

Copepods in the Mountain Waters of Honshû, Japan

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The present report is based on a study of the harpacticoid copepods collected by Dr. Tomiko Ito, Hokkaido Fish Hatchery (13 samples, April 1979 to October 1981) and on the copepods of my own collection (46 samples, March 1986 to May 1988) gathered from the mountain waters of Honshû, Japan. Having examined these specimens, I was able to determine 14 species of cyclopoids and 26 species of harpacticoids, of 20 of the harpacticoid species (Ishida 1987) are common to Hokkaido, northern Japan. Our collection was mainly taken from the waters in the coniferous forests, since the majority of primeval broad-leaved forests of the mountainous region of Honshû have already been replaced by the plantations of conifers, mainly sugi (*Cryptomeria japonica*). Accordingly, the present result is biased in favour of the primary copepod fauna found in Honshû. In future, this bias must be corrected by collections taken from the waters in the broad-leaved forests which still remain. In the present paper, I try to summarize the distribution of the species, and offer some illustrations for diagnosis.

The methods of sampling in the fields and sorting in the laboratory are same to those of the previous report (Ishida 1987).

The following species were found in the samples examined :

	Number of localities occupied	Total number of individuals obtained
Cyclopoida		
1. <i>Macrocyclus fuscus</i> (Jurine)	9	19
2. <i>Macrocyclus albidus</i> (Jurine)	2	5
3. <i>Macrocyclus</i> sp.	15	57
4. <i>Eucyclus serrulatus</i> (Fischer)	17	265
5. <i>Paracyclus fimbriatus</i> (Fischer)	16	51
6. <i>Paracyclus affinis</i> (Sars)	2	2
7. <i>Cyclus visinus</i> Uljanin	1	1
8. <i>Acanthocyclus vernalis</i> (Fischer)	4	24
9. <i>Diacyclus languidus</i> (Sars)	2	3
10. <i>Diacyclus languidoides</i> (Lilljeborg)	1	1
11. <i>Diacyclus crassicaudis</i> (Sars)	1	2
12. <i>Mesocyclus leuckarti</i> (Claus)	1	1
13. <i>Microcyclus varicans</i> (Sars)	2	2
14. <i>Speocyclus yezoensis</i> Ito	10	17

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Harpacticoida		
1. * <i>Harpacticella paradoxa</i> (Brehm)	2	72
2. * <i>Canthocamptus staphylinus</i> (Jurine)	3	31
3. * <i>Canthocamptus mirabilis</i> Štěrba	4	183
4. * <i>Canthocamptus</i> sp. 2**	30	3,074
5. <i>Canthocamptus</i> sp. 3	13	732
6. <i>Canthocamptus</i> sp. 4	20	1,065
7. <i>Canthocamptus</i> sp. 5	2	62
8. <i>Canthocamptus</i> sp. 7	1	5
9. <i>Attheyella coiffaiti</i> Chappuis	2	16
10. * <i>Attheyella nakaii</i> (Brehm)	51	1,541
11. * <i>Attheyella crassa</i> (Sars)	6	73
12. * <i>Attheyella orientalis</i> Chappuis	6	13
13. * <i>Attheyella</i> sp. M	12	33
14. * <i>Attheyella nordenskjöldii</i> (Lilljeborg)	1	1
15. <i>Attheyella</i> sp. T	2	2
16. * <i>Maraenobiotus vejnovskyi</i> Mrázek	1	1
17. * <i>Maraenobiotus brucei</i> (Richard)	3	4
18. * <i>Moraria duthiei</i> (T. & A. Scott)	1	3
19. * <i>Moraria poppei</i> (Mrázek)	2	3
20. * <i>Moraria verica</i> (Graeter)	6	11
21. * <i>Moraria</i> sp. B	5	5
22. * <i>Bryocamptus zschokkei</i> (Schmeil)	44	652
23. * <i>Bryocamptus hiemalis</i> (Pearse)	1	8
24. * <i>Bryocamptus calvus</i> (Brehm)	51	1,329
25. * <i>Bryocamptus nivalis</i> (Willey)	3	6
26. * <i>Paracamptus reductus</i> Wilson	1	1

* Synonymy lists and illustrations of species with asterisk are given in Ishida (1987).

** The roman numeral used in Ishida (1987) was changed with Arabic after Kikuchi and Ishida (1988).

Abbreviations : The following abbreviations are used in plates ; P1-P5=legs 1-5, Enp.=endopodite, Fu=caudal rami with a part of the abdomen, f=female, m=male.

List of Localities and the Species Obtained

No. 1. Yunotanimura, Niigata Pref. (37°13'N, 139°01'E), a spring seeping area, 1 April 1979. *Canthocamptus* sp. 2 40 ♀, 17 ♂.

No. 2. Chûgûshi, Nikkô, Tochigi Pref. (36°44'N, 140°33'E), a small stream, 21 July, 1 September, 24 November and 30 December 1979. *Harpacticella paradoxa* 30 ♀, 20 ♂ ; *Cantho-*

camptus sp. 2 235 ♀, 49 ♂ ; *Attheyella nakaii* 69 ♀, 34 ♂ ; *A. orientalis* 1 ♀ ; *Bryocamptus calvus* 5 ♀, 1 ♂.

No. 3. Ôizumimura, Yamanashi Pref. (35°51'N, 138°22'E), a small spring stream, 28 December 1979. *Canthocamptus* sp. 2 5 ♀, 5 ♂.

No. 4. Kifune, Kyoto Pref. (35°06'N, 135°46'E), a small stream, 1 February 1981. *Canthocamptus* sp. 5 2 ♀, 2 ♂ ; *Attheyella nordenskjöldi* 1 ♀ ; *Bryocamptus calvus* 5 ♀.

No. 5. Jôetsushi, Niigata Pref. (37°05'N, 138°12'E), a small stream, 24 April 1981. *Canthocamptus mirabilis* 29 ♀, 28 ♂ ; *Canthocamptus* sp. 2 1 ♀ ; *Bryocamptus zschokkei* 2 ♀ ; *B. calvus* 18 ♀, 7 ♂.

No. 6. Ôkuwamura, Nagano Pref. (35°41'N, 137°41'E), a small stream, 26 April 1981. *Canthocamptus* sp. 2 2 ♀, 2 ♂ ; *Canthocamptus* sp. 4 6 ♀, 13 ♂ ; *Attheyella nakaii* 15 ♀, 11 ♂ ; *Moraria* sp. B 1 ♂ ; *Bryocamptus zschokkei* 4 ♀ ; *B. calvus* 41 ♀, 6 ♂.

No. 7. Mikawamura, Niigata Pref. (37°43'N, 139°24'E), a small stream, 28 April and 29 June 1981. *Canthocamptus* sp. 2 36 ♀, 54 ♂ ; *Attheyella nakaii* 32 ♀, 12 ♂ ; *Attheyella* sp. M 2 ♀ ; *Moraria* sp. B 1 ♀ ; *Bryocamptus zschokkei* 2 ♀, 1 ♂ ; *B. calvus* 38 ♀, 5 ♂ ; *B. nivalis* 1 ♀.

No. 8. Hanamaki-onsen, Iwate Pref. (39°28'N, 141°00'E), a small stream, 30 April 1981. *Canthocamptus mirabilis* 5 ♂, 1 ♂ ; *Canthocamptus* sp. 4 1 ♀, 1 ♂ ; *Attheyella nakaii* 1 ♀, 4 ♂ ; *Bryocamptus zschokkei* 4 ♀ ; *B. calvus* 15 ♀, 2 ♂.

No. 9. Futakuchi-onsen, Miyagi Pref. (38°16'N, 140°33'E), a small stream, 30 April 1981. *Canthocamptus* sp. 2 2 ♀, 1 ♂ ; *Attheyella nakaii* 1 ♀, 2 ♂ ; *Moraria varica* 1 ♀ ; *Moraria* sp. B 1 ♂ ; *Bryocamptus zschokkei* 1 ♀ ; *B. calvus* 8 ♀, 1 ♂.

No. 10. Kajikawamura, Niigata Pref. (37°59'N, 139°21'E), a small stream, 27 June 1981. *Attheyella nakaii* 10 ♀, 7 ♂ ; *Moraria duthiei* 2 ♀, 1 ♂ ; *M. varica* 2 ♀, 1 ♂ ; *Bryocamptus calvus* 2 ♀ ; *B. nivalis* 4 ♀.

No. 11. Kurokawamura, Niigata Pref. (38°03'N, 139°28'E), a small stream, 19 September 1981. *Canthocamptus* sp. 2 21 ♀, 20 ♂ ; *Attheyella nakaii* 10 ♀, 6 ♂ ; *A. crassa* 10 ♀, 5 ♂ ; *Bryocamptus zschokkei* 3 ♀ ; *B. calvus* 117 ♀, 11 ♂.

No. 12. Shibatashi, Niigata Pref. (37°57'N, 139°21'E), a small stream, 20 September 1981. *Canthocamptus* sp. 2 13 ♀, 5 ♂ ; *Attheyella crassa* 2 ♀ ; *Bryocamptus calvus* 9 ♀, 2 ♂.

No. 13. Hakusan, Ishikawa Pref. (36°15'N, 136°46'E), small streams, 6 October 1982. *Canthocamptus* sp. 3 1 ♀, 1 ♂ ; *Canthocamptus* sp. 4 40 ♀, 9 ♂ ; *Attheyella nakaii* 3 ♀, 3 ♂ ; *Moraria* sp. B 1 ♀ ; *Bryocamptus calvus* 1 ♀.

