

# Key to freshwater Cyclopidae of Russia and adjacent lands (Crustacea)

V.R. Alekseev

Alekseev, V.R. 1998. Key to freshwater Cyclopidae of Russia and adjacent lands (Crustacea). *Zoosystematica Rossica*, 7(1): 25-43.

A key to the identification of freelifving freshwater Cyclopidae of Russia and adjacent lands with the exception of the Baikalian endemics and underground species is suggested. More than 60 species of 16 genera with brief illustrated essays on morphology, ecology and geographic distribution for 21 species added to the fauna in the last 50 years are included.

V.R. Alekseev, Zoological Institute, Russian Academy of Sciences, Universitetskaya nab. 1, St.Petersburg 199034, Russia.

Since the well known book of Rylov (1948) on freshwater cyclopids of Russia, only two regional summaries, on the Ukraine (Monchenko, 1975) and Baikal (Mazepova, 1978) cyclopids, have been published.

Over this 50 year period many new species have been described and some species recorded for the first time from Russia and adjacent lands (Monchenko, 1974; Mirabdullaev, 1989, 1990; Alekseev, 1993, 1995, etc.). New methods for better identification of crustacean species have emerged that encouraged scientists to revise the regional and world faunas (Einsle, 1993).

In other freshwater microcrustaceans, a revision has started, and as a result our knowledge of the fauna composition changed very significantly and provided the biodiversity investigations in our country and abroad with many important new data (Smirnov, 1992; Korovchinsky, 1992).

This key for identification of freelifving Cyclopidae in surface waters of Russia and adjacent lands with the exception of the Baikalian endemics is a result of our study in this field that has summarized the changes in knowledge of the fauna at species level in this country for 50 years and should be considered as a basis for subsequent revision of this group of invertebrates very important for freshwater ecosystem.

Abbreviations used in this paper: P1-P5, thoracic appendages; Th1-Th5, thoracosomites.

The modern systematic position of Cyclopidae (after Huis & Boxshell, 1991 and Dussart & Defaye, 1995, with changes) is as follows: class Copepoda Milne Edwards, 1840, infraclass Podoplea Giesbrecht, 1882, superorder Cyclopoida Burmeister, 1835, order Cyclopiformes Starobogatov, 1986, family Cyclopidae Burmeister, 1834.

All freshwater cyclopoids belong to the family Cyclopidae, in which only two subfamilies are mainly freshwater.

## Key to subfamilies

- 1(2). Last or single segment of P5 with 3 appendices ..... **Eucyclopinae**
- 2(1). Last or single segment of P5 with 1-2 appendices ..... **Cyclopinae**

## Subfamily EUCYCLOPINAE

More than 25 species of 5 genera are known from Russia and adjacent lands of which about 10 species are Baikalian endemics and groundwater inhabitants and not included here.

## Key to genera

- 1(2). P5 two-segmented; antennules 17-segmented . . . . . **Macrocyclops** Claus, 1893
- 2(1). P5 uni-segmented or fused with fifth thoracosomite; antennules 6-12-segmented.
- 3(8). P5 uni-segmented, triangular.
- 4(7). Antennules 12-segmented.

- 5(6). Furcal rami at least 3.5 times as long as wide, usually with a row of spinules at external side . . . . . **Eucyclops** Claus, 1893
- 6(5). Furcal rami not more than 3.5 times as long as wide, without a row of spinules at external side . . . . . **Tropocyclops** Kiefer, 1927  
In Russia only *T. prasinus* (Fischer, 1860) known from Amur Province and south of the former USSR.
- 7(4). Antennules 6-11-segmented . . . . . **Paracyclops** Claus, 1893
- 8(3). P5 fused with fifth thoracosomite; furcal rami ornamented with several transverse rows of spinules . . . . . **Ectocyclops** Brady, 1904  
In Russia only *E. phaleratus* (Koch, 1839) known from all climatic zones and zoogeographic provinces.

#### Key to species of the genus *Macrocylops*

- 1(2). Internal side of furcal rami without hairs . . . . . **M. albidus** (Jurine, 1820)
- 2(1). Internal side of furcal rami with hairs.
- 3(4) Last segment of antennules with serrated hyaline lamellula; internal spine of P5 about twice as long as external spine . . . **M. fuscus** (Jurine, 1820)
- 4(3). Last segment of antennules with smooth hyaline lamellula; internal spine of P5 not more than 1.3 times as long as external spine . . . . . **M. distinctus** (Richard, 1887)

#### Key to species of the genus *Eucyclops*

- 1(6). Furcal rami with long row of spinules at outer margin.
- 2(3). Last segment of antennules with smooth hyaline lamellula . . . . . **E. serrulatus** (Fischer, 1851)
- 3(2). Last segment of antennules with serrated hyaline lamellula.
- 4(5). This lamellula with small thin dents; furcal rami 7-9 times as long as wide . . . . . **E. macruroides** (Lilljeborg, 1901)
- 5(4). This lamellula with large rough dents; furcal rami 4.5-7 times as long as wide . . . . . **E. denticulatus** (Graeter, 1903)
- 6(1). External side of furcal rami with reduced row of spinules.
- 7(10). This row one-third to half as long as furca; if the row is shorter, then P5 with very strong inner spine as wide as one-third of maximum width of the leg.
- 8(9). Furcal rami 6-8 times as long as wide . . . . . **E. speratus** (Lilljeborg, 1901)
- 9(8). Furcal rami 3.4-4 times as long as wide . . . . . **E. arcanus** Alekseev, 1990 (Figs 10-17)
- 10(7). External side of furcal rami with only 3-5 spinules inserted near lateral setae; P5 with inner spine of normal size.
- 11(12). Furcal rami 4-5.2 times as long as wide . . . . . **E. persistens** Monchenko, 1978 (Figs 18-20)
- 12(11). Furcal rami at least 6 times as long as wide.
- 13(14). Furcal rami 6.4-7.5 times as long as wide; furca with parallel branches . . . . . **E. orthostylis** Lindberg, 1952 (Figs 21-22)

- 14(13). Furcal rami 8-10 times as long as wide; furca with slightly curved branches . . . . . **E. macrurus** (Sars, 1863)

#### Key to species of the genus *Paracyclops*

- 1(2). Antennules 11-segmented; furcal rami not more than twice as long as wide . . . . . **P. affinis** (Sars, 1863)
- 2(1). Antennules 8-10-segmented; furcal rami longer.
- 3(4). Antennules 10-segmented; furcal rami 2-2.4 times as long as wide . . . . . **P. dilatatus** Lindberg, 1959 (Figs 29-30)
- 4(3). Antennules 8-segmented; furcal rami longer.
- 5(10). Furcal rami with short transversal row of small spinules above lateral seta.
- 6(9). Furcal rami 4-6.5 times as long as wide.
- 7(8). Distance between furcal rami more than width of furcal branch; inner spine of P5 about half as long as central spine . . . . . **P. fimbriatus** (Fischer, 1853)
- 8(7). Distance between furcal rami less than width of furcal branch; inner spine of P5 about 0.77 times as long as central spine . . . . . **P. orientalis** Alekseev, 1995 (Figs 23-28)
- 9(6). Furcal rami only 2.3-3.5 times as long as wide . . . . . **P. chiltoni** (Thomson, 1882)
- 10(5). Furcal rami with long dorsal row of small spinules running from base of lateral setae to base of furca . . . . . **P. poppei** (Rehberg, 1880)

#### Subfamily CYCLOPINAE

In this region, about 80 species of 13 genera are known, including the stygobionts of the genera *Graeteriella* and *Speocyclops*. Both stygobionts and Baikalian endemics are out of the key. The only exception is made for the ancient species *Orthocyclops bergianus* Mazepova, 1952 (Figs 1-3) that possibly will be found in other lakes of Asia.

#### Key to genera

- 1(2). P5 three-segmented . . . . . **Orthocyclops** Forbes, 1897  
In Russia only *O. bergianus* Mazepova, 1952 (Figs 1-3) in meiobenthos of Baikal has been found
- 2(1). P5 uni- or two-segmented.
- 3(14). P5 two-segmented.
- 4(11). First segment of P5 with a long outer seta and a short inner spine.
- 5(6). First segment of P5 not expanded laterally, with several long hairs at the base of the outer seta; inner spine usually at middle of inner margin; furcal rami with longitudinal fold . . . . . **Cyclops** Müller, 1776
- 6(5). First segment of P5 expanded laterally; without hairs at the base of the outer seta; furcal rami without longitudinal fold.

- 7(8). First segment of P5 with inner spine at least 1.5 times as long as width of the segment . . . . . **Diacyclops** Kiefer, 1927
- 8(7). First segment of P5 with inner spine with length usually not more than width of the segment.
- 9(10). First segment of P5 with tiny inner spine at middle of inner margin; furcal rami with hairs on internal margin . . . . . **Megacyclops** Kiefer, 1927
- 10(9). First segment of P5 with longer inner spine inserted closer to seta; furcal rami normally without hairs on internal margin . . . . . **Acanthocyclops** Kiefer, 1927
- 11(4). First segment of P5 with a long outer seta and an inner spine (seta), both long and of subequal length.
- 12(13). The inner spine (seta) inserted near the outer seta . . . . . **Thermocyclops** Kiefer, 1937
- 13(12). The inner spine inserted at the middle of the internal margin . . . . . **Mesocyclops** Sars, 1914
- 14(3). P5 uni-segmented.
- 15(18). Furcal rami with lateral seta inserted in the middle of external margin.
- 16(17). P5 much longer than wide, with long seta and small spine terminally . . . . . **Metacyclops** Kiefer, 1927
- 17(16). P5 much wider than long; its plate with seta and spine at opposite sides . . . . . **Apocyclops** Lindberg, 1927  
In Russia only *A. dengizicus* (Lepeschkin, 1900) from salt marshes and northern part of Caspian Sea is known.
- 18(15). Furcal rami with lateral seta inserted in the last third or quarter of external margin.
- 19(20). Endopodite 2 of P4 with two spines of which inner not more than twice as long as outer . . . . . **Microcyclops** Claus, 1893
- 20(19). Endopodite 2 of P4 with two spines of which inner more than 3 times as long as outer . . . . . **Cryptocyclops** Sars, 1927  
In Russia only *C. bicolor* (Sars, 1863), with subspecies *C. b. bicolor* (Sars, 1863) and *C. b. linjaniticus* (Kiefer, 1928), is known.
- 7(6). Furcal rami 7-9 times as long as wide, with lateral seta at the last quarter of external margin; spine formula of exopodites 3/4/3/3 . . . . . **C. vicinus** Uljanin, 1875  
In Russia three subspecies are known: *C. v. vicinus* Uljanin, 1875, *C. v. kikuchii* Smirnov, 1932 and *C. v. lobosus* Kiefer, 1954.
- 8(5). Th4 without wing-shaped blades.
- 9(10). P5 with small spine shorter than half of length of the segment; Th4 and Th3 of similar shape . . . . . **C. laeustris** Sars, 1863
- 10(9). P5 with strong spine much longer than half of length of the segment; shape of Th4 different from shape of Th3.
- 11(12). Spine formula of exopodites 2/3/3/3 . . . . . **C. kolensis** Lilljeborg, 1901
- 12(11). Spine formula of exopodites 3/4/3/3.
- 13(14). First segment of P5 with very short seta not more than 1.5 times as long as length of the segment or strong inner spine . . . . . **C. sibiricus** Lindberg, 1950 (Figs 37-42)
- 14(13). This seta at least twice as long as length of the segment or inner spine.
- 16(21). Inner terminal seta of furcal rami shorter than furca; if not, furcal rami 4-6 times as long as wide.
- 17(18). Furcal rami very short, about 4 times as long as wide, with only few hairs at internal margin . . . . . **C. ricae** Monchenko, 1977 (Figs 50-53)
- 18(17). Furcal rami at least 5 times as long as wide, with more or less dense hairs at internal margin.
- 19(20). Coxopodite P4 with 3-4 groups of spinules (A-C-D?-E); helms of connective lamellula of P4 only reaching upper margin . . . . . **C. strenuus** Fischer, 1851  
In Russia 3 subspecies are known: *C. s. strenuus* Fischer, 1851; *C. s. divergens* Lindberg, 1936; *C. s. landei* Koźmiński, 1933.
- 20(19). Coxopodite P4 with 5 groups of spinules (A-C-D-E-F); helms of connective lamellula usually protruded out of upper margin . . . . . **C. canadensis** Einsle, 1988 (Figs 31-36)
- 21(16). Inner terminal seta of furcal rami longer than furca; furcal rami at least 6 times as long as wide; helms of connective lamellula always protruded out of upper margin . . . . . **C. abyssorum** Sars, 1863  
In Russia 5 subspecies are known: *C. a. abyssorum* Sars, 1863; *C. a. bohemicus* Šramek-Hušek, 1937; *C. a. gracilipes* Sars, 1903; *C. a. sevani* Meshkova, 1947 (Figs 43-49); *C. a. tatricus* Koźmiński, 1927.

