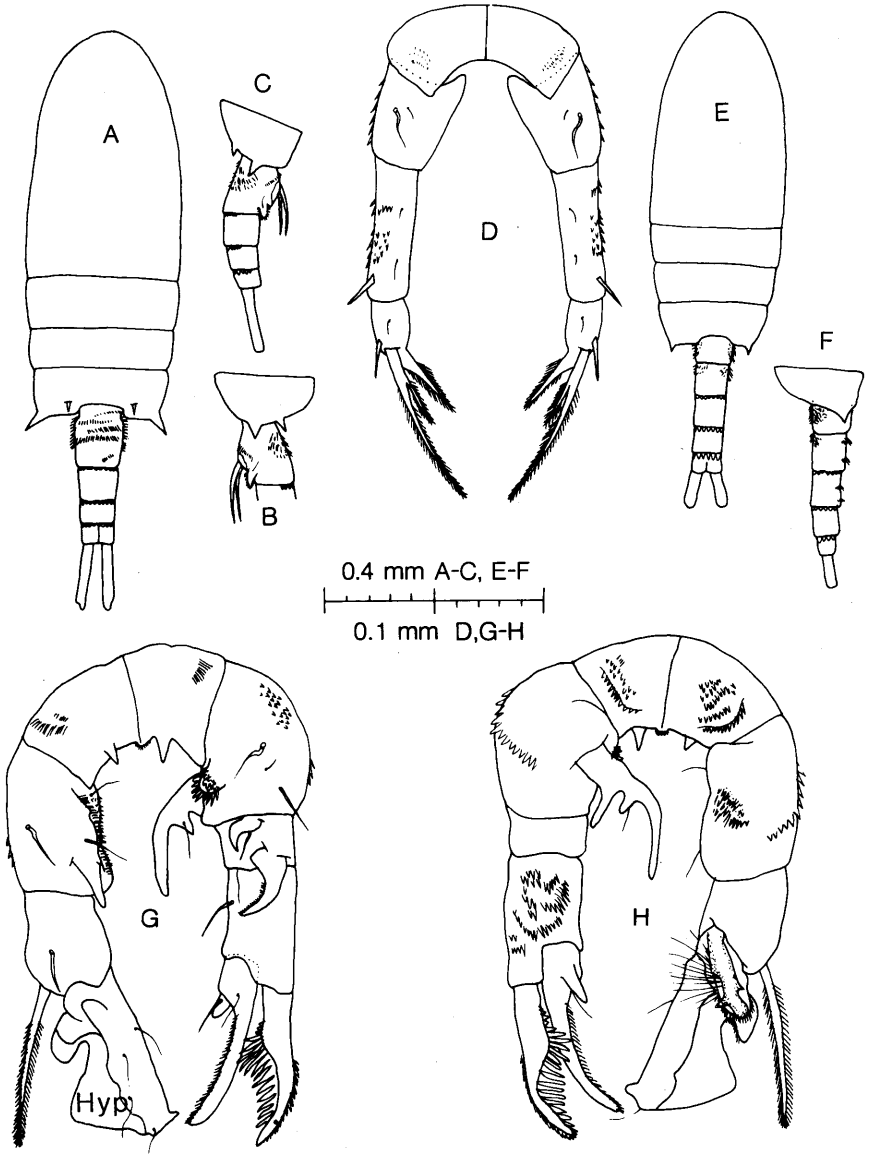

Fig. 12. *Pseudodiaptomus occidentalus*, sp. nov. *A–D*, adult female: *A*, dorsal view; *B*, lateral view of Ur left side; *C*, lateral view of Ur right side; *D*, posterior view of P5. *E–H*, adult male: *E*, dorsal view; *F*, lateral view of Ur right side; *G*, posterior view of P5; *H*, anterior view of P5.

in length to Re3. Re3 with large basal process. Left leg, B1 with fine spinules and medial projection smaller than in right B1. B2 medial margin sculptured with hairs and distomedial spiniform process. Re1 with long thin plumose Se. Re2 with proximomedial lobe that overlaps Re1, incised lateral hyaline plate, 4 surface setae and medially directed distomedial corner.

Anterior view (Fig. 12*H*): right leg, B1 with spinule rows. B2 with large trifid digitiform Ri; middle point shortest with seta, apical point longest. Re2 with extensive surface spinules. Left leg, B1 same. B2 with surface spinule patch. Re2 with irregularly shaped hirsute proximolateral process that overlies a hirsute, laterally directed spiniform process.

The specific name *occidentalus* is given to note that this species, which resembles the east coast species *P. baylyi*, was collected from the west coast of Australia.

