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177

A new species of *Pasiphaea* from the Red Sea

(Crustacea: Decapoda: Pasiphaeidae).

With 3 Text-Figures and 3 Tables.

NOZOMU IWASAKI

Abstract.

[IWASAKI, N. (1989): A new species of *Pasiphaea* from the Red Sea (Crustacea: Decapoda: Pasiphaeidae). — *Senckenbergiana marit.*, 20 (5/6): 177-186, 3 figs., 3 tabs.; Frankfurt a. M.].

Pasiphaea marisrubri n. sp., a pasiphaeid shrimp is described. The species is apparently endemic to the Red Sea.

Kurzfassung.

[IWASAKI, N. (1989): Eine neue *Pasiphaea*-Art aus dem Roten Meer (Crustacea: Decapoda: Pasiphaeidae). — *Senckenbergiana marit.*, 20 (5/6): 177-186, 3 Abb., 3 Tab.; Frankfurt a. M.].

Pasiphaea marisrubri n. sp., eine neue Pasiphaeiden-Art, die anscheinend endemisch für das Rote Meer ist, wird beschrieben.

Introduction.

A new *Pasiphaea* species was collected from the Red Sea during the "Metalliferous Sediments Atlantis II-deep (Meseda)"-expeditions with R. V. "SONNE" and R. V. "VALDIVIA" (THIEL, 1980) and from the "METEOR CRUISE 5" with R. V. "METEOR" (TÜRKAY & THIEL, 1987). The new species resembles *Pasiphaea sivado* (RISSO 1816) and *P. japonica* OMORI, 1976 which are sibling species and are distinguished by the number of spines on the meri of the first and second pereopods and the ratio of the length of antennal scale to the length of propodus of the first pereopod (OMORI, 1976). In this paper the new species is described and recognition characters for distinguishing it from *P. sivado* and *P. japonica* are given. The type material and supplementary specimens from the Red Sea and the Gulf of Aden are deposited in the Senckenberg-Museum (Frankfurt/Main, Federal Republic of Germany) and Zoologische Staatssammlung (München, Federal Republic of Germany).

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An additional specimen from the Gulf of Aqaba is deposited in the Rijksmuseum van Natuurlijke Historie (Leiden, The Netherlands). The samples were collected with an Isaacs-Kidd midwater trawl (IKMT), a closing trawl (TA) which was towed obliquely and a beamtrawl. The IKMT consisted of four parts; the first 0.5 m had a mesh opening of 20 mm, the following 0.5 m 16 mm, the following 8.25 m 11 mm, and the last 4 m 6 mm. The size of its mouth was 2.5×4 m (WEIKERT pers. comm.). The TA had a length of 7.4 m, with a mesh opening of 30 mm for the first 2.4 m, 20 mm in the mid 3.3 m, and 0.8 mm in the last 1.7 m. The width and height of its fishing mouth were 3 m and 1 m, respectively (THIEL, 1980).

The following abbreviations are used throughout this paper: CL = carapace length; Ku = station in which beamtrawl was towed; NPI = station in which IKMT was towed obliquely; RMNH = Rijksmuseum van Natuurlijke Historie, Leiden; SMF = Senckenberg-Museum, Frankfurt/Main; ST = closing trawl; TAP = station in which TA was towed pelagically; ZSM = Zoologische Staatssammlung, München.

Pasiphaea marisrubri n. sp.

(Figs. 1-3; Tabs. 1-3).

Holotype: 1♂ [10.0 mm CL] (SMF 17543), central Red Sea, Sta. So-02/43-TAP (21°14.80'N 37°15.40'E-21°18.20'N 37°12.00'E), 0-220 m depth, ST-206, 18. X. 1977, R. V. "SONNE".

Allotype: 1 ovig. ♀ [11.17 mm CL] (SMF 17544) data as holotype.

Paratypes: 7♂ [7.2-10.5 mm CL]; 7♀ (1 ovig.) [6.5-12.1 mm] (SMF 17545), data as holotype.

Material examined: 1 ovig. ♀ (RMNH), Gulf of Aqaba (the specimen was washed on the shore), 13. IV. 1977.