**Key to species of the genus *Cyclops***

- 1(4). Genital somite widened on frontal side and almost cylindrical on back side; of terminal setae of furcal rami inner seta not more than 1.4 times as long as outer seta.
- 2(3). Antennules 14-segmented; P5 with spine in the middle of internal margin . . . . . **C. insignis** Claus, 1857
- 3(2). Antennules 17-segmented; P5 with spine inserted near seta . . . . . **C. furcifer** Claus, 1857
- 4(1). Genital somite of other shape; of terminal setae of furcal rami, inner seta more than 1.4 times as long as outer seta.
- 5(8). Th4 with well developed wing-shaped blades.
- 6(7). Furcal rami 4.2-6.5 times as long as wide, with lateral seta at the last third of external margin; spine formula of exopodites 2/3/3/3 . . . . . **C. scutifer** Sars, 1863  
In Russia two subspecies are known: *C. s. scutifer* Sars, 1863 and *C. s. wigransii* Koźmiński, 1927.

**Key to species of the genus *Megacyclops***

- 1(2). Furcal rami 2.5-4.5 times as long as wide; inner terminal seta of furca more than 1.3 times as long as furca . . . . . **M. viridis** (Jurine, 1820)
- 2(1). Furcal rami 5-7 times as long as wide; inner terminal seta of furca 0.9-1.2 times as long as furca.
- 3(4). Third segment of endopodite P4 at least twice as long as wide; lateral setae of this segment not reaching the ends of apical spines . . . . . **M. gigas** (Claus, 1857)

- 4(3). Third segment of endopodite P4 less than twice as long as wide; lateral setae of this segment reaching the ends of apical spines . . . . .  
 . . . . . **M. latipes** (Lowndes, 1927)

#### Key to species of the genus *Acanthocyclops*

- 1(6). Antennules 17(18)-segmented.  
 2(3). Genital somite in its upper part rounded; of terminal setae of furca inner seta 1.6-2.1 times as long as outer seta . . . . .  
 . . . . . **A. americanus** (Marsh, 1893) (Figs 54-59)  
 In Russia two subspecies: *A. a. americanus* (Marsh, 1893) and *A. a. spinosus* Monchenko, 1961.  
 3(2). Genital somite in its upper part angular; of terminal setae of furca, inner seta usually not more than 1.5 times as long as outer seta.  
 4(5). Setae of last segment of P4 covered with equal long hairs along all its length . . . . .  
 . . . . . **A. vernalis** (Fischer, 1853)  
 5(4). Setae of last segment of P4 in its distal part with very short hairs . . . . . **A. robustus** (Sars, 1863)  
 6(1). Antennules 11(12)-segmented.  
 7(8). Furcal rami 5-7 times as long as wide; lateral setae inserted near the middle of external margin of furcal rami . . . . . **A. capillatus** (Sars, 1863)  
 8(7). Furcal rami 1.5-4 times as long as wide; lateral setae at least at the last third of external margin of furcal rami.  
 9(10). Rather large cyclopids (0.85-1.5 mm); furcal rami 3-4 times as long as wide, covered with several rows of small spinules . . . . .  
 . . . . . **A. venustus** (Norman & Scott, 1906)  
 10(9). Small cyclopids (0.4-0.55 mm); smooth furcal rami 1.5-4 times as long as wide . . . . .  
 . . . . . **A. reductus** (Chappuis, 1925)  
 In Russia 2 subspecies are found both in springs and wells: *A. r. reductus* (Chappuis, 1925) and *A. r. propinquus* Pleša, 1957.

#### Key to species of the genus *Diacyclops*

- 1(8). P1-P2 three-segmented.  
 2(5). Furcal rami with lateral seta at the last third or even close to the middle of external margin of furca.  
 3(4). Of terminal setae of furca, inner seta practically equal to outer seta; terminal seta of P5 about twice as long as inner spine . . . . .  
 . . . . . **D. bicuspidatus** (Claus, 1857)  
 In Russia only *D. b. bicuspidatus* (Claus, 1857) and *D. b. odessana* (Schmankevitsch, 1875) are known.  
 4(3). Of terminal setae of furca, inner seta 1.2-1.3 times as long as outer seta; terminal seta of P5 about 2.5-3 times as long as inner spine . . . . .  
 . . . . . **D. limnobioides** Kiefer, 1936 (Figs 69-73)  
 5(2). Furcal rami with lateral seta at the last quarter of outer margin of furca; of apical spines of last segment of endopodite P4, inner spine longer than outer spine.

- 6(7). Antennules 17-segmented . . . . .  
 . . . . . **D. bisetosus** (Rehberg, 1880)  
 7(6). Antennules 12-segmented . . . . .  
 . . . . . **D. crassicaudis** (Sars, 1863)  
 In Russia only *D. c. crassicaudis* (Sars, 1863) and *D. c. brachycercus* Kiefer, 1927 are known.  
 8(1). At least endopodites of P1-P2 two-segmented.  
 9(10). P1-P2 with 3-segmented exopodites . . . . .  
 . . . . . **D. stygius** (Chappuis, 1924)  
 Two subspecies: *D. s. stygius* (Chappuis, 1924) and *D. s. deminutus* (Chappuis, 1924).  
 10(9). Exopodites P1 two-segmented.  
 11(12). Antennules with 16 (sometimes 13-14) segments . . . . . **D. languidus** (Sars, 1863)  
 In Russia 4 subspecies: *D. l. languidus* (Sars, 1863); *D. l. belgicus* (Kiefer, 1936); *D. l. deminutus* Štěrba, 1955\*; *D. l. disjunctus* (Thallwitz, 1927).  
 This name is a junior secondary homonym of *D. stygius deminutus* (Chappuis, 1924).  
 12(11). Antennules 10-11-segmented.  
 13(14). Furcal rami with lateral seta at the middle of outer margin of furca . . . . . **D. nanus** (Sars, 1863)  
 14(13). Furcal rami with lateral seta inserted closer to last third of outer margin of furca.  
 15(16). P1-P4 with spines at the outer margin . . . . .  
 . . . . . **D. abyssicola** (Lilljeborg, 1901)  
 16(15). P1-P4 with setae at the outer margin.  
 17(18). Of terminal setae of furcal rami, inner seta at least 1.6 times as long as outer seta . . . . .  
 . . . . . **D. insularis** Monchenko, 1982 (Figs 63-68)  
 18(17). These setae subequal or inner seta not more than 1.4 times as long as outer seta . . . . .  
 . . . . . **D. languidoides** (Lilljeborg, 1901)  
 In Russia and adjacent countries, 6 subspecies are known: *D. l. languidoides* (Lilljeborg, 1901); *D. l. cladestinus* (Kiefer, 1926); *D. l. cohabitans* Monchenko, 1980; *D. l. moravicus* Štěrba, 1956; *D. l. nagysalloensis* Kiefer, 1927; *D. l. zschokkei* (Graeter, 1910).

#### Key to species of the genus *Metacyclops*

- 1(2). Antennules 9-segmented . . . . .  
 . . . . . **M. planus** (Guernsey, 1909)  
 2(1). Antennules 11-segmented.  
 3(4). Of terminal setae of furca, outer seta shorter than inner seta . . . . . **M. gracilis** (Lilljeborg, 1853)  
 4(3). Of terminal setae of furca, outer seta 1.5-2 times as long as inner seta . . . . .  
 . . . . . **M. minutus** (Claus, 1863)

#### Key to species of the genus *Microcyclops*

- 1(2). Furcal rami at least 4 times as long as wide; of distal spines of endopodite P4, inner spine about twice as long as outer spine . . . . .  
 . . . . . **M. afghanicus** Lindberg, 1959 (Figs 4-6)  
 2(1). Furcal rami less than 4 times as long as wide; of distal spines of endopodite P4, inner spine not more than 1.5 times as long as outer spine.

\* This name is a junior secondary homonym of *D. stygius deminutus* (Chappuis, 1924).

