V.R. Alekseev. Genera *Eucyclops* Claus, 1893, *Isocyclops* Kiefer, 1957 and *Stygocyclops* Pleša, 1971 (Copepoda: Cyclopoida). Identification guide of the world fauna. Arthropoda Selecta. Supplement No. 6. 2024. Moscow: KMK Scientific Press. 201 p.

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V.R. Alekseev *Eucyclops, Isocyclops and Stygocyclops*. Identification guide of the world fauna

Arthropoda Selecta. Supplement No. 6

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Zoological Institute of the Russian Academy of Sciences, Universitetskaya emb., 1, St.-Petersburg 199034 Russia. E-mail: alekseev@zin.ru

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Зоологический институт РАН, Университетская наб., д.1, Санкт-Петербург 199034 Россия.
E-mail: alekseev@zin.ru

Монография представляет собой том 28 серии определителей “ Identification guides to the plankton and benthos of inland waters”, издаваемых под редакцией Генри Дюмона. В монографии проведена ревизия подсемейства Eucyclopinae Kiefer, 1927 и описания трех родов: *Eucyclops* Claus, 1893, *Stygocyclops* Pleša, 1971 и *Isocyclops* Kiefer, 1957. Род *Eucyclops*, один из крупнейших среди циклопид родов, после ревизии включает 112 валидных таксонов, в том числе 92 вида. Систематическая часть предваряется подробным описанием внешней морфологии представителей этих родов на основе типового для подсемейства вида *Eucyclops serrulatus* (Fischer, 1851). Даны морфологические описания и иллюстрации важнейших, таксономически значимых структур внешнего строения каждого таксона. Род *Eucyclops* разделен на 9 подродов, приводятся определительные ключи для подродов, видов и подвидов. Монотипичный род *Stygocyclops* с единственным видом *S. teras* (Graeter, 1907) и небольшой род *Isocyclops* с двумя видами описаны по тому же принципу. Монография иллюстрирована 119 рисунками, имеет указатель латинских наименований, а также список синонимов и невалидных названий. Список литературы включает 135 наименований и охватывает все публикации с первоописаниями валидных таксонов. Монография публикуется на английском языке и предназначена для широкого круга специалистов-систематиков копепод, гидробиологов широкого профиля и студентов биологических специальностей, интересующихся гидробиологией.

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Devoted to the memory of Dr. Sebastian Fischer

"as Taxonomy progresses, more and more detail is incorporated with the result that specific distinctions, unless they are carefully tested by breeding experiments, become more and more unreliable."
Lowndes, 1934

Preface

Sebastian Fischer, to whom this book is devoted, was a graduate of Munich University who moved to St. Petersburg in the mid-1840s to work at the court of Tsar Nikolay I as a medical doctor. Dr. Brandt, a copepodologist and employee of the Russian Academy of Sciences, likely invited Sebastian Fischer to work in St. Petersburg. His work on copepods, published in the middle of 19th century [Fischer, 1851, 1853], was carried out in his spare time. Along with *Cyclops* (*Eucyclops*) *serrulatus*, he described *Cyclops strenuus, Cyclops* (*Acanthocyclops*) *vernalis, Cyclops* (*Paracyclops*) *fimbriatus* and *Cyclops* (*Thermocyclops*) *crassus* from Peterhof (St. Petersburg vicinity). These species were considered "cosmopolitan" for decades. Although Fischer was affiliated with the Imperial Academy of Sciences, his collections cannot be found in either the Zoological Institute or Museum of the Russian Academy of Sciences in St. Petersburg, nor in the Zoological Museum in Moscow University — the only zoological collections in existence at that time. In 1991, a collection of Fischer's species was deposited in the Federal Collection of the Zoological Academic Institute in St. Petersburg [Alekseev *et al*., 2006].

Henri Dumont and Jeannine Pensaert attempted a study on the world's *Eucyclops*. Various difficulties did not allow them to complete their revision, but they managed to reveal a significant morphological variability within the *E.* (*E.*) *serrulatus* type population. Differences that were commonly used to distinguish *E.* (*E.*) *serrulatus* from other species overlapped significantly with each other [Alekseev *et al*., 2006]. Significant difficulties for the revision arose from the different qualities and levels of detail in the descriptions of the species considered. A third of the species previously described had only been found once, and often no holotypes were selected. It was necessary to collect new topotypes from all continents. The most important collections of *Eucyclops* were made by F. Kiefer in Karlsruhe Natural History Museum in Germany, B. Dussart at the National Natural History Museum in Paris, France, and V. Monchenko at the Institute of Zoology in Kyiv, Ukraine. Important materials on *Eucyclops* are also stored in National History Museums in Australia (Sydney), Austria (Vienna), Great Britain (London), Mexico, Sweden (Lund), and USA (Washington). Some holotypes and neotypes, including the neotype of *E.* (*E.*) *serrulatus*, are now kept at the Zoological Institute in St. Petersburg, Russia. Materials on two other small genera, *Isocyclops* Kiefer, 1957 and *Stygocyclops* Pleša, 1971 can also be found in Kiefer's Reference collection.

Introduction

Class Copepoda (Crustacea) is comprised of ten orders [Huys, Boxshall, 1991]. Cyclopoida live mainly in continental waters, with Cyclopidae being the largest group. Three other families (Oithonidae, Cyclopinidae and Cyclopettidae) are sparsely represented in inland waters. According to Dussart, Defaye [2006], the family Cyclopidae currently consists of approximately 60 genera and over 1,000 species and subspecies. Kiefer [1927b, 1929c] divided the family Cyclopidae into three subfamilies — Cyclopinae (characterized by two or one appendages on the last segment of the fifth leg), Eucyclopinae (characterized by mainly three appendages on the last segment of the fifth leg) and Halicyclopinae (characterized by four appendages on the last segment of the fifth leg). Monchenko [1974] added Euryteinae (based on modification of maxillular palp and maxilliped).

A recent revision [Alekseev, 2019] divided the subfamily Eucyclopinae into 12 genera, including: *Afrocyclops* (Sars G.O., 1927), *Defayeicyclops* Alekseev et Vaillant, 2013, *Ectocyclops* Brady, 1904, *Eucyclops* Claus, 1893, *Homocyclops* Forbes, 1897, *Isocyclops* Kiefer, 1957, *Macrocyclops* Claus, 1893, *Ochridacyclops* Kiefer, 1937, *Paracyclops* Claus, 1893, *Stygocyclops* Plesa, 1971, *Thaumasiocyclops* Kiefer, 1930, and *Tropocyclops* Kiefer, 1927. The genus *Austriocyclops* Kiefer, 1964 was relocated from the Eucyclopinae to the Cyclopinae, which is where it was originally classified by Kiefer [1964]. *Australoeucyclops*, a genus erected by Karanovic [2006] for several Australian taxa, is closely related to *Paracyclops* and could be regarded as its subgenus.

Isocyclops and *Stygocyclops* were initially described by authors as subgenera. *Isocyclops* exhibits features of archaic structure, in particular, the lateral caudal seta is very long and similar in length to the outermost seta. This genus is considered endemic to Africa and has only persisted in ancient Lake Tanganyika. At the same time, this feature (elongated lateral seta) can be observed in some other species of Africa (*Eucyclops* (*Eucyclops*) *sublaevis* (Sars G.O., 1927)) and America (*E.* (*E.*) *demacedoi* Lindberg, 1957, *E.* (*E.*) *torresphilipi* Suárez-Morales, 2004, *E.* (*E.*) *delachauxi* (Kiefer, 1925) and *E.* (*E.*) *tziscao* Mercado-Salas, 2013) as well. On the contrary, the genus *Stygocyclops*, which has lost one of P5 appendages and setulae on last thoracic somite, is close to the likely younger subfamily Cyclopinae. Overall, these two genera illustrate an evolutionary trend in external morphology.

The genus *Eucyclops* is taxonomically complicated [Alekseev *et al*., 2006; Reid, Williamson, 2010; Mercado-Salas, Suárez-Morales, 2021]. After separating two former subgenera, *Isocyclops* and *Stygocyclops*, the genus still comprises about 120 taxa. Lindberg's revisions of the genus in 1939 and 1957 became key reference works for the taxonomy of Eurasian and African *Eucyclops* species [Lindberg, 1939, 1957b]. Since then, few regional revisions have been conducted: for Australia by Morton [1990], for Ukraine by Monchenko [1974], for Japan by Ishida [2002], and for Mexico by Mercado-Salas *et al*. [2016].

Recent detailed species descriptions of the last two decades contrast with the more succinct and generalized descriptions used by taxonomists in the past (e.g. Sars, Lowndes, Kiefer, Gurney). These earlier scholars likely omitted details out of a concern that providing too much information could lead to chaos in taxonomy. For example, Lowndes [1934] noted that overly detailed descriptions without a study of variability could be detrimental to taxonomy. Kiefer also saw this danger and wrote: "In those species in which a sufficient number of individuals have been subjected to careful study, it is clear that each trait can exhibit a characterificant degree of variation; and it is impossible to judge the value of such differences as criteria for the differentiation of species until we know the range of variation that can be found in such a species, firstly, in an environment of a stable nature and, secondly, in a different environment" [Kiefer, 1952].

The rapid and global changes in biogeography and biodiversity caused by climate change and human-mediated bioinvasions have created the necessity to provide taxonomists with world faunistic keys, which is a complex task for such a speciose genus as *Eucyclops*. Along with the large number of taxa, the different levels of external morphology description present significant difficulties in a world *Eucyclops* revision. Not all of the described *Eucyclops* species represent true biological species, as some of them were selected based on variation. Among the available descriptions there are obvious mistakes, for example, *E. brevifurcatus* Grandori, 1925, as Gurney [1933] noted, is an immature female at the fifth copepodite stage, which requires transferring this name to the category nom.nud. List of the synonyms and nom.nud. is provided at the end of this guide. More transformation in the *Eucyclops* system is expected to happen as soon as molecular and/or hybridization tools become widely applied. This book is also intended to serve as a basis for future revisions of the genus.

Recently, the type species for the genus *Eucyclops*, *E.* (*E.*) *serrulatus*, was examined and re-described using molecular analysis and interspecies hybridisation [Alekseev *et al*., 2006]. Several stable key micro-characters important for species identification were revealed in elements of ornamentation, specifically on the basipodite of the antenna and the fourth coxopodite of the swimming leg with a coxal spine. These microcharacters are used here to differentiate the species together with traditionally used morphological characters, including antennule segmentation, length ratios of setae of caudal rami and swimming legs, relative antennule length and hyaline plate structure on the three distal segments, length ratios of fifth leg appendages in female and sixth leg appendages in males.

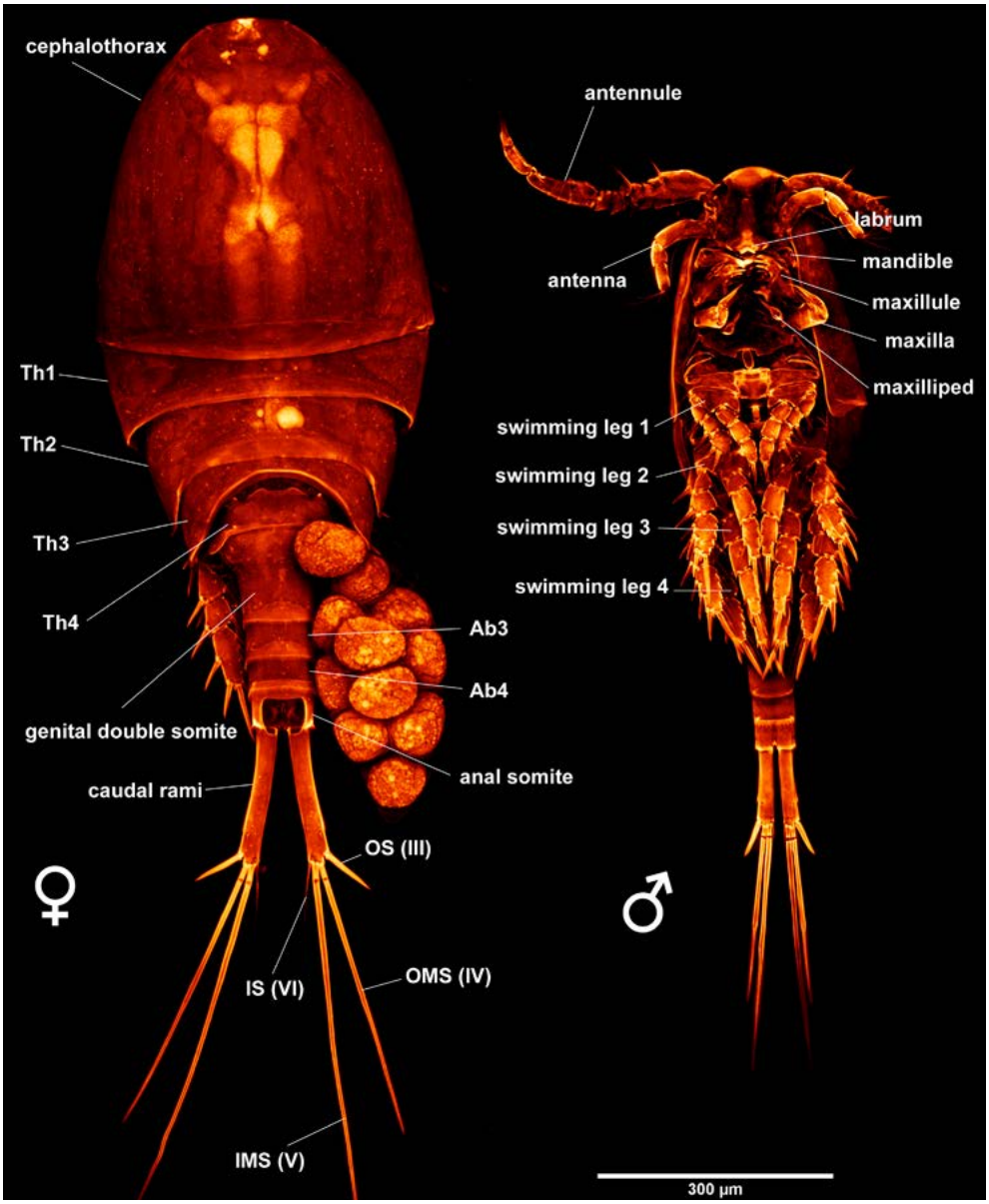


Fig. 1. Habitus and morphological structures of *Eucyclops*. Confocal image of *E.* (*D.*) *macruroide*s (Lilljeborg, 1901) from Valencia, Spain, orig.

Рис. 1. Габитус и морфологические структуры *Eucyclops*. *E.* (*D.*) *macruroides* (Lilljeborg, 1901) из Валенсии, Испания, конфокальное изображение, ориг.

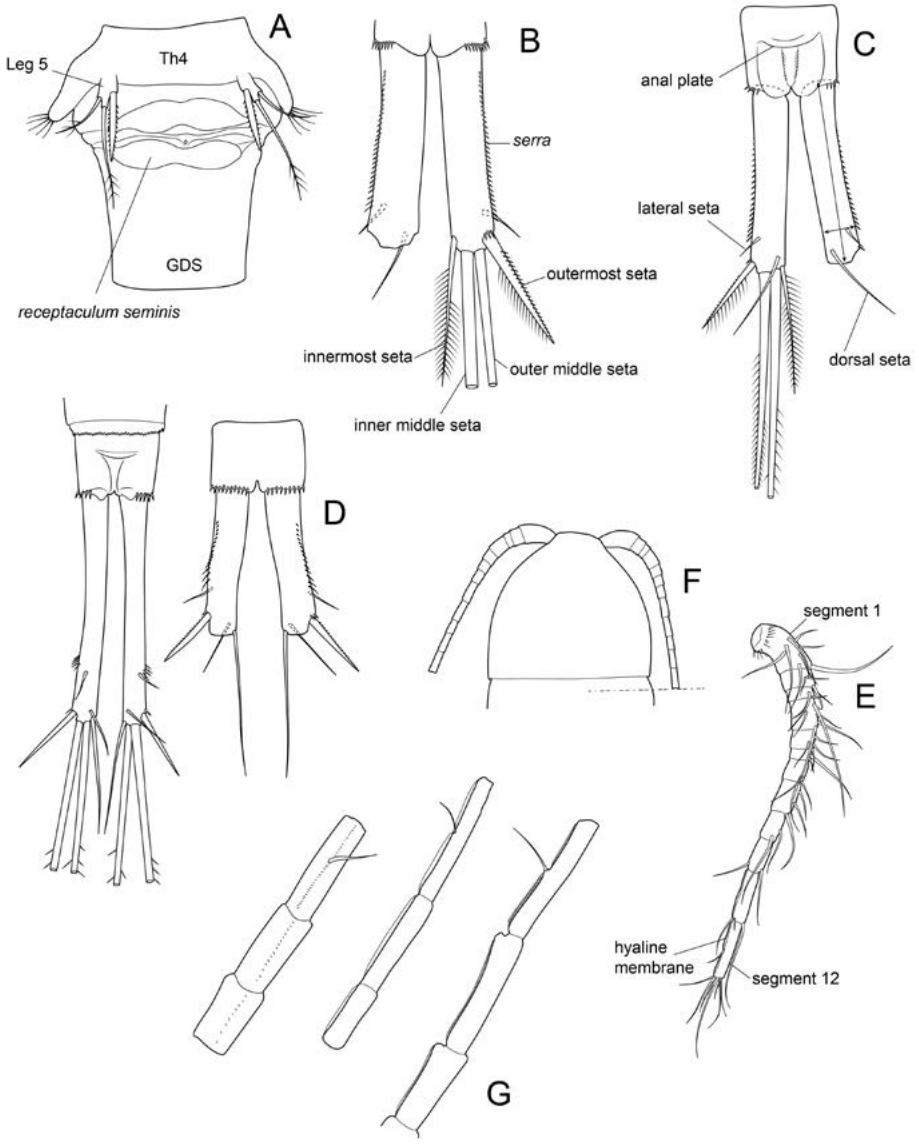


Fig. 2. Morphological structures of *Eucyclops*: A — genital double somite; B — caudal rami, ventral; C — caudal rami, dorsal; D — examples of caudal rami of different subgenera; E — antennule; F — relative length of antennule; G — examples of antennules of different subgenera.

Рис. 2. Морфологические структуры *Eucyclops*: A — генитальный сомит; B — каудальные ветви, вентрально; C — каудальные ветви, дорсально; D — примеры каудальных ветвей разных подродов; E — антеннулы; F — относительная длина антеннулы; G — примеры антеннул разных подродов.

For practical purposes and given the clear similarity in morphology, nine subgenera were established later on [Alekseev, 2019].

External morphology, terminology and abbreviations used

The BODY of *Eucyclops* is divided into a **cephalothorax** (CTh), **thorax** (Th), and **abdomen** (Abd). **Cephalothorax** comprises the thoracic part — the first pedigerous somite — and the cephalon or head section, which are fused together (Fig. 1). The thoracic region is comprised of **thoracic free somites** 1 to 4 (Th1–4), which are the four somites that follow the cephalothorax and correspond to pedigerous somites 2 to 5. The fourth somite (Th4) laterally bears long and dense hairs or hair-like setulae. The **abdomen** consists of four (in females) or five (in males) somites, with the first two fused into a single **genital double somite** (GDS) in females (Fig. 2A). The ventral surface of GDS is provided with a special organ that participates in breeding, the ***receptaculum seminis*** (RS). In most species of *Eucyclops*, the RS has a typical *serrulatus*-like shape, with narrow anterior and posterior parts and a concavity in the middle. It's not usually used in species identification. Occasionally, bean-like spermatophores attached by males to the GDS of females can be observed. The last abdominal somite (**anal somite**) possesses an **anal operculum**, or **anal plate**, on its dorsal surface (Fig. 2C). The operculum may be weakly developed, appearing as an almost straight structure, or strongly developed, with a more prominent and rounded shape. The anal somite extends posteriorly into two symmetrical **caudal rami** or branches (CR), which often have a row of denticles at the line of insertion (Fig. 2B).

CR, or **Furca**, is traditionally one of the most important structures in Copepod taxonomy. In the past, manuals based solely on their morphology were published for many Palearctic species within three continental copepod orders (Borutzky, 1960). Caudal rami in species of *Eucyclops* usually carry lateral spinules, known as "***serra***" (meaning "saw" in Latin). This *serra* may extend to the base of the ramus or be reduced (or even absent) (Fig. 2D). The *serra* can run along the lateral edge or shift to the ventral surface in its proximal section. The *serra* on caudal rami can consist of small, subequal denticles, as seen in *E.* (*Sp.*) *speratus*, or strong, distally elongated ones, as in *E.* (*E.*) *bondi*. The most taxonomically significant features of caudal rami include the length-to-width ratio (L/W), the width measured at the place of lateral seta insertion (Fig. 2C), and the form of the *serra*. In addition, the length ratios of the distal **caudal setae** are important characteristics. Each caudal ramus is equipped with 6 **caudal setae** attached distally. The four most distal setae include the **innermost seta** (IS), the **inner middle seta** (IMS), the **outer middle seta** (OMS) and the **outermost seta (OS).** On the dorsal surface, the **dorsal seta** (DS) is situated, and the lateral edge is equipped with a **lateral seta** (LS). Some authors use a numerical system for describing setae of the caudal rami, a practice that I consider unnecessary. Despite this, for the ease of the reader, I have included it in Fig. 1.

BODY APPENDAGES

Antennules (A1) (Fig. 2E) comprise 12 or (rarely) 11 cylindrical segments in females, while consisting of 14 segments in males. In cyclopoids, both male antennules are geniculate and modified for grasping females. The reported occurrence of 15–17 segments of *Eucyclops* male A1 in some copepodologist's studies [Suarez-Morales, Walsh, 2009; Mercado-Salas *et al*., 2016; Holynska *et al*., 2021] may be due to optical mistakes, as flexible membranes or folds can create this illusion. An useful taxonomical character is the relative length of female antennule (Fig. 2F), which can be short, sometimes not reaching the distal edge of cephalothorax, or long, reaching distal edge of Th2 and more. It is possible that antennule setation, relative length of its setae, spines or aesthetascs, ornamentations of some segments with groups of denticles etc., are relevant for species delineation, but they are not well studied in most *Eucyclops* species. Traditionally, attention is paid to the form of a **hyaline membrane** on the last three (10–12) segments of A1 (Fig. 2G). In *Eucyclops*, this

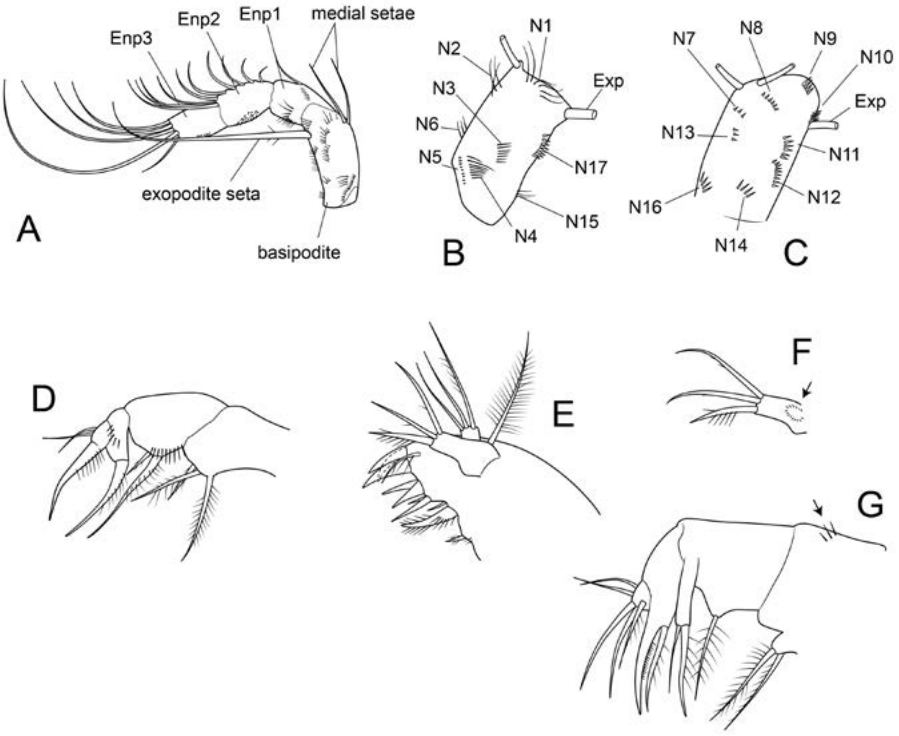


Fig. 3. Morphological structures of *Eucyclops*: A — antenna (A2); B — A2 Bas, caudal surface, numbering system; C — A2 Bas, frontal surface, numbering system; D — maxilliped; E — maxillule; F — maxillulary palp, example of ornamentation; G — maxilla, example of ornamentation of praecoxa. E, G — *E.* (*E.*) *serrulatus* (Fischer, 1851), type locality.

Рис. 3. Морфологические структуры *Eucyclops*: A — антенна (A2); B — A2 Bas, каудальная сторона, система нумерации; C — A2 Bas, фронтальная сторона, система нумерации; D — максиллипед; E — максиллула; F — пальп максиллулы, пример орнаментации; G — максилла, пример орнаментации прекоксы. E, G — *E.* (*E.*) *serrulatus* (Fischer, 1851), типовой водоем.

membrane can be smooth, finely or roughly denticulated, or consist of separate denticles; the width of this membrane varies among species, from wide to narrow, or it can be missing.

Antennae, or second antennae (A2), consist of one branch of four segments, while the exopod branch is reduced to a single long seta (Fig. 3A). The first segment is represented by a **basipodite** (Bas), which posteriorly bears two short medial setae and a long, whip-like exopodite seta. The presence and pattern of denticle and setule arrangement on the frontal and caudal surfaces of A2 basipodite is an important taxonomic characteristic. For ease of reference, the most common groups of denticles and setulae have been labeled with numbers (Fig. 3B, C). The remaining three segments of A2 are represented by endopodite segments 1–3, which are equipped 1, 7–9, and 8 setae of varying lengths, respectively.

The distinction between the **frontal** and **caudal** sides of the antenna is a matter of confusion in the literature, with differing opinions. The solution can be found through analysis of the functional morphology. The antenna in copepods is employed for the movement of water towards the mouth through rapid beating from head to tail, mimicking the wing of a bird. As a functional adaptation, the Bas structure features a robust outgrowth on its **frontal** side, preventing the limb from folding. The presence of the outgrowth provides identification of the frontal or anterior side of A2.

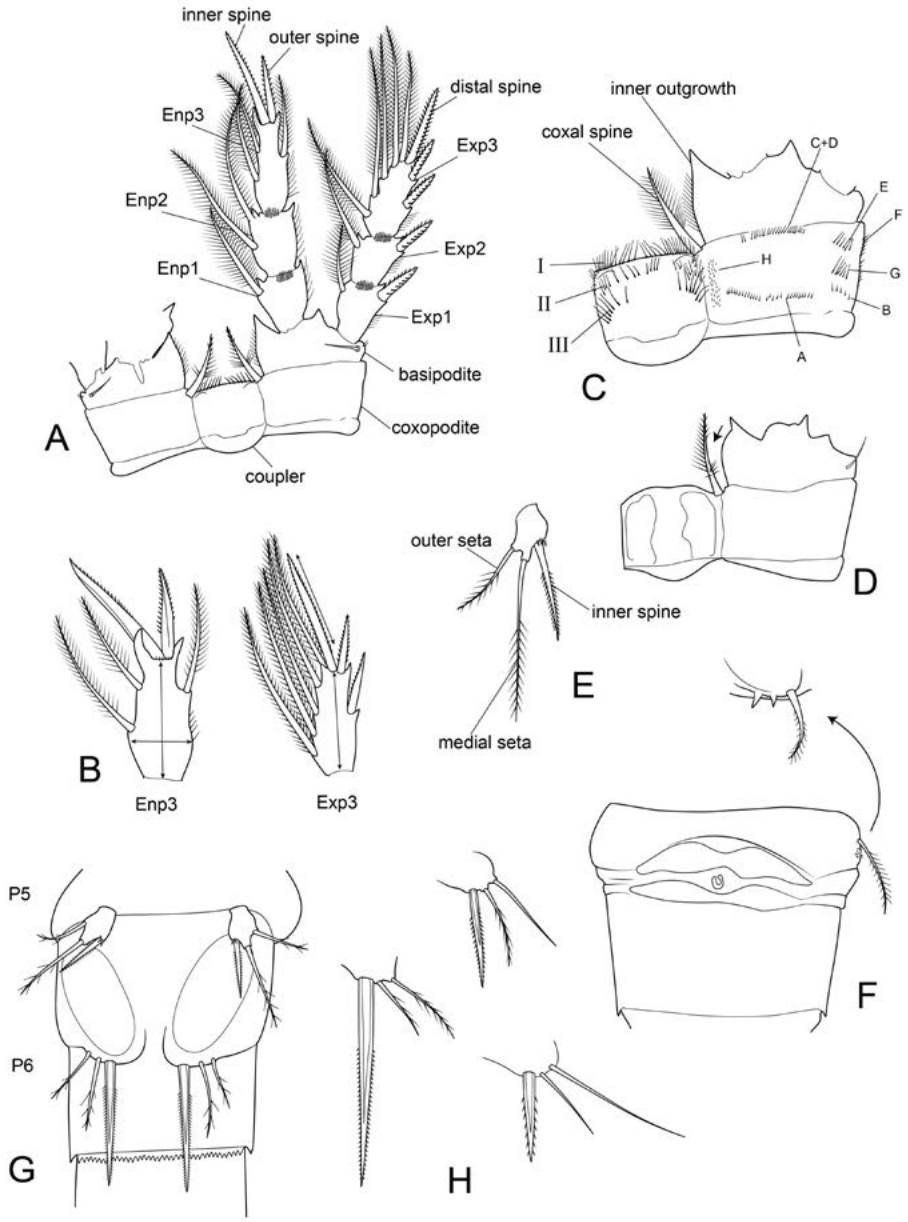


Fig. 4. Morphological structures of *Eucyclops*: A — P4; B — measurement of P4 distal segments; C — main groups of ornamentation of P4 coxa and intercoxal plate, caudal; D — gap of coxal spine pinnation in *E.* (*E.*) *serrulatus*; E — P5; F — P6 in female; G — P5 and P6 in male; H — examples of male P6 in different *Eucyclops* species.

Рис. 4. Морфологические структуры *Eucyclops*: A — P4; B — измерение дистальных сегментов P4; C — основные группы орнаментации коксы и межкоксальной пластинки P4, каудально; D — пропуск в оперении коксального шипа *E.* (*E.*) *serrulatus*; E — P5; F — P6 самки; G — P5 и P6 самца; H — примеры P6 самцов разных видов *Eucyclops*.

Mouth appendages (Fig. 3D–G) are rarely used in taxonomic identification of *Eucyclops* due to their small size and the challenges associated with dissection and observation. These appendages include the **labrum** (Lbr), **mandible** (Mdb), **maxillule** (Mxl), **maxilla** (Mx), and **maxilliped** (Mxp). Of the mouth appendages mentioned, only the presence of denticles on Mxl palp (Fig. 3F) and spinules on Mx praecoxopodite (Fig. 3G) have been successfully used for identification [Ishida, 2002].

Following the mouth appendages, there are four pairs of thoracic appendages, **swimming legs** (P1–P4), and two pairs of reduced (P5) and rudimentary (P6) legs. The swimming legs comprise two branches, each consisting of three segments, the inner **endopodite** (Enp) and the outer **exopodite** (Exp). The structure of the **fourth pair** of swimming legs (P4) has largest taxonomic significance (Fig. 4A–D). Upon studying the distal segment of the endopodite of P4 (P4 Enp3), attention is paid to the L/W ratio of the segment, the length ratio of the inner and outer spines, and the length ratio of the inner spine and the segment (Fig. 4B). The relative extension of the distal setae in relationship to their adjacent spines also has importance. When observing the most distal segment of the exopodite of P4 (P4 Exp3), the legth of the distal (apical) spine relative to the segment length becomes relevant. Altered morphology (modification) of the distal setae (i.e. spatulation), usually found on the fourth and third swimming legs, is occasionally observed. Exopodite and endopodite are connected by a **basipodite** (Bas) with a typical for genus triangular inner outgrowth (Fig. 4C). The Bas is situated on the **coxopodite** (Coxa). The right and left coxal segments are linked by an **intercoxal plate** (IntCox, **coupler**). The arrangement of denticles and setulae on the coxa and coupler, particularly in P4, is a significant element for taxonomy. The main groups of these ornamentation structures are shown in Fig. 4C, but these microcharacters may vary among individuals and populations and should be used with caution. Intercoxal plate bears two **coxal spines/setae**. The ornamentation of the coxal spine is crucial in species identification, which was confirmed through hybridization experiments [Alekseev *et al*., 2006]. Hairs or spinules spread over the spine, either uniformly or with a **gap** on the outer edge (Fig. 4D), with the length of hairs/spinules subequal or decreasing toward the tip. The length of the coxal spine in comparison to the height of the inner outgrowth of the Bas is also useful character. The caudal surface of P1–4 intercoxal plates usually feature 1–3 groups of hairs/setulae arranged in 1–3 rows (I–III), with the distal row I being the most easily visible (Fig. 4C).

The **fifth pair of legs** (P5) looks similar in both sexes (Fig. 4E, G) and consists of one segment equipped with an inner spine and two setae; typically, the medial seta is the longest. The length ratio of the segment and its appendages is important taxonomic character for many cyclopid genera, including *Eucyclops*.

The **sixth pair of legs** (P6) is vestigial. Female *Eucyclops* exhibit it as two tiny spines and a single bent seta located laterally on the genital double somite at the level of RS (Fig. 4F). On the other hand, for males, this structure appears as a narrow plate with an inner spine and two setae (Fig. 4G, H). The length ratio of P6 appendages of male is valuable taxonomic character.

Variation of characters among *Eucyclops* species

There are several infraspecies levels of variation. One of examples of individual variation is bilateral asymmetry, in which differences occur between the left and right sides of the same individual. The variation observed among specimens collected in different seasons is known as seasonal variation. Interpopulation variation is observed among distant more or less isolated populations. Differences in microcharacters do not always indicate differences at the species level. Only after confirmation of their stability among all above mentioned levels of infraspecies variation they can be used for species identification. The reliance on microcharacters alone is inadequate for describing new taxa.

Instead, the use of hybridization experiments or molecular analysis is required to confirm their validity. Some past taxa described on the basis of differences in micropatterns alone seems to be unreliable and incorrect.

Key to genera of subfamily Eucyclopinae

1. P5 is one-segmented, armed with only 2 long subequal setae/spines; Th4 rarely with few long setulae laterally; Bifidaeucyclopina group (possibly a new subfamily) 2
– P5 is one- or two-segmented or fused with thoracic somite; distal segment is equipped with three appendages; Th4 usually bears a group of long setulae laterally; Trifidaeucyclopina group 4
2. Caudal rami L/W more than 4; Th4 lacks of lateral hairs/setulae .... *Stygocyclops* Pleša, 1971
– Caudal rami shorter, with L/W about 2–3; Th4 smooth or with hairs/setulae 3
3. P5 is equipped with 2 long subequal setae; Th4 smooth or with tiny spines laterally; inner outgrowth of P4 Bas has a round shape..... ..*Defayeicyclops* Alekseev et Vaillant, 2013
– P5 is equipped with a strong inner spine and a weak seta, the latter is about 1.5 times shorter than the spine; Th4 with long lateral setulae .....*Thaumasiocyclops* Kiefer, 1930
4. P5 is two-segmented .... *Macrocyclops* Claus, 1893
– P5 is one-segmented or fused with thoracic somite..... 5
5. Antennule 17-segmented..... ..... *Homocyclops* Forbes, 1897
– Antennule with less number of segments, 12 or less 6
6. P4 Bas with triangular inner outgrowth..... 7
– P4 with round inner outgrowth 8
7. CR with long lateral seta, almost twice of ramus width, and about as long as weak and setiform outermost seta or longer .... *Isocyclops* Kiefer, 1957
– Lateral seta shorter.....*Eucyclops* Claus, 1893
8. CR L/W at least 5.2; P5 is one-segmented, equipped with 2 setae and a spine subequal in length .....*Afrocyclops* Sars G.O., 1927
– CR usually shorter; P5 spine usually shorter than setae 9
9. A1 long, reaching 3rd free thoracic somite; RS with upper part horn-like shaped..... .....*Tropocyclops* Kiefer, 1927
– A1 shorter, not reaching distal edge of CTh; RS has different shape 10
10. CR smooth .....*Ochridacyclops* Kiefer, 1937
– CR with distinct rows spinules on dorsal/ventral surfaces 11
11. P5 fused to Th, segment is wider than long; CR short, L/W not more than 2, with several diagonal rows of short spinules on dorsomedial surface, ventral surface bears transverse rows of long spinules above setae ....*Ectocyclops* Brady, 1904
– P5 is separated from Th; CR is longer, with only one row of spinules on dorsal surface, spinules above setae on ventral surface are much shorter ..... *Paracyclops* Claus, 1893

GENUS ***Eucyclops*** Claus, 1893

Small and medium sized cyclopids, with an oval prosome that is well separated from thin urosome; the last thoracic somite (fifth pedigerous) in most species is decorated with more or less long and dense hair-like setulae (Fig. 2A). Genital double somite wide proximally then abruptly narrowing distally. Antennule usually 12-, rarely 11-segmented. Caudal rami (Fig. 2B) usually bear lateral *serra*; a lateral seta is situated at the distal end of the ramus; outermost caudal seta is thick, spine-like. Three distal segments of A1 (Fig. 2G) usually with transparent hyaline membrane, sometimes absent or invisible. Antenna Bas (Fig. 3B, C) with 10–20 groups of denticles/setulae. Mouth appendages, segmentation and armament with setae and spines typical for family and rarely used in taxonomy, but more fine ornamentation of maxillular palp is promising for species separation (Fig. 3E, F). Swimming legs P1–4 biramous and three-segmented; P4 Bas (Fig. 4C) with elongated sharp inner outgrowth, which is a distinctive character for three genera: *Eucyclops*, *Isocyclops* and *Stygocyclops*, but missing in *Afrocyclops*, *Ochridacyclops*, *Tropocyclops* and *Defayeicyclops.* P5 consists of triangular segment, equipped with inner spine and two setae (Fig. 4E). Males are smaller than females, with shorter caudal rami; *serra* is absent; P6 consists of strong inner spine and two setae.

The most important characters used in *Eucyclops* taxonomy are: body length without caudal setae; shape of anal plate (Fig. 2C); shape and L/W ratio of caudal rami; length ratio of caudal setae; form of *serra*; ornamentation of medial, ventral and dorsal surfaces of CR; relative length of A1 (Fig. 2F); form of hyaline membrane on three distal segments of A1 (Fig. 2G); A2 Bas ornamentation

(particularly presence/absence of hairs/setulae at positions N1 and N2 (Fig. 3B, C); ornamentation of P4 intercoxal plate (Fig. 4C); ornamentation of P4 coxal spine (Fig. 4C, D); structure of P4 Enp3 and Exp3 (Fig. 4B); structure of P5 (Fig. 4E). In male, P6 structure is especially important (Fig. 4G, H). More than 100 valid *Eucyclops* taxa were subdivided into 9 subgenera on the basis of these morphological features [Alekseev, 2019]. A key to subgenera is provided below.

Key for genus *Eucyclops* subgenera

1. Antennule 11-segmented ..... *Eucyclops* (*Mrazekicyclops*) Alekseev, 2019
– Antennule 12-segmented 2
2. Caudal rami with hair-setulae or large spinules on medial/dorsal surfaces ....*Eucyclops* (*Ciliocyclops*) Alekseev, 2019
– Caudal rami smooth on medial/dorsal surfaces 3
3. Caudal rami very short (L/W less than 2.7).... ..... *Eucyclops* (*Breviramocyclops*) Alekseev, 2019
– CR longer (L/W more than 2.7, usually more than 3)..... 4
4. Distal setae of P4 Enp3 long, extending above tips of nearest spines; lateral *serra* absent or very reduced, extending not higher than half of ramus proximally; CR with L/W ratio not more than 6.5 ..... *Eucyclops* (*Subterrocyclops*) Alekseev, 2019
– Distal setae of P4 Enp3 shorter than nearest spines or only outer seta reaches tip of adjacent spine; or long distal setae of P4 Enp3 combined with presence of developed lateral *serra* of CR 5
5. Antennule with denticulate hyaline membrane at distal segments..... ... *Eucyclops* (*Denticyclops*) Alekseev, 2019
– Antennule with smooth, finely-serrated or absent hyaline membrane 6
6. P5 with strong inner spine at least twice wider than setae and longer than segment 7
– P5 with weak inner spine 8
7. A2 Bas with 1 or 2 distal groups of setulae at positions N1, N2 ....*Eucyclops* (*Eucyclops*) Claus, 1893
– A2 Bas without distal groups of setulae at positions N1, N2 ..... *Eucyclops* (*Speratocyclops*) Alekseev, 2019
8. CR with lateral *serra* (full or partly reduced). ....*Eucyclops* (*Sarsicyclops*) Alekseev, 2019
– CR smooth with spinules only at lateral seta insertion (sometimes as oblique or transverse row) and at outermost seta insertion..... *Eucyclops* (*Macrurocyclops*) Alekseev, 2019

1. SUBGENUS ***Eucyclops*** (***Eucyclops***) Claus, 1893

Eucyclopids relatively small or medium in size with body length from 600 to 1640 μm. Th4 with long setulae at posterolateral angles. Caudal rami with long or partly reduced lateral *serra;* from 3 to 9 times longer than broad. Antennule 12-segmented, usually extends up to the distal edge of the cephalothorax or beyond. A1 hyaline membrane (if present) is either smooth or slightly serrated. On caudal side of A2 Bas, there are one or two groups of rather long setulae in distal positions N1, N2. In most American species, group N2 modified to row of short spinules. P4 Enp3 L/W ratio 1.8–3.0; inner/outer spine ratio 1.1–1.6; distal setae usually not reaching beyond distal tips of nearest spines; coxal spine often with gap on outer margin; IntCox distal margin ornamented with setulae. P5 armed with inner spine wider than setae, 1.1–2.7 times longer than segment; medial seta 0.8–3.0 times as long as spine. Subgenus includes 30 species, inhabiting all continents except Antarctic.

Key to subgenus *Eucyclops* (*Eucyclops*) species

1. Lateral seta more than 1.5 times longer than caudal rami width 2
– Lateral seta shorter, less than 1.5 times as long as caudal rami width..... 6
2. Distal setae of P4 Enp3 rather long, outer seta reaching tip of outer spine 3
– Distal setae of P4 Enp3 shorter..... 5
3. Lateral *serra* with distal spinules noticeably longer than proximal; male P6 with inner spine not longer than both setae ....*E.* (*E.*) *demacedoi* Lindberg, 1957 [Peru, South America]
– Lateral *serra* with almost equal spinules; male P6 with inner spine longer than both of setae 4
4. Innermost caudal seta about 1.5 times longer than outermost caudal seta..... ..*E.* (*E.*) *torresphilipi* Suárez-Morales, 2004 [Mexico, North America]
– Innermost caudal seta about as long as outermost caudal seta..... .....*E.* (*E.*) *delachauxi* (Kiefer, 1925) [Peru, South America]
5. CR long, L/W ratio about 7.5..... .....*E.* (*E.*) *sublaevis* (Sars G.O., 1927) [South Africa, Africa]

– CR rather short, L/W ratio about 4 ....*E.* (*E.*) *tziscao* Mercado-Salas, 2013 [Mexico, North America]

6. Caudal rami usually with L/W shorter than 6.5, with *serra* of small subequal spinules extending 25–90% of ramus length; A2 Bas with long thin hairs of equal length at positions N1 and N2; in P4 coxal spine with a gap on outer side; innermost caudal seta not shorter than outermost seta 7

– Combination of characters is different..... 8

7. In A2 Bas caudal side with groups N1 and N2 presented by dense hairs, 3–8 hairs in each group..... *E.* (*E.*) *serrulatus* s.lat. with 3 subspecies: *E.* (*E.*) *s. serrulatus* (Fischer, 1851); *E.* (*E.*) *s. hadjebensis* (Kiefer, 1926)*; E.* (*E.*) *s. turcomanus* Lindberg, 1959 [Palaearctic; in North America, New Zealand, Australia, South Africa, South-East Asia and India as invasive species]

– A2 Bas caudal side with group N1–2 presented by 2–3 short hairs located close to medial setae ..... *E.* (*E.*) *borealis* s.lat. with two subspecies: *E.* (*E.*) *b. borealis* Ishida, 2001; *E.* (*E.*) *b. tsushimensis* Ishida, 2001 [North-Pacific America, Japan, Northeast Asia?]

8. Caudal rami short, with L/W 3–4; dorsal seta longer or at least not shorter than outermost caudal seta; P4 coxal spine with distinctive gap on outer side..... *E.* (*E.*) *bondi* s.lat. with 2 subspecies: *E.* (*E.*) *b. bondi* Kiefer, 1934 [Haiti, Americas]; *E.* (*E.*) *b. conrowae* Reid, 1992 [USA]

– Caudal rami L/W more than 4; if shorter then dorsal seta shorter than outermost seta..... 9

9. Caudal rami long, L/W more than 6 10

– Caudal rami shorter, with L/W 3.0–6.0..... 12

10. *Serra* extending along at least half of ramus length ..... *E.* (*E.*) *elegans* s.lat. with 2 subspecies: *E.* (*E.*) *e. elegans* (Herrick, 1884); *E.* (*E.*) *e. mittmanni* Mercado-Salas et Suarez-Morales, 2016 comb.n. [Americas]

– *Serra* shorter.....11

11. A2 Bas caudal side with 2 groups of long hair-setae (N1, N2); group N1 presented by 4–7 setulae; body length usually more than 1.2 mm; male P6 with inner spine about 60 μm ..... *E.* (*E.*) *neumani* (Pesta, 1927) [Central and South America]

– A2 Bas caudal side with one group of long hair-setulae (N1 with 1–3 setulae); body length usually less than 1.2 mm; male P6 with inner spine about 85 μm..... ..... *E.* (*E.*) *titicacae* Kiefer, 1957 (part.) [Lake Titicaca in Peru; possibly Lake Valencia in Venezuela and laguna in Colombia]

12. A1 hyaline membrane usually wide, more than one third of segment width; A2 Bas caudal side with setulae at least in position N1; P4 coxal spine homogeneously plumose on both sides .....*E.* (*E.*) *agiloides* s.lat. with 5 subspecies: *E.* (*E.*) *a. agiloides* (Sars G.O., 1909), *E.* (*E.*) *a. pacificus* Ishida, 2000, *E. a. roseus* Ishida, 1997, *E.* (*E.*) *a. miracleae* Alekseev, 2010, *E.* (*E.*) *a. sarsi* Alekseev, 2023 [Pantropics?]

– A1 hyaline membrane more narrow or even missing; A2 Bas with groups N1 and N2, but last one group usually presented with short spinules/denticles (in American taxa); P4 coxal spine covered with setulae of different length, sometimes with gap on outer side..... 13

13. Caudal rami with long *serra* practically along whole ramus length..... 14

– Caudal rami with shortern *serra* 28

14. Innermost caudal seta shorter than outermost seta..... 15

– Innermost caudal seta subequal or longer than outermost seta..... 16

15. A1very short and significantly not reaching CTh distal edge..... .....*E.* (*E.*) *spatharum* Harding, 1942 [Rift Valley Lakes, Africa]

– A1 clearly longer and reaching middle of Th1 ..... *E.* (*E.*) *acanthoides* (Douwe, 1914) [Tropical Africa]

16. Innermost caudal seta short, subequal or not more than 1.2 times as long as outermost seta; if longer then in P5 inner spine longer than outer seta..... 17

– Innermost caudal seta usually more than 1.2 times as long as outermost seta; if shorter then P5 with inner spine subequal or longer than outer seta..... 22

17. In P5 inner spine longer or subequal to outer seta; P4 Enp3 with distal outer spine as long as segment; caudal rami with long (up to half of caudal rami width) spines on outer edge.. 18

– In P5 inner spine shorter than outer seta; P4 Enp3 with distal outer spine shorter than segment; caudal rami with moderate or short spines on outer edge 19

18. P4 Enp3 with subequal distal spines; P5 inner spine as long as outer seta..... .....*E.* (*E.*) *vandouwei* (Brehm, 1909) [Tropical Africa]

– P4 Enp3 inner spine longer than outer spine; P5 inner spine longer than outer seta ..... *E.* (*E.*) *albuferensis* Alekseev, 2008 [Spain]
19. Caudal rami relatively long (L/W > 6) ....*E.* (*E.*) *procerus* Dussart, 1981 [Africa]
– Caudal rami shorter..... 20
20. Inner medial caudal seta less than two times as long as outer medial seta ....*E.* (*E.*) *ensifer* Kiefer, 1936 [Central and South America]
– Inner medial caudal seta 2.5 times and more as long as outer medial seta ....*E.* (*E.*) *pectinifer* s.lat. with two subspecies: *E.* (*E.*) *p. pectinifer* (Cragin, 1883), *E.* (*E.*) *p. ishidai* Mercado-Salas et Suarez-Morales, 2016 [North America]
21. Caudal rami relatively long, with L/W 4.8–5.9 22
– Caudal rami shorter, with L/W 3.0–4.7..... 27
22. P5 outer seta long, almost equal to medial seta and about twice of inner spine length; CR *serra* with small, subequal spinules ..... *E.* (*E.*) *spatulatus* Morton, 1990 [Australia]
– P5 outer seta shorter than medial seta and about as long as inner spine; CR *serra* with relatively large and different in size spinules 23
23. Innermost caudal seta not less than 1.2–1.5 as long as outermost seta; CR parallel; dorsal seta about as long as outermost seta 24
– Innermost caudal seta less than 1.2 times as long as outermost seta or equal to it 25
24. P4 coxal spine homogeneously plumose on both sides; CR *serra* consists of tiny spinules..... *E.* (*E.*) *australiensis* Morton, 1990 [Australia]
– P4 coxal spine has a gap on outer side (*serrulatus*-like); CR *serra* consists of long spinules .....*E.* (*E.*) *wixarica* Mercado-Salas et Suárez-Morales, 2016 [Mexico]
25. P4 Enp3 distal spines almost equal (not more than 1.2 times difference); P5 inner spine length about 2/3 of outer seta ....*E.* (*E.*) *silvestrii* (Brian, 1927) [South America]
– P4 Enp3 distal inner spine 1.3–1.5 as long as outer one 26
26. In P5 inner spine at least 1.5 times as short as outer seta; A1 > CTh.. *E.* (*E.*) *chilensis* s.lat. with two subspecies: *E.* (*E.*) *c. chilensis* Löffler, 1961 [Chile]; *E.* (*E.*) *c. cuatrocienegas* Suárez-Morales et Walsh, 2009 [Mexico]
– In P5 inner spine subequal in length to outer seta; A1 < CTh.....*E.* (*E.*) *prionophorus* Kiefer, 1931 [Americas]
27. CR with short *serra* occupying less than half of outer edge 28
– CR *serra* occupies not less than half of outer edge..... 29
28. P4 Enp3 inner spine as long as segment; P5 inner spine about 1.5 times shorter than outer seta ....*E.* (*E.*) *farsicus* Lindberg, 1941 [Iran]
– P4 Enp3 distal inner spine shorter than segment; P5 inner spine about 1.2 times shorter than outer seta..... ..... *E.* (*E.*) *defectus* Lindberg, 1937 [India]
29. Innermost caudal seta about 1.5 times longer than outermost seta .... *E.* (*E.*) *bryophilus* Lindberg 1950 [India]
– Innermost seta about as long as outermost seta 30
30. Dorsal caudal seta subequal to innermost seta or slightly longer; outermost seta not more than 0.5 as long as ramus length; P5 inner spine subequal in length to outer seta..... .....*E.* (*E.*) *romaniensis* Alekseev, 2010 [Spain, Morocco]
– Dorsal caudal seta about 1.5 times shorter than innermost seta; outermost seta more than 0.5 as long as ramus length; P5 inner spine shorter than outer seta..... ..... *E.* (*E.*) *parvicornis* Harding, 1942 [Zambia, probably endemic of Lake Young]

Morphological groups among *Eucyclops* (*Eucyclops*) *serrulatus*-like species and subspecies

Among the studied taxa of this subgenus, three groups of species can be distinguished based on peculiarities in the ornamentation of A2 Bas and the setulation of the P4 coxal spine:

1. (true *serrulatus*-group): in A2 Bas with long hair-setulae at positions N1 and N2; in P4 coxal spine with a gap among setulae on the outer edge — includes 4 species (taxa): *E.* (*E.*) *serrulatus* s.lat., *E.* (*E.*) *borealis* s.lat., *E.* (*E.*) *romaniensis*, *E.* (*E.*) *wixarica* mainly distributed in Palaearctic and Pacific part of North America.