13♂ 73♀ (4 ovig.), 40 Carapaces, 6 sex unknown (damaged) (SMF 17546), data as holotype; 6♂ 15♀ (1 ovig.), 18 Abdomen, 20 Carapaces, 2 sex unknown (damaged) (SMF 17547), central Red Sea, Sta. So-02/45-TAP (21°17.10'N 38°04.70'E-21°20.10'N 38°00.70'E), 0-255 m depth, ST 207, 19-20. X. 1977, R. V. "SONNE"; 1♀ (SMF 17548), central Red Sea, Sta. Va-22/59-NPI (21°24.6'N 38°04.0'E), 0-320 m depth, IKMT-3, 25. III. 1979, R. V. "VALDIVIA"; 5♂ 8♀ (SMF 17549), central Red Sea, Sta. Va-22/63-NPI (21°25.9'N 38°05.8'E), 0-500 m depth, IKMT-4, 27. III. 1979, R. V. "VALDIVIA"; 30♂ 74♀ (29 ovig.) (SMF 17550), central Red Sea, Sta. Va-22/79-NPI (21°20.65'N 38°05.4'E), 0-200 m depth, IKMT-6, 29. III. 1979, R. V. "VALDIVIA"; 2♀ (1 ovig.) (SMF 17551), central Red Sea, Sta. Va-22/99-TA (21°33.00'N 38°21.00'E), 753-804 m depth, ST 230, 9. IV. 1979, R. V. "VALDIVIA"; 1 ovig. ♀ (SMF 17552), central Red Sea, Sta. Va-22/102-TA (21°25.06'N 38°05.21'E), 1852-1907 m depth, ST 232, 10. IV. 1979, R. V. "VALDIVIA"; 2♂ (ZSM 546/1), central Red Sea, Sta. M5/75-Ku (22°53.8'N 36°29.2'E-22°54.3'N 36°28.7'E), 748-845 m depth, 5. II. 1987, R. V. "METEOR"; 2♂ 2♀ (1 ovig.), 1 sex unknown (damaged) (ZSM 546/2), 1♂ 1♀ (SMF 17553), central Red Sea, Sta. M5/80-Ku (22°55.0'N 37°22.7'E-22°56.2'N 37°22.0'E), 1276-1294 m depth, 6. II. 1987, R. V. "METEOR"; 1♂ 1♀ ovig. (ZSM 546/3), central Red Sea, Sta. M5/84-Ku (22°52.7'N 37°03.4'E-22°52.5'N 37°03.5'E), 880-884 m depth, 7. II. 1987, R. V. "METEOR"; 1♂ 1♀ (1 ovig.) (ZSM 546/4), 1♀ (SMF 17554), central Red Sea, Sta. M5/85-Ku (22°35.2'N 36°45.9'E-22°34.8'N 36°46.2'E), 772-779 m depth, 7. II. 1987, R. V. "METEOR"; 1♂ 2♀ (2 ovig.) (ZSM 546/5), 1♀ (SMF 17555), central Red Sea, Sta. M5/90-Ku (22°15.4'N 37°44.7'E-22°14.4'N 37°45.0'E), 1095-1116 m depth, 8. II. 1987, R. V. "METEOR"; 1♂ (ZSM 546/6), central Red Sea, Sta. M5/99-Ku (22°08.4'N 37°28.9'E-

