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Eucyclops dumonti sp.nov. from Central Mongolia

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Abstract

Eucyclops dumonti sp.nov. is described from a shallow spring-fed lake in Central Mongolia. Data on its morphological variability are given, a comparison with the type population of *Eucyclops serrulatus* (Fischer, 1853) from St. Petersburg area is made, and its position relative to some closely related congeners is discussed.

Introduction

Less than 20 species of *Eucyclops* have become known from the Palaearctic, representing only about 15% of the world species of this genus (Dussart & Defaye, 1985; Alekseev, 1998). This small number of species for such a large area is striking, especially after comparison with Central and South Africa, from where more than 30 species have been cited. In some respects, this impoverished fauna of *Eucyclops* in the Palaearctic might be explained by the tropical origin of this genus (Rylov, 1948). But there are also several regions and specific ecosystems, in Central Asia area for example, which have hardly been studied from a zoological point of view. Mongolia is such an area, and the stagnant waters and springs of this country have practically been missed by all previous investigators of cyclopoids. A new species of *Eucyclops*, found in spring waters during an expedition of the Russian Academy of Sciences to Mongolia in summer 1999, is hereinafter described.

Materials and methods

The new species was found in Bur-Nuur Lake (48° 27′ 07″ N; 106° 16′ 07″ E) situated about 100 km North of the capital of Mongolia, Ulan-Bator (Fig. 1). This shallow lake, with an average depth of only about 50 cm, is created by the outflow of several springs which open in the middle of the lake. The inflow of underground water can be identified by the absence of water plants at the spring mouth (the rest of it is covered by *Potamogeton* sp.) and by the lower temperature of the spring water (Fig. 2). The lake has an area of about 5 ha, with a weak outflow in its north part. Fish were not seen. Sampling was done at several points in the area affected by spring water. About 100 l of water were filtered through a plankton net of 100 μm size mesh. Animals were preserved in 70% ethanol.

For the description, 25 mature females and three males were selected. Fifteen females, including the holotype, and two males were dissected under a stereomicroscope, mounted on microscope slides in glycerol and sealed with canada balsam. The other animals were observed ventrally under a compound microscope in a drop of glycerol without dissection. The swimming legs 4 and caudal rami of these animals were measured *in situ*, separately for the right and left sides to reveal possible body asymmetries (Table 1). About 300 eggs from these females were collected and divided in two portions for DNA analyses (Alekseev et al., in press). The holotype female and a paratype male were drawn using a camera lucida under oil immersion. For comparison, some measurements of *Eucyclops serrulatus* (Fischer, 1853) from the type locality (Alekseev et al., in press) have also been used. In the description, I follow the unified terminology for copepod external morphology of Huys & Boxshall (1991), adapted to cyclopoids by Dussart & Defaye (1995), with some minor changes.

