

Redescription of *Oithona brevicornis* GIESBRECHT, and *O. aruensis* FRÜCHTL, new rank, with notes on the status of *O. spinulosa* LINDBERG^{1), 2)}

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Abstract

A single female specimen on WILHELM GIESBRECHT's slide of *Oithona brevicornis* GIESBRECHT, 1891, and 11 female specimens in FRITZ FRÜCHTL's bottle of *O. brevicornis* f. *aruensis* FRÜCHTL, 1923, were examined and compared with rostrate *Oithona* specimens collected from the area of Hong Kong Harbor (the presumed type locality of *O. brevicornis*), Surabaya Harbor, and descriptions of *O. brevicornis*, *O. spinulosa* LINDBERG, 1947, and *O. wellershausi* FERRARI, 1981. *Oithona brevicornis* f. *aruensis* is concluded to be distinct from *O. brevicornis* and raised to a species, *O. aruensis*, new rank. *Oithona spinulosa* is considered a junior synonym of *O. brevicornis*.

Questions about the identity of *Oithona brevicornis* GIESBRECHT, 1891, and its status relative to *O. spinulosa* LINDBERG, 1947, center around a unique suite of morphological characters for the latter species. In describing his new species, *O. spinulosa*, LINDBERG (1947b, 1950) noted and illustrated a long, thick seta on the leg 5, distinctly ornamented with short, thick setules; a patch of long hairs laterally on each side of the genital segment; two dorsolateral rows of short hairs on the posterior 1/3 of the genital segment, and two similar rows on the following, third urosomal segment; an external seta on the caudal ramus placed more anteriorly than in other species. FERRARI (1981) felt this suite of characters distinct enough not to have been overlooked by GIESBRECHT (1892) in his description of *O. brevicornis*, and thus retained the name *O. spinulosa* for Indo-West Pacific coastal oithonids possessing the combination. WELLERSHAUS (1969), in illustrating these distinctive characters on specimens from Cochin, India, remarked that he did not find much difference between *O. spinulosa* and *O. brevicornis*, and considered them synonyms (WELLERSHAUS 1970). This decision has been supported implicitly by NISHIDA et al. (1977) and NISHIDA (1981). WELLERSHAUS (1969, 1970) miscited the original description of *O. spinulosa* which appeared in LINDBERG (1947b, not 1947a). FERRARI (1981) incorrectly assumed the species had initially been described in LINDBERG (1950).

Another problem concerning *O. brevicornis* has been the taxonomic status of *O. brevicornis* f. *aruensis* FRÜCHTL, 1923, which is taxonomically valid as a subspecies (see STOLL

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²⁾ *Oithona brevicornis* GIESBRECHT と *O. aruensis* FRÜCHTL の再記載および *O. spinulosa* LINDBERG の分類学的地位

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et al. 1964, I.C.Z.N., Article 45d-e), and is referable both to *O. spinulosa* and *O. wellershausi* FERRARI, 1981, because FRÜCHTL did not mention the structure of many appendages including the first maxilla, an important character differentiating these species. WELLERSHAUS (1969) noted a slight difference in the shape of the terminal spines on the second basal segment of mandible between *O. brevicornis* from Cochin and *O. brevicornis* f. *aruensis*; these spines are blunt in the former and sharply pointed in the latter.

The discovery of a slide labelled *O. brevicornis* in WILHELM GIESBRECHT's slide collections and the specimens in the bottle of *O. brevicornis* f. *aruensis* labelled by FRITZ FRÜCHTL has given us an opportunity to infer some aspects of these incompletely described species.

Materials

GIESBRECHT's slide of *O. brevicornis* was loaned by Stazione Zoologica, Naples, Italy and the specimens of *O. brevicornis* f. *aruensis* in Dr. H. MERTON's collection by the Forschungsinstitut Senckenberg, Frankfurt, F.R.G. Specimens collected in Hong Kong Harbor near Kowloon City, the presumed type locality of *O. brevicornis*, augmented descriptions of this species. Female specimens morphologically similar to the syntypes of *O. aruensis* were collected with cooccurring males in Surabaya Harbor, Indonesia during the cruise of the R/V Hakuho Maru of the Ocean Research Institute, University of Tokyo. These were used in augmenting the description of *O. aruensis*.