22°09.2'N 37°29.5'E), 827-863 m depth, 9. II. 1987, R. V. "METEOR"; 5♂ 1♀ ovig. (ZSM 546/7), 1♂ 1♀ ovig. (SMF 17556), central Red Sea, Sta. M5/107-Ku (21°19.8'N 38°03.9'E-21°20.5'N 38°03.0'E), 1865-1995 m depth, 12. II. 1987, R. V. "METEOR"; 1 sex unknown (damaged) (ZSM 546/8), central Red Sea, Sta. M5/120-Ku (21°33.2'N 38°02.2'E-21°33.8'N 38°02.2'E), 1635-1672 m depth, 14. II. 1987, R. V. "METEOR"; 1♀ (ZSM 546/9), central Red Sea, Sta. M5/136-Ku (19°54.1'N 38°28.7'E-19°55.4'N 38°28.5'E), 1801-1858 m depth, 18. II. 1987, R. V. "METEOR"; 1♂ 1♀ (1 ovig.) (ZSM 546/10), 1♀ (SMF 17557), central Red Sea, Sta. M5/141-Ku (19°56.1'N 38°09.2'E-19°57.4'N 38°09.3'E), 807-863 m depth, 19. II. 1987, R. V. "METEOR"; 2 ovig. ♀ (ZSM 546/11), central Red Sea, Sta. M5/163-Ku (19°17.9'N 38°51.0'E-19°16.6'N 38°52.2'E), 1972-1975 m depth, 22. II. 1987, R. V. "METEOR"; 4♂ 8♀ (6 ovig.) (ZSM 546/12), 4♂ 4♀ (SMF 17997), central Red Sea, Sta. M5/170-Ku (18°48.1'N 39°19.8'E-18°47.4'N 39°20.9'E), 857-1032 m depth, 23. II. 1987, R. V. "METEOR"; 1♂ 1 sex unknown (damaged) (ZSM 546/13), central Red Sea, Sta. M5/171-Ku (18°34.5'N 39°02.4'E-18°35.3'N 39°03.5'E), 434-469 m depth, 23. II. 1987, R. V. "METEOR"; 1♂ 1♀ (ZSM 546/14), central Red Sea, Sta. M5/172-Ku (18°34.8'N 39°03.2'E-18°34.7'N 39°01.9'E), 428-459 m depth, 23. II. 1987, R. V. "METEOR"; 1♂ 4♀ (3 ovig.) (ZSM 576/15), 1♂ 3♀ (SMF 17998), central Red Sea, Sta. M5/176-Ku (19°18.0'N 38°51.8'E-19°16.7'N 38°53.7'E), 1968-1972 m depth, 24. II. 1987, R. V. "METEOR"; 1♀ (ZSM 546/16), central Red Sea, Sta. M5/183-Ku (19°35.0'N 38°40.0'E-19°35.0'N 38°40.0'E), 2119-2120 m depth, 26. II. 1987, R. V. "METEOR"; 1♂ (ZSM 546/17), central Red Sea, Sta. M5/188-Ku (19°33.8'N 38°39.1'E-19°35.4'N 38°38.4'E), 2060-2061 m depth, 27. II. 1987, R. V. "METEOR"; 3♂ 6♀ (3 ovig.), 1 sex unknown (damaged) (ZSM 546/18), 4♀ (SMF 17999), central Red Sea, Sta. M5/193-Ku (19°24.3'N 38°31.2'E-19°25.5'N 38°30.9'E), 696-705 m depth, 28. II. 1987, R. V. "METEOR"; 9♂ 2♀ (1 ovig.) (ZSM 546/19), 1♂ 1♀ (SMF 18000), central Red Sea, Sta. M5/197-Ku (19°52.2'N 37°35.3'E-19°53.4'N 37°35.1'E), 747-778 m depth, 1. III. 1987, R. V. "METEOR".

1 ovig. ♀ (ZSM 546/20), Gulf of Aden, Sta. M5/279-Ku (12°52.5'N 45°53.3'E-12°51.7'N 45°52.7'E), 1185-1186 m depth, 15. III. 1987, R. V. "METEOR".

Diagnosis: Carapace not carinate, with a prominent and short rostrum projecting anterodorsally, not extending beyond anterior margin of carapace. Abdomen smooth, not carinate. Telson truncated, with 4 pairs of terminal spines. First pereopod with 8 to 20 spines on ventral margin of merus (the sum of spines on a pair of meri is 16 to 34). Second pereopod with 12 to 25 spines on ventral margin of merus (the sum of spines on a pair of meri is 31 to 50).

Description: Rostrum prominent and short, directed obliquely upward, not extending beyond anterior margin of carapace. Carapace not carinate, with supra-branchial carina on its lateral surface. Branchiostegal spine present. Eyes well developed, cornea rounded, well-pigmented.

Length ratios of first to third segments of antennular peduncle as follows: 47:19:34. Antennular peduncle almost reaching 3/4 length of antennal scale. Antennal scale armed with a strong tooth on outer margin. Antennal peduncle reaching to about 2/3 length of antennular peduncle.