2. (*pectinifer*-group) in A2 Bas with long hair-setulae at position N1 and short spinules at position N2; P4 coxal spine with a gap among setulae on the outer edge — uniting several taxa mainly distributed in Atlantic area of USA, Canada and Mexico and in Central and South America .

3. (*agiloides*-like taxa having A2 Bas with long hair-setulae, sometimes as united group N1+2; P4 coxal spine without a gap among setulae on outer edge — inhabiting Africa, India, Australia and America, but also known in Europe and South-

East Asia. The clustering of species within the subgenus may reflect a long evolutionary history of the ancestral species. These three groups of species within the subgenus is possibly a result of speciation driven by continental drift and the gradual closing of the Tethys Sea channels within last 20 Mya [Alekseev, 2023].

Eucyclops (*Eucyclops*) *serrulatus* s.lat.

The body length varies significantly among subspecies and local populations, with individuals ranging from 750 to 1400 μm. These length variations appear to be inversely related to water temperature. Similarly, the caudal rami's L/W ratio can range from 4 in certain southern populations to 7 in arctic and mountain regions. The most common caudal rami L/W ratio is typically between 4.5 and 5.5 among adult female specimens. Caudal *serra* consisting of short, usually subequal spinules is present on 25–90% of the ramus length with a tendency to decline in more southern taxa and populations. Innermost caudal seta not shorter than outermost seta. A2Bas with distal groups N1 and N2 of long thin hairs that also vary in numbers among taxa and populations. P4 coxal spine with a gap among hairs or spinules on outer edge. The species inhabits the Palaearctic and comprises geographically isolated subspecies with distribution along distal range borders: *E.* (*E.*) *s. hadjebensis* in North Africa and *E.* (*E.*) *s. turcomanus* near Turano-Indian border. The type locality for nominal taxon *E.* (*E.*) *serrulatus* s.str. is a still existing pond in town Peterhof near St. Petersburg (Northwest Russia). Several isolated populations in New Zealand, Australia, South-East Asia, Atlantic and Pacific coasts of North America and in South Africa should be regarded as human-mediated invasions.

Key to subspecies of *Eucyclops* (*Eucyclops*) *serrulatus* s.lat.

1. In CR lateral *serra* is greatly (up to 25% of ramus length) reduced ....*E.* (*E.*) *s. hadjebensis* (Kiefer, 1926) [Morocco]
– CR *serra* is not reduced 2
2. In P3–4 Exp3 distal setae have regular appearance, covered with equal hair-setulae..... .....*E.* (*E.*) *s. serrulatus* (Fischer, 1851) [Most of Palaearctic]
– In P3–4 Exp3 distal setae are "stylet-modified", armed with wide transparent blades ....*E.* (*E.*) *s. turcomanus* Lindberg, 1959 [Herat province Afghanistan, Algeria?]

1. *Eucyclops* (*Eucyclops*) *serrulatus serrulatus* (Fischer, 1851)
Figs 3E,G, 5.

The type species for genus and subgenus.

SYNONYMY: *Cyclops serrulatus*: Fischer, 1851; *Leptocyclops agilis*: Sars G.O., 1914; *Cyclops agilis*: Gurney, 1933; *Eucyclops serrulatus*: Monchenko, 1974 (part.); Alekseev *et al*., 2006; Dussart, Defaye, 2006; Alekseev, Defaye, 2011; *Eucyclops* (*Eucyclops*) *serrulatus*: Alekseev, 2019; *Eucyclops abdelkader*: Dumont *et al*., 1979; *Eucyclops defayeae*: Mercado-Salas, Suares-Morales, 2016.

TYPE LOCALITY: Olgin and Orlov ponds in Peterhof, 18 km SW of St. Petersburg, Russia (59°52′N, 29°55′E).

HOLOTYPE PRESENCE AND STORING: Fischer's holotype was lost; female neotype was erected and described from the type locality [Alekseev *et al*., 2006], deposited in Federal collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: Female neotype #55031 and male paratype #55032. Populations from Siberia (Tumen) and Central Europe, Belgium, Ghent, used in hybridization experiments (more than one hundred specimens, both sexes from 3 local populations, successive hybrids in two following generations). Individuals from more than 50 populations along Palaearctic, from Portugal to Kamchatka and Japan.

DESCRIPTION. FEMALE (Figs 3E,G, 5A, C–H). Body length without caudal setae 800–1400 μm, rusty brownish color (rarely dark brown or grayish). Cephalothorax about as long as broad with maximum width close to posterior margin (Fig. 5A). Thoracic 4th free somite with long lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical of genus, composed of two flattened parts concave in middle (Fig. 5C). Caudal rami's L/W ratio 3.5–7.0, usually about 5, slightly or strongly divergent; *serra* along almost whole margin (Fig. 5D). Anal operculum weakly developed, smooth. Outermost caudal seta spiniform, its outer edge with small spinules, inner edge with or without long hairs. Innermost seta plumose or rarely naked, 1.0–1.5 times as long as outermost seta and 0.50–0.85 times as long as caudal ramus length. Dorsal seta 0.5–0.9 times as long as outermost seta. Distal setae approximate length ratio beginning with outermost one: 1.0/ 5.0–7.0/ 8.0–10.0/ 1.0–1.5.

Antennule 12-segmented, reaching posterior edge of first free thoracic somite (Fig. 5A), with smooth or finely-serrated hyaline membrane along three distalmost segments. Setation of antennular segments, beginning with first:

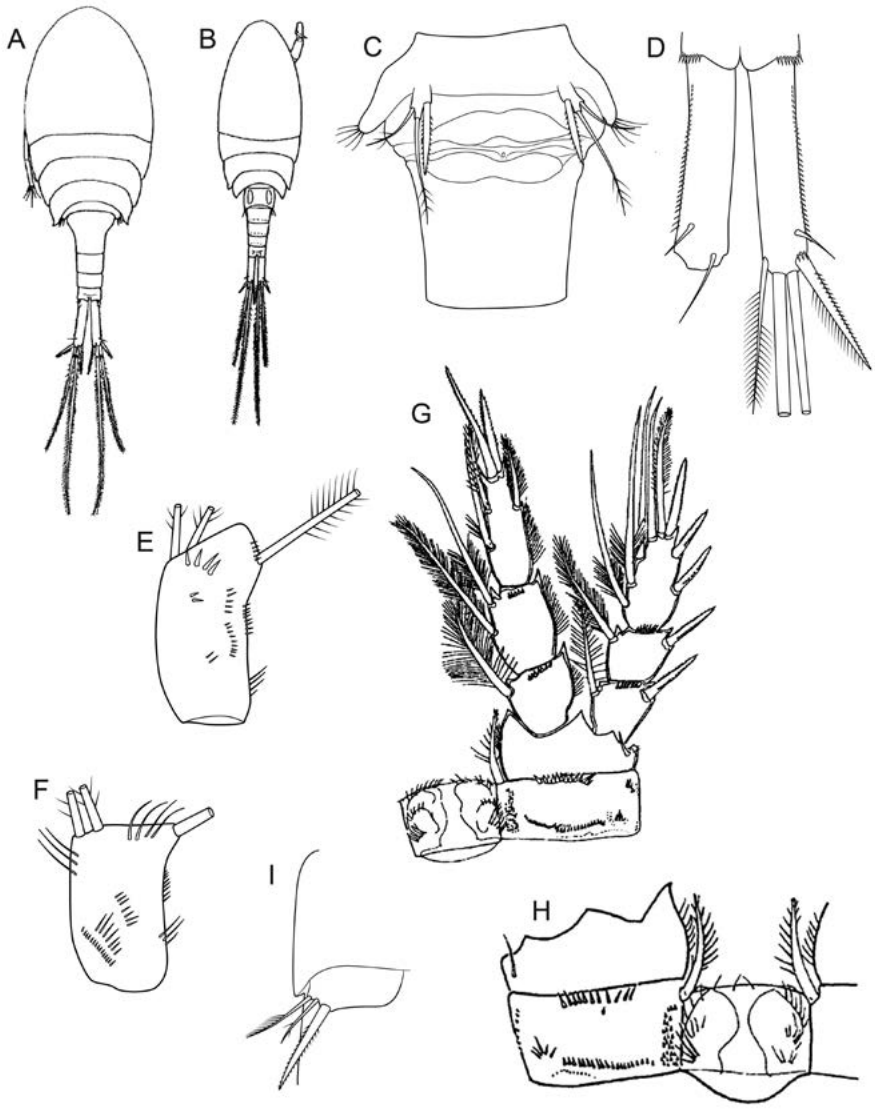


Fig. 5. *Eucyclops* (*Eucyclops*) *serrulatus serrulatus* (Fischer, 1851). A, B — habitus; C — Th4, genital double somite and P5; D — caudal rami; E — A2 Bas, frontal; F — A2 Bas, caudal; G, H — P4, caudal; I — P6. A, C–H — female; B, I — male. Northwestern Russia, after Alekseev *et al*. [2006].

Рис. 5. *Eucyclops* (*Eucyclops*) *serrulatus serrulatus* (Fischer, 1851). A, B — габитус; C — Th4, генитальный сомит и P5; D — каудальные ветви; E — A2 Bas, фронтально; F — A2 Bas, каудально; G, H — P4, каудально; I — P6. A, C–H — самка; B, I — самец. Северо-Запад России, по Alekseev *et al*. [2006].

8/4/2/5+I/4/2/2/3/2/2/2+I/6+II (seta — arabic; aesthetasc — roman). A2 Enp setation: 1, 9, 7. A2 Bas ornamentation on caudal surface with long hair-setulae at positions N1 and N2, other groups as in Fig. 5F; frontal surface ornamentation as in Fig. 5E. Mouth appendages typical of genus. Maxillular palp surface without ornamentation (see Fig. 3E). Maxilla praecoxa with group of rather long spinules close to lateral margin (see Fig. 3G, arrow).

Swimming legs P1–4: distal exopodite spine formula: 3/4/4/3. P1 inner basipodite spine reaching middle of Enp3. Inner outgrowth of basipodite P1–P4 with hairs. Coxa P4 ornamentation as in Fig. 5G, H. Intercoxal plate of P4 with three rows of setulae with gap in middle: I, II, III (Fig. 5G, H). Coxal spine P4 covered with hair-setulae on inner side (proximal hair-setulae longer, distal setulae/denticles short); outer edge with large central gap, so only few most proximal and most distal setulae/denticles present (Fig. 5H). P4 Enp3 long and slender, with L/W about 2.5; inner/outer spine ratio 1.2–1.6 (Fig. 5G). P5 with strong knife-like inner spine 1.6–2.5 times as long as segment and two setae; length ratio beginning with inner spine: 1.0/ 1.3–1.9/ 0.8–1.1 (Fig. 5C).

Morphological variation in the type population was classified into three distinct forms [Alekseev *et al*., 2006]:

Form A (with long hair-like setulae on caudal setae): Caudal rami L/W 5.0–5.7; slightly divergent. Outermost seta inner edge with long hairs. Innermost seta with long hair-setules on both sides, about 1.3–1.5 times as long as outermost seta. Medial caudal setae with dense and long hair-setulae. A2 Bas ornamentation (hair-setulae in roman, denticles in arabic numerals, in brackets): N1 (IV–VIII), N2 (I–III), N3 (6–10), N4 (7–9), N5 (12–18), N6 (0–4), N7 (4–5), N9 (5–8), N11 (5–6), N12 (6–8), N13 (0–4), N14 (3–8), N15 (4–7), N16 (3–8), N17 (5–11). Swimming legs P1–4 with plumose setae of endo- and exopodites. P4 IntCox with dense long hair-setulae at rows I, II, III, sometimes as long as half of IntCox plate width. P4 Enp3 inner apical spine 1.5–1.6 times as long as outer apical spine and about 1.4 times as long as segment itself; distal outer seta relatively long, reaching middle of outer apical spine. P4 Exp3 with relatively short distal spine, about 0.7 times as long as supporting segment and about half as long as distalmost seta. P5 with relatively slender spine as long as outer seta.

Form B (with short setulae on caudal setae): Caudal rami L/W 4.0–5.1. Outermost seta without hairs on inner edge. Innermost seta hairless as well, subequal to outermost seta. A2 basipodite ornamentation: N1 (V–IX), N2 (III–IV), N3 (7), N4 (9), N5 (13), N6 (4–5), N7 (3–4), N9 (5–6), N11 (5–6), N12 (7), N13 (2), N14 (3–4), N15 (4–5). P4 Enp3 and Exp3 setae with reduced hair-setulae. P4 IntCox plate with distal row of short hair-setulae. P4 Enp3 inner apical spine 1.3–1.4 times as long as outer apical spine and 0.9–1.2 times as long as supporting segment; distal outer seta relatively short, reaching about 1/3 of outer apical spine; distal half of setae stylet-shaped, narrowed and with much shorter setulae than on proximal part. P4 Exp4 with relatively long apical spine, about 0.9 times as long as supporting segment and about 0.7 times as long as distalmost seta; most setae stylet-shaped, narrowed and with much shorter setulae than on proximal part. P5 with inner spine usually slightly longer than outer seta.

Form C (pitted form): similar to form A, but characterized by pitted surfaces of cephalosome, urosome, caudal rami and A1.

In the ponds of Peterhof, form C was rare in spring (15%), but more common in autumn (40%). Forms A and B were most abundant in spring (about 40% each); hybrids between them dominated in summer and autumn.

MALE (Fig. 5B, I). Body length without caudal setae 600–950 μm. Caudal rami L/W 2.5–5.0, without *serra*. Slender innermost seta 1.5–2.0 times as long as outermost seta. Lateral seta shifted to dorsal side, with several spinules at its base. Dorsal seta 0.6–0.9 times as long as outermost seta. Antennule 14-segmented with six setae and three aesthetascs on first segment. Segments 2, 3, 4, 6 and 10 also with aesthetascs. Antennal basipodite basically as in female, with 4–6 long hairs posteriorly (N1, N2). Morphology of mouth parts, swimming legs and P5 basically as in female. P6 with strong inner spine and two setae; length ratio beginning from inner spine: 1/0.5–0.7/0.7–1.0 (Fig. 5I).

DISTRIBUTION: Palaearctic, including Europe, Northern Africa, Siberia (up to the Lena River delta), Far East of Russia till Kamchatka and Japan. As invasive form: North America (USA, Canada, Mexico), Australia, New Zealand, South East Asia, local populations close to sea ports.

COMMENTS: *E.* (*E.*) *serrulatus* s.str. shows much variation in caudal rami proportion and plumosity of appendages. Even in the type population, I found considerable seasonal variations and the presence of at least three infrapopulation groups (A, B, C) that easily hybridize in lab experiments, but coexist in environmental conditions. All these forms and seasonal variations maintain stable combinations of micropatterns on the A2

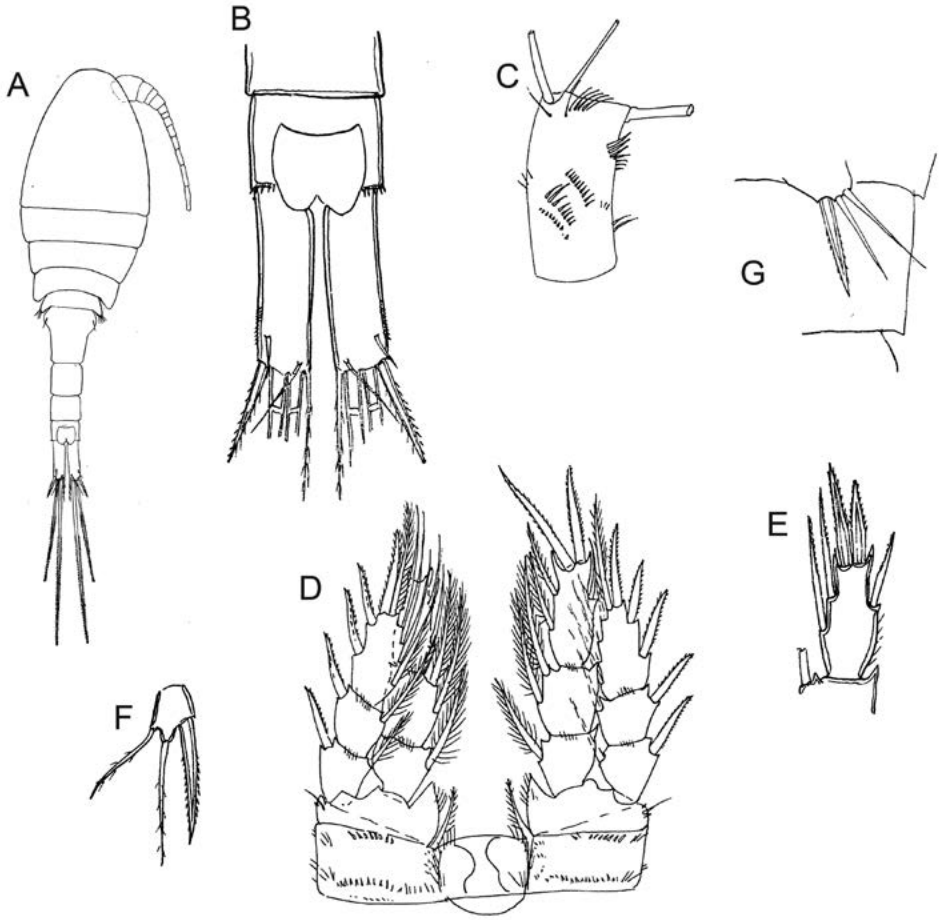


Fig. 6. *Eucyclops* (*Eucyclops*) *serrulatus hadjebensis* (Kiefer, 1926). A — habitus; B — caudal rami, dorsal; C — A2 Bas, caudal; D, E — P4; F — P5; G — P6. A–F — female; G — male. Morocco. A, B, E–G — after Kiefer, 1928a; C, D — after Alekseev & Defaye [2004].

Рис. 6. *Eucyclops* (*Eucyclops*) *serrulatus hadjebensis* (Kiefer, 1926). A — габитус; B — каудальные ветви, дорсально; C — A2 Bas, каудально; D, E — P4; F — P5; G — P6. A–F — самка; G — самец. Марокко. A, B, E–G — по Kiefer, 1928a; C, D — по Alekseev & Defaye [2004].

basipodite (with presence of groups N1 and N2 as hairs) and P4 coxal spine structure (with gap on outer edge), which were analysed in distant populations from the Central European area of St. Petersburg to Siberia [Alekseev *et al*., 2006; Alekseev, 2019]. Within these taxonomical features, a set of subspecies can be separated with respect to variation in distal spine length in P4 Enp3, caudal setae proportion and *serra* relative length, N1 and N2 group variation in A2 Bas and coxal segment ornamentation in the case of stability of these characters within selected taxa.

American records of *E.* (*E.*) *s. serrulatus*, as well as its invalid synonym *E. agilis* (n.nud.), should most likely be classified as *E.* (*E.*) *pectinifer* (Cragin, 1883), which was redescribed recently from Pennsylvania (USA) [Alekseev *et al*., 2006]. At the same time, human-mediated transportation of alien species through ship ballast water has resulted in the introduction of many copepod species outside their native range (*E.* (*E.*) *s. serrulatus* in Mexico was possibly described as *E. defayeae*, which should be confirmed with using molecular analysis) [Alekseev, Sukhikh, 2022].

2. ***Eucyclops* (*Eucyclops*) *serrulatus hadjebensis*** (Kiefer, 1926)
Fig. 6.

SYNONYMY: *Cyclops hadjebensis*: Kiefer, 1926a; *Eucyclops hadjebensis*: Kiefer, 1928a; Alekseev, Defaye, 2004; *Eucyclops serrulatus hadjebensis:* Alekseev *et al*., 2006; *Eucyclops* (*Eucyclops*) *hadjebensis*: Alekseev, 2019.

TYPE LOCALITY: Springs in El Hajeb, Atlas Mountains, Morocco

HOLOTYPE PRESENCE AND STORING: deposited in Kiefer's Reference collection (KRC), State Museum of Natural History (SMNK), Karlsruhe, Germany.

MATERIAL EXAMINED: holotype #00834 and paratypes #00835–00839, other specimens from Morocco; #02444–02448, from type locality, from Dumont collection, Brussels, Belgium.

DESCRIPTION. FEMALE (Fig. 6A–F). Body length without caudal setae about 900 μm, reddish color. Th4 with lateral setulae. Genital double somite about as long as broad; *receptaculum seminis* typical of genus. Caudal rami L/W ratio 4.2–4.8, parallel or slightly divergent; *serra* is short, composed of small denticles that occupy about 25% of lateral edge length (Fig. 6B). Anal operculum weakly developed, smooth. Lateral seta shorter than ramus width. Distal setae approximate ratio beginning with outermost one: 1.0/ 4.8/ 7.9/ 1.3.

Antennule 12-segmented, short, reaching distal edge CTh (Fig. 6A); three distalmost segments with narrow smooth hyaline membrane. Mouth appendages typical of genus. Maxillular palp surface without ornamentation. A2 Bas, as well as mouth appendages, as in type taxon. Swimming legs P1–4: distal exopodite spine formula 3/4/4/3. P4 Enp3 L/W ratio about 2.5; inner/outer spine ratio 1.4; distal setae reaching 1/2–3/4 of adjacent spine length (Fig. 6D, E). P4 Bas inner outgrowth covered with long rare hairs; coxal spine typical for nominal species, with gap on outer edge. P5 with long and strong inner spine, twice longer than segment itself, and two setae slightly longer than spine (Fig. 6F).

MALE (Fig. 6G). Smaller than female, body length about 740 μm; caudal rami shorter than in female, without lateral *serra*. Distal setae ratio as in female. Antennule 14-segmented. Morphology of mouth parts, swimming legs and reduced P5 basically as in female. P6 with strong inner spine and two setae; all appendages are subequal in length (Fig. 6G).

DISTRIBUTION: Northern Africa (Morocco, Algeria, Tunisia), Spain (well in Majorca isl); finding of *E.* (*E.*) *s. hadjebensis* in South Africa [Dussart, Defaye, 2006] needs confirmation.

COMMENTS: This form in most details including A2 Bas ornamentation, P4 Coxa armament is similar to *E.* (*E.*) *serrulatus* s.str. Among type slides in Keifer's collection one slide was labeled as "*Eucyclops serrulatus hadjebensis*", which refers to uncertainty of Keifer about the rank of this form. Partly reduced *serra* (not in all specimens) and pink color of chitin in live animals from the type spring in Morocco are the main differences with *E.* (*E.*) *s. serrulatus.*

3. ***Eucyclops* (*Eucyclops*) *serrulatus turcomanus*** Lindberg, 1959, **comb.n**.
Fig. 7.

SYNONYMY: *Eucyclops turcomanus*: Lindberg, 1959; Alekseev *et al*., 2006.

TYPE LOCALITY: river Tagao Boraq, Qal'eh Nou, Herat Province, alt. 990 m; spring near Sar-Pol, alt. 535 m, Afghanistan.

HOLOTYPE PRESENCE AND STORING: holotype and paratypes in Institute of Natural Sciences, Brussels (part of Lindberg's collection).

MATERIAL STUDIED: female holotype #30252, 10 females paratypes from Lindberg's type seria, and 12 females from second locality, a pond ('birket'), 165 km, S. of Amman, Jordan (30°35′N, 35°50′E), 16 April 1978, Lindberg's collection.

DESCRIPTION. FEMALE (Fig. 7A–G). Body length without caudal setae about 800 μm, elongated shape, yellowish color. Th4 with lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical of genus (Fig. 7B). Caudal rami L/W ratio about 3.7, almost parallel or more or less divergent; *serra* along almost whole lateral margin composed of very small and dense denticles (Fig. 7A). Anal operculum round, smooth. Outermost spiniform seta with row of spinules along outer margin. Innermost/ outermost caudal setae length ratio about 1.5 (1.2–1.9). Caudal middle setae thick and naked in their proximal 1/3.

Antennule 12-segmented, with smooth or finely-serrated very narrow hyaline membrane along three distalmost segments. Antenna basipodite, as well as mouth appendages, basically as in *E.* (*E.*) *s. serrulatus* (Fig. 7C, D). Swimming legs P1–4: distal exopodite spine formula: 3/4/4/3. P2–P4 Exp spines wide, lanceolate. P4 distal setae are modified, stylet-shaped (Fig. 7F). P4 IntCox with three rows of hair-setulae: I, II, III; I and III with long setulae (Fig. 7E). P4 coxal spine typical for nominal

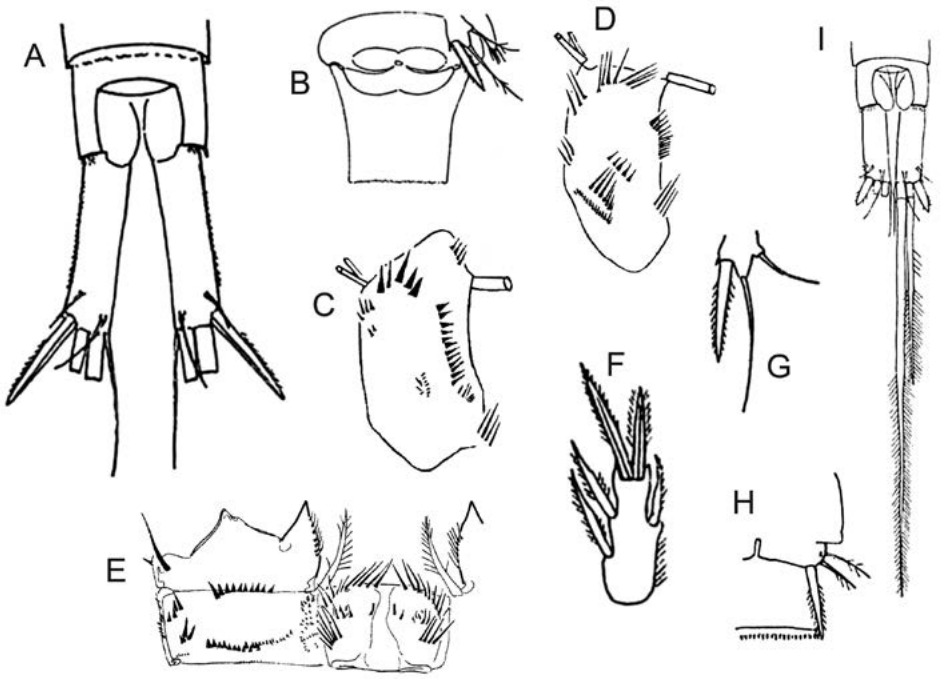


Fig. 7. *Eucyclops* (*Eucyclops*) *serrulatus turcomanus* (Lindberg, 1959) comb.n. A, I — caudal rami, dorsal; B — Th4, genital double somite and P5; C — A2 Bas, frontal; D — A2 Bas, caudal; E — P4 basipodite, coxa and intercoxal plate, caudal; F — P4 Enp3; G — P5; H — P6. A–G — female; H, I — male. Afghanistan. A, B, F–I — after Lindberg [1959]; C–E — after Alekseev *et al*. [2006].

Рис. 7. *Eucyclops* (*Eucyclops*) *serrulatus turcomanus* (Lindberg, 1959) comb.n. A, I — каудальные ветви, дорсально; B — Th4, генитальный сомит и P5; C — A2 Bas, фронтально; D — A2 Bas, каудально; E — базиподит, кокса и межкоксальная пластинка P4, каудально; F — P4 Enp3; G — P5; H — P6. A–G — самка; H, I — самец. Афганистан. A, B, F–I — по Lindberg [1959]; C–E — по Alekseev *et al*. [2006].

species, with gap on outer edge. P4 Enp3 proportions and P5 structure as in *E.* (*E.*) *s. serrulatus*.

MALE (Fig. 7 H, I). Body length without caudal setae about 700 μm. Caudal rami L/W ratio 2.9–3.4, parallel, without *serra* (Fig. 7I). Caudal setae structure and proportions basically as in female. Swimming legs and P5 structure and proportions basically as in female. P6 with strong inner spine and two shorter setae (Fig. 7H).

DISTRIBUTION: Afghanistan.

COMMENTS. Described by Lindberg [1959] from Afghanistan, this form was found by author there again in 1960 [Lindberg, 1960]. The Mediterranean findings are the first non-Mesasian records of a taxon with an apparently Iranian-Turanian range. The similarity of this form to *E.* (*E.*) *serrulatus* s.str. suggests that *E.* (*E.*) *s. turcomanus* is a distant population of *E.* (*E.*) *s. serrulatus* type B at the southern part of its range. But due to some differences in integumental pore pattern, lanceolate spines of swimming legs, and longer inner spine of P6 in male, this form has been retained as a subspecies.

4. ***Eucyclops* (*Eucyclops*) *acanthoides***
(Douwe, 1914)
Fig. 8.

SYNONYMY: *Cyclops acanthoides*: Douwe, 1914; *Eucyclops acanthoides*: Dumont, Verheye, 1984; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *acanthoides*: Alekseev, 2019.

TYPE LOCALITY: Sarh, Chad, Central Africa.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 8). Body length without caudal setae about 800 μm, light

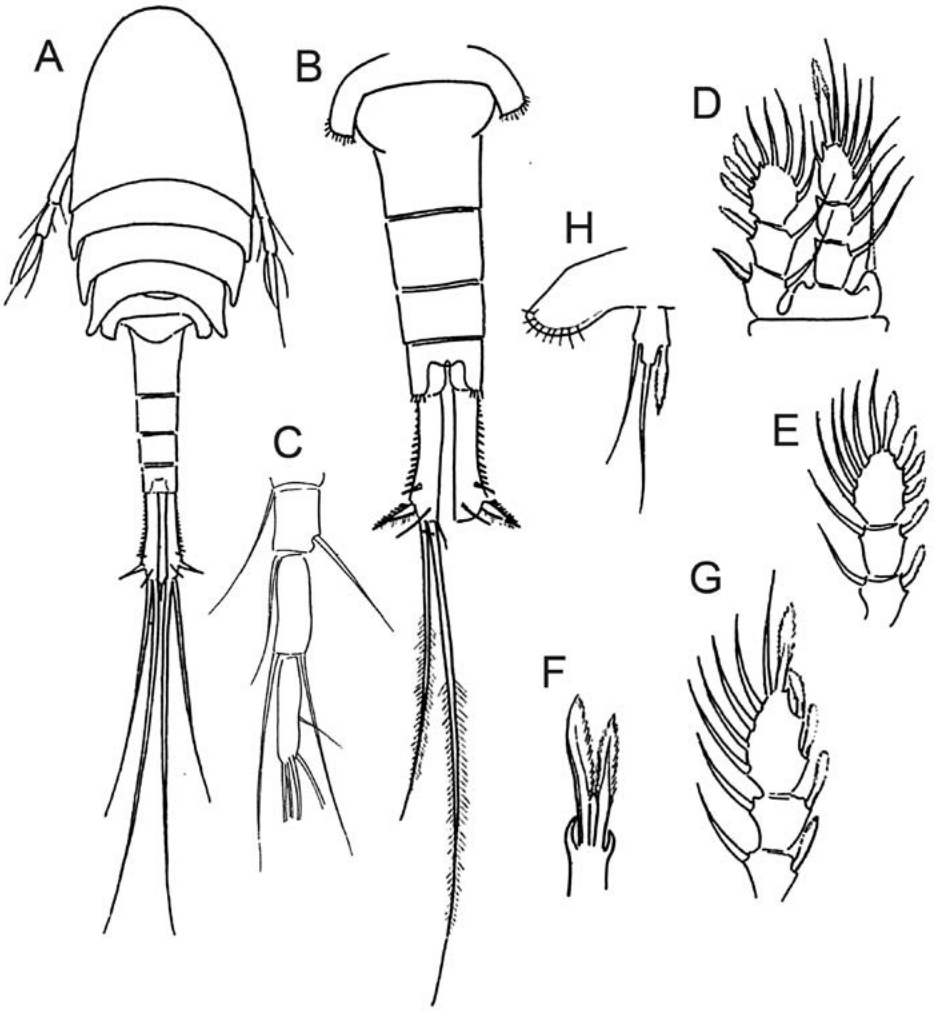


Fig. 8. *Eucyclops* (*Eucyclops*) *acanthoides* (Douwe, 1914). Female: A — habitus; B — abdomen; C — three last segments of A1; D — P1; E — P3 Exp3; F — P4 Enp3; G — P4 Exp3; H — P5. Chad, Central Africa, after Douwe [1914].

Рис. 8. *Eucyclops* (*Eucyclops*) *acanthoides* (Douwe, 1914). Самка: A — габитус; B — абдомен; C — три последних членика A1; D — P1; E — P3 Exp3; F — P4 Enp3; G — P4 Exp3; H — P5. Чад, Центральная Африка, по Douwe [1914].

brown. Cephalothorax slightly longer than wide, with maximum width close to posterior margin. Last two thoracic somites with long lateral protrusions posteriorly (Fig. 8A, B). Th4 lateral hair-setulae rather short. CTh and Th surfaces covered by pits. Abdomen long and slender. Caudal rami L/W ratio about 5, parallel; lateral *serra* of large spinules occupying almost whole lateral margin (Fig. 8B). Outermost spiniform caudal seta strong, its outer edge with small spinules, inner edge with thin hairs. Innermost caudal seta naked, short, slightly shorter than outermost spine or subequal to it.

Antennule 12-segmented, reaching posterior border of Th1; 3 distal segments with very narrow, hardly visible, smooth hyaline membrane (Fig. 8C). A2 Bas as well as mouth appendages not described. Swimming legs P1–P4: distal exopodite spine

formula: 3/4/4/3; spines surrounded with hyaline membrane (leaf-like shaped) with thin small denticles (Fig. 8D–G). In P4 Enp3, inner/outer spine ratio about 1.2. In reduced P5, inner spine short and wide, showing same leaf-like appearance as in spines of swimming legs 3–4 (Fig. 8H).

MALE unknown.

DISTRIBUTION: Sarh, Chad, Central Africa.

COMMENTS: This species was poorly described even for its time, but it can be recognized meanwhile. Van Douwe points out the leaf-like structure of P3–P5 spines as the most characteristic feature, similar to that of *E.* (*E.*) *agiloides* s.lat. and *E.* (*D.*) *euacanthus* s.lat. At the same time, *E.* (*E.*) *acanthoides* is clearly distinguished from these forms by narrow and barely visible smooth hyaline membrane of A1 (versus rather wide hyaline membrane in *E.* (*E.*) *agiloides*) and parallel caudal rami with larger denticles in *serra*. *E.* (*E.*) *acanthoides* differs from *E.* (*D.*) *euacanthus* in having shorter innermost caudal seta, short but wide leaf-like inner spine in P5 (versus weak inner spine in *E.* (*D.*) *euacanthus*), and smooth hyaline membrane in A1 (versus denticulated hyaline membrane in *E.* (*D.*) *euacanthus*).

***Eucyclops* (*Eucyclops*) *agiloides* s.lat.

Caudal rami of medium length, with L/W ratio usually 4–5. A1 distal segments with smooth and usually rather broad hyaline membrane. A2 Bas with hair-setulae in positions N1 and N2, sometimes fused into one group. In P4 coxal spine homogenously covered with hairs/spinules on both sides without a gap on outer edge. In reduced P5 inner spine about as long as segment and subequal to outer seta length. Species unites 5 subspecies: *E.* (*E.*) *a. agiloides* (Sars G.O., 1909), *E.* (*E.*) *a. pacificus* Ishida, 2000, *E.* (*E.*) *a. roseus* Ishida, 1997, *E.* (*E.*) *a. miracleae* Alekseev, 2010, *E.* (*E.*) *a. sarsi* Alekseev, 2023, inhabiting the tropics and subtropics of the Old World. *Eucyclops serrulatus tropicalis* Dussart et Fernando, 1985, was described briefly but seems like also belonging to *E.* (*E.*) *agiloides* s.lat. This form to be recognized as valid one should be redescribed especially for microcharacters of A2 Bas and P4.

Key to subspecies of *Eucyclops* (*Eucyclops*) *agiloides* s.lat.

1. A2 Bas has no setulae at position N2..... 2
– A2 Bas with group of setulae at position N2 3
2. In CR, lateral *serra* extending over more than 40% of outer margin; in P5, outer seta not longer than medial seta ....*E.* (*E.*) *a. agiloides* (Sars G.O., 1909)
– In CR, lateral *serra* is reduced to about 20% of outer margin; in P5, outer seta longer than medial seta ...*E.* (*E.*) *a. sarsi* Alekseev, 2023
3. In CR, lateral *serra* in the distal part with spinules sharply increasing in size; in P4, intercoxal plate with a distal group I consisting of long hairs on each sides with a gap in the middle; in P4 Exp3, distal seta does not extend beyond the end of the terminal spine ..... *E.* (*E.*) *a. miracleae* Alekseev, 2010
– CR lateral *serra* with distal spinules gradually increasing in size; P4 intercoxal plate with a continuous distal line of hairs I; P4 Exp3 distal seta prominently extending beyond the end of the terminal spine 4
4. P4 Exp3 distal spine noticeably shorter than distal segment; anal operculum almost straight ..... *E.* (*E.*) *a. pacificus* Ishida, 2000
– P4 Exp3 distal spine about as long as distal segment; anal operculum noticeably convex .....*E.* (*E.*) *a. roseus* Ishida, 1997.

5. ***Eucyclops* (*Eucyclops*) *agiloides agiloides*** (Sars G.O., 1909) Fig. 9.

SYNONYMY: *Cyclops agiloides*: Sars G.O., 1909; *Eucyclops agiloides*: Kiefer, 1927a; Defaye, 1988; Holynska *et al*., 2021; *Eucyclops* (*Eucyclops*) *agiloides agiloides*: Alekseev, 2019.

TYPE LOCALITY: Lake Victoria, Bukoba, Tanzania, Equatorial Africa.

HOLOTYPE PRESENCE AND STORING: female holotype deposited in the Natural History Museum (London, United Kingdom).

MATERIAL STUDIED: topotype specimens from Lake Victoria (Prof. H. Dumont's collection); author's description and drawings; holotype re-description and drawings by Holynska *et al*. [2021]; slides from Kiefer's Reference collection, SMNK, Germany

DESCRIPTION. FEMALE (Fig. 9). Body length without caudal setae 850–1150 µm. Cephalothorax about as long as broad, with maximal width close to posterior margin (Fig. 9A). Th4 (in some populations also Th3, after Holynska *et al*. [2021]) with thin long hairs or short setules laterally. Genital double somite about as long as broad; *receptaculum seminis* typical for genus. Caudal rami: L/W ratio 4–6, slightly divergent; lateral *serra* reduced up to 50–70% of lateral margin, composed of tiny spinules proximally and longer ones distally (Fig. 9B). Outermost

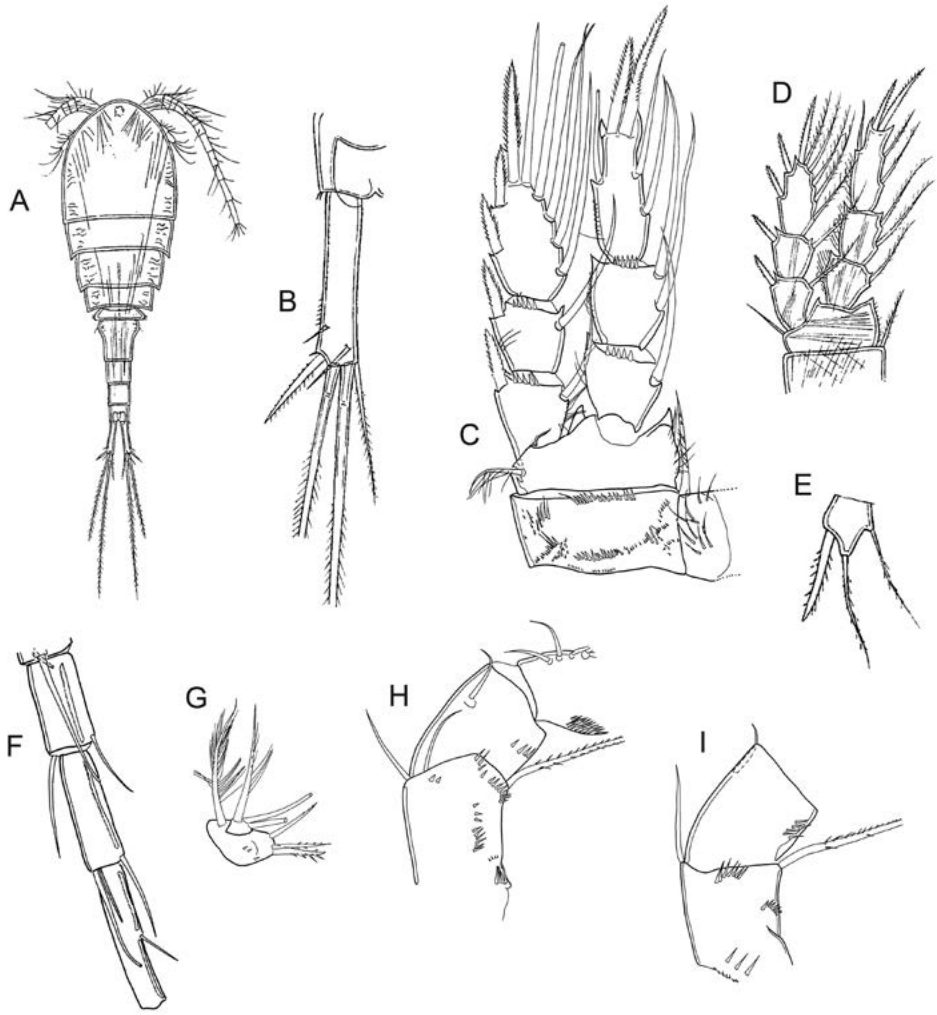


Fig. 9. *Eucyclops* (*Eucyclops*) *agiloides agiloides* (Sars G.O., 1909). Female: A — habitus; B — caudal ramus, dorsal; C, D — P4; E — P5; F — A1, three distal segments; G — maxillulary palp; H — A2 Bas, frontal; I — A2 Bas, caudal. Lake Victoria, Tanzania. A, B, D, E — after Sars G.O. [1909]; C, F–I — after Holynska *et al*. [2021].

Рис. 9. *Eucyclops* (*Eucyclops*) *agiloides agiloides* (Sars G.O., 1909). Самка: A — габитус; B — каудальная ветвь, дорсально; C, D — P4; E — P5; F — A1, три дистальных членика; G — пальп максиллулы; H — A2 Bas, фронтально; I — A2 Bas, каудально. Озеро Виктория, Танзания. A, B, D, E — по Sars G.O. [1909]; C, F–I — по Holynska *et al*. [2021].

spiniform caudal seta inserted at some distance from outer middle seta (higher), its outer edge with small spinules, inner edge with fine hairs. Innermost caudal seta plumose, 1.5–1.9 times as long as outermost seta. Dorsal seta about 0.7 times as long as outermost seta. Distal seta approximate length ratio beginning with outermost: 1.0/5.2/8.0/1.5–1.9.

Antennule 12-segmented, reaching middle or posterior edge of Th1; with smooth hyaline membrane along three distalmost segments (Fig. 9F). Setation of antennular segments, beginning with first: 8/4/2/6/4/2/2/3/2+I/2/2+I/7+I (seta — arabic; aesthetasc — roman). A2 Enp setation: 1, 9, 7. A2 Bas on caudal surface with several long setulae at position N1, other groups as in Fig. 9I; frontal

surface ornamentation as in Fig. 9H. Mxl palp with few denticles (Fig. 9G). Other mouth appendages as in congeners. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P1 IntCox plate naked. In P1, Bas inner seta reaching middle of Enp3. In P2 and P3, IntCox plate on frontal surface with two groups of hairs and row of small denticles (sometimes missing in P2) on caudal surface. In P4, IntCox plate caudal surface with two or three rows of hair-setulae; distal row I of hair-setulae on lateral sides with gap in middle. P4 (Fig. 9C, D) Bas inner outgrowth with long hairs; coxal spine homogenously plumose. P4 Enp3 L/W ratio about 2.5; inner/outer spine ratio about 1.4; inner spine subequal to segment length. Distal setae of P4 Enp3 not reaching beyond tips of nearest spines. In reduced P5 (Fig. 9E) inner spine distinctly longer than segment; medial and outer setae are subequal, distinctly longer than inner spine.

MALE: not described by author (see comments).

DISTRIBUTION: Africa.

COMMENTS: Sars [1909] describes this species basing on specimens collected from two specific locations in Equatorial Africa: Lake Victoria (holotype) and Lake Tanganyika (paratypes). *E.* (*E.*) *agiloides* collected later in other sites from Africa and Asia differ somewhat from Sars's type specimens, especially in micropatterns in A2 Bas. When comparing *E.* (*E.*) *agiloides* s.lat. from several localities in Africa, variability in number of setulae in A2 Bas at position N1+2 (from 3 to 9) can be observed. Some differences were found in specimens from the type localities by Sars, but he considered these differences as "minor" and regarded them as local population variability of the same species. Most African and European populations of *E.* (*E.*) *agiloides* s.lat. studied have wide hyaline membrane on three distal segments of antennule (up to half of segment width). This membrane is never so wide in Asian populations and subspecies. All records of *E.* (*E.*) *a. agiloides*, especially outside of Africa should be re-examined on the basis of confirmed characters including micro patterns in A2 Bas and P4 ornamentation. Male was known from the type localities (Lake Victoria and Lake Tanganyika), but it was not described by author. The only specimen of male from Africa (Cameroon) was described by Kiefer [1927a]. According to his figures, P6 in male of *E.* (*E.*) *a. agilodes* is armed with three appendages subequal in length; the inner spine barely reaches the middle of next somite. Kiefer [1933] describes a male of *E.* (*E.*) *agiloides* from an area of Southeast Asia (Malay Archipelago) also having subequal appendages, with both setae slightly shorter than the inner spine, which almost reaches the distal margin of the next abdominal segment. Males of Indian populations studied by Lindberg [1939] also had P6 with a relatively short inner spine, shorter than next segment length.

6. ***Eucyclops* (*Eucyclops*) *agiloides miracleae*** Alekseev, 2010
Fig. 10.

SYNONYMY: *Eucyclops miracleae*: Alekseev, 2010; *Eucyclops* (*Eucyclops*) *agiloides miracleae*: Alekseev, 2019.

TYPE LOCALITY: small pond in vicinity of Lake Albufera, Valencia, Spain.

HOLOTYPE PRESENCE AND STORING: holotype female #55052 and paratype #55053 deposited in Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: Holotype and paratype specimens.

DESCRIPTION. FEMALE (Fig. 10). Body length without caudal setae about 1180 µm, yellow-brown color. Cephalothorax as long as broad, with maximal width close to posterior border (Fig. 10A). Th4 with long lateral hair-setulae. Genital double somite about 1.1 times as long as broad; *receptaculum seminis* typical of genus. Caudal rami: L/W ratio about 5, parallel or slightly divergent; lateral *serra* extending along most of lateral margin, composed of spinules noticeably increasing distally (Fig. 10B, C). Anal operculum rather developed, convex. Outermost spiniform seta inserted without noticeable space from outer middle seta; its outer edge with small denticles, inner edge with fine hairs. Innermost caudal seta plumose, about 1.3 times as long as outermost seta. Lateral seta about as long as ramus width or shorter. Dorsal seta about 0.5 times as long as outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.9/ 8.9/ 1.3.

