駿河湾および隣接海域のOithone科橈脚類

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Cyclopoid Copepods of the Family Oithonidae in Suruga Bay and Adjacent Waters[1)]

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Abstract

The taxonomy of the family Oithonidae in Suruga Bay and adjacent waters is studied. Eighteen species of the genus *Oithona* including three new species, and one species of the genus *Paroithona* are described with the keys to the genera and species. The problems on the identification of the species of the family are discussed.

Introduction

Cyclopoid copepods of the family Oithonidae are common and abundant zooplankters in the coastal and estuarine waters. Because of their relatively small size, identification to the species level is often toilsome, and thus a taxonomic study of this family in Japanese waters has been lacking. The family Oithonidae consists of two genera, *Oithona* BAIRD, 1893 and *Paroithona* FARRAN, 1908. Eight species have been reported from the coasts of Japan; *Oithona decipiens*, *O. fallax*, *O. nana*, *O. plumifera*, *O. rigida*, *O. robusta*, *O. setigera* and *O. similis*.

The present paper deals with the taxonomy of Oithonidae collected in Suruga Bay and adjacent waters. Although males were rarely collected, we found 18 species of the genus *Oithona*, of which 3 are new, and 1 species of the genus *Paroithona*. It was noted that the specimens of the present collection in Suruga Bay were mainly composed of oceanic species. A typical neritic species, *O. brevicornis*, was abundantly distributed in Tokyo Bay.

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Materials and Methods

Zooplankton in Suruga Bay was collected by the Shizuoka Fisheries Experiment Station during 1973 and 1974. In addition, Tokyo Bay and its southern offshore waters were sampled by

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the R/V Tansei Maru in 1971 and 1975. Sampling dates and localities are shown in Table 1 and Figure 1. The samples were mostly collected by vertical net haul from 150 m depth to

TABLE 1. ZOOPLANKTON SAMPLING DATA.

Station	Lat.	Long.	Sea aera	Sampling date	Sampling gear
1	34-34.0N	138-50.6E	Suruga Bay	Apr. 20, 1973	Marutoku net
7	34-19.0N	138-27.8E	Suruga Bay	Apr. 19, 1973	Marutoku net
				June 14, 1973	
				July 11, 1973	
				Aug. 7, 1973	
				Oct. 12, 1973	
				Dec. 12, 1973	
				Feb. 1, 1974	
18	34-36.0N	138-31.0E	Suruga Bay	Apr. 19, 1973	Marutoku net
				June 9, 1973	
				July 11, 1973	
				Aug. 6, 1973	
				Oct. 12, 1973	
				Dec. 12, 1973	
				Jan. 23, 1974	
				Feb. 28, 1974	
26	34-52.0N	138-43.0E	Suruga Bay	Apr. 18, 1973	Marutoku net
				June 6, 1973	
				July 13, 1973	
				July 31, 1973	
				Oct. 12, 1973	
				Dec. 3, 1973	
				Jan. 22, 1974	
				Feb. 21, 1974	
29	35-01.6N	138-34.0E	Suruga Bay	Apr. 18, 1973	Marutoku net
				June 6, 1973	
				July 13, 1973	
				July 31, 1973	
				Oct. 12, 1973	
				Dec. 3, 1973	
				Jan. 22, 1974	
				Feb. 27, 1974	
A1	35-14.9N	139-19.9E	Sagami Bay	Apr. 26, 1975	Norpac net
A3	34-40.5N	139-40.0E	Kuroshio area	Apr. 22, 1975	,,
A5	34-00.9N	140-18.9E	,,	Apr. 23, 1975	,,
A7	33-20.3N	140-39.7E	,,	Apr. 24, 1975	,,
T4	35-24.8N	139-44.9E	Tokyo Bay	Nov. 30, 1971	,,
				Apr. 22, 1975	
T7	35-10.0N	139-47.0E	Tokyo Bay	Nov. 30, 1971	Norpac net
T8	35-03.0N	139-41.0E	,,	Apr. 22, 1975	,,
T9	34-59.5N	139-39.8E	,,	Apr. 22, 1975	,,
---	35-09.2N	139-37.0E	Aburatsubo Cove (Sagami Bay)	Aug. 31, 1975	Van Dorn water sampler

the surface with either the Marutoku net, 45 cm in mouth diameter and 0.33 mm in mesh openings, or the Norpac net, 45 cm in mouth diameter and 0.10 mm in mesh openings. Where the water column was shallower than 150 m, the net was hauled from the bottom to the surface. Volume of water filtered was measured by means of a flowmeter. *Oithona* were also collected with a Van Dorn water sampler at one station.

Hydrographical conditions of the sampling area have been considerably well known. Temperature, salinity, nutrients and phytoplankton standing stock were determined at the same time when the present samplings were carried out. Relation between the abundance and distribution of *Oithona* and environment will be discussed by one of the authors (S.N.) elsewhere.

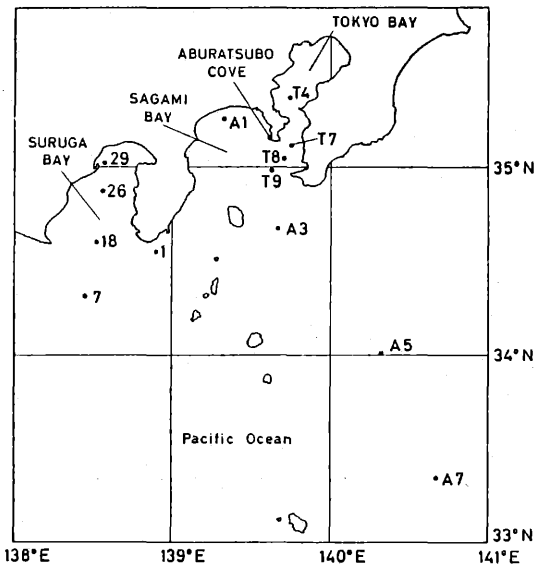

Fig. 1. Sampling stations.

The samples were preserved in a 10 % formaline-seawater solution. In the laboratory the zooplankton samples were split into smaller subsamples by means of a modified Folsom splitter. Usually 1/2 or 1/4 of the original sample was sorted into its major taxonomic components. The copepods from the sorted fraction of a subsample were enumerated, and the adult specimens of the Oithonidae were identified. The number of individuals per cubic meter was calculated from the volume of water filtered (Table 2). However, density estimated for small species such as *O. nana* or *O. similis* may be seriously underestimated in samples from Suruga Bay because of escapement through the coarse mesh of the Marutoku net. The copepods were stained with methylene blue and dissected in 50% aqueous solution of lactic acid. Illustrations were drawn with the aid of a camera lucida. The total body length, prosome length, urosome length and prosome width were measured to the nearest 0.01 mm. The ratio between the prosome length and urosome length (PL/UL) was determined. Type

TABLE 2-A. MONTHLY OCCURRENCE OF *Oithona* AT STN. 7 IN SURUGA BAY. SPECIES AND NUMBER OF INDIVIDUALS PER M^3 IN THE WATER COLUMN BETWEEN THE SURFACE AND APPROX. 150 M DEPTH.

Species	1973 Apr.	June	July	Aug.	Oct.	Dec.	1974 Feb.
Oithona atlantica		1.5	0.9	0.5		0.8	7.3
O. attenuata							
O. brevicornis							
O. cruralis, n.sp.							
O. decipiens							
O. fallax		0.5				1.5	0.2
O. longispina, n.sp.	3.9	2.8	1.4	0.5	0.3	0.8	8.6
O. nana	0.2						
O. plumifera	4.1	3.0	6.3	0.5	3.7	7.7	5.8
O. pseudofrigida							
O. robusta							
O. setigera							
forma *typica*	0.5		0.5		0.3	0.2	
forma *pelagica*		2.8	0.2	0.3	3.5	2.1	1.9
O. similis	3.4	6.0				0.2	0.2
O. tenuis		0.3				1.0	0.6
O. vivida							
Total number of individuals per m^3	12.1	16.8	9.3	1.8	7.6	14.4	24.6
Number of species	5	7	4	4	3	7	7

TABLE 2-B. MONTHLY OCCURRENCE OF *Oithona* AT STN. 18 IN SURUGA BAY. SPECIES AND NUMBER OF INDIVIDUALS PER M^3 IN THE WATER COLUMN BETWEEN THE SURFACE AND APPROX. 150 M DEPTH.

Species	1973 Apr.	June	July	Aug.	Oct.	Dec.	1974 Jan.	Feb.
Oithona atlantica		2.6	3.0		0.2	9.1	1.8	1.6
O. attenuata								
O. brevicornis								
O. cruralis, n.sp.								
O. decipiens								
O. fallax	0.2		0.2				1.4	0.4
O. longispina, n.sp.	34.9	3.4	5.7	0.7	0.2	5.2	6.3	5.8
O. nana								
O. plumifera	16.7	2.2	6.1	0.2	5.3	4.7	8.9	5.1
O. pseudofrigida							0.1	
O. robusta								
O. setigera								
forma *typica*			0.2		0.3	0.3	0.2	
forma *pelagica*	2.3	0.7	4.2	0.5	0.8	3.5	1.9	1.8
O. similis	2.7	0.2	0.8				0.2	
O. tenuis	0.6		0.2				0.4	0.5
O. vivida	0.2							
Total number of individuals per m^3	57.4	9.1	20.5	1.4	6.7	22.7	21.3	15.2
Number of species	7	5	7	3	4	4	8	6

TABLE 2-C. MONTHLY OCCURRENCE OF *Oithona* AT STN. 26 IN SURUGA BAY. SPECIES AND NUMBER OF INDIVIDUALS PER M^3 IN THE WATER COLUMN BETWEEN THE SURFACE AND APPROX. 150 M DEPTH.

Species	1973 Apr.	June	July	Aug.	Oct.	Dec.	1974 Jan.	Feb.
Oithona atlantica		0.7	3.4		0.2	1.3	4.3	4.9
O. attenuata		0.2						
O. brevicornis								
O. cruralis, n.sp.	0.2							
O. decipiens					0.2			
O. fallax			0.3		1.2		0.7	
O. longispina, n.sp.	10.7	5.2	4.5	0.8	1.6	0.5	6.4	1.0
O. nana								
O. plumifera	6.7	1.8	5.6	9.9	8.4	1.7	4.8	0.4
O. pseudofrigida								
O. robusta	0.2					0.1		
O. setigera								
forma *typica*				0.4	0.4			
forma *pelagica*	0.7	3.6	0.8	2.5	1.2	0.8	2.1	1.4
O. similis	2.9	0.2	1.4			0.2		
O. tenuis				0.2				
O. vivida								
Total number of individuals per m^3	21.2	11.7	16.0	13.8	13.1	4.6	18.3	7.8
Number of species	6	6	6	4	6	6	5	4

TABLE 2-D. MONTHLY OCCURRENCE OF *Oithona* AT STN. 29 IN SURUGA BAY. SPECIES AND NUMBER OF INDIVIDUALS PER M^3 IN THE WATER COLUMN BETWEEN THE SURFACE AND APPROX. 150 M DEPTH.

Species	1973 Apr.	June	July	Aug.	Oct.	Dec.	1974 Jan.	Feb.
Oithona atlantica		0.9	14.2	0.1	0.8	1.4	2.2	3.7
O. attenuata								
O. brevicornis							0.2	0.4
O. cruralis, n.sp.	0.4							
O. decipiens								
O. fallax	0.6		0.4		1.0	1.1	2.4	
O. longispina, n.sp.	15.6	0.2	5.6	2.0	2.3	1.3	4.0	0.8
O. nana					0.3			
O. plumifera	9.0	0.7	5.2	7.3	11.5	3.9	4.9	0.5
O. pseudofrigida								
O. robusta								
O. setigera								
forma *typica*	0.2		0.4	0.2	0.4		0.2	
forma *pelagica*	0.9	0.9	2.6	1.1	4.9	1.8	0.7	0.6
O. similis	0.4	0.5	4.1		0.7	0.2	7.7	2.8
O. tenuis				0.2	0.8		0.2	
O. vivida								
Total number of individuals per m^3	27.0	3.1	32.4	11.0	22.8	9.6	22.8	8.8
Number of species	6	5	6	5	8	6	9	6

specimens of 3 new species have been deposited in the National Science Museum, Tokyo (NSMT). All other specimens are in the Plankton Laboratory, Ocean Research Institute.

Abbreviations used through this paper are as follows:

TL, PL, UL	Total length, prosome length and urosome length
PW	Prosome width
Th1, Th2, Th3, Th4, Th5	1st, 2nd, 3rd, 4th and 5th thoracic segments
Gn Sgm	Genital segment
Abd3, Abd4	3rd and 4th abdominal segments
An Sgm	Anal segment
A1, A2	1st and 2nd antennae
Md	Mandible
Max1, Max2	1st and 2nd maxillae
Mxp	Maxilliped
P1, P2, P3, P4, P5	1st, 2nd, 3rd, 4th and 5th swimming legs
B1, B2	1st and 2nd basal segments
Re	Exopod
Re1, Re2, Re3	1st, 2nd and 3rd segments of the exopod
Ri	Endopod
Ri1, Ri2, Ri3	1st, 2nd and 3rd segments of the endopod
Se	Outer marginal seta or spine (see Figure 2)
Si	Inner marginal seta (see Figure 2)
St	Terminal spine (see Figure 2)

Notes on the Identification of the Species of the Family Oithonidae

The identification, systematics and phylogeny of the family has been previously discussed by BURCKHARDT (1913), FARRAN (1913), ROSENDORN (1917), KIEFER (1935) and WELLERSHAUS (1970). Identification at the specific level is mainly based on 1) the shape of the rostrum, 2) the shape and number of setae (or hooks) on Md B2, and 3) the formulae of Se of P1-P4 Re. The PL/UL ratio, PL/PW ratio, the number of setae on Max1 Ri and the Si formulae of P1-P4 Re may also give some aid.