Examination of Giesbrecht's Specimen

The contents of GIESBRECHT's slide (no specimen number on the slide; the slide read '*Oithona brevicornis*' and 'Hong Kong') were dried out. Initially we were able to determine only that a single adult female, compressed dorsolaterally, adhered to the underside of the coverslip. The coverslip was separated from the asphalt lacquer sealant with xylene, and brought through a series of xylene/ethanol and ethanol/glycerine solutions to 100 % glycerine. We had hoped that the final solution would soften the tissue, allowing the specimen to be removed intact from the coverslip. When the specimen was touched with a fine pin, it broke into three parts: the prosome anterior to the swimming legs, posterior prosome, and the first and second urosomal segments. The rest of the urosome, including caudal ramus, and parts of the freed appendages remained on the coverslip. Examination of the freed parts proved un-instructive. Examination of the coverslip indicated the external spine of the terminal setae are long and thick. The structure of one of the third exopodal segment of leg 4 can also be seen on the coverslip. These structures are similar to those on the specimens recently described as *O. spinulosa* (FERRARI 1981).

Additional Description of *O. brevicornis*

Descriptions of specimens of *O. brevicornis* can be found in WELLERSHAUS (1969) from Cochin Backwater, India, in NISHIDA et al. (1977) from Suruga and Tokyo Bays, Japan, in NISHIDA (1981) from Sri Lanka, Persian Gulf, South Yemen and Malaysia, and as *O. spinu-*

losa by LINDBERG (1947b, 1950) from Madras, India, and FERRARI (1981) from the Pearl River Mouth. Size dimorphism of the species is treated by NISHIDA (1981). One important character useful in separating *O. brevicornis* from cooccurring congener, *O. aruensis* and *O. wellershausi*, is the distal-most spine on the first inner lobe of the first maxilla, which is long in the latter two species, but short and curved away from the plane of the lobe in *O. brevicornis*. This difference is difficult to see in the illustration of the female first maxilla by FERRARI (1981, Fig. 4A); the male first maxilla (FERRARI 1981, Fig. 4B) is incorrectly shown with one not three setae on the endopod, and five not four setae on the exopod. These appendages are correctly illustrated in Fig. 1. The following diagnosis is prepared from specimens collected in Hong Kong Harbor near Kowloon City on 8 Feb., 1982.