Antennule 12-segmented, reaching middle or posterior edge of Th1; with smooth hyaline membrane along three distalmost segments. Setation of antennular segments, beginning with first: 8/4/2/6/4/2/2/3/2/2/3/8. A2 Bas on caudal surface with several long hair-like setulae at positions N1 and N2, other groups as in Fig. 10E; frontal surface ornamentation as in Fig. 10D. Mouth appendages as in congeners.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P1, intercoxal plate with middle row of spinules. In P2–P4, with groups of hair-setulae. P4 (Fig. 10G) Bas inner outgrowth covered with long hairs; coxal spine plumose on

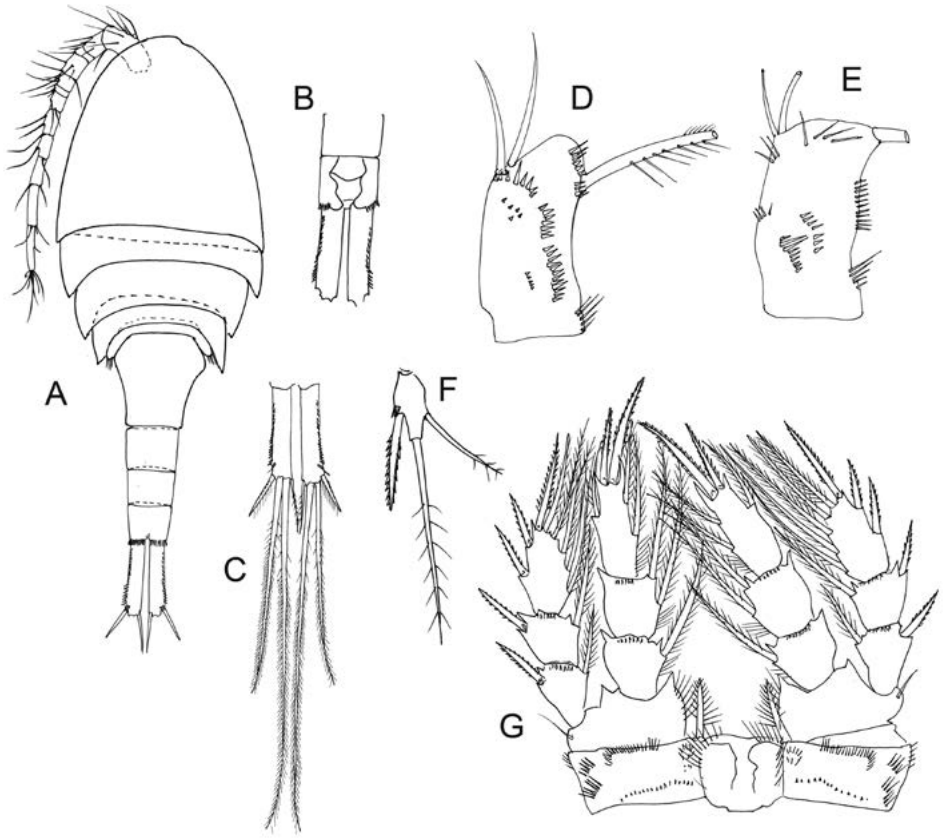


Fig. 10. *Eucyclops* (*Eucyclops*) *agiloides miracleae* Alekseev, 2010. Female: A — habitus; B, C — caudal rami; D — A2 Bas, frontal; E — A2 Bas, caudal; F — P5; G — P4, caudal. Spain, orig.

Рис. 10. *Eucyclops* (*Eucyclops*) *agiloides miracleae* Alekseev, 2010. Самка: A — габитус; B, C — каудальные ветви; D — A2 Bas, фронтально; E — A2 Bas, каудально; F — P5; G — P4, каудально. Испания, ориг.

both sides, without gap, but hairs on outer side begin more distally than on inner side. P4 Coxa caudal surface with lateral group of spinules F, missing in *E.* (*E.*) *a. agiloides*. P4 Enp3 L/W ratio about 2.4; inner/outer spine ratio about 1.4; inner spine slightly longer than segment; distal setae reaching 1/2–2/3 of adjacent spines. P4 Exp3 distal spine longer than segment. In reduced P5 (Fig. 10F), inner spine strong, slightly bent about 1.5 times as long as segment; approximate length ratio of appendages in type specimens beginning with inner spine: 1.0/ 2.1/ 1.0.

MALE unknown.

DISTRIBUTION: Spain.

COMMENTS: Originally described as a separate species, this form is regarded here along with several other taxa as subspecies of *E.* (*E.*) *agilodes* s.lat. This form differs from the nominal taxon from the type locality at Lake Victoria in several details, such as presence of long hairs on P4 coxa at position F, missing in *E.* (*E.*) *a. agiloides* and presented by a set of short spinules in *E.* (*E.*) *a. roseus*. Following set of signs separates it from other congeners: A1 long with wide smooth hyaline membrane on 10–12 segments, A2 Bas on caudal side with several long hairs in NN 1, 2 positions, P4 coxal spine/ seta with thin hairs homogeneously presented on both sides without a gap; in CR, lateral *serra* not reduced, and spinules in the distal part increase sharply in size.

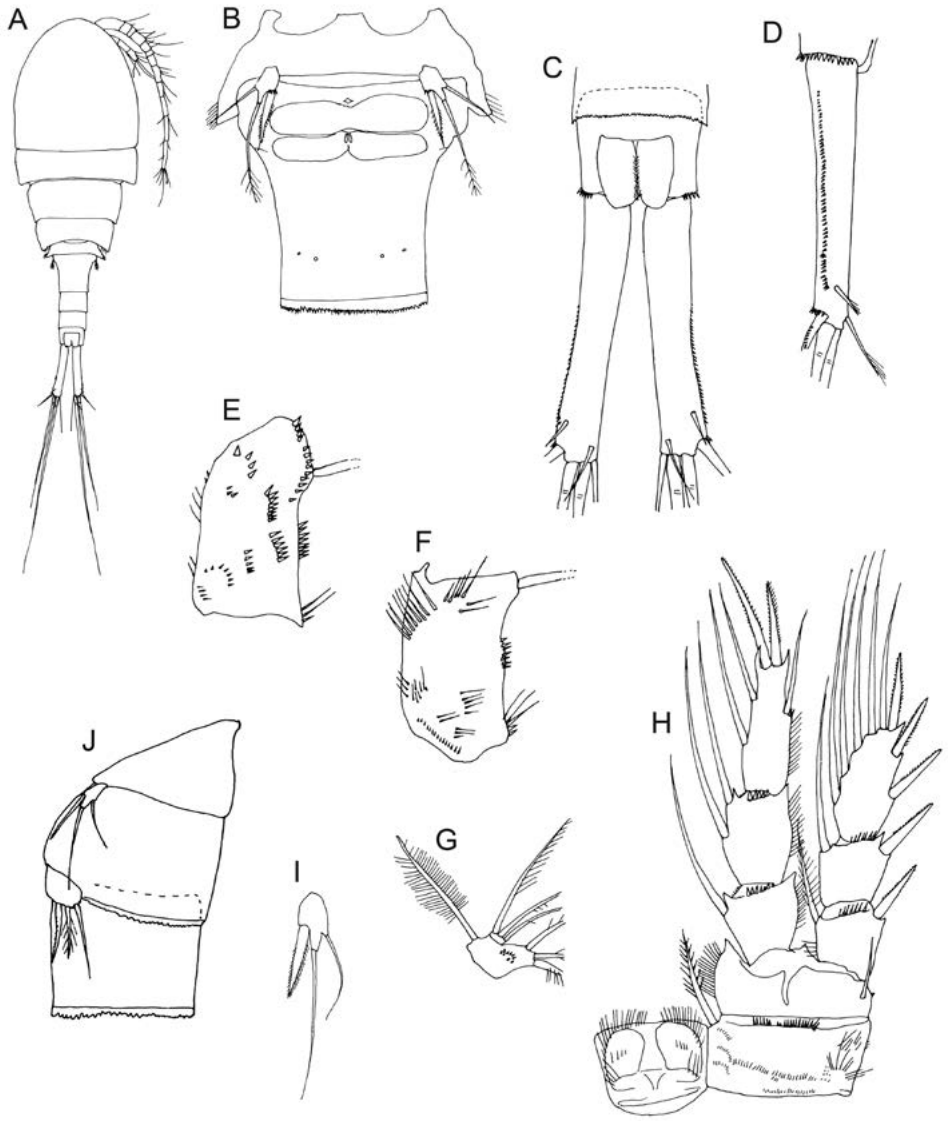


Fig. 11. *Eucyclops* (*Eucyclops*) *agiloides pacificus* Ishida, 2000 comb.n. A — habitus; B — Th4, genital double somite and P5; C, D — caudal rami; E — A2 Bas, frontal; F — A2 Bas, caudal; G — maxillulary palp; H — P4, caudal; I — P5; J — P5 and P6. A–I — female; J — male. Japan, after Ishida [2000].

Рис. 11. *Eucyclops* (*Eucyclops*) *agiloides pacificus* Ishida, 2000 comb.n. A — габитус; B — Th4, генитальный сомит и P5; C, D — каудальные ветви; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — пальп максиллулы; H — P4, каудально; I — P5; J — P5 и P6. A–I — самка; J — самец. Япония, по Ishida [2000].

7. ***Eucyclops*** (***Eucyclops***) ***agiloides pacificus*** Ishida, 2000 **comb.n.**
Fig. 11.

SYNONYMY: *Eucyclops pacificus*: Ishida, 2000; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *pacificus*: Alekseev, 2019.

TYPE LOCALITY: roadside ditch in Yoichi town, Hokkaido, Japan.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male deposited in the National Science Museum (Tokyo, Japan); 15 females and 6 males, undissected in 70% ethanol, deposited in the Smithsonian National Museum of Natural History, Washington, USA, one female paratype (author's donation) in VA collection.

MATERIAL STUDIED: female paratype (author's donation to VA), author's description and drawings.

DESCRIPTION. FEMALE (Fig. 11A–I). Body length without caudal setae 930–1640 μm. Cephalothorax slightly longer than broad, with maximum width about posterior 1/4 (Fig. 11A). Th3 lateral margins are serrated with few short hair-setulae dorsolaterally as in type taxon from Africa. Th4 with long lateral hair-setulae. Genital double somite about as long as broad; *receptaculum seminis* typical of genus (Fig. 11B). Caudal rami: L/W ratio 4–6, slightly divergent; *serra* extending along most of lateral margin, composed of fine denticles not increasing noticeably distally (Fig. 11C, D). Anal operculum almost flat. Outermost spiniform seta inserted without such noticeable space from other terminal setae as in *E.* (*E.*) *a. roseus*. Lateral seta about as long as ramus width. Dorsal seta about 0.8 times as long as outermost seta and about 0.5 times as long as innermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.3/ 7.9/ 1.7.

Antennule 12-segmented, reaching distal edge of Th1; with smooth or finely serrated hyaline membrane along three distalmost segments. A2 Bas on caudal surface with distal group of long hair-setulae in position N1+2; other groups of A2 Bas ornamentation as in Fig. 11E, F. Mxl palp surface with group of spinules (Fig. 11G). Maxilla praecoxa with row of prominent spinules at lateral margin. Other mouth appendages as in congeners.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P1–P2 IntCox on caudal surfaces naked. P3–P4 IntCox on caudal surfaces with hair-setulae; in P4, distal row I of long hair-setulae at sides with central gap. In P4 (Fig. 11H) Bas, inner outgrowth with long hairs; coxal spine homogenously plumose, with hairs without gap. In P4 Enp3, L/W ratio about 2.7; inner/outer spine ratio about 1.4; inner spine slightly shorter than segment; distal setae reaching 1/2–3/4 of adjacent spines. In P4 Exp3, distal spine short, 0.6–0.8 times as long as segment. In reduce P5 (Fig. 11I) inner spine wide, about 1.5 times as long as segment; approximate length ratio of appendages in type specimens beginning with inner spine: 1.0/ 1.6/ 1.0.

MALE (Fig. 11J). Body length without caudal setae 990–1130 μm. Caudal rami L/W ratio = 4.3, parallel, without lateral *serra*. Caudal setae structure and proportions basically as in female. Armament of A2 Bas and Mxl palp similar to female. In reduced P5, structure and proportions similar to female. Rudimental P6 with short inner spine reaching middle of following somite; of two setae, middle one slightly shorter than inner spine, outer one noticeably longer than inner spine.

DISTRIBUTION: Japan.

COMMENTS: This form belongs to the *agiloides* complex, as it has a set of long dense hairs on antennal basipodite in position N1+2 and P4 coxal spine homogenously covered with hair-like setulae on both sides without a gap on the outer edge. The figures attributed to *E.* (*E.*) *a. pacificus* presented in the work of Lee *et al*. [2005] differ markedly from the description of Ishida (see, for example, the length ratio of innermost and outermost caudal setae, which are almost equal to 1 in Korean and 1.5 in Japanese specimens; A2 Bas group N2 with rarer setulae); most likely this is also a form of *agiloides*, but as an independent subspecies that has not yet been described. Following set of characters separates *E.* (*E.*) *a. pacificus* from congeners: caudal rami with long lateral *serra* almost reaching top of ramus, A2 Bas on caudal surface with distal group of long hair-setulae in position N1+2; maxilar palp surface with a group of denticles, inner spine of P5 less than 1.5 times shorter than middle seta; anal operculum rather straight.

8. ***Eucyclops* (*Eucyclops*) *agiloides roseus***
Ishida, 1997
Fig. 12.

SYNONYMY: *Eucyclops roseus*: Ishida, 1997; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *agiloides roseus*: Alekseev, 2019; *Eucyclops serrulatus extensus* Hsiao, 1950.

TYPE LOCALITY: Hiji Creek, Kunigamison, Okinawa, Japan.

HOLOTYPE PRESENCE AND STORING: female holotype deposited in the National Science Museum (Tokyo, Japan); 20 undissected females are deposited in the US National Museum of Natural History; 1 dissected paratype female is in VA personal collection (donation of Prof. Ishida).

MATERIAL STUDIED: female paratype (author's donation to VA), author's description and drawings.

DESCRIPTION. FEMALE (Fig. 12A–J). Body length without caudal setae 890–1080 μm (Fig. 12A), pale pink color. Cephalothorax

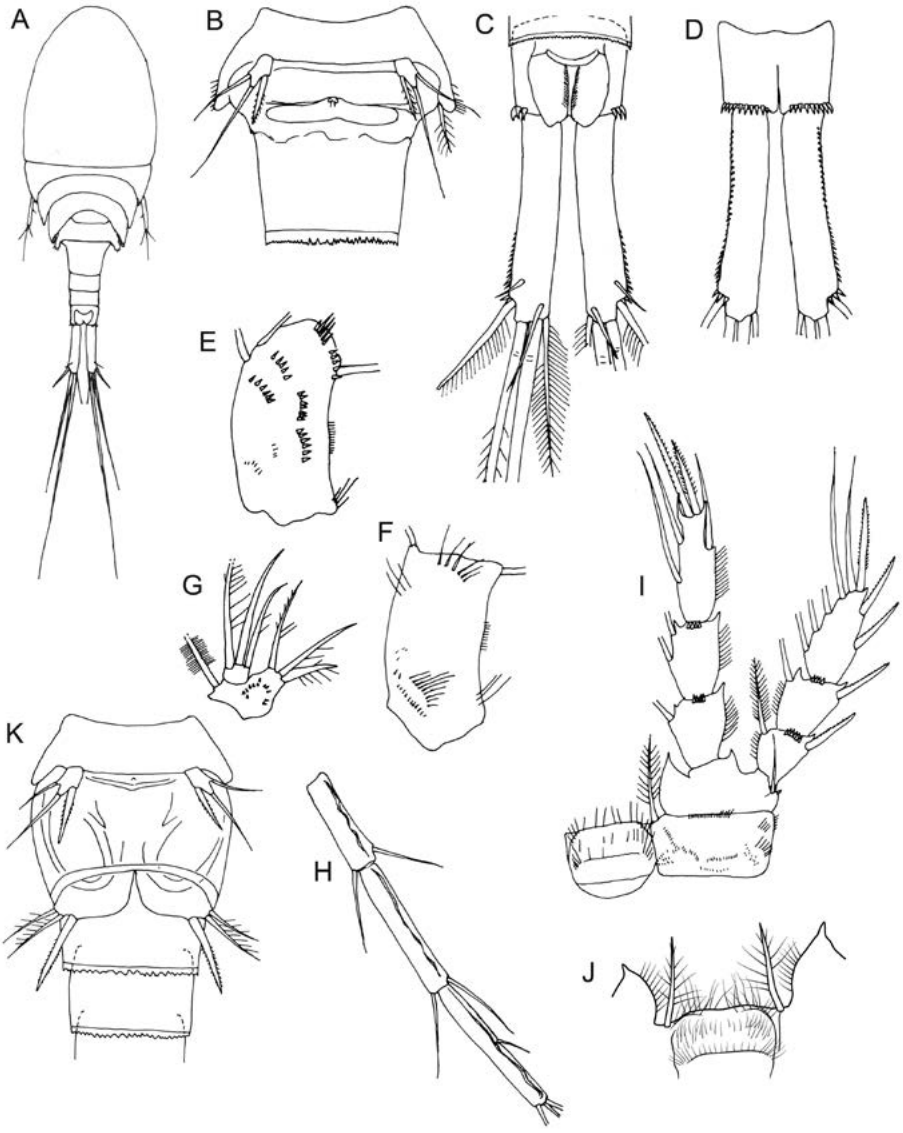


Fig. 12. *Eucyclops* (*Eucyclops*) *agiloides roseus* Ishida, 1997. A — habitus; B — Th4, genital double somite and P5; C, D — caudal rami; E — A2 Bas, frontal; F — A2 Bas, caudal; G — maxillulary palp; H — A1, three distal segments; I — P4, caudal; J — P4 intercoxal plate and coxal spine, caudal; K — P5 and P6. A–J — female; K — male. A–F, H, I, K — Japan, after Ishida [1997]; G — Japan, after Ishida [2002]; J — Russian Far East, after Alekseev & Chaban [2021].

Рис. 12. *Eucyclops* (*Eucyclops*) *agiloides roseus* Ishida, 1997. A — габитус; B — Th4, генитальный сомит и P5; C, D — каудальные ветви; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — пальп максиллулы; H — A1, три дистальных членика; I — P4, каудально; J — межкоксальная пластинка и коксальный шип P4, каудально; K — P5 и P6. A–J — самка; K — самец. A–F, H, I, K — Япония, по Ishida [1997]; G — Япония, по Ishida [2002]; J — Дальний Восток России, по Alekseev & Chaban [2021].

slightly longer than broad, with maximal width about posterior 1/4. Th3 lateral margins serrated with few short hair-setulae dorso-laterally. Th4 with lateral hair-setulae. Genital double somite about 1.2 times wider than long; *receptaculum seminis* typical of genus, with wider anterior part (Fig. 12B). Caudal rami: L/W ratio about 5, slightly divergent; *serra* extending along most of lateral margin, composed of fine denticles increasing distally (Fig. 12C, D). Anal operculum rather strongly developed, convex. Outermost spiniform seta inserted higher than outer middle seta. Lateral seta about as long as ramus width. Dorsal seta about 0.9 times as long as outermost seta and about 0.7 times as long as innermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 6.1/ 8.0/ 1.4.

Antennule 12-segmented, rather long, reaching distal edge of Th2; with smooth or finely serrated hyaline membrane along three distalmost segments (Fig. 12H). A2 Bas on caudal surface with two distal groups of long hair-setulae in positions N1, N2; other groups of A2 ornamentation as in Fig. 12E, F. Mxl palp surface with group of denticles forming circle (Fig. 12G). Maxilla praecoxa without row of denticles at lateral margin (in Japanese specimens). Other mouth appendages as in congeners.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P1 IntCox, frontal surface with hairs. In P1–P2 IntCox, caudal surfaces naked. In P3–4 IntCox, caudal surfaces with hair-setulae. In P4 (Fig. 12I, J) distal row I of long hair-setulae along whole margin without central gap; Bas inner outgrowth covered with long hairs; coxal spine plumose on both sides, without gap, but hairs on outer margin often begin more distally than on inner margin (Fig. 12J). In P4 Enp3, L/W ratio about 2.7; inner/outer spine ratio about 1.5; inner spine slightly longer than segment. Distal setae of P4 Enp3 not reaching beyond tips of nearest spines. In P4 Exp3, distal spine subequal to segment. In reduced P5, inner spine 1.5–2.0 times as long as segment; medial and outer setae longer than inner spine (in type specimens).

MALE (Fig. 12K). Body length about 680 μm (paratype). Caudal rami: L/W ratio 3.6, parallel, without lateral *serra*. Caudal setae and P1–P5 structure and proportions basically as in female. Rudimental P6: inner spine slightly longer than both setae and almost reaching middle of following somite.

DISTRIBUTION: Japan; Sakhalin Isl., Far East of Russia, Baikal vicinity; China; Issyk-Kul vicinity, Kyrgyzstan; Kazakhstan; Lake Victoria (between Kenya, Uganda, and Tanzania); Europe: Crimea Peninsula, South Germany, Dagestan (Caspian coastal rivers).

COMMENTS: This form appears to be more widespread than *E.* (*E.*) *a. agiloides*, which is probably endemic to African Great Valley lakes. Following combination of characters separates this form from other congeners: caudal rami with long lateral *serra*, A2 Bas on caudal surface with long-hair setulae in position N1, 2; anal operculum noticeably convex ; circle of denticles on Mxl palp.

9. ***Eucyclops* (*Eucyclops*) *agiloides sarsi***
Alekseev, 2023
Fig. 13.

SYNONYMY: *Eucyclops* (*Eucyclops*) *agiloides sarsi*: Alekseev, 2023.

TYPE LOCALITY: Burundian shore of Lake Tanganyika, near Bujumbura, Africa.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male dissected specimens, coll. Nov. 1983 by Prof. Henri Dumont, deposited in the Zoological Institute of Russian Academy of Sciences (St. Petersburg, Russia).

MATERIAL STUDIED: female holotype #55495, male paratype #55494 , female paratype #55465 specimens.

DESCRIPTION. FEMALE (Fig. 13A–F). Body length without caudal setae 920 μm. Cephalothorax slightly longer than broad, with maximal width close to posterior margin. Th4 with long lateral hair-setulae. Genital double somite about as long as broad; *receptaculum seminis* typical of genus. Caudal rami: L/W ratio 4.5, almost parallel; *serra* covering 20% of outer margin, consisting of 7–10 denticles (Fig. 13A). Anal operculum slightly convex. Outermost spiniform seta inserted without noticeable space from outer middle seta; its outer edge with stiff setulae, inner edge with thin hair-setae. Innermost seta plumose, about 1.4 times as long as outermost seta. Lateral seta longer than ramus width. Dorsal seta 0.6–0.7 times as long as outermost seta. Distal setae length ratio beginning with outermost: 1.0/ 3.9/ 5.8/ 1.4.

Antennule 12-segmented, reaching middle or posterior edge of Th1; with smooth or finely-serrated hyaline membrane along three distalmost segments. Setation of antennular segments as in nominal species. A2 Enp setation as in nominal species. A2 Bas on caudal surface with 3–4 stiff setulae at position N1, other groups as in Fig. 13C; frontal surface ornamentation as in Fig. 13B. Mxl palp surface without spinules (Fig. 13F). Other mouth appendages as in congeners. Swimming legs P1–P4: distal exopodite spine formula

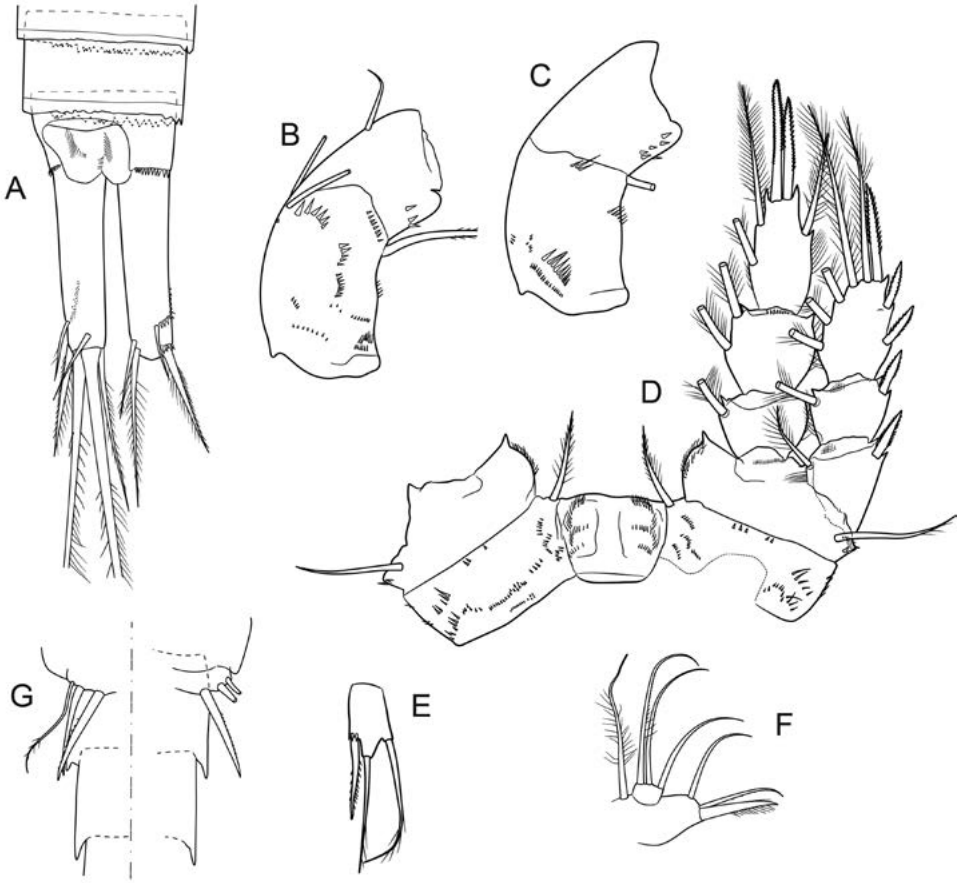


Fig. 13. *Eucyclops* (*Eucyclops*) *agiloides sarsi* Alekseev, 2023. A — caudal rami, dorsal; B –A2 Bas, frontal; C — A2 Bas, caudal; D — P4, caudal; E — P5; F — maxillulary palp; G — P5 and P6. A–F — female; G — male. Lake Tanganyika, after Alekseev [2023].

Рис. 13. *Eucyclops* (*Eucyclops*) *agiloides sarsi* Alekseev, 2023. A — каудальные ветви, дорсально; B — A2 Bas, фронтально; C — A2 Bas, каудально; D — P4, каудально; E — P5; F — пальп максиллулы; G — P5 и P6. A–F — самка; G — самец. Озеро Танганьика, по Alekseev [2023].

3/4/4/3. In P1–P3, IntCox plate with two rows of small spinules caudally and naked frontally. In P4 ,(Fig. 13D) IntCox caudal surface with three rows (I, II, III) of spinules, with gap in middle; coxa with noticeably reduced row of spinules C+D. In P4 Bas, inner outgrowth with short, stiff and dense setulae; coxal spine with few long hairs on proximal section and strong shorter spinules distally; both margins with continuous setulation. P4 Enp3: L/W ratio 1.85; inner/outer spine ratio 1.2; inner spine subequal to segment; inner distal seta almost reaching distant end of inner spine; outer distal seta reaching 2/3 of outer spine length. In P4 Exp3, distal spine 0.9 times as long as segment length. In reduced P5 (Fig. 13E), inner spine only 1.1 times as long as segment; outer seta longer than medial seta, relative length ratio beginning with inner spine: 1.0/ 1.4/ 1.7.

MALE (Fig. 13G). Body length without caudal setae 665 μm. Caudal rami: L/W ratio 2.5, parallel, without lateral *serra*. Dorsal seta longer than in female, 0.6 times as long as caudal ramus and 0.8 times as long as outermost caudal seta. Outer edge of outermost caudal seta with short spinules, inner edge with thin hair-setulae. Innermost caudal seta longer than in female, in-

nermost/outermost caudal seta ratio 1.8. A2 Bas ornamentation generally as in female, but some groups of small spinules missing — such as on frontal surface: at position N7; of three rows of spinules below N12 only one row visible; on caudal surface: group at position N6 missing. Rudimental P6 with inner spine reaching posterior margin of next somite; relative lengths beginning with inner spine: 1.0/ 0.9/ 1.1.

DISTRIBUTION: known only from the type locality in Lake Tanganyika.

COMMENTS: Easily distinguishable from other subspecies by reduced length of *serra* and long outer seta of P5, conspicuously exceeding both other appendages.

10. ***Eucyclops* (*Eucyclops*) *albuferensis***
Alekseev, 2008
Fig. 14.

SYNONYMY: *Eucyclops albuferensis*: Alekseev, 2008; *Eucyclops* (*Eucyclops*) *albuferensis*: Alekseev, 2019.

TYPE LOCALITY: Lake (Mediterranean Sea lagoon) Albufera, Valencia vicinity, Spain.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male, coll.: January 2007 by V. Alekseev, deposited in the Zoological Institute of Russian Academy of Sciences (St. Petersburg, Russia).

MATERIAL STUDIED: female holotype #55050 and male paratype #55051 specimens.

DESCRIPTION. FEMALE (Fig. 14A–K). Body length without caudal setae 1160 μm, bluish purple prosome, yellowish brown genital double somite. Cephalothorax as long as broad, with maximal width close to middle (Fig. 14A). Th4 with long lateral hair-setulae. Genital double somite 0.9 times as long as broad; *receptaculum seminis* typical of genus (Fig. 14B). Caudal rami: L/W ratio about 5, slightly divergent (Fig. 14C); *serra* extending along most of lateral margin, composed of rather long spinules noticeably increasing distally, 4 distal ones longer than half of ramus width (Fig. 14D). Outermost spiniform seta inserted without noticeable space from outer middle seta. Innermost seta 1.4 times as long as outermost seta. Lateral seta about as long as ramus width. Dorsal seta 0.6 times as long as outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 3.8/ 6.9/ 1.4.

Antennule (Fig. 14G) 12-segmented, reaching middle of Th1; with narrow smooth hyaline membrane along three distalmost segments. Setation of antennular segments, beginning with first: 8/4/2/6/4/2/2/3/2/2/3/8. A2 Bas on caudal surface with several long hair-like setulae at positions N1 and N2, other groups as in Fig. 14E; frontal surface ornamentation as in Fig. 14F. Mxl palp surface naked (Fig. 14H). Maxilla praecoxa without spinules at lateral margin. Other mouth appendages as in congeners.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P1–P3, IntCox plate with hair-setulae. In P4, IntCox with 3 groups of hair-setulae (I–III) (Fig. 14I). P4 Bas inner outgrowth with hairs; coxal spine on inner margin with long strong hairs proximally and short spinules distally, outer margin with few hairs proximally and without spinules distally. In P4 Enp3, L/W ratio about 2.5; inner/outer spine ratio about 1.4; inner spine longer than segment; distal setae reaching 1/2–3/4 of adjacent spines (Fig. 14J). In P4 Exp3, distal spine short, about 0.7 times as long as segment. In reduced P5, inner spine slightly curved, long, strong, armed with rather large spinules, about 2 times as long as segment; approximate length ratio of appendages in type specimens beginning with inner spine: 1.0/ 1.3/ 0.6 (Fig. 14K).

MALE (Fig. 14L). Body length without caudal setae 720–780 μm. Caudal rami: L/W ratio about 4, parallel, without lateral *serra*. Caudal setae structure and proportions basically as in female. A2 Bas on caudal surface without N2 group. Mouth appendages and swimming legs basically as in female, but P4 coxal spine with long hairs on both sides. In reduced P5, outer seta about 1.5 times as short as inner spine; medial seta about 1.8 times as long as inner spine. Rudimental P6 with rather long, strong inner spine and two short setae.

DISTRIBUTION: Albufera Mediterranean lagoon; several small water bodies along the coast of the Mediterranean Sea in Spain.

COMMENTS: *E.* (*E.*) *albuferensis* belongs to *serrulatus*-group, as it has hair-like setulae in positions N1, N2 on A2 Bas caudal surface, P4 coxal spine with a gap on outer edge, and P5 with strong inner spine. Its distinguishing characteristics include: blue-violet color in living specimens, caudal *serra* with long spinules, P4 Enp3 with elongated inner distal spine longer than segment, P5 with large and distinctly bent spine twice as long as outer seta, in male P6 with long inner spine. Aquatic fauna of Iberian Peninsula shows similarity with African continental fauna, and this form may turn out to become a junior synonym of some poorly described African species, such as *E.* (*E.*) *vandouwei*.

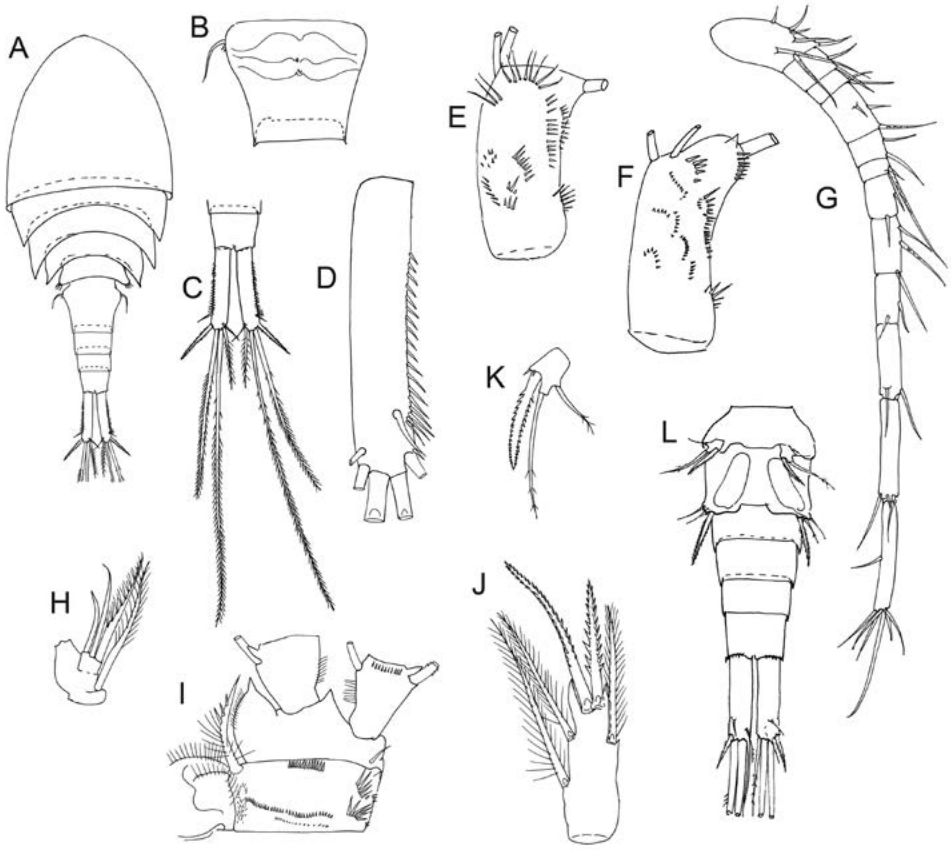


Fig. 14. *Eucyclops* (*Eucyclops*) *albuferensis* Alekseev, 2008. A — habitus; B — genital double somite; C, D — caudal rami; E — A2 Bas, caudal; F — A2 Bas, frontal; G — A1; H — maxillulary palp; I — P4 basipodite, coxa and intercoxal plate, caudal; J — P4 Enp3; K — P5; L — abdomen. A–K — female; L — male. Spain, after Alekseev [2008].

Рис. 14. *Eucyclops* (*Eucyclops*) *albuferensis* Alekseev, 2008. A — габитус; B — генитальный сомит; C, D — каудальные ветви; E — A2 Bas, каудально; F — A2 Bas, фронтально; G — A1; H — пальп максиллулы; I — базиподит, кокса и межкоксальная пластинка P4, каудально; J — P4 Enp3; K — P5; L — абдомен. A–K — самка; L — самец. Испания, по Alekseev [2008].

11. ***Eucyclops* (*Eucyclops*) *australiensis*** Morton, 1990 Fig. 15.

SYNONYMY: *Eucyclops australiensis*: Morton, 1990; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *australensis*: Alekseev, 2019.

TYPE LOCALITY: Valley Lake, Mt Gambier, South Australia.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 15). Body length without caudal setae 850–1030 μm, prosome elliptical. Th4 with lateral hair-setulae. Genital double somite about 1.3 times as wide as long; *receptaculum seminis* not described. Caudal rami: L/W ratio 4.3–5.8, slightly divergent; *serra* extending along most of lateral margin, composed of rather small spinules (Fig. 15A). Anal operculum slightly convex. Lateral seta slightly longer than ramus width. Outermost spiniform seta inserted at some distance from outer middle seta, its outer edge with small denticles, inner edge with fine hairs. Innermost caudal seta plumose, 1.1–1.2 times as long as outermost seta. Dorsal seta subequal to outermost seta.

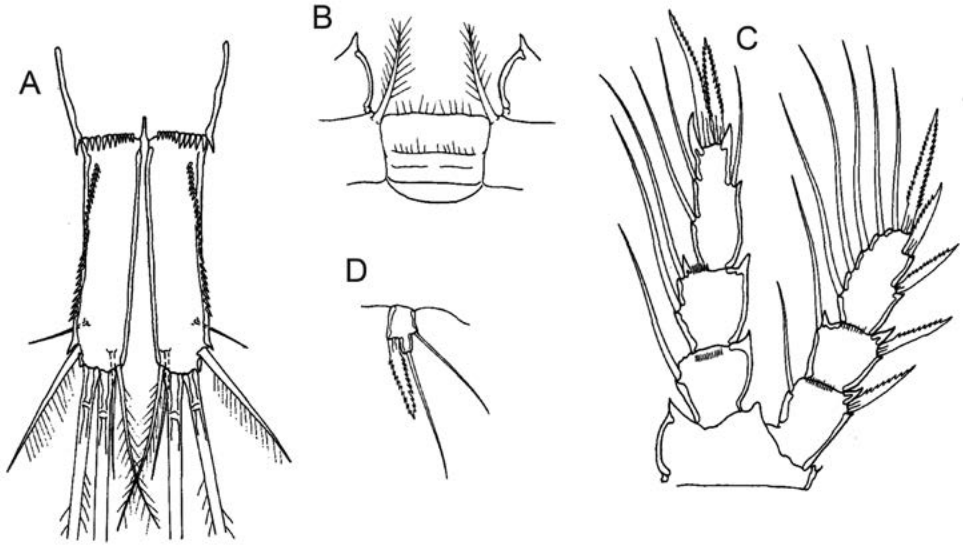


Fig. 15. *Eucyclops* (*Eucyclops*) *australiensis* Morton, 1990. Female: A — caudal rami, ventral; B, C — P4; D — P5. Australia, after Morton [1990].

Рис. 15. *Eucyclops* (*Eucyclops*) *australiensis* Morton, 1990. Самка: A — каудальные ветви, вентрально; B, C — P4; D — P5. (Австралия, по Morton [1990].

Antennule 12-segmented, reaching posterior edge of Th1; without visible hyaline membrane along three distalmost segments. A2 and mouth appendages not described. Swimming legs P1–P4: distal exopodite spine formula not described. In P4, IntCox plate caudal surface with two rows of hair-setulae; coxal spine homogenously plumose (Fig. 15B). In P4 Enp3, L/W ratio 2.4–2.7; inner/outer spine ratio 1.2–1.4; inner spine 1.0–1.2 times as long as segment; distal setae reaching about 3/4 of adjacent spines (Fig. 15C). In P4 Exp3, distal spine long, about 1.1 times as long as segment. In reduced P5, inner spine wide and strong, about 1.7 times as long as segment; approximate length ratio of appendages in type specimens beginning with inner spine: 1.0/ 1.6/ 1.3 (Fig. 15D).

MALE not described.

DISTRIBUTION: Australia (Victoria, New South Wales, Queensland, Tasmania, South Australia, Western Australia, Northern Territory).

COMMENTS: This insufficiently described species clearly differs from two morphologically close congeners: from *E.* (*E.*) *serrulatus* s.lat. by coxal spine in P4 (without a gap in setulae along outer margin) and from *E.* (*E.*) *agiloides* s.lat. by absence (very narrow?) hyaline membrane on distal segments of A1. At the same time, rather short inner spine in P5 that is shorter than the outer seta as well as the structures of P4 possibly means that Morton's taxon is in reality a subspecies of *E.* (*E.*) *agiloides* s.lat. I recently received pictures of an Australian specimen (personal communication from Dr. Kobayashi) that corresponds to Morton's description and may be *E.* (*E.*) *australiensis*. This form, called by Dr. Kobayashi *Eucyclops* sp., has setulae on A2 Bas in position N1, while N2 group is missing; other presented groups are as following: three diagonal rows N3 (3 small spinules), N4 (6 long setulae decreasing laterally), N5 (10 small spinules). In A2, Bas on frontal surface that specimen has following groups: N7, 8, 9, 10, 11, 12, 13, 14, 16. Similar A2 Bas ornamentation can be seen in *E.* (*E.*) *agiloides* s.lat. or in *E.* (*E.*) *borealis* s.lat. For a better delineation, the A2 Bas in specimens from Morton's seria or at least from the type locality should be studied.

Eucyclops* (*Eucyclops*) *bondi s.lat.

Small cyclopids (620–830 μm) with short divergent caudal rami; lateral *serra* of small spinules proximally, which noticeably increasing distally; CR dorsal seta subequal or longer than outermost seta; A1 with smooth hyaline membrane on 3 distal segments; P4 coxal spine with outer side naked or bearing 1–2 distal spinules; P4 IntCox plate with distal row I of rather short spinules. These forms of *Eucyclops* (*Eucyclops*) *bondi* s.lat. are close to *E.*

(*E.*) *prionophorus* in habitus and shape of caudal rami, but they can be distinguished from the last by such characters as the longer dorsal seta of CR. Kiefer [1934] reports also more short inner spine in rudimental P6 of the male *E.* (*E.*) *bondi* (5% of body length vs. 10% in *E.* (*E.*) *prionophorus*) as a particular difference between these two species. *E.* (*E.*) *bondi* s.lat. comprises 2 subspecies, which differ in level of modification of swimming leg distal setae as well as in A1 length. Perhaps these small morphologically close *Eucyclops* from the southern US and Mexico are local populations of one species *E.* (*E.*) *b. bondi*, so hybridization experiments are required.

KEY TO SUBSPECIES OF *EUCYCLOPS* (*EUCYCLOPS*) *BONDI* S.LAT.

1. A1 short, reaching only posterior edge of CTh; in P4, Enp3 distal setae have a normal structure .....*E.* (*E.*) *bondi bondi* Kiefer, 1934 [Americas and Caribbean islands]
–A1 longer, reaching at least posterior edge of Th1; in P4 Enp3, distal setae are modified .. ..*E.* (*E.*) *b. conrowae* Reid, 1992 [Florida, USA]

12. ***Eucyclops*** (***Eucyclops***) ***bondi bondi*** Kiefer, 1934 Fig. 16.

SYNONYMY: *Eucyclops bondi*: Kiefer, 1934; Dussart, Defaye, 2006; Mercado-Salas, Suárez-Morales, 2014a; *Eucyclops* (*Eucyclops*) *bondi*: Alekseev, 2019.

TYPE LOCALITY: lake near Trou Caiman, Haiti.

HOLOTYPE PRESENCE AND STORING: female holotype and male paratype deposited in Kiefer's Reference collection, SMNK, Germany

MATERIAL STUDIED: female holotype #02079, male paratype #02080 deposited in the State Museum of Natural History, Karlsruhe, Germany (Kiefer's Reference collection), 1 female from Florida, USA (Prof. B. Kuperman donation to VA), dissected, #55472, in Federal collection, Zoological Institute, St. Petersburg, Russia; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 16A–E). Body length without caudal setae 720–800 μm. Cephalothorax slightly longer than broad, with maximal width about posterior 1/4. Th4 with lateral hair-setulae. Genital double somite about as long as broad; *receptaculum seminis* typical of genus (Fig. 16B). Caudal rami: L/W ratio about 3.5, slightly divergent; *serra* extending along most of the lateral margin, composed of rather short denticles proximally and much longer denticles distally (Fig. 16C). Outermost seta outer edge with small denticles, inner edge with fine hairs. Innermost seta plumose, about 1.1–1.2 times as long as outermost seta. Dorsal seta about 1.1–1.2 times as long as outermost seta. Lateral seta about as long as ramus width or longer. Distal setae approximate length ratio beginning with outermost one: 1.0/ 4.2/ 9.2/ 1.1–1.2.

Antennule 12-segmented, short, reaching only posterior edge of CTh (Fig. 16A); with very narrow, smooth hyaline membrane along three distalmost segments. A2 and mouth appendages ornamentation not described and not observable on the type specimens slides. Swimming legs P1–4: distal exopodite spine formula 3/4/4/3. P4 spines and setae have a normal structure. P4 IntCox caudal surface with three rows (I, II, III) of setulae, distal row I consists of rather short spinules with a small gap in the middle; coxal spine plumose on inner side and have only few distal denticles on the outer side (or naked outer side) (Fig. 16E). P4 Enp3 L/W ratio about 2.2; inner/outer spine ratio about 1.5; inner spine longer than segment; distal setae reaching about 2/3 of adjacent spines (Fig. 16D). P4 Exp3 distal spine shorter than segment. P5 with strong inner spine, 1.6 times as long as segment; outer seta inserted lower than inner spine; approximate length ratio of appendages in type specimens beginning with inner spine: 1.0/ 1.3/ 1.3.

MALE (Fig. 16F). Body length without caudal setae 580–600 μm. Caudal rami: L/W ratio 2.6, parallel, without lateral *serra*. Rudimental P6 with rather short inner spine not reaching posterior border of following somite; of two setae, middle one subequal in length to inner spine, outer seta noticeably longer than inner spine (Fig. 16F).

DISTRIBUTION: Americas and Caribbean Islands: Colombia, Costa Rica, Cuba, Dominican Republic, Guatemala, Haiti, Mexico (Quintana Roo, Yucatan), Trinidad, USA: Florida (including Everglades National Park).

COMMENTS: Kiefer's taxon can be distinguished from the nearest *E.* (*E.*) *b. conrowae* from Florida by unmodified setae of P4, shorter distal spine of Exp3 and shorter A1.

13. ***Eucyclops*** (***Eucyclops***) ***bondi conrowae*** Reid, 1992, **comb.n**. Fig. 17.

SYNONYMY: *Eucyclops conrowae*: Reid, 1992; Dussart, Defaye, 2006; ?Mercado-Salas, Suárez-Morales, 2014a.

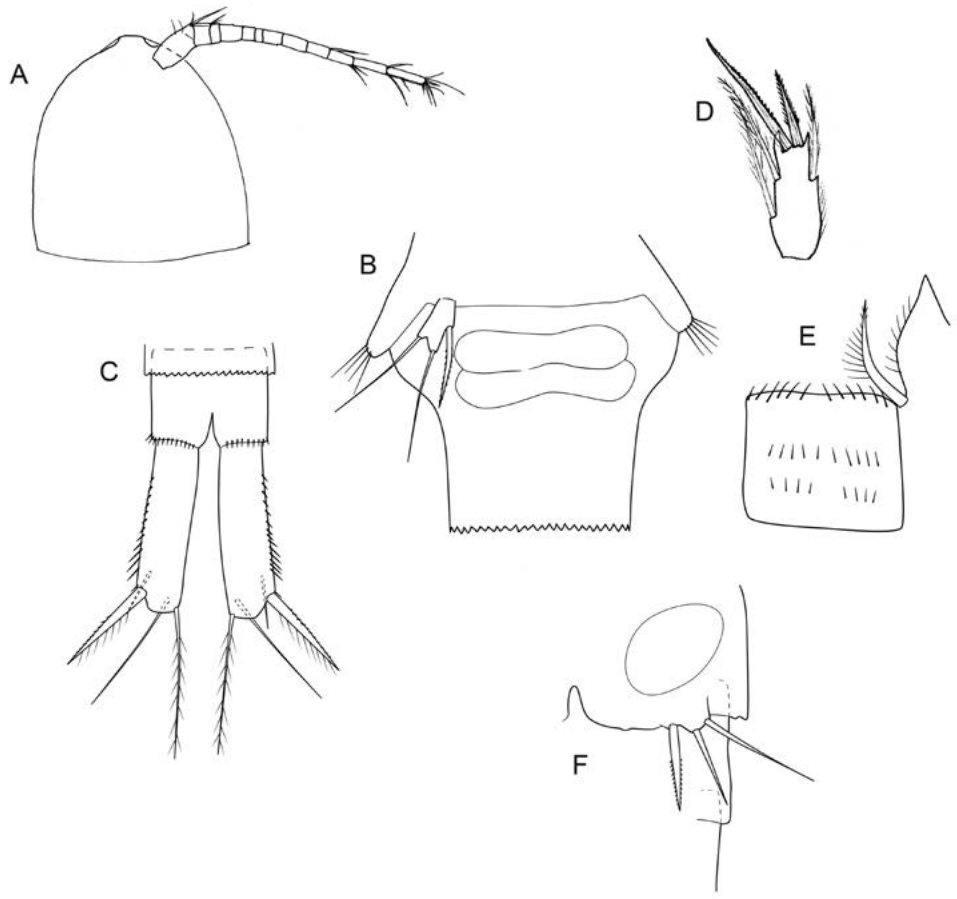


Fig. 16. *Eucyclops* (*Eucyclops*) *bondi bondi* Kiefer, 1934. A — cephalothorax and A1; B — Th4, genital double somite and P5; C — caudal rami, ventral; D — P4 Enp3; E — P4 intercoxal plate, caudal; F — P6. A–E — female; F — male. Trou Caiman, Haiti. A, E — orig., slide #02079 KRC; B, C — after Kiefer [1934]; D, F — drawings of F.Kiefer, after Mercado-Salas & Suárez-Morales [2014a].

Рис. 16. *Eucyclops* (*Eucyclops*) *bondi bondi* Kiefer, 1934. A — цефалоторакс и A1; B — Th4, генитальный сомит и P5; C — каудальные ветви, вентрально; D — P4 Enp3; E — межкоксальная пластинка P4, каудально; F — P6. A–E — самка; F — самец. Тру-Кайман, Гаити. A, E — ориг., преп. #02079 KRC; B, C — по Kiefer [1934]; D, F — рисунки Ф. Кифера, по Mercado-Salas & Suárez-Morales [2014a].

TYPE LOCALITY: Shark River Slough, Everglades, Florida, USA.

HOLOTYPE PRESENCE AND STORING: holotype female and paratypes of 8 females and 2 males, coll. April 1986, deposited in the Smithsonian National Museum of Natural History, Washington, USA; 6 females and 2 males, undissected in ethanol, deposited in the South Florida Research Center, Everglades National Park, Florida, USA.

MATERIAL STUDIED: author's description and drawings, paratype redescription [Mercado-Salas, Suárez-Morales, 2014].