- 3(4). Furcal rami 2.5-3 times as long as wide; antennules usually 11-segmented . . . . .  
 . . . . . **M. rubellus** (Lilljeborg, 1901)  
 4(3). Furcal rami 3.5-4 times as long as wide; antennules always 12-segmented . . . . .  
 . . . . . **M. varicans** (Sars, 1863)

**Key to species of the genus *Mesocyclops***

- 1(2). Furcal rami with thick hairs on internal margin. . . **M. aspericornis** (Daday, 1906) (Figs 74-78)  
 2(1). Furcal rami without thick hairs on internal margin.  
 3(6). Last thoracosomite with long hairs.  
 4(5). Connective lamellula of P4 without sharp outgrowth; dorsal seta of furcal rami not longer than outer terminal seta . . . . .  
 . . . . . **M. ogunnus** Onabamiro, 1957 (Figs 79-87)  
 5(4). Connective lamellula of P4 with a sharp outgrowth; dorsal seta of furcal rami 1.2-1.5 times as long as outer terminal seta . . . . .  
 . . . . . **M. aequatorialis** Kiefer, 1929  
 Only *M. a. similis* Van der Velde, 1984 (Figs 88-93) found in fish ponds of Uzbekistan (Mirabdullaev, 1989).  
 6(3). Last thoracosomite without long hairs.  
 7(8). Receptaculum seminis with long curved pore canal. . . . . **M. rutteri** Kiefer, 1981 (Figs 94-98)  
 8(7). Receptaculum seminis with short U-shaped pore canal.  
 9(10). Furcal rami 2.6-3.5 times as long as wide; connective lamellula of P4 with a long sharp outgrowth . . . . . **M. leuckarti** (Claus, 1857)  
 10(9). Furcal rami 4-4.5 times as long as wide.  
 11(12). First segment of P5 with long outer seta and about half as long inner spine . . . . .  
 . . . . . **M. bodanicola** Kiefer, 1928  
 12(11). First segment of P5 with long outer seta and subequal in length inner spine . . . . .  
 . . . . . **M. arakhlensis** Alekseev, 1993 (Figs 99-104)

**Key to species of the genus *Thermocyclops***

- 1(2). Furcal rami with lateral seta inserted near the middle of outer margin of furca; dorsal seta at least twice as long as terminal outer seta . . . . .  
 . . . . . **T. oithonoides** (Sars, 1863)  
 2(1). Furcal rami with lateral seta inserted in the last third of outer margin of furca; dorsal seta subequal in length to outer seta.  
 3(4). P4 with endopodite 3 bearing two subequal apical spines . . . . . **T. dybowskii** (Lande, 1890)  
 4(3). P4 with endopodite 3 bearing two apical spines of which inner longer than outer.  
 5(8). Inner apical spine of P4 1.8-2.8 times as long as outer spine.  
 6(7). Of terminal setae of furca, inner seta 3-3.5 as long as outer seta; upper helms of connective lamellula of P4 with rough large spinules . . . . .  
 . . . . . **T. crassus** (Fischer, 1853)  
 7(6). Of terminal setae of furca, inner seta only 2-2.5 times as long as outer seta; upper helms of connective lamellula of P4 with small thin spinules . . . . .  
 . . . . . **T. rylovi** (Smirnov, 1928)

- 8(5). Inner apical spine of P4 at least 3 times as long as outer spine.  
 9(10). Receptaculum seminis with strongly bent lateral outgrowths; upper helms of connective lamellula of P4 with 5-7 thin spinules . . . . .  
 . . . . . **T. asiaticus** (Kiefer, 1932)  
 10(9). Receptaculum seminis with slightly bent lateral outgrowths; upper helms of connective lamellula of P4 with 3 rough teeth . . . . .  
 . . . . . **T. vermifer** Lindberg, 1959 (Figs 7-9)

**Brief descriptions of Cyclopidae recorded after 1948 from the former USSR, except subterranean species and Baikalian endemics**

***Orthocyclops bergianus* Mazepova, 1952**  
 (Figs 1-3)

*Type locality.* Lake Baikal.

*Description.* Length about 1 mm; abdomen narrow; antennules 16-segmented; P1-P4 with 3-segmented rami; endopodite P4 with two subequal apical spines and about twice longer seta inserted subapically; P5 3-segmented, with long apical seta and half as long inner spine; furcal rami about 5 times as long as wide, with lateral seta inserted near the middle of internal margin; of terminal setae, inner seta about 6 times as long as outer seta.

*Distribution.* Lake Baikal from depth about 50 m till maximum (Mazepova, 1978); possibly will be found in meiobenthos of other ancient Asian lakes.

*Ecology.* Rare species, associated with silt (Mazepova, 1978).

***Microcyclops afghanicus* Lindberg, 1959**  
 (Figs 4-6)

*First mention.* Lake Ubsu-Nuur, Tuva (51° N, 97° E) (Alekseev, 1995a).

*Description.* Length about 0.9 mm; antennules 11-segmented; furcal rami with parallel branches at least 4 times as long as wide; inner and outer furcal seta of subequal length; of distal spines of endopodite P4, inner spine 1.9 times as long as outer spine.

*Distribution.* Middle and Central Asia.

*Ecology.* Summer form on littoral of big lakes and reservoirs.

***Thermocyclops vermifer* Lindberg, 1960**

*First mention.* The Volga River delta (46° N, 49° E) (Alekseev, 1995a).

*Description.* Length 0.7 mm; body slender, colourless; receptaculum seminis hammer-

shaped with rounded ends; P4 with long curved inner and 4 times shorter outer distal spines; connective membrane of P4 with long helms armed with 3 rough teeth.

*Distribution.* South of Eurasia.

*Ecology.* Inhabitant of small waterbodies with warm water.

**Eucyclops arcanus** Alekseev, 1990  
(Figs 10-17)

*Type locality.* Lake Saga-Nuur, Transbaikal (54° N, 109° E).

*Description.* Length about 1.00 mm; body massive; short antennules reaching only the middle of Th2, with smooth hyaline membrane on two distal segments; furcal rami 3.4-3.5 times as long as wide, slightly curved; inner and outer furcal setae subequal in length, inner seta 0.7 times as long as furca; of median furcal setae, external seta less than half as long as outer seta; endopodite P4 with two long spines at distal segment, inner spine at least 1.2 times as long as the segment.

*Distribution.* East Siberia, Baikal, the Northern Ural Mts (Vorkuta Distr.).

*Ecology.* This species was found in plankton and meiobenthos of lakes and in springs with cold water, but females with eggs appeared in summer months.

**Eucyclops persistens** Monchenko, 1978  
(Figs 18-20)

*Type locality.* River Kintrishi, near Kobulety, Georgia (41° N, 42° E).

*Description.* Length about 0.82 mm; rather short 12-segmented antennules reaching only the end of cephalothorax, with very narrow smooth hyaline membrane on distal segments; furcal rami 4.7 times as long as wide, with parallel, closely inserted branches; of terminal setae of furca, inner seta about twice as long as outer seta.

*Distribution.* The region of Azov and Black seas (Monchenko, 1978).

*Ecology.* The species has been found in interstitial of river mouth with salinity about 0.5-1.4‰.

**Eucyclops orthostylis** Lindberg, 1952  
(Figs 21-22)

*Type locality.* The Volga River delta (46° N, 49° E).

*Description.* Length 0.85-0.9 mm; antennule longer than syncephalon; furcal rami

6.4-7.5 times as long as wide, with only one spinule inserted near lateral seta; furcal branches parallel, inserted very close to each other.

*Distribution.* Only one sample with two females of the species from the River Volga delta was done by Prof. N.M. Knipovitch in 1927 (Lindberg, 1952).

*Ecology.* Nothing is known; a rare species.

**Paracyclops orientalis** Alekseev, 1995  
(Figs 23-28)

*Type locality.* Cleaning reservoirs of Baikalsk Paper & Pulp Miln (52° N, 104° E).

*Description.* Length 0.88 mm; stocky body brown coloured; antennules 8-segmented; furcal rami 5-5.5 times as long as wide, with narrow row of spinules above lateral seta insertion; of apical furcal setae, inner seta 1.3-1.4 times as long as outer seta.

*Distribution.* Baikal and surrounding water bodies.

*Ecology.* Females with egg sacks were found in summer both in springs with cold water and in cleaning reservoirs with warm water; in Baikal, the species has been found in shallow bays only.

**Paracyclops dilatatus** Lindberg, 1959  
(Figs 29-30)

*Type locality.* The Caspian Sea.

*Description.* Length 0.77-0.81 mm; antennules 10-segmented, reaching Th1; spine formula of P1-P4 3/4/4/3; furca with parallel branches 2-2.4 times as long as wide; of apical furcal setae, inner seta 1.3 times as long as outer seta, dorsal seta longer than inner seta.

*Distribution.* Probably endemic of the Caspian Sea.

*Ecology.* Nothing is known; rare species.

**Cyclops canadensis** Einsle, 1988  
(Figs 31-36)

*First mention.* Delta of the River Lena (73° N, 125° E) (E.A. Abramova, personal communication).

*Description.* Length about 1.8 mm; short 17-segmented antennules not reaching end of syncephalon; spine formula of P1-P4 3/4/3/3; P5 with shortened setae; furcal rami about 5 times as long as wide; of abdominal furcal setae, inner seta 1.5-1.6 times as long as outer seta. Rather close to *C. sibiricus* Lindberg, 1950.

*Distribution.* Arctic regions of Old and New World.

*Ecology.* Inhabitant of small lakes and pools.

**Cyclops sibiricus** Lindberg, 1950  
(Figs 37-42)

*Type locality.* East Siberia.

*Description.* Length 1.74-2.04 mm; short antennules reaching end of Th1; spine formula of exopodites P1-P4 3/4/3/3; P5 with long inner spine and very short apical seta 1.3-1.5 times as long as the spine; furcal rami 4.51-6.7 times as long as wide; inner seta 1.62 times as long as outer seta and 0.66 times as long as furcal branch.

*Distribution.* Arctic regions of Old World.

*Ecology.* Inhabitant of arctic pools and lakelets.

**Cyclops abyssorum sevani** (Meshkova, 1947)  
(Figs 43-49)

*Type locality.* Lake Sevan, Armenia (41° N, 45° E).

*Description.* Length about 1.5 mm; long antennules reaching end of Th1; furcal rami with sparse thin hairs at inner margin; inner spine of furca as long as furcal branch; elongated P5 with rather thin inner spine and long apical seta; helms of connective membrane of P4 always protruded out of upper margin.

*Distribution.* Endemic of Lake Sevan and the Razdan River (Alekseev, 1988).

*Ecology.* Planktonic polycyclic species with maximum of breeding in summer.

**Cyclops ricea** Monchenko, 1977  
(Figs 50-53)

*Type locality.* Lake Ritsa in Georgia, near seashore of the Black Sea (43° N, 41° E).

*Description.* Length about 1.2 mm; antennules reaching end of Th2; spine formula of exopodites P1-P4 3/4/3/3; furcal rami 4 times as long as wide, with only few hairs in distal part of internal margin and practically invisible cuticulae striae on dorsal side; internal seta 1.22 times as long as furcal branch and 1.61 times as long as outer seta; P5 with very strong inner spine and 3 times longer apical seta.

*Distribution.* Endemic of Lake Ritsa (Monchenko, 1977).

*Ecology.* Summer breeding species (?).