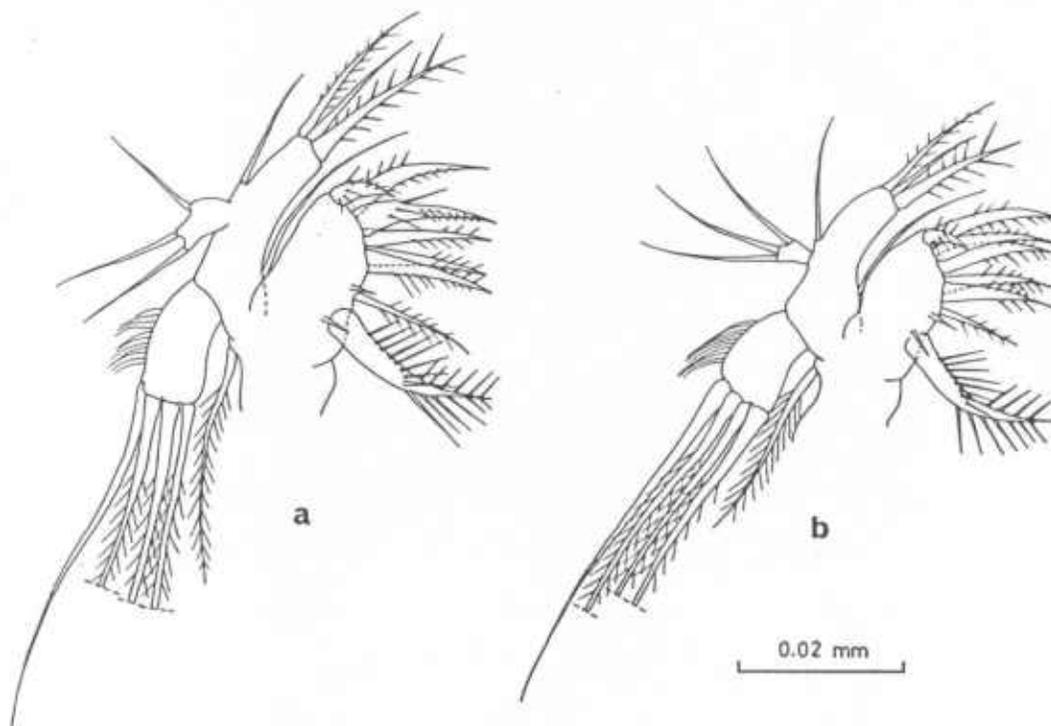


Fig. 1. *Oithona brevicornis* from Hong Kong Harbor. First maxilla; a, female; b, male.

Oithona brevicornis GIESBRECHT, 1891

Oithona brevicornis GIESBRECHT, 1891: 475. GIESBRECHT, 1892: 538, 549, Plate 34, Figs. 6-7. HERBST, 1964: 155. WELLERSHAUS, 1969: 279, Figs. 103-119. CHEN et al., 1974: 36, Plate 4, Figs. 1-8.

Oithona brevicornis f. *typica* NISHIDA et al., 1977: 129, Figs. 4c-h, 5b.

Not *Oithona brevicornis* f. *aruensis* FRÜCHTL, 1923: 454. FRÜCHTL, 1924: 88, Figs. 44(1)-(2), Table 7.

Not *Oithona brevicornis* f. *arostrata* FRÜCHTL, 1923: 454. FRÜCHTL, 1924: 91, Figs. 45-46.

Not *Oithona brevicornis* f. *minor* NISHIDA et al., 1977: 131, Figs. 4a-b, 5a-c.

? *Oithona brevicornis* ROSENDORN, 1917: 34, Fig. 19.

Oithona spinulosa LINDBERG, 1947b: 129, Fig. 1. LINDBERG, 1950: 259, Figs. 1-2. FERRARI, 1981: 1246, Figs. 1A-C, 2A-D, 3A-D, 4A-C, 5A-F, 6A-D, 7A-D.

Female. Length range 0.58-0.63 mm (30 specimens). Length ratio prosome/urosome 1.3.

Rostrum present, pointed ventrally. Genital segment laterally with patch of hairs on each side, posterior to genital opening; 2 parallel lines of short hairs dorsolaterally, and 2-4 similar lines on following third urosomal segment. Caudal ramus 3× long as wide, with external seta placed anteriorly. Second basal segment of mandible with 2 similar thick, curved spines with spinules; exopod with 5 setae; endopod with 4 setae. On first maxilla (Fig. 1a), distal seta of first inner lobe short and curved; exopod with 4 setae; endopod with 3 setae. Leg 5 with long, thick seta ornamented with short, thick setules.

Male. Length range 0.52-0.57 mm (30 specimens). Length ratio prosome/urosome 1.6. Rostrum absent. Cephalosome flap digitiform, reaching beyond posterior articulation of second prosomal segment. Caudal ramus 2× long as wide. Second basal segment of mandible with 2 dissimilar spines, ventral like female, dorsal shorter and thinner. Endopod of first maxilla (Fig. 1b) with 3 setae; exopod with 4 setae. Leg 5 with 1 long, thick seta ornamented with short, thick setules; seta of genital flap similar.