DESCRIPTION. FEMALE (Fig. 17). Body length without caudal setae 630–830 μm. Cephalothorax L/W ratio 1.1, with maximum width about posterior 1/3. Th3 lateral margins finely serrated, without hair-setulae. Th4 with lateral long setulae. Genital double somite slightly longer than broad; *receptaculum seminis* with narrow anterior part

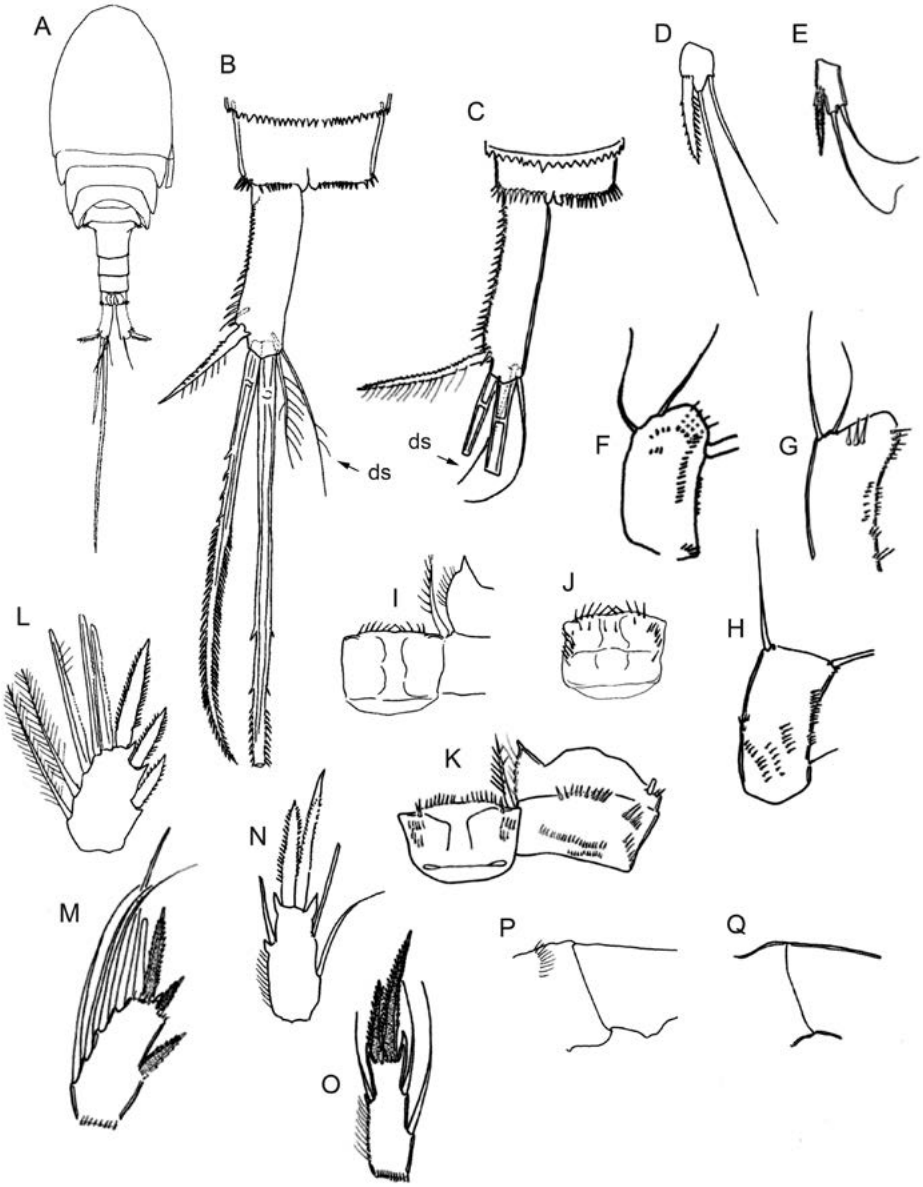


Fig. 17. *Eucyclops* (*Eucyclops*) *bondi conrowae* Reid, 1992. Female: A — habitus; B, C — caudal rami, ventral; D, E — P5; F–H — A2 Bas; I, J — intercoxal plate; K — P4 basipodite, coxa and intercoxal plate, caudal; L, M — P4 Exp3; N, O — P4 Enp3; P, Q — maxilla praecoxa. Florida. A, B, D, F, I, J, L, N, P — after Reid, 1992; C, E, G, H, K, M, O, Q — paratype, after Mercado-Salas & Suárez-Morales [2014a].

Рис. 17. *Eucyclops* (*Eucyclops*) *bondi conrowae* Reid, 1992. Самка: A — габитус; B, C — каудальные ветви, вентрально; D, E — P5; F–H — A2 Bas; I, J — межкоксальная пластинка; K — базиподит, кокса и межкоксальная пластинка P4, каудально; L, M — P4 Exp3; N, O — P4 Enp3; P, Q — прекокса максиллы. Флорида. A, B, D, F, I, J, L, N, P — по Reid, 1992; C, E, G, H, K, M, O, Q — паратип, по Mercado-Salas & Suárez-Morales [2014a].

and twice wider posterior part. Caudal rami: L/W ratio about 3.5, divergent; *serra* extending along most of lateral margin, composed of small denticles noticeably increasing distally (Fig. 17B). Anal operculum weakly convex. Lateral caudal seta shorter than ramus width. Outermost spiniform seta placed near other terminal setae at right angle to ramus in most specimens, slightly bent in some specimens, its outer edge with small spinules, inner edge with fine hairs. Innermost caudal seta plumose, 1.1 times as long as outermost seta in holotype specimen. Dorsal seta weakly plumose, 1.5 times as long as outermost seta. Distal seta length ratio, in holotype specimen, beginning with outermost seta: 1.0/ 3.8/ 8.1/ 1.1.

Antennule 12-segmented, reaching posterior edge of Th1; with smooth narrow hyaline membrane along three distalmost segments. A2 Bas on caudal surface with 4 setulae at position N1 (according to original description by Reid [1992]) (Fig. 17F), but without these setulae in paratype redescription [Mercado-Salas, Suárez-Morales, 2014] (Fig. 17H); frontal surface ornamentation as in Fig.17F according to original description and drawings by Reid [1992], but paratype redescription with different ornamentation (Fig. 17G). Mxl palp surface without row of spinules. Maxilla praecoxa with row of prominent spinules at lateral margin according to original description (Fig. 17P), but without such spinules in paratype redescription (Fig. 17Q). Other mouth appendages as in congeners. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P2, IntCox plate on caudal surface naked. In P3, IntCox plate on caudal surface with 3 rows of slender hair-setulae. In P4, IntCox plate on caudal surface with three rows (I, II, III) of setulae, distal row I of stiff spinules with small gap in middle; coxal spine plumose on inner edge and naked outer one (figured with few distal spinules on outer side in paratype re-description) (Fig. 17I, J, K). P4 Bas with plumose inner outgrowth. P4 Enp3: L/W ratio 2.2; inner/outer spine ratio 1.3 (1.6 in paratype re-description); inner spine/segment ratio 1.25; distal setae modified, plumose but broader than other setae, with blunt tips, reaching 1/3 to 1/2 of adjacent spines (Fig. 17N, O). P4 Exp3: distal spine subequal to segment length (noticeably shorter than segment in paratype re-description), three distal setae modified, without plumage, with "finely crenulate flanges along lateral margins" (Fig. 17L, M). In P5, inner spine wide, "at base about five times breadth" of medial and outer setae, 1.8 times as long as segment (1.3 in paratype re-description); outer seta inserted at same level as inner spine (but lower than inner spine in paratype re-description); approximate length ratio of appendages beginning with inner spine: 1.0/ 2.4/ 1.8 (Fig. 17D, E).

MALE unknown (see comments).

DISTRIBUTION: Florida, USA.

COMMENTS: In many taxonomically important characters (caudal rami and terminal setae proportions, P4 and P5 structure and armament), this taxon resembles *E.* (*E.*) *b. bondi*. The above mentioned differences between Reid's original description and the recent redescription of the paratype suggests that the chosen paratype does not belong to this species. Reported caudal rami proportion of male suggests that the male specimens had been mistakenly selected. CR L/W ratio 5.5–6.0 indicated in the description of the male and shown in the figure is about twice as long as that of the female, although in all cyclopids this ratio slightly less or (in small species) subequal but never higher than in female. Therefore, to avoid confusion, the male description of author is not given here.

Eucyclops (***Eucyclops***) ***borealis*** s.lat.

Medium size cyclopids with female length more than 1 mm. Caudal *serra* usually partly reduced, occupying about 1/2 of ramus length; A2 Bas with group N1+2 presented by 1–3 setulae. Two taxa were found in North Pacific areas of America and in Asia.

Key for subspecies of *Eucyclops* (*Eucyclops*) *borealis* s.lat.

1. In P4 Exp3, distal spine about 0.84 times as long as segment; Exp3 segment with L/W ratio about 2; in P4 Coxa, caudal surface A+C group composed of 12–16 spinules .... *E.* (*E.*) *borealis borealis* Ishida, 2001 [Alaska, USA]
– In P4 Exp3, distal spine about 0.66 times as long as segment; Exp3 segment L/W ratio about 1.6; in P4 Coxa, A+C group composed of 16–20 spinules..... *E.* (*E.*) *b. tsushimensis* Ishida, 2001 [Japan]

14. ***Eucyclops*** (***Eucyclops***) ***borealis borealis*** Ishida, 2001
Fig. 18.

SYNONYMY: *Eucyclops borealis* Ishida, 2001; Dussart, Defaye, 2006.

TYPE LOCALITY: small pond by Wonder Lake, Denali National Park and Preserve, Alaska, USA.

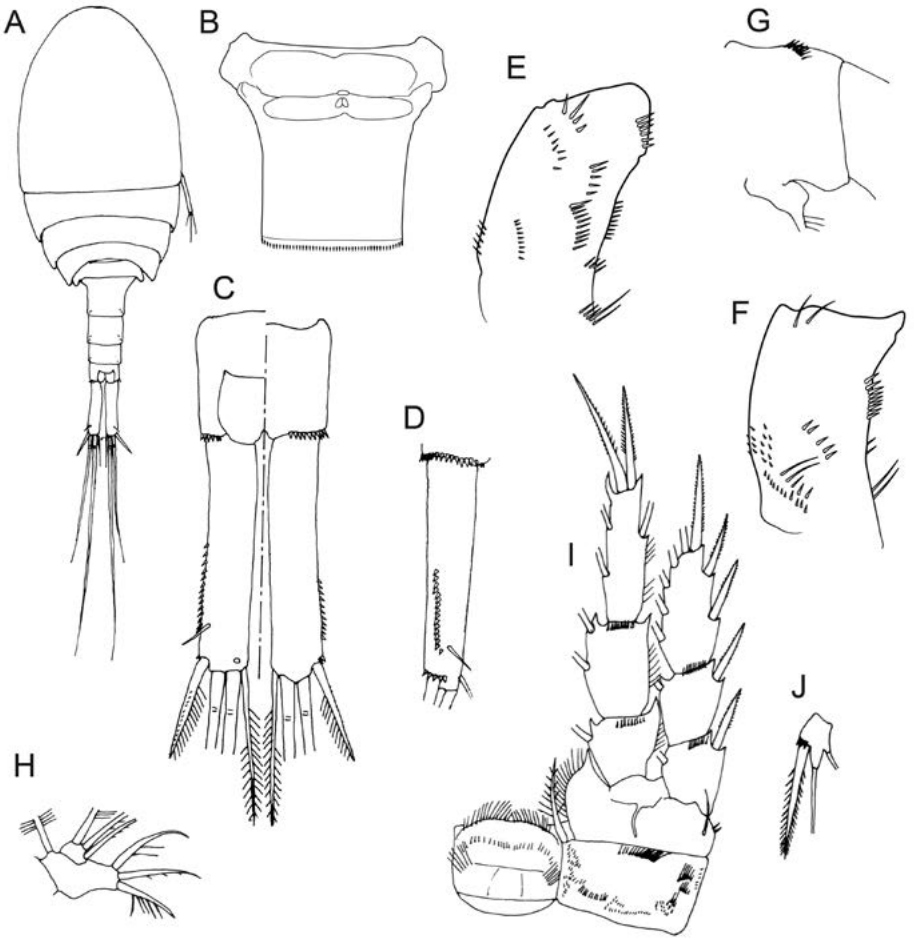


Fig. 18. *Eucyclops* (*Eucyclops*) *borealis* Ishida, 2001. Female: A — habitus; B — genital double somite; C — caudal ramus, dorsal and ventral; D — caudal ramus, lateral; E — A2 Bas, frontal; F — A2 Bas, caudal; G — maxilla praecoxa; H — maxillulary palp; I — P4, caudal; J — P5. Central Alaska, after Ishida [2001].

Рис. 18. *Eucyclops* (*Eucyclops*) *borealis* Ishida, 2001. Самка: A — габитус; B — генитальный сомит; C — каудальная ветвь, дорсально и вентрально; D — каудальная ветвь, латерально; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — прекокса максиллы; H — пальп максиллулы; I — P4, каудально; J — P5. Центральная Аляска, по Ishida [2001].

HOLOTYPE PRESENCE AND STORING: female holotype and paratypes deposited in the National Science Museum (Tokyo, Japan).

MATERIAL STUDIED: female paratype (author's donation to VA), author's description and drawings.

DESCRIPTION. FEMALE (Fig. 18). Body length without caudal setae 1160 (1070–1220) μm. Cephalothorax slightly longer than broad, with maximal width close to posterior margin. Th4 with lateral hair-setulae. Genital double somite as long as broad; *receptaculum seminis* typical of genus (Fig. 18B). Caudal rami: L/W ratio 4.5–5.0, almost parallel; lateral *serra* usually short, along 1/2 and 1/3 of full length in holotype, 2/5–5/8 in paratypes, composed of relatively large spinules (Fig. 18C, D). Anal operculum weakly rounded. Lateral seta shorter than ramus width. Distal caudal setae ap-

proximate length ratio beginning with outermost: 1.0/ 5.1/ 8.7/ 1.4.

Antennule 12-segmented, reaching middle of first free thoracic somite, with smooth hyaline membrane along three distalmost segments. A2 Bas on caudal surface with few short hair-setulae in position N1+2, other groups as in Fig. 18F; frontal surface ornamentation as in Fig. 18E. Mxl palp without surface ornamentation (Fig. 18H). Mx praecoxa with row of prominent spinules (Fig. 18G). Other mouth appendages as in congeners. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 long and slender with L/W ratio about 3; inner/outer spine ratio 1.2 (Fig. 18I). P4 Bas inner outgrowth with long hairs; P4 coxal spine with long hairs on both sides. P4 Coxa A+C group composed of 12–16 spinules, other groups as in Fig. 18I. P4 IntCox plate on caudal surface with three rows of spinules; distal row I of long, strong spinules. Reduced P5 with rather long strong inner spine twice longer than segment (Fig. 18J).

MALE unknown.

DISTRIBUTION: known only from type locality.

COMMENTS: This form seems like originated from *E.* (*E.*) *serrulatus* s.lat. in the Pacific distant part of its ancient area. From other congeners it can be separated by set of characters that includes: body size, long A1, A2 Bas ornamentation, P4 Exp3 and Enp3 armament and proportions.

15. ***Eucyclops*** (***Eucyclops***) ***borealis tsushimensis*** Ishida, 2001 **comb.n**.
Fig. 19.

SYNONYMY: *Eucyclops tsushimensis*: Ishida, 2001; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *serrulatus tsushimensis*: Alekseev, 2019.

TYPE LOCALITY: stream in mountain area, Izuhara, Tsushima, Japan.

HOLOTYPE PRESENCE AND STORING: deposited in the National Science Museum (Tokyo, Japan).

MATERIAL STUDIED: female paratype (author's donation to VA), author's description and drawings.

DESCRIPTION. FEMALE (Fig. 19A–L). Body length without caudal setae about 1050–1140 μm. Cephalothorax slightly longer than broad, with maximal width close to posterior margin. Th4 with lateral hair-setulae. Genital double somite as long as broad; *receptaculum seminis* typical of genus (Fig. 19B). Caudal rami: L/W ratio 4.9–5.2, almost parallel; lateral *serra* usually short, occupying 1/2–4/5 of full ramus length, composed of dense small denticles (Fig. 19C, D). Anal operculum weakly developed. Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.7/ 9.1/ 1.7.

Antennule 12-segmented, reaching distal edge of Th1 (Fig. 19A); with smooth hyaline membrane along three distalmost segments. A2 Bas on caudal surface with few short hair-setulae in position N1+2; other groups of A2 Bas ornamentation as in Fig. 20E, F. Mouth appendages as in *E.* (*E.*) *b. borealis*. Swimming legs P1–P4 similar to *E.* (*E.*) *b. borealis* except shorter P4 Exp3 segment (L/W about 1.6) and shorter distal spine of Exp3 (spine/ segment length ratio about 0.66) (Fig. 19K). In P4, Coxa ornamentation on caudal surface with A+C group composed of 16–20 spinules. In reduced P5, inner spine strong, about 1.5 times as long as segment; approximate length ratio of appendages beginning with inner spine: 1.0/ 1.7/ 0.8 (Fig. 19L).

MALE (Fig. 19M). Body length 820–840 μm. Caudal rami short with L/W ratio 3.6, parallel, without lateral *serra*. Caudal seta structure and proportions basically as in female. A2 Bas with hair-setulae in position N1 (denser than in female). P1–P5: structure and proportions basically as in female. Rudimental P6 armed with inner spine and two setae subequal to spine in length; all appendages not reaching posterior border of following somite (Fig. 19M).

DISTRIBUTION: known from the type locality only.

COMMENTS: Ishida [2001] describes this taxon as close to *E.* (*E.*) *borealis*, similar in size, body shape, A1 and A2 structure, armament and ornamentation, similar mouth parts, swimming legs, and P5 as well, with only few minute differences between them: relative length of P4 Exp3 distal spine, slightly different size of spinules in caudal *serra*, different (but with overlapping variation in the nominative taxon) number of spinules A+C in P4 Coxa. These differences may be partly related to environmental conditions, mountain area in Japan site *versus* lowlands type localities in Alaska. Since both taxa were described in the same paper, so I select *E.* (*E.*) *borealis* as the nominative one and retain *E.* (*E.*) *borealis tsushimensis* for Japanese taxon with a limited, possibly endemic range, as suggested by author [Ishida, 2001].

16. ***Eucyclops*** (***Eucyclops***) ***bryophilus*** Lindberg, 1950 **comb.n**.
Fig. 20.

SYNONYMY: *Eucyclops bryophilus*: Lindberg, 1950; Dussart, Defaye, 2006; *Eucyclops* (*Subterrocyclops*) *bryophilus*: Alekseev, 2019.

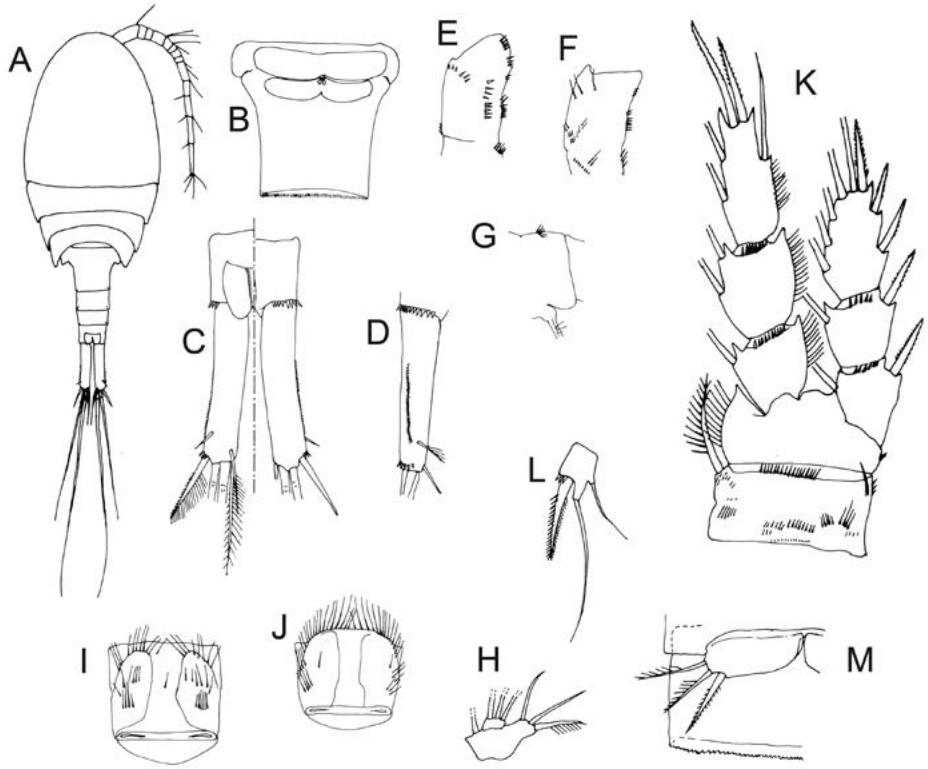


Fig. 19. *Eucyclops* (*Eucyclops*) *borealis tsushimensis* Ishida, 2001. A — habitus; B — genital double somite; C — caudal rami; D — caudal ramus, lateral; E — A2 Bas, frontal; F — A2 Bas, caudal; G — maxilla praecoxa; H — maxillulary palp; I — P3 intercoxal plate, caudal; J — P4 intercoxal plate, caudal; K — P4, caudal; L — P5; M — P6. A–L — female; M — male. Japan. A–G, I–M — after Ishida [2001]; H — after Ishida [2002].

Рис. 19. *Eucyclops* (*Eucyclops*) *borealis tsushimensis* Ishida, 2001. A — габитус; B — генитальный сомит; C — каудальные ветви; D — каудальная ветвь, латерально; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — прекокса максиллы; H — пальп максиллулы; I — межкоксальная пластинка P3, каудально; J — межкоксальная пластинка P4, каудально; K — P4, каудально; L — P5; M — P6. A–L — самка; M — самец. Япония. A–G, I–M — по Ishida [2001]; H — по Ishida [2002].

TYPE LOCALITY: Waterfall Shillon (littoral moth) in mountains, altitude 1500 m a.s.l., India.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 20). Body length without caudal setae 874 µm, live specimens light pink colored. Cephalosome with L/W ratio less than 1. Th4 with lateral setulae. Genital double somite shorter than broad, L/W ratio 0.9 (Fig. 20B); *receptaculum seminis* typical for genus. Abdominal somites serrated ventrally. Anal somite shorter than previous one; anal operculum weakly convex. Caudal rami parallel; L/W ratio 2.8; with rather developed *serra* of about 12 spinules increasing distally; bending to ventral surface proximally (Fig. 20C, D). Lateral seta not longer than ramus width. Outermost spiniform seta: outer edge with short setulae, inner edge with fine hairs, about 0.6 times as long as ramus length. Innermost seta plumose, about 1.8 times as long as outermost seta; about 1.1 times as long as ramus length. Dorsal seta shorter than outermost seta.

Antennule 12-segmented, rather short, just reaching distal edge of CTh; 3 distal segments without visible hyaline membrane (Fig. 20E). Antenna and mouth appendages not studied.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with

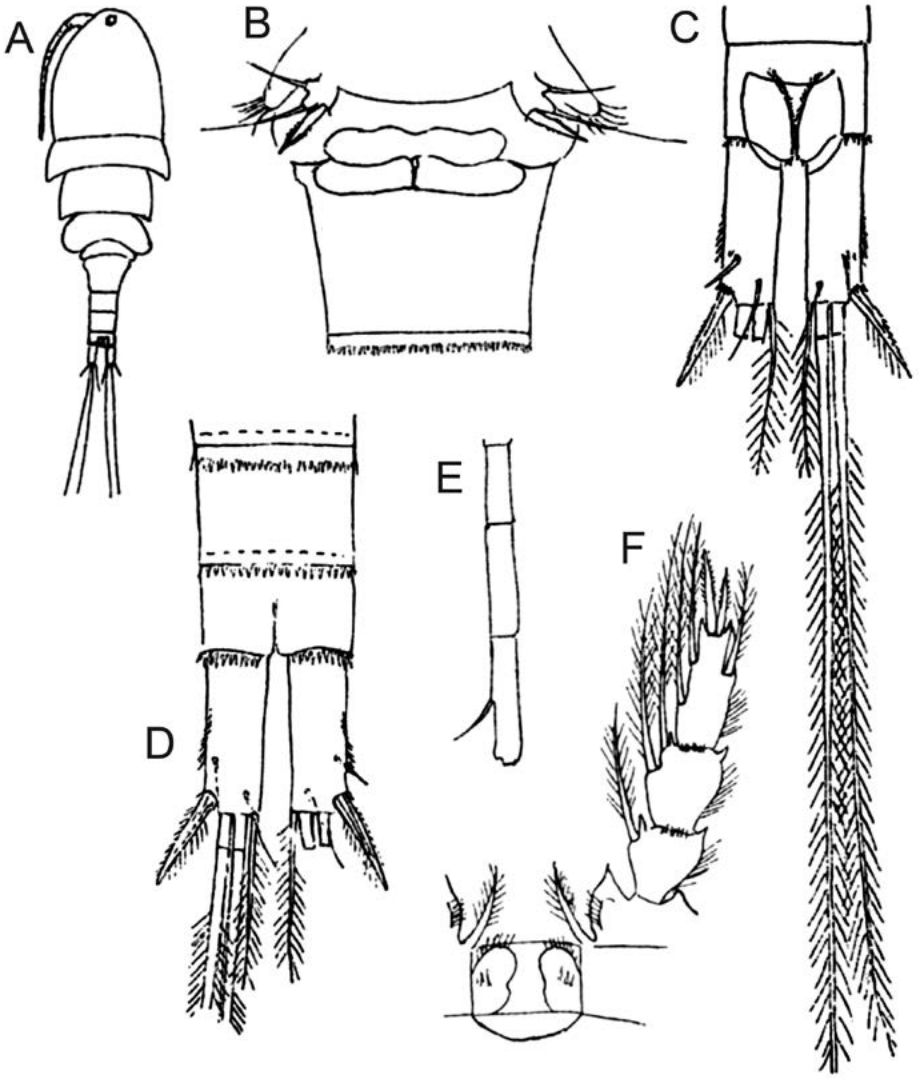


Fig. 20. *Eucyclops* (*Eucyclops*) *bryophilus* Lindberg, 1950. Female: A — habitus; B — Th4, genital double somite and P5; C — caudal rami, dorsal; D — caudal rami, ventral; E — A1, three distal segments; F — P4. Northeastern India, after Lindberg [1950].

Рис. 20. *Eucyclops* (*Eucyclops*) *bryophilus* Lindberg, 1950. Самка: A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви, дорсально; D — каудальные ветви, вентрально; E — A1, три дистальных членика; F — P4. Северо-Восточная Индия, по Lindberg [1950].

two rows (I, II) of setulae with gap in middle (Fig. 20F); Bas inner outgrowth with hairs. P4 Enp3 L/W ratio about 2 (longer in drawing); with rather short distal spines; inner/outer spine ratio 1.2; inner spine 0.8 times as long as segment; distal setae long practically reaching tips of nearest spines (Fig. 20F). Reduced P5 (Fig. 20B): segment longer than wide; inner spine strong, about 1.5 times as long as segment; outer seta about as long as inner spine; medial seta about 1.6 times as long as inner spine.

MALE unknown.

DISTRIBUTION: known from the type locality only in India.

COMMENTS: Short caudal rami along with rather developed lateral *serra*, long distal setae in P4 Enp3, long innermost and inner median caudal setae allow to distinguish this not sufficiently described species from all congeners. Elongated distal setae on P4Enp3 reaching tips of nearest spines place this form as close to *Eucyclops* (*Subterrocyclops*) subgenus. Redescription based on more number of individuals is required.

***Eucyclops* (*Eucyclops*) *chilensis* s.lat.

Cyclopids of medium size with a female body length of 818–1130 μm. Caudal rami with L/W ratio = 3.1–4.1, with well-developed lateral *serra*; dorsal seta subequal or shorter than outermost seta; innermost/outermost setae ratio 1.1. A1 short, barely reaching Th1 or even shorter. In A2 Bas, caudal ornamentation with groups N1 (5–9 hairs) and N2 (3–5 short spinules), as in most American species of *serrulatus*-group. Reduced P5 with relatively short spine and 2 long subequal setae that are 2–3 times longer than the spine. Includes 2 subspecies, geographically well separated each from other: *E.* (*E.*) *c. chilensis* Löffler, 1961 (Pacific coast, Chile, South America) and *E.* (*E.*) *c. cuatrocienegas* Suarez-Morales et Walsh, 2009 comb.n. [Mexico].

KEY TO SUBSPECIES OF *EUCYCLOPS* (*EUCYCLOPS*) *CHILENSIS* S.LAT.

1. P5 inner spine about twice (1.7–2.1) shorter than middle seta, about 1.5 times as long as the segment; caudal outermost seta/ramus length ratio about 0.8; P4 IntCox plate with long hair-setulae at free margin .... *E.* (*E.*) *chilensis chilensis* Löffler, 1961 [Pacific coast, Chili, South America]
– P5 inner spine more than two times (2.2–3.0) shorter than middle seta, about 1.0–1.3 times as long as the segment; caudal outermost seta/ramus length ratio about 0.5–0.6; P4 IntCox plate with short spinules at free margin..... ... *E.* (*E.*) *c. cuatrocienegas* Suarez-Morales et Walsh, 2009 comb.n. [Mexico].

17. ***Eucyclops* (*Eucyclops*) *chilensis chilensis*** Löffler, 1961
Fig. 21.

SYNONYMY: *Eucyclops serrulatus* var. *chilensis*: Löffler, 1961; *Eucyclops chilensis*: Menu-Marque, Locascio de Mitrovich, 2011; *Eucyclops* (*Eucyclops*) *chilensis*: Alekseev, 2019.

TYPE LOCALITY: Lake Villarica, Llanquihue, Puyehue, Chile, South America.

HOLOTYPE PRESENCE AND STORING: female holotype deposited in the Naturhistorisches Museum of Vienna, not found yet.

MATERIAL STUDIED: descriptions and drawings of Löffler [1961], Suarez-Morales & Walsh [2009], Menu-Marque & Locascio de Mitrovich [2011].

DESCRIPTION. FEMALE (Fig. 21). Body length without caudal setae 960–1130 μm. Th4 with lateral hair-setulae. Genital double somite and *receptaculum seminis* shape not described. Caudal rami: L/W ratio 3.7–4.1 (3.1–4.1 in specimens from Argentina), *serra* extending along most of lateral margin, composed of well-developed spinules almost not increasing in length distally (Fig. 21A, B). Outermost seta on outer edge with small spinules, inner edge with short hairs. Innermost seta plumose, about as long as outermost seta or slightly longer. Dorsal seta about 0.7–0.9 times as long as outermost seta. Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.2–4.8/ 6.8–8.1/1.0–1.4 (1.0/ 3.7/ 6.1/ 1.2 in specimens from Argentina).

Antennule 12-segmented (reaching posterior edge of Th1 in specimens from Argentina), with smooth or finely serrated hyaline membrane along three distalmost segments. A2 Bas on caudal surface with N1 (about 9 hairs) and N2 (about 3 short setulae) groups in specimens from Argentina (Menu-Marque, Locascio de Mitrovich [2011]) (Fig. 21G). Other ornamentation as in Fig.21F, G. Maxilla praecoxa with row of prominent spinules at lateral margin and patches of small spines on both sides in specimens from Argentina. Mxl palp with surface without denticles in specimens from Argentina. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4, IntCox plate on caudal surface with long hairs (row I); coxal spine on inner margin with long setulae proximally and shorter setulae distally, outer margin with gap in setulation (Fig. 21J, K). In P4 Enp3, L/W ratio about 2.2; inner/outer spine ratio 1.3–1.4; inner spine longer than segment; distal setae reaching 1/2 of adjacent spines (Fig. 21H, I). Reduced P5 with strong inner spine, 1.5–1.6 times as long as segment, and two long setae; approximate length ratio of appendages in Chilean specimens beginning with inner spine: 1.0/ 1.7–2.1/ 1.8–2.3; and 1.0/ 1.7/ 1.5 in specimens from Argentina (Fig. 21C, D).

MALE not described.

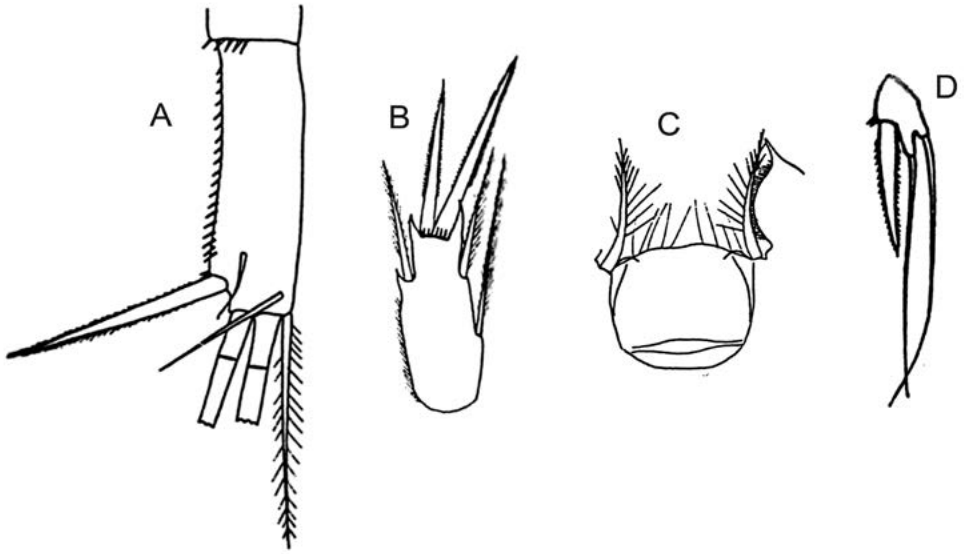


Fig. 21. *Eucyclops* (*Eucyclops*) *chilensis chilensis* Löffler, 1961. Female: A — caudal ramus; B — P4 Enp3; C — P4 intercoxal plate; D — P5. Chile, Lago Llanquihe, after Löffler [1961].

Рис. 21. *Eucyclops* (*Eucyclops*) *chilensis chilensis* Löffler, 1961. Самка: A — каудальная ветвь; B — P4 Enp3; C — межкоксальная пластинка P4; D — P5. Чили, озеро Льянкиуэ, по Löffler [1961].

DISTRIBUTION: coastal waterbodies in Chile, Argentina, South America.

COMMENTS: Löffler [1961] assigns this taxon to *E.* (*E.*) *serrulatus* s.lat. on the basis of general structure, but separates it from the nominal species on the basis of the unusual length ratio of the P5 appendages. Redescription of this species by Menu-Marque & Locascio de Mitrovich [2011] was carried out on specimens collected from another country (Argentina) and has some differences from the type specimens of Löffler.

18. ***Eucyclops* (*Eucyclops*) *chilensis cuatrocienegas*** Suarez-Morales et Walsh, 2009 **comb.n**.

Fig. 22.

SYNONYMY: *Eucyclops cuatrocienegas*: Suarez-Morales, Walsh, 2009; Mercado-Salas *et al*., 2016; *Eucyclops* (*Eucyclops*) *cuatrocienegas*: Alekseev, 2019.

TYPE LOCALITY: pond in Cuatro Ciénegas, Mexico (26º55.887′N; 102º07.482′W).

HOLOTYPE PRESENCE AND STORING: holotype female and paratypes — 5 females and 1 males, coll. 7 July 2006, deposited in the Collection of Zooplankton of El Colegio de la Frontera Sur (ECO-CHZ), in Chetumal, Mexico.

MATERIAL STUDIED: author's description and drawings; redescription of Mercado-Salas et al., 2016.

DESCRIPTION. FEMALE (Fig. 22). Body length without caudal setae about 818 μm. Th4 with dense long lateral hair-setulae. Genital double somite and *receptaculum seminis* typical of genus. Caudal rami: L/W ratio 3.1–3.7, *serra* extending along most of the lateral margin, composed of well-developed spinules increasing in size distally (Fig. 22B, C). Outermost spiniform seta 0.5–0.6 times as long as caudal ramus. Innermost seta about 1.3 times as long as outermost seta. Dorsal seta shorter than outermost seta. Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.0–4.5/ 9.0–10.0/1.3.

Antennule 12-segmented, reaching posterior edge of CTh, with smooth or finely serrated hyaline membrane along three distalmost segments (Fig. 22I). Setation of antennular segments, beginning with first: 8/3/2/5/2/3/2/3/2/2/2/7+I (seta — arabic; aesthetasc — roman); (8/4/2/6/4/2/2/3/2+I/2/3/7+I according to Mercado-Salas *et al*. [2016]). A2 Enp setation: 1, 8, 7 (1, 9, 7 after Mercado-Salas *et al*. [2016]). A2 Bas on caudal surface with long setulae at position N1, short spinules at N2 (after Mercado-Salas *et al*. [2016]), other groups as in

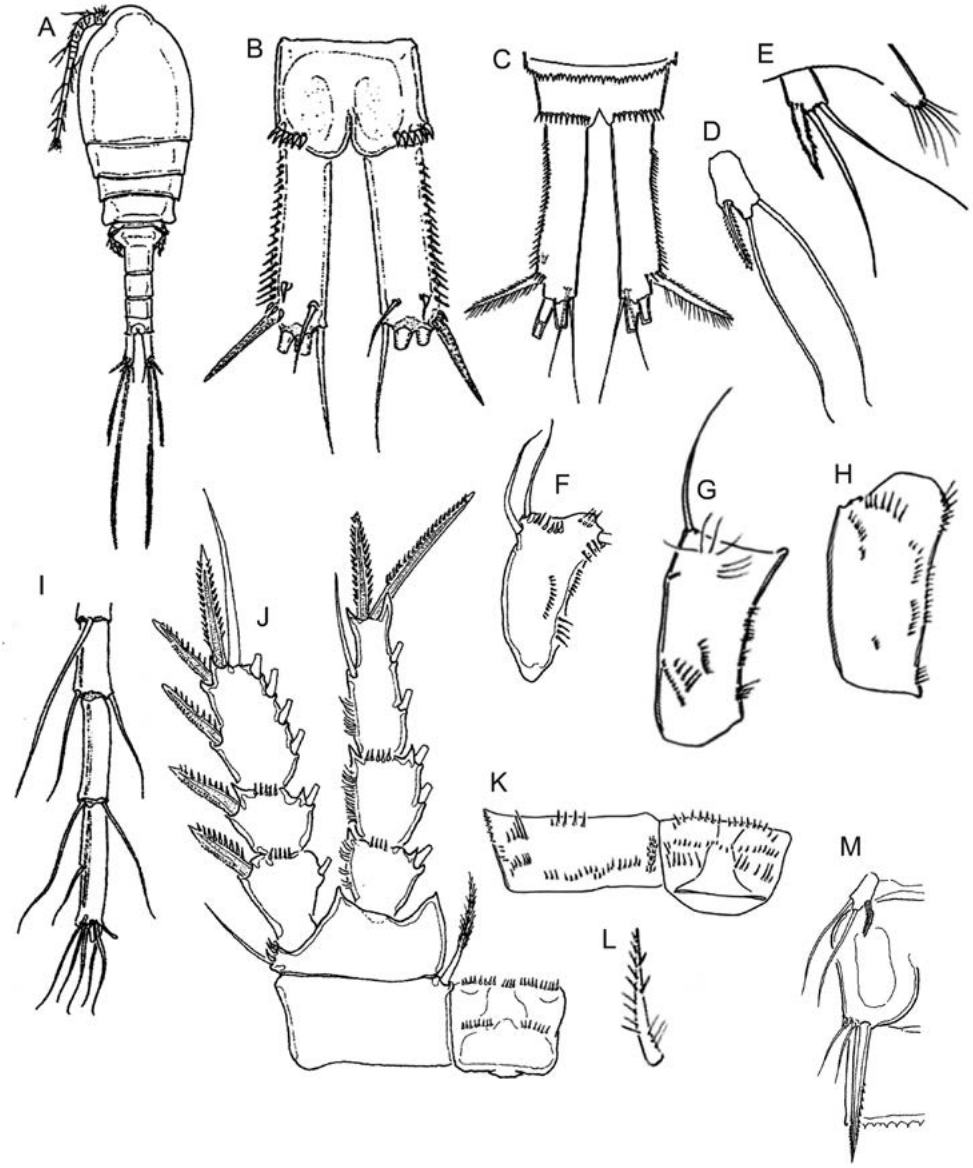


Fig. 22. *Eucyclops* (*Eucyclops*) *chilensis cuatrocienegas* Suarez-Morales et Walsh, 2009 comb.n. A — habitus; B, C — caudal rami; D, E — P5; F–H — A2 Bas; I — A1, three distal segments; J — P4; K — P4 coxa and intercoxal plate; L — P4 coxal spine; M — P5 and P6. A–L — female; M — male. Mexico. A, B, D, F, I, J, M — after Suarez-Morales & Walsh [2009]; C, E, G, H, K, L — after Mercado-Salas *et al*. [2016].

Рис. 22. *Eucyclops* (*Eucyclops*) *chilensis cuatrocienegas* Suarez-Morales et Walsh, 2009 comb.n. A — габитус; B, C — каудальные ветви; D, E — P5; F–H — A2 Bas; I — A1, три дистальных членика; J — P4; K — кокса и межкоксальная пластинка P4; L — коксальный шип P4; M — P5 и P6. A–L — самка; M — самец. Мексика. A, B, D, F, I, J, M — по Suarez-Morales & Walsh [2009]; C, E, G, H, K, L — по Mercado-Salas *et al*. [2016].

Fig. 22G; frontal surface ornamentation as in Fig. 22F, H. Mxl palp surface naked. Maxilla praecoxa without row of spinules at lateral margin. Other mouth appendages as in congeners.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P1 IntCox plate on frontal surface with bent rows of spinules at each side and distal row of short spinules between rounded projections on free edge; according to Mercado-Salas *et al*. [2016], frontal surface with only curved rows of spinules at each side and caudal surface smooth. In P2 IntCox plate on caudal surface with one middle row of tiny spinules; according to Mercado-Salas *et al*. [2016], frontal surface with curved rows of spinules at each side. P3 IntCox plate with two rows of tiny spinules; after Mercado-Salas *et al*. [2016], frontal surface with semi-circular rows of spinules at each side and caudal surface with three rows of spinules, proximal row with longest spinules. P4 IntCox plate with two rows of spinules (Fig. 22J); after Mercado-Salas *et al*. [2016], frontal surface with semi-circular rows of tiny spinules at each side and caudal surface with three rows of spinules, proximal row with longest spinules (Fig. 22K). P1–P4 Bas inner outgrowth with long hairs. According to Mercado-Salas *et al*. [2016], P4 inner coxal spine heterogeneously plumose, proximal inner margin with long hairs, distal margin with spinules; outer margin with few spinules distally, few hairs proximally, and short gap in the middle (Fig. 22L). P4 Coxa ornamentation as in Fig. 22K. P4 Enp3 L/W ratio 2.6; inner/outer spine ratio 1.4–1.5; inner spine 1.1–1.3 times as long as segment; distal setae modified, reaching 1/2 of adjacent spines. P4 Exp3 distal spine about as long as segment. In reduced P5, segment L/W ratio 1.7–2.2; with slightly bent inner spine about as long as segment; middle and outer setae subequal, about 3 times longer than inner spine (2.1 after Mercado-Salas *et al*. [2016]) (Fig. 22D, E).

MALE (Fig. 22M). Body length without caudal setae 680 µm. Caudal rami: L/W ratio 2.8, parallel, without lateral *serra*. Rudimental P6 with two short subequal setae and long strong inner spine about twice longer than setae (Fig. 22M).

DISTRIBUTION: known from the type locality only.

COMMENTS: *E* (*E.*) *c. cuatrocienegas* was recognized as a new species by Suarez-Morales & Walsh [2009] based on the feature of its fifth leg, which, unlike most of its American congeners, has a very short inner spine and two long, setae. These characters as well as most others correspond to *E.* (*E.*) *chilensis* s.lat. according to Löffler. Some difference in length of inner spine in P5 with nominative form allows this taxon to be retained as geographically distant subspecies. At the same time, significant morphological variation in the type population of this form shown by Mercado-Salas *et al*. [2016], possibly means that *E.* (*E.*) *chilensis* s.lat. is a variable form such as *E.* (*E.*) *serrulatus* s.lat.

19. ***Eucyclops* (*Eucyclops*) *defectus***
Lindberg, 1937
Fig. 23.

SYNONYMY: *Eucyclops defectus*: Lindberg, 1937; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *defectus*: Alekseev, 2019.

TYPE LOCALITY: pond in Pachmarhi, Central India.

HOLOTYPE PRESENCE AND STORING: 1 female was collected in January 1936 by George Daniel was used as holotype, but it was not found yet.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 23). Body length without caudal setae 960 µm. Th4 with lateral hair-setulae. *Receptaculum seminis* not observed. Caudal rami: L/W ratio about 4.5, almost parallel; lateral *serra* significantly reduced with only 2–3 large spinules above lateral seta (Fig. 23A). Outermost spiniform seta on outer and inner edges with short setulae. Innermost caudal seta plumose, about 1.7 times as long as outermost seta. Dorsal seta long 1.2 times as long as outermost seta. Lateral seta longer than ramus width. Caudal terminal setae length ratio beginning with outermost: 1.0/ 5.3/ 8.7/ 1.7.

Antennule 12-segmented, slightly exceeding distal margin of CTh; with very thin or absent hyaline membrane. A2 and mouth appendages not described. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4, spines and setae of normal structure. P4 Enp3: L/W ratio 2.2; inner/outer spine ratio 1.4; inner spine shorter than segment (0.9: 1); distal setae reaching from 2/3 to 5/6 of adjacent spines (Fig. 23C). Reduced P5 with strong inner spine, about 1.3 times as long as segment; outer seta inserted at same level as inner spine; length ratio of appendages beginning with inner spine: 1.0/ 2.0/ 1.1 (Fig. 23B).

MALE unknown.

DISTRIBUTION: known only from the type locality in Pachmarhi, Central India.

COMMENTS: This form was briefly described on the single individual (female) and

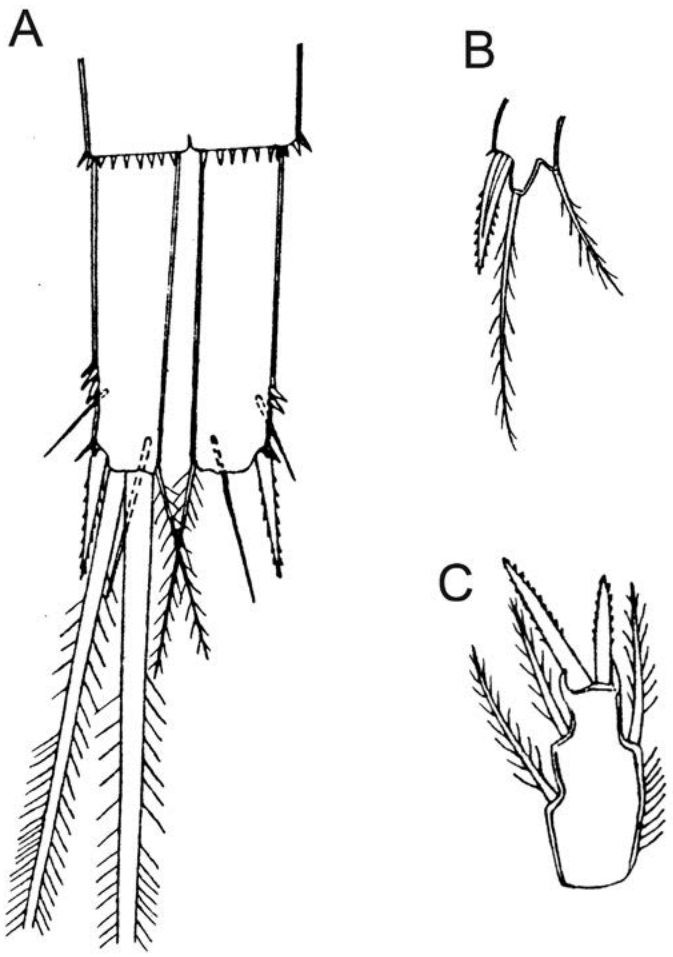


Fig. 23. *Eucyclops* (*Eucyclops*) *defectus* Lindberg, 1937. Female: A — caudal rami; B — P5; C — P4 Enp3. India, after Lindberg [1937].

Рис. 23. *Eucyclops* (*Eucyclops*) *defectus* Lindberg, 1937. Самка: A — каудальные ветви; B — P5; C — P4 Enp3. Индия, по Lindberg [1937].

never reported again. It is clearly distinguishable meanwhile by strong reduction of lateral caudal *serra* presented by 2–3 large size denticles combined with P5 strong inner spine, about 1.3 times as long as segment and shorter than outer seta. Redescription is necessary.

20. ***Eucyclops* (*Eucyclops*) *delachauxi*** (Kiefer, 1925) **comb.n.**
Fig. 24.

SYNONYMY: *Cyclops delachauxi*: Kiefer, 1925, 1926c; *Eucyclops delachauxi*: Dussart, Defaye, 2006; Mercado-Salas, Suárez-Morales, 2014a; *Eucyclops* (*Subterrocyclops*) *delachauxi*: Alekseev, 2019.

TYPE LOCALITY: caves in Peru, South America.

HOLOTYPE PRESENCE AND STORING: female holotype and 6 paratypes in Kiefer's Reference collection, SMNK, Germany (holotype in bad state).

MATERIAL STUDIED: female holotype #00248 and 6 paratypes (3 females and 3 males) #00249-00254 specimens, author's description and drawings.

