

## *Eucyclops leschermoutouae* sp. n. from Majorca, Balearic Islands (Crustacea, Copepoda: Cyclopidae)

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*Eucyclops leschermoutouae* sp. n. is described from a well located in the vicinity of Soller (Majorca, Balearic Islands, Spain). This new species belongs to the *serrulatus*-group and can be distinguished from its nearest congeners by a set of characters, which includes the fine armature of the antennar basipode and coxa of the swimming leg 4, and the relative lengths of the caudal setae. Taxonomic differences of the new taxon and closely related species from Africa, Asia and Americas are discussed.

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### Introduction

Most of *Eucyclops* species inhabiting the surface waters of Europe were described in the 19th and early 20th centuries. One of the rare exceptions is the Eurasian *Eucyclops roseus* Ishida, 1998 found in Germany and Japan. This species might be a species recently introduced into Europe from the tropics, as it was also found in the African Lake Victoria (Ishida, 2000). The European complex of *Eucyclops* species from surface waters was, till recently, represented by 7 taxa (Dussart & Defaye, 1985).

*Eucyclops* species from the subterranean habitats of Europe were mainly studied during the 20th century. They comprise approximately the same number of species and subspecies as inhabitants of European surface waters, and their fauna is insufficiently known (Pesce & Galassi, 1987).

Hereafter, we describe a new species of *Eucyclops* from a well in Majorca that could be considered as belonging to subterranean fauna. Four females of this species were sorted from a sample of Dr. Françoise Lescher-Moutouï's collection (Ecole Normale Supérieure, Paris). Two females were dissected and mounted on a slide in lactic acid. The observations and pictures were done with a compound microscope (Leica DMLB) and a camera lucida under oil immersion mainly. The specimens were then transferred to glycerol and the cover glasses sealed with

Eukitt (O. Kindler GmbH & Co, Freiburg, Germany) for long-term preservation. Two females were studied without dissection and preserved in alcohol.

### *Eucyclops leschermoutouae* sp. n. (Figs 1-14)

*Holotype*. ♀, dissected and mounted in glycerol on one slide, registration number MNHN-Cp2158, **Spain, Balearic Islands**, Majorca, well in vicinity of the small town Soller; deposited at the Muséum National d'Histoire Naturelle, Paris,

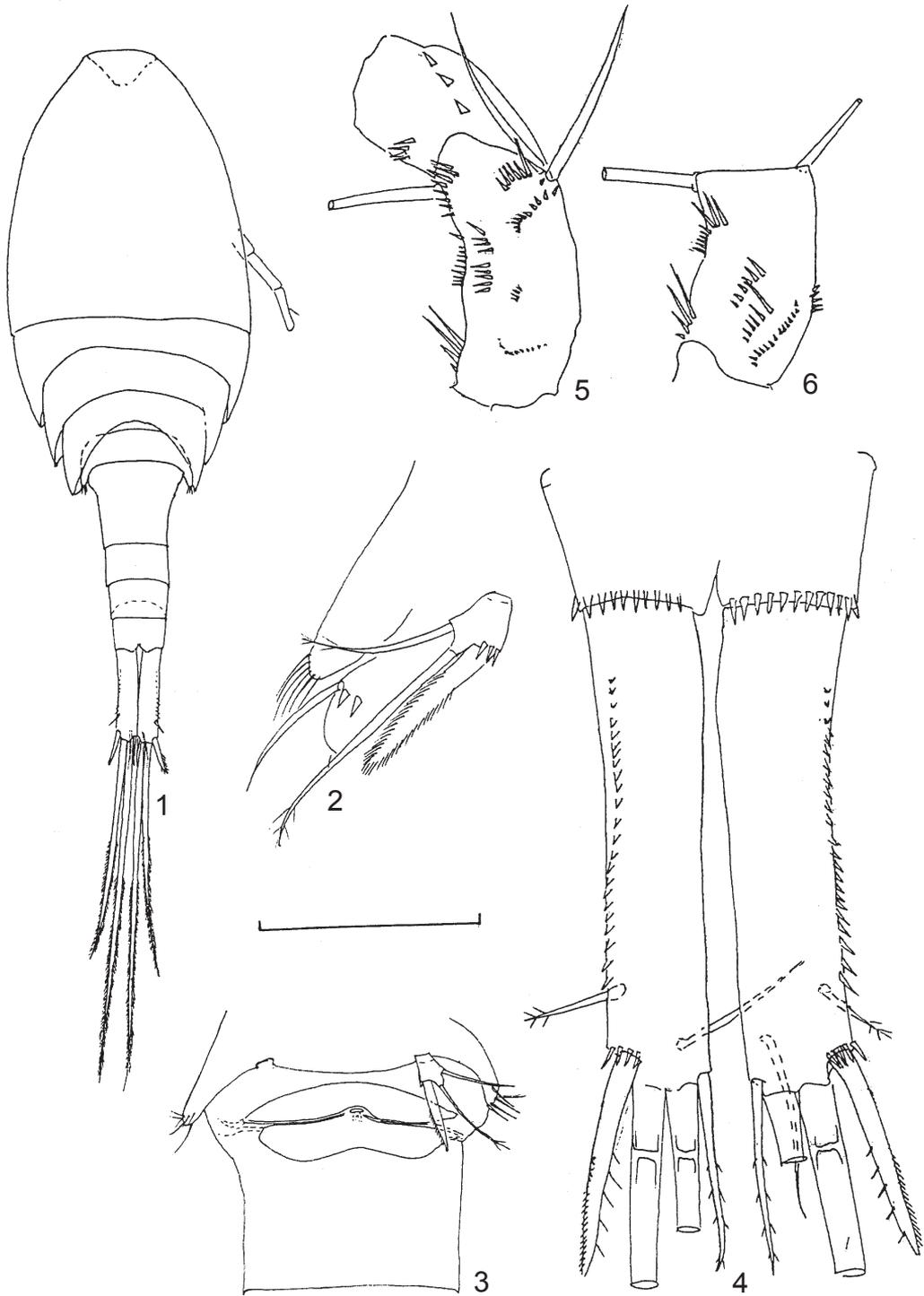
*Paratypes*, all from the same locality: 1 ♀ dissected and mounted as the holotype, deposited in the personal collection of V. Alekseev; 2 undissected ♀ preserved in alcohol, registration number MNHN-Cp2159, deposited as the holotype.