Remarks. GIESBRECHT (1892) noted the type locality of *O. brevicornis* simply as Hong Kong. We obtained three plankton samples collected in the harbor area of Kowloon City (114°29.1'E, 22°19.2'N) and Sha Tin Hoi (114°13.5'E, 22°26.5'N and 114°12.6'E, 22°26.5'N). These contain various Indo-West Pacific inlet species including a *Dioithona* and a rostrate *Oithona*, and inlet-oceanic species, *O. attenuata*, *O. nana* and *O. simplex* (NISHIDA 1981). The rostrate *Oithona* specimens are similar to those described by GIESBRECHT as *O. brevicornis*, and possess the distinctive suite of characters mentioned above. This is another reason why we conclude that *O. spinulosa* LINDBERG, 1947, is a synonym of *O. brevicornis* GIESBRECHT, 1891. In doing so, we assume that in the 100 years since GIESBRECHT's specimens were collected, the oithonid fauna of Hong Kong Harbor area has not been changed by introduction of species endemic to other localities. We are aware of evidence for introductions of pelagic calanoid and cyclopid copepods into coastal habitats (JONES 1966, GRINDLEY & GRICE 1969, ORSI et al. 1983). Mechanisms for such introductions by ship ballast water are being studied (CARLETON, personal communication).

The type specimen from GIESBRECHT's slide has been returned to Stazione Zoologica in two vials with the original slide. One vial contains the three separated parts, the second a piece of the coverslip with appendages and part of the urosome attached. Specimens from the type locality (Hong Kong Harbor area) will be deposited at the National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A. and the Ocean Research Institute, University of Tokyo, Japan.

Description of Fruchtl's Specimens

Oithona aruensis FRÜCHTL, 1923, new rank

Oithona brevicornis f. *aruensis* FRÜCHTL, 1923: 454. FRÜCHTL, 1924: 88, Figs. 44(1)-(2), Table 7.

Oithona brevicornis f. *minor* NISHIDA et al., 1977: 131, Figs. 4a-b, 5a-c.

Oithona brevicornis GIESBRECHT. UCHIMA, 1979: 59, Figs. 1-5.

Oithona sp. 1, NISHIDA, 1981: 149, Figs. 64-67.

Material. Syntypes, 11 females and 1 copepodid IV (Aru Island, Indonesia), SMF 3056.

Female. Length range 0.44-0.46 mm (11 specimens). Length ratio prosome/urosome 1.4-1.5. Rostrum present, pointed ventrally. Genital segment and third urosomal segment, unlike *O. brevicornis*, without patches or lines of short hairs. Caudal ramus 2.0-2.4× long as wide, with external seta placed medially, rather than anteriorly. Second basal segment of mandible with 2 similar thick curved spines with spinules; tip of the spines more pointed than in *O. brevicornis*; exopod with 5 setae; endopod with 4 setae. On first maxilla, distal seta of first inner lobe very long, about 3× long as next seta; exopod with 4 setae; endopod with 3 setae. First basal segment of legs 1-4 with 1 inner marginal seta; exopod with 1, 1, 3; 1, 1, 3; 1, 1, 3; 1, 1, 2 outer marginal spines and 0, 1, 4; 0, 1, 5; 0, 1, 5; 0, 1, 5 inner marginal setae; endopod with 0, 0, 1; 0, 0, 1; 0, 0, 1; 0, 0, 1 outer and 1, 1, 5; 1, 2, 5; 1, 2, 5; 1, 2, 4 inner marginal setae. Second basal segment of leg 1 with 1 inner distal marginal seta, thinner and longer than in *O. brevicornis*. On endopod of leg 4, distal seta of second segment and proximal seta of