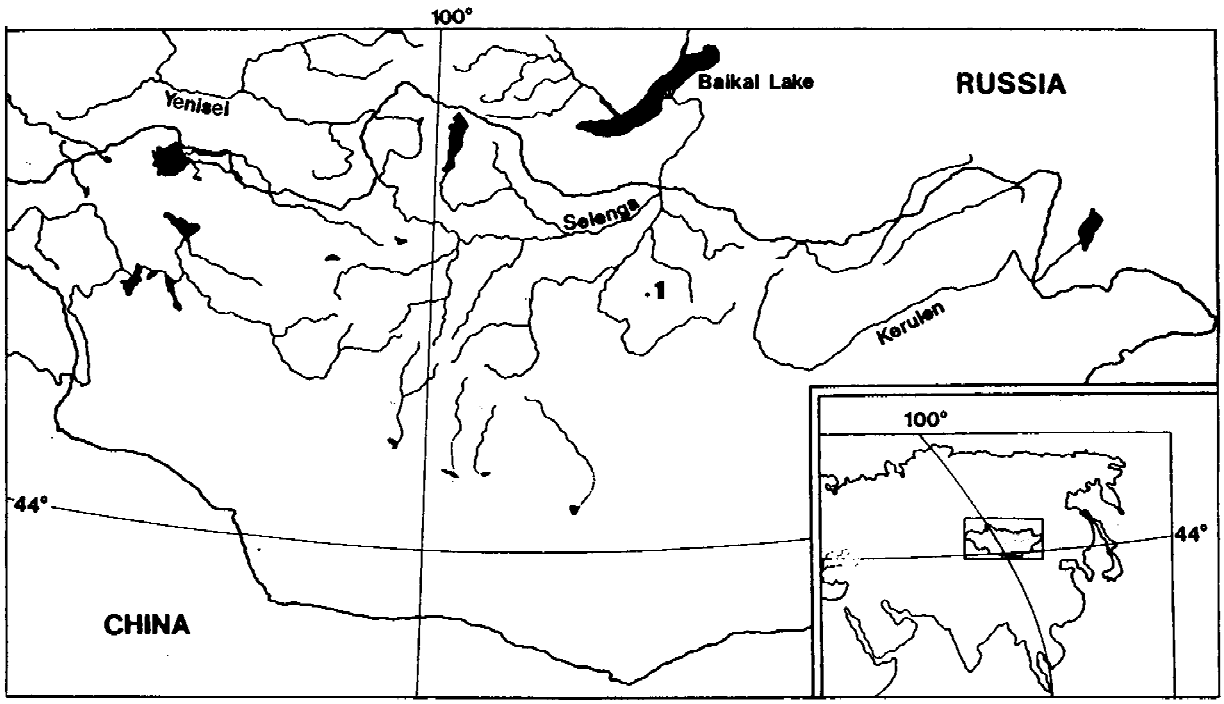

Figure 1. Map of Mongolia with sampling site indicated. 1. Lake Bur-Nuur.

Results

The description of the holotype female and allotype male of the new species is as follows:

Eucylops dumonti sp. nov.

Female

Holotype N 55021 is deposited in the type collection of Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia. The entire type series is also kept in the same repository and includes 27 females preserved in 70% alcohol (N 55024) and 30 females preserved in pure glycerol (N 55025). Full body length without setae is 930 μm, with caudal setae it is 1310 μm. Cephalosome is 1.1 times as long as wide, with maximum width in its last third (Fig. 3A).

Last segment of prosome with a group of small setae at its lateral margin. Narrow genital double somite 0.76 times as long as wide, with typical *Eucyclops* shape of the seminal receptacle (Fig. 3B).

Caudal ramus narrow, about 2.9 times as long as wide, with a rather long line of spinules at the outer edge of the dorsal side and six setae at the distal part of the ramus (Fig. 3C). Proportions of the length of the four distal setae, beginning from the outer terminal seta: 1/3.7/6.12/1.42 (Table 1). Dorsal seta about half the length of the inner seta and lateral seta about half the dorsal seta.

Antennule of 12 segments, reaching the middle of first free somite, with a narrow, smooth, hyaline membrane along the last three segments (Fig. 3A,D). Setation of antennular segments: 8/4/2/6/4/2/2/3/2/3/3/8. First segment of antennula with a row of rather long setae at its basis.

Antennal basipodite at caudal side with two groups of spinules above the insertion of the seta and six groups of spinules below it (Fig. 4 A). Antennal basipodite at frontal side with two groups of spinules and one – common to both sides – group of spinules at the lateral side of the segment (Fig. 4B).

Gnathobase of mandible with six large teeth, basis of mandibule with a long row of long hear-setae around the rudiment of the endopodial segment and with two long and one short setae at its end (Fig. 4C–E).

Maxillula biramous, with seven strong teeth and two small and one strong seta at the praecoxal artrite; basal exite with seven setae, different in length (Fig. 4G).

Figure 2. Picture of Lake Bur-Nuur with indication of sampling sites.

Maxilla of four segments, praecoxa with two strong setae in its middle part; coxa with a strong spine in the middle and small setae and a strong spine at its distal end; basal endite with two very strong spines and small setae near the place of fusion of the rudimentary endopod, bearing two strong spines and three hairless setae (Fig. 4F).