**Acanthocyclops americanus americanus** (Marsh, 1893)  
(Figs 54-59)

*First mention.* Water body near Kiev (50° N, 30° E) (Monchenko, 1961).

*Description.* Length 1.2-1.5 mm; antennules short, 17-segmented; genital segment rounded in upper part; furcal rami about 5 times as long as wide, with inner seta 1.7 times as long as outer seta; elongated P5 with inner spine rather long for this genus, practically equal to the maximum width of the segment; endopodite P4 with long hairs at distal ends of setae.

*Distribution.* Holarctic.

*Ecology.* Typical planktonic species in big lakes and reservoirs.

**Acanthocyclops americanus spinosus** Monchenko, 1961  
(Figs 60-62)

*Type locality.* Water body near Kiev (50° N, 30° E).

*Description.* Differs from the typical form in the longer inner furcal seta (twice as long as outer seta), tiny inner spine of P5, and distal setae of endopodite P4 covered with short hairs in the distal part only.

*Distribution.* Ukraine, the Volga River delta (Alekseev & Kosova, 1977).

*Ecology.* Typical planktonic species, the subspecies more common in small lakes and ponds.

**Diacyclops insularis** Monchenko, 1980  
(Figs 63-68)

*Type locality.* The mouth of the river Psuapse, the West Caucasus Mts (44° N, 38° E).

*Description.* Length 0.66 mm; short 11-segmented antennules not reaching end of syncephalon; parallel furcal rami 4.4 times as long as wide, with lateral seta inserted in last quarter of external margin; of terminal furcal setae, inner seta 1.7 times as long as outer seta; P1 with 2-segmented rami; endopodite P2 2-segmented; exopodite P2 3-segmented; P3-P4 with 3-segmented rami; very elongated P5 with inner spine of the same length and 3 times longer apical seta.

*Distribution.* Seashore ecosystems of the Black Sea (Monchenko, 1982).

*Ecology.* Inhabitant of brackish water with salinity till 6‰.

**Diacyclops limnobioides** (Kiefer, 1936)  
(Figs 69-73)

*First mention.* The Volga River delta (46° N, 49° E) (Alekseev & Popov, 1986).

*Description.* Length 0.7-0.86 mm; body slender, colourless; genital segment 1.2-1.3 times as long as wide; furcal rami 4-5 times as long as wide, with lateral seta inserted close to the middle of external margin; of terminal furcal setae, inner seta 1.2-1.3 times as long as outer seta; P5 with spine subequal to the length of the segment and about 3 times longer apical seta.

*Distribution.* South of Eurasia.

*Ecology.* In plankton of lakes.

**Mesocyclops aspericornis** (Daday, 1906)  
(Figs 74-78)

*First mention.* Fish pond in Uzbekistan (42° N, 69° E) (Mirabdullaev, 1990).

*Description.* Length 1.19-1.41 mm; receptaculum seminis with long curved meridional pore canal; of apical spines of endopodite P4, inner one slightly longer than outer spine, with only 1-6 spinules on external margin; P5 with long apical seta and slightly shorter inner spine; furcal rami about 3 times as long as wide, with long dense hairs on internal margin.

*Distribution.* Mediterranean, Aralo-Caspian and Chinese provinces.

*Ecology.* Inhabitant of lakes.

**Mesocyclops ogunnus** Onabamiro, 1957  
(Figs 79-87)

*First mention.* Fish ponds and rice fields in Uzbekistan (41° N, 68° E) (Mirabdullaev, 1989).

*Description.* Length 1.02-1.27 mm; Th5 with sparse hairs at external margin; genital segment with long, curved meridional pore canal; distal spines of exopodite P4 subequal in length; connective membrane of P4 practically without outgrowths; P5 with long distal seta and shorter inner spine; furcal rami without hairs, 3 times as long as wide, inner seta 3.5 times as long as outer seta.

*Distribution.* Sahara, Mozambique, Israel (Van der Velde, 1984), Uzbekistan. Desert regions of the Old World.

*Ecology:* unknown.

**Mesocyclops aequatorialis similis** Van der Velde, 1984  
(Figs 88-93)

*First mention.* Fish ponds and rice fields in Uzbekistan (41° N, 68° E) (Mirabdullaev, 1989).

*Description.* Length 1.11-1.3 mm; antennules with very wide hyaline membrane armed in distal part with large hook; Th5 with dense hairs at external margin; genital segment with long, straight meridional pore canal; of distal spines of exopodite P4, inner spine longer than outer spine; connective membrane of P4 without long outgrowth but with small helms only; P5 with long distal seta and subequal inner spine; furcal rami without hairs, 3 times as long as wide, inner seta 3 times as long as outer seta.

*Distribution.* Kenya (Van der Velde, 1984), Uzbekistan; probably inhabits tropical and subtropical regions of the Old World.

*Ecology.* Inhabitant of big lakes (Victoria, Navasha) and shallow water bodies.

**Mesocyclops ruttneri** Kiefer, 1981  
(Figs 94-98)

*First mention.* Fish pond near Andizhan (41° N, 72° E) (Mirabdullaev & al., 1995).

*Description.* Length 1.38-1.6 mm; receptaculum seminis with long, curved meridional pore canal; of apical spines of endopodite P4, inner spine 1.2 times as long as outer spine; P5 with long apical seta and slightly shorter inner spine; furcal rami 3.4-4 times as long as wide.

*Distribution.* Austria (pond in botanical garden), Java, Sumatra, Japan, China (Kiefer, 1981), Uzbekistan; probably inhabits tropical and subtropical freshwaters of the Old World.

*Ecology.* Found in plankton of fish ponds and small lakes (Mirabdullaev & al., 1995).

**Mesocyclops arakhlensis** Alekseev, 1993  
(Figs 99-104)

*Type locality.* Lake Arakhley, Chita Prov., East Siberia (52° N, 112° E).

*Description.* Length 1.18 mm; body elongated, colourless; antennules reaching Th2 with narrow denticulated hyaline membrane on distal segment; genital segment 1.5 times as long as wide, with small U-shaped pore canal; furcal rami 4.4-4.6 times as long as wide, with very long lateral seta inserted between the middle and last third of external margin; connective membrane of P4 with long spine-shaped outgrowths; last segment of endopodite P4 3.77 times as long as wide.

*Distribution.* South of East Siberia and the Far East.

*Ecology.* Inhabitant of plankton of lakes in summer months.

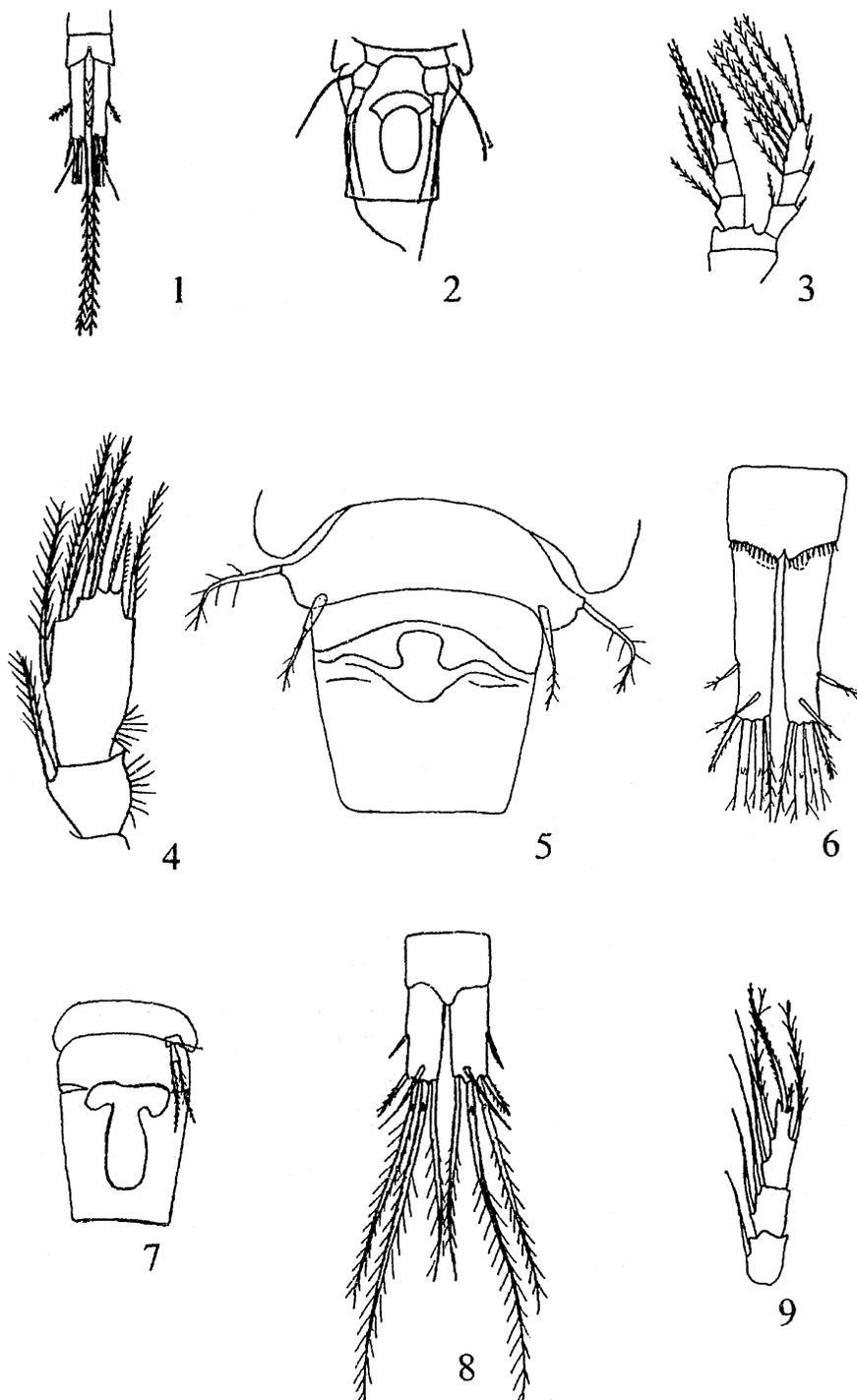
## Acknowledgements

The survey of Cyclopidae species of Russia and adjacent lands in the context of present-day state of knowledge on taxonomy was started in 1995 under support of the Russian Foundation for Basic Research (Grant 95-04-11836a).