The problem which we would like to address is that these diagnostic features do not include morphological characteristics related to sexual maturity. Oithonids are commonly distributed in the coastal waters where temperature, salinity and food availability change markedly from place to place and from time to time. In comparison with secondary sexual characteristics, the above morphological features of Oithonids, particularly the number of setae on Md and Max1 and the setae formulae of P1-P4 Re, may reflect rather sensitively the environmental differences of the habitats of populations of the same species. As a matter of fact, as described in the following annotated list of the species, there is frequent variation of ± 1 seta in various feeding and swimming appendages. And, in the Oithonidae such a small difference is considered to be an important diagnostic feature to distinguish one species

from another. Body length also varies considerably in the species, and in *Oithona brevicornis* and *O. setigera* apparently two populations of different size occur together. The only diagnostic feature used to distinguish *Oithona frigida* from *O. pseudofrigida* and to separate *O. atlantica* from *O. longispina* is the length of Se on P3 Re3 and P4 Re3 respectively.

At present no one can deny that differences in environmental conditions may cause ecophenotypic variation, directly or indirectly, in body size and the number and the length of setae on the swimming and feeding appendages. Consideration of potential ecophenotypic variation has lead to a cautious approach to species designation by some taxonomists (see GIESBRECHT, 1881; WELLERSHAUS, 1970; SHUVALOV, 1972b). However, the level of variability that is acceptable within a designated species is still an open question. Confirmation of species distinctiveness by zoogeographical approaches with extensive material from many localities, physiological-genetical approaches with rearing under different experimental conditions or crossbreeding experiments in laboratory must be undertaken to solve the problem. Discovery of new morphological characteristics such as the integumental organs (FLEMINGER, 1973) may also clarify the taxonomy of copepods in the future.

There is still doubt whether all Oithonid species described here are truly distinct species. However, we think we are doing right thing at this stage to document the differences and name the various forms of Oithonidae in Japanese waters. This may make it easier to discuss the distribution of coastal copepods and status of the Japanese species in the future.

Key to the Genera of the Family Oithonidae

1. P1-P4 Ri 3-segmented ..... *Oithona*
2. P1-P4 Ri 2-segmented ..... *Paroithona*

Key to the Species of the Genus *Oithona* in Suruga Bay and Adjacent Waters

Female: A1 not geniculated, urosome 5 segmented (Abd1 and Abd2 fused).

1. Rostrum pointed 2
   Rostrum not pointed 8
2. Rostrum visible dorsally 3
   Rostrum not visible dorsally 7
3. P1-P4 Re Se formulae:
   1,1,3; 1,1,3; 1,1,3; 1,1,2 ..... *O. robusta*
   1,1,3; 1,1,3; 1,1,2; 1,1,2 ..... *O. vivida*
   1,1,3; 1,1,3; 1,0,1; 0,0,1 ..... *O. pseudofrigida*
   1,1,3; 1,0,2; 1,0,1; 0,0,1 ..... *O. setigera*
   1,1,2; 1,1,3; 1,0,2; 0,0,1 ..... *O. rostralis*, n. sp.
   1,1,2; 1,1,2; 1,1,1; 1,1,1 ..... *O. cruralis*, n. sp.
   1,1,2; 1,0,2; 1,0,1; 0,0,1 4
4. Prosome oval, Md Ri with more than 3 setae 5
   Prosome slender, Md Ri with 2 setae ..... *O. tenuis*

5. Gn Sgm with a tuft of hairs on the ventral proximal part, Md Ri with 3 setae ..... *O. plumifera*
   Gn Sgm without such a tuft, Md Ri with 4 setae 6
6. P4 Re3 Se straight and about as long as St ..... *O. longispina*, n. sp.
   P4 Re3 Se bent slightly at the proximal part and about 2/3 times as long as St ..... *O. atlantica*
7. P1-P4 Re Se formulae:
   1,1,3; 1,1,3; 1,1,3; 1,1,2 ..... *O. brevicornis*
   1,1,2; 1,0,2; 1,0,1; 0,0,1 ..... *O. fallax*
   1,1,2; 1,0,1; 1,0,1; 0,0,1 ..... *O. similis*
   1,0,2; 1,1,2; 1,0,1; 0,0,1 ..... *O. decipiens*
8. P4 Re3 with 2 Se 9
   P4 Re3 with 3 Se ..... *O. simplex*
9. Md B2 with 1 strong spine and 1 seta, P5 with 1 terminal seta 10
   Md B2 with 2 minute spines, P5 with 2 terminal setae ..... *O. oculata*
10. PL/UL less than 1.0, furcal rami longer than An Sgm ..... *O. attenuata*
    PL/UL greater than 1.0, furcal rami about as long as An Sgm ..... *O. nana*

Male: A1 geniculated, urosome 6 segmented.

1. P1-P4 Re Se formulae:
   1,1,3; 1,1,3; 1,1,3; 1,1,3 ..... *O. simplex*
   1,1,3; 1,1,3; 1,1,3; 1,1,2 2
   1,1,2; 1,1,3; 1,1,3; 1,1,2 ..... *O. plumifera*
   1,1,2; 1,1,3; 1,1,2; 1,1,2 ..... *O. fallax*
   1,1,2; 1,1,2; 1,1,2; 1,1,2 ..... *O. similis*
2. Md B2 with 1 strong spine and 1 seta ..... *O. nana*
   Md B2 with 1 blunt hook and 1 minute spine ..... *O. brevicornis*, f. *typica*
   Md B2 with 2 minute spines ..... *O. brevicornis*, f. *minor*

1. *Oithona atlantica* FARRAN, 1908 (Fig. 2)

Oithona atlantica FARRAN, 1908, p. 500.—ROSENDORN, 1917, p. 12, figure 2a-f.
Oithona spinirostris, SARS, 1918, p. 6, pls. 1, 2.
? *Oithona spinirostris* CLAUS, 1863, p. 105, pl. 11 figures 4-9.
? *Oithona plumifera*, MORI, 1937, p. 109, pl. 60 figures 3-15.

Material examined

Stn. 7: June 1973, 5 females; Feb. 1974, 17 females.—Stn. 18: June 1973, 7 females; Dec. 1973, 6 females; Feb. 1974, 3 females.—Stn. 26: June 1973, 2 females; Feb. 1974, 15 females.—Stn. 29: Feb. 1974, 6 females.

Descriptive notes

Female.—TL 1.11-1.29 mm (average 1.22 mm). PL 0.62—0.71 mm (0.66). PW 0.24-0.28 mm (0.26). PL/UL 1.17-1.32 (1.24).

Rostrum sharply pointed, visible dorsally. Gn Sgm without a tuft of hairs on the ventral anterior margin. A1 extending to the end of Abd3. Md B2 with 2 large spines, Ri with 4 setae. Max1 Ri with a seta which is at least twice as long as Ri. P1–P4 Re armed as follows:

Se 1, 1, 2; 1, 0, 2; 1, 0, 1; 0, 0, 1

Si 1, 1, 4; 0, 1, 5; 0, 1, 5; 0, 1, 5

P1–P4 B2 with a naked Se. P4 Re3 Se not so sharply bent as *O. plumifera*, and about 2/3 times as long as St.

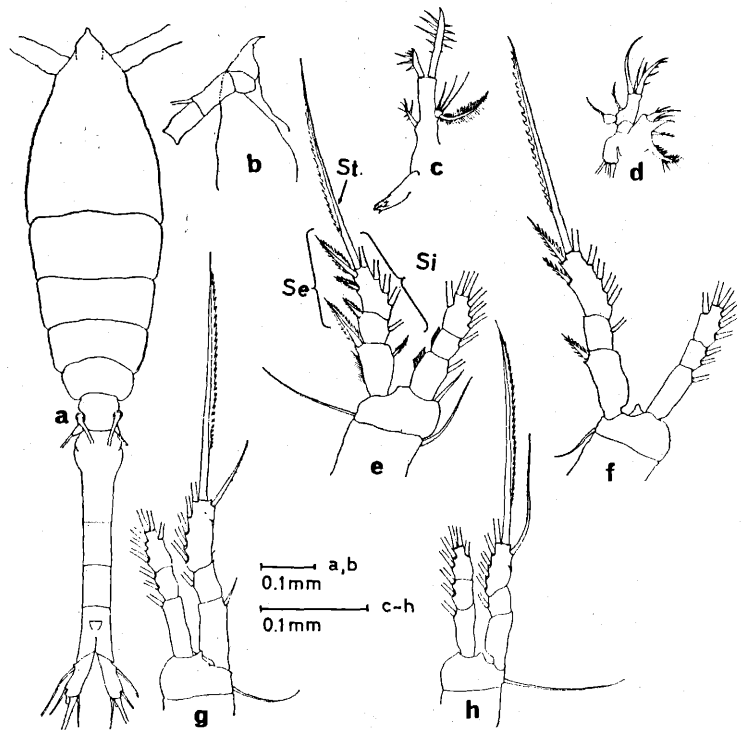

Fig. 2. *Oithona atlantica* FARRAN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg; Se, outer marginal seta; Si, inner marginal seta; St, terminal spine.

Remarks

With regard to the setae formulae of P1–P4 Re, the original description mentioned that the arrangement was as in *O. plumifera* BAIRD redescribed by GIESBRECHT (1892), that is, Se 1, 1, 2; 1, 0, 2; 1, 0, 2(1+a minute); 0, 0, 1. ROSENDORN (1917) showed Se 1, 1, 2; 1, 0, 2, 1, 0, 1; 0, 0, 1 as like the present specimens, but her P1 Re Si arrangement was 0, 1, 4 instead of 1, 1, 4. As this species very closely resembles *O. plumifera*, there is little doubt that this species has often been confused with the latter species in the past. However, these two species can be clearly separated by the armature of a group of hairs on the ventral

anterior margin of Gn Sgm, the difference of number of the setae on Md Ri and the length of the seta on Max1 Ri. In addition, the shapes and lengths of the P4 Re3 Se are different in the two species. FRÜCHTL (1923) was of opinion that *O. atlantica* is a variety of *O. plumifera*, and CHENG *et al.* (1974) treated *O. atlantica* as *O. plumifera*. SARS (1918) considered *O. atlantica* as a synonym of *O. spinirostris* CLAUS (1863), and accordingly his opinion was followed by various authors (WILSON, 1942; SEWELL, 1947; CRISAFI, 1959). However, Claus' diagnosis is insufficient to distinguish *O. spinirostris* from its close relative *O. setigera* DANA because there is no description about the number of Se of P1 Re3 (see FARRAN, 1908). Thus it is uncertain if Claus' specimen was really the same as *O. spinirostris* which was described by SARS later. We propose the name *O. atlantica* for the present specimens. Males of *O. atlantica* so closely resembles those of *O. plumifera* that for all practical purpose the two are almost indistinguishable. A detail comparative study with many male specimens of these species is needed to separate them.

Distribution

Coast of Ireland (FARRAN, 1908), temperate Indian Ocean (ROSENDORN, 1917), Norwegian coast (SARS, 1918), Bay of Biscay (FARRAN, 1926), Friday Harbor (JOHNSON, 1932), Strait of Messina (CRISAFI, 1959), North Pacific (SHUVALOV, 1972a). This is the first record of occurrence from the coast of Japan.

2. *Oithona attenuata* FARRAN, 1913 (Fig. 3)

Oithona attenuata FARRAN, 1913, p. 187, pl. 30 figures 3-7.—ROSENDORN, 1917, p. 42, figure 25a-h.

Material examined

Stn. 26: July 1973, 1 female.—Stn. A5: Apr. 1975, 1 female.

Descriptive notes

Female.—TL 0.84-0.88 mm (0.86). PL 0.39-0.40 mm (0.40). PW 0.19-0.20 mm (0.20). PL/UL 0.82-0.87 (0.85).

Rostrum rounded. Lateral margins of Gn Sgm with a small process on each side. A1 extending to the middle of Th5. Md B2 with one large spine and one delicate seta, Ri with 4 setae. Max1 Ri with 1 seta. P1-P4 Re armed as follows:

Se 1,1,3; 1,1,3; 1,1,3; 1,1,2
Si 1,1,4; 1,1,5; 1,1,5; 1,1,5

Remarks

The specimen agrees well with *O. attenuata* redescribed by ROSENDORN (1917), except that her specimen has 4 setae on Max1 Ri. The species is very closely allied to *O. nana* GIESBRECHT in the structure of Md and in the setae formulae of P1-P4. The following characteristics distinguish the female of *O. attenuata* from the female of *O. nana*. 1. Furcal rami are longer than An Sgm, and 3.8 times as long as wide (in *O. nana* they are about as long as An Sgm). 2. Gn Sgm is slender in shape and 2.9 times as long as wide (that of *O. nana* is much produced laterally, and 1.5 times as long as wide). 3. PL/UL is less than 1.0 (it

is greater than 1.0 in *O. nana*). WELLERSHAUS (1970) considers that *O. attenuata* is an oceanic ecophenotype of *O. nana*. The male is described by ROSENDORN (1917).