Maxilliped of 3–4 segments, praecoxa+coxa with two strong setae in the middle part and small setae at their distal end; basis with two setae of different length and a group of strong spinules near the insertion of the setae; first segment of endopod with a strong spine and a group of hair-setae around the rudimentary rest of the other segments of the endopod, bearing a strong spine and three hairless setae (Fig. 4D).

Swimming legs 1–4 with 3-segmented rami (Fig. 5 A–D). Distal segment of the exopod of legs 1 and 4 with four spines and five setae; legs 2 and 3 with four spines and five setae. Distal segment of the endopod of legs 1–3 with a spine and five setae.

Distal segment of endopod leg 4 elongated, 2.6 times as long as wide, with two strong spines at its end, and the inner spine 1.3 times as long as the outer spine. Inner edge of the basis of legs 1–3 with a group of long hair-setae, that of leg 4 hairless.

Coxa of legs 1–4 with a strong spine bearing dense hair-setae on both sides and several groups of spinules and hair-setae on the caudal side of the coxa, as shown in Figure 5. Intercoxal sclerites of legs 1–2 with a row of hair-setae, those of legs 3–4 with two rows of hair-setae and groups of hair-setae near the inner coxa edge.

Rudimentary fifth leg 1-segmented, with rather strong inner spine and two setae, outer seta equal to spine in length, middle seta about 1.5 times as long as spine (Fig. 3B).

Egg sacs with 5–10 large eggs each (Fig. 3A). Biometrical data on the holotype specimen as well as on other 12 females from the same locality are given in Table 1.

Male

Allotype, N 55022, is mounted in glycerol on a slide. Ten males from the paratype series are preserved in pure glycerol (N 55025) and placed also in the collection of the Zoological Institute of the Russian Academy of Sciences.