No. 14. Tamarumachi, Miye Pref. (34°28'N, 136°39'E), a small stream, 15 March 1986. *Macrocyclops* sp. 3 ♀ ; *Paracyclops fimbriatus* 2 ♀, 1 ♂ / *Canthocamptus* sp. 2 227 ♀, 78 ♂ ; *Canthocamptus* sp. 3 3 ♀, 11 ♂ ; *Canthocamptus* sp. 4 2 ♀ ; *Attheyella nakaii* 132 ♀, 37 ♂ ; *A. orientalis* 1 ♀, 1 ♂ ; *Attheyella* sp. M 2 ♀, 1 ♂ ; *Bryocamptus zschokkei* 40 ♀, 17 ♂ ; *B. calvus* 57 ♀, 5 ♂.

No. 15. River Ômiya, Shiga Pref. (35°04'N, 135°52'E), a stream, 17 March 1986. *Macrocyclops* sp. 3 ♀ / *Canthocamptus* sp. 3 85 ♀, 31 ♂ ; *Canthocamptus* sp. 5 50 ♀, 8 ♂ ; *Attheyella nakaii* 4 ♀, 3 ♂ ; *Bryocamptus zschokkei* 5 ♀, 3 ♂.

No. 16. Ômachi, Nagano Pref. (36°36'N, 137°51'E), a small spring flowing to Lake Nakatsuna, 25 May 1986. *Canthocamptus* sp. 2 29 ♀, 21 ♂ ; *Attheyella nakaii* 119 ♀, 25 ♂ ;

Attheyella sp. M 3 ♀; *Bryocamptus zschokkei* 4 ♀, 1 ♂; *B. calvus* 45 ♀, 6 ♂.

No. 17. Ômachi, Nagano Pref. (36°37'N, 137°51'E), a small inflow of Lake Aoki, 25 May 1986. *Macrocylops fuscus* 2 ♀; *Eucyclops serrulatus* 2 ♀; *Paracyclops fimbriatus* 2 ♀ / *Canthocamptus staphylinus* 3 ♀, 2 ♂; *Canthocamptus* sp. 2 48 ♀, 11 ♂; *Attheyella nakaii* 12 ♀, 3 ♂; *A. crassa* 50 ♀, 3 ♂; *A. orientalis* 2 ♀, 1 ♂; *Bryocamptus zschokkei* 5 ♀, 3 ♂; *B. calvus* 2 ♀.

No. 18. Lake Aoki, Nagano Pref. (36°37'N, 137°51'E), the deepest bottom of Lake Aoki, 26 May 1986. *Attheyella nakaii* 2 ♀, 6 ♂; *A. orientalis* 4 ♀.

No. 19. River Nippara, Okutama, Tokyo (35°49'N, 139°05'E), a small stream, 19 November 1986. *Canthocamptus* sp. 2 37 ♀, 29 ♂; *Attheyella nakaii* 12 ♀, 6 ♂; *Maraenobiotus brucei* 1 ♀; *Bryocamptus zschokkei* 16 ♀, 7 ♂; *B. calvus* 2 ♀, 1 ♂; *B. nivalis* 1 ♀.

No. 20. Kokubunji, Tokyo (35°42'N, 139°30'E), a spring stream, 19 November 1986. *Eucyclops serrulatus* 44 ♀, 3 ♂; *Paracyclops fimbriatus* 1 ♀, 1 ♂ / *Harpacticella paradoxa* 18 ♀, 4 ♂; *Canthocamptus* sp. 2 17 ♀, 1 ♂; *Attheyella nakaii* 4 ♀, 13 ♂; *Bryocamptus calvus* 43 ♀, 3 ♂.

No. 21. Mt. Yamizo, Ibaraki Pref. (36°54'N, 140°20'E), a small stream, 20 November 1986. *Canthocamptus* sp. 2 4 ♀, 1 ♂; *Canthocamptus* sp. 7 2 ♀; *Attheyella nakaii* 2 ♀; *Maraenobiotus brucei* 1 ♀; *Bryocamptus zschokkei* 5 ♀, 2 ♂; *B. calvus* 35 ♀, 6 ♂.

No. 22. Daigomachi, Ibaraki Pref. (36°48'N, 140°22'E), a small stream, 20 November 1986. *Macrocylops fuscus* 1 ♀; *Eucyclops serrulatus* 8 ♀, 3 ♂; *Paracyclops fimbriatus* 1 ♀, 2 ♂; *P. affinis* 1 ♀ / *Canthocamptus* sp. 2 75 ♀, 5 ♂; *Moraria poppei* 1 ♂; *Bryocamptus zschokkei* 6 ♀, 4 ♂; *B. calvus* 13 ♀, 1 ♂.

No. 23. Yujimata-onsen, Fukushima Pref. (36°53'N, 140°29'E), a small stream, 20 November 1986. *Canthocamptus* sp. 2 24 ♀, 11 ♂; *Attheyella nakaii* 3 ♀, 1 ♂; *Bryocamptus zschokkei* 5 ♀; *B. calvus* 5 ♀.

No. 24. Shingûmachi, Hyôgo Pref. (34°55'N, 134°34'E), a small stream, 10 January 1987. *Macrocylops fuscus* 1 ♀, 2 ♂; *Macrocylops* sp. 1 ♀ / *Canthocamptus* sp. 3 9 ♀, 2 ♂; *Attheyella nakaii* 4 ♀, 2 ♂; *Bryocamptus zschokkei* 22 ♀, 8 ♂; *B. calvus* 11 ♀, 1 ♂.

No. 25. Mikazukimachi, Hyôgo Pref. (35°00'N, 134°27'E), a small stream, 10 January 1987. *Canthocamptus* sp. 3 20 ♀, 10 ♂; *Attheyella nakaii* 5 ♀, 1 ♂; *A. coiffaiti* 10 ♀, 5 ♂; *Attheyella* sp. M 1 ♀, 1 ♂; *Bryocamptus zschokkei* 5 ♀, 3 ♂; *B. calvus* 5 ♀, 1 ♂.

No. 26. Mikazukimachi, Hyôgo Pref. (35°00'N, 134°27'E), a stream, 10 January 1987. *Macrocylops albidus* 1 ♀, 1 ♂; *Eucyclops serrulatus* 10 ♀, 3 ♂; *Paracyclops fimbriatus* 1 ♀; *Mesocyclops leuckarti* 1 ♀ / *Canthocamptus staphylinus* 24 ♀, 1 ♂; *Canthocamptus* sp. 3 281 ♀, 98 ♂; *Attheyella nakaii* 37 ♀, 12 ♂; *A. orientalis* 1 ♀, 1 ♂; *Bryocamptus calvus* 87 ♀, 2 ♂.

No. 27. Ômamachi, Aomori Pref. (41°27'N, 140°53'E), a small stream, 1 June 1987. *Eucyclops serrulatus* 11 ♀, 2 ♂; *Speocyclops yezoensis* 2 ♀ / *Canthocamptus* sp. 2 13 ♀, 17 ♂; *Bryocamptus zschokkei* 4 ♀; *B. calvus* 39 ♀, 3 ♂.

No. 28. Hotokegaura, Aomori Pref. (41°17'N, 140°49'E), a stream, 1 June 1987. *Eucyclops serrulatus* 6 ♂; *Speocyclops yezoensis* 5 ♀ / *Canthocamptus* sp. 2 24 ♀, 14 ♂; *Attheyella nakaii* 7 ♀, 1 ♂; *Bryocamptus zschokkei* 29 ♀, 13 ♂; *B. calvus* 18 ♀.

No. 29. Taneichimachi, Iwate Pref. (40°17'N, 141°45'E), a small stream, 2 June 1987. *Canthocamptus* sp. 2 62 ♀, 119 ♂; *Attheyella nakaii* 4 ♀, 2 ♂; *Bryocamptus calvus* 7 ♀.

No. 30. Kujikeiryû, Iwate Pref. (40°11'N, 141°43'E), a trickle, 3 June 1987. *Macrocylops*

fuscus 1 ♀ ; *Paracyclops fimbriatus* 2 ♀ ; *Acanthocyclops vernalis* 2 ♀, 1 ♂ / *Canthocamptus* sp. 2 664 ♀, 393 ♂ ; *Attheyella nakaii* 43 ♀, 31 ♂ ; *Moraria varica* 1 ♀ ; *Bryocamptus zschokkei* 25 ♀, 7 ♂ ; *B. calvus* 109 ♀, 21 ♂ .

No. 31. Yamagatamura, Iwate Pref. (40°08'N, 141°33'E), a stream, 3 June 1987. *Macrocyclus fuscus* 4 ♀, 1 ♂ ; *Eucyclops serrulatus* 48 ♀, 16 ♂ ; *Acanthocyclops vernalis* 1 ♀ ; *Diacyclops crassicaudis* 2 ♀ / *Canthocamptus* sp. 2 69 ♀, 46 ♂ ; *Attheyella nakaii* 9 ♀, 9 ♂ ; *A. crassa* 1 ♂ ; *Bryocamptus zschokkei* 1 ♀ ; *B. calvus* 6 ♀ .