Distribution

Christmas Island (FARRAN, 1913), Samoa Islands, Arabian Sea and off Cape Cod (ROSENDORN, 1917), Aru Archipelago (FRÜCHTL, 1924), Nicobar Islands (SEWELL, 1947), Indian Ocean (TANAKA, 1960), Yellow Sea and East China Sea (CHENG *et al.*, 1974). This is the first record of occurrence from the coast of Japan.

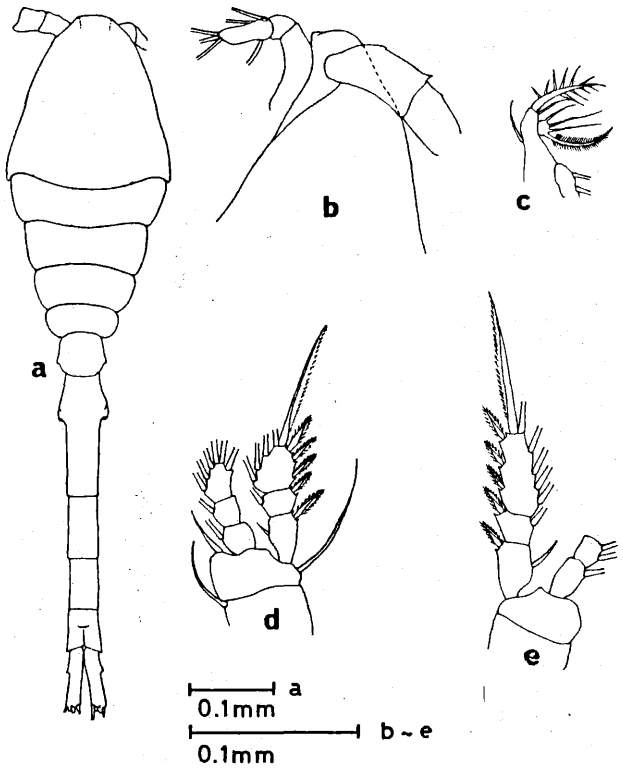

Fig. 3. *Oithona attenuata* FARRAN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st swimming leg; e, 2nd swimming leg.

3. *Oithona brevicornis* GIESBRECHT, 1891 (Figures 4 and 5)

a. Forma *typica*

Oithona brevicornis GIESBRECHT, 1892, p. 538, pl. 34 figures 6-7.—ROSENDORN, 1917, p. 34, figure 19a-g.—WELLERSHAUS, 1969, p. 279, figures 103-106, 109-119.—CHENG *et al.*, 1974, p. 36, pl. 4 figures 1-8.

Material examined

Stn. 29: Jan. 1974, 1 female.—Stn. T8: Apr. 1975, 14 females and 5 males.

Descriptive notes

Female.—TL 0.62-0.71 mm (0.66). PL 0.34-0.41 mm (0.37). PW 0.14-0.17 mm (0.15). PL/

UL 1.16-1.37 (1.26).

Head curved ventrally into sharply pointed rostrum. Rostrum not visible dorsally. Outer marginal seta of furcal rami is placed at about 1/5 of the furcal length from the anterior end. A1 extending to the middle of Th2. Md B2 with 2 blunt hooks with spinules, Ri with 4 setae. Max1 Ri with 1 seta. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 1, 3; 1, 1, 3; 1, 1, 2

Si 0, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

Setae of P5 and furca with abundant hair.

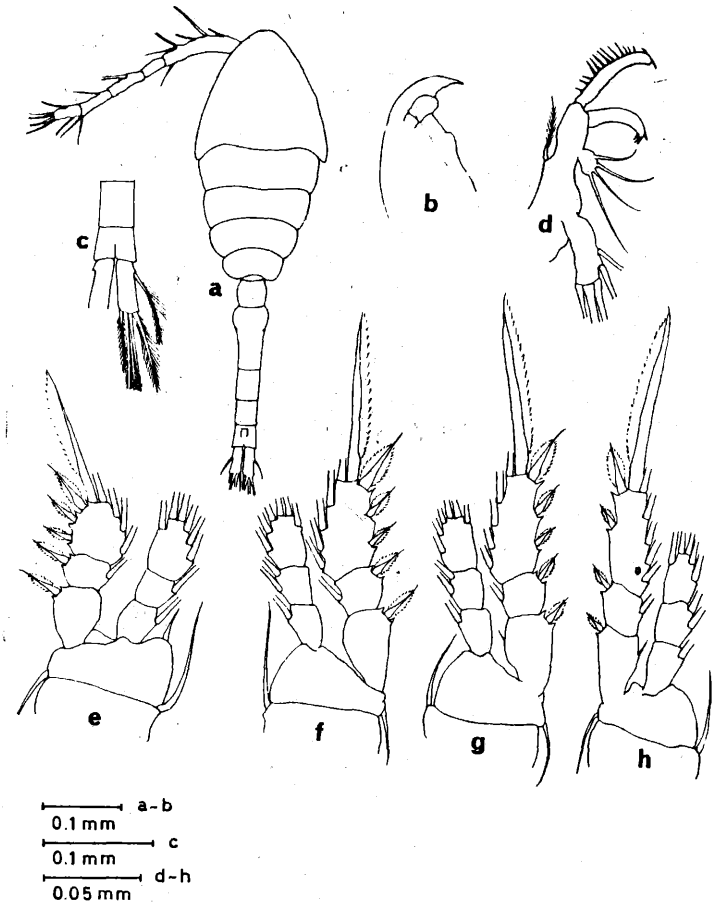

Fig. 4. *Oithona brevicornis* GIESBRECHT, female: a, forma *minor*, whole animal, dorsal view; b, forma *minor*, head, lateral view; c, forma *typica*, furcal rami; d, forma *typica*, mandible; e, forma *typica*, 1st swimming leg; f, forma *typica*, 2nd swimming leg; g, forma *typica*, 3rd swimming leg; h, forma *typica*, 4th swimming leg.

Male.—TL 0.56-0.59 mm (0.58). PL 0.33-0.37 mm (0.35). PW 0.15-0.16 mm (0.15). PL/UL 1.43-1.68 (1.57).

Rostrum not pointed. Md B2 with 2 hooks, one of which blunt and rounded at the top,

the other minute and pointed; Ri with 4 setae. Max1 Ri with 1 seta. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 1, 3; 1, 1, 3; 1, 1, 2

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

b. Forma *minor*

Oithona brevicornis, (smaller form from Cochin Backwater) WELLERSHAUS, 1969, p. 282, figures 107, 108.

? *Oithona brevicornis* forma *aruensis* FRÜCHTL, 1924, p. 88.

Material examined

Stn. T4: Nov. 1971, 10 females and 1 male; Apr. 1975, 10 females and 8 males.—Stn. T7: Nov. 1971, 9 females and 6 males.—Stn. T8: Apr. 1975, 8 females and 1 male.—Aburatsubo Cove: 5 females.

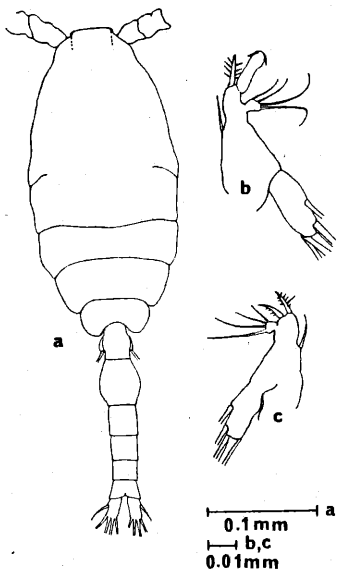

Fig. 5. *Oithona brevicornis* GIESBRECHT, male: a, forma *minor*, whole animal, dorsal view; b, forma *typica*, mandible; c, forma *minor*, mandible.

Descriptive notes

Female.—TL 0.49-0.61 mm (0.56). PL 0.27-0.34 mm (0.30). PW 0.13-0.17 mm (0.15). PL/UL 1.11-1.38 (1.24).

Rostrum as in the forma *typica*. Md B2 with 2 blunt hooks; Ri with 4 setae. Outer marginal seta of furcal rami located on about the middle part of the rami. Setae formulae of P1-P4 Re as in the forma *typica*. Setae of P5 and furca with poor hair.

Male.—TL 0.47-0.54 mm (0.50). PL 0.33-0.37 mm (0.35). PW 0.14-0.17 mm (0.15). PL/UL 1.50-1.79 (1.62).

Structures of the prosome and P1-P4 as in the forma *typica*, but it is distinguished from the *typica* by the shape of appendages on Md B2. In the forma *minor* both of the two

spines on Md B2 are minute and not swollen as in the forma *typica*.

Remarks

The arrangement of the female's P1-P4 Re Si of *O. brevicornis* showed slight variation: ROSENDORN (1917) indicated 0,1,4; 0,1,5; 0,1,5; 0,1,5 whereas WELLERSHAUS (1969) figured 1 minute, 1,4; 0,1,4; 0,1,4; 1,1,5. WELLERSHAUS (1969) called attention to the fact that there were two forms in *O. brevicornis* from Cochin Backwater, and suggested that the morphological differences were due to environmental conditions. In the present study we also found two forms, which coinside with the typical form of *O. brevicornis* GIESBRECHT and the smaller Cochin form. We give the name forma *minor* to the latter form. The forma *minor* occurred abundantly in the highly eutrophic inner part of Tokyo Bay, while forma *typica* occurred only in small number mainly at the mouth of this bay.

Distribution

Oithona brevicornis occurs abundantly in neritic and coastal waters of warm region. It has been reported from Hong Kong Harbour (GIESBRECHT, 1892), Congo River estuary (ROSENDORN, 1917), Aru Islands (FRÜCHTL, 1924), Arabian Sea (SEWELL, 1947), Tisbury Great Pond (DEEVEY, 1948), Gulf of Mexico (GRICE, 1960), Cochin Backwater (WELLERSHAUS, 1969), and Yellow Sea (CHENG *et al.*, 1974).

4. *Oithona cruralis* TANAKA, new species (Figure 6)

Type specimens

Holotype (No. NSMT-Cr. 5458): female (TL 0.93 mm), Stn. 26, Apr. 1973. Paratype (No. NSMT-Cr. 5459): female, Stn. 29, Apr. 1973.

Material examined

Stn. 26: Apr. 1973, 1 female.—Stn. 29: Apr. 1973, 2 females.

Descriptive notes

Female.—TL 0.83-0.97 mm (0.91). PL 0.43 mm (holotype). PW 0.22 mm (holotype). PL/UL 1.22 (holotype).

Prosome oval, 2.4 times as long as wide. Rostrum pointed, visible dorsally. Furcal rami 2.5 times as long as wide. A1 measured 0.81 mm in length, extending to the end of Abd4. Md B2 with 2 spines, Ri with 3 setae. Max1 Ri with a seta twice as long as Ri. P1-P4 Re armed as follows:

Se 1,1,2; 1,1,2; 1,1,1; 1,1,1
Si 1,1,4; 1,1,5; 1,1,5; 0,1,5

P2-P4 B1 without Si.

Etymology

The specific name *cruralis* indicates the characteristic arrangement of P1-P4 Re Se.

Remarks

This species closely resembles *O. plumifera* in having 3 setae on Md Ri. However, the setae formulae of P2-P4 Re are different from those of *O. plumifera*. The male is unknown.

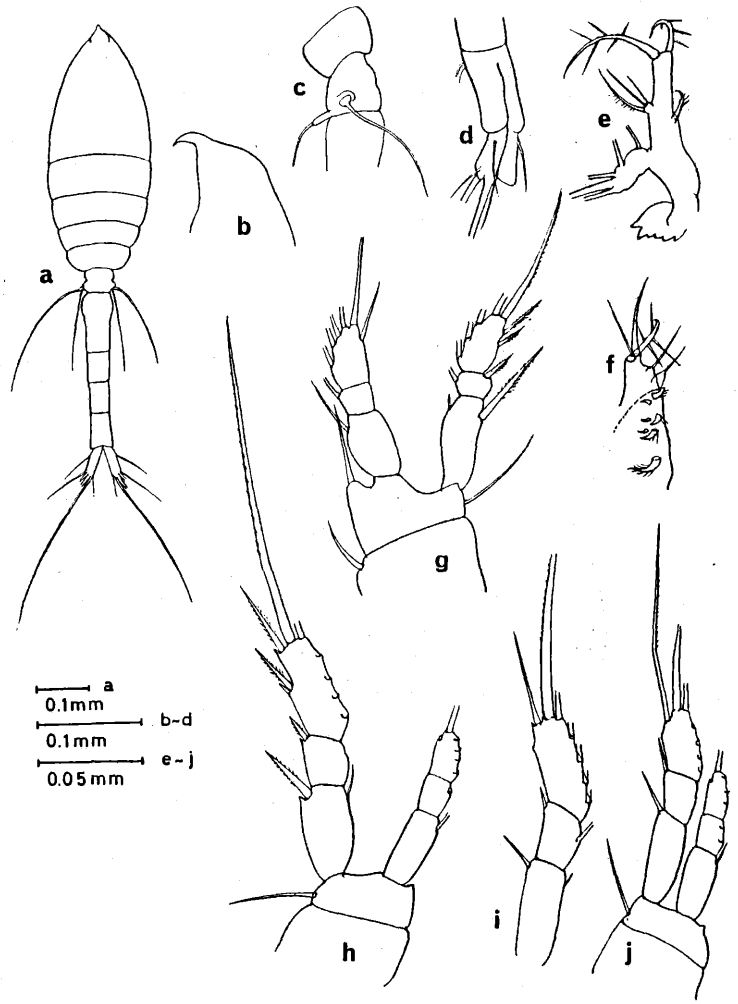

Fig. 6. *Oithona cruralis* n.sp., female: a, whole animal, dorsal view; b, head, lateral view; c, 5th thoracic segment, lateral view; d, furcal rami; e, mandible; f, 1st maxilla; g, 1st swimming leg; h, 2nd swimming leg; i, 3rd swimming leg; j, 4th swimming leg.