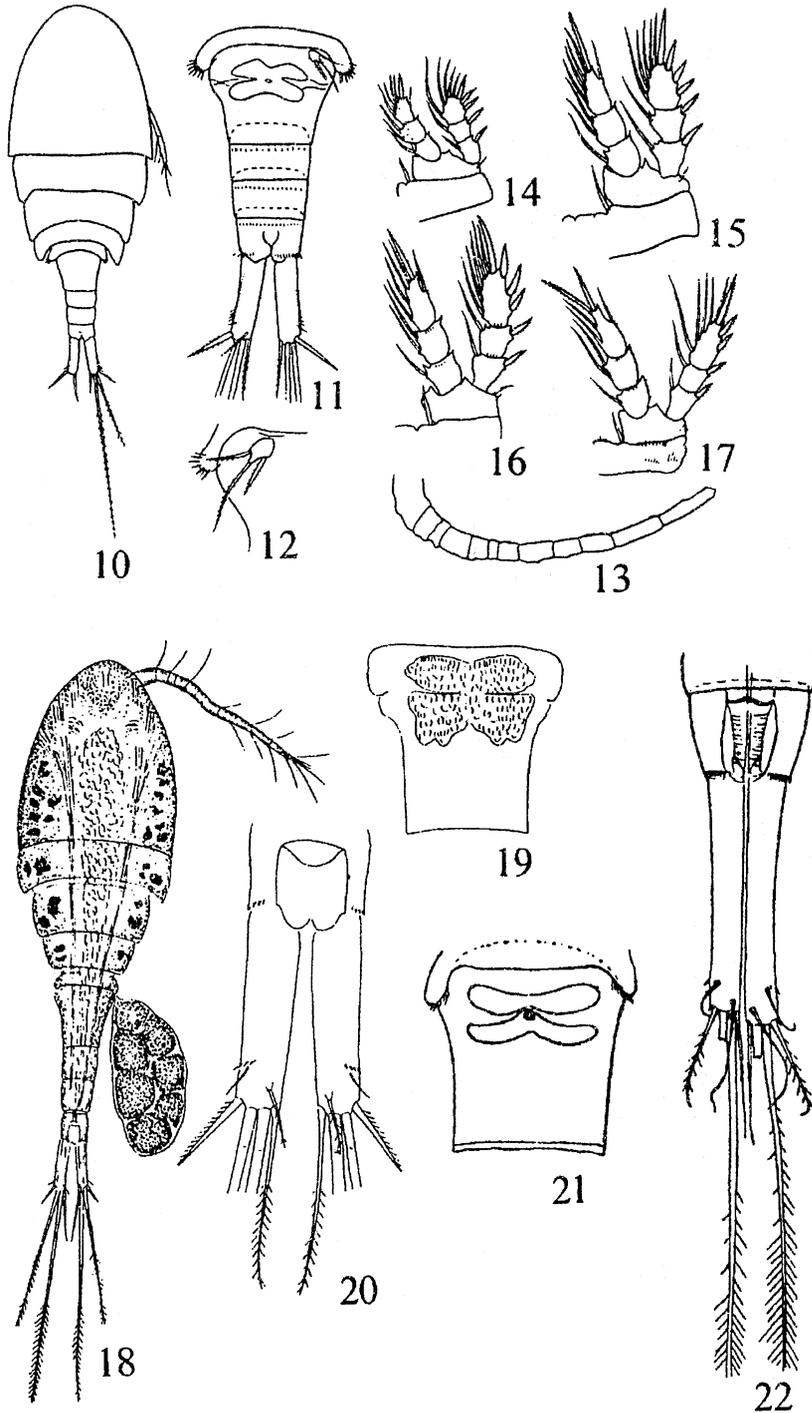
## References

- Alekseev, V.R. & Kosova, A.A. 1976. A finding of *Acanthocyclops americanus* (Copepoda) in the Volga River delta. *Zool. Zhurn.*, **53**: 1726-1728. (In Russian).
- Alekseev, V.R. 1988. Changes in the species identification of Sevan endemic *Cyclops* (Crustacea, Copepoda). *Zool. Zhurn.*, **67**: 1910-1914. (In Russian).
- Alekseev, V.R. 1990. *Eucyclops arcamus* sp. n. (Copepoda, Cyclopoida) from waterbodies of Bolshhezemelskaya Tundra and Prebaikalia. *Zool. Zhurn.*, **69**: 135-139. (In Russian).
- Alekseev, V.R. 1993. A new subspecies of *Mesocyclops leuckarti* from East Siberia (Crustacea, Cyclopoida: Cyclopidae). *Zoosyst. ross.*, **2**: 55-58.
- Alekseev, V.R. 1995. *Paracyclops fimbriatus orientalis* ssp. n. (Crustacea, Copepoda) from water bodies of the Baikal region. *Zool. Zhurn.*, **74**: 133-138. (In Russian).
- Alekseev, V.R. 1995a. Cyclopoida. In: S.J. Tsalolikhin (ed.). *Opredelitel' presnovodnykh bespozvonochnykh Rossii i sopredel'nykh territoriy* [Key to freshwater invertebrates of Russia and adjacent lands]. Vol. 2 (Crustacea): 109-120. St. Petersburg. (In Russian).
- Alekseev, V.R. & Popov, N.Ya. 1986. On the specific status of *Diacyclops limnobioides* Kiefer – new to the fauna of the USSR. *Trudy zool. Inst. Akad. Nauk SSSR*, **152**: 106-115. (In Russian).
- Dussart, B. & Defaye, D. 1995. Introduction to the Copepoda. *Guides to the identification of the microinvertebrates of the continental waters of the World*, **7**: 1-277. Amsterdam, SPB Academic Publishing.
- Einsle, U. 1988. *Cyclops canadensis* n. sp. and *Cyclops scutifer* Sars, 1863 (Crustacea: Copepoda) from northern Canada. *Can. Journ. Zool.*, **66**: 2146-2149.
- Einsle, U. 1993. Crustacea: Copepoda: Calanoida und Cyclopoida. *Süßwasserfauna von Mitteleuropa*, **122**: 1-209. Stuttgart, Jena, N.Y., G. Fischer Verlag.
- Huis, R. & Boxshell, G. 1991. Copepod evolution. *The Ray Society*, **159**: 1-468. London.
- Kiefer, F. 1981. Beitrag zur Kenntnis von Morphologie, Taxonomie und geographischer Verbreitung von *Mesocyclops leuckarti* auctorum. *Arch. Hydrobiol., Suppl.* **62**, 1: 148-190.
- Korovchinsky, N.M. 1992. Sididae & Holopedidae. *Guides to the identification of the microinvertebrates of the continental waters of the World*, **3**: 1-82. The Hague.
- Lindberg, K. 1952. Deux Cyclopidés (Crustacés, Copepodes) nouveaux de l'URSS. *Bull. Soc. zool. France*, **77**: 79-83.
- Mazepova, G.F. 1978. *Tsiklopy ozera Baikal* [Cyclopides of the Lake Baikal]: 1-137. Novosibirsk, Nauka. (In Russian).
- Mirabdullaev, I. 1989. Two new for the fauna of USSR species of the genus *Mesocyclops* (Crustacea, Copepoda) from water bodies of Uzbekistan. *Uzbek. biol. Zhurn.*, **1989**(6): 42-45. (In Russian).
- Mirabdullaev, I. 1990. *Mesocyclops aspericornis* (Daday, 1906) (Crustacés, Copepodes) – a new tropical species in the fauna of USSR. *Dokl. Akad. Nauk Uzbek. SSR*, **1990**(4): 60-61. (In Russian).
- Mirabdullaev, I., Stuge, T.S. & Kuzmetov, A.R. 1995. On *Mesocyclops ruttneri* Kiefer, 1981, a species new to Kazakhstan. *Selevinia*, **2**: 31-33.
- Monchenko, V.I. 1961. On species status of *Acanthocyclops americanus* (Marsh) and its finding in the USSR. *Zool. Zhurn.*, **40**: 13-19. (In Russian).
- Monchenko, V.I. 1974. Cyclopoidae. *Fauna Ukrainy*, **27**, 3: 1-452. (In Ukrainian).
- Monchenko, V.I. 1978. On a new endemic species of the Black Sea basin *Eucyclops persistens* sp. n. (Crustacea, Copepoda). *Vestnik Zool.*, **1978**(6): 50-58. (In Russian).
- Monchenko, V.I. 1977. A new species of *Cyclops* (Crustacea, Copepoda) in the lake Ritza (Great Caucasus). *Zool. Zhurn.*, **54**: 1725-1728. (In Russian).
- Monchenko, V.I. 1982. On two sympatric Black Sea estuarine cyclops of the genus *Diacyclops* (Crustacea, Copepoda). *Zool. Zhurn.*, **59**: 182-190. (In Russian).
- Rylov, V.M. 1948. Cyclopoidae of inland waters. *Fauna SSSR. Crustacea*, **3**, 3: 1-314. (In Russian).
- Smirnov, N.N. 1992. The Macrothricidae of the World. *Guides to the identification of the microinvertebrates of the continental waters of the World*, **1**: 1-143. The Hague, SPB Academic Publishing.
- Van der Velde, I. 1984. Revision of the African species of the genus *Mesocyclops* Sars, 1914 (Copepoda: Cyclopoidae). *Hydrobiologia*, **109**: 3-66.