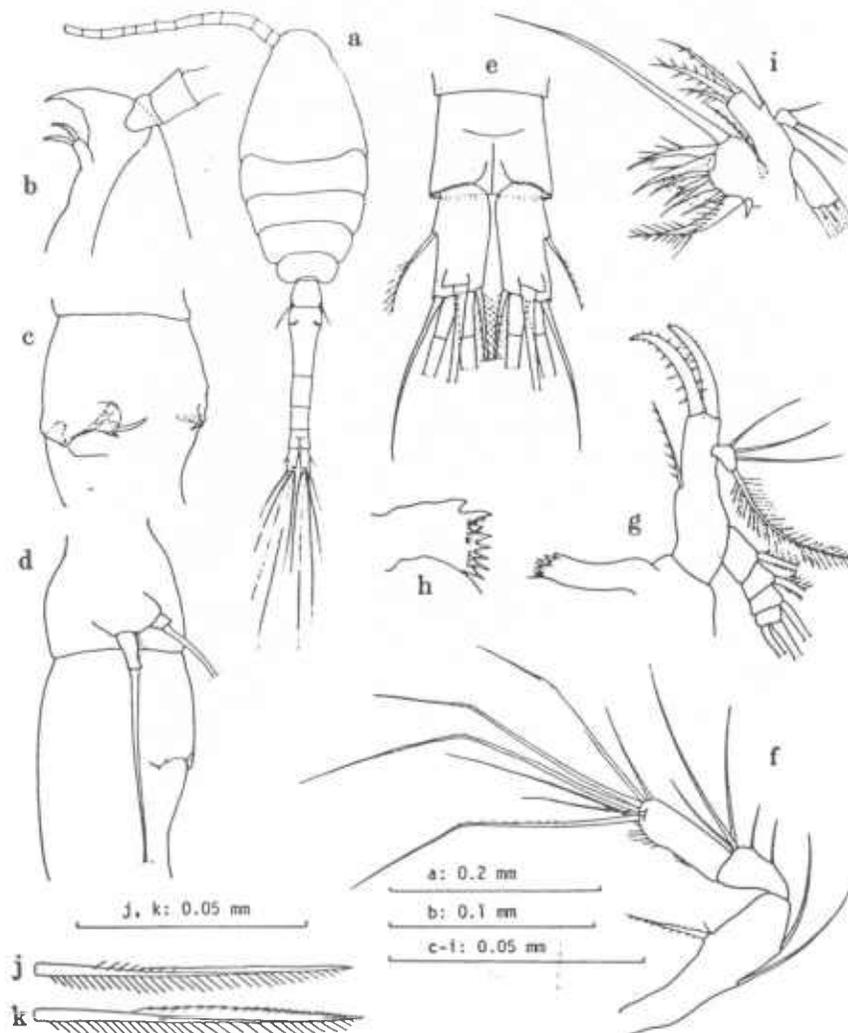


Fig. 2. *Oithona aruensis* from Surabaya Harbor. Female; a, dorsal view; b, head, lateral view; c, genital segment, dorsolateral view; d, leg 5, lateral view; e, anal segment and caudal rami, dorsal view; f, second antenna; g, mandible; h, mandibular blade; i, first maxilla; j, leg 4 endopod, distal seta of second segment; k, leg 4 endopod, proximal seta of third segment.

third segment modified; the former with thin flange on distal 2/3, latter with thick flange on distal 3/4. Leg 5 with a long naked seta.

Oithona aruensis from Surabaya Harbor

FRÜCHTL's syntypes consist of only females and a copepodid IV juvenile. The above description lacks detailed information on the characters which are difficult to observe without dissection. Dissection of syntypes was not carried out because there was a possibility of destroying a few specimens to get a complete set of well-dissected appendages. Therefore, complete descriptions of both female and male are presented for *O. aruensis* collected in Surabaya Harbor, Indonesia (112°45'E, 7°12'S) on 18⁴ Jan. 1977 (Figs 2-5).

Female. Length range 0.43-0.45 mm (5 specimens). Prosome oval in dorsal view; greatest width at first thoracic segment; length ratio prosome/urosome 1.3-1.4. First antenna short,