No. 32. Iwatemachi, Iwate Pref. (39°58'N, 141°20'E), a ditch, 3 June 1987. *Eucyclops serrulatus* 1 ♂ ; *Microcyclus varicans* 1 ♀ / *Canthocamptus* sp. 2 2 ♀, 2 ♂ ; *Attheyella nakaii* 4 ♀, 5 ♂ ; *Bryocamptus calvus* 16 ♀, 3 ♂ .

No. 33. Hanamakishi, Iwate Pref. (39°26'N, 141°16'E), a small stream, 3 June 1987. *Paracyclops fimbriatus* 1 ♀ / *Canthocamptus* sp. 2 6 ♀, 1 ♂ ; *Attheyella nakaii* 2 ♀, 1 ♂ ; *Bryocamptus zschokkei* 3 ♀, 2 ♂ ; *B. calvus* 2 ♀ .

No. 34. Wagamachi, Iwate Pref. (39°19'N, 140°52'E), a trickle, 3 June 1987. *Eucyclops serrulatus* 50 ♀, 11 ♂ ; *Speocyclops yezoensis* 3 ♀ / *Canthocamptus mirabilis* 93 ♀, 26 ♂ ; *Attheyella nakaii* 40 ♀, 27 ♂ ; *Moraria varica* 1 ♀ ; *Bryocamptus zschokkei* 8 ♀, 2 ♂ ; *B. calvus* 5 ♀, 2 ♂ .

No. 35. Higashiyurimachi, Akita Pref. (39°21'N, 140°12'E), a small stream, 4 June 1987. *Macrocyclus fuscus* 1 ♀ ; *Eucyclops serrulatus* 1 ♀, 1 ♂ ; *Paracyclops fimbriatus* 1 ♀ / *Canthocamptus mirabilis* 1 ♀ ; *Canthocamptus* sp. 2 16 ♀, 14 ♂ ; *Attheyella nakaii* 25 ♀, 11 ♂ ; *A. orientalis* 1 ♀ ; *Bryocamptus zschokkei* 2 ♀ ; *B. calvus* 12 ♀ .

No. 36. Hinaimachi, Akita Pref. (40°12'N, 140°40'E), a small stream, 4 June 1987. *Macrocyclus fuscus* 1 ♂ ; *Diacyclops languidoides* 1 ♀ ; *Microcyclus varicans* 1 ♀ ; *Speocyclops yezoensis* 1 ♀ / *Canthocamptus* sp. 2 3 ♀ ; *Attheyella nakaii* 1 ♀ ; *Bryocamptus calvus* 7 ♀ .

No. 37. Lake towada, Akita Pref. (40°25'N, 140°54'E), shoreline, 4 June 1987. *Eucyclops serrulatus* 1 ♀ ; *Acanthocyclops vernalis* 11 ♀, 6 ♂ ; *Diacyclops languidus* 2 ♀ / *Canthocamptus* sp. 2 1 ♀, 1 ♂ ; *Attheyella* sp. T 1 ♀ ; *Attheyella nakaii* 1 ♀ ; *Maraenobiotus vejdotskyi* 1 ♀ ; *Moraria* sp. B 1 ♀ ; *Bryocamptus zschokkei* 3 ♀ .

No. 38. Oirasekeiryū, Aomori Pref. (40°32'N, 140°59'E), a small stream, 4 June 1987. *Eucyclops serrulatus* 1 ♀ ; *Acanthocyclops vernalis* 3 ♂ / *Canthocamptus* sp. 2 10 ♀, 3 ♂ ; *Attheyella nakaii* 2 ♀, 2 ♂ ; *Bryocamptus zschokkei* 2 ♀ ; *B. hiemalis* 6 ♀, 2 ♂ .

No. 39. Chikatsu, Fukushima Pref. (36°58'N, 140°22'E), a small stream, 8 February 1988. *Macrocyclus fuscus* 2 ♀ ; *M. albidus* 2 ♀, 1 ♂ ; *Macrocyclus* sp. 1 ♀, 1 ♂ ; *Eucyclops serrulatus* 36 ♀, 3 ♂ ; *Paracyclops fimbriatus* 2 ♀, 1 ♂ ; *Speocyclops yezoensis* 1 ♀ / *Canthocamptus* sp. 2 299 ♀, 58 ♂ ; *Attheyella nakaii* 3 ♀, 2 ♂ ; *Attheyella* sp. M 2 ♀, 2 ♂ ; *Bryocamptus zschokkei* 5 ♀, 1 ♂ ; *B. calvus* 46 ♀, 5 ♂ .

No. 40. Mt. Yamizo, Ibaraki Pref. (36°53'N, 140°17'E), a trickle, 9 February 1988. *Macrocyclus* sp. 6 ♀, 3 ♂ ; *Eucyclops serrulatus* 1 ♀ ; *Paracyclops fimbriatus* 2 ♀, 1 ♂ / *Canthocamptus* sp. 2 31 ♀, 4 ♂ ; *Canthocamptus* sp. 7 1 ♀, 2 ♂ ; *Attheyella nakaii* 94 ♀, 70 ♂ ; *Attheyella* sp. M 2 ♀, 2 ♂ ; *Bryocamptus zschokkei* 25 ♀, 16 ♂ ; *B. calvus* 117 ♀, 21 ♂ .

No. 41. Gozenyama, Ibaraki Pref. (36°31'N, 140°18'E), a stream, 9 February 1988. *Macrocyclus fuscus* 2 ♀, 1 ♂ ; *Macrocyclus* sp. 1 ♀, 1 ♂ ; *Paracyclops affinis* 1 ♀ / *Canthocamptus* sp. 2 12 ♀, 1 ♂ ; *Canthocamptus* sp. 3 96 ♀, 8 ♂ ; *Attheyella nakaii* 1 ♀ ; *Bryocamptus calvus* 31 ♀ ,

3♂.

No. 42. Miyazu, Kyôto Pref. (35°29'N, 135°10'E), a small stream, 22 May 1988. *Paracyclops fimbriatus* 2♂ / *Canthocamptus* sp. 3 8♀, 4♂ ; *Canthocamptus* sp. 4 20♀, 2♂ ; *Attheyella nakaii* 13♀, 2♂ ; *Attheyella* sp. M 3♀, 2♂ ; *Moraria varica* 1♀ ; *Bryocamptus zschokkei* 6♀, 1♂ ; *B. calvus* 4♀, 1♂.

No. 43. Ôe, Kyôto Pref. (35°26'N, 135°09'E), a small stream, 22 May 1988. *Macrocyclus* sp. 9♀, 3♂ ; *Paracyclops fimbriatus* 1♀ / *Canthocamptus* sp. 3 12♀, 1♂ ; *Canthocamptus* sp. 4 1♂ ; *Attheyella nakaii* 23♀, 16♂ ; *Attheyella* sp. M 1♀, 1♂ ; *Bryocamptus zschokkei* 1♀ ; *B. calvus* 11♀.

No. 44. Kutsukake, Kyôto Pref. (34°59'N, 135°39'E), a trickle, 22 May 1988. *Macrocyclus* sp. 1♀ ; *Eucyclops serrulatus* 1♀ ; *Paracyclops fimbriatus* 7♀, 6♂ ; *Speocyclops yezoensis* 1♀ / *Canthocamptus* sp. 3 17♀, 6♂ ; *Attheyella nakaii* 13♀, 4♂ ; *Bryocamptus zschokkei* 6♀, 1♂ ; *B. calvus* 10♀, 1♂.

No. 45. Imazu, Shiga Pref. (35°26'N, 136°01'E), a stream, 23 May 1988. *Cyclops vicinus* 1♀ / *Canthocamptus* sp. 3 10♀, 9♂ ; *Canthocamptus* sp. 4 20♀, 9♂ ; *Attheyella* sp. T 1♂ ; *A. nakaii* 12♀, 6♂ ; *A. coiffaiti* 1♂ ; *A. crassa* 1♀ ; *Moraria varica* 4♀ ; *Bryocamptus zschokkei* 16♀, 2♂ ; *B. calvus* 17♀, 4♂.

No. 46. Ôsaki, Lake Biwa, Shiga Pref. (35°28'N, 136°07'E), a small stream, 23 May 1988. *Macrocyclus* sp. 1♀ ; *Paracyclops fimbriatus* 3♀, 3♂ / *Canthocamptus* sp. 4 22♀, 7♂ ; *Attheyella nakaii* 68♀, 26♂ ; *Bryocamptus zschokkei* 8♀, 4♂ ; *B. calvus* 23♀, 15♂.

No. 47. Kinomotomachi, Shiga Pref. (35°34'N, 136°16'E), a trickle, 23 May 1988. *Macrocyclus* sp. 1♀ ; *Speocyclops yezoensis* 1♀ / *Canthocamptus* sp. 4 29♀, 29♂ ; *Attheyella nakaii* 8♀, 3♂ ; *Attheyella* sp. M 3♀, 1♂ ; *Bryocamptus zschokkei* 28♀, 11♂ ; *B. calvus* 13♀, 3♂.

No. 48. Sakauchimura, Gifu Pref. (35°36'N, 136°23'E), a trickle, 23 May 1988. *Macrocyclus* sp. 4♀, 1♂ / *Canthocamptus* sp. 4 85♀, 22♂ ; *Attheyella nakaii* 16♀, 5♂ ; *Bryocamptus zschokkei* 14♀, 5♂ ; *B. calvus* 7♀.

