

Groundwater Copepods from South-western Japan

by

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(With 80 Text-figures and 14 Tables)

The present study is based on the copepod materials collected by Messrs. YOSHIFUMI MIURA of Tatsuno High School, YOSHINOBU MORIMOTO and Toshihiko Yokota of Himeji Municipal High School, from the thirty-one wells and two limestone caves in the south-western parts of Japan as well as in the Island of Amami-Oshima.

Before going further, I wish to acknowledge my indebtedness to Messrs. Y. MIURA, Y. MORIMOTO and T. YOKOTA, who have kindly sent valuable materials for my use. I also wish to express many thanks to Dr. MASUZO UENO of the Otsu Hydrobiological Station, Kyoto University, for his kind advice on many matters. The present work was rendered possible through a scientific research grant from the Ministry of Education, to which I wish to express my sincere obligation.

LIST OF THE LOCALITIES AND THE SPECIES FOUND

The wells as the source of the waterworks of Aioi City, Hyogo Prefecture. (Collected by Y. MIURA).

No. 1: 2-VI-1953.

Paracyclops aioiensis n. sp. 1 ♀; *Acanthocyclops miurai* n. sp. 1 ♀;

Diacyclops languidoides japonicus ITO 1 ♀.

No. 2: 2-VI-1953.

Nothing.

No. 3: 20-VIII-1952.

Macrocyclus albidus (JURINE) 1 ♂; *Acanthocyclops miurai* n. sp.

2 ♀♀, 1 ♂.

No. 4: 20-VIII-1952.

Eucyclops miurai ITO 1 ♀, 1 ♂; *Diacyclops disjunctus* (THALLWITZ) 1 ♀; *Diacyclops languidoides japonicus* ITO 4 ♀♀, 1 ♂; Copepodid (Cyclopoida) 5.

No. 5: 10-IX-1953.

Macrocyclus albidus (JURINE) 1 ♀.

No. 6: 10-IX-1953.

Macrocyclus albidus (JURINE) 1 ♀.

The Chugoku district (Collected by T. YOKOTA)

No. 7: A well with pump; Karita-mura, Hiroshima Pref., W. T. 19.0° C, pH 5.8—6.1; 27-III-1954.

Diacyclops disjunctus (THALLWITZ) 2 ♀♀, 3 ♂♂; *Diacyclops languidoides* (LILLJEBORG) 1 ♀; Copepodid (Cyclopoida) 3.

No. 8: A well with pump; Yoshida-machi, Hiroshima Pref., W. T. 14.5° C, pH 6.2; 26-III-1954.

Eucyclops serrulatus (FISCHER) 5 ♀♀, 4 ♂♂; *Diacyclops disjunctus* (THALLWITZ) 2 ♀♀, 1 ♂; *Diacyclops languidoides* (LILLJEBORG) 1 ♀; *Diacyclops languidoides japonicus* ITO 11 ♀♀, 3 ♂♂; Copepodid (Cyclopoida) 11; Harpacticoida 6.

No. 9: A well with pump; Yoshida-machi, Hiroshima Pref., W. T. 14.5° C, pH 6.4; 18-VIII-1954.

Diacyclops languidoides japonicus ITO 3 ♀♀, 1 ♂; *Diacyclops languidoides suoensis* ITO 1 ♂; Harpacticoida 1.

No. 10: A well with pump; Kamisugi-mura, Hiroshima Pref., 18-VIII-1954. Ostracoda 15.

No. 11: A well with pump; Hamada City, Shimané Pref., 19-VIII-1954. *Diacyclops disjunctus* (THALLWITZ) 1 ♂.

No. 12: A well with pump; Iwakuni City, Yamaguchi Pref., 23-VIII-1954. *Eucyclops serrulatus* (FISCHER) 18 ♀♀, 5 ♂♂; *Acanthocyclops miurai* n. sp. 1 ♀; *Diacyclops disjunctus* (THALLWITZ) 1 ♀; Copepodid (Cyclopoida) 1.

No. 13: A well with pump; Yamaguchi City, Yamaguchi Pref., 21-VIII-1954. *Diacyclops disjunctus* (THALLWITZ) 2 ♀♀, 1 ♂; Copepodid (Cyclopoida) 1.

No. 14: A well; Akiyoshi, Yamaguchi Pref., 22-VIII-1954.

Paracyclops fimbriatus (FISCHER) 4 ♀♀; *Diacyclops languidoides* (LILLJEBORG) ? 1 ♂; *Mesocyclops leuckarti* (CLAUS) 7 ♀♀.

No. 15: A pool in limestone cave „Shuhodo”; Yamaguchi Pref., 22-VIII-1954. *Mesocyclops leuckarti* (CLAUS) 2 ♀♀.

Shikoku (Collected by Y. MORIMOTO)

- No. 16: A well with pump; Ikeda-machi, Tokushima Pref., W. T. 18.0° C, pH 6.2; 25-VIII-1953.
Copepodid (Cyclopoida) 1.
- No. 17: A well with pump; Akebono-cho, Kuma-machi, Ehimé Pref., W. T. 18.3° C, pH 6.2; 26-VIII-1953.
Eucyclops serrulatus (FISCHER) 1 ♀.
- No. 18: A well with pump; Sugao, Kuma-machi, Ehimé Pref., W. T. 18.2° C, pH 6.2; 26-VIII-1953.
Eucyclops serrulatus (FISCHER) 1 ♀; *Diacyclops disjunctus* (THALLWITZ) 1 ♂; Copepodid (Cyclopoida) 4.
- No. 19: A pool in limestone cave „Ryugado”; Kochi Pref., 26-VIII-1953.
Eucyclops serrulatus (FISCHER) 3 ♀♀, 2 ♂♂; *Microcyclops* (*Microcyclops*) *varicans* (G. O. SARS) 2 ♂♂; Copepodid (Cyclopoida) 4.

Kyushu (Collected by Y. MIURA)

- No. 20: A well; Sasaguri Station, Fukuoka Pref., W. T. 19.5° C, pH 6.1; 8-VIII-1954.
Thermocyclops uénoi ITO 1 ♀; Copepodid (Cyclopoida) 3.
- No. 21: A well; Sasaguri Station, Fukuoka Pref., W. T. 19.5° C, pH 6.1; 8-VIII-1954.
Eucyclops serrulatus (FISCHER) 1 ♂; *Diacyclops disjunctus* (THALLWITZ) 2 ♀♀; *Thermocyclops uénoi* ITO 15 ♀♀; 1 ♂; Copepodid (Cyclopoida) 2.
- No. 22: A well; Seto-mura, Fukuoka Pref., W. T. 19.3° C, pH 6.1; 8-VIII-1954.
Diacyclops disjunctus (THALLWITZ) ? 2 ♂♂; Copepodid (Cyclopoida) 5.
- No. 23: A well; Sasaguri-machi, Fukuoka Pref., W. T. 19.8° C, pH 6.0; 8-VIII-1954.
Diacyclops disjunctus (THALLWITZ) 1 ♀; 2 ♂♂; Copepodid (Cyclopoida) 10.
- No. 24: A well; Araki Station, Fukuoka Pref.; W. T. 21.2° C, pH 5.8; 8-VIII-1954.
Eucyclops serrulatus (FISCHER) 4 ♀♀, 1 ♂; Copepodid (Cyclopoida) 1.
- No. 25: A well with pump; Araki-machi, Fukuoka Pref., W. T. 21.7° C, pH 6.0; 8-VIII-1954.
Copepodid (Cyclopoida) 1.

No. 26: A well; Setaka-machi, Fukuoka Pref., W. T. 18.5° C, 8-VIII-1954.

Diacyclops disjunctus (THALLWITZ) 2 ♀♀, 1 ♂; *Diacyclops crassicaudis* (G. O. SARS) 1 ♀; *Diacyclops languidoides* (LILLJEBORG) 7 ♀♀, 4 ♂♂; Copepodid (Cyclopoida) 8.

No. 27: A well with pump; Hinagu-machi, Kumamoto Pref., W. T. 21.4° C, pH 7.4; 9-VIII-1954.

Halicyclops higoensis n. sp. 8 ♀♀, 1 0♂♂.

No. 28: A well; Hinagu-machi, Kumamoto Pref., W. T. 18.5° C, pH 6.6; 9-VIII-1954.

Copepodid (Cyclopoida) 2.

No. 29: An artesian well; Kitakawa-mura, Miyazaki Pref., W. T. 18.0° C, pH 6.4; 12-VIII-1954.

Eucyclops serrulatus (FISCHER) 1 ♂.

Island of Amami-Oshima (Collected by Y. MORIMOTO)

No. 30: A well with pump; Naze High School, Naze City; W. T. 24.0° C, pH 6.0; 12-VIII-1954.

Diacyclops disjunctus (THALLWITZ) 2 ♀♀, 1 ♂; *Diacyclops languidoides suoensis* ITO 1 ♀, 1 ♂; Copepodid (Cyclopoida) 3.

No. 31: A well with pump; Saiwai-cho, Naze City; W. T. 21.5° C, pH 6.4; 16 and 18-VIII-1954.

Harpacticoida 3.

No. 32: A well with pump; Kariya-cho, Naze City; W. T. 21.2° C, pH 7.6; 18 and 19-VIII-1954.