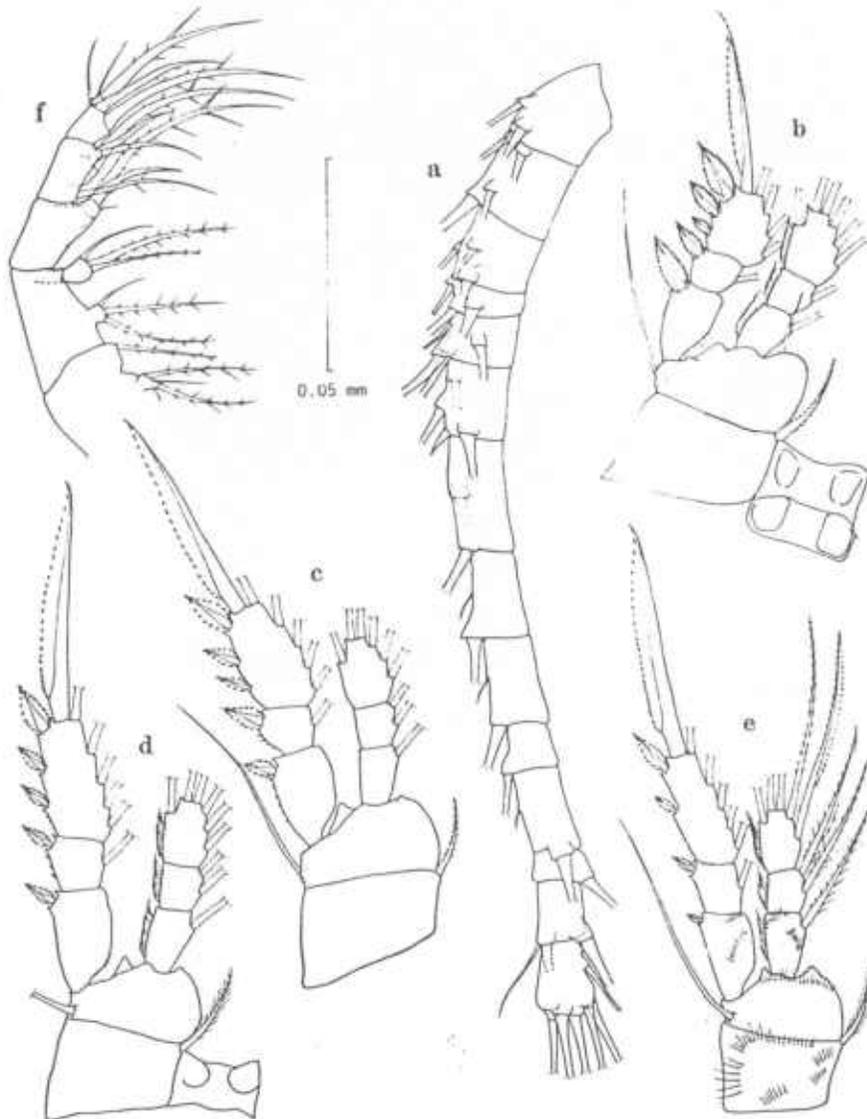


Fig. 3. *Oithona aruensis* from Surabaya Harbor. Female; a, first antenna; b, leg 1; c, leg 2; d, leg 3; e, leg 4; f, second maxilla.

with posteroventral longitudinal row of rudimentary teeth on 8th-14th segments, length $0.8-0.9 \times$ prosome. 20th-22nd segments fused, shorter than 23th-25th segments combined. 25th segment without aesthete. First and second basal segments of second antenna fused, with 1 midmarginal and 1 distal marginal inner setae, and 1 moderately long and 1 minute outer midmarginal setae. Second endopodal segment of second maxilla with 2 long, spinulose subequal setae and 2 short subequal setae. Second basal segment of maxilliped with inner marginal row and distal anterior surface row of short, fine setae; second endopodal segment with 2 long subequal setae with spinules, 1 short spine and 1 minute seta. Leg 6 represented by 1 slightly curved spine and 1 minute pointed process. Other characters as described for the syntypes.

Male. Length range 0.40-0.41 mm (3 specimens). Prosome oval; greatest width at posterior end of first thoracic segment; length $2.0-2.1 \times$ width, $1.6 \times$ urosome. Rostrum absent. Cephalo-

