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Eight Harpacticoid Species of Harpacticidae (Copepoda, Harpacticoida) from Korea

Song, Sung Joon and Chang, Cheon Young

(Department of Biology, College of Natural Sciences, Taegu University, Kyongsan-kun 713-714,
Republic of Korea)

Harpacticidae科에 속하는 하르팍티쿠스류 8종의 분류

宋 聖 準 · 張 千 永

(大邱大學校 自然科學大學 生物學科)

摘 要

한국 해안의 47개 지소에서 채집한 Harpacticidae科에 속하는 하르팍티쿠스류 8종을 동정, 분류하였다. 8종 중 5종은 한국미기록종이며 이들에 대하여는 재기재하는 한편 도판을 작성였다.

Key words: Taxonomy, Copepoda, Harpacticoida, Harpacticidae, Korea

INTRODUCTION

The family Harpacticidae contains nine genera and 65 species or subspecies (Bodin, 1988), which are mostly marine or brackishwater macroalgal associates, with a few freshwater forms.

In Korea, three species are currently known in the family. *Tigriopus japonicus* Mori, 1938 was reported from Chinhae Bay by Lee (1972), from south coast of Korea by Park and Lee (1982), and from Garolim Bay by Kim and Huh (1983). *Harpacticus uniremis* Kröyer, 1842 was reported from

Garolim Bay by Kim and Huh (1983), and finally *Harpacticella itoi* was described by Chang and Kim (1991) as new from the mouth of Tamjin River and Sömjin River. Yeatman (1983) once reported *Tigriopus californicus* from Cheju Island and Pusan, but it was considered as a misidentification for *T. japonicus*, judging from his description and figures.

Thereafter, as a result of examining the harpacticoid specimens collected from 159 localities of South Korea since 1980, the authors confirmed eight species of family Harpacticidae from 47 localities, including five species which are newly reported from Korea: *Harpacticus nipponicus* Ito, 1976; *H. compsonyx* Monard, 1926; *Harpacticella oceanica* Ito, 1977; *Zaus robustus* Ito, 1974; *Zaus unisetosus* Ito, 1974. This report deals with the redescrptions of the above five species, in addition to a key to the eight Korean species of Harpacticidae and some remarks on their distributions in Korea.

MATERIALS AND METHODS

The materials examined in the present study were obtained from 47 localities in south Korea during the period from July, 1986 to September, 1993 (Fig. 1). Collections were made with a dipnet of no.10 (or no.25) mesh aperture, or by rinsing the macroalgae. Samples were fixed with 5-8% formalin, and preserved in 95% ethyl alcohol. All the specimens were dissected, drawn and measured in lactic acid, later mounted in polyvinyl lactophenol. Some specimens were tinted with lignin pink or methyl blue. Figures were made with the aid of a camera lucida. All specimens examined are deposited in the Department of Biology, Taegu University.

SYSTEMATIC ACCOUNTS

Genus *Harpacticus* Milne-Edwards, 1840

1. *Harpacticus nipponicus* Ito, 1976 (Figs. 2-3)

Harpacticus nipponicus Ito, 1976a (p. 448, figs. 1-14).

Material examined. 1 ♀, Kuryongp'o, Oct. 31, 1992, S. J. Song; 6 ♀ ♀ (4 ovi.), 3 ♂ ♂, Songj'ong, Pusan, Sep. 16, 1993, J. M. Lee; 2 ♀ ♀, Hwasun, Cheju I., May 25, 1993, C.Y. Chang.

Female. Body length about 0.68 mm, rostrum and furcal setae excluded. Cephalothorax slightly (1.10 times) longer than greatest width. Rostrum a little protruding downward, rectangular in shape with 1 pair of sensory hairs and 2 hairs on dorsal surface. Abdomen somewhat depressed dorsoventrally, including genital double somites which occupied half of abdominal segments. Furcal rami a little divergent; ramus tapering posteriorly, 1.5 times broader than long; inner terminal seta much longer (about 1.75 times) than outer one.

Antennule of 9 segments with 2 aesthetascs, each on tip of fourth and last segment (nearly same in length each other); first 3 segments as long as total of next 6 segments. Exopod of antenna distinctly 2-segmented; both segments of equal length; endopod shorter than allobasis, gradually swollen distally, with 4 geniculate spines and 3 spines.

Exopod of mandible about 1.44 times as long as endopod, both rami consisting of only 1 segment.

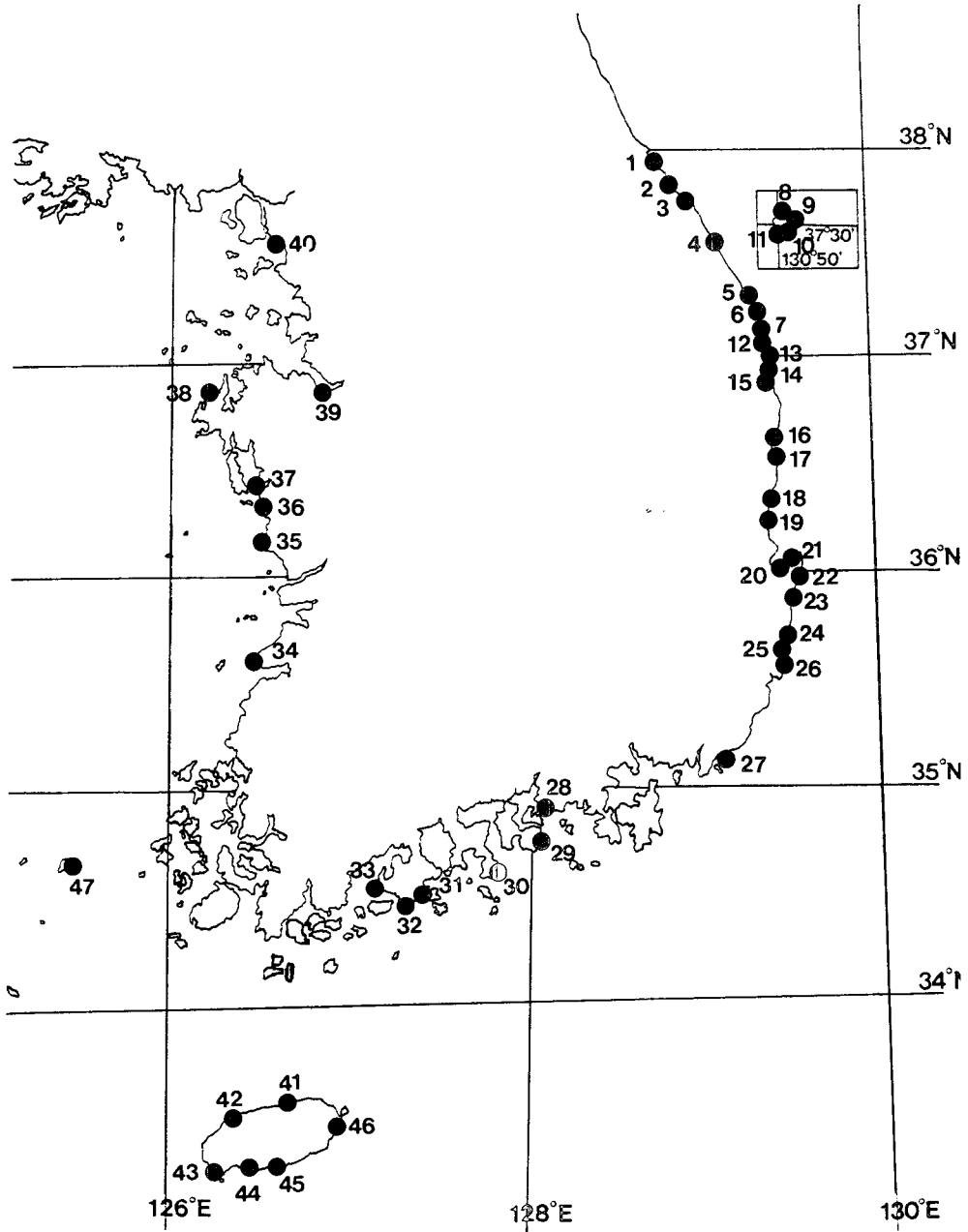


Fig. 1. Collection localities. 1, Namae, Yangyang-kun; 2, Yongok, Yangyang-kun. 3, Kyongp'odae; 4, Ch'u Tonghae; 5, Changho; 6, Imwon; 7, Hosan; 8, Sommok, Ulrung I.; 9, Naesujon; 10, Todong; 11, Sadong; Chukpyon; 13, Onyang 1-ri; 14, Uljin; 15, Mouth of Wangp'ich'on; 16, Koraebul, Yongdok-kun; 17, Tae Yongdok-kun; 18, Chosa-ri, Yongil-kun; 19, Wolp'o, Yongil-kun; 20, Kuman 1-ri, Yongil-kun; 21, Kuryong 22, Kuryongp'o Beach; 23, Yangp'o, Yongil-kun; 24, Suryom 1-ri, Kyongju-kun; 25, Chej Kyongju-kun; 26, Chujon-dong, Ulsan; 27, Songjong, Pusan; 28, Samch'onp'o; 29, Songjong, Namhae-kun; Pangjukp'o, Tolsan I.; 31, Ikkum, Kohung-kun; 32, Naebal-ri, Kohung-kun; 33, Sorok I.; Ch'aesokkang; 35, Piin; 36, Taech'on; 37, near Poryong Power Plant; 38, Hakamp'o; 39, Sapkyoch'on; Sari, Ansan; 41, Samyang-dong, Cheju I.; 42, Aewol; 43, Mosulp'o; 44, Hwasun; 45, Saesom; Songsanp'o; 47, Chin-ri, Huksan I.