Mandible with eleven-toothed incisor process, palp absent. First maxilla with rounded proximal endite, strongly toothed distal endite and simple endopod armed with a seta. Second maxilla with simple endopod and large scaphognathite. First maxilliped reduced to large elongate lamina, incompletely articulated distally. Second maxilliped simple, consisting of five segments without epipod or exopod. Third maxilliped extending slightly beyond the antennal scale, with three-segmented endopod, exopod well developed.

All pereopods with well developed exopods, but no epipod. First pereopod reaching with fingers and 2/3 of palm beyond antennal scale, fingers slender, cutting edges toothed, tips curved and capable of crossing one another, they are 0.8 times the length of palm, basis without a spine but rarely armed with a spine on ventral

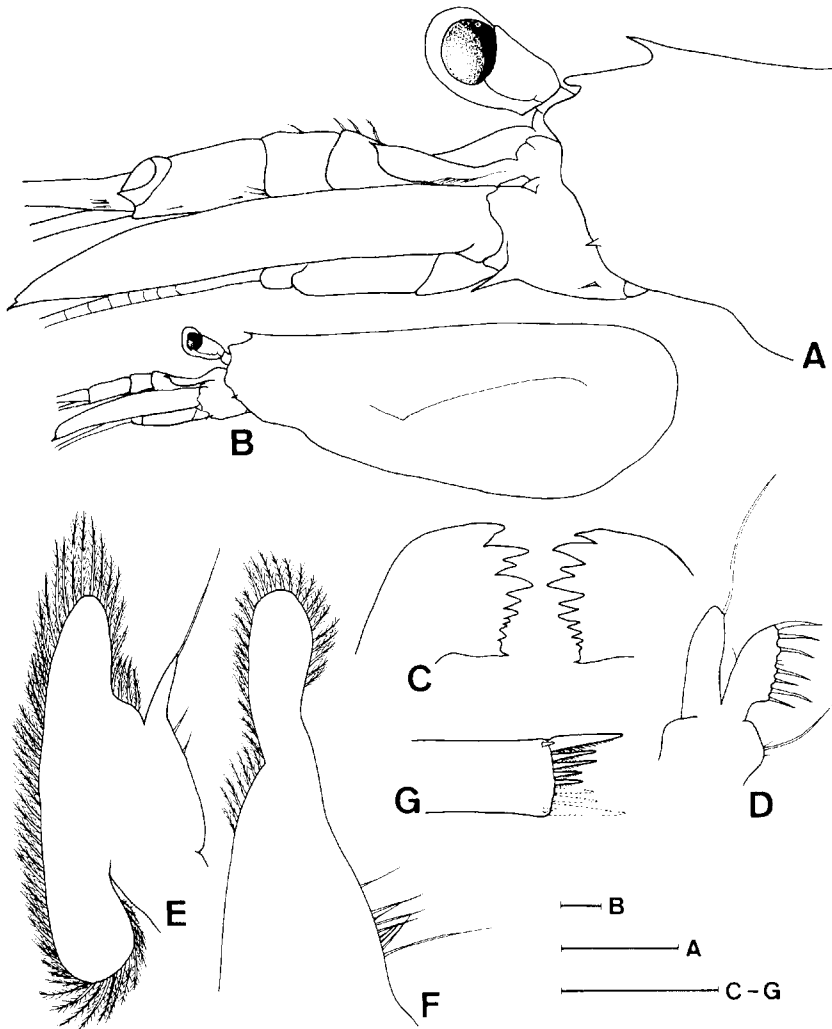


Fig. 1. *Pasiphaea marisrubri* n. sp., female. — A. Anterior part of carapace; B. Carapace; C. Mandible; D. First maxilla; E. Second maxilla; F. First maxilliped; G. Tip of telson. — Scale 1 mm.

Abb. 1. *Pasiphaea marisrubri* n. sp., Weibchen. — A. Vorderteil des Carapax; B. Carapax; C. Mandibel; D. 1. Maxille; E. 2. Maxille; F. 1. Maxilliped; G. Spitze des Telsons. — Maßstäbe 1 mm.