Remarks

This species is a member of the Hyalinus species group and *trihamatus* subgroup and appears to be most closely related to *P. trihamatus*. The following characteristics of *P. occidentalus* easily separate it from the latter: female, (*a*) Ur1 lacks strong pair of posterodorsal spines; (*b*) P5 lacks tuft of fine hairs at Re2 medial margin; male P5, (*a*) left B1 with medial spiniform process, without distomedial process and palmate spine cluster; (*b*) right Re1 with pair of small spiniform processes; (*c*) Re2 Se heavily serrate. *P. occidentalus* differs from *P. baylyi* in that the male P5 right Ri is trifid not bifid.

At present reported only from Shark Bay, W.A.

Pseudodiaptomus annandalei Sewell

(Fig. 13*A–H*)

Pseudodiaptomus annandalei Sewell 1919, pp. 5–7, pl. 10, fig. 9; 1924, p. 787, pl. 44, fig. 2*a–c*. Brehm 1934, pp. 88–92, figs 3–4; 1953, pp. 306–8, figs 68–71. Kasturirangan 1963, p. 39, fig. 35*a–d*. Wellershaus 1969, p. 263, figs 25–6. Pillai 1980, pp. 248–50, fig. 1*g–j*. Grigg 1972, pp. 84–6, figs 34*a–b*, 36*a–e*. Bayly 1975, table 1. Reddy and Radhakrishna 1982, pp. 268–70, pl. 6, figs 1–12. Goswami 1983, pp. 254–7. Walter 1986*b*, pp. 159–62, figs 14*A–I*.

Pseudodiaptomus nostradamus Brehm 1933, pp. 137–42, figs 8–12; 1934, pp. 84–92, figs 5–6. Kiefer 1938, pp. 81–91, figs 9–17.

Pseudodiaptomus dubius Kiefer 1936, pp. 231–5, figs 9–12; 1938, pp. 86–91, figs 18–24.

Schmackeria annandalei (Sewell). Marsh 1933, pp. 42–3, pl. 20 fig. 8, pl. 21 fig. 1.

Schmackeria dubia (Kiefer). Shen 1979, pp. 77–8, fig. 34*a–e*. Chen and Zhang 1965, p. 23, pl. 32, figs 1–6.

Material Examined

No Australian material was available for study; therefore I refer to the following material: **Philippines:** Batangas Province, Calatagan, surface plankton tow, 21.ix.1984, 2 males, 2 females, USNM 216781; coll. by M. Trinidad. **India:** Lake Kolleru, Andhra Pradesh State, surface plankton tow, July 1974, 2 males, 6 females, USNM 216573; gift of R. Reddy. Cochin Backwater, surface plankton tow, 22–23.xi.1968, 9 males, 30 females, USNM 210671; coll. by T. E. Bowman. Cochin Backwater, surface plankton tow, March 1972, 11 males, 16 females, USNM 213189; coll. by M. Madhupratap.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	13	1·22–1·26	1·24	0·85	0·43	1·9 : 1
Male	20	1·05–1·13	1·07	0·70	0·39	1·8 : 1

Description

This species was completely redescribed by Reddy and Radhakrishna (1982) and Walter (1986*b*).

Female (Fig. 13*A–C*): Head and Pdg1 fused. Pdg2–5 dorsal and lateral margins with small posterior spine rows. Pdg4–5 fused with a double spine row and larger triangular posterolateral spines along rounded Pdg5 corner. P1–4 with lateral spinule row on B2. Ur1 with 2 large lateral spines. CR 3 times longer than wide. Ur segments and CR with proportions 37 : 15 : 19 : 10 : 19 = 100. A1 with 22 segments (Fig. 1*C*), but without modified barbed

seta on antepenultimate segment. P5 (Fig. 13*C*): B2 with spinule row that extends to disto-lateral corner. Re2 almost 4 times longer than Re2.

Male (Fig. 13*D–H*): Pdg4–5 with pair of small dorsal spines and round Pdg5 corners. Ur1 with partial posterodorsal spine row. Ur2 with dorsal circular spinule patch. CR 2·5