Arthrite of maxillula with several dentates; two parallel setae on dorsal surface; exopod as long as endopod, the former bearing 2 bare setae and 1 plumose one, and the latter bearing 3 setae in total. Syncoxa of maxilla consisting of 3 well-developed endites; basis forming a strong claw. Basis of maxilliped tapering distally; first endopod with 2 transverse spinular rows inwards; second one with 1 stout claw.

Exopod of leg 1 about 1.70 times as long as endopod; exopod consisting of 3 segments, first segment as long as first endopodal segment; second one somewhat shorter than first one; distal one bearing 4 arched claws and 1 spine. First endopodal segment about 5.1 times as long as wide with many setules on both margin; inner seta at distal sixth of inner margin; distal segment as long as wide, bearing 2 arched claws with 2 bare setae. Thoracic legs 2-4, each with exopod and endopod of 3 segments. The ornamentation of legs 2-4 as follow (Roman numerals indicating spines; arabic numerals representing setae):

Leg 2	basis 0-1	exp. 1-I, 1-I, 2-2-III enp. 1-0, 1-0, 2-2-I
Leg 3	basis 0-1	exp. 1-I, 1-I, 3-2-III enp. 1-0, 1-0, 3-2-I
Leg 4	basis 0-1	exp. 1-I, 1-I, 3-2-III enp. 1-0, 1-0, 2-2-I

Distal end of leg 5 baseoendopod reaching middle of exopod; baseoendopod triangular in shape, 1.26 times broader than long, bearing 4 setae; exopod about 2.7 times as long as broad with a few spinules along both margins, bearing 5 setae in total.

Remarks. The genus *Harpacticus* comprises 25 species and 3 subspecies (Bodin, 1988). As well-pointed out by Ito (1976a), *H. nipponicus* Ito is discernable from its congeners by the combination of the following features: (1) 9-articulated antennule and its articulation in female; (2) first endopodal segment of leg 2 elongated, and second endopodal segment furnished with only one seta; (3) very elongate leg 5 exopod (about 2.7 times longer than wide) and the arrangement of setae on it. Our specimens agree well with original description of Ito (1976a) except that the female leg 5 exopod is a little longer (2.7 times) than Ito's (2.4 times).

H. nipponicus was originally described from Oshoro, Japan by Ito (1976a), and this report is the second record on it. *H. nipponicus* was collected from Cheju I., East Sea and South Sea, as shown in Fig. 9a.

Distribution. Korea (East Sea, South Sea, Cheju I.) and Japan.

2. *Harpacticus compsonyx* Monard, 1926 (Fig. 4)

Harpacticus compsonyx Monard, 1926 (p. 421, figs. 26-34) (cited from Lang, 1948); Klie, 1941 (p. 11); Lang, 1948 (p. 332, fig. 5); Vervoort, 1962 (p. 407, figs. 5-6); Wells, 1967 (p. 252, fig. 24).

Material examined. 1 ♀ (ovi.), Kyongp'odae, Sep. 22, 1993, C.Y. Chang.

Female. First abdominal segment fused with second one, third and fifth ones furnished with a spinular row on ventral surface. Rostrum rectangular, as long as broad. Furcal ramus about 1.27 times as wide as long.

Antennule 9-segmented, third segment longest, fifth one as long as sixth, fourth and apical one with aesthetasc. Exopod of antenna 2-segmented, first segment slightly longer than second; endopod

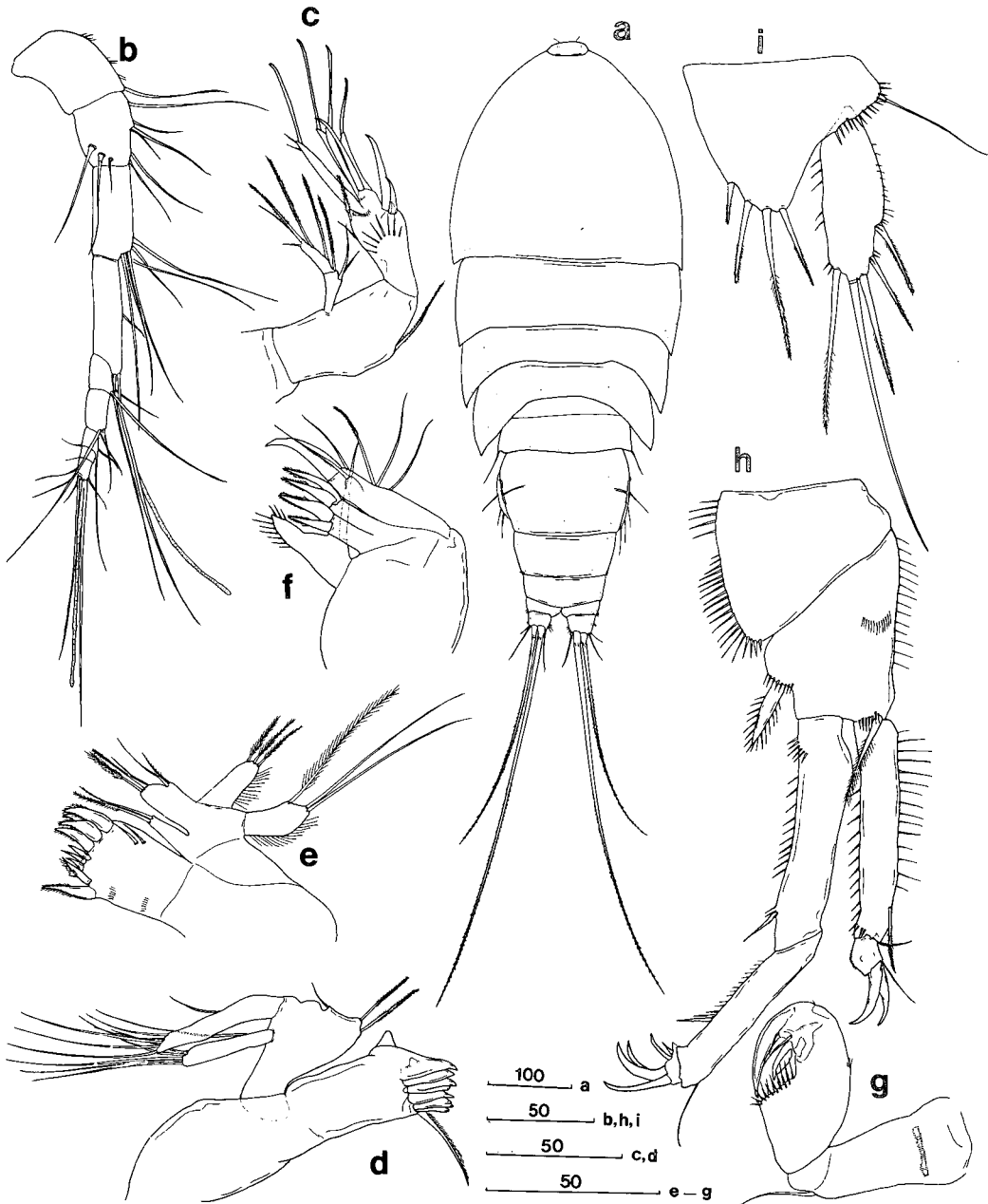


Fig. 2. *Harpacticus nipponicus* Ito, female: a, habitus, dorsal; b, antennule; c, antenna; d, mandible; e, maxillula; f, maxilla; g, maxilliped; h, leg 1; i, leg 5. (unit of scales in μm)

shorter than allobasis, gradually thickened with 4 geniculate spines and 3 serrated ones.