5. *Oithona decipiens* FARRAN, 1913 (Figure 7)

Oithona decipiens FARRAN, 1913, p. 184, pl. 28 figures 4-11.—ROSENDORN, 1917, p. 26—MORI, 1937, p. 111, pl. 61 figures 9-14.—CHENG *et al.*, 1974, p. 32, pl. 2 figures 1-5.

Material examined

Stn. 26: Oct. 1973, 2 females.—Stn. A3: Apr. 1975, 2 females.—Stn. A5: Apr. 1975, 16 females.—Stn. A7: Apr. 1975, 3 females.

Descriptive notes

Female.—TL 0.64-0.67 mm (0.65). PL 0.35-0.37 mm (0.36). PW 0.13-0.15 mm (0.14). PL/UL 1.16-1.28 (1.21).

Rostrum pointed but short, directing ventrally, not visible dorsally. A1 extending to the anterior margin of Gn Sgm. Md B2 with 2 spines, Ri with 3 setae. Max1 Ri without seta. P1-P4 Re armed as follows:

Se 1,0,2; 1,1,2; 1,0,1; 0,0,0(1)

Si 0,1,4; 0,1,5; 0,1,5; 0,1,5

P3 Re3 with a tooth on the outer margin.

Remarks

Md Ri has 2 setae in the specimens examined by FARRAN (1913) and ROSENDORN (1917), but it has 3 setae in Japanese one (MORI, 1937). According to FARRAN (1913), P1 Ri is 2-segmented, but it is 3-segmented in the present specimens, which agree with the description of ROSENDORN (1917), MORI (1937) and CHENG *et al.* (1974). P4 Re Se arrangement may 0,0,1 in some specimens. The male is unknown.

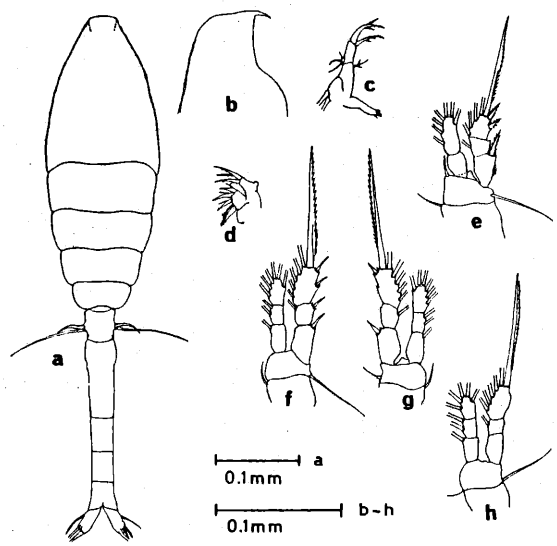

Fig. 7. *Oithona decipiens* FARRAN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

Distribution

Indian Ocean (FARRAN, 1913; ROSENDORN, 1917), Japanese coasts (MORI, 1937), East China Sea (CHENG *et al.*, 1974).

6. *Oithona fallax* FARRAN, 1913 (Figures 8 and 9)

Oithona fallax FARRAN, 1913, p. 185, pl. 27 figures 9-12, pl. 28 figures 1-3.—ROSENDORN, 1917, p. 27, figures 14a-b, 15a-h.—MORI, 1937, p. 112, pl. 62 figures 13-18.

Material examined

Stn. 7: Dec. 1973, 1 female.—Stn. A3: Apr. 1975, 1 female.—Stn. A5: Apr. 1975, 1 female.—

Stn. A7: Apr. 1975, 1 female.—Stn. T9: Nov. 1971, 1 male.

Descriptive notes

Female.—TL 0.88-1.01 mm (0.96). PL 0.50-0.57 mm (0.54). PW 0.20-0.24 mm (0.22). PL/UL 1.30-1.32 (1.31).

Rostrum as in *O. decipiens*. A1 extending to the distal margin of Th5. Md B2 with 2 spines, Ri with 4 setae. Max1 Ri with a seta. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 0, 2; 1, 0, 1; 0, 0, 1

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

P2, P3, Re3 with a tooth on the outer margin.

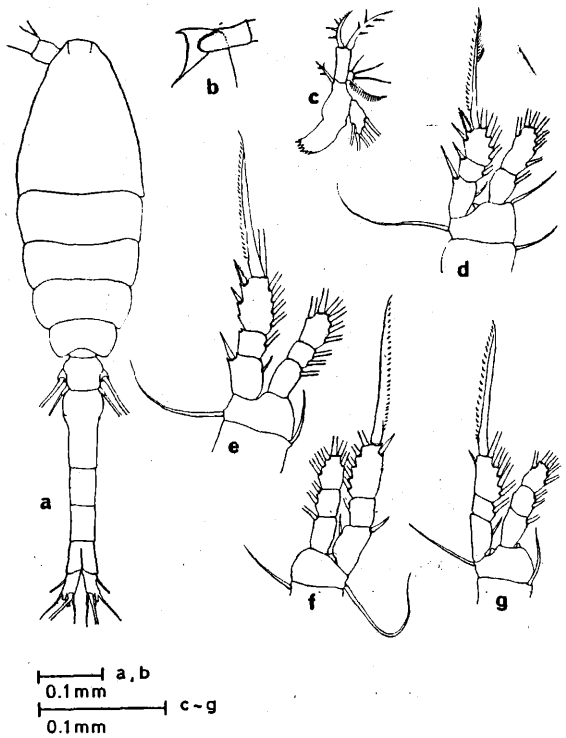

Fig. 8. *Oithona fallax* FARRAN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st swimming leg; e, 2nd swimming leg; f, 3rd swimming leg; g, 4th swimming leg.

Male.—TL 0.77 mm. PL 0.49 mm. PW 0.22 mm. PL/UL 1.75.

Rostrum not pointed. Md B2 with 2 spines, Ri with 4 setae. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 1, 3; 1, 1, 2; 1, 1, 2

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

P2, P3 Re2, Re3 outer margin with small teeth.

Remarks

As FARRAN (1913) described, there is no boundary between P1 Ri2 and Ri3 of the present

females. The existance of P4 Re3 Se, which is lacking in Farran's specimen, coincide with the diagnosis by MORI (1937) and ROSENDORN (1917).

Distribution

Christmas Island (FARRAN, 1913), Arabian Sea and tropical Atlantic (ROSENDORN, 1917), Aru Archipelago (FRÜCHTL, 1924), Kii-Channel, Japan (MORI, 1937), Samoa Islands (WILSON, 1942), East China Sea (CHENG *et al.*, 1974), tropical waters off Chili (SHUVALOV, 1972a).

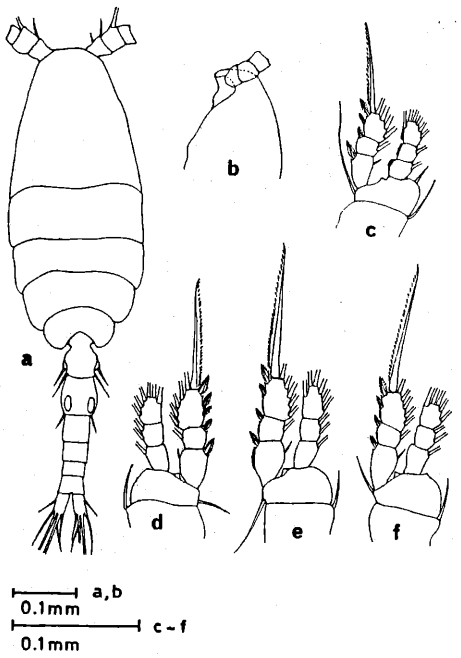

Fig. 9. *Oithona fallax* FARRAN, male: a, whole animal, dorsal view; b, head, lateral view; c, 1st swimming leg; d, 2nd swimming leg; e, 3rd swimming leg; f, 4th swimming leg.

7. *Oithona longispina* NISHIDA, new species (Figure 10)

Oithona atlantica, SHUVALOV, 1972b (part), p. 169.

Type specimens

Holotype (No. NSMT-Cr. 5460): female (TL 1.06 mm), Stn. 26, June 1973. Paratypes (No. NSMT-Cr. 5461 and 5462): 8 females, Stn. 7, Feb. 1974; 12 females, Stn. 26, June 1973.

Material examined

Stn. 7: Dec. 1973, 3 females; Feb. 1974, 16 females.—Stn. 18: Oct. 1973, 1 female; Dec. 1973, 5 females.—Stn. 26: June 1973, 13 females; Oct. 1973, 3 females; Dec. 1973, 1 female; Feb. 1974, 7 females.—Stn. 29: Aug. 1973, 7 females; Oct. 1973, 9 females; Feb. 1974, 7 females.

Descriptive notes

Female.—TL 0.93-1.55 mm (1.05). PL 0.52-0.64 mm (0.57). PW 0.19-0.25 mm (0.22). PL/

UL 1.15–1.34 (1.24).

Rostrum sharply pointed, visible dorsally. Furcal rami about 3 times as long as wide. A1 extending to the middle of Gn Sgm. Md B2 with 2 spines, Ri with 4 setae. Max1 Ri with a seta about 1.4 times as long as Ri. P1–P4 Re armed as follows:

Se 1, 1, 2; 1, 0, 2; 1, 0, 1; 0, 0, 1

Si 1, 1, 4; 0, 1, 5; 0, 1, 5; 0, 1, 5

P4 Re3 Se about as long as St.

Etymology

The name *longispina* refers to the morphological character of P4 Re3 Se of this species.

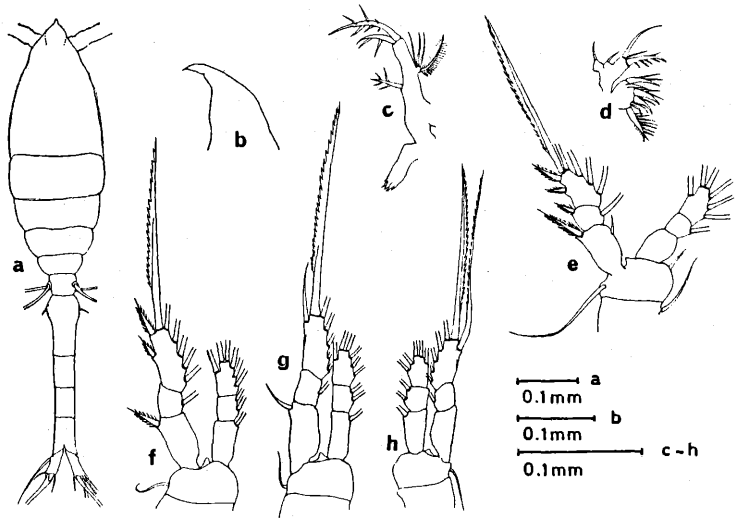

Fig. 10. *Oithona longispina* n.sp., female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

Remarks

SHUVALOV (1972b) found that there were two forms of *O. atlantica*, but TL and the proportional length of A1 to TL of his specimens from the Atlantic Ocean showed clinal change from northern (cold) to southern (warm) waters. The present specimens are the same as Shuvalov's southern, smaller form of *O. atlantica*. However, since these specimens showed remarkable differences from *O. atlantica* FARRAN in TL and the length of P4 Re3 Se, we raised this form to the rank of species. Our opinion may be supported by the facts that both *O. atlantica* and the present species occur throughout the year in the same environment of Suruga Bay and that there was no feature of any hybrid offspring. The vertical distribution of these two species showed difference; in June 1974, *O. atlantica* was distributed widely in 10–600 m depth by day, while *O. longispina* was not observed below 100 m depth. The male is unknown.

8. *Oithona nana* GIESBRECHT, 1892 (Figures 11 and 12)

Oithona nana GIESBRECHT, 1892, p. 538, pl. 34 figures 10, 11, 20, 24, 26, 34, 35, 42, pl. 44 figures 2, 4, 6.—ROSENDORN, 1917, p. 40, figure 24a-d.—GONZALEZ and BOWMAN, 1965, p. 272, figure 20c-g.

