

Title	Misophriopsis okinawensis sp. nov. (Crustacea: Copepoda) from Hyperbenthic Waters off Okinawa, South Japan, with Definitions of Related Genera Misophria Boeck, 1864 and Stygomisophria gen. nov.
Author(s)	Ohtsuka, Susumu; Huys, Rony; Boxshall, Geoffrey A.; Ito, Tatsunori
Citation	Zoological Science (1992), 9(4): 859-874
Issue Date	1992-00
URL	<a href="http://hdl.handle.net/2433/108631">http://hdl.handle.net/2433/108631</a>
Right	(c) 日本動物学会 / Zoological Society of Japan
Type	Journal Article
Textversion	publisher

***Misophriopsis okinawensis* sp. nov. (Crustacea: Copepoda)  
from Hyperbenthic Waters off Okinawa, South Japan,  
with Definitions of Related Genera *Misophria* Boeck,  
1864 and *Stygomisophria* gen. nov.**

SUSUMU OHTSUKA<sup>1</sup>, RONY HUYS<sup>2</sup>, GEOFFREY A. BOXSHALL<sup>2</sup>  
and TATSUNORI ITÔ<sup>3</sup>

<sup>1</sup>*Fisheries Laboratory, Hiroshima University, Takehara, Hiroshima 725, Japan,*

<sup>2</sup>*Department of Zoology, The Natural History Museum, Cromwell Road,  
London SW7 5BD, England, and* <sup>3</sup>*The Seto Marine Biological  
Laboratory, Kyoto University, Wakayama 649-22, Japan*

**ABSTRACT**—A new misophrioid copepod *Misophriopsis okinawensis* (Crustacea) is reported from Kume Island, Okinawa, South Japan. A full description of the new misophrioid is presented, together with supplementary notes on the males of *Misophria pallida* Boeck, 1864. Consideration of the phylogeny of the new species led to a reassessment of the affinities between all the named species of *Misophria* Boeck, 1864 and *Misophriopsis* Boxshall, 1983. A new genus, *Stygomisophria*, is recognised based on *Misophria kororiensis* Boxshall et Iliffe, 1987. Diagnoses are presented of all three genera.

### INTRODUCTION

During taxonomic and phylogenetic studies of the marine hyperbenthic copepod fauna of Japan by one of the authors (SO) (e.g., [1, 2]), a new species of *Misophriopsis* Boxshall, 1983 (Copepoda: Misophrioida) was collected at a depth of ca. 170 m off Kume Island, Okinawa, South Japan. The new species is described in detail in the present paper. The misophrioid copepods were infested by a new small crustacean ectoparasite, whose description is given in another paper by the same authors as the first record of the subclass Tantulocarida in the North Pacific region (see [3]).

The genus *Misophriopsis* comprised two species, namely, the type species, *M. dichotoma* Boxshall, 1983 [4] and an undescribed new species referred to as *Misophriopsis* sp. nov. by Boxshall [5] and by Huys and Boxshall [6]. The original diagnosis of *Misophriopsis* emphasized the presence of a discrete 1-segmented endopod on the female fifth leg

(see [4]) but the discovery of a similar discrete endopod in female *Misophria pallida* Boeck, 1864 by Huys and Boxshall [6] makes a reexamination of the validity by these two genera necessary. The group of species currently placed in *Misophria* comprises the type species, *M. pallida*, plus two additional species, *M. kororiensis* Boxshall and Iliffe, 1987 [7] and *M. sinensis* Boxshall, 1990 [8]. Distinct genera can be recognized within this complex of species by reference, in particular, to the segmentation of the antennules, the form of the seminal receptacle of the female, and the structure and armature of the fifth and sixth legs of both sexes. Based on these characters, new differential diagnoses of *Misophriopsis*, *Misophria*, and a new genus accommodating *M. kororiensis* are presented here. The male of *Misophria pallida* Boeck, 1864 is also redescribed in order to redefine these three genera.

One of the authors, Tatsunori Itô deceased suddenly on April 8, 1990 before he finished describing the new host misophrioid copepod and the new parasitic tantulocaridan. This study is dedicated to the late Dr. T. Itô by the first three authors (SO, RH, GAB), in honor of his excellent

Accepted May 28, 1992

Received January 31, 1992

<sup>1</sup> To whom all correspondence should be addressed.

<sup>3</sup> Deceased on April 8th, 1990

taxonomic and phylogenetic works on maxillopodans.

## MATERIALS AND METHODS

The new misophrioid copepods were collected with an originally designed sledge-net (mouth area: 1450 mm × 326 mm; mesh size: 0.33 mm) at a depth of about 167 m off Kume Island, Okinawa, South Japan (26°17.9'N, 126°54.2'E) on 23 May 1989 (local time: 0824–0858). The sledge-net was towed along the bottom at a speed of 2 knots by the T/RV Toyoshio-maru of Hiroshima University for ca. 5 minutes while the depth was measured by a remote-sensing system (Furuno-denki, Color net recorder CN-8). The specimens were fixed in 10% neutralized formalin/sea-water immediately after collection. The new misophrioids were examined with differential interference microscopes (Leitz Dialux 20; Nikon Optiphot) and a scanning electron microscope (JEOL JST-T20). All types of the new species of Misophrioida are deposited in the collections of The Natural History Museum, London.

*Misophria pallida* was redescribed based on three adult males collected from deep sediment of an unspecified locality in Norway (Zoologisk Museum, Oslo (G. O. Sars collection), reg. no. F20793).

Redefinition of *Misophriopsis* Boxshall,  
1983 and description of *Misophriopsis*  
*okinawensis* sp. nov.

Family Misophriidae Brady  
Genus *Misophriopsis* Boxshall, 1983

**Diagnosis.** Female antennule 18-segmented; male antennule 12-segmented, with aesthetasc on segment I. Seminal receptacle produced transversely. Fifth legs without intercoxal sclerite in both sexes; female 5th leg with undivided protopod, endopod a small unisetose lobe, free or fused to protopod, proximal exopod segment unarmed, distal exopod segment with 1 seta on each side of apical spine; male 5th leg with undivided protopod, unisetose free endopod and 3-segmented exopod, 1st exopod segment unarmed,

2nd with 1 inner seta, 3rd with 1 inner seta and 1 seta on each side of apical spine; 6th legs with 1 long seta and 2 short spines in female, with 1 spine and 2 setae in male.

**Type species.** *Misophriopsis dichotoma* Boxshall, 1983.

**Remarks.** Remarks on the genus *Misophriopsis* is presented after the description of the new species described below.

*Misophriopsis okinawensis* sp. nov.  
(Figs. 1–9)

**Types.** All types collected from near sandy bottom (ca. 167 m in depth) off Kume Island, Okinawa, Japan, and deposited in The Natural History Museum, London. Holotype: adult female, dissected and mounted on glass slides, BM (NH) 1991. 151. Paratypes: two adult females and two adult males, dissected and mounted on glass slides, BM (NH) 1991. 152–155; 25 adult females and two adult males, whole specimens, BM (NH) 1991. 156–182; 15 adult females, whole specimens, BH (NH) 1991. 376–390.

**Body length.** Female: mean ± standard deviation = 0.73 ± 0.03 mm (range = 0.66–0.79 mm, number examined = 28). Male: 0.54 ± 0.01 mm (r = 0.52–0.55 mm, n = 5).