*Description. Female*. Body length: 0.880 mm without caudal setae, 1.320 mm, caudal setae included.

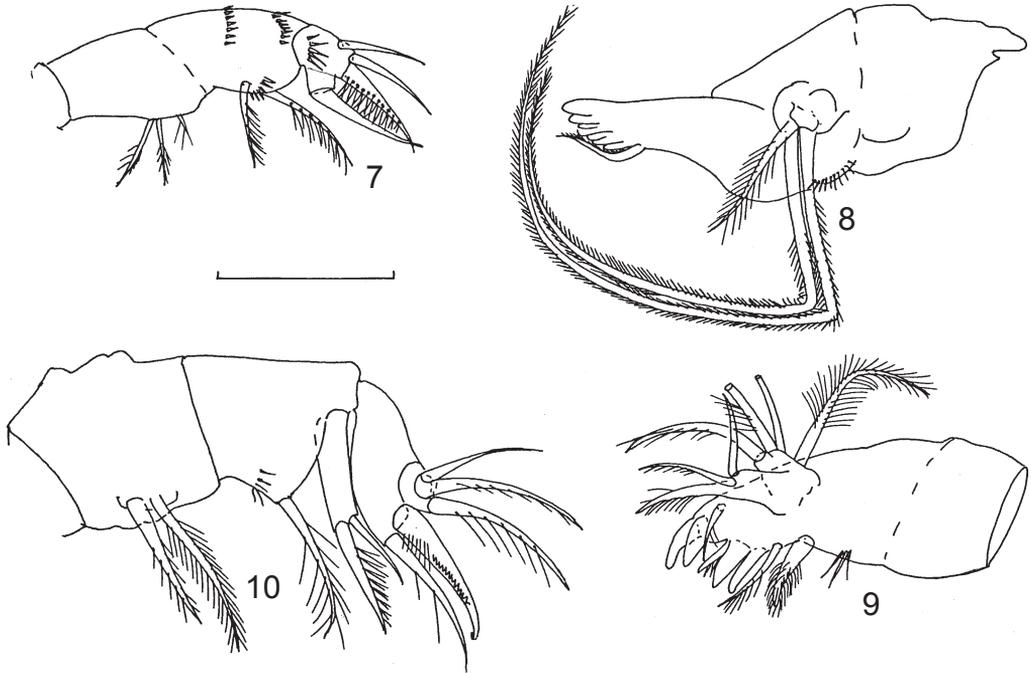
Body slender and colourless. Cephalosome 1.1 times as long as wide (Fig. 1).