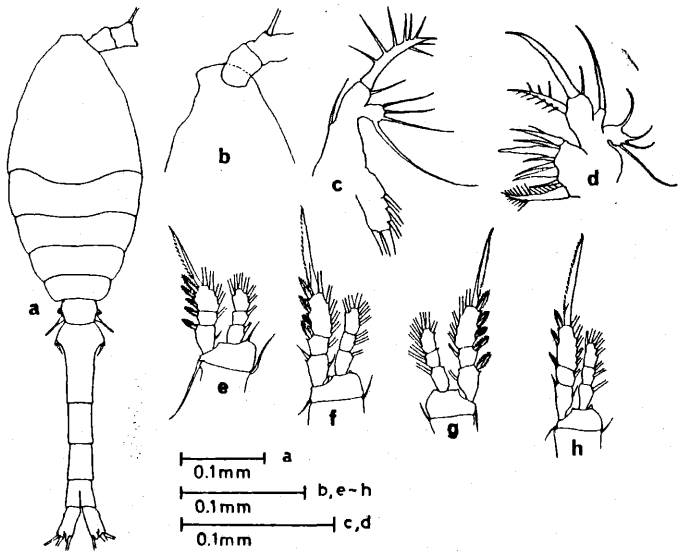

Fig. 11. *Oithona nana* GIESBRECHT, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

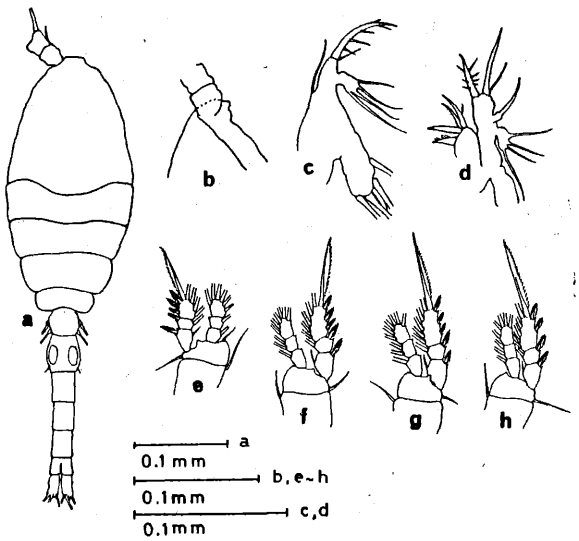

Fig. 12. *Oithona nana* GIESBRECHT, male: a, whole animal, dorsal view; b, head lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

Material examined

Stn. 7: Apr. 1973, 4 females.—Stn. 29: Nov. 1973, 4 females; Jan. 1974, 2 females.—Stn. A3: Apr. 1975, 12 females and 1 male.—Stn. A5: Apr. 1975, 6 females.—Stn. A7: Apr. 1975, 2 females.—Stn. T9: Apr. 1975, 2 males.

Descriptive notes

Female.—TL 0.54-0.62 mm (0.58). PL 0.28-0.32 mm (0.31). PW 0.13-0.17 mm (0.15). PL/UL 1.04-1.25 (1.14).

Rostrum absent. Gn Sgm produced laterally on the proximal region. A1 extending to the end of Th4. Md B2 with a strong spine with spinules and a delicate seta, Ri with 4 setae. Max1 Ri with 4 setae. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 1, 3; 1, 1, 3; 1, 1, 2

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

Male.—TL 0.48-0.51 mm (0.50). PL 0.28-0.30 mm (0.29). PW 0.12-0.15 mm (0.13). PL/UL 1.38-1.43 (1.40).

Rostrum absent. Md B2 with a strong spine and a seta as in the females, Ri with 4 setae. P1-P4 Re armed as in the females.

Distribution

Neapel (GIESBRECHT, 1892), Christmas Island (FARRAN, 1913), Indian Ocean (ROSENDORN, 1917), Aru archipelago (FRÜCHTL, 1924), Woods Hole (WILSON, 1932), neritic waters of Japan (MORI, 1937), Palau Islands (MORI, 1942), Arabian Sea (SEWELL, 1947), Gulf of Mexico (GRICE, 1960), Yellow Sea and East China Sea (CHENG *et al.*, 1974).

9. *Oithona oculata* FARRAN, 1913 (Figure 13)

Oithona oculata FARRAN, 1913, p. 188, pl. 30 figures 8, 9, pl. 31 figures 2-9.—ROSENDORN, 1917, p. 37, figure 23a-g.—SEWELL, 1947, p. 254.—TANAKA, 1960, p. 60, pl. 26 figures 5-10.—GONZALEZ and BOWMAN, 1965, p. 273, figures 20h, i, 21a-e.

Material examined

Aburatsubo cove: Aug. 1975, 1 female.

Descriptive notes

Female.—TL 0.76 mm. PL 0.45 mm. PW 0.23 mm. PL/UL 1.45.

Anterior body broad. Anterior margin of the head wide dorsally.

Rostrum not pointed. A1 short, extending to the end of Th2. Md B2 with 2 spines about eqal in length, Ri with 5 setae. Max1 Ri with 4 setae. The setae formulae for P1-P4 Re are the same as those for *Oithona nana*. P4 Re St about as long as Re. P5 with 2 setae.

Remarks

The broad anterior body, short A1, and heavy chitin markedly distinguish this species from its close relative *O. nana*. This species also resembles *O. rigida* GIESBRECHT, but in the latter species P4 Re St is much shorter than P4 Re itself. The males have been described by ROSENDORN (1917) and GONZALEZ and BOWMAN (1965).

Distribution

Indian Ocean (FARRAN, 1913), Samoa Islands (ROSENDORN, 1917), Nicobar Islands (SEWELL, 1947), off Cape of Good Hope (TANAKA, 1960). This is the first record of occurrence of the species from the coast of Japan.

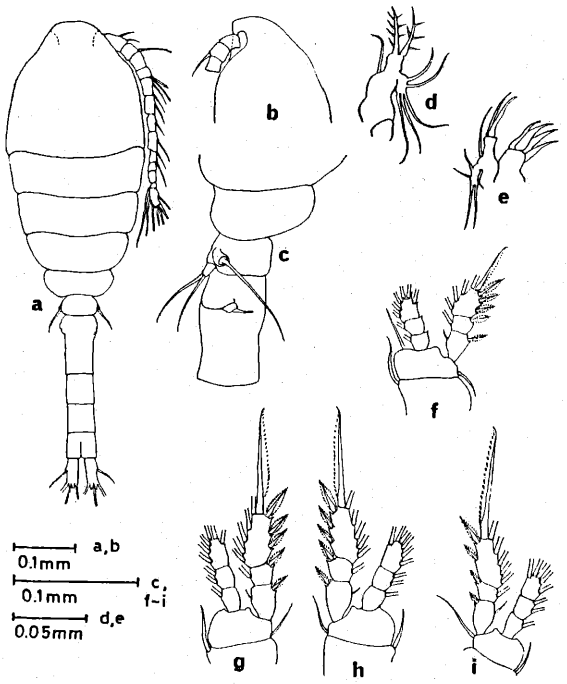

Fig. 13. *Oithona oculata* FARRAN, female: a, whole animal, dorsal view; b, head, lateral view; c, 5th thoracic segment, 5th leg and genital segment, lateral view; d, mandible; e, 1st maxilla; f, 1st swimming leg; g, 2nd swimming leg; h, 3rd swimming leg; i, 4th swimming leg.

10. *Oithona plumifera* BAIRD, 1843 (Figures 14 and 15)

Oithona plumifera, GIESBRECHT, 1892, p. 537, pl. 4 figure 10, pl. 34 figures 12, 13, 22, 25, 27, 29, 32, 33, pl. 44 figures 1, 7, 12-15.—ROSENDORN, 1917, p. 10, figure 1a-d.—SEWELL, 1947, p. 255.

Material examined

Stn. 7: Dec. 1973, 7 females.—Stn. 26: June 1973, 5 females.—Stn. A1: Apr. 1975, 1 female.—Stn. A3: Apr. 1975, 1 female and 1 male.—Stn. A5: Apr. 1975, 11 females.

Descriptive notes

Female.—TL 1.16-1.46 mm (1.30). PL 0.61-0.77 mm (0.68). PW 0.22-0.31 mm (0.27). PL/UL 1.02-1.21 (1.10).

Rostrum sharply pointed, visible dorsally. Gn Sgm with a tuft of hairs on the ventral proximal margin. A1 extending to the end of Abd4. Md B2 with 2 spines, Ri with 3 setae. Max1 Ri with a minute seta. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 0, 2; 1, 0, 1; 0, 0, 1

Si 1, 1, 4; 0, 1, 5; 0, 1, 5; 0, 1, 5

P3, P4 Re3 with a minute spinule on the middle of the outer margin. P1-P4 B2 Se usually plumose. P4 Re3 Se slender and smoothly curved inwards.

Male.—TL 0.64 mm. PL 0.41 mm. PW 0.16 mm. PL/UL 1.78.

Rostrum absent. Md B2 with 2 terminal spinules, Ri with 3 setae. Max1 Ri with a minute seta. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 1, 3; 1, 1, 3; 1, 1, 2

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

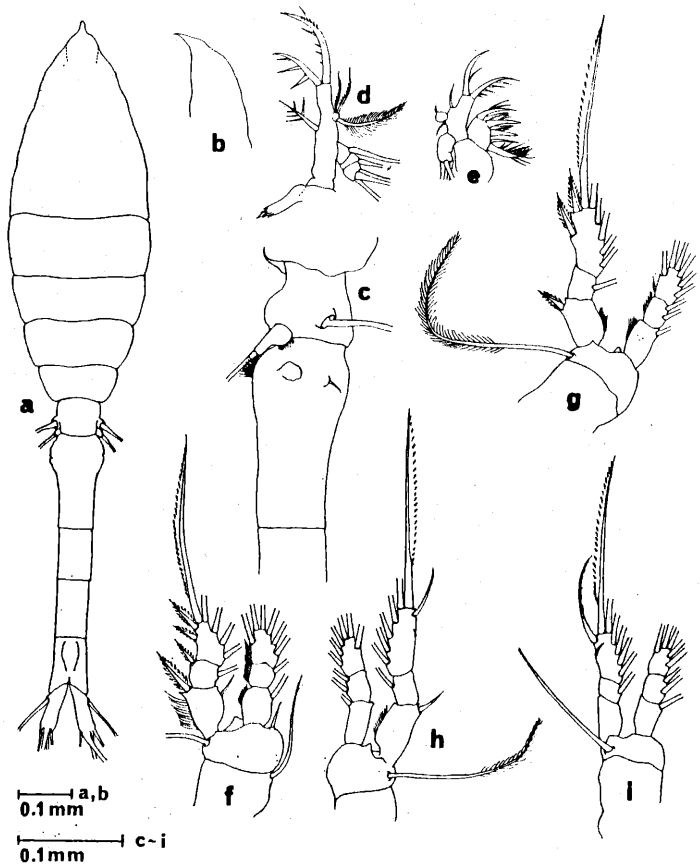

Fig. 14. *Oithona plumifera* BAIRD, female: a, whole animal, dorsal view; b, head, lateral view; c, genital segment; d, mandible; e, 1st maxilla; f, 1st swimming leg; g, 2nd swimming leg; h, 3rd swimming leg; i, 4th swimming leg.

Remarks

The setae formulae of P1-P4 of the present specimens for both females and males agreed with those given by ROSENDORN (1917). GIESBRECHT (1892) figured the arrangement of P3 Re Se 1, 0, 2 (1+a minute) in the female and that of P4 Re Se 1, 1, 3 in the male. The

earlier authors have called attention to the fact that there exist among the specimens of *O. plumifera* some examples furnished with tapered setae instead of plumose ones on the outer margin of P1-P3 B2. FARRAN (1913) suggested that they might have been broken off, whereas SEWELL (1947) concluded that the plumose termination was a variable character, though it may in some cases be wanting. SHUVALOV (1972b) stated that in the Atlantic there was a series of transition from the specimens with short, naked setae in higher latitudes to those with long, abundantly haired setae in lower latitudes. In Suruga Bay, 72% of the specimens of *O. plumifera* which were counted were of the plumose form. *Oithona plumifera* recorded by MORI (1937) from Japanese coasts is doubtful. He described Md Ri with 4 setae, and figured P1 Re Se arrangement 1, 1, 3. These characters coincide with those of *O. setigera* DANA.

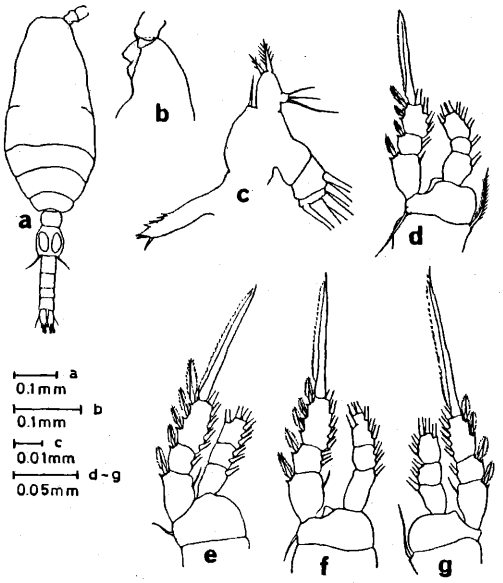

Fig. 15. *Oithona plumifera* BAIRD, male: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st swimming leg; e, 2nd swimming leg; f, 3rd swimming leg; g, 4th swimming leg.