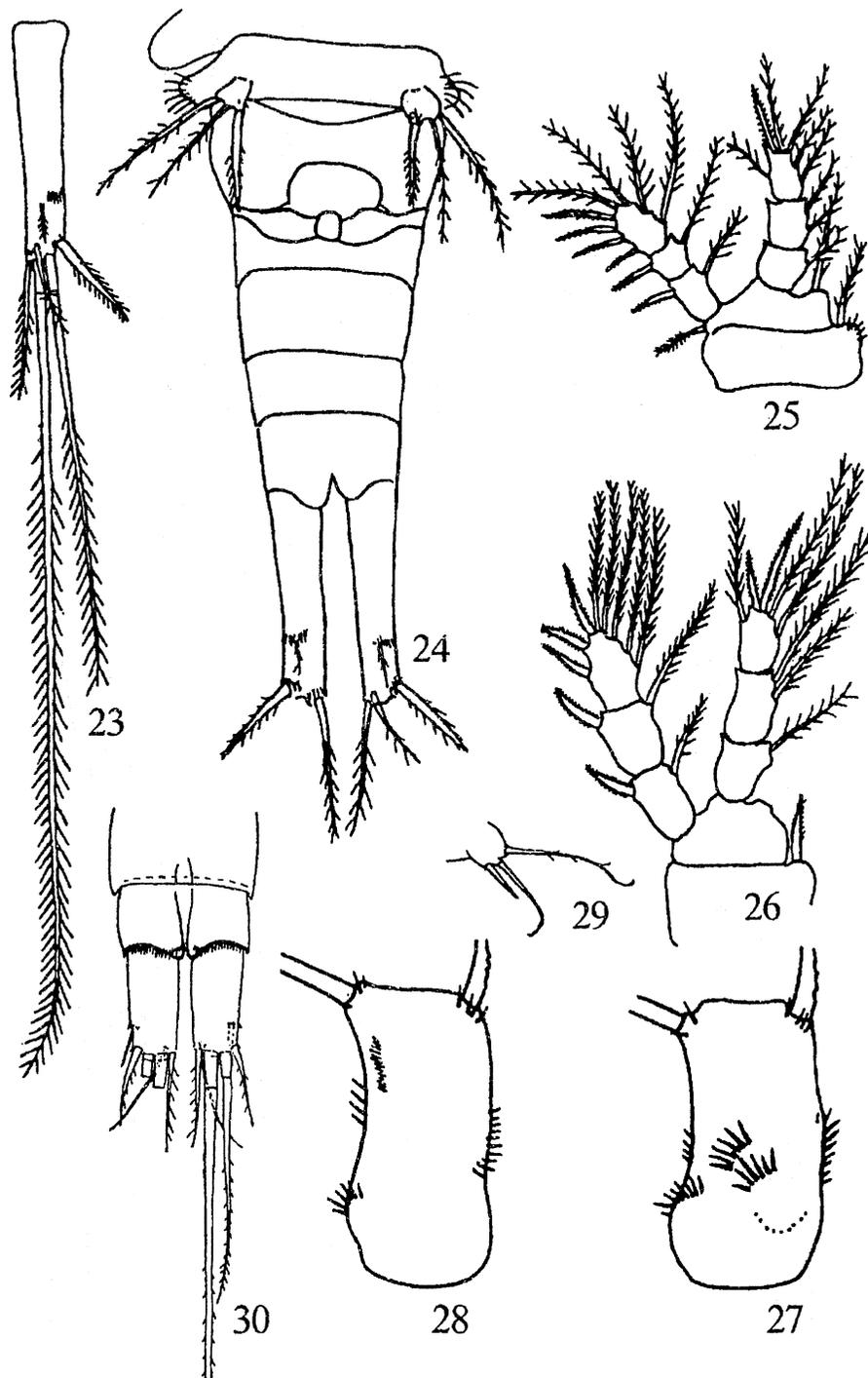
Received 6 January 1998



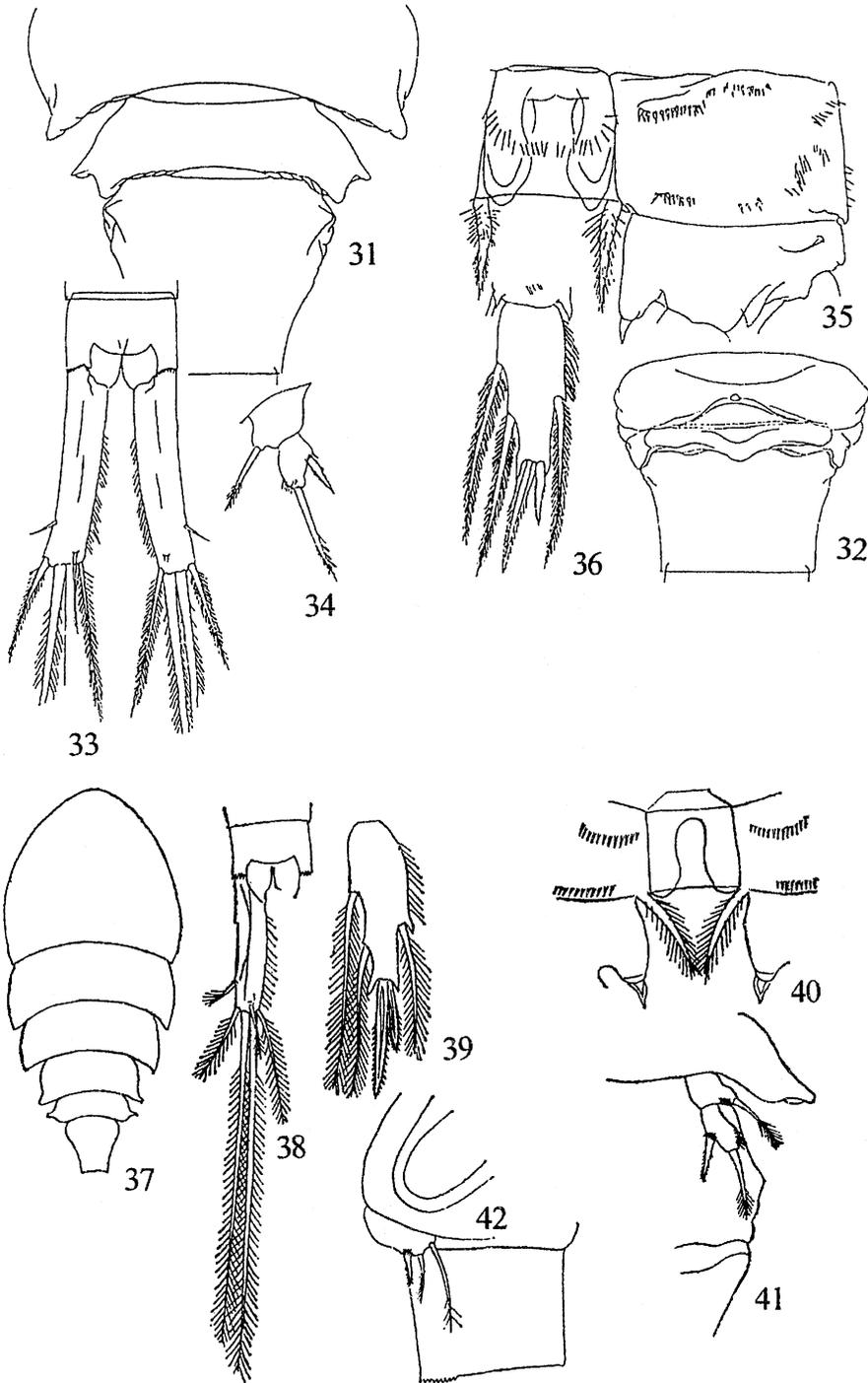
**Figs 1-9.** 1-3, *Orthocyclops bergianus* Mazepova: 1, furcal rami; 2, genital somite with P5; 3, endopodite P4. 4-6, *Microcyclops afghanicus* Lindberg: 4, endopodite P4; 5, Th5 with genital somite; 6, furcal rami. 7-9, *Thermocyclops vermifer* Lindberg: 7, genital somite with P5; 8, furcal rami; 9, endopodite P4. (1-3: Mazepova, 1952; 4-9: original).



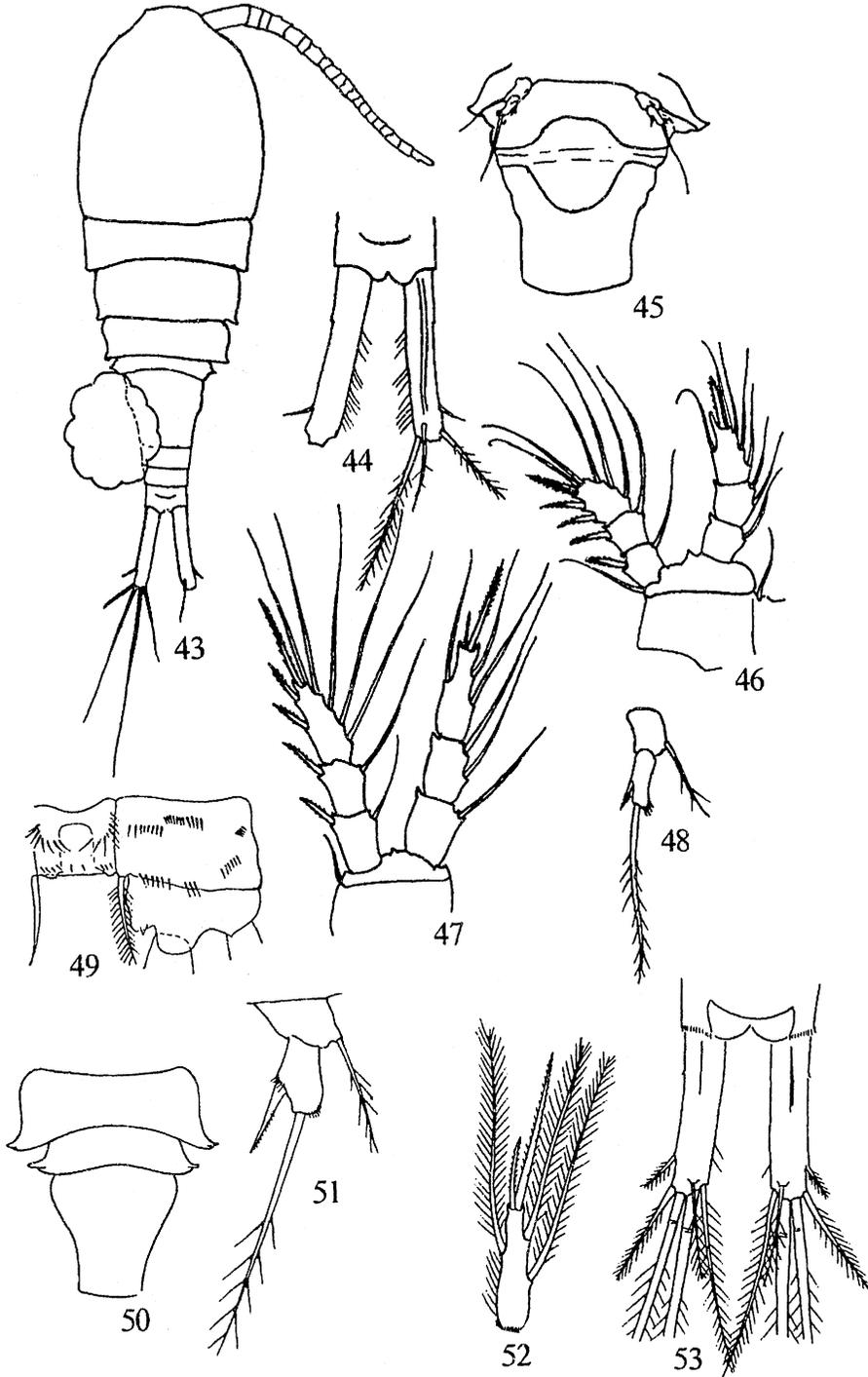
Figs 10-22. 10-17, *Eucyclops arcanus* Alekseev: 10, female, dorsal view; 11, abdomen; 12, P5; 13, antennule; 14-17, P1-P4. 18-20, *E. persistens* Monchenko: 18, female, dorsal view; 19, genital somite; 20, furcal rami. 21-22, *E. orthostylis* Lindberg: 21, genital somite; 22, furcal rami. (10-17: Alekseev, 1990; 18-20: Monchenko, 1978 ; 21-22: Lindberg, 1952).