Coxa and basis of leg 1 obliquely divided, outer margin of basis shorter than inner (about 2.29 times); exopod consisting of 2 segments, first exopodal segment as long as second one, bearing 4 serrated claws and 1 thin bare seta; endopod much slender than exopod; first endopodal segment as long as first exopodal segment, with 1 inner seta on distal corner; second endopodal segment with 1

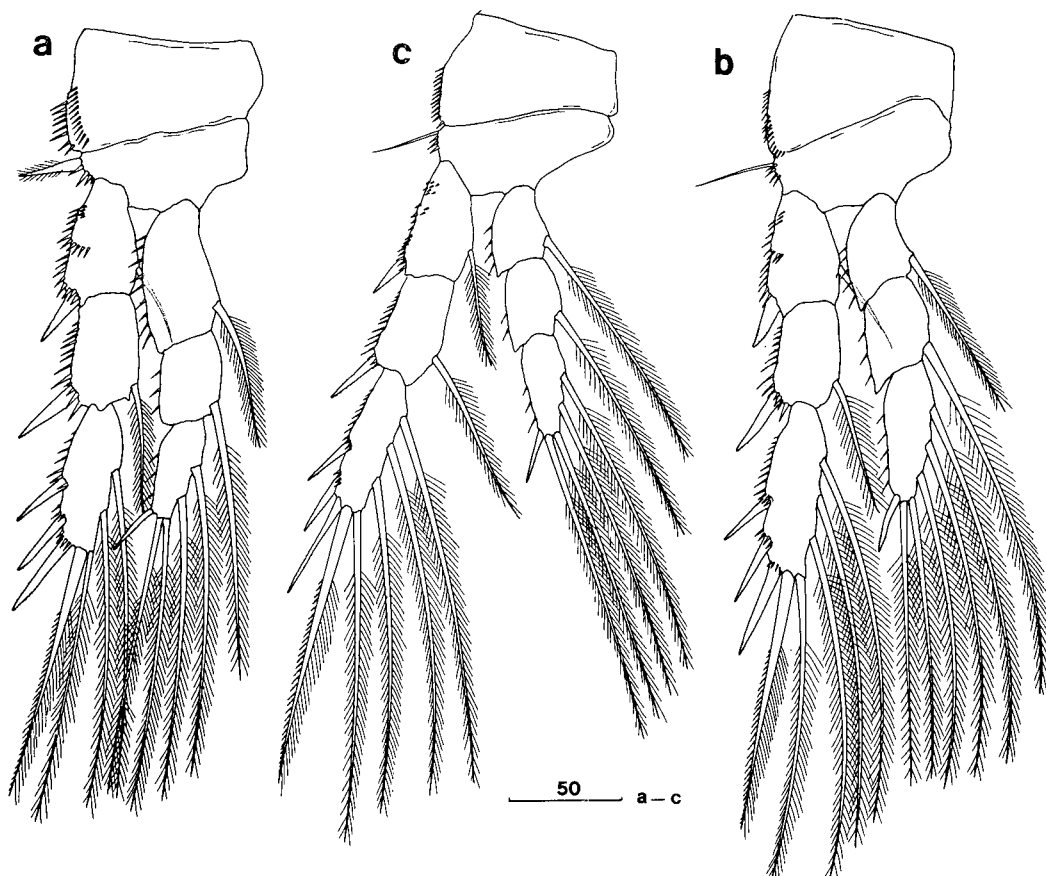


Fig. 3. *Harpacticus nipponicus* Ito, female: a-c, leg 2-4. (unit of scales in μm)

seta on inner margin, 2 clusters of spinules on middle surface, 1 serrated claw and 1 bare seta at distal end also. Both exo- and endopod of legs 2-4 consist of 3 segments. All second endopodal segments of legs 2-4 bearing only 1 inner seta; all laterodistal spines of second and third exopodal segment of legs 2-4 outwardly serrated. The ornamentation of legs 2-4 as follows (Roman numerals indicating spines; arabic numerals representing setae):

Leg 2	basis 0-1	exp. 1-I, 1-I, 1-2-III enp. 1-0, 1-0, 1-2-0
Leg 3	basis 0-1	exp. 1-I, 1-I, 2-2-III enp. 1-0, 1-0, 3-2-I
Leg 4	basis 0-1	exp. 1-I, 1-I, 3-2-III enp. 1-0, 1-0, 2-2-I

Baseoendopod of leg 5 about 0.90 times as long as wide and bearing 4 setae, of which distal seta longest and about 2.35 times as long as first one; inner margin of baseoendopod chitinous, its tip far beyond half of exopod; exopod about 1.82 times longer than wide with 5 apical or subapical setae.

Remarks. *Harpacticus compsonyx* Monard belongs to a group of *H. nipponicus*, *H. pacificus*, *H. pulex*, etc., which bears 1 inner seta on second endopodal segment of leg 2, but this species is distinguished from its congeners by having only 3 setae in total on distal segment of leg 2. Our

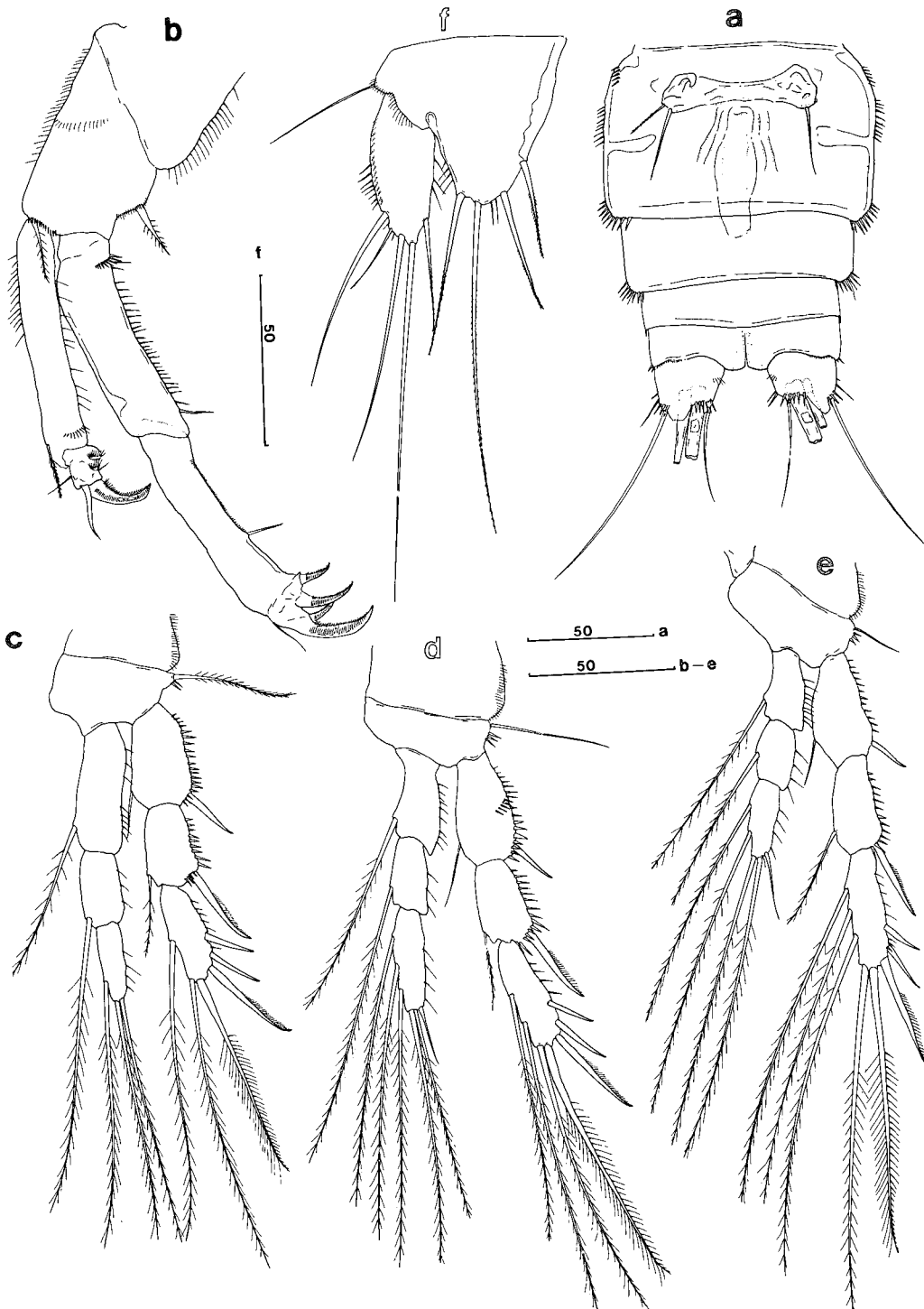


Fig. 4. *Harpacticus compsonyx* Monard, female: a, abdomen, ventral; b-f, leg 1-5. (unit of scales in μm)

specimens have two minor discrepancies with other descriptions as follows: (1) second exopodal segment of leg 1 have 4 claws, while 3 claws in Vervoort (1962) and Lang (1948); (2) length to width ratio of leg 5 exopod is about 2.2 times, while 2.0 times in Lang (1948), 2.1 times in Vervoort (1962) and 1.6 times in Wells (1967).