Distribution

This species has often been confused with *O. atlantica* in the past. Reliable previous records of occurrence are as follows:

Neapel (GIESBRECHT, 1892), southwest coast of Ireland (FARRAN, 1908), tropical and temperate Atlantic (FARRAN, 1929), Christmas Islands and Great Barrier Reef (FARRAN, 1936), Arabian Sea (SEWELL, 1947), Woods Hole (WILSON, 1932), Fiji Islands (WILSON, 1950), Strait of Messina (CRISAFI, 1958), tropical and temperate Indian Ocean (TANAKA, 1960). SHUVALOV (1972b) stated that *O. plumifera* is a tropical species widely distributed in the tropical waters of all three oceans, whereas *O. atlantica* is a boreal species which inhabits the temperate zone of the North Atlantic, Mediterranean Sea and the northern part of the Gulf of Mexico.

11. *Oithona pseudofrigida* ROSENDORN, 1917 (Figure 16)

Oithona pseudofrigida ROSENDORN, 1917, p. 19, figure 9a-h.

Material examined

Stn. 18: Jan. 1974, 1 female.—Stn. 26: June 1974, 7 females.

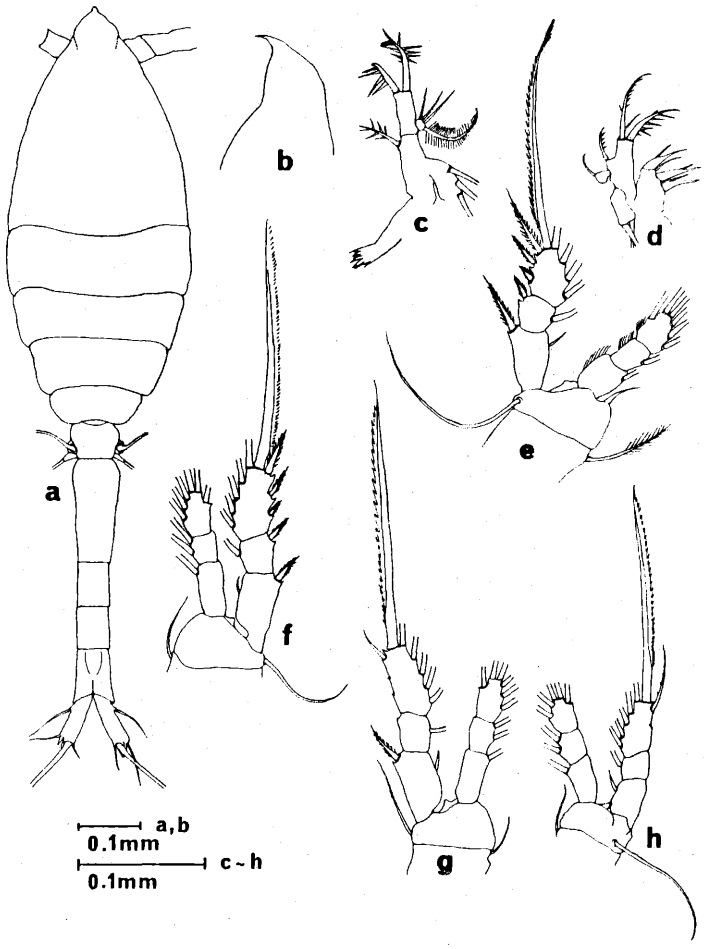

Fig. 16. *Oithona pseudofrigida* ROSENDORN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

Descriptive notes

Female.—TL 1.07-1.24 mm (1.17). PL 0.61-0.69 mm (0.66). PW 0.27-0.31 mm (0.29). PL/UL 1.24-1.35 (1.29).

Rostrum sharply pointed, visible dorsally. A1 extending to the distal end of Th5. Md B2 with 2 spines, Ri with 4 setae. Max1 Ri with a slender seta. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 1, 3; 1, 0, 1; 0, 0, 1

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

P3 Re3 Se about as long as Re3. P4 Re3 Se short and curved, about 1/3 times as long as St.

Remarks

The present species is closely allied to *O. frigida* GIESBRECHT (1902) in general appearance and in the structure of the mouth parts and swimming legs. However, in *O. pseudofrigida* P3 Re3 Se is about as long as Re3, whereas it is longer than Re itself in *O. frigida*; also P4 Re3 Se is very delicate in *O. pseudofrigida*, but is long and straight in the latter. The species is also similar to *O. setigera*, but there are differences in the P2 Re Se formula and the proportional length of A1 to TL. The male is unknown.

Distribution

Atlantic and Indian Oceans (ROSENDORN, 1917). This is the first record of occurrence of the species from Japanese coasts.

12. ***Oithona robusta*** GIESBRECHT, 1892 (Figure 17)

Oithona robusta GIESBRECHT, 1892, p. 538, pl. 34 figures 4, 5, 16, 17, 23, 30, 31, 43.—ROSENDORN, 1917, p. 29, figures 16a-c, 17a-e.

Material examined

Stn. 26: Apr. 1973, 1 female; Jan. 1974, 1 female.

Descriptive notes

Female.—TL 1.66 mm. PL 0.91 mm. PW 0.41 mm. PL/UL 1.21.

Rostrum visible dorsally, slender and produced ventrally. A1 extending to the distal margin of Th3. Md B2 with 2 pointed spines with spinules, Ri with 5 setae. Max1 Ri with 3 setae. P1-P4 Re armed as follows:

Se 1,1,3; 1,1,3; 1,1,3; 1,1,2

Si 1,1,4; 1,1,5; 1,1,5; 1,1,5

P2-P4 Re St and Se very thick.

Remarks

GIESBRECHT (1892) showed Md Ri with 4 setae. Rosendorn's (1917) specimens had P1 Re Si arrangement 1,1,5. The male has been described by ROSENDORN (1917).

Distribution

Mediterranean Sea (GIESBRECHT, 1892), Arabian Sea (ROSENDORN, 1917), Christmas Island (FARRAN, 1913), East China Sea (MORI, 1937), tropical Pacific (WILSON, 1942).

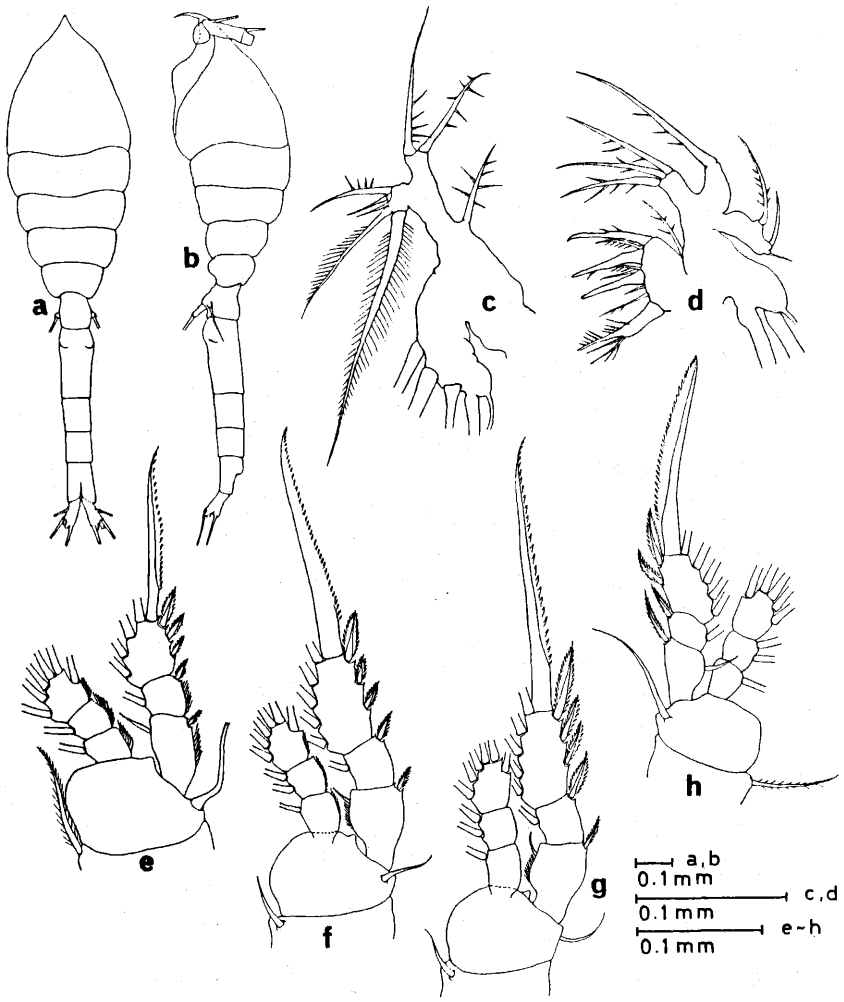

Fig. 17. *Oithona robusta* GIESBRECHT, female: a, whole animal, dorsal view; b, whole animal, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

13. *Oithona rostralis* TANAKA, new species (Figure 18)

Type specimen

Holotype (No. NSMT-Cr. 5463): female (TL 1.00 mm), Stn. 1, Apr. 1973.

Material examined

Stn. 1: Apr. 1973, 1 female (holotype).

Descriptive notes

Female.—TL 1.00 mm. PL 0.53 mm. PW 0.20 mm. PL/UL 1.13.

Prosome oval, 2.7 times as long as wide. Rostrum pointed, visible dorsally; it is swollen in the proximal region. A1 measured 0.7 mm in length, extending to the distal margin of Gn

Sgm. Md B2 with 2 spines, of which the inner one large, Ri with 3 setae. Max1 Ri with a long seta. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 1, 3; 1, 0, 2; 0, 0, 1

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

P4 Re3 Se about as long as Re3 St.

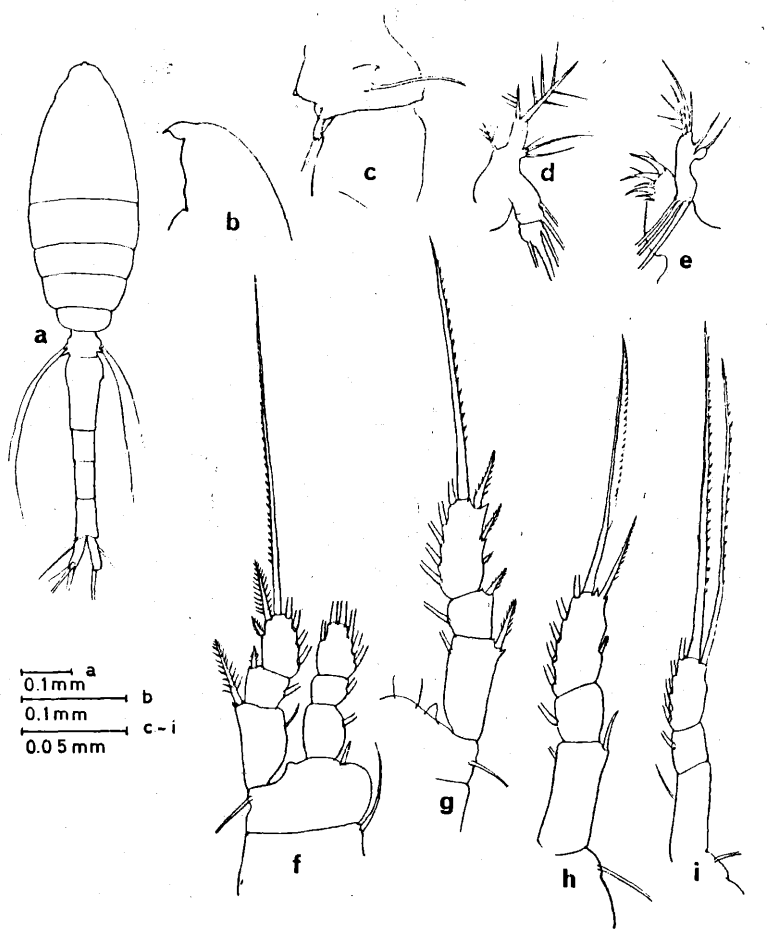

Fig. 18. *Oithona rostralis* n.sp., female: a, whole animal, dorsal view; b, head, lateral view; c, 5th thoracic segment; d, mandible; e, 1st maxilla; f, 1st swimming leg; g, 2nd swimming leg; h, 3rd swimming leg; i, 4th swimming leg.

Etymology

The specific name *rostralis* refers to the characteristic shape of the rostrum of this species.

Remarks

Although the present new species is closely related to *O. plumifera* in having the mouth appendages similar in structure, it can easily be distinguished from the latter species by the shape of rostrum and the P2-P4 Re setae formulae. This species also resembles *O. pseudo-*

frigida and *O. setigera*, but there are differences in the P1-P4 setae formulae, the shape of rostrum and the number of setae on Md Ri. The male is unknown.

14. *Oithona setigera* DANA, 1849 (Figures 19 and 20)

a. Forma *typica*

Oithona setigera, GIESBRECHT, 1892, p. 538, pl. 34 figures 3, 14, 15, 41.—FARRAN, 1913, p. 182.—ROSENDORN, 1917, p. 20, figure 10a-c.—SEWELL, 1947, p. 257.—CHENG *et al.*, 1974, p. 37, pl. 5 figures 1, 2.