Diacyclops languidoides suoensis ITO 1 ♂; Copepodid (Cyclopoida) 1; Harpacticoida 1.

No. 33: A well with pump; Saiwai-cho, Naze City; W. T. 21.8° C, pH 6.6; 18-VIII-1954.

Harpacticoida 1.

DESCRIPTION OF THE NEW FORMS AND REMARKS

1) *Macrocyclus albidus* (JURINE) (Table 1).

Length: Female 1.190 mm, Male 0.940 mm. Body white, without nauplius eye.

Occurrence: No. 3 (1 ♂); No. 5 (1 ♀); No. 6 (1 ♀).

Table 1. *Macrocyclops albidus* (JURINE)*

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♂ 0.942	56 : 25 = 2.3 : 1	195 : 63 = 3.1 : 1	66 : 23 = 2.9 : 1	50 : 54 = 0.9 : 1	No. 3

* i, inner; o, outer; L, Length; B, Breadth;

2) *Eucyclops serrulatus* (FISCHER) (Table 2)

Length: Female 0.868—1.277 mm, male 0.744—0.955 mm.

Body yellowish brown in colour, without nauplius eye.

Occurrence: No. 8 (5 ♀♀, 4 ♂♂); No. 12 (18 ♀♀, 5 ♂♂); No. 17 (1 ♀); No. 18 (1 ♀); No. 19 (3 ♀♀, 2 ♂♂); No. 21 (1 ♂); No. 24 (4 ♀♀, 1 ♂); No. 29 (1 ♂).

Table 2. *Eucyclops serrulatus* (FISCHER)

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 1.265	142 : 26 = 5.4 : 1	99 : 63 = 1.6 : 1	73 : 23 = 3.1 : 1	66 : 50 = 1.3 : 1	No. 8
♂ 0.905	86 : 23 = 3.7 : 1	73 : 46 = 1.6 : 1	56 : 20 = 2.8 : 1	53 : 40 = 1.3 : 1	„
♀ 1.314	135 : 26 = 5.1 : 1	106 : 79 = 1.3 : 1	66 : 30 = 2.2 : 1	69 : 53 = 1.3 : 1	No. 12
„ 1.265	125 : 28 = 4.5 : 1	102 : 79 = 1.3 : 1	66 : 28 = 2.4 : 1	66 : 50 = 1.3 : 1	„
„ 1.166	112 : 23 = 4.9 : 1	88 : 66 = 1.5 : 1	59 : 26 = 2.3 : 1	59 : 46 = 1.3 : 1	„
„ 0.868	106 : 26 = 4.0 : 1	83 : 66 = 1.3 : 1	59 : 26 = 2.3 : 1	59 : 40 = 1.5 : 1	„
♂ 0.955	86 : 21 = 4.0 : 1	86 : 50 = 1.7 : 1	50 : 20 = 2.5 : 1	56 : 36 = 1.5 : 1	„
„ 0.868	66 : 21 = 3.0 : 1	76 : 46 = 1.6 : 1	46 : 20 = 2.3 : 1	50 : 36 = 1.3 : 1	„
♀ 1.004	106 : 25 = 4.3 : 1	109 : 73 = 1.5 : 1	59 : 23 = 2.6 : 1	59 : 46 = 1.3 : 1	No. 17
„ 1.277	135 : 28 = 4.8 : 1	102 : 69 = 1.5 : 1	63 : 26 = 2.4 : 1	69 : 53 = 1.3 : 1	No. 18
„ 1.042*	109 : 23 = 4.7 : 1	79 : 66 = 1.2 : 1	53 : 26 = 2.0 : 1	66 : 46 = 1.4 : 1	No. 19
„ 1.004	99 : 21 = 4.6 : 1	83 : 63 = 1.3 : 1	53 : 26 = 2.0 : 1	59 : 46 = 1.3 : 1	„
„ 0.980	102 : 23 = 4.4 : 1	83 : 63 = 1.3 : 1	56 : 23 = 2.4 : 1	59 : 46 = 1.3 : 1	„
♂ 0.806	76 : 17 = 4.6 : 1	53 : 36 = 1.5 : 1	43 : 18 = 2.4 : 1	46 : 33 = 1.4 : 1	„
♀ 1.128	109 : 23 = 4.7 : 1	83 : 69 = 1.2 : 1	59 : 26 = 2.3 : 1	59 : 43 = 1.4 : 1	No. 24
♂ 0.868	69 : 20 = 3.5 : 1	92 : 46 = 2.0 : 1	56 : 26 = 2.1 : 1	46 : 36 = 1.3 : 1	„
„ 0.744	73 : 17 = 4.4 : 1	79 : 33 = 2.4 : 1	40 : 20 = 2.0 : 1	40 : 23 = 1.7 : 1	No. 29

* with egg-sacs.

3) *Eucyclops miurai* ITO

Length: Female 0.828 mm, male 0.644 mm. Body white in colour, without nauplius eye.

Occurrence: No. 4 (1 ♀, 1 ♂).

4) *Paracyclops fimbriatus* (FISCHER) (Table 3)

Length: Female 0.930—0.980 mm, body yellowish white in colour. Nauplius eye entirely absent.

Occurrence: No. 14 (4 ♀♀).

Table 3. *Paracyclops fimbriatus* (FISCHER)

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀0.980*	125 : 20 = 6.3 : 1	73 : 63 = 1.2 : 1	40 : 20 = 2.0 : 1	63 : 33 = 1.9 : 1	No. 14
„0.942*	122 : 18 = 6.7 : 1	69 : 59 = 1.2 : 1	36 : 18 = 2.0 : 1	59 : 33 = 1.8 : 1	„
„ 0.930	119 : 17 = 7.2 : 1	69 : 63 = 1.1 : 1	36 : 18 = 2.0 : 1	63 : 33 = 1.9 : 1	„

* , with egg-sacs.

5) *Paracyclops aioiensis* n. sp. (Figs. 1—9; Table 4)

Female. — Length 0.608 mm except furcal setae. Body relatively flattened, yellowish brown in colour, without nauplius eye; abdominal segments not serrated except the last segment; anal incision fringed with marginal hairs.

Furcal rami relatively short, 2.7 times as long as wide, slightly wide apart; lateral seta very small, inserted at distal 1/2.5, with a few transversely arranged denticles in front of the lateral seta on the dorsal surface; furcal setae well-developed, their length is, from inner to outer and dorsal, successively as follows:

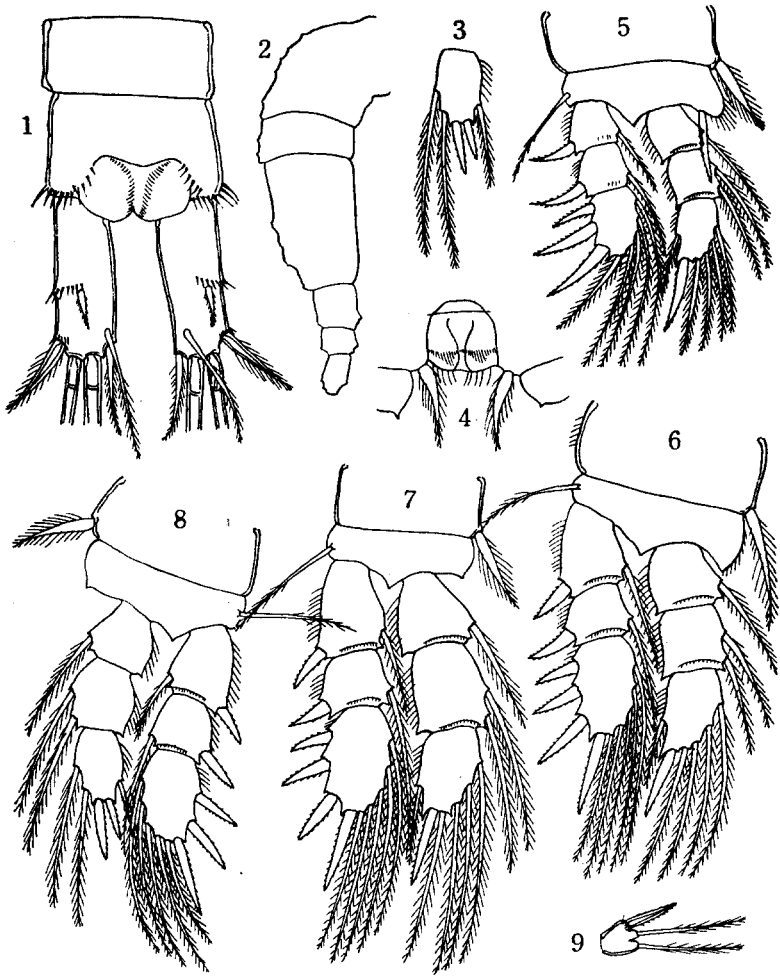
Loc.	I (in.)	II	III	IV (out.)	V (dors.)	(μ)
Aioi (Hyogo)	36	335	186	33	53	(μ)

Inner furcal seta a little longer than the outer (1.1 : 1), and a little longer than half the length of furcal rami; outer seta somewhat spine-like and shorter than the dorsal seta (Fig. 1).

First antenna markedly shorter than cephalothorax, consisting of 6 segments, the 3rd of which is very long (Fig. 2).