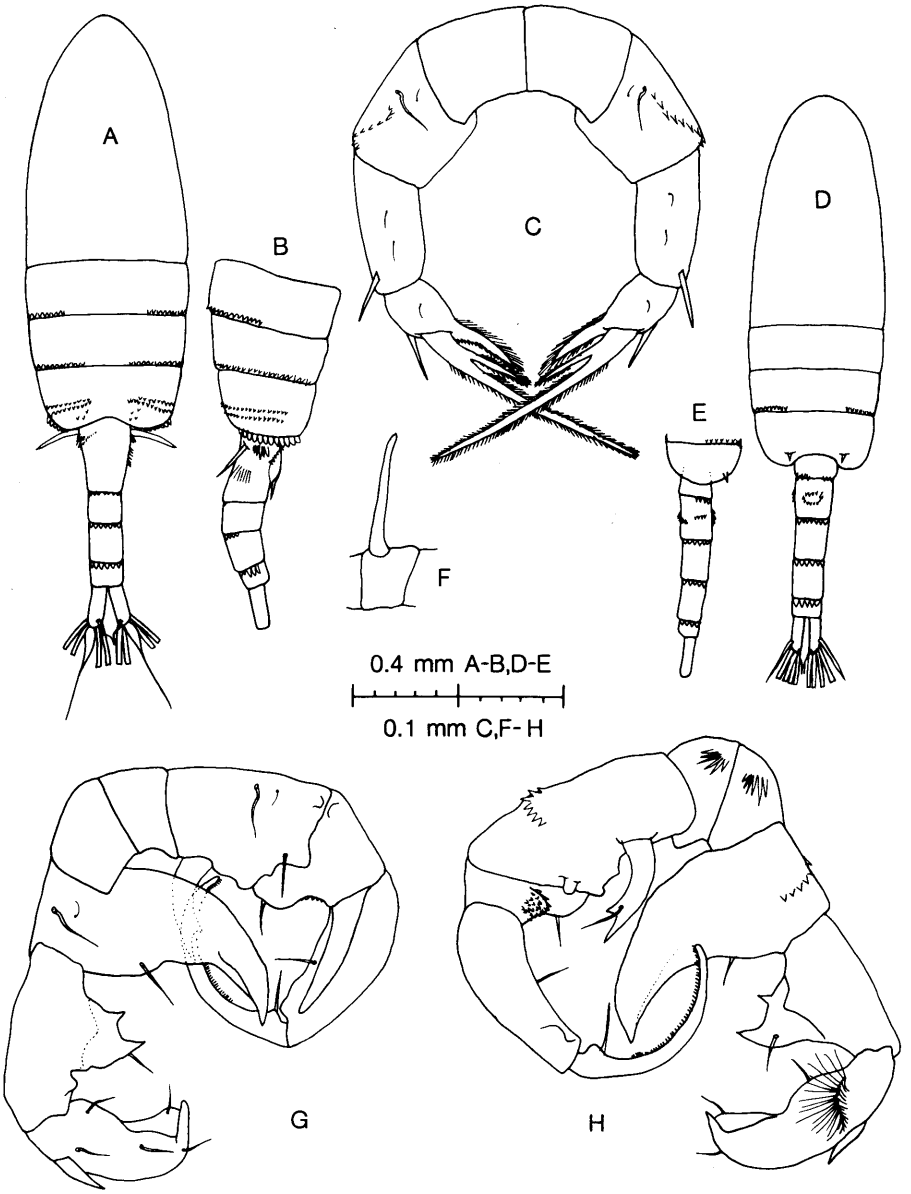

Fig. 13. *Pseudodiaptomus annandalei* Sewell. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Pdg2–5 and Ur left side; *C*, posterior view of P5. *D–H*, adult male: *D*, dorsal view; *E*, lateral view of Ur left side; *G*, posterior view of P5; *H*, anterior view of P5.

times longer than wide. Ur segments and CR with proportions 13 : 20 : 20 : 20 : 7 : 20 = 100. The most lateral CR seta replaced by small spine. Right A1 with 20 segments, segment 10 with elongate straight spine (Fig. 1*B*, 13*F*). P5 posterior view (Fig. 14*G*): right leg, Re1

with stout spine almost as long as Re2. Re3 elongate and strongly curved. Left leg, B2 with very large medially projecting process with laterally curved pointed apex. Re1 produced medially with 2 points. Re2 with 5 seta, large proximal Se and medially bent distal tip. Anterior view (Fig. 14*H*): right leg, B2 with distomedial knob; Ri simple and notched at apex with seta. Re1 with raised surface covered with scales.

Remarks

I did not have any Australian specimens of *P. annandalei* for study, but its inclusion here is based on the Australian records of Grigg (1972) and Bayly (1975). This species is the only member of the Lobus species group and *forbesi* subgroup (Table 1) known from Australian waters. The laterally directed spines on the female Ur1, rounded Pdg5 corners and paired egg sacs easily distinguish it from any other local pseudodiaptomid.

This species has been reported from India, the Philippines, China, Indonesia and Australia, and therefore has one of the largest geographical ranges for Indo-Pacific pseudodiaptomids.

Pseudodiaptomus clevei Scott

(Fig. 14*A–G*)

Pseudodiaptomus clevei Scott 1909, pp. 116–7, pl. 37, figs 1–8. Früchtl 1924, pp. 48–9, figs 29–30. Sewell 1932, p. 235. Marsh 1933, p. 31, pl. 6, figs 1–2. Mori 1942, p. 553. Pillai 1980, pp. 246, 256, figs 1*o–s*. Walter 1986*b*, pp. 139–40, figs 4*A–H*.