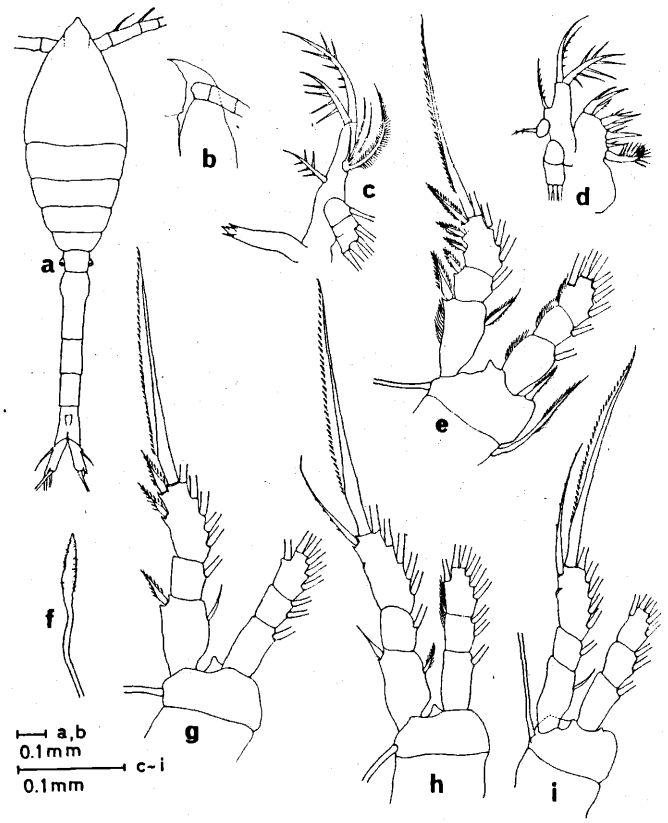

Fig. 19. *Oithona setigera* DANA, forma *typica*, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, outer marginal seta on 2nd basal segment of 1st swimming leg; g, 2nd swimming leg; h, 3rd swimming leg; i, 4th swimming leg.

Material examined

Stn. 7: Dec. 1973, 1 female.—Stn. 26: Aug. 1973, 1 female.—Stn. 29: Oct. 1973, 2 females.

Descriptive notes

Female.—TL 1.65-1.73 mm (1.70). PL 0.85-0.89 mm (0.87). PW 0.37-0.42 mm (0.39). PL/UL 1.05-1.09 (1.07).

Rostrum pointed, visible dorsally. A1 extending to the middle of Abd4. Md B2 with 2 strong spines, one of which a little shorter, Ri with 4 setae. Max1 Ri with a seta, approximately 1.5 times as long as Ri. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 0, 2; 1, 0, 1; 0, 0, 1

Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

P1-P4 B2 Se clavate and ciliated near the distal end.

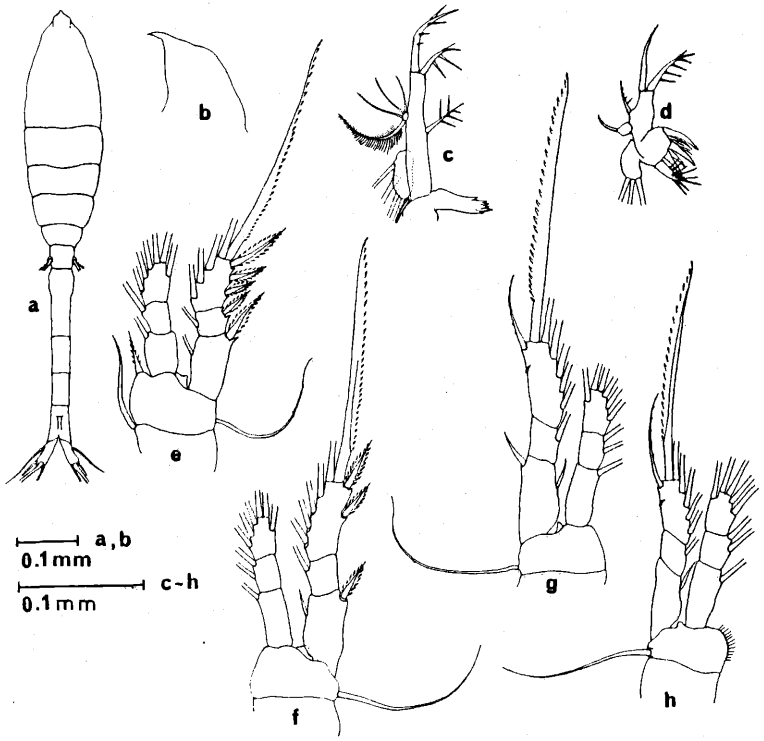

Fig. 20. *Oithona setigera* DANA, forma *pelagica*, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

b. Forma *pelagica*

Oithona pelagica FARRAN, 1908, p. 501.—1913, p. 183.

Material examined

Stn. 26: Feb. 1974, 5 females.—Stn. 29: Oct. 1973, 9 females.—Stn. A3: Apr. 1975, 1 female.—Stn. A5: Apr. 1975, 10 females.

Descriptive notes

Female.—TL 1.15-1.90 mm (1.43). PL 0.60-0.94 mm (0.73). PW 0.23-0.39 mm (0.28). PL/UL 0.93-1.17 (1.05).

Rostrum, Md, Max1, setae formulae of P1-P4 Re and Ri as in *O. setigera* f. *typica*. P1-P4 B2 Se not clavate and ciliated, but tapered.

Remarks

The males have been described by GIESBRECHT (1892) and ROSENDORN (1917). The specimens of *O. setigera* described by GIESBRECHT (1892) has club-shaped setae on P1-P4 B2. FARRAN (1908) described a species under the name *O. pelagica* which closely resembles *O. setigera* but differing from the latter only in the absence of the club-shaped setae. Subsequently, FARRAN himself (1913), and ROSENDORN (1917) and SEWELL (1947) considered that presence or absence of the clavate setae was not a reliable character. According to FARRAN (1913), most of Christmas Island specimens of *O. setigera* could be recognized by their large body size (TL 1.6-1.9 mm) and by having the clavate setae (typical form of *O. setigera*). In a few specimen, however, these setae were long and slender and did not show signs of thickening, and some others showed a good deal of variation in the thickening of the setae. In addition, he recorded the occurrence of a few small form with slender setae (TL 1.20-1.26 mm). Thus, 3 types of *O. setigera* have been recorded. In the present paper, the name *O. setigera* forma *pelagica* is proposed for the latter 2 types in order to clarify the differences in geographical distribution between two forms in the future studies. The forma *pelagica* is distributed in higher latitudes than the forma *typica* and is dominant over the latter forma in the studied area. This species is distinguished from the closely allied species *O. atlantica* by the number of Se on P1 Re3 and the shape of Se on P4 Re3.

Distribution

Oithona setigera has been recorded from warm waters of the Atlantic (FARRAN, 1908; GRICE, 1960), Pacific (FARRAN, 1936; MORI, 1937) and Indian Oceans (SEWELL, 1947). It has also been found in the Mediterranean Sea (CRISAFI, 1959).

15. *Oithona similis* CLAUS, 1866 (Figures 21 and 22)

Oithona similis, GIESBRECHT, 1892, p. 538, pl. 34 figures 2, 18, 19, 21, 36-39, pl. 44 figures 3, 5, 8, 11.—ROSENDORN, 1917, p. 24, figure 13a-e.—SARS, 1918, p. 8 and 207, pl. 3.—MORI, 1937, p. 112, pl. 62 figures 1-12.

Material examined

Stn. A1: Apr. 1975, 6 females and 4 males.—Stn. A3: Apr. 1975, 4 females and 2 males.—Stn. A7: Apr. 1975, 16 females.

Descriptive notes

Female.—TL 0.69-0.84 mm (0.75). PL 0.40-0.46 mm (0.42). PW 0.15-0.22 mm (0.17). PL/UL 1.21-1.40 (1.28).

Rostrum pointed, not visible dorsally. A1 extending to the end of Th5. Md B2 with 2 sharp spines with spinules, Ri with 3 setae. Max1 Ri without seta. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 0, 1; 1, 0, 1; 0, 0, 1

Si 0, 1, 4; 0, 1, 5; 0, 1, 5; 0, 1, 5

P2, P3 Re3 with a tooth on the middle part of the outer margin.

Male.—TL 0.60-0.65 mm (0.62). PL 0.38-0.42 mm (0.40). PW 0.17-0.21 mm (0.18). PL/UL 1.73-1.90 (1.81).

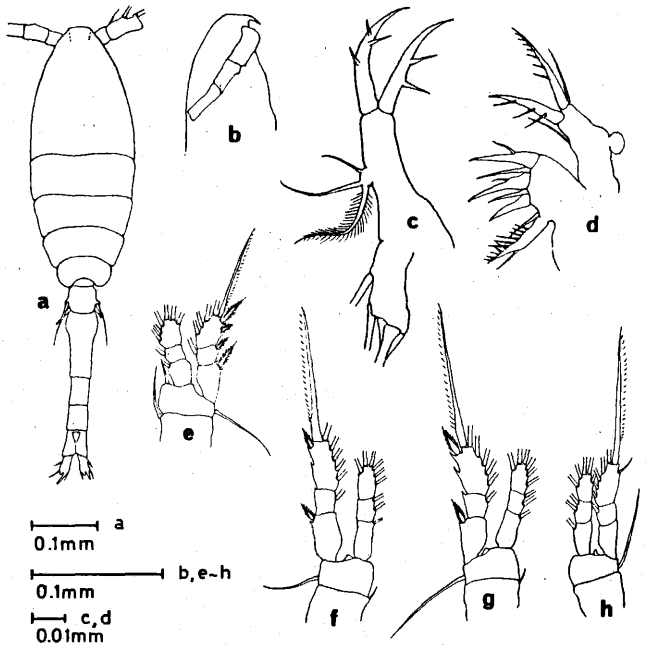

Fig. 21. *Oithona similis* CLAUS, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

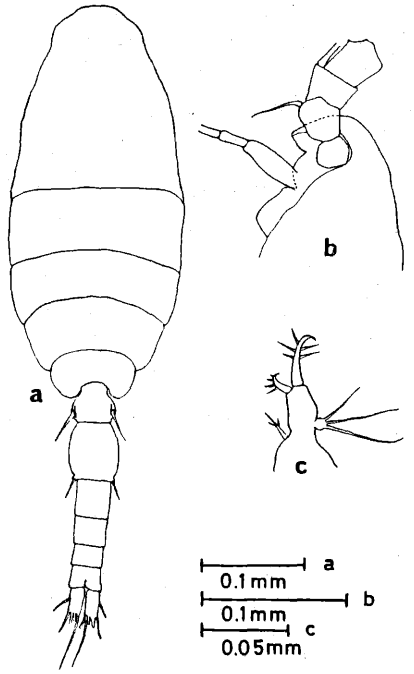

Fig. 22, *Oithona similis* CLAUS, male: a, whole animal, dorsal view; b, head, lateral view; c, mandible.

Rostrum absent. Md B2 with 2 pointed spines, Ri with 3 setae. Max1 with a small Ri without seta. P1-P4 Re armed as follows:

Se 1, 1, 2; 1, 1, 2; 1, 1, 2; 1, 1, 2
Si 0, 1, 4; 0, 1, 5; 0, 1, 5; 0, 1, 5

P1 Re Si arrangement may 0, 1, 5 in some specimens.

Remarks

There seems to be some confusion about the name of this species. CLAUS (1866) firstly described *O. similis* from Nice. The species was redescribed by GIESBRECHT (1892), and it has been accepted by FARRAN (1913), ROSENDORN (1917) and many other authors. However, SARS (1918) once considered that *O. similis* CLAUS was a synonym of *O. helgolandica* CLAUS, 1863. Later, he (1918) stated that *O. similis* differ from *O. helgolandica*, and the latter species was identical with *O. nana*. Meanwhile, FARRAN (1913) described two new species, *O. decipiens* and *O. fallax*, which are closely allied to *O. similis*. He distinguished these species from *O. similis* mainly by the setae formulae of the P1-P4, which were made no account in Claus' description of *O. helgolandica*. Therefore, it is not certain at present if *O. helgolandica* was truly the same species as *O. similis*. We are of opinion that Giesbrecht's description of *O. similis* is accepted as a good species, while that of *O. helgolandica* CLAUS should be rejected of uncertainty.

Distribution

The species is widely distributed in the Atlantic, Indian and Pacific Oceans, and adapted to somewhat low temperature.

16. *Oithona simplex* FARRAN, 1913 (Figure 23)

Oithona simplex FARRAN, 1913, p. 187, pl. 29 figures 10-14, pl. 30 figures 1-2.—ROSENDORN, 1917, p. 45, figure 26a-f.—FRÜCHTL, 1924, p. 73.—TANAKA, 1960, p. 64, pl. 28 figures 1-6.—GONZALEZ and BOWMAN, 1965, p. 274, figure 21f-i.—CHENG *et al.*, 1974, p. 34, pl. 3 figures 4-9.

Material examined

Stn. A3: Apr. 1975, 1 male.—Stn. A5: Apr. 1975, 2 females.—Stn. A7: Apr. 1975, 2 females.

Descriptive notes

Female.—TL 0.43-0.46 mm (0.45). PL 0.28-0.30 mm (0.29). PW 0.14-0.15 mm (0.15). PL/UL 1.71-1.88 mm (1.82).

