



Two new species of *Mesocyclops* from southern China and notes on the genus *Mesocyclops* in China

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Abstract

Two new *Mesocyclops* species, *M. mariae* n. sp. and *M. shenzhenensis* n. sp., are described from southern China, the former species from Guangxi province, the latter from Guangdong province. Both species have setules on the medial margin of the caudal rami. Compared with each other, there are some conspicuous differences, such as the spinule pattern of the antenna basipodite, the structure of receptaculum seminis, the armature of coxopodite and basipodite of P4 and the armature of the caudal rami. The paper also compares the two new species with their supposedly closest relatives, *M. pseudospinosus* Dussart & Fernando, 1988, *M. leuckarti* (Claus, 1857) and *M. pehpeiensis* Hu, 1943. In addition, other species of *Mesocyclops* in China are discussed and a key to 10 Chinese species of *Mesocyclops* is provided.

Abbreviations: PVL – polyvinyl lactophenol; L – length; W – width; A1 – antennula; A2 – antenna; P1 – leg 1; P2 – leg 2; P3 – leg 3; P4 – leg 4; P5 – leg 5; P6 – leg 6; Cxp. – coxopodite (sometimes called coxa); Bsp – basipodite (sometimes called basis); Enp – endopodite (Enp1 to Enp3); Exp – exopodite (Exp1 to Exp3)

Introduction

The genus *Mesocyclops* is one of the most common Cyclopids in freshwater, and occurs worldwide. Since Van de Velde's (1984) revision of the African species, more than 60 species and subspecies have become known in the world. However, little was known about *Mesocyclops* in China. Tai & Chen (1979) listed only two species, *M. leuckarti* (Claus, 1857) and *M. pehpeiensis* Hu, 1943. Afterwards, Kiefer (1981) recorded *M. thermocycloides* Harada, 1931, *M. aspericornis* (Daday, 1906) and *M. mongoliensis* Kiefer, 1981. In addition, Reid & Kay (1992) described *M. guangxiensis* (a synonym of *M. woutersi* Van de Velde, 1987; Holynska, 1997) from Nanning of Guangxi province and Reid (1993) redescribed *M. rutneri* Kiefer, 1981 (a synonym of *M. pehpeiensis* Hu, 1943, Guo, in

press) from Fujian province. The composition and distribution of *Mesocyclops* in China remained unknown. In the course of my research on the freshwater Copepoda fauna in China, nine species of *Mesocyclops* were identified, viz. *M. leuckarti* (Claus, 1857), *M. pehpeiensis* Hu, 1943, *M. thermocycloides* Harada, 1931, *M. aspericornis* (Daday, 1906), *M. woutersi* Van de Velde, 1987, *M. dissimilis* Defaye & Kawabata, 1993, *M. ogunnus* Onabamiro, 1957, *M. mariae* n. sp. and *M. shenzhenensis* n. sp.

Material and methods

Samples were collected from a wide range of freshwater habitats in China. Plankton nets with mesh sizes 112 μm and 64 μm were used. All samples were pre-

served in 4–7% formalin. Specimens were dissected in glycerine or PVL (polyvinyl lactophenol) under a stereo zoom binocular microscope. Leitz Laborlux K microscope with a camera lucida was used for identifying, measuring and drawing specimens. Measurements were taken following the method of Kozminski (1936). Mounting was done in glycerine and PVL sealed under coverslip with nail polish. A small quantity of modeling clay under the corners of the coverslip was used to prevent the animal from being crushed.

Species descriptions

Mesocyclops mariae n. sp.

Type locality: Shanglin county, Guangxi province, China (23° 32' N, 108° 31' E), a pool near a stream, the upper reach of which connects with Dalongdong reservoir.

Type material: holotype: one dissected female (non-ovigerous) (USNM #3 Holo 288093) mounted on a slide in glycerine; allotype: one dissected male (USNM #2 Allo 288092) mounted on a slide in glycerine; paratype: one dissected female (USNM #1 Para 288091) and one undissected female (USNM #4 Para 288094) mounted as described above;

Repository of type material: holotype, allotype and paratypes have been deposited in the National Museum of Natural History, Smithsonian Institution (USNM). Remaining paratype material in the author's collection.

Etymology: the species is named after Dr Maria Holynska.

Description of female (Figures 1–3)

Average length to the end of caudal rami 1.2 mm ($n=10$); range 1.1–1.3 mm (Figure 1A).

Antennula: 17 segments, reaching distal margin of third prosomal somite. Spinules on segments 1, 4–5 and 7–13 arranged in groups or rows (Figure 1B). Last two segments with serrate hyaline membrane and last one (17th) with a deep notch.

Antenna: Endopodite 1, 2, 3 armed with 1, 7, 7 setae, respectively. Spine pattern of basipodite similar to *Mesocyclops leuckarti*. Following Van de Velde's (1984) terminology, longitudinal row of spines on frontal surface composed of 18 spinules (Figure 1C); longitudinal row of nine spinules on caudal surface, proximal to this row a row of eight spinules, and an ob-

lique row of 21 spinules near medial edge of segment (Figure 1D).

Mandibula, maxillula, maxillulary palp, maxilla and maxilliped (Figure 1E–H) similar to *Mesocyclops leuckarti*.

P1–P4 (Figure 2A–D): Spine and setae formulae as for genus; connecting plates without setules; medial expansion of basipodite P1 without spine.

P4: Enp3 is 2.51 times as long as wide (2.21–2.69, $n=6$); medial apical spine slightly (1.1 \times) longer than lateral (range 0.96–1.20, $n=6$). These two spines shorter than segment. Caudal armature of P4 coxopodite (Figure 3A): intermittent group of large spinules (1–4 + 1–2) near distal rim; oblique row of long spinules (7–13) inserted at lateral distal angle; a row of spinules (5–8) near proximal rim; a patch of hair-setae near lateral rim. BspP4 with group of hair-setae on medial expansion. Two large acute outgrowths on distal margin of connecting plate.

P5 (Figure 3B): Spinous seta slightly longer than apical seta, extending along ca. 3/4 of genital double somite.

P6 (Figure 3C): two small lateral spines and a long medial seta insert on latero-dorsal surface. A group of six pores distal to implantation of P6.

Pediger 5 (Figure 3B): armed with hair-setae on each side.

Receptaculum seminis (Figure 3B, D, E): With two long lateral arms, slightly curved at their ends; tooth-shaped copulatory pore close to level of transverse ducts; Pore-canal downwardly-directed with sinus-like crook in the middle.

Anal segment armed with well-developed spinules ventrally and dorsally on distal margin, laterodorsally with a row of minute spinules near proximal margin (Figure 3F).

Caudal rami (Figure 3F, G): L / W =3.62 (3.21–4.00, $n=13$); pilose medio-proximally; lateral and external terminal setae without spines at their base.

Description of male (Figure 4)

Average length to the end of caudal rami is 0.79 mm ($n=7$); range 0.74–0.82 mm. Antennula has 17 segments and 3 aesthetascs on the first segment, 1 on the 4th and 1 on the 9th segment (Figure 4A). Mouth parts are the same as in female and similar pattern of spines on basipodite of antennae as in female except for lack of an oblique row of fine spinules starting from medial rim on caudal surface (Figure 4B, C). Caudal rami without hairs on medial margin and 2.82