**Description.** **Female** (holotype: Figs. 1-A~F, 6-A~D; paratype: Figs. 2~5). Body (Fig. 1-A) compact, 0.78 mm in length; prosome oval in dorsal view, about 3 times longer than urosome (Fig. 1-A, B). First pedigerous somite entirely concealed beneath carapace-like expansion from posterior end of maxilliped-bearing somite. Third and 4th pedigerous somites produced posteriorly. Urosome (Figs. 1-B, 2-C) 5-segmented; 5th pedigerous somite posterolaterally produced into acute process on both sides; genital and 1st abdominal somites fused to form genital double-somite; original subdivision marked by difference in width between anterior and posterior parts of double-somite; pair of minute copulatory pores located in a small transverse median slit on mid-ventral surface of double-somite, each of which leading to a common, transversely produced seminal receptacle; pair of slit-like genital pores (Figs. 2-C, 3-C) located ventrolaterally on double-somite and co-

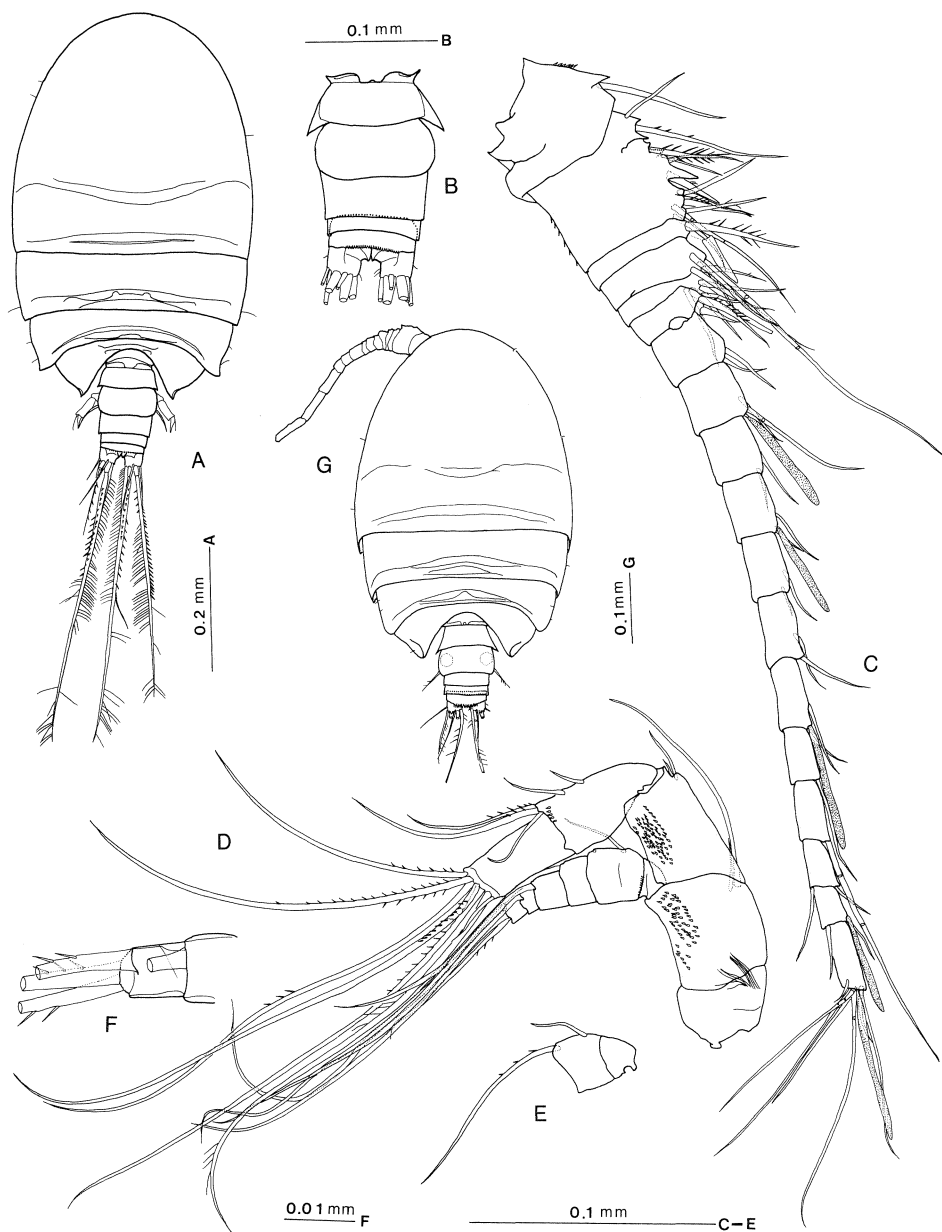


FIG. 1. *Misophriopsis okinawensis* sp. nov. Female (holotype). A. Habitus, dorsal view; B. Urosome, dorsal view; C. Antennule; D. Antenna; E. Basal two exopod segments of antenna; F. Distal exopod segment of antenna. Male (paratype). G. Habitus, dorsal view.

vered by operculum derived from leg 6, armature consisting of 2 spinous processes and 1 seta; 4th somite completely concealed beneath 3rd; anal somite fringed with minute prominences dorsopos-

teriorly. Caudal ramus (Figs. 3-D, 4-A) wider than long, bearing 1 dorsal (VII in Fig. 4-A), 1 anterolateral accessory (I), 1 anterolateral (II), 1 posterolateral (III), 1 terminal accessory (VI) and