No. 49. Kuzemura, Gifu Pref. (35°32'N, 136°30'E), a trickle, 23 May 1988. *Macrocyclus* sp. 8♀, 2♂ ; *Eucyclops serrulatus* 1♀ / *Canthocamptus* sp. 4 233♀, 53♂ ; *Attheyella nakaii* 6♀, 2♂ ; *Attheyella* sp. M 1♀ ; *Maraenobiotus brucei* 1♀, 1♂ ; *Bryocamptus zschokkei* 8♀, 1♂ ; *B. calvus* 14♀, 2♂.

No. 50. Minamimura, Gifu Pref. (35°36'N, 135°56'E), a small stream, 24 May 1988. *Macrocyclus* sp. 1♀ / *Canthocamptus* sp. 4 5♀ ; *Attheyella nakaii* 4♀, 2♂ ; *Bryocamptus zschokkei* 5♀, 1♂ ; *B. calvus* 2♀.

No. 51. Yamatomachi, Gifu Pref. (35°48'N, 136°54'E), a small stream, 24 May 1988. *Canthocamptus* sp. 4 2♀, 2♂ ; *Attheyella nakaii* 1♀, 4♂ ; *Moraria poppei* 1♀, 1♂ ; *Bryocamptus zschokkei* 5♀, 2♂ ; *B. calvus* 1♀, 1♂.

No. 52. Shirotorimachi, Gifu Pref. (35°52'N, 136°50'E), a trickle, 24 May 1988. *Macrocyclus* sp. 3♀, 2♂ / *Canthocamptus* sp. 4 35♀, 31♂ ; *Attheyella nakaii* 10♀, 4♂ ; *Bryocamptus zschokkei* 1♂ ; *B. calvus* 5♀, 2♂.

No. 53. Izumimura, Fukui Pref. (35°52'N, 136°46'E), a trickle, 24 May 1988. *Canthocamptus* sp. 4 98♀, 93♂ ; *Attheyella nakaii* 77♀, 31♂ ; *Attheyella* sp. M 1♀ ; *Moraria poppei* 1♀ ; *Bryocamptus zschokkei* 14♀, 2♂ ; *B. calvus* 45♀, 17♂.

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No. 54. Hatogayu-onsen, Fukui Pref. (36°00'N, 136°39'E), a trickle, 24 May 1988. *Canthocamptus* sp. 4 ♀, 11 ♂; *Attheyella nakaii* 50 ♀, 19 ♂; *Bryocamptus zschokkei* 88 ♀, 22 ♂.

No. 55. Miyamamachi, Fukui Pref. (36°00'N, 136°26'E), a small stream, 25 May 1988. *Speocyclops yezoensis* 1 ♀ / *Canthocamptus* sp. 4 ♀, 2 ♂; *Attheyella nakaii* 4 ♀, 1 ♂; *Bryocamptus zschokkei* 20 ♀, 4 ♂; *B. calvus* 2 ♀; *Paracamptus reductus* 1 ♀.

No. 56. Shimizumachi, Fukui Pref. (36°01'N, 136°06'E), a small stream, 25 May 1988. *Diacyclops languidus* 1 ♀ / *Canthocamptus staphylinus* 1 ♀; *Canthocamptus* sp. 3 ♀, 5 ♂; *Canthocamptus* sp. 4 ♀, 2 ♂; *Attheyella nakaii* 6 ♀, 4 ♂; *A. crassa* 1 ♀; *Bryocamptus zschokkei* 13 ♀; *B. calvus* 4 ♀.

No. 57. Echizenzaki, Fukui Pref. (35°58'N, 135°58'E), a small fall, 25 May 1988. *Eucyclops serrulatus* 1 ♀; *Speocyclops yezoensis* 1 ♀ / *Canthocamptus* sp. 3 ♀, 2 ♂; *Canthocamptus* sp. 4 ♀, 66 ♀, 29 ♂; *Attheyella nakaii* 2 ♀, 2 ♂; *Bryocamptus zschokkei* 17 ♀, 2 ♂; *B. calvus* 2 ♀.

No. 58. Kōnomura, Fukui Pref. (35°49'N, 136°06'E), a trickle, 25 May 1988. *Paracyclops fimbriatus* 3 ♀, 2 ♂; *Speocyclops yezoensis* 1 ♀ / *Canthocamptus* sp. 4 ♀, 24 ♀, 11 ♂; *Attheyella nakaii* 11 ♀, 7 ♂; *Attheyella* sp. M 1 ♀, 1 ♂; *Bryocamptus zschokkei* 13 ♀, 4 ♂; *B. calvus* 10 ♀, 2 ♂.

No. 59. Tsurugashi, Fukui Pref. (35°41'N, 136°05'E), a small stream, 25 May 1988. *Macrocyclus* sp. 1 ♂; *Paracyclops fimbriatus* 3 ♀ / *Attheyella nakaii* 11 ♀, 6 ♂; *Bryocamptus zschokkei* 1 ♀; *B. calvus* 13 ♀.

Cyclopoida

1. *Macrocyclus* sp.

(Plate 1)

Materials illustrated : Kuzemura, Gifu Pref., 23 May 1988.

Remarks : This species has been newly found in Honshū, during the course of the present study. It occurs in the middle and western parts of Honshū, and in a northern insulated area around 36°40'N on the Pacific coast (Loc. No. 14, 15, 24, 39 to 52 and 59; figure 1-A). In the ranges, the individuals are nearly always present in the mountain waters from trickles to streams.

2. *Speocyclops yezoensis* Ito, 1954

Speocyclops yezoensis Ito, 1954, p. 406.

Speocyclops yezoensis Ito. Ito 1960, p. 138.

Remarks : This species has previously been known in Japan as a subterranean copepod (Ito, 1954 and 1960). During my research, I found that it occurred in running mountain waters, especially in trickles, over a large part of Honshu (Loc. No. 27, 28, 34, 36, 44, 47, 55, 57 and 58; Figure 1-A).

Harpacticoida

1. *Harpacticella paradoxa* (Brehm)

Remarks : The first record of this species in Japan was made by Ito and Kikuchi (1977) of individuals from the River Yukawa, Nikkô, in the central part of Honshû. It was also found in our collection at Nikkô (Loc. No. 2). During the survey, a new habitat was found in a spring stream in Kokubunji-ato, Tokyo (Loc. No. 20). This spring is located at the foot of a terrace scarp, where primeval dominant vegetation used to be evergreens.

2. *Canthocamptus staphylinus* (Jurine)

Remarks : During the survey, no specimens of *Canthocamptus staphylinus* were found in the waters shaded by a thick canopy of trees. Their occurrence was seen only in waters at the forest edges and in streams with a sunny surface (Loc. No. 17, 26 and 56).

3. *Canthocamptus mirabilis* Štěrba

Remarks : Until now, two distribution ranges of the *Canthocamptus mirabilis* have been found in Honshû. As Figure 1-B shows, one of the ranges exists between about 39°20'N and 39°30'N, and west of 141°E (Loc. No. 8, 34 and 35), while the other, a small one, exists near 37°N, 138°E (Loc. No. 5). Within the ranges, excepting Loc. No. 35, the species occurred abundantly, and predominated over the sympatric species *Canthocamptus* sp. 2 or sp. 4. It has a wide range of habitat, such as puddles in valleys, seepage springs and moving waters from trickles to streams. It does not, however, occur in lakes.

4. *Canthocamptus* sp. 2

Remarks : Kikuchi and Ishida (1988) have noted that *Canthocamptus* sp. 2 is a widespread (Figure 1-B) occurring in an area extending from the southern part of Hokkaido to the central part of Honshû and Mie Prefecture, western Honshû (Loc. No. 14). The species occurs in habitats similar to those of the *C. mirabilis*.

5. *Canthocamptus* sp. 3 (Plate 2)

Materials illustrated : Mikazukimachi, Hyôgo Pref., 10 January 1987.