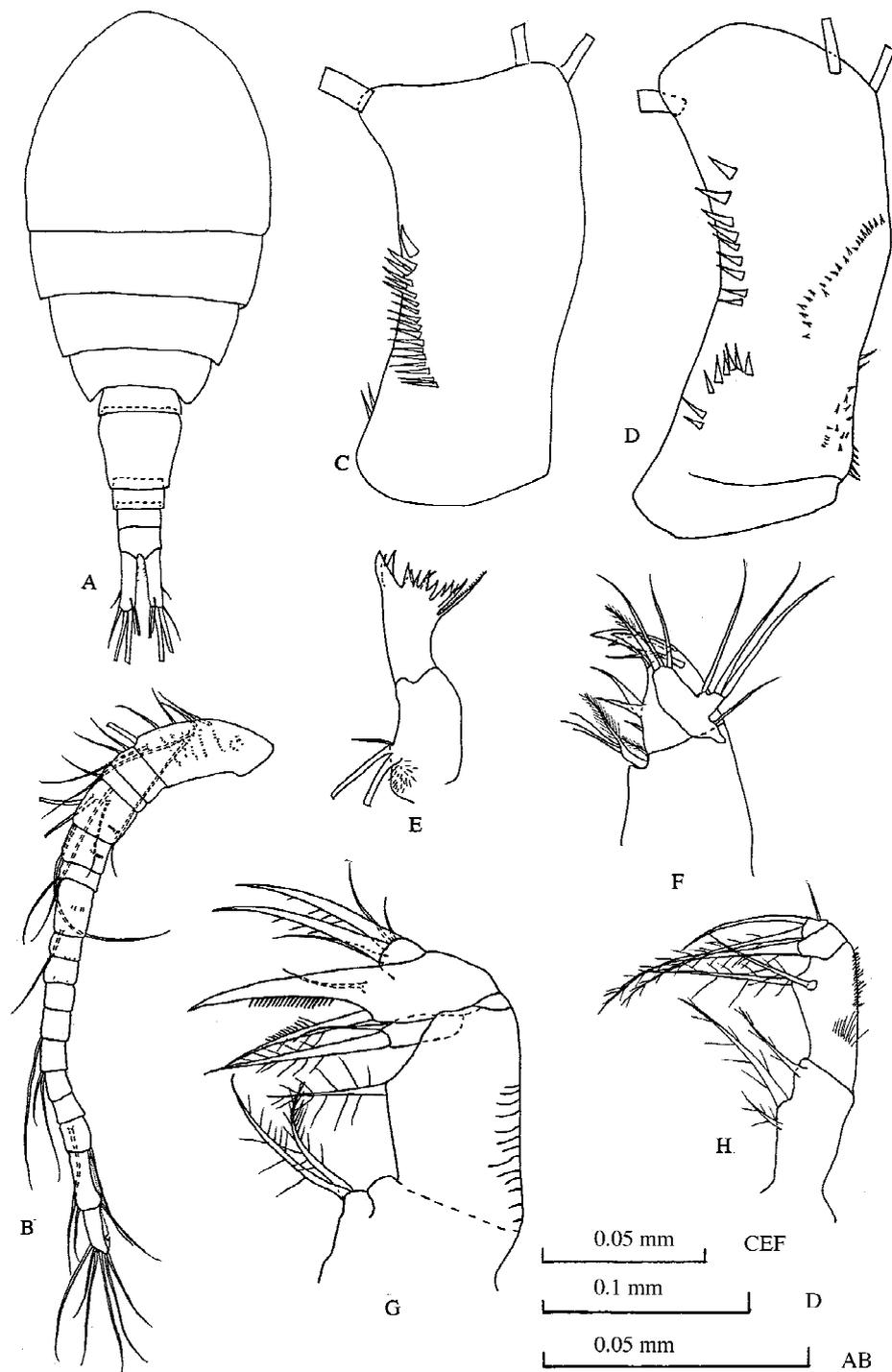


Figure 1. *Mesocyclops mariae* n. sp. Female: (A) habitus; (B) A1; (C) basis of A2, frontal; (D) basis of A2, caudal; (E) mandibula; (F) maxillula; (G) maxilla; (H) maxilliped.

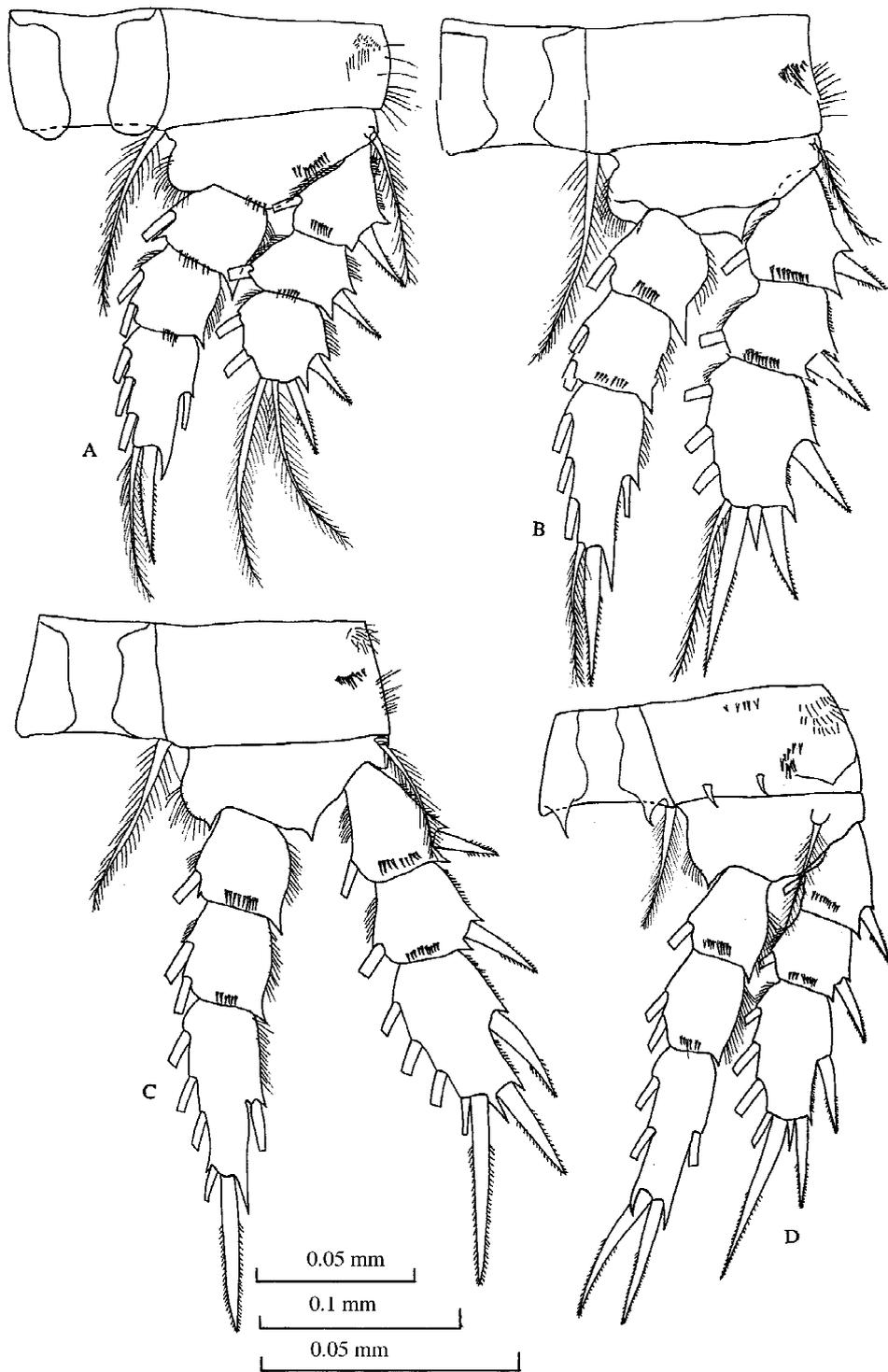


Figure 2. *Mesocyclops mariae* n. sp. Female: (A) P1; (B) P2; (C) P3; (D) P4.