Material Examined

No Australian or Indonesian material available. **Philippines:** Padre Burgos, Quezon Province, emergence traps, 7–10.i.1981, 25 males, 25 females, USNM 210655; coll. by T. C. Walter.

Sex	No.	Length (mm)	$\bar{x}$	Pr $\bar{x}$	Ur $\bar{x}$	Pr : Ur
Female	63	1·86–2·22	2·02	1·36	0·78	1·7 : 1
Male	114	1·62–1·84	1·78	1·24	0·65	1·9 : 1

Description

The following are the important diagnostic features of *P. clevei*; for a complete description of the species see Walter (1986*b*).

Female (Fig. 14*A–C*). Head and Pdg1 not fused. Pdg4–5 with additional pair of dorsal spines. Ventrally Ur1 with prominent dark genital boss and pair of small spines at genital opening. CR 6 times longer than wide. Ur segments and CR in proportions 28 : 17 : 14 : 10 : 31 = 100. A1 with 22 segments (Fig. 1*C*). P5 (Fig. 14*C*): B2 with 4–5 submarginal spinules, distomedial corner produced into bifid spiniform process. Re2 plumose, equal in length to Re3.

Male (Fig. 14*D–G*). Head and Pdg1 not fused. CR 5 times longer than wide. Ur segments and CR in proportions 18 : 19 : 14 : 12 : 11 : 26 = 100. Right A1 with 21 segments (Fig. 1*D*) and straight spine on segment 10 as in *P. annandalei*. P5 posterior view (Fig. 14*F*): right leg, B2 lacks Ri. Re1 with proximomedial hairs and spinules, distolateral corner produced into stout spiniform process. Re2 with long plumose Se. Re3 distally constricted. Left leg, B2 lacks Ri. Re1 with short blunt Se. Re2 ovate with stout Se, 2 St, and 6 setae. Anterior view (Fig. 14*G*): B1 with spinules and fine hairs.

Remarks

This species has been placed in the Nudus group because of its lack of either a right or left Ri on male P5. *P. clevei* was first collected from Kangean Island, Indonesia (Scott 1909)

and later from the Aru Archipelago (Fig. 15) between Wokam and Udjir Islands (Früchtl 1924). It has also been reported from Palau (Mori 1942) and the Andaman Sea (Pillai 1980). *P. clevei* has not been reported from Australia, but the close proximity of the Aru Islands suggests that its range may extend to Papua New Guinea or Australia.