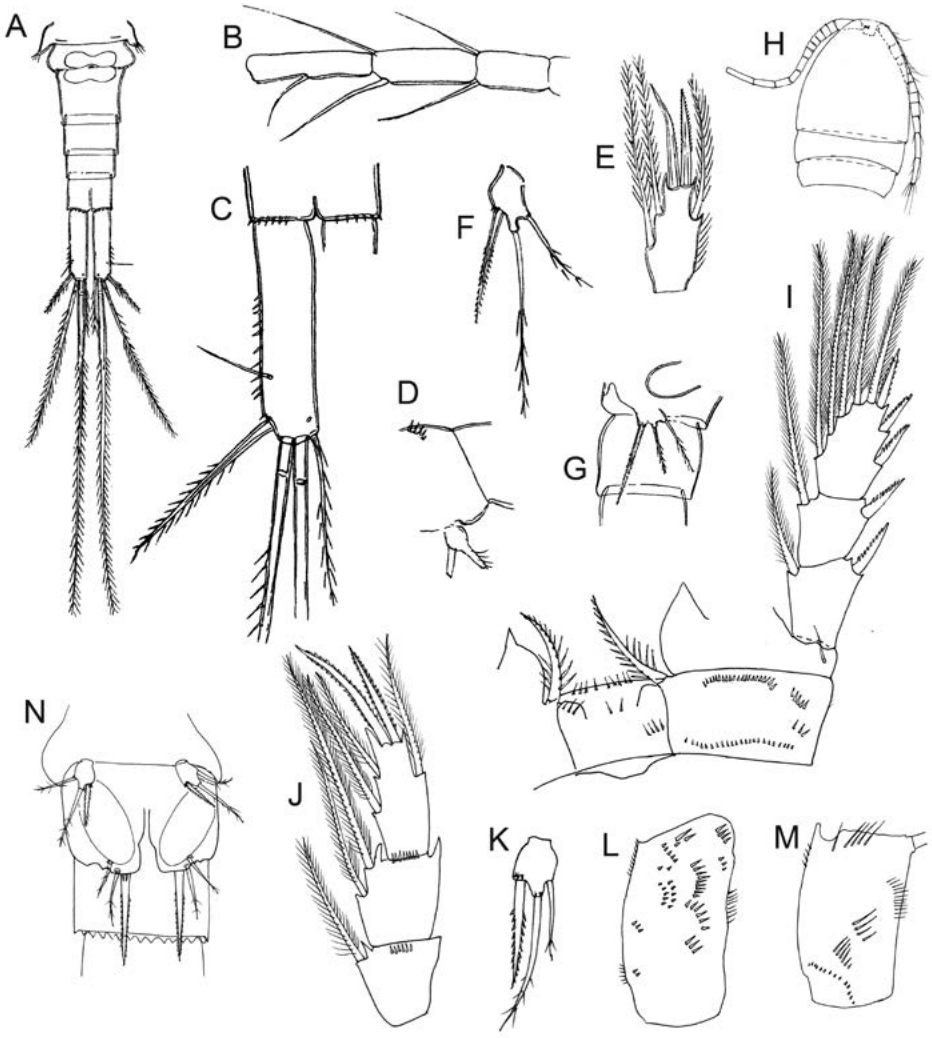


Fig. 24. *Eucyclops* (*Eucyclops*) *delachauxi* (Kiefer, 1925) comb.n. A — abdomen; B — A1, three distal segments; C — caudal ramus; D — maxilla praecoxa; E — P4 Enp3; F, K — P5; G — P6; H — A1 and cephalothorax; I — P4, caudal; J — P4 Enp; L — A2 Bas, frontal; M — A2 Bas, caudal; N — P5 and P6. A–F, H–M — female; G, N — male. Peru. A–G — after Kiefer [1926c]; H–N — orig., slides #00248, 00249, 00251, 00252 KRC.

Рис. 24. *Eucyclops* (*Eucyclops*) *delachauxi* (Kiefer, 1925) comb.n. A — абдомен; B — A1, три дистальных членика; C — каудальная ветвь; D — прекокса максиллы; E — P4 Enp3; F, K — P5; G — P6; H — A1 и цефалоторакс; I — P4, каудально; J — P4 Enp; L — A2 Bas, фронтально; M — A2 Bas, каудально; N — P5 и P6. A–F, H–M — самка; G, N — самец. Перу. A–G — по Kiefer [1926c]; H–N — ориг., преп. #00248, 00249, 00251, 00252 KRC.

DESCRIPTION. FEMALE (Fig. 24). Body length without caudal setae about 950 µm. Th4 with lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical of genus. Anal somite slightly longer than previous one. Caudal rami parallel (Fig. 24A, C), L/W ratio 4.2–5.0; with reduced lateral *serra*, produced by rarely spaced almost equal spinules (about 10); lateral seta about 1.5 times longer than ramus width. Outermost seta spiniform, thin and long,

with long setulae on outer and inner sides, about 0.8 times as long as ramus length. Innermost seta plumose, about 0.8 times as long as ramus length and about 0.9–1.0 times as long as outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.0/ 7.0/ 0.9–1.0.

Antennule 12-segmented, rather long, reaching beyond posterior margin of Th1 (Fig. 24H); 3 distal segments with narrow smooth hyaline membrane. A2 Bas ornamentation: caudal side with few long setulae N1 and short spinules at N2, other groups as in Fig. 24M; frontal side as shown in Fig. 24L. Mouth appendages typical for subgenus. Maxilla praecoxa with row of spinules at lateral margin (Fig. 24D).

Swimming legs P1–P4: distal exopodite spine formula: 3/4/4/3. P4 IntCox distal margin with short setulae; coxal spine with long setulae proximally, inner side with shorter spinules distally, outer side naked distally (Fig. 24I). P4 Enp3 about 2.2 times longer than broad; inner/outer spine ratio 1.1–1.2; inner spine about as long as segment; distal setae long, reaching or almost reaching tips of nearest spines. P4 Exp3 distal spine shorter than segment. Reduced P5 (Fig. 72D, E) armed with rather weak but long inner spine and two setae; outer seta inserted more distally than inner spine; approximate length ratio beginning with spine: 1.0/ 1.6 /0.8.

MALE (Fig. 24G, N). More short and slender than female, Th4 hairless laterally. Caudal rami parallel and short: L/W ratio less than 4, terminal seta ratio as in female. Antennule 14-segmented. Antennal basipodite ornamentation and oral appendages not examined. P1–P5 similar to female. Rudimentary P6 (see Fig. 24G, N) with long inner spine, reaching beyond posterior margin of next somite, and two shorter setae.

DISTRIBUTION: underground water of Peru, South America.

COMMENTS: Author describing this form in his first words mentions that it is the form of *E. serrulatus*. At that time it was a very broad definition for so named "cosmopolitan" *Eucyclops serrulatus*-like species, with well-developed lateral *serra* along caudal rami. Kiefer [1925] suggests to split this cosmopolitan *serrulatus*-like species into a set of taxa and *E.* (*E.*) *delachauxi* becomes one of those. This species in several important characters is really close to *serrulatus*-like species that includes: 12-segmented antennule of moderate length with smooth hyaline membrane on distal segments, body length about 1mm, antennal basipodite ornamentation on caudal surface with the same "key" groups of setulae in position N1 (hairs), P4 coxal spine on both sides armed with strong spinules having a gap among them on outer edge.

21. ***Eucyclops* (*Eucyclops*) *demacedoi***
Lindberg, 1957
Fig. 25.

SYNONYMY: *Eucyclops de-macedoi* Lindberg, 1957a; *Eucyclops* (*Eucyclops*) *demacedoi*: Alekseev, 2019.

TYPE LOCALITY: Lake Huampucocha, altitude 4700 m a.s.l., Peru, South America.

HOLOTYPE PRESENCE AND STORING: not found/existing.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 25A–D). Body length without caudal setae 1092–1254 μm. Th4 with lateral setulae. Genital double somite: L/W ratio about 1; *receptaculum seminis* typical of genus (Fig. 25B). Anal operculum weakly developed, convex. Caudal rami slightly divergent and relatively long with L/W ratio 5.0–5.7; lateral *serra* relatively long, produced by 11–18 spinules, with distal 4–6 spinules longer than proximal, in some specimens these longer spinules separated from proximal part with gap (Fig. 25A). Lateral seta long and thin, 1.7–2.2 times longer than ramus width. Dorsal seta slightly shorter than outermost seta. Outermost seta long and slender, curved, its outer edge with small spinules, inner edge with hairs; about 0.7 times as long as caudal ramus length. Innermost caudal seta plumose, about as long as outermost seta. Distal setae length ratio beginning with outermost: 1.0/ 3.1–3.3/ 5.2–5.6/ 0.9–1.0.

Antennule 12-segmented, reaching distal edge of CTh or Th1; with narrow smooth hyaline membrane along three distalmost segments. Antenna and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4Enp3 L/W ratio 2.1–2.3; inner/outer spine ratio 1.2–1.4; inner spine 1.3 times as long as segment; outer seta reaching tip of outer spine. Reduced P5 (Fig. 25B): segment about as long as broad; inner spine rather strong, about 1.5 times as long as segment; appendages length ratio beginning with spine: 1.0/1.4–1.8/0.8–1.0.

MALE (Fig. 25E). Body length without caudal setae 960–1054 μm. Body more slender than in female. Th4 hairless laterally. Caudal rami parallel, lateral *serra* absent; L/W ratio 3.8–4.2; lateral seta as long as in female; innermost seta relatively longer than in female, 1.1–1.2 times longer than outermost seta. Antennule 14-segmented. P1–P5 as

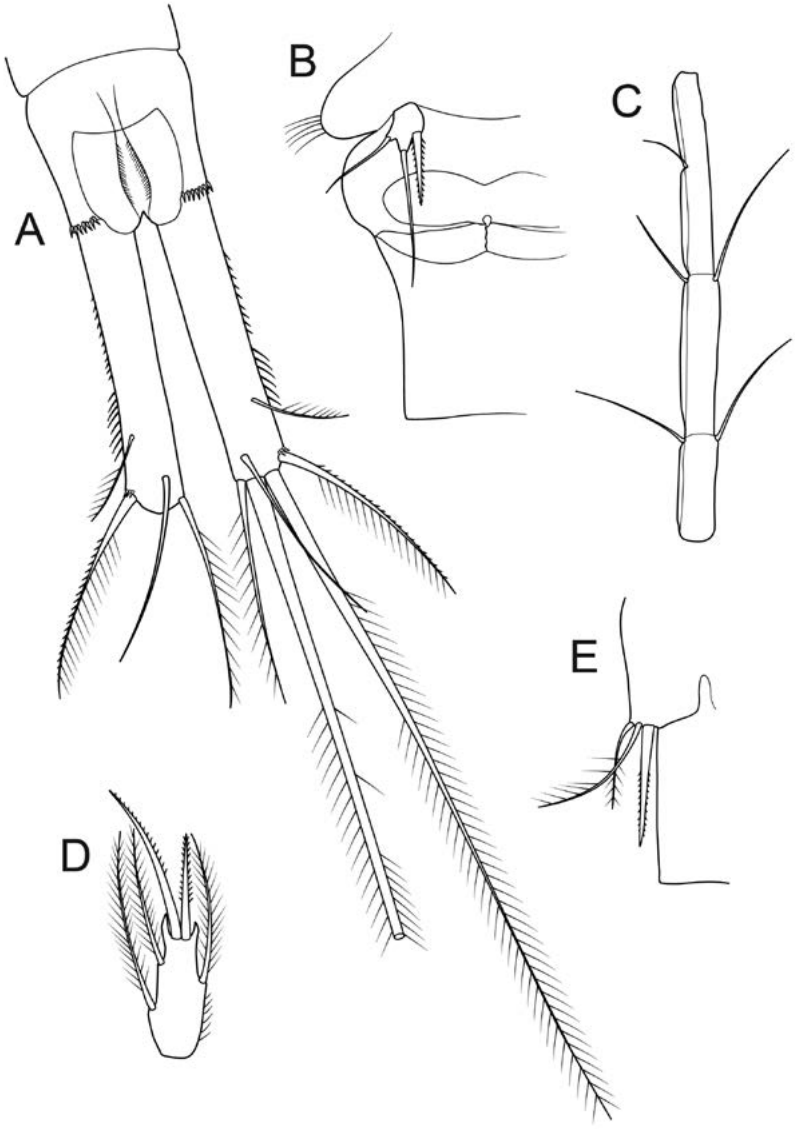


Fig. 25. *Eucyclops* (*Eucyclops*) *demacedoi* Lindberg, 1957. A — caudal rami, dorsal; B — Th4, genital double somite and P5; C — A1, three distal segments; D — P4 Enp3; E — P6. A–D — female; E — male. Andes of Peru, after Lindberg [1957a].

Рис. 25. *Eucyclops* (*Eucyclops*) *demacedoi* Lindberg, 1957. A — каудальные ветви, дорсально; B — Th4, генитальный сомит и P5; C — A1, три дистальных членика; D — P4 Enp3; E — P6. A–D — самка; E — самец. Анды Перу, по Lindberg [1957a].

in female. Rudimentary P6 (see Fig. 25E): armed with strong inner spine not reaching posterior margin of next somite; appendages length ratio beginning with spine: 1.0/1.0/0.6–0.8.

DISTRIBUTION: South America: Peru, Colombia (?).

COMMENTS: Gaviria [1994] reports this species from Colombia, South America. But his

drawings show much longer inner spines of P5 in female and of P6 in male, as well as shorter setae of P4 Enp3. The taxon of Lindberg in many details looks like *E.* (*E.*) *delachauxi* (Kiefer, 1925), found also in Peru, but in caves. Both taxa inhabit cold water environment and possibly are close relatives or even synonyms. Possible synonymy of them should be checked with molecular analysis or hybridization.

Eucyclops (***Eucyclops***) ***elegans*** s.lat.

Cylopids of medium size with female length about 1200–1300 μm. Caudal rami long and slender with L/W ratio about 7–8, equipped with well-developed lateral *serra* occupying most of ramus length. Innermost caudal seta about as long as outermost seta (0.8–1.4: 1); outermost seta spiniform, its outer edge with small spinules, inner edge with fine hairs. A2 Bas with distal groups N1, N2 of long hair-setulae. P4 IntCox distal edge with strong setulae; P4 coxal spine with a gap on outer edge. P5 armed with long, strong inner spine longer than outer seta. North American species presented with two subspecies: *E.* (*E.*) *elegans elegans* (Herrick, 1884) and *E.* (*E.*) *elegans mittmanni* Mercado-Salas et Suarez-Morales, 2016 comb.n.

KEY TO SUBSPECIES OF *EUCYCLOPS* (*EUCYCLOPS*) *ELEGANS*, S.LAT.

1. Middle seta of P5 about 1.5 times as long as inner spine or longer; CR innermost seta subequal or longer than outermost seta ....*E.* (*E.*) *elegans elegans* (Herrick, 1884) [USA, Mexico]
– Middle seta of P5 shorter, about 1.1 times longer than inner spine; CR innermost seta shorter than outermost seta ....*E.* (*E.*) *e. mittmanni* Mercado-Salas et Suarez-Morales, 2016 comb.n. [Mexico]

22. ***Eucyclops*** (***Eucyclops***) ***elegans elegans*** (Herrick, 1884) Fig. 26.

SYNONYMY: *Cyclops serrulatus* var. *elegans*: Herrick, 1884; *Eucyclops elegans*: Kiefer, 1929a; Dussart, Defaye, 2006; Mercado-Salas, Suarez-Morales, 2014b (part.); Mercado-Salas *et al*., 2016; *Eucyclops* (*Eucyclops*) *elegans*: Alekseev, 2019; *Eucyclops solitarius*: Herbst, 1959.

TYPE LOCALITY: underground spring in Mammoth cave, Kentucky, USA.

HOLOTYPE PRESENCE AND STORING: original holotype specimens of Herrick lost, neotype specimen of Kiefer's redescription [1929] deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: Kiefer's slides from N. America #01144, 02775, 02776; Herrick's and Kiefer's description and drawings; redescription of Mercado-Salas & Suarez-Morales [2014b].

DESCRIPTION. FEMALE (Fig. 26). Body length without caudal setae 1340 μm in Herrick's holotype, 1240 μm in Mexican specimens, elongated shape. Cephalothorax L/W ratio about 1. Th4 with long setulae laterally. Genital double somite as long as broad; *receptaculum seminis* with wide posterior part. Caudal rami (Fig. 26A): L/W ratio 7–8, subparallel; lateral *serra* long, extending along most of lateral margin, composed of strong dense spinules increasing distally. Lateral seta subequal or slightly longer than ramus width. Outermost spiniform seta placed at some distance above outer middle seta, its outer edge with small spinules, inner edge with fine hairs. Innermost caudal seta plumose, 1.0–1.4 times as long as outermost seta. Dorsal seta long, 1.2–1.3 times as long as outermost seta in Mammoth cave (Kentucky) specimens by Kiefer, but shorter in Mexican specimens (0.6). Distal setae approximate length ratio beginning with outermost: 1.0/ 4.5/ 7.5/ 0.6–1.3.

Antennule 12-segmented, long, reaching distal margin of Th2 or even Th3; three distal segments with wide smooth hyaline membrane (Fig. 26D). A2 Enp setation: 1, 9, 7. A2 Bas (in Mexican specimens) on caudal surface with long dense hair-setulae at position N1+2, other groups as in Fig. 26F; frontal surface ornamentation as in Fig. 26E. Mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with two-three rows of setulae, distal row I consists of long strong spinules; coxal spine plumose on inner side and with gap on outer side (Fig. 26G, H, I). P4 Enp3 long and slender, L/W ratio about 3; inner/ outer spine ratio 1.3–1.4; inner spine subequal to segment; distal setae reaching 1/2–3/4 of adjacent spines (Fig. 26G). P4 Exp3 distal spine shorter than segment in Kentucky but longer in Mexica. Reduced P5 with strong long inner spine, about 3 times as long as segment; approximate length ratio of appendages beginning from inner spine: 1.0/ 1.5/ 0.6 (Fig. 26B, C).

MALE (Fig. 26K, Mexican specimens). Shorter than female. Caudal rami parallel without *serra*, with only few strong spinules at lateral seta insertion place; L/W ratio about 6; dorsal

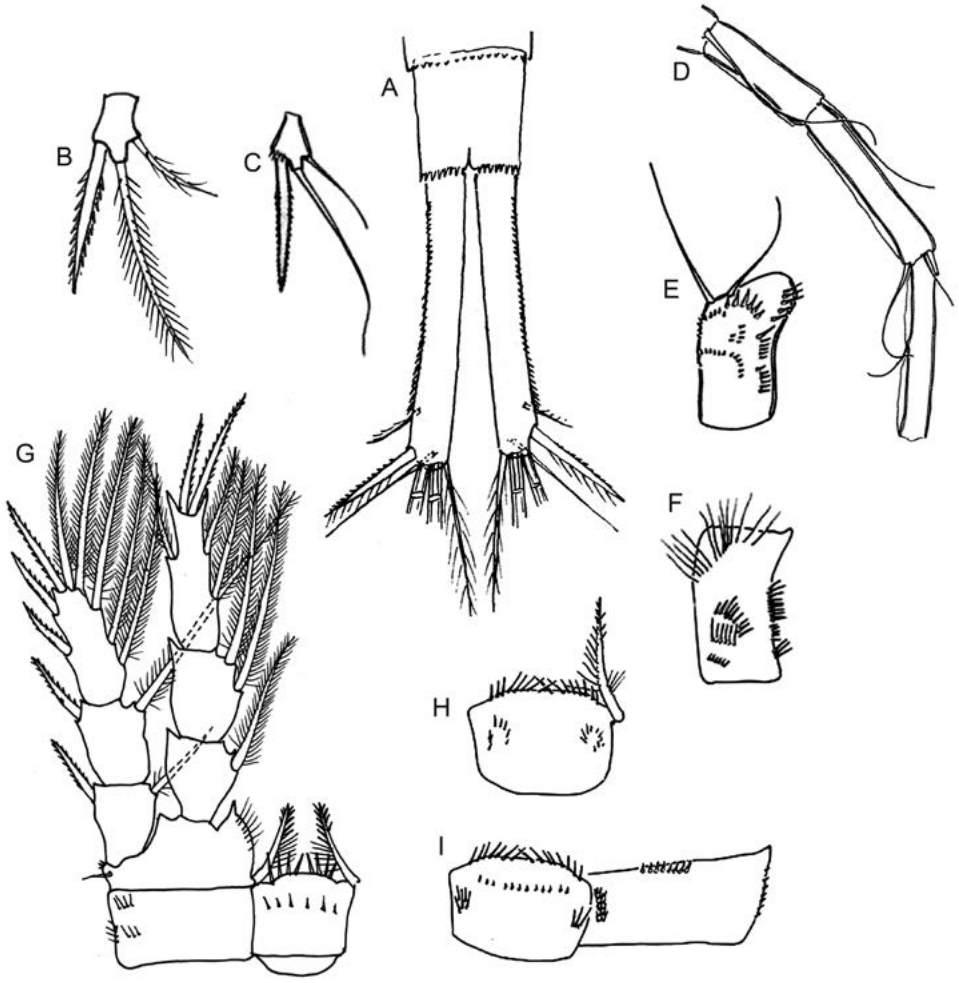


Fig. 26. *Eucyclops* (*Eucyclops*) *elegans elegans* (Herrick, 1884). Female: A — caudal rami, ventral; B, C — P5; D — A1, three distal segments; E — A2 Bas, frontal; F — A2 Bas, caudal; G — P4, caudal; H — P4 intercoxal plate and coxal spine, frontal; I — P4 intercoxal plate and coxa, caudal. A — after Kiefer [1929a]; B, G — Mammoth Cave National Park, Kentucky, USA, orig., slide #01144 KRC; C–F, H, I — Central Mexico, after Mercado-Salas *et al*. [2016].

Рис. 26. *Eucyclops* (*Eucyclops*) *elegans elegans* (Herrick, 1884). Самка: A — каудальные ветви, вентрально; B, C — P5; D — A1, три дистальных членика; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — P4, каудально; H — межкоксальная пластинка и коксальный шип P4, фронтально; I — межкоксальная пластинка и кокса P4, каудально. A — по Kiefer [1929a]; B, G — Национальный парк «Мамонтова пещера», Кентукки, США, ориг., преп. #01144 KRC; C–F, H, I — Центральная Мексика, по Mercado-Salas *et al*. [2016].

seta longer than outermost seta; innermost seta slightly longer than outermost one. Antennule 14-segmented. P4 and P5 structure like in female. Rudimentary P6 with strong but not long inner spine, about as long as middle seta; outer seta shorter than spine (Fig. 26K).

DISTRIBUTION: USA (Kentucky, South of Louisiana, Mississippi, Florida, North Virginia, Oklahoma); Cuba; Mexico; Argentina; ?Brazil; ?French Guyana.

COMMENTS: First described as a subspecies of *E.* (*E.*) *serrulatus*, it was later synonymised with

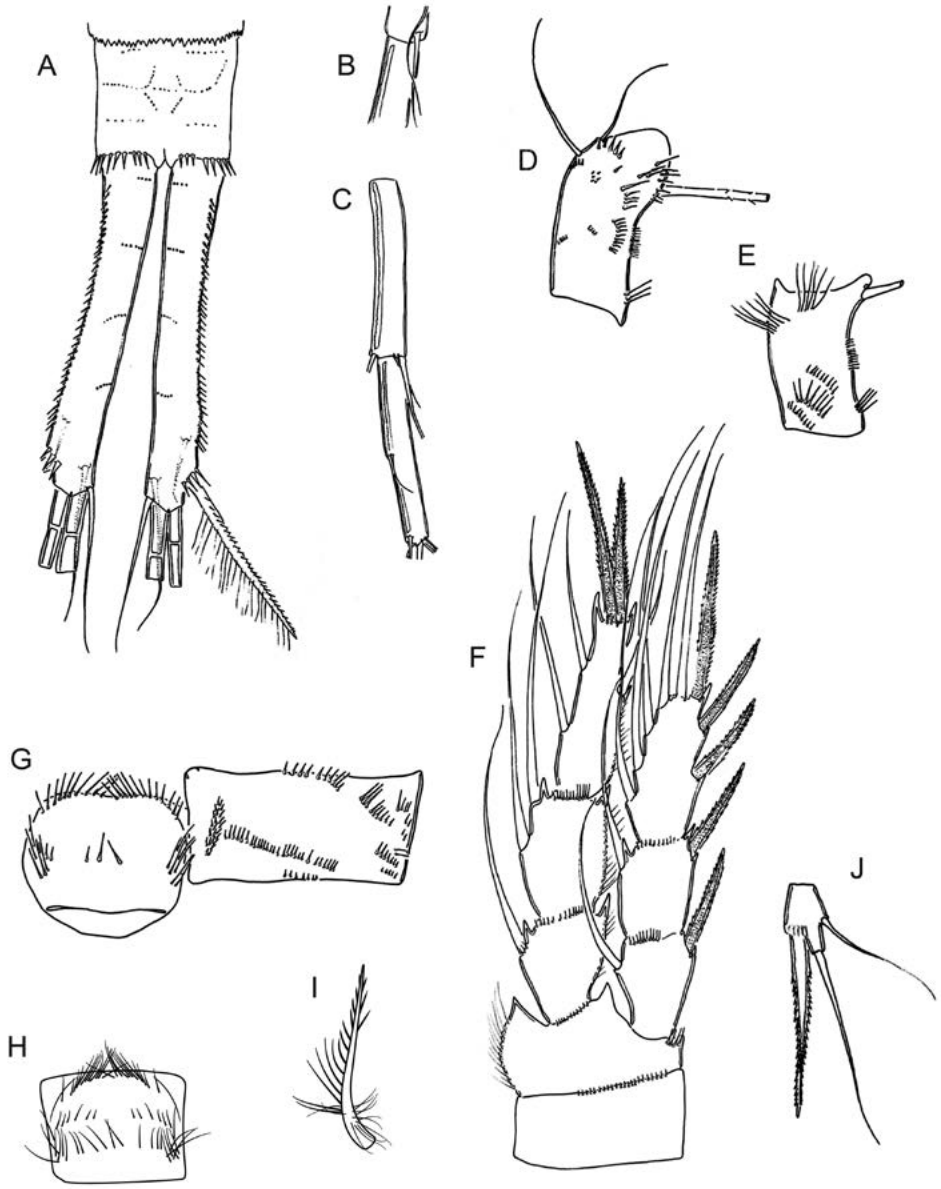


Fig. 27. *Eucyclops* (*Eucyclops*) *elegans mittmanni* Mercado-Salas et Suarez-Morales, 2016. Female: A — caudal rami, ventral; B — 10th segment of A1; C — 11th and 12th segments of A1; D — A2 Bas, frontal; E — A2 Bas, caudal; F — P4, frontal; G — P4 intercoxal plate and coxa, caudal; H — P4 intercoxal plate; I — P4 coxal spine; J — P5. Mexico, after Mercado-Salas *et al*. [2016], H, I — based on SEM photos.

Рис. 27. *Eucyclops* (*Eucyclops*) *elegans mittmanni* Mercado-Salas et Suarez-Morales, 2016. Самка: A — каудальные ветви, вентрально; B — 10-й членик A1; C — 11-й и 12-й членики A1; D — A2 Bas, фронтально; E — A2 Bas, каудально; F — P4, фронтально; G — межкоксальная пластинка и кокса P4, каудально; H — межкоксальная пластинка P4; I — коксальный шип P4; J — P5. Мексика, по Mercado-Salas *et al*. [2016], H, I — по SEM фотографиям.

a nominal species by Marsh [1912]. However, when one female specimen was obtained by Kiefer from Mammoth Cave, USA, he concluded that it was actually a new species. Kiefer redescribed it on neotype, but preserved the name originally given by Herrick and the authorship of the taxon.

23. ***Eucyclops*** (***Eucyclops***) ***elegans mittmanni*** Mercado-Salas et Suarez-Morales, 2016 **comb.n**.
Fig. 27.

SYNONYMY: *Eucyclops mittmanni*: Mercado-Salas *et al*., 2016.

TYPE LOCALITY: creek at Sierra Fria 21 km north of Village La Labor, Calvillo, Aguascalientes, Mexico.

HOLOTYPE PRESENCE AND STORING: deposited in El Colegio de la Frontera Sur, Mexico; holotype female ECO-CH-Z-04948; paratypes 7 adult females ECO-CH-Z-04949. Samples from type locality, coll. 18 February 1989 by Marcelo Silva-Briano.

MATERIAL STUDIED: author's description and illustrations.

DESCRIPTION. FEMALE (Fig. 27). Average body length without caudal setae 1216 µm. Whole body (caudal rami included) ornamented with cuticular pits. Th4 with long lateral setulae. Genital double somite L/W ratio about 0.9; *receptaculum seminis* typical of genus, with wider anterior part. Caudal rami L/W ratio about 7.5, slightly divergent; lateral *serra* extending along most of lateral margin, composed of strong, dense spinules noticeably increasing distally (Fig. 27A). Lateral seta longer than ramus width. Outermost spiniform seta placed at some distance above outer middle seta, its outer edge with small spinules, inner edge with fine hairs. Innermost caudal seta shorter than outermost seta (0.8: 1). Dorsal seta shorter than outermost seta (0.8: 1).

Antennule 12-segmented, long, reaching distal margin of Th2 or even Th3; three distal segments with wide smooth or finely serrated hyaline membrane (Fig. 27C). Setation of antennular segments, beginning with first: 8/4/2/6/4/2/2/3/2+I/2/3/8 (seta — arabic; aesthetasc — roman). A2 Enp setation: 1, 9, 7. A2 Bas on caudal surface with long dense hair-setulae at positions N1 and N2, other groups as in Fig. 27E; frontal surface ornamentation as in Fig. 27D. Maxilla praecoxa without row of spinules at lateral margin. Mxl palp not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with three rows (I, II, III) of rather long strong setules; coxal spine plumose on inner side and with gap on outer side (Fig. 27I). P4 Enp3 long and slender, L/W ratio about 3; inner/outer spine ratio 1.3; inner spine slightly longer than segment; distal setae reaching 1/2 of adjacent spines (Fig. 27F). P4 Exp3 distal spine longer than segment. Reduced P5 with strong long inner spine, about 2.7 times as long as segment; approximate length ratio of appendages beginning with inner spine: 1.0/ 1.1/ 0.8.

MALE: unknown.

DISTRIBUTION: Aguascalientes, Mexico.

COMMENTS: This form is closely related to *E.* (*E.*) *e. elegans*. It is possible that some Mexican and North American records of the latter species should be attributed as *E.* (*E.*) *e. mittmanni.* Ornamentation of A2 Bas in both taxa is similar except groups N1 and N2 separated in *E.* (*E.*) *e. mittmanni* but fused in *E.* (*E.*) *e. elegans*. Molecular analysis of these forms is required.

24. ***Eucyclops*** (***Eucyclops***) ***ensifer*** Kiefer, 1936
Fig. 28.

SYNONYMY: *Eucyclops ensifer*: Kiefer, 1936a: Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *ensifer*: Alekseev, 2019.

TYPE LOCALITY: Laguna larga near Magallanes, Chile.

HOLOTYPE PRESENCE AND STORING: holotype female dissected (slide #03097), paratype male dissected (slide #03098) deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype and paratype, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 28). Body length without caudal setae about 1100 µm. Cephalothorax L/W ratio about 1. Th4 with fine hairs laterally. *Receptaculum seminis* typical of genus. Caudal rami L/W ratio about 3.7, divergent; lateral *serra* extending along most of lateral margin, composed of strong, dense spinules noticeably increasing distally (Fig. 28A, B). Lateral seta shorter than ramus width. Outermost spiniform seta with short setulae on both sides. Innermost caudal seta plumose, slightly shorter than outermost seta (0.9: 1). Dorsal seta characteristically shorter than outermost seta (0.6–0.7: 1).

Antennule 12-segmented, short, reaching only distal edge of CTh; 3 distal segments with narrow smooth hyaline membrane. A2 Bas on caudal surface with 1 (in observed specimen) long hair-setule at N2; frontal surface ornamentation as in Fig. 28D. Mouth appendages not described.

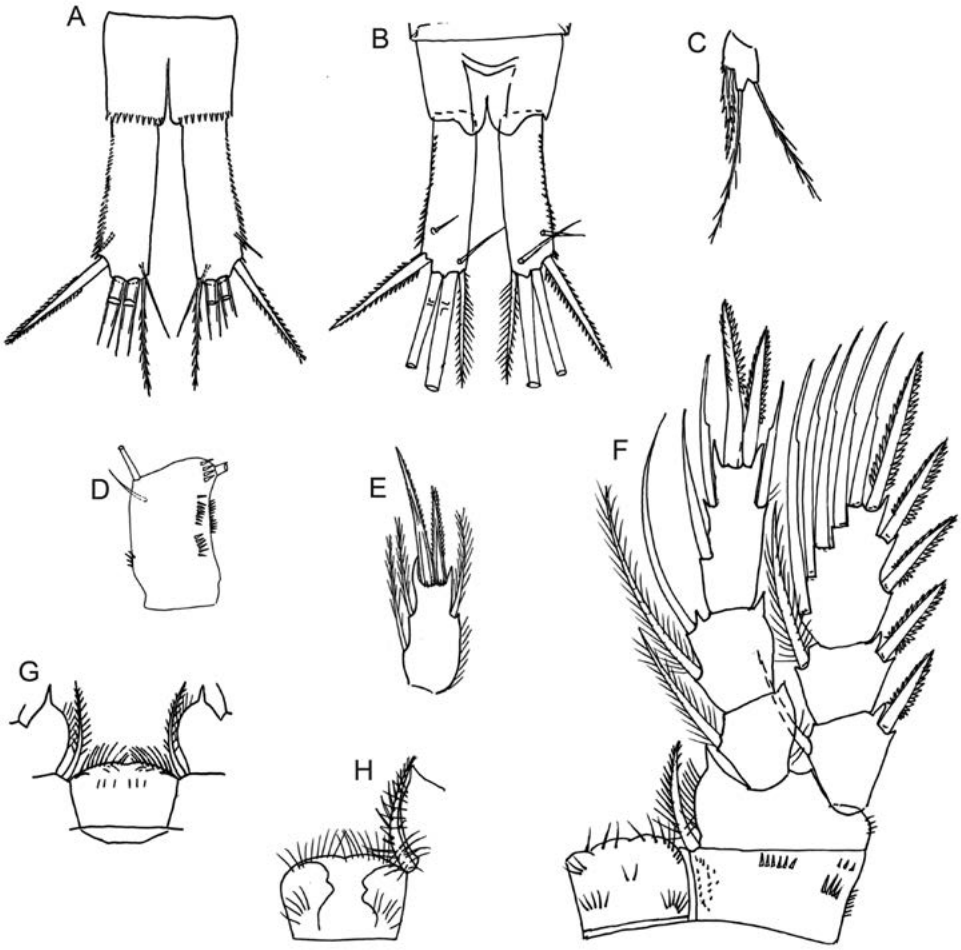


Fig. 28. *Eucyclops* (*Eucyclops*) *ensifer* Kiefer, 1936. Female: A, B — caudal rami; C — P5; D — A2 Bas; E — P4 Enp3; F — P4, caudal; G, H — P4 intercoxal plate. Chile. A, C, E, G — after Kiefer [1936a]; B, D, F, H — orig., slides #03084, 03097 and 03098 KRC.

Рис. 28. *Eucyclops* (*Eucyclops*) *ensifer* Kiefer, 1936. Самка: A, B — каудальные ветви; C — P5; D — A2 Bas; E — P4 Enp3; F — P4, каудально; G, H — межкоксальная пластинка P4. Чили. A, C, E, G — по Kiefer [1936a]; B, D, F, H — ориг., преп. #03084, 03097 и 03098 KRC.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with two-three rows of setulae (Fig. 28F, G, H); coxal spine plumose on inner side and with gap on outer side (see Fig. 28G, H). P4 Enp3 rather short, L/W ratio about 1.8; inner/outer spine ratio 1.3; inner spine longer than segment; distal setae reaching 1/2–2/3 of adjacent spines (Fig. 28E). P4 Exp3 distal spine longer than segment (see Fig. 28F). Basipodite P4 inner outgrowth with long hairs. Reduced P5 with strong inner spine inserted at different level with outer seta (Fig. 28C); spine 1.8 times longer than segment; approximate length ratio of appendages beginning with inner spine: 1.0/ 1.8/ 1.5.

MALE: (Fig. 28 I). Body length without caudal setae 900–940 μm. Caudal rami: L/W ratio 2.9; without lateral *serra*. Antennule 14-segmented. P1–P4 spine formula and structure as in female. P4 Enp3 longer than in female, L/W ratio 2.4; inner/outer spine ratio 1.2; inner spine/segment ratio 1.2. Reduced P5 structure like in female.

Rudimentary P6: inner spine strong and long (in paratype 05 μm, more than 10% of body length); length ratio of appendages beginning with inner spine: 1.0/ 3.0/ 2.4.

DISTRIBUTION: South America: Argentina, Brazil, Chile, Cuba, Nicaragua, Peru, Tierra del Fuego.

COMMENTS: Kiefer [1936a] compares this form with *E.* (*E.*) *silvestrii*, from South America, and finds differences in caudal rami proportions, P4 Enp3 structures and armament. As the most important character, *E.* (*E.*) *ensifer* shows an unusual long inner spine in male P6. Among other cyclopids described up to this time, only males in *Afrocyclops* have such a long spine. Along with much reduced setae so long inner spine can be a good taxonomical sign for this species.

25. ***Eucyclops*** (***Eucyclops***) ***farsicus*** Lindberg, 1941 Fig. 29.

SYNONYMY: *Eucyclops farsicus*: Lindberg, 1941; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *farsicus*: Alekseev, 2019.

TYPE LOCALITY: pond with abundant vegetation 30 km south of Shiraz (Fars province, Iran), at an altitude of about 1500 m a.s.l.; collected in March.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 29A–C). Body length without caudal setae 769–864 μm. Th4 with lateral setulae. Genital double somite L/W ratio about 1. *Receptaculum seminis* typical of genus (Fig. 29A). Anal operculum weakly developed, convex (Fig. 29B). Caudal rami slightly divergent with L/W ratio 3.5–3.9; lateral *serra* short, less than half of ramus length, composed of 2–7 small spinules placed near lateral seta insertion (see Fig. 29B); innermost/outermost caudal seta ratio 1.6–2.0. Dorsal seta characteristically longer than outermost spine-shaped seta. Lateral seta about as long as ramus width. Outermost seta short and thick, plumose only at distal 1/2–2/3 with short setulae; inserted close to middle terminal setae. Distal setae length ratio beginning with outermost: 1.0/ 4.8–6.7/ 8.9–11.2/ 1.6–2.0.

Antennule 12-segmented, reaching middle or posterior margin of Th1; 3 distal segments with narrow smooth hyaline membrane. Antenna Bas ornamentation not described. Oral appendages not described. Swimming legs P1–4: distal exopodite spine formula: 3/4/4/3, spines lanceolate. P4 Enp3 L/W ratio about 2; inner/outer spines ratio 1.2–1.4; distal setae reaching 2/3 – 3/4 of nearest spines (Fig. 29C). P4 IntCox with two rows of short setulae (I and II) (Fig. 29C). Basipodite P4 inner outgrowth: triangular shape, covered with rare hairs. Reduced P5 (see Fig. 29A) with strong inner spine and two longer setae.

MALE (Fig. 29D). Body length without caudal setae 608–646 μm. Th4 without hairs laterally. Caudal rami L/W ratio 3.1–3.4; outermost spine shorter, distal setae length ratio beginning with outermost: 1.0/ 6.4–7.0/ 12.2–14.0/ 1.8–2.3. Antennule 14-segmented. Antennal Bas ornamentation and oral appendages not examined. P1–P4 spine formula and structure as in female. Reduced P5 similar to female with exception of relatively shorter setae. Rudimentary P6 (see Fig. 29D): inner spine strong but short, both subequal setae longer than spine.

DISTRIBUTION: known only from the type locality Shiraz, Fars province, Iran.

COMMENTS: Lindberg [1941] indicates the thick blunt appearance of outermost caudal seta is distinctive feature of his species which can be used to differentiate it from any other closely related congeners with short caudal *serra*, such as *E.* (*E.*) *permixtus* Kiefer, 1928 native to India and Java. Other differences between these two taxa include following: P4 Enp3 shorter in *E.* (*E.*) *permixtus*, antennule longer in *E.* (*E.*) *farsicus* and P5 inner spine longer in *E.* (*E.*) *permixtus*. *E.* (*E.*) *farsicus*, has not been recorded again, and this species is not presented in his collection (Jeannine Pensaert personal communication). As many taxonomically important structures were not observed or described, this species requires detailed re-description.

26. ***Eucyclops*** (***Eucyclops***) ***neumani*** (Pesta, 1927) Fig. 30.

SYNONYMY: *Cyclops neumani*: Pesta, 1927; *Eucyclops neumani*: Lindberg, 1955b; Herbst, 1962; Dussart, Defaye, 2006; Mercado-Salas, Suárez-Morales, 2021; *Eucyclops* (*Eucyclops*) *neumani*: Alekseev, 2019.

TYPE LOCALITY: Lake Chaco, Argentina, South America.

HOLOTYPE PRESENCE AND STORING: Holotype not known. Topotype selected by Dussart stored in Muséum National d'Histoire Naturelle (MNHN) in Paris, France.

MATERIAL STUDIED: Author's description and drawings, descriptions of Herbst [1962], Lindberg [1955b], Dussart, Frutos [1986], Mer-

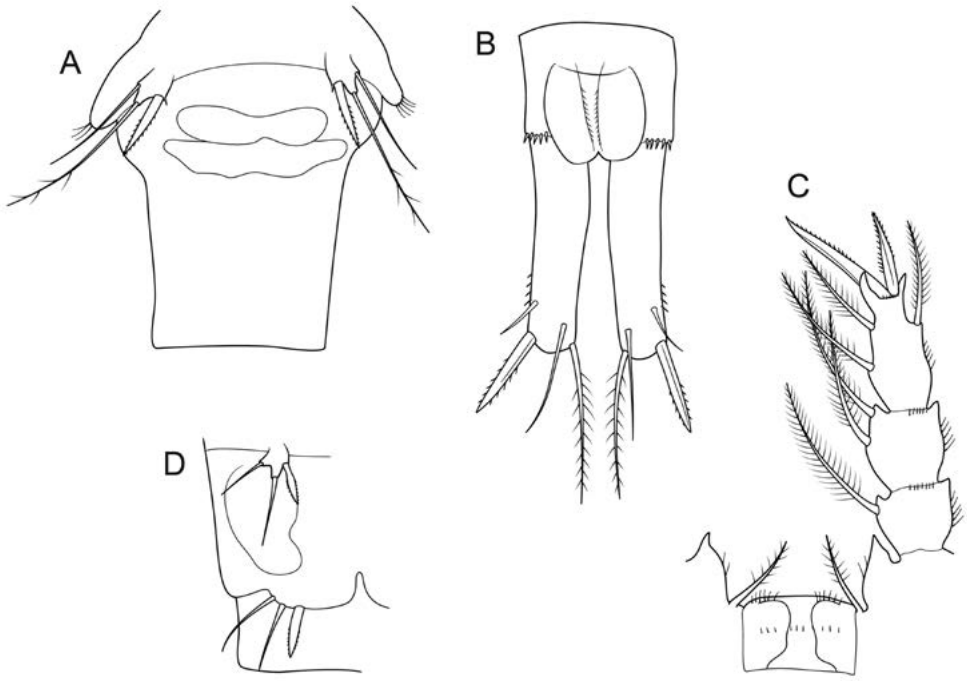


Fig. 29. *Eucyclops* (*Eucyclops*) *farsicus* Lindberg, 1941. A — Th4, genital double somite and P5; B — caudal rami, dorsal; C — P4; D — P5 and P6. A–C — female; D — male. Iran, after Lindberg [1941].

Рис. 29. *Eucyclops* (*Eucyclops*) *farsicus* Lindberg, 1941. A — Th4, генитальный сомит и P5; B — каудальные ветви, дорсально; C — P4; D — P5 и P6. A–C — самка; D — самец. Иран, по Lindberg [1941].

cado-Salas, Suarez-Morales [2021], collection in MNHN, Paris, France.

DESCRIPTION. FEMALE (Fig. 30). Body length without caudal setae 1040–1500 μm. Th3 with few hair-setulae dorso-laterally (according to Lindberg [1955b]). Th4 with lateral hair-setulae. Genital double-somite elongated, about 1.2 times as long as broad; *receptaculum seminis* typical of genus, with narrow lateral arms. Abdominal somites sometimes with rows of small pits on ventral surface. Anal operculum weakly developed, rounded. Caudal rami long and narrow with L/W ratio 6–9, parallel or slightly divergent; with reduced lateral *serra* of 6–15 small spinules. Dorsal seta shorter than outermost seta. Length ratio of innermost/outermost setae 0.9–1.2. Outermost spiniform seta long, thin, with several small spinules in base. Lateral seta subequal to ramus width or longer.

Antennule 12-segmented, short, reaching distal edge of CTh or middle of Th1; with smooth narrow hyaline membrane along three distalmost segments. A2 Bas caudal surface with groups of setulae in positions N1 and N2, other groups as in Fig. 30F, G, H; on frontal surface as in Fig. 30D, E. Mouth appendages not described. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P1 basipodial spine reaching middle of Enp3. P3 IntCox caudal surface with three rows of spinules with gap in the middle. P4 IntCox caudal surface with distal row of 4-5 spinules at each side and middle row of short spinules; coxal spine with long setulae along inner edge and with large gap on outer edge. P4 Enp3: segment short with L/W ratio 1.8–2.1; inner/outer spines ratio 1.4–1.6; inner spine longer than segment. Reduced P5**:** outer lobe of segment extended, so both setae inserted almost at same level; armed with rather long spine and two short usually subequal setae; appendages length ratio beginning with inner spine: 1/ 0.8–1.3/ 0.8–1.3. Rudimental P6 armed with two wide short projections and one plumose seta.

MALE (Fig. 30S). Body length 880–1112 μm, more slender than female. Caudal rami shorter than in female, parallel, without lateral *serra*. Reduced P5: inner spine shorter than in female, appendages length ratio similar to female. Rudimental P6: with

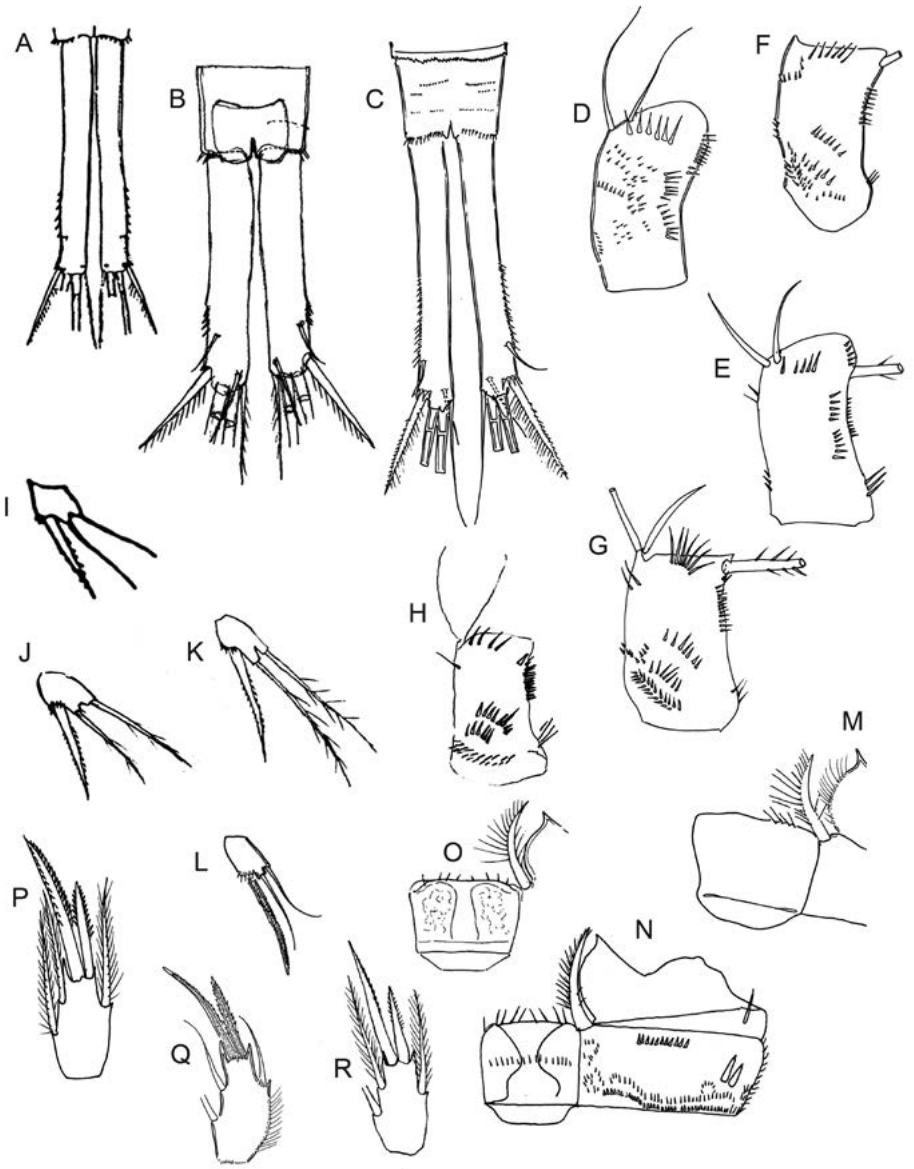


Fig. 30. *Eucyclops* (*Eucyclops*) *neumani* (Pesta, 1927). Female: A–C — caudal rami; D, E — A2 Bas, frontal; F–H — A2 Bas, caudal; I–L — P5; M–O — P4 intercoxal plate; P–R — P4 Enp3. A, I — Argentina, after Pesta, 1927; B, J, K, R — Chile, drawings of F.Kiefer, after Mercado-Salas & Suárez-Morales [2021]; C, D, F, L, M, Q — Argentina, after Mercado-Salas & Suárez-Morales [2021]; E, G — Paraguay, orig., slide #04083 KRC; H — Chile, orig., slide #11150 KRC; N, P — Uruguay, orig., slide #03114 KRC; O — Brazil, after Herbst [1962].

Рис. 30. *Eucyclops* (*Eucyclops*) *neumani* (Pesta, 1927). Самка: A–C — каудальные ветви; D, E — A2 Bas, фронтально; F–H — A2 Bas, каудально; I–L — P5; M–O — межкоксальная пластинка P4; P–R — P4 Enp3. A, I — Аргентина, по Pesta, 1927; B, J, K, R — Чили, рисунки Ф.Кифера, по Mercado-Salas & Suárez-Morales [2021]; C, D, F, L, M, Q — Аргентина, по Mercado-Salas & Suárez-Morales [2021]; E, G — Парагвай, ориг., преп. #04083 KRC; H — Чили, ориг., преп. #11150 KRC; N, P — Уругвай, ориг., преп. #03114 KRC; O — Бразилия, по Herbst [1962].