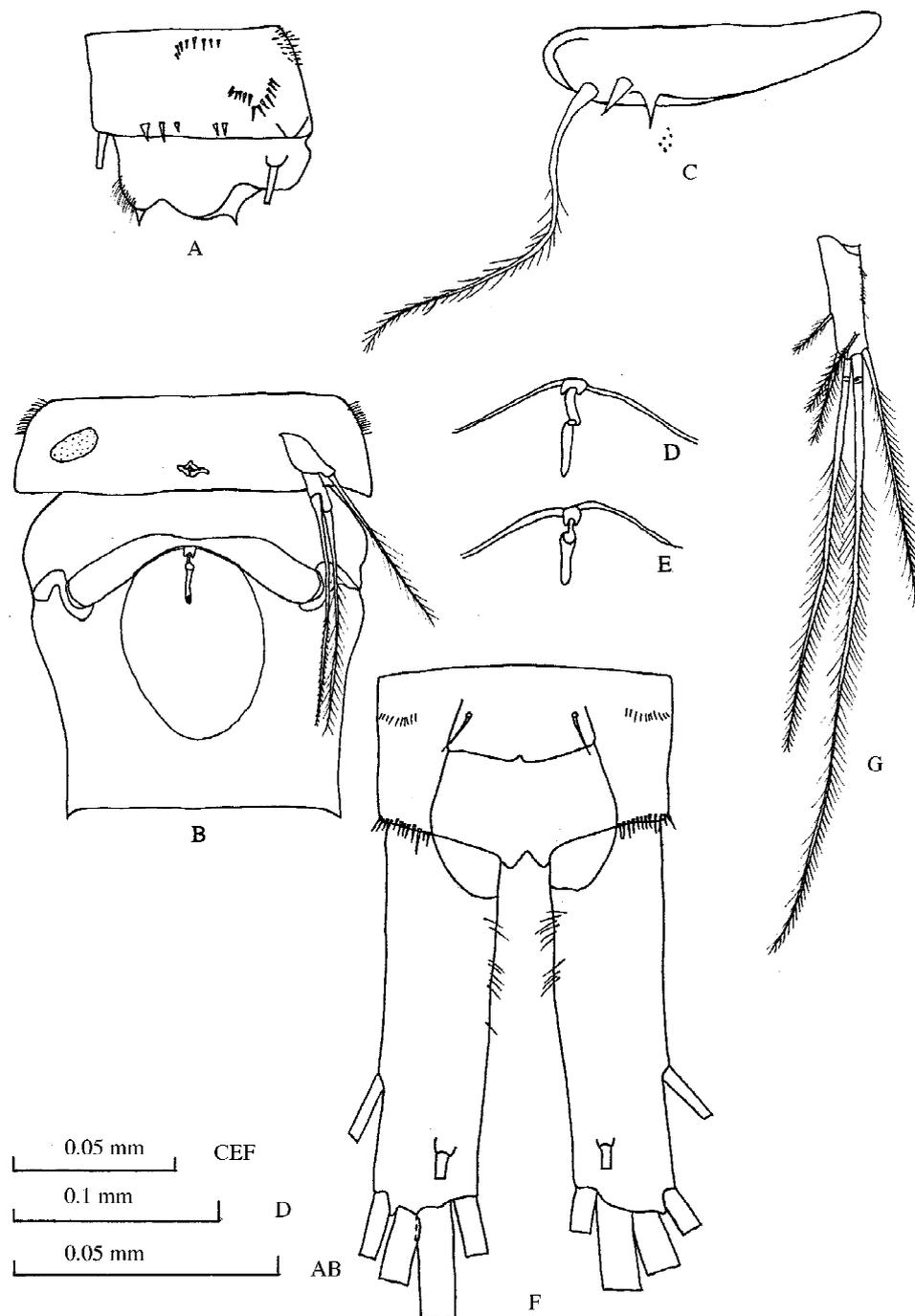


Figure 3. *Mesocyclops mariae* n. sp. Female: (A) coxa and basis of P4, caudal surface; (B) pediger 5; (C) P6; (D-E) copulatory duct; (F) anal segment and caudal rami, dorsal; (G) caudal ramus with setae.

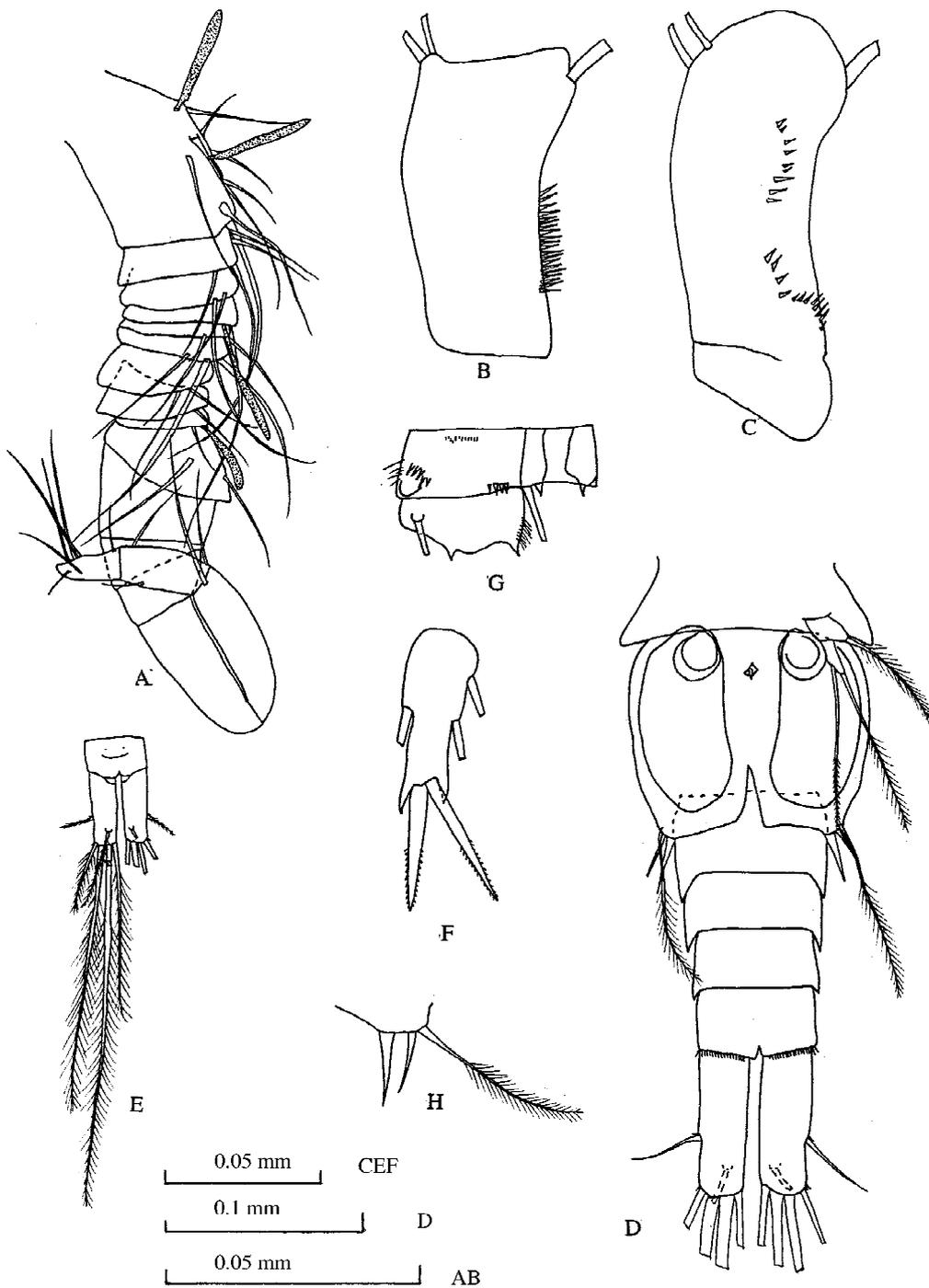


Figure 4. *Mesocyclops mariae* n. sp. Male: (A) A1; (B) basis of A2, frontal; (C) basis of A2, caudal; (D) pediger 5 with P5 and abdomen with caudal rami; (E) caudal rami with setae; (F) Enp3 P4; (G) coxopodite and basipodite of P4; (H) P6.

times as long as wide (2.46–3.00, $n=8$). Lateral and external terminal setae with spines at their base. No hairs on lateral edges of the pediger 5 (Figure 4D, E). P1–P5 with similar structure as in female. Enp3 P4 (Figure 4 F) 2.47 times as long as wide (2.3–2.6, $n=5$) and medial terminal spine 1.05 times as long as lateral one. Caudal armature of P4 coxopodite (Figure 4 g): intermittent group of large spinules (4–5 + 0–3) near distal rim; oblique row of long spinules (5–6) inserted at lateral distal angle; a row of spinules (11–13) near proximal rim. P6 (Figure 4H) composed of 2 spines and 1 seta, the medial spine is stronger and longer than the middle one, the lateral seta is very long and almost reaching the distal margin of the fifth urosomal somite.