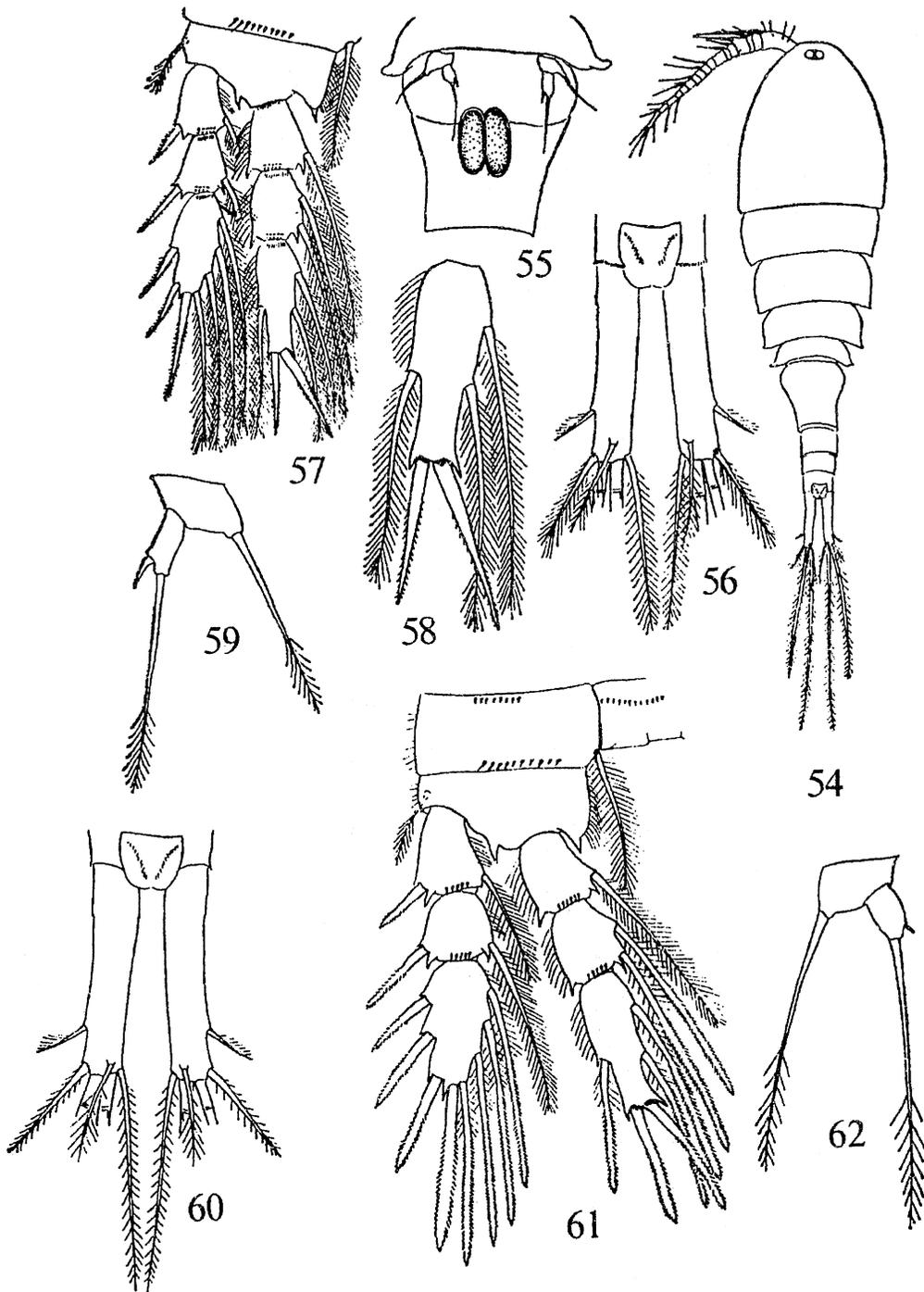
Figs 23-30. 23-28, *Paracyclops orientalis* Alekseev: 23, furcal branch; 24, abdomen; 25, P1; 26, P4; 27, 28, frontal and caudal sides of antennal basipodite. 29-30, *P. dilatatus* Lindberg: 29, P5; 30, furcal rami. (23-28: Alekseev, 1995; 29-30: Lindberg, 1959).



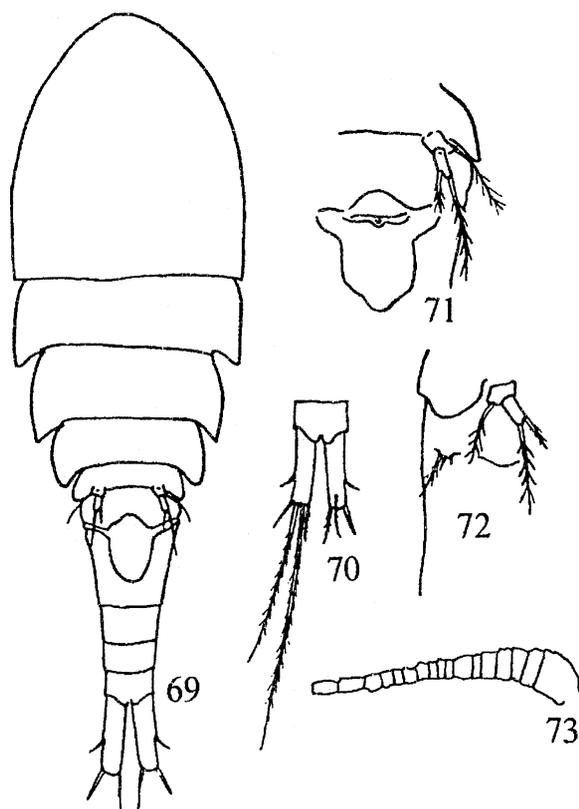
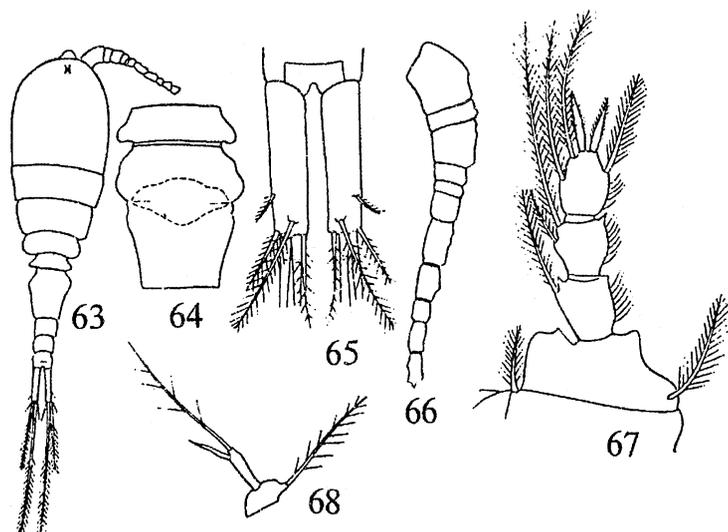
Figs 31-42. 31-36, *Cyclops canadensis* Einsle: 31, Th4-5 and genital segment, dorsal view; 32, genital segment; 33, furcal rami; 34, P5; 35, coxa and connective membrane of P4; 36, distal segment of endopodite P4. 37-42, *C. sibiricus* Lindberg: 37, thoracal and genital somites; 38, furcal branch; 39, distal segment of endopodite P4; 40, coxa and connective membrane of P4; 41, P5; 42, P6. (31-36: Einsle, 1988; 37-42: Lindberg, 1950).



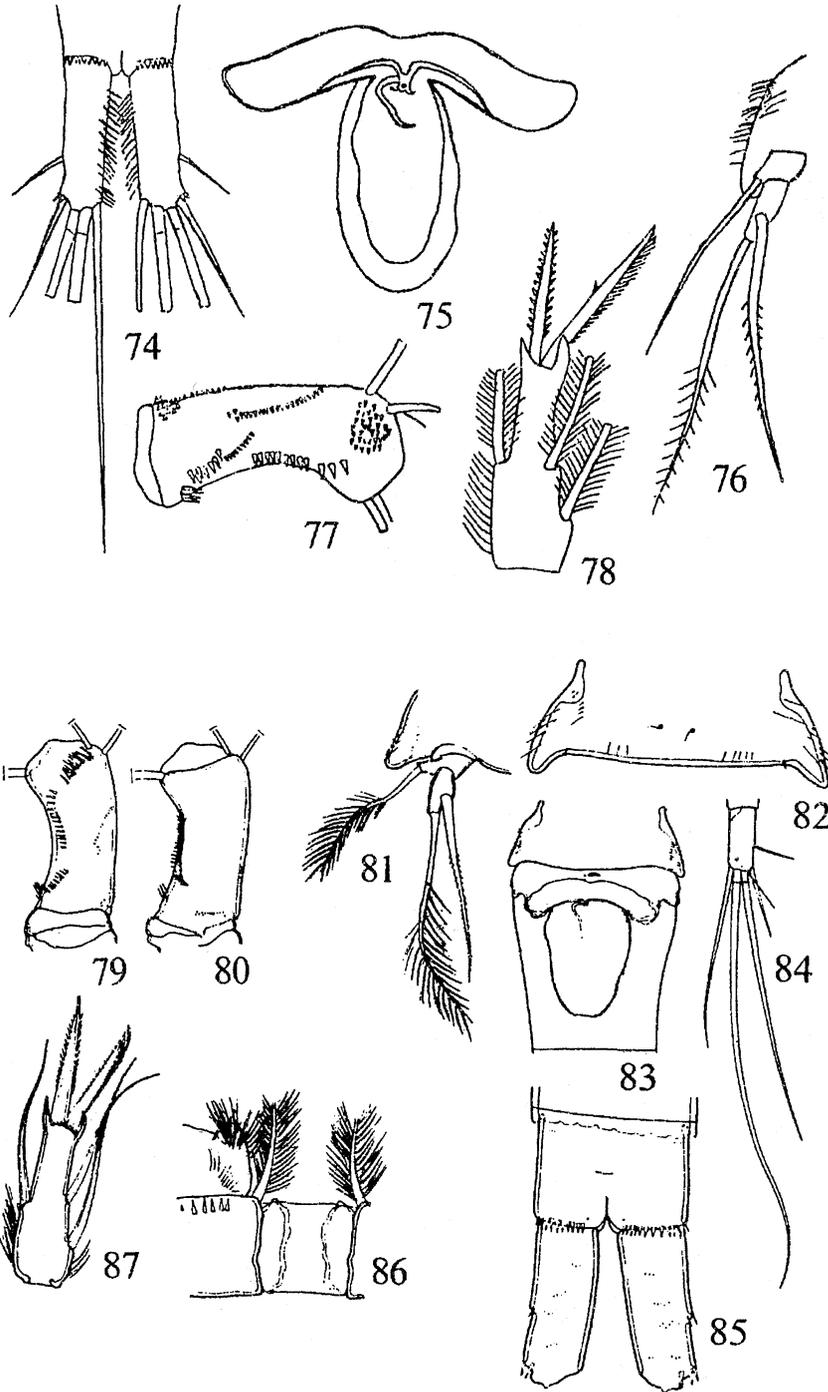
Figs 43-53. 43-49, *Cyclops abyssorum sevani* (Meshkova): 43, female, dorsal view; 44, furcal rami; 45, genital segment; 46, P1; 47, P4; 48, P5; 49, coxa and connective membrane of P4. 50-53, *C. ricue* Monchenko: 50, Th4-5 and genital segment, dorsal view; 51, P5; 52, distal segment of endopodite P4; 53, furcal rami. (43-48: original; 49: Alekseev, 1988; 50-53: Monchenko, 1977).