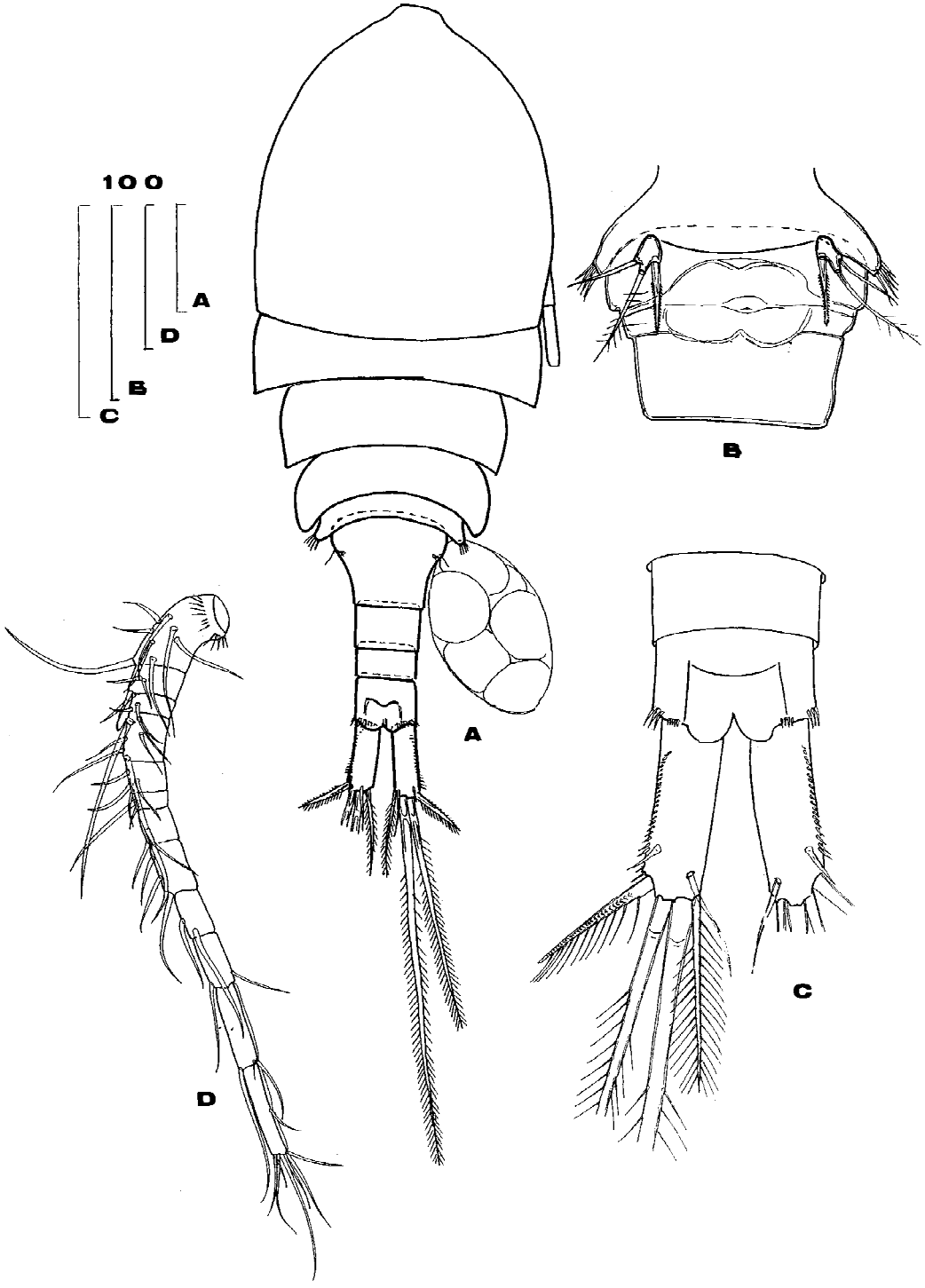

Figure 3. Eucyclops dumonti sp. nov. (female). (A) habitus dorsally; (B) last segment of prosome with rudimentary leg 5 and double genital somites; (C) caudal rami; (D) antennula.