The present report is the first record from the Northern Pacific.

Distribution. Mediterranean, South Africa, Black Sea, Pacific Ocean and Korea (East Sea).

3. *Harpacticus uniremis* Kröyer, 1842

Harpacticus uniremis Kröyer, 1842 (p. 43, fig. 1a-p) (cited from Lang, 1948); Lang, 1948 (p. 321, fig. 150); Klie, 1949 (p. 110); Lang, 1965 (p. 108, fig. 55); Ito, 1971 (p. 235, figs. 1-6); Ito, 1976b (p. 481).

Material examined. 1 ♀, Namae, Jan. 15, 1991, C.Y. Chang; 1 ♀, Imwon, Sep. 23, 1993, C. Y. Chang; 1 ♂, Chukpyon July 24, 1992, S.J. Song; 1 ♀ (ovi.), Uljin, Feb. 16, 1993, S.J. Song; 2 ♀ ♀ (1 ovi.), 2 ♂ ♂, Koraebul, Pyönggok, Jan. 14, 1991, C.Y. Chang; 3 , Wolpo, Apr. 6, 1991, J.H. Choi; 2 ♀ ♀, Kuryongp'o, Oct. 31, 1992, S.J. Song; 3 ♀ ♀ (1 ovi.), 2 ♂ ♂, Suryom 1-ri, Kyongju-kun, Apr. 4, 1992, S.H. Kim; 1 ♀, Samch'onp'o, Apr. 27, 1991, C.Y. Chang; 8 ♀ ♀ (3 ovi.), 3 ♂ ♂, Ikkum, Kohung-kun, Jan. 30, 1991, C.Y. Chang; 67 ♀ ♀ (19 ovi.), 25 ♂ ♂, Naebal-ri, Jan. 30, 1991, C.Y. Chang; 1 ♀, Sorok I., Jan 30, 1991, C.Y. Chang; 1 ♂, Piin, March 9, 1992, C.Y. Chang; 1 ♀, 1 ♂, near Poryong Power Plant, March 9, 1992, J.H. Choi; 4 ♀ ♀ (3 ovi.), 3 ♂ ♂, Hakamp'o, Apr. 30, 1992, S.H. Kim; 2 ♀ ♀, 2 ♂ ♂, Sapkyoch'on, Apr. 28, 1992, S.J. Song; 2 ♀ ♀, 1 ♂, Sari, Ansan, Aug. 6, 1993, S.J. Song; 1 ♂, Mosulp'o, Cheju I., Jan. 30, 1991, S.J. Song; 2 ♀ ♀, Chin-ri, Huksan I., July 19, 1986, H.S. Kim.

Remarks. *H. uniremis* Ito is easily discernible from the preceding two species by having 2 inner setae on second endopodal segment of leg 2. In *H. uniremis*, the second endopodal segment of male leg 2 is protruded to be a spiniform process, showing somewhat wide variation range in the length ratio of second segment to third one. The ratio measured 1.92-3.17 in Ito (1971), while the 10 specimens collected from Naebal-ri of Korea were measured 2.60-3.43.

Harpacticus uniremis inhabit the various habitats, and one of the most frequently occurred harpacticoid from all coast of Korea, as shown in Fig. 9a.

Distribution. France, Italy, Algeria, Bulgaria, Egypt, North Pacific, Korea and Japan.

Genus *Tigriopus* Norman, 1868

4. *Tigriopus japonicus* Mori, 1938

Tigriopus japonicus Mori, 1938 (p. 294, pl. IX); Ito, 1969 (p. 58); Ito, 1970 (p. 474).

Material examined. 4 ♀ ♀ (2 ovi.), 6 ♂ ♂, Todong, Ulr ng I., May 8, 1990, C.Y. Chang; 11 ♀ ♀ (7 ovi.), 6 ♂ ♂, Ch'aesokkang, May 17. 1991, S.J. Song; 3 ♀ ♀, Taech'on, March 4, 1992, C.Y. Chang; 1 ♀, Saesom I., Feb. 11, 1987, H.S. Kim.

Remarks. *T. japonicus* is very similar to *T. californicus* in their morphology, but they are easily distinguished by the armature of leg 4. The present species have 2 inner setae on third exopodal segment, while *T. californicus* have 3 setae. Yeatman (1983) reported from Cheju I. and Pusan *T. californicus*, but it must be *T. japonicus* with the consideration of the above-mentioned characters in his description and figures.

The *Tigriopus japonicus* was commonly found from the various types of habitats along the coastal line of Korea (Fig. 9b).

Distribution. Korea and Japan.

Genus Harpacticella Sars, 1908

5. *Harpacticella itoi* Chang and Kim, 1991

Harpacticella itoi Chang and Kim, 1991 (p. 73, figs. 1-3).

Material examined. 4 ♀♀, 2 ♂♂, estuary of Yongokch'on, June 2, 1990, S.J. Song; 5 ♀♀, 3 ♂♂, Mouth of Wangp'ich'on, May 7, 1993, C.Y. Chang; 1 ♀ (ovi.), 1 ♂, Pangjukp'o, Oct. 12, 1989, C.Y. Chang; 3 ♀♀, 2 ♂♂, Aewol, Cheju I., Jan. 28, 1992, S.J. Song.

Ramarks. Type locality is the mouth of Tamjin River, southern coast of Korea. We newly report it from a spring on the beach at Aewol, Cheju Island, and from the mouths of several streams drained into East Sea of Korea (Fig. 9c).

The specimens from Cheju I. were nearly same as type specimens from southern coast, while the specimens from east coast had slightly longer caudal ramus (about 1.2 times longer than wide) and shorter exopod (nearly regular-squared) of female leg 5 than those of type specimens.

Distribution. Korea (East Sea, South Sea, Cheju I.).

6. *Harpacticella oceanica* Ito, 1977 (Figs. 5-6)

Harpacticella oceanica Ito, 1977 (p. 61, figs. 1-11); Bodin, 1988 (p. 47).

Material examined. 1 ♀ (ovi.), Kuman 1-ri, Yongil-kun, Aug. 8, 1992, S.J. Song; 2 ♀♀ (ovi.), Samyang-dong, Cheju I., Jan. 30, 1992, S.J. Song.

Female. Body fairly depressed dorsoventrally, about 0.71 mm long, rostrum and furcal setae excluded. Cephalothorax somewhat triangular and 1.29 times wider than long, with a few short setulae on dorsal surface and along margin. Rostrum protruding downwards with 1 pair of short sensillae apically. First two abdominal segments occupying half of its whole length. Furcal rami a little divergent, 1.3 times broader than long, somewhat tapering distally. Inner terminal seta much longer than outer one; inner apical seta 2.93 times longer than outer one and about 3/4 length of body.

Antennule of 7 segments; proximal 3 segments much longer and stouter than next 4 segments; aesthetascs arising from fourth and last segments, nearly same in length each other, and 1.82 times as long as total length of antennule. Exopod of antenna consisting of 2 segments; proximal one remarkably longer than distal one; and the former bearing one seta, the latter bearing two.

Mandible with praecoxa extending inwards; exopod slightly shorter than endopod, both rami consisting of 3 segments. Exopodite of maxillula remarkably elongated, terminating with 3 bare setae. Maxilla with 1 swollen protuberance bearing 1 plumose seta on inner margin of coxa; basis forming 1 strong claw. Maxilliped long and tapered; first endopod bearing 1 long seta; second one forming 1 stout and tapered claw (extending to middle of first endopod).