Diagnosis

Mesocyclops mariae n. sp. differs from its congeners by the combination of the following characters: spinule pattern on the basipodite of antenna, medial expansion of P4 basis with distal hairs, connecting plate of P4 with two large acute outgrowths on the distal margin, caudal armature of P4 coxopodite, structure of receptaculum seminis, pediger 5 haired laterally, caudal rami with hairs on medio-proximal margin and without spinules at the base of the lateral and external terminal setae and the armature of anal segment.

Mesocyclops shenzhenensis n. sp.

Type locality: Xili reservoir of Shenzhen city (close to Hong Kong), Guangdong province, China (22° 39' N, 114° 3' E).

Type material: Only two female specimens were found. holotype: one dissected female (non-ovigerous) (USNM Holo 288095) mounted on a slide in glycerine; paratype: one dissected female (non-ovigerous) mounted on a slide in PVL.

Etymology: the name refers to the city (Shenzhen) where the species has been collected. Holotype has been deposited in the National Museum Of Natural History, Smithsonian Institution (USNM). Paratype in the author's collection.

Description of female (Figures 5–6)

The length to the end of caudal rami 1.14 mm; 17-segmented antennula reaches distal margin of the second prosomal somite. Spinules on segments 1, 4–5 and 7–13 are arranged in groups or rows. The last two antennular segments with a serrate hyaline mem-

brane and the last one (17th) with one deep notch (Figure 5A).

Basipodite of antenna (Figure 5B, C): On the caudal surface, an oblique row of minute spinules located medially, a patch of minute spinules at the level of medial setae, a longitudinal row of 8 spinules, oblique row of 10 spinules proximally. On the frontal surface, a longitudinal row of 20 spines.

Maxillary palp lacks row of frontal spinules, and coxopodite of maxilla (Figure 5D) without longitudinal spinule rows on frontal surface.

P1–P4: Spine and seta formulae typical for the genus, connecting plates without any setules; medial expansion of P1 basipodite (Figure 5 E) not armed with a spine.

P4 (Figure 6A): Enp3 is 2.47 times as long as wide and medial apical spine / lateral apical spine is 1.28. These two spines are shorter than the segment. Caudal armature of P4 coxopodite: intermittent group of large spinules (3+2) near distal rim; oblique row of long spinules (5) inserted at latero-distal angle; a row of spinules (8) near proximal rim; long hairs next to and on lateral rim. The medial expansion of basipodite of P4 has a row of hairs near proximal rim. Two large acute outgrowths are on the distal margin of connecting plate.

P5 (Figure 6B): Apical seta is slightly longer than spinous seta and not reaching distal margin of genital double somite.

P6 (Figure 5F): Composed of two short spines with equal length and a long dorsal seta. Distal to the implantation of P6, a group of six pores.

Pediger 5 (Figure 5B): without hairs on dorsal, ventral and lateral surface.

Receptaculum seminis (Figure 6B): only transverse ducts, copulatory-pore and pore-canal are distinct. The transverse ducts meet in an acute angle, pore-canal curved posteriorly. The distal margin of anal segment armed with well-developed spinules ventrally and dorsally. *Caudal rami* (Figure 6C–E): L / W = 3.05; pilose on proximo-medial margin and dorsal surface; lateral and external terminal setae with spines at their base.

Diagnosis

Mesocyclops shenzhenensis n. sp. differs from *M. mariae* n. sp. in the following characters: spinule pattern on basipodite of antenna, armature of coxopodite and basipodite of P4, anal segment without latero-dorsal spinules near proximal margin, extension of

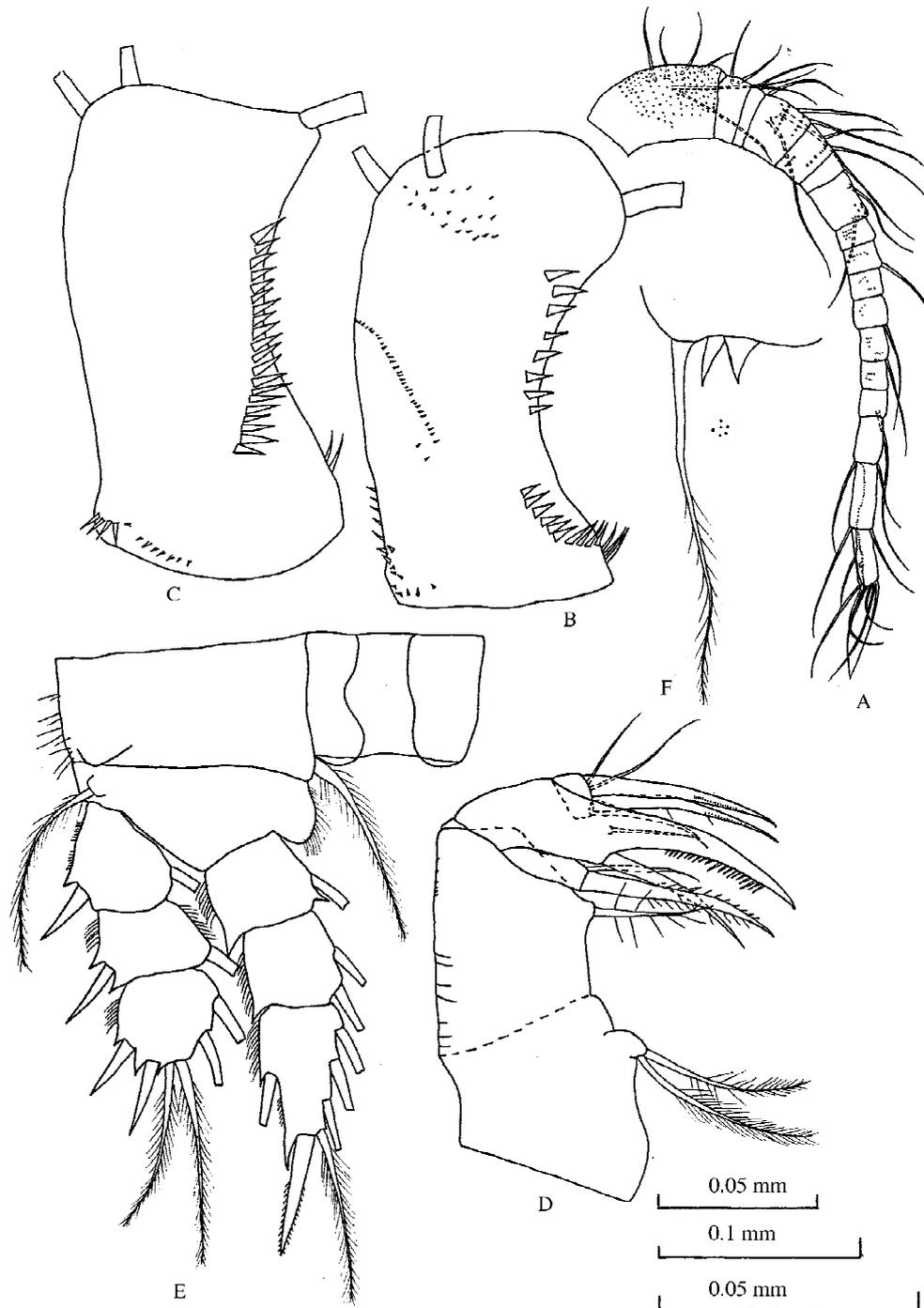


Figure 5. *Mesocyclops shenzhenensis* n. sp. Female: (A) A1; (B) basis of A2, caudal; (C) basis of A2, frontal; (D) maxilla; (E) P1; (F) P6.