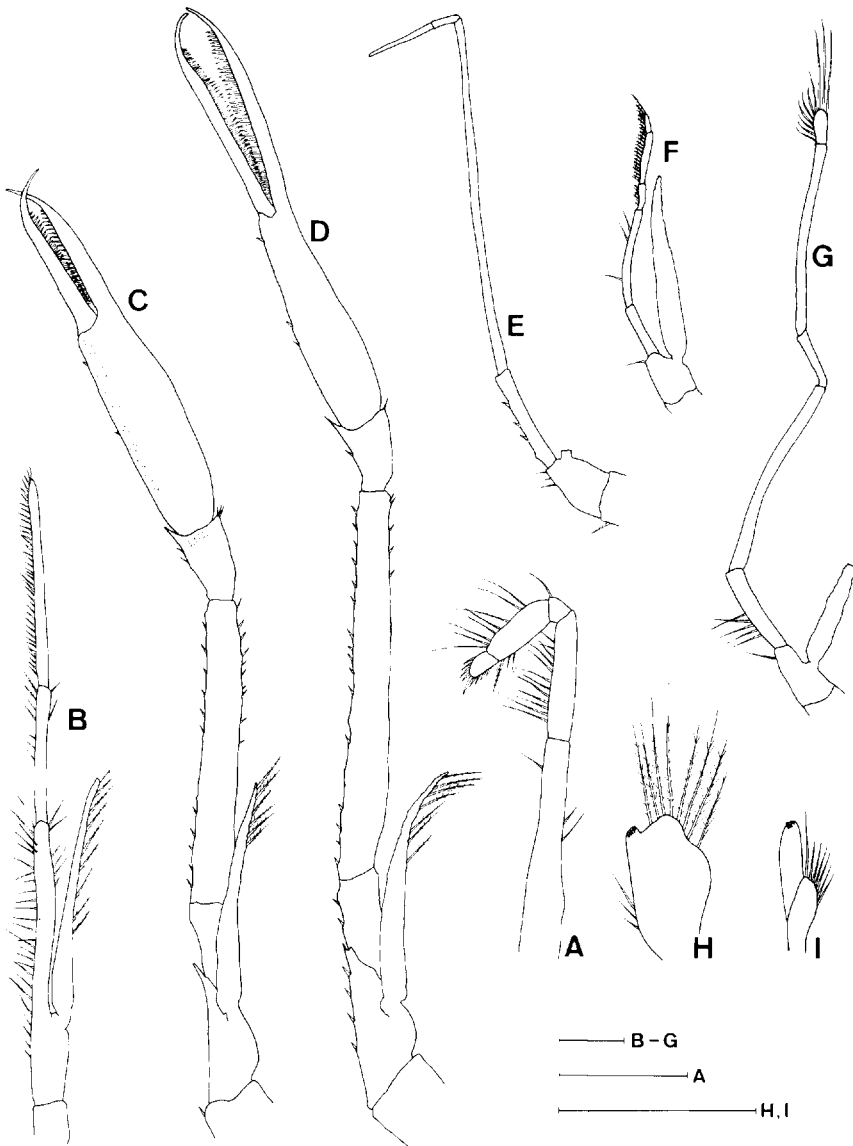


Fig. 2. *Pasiphaea marisrubri* n. sp. — A. Second maxilliped; B. Third maxilliped; C. First pereopod; D. Second pereopod; E. Third pereopod; F. Fourth pereopod; G. Fifth pereopod; H. Endopod of first pleopod; I. Appendices interna and masculina of second pleopod. — A-G. Female; H, I. Male. — Scale 1 mm.

Abb. 2. *Pasiphaea marisrubri* n. sp. — A. 2. Maxilliped; B. 3. Maxilliped; C. 1. Pereiopod; D. 2. Pereiopod; E. 3. Pereiopod; F. 4. Pereiopod; G. 5. Pereiopod; H. Endopodit des 1. Pleopoden; I. Appendices interna und masculina des 2. Pleopoden. — A-G. Weibchen; H, I. Männchen. — Maßstäbe 1 mm.