Table 4. *Paracyclops aioiensis* n. sp.

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 0.608	63 : 23 = 2.7 : 1	36 : 33 = 1.1 : 1	28 : 20 = 1.4 : 1	26 : 20 = 1.3 : 1	No. 1



Figs. 1—9. *Paracyclops aoiensis* n. sp.

Female, Aoi (Loc. No. 1), Hyogo Pref.

1. Furcal rami (dorsal); 2. First antenna; 3. Endopodite 3 of leg 4; 4. Connecting plate of leg 4; 5. Leg 1; 6. Leg 2; 7. Leg 3; 8. Leg 4; 9. Leg 5.

Legs 1—4: formula 3,3/3,3/3,3/3,3; spine-formula 3,4, 4,3; seta-formula 5,5, 5,5. Leg 1 with very long inner spine on the basis, endopodite 3 with a relatively short outer seta. Leg 2: endopodite 2 bearing 2 setae as in legs 1, 3 and 4; outer seta of endopodite 3 shorter than the apical spine. Leg 4: endopodite 3 less than twice as long as wide (1.4 : 1); terminal spines nearly equal in length, the inner spine a little longer than the outer (1.3 : 1) and slightly shorter than the segment (94%), (Fig. 3). Leg 5 consists of a segment, with 2 outer setae, which are usually equal in length, and a stout inner spine. (Fig. 9).

Connecting plate of Leg 4 is as shown in Fig. 4. Receptaculum seminis not distinct.

Locality. — No. 1 (1 ♀).

Holotype: Female (Loc. No. 1); the type is deposited in the Faculty of Fisheries, Prefectural University of Mie.

Remarks: This species is distinguishable from *Paracyclops affinis* (SARS) by the 6-segmented first antenna, the more longer inner furcal seta, the shorter inner terminal spine of the endopodite 3 of leg 4, and by the structure of legs 1—4 and 5.

6) *Acanthocyclops miurai* n. sp. (Figs. 10—19), Table 5)

Female. — Length 1.265 mm except furcal setae. Body white in colour, without nauplius eye.

Furcal rami placed slightly wide apart, relatively short, 3.4 times as long as wide; inner margin without hairs; lateral seta located at about distal 1/3; furcal setae well-developed, their length is, from inner to outer and dorsal, as follows:

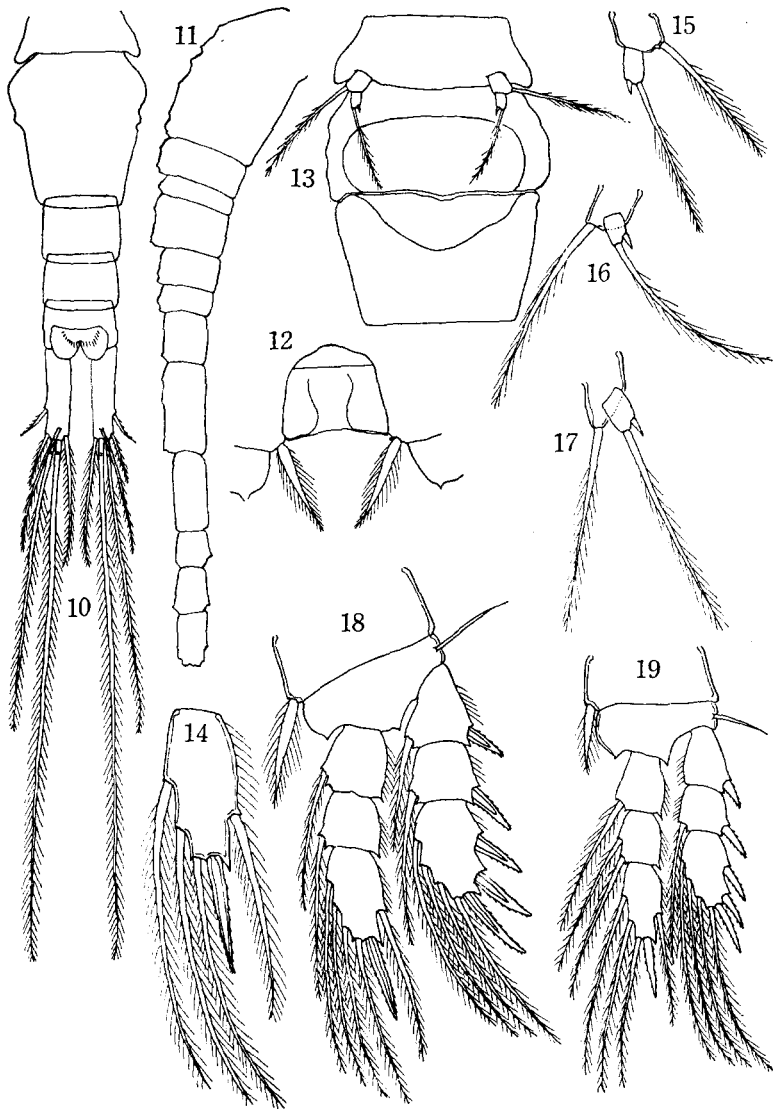
Loc.	I (in.)	II	III	IV (out.)	V (dors.)	
Aioi (Hyogo)	188	670	347	62	136	(μ)

Inner furcal seta much longer than the outer (2.7 : 1), and longer than furcal rami (1.8 : 1); dorsal seta particularly well-developed, much longer than the outer seta, but shorter than the inner one.

Anal segment with a row of denticles on the dorsal surface of anal operculum (Fig. 10). First antenna consists of 12 segments, nearly reaching the end of cephalothorax (Fig. 11).

Legs 1—4: formula 3,3/3,3/3,3/3,3; spine-formula 2,3, 3,3; seta-formula 4,4, 4,4. (Figs. 18—21). Endopodite 3 of leg 4 relatively slender, twice as long as wide, bearing a single terminal spine, 42.9 μ in length; the terminal spine slightly shorter than the segment (81%); and the inner spine transforms into a long and slender, usual seta (Fig. 14).

Leg 5 consists of 2 segments; segment 1 larger and broad, with a



Figs. 10—19. *Acanthocyclops miurai* n. sp.
 Female, Aioi (Loc. No. 3), Hyogo Pref.

10. Abdomen and furcal rami (dorsal); 11. First antenna; 12. Connecting plate of leg 4; 13. Leg 5 and receptaculum seminis; 14. Endopodite 3 of leg 4; 15. Leg 5; 16. Leg 5; 17. Leg 5; 18. Leg 2; 19. Leg 4.

slender seta; seg. 2 small and slender, with a slender terminal seta and a small subapical spine (Fig. 13 and Figs. 15—17).

Connecting plate of leg 4 very simple, as shown in Fig. 12. Receptaculum seminis as shown in Fig. 13.

Male. — Length 1.004 mm. Body white in colour, nauplius eye entirely absent. Furcal rami about 3.9 times as long as wide. Both the inner and the dorsal furcal setae much longer than the outer one (2.7 : 1), and much longer than furcal rami (Fig. 22). Length of furcal setae is, from inner to outer and dorsal, as follows:

Loc.	I (in.)	II	III	IV (out.)	V (dors.)	(μ)
Aioi (Hyogo)	125	533	298	46	99	(μ)

Endopodite 3 of leg 4 relatively long, 1.8 times as long as wide, with a single terminal spine, and inner spine transforms into an usual seta as in female. (Fig. 23).

Type locality. — Aioi City, Hyogo Prefecture (Loc. No. 1, 1 ♀; Loc. No. 3, 2 ♀♀, 1 ♂). The other locality (Loc. No. 12, 1 ♀).

Holotype. — Female; allotype: male (Loc. No. 3). The types are preserved in the Faculty of Fisheries, Prefectural University of Mie.

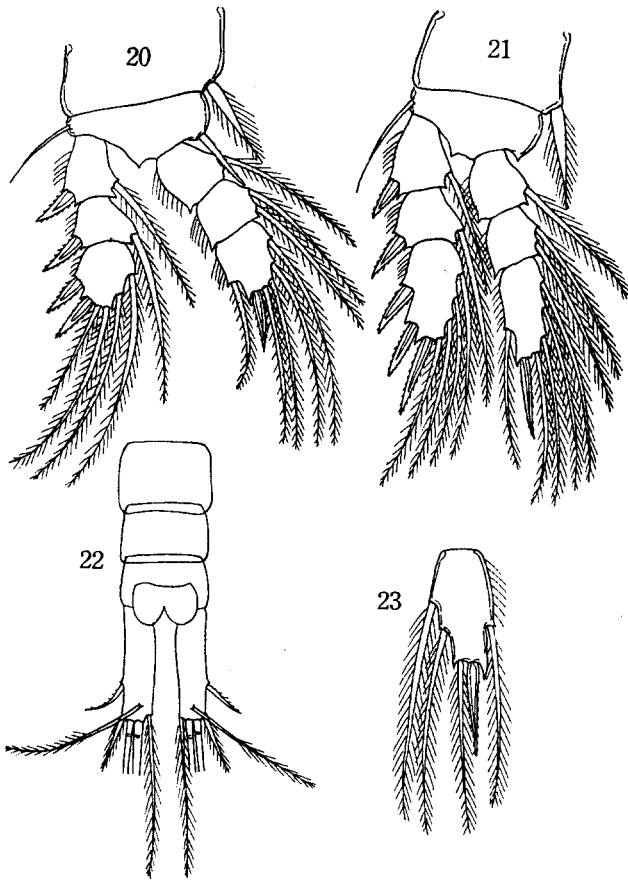
Variation. — The individual and local variations in some taxonomic characters of the new species are as shown in Table 5.