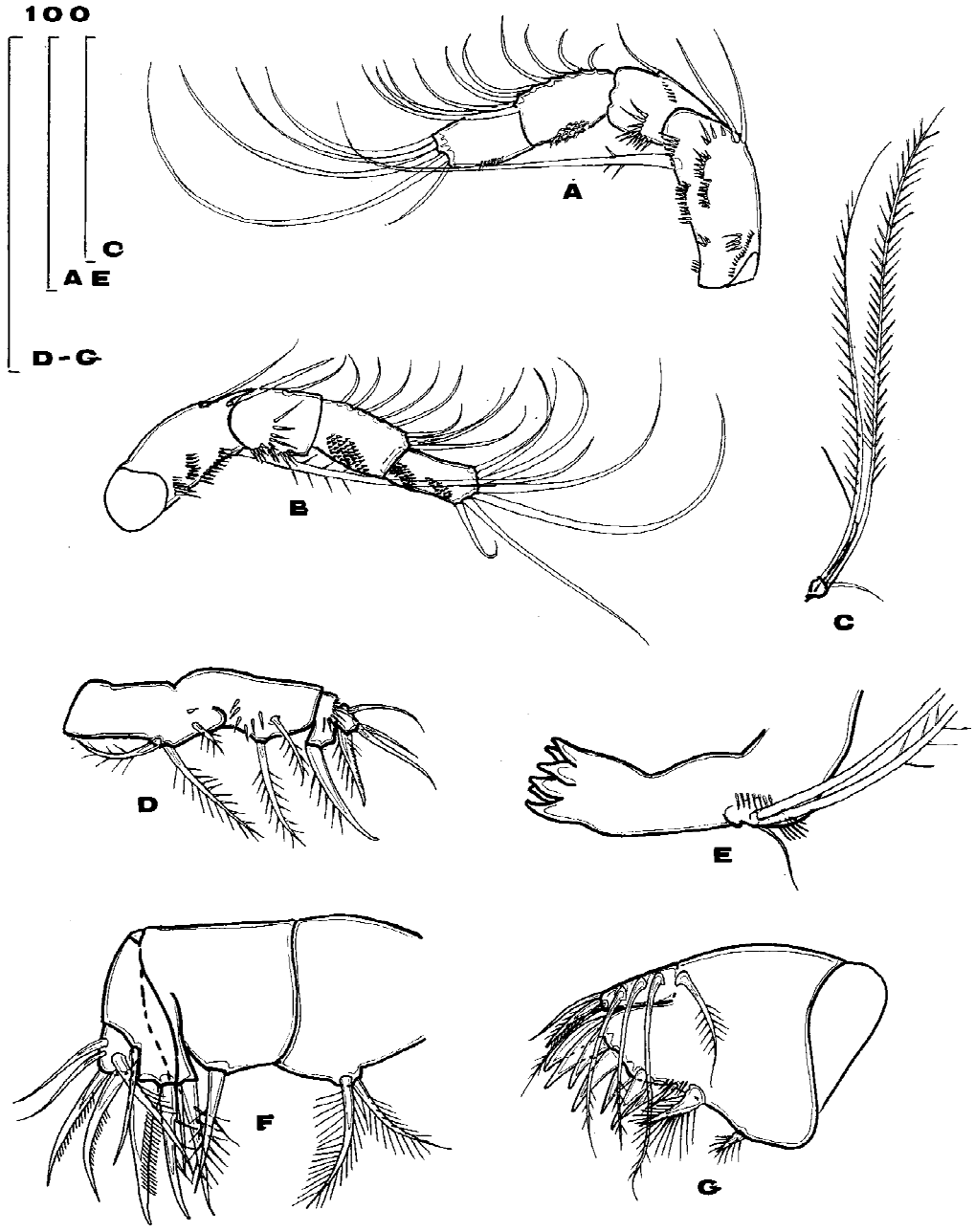

Figure 4. Eucyclops dumonti sp. nov. (female). (A) antenna, caudal side; (B) antenna, frontal side; (C) rudiment of endopodial segments of mandible; (D) maxilliped; (E) mandible; (F) maxilla; (G) maxillule.

Body length is 766 μm, with caudal setae it is 1123 μm. Cephalosome is 1.13 times as long as wide, with maximal width in the middle of its length (Fig. 6A).

Last segment of prosome without setae at its lateral margin. Caudal ramus 3.25 as long as wide, outer seta half as long as the inner seta.

Antennule 14-segmented, as shown in Figure 6A.

Morphology of mouth appendages and swimming legs 1–3 basically as in female. Distal segment of endopod of leg four 2.25 times as long as wide, with inner spine 1.5 times as long as outer spine. Inner edge of basis of leg four with two short hair-setae, coxa of leg four with a strong spine, bearing hair-setae on both