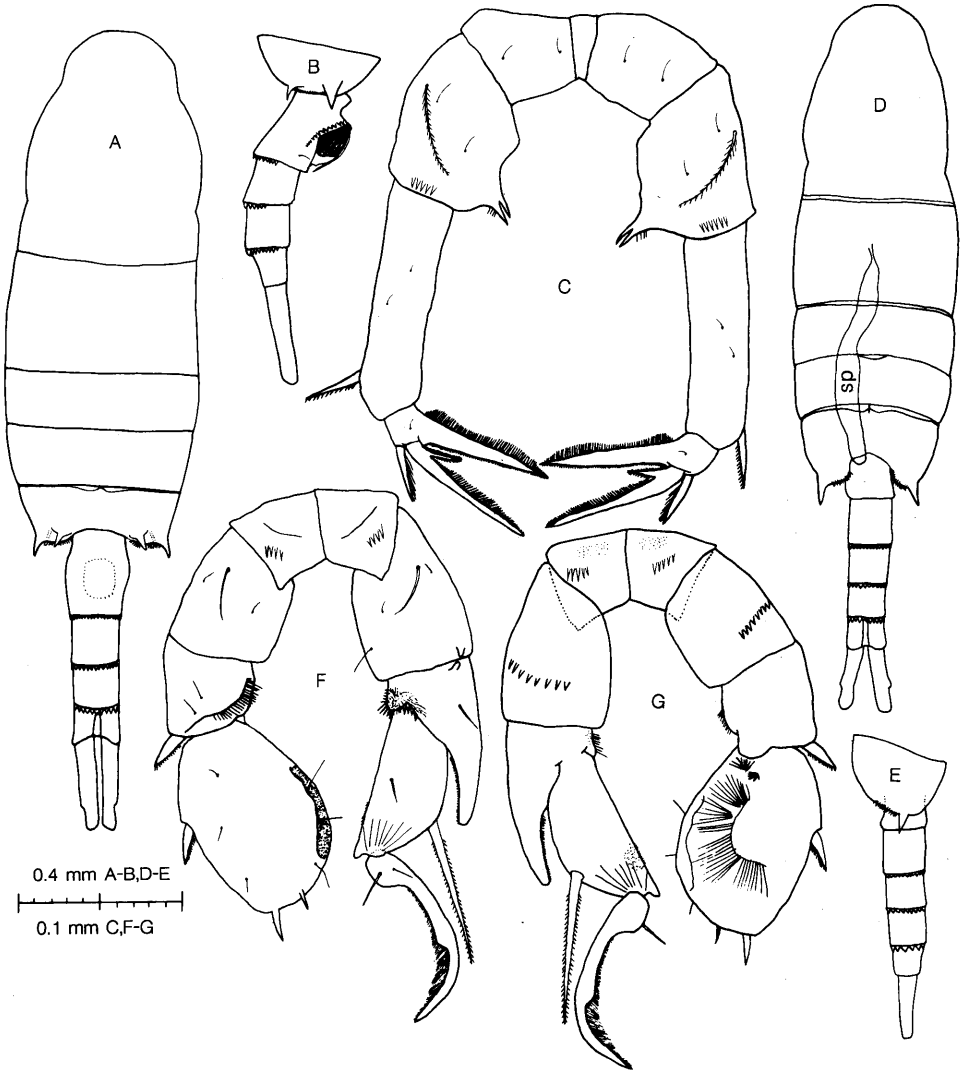

Fig. 14. *Pseudodiaptomus clevei* Scott. *A–C*, adult female: *A*, dorsal view; *B*, lateral view of Ur right side; *C*, posterior view of P5. *D–G*, adult male: *D*, dorsal view; *E*, lateral view of Ur right side; *F*, posterior view of P5; *G*, anterior view of P5.

Discussion

Several Indo-Pacific species of *Pseudodiaptomus* have been reported to have widespread geographic ranges. However, from this study and Walter (1986*b*) it can be shown that the ranges of several of these species are in reality more restricted, with some of the poorly described or previously misidentified species now assignable as new species (Fig. 15).