Last segment of prosome with group of small setae at its lateral margin (Fig. 2).

Genital double somite as long as wide (Fig. 3), with seminal receptacle typical of *Eucyclops*, composed of two parts; anterior part slightly flattened, with anterior edge convex and posterior part of about same size as anterior one, with its posterior margin concave in its median part; copulatory pore situated just posterior to suture cord (for terminology, see Defaye et al., 2003).



**Figs 1-6.** *Eucyclops leschermoutouae* sp. n., female. 1, habitus, dorsal; 2, leg 5 and leg 6; 3, genital double-somite, ventral side; 4, caudal rami, ventral side; 5, antenna, basipode, frontal side; 6, antenna, basipode, caudal side. Scale bar: 1 – 240  $\mu$ m; 3 – 120  $\mu$ m; 2, 4-6 – 60  $\mu$ m.



**Figs 7-10.** *Eucyclops leschermoutouae* sp. n., female, buccal appendages. 7, maxilliped; 8, mandible; 9, maxilla; 10, maxillule. Scale bar: 7 – 120  $\mu$ m; 8-10 – 60  $\mu$ m.

Caudal rami 5 times as long as wide, with dorsal serra of 20-22 small and fine spinules decreasing in size from distal part of serra to its proximal end (Fig. 4). Length ratio of distal setae, starting with the outer terminal seta, as 1 : 6.1 : 9.6 : 0.85. Dorsal seta as long as innermost seta; lateral seta about half as long as dorsal seta. Outermost seta transformed into a strong spine with sparse short hairs internally and small teeth externally; 5 long denticles dorsally at the base of this seta. Innermost seta shorter than outermost seta, ornamented with few short hairs on both sides.

Antennule 12-segmented (not figured), reaching posterior margin of first free thoracosomite, with smooth hyaline membrane present on 10-12th segments. Seta formula of segments starting with basal one (s: spine, a: aesthetasc): 8/ 4/ 2/ 6/ 4/ 2(1+s)/ 2/ 3/ 2/ 2/ 3(2+a)/ 7. Segmental fusion patterns of antennule as I-V, VI-VII, VIII, IX-XI, XII-XIII, XIV, XV-XVI, XVII-XX, XXI-XXIII, XIV, XXV, XXVI-XXVIII.

Antenna 4-segmented, composed of basipode and 3-segmented endopode, the latter bearing 1, 9, 7 setae, respectively. Basipode ornamented as follows: frontal side (Fig. 5) with two rows of strong denticles distally, a row of 8 relatively large spinules in central part forming a line parallel to