Remarks : In the western part of Honshû, the predominant *Canthocamptus* species is replaced by *Canthocamptus* sp. 3 (Kikuchi and Ishida 1988 ; Figure 1-B). Apart from its main distribution range, an isolated patch of this species was found around Mt. Gozenyama, Ibaraki Pref. (Loc. No. 41), where the species occurred abundantly and predominated over the

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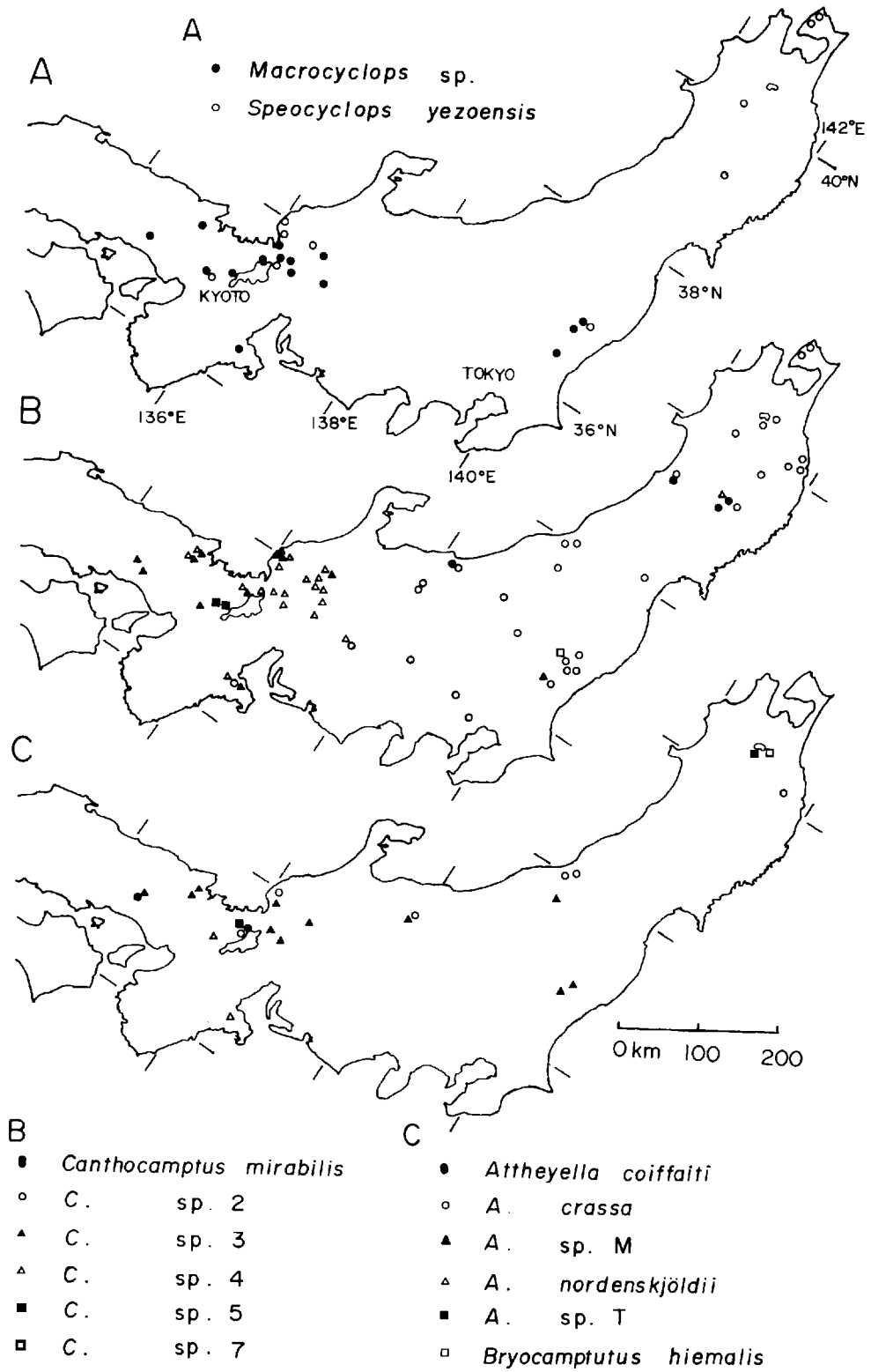


Fig. 1. Distribution maps of noticeable copepods.

Ishida

sympatric *Canthocamptus* sp. 2. Its habitats in the ranges are the same as those of *C. mirabilis* and *C. sp. 2*.

6. *Canthocamptus* sp. 4
(Plate 3)

Materials illustrated : Kuzemura, Gifu Pref., 23 May 1988.

Remarks : This is a species newly found in Japan. Its major distribution range is restricted to the border between central and western Honshu, especially in the northern areas (Loc. No. 6, 13, and 42-58 ; Figure 1-B). Within the range, the abundance of the species is high. The species shows a sympatric distribution with *Canthocamptus* sp. 3 at the boundary zone of the distribution area of each species. Besides its major range, the species seems to be distributed thinly and fragmentarily in Honshû (Loc. No. 8).

7. *Canthocamptus* sp. 5
(Plate 4)

Materials illustrated : Kifune, Kyôto Pref., 1 February 1981.

Remarks : As was the case of *Canthocamptus* sp. 4, *Canthocamptus* sp. 5 has been newly found in Japan as a result of my research. The occurrence is at present known only from a small area north of Kyôto City (Loc. No. 4 and 15 ; Figure 1-B). In the area it was found abundantly in a small stream and a stream. The species is very similar to *C. mirabilis*. If compared with the latter, however, its dwarf body is peculiar. The endemic presence and the similarity of the species to *C. mirabilis* suggest that the species might be an ancient relict of *C. mirabilis*.

8. *Canthocamptus* sp. 7
(Plate 5)

Materials illustrated : Mt. Yamizo, Ibaraki Pref., female-20 November 1986, male-9 February 1988.

Remarks : As Kikuchi and Ishida (1988) have reported, *Canthocamptus* sp. 7 is at present known only among specimens from Mt. Yamizo in Ibaraki Prefecture (Loc. No. 21 and 40 ; Figure 1-B).

9. *Attheyella coiffaiti* Chappuis, 1958
(Plate 6)

Attheyella coiffaiti Chappuis, 1958, p. 71.

Attheyella coreana Miura, 1969, p. 246.

Attheyella coiffaiti Chappuis. Miura, 1984, p. 525.

Materials illustrated : Mikazukimachi, Hyōgo Pref., 10 January 1987.

Remarks : During my survey, *Attheyella coiffaiti* was collected only from two localities (Loc. No. 25 and 45 ; Figure 1-C). The poverty of the occurrence can be attributed to the few sampling efforts made in the western part of Honshū, where the species is distributed widely as a subterranean species (Miura 1984). As Miura (1969) has pointed out, it is closely related to *A. alaskaensis* Wilson, 1958.

10. *Attheyella nakaii* (Brehm)

Remarks : *Attheyella nakaii* is most widespread and abundant throughout Honshū. Its habitats are mountain waters over a wide range, including lakes.

11. *Attheyella crassa* (Sars)

Remarks : This species occurs sporadically in Honshū (Loc. No. 11, 12, 17, 31, 45 and 56 ; Figure 1-C). Its appearance may depend on the microenvironments of its habitats. Spring streams by the forest edges may be one of its preferred habitats.

12. *Attheyella orientalis* Chappuis

Remarks : *Attheyella orientalis* is a common species inhabiting both running and standing waters with sunny surfaces, in other words, waters with vegetation. In this research, it occurred at 6 localities (No. 2, 14, 17, 18, 26 and 35).

13. *Attheyella* sp. M

Remarks : This species occurs frequently in the mountain waters of Honshū (Figure 1-C).

14. *Attheyella nordenskjöldii* (Lilljeborg)

Remarks : Only one individual of this northern species was caught with *Canthocamptus* sp. 5 at a small stream, north of Kyōto City (Loc. No. 4 ; Figure 1-C).

15. *Attheyella* sp. T
(Plate 7)

Materials illustrated : Female-Lake Towada, Akita Pref., 4 June 1987, male-Imazu, Shiga Pref., 23 May 1988.

Ishida

Remarks : Only one female and one male were found from two localities far from each other (Loc. No. 37 and 45 ; Figure 1-C). There is some unconfirmed information which suggests that this species may commonly occur in the western part of Honshû. The species is closely related to *A. illinoisensis* (Forbes), (Coker 1934 and Reid 1987).

16. *Maraenobiotus vejdoskyi* Mrázek

Remarks : Only one female was caught at the shore of Lake Towada (Loc. No. 37).

17. *Maraenobiotus brucei* (Richard)

Remarks : This species was found occasionally in small mountain streams (Loc. No. 19, 21 and 49).

18. *Moraria duthiei* (T. & A. Scott)

Remarks : This species was found only at one locality (No. 10). It seems to be rare in Honshû.

19. *Moraria poppei* (Mrázek)

Remarks : Only 3 individuals of this species were found, at Loc. No. 22 and 51.

20. *Moraria varica* (Graeter)

Remarks : Eleven individuals of the species were obtained at 6 localities (No. 9, 10, 30, 34, 42 and 45). It seems to be a widespread harpacticoid with low density of population.

21. *Moraria* sp. B

Remarks : Five individuals of this species (= *Moraria* sp. 2 by Kikuchi 1984) were found in 5 localities (No. 6, 7, 9, 13 and 37). These records indicate that the central part of Honshû should be added to its known distribution range in the northern Honshû (Kikuchi 1984).

22. *Bryocamptus zschokkei* (Schmeil)

Remarks : This cosmopolitan is one of the commonest and most abundant species throughout Honshû.

23. *Bryocamptus hiemalis* (Pearse)

Remarks : Eight individuals of this species were obtained from Oirasekeiryû near Lake

Towada, northern Honshû (Loc. No. 38 ; Figure 1-C). These individuals may belong to one of the relict populations in Honshû.

24. *Bryocamptus calvus* (Brehm)

Remarks : *Bryocamptus calvus* is one of the most widespread and abundant species of the harpacticoids throughout Honshû (Ishida 1984).

25. *Bryocamptus nivalis* (Willey)

Remarks : The occurrence of *Bryocamptus nivalis* in Honshû is very low. It occurred in only two localities (No. 7 and 10).

26. *Paracamptus reductus* Wilson

Remarks : Only one individual was obtained in the locality of central Honshû (Loc. No. 55). *Paracamptus nakamurai* Chappuis, probably synonymous to *P. reductus*, is known from western Honshû as a subterranean copepod (Chappuis 1958 and Miura 1984).