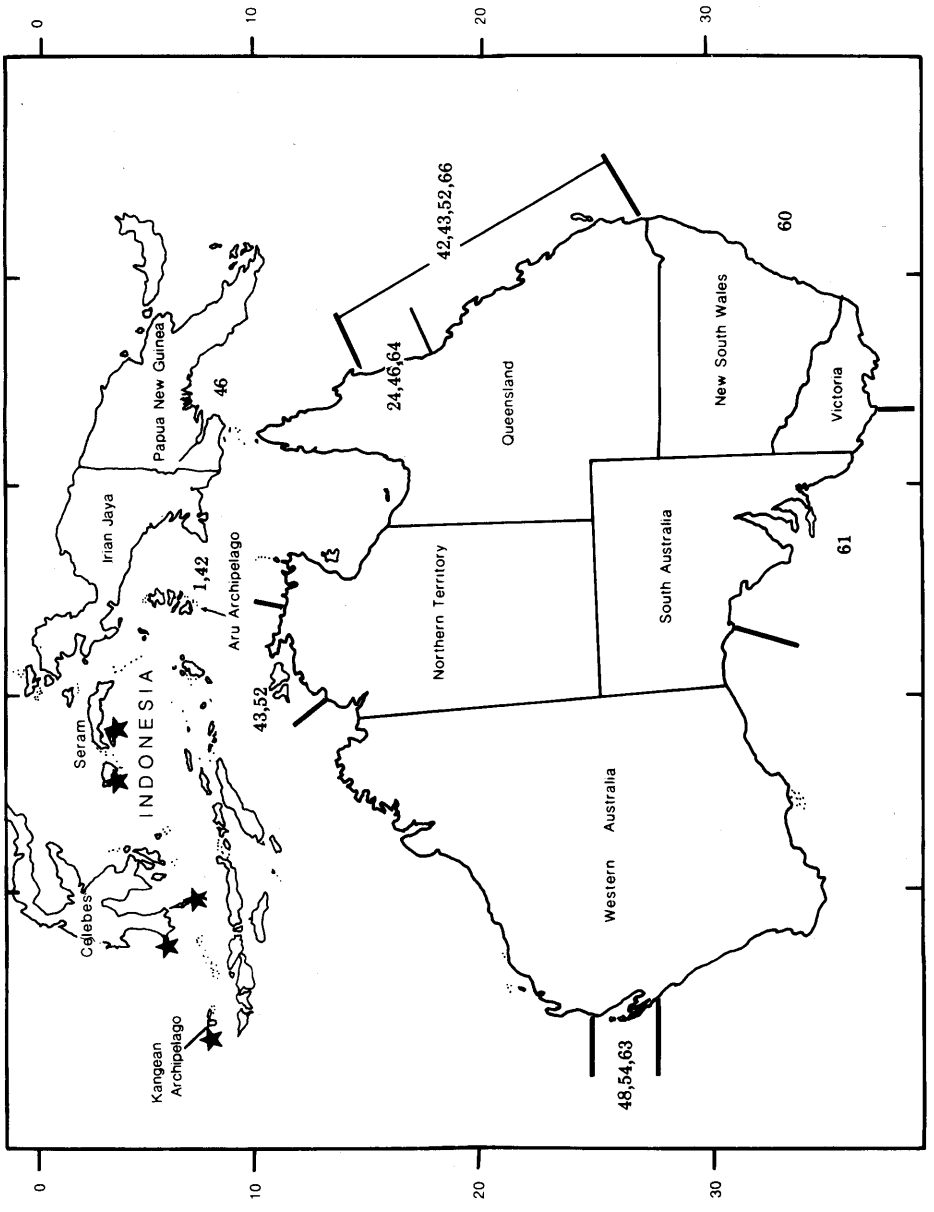

Fig. 15. Map of Australia and southern Indo-West Pacific region showing the distribution of *Pseudodiaptomus*. The numbers on the map correspond to the species listed in Table 1; (*) along the eastern part of Indonesia indicates stations where *P. aurivilii* was found by Scott (1909).

Reports of *P. aurivilli* and *P. mertoni*, of the Hyalinus species group, from waters of India to Australia were reviewed by Walter (1984) who established five new species. The previous extensive distribution of *P. aurivilli* resulted from species misidentification. The Australian species *P. baylyi* had been reported as *P. aurivilli*; the latter occurs further north around the Andaman–Malaysia–Philippine archipelagoes and probably extends as far south as central Indonesia. At present the distribution of *P. mertoni* appears to be limited to southern Indo-West Pacific waters. Neither *P. aurivilli* nor *P. mertoni* occur in Indian coastal waters; there, they are replaced by their subgroup representatives *P. bowmani*, *P. compactus* and at least one unidentified species.

In the Ramosus species group, *P. marinus* was reported to occur from Japan south to Australia and from India east to Hawaii. However, with the descriptions of *P. australiensis*, *P. hypersalinus* and *P. philippinensis* the distribution of *P. marinus* is now limited to the boreal waters of northern Japan. Another member in this species group, *P. cornutus* reported from One Tree Lagoon, Qld (McWilliam *et al.* 1981) was shown by Walter (1986*b*) to be *P. pacificus*. The introduction of the latter supports the belief that *P. cornutus* is restricted to waters south of the 27°S. latitude line.

Results of this study and Walter (1986*b*) indicate that of all the Australian species only *P. pacificus*, *P. annandalei*, *P. clevei* and *P. galleti* have widespread north to south ranges throughout Indo-Pacific waters. *Pseudodiaptomus colefaxi*, *P. cornutus*, *P. occidentalus*, *P. hypersalinus*, and possibly *P. baylyi* and *P. inflexus* appear to be endemic to continental waters. Though much is known about the zoogeography of this genus, additional studies are still needed to clarify the zoogeographic and phylogenetic relationships among species in this genus. Future studies should concentrate on coastal areas throughout the Indo-Pacific region, particularly along the Indonesian archipelago, using alternative collecting methods such as emergence traps or night tows over algal, sand and coral flats.

Acknowledgments

I thank Dr Thomas Bowman and Dr Frank Ferrari, Smithsonian Institution, for their comments and critical review of this study. I also acknowledge the following who provided me with information and/or specimens: Dr J. L. Barnard, Smithsonian Institution; Dr I. A. E. Bayly, Monash University, Clayton, Vic.; Dr J. G. Greenwood, University of Queensland; Dr R. Hartwick, James Cook University of North Queensland; Mr D. McKinnon, University of Melbourne; Ms P. S. McWilliam, Division of Fisheries Research, CSIRO; Dr W. Zeidler, South Australian Museum; Mr R. Springthorpe, Australian Museum, Sydney.

References

Alldredge, A. L. (1985). Abundance of demersal zooplankton on tropical seagrass meadows. *Natl Geogr. Soc. Res. Rep.* **19**(1), 95–101.

Alldredge, A. L., and King, J. M. (1977). Distribution, abundance and substrate preferences of demersal reef zooplankton at Lizard Island Lagoon, Great Barrier Reef. *Mar Biol. (Berl.)* **41**(4), 317–33.

Bayly, I. A. E. (1965). Ecological studies on the planktonic Copepoda of the Brisbane River Estuary with special reference to *Gladioferens pectinatus* (Brady) (Calanoida). *Aust. J. Mar. Freshw. Res.* **16**(3), 315–50.

Bayly, I. A. E. (1966). A new species and new records of *Pseudodiaptomus* (Copepoda : Calanoida) from the Brisbane River Estuary, Queensland. *Proc. R. Soc. Queensl.* **78**(5), 49–57.