Thoracic legs 1-4 (Fig. 6a-d) each with exopod and endopod of 3 segments. Exopod of leg 1 about 1.3 times as long as endopod; first exopodal segment about 1.1 times as long as next one; third one short with 4 serrated claws; first endopodal segment with 1 long seta near middle of inner margin; second one as long as third; distal segment with 1 stout claw. The ornamentation of legs 2-4 as follows (Roman numerals indicating spines; arabic numerals representing setae):

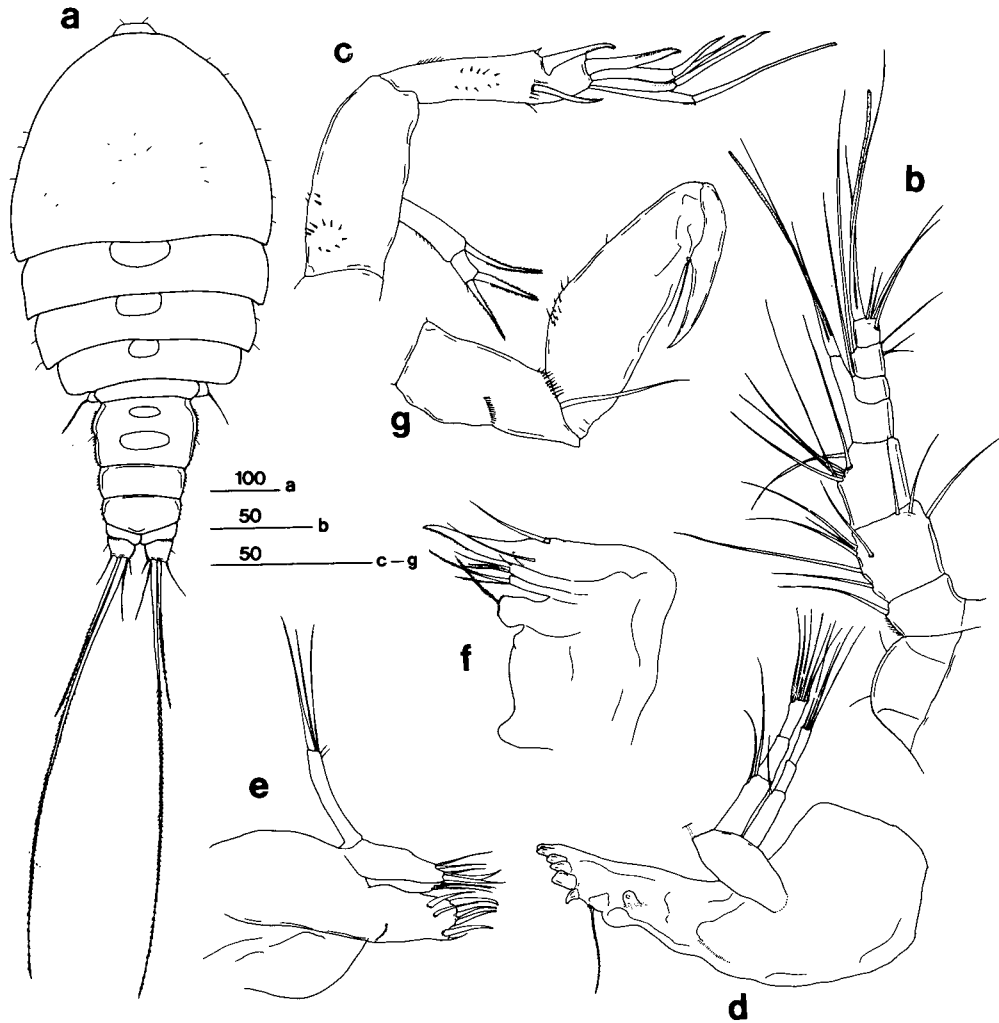


Fig. 5. *Harpacticella oceanica* Ito, female: a, habitus, dorsal; b, antennule; c, antenna; d, mandible; e, maxillula; f, maxilla; g, maxilliped. (unit of scales in μm)

Leg 2	basis 0-1	exp. 1-I, 1-I, 2-2-III enp. 1-0, 1-0, 2-2-I
Leg 3	basis 0-1	exp. 1-I, 1-I, 3-2-III enp. 1-0, 1-0, 3-2-I
Leg 4	basis 0-1	exp. 1-I, 1-I, 3-2-III enp. 1-0, 1-0, 2-2-I

Leg 5 with inner expansion of baseoendopod, bearing 5 terminal setae, of which the second from outer margin is the longest. Exopod elongated, about 2.24 times as long as broad bearing 4 apical setae and 1 stout subapical seta; tip of exopod slightly beyond baseoendopod.

Remarks. *Harpacticella oceanica* Ito (1977) was described from the Bonin Islands of Japan, and is the only genuine marine species in genus *Harpacticella*. This report from a sand beach of Cheju I. is

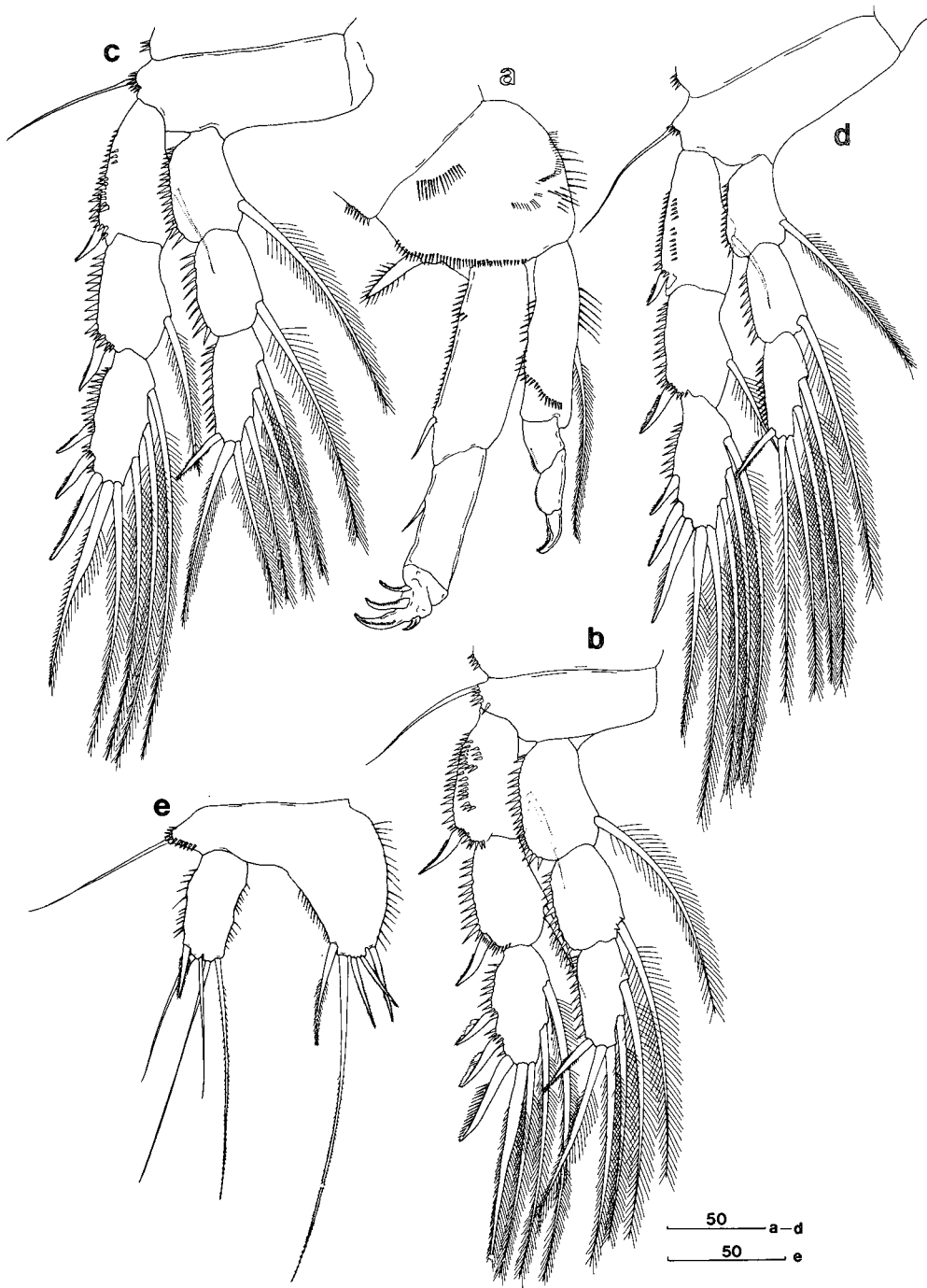


Fig. 6. *Harpacticella oceanica* Ito, female: a-e, leg 1-5. (unit of scales in μm)

the second record of *H. oceanica*.

According to character comparisons between 6 congeners of *Harpacticella* so far known by Chang and Kim (1991), the present species is characterized by having the conspicuously elongated leg 5 exopod in female and 4 apical or subapical setae of leg 5 exopod in male.