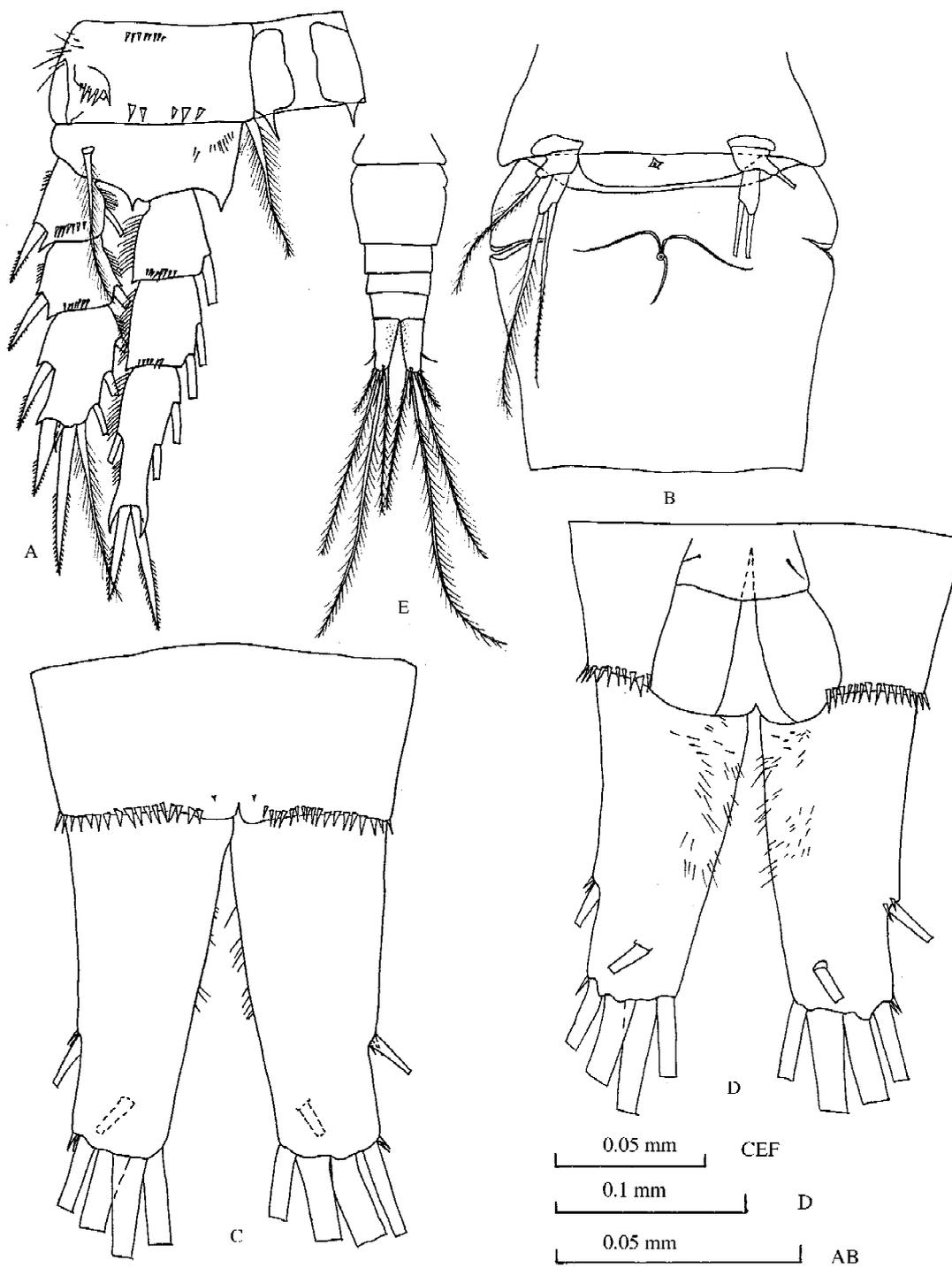


Figure 6. *Mesocyclops shenzhenensis* n. sp. Female: (A) P4; (B) pediger 5 and genital segment; (C) caudal rami, ventral; (D) caudal rami, dorsal; (E) pediger 5, abdomen and caudal rami with setae.

hairiness on caudal rami, spinules at the base of the lateral and the external terminal setae, acute angle formed by transverse ducts before copulatory pore, and pediger 5 laterally naked.

Notes on *Mesocyclops* species of China

M. leuckarti (Claus, 1857)

This species was previously considered to be cosmopolitan. Kiefer (1981) and Van de Velde (1984) made a detailed redescription of *M. leuckarti* and distinguished it from other species of Old World *Mesocyclops*. The species seems to be restricted to Europe and northern Asia. *M. leuckarti* described by Tai & Chen (1979) is not genuine one, probably mixed up with other species of *Mesocyclops* in China because the outgrowths on connecting plate of P4, instead of the large acute form, are small like in *M. thermocycloides* species-group. Based on the results of the author, *M. leuckarti* occurs in northern China, including Xinjiang, Gansu, Qinghai, Ningxia, Inner Mongolia and Heilongjiang provinces.

M. pehpeiensis Hu, 1943

This species was first described by Hu (1943) in Beipei, Sichuan province of China and afterwards, Shen (1956) and Tai & Chen (1979) reported and redescribed it. However, they provided few of the morphological details so that this species gave rise to controversy. The author made a redescription about this species and compared it with *M. ruttneri*, so the question has been resolved and *M. ruttneri* Kiefer, 1981 is synonymized with *M. pehpeiensis* Hu, 1943 (Guo, in press).

M. pehpeiensis can be distinguished from its congeners by the following characters: Antennula 17-segmented with groups or rows of spinules on segment 1, 4, 5 and 7–13 and segment 17 with one deep notch. Antenna basipodite presents caudally, in addition to the spinule pattern of *M. leuckarti* (Van de Velde, 1984), a row of 6–7 small spinules at the level of medial setae and 2–4 small spinules near the distal margin. Maxillulary palp without spinules. Maxillar syncoxa frontally with distinct rows of spinules. Medial expansion of P1 basis without spine. Distal margin of connecting plate of P4 with two large acute outgrowths, medial expansion of P4 basis without hairs. Pediger 5 naked laterally and dorsally. Receptaculum seminis with two short lateral arms slightly curved at

their ends and transverse ducts from copulatory pore slightly V-shaped. Caudal rami without hairs on medial margin and armed with spinules at the bases of the lateral and the external terminal setae, the ratio (L/W) 2.87–4.07.

M. pehpeiensis occurs in southern China including Sichuan, Guizhou, Jiangsu, Fujian, Guangdong, Guangxi provinces.

M. thermocycloides Harada, 1931

M. thermocycloides was described by Harada (1931) from Sun Moon Lake of Taiwan. Afterwards, many researchers, Kiefer (1981), Lim & Fernando (1985), Dussart & Fernando (1988), Holynska & Fiers (1994) and Holynska (1994), reported and redescribed it. Especially Holynska (1994) made a detailed redescription. Based on the presence of spiniform armature on the frontal surface of coxopodite of maxilla and combined with other six characteristics, Holynska & Fiers (1994) defined *Mesocyclops thermocycloides* species-group.

M. thermocycloides occurs in southern China, including Hubei, Hunan, Anhui, Jiangsu, Fujian, Sichuan, Yunnan, Guangdong, Guangxi, Hainan and Taiwan provinces.

M. aspericornis (Daday, 1906) (Figure 7)

This species is easily distinguished from its congeners by the caudal rami possessing hairs along the entire medial margin (Figure 7A, B) and by the caudal spine ornamentation of antennary basis hairing a group of minute spinules inserted between the longitudinal row of spines and the row of spines proximal to that row (Figure 7C). Kiefer (1981) and Van de Velde (1984) made a detailed redescription. *M. aspericornis* belongs to the *Mesocyclops thermocycloides* species-group (Figure 7E–G). Kiefer (1981) reported its occurrence from southern China and Taiwan. I found the species in Guangdong and Hainan provinces of China.