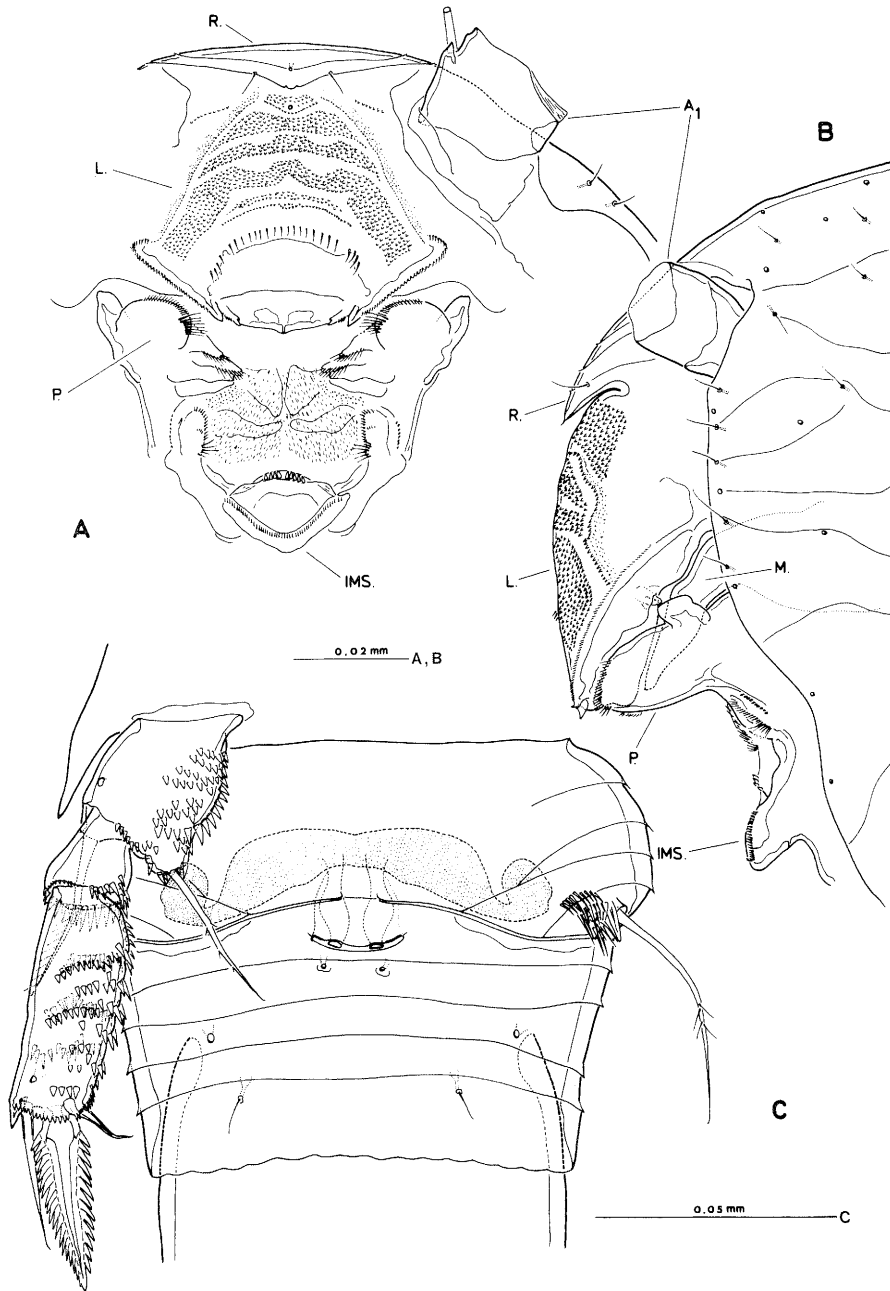


FIG. 2. *Misophriopsis okinawensis* sp. nov. Female (paratype). A. Ventral view of oral area and rostrum; B. Lateral view of oral area and rostrum; C. Legs 5 and 6 and genital double-somite, dotted area indicates seminal receptacle. A<sub>1</sub>: Antennule; R.: Rostrum; L.: Labrum; P.: Paragnath; M.: Mandible; IMS.: Intermaxillary swelling.

2 stout, terminal spinulose setae (IV and V). Rostrum (Fig. 2-A, B) partly fused with labrum, posteroventrally produced, and furnished with a

pair of sensilla near its pointed tip. Naupliar eye absent. Labrum (Fig. 2A, B) covered with numerous minute spinules, bearing row of fine hairs near

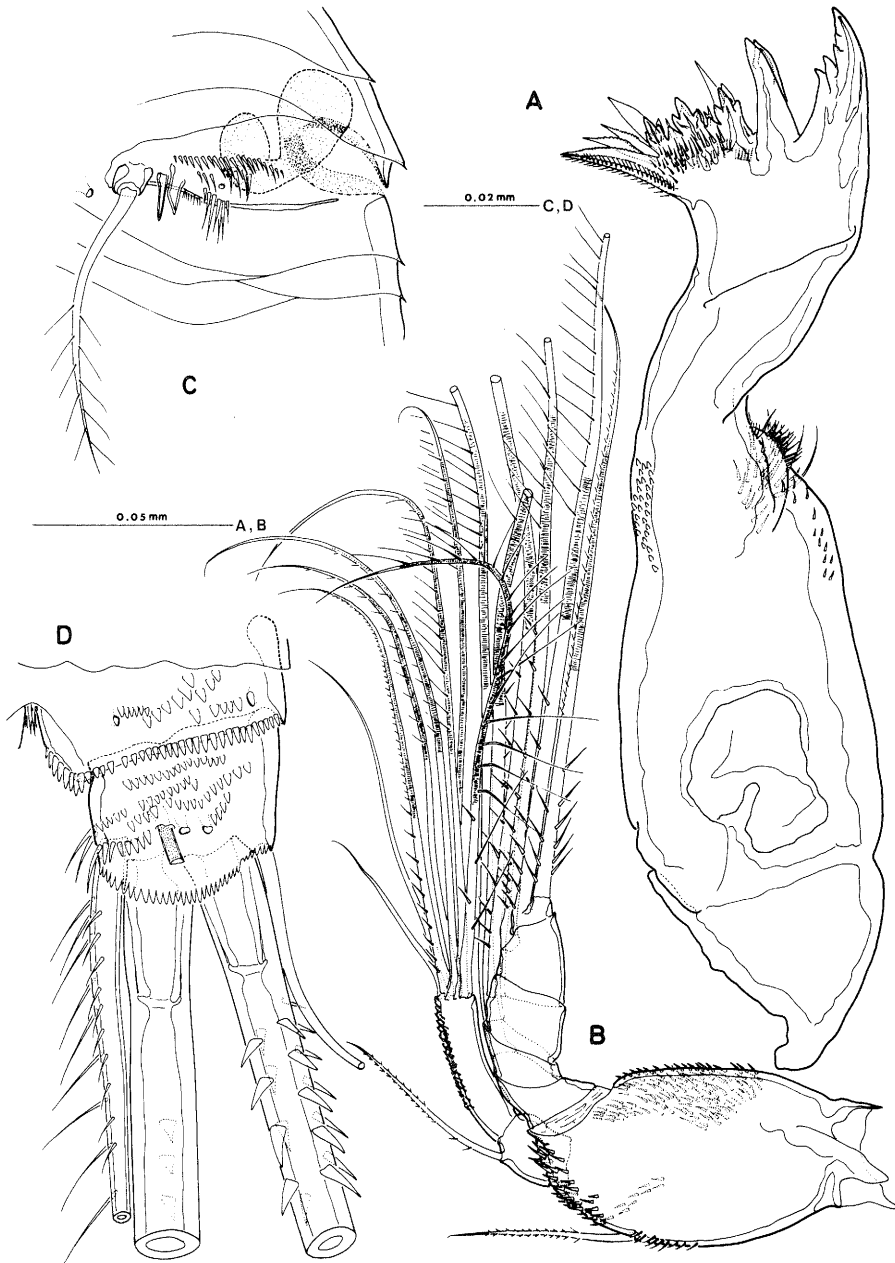


FIG. 3. *Misophriopsis okinawensis* sp. nov. Female (paratype). A. Mandibular gnathobase; B. Mandibular palp; C. Leg 6 and genital and copulatory pores on genital double-somite, lateral view; D. Caudal ramus, ventral view.

its posterior margin and pair of short prominences on both sides of posterior end. Pair of paragnaths (Fig. 2-A, B) located posterior to end of labrum, ornamented with fine spinules on tip; intermaxillary swelling (Fig. 2-A, B) arising from mid-

ventral surface, with row of minute spinules along posterior margin.

Antennule (Fig. 1-C) 18-segmented. Segmental distribution of armature elements compiled in Table 1. Antenna (Fig. 1-D~F): coxa bearing row



FIG. 4. *Misophriopsis okinawensis* sp. nov. Female (paratype). A. Caudal ramus, lateral view; B. Maxillule.

of fine setules near anterior margin; basis with 2 apical setae of unequal lengths and patch of fine spinules on posterior surface. Endopod 3-segmented; segment 1 bearing 2 small, subdistal inner setae of unequal lengths and patch of minute

spinules on posterior surface; segment 2 with 2 lateral and 3 distal setae along inner margin; segment 3 bearing 6 long setae and short seta apically. Exopod 6-segmented; setal formula as follows: 0, 2, 1, 1, 1, 3. Mandibular gnathobase