No remarkable difference was found between Ito's (1977) original description and our specimens except that the female leg 5 exopod of ours were a little shorter (2.24 times) than Ito's (2.50 times).

Distribution. Korea (East Sea, Cheju I.) and Japan.

Genus *Zaus* Goodsir, 1845

7. *Zaus robustus* Ito, 1974 (Fig. 7)

Zaus robustus Ito, 1974 (p. 555, figs. 4-7); Ito, 1976b (p. 211, figs. 1-8); Ito, 1980 (p. 61, figs. 7-9).

Material examined. 7 ♀♀ (4 ovi.), 4 ♂♂, Naesujon, Ulrung I., May 8, 1990, C.Y. Chang; 1 ♂, Sommok, May 9, 1990, C.Y. Chang; 1 ♂, Sadong, May 10, 1990, C.Y. Chang.

Female. Body much flattened dorsoventrally, length 0.53mm, rostrum and furcal setae excluded. Cephalothorax width about 1.70 times as its length, with many hairs on dorsal surface and lateral margins. Rostrum almost square. Abdomen including genital double somites and occupying one third of whole body length; lateral margins of first to third abdominal segment with many long hairs. Furcal rami somewhat divergent, with inner margin slightly rounded.

Antennule of 9 segments, third one longest, sixth somewhat longer than fifth, fourth one with 1 slender aesthetasc. Distal edge of endopod of antenna furnished with 3 serrated claws and 3 geniculate spines; exopod consisting of 2 segments of nearly equal in length each other.

Mandible with blunt sclerotized process; basis thickened outwards, with 2 setae on inner corner; exopod and endopod consisting of only 1 segment with many setae. Arthrite of maxillula praecoxa with 6, more or less spinulose, claws and 2 parallel setae on middle surface; coxal endopod with 4 setae at tip; inner process of basis longer than coxal endopod; exopod and endopod each consisting of 1 segment; exopod over 2 times as endopod. In maxilla, outer margin of syncoxa thickly sclerotized with 3 endites; basis forming a strong claw. Maxilliped coxa as long as basis, slenderer distally; first endopodal segment somewhat elongated with row of spinules on surface; second one protruded into 1 strongly hooked claw.

Leg 1, coxa and basis obliquely divided, outer margin of basis shorter than inner margin; coxa much swollen outwardly. Exopod consisting of 3 segments, first one somewhat longer than first endopodal segment with 1 seta on distal end; second one as long as first, gradually thickened from base to end of segment; last one shortest, with 3 serrated claws; endopod 3-segmented, first one with 1 seta at inner distal corner; third one as long as second with 1 serrated claw and 1 bare seta. Basal seta of legs 2-4 somewhat different in shape and length; leg 2 bearing 1 short plumose seta, leg 3 with thin and long bare one, leg 4 with 1 short bare one. Both exopods and endopods of legs 2-4 3-segmented. The ornamentation of legs 2-4 as follows (Roman numerals indicating spines; arabic numerals representing setae):

Leg 2	basis 0-1	exp. 1-I, 1-I, 2-2-III enp. 1-0, 2-0, 2-2-I
Leg 3	basis 0-1	exp. 1-I, 1-I, 3-2-III

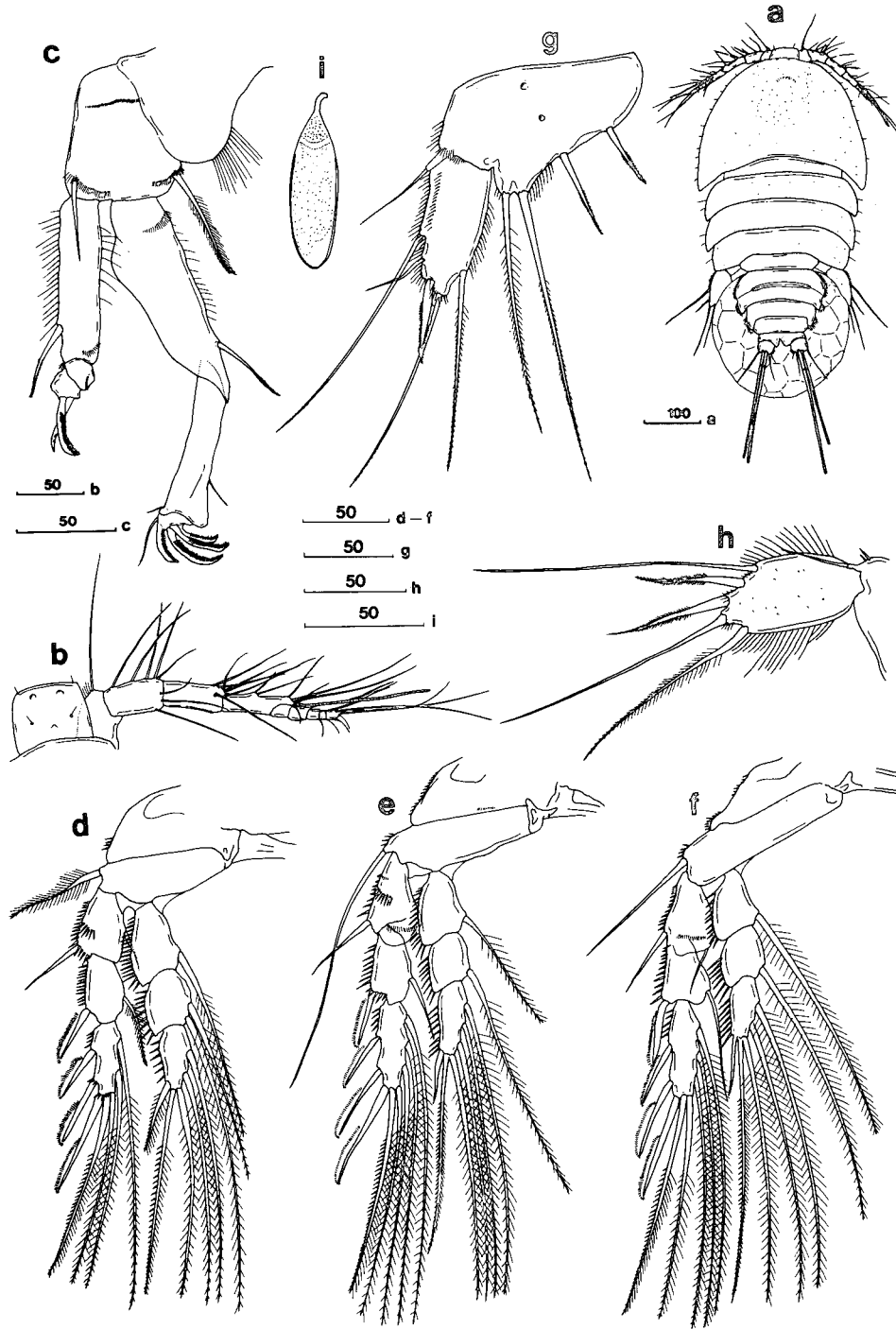


Fig. 7. *Zaus robustus* Ito, female: a, habitus, dorsal; b, antennule; c-g, leg 1-5. male: h, leg 5; i, spermatophore (unit of scales in μm)

		enp. 1-0, 1-0, 3-2-I
Leg 4	basis 0-1	exp. 1-I, 1-I, 3-2-III
		enp. 1-0, 1-0, 2-2-I

Leg 5 baseoendopod about 1.8 times as broad, with 4 setae of which second one longest (about 4 times as long as third one); exopod 1.78 times as long as wide, bearing 5 setae.

Male. Body length 0.49 mm. Abdomen occupying about 3/10 of whole body length. Leg 5 exopod 2.56 times as long as wide, bearing 5 setae in total with many long hairs on both lateral margins. Leg 6 represented by 1 short seta on first abdominal segment.

Remarks. *Zaus robustus* was mainly collected by rinsing algae and its occurrences in Korea were restricted to Ulr ũng I. still yet (Fig. 9d).

Distribution. Korea (Ulr ũng I.) and Japan.

8. *Zaus unisetosus* Ito, 1974 (Fig. 8)

Zaus unisetosus Ito, 1974 (p. 570, figs. 12-14).