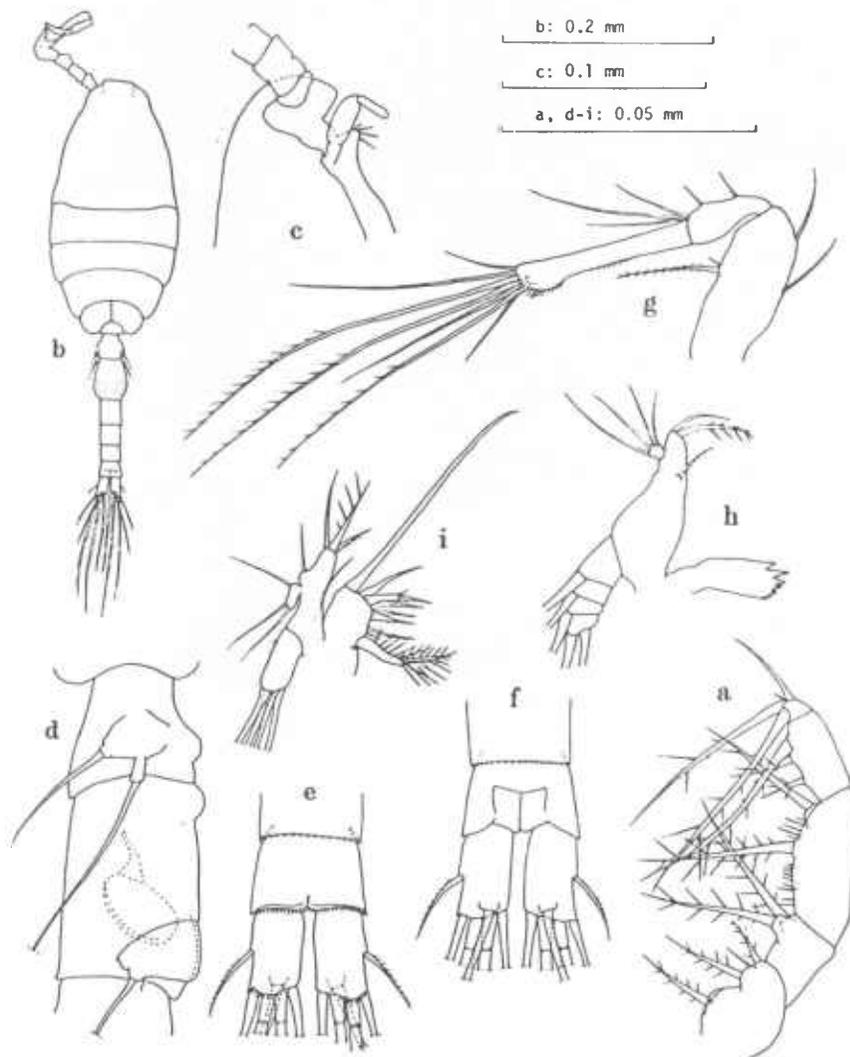


Fig. 4. *Oithona aruensis* from Surabaya Harbor. Female; a, maxilliped. Male; b, dorsal view; c, head, lateral view; d, leg 5 and genital segment, lateral view; e, anal segment and caudal rami, ventral view; f, anal segment and caudal rami, dorsal view; g, second antenna; h, mandible; i, first maxilla.

some flap digitiform, extending beyond posterior articulation of first thoracic segment; pore signature of 'hebes' type (FERRARI 1981). Proportional lengths of first to sixth urosomal segments and caudal ramus 15:24:16:13:12:9:10. Genital segment length $1.3-1.5\times$ width. Anal segment length $1.7-2.0\times$ width, $1.1-1.2\times$ anal segment; posteroventral margin serrated. Terminal segment of first antenna without aesthete. Second basal segment of mandible with 2 slender, sharply pointed subequal spines, inner one with spinules. First exopodal segment of legs 2-4 with 1 inner marginal seta. Endopodal segments of leg 4 without modified setae. Other characteristics of oral appendages and legs 1-5 as in female. Leg 6 represented by 1 long and 1 minute setae.