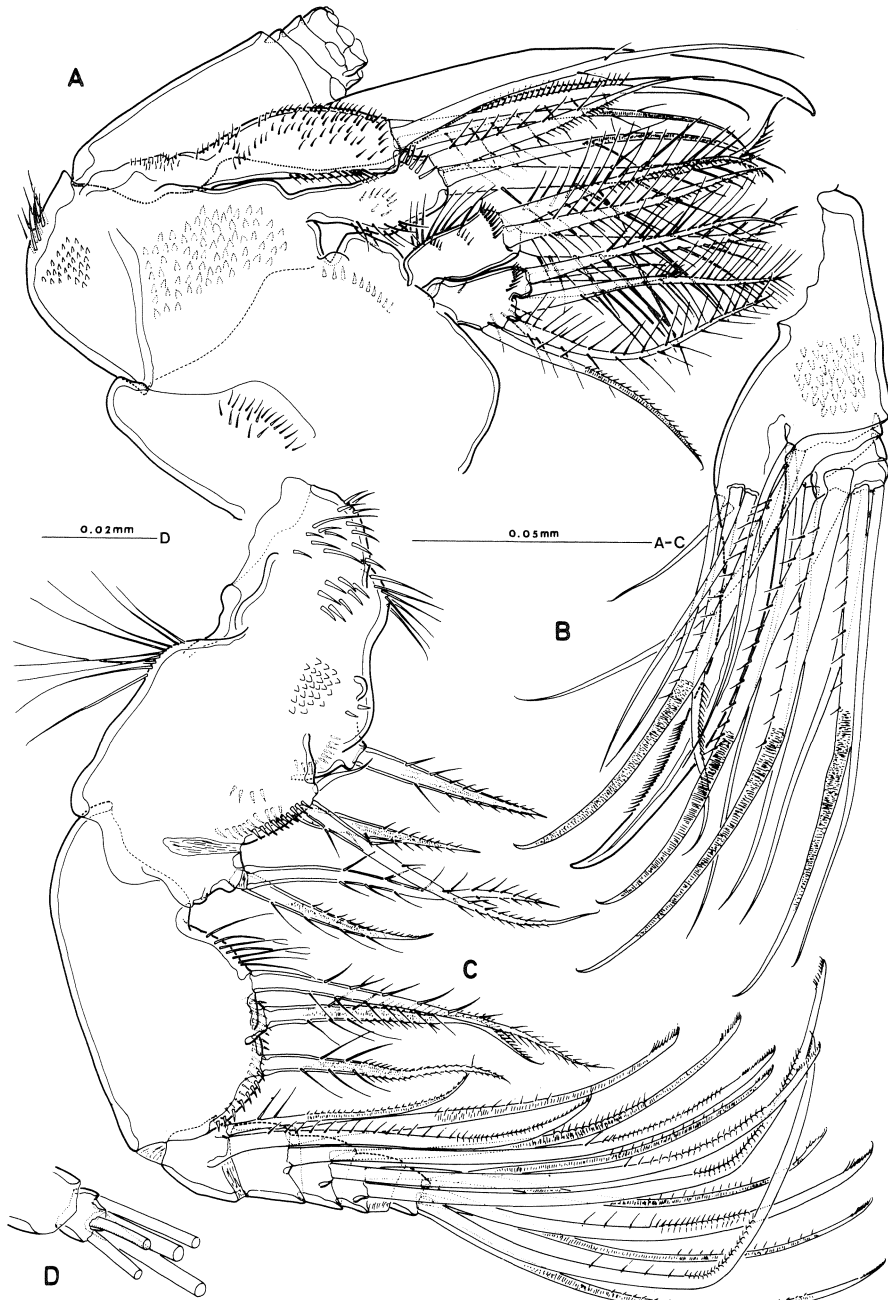


FIG. 5. *Misophriopsis okinawensis* sp. nov. Female (paratype). A. Maxilla, setae of allobasis and endpod omitted; B. Maxillary allobasis and endpod; C. Maxilliped; D. Distal segment of maxillipedal endopod.

(Fig. 3-A) with 5 multicusped teeth, 3 serrate blades and 1 spiniform seta; ornamentation of fine spinules and relatively long setules present on anterior surface near palp. Mandibular palp (Fig.

3-B) biramous; basis bearing patches of fine spinules and inner medial seta. Endopod 2-segmented; proximal segment with inner subterminal seta; distal segment bearing 1 medium



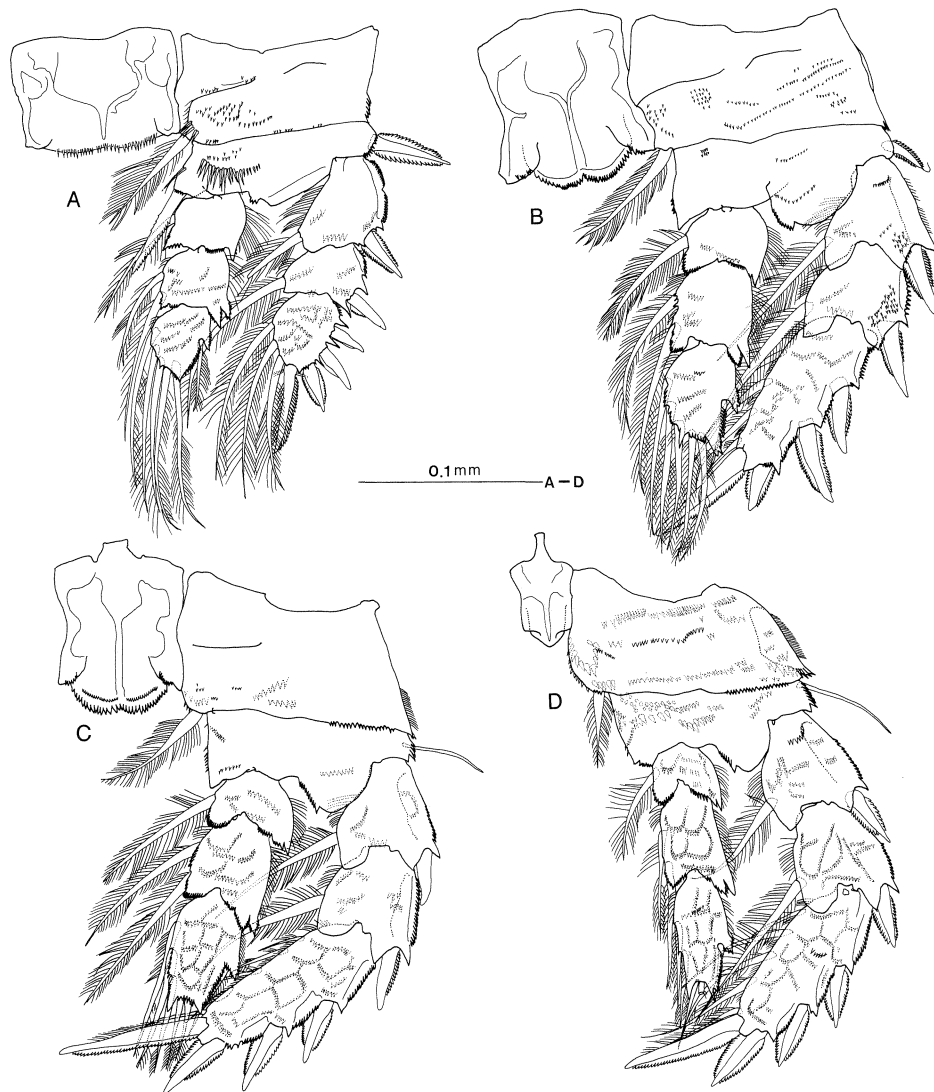


FIG. 6. *Misophriopsis okinawensis* sp. nov. Female (holotype). A. Leg 1, anterior surface; B. Leg 2, anterior surface; C. Leg 3, anterior surface; D. Leg 4, anterior surface.

length, 1 short and 6 long setae. Exopod 5-segmented; setal formula as follows: 1, 1, 1, 1, 2. Maxillule (Fig. 4-B): praecoxal arthrite with 7 strong spines and 8 setae, 2 of which arising from anterior surface; coxal endite bearing 1 thick serrate seta and 5 pinnate setae distally; proximal basal endite with 4 apical setae, distal basal endite armed with 4 setae; epipodite of coxa with 7 setae of unequal lengths. Endopod comprising single compound segment, representing fused 1st to 3rd

segments; armature divided into groups of 3 inner medial, 3 inner subterminal and 6 terminal setae representing original segmental elements. Exopod 1-segmented, bearing 3 inner lateral and 5 terminal setae and relatively long setules along inner and outer margins. Maxilla (Fig. 5-A, B): praecoxa partly fused with coxa, with 2 endites, proximal armed with 6 setae, distal with 3 setae; coxa with 2 endites and outer patch of fine spinules, each endite with 3 distal setae; allobasis (Fig. 5-B)