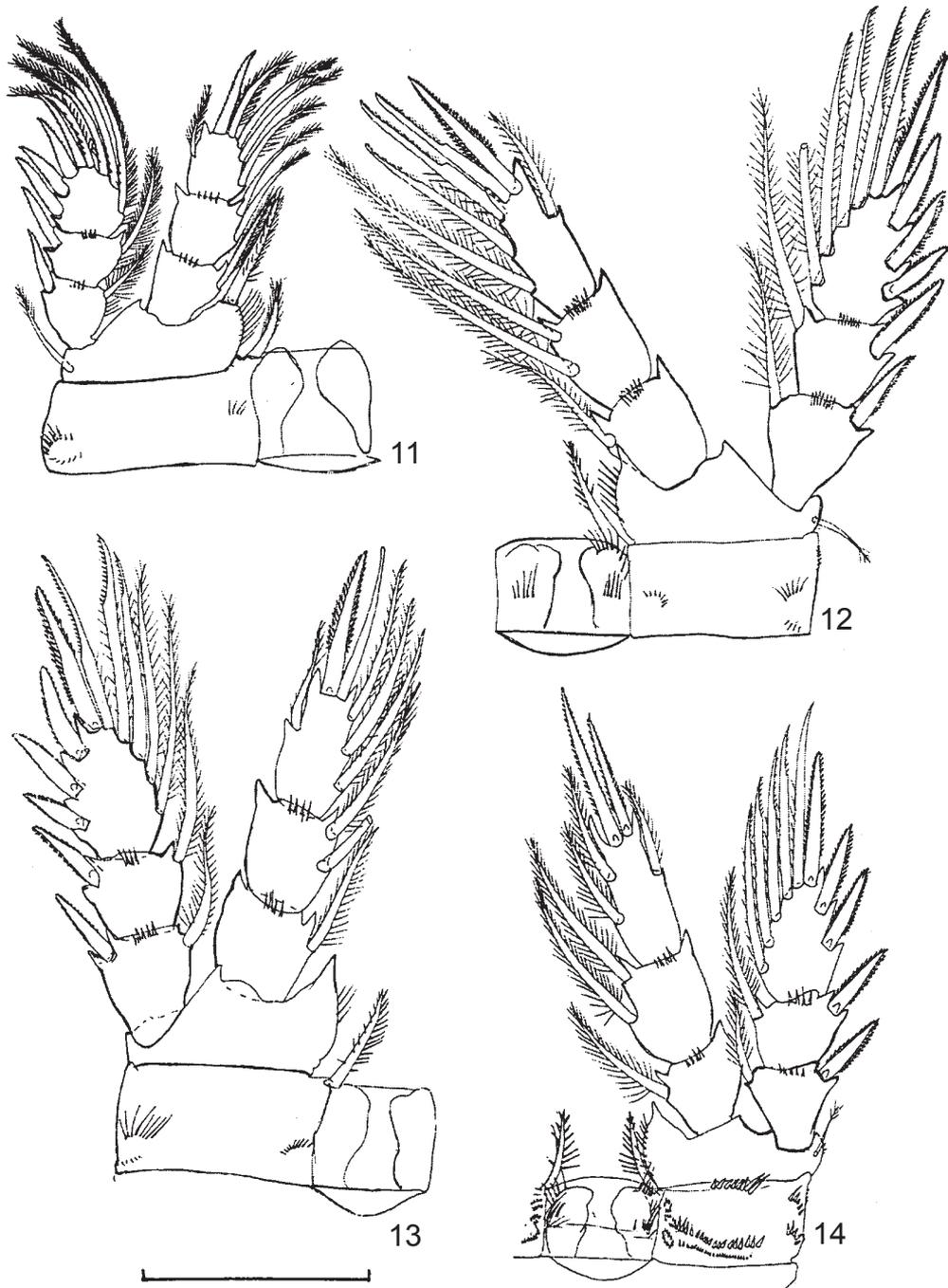
external side of segment, a group of 8 spinules at insertion of two distal internal setae, and two groups of tiny spines; caudal side (Fig. 6) with three parallel lines of spines situated diagonally in antero-central part and two groups of hair-setae on external lateral side, but no group of long hair-setae at its distal part, in contrast to other species of *serrulatus*-group.

Mandible: gnathobase with six teeth and a denticulated seta; palp with two long setae and a short seta with hairs (Fig. 8).

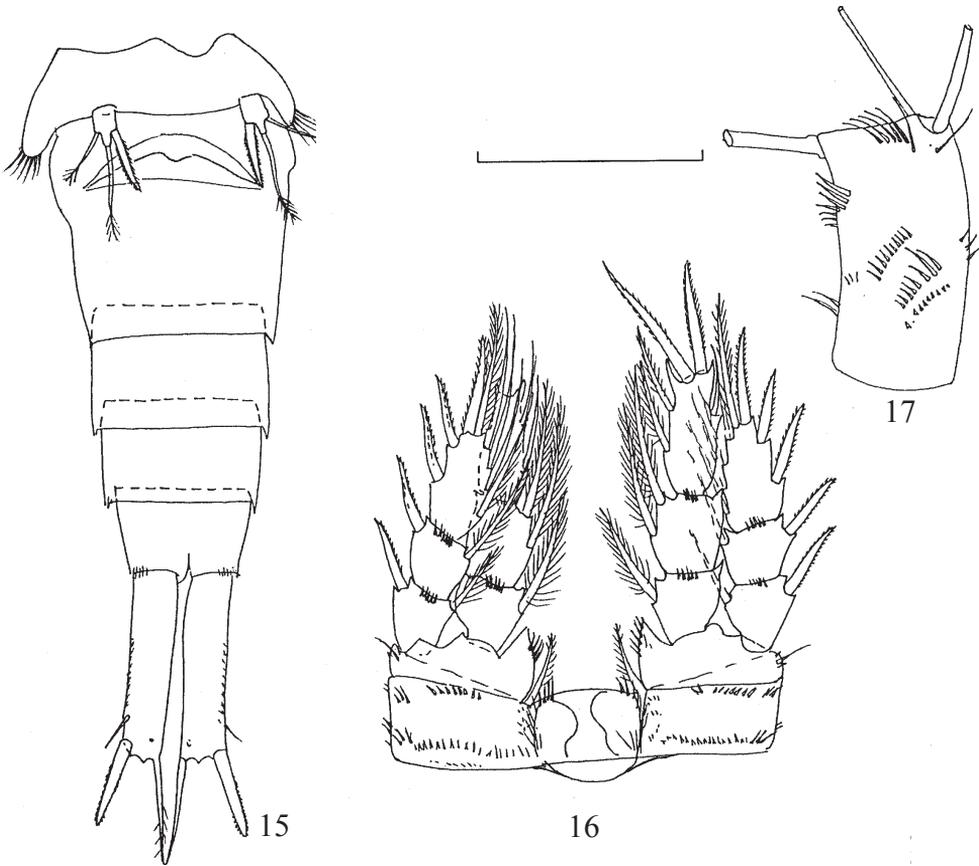
Maxillule ending in four strong teeth, three strong setae with long hairs, and a strong seta on praecoxal arthrite; basal exite (maxillulary palp) with seven setae, without spine or hairs on its surface (Fig. 9).