Acknowledgements

I wish to pay special thanks to Dr. Tomiko Ito, Hokkaido Fish Hatchery, for the gift of valuable specimens, and Dr. Yoshiaki Kikuchi, Ibaraki University, for his kindly guidance for the survey at Mt. Yamizo, Ibaraki Prefecture, and the adjacent areas.

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本州の山地水域のかいあし類

石田 昭夫

本州山地水域から採集された59試料に含まれていたかいあし類について種の同定と個体数の算定を行った。えられた種はケンミジンコ14種と、北海道との共通種20種をふくむソコミジンコ26種である。それぞれの種について、分布域、密度、生息場所等についてのべた摘要と、本研究で新しく見出された種について Ishida (1987) と同じ形式で描いた図版をそえた。

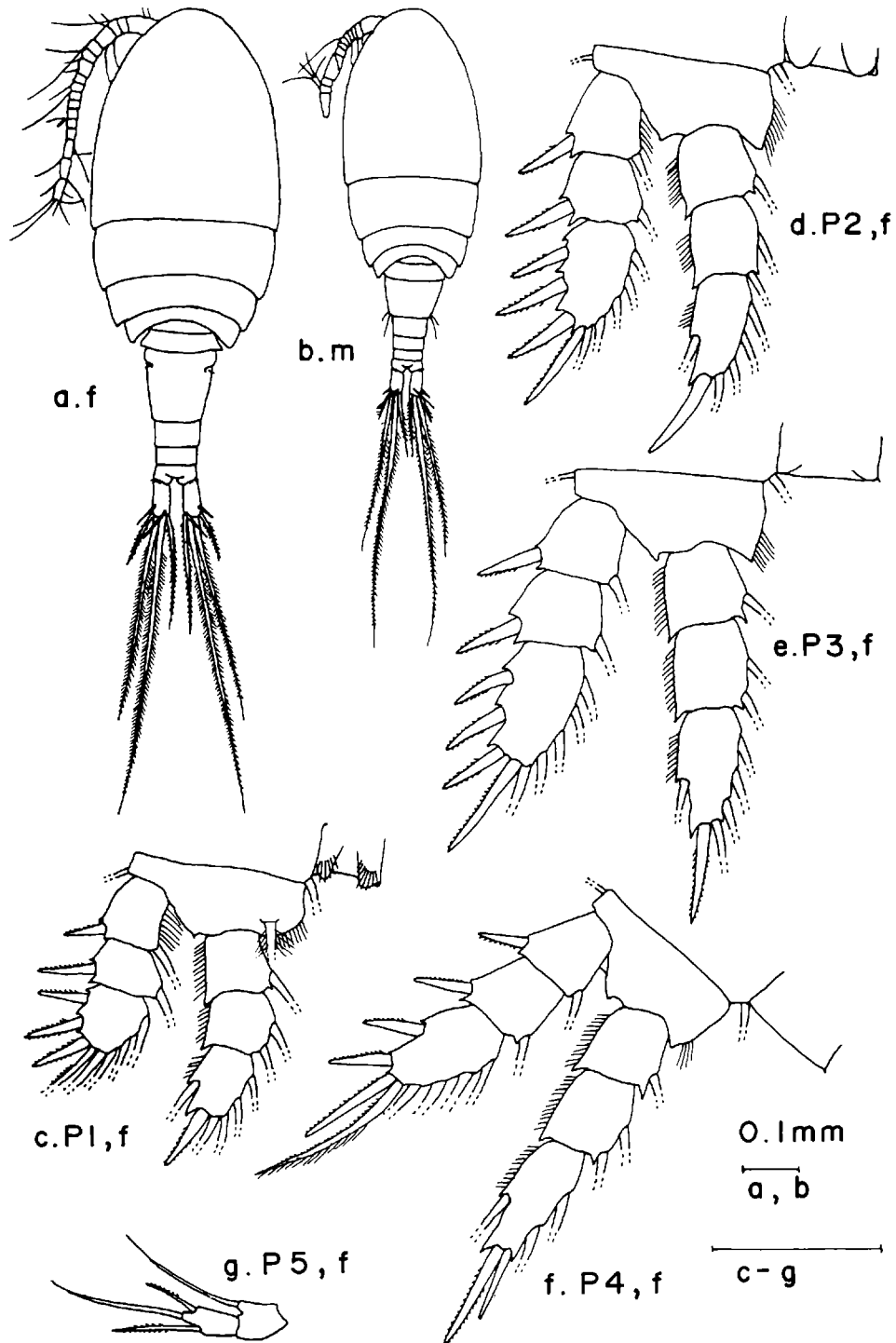


Plate 1. *Macrocylops* sp.