Material examined. 2 ♀♀ (1 ovi.), 1 ♂, Ch'uam, Jan. 15, 1992, C.Y. Chang; 7 ♀♀ (6 ovi.), 1 ♂, Changho, Jan. 15, 1992, C.Y. Chang; 3 ♀♀ (1 ovi.), Hosan, Jan. 14, 1991, C.Y. Chang; 1 ♀, 1 ♂, Onyang 1-ri, July 24, 1992, S.J. Song; 3 ♀♀ (1 ovi.), 2 ♂♂, Taejin, July 2, 1992, S.J. Song; 6 ♀♀ (3 ovi.), 4 ♂♂, Chosa-ri, Jan. 14, 1991, J.H. Choi; 7 ♀♀ (3 ovi.), 3 ♂♂, Wolp'o 2-ri, June 27, 1991, C.Y. Chang; 2 ♀♀ (1 ovi.), 1 ♂, Kuman 1-ri, July 11, 1992, S.J. Song; 1 ♀, Kuryongp'o, Oct. 30, 1992, S. J. Song; 2 ♀♀, Yangp'o, July 25, 1990, C.Y. Chang; 2 ♀♀, 1 ♂, Suryom 1-ri, Apr. 4, 1992, S.J. Song; 8 ♀♀ (4 ovi.), 5 ♂♂, Chejon, Ky ũngju-kun, Apr. 4, 1992, S.J. Song; 6 ♀♀ (3 ovi.), 3 ♂♂, Chujon-dong Ulsan, Apr. 4, 1992, S.J. Song; 2 ♀♀, 1 ♂, Samch'onp'o, Jan. 31, 1991, C.Y. Chang; 5 ♀♀ (2 ovi.), 3 ♂♂, Songjong, Namhae-kun, July 3, 1991, S.H. Kim; 2 ♀♀ (ovi.), 1 ♂, Ikkum, Kohung-kun, Jan. 30, 1991, C.Y. Chang; 2 ♀♀, Songsanp'o, Cheju I., Jan. 29, 1992, S.J. Song.

Female. Body much flattened dorsoventrally, length 0.54mm, rostrum and furcal setae excluded. Cephalothorax and thorax occupying about 2/3 of whole body length. Rostrum trapezoid, about 2.37 times as long as broad. Abdomen including genital double somites. Furcal ramus as long as broad.

Antennule 9-segmented, third one longest, sixth nearly as long as fifth, aesthetascs arising from fourth and apical segments.

Leg 1 exopod longer than endopod (about 1.77 times in length); last endopodal segment with 4 serrated claws. Second endopodal segment of leg 2 with 2 inner setae. Leg 5 baseoendopod as long as wide, with 4 setae, gradually shortened outward; exopod elongated, about 2.13 times as long as wide, bearing 5 setae of which apical one longest, with many spinules on outer margin.

Body length of male about 0.45mm. Cephalothorax about 1.31 times as long as broad. Other characteristics nearly same as in preceding species, *Z. robustus*.

Remarks. The genus *Zaus* comprises 9 species and 2 subspecies (Bodin, 1988). *Z. unisetosus* Ito, as indicated in the specific name, has only one seta on inner distal edge of second endopodal segment of leg 2, which makes this species distinguished from its congeners, including the preceding species, *Z. robustus* Ito.

Z. unisetosus is one of the most frequent and dominant harpacticoids in Korea, especially as a

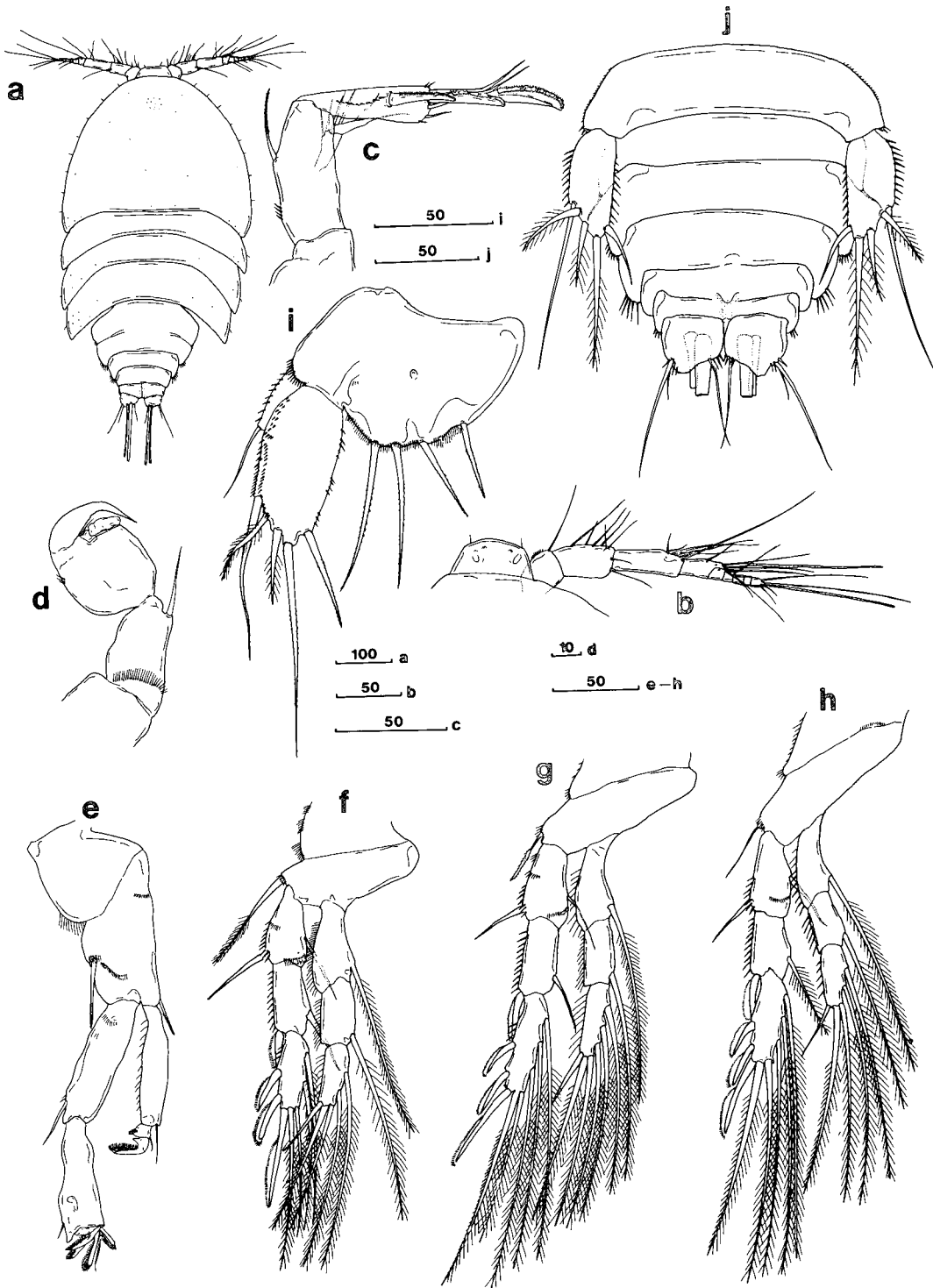


Fig. 8. *Zaus unisetosus* Ito, female: a, habitus, dorsal; b, antennule; c, antenna; d, maxilliped; e-i, leg 1-5. male: j, leg 5 and leg 6. (unit of scales in μm)