Table 5. *Acanthocyclops miurai* n. sp.

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 1.339	116 : 30 = 3.9 : 1	165 : 73 = 2.3 : 1	59 : 26 = 2.3 : 1	** 49.5	No. 3
♂ 1.265	102 : 30 = 3.4 : 1	188 : 69 = 2.7 : 1	53 : 26 = 2.0 : 1	** 42.9	„
♂ 1.004	89 : 23 = 3.9 : 1	125 : 46 = 2.7 : 1	46 : 26 = 1.8 : 1	** 36.3	„
♀ 1.290	125 : 26 = 4.8 : 1	185 : 46 = 4.0 : 1	59 : 30 = 2.0 : 1	** 52.8	No. 12

** The inner terminal spine transforms into a usual seta.

Remarks. — In its 12-segmented first antennae, longer inner and dorsal furcal setae, and formulae in legs 1—4, this new species is nearly allied to *Acanthocyclops morimotoi* ITO which was described by the author (1952) on the basis of specimens taken in the wells used for the water-works of Himeji City, Hyogo Prefecture. It is, however, distinguishable from *A. morimotoi* in the presence of a row of denticles on the dorsal surface of anal operculum and its inner terminal seta on endopodite 3 of leg 4.



Figs. 20—23. *Acanthocyclops miurai* n. sp.
20—21. Female; 22—23. Male; 20. Leg 1; 21. Leg 3; 22. Furcal rami (dorsal);
23. Endopodite 3 of leg 4.

Table 6. *Diacyclops disjunctus* (THALLWITZ)

Body-length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 0.868	69 : 20 = 3.5 : 1	36 : 30 = 1.2 : 1	32 : 23 = 1.4 : 1	43 : 33 = 1.3 : 1	No. 7
♂ 0.682	53 : 17 = 3.2 : 1	50 : 33 = 1.5 : 1	26 : 20 = 1.3 : 1	26 : 23 = 1.1 : 1	„
„ 0.558	46 : 15 = 3.1 : 1	23 : 23 = 1.0 : 1	23 : 17 = 1.4 : 1	23 : 17 = 1.4 : 1	„
„ 0.508	40 : 17 = 2.4 : 1	23 : 26 = 0.9 : 1	20 : 15 = 1.3 : 1	20 : 17 = 1.2 : 1	„
♀ 0.992	79 : 23 = 3.4 : 1	33 : 40 = 0.8 : 1	36 : 26 = 1.4 : 1	50 : 36 = 1.4 : 1	No. 8
„ 0.880	73 : 20 = 3.7 : 1	33 : 36 = 0.9 : 1	33 : 23 = 1.4 : 1	43 : 33 = 1.3 : 1	„
♂ 0.694	63 : 17 = 3.8 : 1	36 : 40 = 0.9 : 1	30 : 20 = 1.5 : 1	33 : 26 = 1.3 : 1	No. 11
♀ 0.918	83 : 20 = 4.2 : 1	73 : 43 = 1.7 : 1	33 : 20 = 1.4 : 1	30 : 26 = 1.1 : 1	No. 12
„ 0.955	76 : 23 = 3.3 : 1	46 : 36 = 1.3 : 1	36 : 26 = 1.4 : 1	43 : 36 = 1.2 : 1	No. 13
♂ 0.645	69 : 17 = 4.2 : 1	66 : 30 = 2.2 : 1	30 : 23 = 1.3 : 1	30 : 23 = 1.3 : 1	„
„ 0.806	69 : 20 = 3.5 : 1	50 : 33 = 1.5 : 1	30 : 23 = 1.3 : 1	40 : 30 = 1.3 : 1	No. 18
♀ 0.880	79 : 20 = 4.0 : 1	36 : 40 = 0.9 : 1	33 : 23 = 1.4 : 1	36 : 30 = 1.2 : 1	No. 21
„ 0.744	79 : 20 = 4.0 : 1	36 : 40 = 0.9 : 1	30 : 20 = 1.5 : 1	36 : 30 = 1.2 : 1	„
„ 0.868	69 : 23 = 3.0 : 1	109 : 50 = 2.2 : 1	36 : 23 = 1.6 : 1	36 : 23 = 1.6 : 1	No. 23
♂ 0.657	56 : 20 = 2.8 : 1	33 : 33 = 1.0 : 1	30 : 20 = 1.5 : 1	36 : 30 = 1.2 : 1	„
♀ 1.029*	79 : 25 = 3.2 : 1	36 : 46 = 0.8 : 1	36 : 26 = 1.4 : 1	46 : 36 = 1.3 : 1	No. 26
„ 0.942*	66 : 20 = 3.3 : 1	33 : 40 = 0.8 : 1	30 : 23 = 1.3 : 1	40 : 33 = 1.2 : 1	„
♂ 0.781	59 : 18 = 3.3 : 1	33 : 40 = 0.8 : 1	26 : 23 = 1.1 : 1	40 : 33 = 1.2 : 1	„
♀ 0.769	56 : 20 = 2.8 : 1	83 : 36 = 2.3 : 1	23 : 20 = 1.2 : 1	26 : 21 = 1.2 : 1	No. 30
„ 0.620	56 : 20 = 2.8 : 1	96 : 36 = 2.6 : 1	26 : 23 = 1.1 : 1	23 : 20 = 1.2 : 1	„
♂ 0.645	46 : 17 = 2.8 : 1	69 : 30 = 2.3 : 1	23 : 17 = 1.4 : 1	23 : 20 = 1.2 : 1	„

*, with egg-sacs.

7) *Diacyclops disjunctus* (THALLWITZ) (Table 6)

Length in mm: Female 0.868, male 0.508—0.682 (Loc. No. 7); female 0.880—0.992 (Loc. No. 8); male 0.694 (Loc. No. 11); female 0.918 (Loc. No. 12); female 0.955, male 0.645 (Loc. No. 13); female 0.744—0.880 (Loc. No. 21); female 0.868, male 0.657 (Loc. No. 23); female 0.942—1.209, male 0.781 (Loc. No. 26); female 0.620—0.769, male 0.645 (Loc. No. 30).

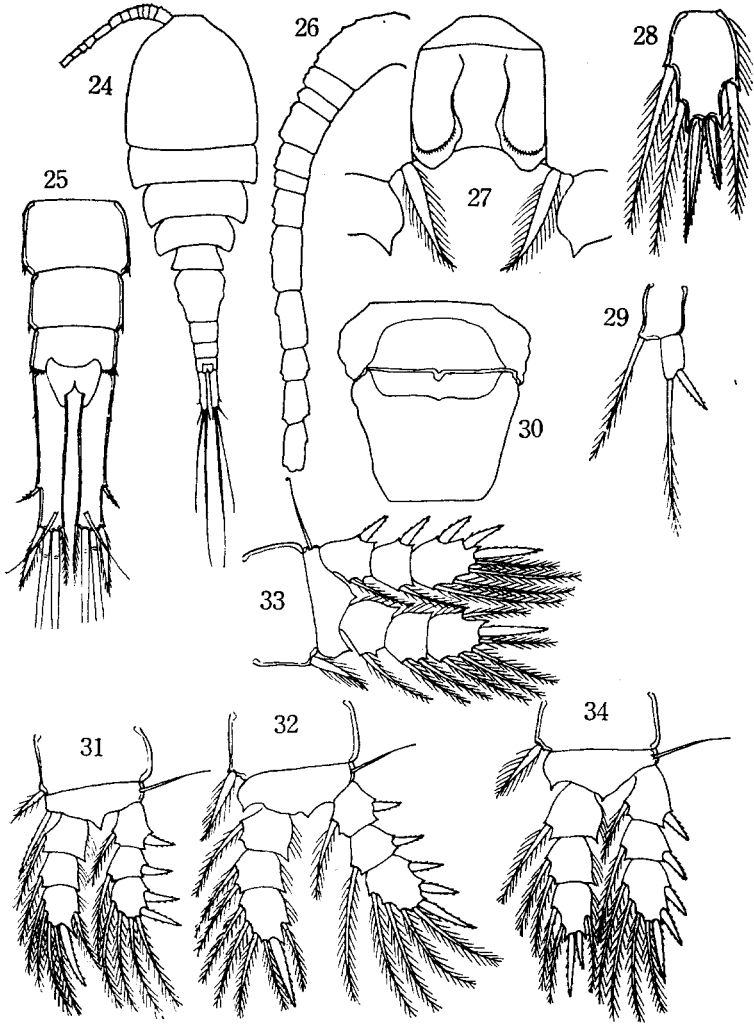
Body white in colour, nauplius eye entirely absent.