M. ogunnus Onabamiro, 1957 (Figure 8)

M. thermocycloides and *M. dussarti* Van de Velde, 1984, are morphologically allied to *M. ogunnus*, but *M. ogunnus* has a special feature: the maxillulary palp bears a row of spinules (Figure 8A), by which it is easily distinguished from its congeners. In addition, *M. ogunnus* differs from *M. thermocycloides* by the caudal rami armed with spinules at the base

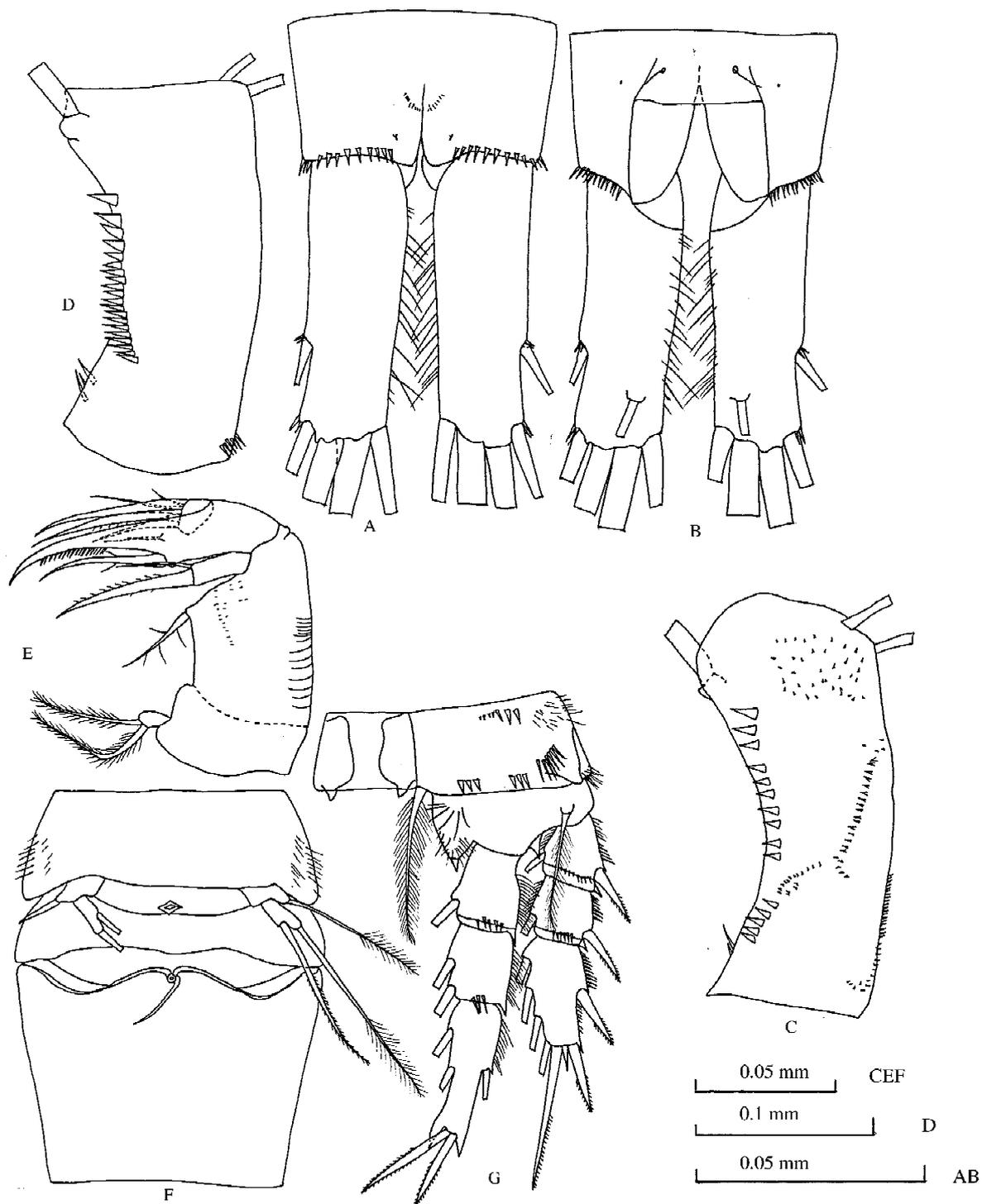


Figure 7. *Mesocyclops aspericonis*. Female: (A) anal segment and caudal rami, ventral; (B) anal segment and caudal rami, dorsal; (C) basis of A2, caudal; (D) basis of A2, frontal; (E) maxilla; (F) pediger 5 and genital segment; (G) P4.

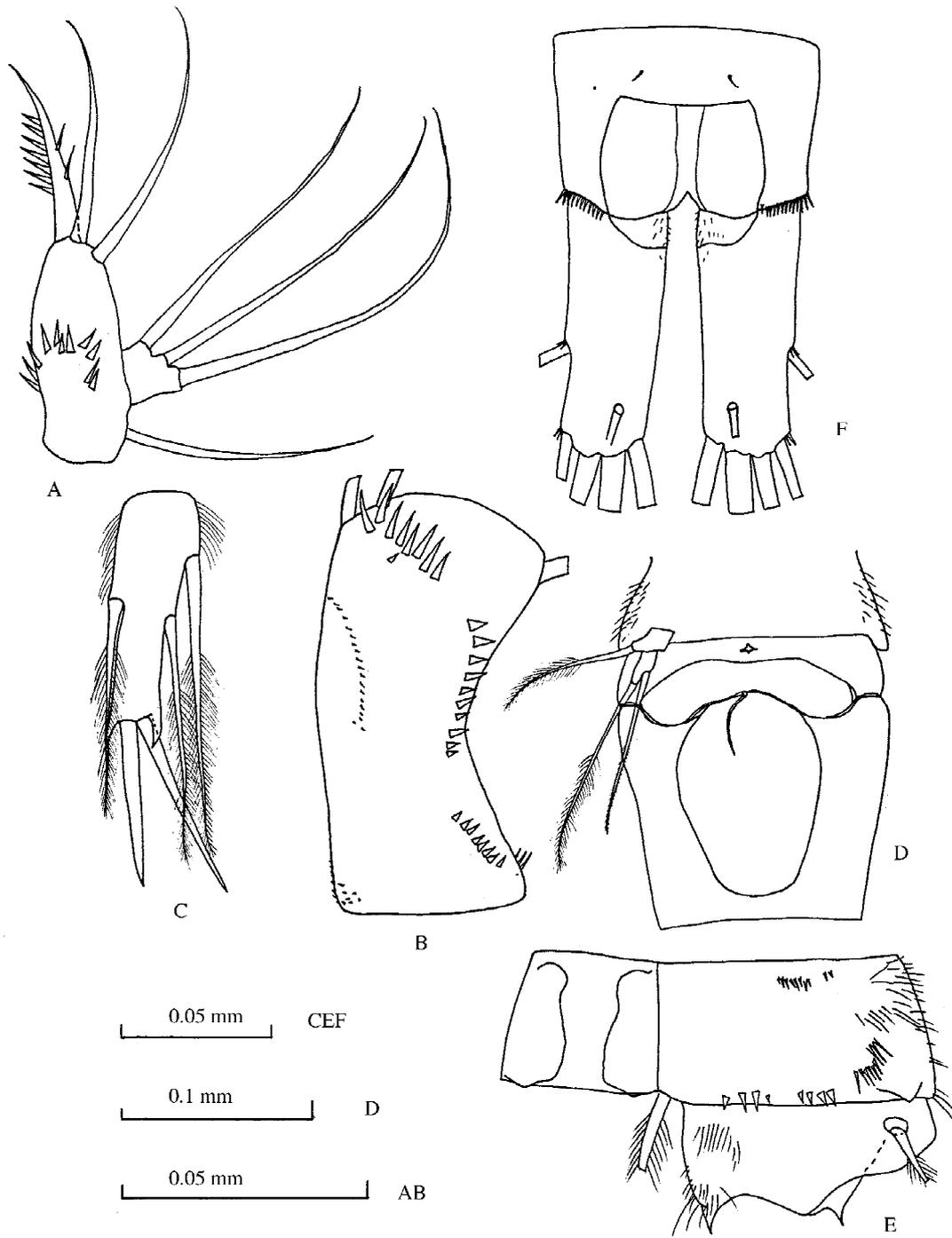


Figure 8. *Mesocyclops ogunnus*. Female: (A) maxillary palp; (B) basis of A2, caudal; (C) Enp3 P4; (D) pediger 5 and genital segment; (E) coxopodite and basipodite of P4, caudal; (F) anal segment and caudal rami, dorsal.