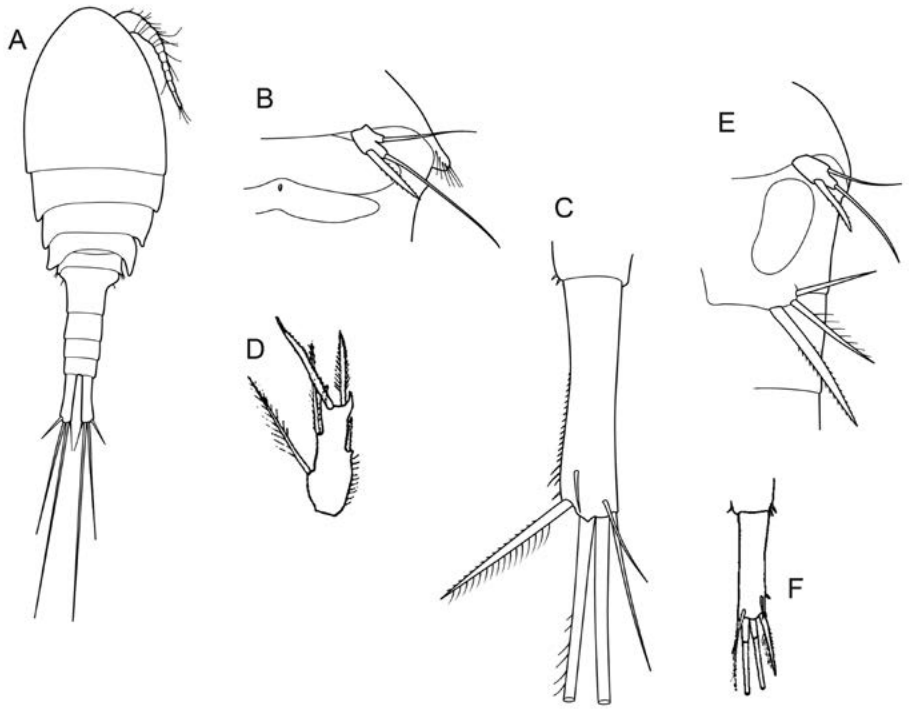


Fig. 31. *Eucyclops* (*Eucyclops*) *parvicornis* Harding, 1942. A — habitus; B — Th4, genital double somite and P5; C — caudal ramus; D — P4 Enp3; E — P5 and P6. A–D — female; E — male. Zambia, Lake Young, after Harding [1942].

Рис. 31. *Eucyclops* (*Eucyclops*) *parvicornis* Harding, 1942. A — габитус; B — Th4, генитальный сомит и P5; C — каудальная ветвь; D — P4 Enp3; E — P5 и P6. A–D — самка; E — самец. Замбия, озеро Янг, по Harding [1942].

strong long inner spine and two shorter setae, appendages approximate length ratio beginning with inner spine: 1/ 0.4/ 0.6.

DISTRIBUTION: South America.

COMMENTS: A comparison of several populations of *E.* (*E.*) *neumani* from different countries of South America from Chile to Paraguay demonstrates significant variability in the ornamentation of the basipodite of A2, while the armament of P5 and the structure of the caudal branches are more stable. It is possible that further researches will reveal the presence of a bouquet of sibling species within the taxon.

27. ***Eucyclops* (*Eucyclops*) *parvicornis***
Harding, 1942
Fig. 31.

SYNONYMY: *Eucyclops parvicornis*: Harding, 1942; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *parvicornis*: Alekseev, 2019.

TYPE LOCALITY: Lake Young, Zambia, Southeast Africa.

HOLOTYPE PRESENCE AND STORING: holotype and paratype specimens not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 31A–D). Body length excluding caudal setae 1020–1060 μm, slender (Fig. 31A). Th4 with long setulae at posterolateral angles. Genital double somite as long as broad, *receptaculum seminis* typical for genus, with wider anterior part (Fig. 31B). Caudal rami slightly divergent, about 4.5 times as long as broad, with lateral *serra* of teeth which become smaller and situated more ventrally in anterior part (Fig. 31C). Lateral caudal seta shorter than ramus width. Dorsal seta naked, in description about as long as innermost seta (though only 0.6 :1 in Harding's drawing). Outermost seta spiniform, with hairs on inner edge and short spinules on outer edge, 0.7 times as long as ramus length. Innermost

seta about as long as outermost seta or slightly longer. Approximate length ratio of terminal setae beginning with outermost: 1.0/4.0 / 7.0 /1.0–1.1.

Antennule 12-segmented, very short, not reaching posterior border of CTh (see Fig. 31A), with narrow, finely serrated hyaline membrane on last three segments. Antenna and mouth parts not observed.

Swimming legs P1–P4 exopodite spine formula 3/4/4/3. Outer spines of swimming legs with strong teeth. P4 Enp3 (Fig. 31D) about 2.4 times as long as broad; inner spine about 1.4 times as long as outer spine and subequal to segment length; distal setae not reaching tips of nearest spines; outer seta modified and very short. P4 Coxa and intercoxal plate ornamentation not described. Reduced P5 (Fig. 31B) with strong knife-like inner spine about twice longer than segment and with two long setae; length ratio beginning with spine: 1.0/ 2.2 / 1.3.

MALE (Fig. 31E, F). Body length without caudal setae 800–820 μm. Th4 without lateral hairs. Caudal rami parallel, shorter than in female, with L/W ratio about 4, without lateral *serra* (Fig. 31F). Reduced P5 with shorter appendages than in female. Rudimentary P6 (see Fig. 31E) with strong inner spine (about 62 μm, length after author) and two shorter subequal setae.

DISTRIBUTION: known from the type locality only.

COMMENTS: Harding [1942] in his description does not mention modification of outer setae of P4 Enp3. He does not find any other difference in swimming leg structure separating his species and "*E. agilis*" (non valid synonym of *E.* (*E.*) *serrulatus* s.lat.) as well as from other *serrulatus*-like species. This modification of P4Enp3 outer seta, if exists could be a good character to separate Harding's form from other congeners. As many other African taxa, it should be redescribed. There is no holotype of this species. In the Natural History Museum in London, only the author's drawings given here are preserved as "holotype". With relatively small possibility (*speratus*-like species was not reported from Central and South Africa), because of missing A2 Bas ornamentation Harding's taxon could be assigned to subgenus *Speratocyclops* as well.

Eucyclops* (*Eucyclops*) *pectinifer s.lat.

Cyclopids of medium size with female length without caudal setae about 800–1000 μm. Caudal rami L/W ratio about 4–5, with long lateral *serra*. Depending on seasons and latitudes, body and caudal rami lengths can be longer at low temperatures during cold season or at high altitudes in mountains. The most remarkable similarity of these no doubt relative taxa is ornamentation in A2 Bas. P4 coxal spine, another crucial character for s*errulatus*-group, with gap on outer side, same as in *E.* (*E.*) *serrulatus*. The species comprises 2 subspecies with some differences in caudal setae ratio, while in the structure of A2 Bas and the elements of coxal ornamentation in P4, these forms are almost identical and, possibly, will be synonymized after molecular analysis or hybridization experiments.

Key to *Eucyclops* (*Eucyclops*) *pectinifer* s.lat. subspecies

1. Innermost caudal seta about as 0.6 times as long as CR length; dorsal caudal seta shorter than outermost seta ....*E.* (*E.*) *pectinifer pectinifer* (Cragin, 1883) [USA, Canada]
– Innermost caudal seta about as long as CR length; dorsal caudal seta longer than outermost seta ... *E.* (*E.*) *p. ishidai* Mercado-Salas et Suarez-Morales, 2016 comb.n. [Mexico]

28. ***Eucyclops* (*Eucyclops*) *pectinifer pectinifer*** (Cragin, 1883)
Fig. 32.

SYNONYMY: *Cyclops pectinifer*: Cragin, 1883; *Eucyclops pectinifer*: Alekseev *et al*., 2006; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *pectinifer*: Alekseev, 2019; *Eucyclops chihuahuensis*: Suárez-Morales, Walsh, 2009.

TYPE LOCALITY: littoral of Gees Lake near Philadelphia, Pennsylvania, USA.

HOLOTYPE PRESENCE AND STORING: type material used by Cragin lost. On basis of material collected in the type waterbody by VA a neotype was established and described [Alekseev *et al*., 2006]. Neotype and paratypes deposited in collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: neotype specimens; Cragin's description and drawings.

DESCRIPTION. FEMALE (Fig. 32A–H). Body length without caudal setae of neotype specimen 1030 μm, yellowish, dark brown. Cephalothorax slightly longer than broad, with maximal width close to posterior border (Fig. 32B). Th4 with lateral setulae (Fig. 32C, D). Genital double somite as long as broad; *receptaculum seminis* typical of genus, composed of two flattened parts concave in middle. Caudal rami (Fig. 32A, B) about 5 (4.5–5.5) times longer than broad, slightly

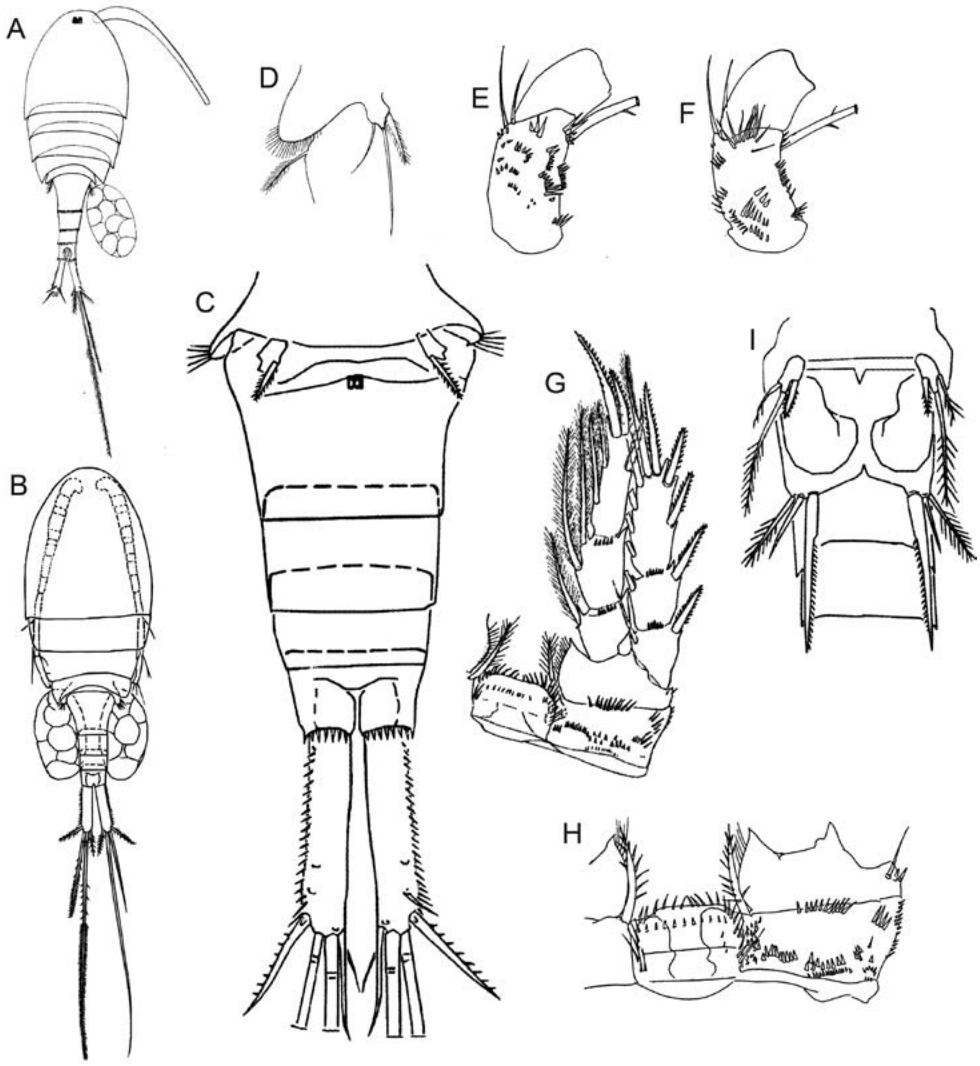


Fig. 32. *Eucyclops* (*Eucyclops*) *pectinifer pectinifer* (Cragin, 1883). A, B — habitus; C — abdomen; D — P5; E — A2 Bas, frontal; F — A2 Bas, caudal; G — P4, caudal; H — P4 intercoxal plate and coxa, caudal; I — P5 and P6. A–H — female; I — male. USA. A, D — after Cragin [1883]; B, C, G, I — after Alekseev *et al*. [2006]; E, F, H — orig.

Рис. 32. *Eucyclops* (*Eucyclops*) *pectinifer pectinifer* (Cragin, 1883). A, B — габитус; C — абдомен; D — P5; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — P4, каудально; H — межкоксальная пластинка и кокса P4, каудально; I — P5 и P6. A–H — самка; I — самец. США. A, D — по Cragin [1883]; B, C, G, I — по Alekseev *et al*. [2006]; E, F, H — ориг.

divergent, lateral *serra* extending along most of lateral margin, composed of strong spinules increasing distally (Fig. 32C). Dorsal seta shorter than outermost seta. Outermost seta spiniform, long and thin, with denticulate outer edge and hairs on inner edge. Innermost seta 0.6–0.7 times as long as ramus length and 1.0–1.3 times as long as outermost seta. Lateral seta shorter than ramus width. Length ratio of terminal caudal setae beginning with outermost: 1.0/ 3.2–4.9/ 8.7–9.0/ 1.0–1.3.

Antennule 12-segmented, reaching posterior margin of Th1 or Th2 (Fig. 32B), with smooth

or finely serrated hyaline membrane along three distalmost segments. Setation of antennular segments beginning with first: 8/4/2/6/4/2/2/3/2/3/3/8. A2 Bas on caudal surface with one group of long hair-setulae at N1 position and one group of short spinules at N2 position, other groups as in Fig. 32F; frontal surface ornamentation as in Fig. 32E. Mouth appendages as in congeners.

Swimming legs P1–P4: exopodite spine formula 3/4/4/3. P3–4 distal setae often modified, lanceolate. P4 Enp3 segment elongated with L/W ratio = 2.5–3.0; inner spine 1.3–1.6 times as long as outer spine and subequal to segment length; distal setae not reaching tips of nearest spines (Fig. 32G). P4 coxal spine gap on outer margin similar to *E.* (*E.*) *serrulatus* s.lat. Reduced P5 (Fig. 32C, D) with rather short but strong inner spine 1.3–1.6 times as long as segment; outer seta about as long as inner spine or slightly longer; middle seta about 2 times longer than inner spine.

MALE (Fig. 32I). More small and slender than female. Th4 without lateral hairs. Caudal rami shorter than in female, parallel, with L/W ratio about 4.5, without lateral *serra*. Antennule 14-segmented. Swimming legs and reduced P5 similar to female. Rudimental P6 with strong and long inner spine and two twice shorter setae.

DISTRIBUTION: Americas. Probably as *E. agilis* or *E. serrulatus* known in Canada, USA, Mexico, Venezuela, Brazil.

COMMENTS: Cragin's type material was not preserved so the species was redescribed from the neotype [Alekseev *et al*., 2006]. Nevertheless, a comparison of the neotype with Cragin's original drawings leaves no doubt about their identity.

29. ***Eucyclops*** (***Eucyclops***) ***pectinifer ishidai*** Mercado-Salas et Suárez-Morales, 2016 **comb.n**.
Fig. 33.

SYNONYMY: *Eucyclops ishidai*: Mercado-Salas *et al*., 2016.

TYPE LOCALITY: creek at Sierra Fria, 21 km from La Labor, Calvillo, Aguascalientes, Mexico.

HOLOTYPE PRESENCE AND STORING: holotype and paratype females deposited in the El Colegio de la Frontera Sur (ECO-CH-Z), in Chetumal, Mexico. Samples from the type locality collected by Marcelo Silva-Briano.

MATERIAL STUDIED: authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 33). Body length without caudal setae about 800 µm. Body surface (including caudal rami) ornamented with small pits. Cephalothorax slightly longer than broad with maximal width close to posterior border. Th4 with long setulae at posterolateral angles. Genital double somite as long as broad, *receptaculum seminis* typical for genus, with smaller anterior part. Caudal rami divergent, L/W ratio about 4.1; lateral *serra* long, extending along most of lateral margin, of spinules increasing distally (Fig. 33A). Dorsal seta 0.8 times as long as caudal ramus and longer than outermost seta. Length ratio of innermost/outermost caudal setae about 1.5. Lateral seta about as long as ramus width. All terminal setae plumose.

Antennule 12-segmented, reaching distal edge of CTh; 3 distal segments with smooth or finely serrated narrow hyaline membrane (Fig. 33B), segments ornamented with small pits. Setation of antennular segments, beginning with first: 8/ 4/ 2/ 6/ 3 /2/ 2/ 3/ 2+I/ 2/ 3/ 7+I (seta — arabic; aesthetasc — roman). A2 Enp setation: 1, 9, 7. A2 Bas on caudal surface with long hair-setulae at position N1 and short spinules at position N2, other groups as in Fig. 33C; frontal surface ornamentation as in Fig. 33D. Maxilla praecoxa with group of spinules close to lateral margin. Other mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox distal margin with long and slender spinules, other rows as in Fig. 33F; coxal spine with gap on outer margin (Fig. 33E). Length/width ratio of P4Enp3 2.6; inner spine of Enp3 slightly longer than segment; inner/outer spine ratio 1.4; distal setae reaching 1/2 of adjacent spines (Fig. 33E). P4 Exp3 distal spine slightly shorter than segment. No modified setae or spines observed. Reduced P5 (Fig. 33G) with strong inner spine about twice longer than segment; outer seta about as long as spine; medial seta about 1.6 times longer than spine.

MALE: unknown.

DISTRIBUTION: Mexico, North America?

COMMENTS: Authors admit that their form is morphologically close to *E.* (*E.*) *pectinifer*. Small differences in taxonomically unconfirmed characters are hardly enough to separate them at the species level, but together with geographical distance between these populations make possible to save this taxon as subspecies *Eucyclops* (*Eucyclops*) *pectinifer ishidai*.

30. ***Eucyclops*** (***Eucyclops***) ***prionophorus*** Kiefer, 1931
Fig. 34.

SYNONYMY: *Eucyclops prionophorus*: Kiefer, 1931, 1936a; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *prionophorus*: Alekseev, 2019.

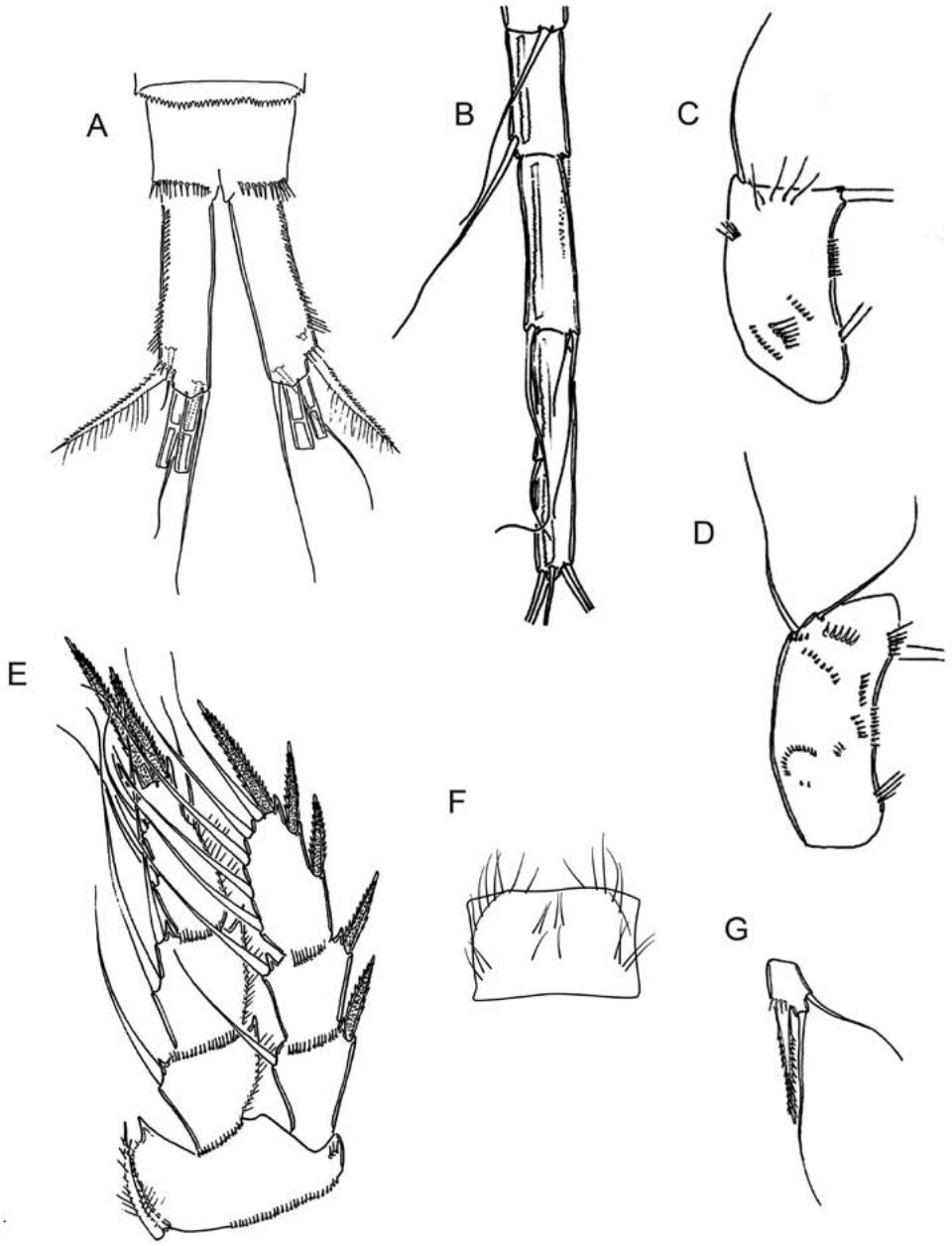


Fig. 33. *Eucyclops* (*Eucyclops*) *pectinifer ishidai* Mercado-Salas et Suárez-Morales, 2016 comb.n. Female: A — caudal rami, ventral; B — A1, three distal segments; C — A2 Bas, caudal; D — A2 Bas, frontal; E — P4, frontal; F — P4 intercoxal plate, caudal; G — P5. Mexico, after Mercado-Salas *et al*. [2016].

Рис. 33. *Eucyclops* (*Eucyclops*) *pectinifer ishidai* Mercado-Salas et Suárez-Morales, 2016 comb.n. Самка: A — каудальные ветви, вентрально; B — A1, три дистальных членика; C — A2 Bas, каудально; D — A2 Bas, фронтально; E — P4, фронтально; F — межкоксальная пластинка P4, каудально; G — P5. Мексика, по Mercado-Salas *et al*. [2016].

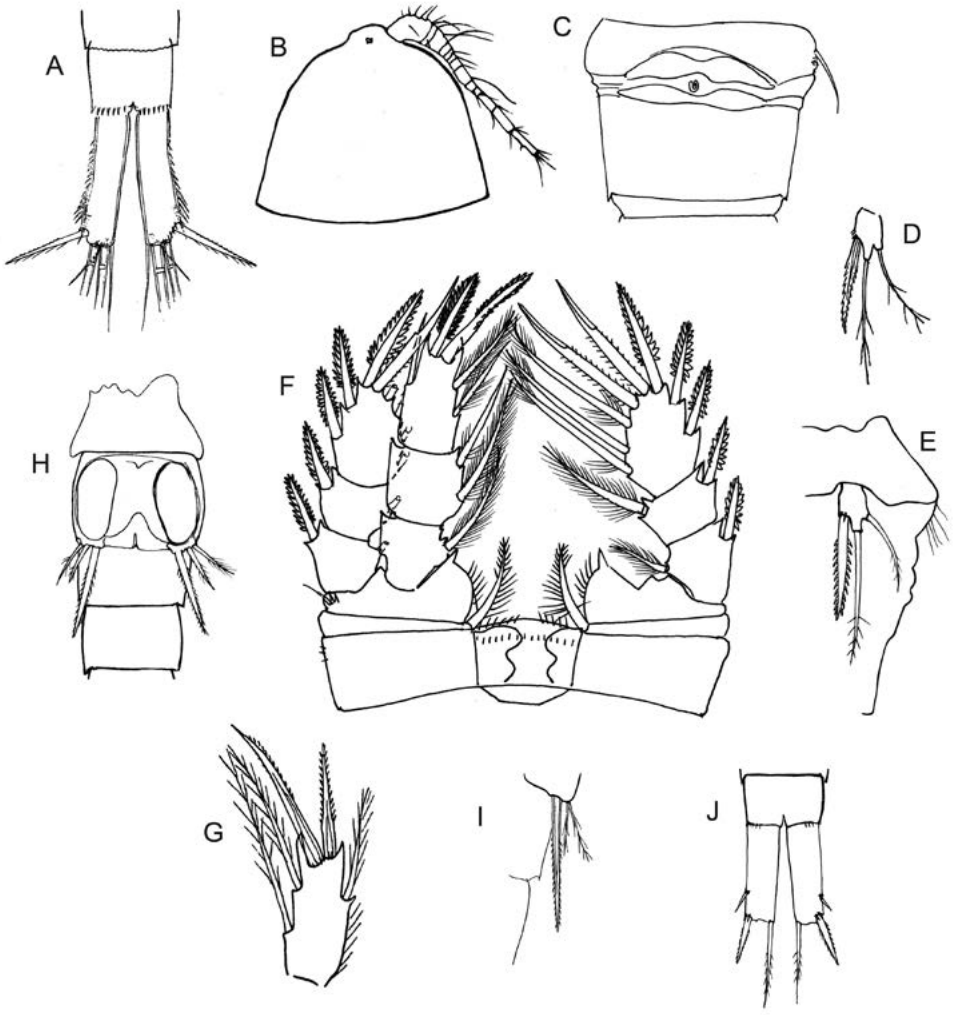


Fig. 34. *Eucyclops* (*Eucyclops*) *prionophorus* Kiefer, 1931. A, J — caudal rami, ventral; B — A1 and cephalothorax; C — genital double somite; D, E — P5; F — P4; G — P4 Enp3; H, I — P6. A–G — female; H–J — male. New Haven, USA. A — after Kiefer [1931]; D, G, I — after Kiefer [1936a]; B, C, E, F, H, J — orig., slides #01506, 01507, 01508 KRC.

Рис. 34. *Eucyclops* (*Eucyclops*) *prionophorus* Kiefer, 1931. A, J — каудальные ветви, вентрально; B — A1 и цефалоторакс; C — генитальный сомит; D, E — P5; F — P4; G — P4 Enp3; H, I — P6. A–G — самка; H–J — самец. Нью-Хейвен, США. A — по Kiefer [1931]; D, G, I — по Kiefer [1936a]; B, C, E, F, H, J — ориг., преп. #01506, 01507, 01508 KRC.

TYPE LOCALITY: slow-moving stream in Connecticut, New Heaven, USA.

HOLOTYPE PRESENCE AND STORING: Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype #01506 and paratype #01502–01506 specimens, author's description and drawings, redescription by Mercado-Salas and Suarez-Morales, 2014.

DESCRIPTION. FEMALE (Fig. 34A–G). Body length without caudal setae 940 μm in holotype specimen; rather flattened dorso-ventrally. Th4 with lateral hair-setulae. Genital double somite wider than long; *receptaculum seminis* typical of genus, composed of two flattened parts, mouth-shaped (Fig. 34C). Caudal rami slightly divergent (Fig. 34A), with L/W ratio 4.0–4.5; lateral *serra*

long, almost reaching CR base, composed of thin spinules increasing in length distally. Long and thin outermost caudal seta spiniform and pointing almost straight outwards, with denticulate outer edge and short hairs on inner edge. Innermost caudal seta weak, about 0.6 times as long as ramus length and about as long as outermost seta. Dorsal seta shorter than outermost seta. Lateral seta about as long as ramus width.

Antennule 12-segmented, short, hardly reaching distal edge of CTh (Fig. 34B); 3 distal segments with smooth narrow hyaline membrane. Antenna ornamentation and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P1 inner basipodite spine not reaching middle of Enp3, 0.6 times as long as whole Enp length (USA); this spine reaching middle of Enp3, 0.75 times as long as Enp length (Paraguay). Some setae in P3–4 Enp3 and Exp3 spatulate (Paraguay). P4 IntCox of holotype not observed; Paraguay specimens' intercoxal plate (Fig. 34F) with spinules at distal margin (row I). P4 coxal spine: inner side with long hairs proximally and short spinules distally; outer side naked or with few short distal spinules (with large gap). P4 Enp3 L/W ratio 2.2 in USA holotype specimen and 1.8 in Paraguay; inner/outer spine ratio 1.4–1.5; inner spine/ segment ratio 1.2–1.4. P4 Exp3 distal spine 0.8 (USA) or 1.2 (Paraguay) times as long as segment. Reduced P5 with noticeably broad and rather long inner spine and two setae; middle seta about 1.3–1.6 times longer than inner spine (Fig. 34D, E). Rudimentary P6 armed with two short spines and one long seta (Fig. 34C).

MALE (Fig. 34H–J). Body length without caudal setae about 800 μm. Th4 without lateral hairs. Caudal rami: L/W ratio about 3.5 (Fig. 34J). Antennule 14-segmented. Reduced P5 like in female. Rudimentary P6 (Fig. 34H, I) with strong and long inner spine and two short weak setae; these setae subequal and twice shorter than inner spine in USA paratype specimen, but in Paraguay forms length ratio is: 1/ 0.3/ 0.7.

DISTRIBUTION: lakes and slow-moving creeks in USA, Canada (Great Lakes), South America: Argentina, Uruguay, Paraguay.

COMMENTS: Kiefer [1936a] compares specimens collected both in the North (USA) and South (Uruguay and Paraguay) Americas. He notes that, despite some small differences in caudal rami and P4Enp3 proportions, these populations are similar in their main characters (caudal seta proportions, lateral *serra* structure, short A1, P4 and P5 structure and spine ratio). Females from Mexico identified and re-described as *E.* (*E.*) *prionophorus* [Mercado-Salas *et al*., 2016], in some taxonomically important characters do not fit Kiefer's type. The differences include: longer antennule, longer lateral *serra* with smaller distal spinules, different structure of P5. This Mexican form seems like belong to another, possibly new species and both these taxa in Mexico should be re-studied/redescribed.

31. ***Eucyclops* (*Eucyclops*) *procerus***
Dussart, 1981
Fig. 35.

SYNONYMY: *Eucyclops procerus*: Dussart, 1981; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *procerus*: Alekseev, 2019.

TYPE LOCALITY: Lake Tele, Republic of the Congo, Africa.

HOLOTYPE PRESENCE AND STORING: female holotype and male paratype deposited in Copepod collection in Muséum National d'Histoire Naturelle in Paris, France. One female paratype from the type seria (Dussart's donation to VA) dissected and placed on slide #55504 deposited in collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: holotype and paratype specimens; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 35). Body length without caudal setae 860 μm, elongated shape, yellowish color. Cephalothorax oval with L/W ratio about 1.2 (Fig. 35A). Th4 with lateral hair-setulae (Fig. 35I). Genital double somite about as long as broad; r*eceptaculum seminis* typical of genus. Anal operculum round and smooth. Caudal rami subparallel with L/W ratio about 7; lateral *serra* extending along most of lateral margin, composed of small spinules (Fig. 35B). Dorsal seta about as long as or slightly shorter than thin and long outermost spine-shaped seta. Lateral seta about 1.4 times longer than ramus width; innermost seta 1.1–1.2 times as long as outermost seta. Outermost seta inserted at noticeable distance above outer middle setae with few small spinules near its insertion place.

Antennule 12-segmented, reaching posterior margin of Th1, with smooth hyaline membrane along three distalmost segments. A2 Bas on caudal surface with 1 long hair in position N1, single small spinule in position N2, other groups as in Fig. 35D; frontal surface ornamentation as in Fig. 35E.

Swimming legs P1–P4: exopodite spine formula 3/4/4/3. P4 Enp3 segment with L/W ratio

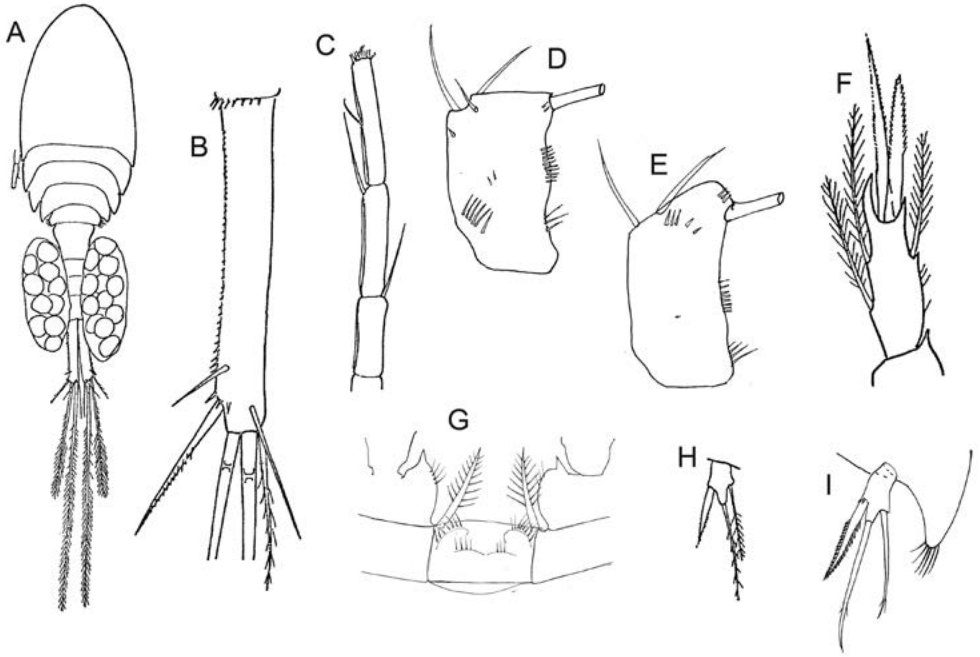


Fig. 35. *Eucyclops* (*Eucyclops*) *procerus* Dussart, 1981. Female: A — habitus; B — caudal rami; C — A1, three distal segments; D — A2 Bas, caudal; E — A2 Bas, frontal; F — P4 Enp3; G — P4 intercoxal plate; H, I — P5. Lake Tele, Congo. A–C, F, H — after Dussart [1981]; D, E, G, I — orig., type slides.

Рис. 35. *Eucyclops* (*Eucyclops*) *procerus* Dussart, 1981. Самка: A — габитус; B — каудальные ветви; C — A1, три дистальных членика; D — A2 Bas, каудально; E — A2 Bas, фронтально; F — P4 Enp3; G — межкоксальная пластинка P4; H, I — P5. Озеро Теле, Конго. A–C, F, H — по Dussart [1981]; D, E, G, I — ориг., типовые препараты.

about 2.5; inner spine 1.3 times as long as outer spine and longer than segment length; distal setae reaching middle of nearest spines (Fig. 35F). P4 coxal spine homogeneously plumose and reaching tip of inner basipodite outgrowth. P4 IntCox distal margin with setulae at sides and large gap in middle (Fig. 35G); Bas inner outgrowth covered with rare hairs. Reduced P5 armed with rather short inner spine about 1.3 times as long as segment, both middle and outer setae longer than spine (Fig. 35H, I).

MALE unknown.

DISTRIBUTION: known only from the type locality Republic of the Congo, Africa.

COMMENTS: This species is close in caudal rami length and armament to several species from Lake Tanganyika, but can be separated from them by the longer internal spine of P5 and some other taxonomically important characters. This taxon is also close to *E.* (*E.*) *borealis* s.lat. in ornamentation A2 Bas, being far from distribution of latter taxon.

32. ***Eucyclops*** (***Eucyclops***) ***romaniensis*** Alekseev, 2010
Fig. 36.

SYNONYMY: *Eucyclops romaniensis*: Alekseev, 2010; *Eucyclops* (*Eucyclops*) *romaniensis*: Alekseev, 2019.

TYPE LOCALITY: spring in Villa Romane in Albufera Natural Park, Valencia, Spain (39°20.234′N, 0°20.364′W).

HOLOTYPE PRESENCE AND STORING: holotype female dissected and placed to one slide and 3 undissected females paratypes deposited in Federal Collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: holotype #55054 and paratype #55055 specimens.

DESCRIPTION. FEMALE (Fig. 36). Total body length without caudal setae 1160 μm in holotype, with caudal setae 1655 μm. Body almost transparent and colourless. Cephalothorax as long

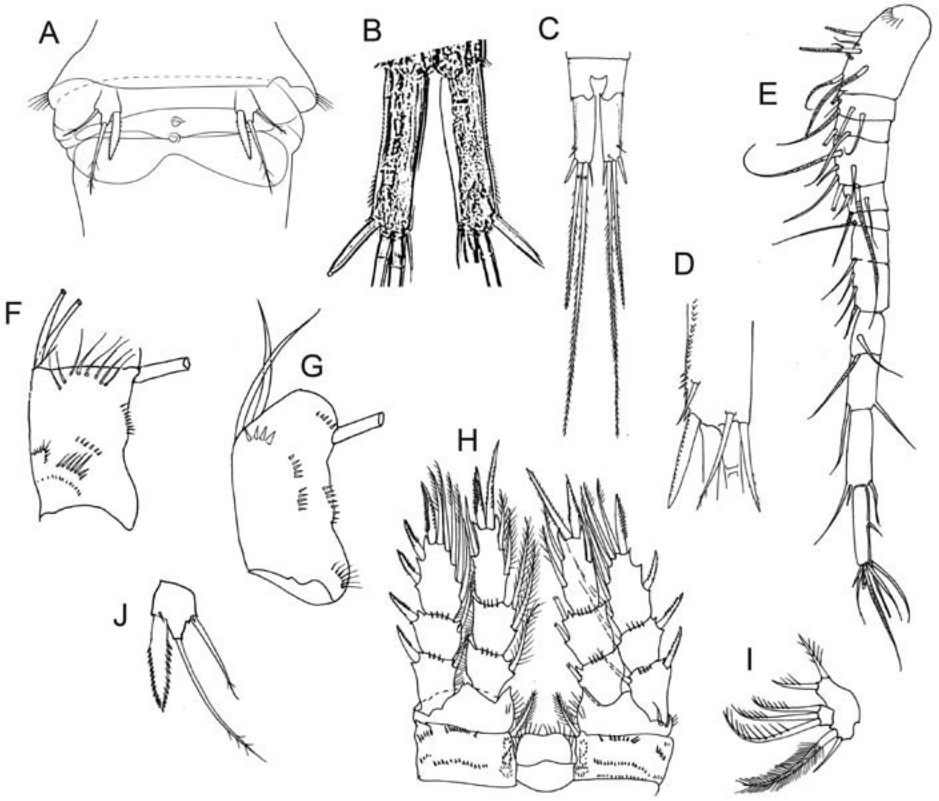


Fig. 36. *Eucyclops* (*Eucyclops*) *romaniensis* Alekseev, 2010. Female: A — Th4, genital double somite and P5; B, C, D — caudal rami; E — A1; F — A2 Bas, caudal; G — A2 Bas, frontal; H — P4, caudal; I — maxillulary palp; J — P5. Valencia, Spain, orig..

Рис. 36. *Eucyclops* (*Eucyclops*) *romaniensis* Alekseev, 2010. Самка: A — Th4, генитальный сомит и P5; B, C, D — каудальные ветви; E — A1; F — A2 Bas, каудально; G — A2 Bas, фронтально; H — P4, каудально; I — пальп максиллулы; J — P5. Валенсия, Испания, ориг.

as broad, with maximum width close to middle. Th4 with lateral setulae. Genital double somite 0.7 times as long as broad; *receptaculum seminis* typical for genus, with larger posterior part.

Caudal rami (Fig. 36B, C, D) slightly divergent, L/W ratio 3.5–4.2; lateral *serra* extending along most of lateral margin, composed of tiny denticles proximally and longer spinules distally. Outermost seta spiniform, short and thick, 0.4 times as long as ramus length; dorsal seta about as long as outermost seta; innermost seta weak, shorter than outermost seta. Lateral seta shorter than ramus width. Length proportions of terminal setae, beginning with outermost:1.0/5.5/10.9/0.8–0.9.

Antennule (Fig. 36E) 12-segmented, rather short, reaching middle of Th1; 3 distal segments with narrow smooth hyaline membrane. Setation of A1 segments beginning with first: 8/4/2/6/4/2/2/3/2/2/3/8. A2 Bas on caudal surface with long hair-setulae at position N1+N2, other groups as in Fig. 36F; frontal surface ornamentation as in Fig. 36G. Mouth appendages typical for genus; Mxl palp surface without spinules (Fig. 36I).

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Spines are wide; distal setae modified. Distal segment P4 Enp3 2.1–2.4 times as long as broad, with inner distal spine 1.4 times as long as outer spine; inner spine longer than segment. In P4 Exp3, distal spine shorter than segment (Fig. 36H). Inner edge of P1–P4 basipodites with long hair-setae. P1 basipodite with relatively long inner seta reaching distal end of Enp3. P1 IntCox

with row of small spines in middle. P4 IntCox with setulae on free edge; coxal spine homogeneously covered with dense hair-setae on both sides. Reduced P5 (Fig. 36J) armed with strong wide knife-like inner spine, about 1.5 times as long as segment; outer seta about as long as inner spine; middle seta about 1.4 times as long as spine.

MALE unknown.

DISTRUBUTION: Spain, springs in Morocco.

COMMENTS: This species has A1 with smooth hyaline plate on three distal segments; A2 Bas with single distal group of hairs in position N1+N2; spine P4 evenly plumose on both sides, and accordingly belongs to group *agilodes* [Alekseev, 2023]. It is distinguished from other representatives of this group by a shortened innermost caudal seta and wide spine of P5.

33. ***Eucyclops*** (***Eucyclops***) ***silvestrii*** (Brian, 1927) Fig. 37.

SYNONYMY: *Cyclops silvestrii*: Brian, 1927; *Eucyclops silvestrii*: Kiefer, 1936a; *Eucyclops* (*Eucyclops*) *silvestrii*: Alekseev, 2019.

TYPE LOCALITY: Rio-de la-Plata, Argentina, South America.

HOLOTYPE PRESENCE AND STORING: Holotype in bad state with dried up medium deposited in Kiefer's Reference collection, SMNK, Germany, as well as paratype and topotype slides.

MATERIAL STUDIED: holotype specimens slide #01196, paratype slide #01199; topotypes #02200, 02403 author's description and drawings.

DESCRIPTION. FEMALE (Fig. 37A–F, H). Body length without caudal setae about 1000 μm, elongated shape. Th4 with lateral hair-setulae. Genital double somite wider than long; *receptaculum seminis* typical of genus. Anal operculum slightly convex. Caudal rami slightly divergent (Fig. 37B, C), L/W ratio about 3.1; *serra* extending along most of lateral margin, composed of small denticles proximally and longer spinules distally. Outermost spiniform seta with denticles on outer side and short setulae on inner side, inserted without noticeable space from outer middle seta. Innermost seta about as long as outermost seta. Dorsal seta shorter than outermost seta. Lateral seta as long as ramus width.

Antennule (Fig. 37G) 12-segmented, short, reaching slightly beyond distal edge of CTh; with narrow smooth hyaline membrane along three distalmost segments. A2 Bas and mouth appendages not visible and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox with 3 rows of short setulae (I–III) (Fig. 37F, H). Basipodite P4 inner outgrowth covered with long hairs; coxal spine on inner margin with long setulae proximally and short setulae distally, outer margin with few short setulae proximally and without setulae distally. P4 Enp3 segment rather short, L/W ratio about 2; inner/outer spine ratio about 1.2; inner spine longer than segment; distal setae reaching 1/3–1/2 of adjacent spines (Fig. 37E, F). Distal setae of P4 partly modified, stillet-like. Reduced P5: elongated segment armed with strong bent inner spine about 1.5 times longer than segment and two subequal setae about 1.5 times longer than spine (Fig. 37D).

MALE (Fig. 37G, I). Body length without caudal setae 840 μm. Th4 without hairs laterally. Caudal rami: L/W ratio 2.5. Antennule 14-segmented. P1–P4 structure as in female, but coxal spine homogeneously plumose and distal spines shorter. Reduced P5 like in female. Rudimentary P6 (see Fig. 37I): inner spine strong, slightly longer than both setae; length ratio beginning with spine:1.0/0.6/0.8.

DISTRIBUTION: Argentina, Chile, Uruguay, Venezuela.

COMMENTS: Brian [1927], studying Professor Silvestri's collection of copepods, gave one of the specimens of *Eucyclops* with short caudal branches the name *Cyclops silvestrii* and promised to give a full description later. Kiefer, working with copepods from Uruguay, found species with similar caudal rami and asked Brian, who had not published any additional information about his species, to share material from the Silvesteri collection. After getting 2 females and one male, Kiefer described *E.* (*E.*) *silvestrii*, keeping the name and authorship of Brian. As Brian never reported his own description or type individuals, the holotype and paratype stored in Kiefer's collection in Karlsruhe, Germany should be recognized as the only type specimens for this particular South American species. From other congeners it can be separated by short caudal rami with not reduced lateral *serra* and subequal outermost and innermost caudal setae.

34. ***Eucyclops*** (***Eucyclops***) ***spatharum*** Harding, 1942 **comb.n**. Fig. 38.

SYNONYMY: *Eucyclops spatharum*: Harding, 1942; Dussart, Defaye, 2006; *Eucyclops* (*Sarsicyclops*) *spatharum*: Alekseev, 2019.

TYPE LOCALITY: Lake Young, near Lake Malawi, Rift Lake Valley, Eastern Africa.

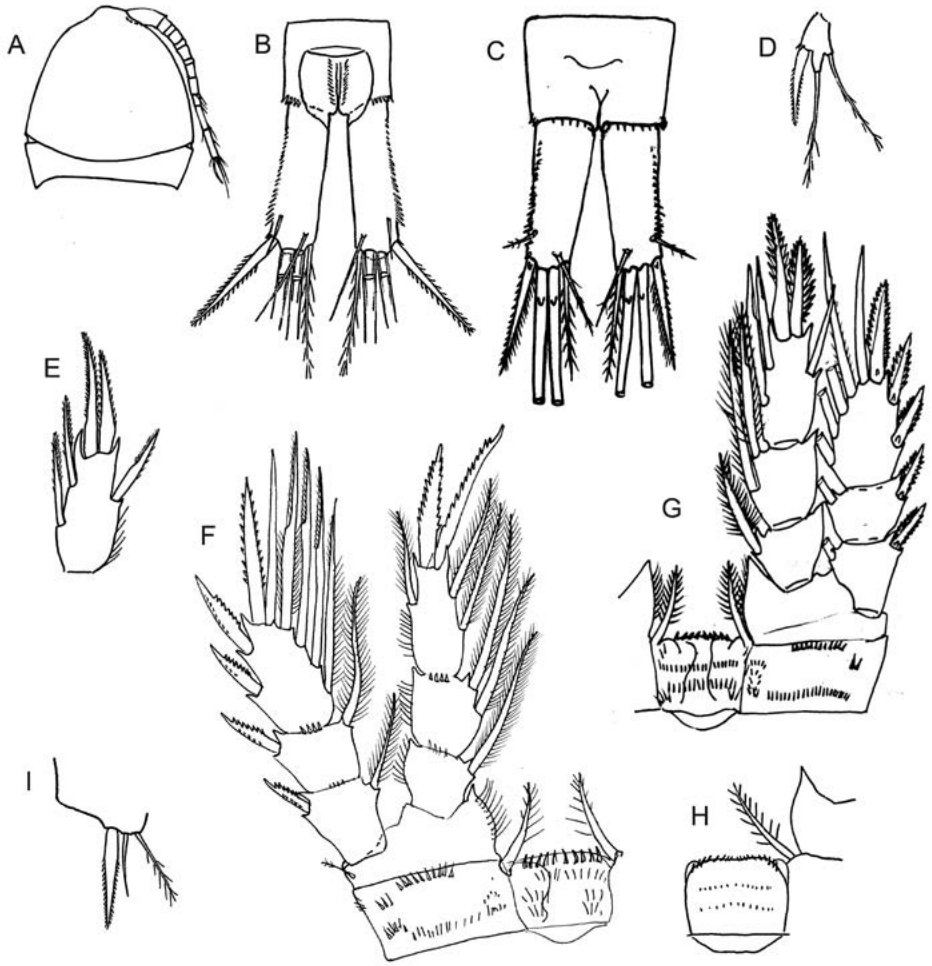


Fig. 37. *Eucyclops* (*Eucyclops*) *silvestrii* (Brian, 1927). A — A1 and cephalothorax; B, C — caudal rami; D — P5; E — P4 Enp3; F, G — P4, caudal; H — P4 intercoxal plate; I — P6. A–F, H — female; G, I — male. A, C, G — Argentina, orig., slides #01196, 01199, 02403 KRC; B, D, E, H, I — Uruguay, after Kiefer [1936a]; F — Uruguay, orig., slide #02200 KRC.

Рис. 37. *Eucyclops* (*Eucyclops*) *silvestrii* (Brian, 1927). A — A1 и цефалоторакс; B, C — каудальные ветви; D — P5; E — P4 Enp3; F, G — P4, каудально; H — межкоксальная пластинка P4; I — P6. A–F, H — самка; G, I — самец. A, C, G — Аргентина, ориг., преп #01196, 01199, 02403 KRC; B, D, E, H, I — Уругвай, по Kiefer [1936a]; F — Уругвай, ориг., преп. #02200 KRC.

HOLOTYPE PRESENCE AND STORING: type material exists only as author's drawings in British Museum of Natural History, London, U.K.

MATERIAL STUDIED: author's description and drawings, drawings and description of Dussart [1974].

DESCRIPTION. FEMALE (Fig. 38A–D). Body length without caudal setae 640–710 μm (Fig. 38A). Th4 with long lateral hair-setulae. Genital double somite: L/W ratio less than 1; *receptaculum seminis* typical of genus (Fig. 38C). Anal somite longer than previous one. Caudal rami subparallel, L/W ratio about 5.4; lateral *serra* rather long, occupying most ramus length, composing of strong spinules increasing in size distally (Fig. 38B). Outermost spiniform seta inserted without noticeable space from outer middle seta; its outer edge with small denticles, inner edge with fine hairs. Innermost caudal seta shorter than outermost and dorsal setae. Lateral seta shorter than ramus

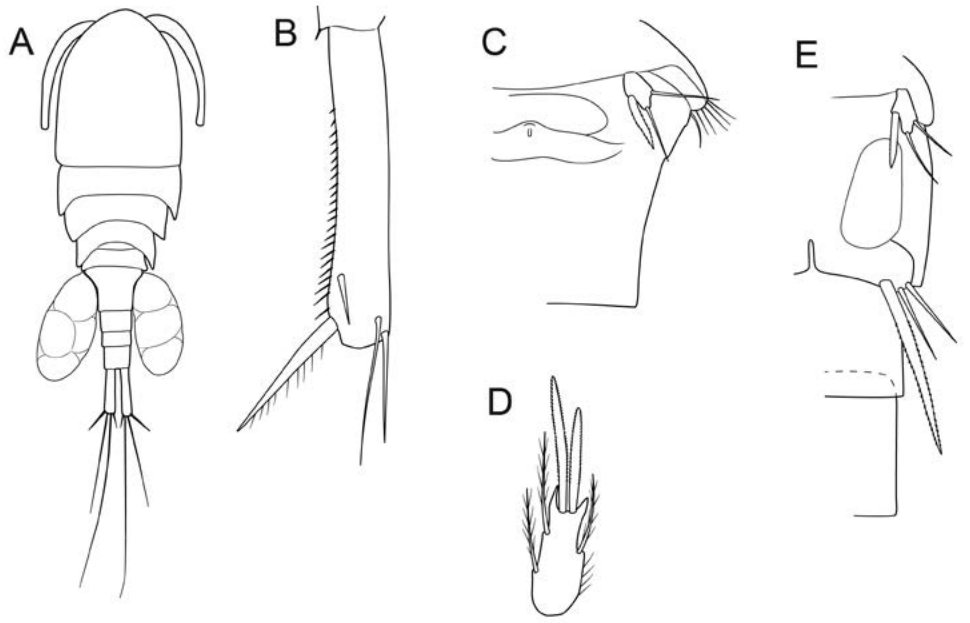


Fig. 38. *Eucyclops* (*Eucyclops*) *spatharum* Harding, 1942 comb.n. A — habitus; B — caudal ramus; C — Th4, genital double somite and P5; D — P4 Enp3; E — P5 and P6. A–D — female; E — male. Zambia, Lake Young, after Harding [1942].