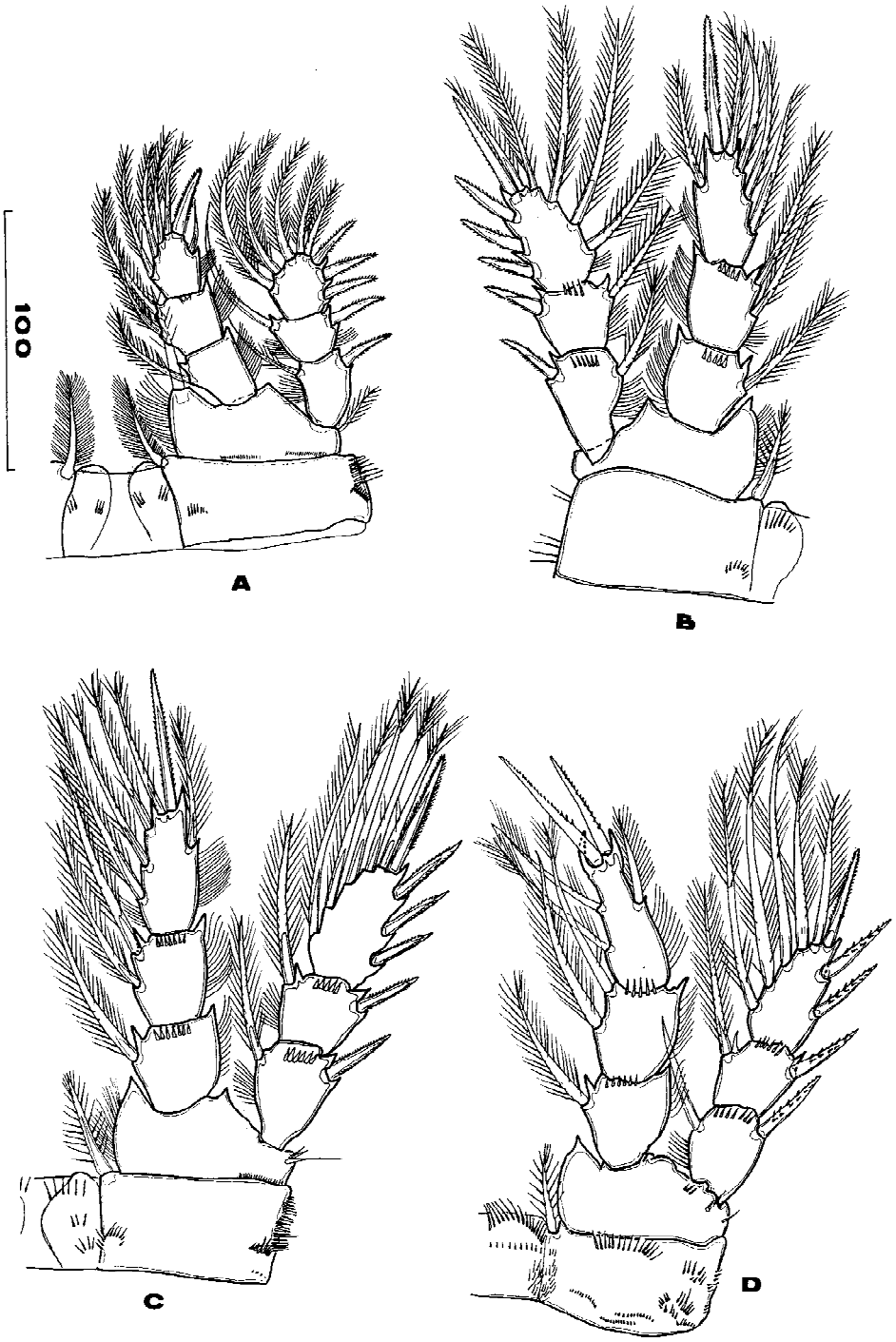

Figure 5. Eucyclops dumonti sp. nov. (female). (A) swimming leg 1; (B) swimming leg 2; (C) swimming leg 3; (D) swimming leg 4.