Occurrence: No. 4 (1 ♀); No. 7 (2 ♀♀, 3 ♂♂); No. 8 (2 ♀♀, 1 ♂); No. 11 (1 ♂); No. 12 (1 ♀); No. 13 (2 ♀♀, 1 ♂); No. 18 (1 ♂); No. 21 (2 ♀♀); No. 22 (2 ♂♂); No. 23 (1 ♀, 2 ♂♂); No. 26 (2 ♀♀, 1 ♂); No. 30 (2 ♀♀, 1 ♂).

8) *Diacyclops crassicaudis* (G. O. SARS) (Figs. 24—34, Table 7)

Female. — Length 1.141 mm except furcal setae. Body white in colour, without nauplius eye.

Furcal rami very slender, 5.7 times as long as wide, placed relatively narrow together; lateral seta inserted at distal 1/4; inner margin



Figs. 24—34. *Diacyclops crassicaudis* (G. O. Sars)

Female, Setaka (Fukuoka Pref.)

24. Female (dorsal); 25. Furcal rami (dorsal); 26. First antenna; 27. Connecting plate of leg 4; 28. Endopodite 3 of leg 4; 29. Leg 5; 30. Receptaculum seminis; 31. Leg 1; 32. Leg 2; 33. Leg 3; 34. Leg 4.

without hairs; length of furcal setae is, from inner to outer and dorsal, as follows:

Loc.	I (in.)	II	III	IV (out.)	V (dors.)	(μ)
Setaka (Fukuoka)	40	484	322	53	53	(μ)

Inner furcal seta a little shorter than the outer (0.8 : 1), and markedly shorter than furcal rami (about 1/3); the dorsal seta nearly as long as the outer one, but longer than the inner seta. (Fig. 25).

First antenna consists of 12 segments, relatively short, not reaching the end of cephalothorax (Figs. 24 and 26).

Legs 1—4: formula 3,3/3,3/3,3/3,3; spine-formula 2,3, 3,3; seta-formula 4,4, 4,4. (Figs. 31—34). Endopodite 3 of leg 4 rather short, 1.2 times as long as wide; terminal spines markedly unequal, the inner spine much longer than the outer (1.8 : 1) and longer than the segment (125%). (Fig. 28). Connecting plate of leg 4 and receptaculum seminis are as shown in Fig. 27 and Fig. 30 respectively.

Leg 5 consists of 2 segments as shown in Fig. 29.

Occurrence. — No. 26 (1 ♀).

Male. — Not collected.

Table 7. *Diacyclops crassicaudis* (G. O. SARS)

Body-length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i : o. (μ)	Loca- lity
♀1.141*	122 : 21 = 5.7 : 1	40 : 53 = 0.8 : 1	40 : 33 = 1.2 : 1	50 : 28 = 1.8 : 1	No. 26

*, with egg-sacs.

9) *Diacyclops languidoides* (LILLJEBORG) (Table 8)

Length in mm: Female 0.496 (Loc. No. 7); female 0.484 (Loc. No. 8); female 0.583—0.744 (Loc. No. 26).

Body white in colour, without nauplius eye.

Occurrence: No. 7 (1 ♀); No. 8 (1 ♀); No. 14 (1 ♂); No. 26 (7 ♀♀, 4 ♂♂).

Table 8. *Diacyclops languidoides* (LILLJEBORG)

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 0.496	46 : 15 = 3.1 : 1	20 : 26 = 0.8 : 1	23 : 17 = 1.4 : 1	20 : 15 = 1.3 : 1	No. 7
„ 0.484	40 : 13 = 3.0 : 1	13 : 23 = 0.6 : 1	20 : 17 = 1.2 : 1	23 : 17 = 1.4 : 1	No. 8
♂ 0.657	50 : 17 = 3.0 : 1	36 : 33 = 1.1 : 1	26 : 18 = 1.5 : 1	33 : 26 = 1.3 : 1	No. 14
♀ 0.744	69 : 23 = 3.0 : 1	33 : 40 = 0.8 : 1	30 : 23 = 1.3 : 1	43 : 36 = 1.2 : 1	No. 26
„ 0.583	50 : 17 = 3.0 : 1	26 : 33 = 0.8 : 1	33 : 26 = 1.3 : 1	33 : 26 = 1.3 : 1	„

10) *Diacyclops languidoides japonicus* ITO (Table 9)

Length in mm: 0.794—0.843, male 0.682 (Loc. No. 8); female 0.893, male 0.707 (Loc. No. 9).

Body white in colour, nauplius eye entirely absent.

Occurrence: No. 1 (1 ♀); No. 4 (4 ♀♀, 1 ♂); No. 8 (11 ♀♀, 3 ♂♂); No. 9 (3 ♀♀, 1 ♂).

Table 9. *Diacyclops languidoides japonicus* ITO

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 0.843	79 : 20 = 4.0 : 1	92 : 40 = 2.3 : 1	26 : 23 = 1.1 : 1	30 : 26 = 1.1 : 1	No. 8
„ 0.806	79 : 20 = 4.0 : 1	96 : 43 = 2.2 : 1	30 : 23 = 1.3 : 1	36 : 33 = 1.1 : 1	„
„ 0.794	69 : 20 = 3.5 : 1	86 : 40 = 2.2 : 1	23 : 23 = 1.0 : 1	28 : 26 = 1.1 : 1	„
♂ 0.682	59 : 20 = 3.0 : 1	66 : 30 = 2.2 : 1	23 : 20 = 1.2 : 1	23 : 20 = 1.2 : 1	„
♀ 0.893	79 : 20 = 4.0 : 1	76 : 36 = 2.1 : 1	33 : 26 = 1.3 : 1	33 : 26 = 1.3 : 1	No. 9
♂ 0.707	59 : 17 = 3.6 : 1	76 : 30 = 2.6 : 1	26 : 20 = 1.3 : 1	30 : 26 = 1.1 : 1	„

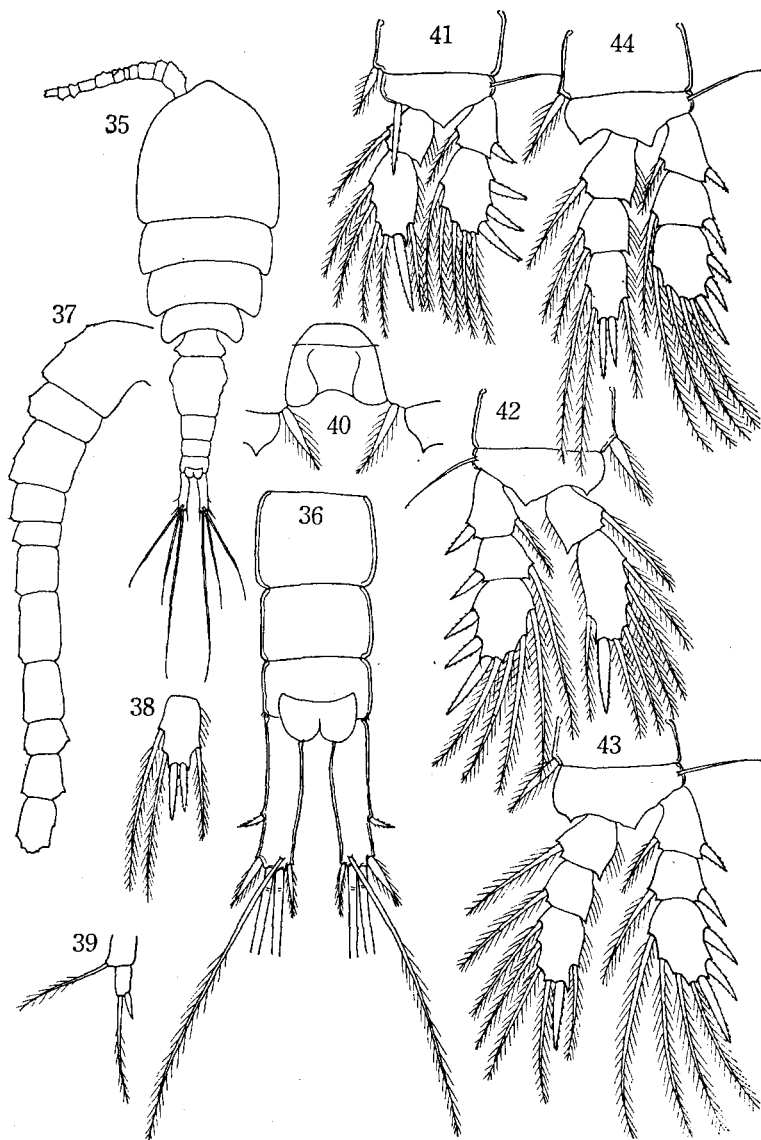
11) *Diacyclops languidoides suoensis* ITO

(Figs. 35—44, Figs. 45—48; Table 10)

Diacyclops languidoides suoensis, 1954, ITO, T., Report of Faculty of Fisheries, Prefectural University of Mie, Vol. 1, No. 3, p. 399—401, Figs. 144—148.

Male — Length 0.496 mm. (Loc. No. 9), 0.508 mm. (Loc. No. 32) except furcal setae. Body white in colour, nauplius eye entirely absent.