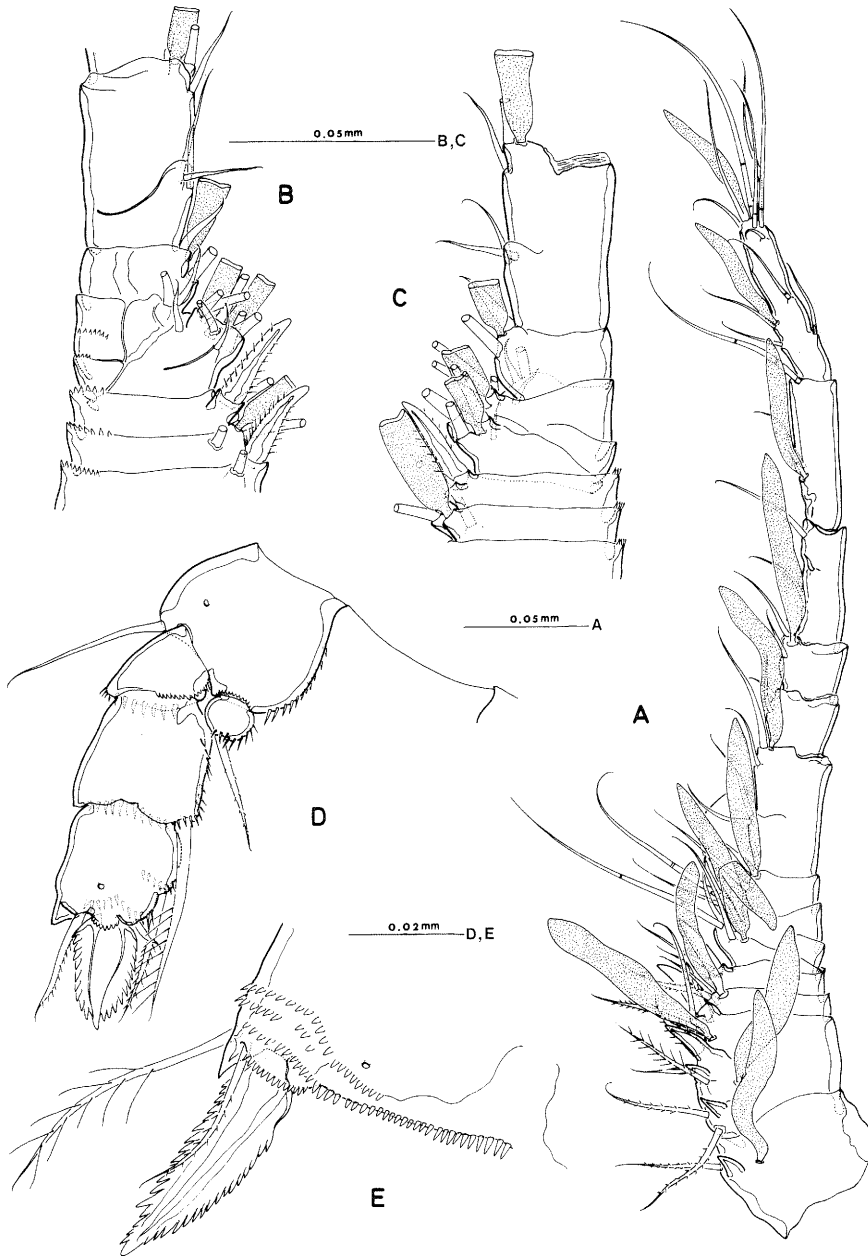


FIG. 7. *Misophriopsis okinawensis* sp. nov. Male (paratype). A. Antennule; B. Antennular segments 3 to 7, dorsal view; C. Antennular segment 3 to 7, ventral view; D. Leg 5, anterior surface; E. Leg 6, anterior surface.

derived from fusion of basis and 1st endopodal segment; produced into strong curved claw and bearing 6 setae (3 of which are derived from 1st endopodal segment); free endopod indistinctly 3-segmented, with setal formula 2, 2, 4. Maxilliped

(Fig. 5-C, D) having 4 endites on syncoxa with setal formula 0, 1, 3, 2; row of long spinules along outer medial margin; proximal patch of minute spinules and irregular rows of small spinules near bases of setae on middle and subdistal endites;

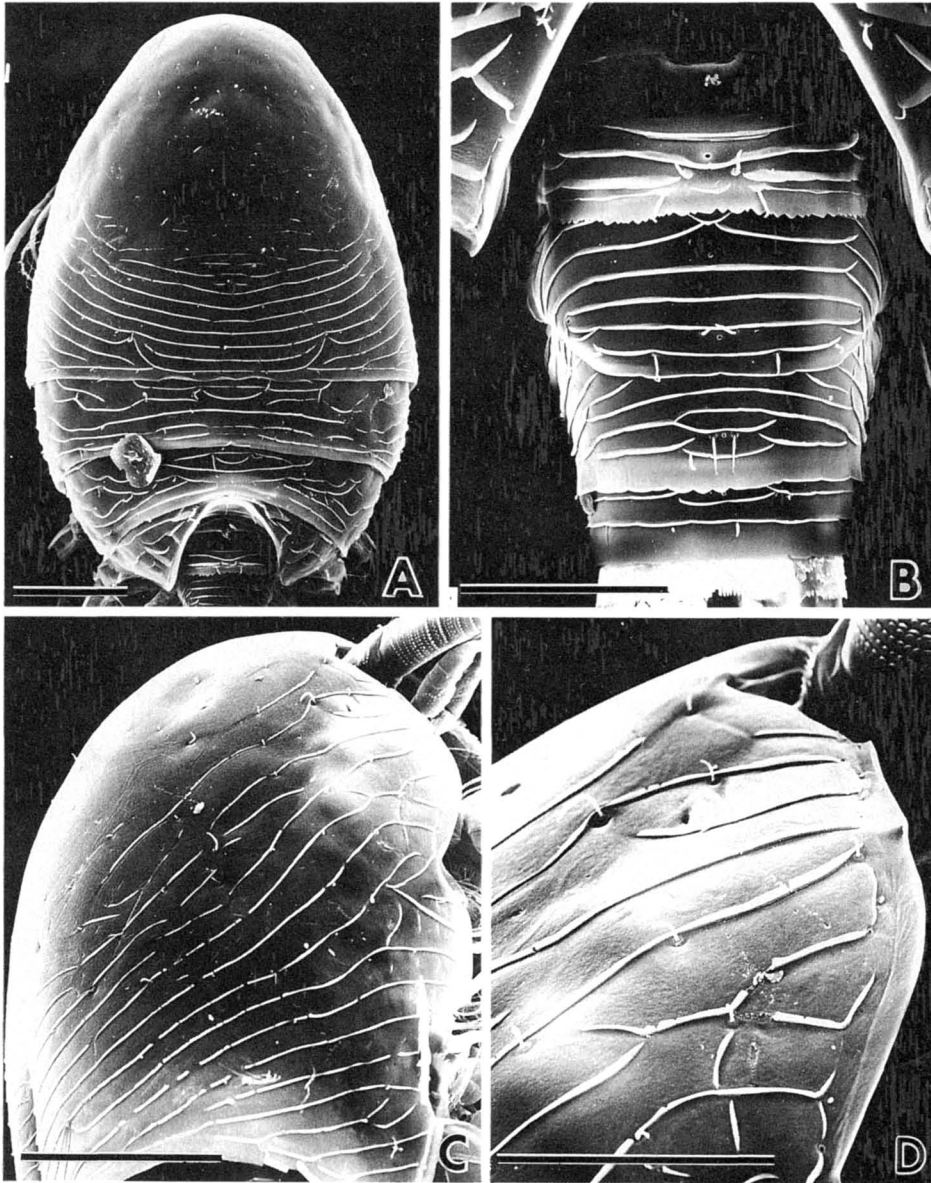


FIG. 8. *Misophriopsis okinawensis* sp. nov. SEM micrographs of female. A. Prosome, dorsal view; B. Urosome, dorsal view; C. Cephalosome, lateral view; D. Epicuticular ornamentation on cephalosome. Scale bars = 100  $\mu\text{m}$  (A, C); 50  $\mu\text{m}$  (B, D).

basis with 3 spinulose inner setae medially and row of long spinules proximally, fringed with short spinules along posterior half of inner margin; free endopod 5-segmented; setal formula: 2, 2, 2, 2, 5.