Рис. 38. *Eucyclops* (*Eucyclops*) *spatharum* Harding, 1942 comb.n. A — габитус; B — каудальная ветвь; C — Th4, генитальный сомит и P5; D — P4 Enp3; E — P5 и P6. A–D — самка; E — самец. Замбия, озеро Янг, по Harding [1942].

width. Dorsal seta about as long as outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.0/ 7.0/ 0.8.

Antennule 12-segmented, short, not reaching distal edge of CTh; hyaline membrane of three distalmost segments not described. A2 Bas and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Spines wide "with minutely serrated hyaline margins". In P4 Enp3, L/W ratio about 2.1; inner/outer spine ratio about 1.3; inner spine longer than segment; distal setae reaching 1/3–1/2 of adjacent spines (Fig. 38D). Reduced P5 (Fig. 38C) armed with strong but short inner spine about 1.4 times longer than segment; medial seta about as long as spine; outer seta about 1.2 times longer than spine.

MALE (Fig. 38E). Body length without caudal setae 660–690 μm. Th4 without lateral setulae. Caudal rami shorter than in female with L/W ratio about 4.5; lateral *serra* absent, distal setae similar to female. Antennule 14-segmented. P1–P4 legs structure and armament as in female, including spatulated spines. Reduced P5 similar to female. Rudimentary P6 with long strong inner spine and two subequal setae twice shorter than spine.

DISTRIBUTION: Rift valley lakes, East Africa.

COMMENTS: Dussart [1974] reported finding of *Eucyclops spatharum* in Ethiopia and identified it based on its short antennule, spade-shaped modified spines on its swimming legs. In his drawings, which are more detailed than in Harding's description, the reduced P5 is armed with a shortened and weak inner spine, so it seems to belong to the subgenus *Eucyclops* (*Sarsicyclops*). That is why in my previous revision Harding's taxon was placed in this subgenus [Alekseev, 2019]. Closer examination of the Paris slides and Harding's descriptions and drawings revealed differences between the specimens collected by Dussart in Ethiopia and the Rift Valley lake specimens used by Harding. In contrast to Harding's description, in Dussart's specimens the innermost caudal seta is longer than the outermost one, and the proportions of P4Enp3 are also different. It appears that Dussart found another species with spatulate spines instead of *E.* (*E.*) *spatharum*. The spade-shaped transfor-

mation of spines in P1–P4 can also be observed in several other *Eucyclops* species inhabiting tropics and subtropics. Dussart's taxon from Ethiopia is given hereinafter as a new form of *Eucyclops* (*Sarsicyclops*). From their closest congeners with shortened innermost caudal seta, such as *E.* (*E.*) *acanthoides* and *E.* (*E.*) *romaniensis*, Harding's species (also belonging to the type subgenus) can be separated by very short A1 not reaching the posterior margin of CTh and shortened medial seta of P5, subequal to the inner spine.

35. ***Eucyclops*** (***Eucyclops***) ***spatulatus*** Morton, 1990
Fig. 39.

SYNONYMY: *Eucyclops speratus* var. *tasmanica*: Brehm, 1953; *Eucyclops spatulatus*: Morton, 1990; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *spatulatus*: Alekseev, 2019.

TYPE LOCALITY: Valley Lake, Mount Gambier, South Australia.

HOLOTYPE PRESENCE AND STORING: holotype female, paratype male and 12 other paratypes, coll. D.W. Morton, 12.vii.74, were deposited in NH Museum of Victoria, Australia.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 39). Body length without caudal setae 820–1200 μm. Th4 with lateral hair-setulae. Genital double somite elongated with L/W ratio slightly more than 1. Anal operculum round in shape, weakly developed. Caudal rami (Fig. 39A) subparallel with L/W ratio 4.5–5.2; lateral *serra* beginning proximally from a point approximately 1 ramus width from ramus base, composing of tiny, equal in size spinules similar to *E.* (*Sp.*) *speratus*. Lateral seta shorter than ramus width. Outermost spiniform seta inserted without noticeable space from outer middle seta; its outer edge with small denticles, inner edge with short rare hairs. Innermost caudal seta with long rare hairs, 1.2–1.6 times as long as outermost seta. Dorsal seta longer than outermost seta and subequal to innermost seta (although in Morton's figure dorsal seta shorter than innermost one).

Antennule 12-segmented, reaching posterior edge of Th1; three distalmost segments without visible hyaline membrane. A2 Bas and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. All setae in P4 and distal setae of P3 spatulate (widened and flattened). P4 IntCox with long setulae at distal margin (Fig. 39C). In P4 Enp3, L/W ratio about 2.5; inner/outer spine ratio about 1.4; inner spine about as long as segment; distal setae reaching 1/2 of adjacent spines (Fig. 39B). In P4 Exp3, distal spine longer than segment. Reduced P5 (Fig. 39D): segment relatively short, armed with wide and strong inner spine and two long setae, approximate length ratio beginning with spine:1.0/1.9/1.7.

MALE: Body shorter than in female, 680–830 μm; Th4 hairless laterally. Caudal rami shorter than in female: L/W ratio = 3.8–4.0; without lateral *serra*; innermost caudal seta longer than in female, about 0.8 times as long as ramus length. Antennule 14-segmented. Swimming legs P1–P4 and reduced P5 as in female. Rudimentary P6 with strong inner spine reaching middle of 3rd abdominal somite; medial seta about as long as spine; outer seta about twice longer than medial seta.

DISTRIBUTION: Australia (Victoria, New South Wales, South Australia, West Australia, Tasmania).

COMMENTS: In the middle of last century, Brehm [1953] briefly describes an *Eucyclops* from Tasmania as *E. speratus* f. *tasmanica* without figures or a holotype indicated. Morton believes that his *E. spatulatu*s is close to Brehm's insufficient description and denominates *E. speratus* f. *tasmanica*. He compares *E.* (*E.*) *spatulatus* with *E.* (*E.*) *serrulatus* from Europe (London vicinity). To some extent (reduced lateral *serra* of tiny denticles in caudal rami, P4 coxal spine ornamentation, P5 structure and armament as well) this form should be compared with *E.* (*Sp.*) *speratus*, as Brehm supposes. Missing data on antennal basipodite ornamentation as well as absence of this subgenus outside Palearctic do not allow me to include it into the *Speratocyclops* subgenus, but it is possible that after redescription *of E.* (*E.*) *spatulatus*, it will become the first member of this subgenus in Australia.

36. ***Eucyclops*** (***Eucyclops***) ***sublaevis*** (Sars G.O., 1927)
Fig. 40.

SYNONYMY: *Leptocyclops sublaevis*: Sars G.O., 1927; *Eucyclops sublaevis*: Dussart, Defaye, 2006.

TYPE LOCALITY: pond in Cape Flats, Cape prov., South Africa.

HOLOTYPE PRESENCE AND STORING: Zoological Museum in Lund, not found.

MATERIAL STUDIED: topotype female from Kiefer's Reference collection, SMNK, Germany, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 40). Body length without caudal setae 1200 μm, elongated shape (Fig. 40A). Th4 with lateral setulae. Caudal

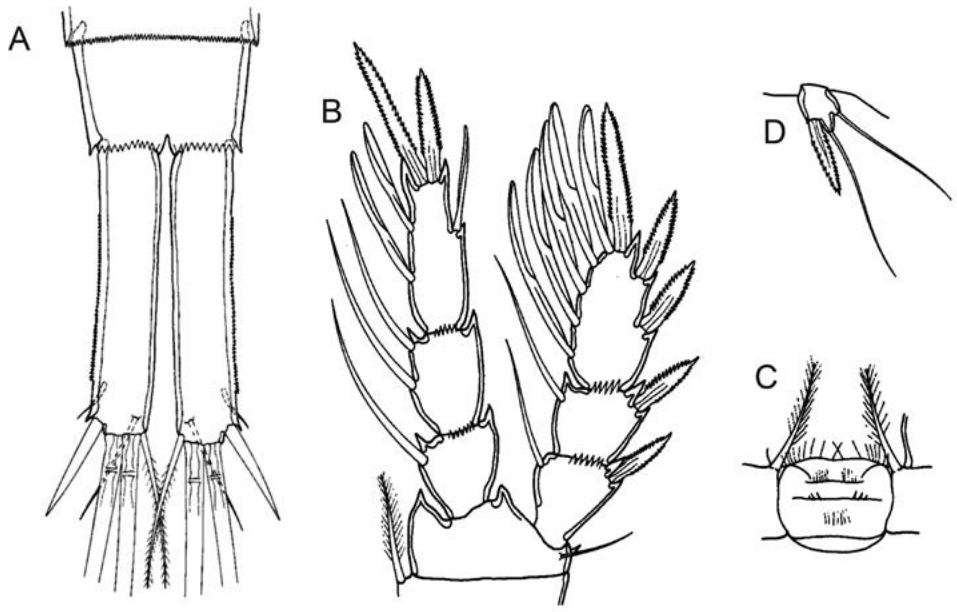


Fig. 39. *Eucyclops* (*Eucyclops*) *spatulatus* Morton, 1990. Female: A — caudal rami, ventral; B — P4; C — P4 intercoxal plate; D — P5. South Australia, after Morton [1990].

Рис. 39. *Eucyclops* (*Eucyclops*) *spatulatus* Morton, 1990. Самка: A — каудальные ветви, вентрально; B — P4; C — межкоксальная пластинка P4; D — P5. Южная Австралия, по Morton [1990].

rami slightly divergent (Fig. 40D), long, L/W ratio about 7.5; lateral *serra* short, of 8–12 spinules slightly increasing distally, occupying less than 25% of ramus length and missing in some individuals. Innermost seta slightly longer than outermost one. Outermost spiniform seta inserted without noticeable space from outer middle seta; its outer edge with denticles, inner edge with short setulae. Lateral seta about 1.8 times longer than ramus width. Dorsal seta shorter than outermost spine or subequal.

Antennule 12-segmented, almost reaching posterior edge of Th1; three distalmost segments without visible hyaline membrane. A2 Bas and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 long, with L/W ratio about 2.8; inner/outer spine ratio 1.5; inner spine shorter than segment; inner distal seta reaching middle of nearest spines. P4 Exp3 distal spine very long, 1.1 times as long as segment length; distal seta not reaching beyond tip of distal spine. Reduced P5 (Fig. 40D) armed with strong but rather short and bent inner spine 1.4 times as long as segment, outer seta shorter than spine, medial seta 1.5 times as long as spine.

MALE: not described.

DISTRIBUTION: South Africa.

COMMENTS: Sars [1927] finds some similarity of CR construction in his taxon and in European *E.* (*Sp.*) *speratus*. Following set of characters separates Sars's species from other congeners: short innermost caudal seta subequal to dorsal and outermost setae, much reduced lateral *serra* of few spinules, long lateral seta, narrow and long CR with L/W ratio 7–8.

37. ***Eucyclops* (*Eucyclops*) *torresphilipi*** Suárez-Morales, 2004 Fig. 41.

SYNONYMY: *Eucyclops torresphilipi*: Suárez-Morales, 2004.

TYPE LOCALITY: Pond in Ejido "El Aguila", Cacahoatán, Chiapas, Mexico.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype females and males, deposited in the El Colegio de la Frontera Sur (ECO-CH-Z), in Chetumal, Mexico. Five undissected females and one undissected male deposited in the Muséum National d'Histoire Naturelle, Paris, France (MNH-Cp-2182). Additional, nontype specimens in collection of E. Suárez-Morales.

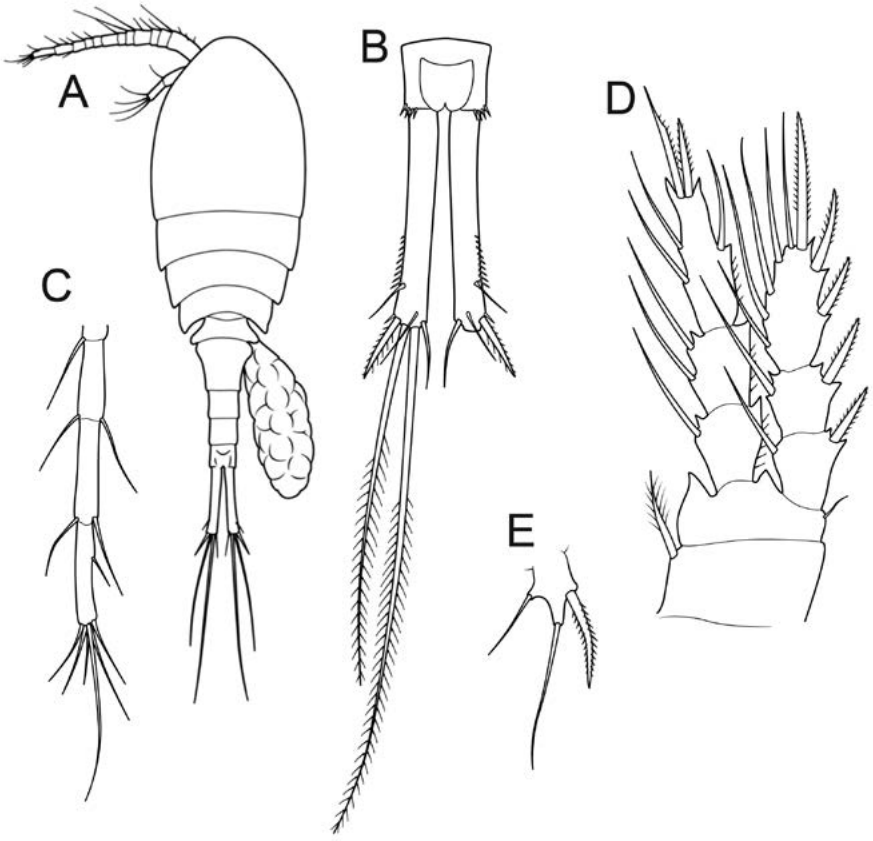


Fig. 40. *Eucyclops* (*Eucyclops*) *sublaevis* (Sars G.O., 1927). Female: A — habitus; B — caudal rami, dorsal; C — A1, three distal segments; D — P4; E — P5. South Africa, after Sars G.O. [1927].

Рис. 40. *Eucyclops* (*Eucyclops*) *sublaevis* (Sars G.O., 1927). Самка: A — габитус; B — каудальные ветви, дорсально; C — A1, три дистальных членика; D — P4; E — P5. Южная Африка, по Sars G.O. [1927].

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 41). Average body length without caudal setae about 680 μm. Cephalothorax slightly wider than long with maximal width close to posterior border (Fig. 41A). Th4 with long setulae at posterolateral angles. Genital double somite wider than long, *receptaculum seminis* typical for genus, but rather extended antero-posteriorly (Fig. 41B). Anal operculum weakly developed. Caudal rami: L/W ratio 4.1–4.5, slightly divergent; *serra* partly reduced, composed of rather strong teeth, slightly increasing distally. Lateral seta about 2 times as long as ramus width. Outermost seta spiniform but thin, 0.75 times as long as ramus length. Innermost seta about 1.6 times as long as outermost seta. Dorsal seta 1.0–1.2 times as long as outermost seta. Approximate length ratio of terminal setae beginning with outermost: 1.0/5.0 / 8.0 /1.6.

Antennule 12-segmented, rather short, reaching middle of Th1. Setation of antennular segments, beginning with first: 8/ 4/ 2/ 6/ 4 /2/ 2/ 3/ 2+I/ 2/ 3/ 7+I (seta — arabic; aesthetasc — roman). A2 Enp setation: 1, 9, 7. A2 Bas on caudal surface with long hair-setulae at position N1 and short spinules at position N2, other groups as in Fig. 41F; frontal surface ornamentation as in Fig. 41E. Mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox distal margin with few long strong spinules, other rows as in Fig. 41I; coxal spine with gap on outer margin. Length/ width ratio of P4 Enp3 2.1; inner spine longer

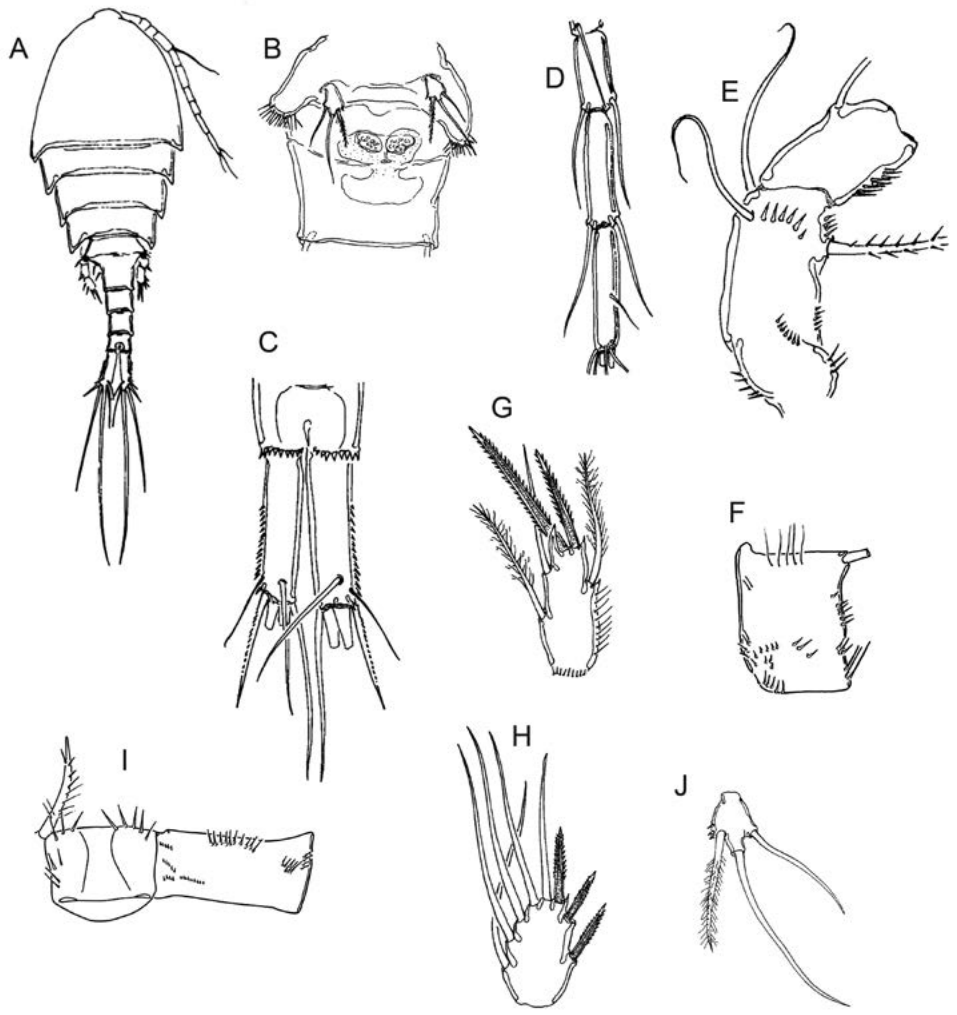


Fig. 41. *Eucyclops* (*Eucyclops*) *torresphilipi* Suárez-Morales, 2004. Female: A — habitus; B — Th4, genital double somite and P5; C — caudal rami; D — A1, three distal segments; E — A2 Bas, frontal; F — A2 Bas, caudal; G — P4 Enp3; H — P4 Exp3; I — P4 intercoxal plate and coxa, caudal; J — P5. Mexico, after Suárez-Morales [2004].

Рис. 41. *Eucyclops* (*Eucyclops*) *torresphilipi* Suárez-Morales, 2004. Самка: A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви; D — A1, три дистальных членика; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — P4 Enp3; H — P4 Exp3; I — межкоксальная пластинка и кокса P4, каудально; J — P5. Мексика, по Suárez-Morales [2004].

than segment; inner/outer spine ratio 1.5; distal setae rather long, reaching beyond 3/4 of adjacent spines (Fig. 41G). P4 Exp3 distal spine relatively short, about 0.7 times as long as segment. Reduced P5 (Fig. 41J) with rather slender inner spine about twice longer than segment; outer seta about as long as spine; medial seta about 1.6 times longer than spine. P6 with laterally directed seta and two tiny spines.

MALE: Body length about 650 μm, slender than in female; Th4 without lateral setulae. CR shorter than in female; lateral seta slightly longer than CR width; lateral *serra* absent. Antennules 14-segmented. Antennal Bas with ornamentation similar to female, groups N1, 2 presented. Legs P1–P4: shape, segmentation and armament as in female. Reduced P5 as in female. Rudimentary P6 with long inner spine and two twice shorter setae.

DISTRIBUTION: known from the type locality only: Cacahoatán, Chiapas, Mexico.

COMMENTS. This form belongs to American group of *serrulatus*-like species: coxal spine with a gap among setulae on outer edge; A2 Bas on caudal surface with short spinules in position N2 and long hairs in position N1.

38. ***Eucyclops*** (***Eucyclops***) ***tziscao***
Mercado-Salas, 2013
Fig. 42.

SYNONYMY: *Eucyclops tziscao*: Gutiérrez-Aguirre *et al*., 2013.

TYPE LOCALITY: Laguna Tziscao, Chiapas, Mexico.

HOLOTYPE PRESENCE AND STORING: holotype female and paratypes, coll. 15 April 2000, deposited in the Collection of Zooplankton of El Colegio de la Frontera Sur (ECOSUR) at Chetumal, Mexico (ECO-CH-Z), and in the Colección Nacional de Crustáceos (CNCR) del Instituto de Biología, Universidad Nacional Autónoma de México.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 42A–F). Body length without caudal setae 620 µm. Th4 with long lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical of genus (Fig. 42B). Caudal rami: L/W ratio about 4, slightly divergent; lateral *serra* partly reduced, composed of strong spinules increasing distally (Fig. 42A). Anal operculum weakly convex, slightly serrated. Lateral seta about 1.6 times longer than ramus width. Outermost spiniform seta inserted close to outer middle seta, about 0.7 times as long as ramus length. Innermost seta 1.2 times as long as outermost seta. Dorsal seta 1.1 times as long as outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.0/ 8.5/ 1.2.

Antennule 12-segmented, reaching middle/ distal margin of Th2; with finely serrated hyaline membrane along three distalmost segments. Setation of antennular segments, beginning with first: 8/4/2/6/4/2/2/3/2+I/2/3/7+I (seta — arabic; aesthetasc — roman). A2 Enp setation: 1, 9, 7. A2 Bas on caudal surface with few long setulae at position N1 and short spinules at N2, other groups as in Fig. 42D; frontal surface ornamentation as in Fig. 42C. Mxl palp with naked surface. Maxilla praecoxa with row of spinules at lateral margin. Other mouth appendages as in congeners.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P1–P4 IntCox on frontal surfaces with arcs of spinules at sides. In P1 ,IntCox on caudal surface with two rows of tiny spinules (II, III). In P2, IntCox on caudal surface with one row of tiny setulae (III). In P3, IntCox on caudal surface with three rows of spinules (I, II, III); distal row I bearing long hair-like setulae at each side, middle and proximal rows (II, III) with tiny spinules. In P4, IntCox on caudal surface with three rows of spinules (I, II, III) of different length (Fig. 42E). In P1–4 Bas, inner outgrowth with long hairs. P4 coxal spine plumose on inner side and with only few distal spinules on outer side (Fig. 42E). P4 Enp3 L/W ratio about 2.6; inner/outer spine ratio about 1.4; inner spine 1.1 times as long as segment; distal setae modified, broader than other setae, with blunt tips, reaching 1/3 to 1/2 of adjacent spines (Fig. 42F). P4 Exp3 distal spine about 0.9 times as long as segment; distal setae modified. Reduced P5: segment 2.1 times longer than broad; with strong inner spine, 1.5 times as long as segment; approximate length ratio of appendages beginning with inner spine: 1.0/ 1.5/ 1.2 (Fig. 42B).

MALE (Fig. 42G). Body length without caudal setae 509 µm. Anal operculum slightly rounded, smooth. Caudal rami: L/W ratio 3.5, parallel, without lateral *serra*. Dorsal seta 0.75 times as long as outermost seta. Innermost seta 1.6 times as long as outermost seta. In A2, Bas ornamentation similar to female, with N1 and N2 on caudal surface; but without groups N8 and N11 on frontal surface. In P4 IntCox plate, caudal surface with distal row I, composed of 9 spinules longer and slender than in female. In P4 Enp3: L/W ratio about 2.4; inner/outer spine ratio about 1.2; inner spine 1.2 times as long as segment; distal setae not modified, reaching 1/2 of adjacent spines. P4 Exp3: distal spine about 1.2 times as long as segment; distal setae are not modified. Reduced P5: segment 1.5 times longer than broad; with strong inner spine, 1.8 times as long as segment; approximate length ratio of appendages beginning with inner spine: 1.0/ 1.3/ 1.3. Rudimental P6 with long inner spine reaching distal margin of fourth urosomite and two unequal setae; approximate length ratio of appendages beginning with inner spine: 1.0/ 0.4/ 0.6 (Fig. 42G).

DISTRIBUTION: known only from the type locality.

COMMENTS: This form resembles *E. bondi*, but can be easy distinguished by very long lateral caudal seta.

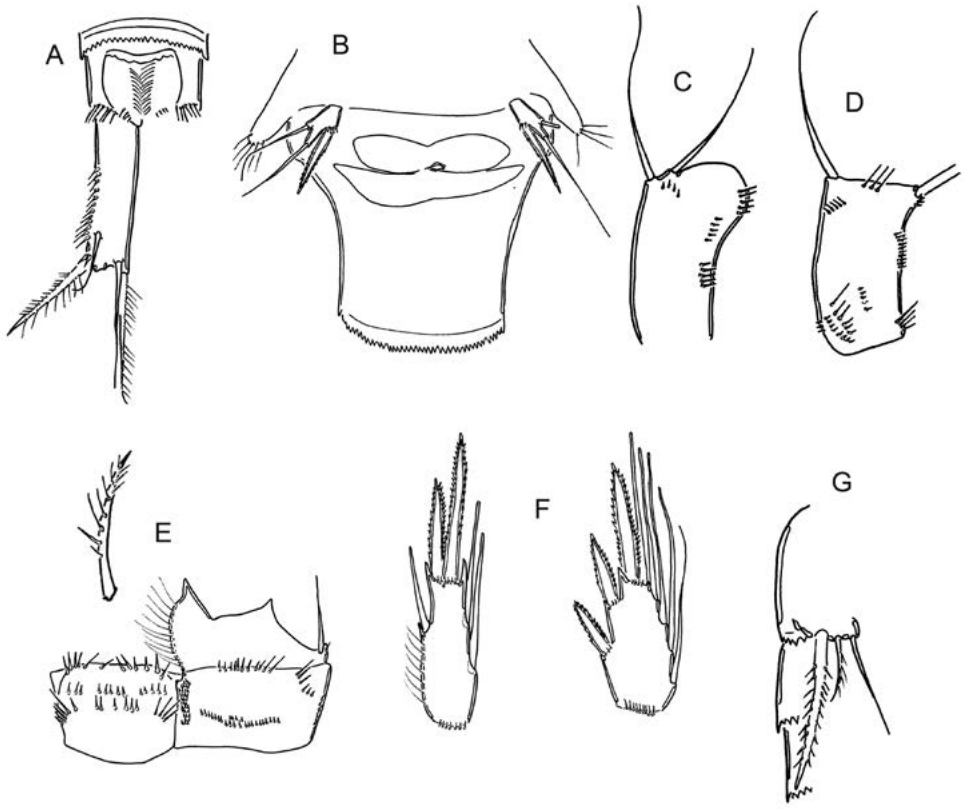


Fig. 42. *Eucyclops* (*Eucyclops*) *tziscao* Mercado-Salas, 2013. A — caudal ramus, dorsal; B — Th4, genital double somite and P5; C — A2 Bas, frontal; D — A2 Bas, caudal; E — P4 basipodite, coxa, intercoxal plate and coxal spine, caudal; F — P4 Enp3 and Exp3; G — P6. A–F — female; G — male. Mexico, after Gutiérrez-Aguirre *et al*. [2013].

Рис. 42. *Eucyclops* (*Eucyclops*) *tziscao* Mercado-Salas, 2013. A — каудальная ветвь, дорсально; B — Th4, генитальный сомит и P5; C — A2 Bas, фронтально; D — A2 Bas, каудально; E — базиподит, кокса, межкоксальная пластинка и коксальный шип P4, каудально; F — P4 Enp3 и Exp3; G — P6. A–F — самка; G — самец. Мексика, по Gutiérrez-Aguirre *et al*. [2013].

39. ***Eucyclops*** (***Eucyclops***) ***vandouwei*** (Brehm, 1909) Fig. 43.

SYNONYMY: *Cyclops van Douwii*: Brehm, 1909; *Cyclops fragilis*: Kiefer, 1926b; *Eucyclops fragilis*: Kiefer, 1927a; *Eucyclops vandouwei*: Dumont, Verheye, 1984; Dussart, Defaye, 2006; Alekseev, Defaye, 2011; *Eucyclops* (*Eucyclops*) *vandouwei:* Alekseev, 2019.

TYPE LOCALITY: Cameroun, Africa.

HOLOTYPE PRESENCE AND STORING: not found/existing.

MATERIAL STUDIED: Topotypes from Kiefer's Reference collection, SMNK, Germany, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 43). Body length without caudal setae 900–1000 μm, elongated shape, dark yellow color. Cephalothorax as long as broad. Th4 with lateral setulae. Genital double somite about as long as broad; *receptaculum seminis* typical for genus. Caudal rami parallel, L/W ratio about 4; lateral *serra* long, composed of strong spinules increasing distally, occupying most of ramus length (Fig. 43B–D). Innermost caudal seta 1.3–1.5 times longer than outermost seta. Lateral seta about as long as ramus width. Long, thin outermost spiniform seta inserted without noticeable space from outer middle seta. Dorsal seta about 0.8 times as long as outermost seta.

Antennule 12-segmented, almost reaching posterior edge of Th1; without visible hyaline membrane along three distalmost segments (Fig. 43E). Antenna and mouth appendages not described.

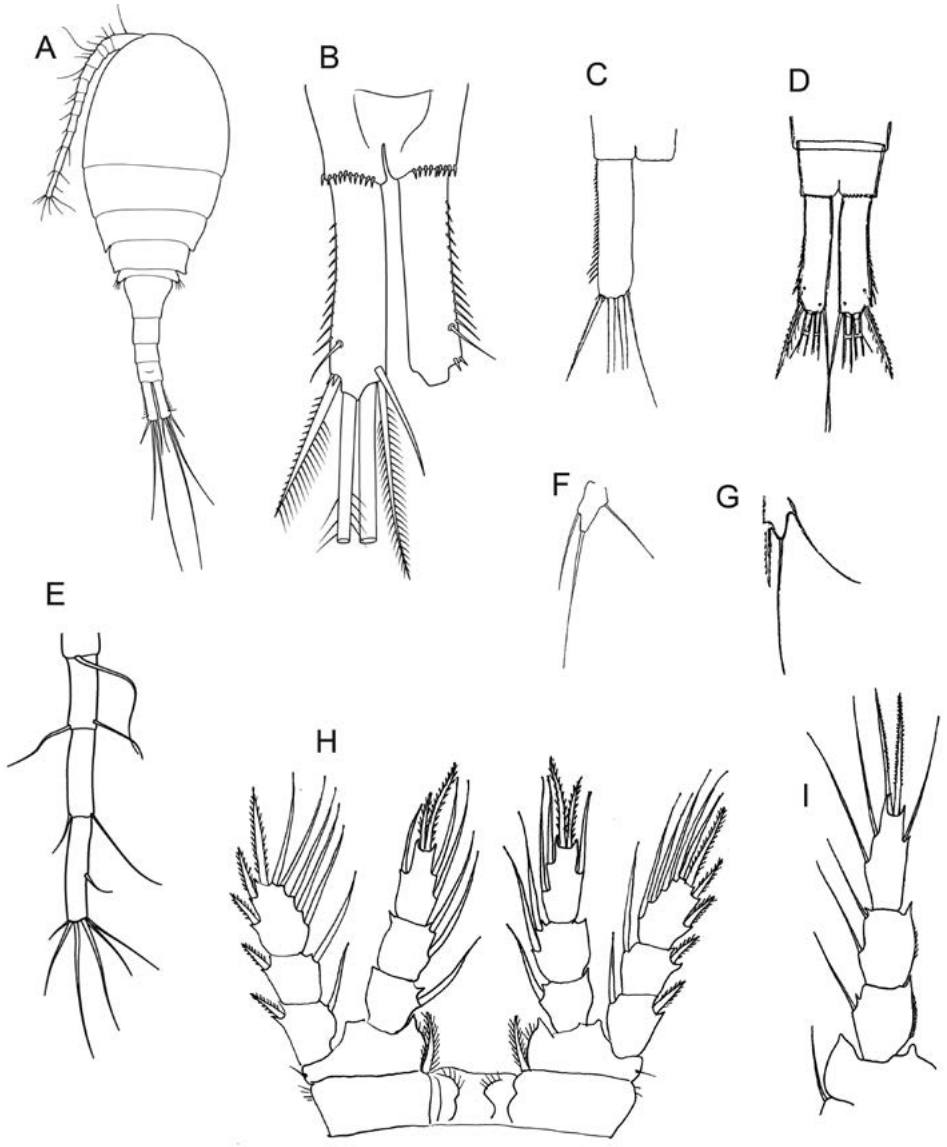


Fig. 43. *Eucyclops* (*Eucyclops*) *vandouwei* (Brehm, 1909). Female: A — habitus; B, C, D — caudal rami; E — A1, three distal segments; F, G — P5; H, I — P4. A, E — Congo, orig., slide #06121 KRC; B — Congo, orig., slide #06119 KRC; C, F, I — Cameroon, after Brehm [1909]; D, G — Cameroon, after Kiefer [1927a]; H — Congo, orig., slide #06120 KRC.

Рис. 43. *Eucyclops* (*Eucyclops*) *vandouwei* (Brehm, 1909). Самка: A — габитус; B, C, D — каудальные ветви; E — A1, три дистальных членика; F, G — P5; H, I — P4. A, E — Конго, ориг., преп. #06121 KRC; B — Конго, ориг., преп. #06119 KRC; C, F, I — Камерун, по Brehm [1909]; D, G — Камерун, по Kiefer [1927a]; H — Конго, ориг., преп. #06120 KRC.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 coxal spine homogeneously covered with hairs. P4 Enp3 (Fig. 43H, I): L/W ratio about 2; inner/outer spine ratio 1.1–1.3; inner spine longer than segment; distal setae almost reaching tips of nearest spines. In P4 Exp3, distal spine 1.2 times as long as segment length. P4Bas inner outgrowth covered with long rare hairs. Reduced P5 (Fig. 43F, G) armed with weak inner spine about 1.5 times as long as segment; outer seta 0.9–1.5 times as long as spine, middle seta about twice as long as spine.

MALE unknown.

DISTRIBUTION: Africa (Angola, Cameroon, Democratic Republic of Congo, Ivory Coast (Ebrie Lagoon)).

COMMENTS: Brehm [1909] describes this form by comparing it with the European *E.* (*E.*) *serrulatus* and the African *E.* (*D.*) *euacanthus*. He finds that *E.* (*E.*) *vandouwei* differs from the first species in its P5 armament (weak and narrow inner spine versus wider one of *E.* (*E.*) *serrulatus*). He also states that Sars [1909] does not describe P5 in *E.* (*D.*) *euacanthus*. As a result, Brehm separates *E.* (*E.*) *vandouwei* from its congeners by the difference in the ratio of the innermost to outermost caudal setae, which is about 2 in *E.* (*D.*) *euacanthus* and 1.3–1.5 in *E.* (*E.*) *vandouwei*. From subsequent publications describing P5 in *E.* (*D.*) *euacanthus*, we know that they also differ in the length of the inner spine of P5, which is not longer than the segment in species of Sars and 1.5 times longer than the segment in *E.* (*E.*) *vandouwei.* After getting more material from Africa Kiefer [1929b] synonymized his *E. fragilis* with Brehm's taxon.

40. ***Eucyclops* (*Eucyclops*) *wixarica***
Mercado-Salas et Suárez-Morales, 2016
Fig. 44.

SYNONYMY: *Eucyclops wixarica*: Mercado-Salas *et al*., 2016.

TYPE LOCALITY: San Francisco Pond, San Francisco, San Luis Potosí, Mexico (22°03′13.8″ N; 99°50′50.3″W).

HOLOTYPE PRESENCE AND STORING: holotype female and paratype females and males, deposited in the El Colegio de la Frontera Sur (ECO-CH-Z), in Chetumal, Mexico.

MATERIAL STUDIED: authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 44). Body length without caudal setae about 850 μm. Th4 with long setulae at posterolateral angles (Fig. 44B). Genital double somite as long as broad, *receptaculum seminis* typical of genus. Anal operculum strongly developed, round, smooth. Caudal rami divergent, L/W ratio about 5.1; lateral *serra* long, extending along most of lateral margin, of strong rarely spaced spinules increasing distally (Fig. 44A). Dorsal seta slightly shorter than outermost seta. Outermost seta spiniform, long and thin, with denticulate outer edge and long hairs on inner edge. Innermost seta plumose, about 0.5 times as long as ramus length and about 1.1 times as long as outermost seta. Lateral seta about 1.6 times longer than ramus width.

Antennule 12-segmented, reaching middle of Th1, with smooth or finely serrated hyaline membrane along three distalmost segments (Fig. 44C). Setation of antennular segments beginning with first: 8/4/2/6/4/2/2/3/2+I/2/2+I/8. A2 Enp setation: 1/9/7. A2 Bas on caudal surface with two groups of long hair-setulae at N1 and N2 positions, other groups as in Fig. 44D; frontal surface ornamentation as in Fig. 42E (+ group of strong spinules at N8, which was not drawn, but present in photographs). Mouth appendages not described except maxilla, which has structure typical for genus, without spinules at lateral margin of praecoxa.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4, distal margin of IntCox with row I bearing long hairs (Fig. 44F, G). Inner coxal spine on inner margin with long hairs on proximal section and with strong spinules distally; outer margin with long gap in the middle. P4 Enp3 L/W ratio about 2.4; inner/outer spine ratio 1.4; inner spine longer than segment; distal setae long, almost reaching tips of adjacent spines (Fig. 44F). P4 Exp3 distal spine rather short, not longer than segment. Reduced P5 with strong long inner spine, about 2.6 times as long as segment; outer seta shorter than spine; medial seta about 1.5 times longer than spine (Fig. 44B).

MALE: Body length shorter than in female. Caudal rami: L/W ratio about 3.8, without lateral *serra*, only with few strong spinules at lateral seta insertion place; dorsal seta about 0.9 times as long as outermost seta. Innermost /outermost caudal setae ratio about 1.8. Swimming legs and P5 structure as in female. Rudimentary P6 armed with strong inner spine and two shorter setae. Inner spine reaching beyond posterior margin of second abdominal somite, 1.5 times longer than medial seta and 1.6 longer than outer seta. Strong spinules at insertion of inner spine.

DISTRIBUTION: known only from the type locality in Mexico.

COMMENTS: This form in many morphometric features as well as in such taxonomically important microcharacters as A2Bas ornamenta-

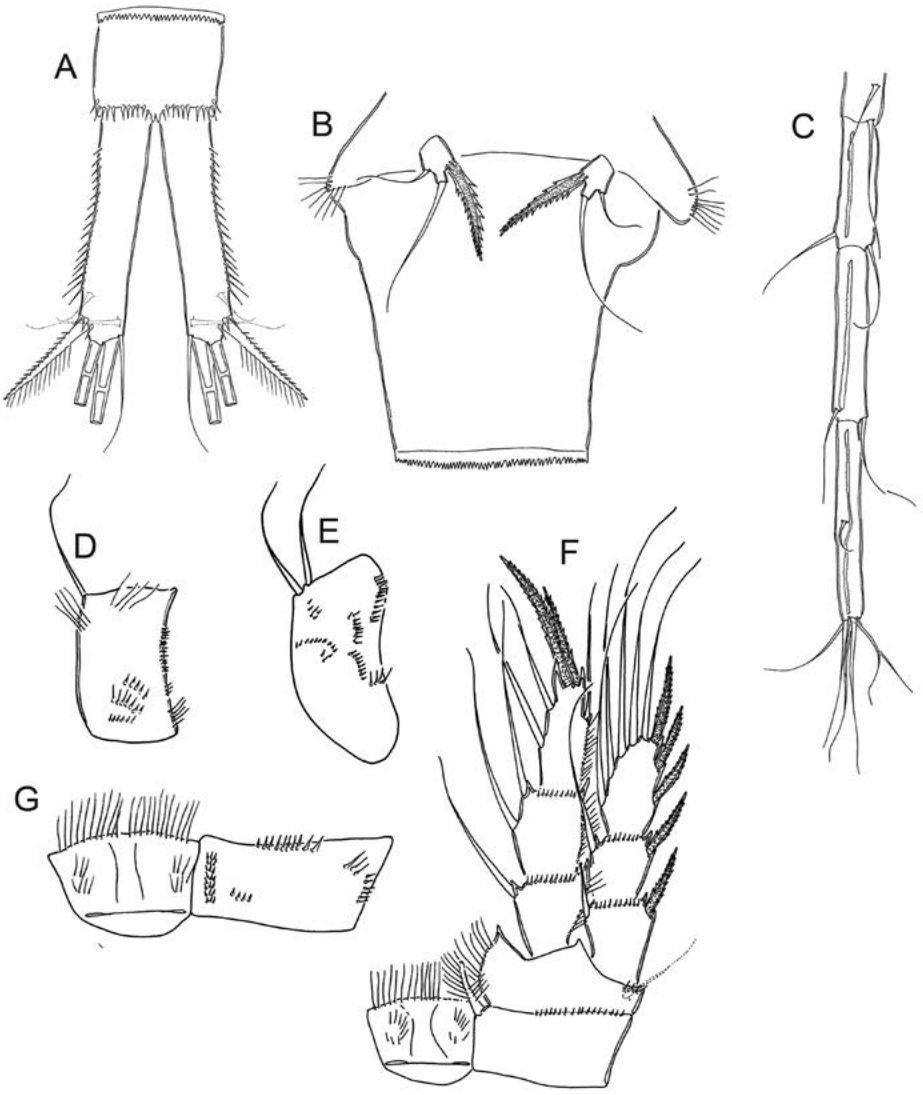


Fig. 44. *Eucyclops* (*Eucyclops*) *wixarica* Mercado-Salas et Suárez-Morales, 2016. Female: A — caudal rami; B — Th4, genital double somite and P5; C — A1, three distal segments; D — A2 Bas, caudal; E — A2 Bas, frontal; F — P4, frontal; G — P4 intercoxal plate and coxa, caudal. Mexico, after Mercado-Salas *et al*. [2016].

Рис. 44. *Eucyclops* (*Eucyclops*) *wixarica* Mercado-Salas et Suárez-Morales, 2016. Самка: A — каудальные ветви; B — Th4, генитальный сомит и P5; C — A1, три дистальных членика; D — A2 Bas, каудально; E — A2 Bas, фронтально; F — P4, фронтально; G — межкоксальная пластинка и кокса P4, каудально. Мексика, по Mercado-Salas *et al*. [2016].

tion (N1 and N2 of long hairs), P4 coxal spine with a gap among setulae on outer margin reminds *E.* (*E.*) *serrulatus* s.lat. from Palearctic. Clear difference can be seen mainly in caudal *serra* construction that is represented in Mexican form by very long spinules and P4 IntCox distal margin with very long thin hairs. This species along with *E.* (*E.*) *borealis* s.str. Ishida, 2000 seems like the only American member of *serrulatus* complex close to Palearctic forms. The question on the possible introduction of these two species from Palearctic area by ships needs to be studied.

2. SUBGENUS ***Eucyclops*** (***Breviramocyclops***) Alekseev, 2019

Small and average size cyclopids with body length without caudal setae 600–1160 μm, inhabiting mainly marsh habitats, near shore areas or ground waters. Body colour brown or brown-yellowish, sometimes colorless. Caudal rami short, parallel, L/W ratio in adult female from 1.7 to 2.6; with full lateral *serra* (South American species) or reduced to few spinules near lateral seta and sometimes with groups of spinules on ventral surface (underground waters). Antennule 12-segmented, short, reaching only distal edge of CTh or Th1. P4 Enp3 short, with L/W ratio 1.5–2.2. Length of inner spine of P5 varies from very short to extremely long. Subgenus includes five species found in America, Australia and West Asia.

Key to subgenus *Eucyclops* (*Breviramocyclops*) species

1. CR with lateral *serra* reduced to few spinules near lateral seta base 2
– CR with well-developed *serra* occupying at least half of lateral edge 3
2. P5 with very long inner spine, subequal to medial seta; CR with oblique rows of spinules on ventral surface ..... *E.* (*B.*) *edytae* Tang, Knott, 2009 [caves in Australia]
– P5 with inner spine shorter than medial seta; CR without oblique rows of spinules on ventral surface ..... *E.* (*B.*) *puteincola* Kiefer, 1981 [wells in Syria]
3. P5 with weak and short inner spine about as long as segment and at least 3 times shorter than outer seta ..... *E.* (*B.*) *siolii* Herbst, 1962 [Brazil]
– P5 with strong inner spine, at least 1.5 times longer than segment and about as long as outer seta 4
4. Female body length more than 1 mm; A2 Bas without distal setulae at positions N1, N2 .... *E.* (*B.*) *breviramatus* Löffler, 1963 [Ecuador]
– Female body length less than 1 mm; A2 Bas with distal setulae at positions N1, N2 ..... *E.* (*B.*) *angeli* Gutiérrez-Aguirre et Cervantes-Martínez, 2013 [Mexico]

Description of the type species for subgenus

41. ***Eucyclops*** (***Breviramocyclops***) ***breviramatus*** Löffler, 1963
Fig. 45.

SYNONYMY: *Eucyclops breviramatus*: Löffler, 1963; Dussart, Defaye, 2006; Mecado-Salas, Suarez-Morales, 2021; *Eucyclops* (*Breviramocyclops*) *breviramatus*: Alekseev, 2019.

TYPE LOCALITY: Lake in Andes, Papallacta region, Ecuador, South America

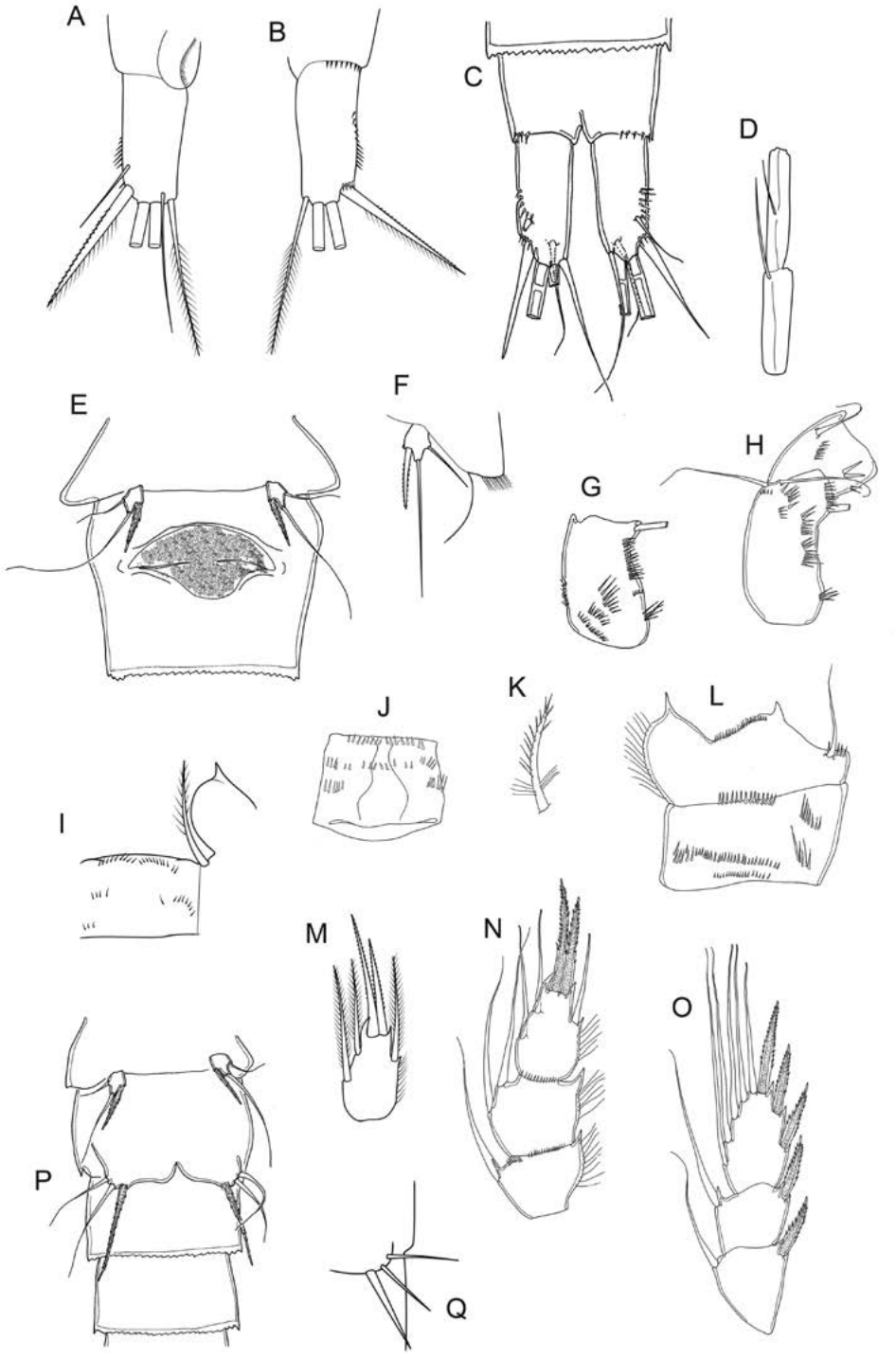
HOLOTYPE PRESENCE AND STORING: holotype not selected by author, type specimens of females and male dissected on slides in Museum of Natural History, Vienna, Austria (#22245, 222247, 22250), collected by Herrn Prescott; these slides were re-examined by Nancy Mercado-Salas, Suarez-Morales [2021]

MATERIAL STUDIED: author's description and drawings; Mecado-Salas & Suarez-Morales [2021] re-description and drawings.