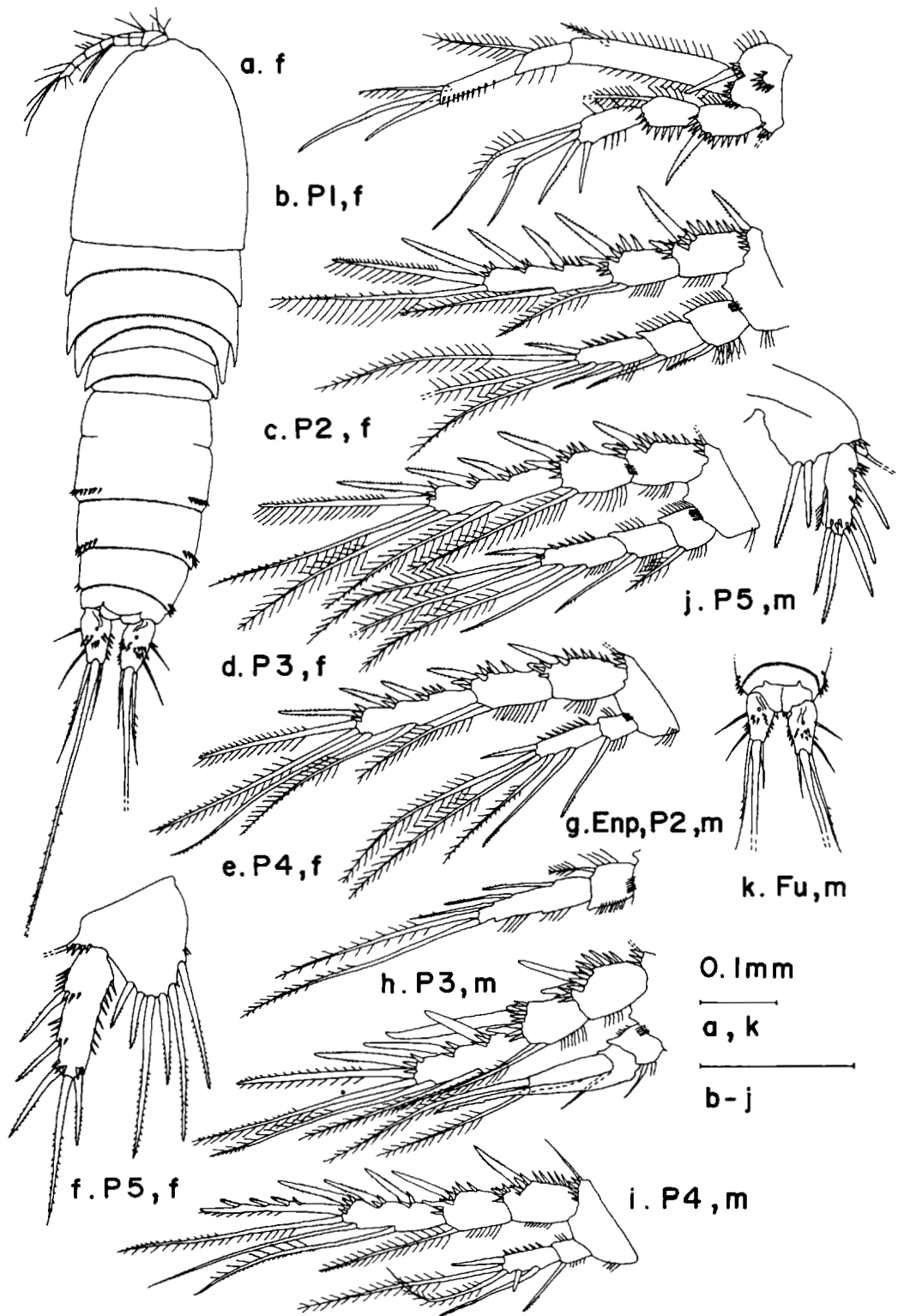


Plate 2. *Canthocamptus* sp. 3

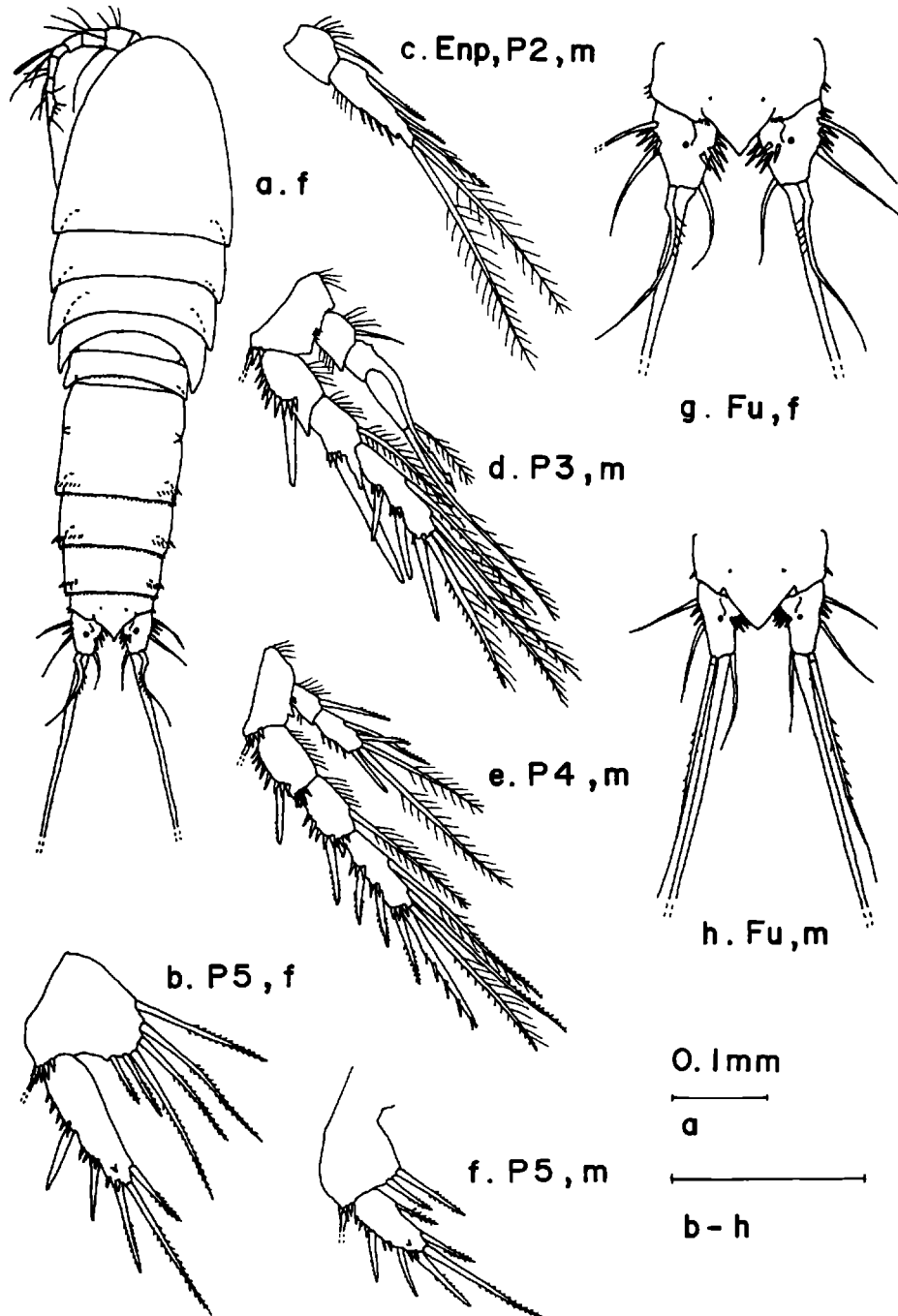


Plate 3. *Canthocamptus* sp. 4

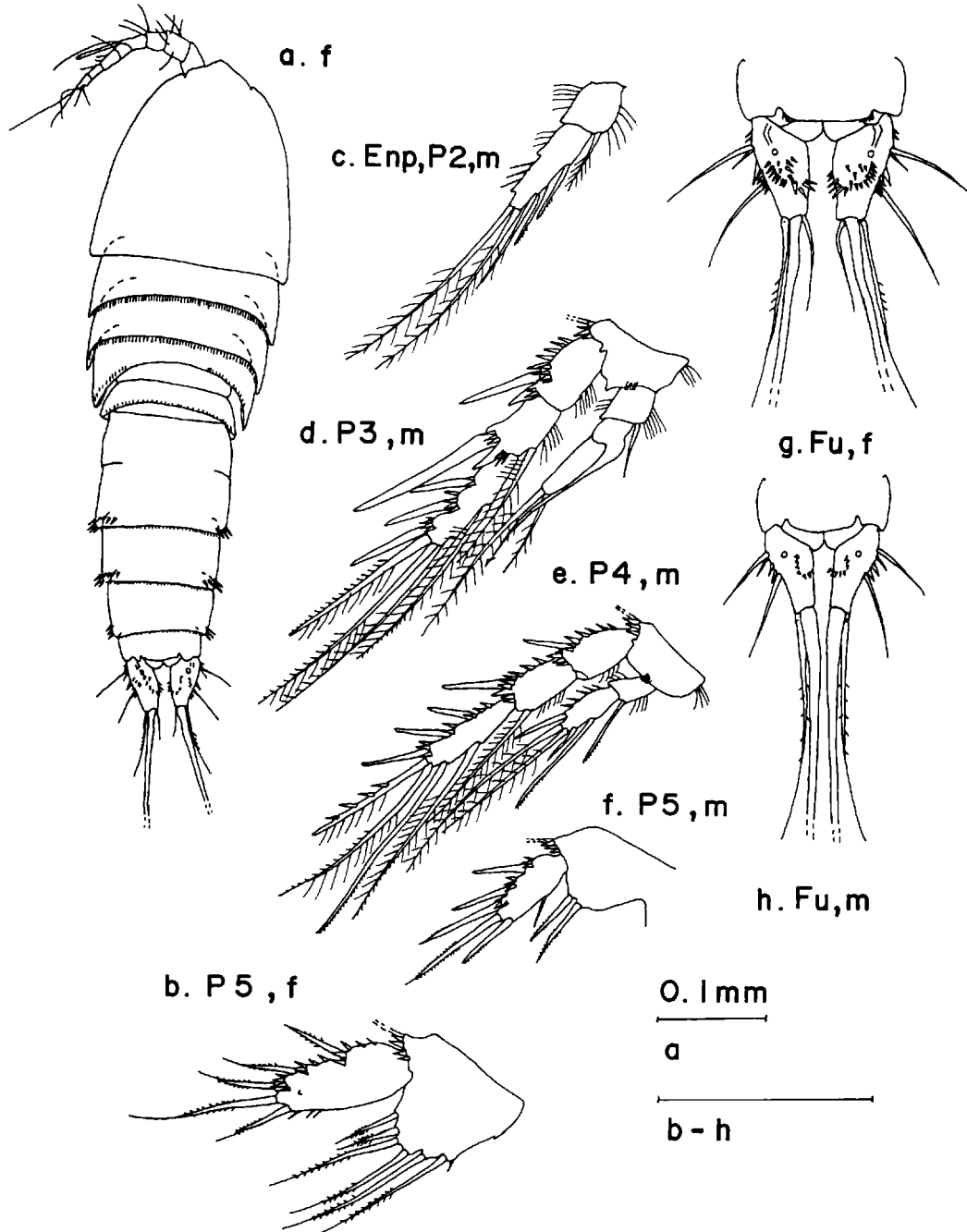


Plate 4. *Canthocamptus* sp. 5