margin, ischium without a spine but rarely armed with a spine on both or either of ventral and dorsal margins, merus armed with 8 to 20 spines along entire ventral margin (the sum of spines on a pair of meri is 16 to 34) and with 1 to 17 spines along dorsal margin (the sum of spines on a pair of meri is 3 to 29); carpus armed with 0 to 4 spines on ventral margin (the sum of spines on a pair of carpi is 2 to 8); palm armed with 1 to 19 spines along ventral inner margin (the sum of spines on a pair of palms is 8 to 37). Second pereopod slightly longer than first pereopod, fingers slender, cutting edges toothed, tips curved and capable of crossing one another, they are as long as palm, basis armed with 2 to 7 spines on ventral margin (the sum of spines on a pair of bases is 4 to 12); ischium armed with 0 to 2 spines on ventral margin (the sum of spines on a pair of ischia is 1 to 4) and with 0 to 2 spines on dorsal margin (the sum of spines on a pair of ischia is 0 to 3); merus armed with 12 to 25 spines along entire ventral margin (the sum of spines on a pair of meri is 31 to 50) and with 0 to 12 spines along distal part of dorsal margin (the sum of spines on a pair of meri is 0 to 17); carpus armed with 0 to 3 spines on ventral margin (the sum of spines on a pair of carpi is 1 to 4); palm armed with 1 to 10 spines on ventral margin (the sum of spines on a pair of palms is 5 to 18). Third pereopod slender, reaching mid-length of carpus of second pereopod, ischium armed with 0 to 4 spines on ventral margin (the sum of spines on a pair of ischia is 1 to 7). Fourth pereopod short, reaching mid-length of basis of second pereopod. Fifth pereopod overreaching merus-ischium articulation of third pereopod, dactyl laterally broad and rounded distally.

Abdomen smooth, all abdominal somites without dorsal carinae, sixth abdominal somite with a small spine posterodorsally. Carapace and first to sixth abdominal somites have the proportional lengths, 38:6:9:12:6:8:21.

First pleopod in male and female with broadly ovate endopod, small lobe bearing some hooks. Second pleopod in male with longer appendix interna bearing some hooks distally and with shorter appendix masculina bearing setae. Uropod elongate, exopod 5 times as long as broad and 1.3 times the length of endopod.

Telson 0.7 times the length of sixth abdominal somite, truncated its tip with 4 pairs of terminal spines, outermost pair largest and bearing a spinule at base of outer spine.

Colour in life: Body and appendages transparent, eyes black, fingers of first and second pereopods, telson and uropod faintly red.

Type locality: Central Red Sea, 21°14.80'N 37°15.40'E-21°18.20'N 37°12.00'E), 0-220 m depth.

Range: Red Sea, including Gulf of Aqaba; Gulf of Aden.

Etymology: The name "*marisrubri*" refers to the type locality: the Red Sea.

Measurements and maturity: Measurements of the body length, carapace length, antennal scale, merus of the first pereopod and propodus of that limb are shown in Table 1. The maximum length is 15.1 mm CL in female and 12.9 mm CL in male. The relation between body length (BL) and carapace length (CL) is shown by the following relationship: Female BL = 2.93 CL + 4.61 (N = 47, r = 0.86) Male BL = 2.76CL + 4.84 (N = 24, r = 0.90). The smallest ovigerous female examined in the material available had 9.38 mm CL. The maximum number of eggs in one brood is 30. The average dimension of eggs is 1.16 mm (SD = 0.05, N = 24) × 0.77 mm (SD = 0.05, N = 24).

Table 1. Measurements of *Pasiphaea marisrubri* from the Red Sea. — Abbreviations: SD = Standard deviation; N = Number of specimens.

Tabelle 1. Maße von *Pasiphaea marisrubri* aus dem Roten Meer. — Abkürzungen: SD = Standardabweichung; N = Anzahl der Tiere.