Maxilla of four segments; praecoxa with two strong setae medially; coxopod laterally with a strong spine and a group of hairs near its base; basal endite with two strong spines and small setae near the place of fusion of endopode, the latter bearing a strong spine and four setae (Fig. 10).

Maxilliped of 3 segments, praecoxopod + coxopod with two strong setae in the middle and small setae distally; basis with two setae of different lengths and three groups of strong hairs as shown in Fig. 7; endopod with strong spine and



**Figs 11-14.** *Eucyclops leschermoutouae* sp. n., female, swimming legs. 11, leg 1; 12, leg 2; 13, leg 3; 14, leg 4. Scale bar: 120  $\mu$ m.



**Figs 15-17.** *Eucyclops hadjebensis* (Kiefer, 1926) from the type locality (Atlas Mountains, Morocco). **15**, urosome, ventral side; **16**, leg 4, ventral side; **17**, antennal basipode, caudal side. Scale bar: 15 – 120  $\mu\text{m}$ ; 16 – 80  $\mu\text{m}$ ; 17 – 60  $\mu\text{m}$ .

a group of hairs proximally and a strong spine and two hairless setae distally.

Swimming legs 1-4 with 3-segmented rami (Figs 11-14). Distal segment of leg 4 endopode elongate, 2.25 times as long as wide, with two strong spines at its end; inner spine 1.3 times as long as outer spine and the segment itself. Inner seta of leg 4 endopode reaching the middle of nearest spine.

Inner edge of the basis of legs 1-4 with group of long hairs. Coxa of leg 4 with strong spine bearing dense and strong hairs on inner side and with large gap among hairs on outer side (Fig. 14). Caudal surface of coxa with several groups of denticles and hair-setae (Fig. 14), coxa in its distal-middle part with 8 large spinules. Intercoxal plate of leg 4 without prominences and hairs at distal edge, with 3 short rows of long hairs near coxal segments (Fig. 14). Chaetotaxy

of swimming legs is summarized in the following table (spines in Roman, setae in Arabic numerals; Cp = Coxopode, Bp = Basipode):

	Cp	Bp	Exopode	Endopode
P1	0-1	1-I	I-1; I-1; III, I-1,3	0-1; 0-2; I, I-1,3
P2	0-1	1-0	I-1; I-1; III, I-1,4	0-1; 0-2; I, I-1,3
P3	0-1	1-0	I-1; I-1; III, I-1,4	0-1; 0-2; I, I-1,3
P4	0-1	1-0	I-1; I-1; II, I-1,4	0-1; 0-2; I, II,2

Leg 5 one-segmented, with strong knife-like inner spine and three long denticles at the base of this spine. Outer seta shorter than spine; middle seta about 1.5 times as long as spine (Fig. 2).

Variability of important ratios in other specimens of the type series is as follows (average  $\pm$  standard error (min-max)): innermost/ outermost ratio in caudal setae  $0.82 \pm 0.037$  (0.65-0.95); length/ width ratio in caudal rami  $4.63 \pm 0.139$  (4.07-5.04); inner/ outer distal spine of P4 endopode  $1.29 \pm 0.032$  (1.21-1.37).

Male unknown.

*Etymology.* This species is named after Dr. Françoise Lescher-Moutoué for her major contribution to systematics and ecology of the subterranean Copepoda, especially cyclopids.