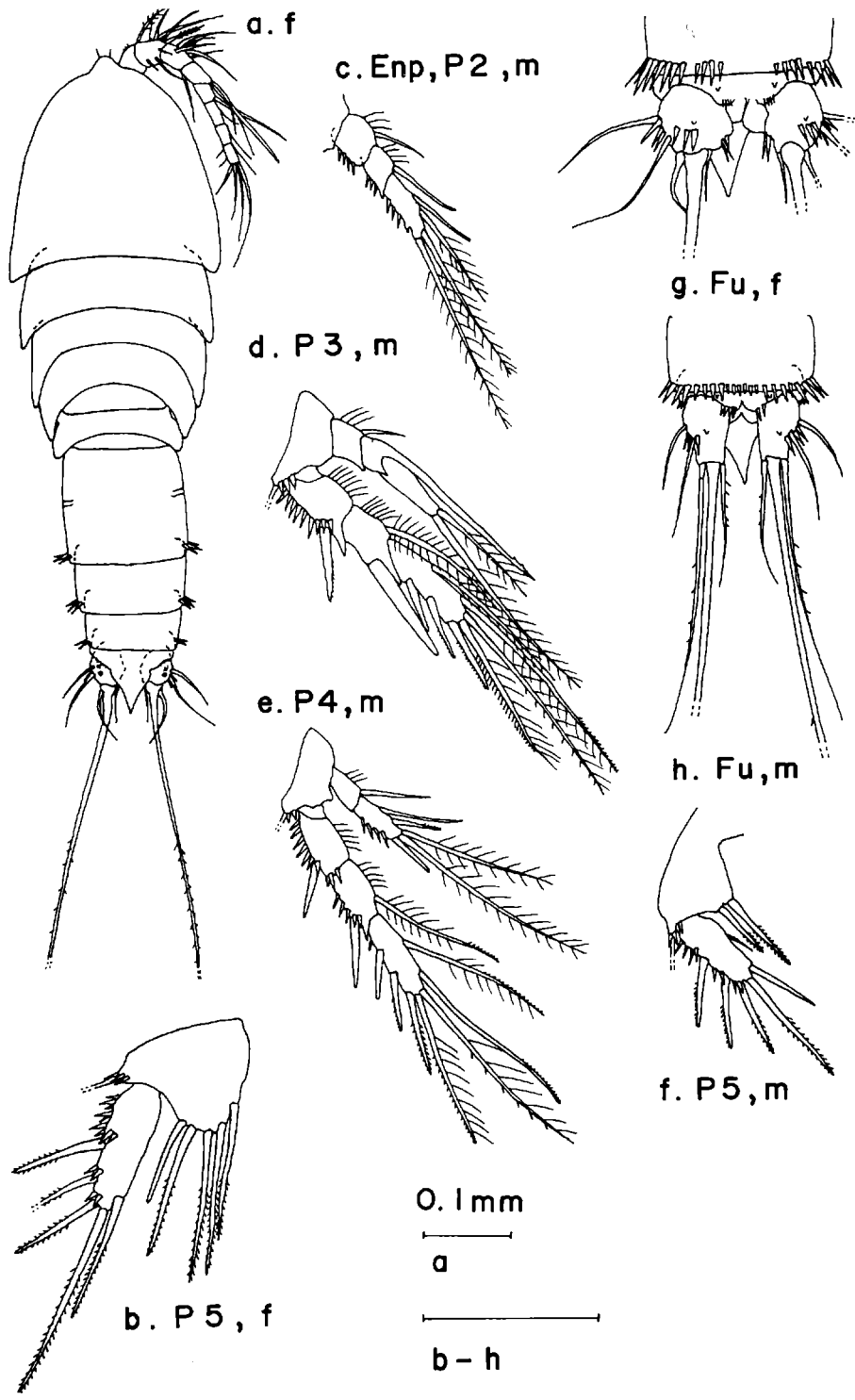


Plate 5. *Canthocamptus* sp. 7

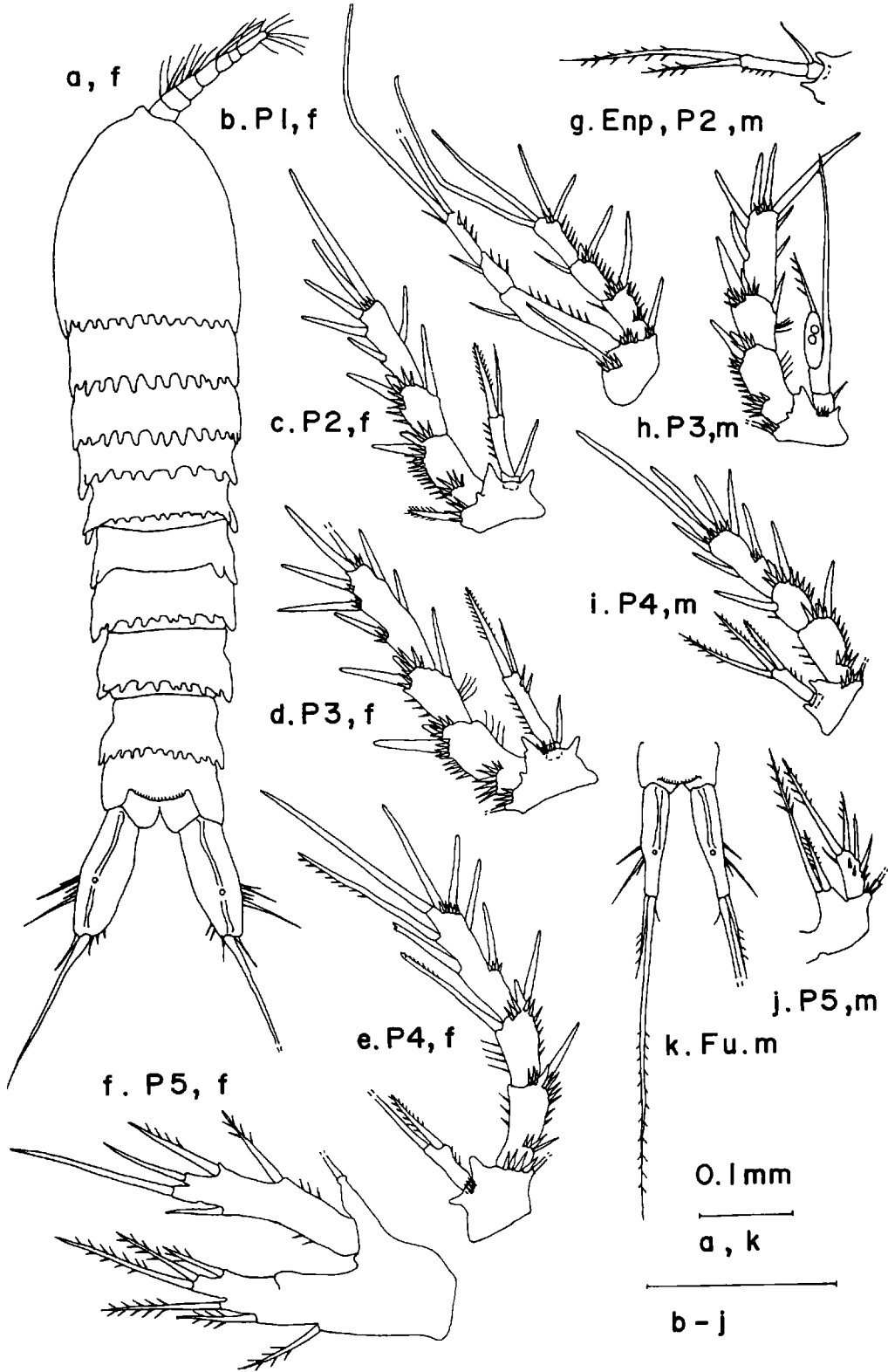


Plate 6. *Attheyella coiffaiti* Chappuis

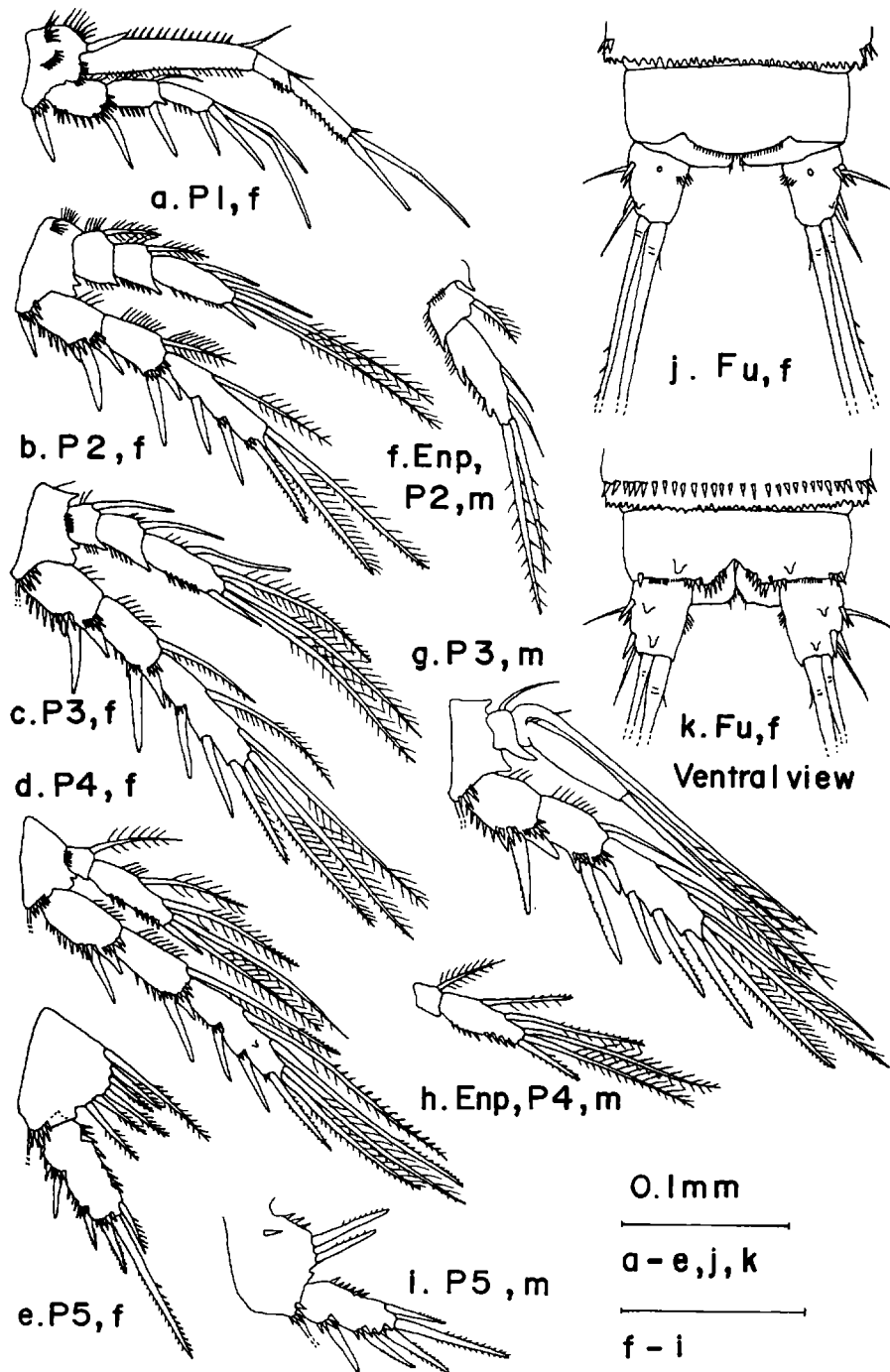


Plate 7. *Attheyella* sp. T