The armature formula of legs 1 to 4 is shown in Table 2 and compared with two other congeneric

species, *Misophriopsis dichotoma* and *M. sinensis* (Boxshall, 1990) comb. nov. Leg 1 (Fig. 6-A): coxa with relatively long spinules near base of plumose inner distal seta; intercoxal sclerite with spinulose row along distal margin; basis bearing row of spinules on anterior surface, and its medial

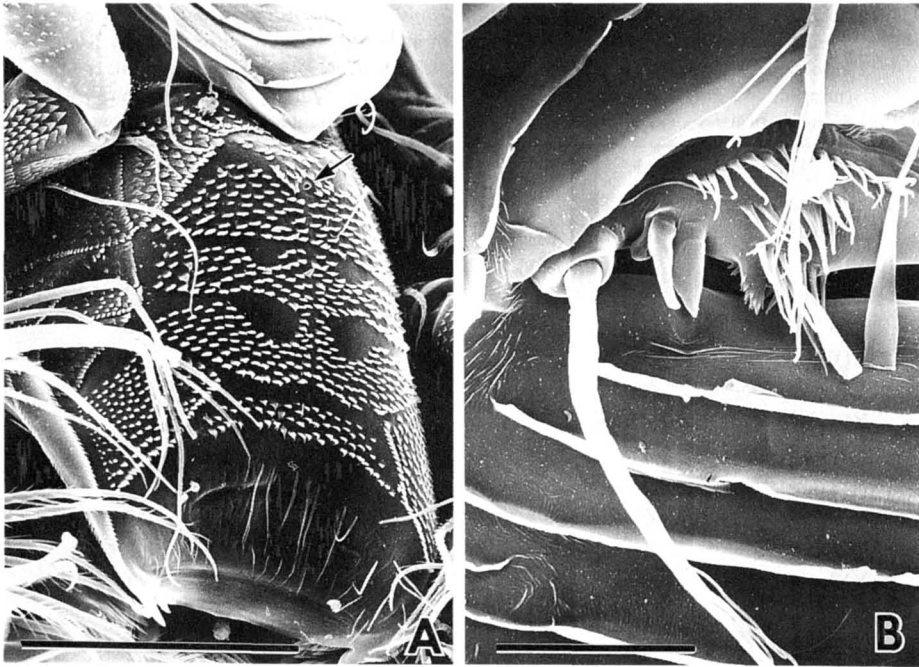


FIG. 9. *Misophriopsis okinawensis* sp. nov. SEM micrographs of female. A. Labrum, pore indicated by an arrow; B. Leg 6. Scale bars=50  $\mu\text{m}$  (A); 10  $\mu\text{m}$  (B).

distal margin expanded into lamellar plate; inner distal spine on basis reaching beyond distal angle of 1st endopod segment; outer distal angle of 2nd endopod segment bifid; outer margins of 1st and 2nd exopod segments lamellar, fringed with minute serrations. Leg 2 (Fig. 6-B): inner distal margin of basis produced into acute tip; its medial distal end expanding into fan-like structure with serrate inner margin; inner distal angle of 2nd endopod segment irregularly produced; inner distal angles of 1st and 2nd exopod segments produced into blunt process. Leg 3 (Fig. 6-C) similar to leg 2, but basis bearing outer medial seta instead of spine and 3rd exopod segment with 5 inner setae. Leg 4 (Fig. 6-D) covered with numerous spinules, in particular, on posterior surface; inner distal end of basis not produced as in legs 2 and 3; intercoxal sclerite relatively small compared with in preceding legs. Leg 5 (Fig. 2-C) indistinctly biramous; protopod comprising fused coxa and basis; inner distal seta on inner process representing endopod partly separated from basis by proximal constriction; outer basal seta present. Pro-

topod fringed by minute spinules along inner margin. Exopod 2-segmented; proximal exopod segment unarmed; distal segment laterally and medially bearing fine spinules, and distally serrate spine, inner small and outer medium-length setae. Leg 6 (Figs. 2-C, 3-C) represented by genital operculum bearing outer seta on low cylindrical process and 2 small blunt processes.

*Male* (paratypes). Body (Fig. 1-F) 0.54 mm in length, much smaller than in female. Urosome 6-segmented; 5th pedigerous somite with acute posterolateral angles; genital somite large; 3rd abdominal somite small, largely concealed beneath 2nd. Both antennules (Fig. 7-A~C) 12-segmented; geniculate with geniculation between 10th (XIX-XX) and 11th (XXI-XXIII) segments; fusion pattern and distribution of armature elements shown in Table 1. Leg 5 (Fig. 7-D) biramous; compound protopodal segment fringed by minute spinules along inner margin, and bearing 1 seta derived from basis; endopod represented by small subcircular segment, bearing small seta distally. Exopod 3-segmented; proximal segment

TABLE 1. Armatures of antennules of *Misophriopsis okinawensis* sp. nov. and *Misophria pallida*. Number of antennular segment of ancestral copepod represented by Roman numeral. Number of setae on the segment represented by Arabic numeral: a+b= (number of anterior setae)+(number of posterior setae). ae: Aesthetasc; proc: Spinous process derived from modification of setal element

<i>M. okinawensis</i> (female)		<i>M. pallida</i> (female)	
I	1	I	1
II-VII	12	II-VIII	14
VIII	2	IX-XII	8
IX-XII	8	XIII	2
XIII	2	XIV	2
XIV	2	XV	2
XV	2	XVI	2+ae
XVI	2+ae	XVII	2
XVII	2	XVIII	2+ae
XVIII	2+ae	XIX	2
XIX	2	XX	2
XX	2	XXI	2+ae
XXI	2+ae	XXII	1
XXII	1	XXIII	1
XXIII	1	XXIV	1+1
XXIV	1+1	XXV	1+1+ae
XXV	1+1+ae	XXVI-XXVIII	7+ae
XXVI-XXVIII	7+ae		
<i>M. okinawensis</i> (male)		<i>M. pallida</i> (male)	
I	1+ae	I	1
II-VI	9+2ae	II-VI	9+2ae
VII	2+ae	VII	2+ae
VIII	2	VIII	2
IX-XIII	10+2ae	IX-XIII	10+ae
XIV	2+ae	XIV	2+ae
XV-XVI	4+ae	XV	2
XVII	2	XVI	2+ae
XVIII	2+ae	XVII	2
XIX-XX	2+proc	XVIII	2+ae
XXI-XXIII	3+ae	XIX-XX	2+2proc
XXIV-XXVIII	11+2ae	XXI-XXIII	3+ae+proc
		XXIV-XXVIII	11+2ae

unarmed; middle segment with thick, plumose seta at distal inner angle; apical segment with 1 inner seta and 1 seta on each side of apical serrate spine. Leg 6 (Fig. 7-E) forming opercular plate overlying genital opening, bearing large serrate inner spine and 2 plumose setae.