	Body length (mm)	Carapace length (mm)	Antennal scale (mm)	Merus of 1st pereopod (mm)	Propodus of 1st pereopod (mm)
Female					
Mean	36.88	10.95	3.96	4.23	6.00
Range	25.50–48.22	7.60–15.14	2.60–5.50	2.70–5.60	4.10–8.00
SD	5.33	1.58	0.58	0.63	0.88
N	47	50	47	50	50
Male					
Mean	33.24	10.13	3.82	3.94	5.44
Range	26.31–39.40	7.40–12.94	2.70–4.75	2.85–4.90	4.00–6.70
SD	3.58	1.26	0.54	0.52	0.62
N	24	30	28	30	28

Relationships: *Pasiphaea marisrubri* is closely related to *P. sivado* and *P. japonica*, but is distinguished from these species by the following characters which OMORI (1976) also used for distinguishing *P. sivado* from *P. japonica*:

- (1) Significant differences in the number of spines on the ventral margin of meri of the first and second pereopods. These frequency distributions overlap in *P. marisrubri* and *P. japonica*, respectively. However, mean numbers of those in *P. marisrubri* are the highest among the three species (Table 2). The number of spines on the ventral margin of the meri of the first and second pereopods increases with the carapace length in *P. marisrubri* (Fig. 3).

Table 2. Comparison of the total number of spines on ventral margin of meri of the first and second pereopods. — Abbreviations: SD = Standard deviation; N = Number of specimens; Z = Test for equality between two means, *Pasiphaea marisrubri* compared with *P. sivado* and *P. japonica*.

Tabelle 2. Vergleich der Gesamtzahl der Dornen am Ventralrand des Merus der 1. und 2. Pereiopoden für *Pasiphaea marisrubri*, *P. sivado* und *P. japonica*. — Abkürzungen: SD = Standardabweichung; N = Anzahl der Tiere; Z = Prüfung zwischen zwei Mittelwerten.

Species	Location	Merus of first pereopod					Merus of second pereopod				
		Mean	Range	SD	N	Z	Mean	Range	SD	N	Z
<i>P. marisrubri</i> *	Red Sea	26.208	16–34	3.978	48	—	40.523	31–50	4.613	44	—
<i>P. sivado</i> **	Mediterranean	11.000	6–15	2.144	48	23.316***	24.490	17–32	3.484	51	18.874***
<i>P. sivado</i> **	Atlantic	8.061	3–11	2.277	33	26.010***	19.438	11–30	3.843	32	21.688***
<i>P. japonica</i> **	Sea of Japan	16.592	11–24	2.922	49	13.546***	34.102	30–43	3.255	49	7.675***

* = Females; ** = Females and males combined. — Data from OMORI (1976);
 *** = Significant (two-sided test, level of significance 5%).

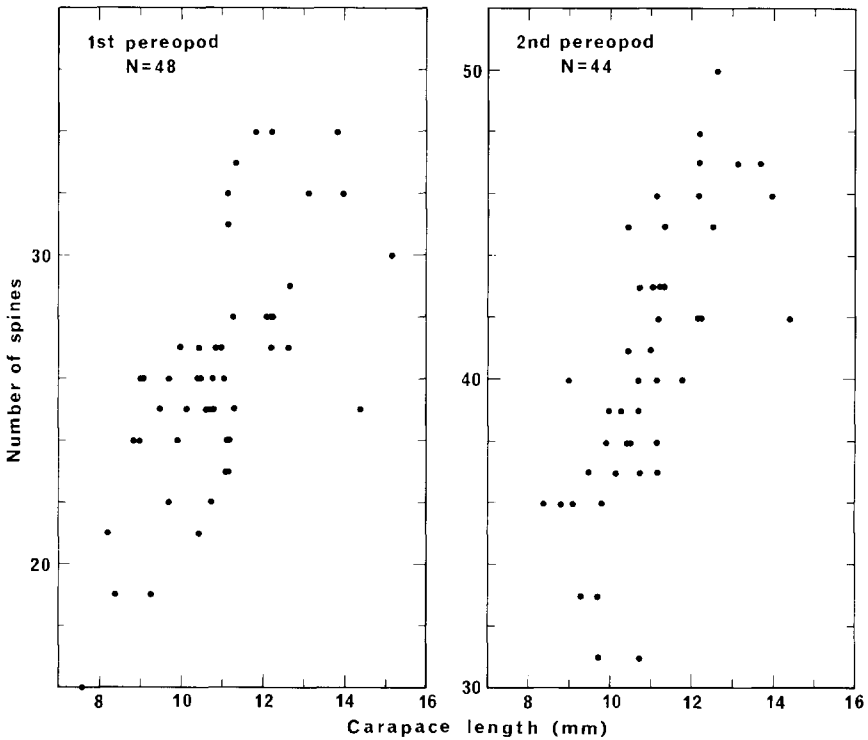


Fig. 3. Correlation of the total number of spines on the ventral margin of the meri of the first and second pereopods with growth in *Pasiphaea marisrubri*.