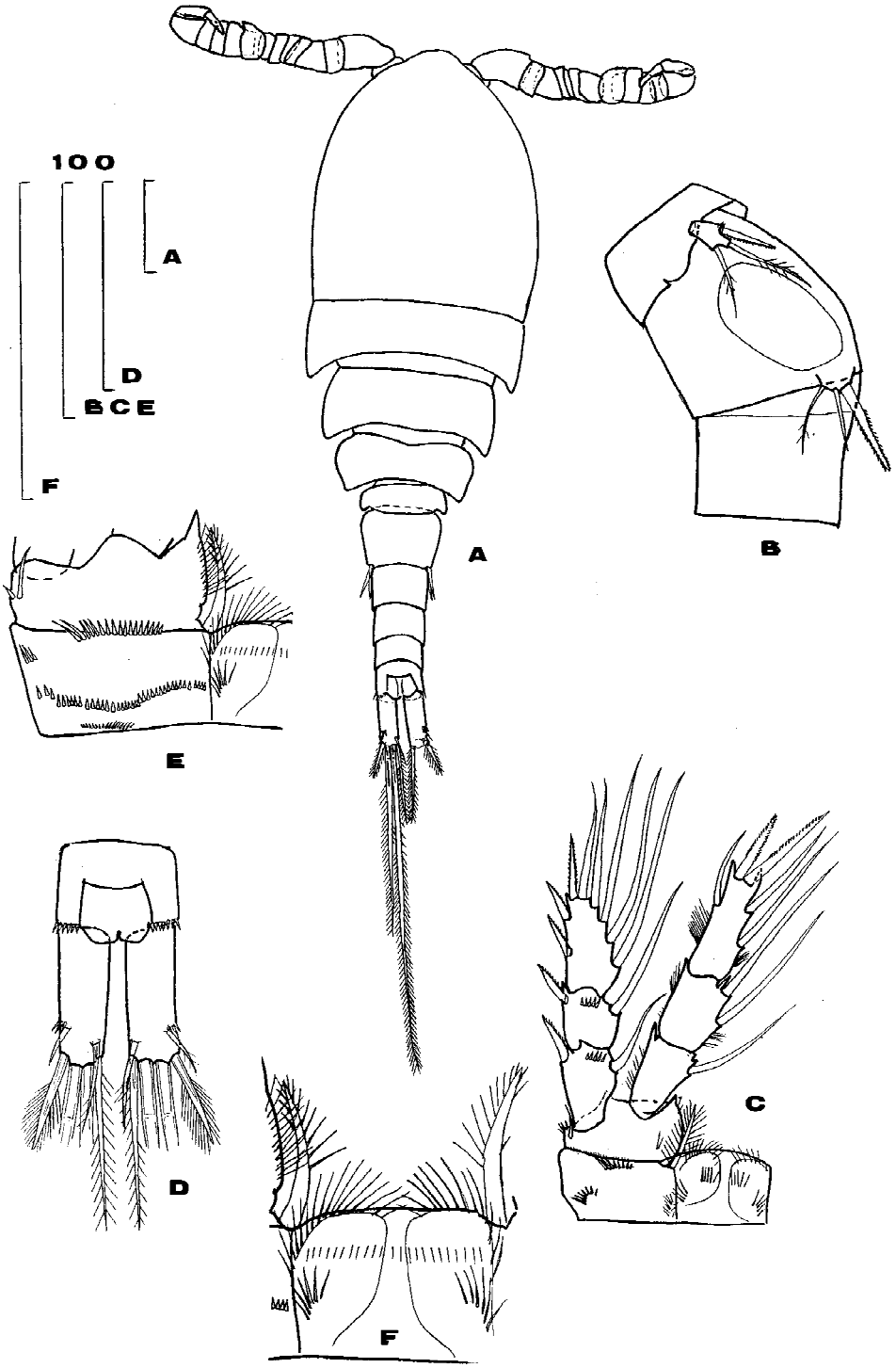

Figure 6. Eucyclops dumonti sp. nov. (male) (A–D) and *Eucyclops serrulatus* (Fischer, 1853) from the type locality, St. Petersburg, Russia (female) (E–F). (A) habituis, dorsally; (B) rudiment legs 5 and 6, laterally; (C) swimming leg 4; (D) caudal rami, dorsally; (E) coxa and basis of swimming leg 4, caudal side; (F) intercoxal sclerite of swimming legs 4.

sides and several groups of spinules on its caudal side, as in Figure 6C.

Rudimentary fifth leg with inner spine shorter than in female and with two setae. The outer seta 1.25 times as long as the spine, the middle seta about two times as long as the spine (Fig. 6C).

Rudimentary sixth leg with strong inner spine and two short setae with length proportion, beginning from the outer seta, as following: 1/0.87/1.27.

Differential diagnosis

In several characters, such as the antennula, the antennal armament, and the swimming leg construction, *E. dumonti* is seen to be part of the *serrulatus* group. However, I found at least three morphological markers that allowed me to consider this form as a new species.

It has a very short caudal ramus with length/width proportion about three, and with small variation in this parameter within the population (Table 1). In the type population of *E. serrulatus* from the St. Petersburg area, this index (l/w) never was less than 4.5. The lowest (3) caudal ramus index for an *Eucyclops serrulatus* population was reported by Monchenko (1974), but the biometric data in his book show a population with l/w = 3.74 only. Other characters separating *E. dumonti* from *E. serrulatus* have not been used as specific characters yet. In a forthcoming paper redescribing *E. serrulatus*, the importance of the morphology of the inner spine of the coxa and exopod of leg 4 has been demonstrated (Alekseev et al., in press). The inner edge of the basis of leg 4 is hairless in *E. dumonti* but always has hair-setae in *E. serrulatus*; the inner spine of the coxa of leg 4 is homogeneously covered with hair-setae in *E. dumonti* but always shows a gap among the hair-setae at the inner side of this spine in *E. serrulatus* (Figs 5D and 6E–F). At the same time, the presence of several hair-setae at the inner edge of the basis of leg 4 in *E. dumonti* males suggests that this species may have become separated from *E. serrulatus* in geologically recent times only.