Remarks. *Oithona aruensis* is similar morphologically to *O. wellershausi*. However, the latter species is slightly larger (0.45-0.50 mm) with three setae on the exopod of the first maxilla in both sexes; males and females of *O. aruensis* have four such setae. Males of *O.*

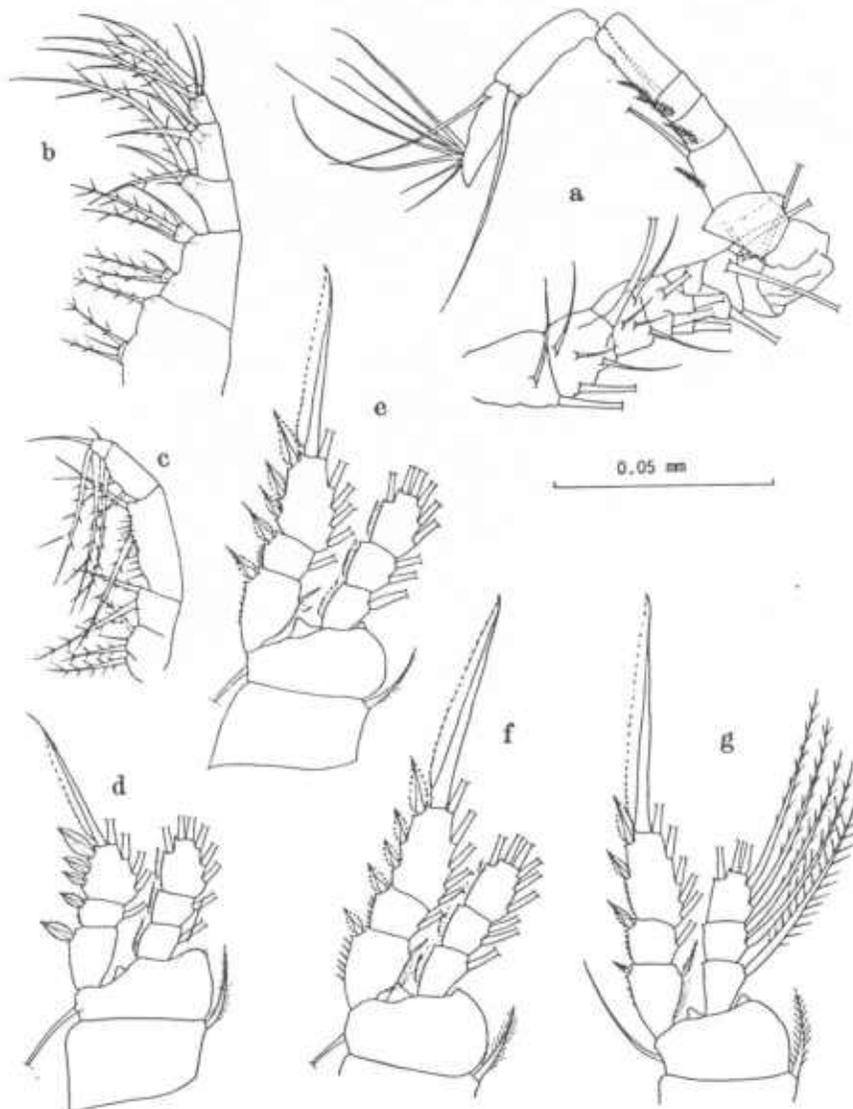


Fig. 5. *Oithona aruensis* from Surabaya Harbor. Male; a, first antenna; b, second maxilla; c, maxilliped; d, leg 1; e, leg 2; f, leg 3; g, leg 4.

aruensis do not have an inner seta on the first exopodal segment of leg 1, while males of *O. wellershausi* have an inner seta on that segment. Females of *O. aruensis* have a flange on the distal 2/3 of the distal seta of the second endopodal segment of leg 4; the proximal seta on the third endopodal segment has a flange on the distal 3/4. In females of *O. wellershausi* the flanges are only 1/5 the length of the distal seta on the second segment and 1/2 the length of the seta on the third segment.

Oithona aruensis has been reported from Aru Island, Indonesia (FRÜCHTL 1923, 1924), Tokyo Bay, Japan (NISHIDA et al. 1977, UCHIMA 1979), Ishigaki Island of the Ryukyu Archipelago, Malaysia and Surabaya, Indonesia (NISHIDA 1981). The specimens described as *O. brevicornis* f. *minor* by NISHIDA et al. (1977) and as *O. brevicornis* by UCHIMA (1979) were re-examined and proved to be *O. aruensis*. Specimens from Surabaya Harbor will be deposited at the Ocean Research Institute.

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