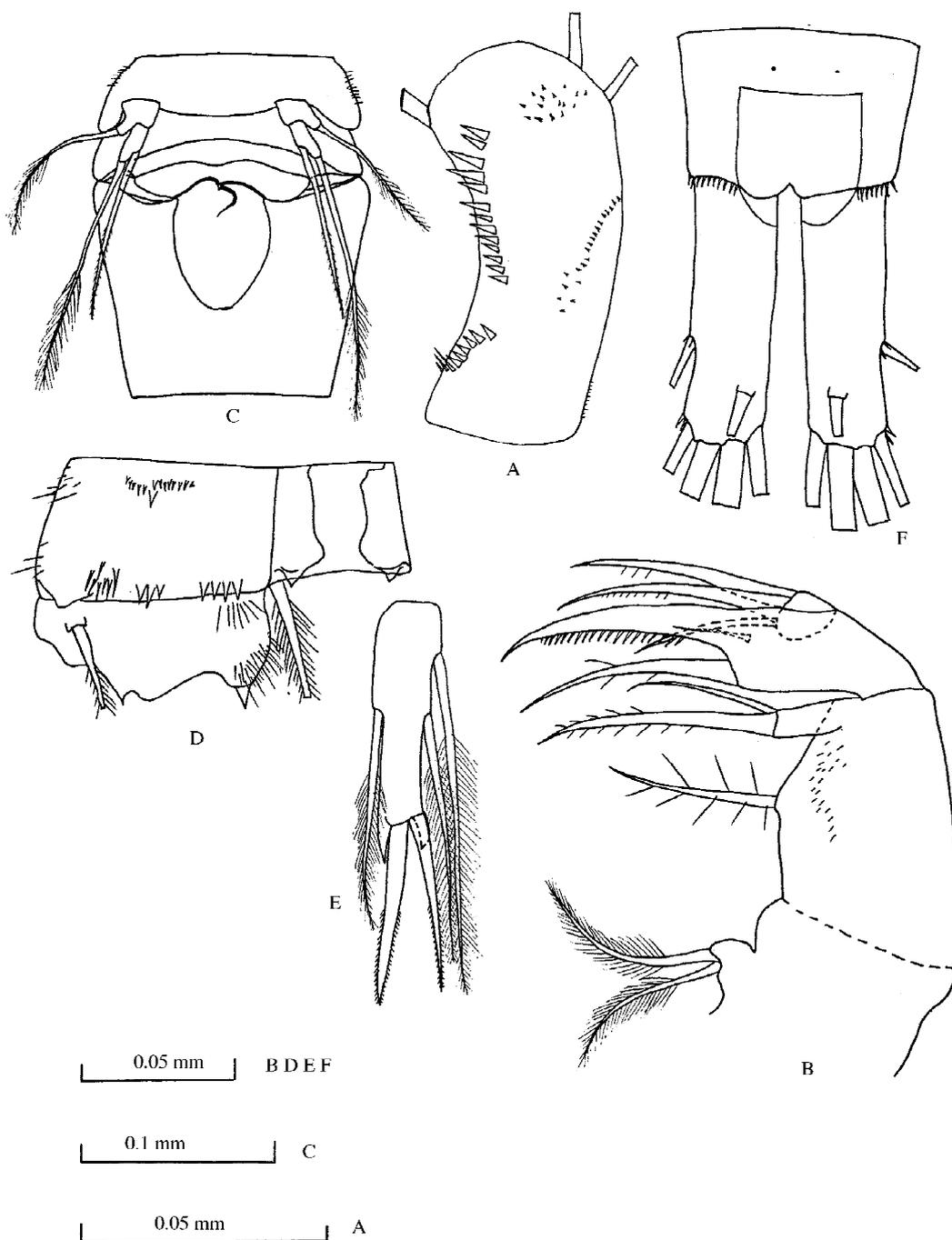


Figure 9. *Mesocyclops dissimilis*. Female: (A) basis of A2, caudal; (B) maxilla; (C) pediger 5 and genital segment; (D) coxopodite and basipodite of P4; (E) Enp3 P4; (F) anal segment and caudal rami.

of the lateral and the external terminal setae (Figure 8F) and differs from *M. dussarti* in having pediger 5 dorsally not completely haired and lacking hairs on the dorsal surface of the genital double-somite (Figure 8D). *M. ogunnus* also belongs to the *Mesocyclops thermocycloides* species-group.

M. ogunnus is a widely distributed Afro-Asian species with great morphological variability. Van de Velde (1984) examined very large material from Africa including two syntypes of *M. ogunnus* and found that contrary to Onabamiro's statement, the caudal rami in *M. ogunnus* are not pilose internally. In my collection from Xili reservoir of Shenzhen, Guangdong province of China, I found that most specimens of this species have several hair-like setules in proximal medial part of caudal rami.

M. ogunnus a first record from China (Guangdong and Hainan provinces).

M. woutersi Van de Velde, 1987

This species, described by Van de Velde (1987) from Papua New Guinea, differs from its congeners by the combination of the following characters: the spinule pattern on the basipodite of the antenna, structure of the receptaculum seminis, armature of coxopodite and basipodite of P4, pediger 5 laterally bearing hairs and caudal rami without spinules at the base of the lateral and external terminal setae. It also belongs to the *Mesocyclops thermocycloides* species-group.

Mesocyclops guangxiensis Reid & Kay, 1992 is the synonym of *M. woutersi* Van de Velde, 1987 (Holynska, 1997). It occurs in southern China, including Guangxi, Guangdong, Guizhou and Hainan provinces.

Key to the Chinese species of *Mesocyclops*

1. Medial margin of caudal rami armed with setules 9
- Medial margin of caudal rami without setules 2
2. Pediger 5 laterally pilose and P4 connecting plate with small outgrowths on the distal margin (the height of the outgrowths ca. as long as their width at the base) 6
- Pediger 5 laterally naked and P4 connecting lamella with large outgrowths on the distal margin (the height of the outgrowths conspicuously bigger than their width at the base) 3
3. Medial expansion of Bsp P4 naked 5
- Medial expansion of Bsp P4 with a group of hairs distally 4
4. The spinous seta of P5 is shorter than the apical seta and Enp3 P4 is about 3.4 times as long as wide *M. leuckarti* (Claus, 1857)
- The spinous seta of P5 is longer than the apical seta and Enp3 P4 is 2.53–2.69 times as long as wide *M. mongoliensis* Kiefer, 1981

M. dissimilis Defaye & Kawabata, 1993 (Figure 9)

M. dissimilis has been described by Defaye & Kawabata from the Lake Biwa, Japan in 1993. It differs from its congeners in the combination of the following characters: the spinule pattern on the basipodite of the antenna (Figure 9A), structure of the receptaculum seminis (Figure 9C), armature of coxopodite and basipodite of P4 (Figure 9D), pediger 5 laterally armed with hairs (Figure 9C) and caudal rami armed with spinules at the base of the lateral and the external terminal setae (Figure 9F). *M. dissimilis* belongs to the *Mesocyclops thermocycloides* species-group. Maxilla coxopodite has a distinct irregular row of spinules on frontal side (Figure 9B), however the original description did not mention it.

This species is here first recorded from China. It has a wide distribution and has been found in Heilongjiang, Jilin, Inner Mongolia, Gansu, Shanxi, Shandong Jiangsu, Anhui, Guangdong, Guangxi, Guizhou and Yunnan provinces.

M. mongoliensis Kiefer, 1981

This species is morphologically allied to *M. leuckarti*, but differs from it since the medial spinous seta of P5 is longer than the apical seta of the same segment and Enp3 P4 is 2.53–2.69 times as long as wide, whereas it is 3.4 times as long as wide in *M. leuckarti*. On the other hand, based on the figures (Kiefer, 1981), *M. mongoliensis* has no hairs on the medial expansion of basipodite P4, however it is haired in *M. leuckarti*. According to the record of Kiefer (1981), *M. mongoliensis* was collected from a small lake near the city Hailar, Inner Mongolia, but this species has never been found in China by the author up to now. It seems that further studies should be done in the future.