Bayly, I. A. E. (1975). Australian estuaries. In 'Managing Aquatic Ecosystems'. (Eds H. A. Nix and M. A. Elliot.) [*Proc. Ecol. Soc. Aust.* **8**, 41–66.]

Bayly, I. A. E. (1980). A preliminary report on the zooplankton of the Purari River Estuary. In 'Aquatic Ecology of the Purari River Catchment'. (Ed. T. Petr.) Purari River (Wabo) Hydroelectric Scheme Environmental Studies No. 11, pp. 7–11.

Brehm, V. (1933). Mitteilungen von der Wallacea Expedition Woltereck. 7. Neue und wenig bekannte Entomostraken. *Zool. Anz.* **104**(5/6), 130–42.

Brehm, V. (1934). Mitteilungen von der Wallacea Expedition Woltereck. 10. Über die systematische Stellung des von der Wallacea Expedition entdeckten *Pseudodiaptomus nostradamus* Brehm und über die Systematik der Pseudodiaptomiden überhaupt. *Zool. Anz.* **106**(3/4), 84–93.

Brehm, V. (1953). Indische Diaptomiden, Pseudodiaptomiden und Cladoceren. *Ost. Zool. Z.* **4**(3), 242–345.

Chen, Q. C., and Zhang, S. Z. (1965). The planktonic copepods of the Yellow Sea and the East China Sea, I. Calanoida. (Hai Yang K'o Hsueh Chi K'an.) *Stud. Mar. Sin.* **7**(1), 20–131.

Cleve, P. T. (1901). Plankton from the Indian Ocean and the Malay Archipelago. *K. Sven. Vetenskapsakad. Handl.* **35**(5), 1–58.

Dakin, W. J., and Colefax, A. N. (1940). 'The Plankton of the Australian Coastal Waters off New South Wales.' [Monograph No. 1, Dept. Zool., Univ. Sydney.] 215 pp.

Früchtl, F. (1923). Cladocera und Copepoda der Aru-Inseln. *Abh. Senckenb. Naturforsch. Ges.* **37**(4), 449–57.

Früchtl, F. (1924). Die Cladoceran- und Copepoden-Fauna des Aru-Archipels. Mit Beiträgen zur Kenntnis der strukturellen Anomalien indo-pazifischer Plankton Copepoden. *Arb. Zool. Inst. Univ. Innsbruck* **2**(2), 3–114.

Goswami, S. C. (1983). Coexistence and succession of copepod species in the Mandovi and Zuari Estuaries, Goa. *Mahasagar- Bull. Natl Inst. Oceanogr.* **16**(2), 251–8.

Greenwood, J. G. (1977). Calanoid copepods of Moreton Bay (Queensland). II. Families, Calocalanidae to Centropagidae. *Proc. R. Soc. Queensl.* **88**(1), 49–67.

Greenwood, J. G. (1981). Occurrences of congeneric pairs of *Acartia* and *Pseudodiaptomus* species (Copepoda, Calanoida) in Moreton Bay, Queensland. *Estuarine Coastal Shelf Sci.* **13**(5), 591–6.

Greenwood, J. G. (1982). Calanoid Copepods of Moreton Bay (Queensland), V. Ecology of the dominant species. *Proc. R. Soc. Queensl.* **93**(1), 49–64.

Grigg, H. (1972). The taxonomy and distribution of *Pseudodiaptomus* (Copepoda : Calanoida) in the Townsville region. M.Sc. Thesis, James Cook University, Queensland, 192 pp.

Grindley, J. R. (1984). The zoogeography of the Pseudodiaptomidae. *Crustaceana* (Leiden) Suppl. **7**, 217–28.

Kasturirangan, L. R. (1963). A key for the identification of the more common planktonic Copepoda of Indian coastal waters. Indian Nat. Comm. Oceanic Res., Council Scientific and Industrial Research, Publ. 2. (New Delhi.) 87 pp.

Kiefer, F. (1936). Indische Ruderfußkrebse (Crustacea : Copepoda) II. *Zool. Anz.* **113**(9/10), 231–3.

Kiefer, F. (1938). Bemerkungen zur Pseudodiaptomidenausbeute der Wallacea-Expedition. *Int. Rev. Gesamten Hydrobiol. Hydrogr.* **38**(1/2), 75–98.

Kimmerer, W. J., McKinnon, A. D., Atkinson, M. J., and Kessell, J. A. (1985). Spatial distributions of plankton in Shark Bay, Western Australia. *Aust. J. Mar. Freshw. Res.* **36**(3), 421–32.

Marsh, C. D. (1933). Synopsis of the calanoid crustacean exclusive of the Diaptomidae, found in fresh and brackish waters, chiefly of North America. *Proc. U.S. Nat. Mus.* **82**(2959), 1–58.