Furcal rami relatively short, 3.5—3.8 times as long as wide; lateral seta located at about distal 1/3; length of furcal setae is, from inner to outer and dorsal, as follows:



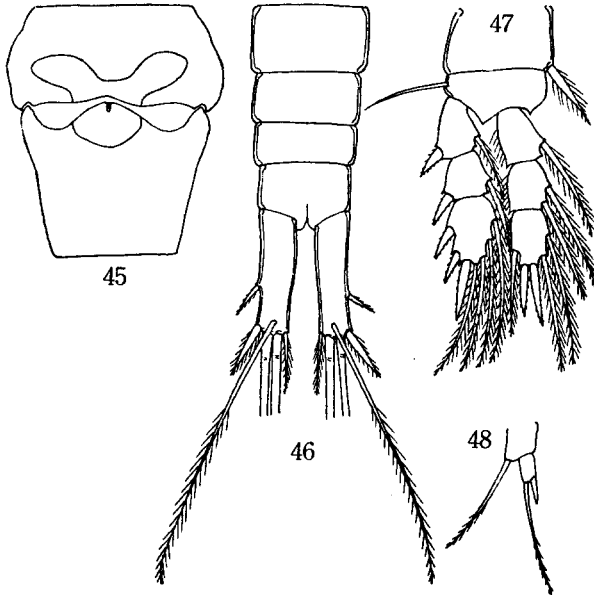
Figs. 35—44. *Diacyclops languidoides suoensis* ITO

Female, Naze (Amami-Oshima Island, Ryukyu).

35. Female (dorsal); 36. Furcal rami (dorsal); 37. First antenna; 38. Endopodite 3 of leg 4; 39. Leg 5; 40. Connecting plate of leg 4; 41. Leg 1; 42. Leg 2; 43. Leg 3; 44. Leg 4.

Loc.		I	II	III	IV	V	
		(in.)			(out.)	(dors.)	
Yoshida (Hiroshima)	(♂)	17	372	119	20	102	(μ)
Naze (Amami-Oshima)	(♂)	23	273	136	26	112	(μ)
„	(♀)	20	248	124	23	132	(μ)
„	(♀)	26	260	124	26	139	(μ)

Inner furcal seta rather small, shorter than the outer (0.8—0.9 : 1), and also shorter than furcal rami (About 1/2); dorsal seta well-developed, markedly longer than furcal rami (about 2 : 1) and as long as the outer-median furcal seta. (Fig. 46).



Figs. 45—48. *Diacyclops languidooides suoensis* Ito
Naze (Amami-Oshima, Ryukyu).

45. Female, 46—48. Male. 45. Receptaculum seminis; 46. Furcal rami (ventral); 47. Leg 4; 48. Leg 5.

Legs 1—4: formula 2,2/3,2/3,3/3,3; spine-formula 2,3, 3,3; seta-formula 5,4, 4,4 as in *Diacyclops languidoides*, *D. languidooides japonicus*. Endopodite 3 of leg 4 very short, 1.2—1.4 times as long as wide; terminal spines nearly equal in length, the inner spine slightly longer than the outer one (1.2 : 1), and as long as the segment (100%). (Fig. 47). Leg 5 consists of 2 segments as shown in Fig. 48.

Female. — Length 0.570—0.657 mm. Body white, without nauplius eye.

Occurrence. — No. 9 (1 ♂); No. 30 (11 ♀♀, 1 ♂); No. 32 (1 ♂).

Table 10. *Diacyclops languidoides suoensis* ITO

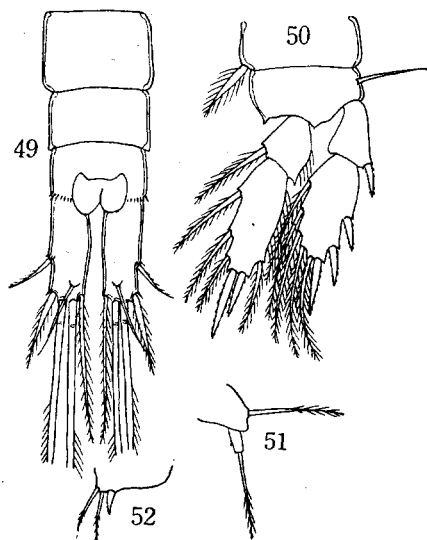
Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♂ 0.496	46 : 13 = 3.5 : 1	17 : 20 = 0.8 : 1	20 : 17 = 1.2 : 1	20 : 17 = 1.2 : 1	No. 9
♀ 0.570	50 : 17 = 3.4 : 1	20 : 23 = 0.9 : 1	23 : 17 = 1.4 : 1	23 : 17 = 1.4 : 1	No. 30
„ 0.620	53 : 15 = 3.6 : 1	20 : 23 = 0.9 : 1	23 : 17 = 1.4 : 1	23 : 20 = 1.2 : 1	„
„ 0.620	53 : 15 = 3.6 : 1	23 : 23 = 1.0 : 1	23 : 18 = 1.3 : 1	23 : 20 = 1.2 : 1	„
„ 0.645	56 : 15 = 3.8 : 1	26 : 26 = 1.0 : 1	26 : 20 = 1.3 : 1	26 : 21 = 1.2 : 1	„
„ 0.657	56 : 15 = 3.8 : 1	23 : 26 = 0.9 : 1	23 : 17 = 1.4 : 1	26 : 20 = 1.3 : 1	„
♂ 0.508	50 : 13 = 3.8 : 1	23 : 26 = 0.9 : 1	23 : 17 = 1.4 : 1	23 : 20 = 1.2 : 1	No. 32

12) *Microcyclops (Microcyclops) varicans* (G. O. SARS)

(Figs. 49—52, Table 11)

Male. — Length 0.595—0.608 mm except furcal setae. Body yellowish white in colour, without nauplius eye.

Furcal rami nearly parallel, rather short, 2.6 times as long as wide; lateral seta inserted at distal about 1/3; inner margin without hairs; length of furcal setae is, from inner to outer and dorsal, as follows:

Figs. 49—52. *Microcyclops (Microcyclops) varicans* (G. O. SARS)

Male, limestone cave, "Ryugado" (Shikoku).

49. Furcal rami (dorsal); 50. Leg 4; 51. Leg 5; 52. Leg 6.

Loc.	I	II	III	IV	V	
	(in.)			(out.)	(dors.)	
Cave „Ryugado” (Kochi)	63	264	168	30	33	(μ)

Inner furcal seta much longer than the outer (1.9—2.1 : 1); and longer than furcal rami; the dorsal seta slightly longer than the outer. (Fig. 49).

Legs 1—4: formula 2,2/2,2/2,2/2,2; spine-formula 3,4, 4,3; seta-formula 5,5, 5,5. Leg 4: exopodite 1 without inner seta; endopodite 2 relatively slender, with 3 setae on inner side, and a single seta on outer side, 2.3—2.5 times as long as wide; terminal spines unequal, the inner spine much longer than the outer (1.8 : 1), but markedly shorter than the segment (60—64%). (Fig. 50).

Table 11. *Microcyclops (Microcyclops) varicans* (G. O. SARS)

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♂ 0.608	43 : 17 = 2.6 : 1	63 : 33 = 1.9 : 1	46 : 20 = 2.3 : 1	30 : 17 = 1.8 : 1	No. 19
„ 0.595	43 : 17 = 2.6 : 1	63 : 30 = 2.1 : 1	50 : 20 = 2.5 : 1	30 : 17 = 1.8 : 1	„

Leg 5 as shown in Fig. 51, similar to that of female. Leg 6: inner spine very small and short; outer 2 setae rather slender, nearly equal in length, and longer than the inner spine (Fig. 52).

Female. — Not found.

Occurrence. — No. 19 (2 ♂♂).

13) *Mesocyclops leuckarti* (CLAUS) (Table 12)

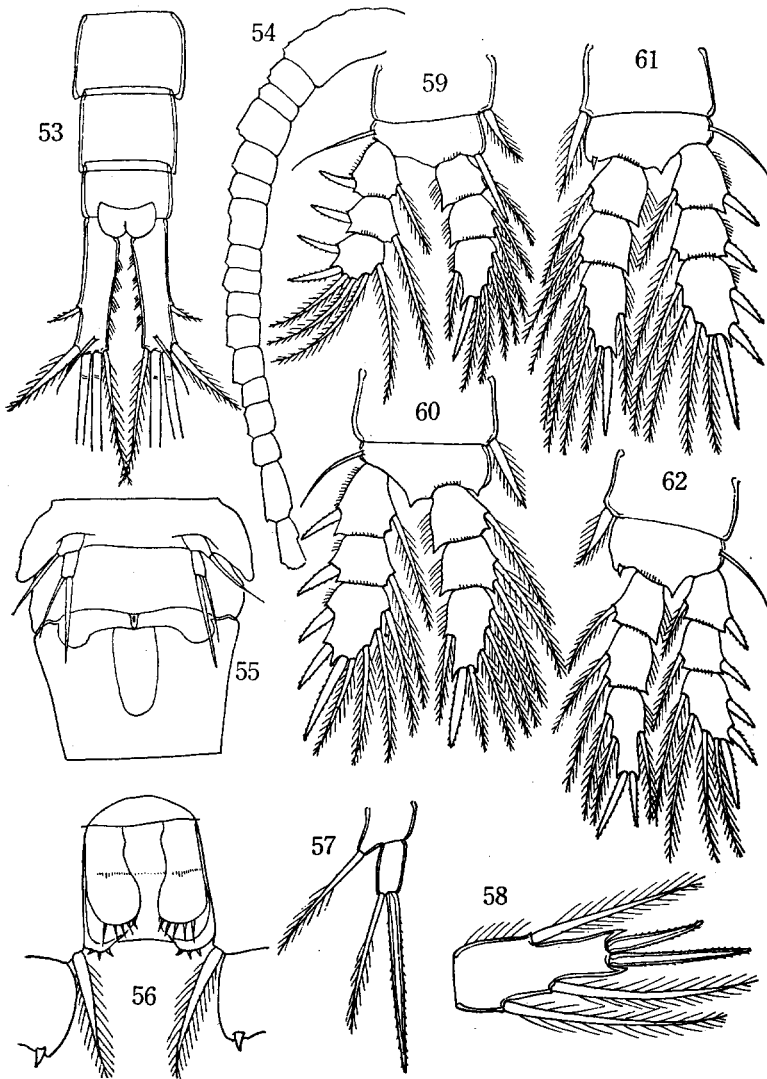
Length: Female 1.302—1.426 mm.