Anterior end of the head curving ventrally. Prosome oval in dorsal view. Rostrum not pointed but right angled laterally. A1 extending to the middle of Th2. Md B2 with a large spine with spinules and a seta, Ri with 5 setae. Max1 Ri with 4 setae. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 1, 3; 1, 1, 3; 1, 1, 3
Si 1, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

Male.—TL 0.39 mm. PL 0.26 mm. PW 0.14 mm. PL/UL 2.00.

Rostrum not pointed. Prosome rectangular in dorsal view. An Sgm shorter than broad. Md, Max1 structure not made out. P1-P4 armed as in the females.

Remarks

According to FARRAN (1913) and GRICE (1960), P1 Ri consisted of 2 segments. However, like the specimens described by TANAKA (1960) and CHENG *et al.* (1974), it is 3-segmented in the present specimens.

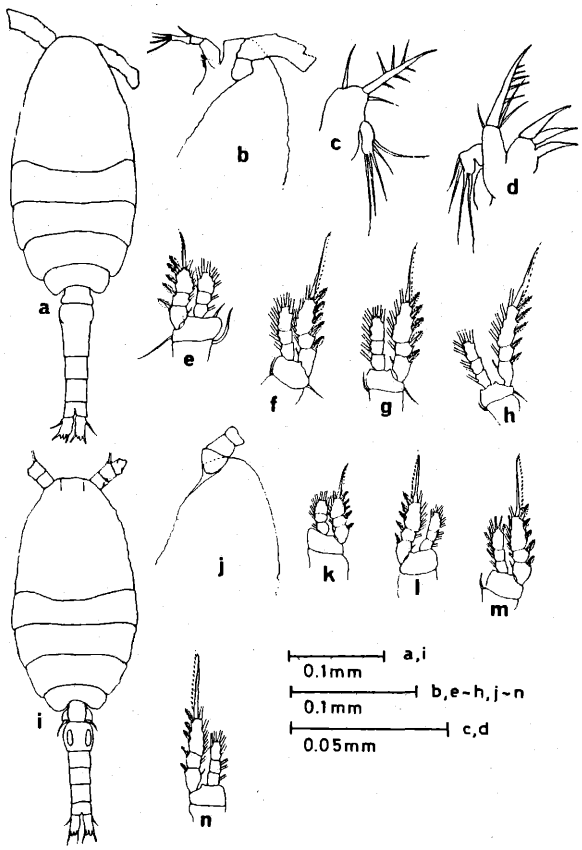

Fig. 23. *Oithona simplex* FARRAN, female (a-h) and male (i-n): a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg; i, whole animal, dorsal view; j, head, lateral view; k, 1st swimming leg; l, 2nd swimming leg; m, 3rd swimming leg; n, 4th swimming leg.

Distribution

Christmas Island (FARRAN, 1913), Bay of Biscay, mouth of Amazon River (ROSENDORN, 1917), Florida west coast (GRICE, 1960), Puerto Rico (GONZALEZ and BOWMAN, 1965), East and South China Seas (CHENG *et al.*, 1974). This is the first record of occurrence from the coast of Japan.

17. *Oithona tenuis* ROSENDORN, 1917 (Figure 24)

Oithona tenuis ROSENDORN, 1917, p. 14, figures 3a-d, 4a-d.—CHENG *et al.*, 1974, p. 38, pl. 5 figures 3-8.

Material examined

Stn. 7: Apr. 1973, 1 female; Dec. 1973, 1 female.—Stn. A3: Apr. 1975, 1 female.—Stn. A5: Apr. 1975, 1 female.—Stn. T9: Apr. 1975, 3 females.

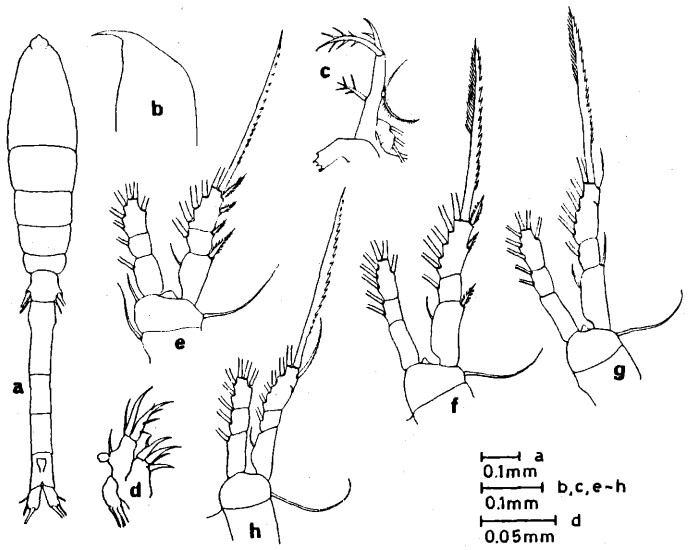

Fig. 24. *Oithona tenuis* ROSENDORN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg.

Descriptive notes

Female.—TL 1.17-1.25 mm (1.22). PL 0.59-0.63 mm (0.61). PW 0.15-0.19 mm (0.17). PL/UL 0.98-1.03 (1.00).

Prosome very slender, about 3.5 times as long as wide. Rostrum pointed, visible dorsally. A1 extending to the middle of Abd3. Md B2 with a long spine and a short spine, Ri with 2 setae. Max1 Ri without seta. P1-P4 Re armed as follows:

Se 1,1,2; 1,0,2; 1,0,1; 0,0,1

Si 1,1,4; 1,1,5; 1,1,5; 1,1,5

Remarks

The specimen agrees well with Rosendorn's original description except that P1-P4 Re1 is furnished with 1 Si instead of 0. The male is unknown.

Distribution

Arabian Sea and Atlantic (ROSENDORN, 1917), Aru Archipelago (FRÜCHTL, 1924), Great Barrier Reef (FARRAN, 1936), Yellow Sea and East China Sea (CHENG *et al.*, 1974). This is the first record of occurrence from the coast of Japan.

18. *Oithona vivida* FARRAN, 1913 (Figure 25)

Oithana vivida FARRAN, 1913, p. 183, pl. 27 figures 1-8.—ROSENDORN, 1917, p. 32, figure 18a-e.—CHENG *et al.*, 1974, p. 39, pl. 5 figures 9-14.

Material examined

Stn. 18: Apr. 1973, 1 female.—Stn. A7: Apr. 1975, 2 females.

Descriptive notes

Female.—TL 0.73-0.77 mm (0.75). PL 0.35-0.39 mm (0.37). PW 0.15-0.17 mm (0.16). PL/UL 0.92-1.06 (1.01).

Rostrum visible dorsally, sharply pointed anteriorly. A1 extending to the middle of Gn Sgm. Md B2 with 2 spines, Ri with 3 setae. Max1 Ri with 4 setae. P1-P4 Re armed as follows:

Se 1, 1, 3; 1, 1, 3; 1, 1, 2; 1, 1, 2

Si 0, 1, 4; 1, 1, 5; 1, 1, 5; 1, 1, 5

P4 Re1-3 Se very delicate.

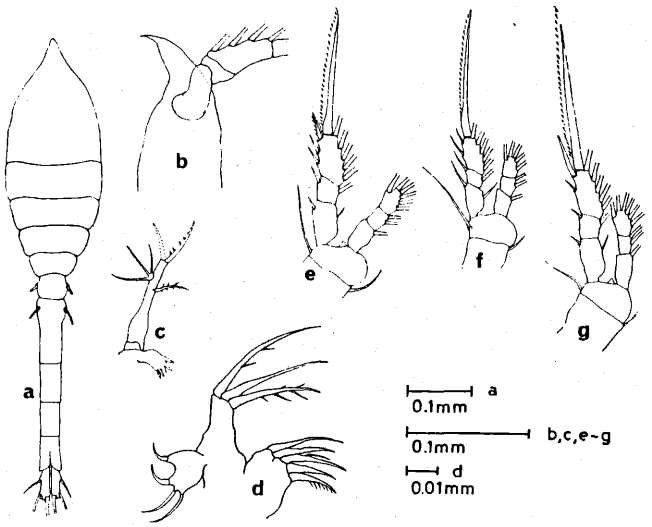

Fig. 25. *Oithona vivida* FARRAN, female: a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 2nd swimming leg; f, 4th swimming leg; g, 3rd swimming leg.

Remarks

Farran's (1913) figures of P2 and P3 are the other way about. He said that P4 Se arrangement appeard to be 1, 1, 3 or 1, 0, 3 but it was 1, 1, 2 in the present specimens. The setae formulae of P1-P4 Re Si was 1, 1, 4; 1, 1, 4; 1, 1, 4; 1, 1, 4 in the original description, whereas it was 1, 1, 5; 1, 1, 5; 1, 1, 5; 1, 1, 5 in ROSENDORN (1917). The male is unknown.

Distribution

Indian Ocean (FARRAN, 1913; ROSENDORN, 1917), eastern tropical Pacific (WILSON, 1942), Yellow Sea and East China Sea (CHENG *et al.*, 1974). This is the first record of occurrence from the coast of Japan.

Genus *Paroithona* FARRAN, 1908

19. *Paroithona pulla* FARRAN, 1913 (Figure 26)

Paroithona pulla FARRAN, 1913, p. 190, pl. 29 figures 1-9, pl. 31 figure 1.—ROSENDORN, 1917, p. 48.

Material examined

Stn. A1: Apr. 1975, 4 females.—Stn. A3: Apr. 1975, 1 female.—Stn. A5: Apr. 1975, 6 females.—Stn. A7: Apr. 1975, 1 female and 1 male.

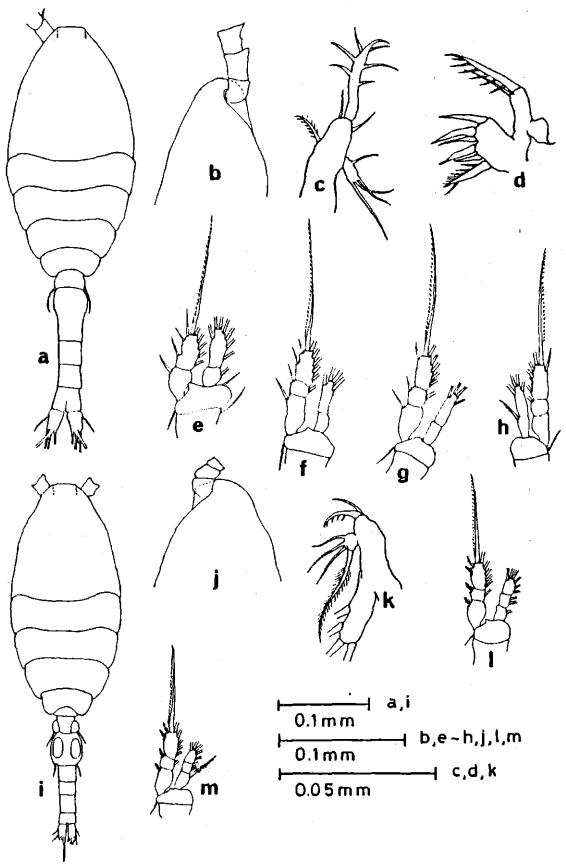

Fig. 26. *Paroithona pulla* FARRAN, female (a-h) and male (i-m): a, whole animal, dorsal view; b, head, lateral view; c, mandible; d, 1st maxilla; e, 1st swimming leg; f, 2nd swimming leg; g, 3rd swimming leg; h, 4th swimming leg; i, whole animal, dorsal view; j, head, lateral view; k, mandible; l, 2nd swimming leg; m, 4th swimming leg.

Descriptive notes

Female.—TL 0.41-0.46 mm (0.43). PL 0.24-0.29 mm (0.26). PW 0.12-0.15 mm (0.13). PL/UL 1.32-1.65 (1.46).

Rostrum rounded. Anterior margin of the head flat in dorsal view. Prosome oval. Gn Sgm

somewhat rounded on the proximal region. An Sgm about as long as wide. A1 extending to Th3. Md B2 with a strong spine and 2 minute setae, Ri with 4 setae. Max1 Ri with a minute seta. P1 Re and Ri 2-segmented, 2nd and 3rd segments combined. P2-P4 Ri 2-segmented, Re 3-segmented. P1-P4 Re armed as follows:

Se 1,1+2; 1,1,2; 1,1,1; 0,0,1

Si 0,1+4; 0,1,5; 0,1,5; 0,1,5

P1-P4 Re St very slender.

Male.—TL 0.40 mm. PL 0.26 mm. PW 0.13 mm. PL/UL 1.86.

Rostrum not pointed, ventral tip terminated in nearly right angle in lateral view. Anterior margin of head flat in dorsal view. Prosome oval. An Sgm about as long as wide. Md B2 with a spine and a seta, Ri with 4 setae. Max1 structure not made out. P1 Re 2-segmented. P2-P4 Re and Ri 3-segmented. P1-P4 Re armed as follows:

Se 1,1+2; 1,1,2; 1,1,2; 1,1,2

Si 0,1+4; 0,1,5; 0,1,5; 0,1,5

P4 Ri1 Si large.

Remarks

Because of the co-occurrence with the females of *P. pulla* and the coincidence in the body size, the segmentation of P1-P4 Re and the structure of Md, the present male is considered to be *P. pulla*. There is a slight difference between the original description of the females (FARRAN, 1913) and the present female specimens in the setae formula of P3 Re, but other structure coincide well with Farran's description.

Distribution

Christmas Island (FARRAN, 1913). This is the first record of occurrence of this species from the coast of Japan.

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