Antennal basipodit on caudal side distally in *E. serrulatus* with 4–6 long hair-setae, while in *E. dumonti* with rather short dentricles (Fig. 4A). We found a difference between these species also in nucleotide sequences of the small subunite of 18-S-ribosomal DNA (Alekseev et al., in press).

E. arcanus Alekseev, 1980, described from the Transbaical region of Siberia (54° N, 109° E), not so far from Mongolia, has a furcal index 3.4–3.5. The two species are indeed close to each other. From *E. arcanus*, the new species differs in the following characters: the inner edge of the basis of leg 4 is hairless in *E. dumonti* but always with hair-setae in *E. arcanus* (female and male); the distal setae of the last segment of exopod P4 in *E. dumont* is short, only reaching the end of the distal spine of the same segment, while in *E. arcanus* this seta is twice as long as the distal spine; in *E. arcanus*, the spine is thick and relatively shorter than in *E. dumonti*, where this appendage looks like a strong, knife-like spine.

Several other *Eucyclops* species have an l/w of less than 3: *E. breviramatus* Loffler, 1963 from Ecuador has an l/w = 1.92–2.61; *E. echinatus* Kiefer, 1926 from Madagascar has an l/w = 2.22–2.40; E. teras from groundwater in Yugoslavia has an l/w of about 2. As well as by geographical distances, these species differ from *E. dumonti* in the following details: *E. teras* has only two appendages at its P5; *E. echinatus* has several spinular rows at the dorsal side of the caudal rami and a reduced serra on the rami; *E. breviramatus* has a short distal segment of endopod P4, 1.2–1.34 as long as wide, and a broad transparent plate at the distal antennular segments.

Several species from areas other than the Palaearctic have a furcal index between 3 and 4: *E. prionophorus* Kiefer, 1931 with l/w about 4 and *E. cornowae* Reid, 1992 both are from North America; *E. bondi* Kiefer, 1934 from Haiti with l/w-3.5; *E. hadjebensis* Kiefer, 1926 from Morocco with l/w=3.23 (see Dumont & Decraemer, 1977); *E. ensifer* Kiefer, 1936 from Chili, Argentina with l/w=3.75 (3.26 after Lindberg, 1954); *E. silvestrii* Brian from South America with l/w=3.5–4; *E. farsicus* Lindberg, 1941 from Indo-Iran with l/w = 3.54-3.78; *E. elburziensis* Lindberg, 1941 from Indo-Iran with l/w = 3.4–4 (1 out of 7 specimens had 3.04!); and *E. turcomanus* Lindberg, 1959 from Afghanistan with l/w = 3.26–4.32 (see also Samraoui et al., 1998).

From all these species, as well as from other congeners, *E. dumonti* differs by the following unique combination of characters: the structure of leg 4, especially the coxal spine and setation of the basipodite, the armament of the exopod and endopod; the relative length of the antennula; the armament of antenal basipoditi; the serra and length/width index of the female caudal rami, and finally, the construction of leg 6 in the male.

Remarks on ecology and distribution

Eucyclops dumonti probably inhabits springs and similar waterbodies, a habit it shares with a number of other *Eucyclops* species, e.g. *E. hadjebensis* (Dumont & Decraemer, 1977). To my mind, the small number of large-sized eggs found in all females without exception indicates an adaptation of the species to life in the poor food conditions of springs, but possibly also low predation levels. At the same time, the relatively big size of adult *Eucyclops dumonti* must limit the possibility of this species to live in the interstitial space among sand granules as are normally found in springs. I suppose that this species is widely distributed in mountain springs of Central and South Mongolia.

In 2000, I found this species also in a sample collected by Prof. Dumont in July in north-east China, in a small temporary pool among sand dunes on the east shore of Hulun Nuur (Lake Hulun), a large headwater lake in the Amur catchment.

Etymology of the name

This species is named after Dr Henri Dumont, widely appreciated for his studies on taxonomy and systematic of invertebrates, Copepoda including.

Acknowledgements

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