Body yellowish brown in colour, without nauplius eye.

Occurrence: No. 14 (7 ♀♀); No. 15 (2 ♀♀).

Table 12. *Mesocyclops leuckarti* (CLAUS)

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i. : o. (μ)	Loca- lity
♀ 1.426	102 : 33 = 3.1 : 1	310 : 109 = 2.8 : 1	89 : 33 = 2.7 : 1	76 : 83 = 0.9 : 1	No. 14
„ 1.302	92 : 31 = 2.9 : 1	298 : 102 = 2.9 : 1	89 : 30 = 3.0 : 1	69 : 83 = 0.8 : 1	„



Figs. 53—62. *Thermocyclops uenoi* ITO

Female, Sasaguri (Fukuoka Pref., Kyushu).

53. Furcal rami (dorsal); 54. First antenna; 55. Leg 5 and receptaculum seminis; 56. Connecting plate of leg 4; 57. Leg 5; 58. Endopodite 3 of leg 4; 59. Leg 1; 60. Leg 2; 61. Leg 3; 62. Leg 4.

14) *Thermocyclops uénoi* ITO

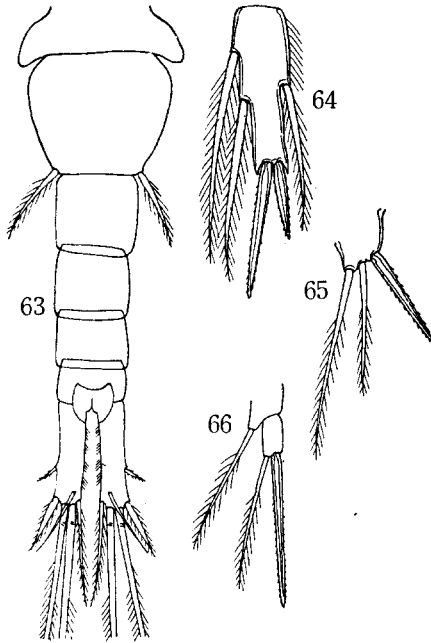
(Figs. 53—62, Figs. 63—66; Table 13)

Female. — Length 1.203—1.290 mm. Body brownish yellow in colour, nauplius eye entirely absent.

Furcal rami 3.4—4.1 times as long as wide; inner margin bearing 4 bundles of fine hairs; length of furcal setae is, from inner to outer and dorsal, as follows:

Loc.		I (in.)	II	III	IV (out.)	V (dors.)	
Sasaguri (Fukuoka)	(♀)	112	434	310	79	66	(μ)
„	(♀)	116	409	298	83	79	(μ)
„	(♀)	116	409	285	76	66	(μ)
„	(♀)	106	372	273	69	59	(μ)
„	(♀)	116	372	298	79	73	(μ)
„	(♂)	83	360	248	46	76	(μ)

First antenna consists of 17 segments, relatively short, reaching to the end of cephalothorax (Fig. 54).



Figs. 63—66. *Thermocuclops uénoi* ITO

Male, Sasaguri (Fukuoka Pref., Kyushu).

63. Abdomen and furcal rami (dorsal); 64. Endopodite 3 of leg 4; 65. Leg 6; 66. Leg 5.

Male. — Length 0.967 mm. Body brownish yellow, without nauplius eye as in female.

Furcal rami nearly parallel in direction, 4 times as long as wide; lateral seta inserted at distal 1/3; inner margin with 4 bundles of fine hairs as in female; inner furcal seta longer than the outer (1.8 : 1), and slightly shorter than furcal rami; the dorsal seta longer than the outer, but shorter than the inner one. (Fig. 63).

Legs 1—4: formula 3,3/3,3/3,3/3,3; spine-formula 2,3, 3,3; seta-formula 4,4, 4,4 as in female. Endopodite 3 of leg 4 relatively slender, 2.6 times as long as wide; terminal spines unequal in length, the inner spine markedly longer than the outer one (1.7 : 1), and slightly shorter than the segment. (Fig. 64). Leg 5 as shown in Fig. 66. Leg 6 bearing a well-developed inner spine and 2 outer setae, the outer seta is longest. (Fig. 65).

Occurrence. — No. 20 (1 ♀); No. 21 (15 ♀♀, 1 ♂).

Table 13. *Thermocyclops uénoi* ITO

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i : o. (μ)	Loca- lity
♀ 1.228	109 : 30 = 3.7 : 1	112 : 79 = 1.4 : 1	66 : 26 = 2.5 : 1	59 : 40 = 1.5 : 1	No. 20
„ 1.290	109 : 30 = 3.7 : 1	116 : 83 = 1.4 : 1	66 : 30 = 2.2 : 1	63 : 43 = 1.5 : 1	No. 21
„ 1.228	109 : 30 = 3.7 : 1	116 : 76 = 1.5 : 1	63 : 30 = 2.1 : 1	59 : 43 = 1.4 : 1	„
„ 1.228	109 : 26 = 4.1 : 1	106 : 69 = 1.5 : 1	66 : 26 = 2.5 : 1	56 : 40 = 1.4 : 1	„
„ 1.203	109 : 28 = 3.9 : 1	116 : 79 = 1.5 : 1	63 : 30 = 2.1 : 1	63 : 43 = 1.5 : 1	„
♂ 0.967	86 : 21 = 4.0 : 1	83 : 46 = 1.8 : 1	59 : 23 = 2.6 : 1	56 : 33 = 1.7 : 1	„

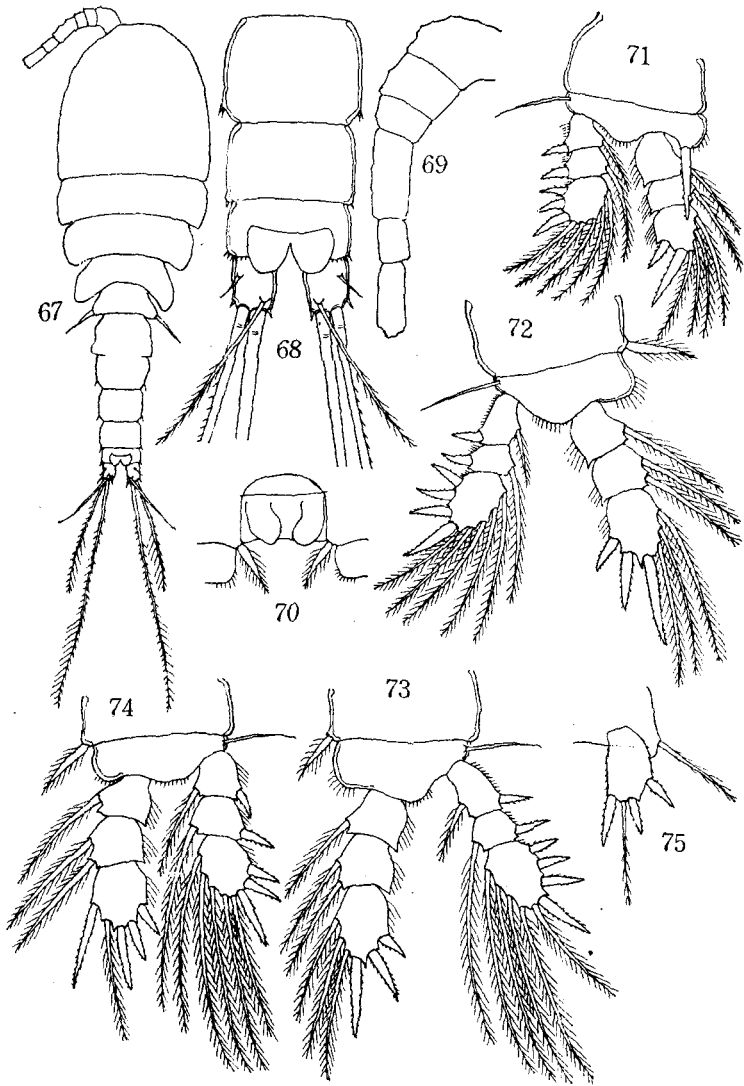
Remarks. — The present species was first described by the present author (1952) in the specimens from a well of Sashiki-machi, Kumamoto Prefecture, in the western part of Kyushu. The specimens of this locality had a distinctly red nauplius eye, but those collected from the wells in Sasaguri-machi, Fukuoka Prefecture, had no nauplius eye. Recently, I also found the blind forms in the specimens collected by Mr. TOSHIHIKO MIZUNO of Osaka Gakugei University from a well on the island „Tomogashima”, Wakayama Prefecture.