*Comparison.* On the basis of the leg 4 structure, especially the armature of the coxal spine showing a clear gap among the strong hairs at the outer side of the spine, *Eucyclops leschermoutouae* sp. n. belongs to the *serrulatus*-group. It can be easily distinguished from *E. serrulatus* (Fischer, 1853) and the closest congeners by the unique combination of the following characters: absence of distal group of long hairs on the caudal side of the antennar basipode; absence of hairs on the distal edge of the intercoxal plate of leg 4; reduced number of denticles (8 instead 12-16) on the top of coxal segment in leg 4; innermost seta of caudal rami shorter than outermost seta.

*Discussion.* The *serrulatus*-group includes about 30 species widely distributed all over the world. Recently, many of them were identified as the cosmopolitan species *E. serrulatus*. During the last decade, it was discovered that *E. serrulatus* occupied mainly the central and northern part of Palaearctic, but was replaced in other zoogeographic regions by other species, morphologically close and forming the *serrulatus*-group (Alekseev, 1989, 2000; Ishida, 1997, 1998, 2000; Alekseev et al., in prep.).

Species of the *serrulatus*-group have 12-segmented antenna with smooth hyaline membrane at distal segments, caudal rami of moderate length (l/w ratio 3.5-6), strong inner spine of 5th leg, and at least one of the two following microcharacters: (1) basipode of antenna in the distal part of the caudal side with one or two groups of hairs; (2) coxal spine of leg 4 with a clear gap in hairs at outer edge (Alekseev et al., in prep.).

Within the *serrulatus*-group, there are three taxa having caudal rami with innermost seta shorter than outermost seta: *E. euacanthus* (Van Douwe, 1914), *E. ensifer* Kiefer, 1936 and *E. serrulatus extensis* Hsiao, 1950. All these *Eucyclops* inhabit quite different areas, and their ranges do not overlap. *E. euacanthus* was described from tropical Africa, *E. ensifer* was reported from Cuba, Central and South America, and *E. serrulatus extensis* was described from China but also found in India (Dussart & Defaye, 1985). All of them show clear morphological differences from *E. leschermoutouae* sp. n.

In *E. euacanthus*, the innermost seta of caudal rami is very short and nearly equal in length to the lateral seta, the inner spine of P5 is about half as long as the outer seta, and the tip of the distal segment of the antennule reaches the second free thoracic somite. In *E. leschermoutouae* sp. n., the innermost seta of caudal rami is twice

as long as the lateral seta, the inner spine of P5 is as long as the outer seta, and the distal segment of the antennule only reaches the first free thoracic somite.

*E. ensifer* has widely divergent and short caudal rami with l/w ratio less than 4, versus 5 in *E. leschermoutouae* sp. n.

*E. serrulatus extensis* is most similar to the species described here. It has the caudal rami parallel and similar to those of *E. leschermoutouae* sp. n. in proportions. These two taxa could be easily divided by the length of the antennule, which in *E. serrulatus extensis* reaches the second free thoracic somite. The inner spine of P5 in *E. serrulatus extensis* is slender, shorter, about half as long as the medial seta, while in *E. leschermoutouae* sp. n. this spine is at least 2/3 length of this seta. Finally, the outermost caudal spine in *E. serrulatus extensis* is very long, about 2/3 length of the caudal ramus; in *E. leschermoutouae* sp. n., this spine is less than half as long as the caudal ramus.

*E. hadjebensis* (Kiefer, 1926) described from Morocco resembles the new species in the spine-like outermost caudal seta and reduced serrula of caudal rami. This species was described briefly and without figures, that is why it could be confused with the new species described here.

Prof. H. Dumont (Ghent, Belgium) kindly provided us with several specimens of *E. hadjebensis* collected by him from the type locality, a spring in the Atlas Mountains (Morocco). In the structure of the caudal rami (Fig. 15) and coxal plate of legs 4 (Fig. 15), these two species are similar indeed. However, the study of the antenna and the 4th swimming legs lead us to a conclusion that *E. hadjebensis* is closer to *E. serrulatus* than to *E. leschermoutouae* sp. n. *E. hadjebensis* has the characteristic row of hairs on the distal edge on caudal side of the antennar basipode that are absent in *E. leschermoutouae* sp. n. (Fig. 16). These two species also differ in the length of the innermost caudal seta, which is 1.1-1.2 times as long as the outermost seta in *E. hadjebensis* and shorter than the outermost seta in *E. leschermoutouae* sp. n. The last character also distinguishes *E. leschermoutouae* sp. n. from all *Eucyclops* known from Europe.

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