Abb. 3. Korrelation der Gesamtzahl der Dornen am Ventralrand des Merus der 1. und 2. Pereiopoden mit dem Wachstum bei *Pasiphaea marisrubri*.

- (2) Significant differences in the ratio of the length of antennal scale to the length of merus of the first pereopod and of the length of antennal scale to the length of propodus of the first pereopod. These ratios in *P. marisrubri* are the smallest among the three species (Table 3).

P. marisrubri further differs from *P. sivado* in that the telson of the latter does not have a spinule at the base of its outer spine. The body length and egg diameter of *P. marisrubri* is smaller than those of *P. sivado* and *P. japonica* (OMORI, 1974, 1976).

These three species are distributed separately as follows: *P. sivado* is found in the Atlantic, Mediterranean and Indian Ocean; *P. japonica* is restricted to coastal waters of Japan, namely Toyama Bay, Suruga Bay, Sagami Bay and Enshu Nada (OMORI, 1976); *P. marisrubri* may be endemic to the Red Sea.

Remarks: CALMAN (1935) clarified the distinction between *P. sivado* from the Red Sea, Gulf of Oman and northern area of Arabian Sea and British specimens.

Table 3. Comparison of the ratios antennal scale : merus of the first pereopod and antennal scale : propodus of the first pereopod. — Abbreviations: SD = Standard deviation; N = Number of specimens; Z = Test for equality between two means, *Pasiphaea marisrubri* compared with *P. sivado* and *P. japonica*.

Tabelle 3. Vergleich der Verhältnisse Antenna-Schuppe : Merus des 1. Pereiopoden und Antenna-Schuppe : Propodus des 1. Pereiopoden für *Pasiphaea marisrubri*, *P. sivado* und *P. japonica*. — Abkürzungen: SD = Standardabweichung; N = Anzahl der Tiere; Z = Prüfung zwischen zwei Mittelwerten.

Species	Location	Antennal scale : Merus of first pereopod					Antennal scale : Propodus of first pereopod				
		Mean	Range	SD	N	Z	Mean	Range	SD	N	Z
Female											
<i>P. marisrubri</i>	Red Sea	0.945	0.83-1.15	0.057	47	—	0.664	0.53-0.72	0.035	47	—
<i>P. sivado</i> *	Mediterranean	0.989	0.93-1.03	0.032	29	4.615**	0.916	0.83-0.97	0.037	29	29.440**
<i>P. sivado</i> *	Atlantic	1.007	0.98-1.06	0.031	14	5.282**	0.932	0.88-1.00	0.034	14	25.713**
<i>P. japonica</i> *	Sea of Japan	1.130	1.04-1.22	0.046	26	15.080**	1.066	0.96-1.19	0.051	26	35.800**
Male											
<i>P. marisrubri</i>	Red Sea	0.963	0.86-1.03	0.031	28	—	0.687	0.61-0.75	0.030	26	—
<i>P. sivado</i> *	Mediterranean	0.980	0.94-1.02	0.026	22	2.108**	0.902	0.85-0.96	0.031	22	24.298**
<i>P. sivado</i> *	Atlantic	1.013	0.95-1.05	0.026	20	6.058**	0.952	0.86-1.01	0.039	20	25.191**
<i>P. japonica</i> *	Sea of Japan	1.111	1.01-1.23	0.047	23	12.962**	1.071	0.98-1.14	0.036	23	40.262**

* = Data from OMORI (1976); ** = Significant (two-sided test, level of significance 5%).

Several distinctive features of CALMAN's specimens are consistent with those of *P. marisrubri*. Therefore CALMAN's *P. sivado* may at least partly belong to *P. marisrubri*. BALSS (1915) collected *P. sivado* from the Red Sea, but only the body length was recorded. Judging from the sampling area and the body length (about 35 mm), however, it is most probably that his specimens are *P. marisrubri*.

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