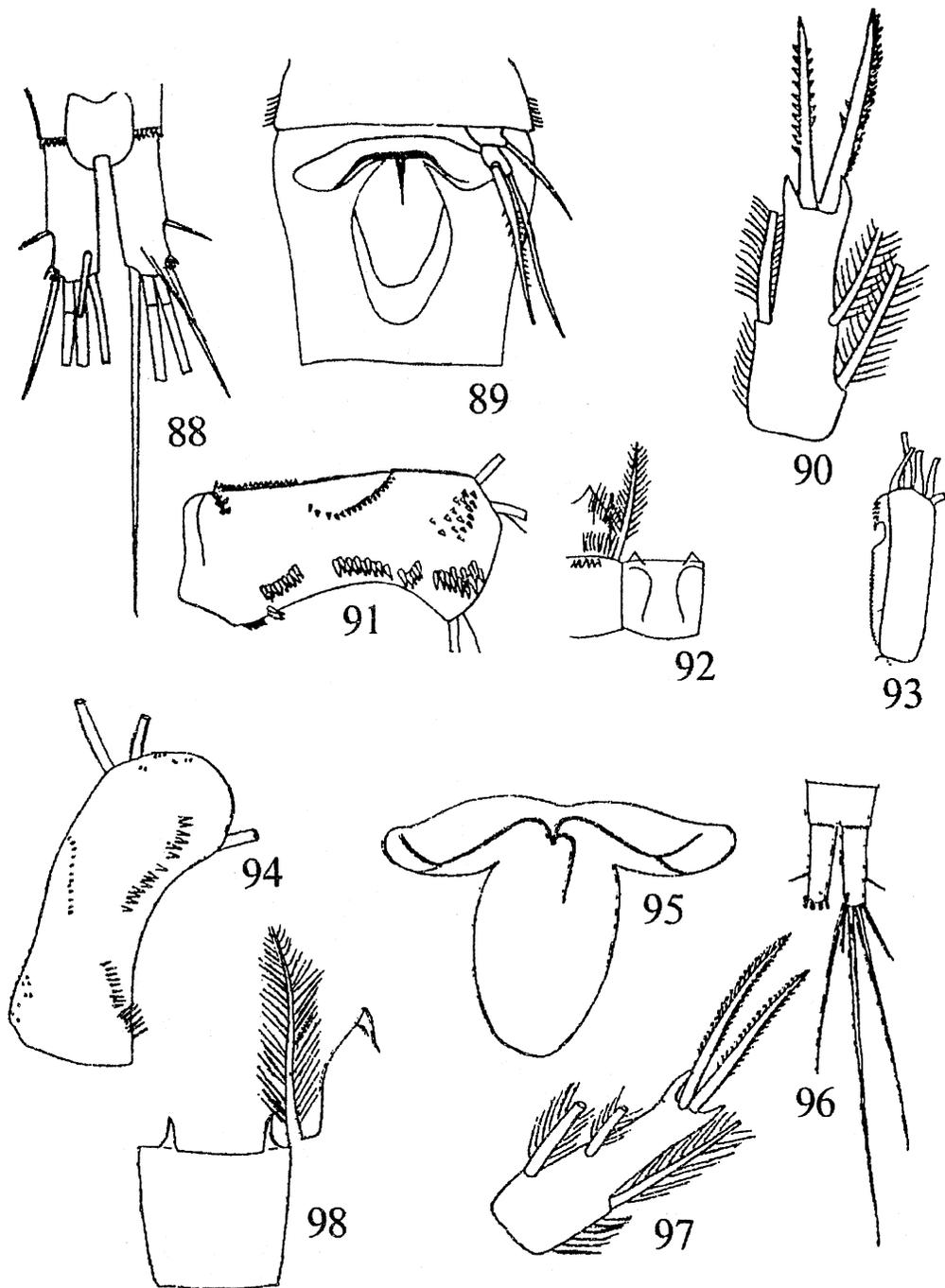
Figs 54-62. 54-59, *Acanthocyclops americanus americanus* (Marsh): 54, female, dorsal view; 55, genital segment; 56, furcal rami; 57, P4; 58, distal segment of endopodite P4; 59, P5. 60-62, *A. americanus spinosus* Monchenko: 60, furcal rami; 61, P4; 62, P5. (54-62: Monchenko, 1974).



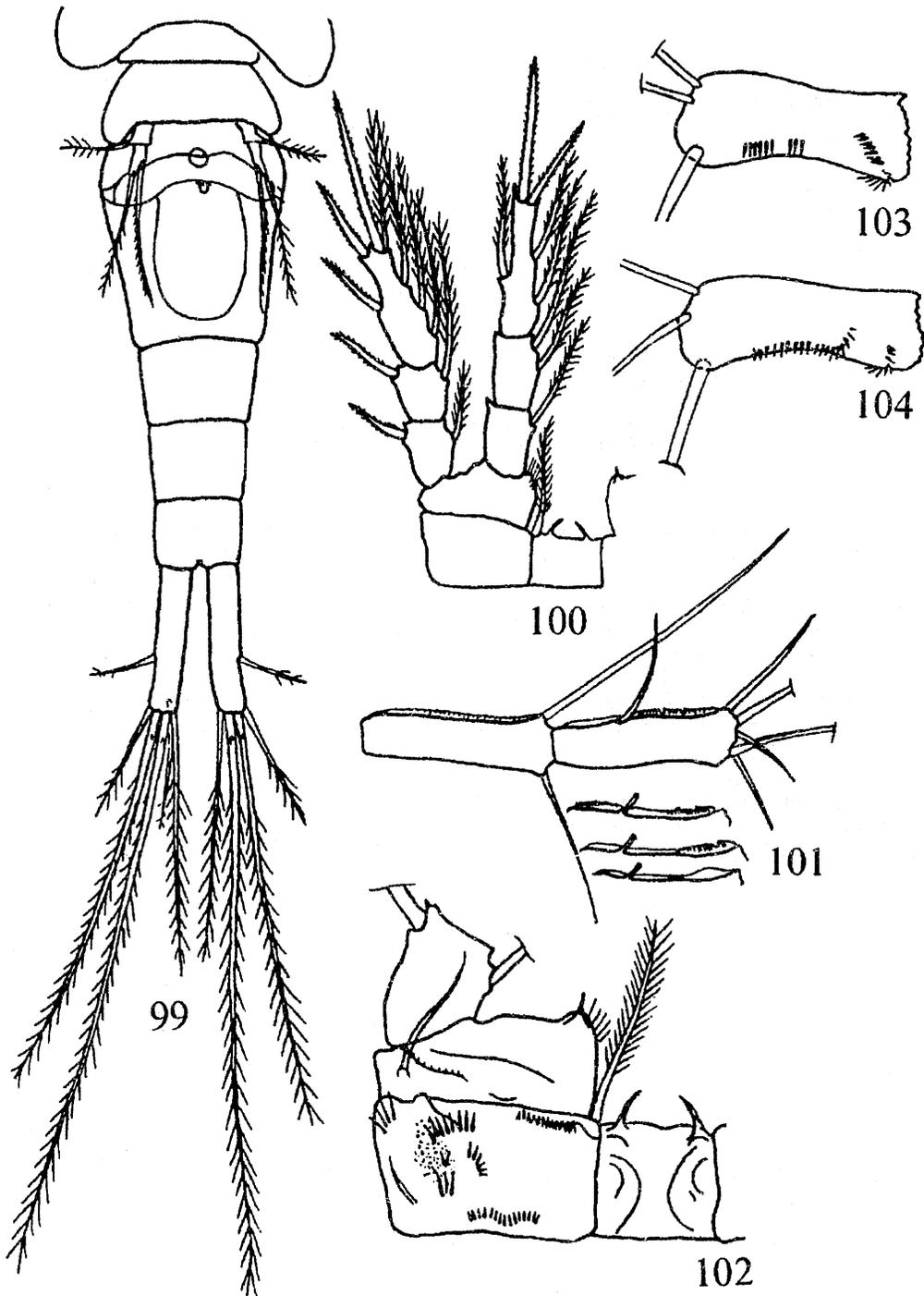
**Figs 63-73.** 63-68, *Diacyclops insularis* Monchenko: 63, female, dorsal view; 64, genital segment; 65, furcal rami; 66, antennule; 67, endopodite P4; 68, P5. 69-73, *D. limnobius* (Kiefer): 69, female, dorsal view; 70, furcal rami; 71, receptaculum seminis and P5; 72, P5 and P6; 73, antennule. (63-68: Monchenko, 1980; 69-73: Alekseev & Popov, 1986).



Figs 74-87. 74-78, *Mesocyclops aspericornis* (Daday): 74, furcal rami; 75, receptaculum seminis; 76, P5; 77, frontal side of antenna basipodite; 78, distal segment of endopodite P4. 79-87, *M. ogunnus* Onabamiro: 79-80, frontal and caudal sides of antenna basipodite; 81, P5; 82, Th5; 83, genital segment; 84, furcal branch; 85, furcal rami; 86, connective membrane of P4; 87, distal segment of endopodite P4 (74-78: Mirabdullaev, 1990; 79-87: Van der Velde, 1984).



Figs 88-98. 88-93, *Mesocyclops aequatorialis similis* Van der Velde: 88, furcal rami; 89, genital segment; 90, distal segment of endopodite P4; 91, frontal side of antennal basipodite; 92, connective membrane of P4; 93, hyaline membrane of antennule. 94-98, *M. ruttneri* Kiefer: 94, frontal side of antennal basipodite; 95, receptaculum seminis; 96, furcal rami; 97, distal segment of endopodite P4; 98, connective membrane of P4 (88-93: Mirabdullaev, 1984; 94-98: Mirabdullaev & al., 1995).



Figs 99-104. *Mesocyclops arakhlensis* Alekseev: 99, abdomen; 100, P4; 101, hyaline membrane of antennule, variability; 102, coxa and basipodite P4 (caudal view); 103, 104, frontal and caudal sides of antennal basipodite. (99-104: Alekseev, 1993).