McWilliam, P. S., Sale, P. T., and Anderson, D. T. (1981). Seasonal changes in resident zooplankton sampled by emergence traps in One Tree Lagoon, Great Barrier Reef. *J. Exp. Mar. Biol. Ecol.* **52**(2/3), 185–203.

Mori, T. (1942). Systematic studies of the plankton organisms occurring in Iwayama Bay, Palao. 4. Copepoda from the bay and adjacent waters. *Palao Trop. Biol. Stat. Studies* **2**(3), 549–80.

Nicholls, A. G. (1944). Littoral Copepoda from South Australia. II. Calanoida, Cyclopoida, Notodelphyoida, Monstrilloida and Caligoida. *Rec. S. Aust. Mus. (Adelaide)* **8**(1), 1–62.

Ohlhorst, S. L. (1982). Diel migration patterns of demersal reef zooplankton. *J. Exp. Mar. Biol. Ecol.* **60**(1), 1–15.

Pillai, P. P. (1980). A review of the calanoid copepod family Pseudodiaptomidae, with remarks on the taxonomy and distribution of the species from the Indian Ocean. *J. Mar. Biol. Assoc. India* **18**(2), 242–65.

Reddy, Y. R., and Radhakrishna, Y. (1982). Redescription and/or remarks on four species of *Pseudodiaptomus* Herrick (Copepoda : Calanoida) from South India. *Hydrobiologia* **87**(3), 255–271.

Robertson, A. I., and Howard, R. K. (1978). Diel trophic interactions between vertically-migrating zooplankton and their fish predators in an eelgrass community. *Mar. Biol. (Berl.)* **48**(3), 207–13.

Rose, M. (1957). Description de copépodes nouveaux du plankton marin de Nha-trang (Vietnam). *Bull. Mus. Natl Hist. Nat. Paris* **29**(2), 235–45.

Sale, P. F., McWilliam, P. S., and Anderson, D. T. (1976). Composition of the near-reef zooplankton at Heron Reef, Great Barrier Reef. *Mar. Biol. (Berl.)* **34**(1), 59–66.

Sale, P. F., McWilliam, P. S., and Anderson, D. T. (1978). Faunal relationships among the near-reef zooplankton at three locations on Heron Reef, Great Barrier Reef, and seasonal changes in this fauna. *Mar. Biol. (Berl.)* **49**(2), 133–45.

Scott, A. (1909). The Copepoda of the Siboga Expedition. Part I. Free-swimming, littoral and semi-parasitic copepods. Siboga Exped. Monogr. No. 1(29*a*), pp. 1–323.

Sewell, R. B. S. (1919). I. A preliminary note on some new species of Copepoda. *Rec. Indian Mus. (Calcutta)* **16**(1), 1–18.

Sewell, R. B. S. (1924). Fauna of the Chilka Lake: Crustacea, Copepoda. *Mem. Indian Mus.* **5**, 771–851.

Sewell, R. B. S. (1932). The Copepoda of Indian Seas. Calanoida. *Mem. Indian Mus.* **10**, 223–407.

Shen, C. J., Ed. (1979). Fauna Sinica, Crustacea. Freshwater Copepoda. Fauna Editorial Committee, Academia Sinica, pp. 1–450. (Science Press: Peking.)

Thompson, I. C., and Scott, A. (1903). Report on the Copepoda collected by Professor Herdman at Ceylon, in 1902. *Rep. Govt Ceylon Pearl Oyster Fish. Gulf Manaar*, Suppl. Rep. **7**(1), 227–307.

Walter, T. C. (1984). New species of *Pseudodiaptomus* from the Indo-Pacific, with a clarification of *P. aurivilli* and *P. mertoni* (Crustacea : Copepoda : Calanoida). *Proc. Biol. Soc. Wash.* **97**(2), 371–93.

Walter, T. C. (1986*a*). The zoogeography of the genus *Pseudodiaptomus* (Calanoida : Pseudodiaptomidae). In 'Proc. 2nd Int. Conf. Copepoda, Ottawa, 1984'. National Museums of Canada, Syllogeus 58, pp. 502–8.

Walter, T. C. (1986*b*). New and poorly known Indo-Pacific species of *Pseudodiaptomus* (Copepoda : Calanoida), with a key to the species groups. *J. Plankton Res.* **8**(1), 129–68.

Walter, T. C., Talaue, L., and Pasamonte, J. N. (1982). A preliminary quantitative study on emergence of reef-associated zooplankton from a Philippine coral reef. Proc. 4th Int. Coral Reef Symp., Manila. Vol. 1, pp. 443–51.

Wellershaus, S. (1969). On the taxonomy of planctonic Copepoda in the Cochin Backwater (a south Indian estuary). *Veröff. Inst. Meeresforsch. Bremerhaven* **11**(2), 245–86.

Manuscript received 28 January 1986, accepted 8 July 1986