*Body surface observed with SEM.* The body surface of *Misophriopsis okinawensis* is almost

entirely covered with shallow, epicuticular lamellae except for the anterior half of the dorsal cephalic shield which has a smooth surface with a number of hair-like sensilla and small pores but no lamellae (Fig. 8-A, C, D). The lamellae are perpendicular to the surface on the prosome (Fig. 8-D), whereas they incline posteriorly on the urosome (Fig. 8-B). Cone organs lacking on the

TABLE 2. Seta and spine formula of legs 1 to 4 of *Misophriopsis okinawensis* sp. nov., *M. dichotoma* and *M. sinensis* comb. nov. Seta represented by Arabic numeral, and spine by Roman numeral. o=outer border of segment; t=terminal border of segment; i=inner border of segment

	Coxa		Basis		Endopod						Exopod							
	o	i	o	i	1		2		3		1		2		3			
					o	i	o	i	o	t	i	o	i	o	i	o	t	i
<i>Misophriopsis okinawensis</i> sp. nov.																		
Leg 1	0	1	I	I	0	1	0	2	1	2	3	I	1	I	1	III	I	3
Leg 2	0	1	I	0	0	1	0	2	1	2	3	I	1	I	1	III	I	4
Leg 3	0	1	1	0	0	1	0	2	1	2	3	I	1	I	1	III	I	5
Leg 4	0	1	1	0	0	1	0	2	1	2	2	I	1	I	1	III	I	5
<i>M. dichotoma</i> <sup>1</sup>																		
Leg 1	0	1	I	I	0	1	0	2	1	2	3	I	1	I	1	III	I	4
Leg 2	0	1	1	0	0	1	0	2	1	2	3	I	1	I	1	III	I	5
<i>M. sinensis</i> comb. nov. <sup>2</sup>																		
Leg 1	0	1	1	I	0	1	0	2	1	2	3	I	1	I	1	III	I	4
Leg 2	0	1	1	0	0	1	0	2	1	2	3	I	1	I	1	III	I	5

<sup>1</sup> Armature formula of legs 3 and 4 the same as in *M. okinawensis* but the third endopod segments of legs 3 and 4 missing.

<sup>2</sup> Armature formula of legs 3 and 4 the same as in *M. okinawensis*.

lateral side of cephalosome (Fig. 8-C) as in *Benthomisophria palliata* Sars, 1909 and *Misophriopsis dichotoma* Boxshall, 1983 [4, 6]. The urosome is covered with lamellae except for the anal somite, as in other misophrioids (Fig. 8-B). The fifth pedigerous somite has a relatively large pore on the dorsomedial surface; the genital somite, anterior and posterior dorsomedial pores; the 1st abdominal somite, posterior medial pore dorsally; the fourth somite, anterior pore dorsomedially.

The labrum is densely covered with ornamentation consisting of dentate scales separated by open smooth areas (Fig. 9-A). Fig. 9-A shows that the rostrum and the labrum are partly separate from each other. A pore located medially on the anterior part of labrum is arrowed in Fig. 9-A. Leg 6 of the female (Fig. 9-B) is armed with a plumose seta on a low cylindrical process, a small spine, and smooth and serrate processes.

*Etymology.* The specific name "*okinawensis*" is derived from the type locality, Okinawa Prefecture.

*Remarks.* *Misophria sinensis* from Hong Kong is known only from the female but conforms to this new generic diagnosis of *Misophriopsis* in the

18-segmented antennule and the absence of any armature from the proximal exopod segment of the fifth legs. It is here transferred to *Misophriopsis*. The nature of the seminal receptacle of *M. sinensis* could not be confirmed in the only available specimen. The genus *Misophriopsis* now comprises the type species plus *M. sinensis* (Boxshall, 1990) comb. nov. and *M. okinawensis* sp. nov. These species differ in the armature of legs 1 and 2 (see Table 2): *M. okinawensis* and *M. dichotoma* have a spine on the outer border of the basis while *M. sinensis* possesses a seta in this position; the numbers of setae along the inner margin of the third exopod segments of legs 1 and 2 are more reduced in *M. okinawensis* than in *M. dichotoma* and *M. sinensis*.

The undescribed *Misophriopsis* species from the North Atlantic off the coast of Norway, mentioned by Boxshall [5] and illustrated in part by Huys and Boxshall [6] differs significantly from the new concept of *Misophriopsis*. Its systematic position will be considered in a separate account after it has been fully described. *Misophria kororiensis*, described from a subtidal anchialine cave in Palau [7], cannot be placed in either *Misophria* or *Mis-*

*ophriopsis*. Accordingly a new genus is proposed to accommodate *M. kororiensis*. The differential diagnosis of the new genus is given below.

Redefinition of *Misophria* Boeck, 1864 and  
establishment of *Stygomisophria* gen. nov.,  
with description of male *Misophria*  
*pallida* Boeck, 1864

Genus *Misophria* Boeck, 1864

*Diagnosis.* Female antennule 17-segmented; male antennule 13-segmented, without aesthetasc on segment I. Seminal receptacle not transversely produced. Fifth legs without intercoxal sclerite in both sexes; female 5th leg with undivided protopod, endopod a small bisetose free lobe, proximal exopod segment with outer seta, distal exopod segment with 1 seta on each side of apical spine; male 5th leg with bisetose endopod fused to undivided protopod, exopod as in female; 6th legs armed with 1 long seta and 2 short spines in female, with 2 setae in male.

*Type species.* *Misophria pallida* Boeck, 1864, monotypy.

*Remarks.* The genus *Misophria* is distinguished from the genus *Misophriopsis* in: (1) the numbers of antennular segments of both sexes; (2) the presence or absence of an aesthetasc on antennular segment I; (3) the shape of seminal receptacle; (4) the armature elements of legs 5 and 6 of both sexes.

*Misophria pallida* Boeck, 1864  
(Fig. 10)

Both sexes of *Misophria pallida* were described by Sars [9] but the description contains insufficient detail for a full comparison to be made with the other known species currently attributed to *Misophria* (see [7, 8]). Huys and Boxshall [6] illustrated some features of *M. pallida*, including the female antennule, the rami of the mandibular palp, the female fifth leg and the female genital region including the sixth legs. Supplementary descriptions of the antennules and the fifth and sixth legs of the males are presented below in order to compare the male of *M. pallida* with that of

*Misophriopsis okinawensis* sp. nov.

Male antennule (Fig. 10-A) 13-segmented, segmental fusion pattern and setation pattern summarized in Table 1; compound segments II-VI and IX-XIII without any incomplete sutures marking fusion planes. Segments XV and XVI partly fused along posterior surface; sheath present on segment XV (arrowed in Fig. 10-B) but with anteroventral margin of sheath integrated into segment leaving shallow transverse furrow (arrowed in Fig. 10-C). Geniculation in neocopepodan position between compound segments XIX-XX and XXI-XXIII.

Male 5th legs (Fig. 10-D) separate, intercoxal sclerite lacking; leg comprising compound protopodal segment bearing outer basal seta and 2 setae on inner distal margin representing endopod armature; endopod completely incorporated into compound protopodal segment, with no vestige of suture remaining; exopod 2-segmented; proximal segment with seta on outer margin, distal segment produced into spinous process at outer distal angle, distal margin armed with long outer seta, bilaterally serrate spine and shorter, naked, inner angle seta (Fig. 10-D). All segments with surface and marginal ornamentation of fine spinules.