15) *Halicyclops higoensis* n. sp.

(Figs. 67—75, Figs. 76—79; Table 14)

Female. — Length 0.521 mm except furcal setae. Body white in colour, nauplius eye entirely absent.

Anterior division of the body broad, somewhat flattened. Margins of abdominal segments smooth; lateral sides of the middle of genital



Figs. 67—75. *Halicyclops higoensis* n. sp.

Female, Hinagu (Kumamoto Pref., Kyushu).

67. Female (dorsal); 68. Furcal rami (dorsal); 69. First antenna; 70. Connecting plate of leg 4; 71. Leg 1; 72. Leg 2; 73. Leg 3; 74. Leg 4; 75. Leg 5.

segment slightly produced; anal segment generally deeply cleft ventrally, with a row of spinules at base of furcal rami. (Figs. 67 and 68).

Furcal rami very short, nearly as long as wide (1.1 : 1); inner and outer margins without hairs; lateral seta very small, inserted at distal 3/5. Length of furcal setae is, from inner to outer and dorsal, as follows:

Loc.	I (in.)	II	III	IV (out.)	V (dors.)	
Hinagu (Kumamoto)	5	285	149	5	76	(μ)

Inner and outer furcal setae very small and short, nearly equal in length, markedly shorter than furcal rami; dorsal seta very long, 3.8 times as long as furcal rami, and beset on a small protuberance; the inner-median seta very long, about twice as long as the outer-median seta; both median setae coarsely feathered. (Figs. 67 and 68).

First antenna consists of 6 segments, reaching to the middle of cephalothorax (Figs. 67 and 69). Second antenna consists of 3 segments.

Legs 1—4: formula 3,3/3,3/3,3/3,3; spine-formula in exopodite 3,4, 4,3; seta-formula in exopodite 5,5, 5,5; spine-formula in endopodite 2,3, 3,4; seta-formula in endopodite 4,3, 3,1. Endopodite 2 of leg 1 bearing a single seta, but those of legs 2—4 with 2 setae respectively. Endopodite 3 of leg 4 rather short, nearly as long as wide (1.2 : 1); terminal spines unequal in length, the inner spine longer than the outer one (1.3 : 1), and also longer than the segment (114%); the outer marginal seta spine-like, 13 μ in length; the proximal inner marginal seta also spine-like, 33 μ in length. (Figs. 71—74).

Leg 5: segment 1 fused with the last thoracic segment, and bears a slender seta; segment 2 is a flat plate, with 3 short spines and a slender seta. (Fig. 75). Connecting plate of leg 4 as shown in Fig. 70.

Male. — Length 0.459 mm. Body white in colour, without nauplius eye as in female.

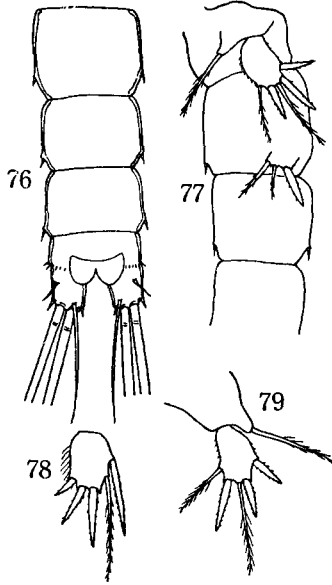
Furcal rami very short, as long as wide (1.0 : 1); length of furcal setae is, from inner to outer and dorsal, as follows:

Loc.	I (in.)	II	III	IV (out.)	V (dors.)	
Hinagu (Kumamoto)	3	235	112	3	56	(μ)

Both inner and outer setae very small, equal in length; the dorsal seta rather long, 3.4 times as long as the furcal rami.

Formulae of legs 1—4 similar to those of female. Endopodite 3 of leg 4 rather short, oval in general outline, 1.2 times as long as wide; the terminal spines unequal in length, the inner spine longer than the outer one (1.6 : 1), and a little longer than the segment (114%); outer marginal and inner proximal setae transforms into a

spine as in female, 11.6 μ and 26,4 μ in length respectively (Fig. 78). Leg 5 with 3 short spines and 2 slender setae (Fig. 79). Leg 6 bears a stout inner spine and 2 outer setae, the outermost seta longer than the median seta (Fig. 77).



Figs. 76—79. *Halicyclops higoensis* n. sp.

Male, Hinagu (Kumamoto Pref., Kyushu).

76. Furcal rami (dorsal); 77. Leg 5 and 6; 78. Endopodite 3 of leg 4; 79. Leg 5.

Type locality. — Hinagu-machi, Kumamoto Prefecture, Kyushu. (Loc. No. 27, 8 ♀♀, 10 ♂♂).

Holotype. — Female; allotype: male (Loc. No. 27). The type are deposited in the Faculty of Fisheries, Prefectural University of Mie.

Variation. — The individual variation in some taxonomic characters of the present species from the type locality are as shown in Table 14.

Table 14. *Halicyclops higoensis* n. sp.

Body- Length mm	Furca (μ)	Furcal seta i. : o. (μ)	Endopod 3, Leg 4 L. : B. (μ)	Spine, Endo- pod 3, Leg 4 i : o. (μ)	Loca- lity
♀ 0.583	20 : 17 = 1.2 : 1	5 : 5 = 1.0 : 1	23 : 23 = 1.0 : 1	26 : 20 = 1.3 : 1	No. 27
„ 0.521	20 : 18 = 1.1 : 1	5 : 5 = 1.0 : 1	23 : 20 = 1.2 : 1	26 : 20 = 1.3 : 1	„
„ 0.521	20 : 18 = 1.2 : 1	4 : 4 = 1.0 : 1	23 : 20 = 1.2 : 1	26 : 20 = 1.3 : 1	„
♂ 0.459	17 : 17 = 1.0 : 1	3 : 3 = 1.0 : 1	23 : 20 = 1.2 : 1	26 : 17 = 1.6 : 1	„

Remarks. — This new species is allied to both *Halicyclops neglectus* KIEFER and *H. rotundipes* KIEFER. The former was reported by KIEFER (1935, 1936) and SCHÄFER (1936) from the brackish-water regions in Holland, Belgium, England and Hiddensee. The latter was described by KIEFER (1935, 1936, 1938a, 1938b) from the Bulgarian coast of the Black Sea and the Korfu Island. This new species is also the closest to *H. rotundipes putealis* KIEFER, which was reported by KIEFER (1938b) from the brackish- and fresh-water wells in Bari City, South Italy. It is, however, distinguishable from the above-mentioned three forms in having the very short, spine-like inner and outer furcal setae, the spine-like inner proximal seta of endopodite 3 of leg 4, and the more slender leg 5.

AN ABNORMAL FORM

An abnormal male of *Eucyclops serrulatus* (FISCHER) was collected from a well in Iwakuni City, Yamaguchi Prefecture, Western Japan. The furcal rami of this animal are remarkably asymmetrical; the left

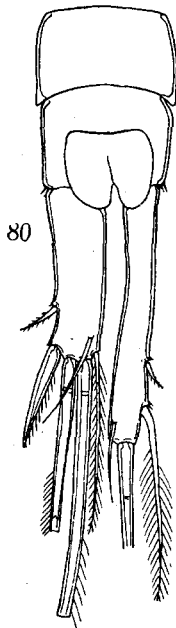


Fig. 80. Abnormal form in furcal rami of *Eucyclops serrulatus* (FISCHER). Iwakuni (Yamaguchi Pref.)

ramus is normal, 2.6 times as long as wide, but the right one is very long and slender, 6.8 times as long as wide, without the inner- and the inner median-setae, the outer seta markedly long, seta-like, about

twice as long as the left one. However, the other characters are normal (Fig. 80).

SUMMARY

In this paper the following 15 groundwater species belonging to the Cyclopoid Copepoda are reported, which were collected in 33 localities, 31 wells and 2 limestone caves, in various districts in South-western Japan, such as Chugoku, Shikoku, Kyushu and the Ryukyu Islands.

Wells: *Macrocyclus albidus* (JURINE)
Eucyclus serrulatus (FISCHER)
Eucyclus miurai ITO
Paracyclus fimbriatus (FISCHER)
Paracyclus aoiensis n. sp.
Acanthocyclus miurai n. sp.
Diacyclus disjunctus (THALLWITZ)
Diacyclus crassicaudis (G. O. SARS)
Diacyclus languidoides (LILLJEBORG)
Diacyclus languidoides japonicus ITO
Diacyclus languidoides suoensis ITO
Mesocyclus leuckarti (CLAUS)
Thermocyclus uénoi ITO
Halicyclus higoensis n. sp.

Subterranean pools in limestone caves:

Microcyclus (Microcyclus) varicans (G. O. SARS) („Rüyga-dō”, Kochi Pref., Shikoku)
Mesocyclus leuckarti (CLAUS) („Shühōdo”, Yamaguchi Pref.).

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