5. Maxillar syncoxa frontally armed with distinct row of spinules. On the caudal surface of basis of A2, an irregular transverse row of 6–7 spinules at the level of the medial setae and 2–4 spinules near the distal margin *M. pehpeiensis* Hu, 1943
6. Maxillary palp provided with a row of spines *M. ogunnus* Onabamiro, 1957
Maxillary palp without any spines 7
7. Antennary basis armed with a group of large spinules on the caudal surface, next to implantation of the medial setae *M. thermocycloides* Harada, 1931
Antennary basis without a group of large spinules on the caudal surface, next to implantation of the medial setae 8
8. Lateral and external terminal setae of caudal rami armed with spinules at their base
..... *M. dissimilis* Defaye & Kawabata, 1993
Lateral and external terminal setae of caudal rami without spinules at their base
..... *M. woutersi* Van de Velde, 1987
9. Medial margin of the caudal rami pilose along the entire margin, and on the caudal surface of antennary basis, a group of minute spinules is inserted between the longitudinal row of spines and the row of spines proximal to that row *M. aspericornis* (Daday, 1906)
Medial margin of the caudal rami pilose in the proximal half only 10
10. Pediger 5 laterally pilose; medial expansion of Bsp P4 with a group of hairs distally and naked proximally; lateral and external terminal setae of caudal rami without spinules at their base *M. mariae* n. sp.
Pediger 5 laterally naked; medial expansion of Bsp P4 with a group of hairs proximally and naked distally; lateral and external terminal setae of caudal rami armed with spinules at their base *M. shenzhenensis* n. sp.

Discussion

Both new species described above have pilose caudal rami and do not belong to the *Mesocyclops thermocycloides*-group (absence of spiniform armature on the maxillar coxopodite, two large acute outgrowths on the distal margin of the connecting plate of P4). In comparison with other species of *Mesocyclops*, *M. mariae* shares some characteristics of *M. pseudospinosus* Dussart & Fernando, 1988, as follows: Caudal rami with setules, large outgrowths on the distal margin of the connecting plate of P4, P5 and similar spinule pattern on basipodite of antenna. However, *M. mariae* differs from *M. pseudospinosus* in position and connection of copulatory pore with transverse ducts, only distal hairiness on the medial expansion of P4 basipodite, and missing spinules at the base of the lateral and the external terminal setae. *M. mariae* also has similarities with *M. leuckarti* in the general morphology of mouth parts, spinule pattern on basipodite of antenna, P5, large outgrowths on the connecting plate of P4 and distally haired medial expansion of P4 basipodite, but differs in pilose caudal rami, a laterally pilose pediger 5, armature of P4 coxopodite and armature of anal segment. *M. shenzhenensis* is supposedly closest related to *M. pehpeiensis*

in large outgrowths on the connecting plate of P4, a laterally naked pediger 5, the general morphology of the receptaculum seminis, spinules at the base of the lateral and external terminal setae, but differs in pilose caudal rami, the caudal spinule pattern on basipodite of antenna, absence of spiniform armature on the maxillar coxopodite frontally and the medial expansion of basipodite of P4 with a row of hairs near proximal margin.

Summarising, the two new species are different from any other species of the genus *Mesocyclops* by enough characters to consider them as good species. *M. mariae* and *M. thermocycloides* coexist in the type locality (Guangxi), and *M. shenzhenensis* coexists with *M. woutersi*, *M. pehpeiensis*, *M. ogunnus* and *M. aspericornis* in the Xili reservoir (Guangdong), where *M. ogunnus*, *M. woutersi* and *M. pehpeiensis* are predominant, whereas *M. aspericornis* and *M. shenzhenensis* were only represented by two specimens, respectively.

M. mongoliensis has not been found by the author so far. It seems that a further study has to be done in the future. Recently, I received the information about this species from Maria Holynska. She examined *M. mongoliensis* in the Kiefer collection, Karlsruhe. The specimens, collected from the type locality by Ueno in

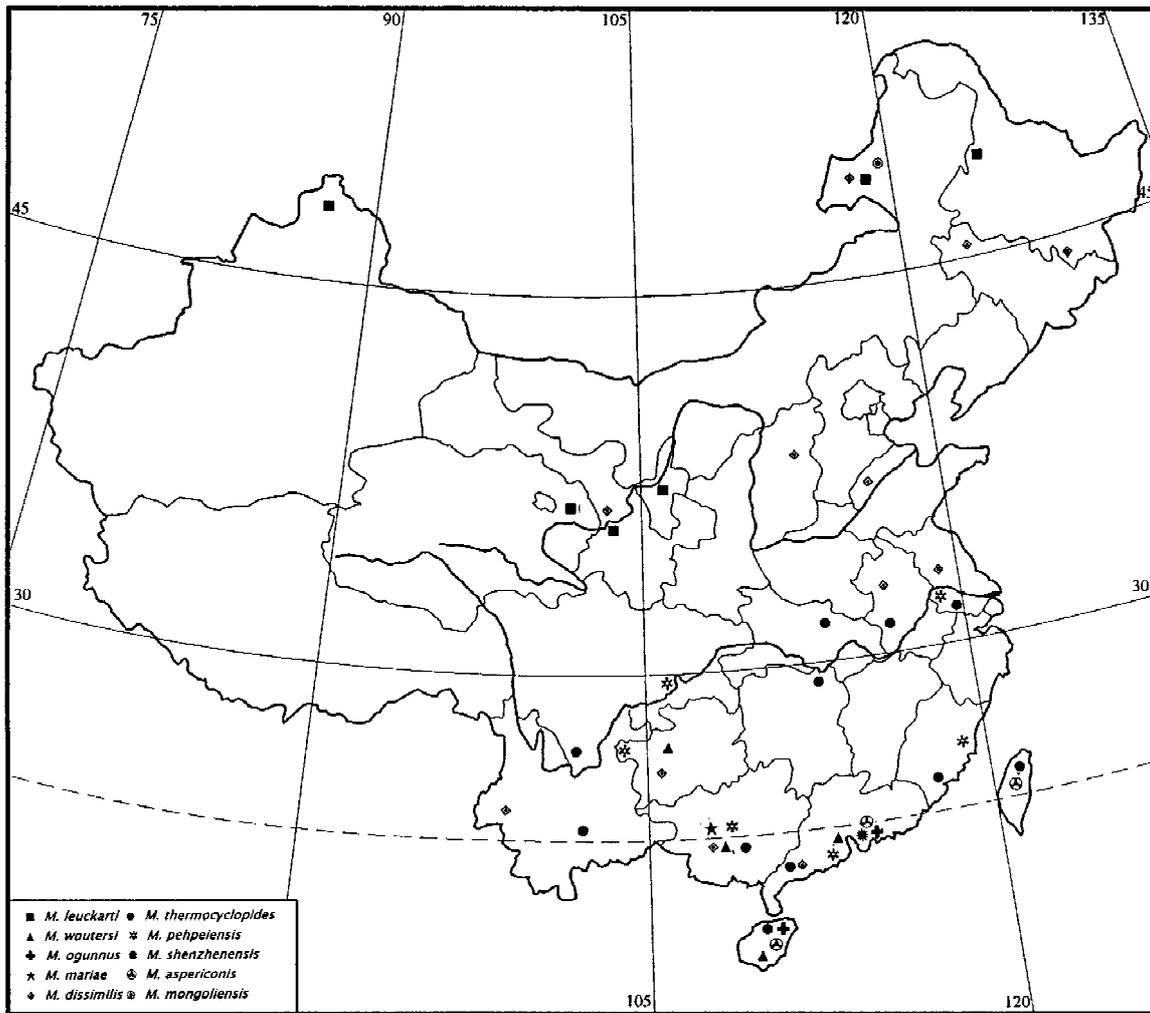


Figure 10. Distribution of *Mesocyclops* in China.

1936 and identified by Kiefer as *M. mongoliensis*, are similar to *M. leuckarti* with having distal hairs on medial expansion of P4 basipodite. It is better to contrast both characteristics (relative length of spinous setae of P5 and L/W of Enp3 P4) in *M. leuckarti* and *M. mongoliensis*.

The genus *Mesocyclops* is one of the most common taxa in freshwater habitats and occurs worldwide. As for the zoogeographical distribution of *Mesocyclops* in China (Figure 10), there are three types: northern China species such as *M. leuckarti* and *M. mongoliensis*; Southern China species such as *M. pehpeiensis*, *M. thermocycloides*, *M. aspericornis*, *M. woutersi*, *M. ogunnus*, *M. mariae* and *M. shenzhenensis*; whole country except western region (Xinjinag, Qinghai, Sichuan and Tibet) with one species – *M. dissimilis*.

The discovery of two new species, *M. mariae* and *M. shenzhenensis*, and two new record species for China, *M. ogunnus* and *M. dissimilis* indicates that the *Mesocyclops* fauna of China is more diverse than previously envisaged.

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