Male 6th leg (Fig. 10-E): a transverse plate closing off genital aperture on each side; armed with 2 setae and ornamented with spinular row along free margin.

*Stygomisophria* gen. nov.

*Diagnosis.* Female antennule 18-segmented. Seminal receptacle not produced transversely. Female 5th leg with intercoxal sclerite and separate coxa and basis, endopod represented by 1 seta on inner distal margin of basis, proximal exopod segment with outer seta, distal exopod segment with 1 seta on each side of apical spine; female 6th leg with 1 long seta and 1 small spine. Male unknown.

*Type species.* *Misophria kororiensis* Boxshall *et* Iliffe, 1987, monotypy.

*Remarks.* The new genus is distinguished from both *Misophria* and *Misophriopsis* by the retention of an intercoxal sclerite and separate coxa and basis in the female fifth leg. It also differs from *Misophria* in segmentation of the female antennule

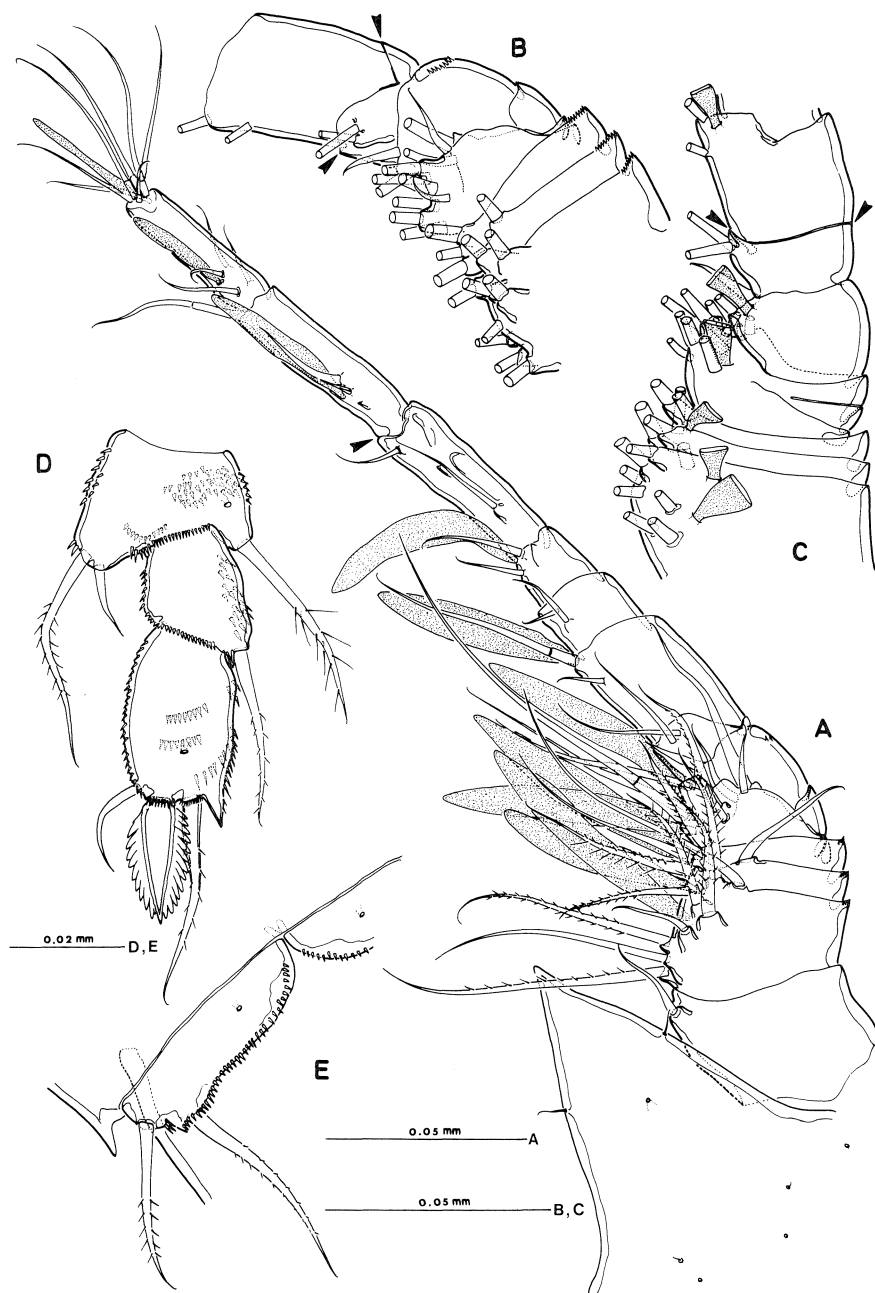


FIG. 10. *Misophria pallida* Boeck, 1864. Male. A. Rostrum and antennule, geniculation indicated by an arrowhead; B. Antennular segments 2 to 8, dorsal surface, distal margin of sheath on segment 7 indicated by arrowheads, aesthetascs omitted; C. Antennular segments 2 to 8, ventral surface, distal margin of sheath on segment 7 indicated by arrowheads; D. Leg 5, anterior surface; E. Leg 6, anterior surface.



and from *Misophriopsis* in the presence of an outer seta on the proximal exopod segment of the female fifth leg.

#### ACKNOWLEDGMENTS

We express our sincere thanks to the captain and crew of the T/RV Toyoshio-maru of Hiroshima University for cooperation at sea. Thanks are due to Prof. E. Harada of the Seto Marine Biological Laboratory for his permission to observe the specimens of the present new misophrioid copepod which the late Dr. T. Itô had been examining just before his death. This work was in part supported by grants from the Research Institute of Marine Invertebrates and the Nissan Science Foundation to one of the authors (SO).

#### REFERENCES

- 1 Ohtsuka, S. and Mitsuzumi, C. (1990) A new asymmetrical near-bottom calanoid copepod, *Paramisophria platysoma*, with observations of its integumental organs, behavior and in-situ feeding habit. *Bull. Plankton Soc. Japan*, **36**: 87–101.
- 2 Ohtsuka, S., Fosshagen, A. and Go, A. (1991) The hyperbenthic calanoid copepod *Paramisophria* from Okinawa, South Japan. *Zool. Sci.*, **8**: 793–804.
- 3 Huys, R., Ohtsuka, S., Boxshall, G. A. and Itô, T. (1992) *Itoitantulus misophricola* gen. et sp. nov.: first record of Tantulocarida (Crustacea: Maxillopoda) in the North Pacific region. *Zool. Sci.*, **9**: 877–888.
- 4 Boxshall, G. A. (1983) Three new genera of misophrioid copepods from the near-bottom plankton community in the North Atlantic Ocean. *Bull. Br. Mus. Nat. Hist. (Zool.)*, **44**: 103–124.
- 5 Boxshall, G. A. (1989) Colonization of inland marine caves by misophrioid copepods. *J. Zool. Lond.*, **219**: 521–526.
- 6 Huys, R. and Boxshall, G. A. (1991) *Copepod Evolution*, The Ray Society, London, 468 pp.
- 7 Boxshall, G. A. and Iliffe, T. M. (1987) Three new genera and five new species of misophrioid copepods (Crustacea) from anchialine caves on Indo-West Pacific and North Atlantic islands. *Zool. J. Linnean Soc.*, **91**: 223–252.
- 8 Boxshall, G. A. (1990) A new species of *Misophria* (Copepoda: Misophrioida) from Hong Kong. In "Proceedings of the Second International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 1986". Ed. by B. Morton, Hong Kong University Press, Hong Kong, pp. 515–522.
- 9 Sars, G. O. (1903) An account of the Crustacea of Norway V. Copepoda Harpacticoida. *Bergen Museum*, pp. 1–28.