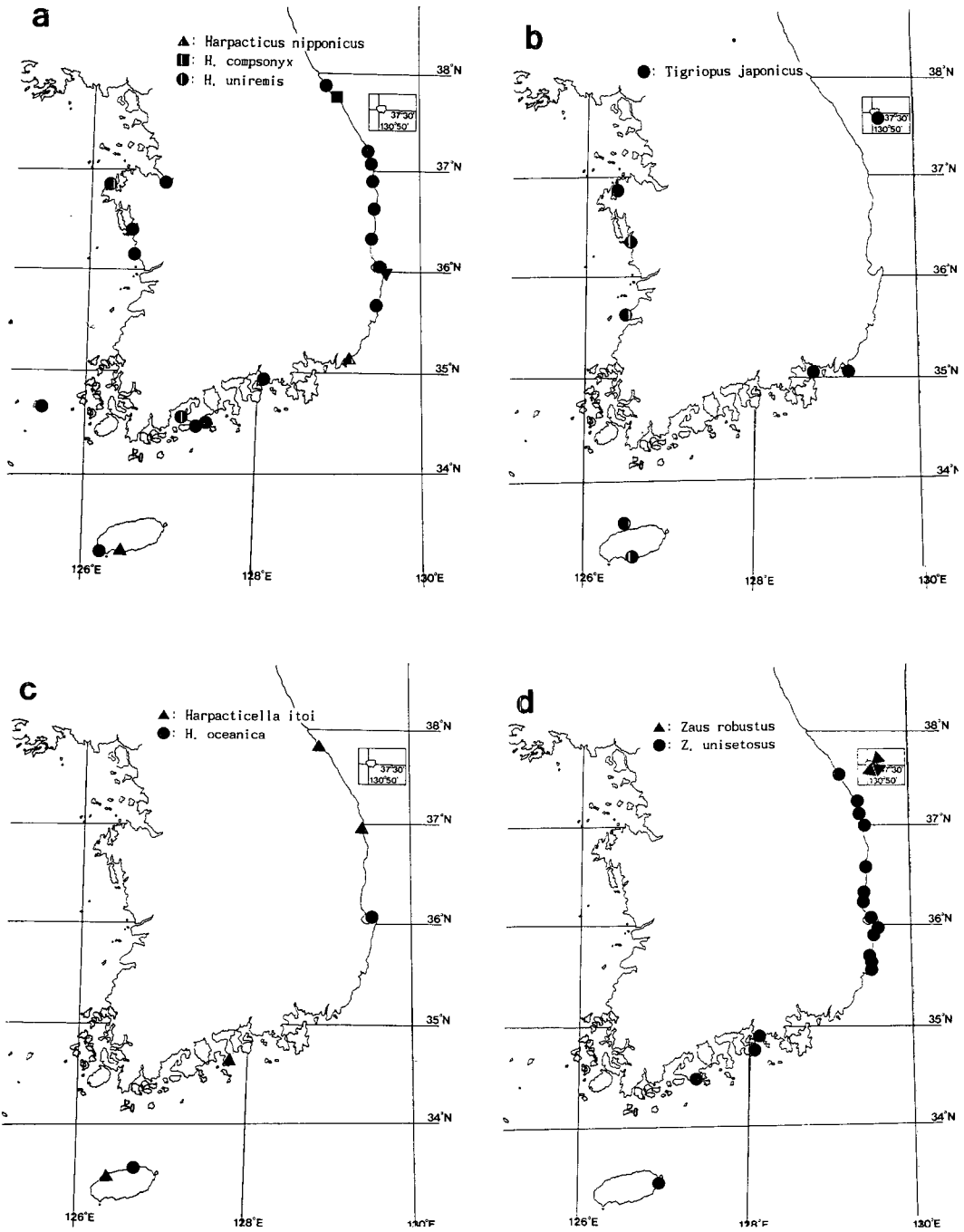


Fig. 9. Occurrences of eight harpacticoid species of family Harpacticidae in Korea. a, genus *Harpacticus*; b, genus *Tigriopus*; c, genus *Harpacticella*; d, genus *Zaus*.

macroalgal associates, although it has not been collected from western coast still yet (Fig. 9d).

Distribution. Korea (East Sea, South Sea, Cheju I.) and Japan.

A key to the genera and species of family Harpacticidae known in Korea

1. Body slender and slightly depressed; claws of leg 1 serrated or with spinules 2
 Body broad, strongly depressed; leg 1 with comblike claw 7 (*Zaus*)
2. Antennule 7-segmented in female; male leg 2 endopod not forming a process
 3 (*Harpacticella*)
 Antennule 8- or 9-segmented in female; male leg 2 endopod forming a process 4
3. Female leg 5 exopod elongated (about 2.5 times as long as wide), bearing 5 setae in total;
 marine *Harpacticella oceanica*
 Female leg 5 exopod quadrangular (about 1.4 times as long as wide), bearing 7 setae in total;
 brackishwater *H. itoi*
4. Exopod of antenna 2-segmented; male leg 3 exopod swollen 5 (*Harpacticus*)
 Exopod of antenna 3-segmented; male leg 3 exopod not swollen; third exopodal segment of
 female leg 4 with 2 inner setae *Tigriopus japonicus*
5. Second endopodal segment of leg 2 in female with 1 seta 6
 Second endopodal segment of leg 2 in female with 2 setae *Harpacticus uniremis*
6. Third endopodal segment of female leg 2 with 5 setae *H. nipponicus*
 Third endopodal segment of female leg 2 with 3 setae *H. compsonyx*
7. Second endopodal segment of leg 2 with 1 inner seta *Zaus unisetosus*
 Second endopodal segment of leg 2 with 2 inner setae *Z. robustus*

ABSTRACT

Eight harpacticoid species of family Harpacticidae, collected from 47 locations of Korea, are identified. The five species newly reported from Korea, are redescribed and illustrated: *Harpacticus nipponicus*, Ito, *H. compsonyx* Monard, *Harpacticella oceanica* Ito, *Zaus robustus* Ito, *Z. unisetosus* Ito.

REFERENCES

- Bodin, P., 1988. Catalogue des nouveaux copepodes harpacticoides marins. Univ. Bretagne Occidentale., 289 pp.
- Chang, C.Y. and H.S. Kim, 1991. *Harpacticella itoi*, a new harpacticoid species from Korea (Copepoda: Harpacticoida: Harpacticidae). Korean J. Syst. Zool., 7(1): 73-80.
- Ito, T., 1969. Description and record of marine harpacticoid copepods from Hokkaido, II. Jour. Fac. Sci. Hokkaido Univ., ser. VI, Zool., 17(1): 58-77.
- Ito, T., 1970. The biology of a harpacticoid copepod, *Tigriopus japonicus* Mori. Jour. Fac. Sci. Hokkaido Univ., ser. VI. Zool. 17: 474-500.

- Ito, T., 1971. The Biology of a harpacticoid copepod *Harpacticus uniremis* Kröyer. Jour. Fac. Sci. Hokkaido Univ., ser. VI, Zool., **18**(2): 305-336.
- Ito, T., 1974. Descriptions and records of marine harpacticoid copepods from Hokkaido, VI. Jour. Fac. Sci. Hokkaido Univ., ser. VI, Zool., **19**(3): 546-640.
- Ito, T., 1976a. Descriptions and records of marine harpacticoid copepods from Hokkaido, VI, Jour. Fac. Sci. Hokkaido Univ., ser. VI, Zool., **20**(3): 448-567.
- Ito, T., 1976b. Morphology of the copepodid stages of *Zaus robustus* Ito and *Paratigriopus hoshidei* Ito from Japan, with reference to some biological observations (Harpacticoida: Harpacticidae). Jour. Fac. Sci. Hokkaido Univ., ser. VI, Zool., **20**(2): 211-229.
- Ito, T., 1977. New species of marine harpacticoid copepods of the genera *Harpacticella* and *Tigriopus* from the Bonin islands, with reference to the morphology of copepodid stages. Jour. Fac. Sci. Hokkaido Univ., ser. VI, Zool., **21**(1): 61-91.
- Ito, T., 1980. Three species of the genus *Zaus* (Copepoda, Harpacticoida) from Kodiak island, Alaska. Publ. Seto Mar. Biol. Lab., **25**(1/4): 51-77.
- Kim, D.Y. and H.T. Huh, 1983. Seasonal variations of copepods in Garolim Bay. Bul. KORDI, **5**: 29-35.
- Klie, W., 1941. Marine Harpacticoiden von Island. Kiel. Meeresforsch., **5**: 1-44.
- Klie, W., 1949. Harpacticoida (Copepoda) aus dem Bereich von Helgoland und der Kieler Bucht. I. Kiel. Meeresforsch., **6**: 90-128.
- Lang, K., 1948. Monographie der harpacticiden. H. Ohlsson, Lund. 2 vols. 1682 pp.
- Lang, K., 1965. Copepoda Harpacticoida from the Californian Pacific coast. K. svenska vetensk. Akad. Handl., **10**(2): 1-566.
- Lee, S.S., 1972. Distribution of copepods in Chinhae Bay and its adjacent region. Bull. Fish. Res. Dev. Agency, **9**: 7-27.
- Mori, T., 1938. *Tigriopus japonicus*, a new species of neritic copepoda. Zool. Mag. (Japan), **50**(5): 294-296.
- Park, J.S. and S.S. Lee. 1982. Distribution and composition of chaetognaths and copepods and their characteristics as biological indicators to assess environmental pollution levels in the South Coast of Korea. Bull. Fish. Res. Dev. Agency, **28**: 89-126.
- Vervoort, W., 1962. Report on some Copepoda collected during the Melanesia Expedition of the Osaka Museum of Natural History. Publ. Seto. Mar. biol. Lab., **10**: 393-470.
- Wells, J.B.J., 1967. The littoral Copepoda (Crustacea) of Inhaca Island, Mozambique. Trans. Roy. Soc. Edinb., **67**(7): 189-358.
- Yeatman, H.C., 1983. Copepods from microhabitats in Fiji, Western Samoa, and Tonga. Micronesica, **19**(1-2): 57-90.

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