DESCRIPTION. FEMALE (Fig. 45A–O). Body length without caudal setae about 1164 μm. Th4 with short dense setulae laterally. Genital double somite wider than long (Fig. 45E); *receptaculum seminis* not clearly visible. Caudal rami (Fig. 45A–C) short, L/W ratio 2.4–2.6, almost parallel; lateral *serra* rather short, composing of spinules increasing distally. Lateral seta longer than ramus width. Outermost spiniform seta long and thin, its outer edge with small spinules, inner edge with fine hairs. Innermost caudal seta slightly longer than outermost seta (1.1–1.2: 1). Dorsal seta slightly shorter than outermost seta (0.9: 1). Distal setae approximate length ratio beginning with outermost: 1.0/ 3.0–3.5/ 5.5–6.0/ 1.1–1.2.

Fig. 45. *Eucyclops* (*Breviramocyclops*) *breviramatus* Löffler, 1963. A, B, C — caudal rami; D — A1, two distal segments; E — Th4, genital double somite and P5; F — Th4 and P5; G — A2 Bas, caudal; H — A2 Bas, frontal; I, J — P4 intercoxal plate; K — P4 coxal spine; L — P4 coxa and basipodite, caudal; M, N — P4 Enp3; O — P4 Exp; P — P5 and P6; Q — P6. A–O — female; P, Q — male. Ecuador. A, B, D, F, I, M, Q — after Löffler [1963]; C, E, G, H, J–L, N–P — after Mercado-Salas & Suárez-Morales [2021].

Рис. 45. *Eucyclops* (*Breviramocyclops*) *breviramatus* Löffler, 1963. A, B, C — каудальные ветви; D — A1, два дистальных членика; E — Th4, генитальный сомит и P5; F — Th4 и P5; G — A2 Bas, каудально; H — A2 Bas, фронтально; I, J — межкоксальная пластинка P4; K — коксальный шип P4; L — кокса и базиподит P4, каудально; M, N — P4 Enp3; O — P4 Exp; P — P5 и P6; Q — P6. A–O — самка; P, Q — самец. Эквадор. A, B, D, F, I, M, Q — по Löffler [1963]; C, E, G, H, J–L, N–P — по Mercado-Salas & Suárez-Morales [2021].


A
B
C
D
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Q

Antennule 12-segmented, reaching beyond distal margin of CTh; last three segments with smooth hyaline membrane (Fig. 45D). Setation of antennular segments, beginning with first: 8/4/1/6/3/2/2/3/2+I/2/2+I/8. A2 Bas on caudal surface without setulae at positions N1 and N2, other groups as in Fig. 45G; frontal surface ornamentation as in Fig. 43H. Mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox (Fig. 45I, J), caudal surface with three rows of short setulae; Bas inner outgrowth covered with long hairs; coxal spine with gap on outer side (Fig. 45K). P4 Enp3 short, with L/W ratio about 1.5; inner/outer spine ratio 1.2–1.3; inner spine longer than segment; distal setae reaching 2/3 of nearest spines (Fig. 45M, N). In P4 Exp3, distal spine slightly shorter than segment (Fig. 45O). Reduced P5 armed with inner spine 1.7–1.9 times as long as segment; medial seta 1.9–2.3 times as long as spine; outer seta 0.7–1.0 times as long as spine.

MALE (Fig. 45P, Q). Body length without caudal seta about 980 μm. Caudal rami shorter than in female, L/W ratio 2.0–2.4, without *serra* laterally, but with few spinules near lateral and outermost setae; dorsal seta slightly longer than outermost seta. Antennules 14-segmented. A2 Bas basically as in female, without setulae in positions N1 and N2. P1–P5 similar to female. Rudimentary P6 armed with rather long inner spine, reaching posterior margin of second or proximal 1/3 of third abdominal somites; two setae about as long or slightly shorter than inner spine.

DISTRIBUTION: Ecuador, South America.

COMMENTS: In South America, there are two species of this subgenus. They are easily distinguished by the structure of the caudal *serra*; in the nominal species it is represented by a relatively small denticles, and in *E.* (*B.*) *siolii* Herbst, 1962 by a longer setulae. Described from Mexico *Eucyclops* (*B.*) *angeli* Gutiérrez-Aguirre et Cervantes-Martínez, 2013 in many taxonomically important details corresponds to *E.* (*B.*) *breviramatus*; but differs from it by presence of full length caudal *serra*, hair-setulae at positions N1, N2 on A2 Bas and long setulae on distal edge of P4 IntCox.

42. ***Eucyclops*** (***Breviramocyclops***) ***angeli*** Gutiérrez-Aguirre et Cervantes-Martínez, 2013

Fig. 46.

SYNONYMY: *Eucyclops angeli*: Gutiérrez-Aguirre *et al*., 2013.

TYPE LOCALITY: grassland, San Cristóbal de las Casas City, Chiapas, Mexico (16°43′43″N; 92°38′14″W).

HOLOTYPE PRESENCE AND STORING: holotype female ECO-CH-Z-8967 and paratype females and males ECO-CH-Z-8968, ECO-CH-Z-8969, deposited in the El Colegio de la Frontera Sur (ECO-CH-Z), in Chetumal, Mexico; MNHN-IU-2013-5970 in Collection of Copepoda of the Muséum National d'Histoire Naturelle, Paris, France; CNCR 27841 in Colección Nacional de Crustáceos del Instituto de Biología, Universidad Nacional Autónoma de México, Mexico.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 46). Body length without caudal setae about 600 μm. Th4 with long setulae at posterolateral angles. Genital double somite as long as broad; *receptaculum seminis* typical of genus. Anal operculum round, smooth. Caudal rami almost parallel, L/W ratio about 2.1; lateral *serra* long, extending along most of lateral margin, of strong spinules increasing distally (Fig. 46A, C). Dorsal seta slightly longer than outermost seta. Outermost seta spiniform, long, with denticulate outer edge and hairs on inner edge. Innermost seta plumose, about as long as ramus length and about 1.5 times as long as outermost seta (1.2 according to drawings). Lateral seta slightly shorter than ramus width.

Antennule 12-segmented, reaching distal margin of Th1, with smooth hyaline membrane along three distalmost segments (Fig. 46D). Setation of antennular segments beginning with first: 8/4/2/6/4/2/2/3/2+I/2/2+I/7+I. A2 Enp setation: 1/9/7. A2 Bas on caudal surface with two groups of hair-setulae at N1 and N2 positions, other groups as in Fig. 46I; frontal surface ornamentation as in Fig. 46H. Mouth appendages typical for genus. Maxilla without spinules at lateral margin of praecoxa. Mxl palp surface naked.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, caudal surface with three rows (I, II, III) of long setulae; distal row I of several long spinules (small gap in middle), rows II and III with long hairs on lateral sides (Fig. 46F). In P4 Bas, inner outgrowth covered with dense hairs; coxal spine with long proximal hairs on both margins; distally with shorter spinules on inner margin and without distal spinules on outer margin (long gap) (Fig. 46G). P4 Enp3 short, L/W ratio 1.8; inner/outer spine ratio 1.3; inner spine 1.3 times as long as segment; distal setae reaching middle of nearest spines. In P4 Exp3, distal spine slightly longer than segment. Modified setae present in both

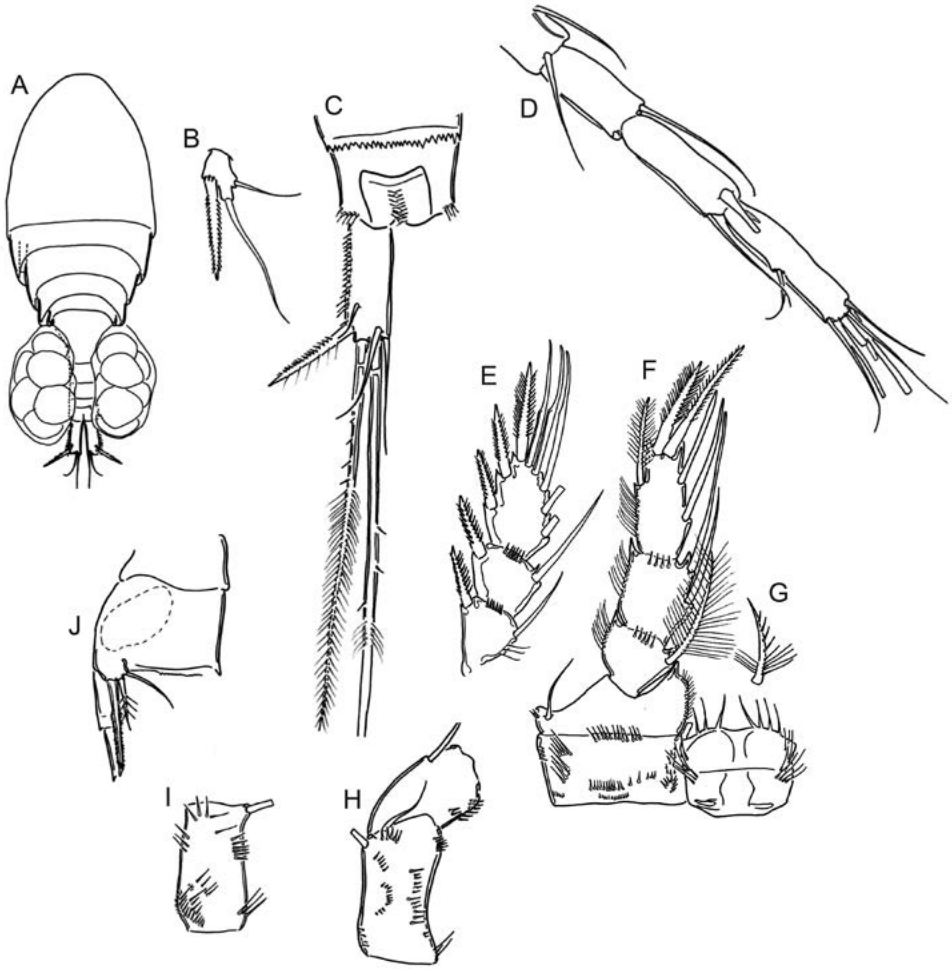

Fig. 46. *Eucyclops* (*Breviramocyclops*) *angeli* Gutiérrez-Aguirre et Cervantes-Martínez, 2013. A — habitus; B — P5; C — caudal ramus, dorsal; D — A1, three distal segments; E — P4 Exp; F — P4, caudal; G — P4 coxal spine; H — A2 Bas, frontal; I — A2 Bas, caudal; J — P6. A–I — female; J — male. Mexico, after Gutiérrez-Aguirre *et al*. [2013].

Рис. 46. *Eucyclops* (*Breviramocyclops*) *angeli* Gutierrez-Aguirre et Cervantes-Martínez, 2013. A — габитус; B — P5; C — каудальная ветвь, дорсально; D — A1, три дистальных членика; E — P4 Exp; F — P4, каудально; G — коксальный шип P4; H — A2 Bas, фронтально; I — A2 Bas, каудально; J — P6. A–I — самка; J — самец. Мексика, по Gutiérrez-Aguirre *et al*. [2013].

P4 Enp3 and Exp3 (Fig. 46E, F). Reduced P5 (Fig. 46B) armed with strong inner spine, twice as long as segment; outer seta 0.7 times as long as inner spine; medial seta 1.3 times as long as inner spine.

MALE (Fig. 46J). Body length without caudal setae 540–580 μm. Th4 without lateral hairs. Caudal rami: L/W ratio about 2; lateral *serra* absent except few spinules above lateral seta base. Lateral seta longer than ramus width. Innermost seta about 1.8 times as long as outermost seta. Antennule 14-segmented. Antennal basipodite ornamentation on caudal surface: N1, N2, N3, N4, N5, N6, N15, N17; on frontal surface: N8, N10, N11, N12 (groups N7, N13 absent). Swimming legs as in female. Reduced P5: outer seta slightly longer than in female (subequal in length to inner spine), inner spine 1.8 times as long as segment. Rudimentary P6 with strong inner spine and two shorter setae (see Fig. 46J).

DISTRIBUTION: Chiapas, Mexico.

COMMENTS: *E.* (*B.*) *angeli* is close in many taxonomically important details to *E.* (*B.*) *breviramatus* Löffler, 1963, the description of which was recently clarified (Mercado-Salas, Suarez-Morales [2021]), including: shortened caudal rami, short P4 Enp3 with a length-to-width ratio of less than 2, P4 coxal spine with large gap at outer side. Missing groups of hair-setulae at positions N1 and N2 in A2 Bas in *E.* (*B.*) *breviramatus* reported by Mercado-Salas and Suárez-Morales [2021] and presence of these setulae in *E.* (*B.*) *angeli* is serious evidence for their separation.

43. ***Eucyclops*** (***Breviramocyclops***) ***edytae*** Tang et Knott, 2009 Fig. 47.

SYNONYMY: *Eucyclops edytae*: Tang, Knott, 2009; *Eucyclops* (*Breviramocyclops*) *edytae*: Alekseev, 2019.

TYPE LOCALITY: Egerton spring. Ellenbrook, Western, Australia (31°46′18″S, 115° 58′51″E), 20 December, 1994.

HOLOTYPE PRESENCE AND STORING: holotype female AM P.78707 and paratype females and males AM P.78708–78713, deposited in Australian Museum (AM), Sydney, Australia.

MATERIAL STUDIED: authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 47A–H). Body length without caudal setae 610–760 µm. Th4 with long lateral hairs. Genital double somite longer than broad; *receptaculum seminis* not observed (Fig. 47C). Anal operculum weakly developed, smooth. Caudal rami almost parallel, L/W ratio about 1.7–1.9; with 4 groups of spinules on ventral surface and above dorsal and outermost setae; lateral *serra* absent (Fig. 47B). Dorsal seta about 1.2 times longer than outermost seta. Outermost seta with long hair-setulae on both sides. Innermost seta almost twice longer than outermost one. Lateral seta about 1.5 times longer than ramus width.

Antennule 12-segmented, reaching distal margin of CTh, with finely serrated hyaline membrane along three distalmost segments (Fig. 47A, D). Setation of antennular segments beginning with first: 8/4/2/6/4/2/2/3/2+I/2/2+I/7+I. A2 Enp setation: 1/9/7. A2 Bas on caudal surface without groups of setulae at N1, N2 positions, other groups as in Fig. 47F; frontal surface ornamentation as in Fig. 47E. Mouth appendages typical for genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, caudal surface with setulae at sides and gap in middle (Fig. 47H). In P4 Bas, inner outgrowth with long rare setulae; coxal seta/spine homogeneously plumose. P4 Enp3 short, L/W ratio 1.9; inner/outer spine ratio 2.2; inner spine 1.3 times as long as segment; distal setae reaching tips of nearest spines (Fig. 47G). In P4 Exp3, distal spine about 0.6 times as long as segment. Rudimentary P5 armed with very long inner spine and two shorter setae; approximate length ratio beginning with spine: 1.0/0.9/0.5; spine/segment ratio about 3.5 (Fig. 47C).

MALE (Fig. 47I). Body length 480–620 µm. Th4 smooth laterally. Caudal rami slightly shorter than in female and without row of spinules above lateral seta. Antennule 14-segmented. Swimming legs and P5 similar to female. Rudimentary P6 (see Fig. 47I) armed with short and weak inner spine with few strong spinules at base and two longer setae.

DISTRIBUTION: springs and caves in Western Australia.

COMMENTS: Taxonomic position of this species is unclear. Some features of female (rows of spinules above insertion of distal caudal setae, extremely long inner spine in P5, unusual inner/outer spine ratio in P4 Enp3) are more reminiscent of features known in *Paracyclops*/*Ectocyclops* than in *Eucyclops* taxa. At the same time, long 12-segmented antennules, elongated and well-separated segment P5, as well as triangular pointed inner process in P4 Bas clearly indicate specific characteristics of *Eucyclops*. It is possible that intermediate taxon between these two genera, preserved from ancient times, still exists in groundwater of Australia. Molecular genetic analysis may be useful in addressing this taxonomic and evolutionary question.

44. ***Eucyclops*** (***Breviramocyclops***) ***puteincola*** Kiefer, 1981 Fig. 48.

SYNONYMY: *Eucyclops puteincola*: Kiefer, 1981; Dussart, Defaye, 2006; *Eucyclops* (*Breviramocyclops*) *puteincola*: Alekseev 2019.

TYPE LOCALITY: Well in Homs, Syria, West Asia.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype females and males deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: Holotype #10311, paratypes #10312–10316, author's description and drawings.

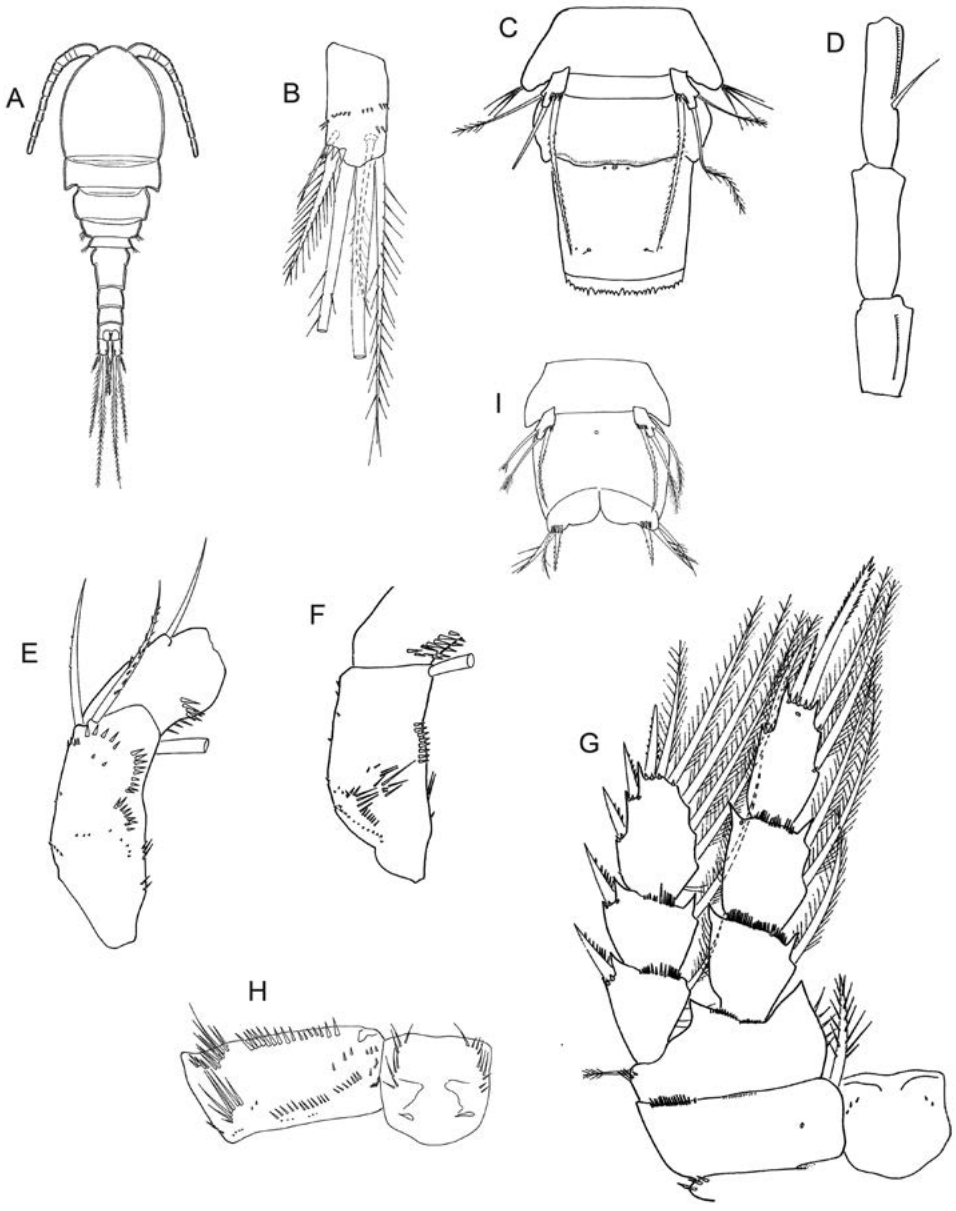

Fig. 47. *Eucyclops* (*Breviramocyclops*) *edytae* Tang et Knott, 2009. A — habitus; B — caudal ramus, ventral; C — Th4, genital double somite and P5; D — A1, three distal segments; E — A2 Bas, frontal; F — A2 Bas, caudal; G — P4, frontal; H — P4 intercoxal plate and coxa, caudal; I — P5 and P6. A–H — female; I — male. Western Australia, after Tang & Knott [2009].

Рис. 47. *Eucyclops* (*Breviramocyclops*) *edytae* Tang et Knott, 2009. A — габитус; B — каудальная ветвь, вентрально; C — Th4, генитальный сомит и P5; D — A1, три дистальных членика; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — P4, фронтально; H — межкоксальная пластинка и кокса P4, каудально; I — P5 и P6. A–H — самка; I — самец. Западная Австралия, по Tang & Knott [2009].

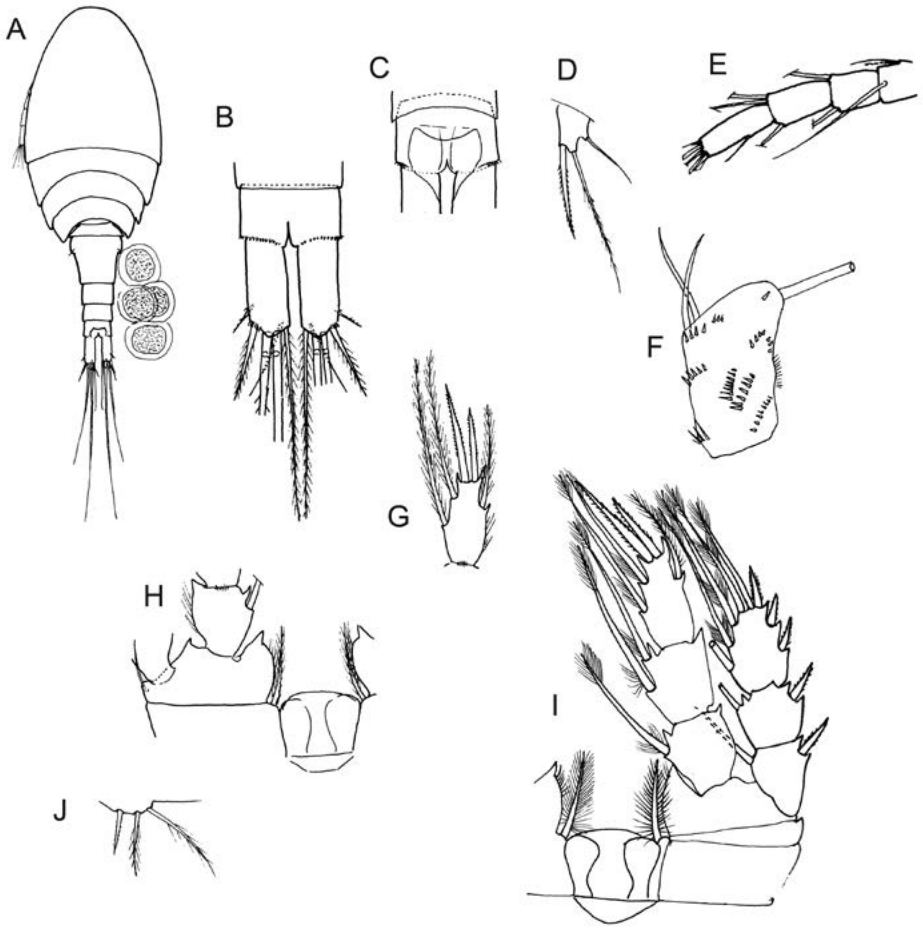

Fig. 48. *Eucyclops* (*Breviramocyclops*) *puteincola* Kiefer, 1981. A — habitus; B, C — caudal rami and anal somite, ventral and dorsal; D — P5; E — A1, three distal segments; F — A2 Bas, frontal; G — P4 Enp3; H — P4 intercoxal plate and basipodite; I — P4; J — P6. A–E, G–I — female; F, J — male. Homs, Syria. A–E, G, H, J — after Kiefer [1981]; F, I — orig., slides #10312, 10316 KRC.

Рис. 48. *Eucyclops* (*Breviramocyclops*) *puteincola* Kiefer, 1981. A — габитус; B, C — каудальные ветви и анальный сомит, вентрально и дорсально; D — P5; E — A1, три дистальных членика; F — A2 Bas, фронтально; G — P4 Enp3; H — межкоксальная пластинка и базиподит P4; I — P4; J — P6. A–E, G–I — самка; F, J — самец. Хомс, Сирия. A–E, G, H, J — по Kiefer [1981]; F, I — ориг., преп. #10312, 10316 KRC.

DESCRIPTION. FEMALE (Fig. 48A–E, G–I). Body length without caudal setae 650–750 μm; Th4 without lateral setulae or with few lateral hairs (paratype #10312). Genital double somite as long as broad; *receptaculum seminis* typical of genus, composed of two flattened parts concave in middle. Anal operculum strongly developed, round, smooth, without hairs at opening (Fig. 48C). Caudal rami parallel, L/W ratio about 2.5; lateral *serra* absent (Fig. 48B). Dorsal seta about as long as outermost seta. Outermost seta weak, thin, with hairs on inner and outer edges. Innermost seta plumose, about twice longer than ramus length and about 2.5 times as long as outermost seta. Lateral seta about as long as ramus width or slightly shorter.

Antennule 12-segmented, short, not reaching distal margin of CTh; without visible hyaline membrane along three distalmost segments (Fig. 48E).

A2 Bas ornamentation and mouth appendages not visible in type slides and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox without visible ornamentation (Fig. 48H, I). P4 Bas inner outgrowth with group of hairs; coxal spine/seta homogeneously plumose. P4 Enp3 short, L/W ratio about 1.9; inner/outer spine ratio about 1.4; inner spine 1.2 times as long as segment; distal setae reaching tips of nearest spines (Fig. 48G, I). In P4 Exp3, distal spine twice shorter than segment. Reduced P5 (Fig. 48D) armed with long and thin inner spine twice longer than segment; medial seta 1.5 times longer than inner spine; outer seta about 0.7 times as long as inner spine.

MALE (Fig. 48J, F). Body smaller than in female; caudal rami shorter than in female, dorsal seta slightly longer than outermost seta; innermost/outermost seta ratio nearly 3. A2 Bas frontal surface ornamentation as in Fig. 48F. Swimming legs and P5 similar to female. Rudimentary P6 with weak short inner spine and two longer setae; length ratio beginning with spine: 1.0/1.4/2.1 (see Fig. 48J).

DISTRIBUTION: Syria, West Asia (underground waters?)

COMMENTS: Complete absence of lateral *serra* on caudal rami, as well as absence of hairs that usually surround anal opening, may be result of permanent living of this form in underground habitat. This is also supported by elongated distal setae of P4 Enp3, which are often found in other cave-dwelling cyclopids of the subgenus *Eucyclops* (*Subterrocyclops*) or genus *Kieferiella*.

45. ***Eucyclops* (*Breviramocyclops*) *siolii*** Herbst, 1962 Fig. 49.

SYNONYMY: *Eucyclops siolii*: Herbst, 1962; Dussart, Defaye, 2006; *Eucyclops* (*Breviramocyclops*) *siolii*: Alekseev, 2019.

TYPE LOCALITY: Igarape Irura, Santarem, Brazil, South America.

HOLOTYPE PRESENCE AND STORING: Natural History Museum, Vienna, Austria.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 49). Body length without caudal setae about 850 μm; cephalothorax with L/W ratio 1.2, cephalothorax/genital somite width ratio 2.4 (Fig. 49A). Th4 with long lateral hairs. Genital double somite: L/W ratio about 0.8; *receptaculum seminis* typical of genus, composed of two flattened parts concave in middle (Fig. 49B). Caudal rami (Fig. 49C): L/W ratio about 2.5, with lateral *serra* produced by strong setulae increasing in size distally. Dorsal and outermost setae subequal in length. Distal setae approximate length ratio beginning with outermost: 1.0/3.3/6.7/1.4.

Antennule 12-segmented, short, almost reaching distal margin of CTh; with thin smooth hyaline membrane of three distalmost segments. A2 Bas and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 about 2.2 times as long as broad; inner/ outer spine ratio 1.5; inner spine/ segment ratio 1.2, distal setae almost reaching distal tips of nearest spines (Fig. 49F). P4 IntCox with two rows of setulae (Fig. 49E); coxal spine/seta densely covered with hairs on both sides and reaching beyond inner basipodite outgrowth. Reduced P5 (Fig. 49D) with elongated segment armed with weak inner spine subequal or shorter than segment and two long setae.

MALE unknown.

DISTRIBUTION: Santarem, Brazil, South America.

COMMENTS: This species can be separated from its closest congener *E.* (*B.*) *breviramus*, also known from South America, but inhabiting mountainous area of Uruguay in the Andes, as well as from other congeners from Mexico and Syria by the following combination of characters: small size less than 1.0 mm, caudal branches with strong lateral *serra*, P5 armed with weak and short inner spine. At the same time, more detailed redescription of this species is required.

3. SUBGENUS ***Eucyclops* (*Ciliocyclops*)** Alekseev, 2019

Small size cyclopids, females not more than 1 mm in length, inhabiting tropical areas mainly. Caudal rami with hairs, setulae, or even with large denticles on inner/dorsal surfaces; L/W ratio 3.0–5.8; lateral *serra* full or reduced. Innermost caudal seta longer than outermost seta. Antennule 12-segmented, not extending beyond distal margin of Th1; last three segments with narrow smooth hyaline membrane or membrane not visible. P4 Enp3 segment rather short, with L/W ratio 1.6–2.3. Reduced P5 armed with short and weak (African species) or longer (South American and Asian species) inner spine. Subgenus includes 5 species.

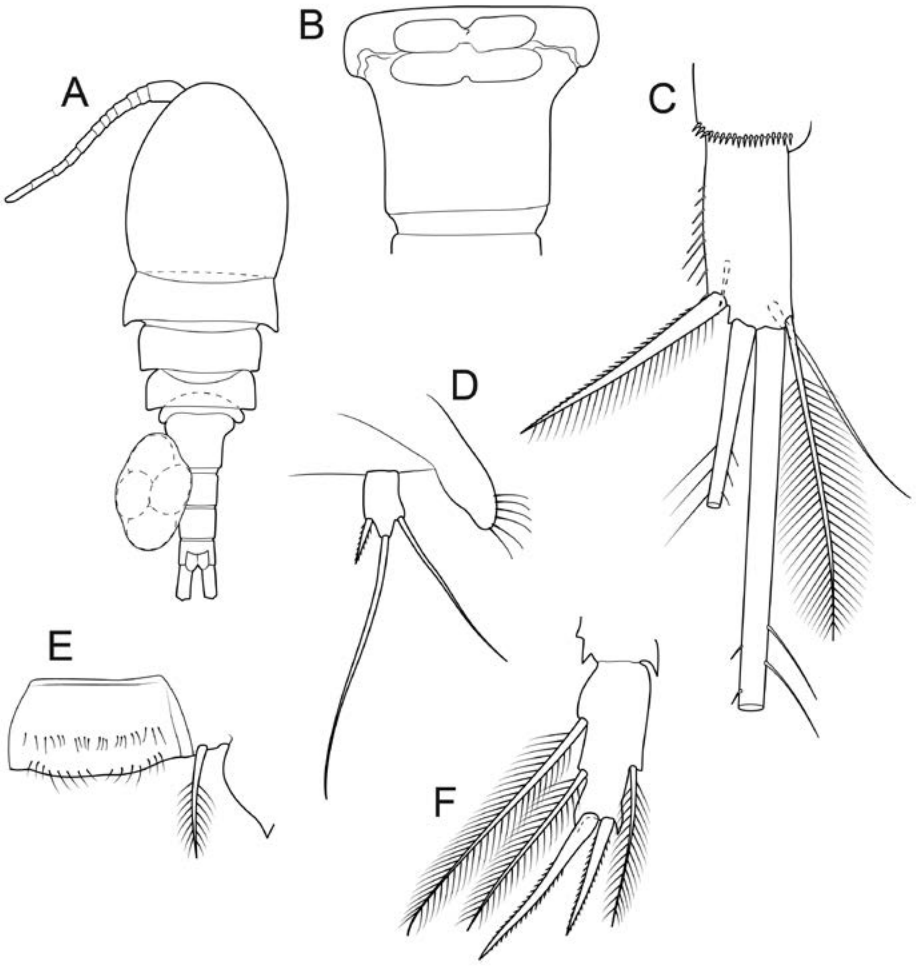

Fig. 49. *Eucyclops* (*Breviramocyclops*) *siolii* Herbst, 1962. Female: A — habitus; B — genital double somite; C — caudal ramus, ventral; D — Th4 and P5; E — P4 intercoxal plate; F — P4 Enp3. Brazil, after Herbst [1962].

Рис. 49. *Eucyclops* (*Breviramocyclops*) *siolii* Herbst, 1962. Самка: A — габитус; B — генитальный сомит; C — каудальная ветвь, вентрально; D — Th4 и P5; E — межкоксальная пластинка P4; F — P4 Enp3. Бразилия, по Herbst [1962].

Key to subgenus *Eucyclops* (*Ciliocyclops*) species

1. Caudal rami with groups of large spinules on dorsal surface ..... *E.* (*C.*) *permixtus* s.lat. with 2 subspecies: *E.* (*C.*) *p. permixtus* Kiefer, 1928 [Asia]; *E.* (*C.*) *p. ruttneri* Kiefer, 1933 [Australia]
– Caudal rami with hair-setulae on inner surface 2
2. CR with short *serra*, extending not more than half of ramus length; inner surface with only proximal hairs 3
– CR with long *serra*, extending almost to ramus base; inner surface with hairs along whole margin 4
3. CR L/W ratio more than 5; P5 armed with strong inner spine twice longer than segment .....*E.* (*C.*) *neotropicus* Kiefer, 1936 [Brazil, South America]

– CR shorter, with L/W ratio less than 4; P5 armed with relatively weak and short inner spine about as long as segment ....*E.* (*C.*) *rarispinus* (Sars G.O., 1909) [Lake Tanganyika, Africa]

4. Caudal outermost seta rather short, about 0.5 times as long as ramus length; dorsal seta longer than outermost seta; P5 armed with weak and short inner spine ....*E.* (*C.*) *ciliatus* (Sars G.O., 1909) [Lake Tanganyika, Africa]

– Caudal outermost seta longer, about 0.6–0.8 times as long as ramus length; dorsal seta shorter than outermost seta; P5 armed with strong inner spine, about 1.6 times as long as segment.... *E.* (*C.*) *subciliatus* Dussart, 1984 [South America]

46. ***Eucyclops*** (***Ciliocyclops***) ***ciliatus*** (Sars G.O., 1909) Fig. 50.

SYNONYMY: *Cyclops ciliatus*: Sars G.O., 1909; *Eucyclops ciliatus*: Dussart, Defaye, 2006; *Eucyclops* (*Ciliocyclops*) *ciliatus*: Alekseev, 2019.

TYPE LOCALITY: Mbete, south of Lake Tanganyika, Africa.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 50). Body length without caudal setae 860 µm, elongated in shape (Fig. 50A). Cephalothorax: L/W ratio about 1.3. Th4 with lateral setulae. Genital double somite elongated, L/W ratio about 1.1; *receptaculum seminis* not described. Anal operculum weakly developed, rounded. Caudal rami parallel or slightly divergent with long rare hairs along whole inner side; L/W ratio about 5.5; lateral *serra* partly reduced, of rather long spinules in distal part (Fig. 50B); lateral seta about as long as ramus width. Outermost seta spiniform, inserted without noticeable space from outer middle seta, its outer edge with small spinules, inner edge with fine hairs. Innermost caudal seta about 1.3 times as long as outermost seta. Dorsal seta about 1.2 times as long as outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.5/ 9.0/ 1.3.

Antennule 12-segmented, reaching distal margin of Th1; last three segments without visible hyaline membrane. A2 and mouth appendages not described. Swimming legs P1–P4 of typical structure. Reduced P5 armed with very weak and short inner spine.

MALE unknown.

DISTRIBUTION: known only from the type locality.

COMMENTS: Species insufficiently described from modern point of view. It has to be redescribed, but this form does not appear to be common in the type locality in the coastal area of Lake Tanganyika. Distinctly ciliated inner side of caudal rami, as well as very short inner spine of P5, are the main characters by which this species can be distinguished from other congeners.

47. ***Eucyclops*** (***Ciliocyclops***) ***neotropicus*** Kiefer, 1936 Fig. 51.

SYNONYMY: *Eucyclops neotropicus*: Kiefer, 1936b; Dussart, Defaye, 2006; *Eucyclops* (*Ciliocyclops*) *neotropicus*: Alekseev, 2019.

TYPE LOCALITY: artificial pond in Rio Branco city, Brazil.

HOLOTYPE PRESENCE AND STORING: Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: female holotype #02865, paratype male #02867; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 51A–D). Body length without caudal setae about 940 µm. Th4 with lateral setulae. Genital double-somite wider than long; *receptaculum seminis* typical of genus. Anal operculum weakly developed, smooth. Caudal rami subparallel, L/W ratio about 5.8; lateral *serra* short, composing of small equal denticles (Fig. 51A); inner side of ramus with proximal group of few short hairs. Dorsal seta slightly shorter than outermost seta. Outermost seta spiniform, inserted without noticeable space from outer middle seta, with denticulate outer side and long hairs on inner side. Innermost seta plumose, about 0.6 times as long as ramus length and 1.2–1.4 times as long as outermost seta. Lateral seta slightly longer than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.0/ 7.5/ 1.2–1.4.

Antennule 12-segmented, reaching middle of Th1; last three segments with narrow smooth hyaline membrane. A2 Bas ornamentation not visible in holotype.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox (Fig. 51C) with strong setulae along distal margin; Bas inner outgrowth without visible hairs; strongly curved coxal spine with setulae along whole inner side and few proximal setulae on outer side. In P4 Enp3 (Fig. 51B, C) segment 1.8 times as long as broad; inner

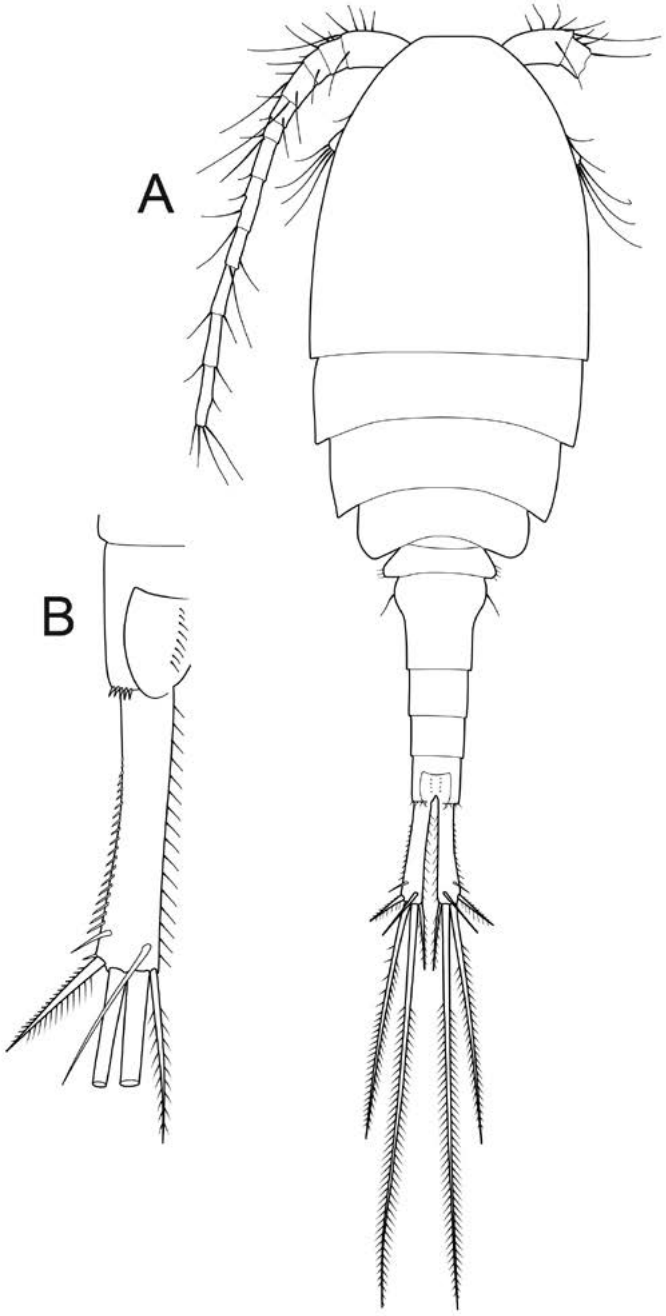

Fig. 50. *Eucyclops* (*Ciliocyclops*) *ciliatus* (Sars G.O., 1909). Female: A — habitus; B — caudal ramus, dorsal. Lake Tanganyika, Zambia, after Sars G.O. [1909].

Рис. 50. *Eucyclops* (*Ciliocyclops*) *ciliatus* (Sars G.O., 1909). Самка: A — габитус; B — каудальная ветвь, дорсально. Озеро Танганьика, Замбия, по Sars G.O. [1909].

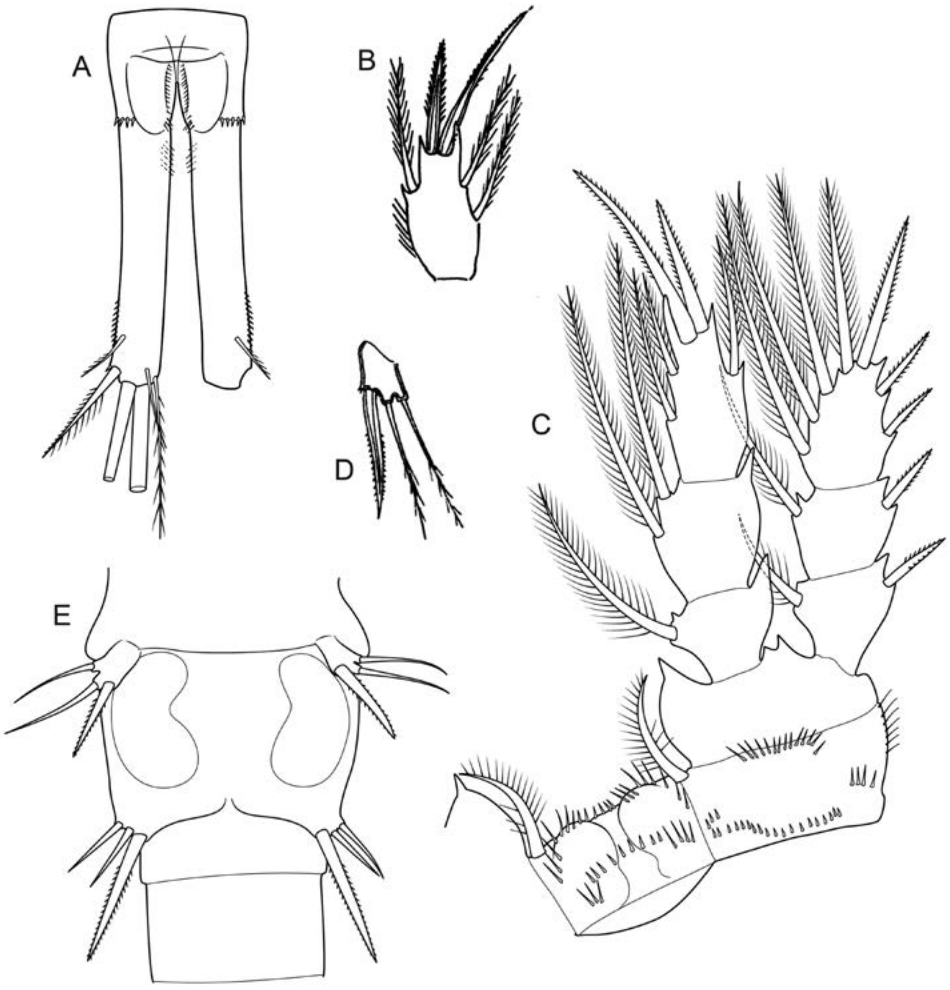

Fig. 51. *Eucyclops* (*Ciliocyclops*) *neotropicus* Kiefer, 1936. A — caudal rami, dorsal; B — P4 Enp3; C — P4, caudal; D — P5; E — P5 and P6. A–D — female; E — male. Brazil. A, B, D — after Kiefer [1936b]; C, E — orig., slide #02865 KRC.

Рис. 51. *Eucyclops* (*Ciliocyclops*) *neotropicus* Kiefer, 1936. A — каудальные ветви, дорсально; B — P4 Enp3; C — P4, каудально; D — P5; E — P5 и P6. A–D — самка; E — самец. Бразилия. A, B, D — по Kiefer [1936b]; C, E — ориг., преп. #02865 KRC.

spine about 1.5 times longer than outer one and 1.3 times longer than segment. P4 Exp3 distal spine long, about 1.2 times as long as segment. P4 Coxa caudal ornamentation as in Fig. 51C. Reduced P5 (Fig. 51D) armed with strong inner spine twice longer than segment and two setae subequal to spine; outer seta inserted at the same level as medial seta.

MALE (Fig. 51E). Body length without caudal setae 740 µm. Th4 somite without lateral setulae. Caudal rami smooth on both edges and shorter than in female, with L/W ratio about 4. Antennules 14-segmented. P1–P4 structure and armament basically as in female but P4 Enp3 more narrow than in female with L/W ratio about 2. Reduced P5 with shorter appendages. Rudimentary P6 with

strong inner spine and two subequal setae twice shorter than inner spine.

DISTRIBUTION: Brazil, neotropics (?)

COMMENTS: Kiefer [1936b] notes that this species is similar to African *E.* (*C.*) *rarispinus* (Sars G.O., 1909) from Lake Tanganyika, but may be separated from it by longer caudal rami. P5 in African form armed with shorter inner spine than in South American congener. On both continents, subgenus *Ciliocyclops* is represented by two species, both with differences in medial hairs of caudal rami, which possibly indicates a common time of their origin in Gondwana block before division into African and South American subblocks. If this is correct, then we should expect more ciliated species of this subgenus also in northern Australia and India.

Eucyclops (***Ciliocyclops***) ***permixtus*** s.lat.

Small (female length 700–950 μm) cyclopids with slender body shape. Caudal rami almost parallel, short, with L/W ratio 3.0–4.6; on dorsal surface with several groups of large denticles; lateral *serra* strongly reduced; innermost caudal seta 1.2–1.6 times longer than outermost seta. Antennule 12-segmented, reaching distal edge of CTh or middle of Th1; with very narrow smooth hyaline membrane along 3 distal segments or without membrane. Reduced P5 with rather short appendages, inner spine 1.4–2.0 times as long as segment, outer seta about as long as inner spine, medial seta 1.2–1.8 times as long as inner spine. Includes two taxa inhabiting tropical Asia and Australia.

KEY TO SUBSPECIES *EUCYCLOPS* (*CILIOCYCLOPS*) *PERMIXTUS* S.LAT.

1. CR L/W ratio 3.8–4.6; innermost caudal seta about 1.2 times as long as outermost seta; P4 Enp3 short, with L/W ratio about 1.6; P5 with long but thin inner spine, about twice longer than segment ....*E.* (*C.*) *permixtus permixtus* Kiefer, 1928
– CR shorter, with L/W ratio 3.0–3.6; innermost caudal seta longer, 1.4–1.6 times as long as outermost seta; P4 Enp3 longer, with L/W ratio 2.0–2.3; P5 with wider but shorter inner spine, 1.5 times longer than segment and shorter than two other setae .... *E.* (*C.*) *p. ruttneri* Kiefer, 1933

48. ***Eucyclops*** (***Ciliocyclops***) ***permixtus permixtus*** Kiefer, 1928 **comb.n.**
Fig. 52.

SYNONYMY: *Eucyclops permixtus*: Kiefer, 1928b; Kiefer, 1933; Lindberg, 1959; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *permixtus*: Alekseev, 2019.

TYPE LOCALITY: Kangra valley, Punjab, Tilok Nath, India.

HOLOTYPE PRESENCE AND STORING: holotype female dissected on one slide and paratype male dissected on one slide, both of bad quality, deposited in Kiefer's Reference collection, SMNK, Germany

MATERIAL EXAMINED: holotype #01054 and paratype specimens #01055–01057, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 52A–P). Body length without caudal setae 740–820 μm. Cephalothorax as long as broad with maximal width in distal part. Th4 with setulae laterally. Genital double somite slightly wider than long; *receptaculum seminis* shape typical of genus (Fig. 52G, H, I). Anal operculum round, smooth. Caudal rami parallel (Fig. 52B–F); on dorsal surface with several groups of large spinules (Fig. 52E, F); L/W ratio 3.8–4.6; lateral *serra* short, composed of small denticles. Dorsal seta about as long as outermost spiniform seta. Distal setae approximate length ratio beginning with outermost (holotype specimen): 1.0/ 4.5/ 7.6/ 1.2.

Antennule 12-segmented, short, not reaching distal edge of CTh (Fig. 52A); 3 distalmost segments with narrow smooth hyaline membrane. A2 Bas ornamentation and mouth appendages not visible on type slides and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 and Exp3 spines lanceolate. In P4, IntCox (Fig. 52O, P) with long thin hairs at sides of distal edge; Bas inner outgrowth with group of hairs. P4 Enp3 (holotype specimen, Fig. 52L) short, with L/W ratio about 1.6; inner/outer spine ratio 1.2; inner spine 1.3 times longer than segment; distal setae almost reaching tips of nearest spines. Reduced P5 (Fig. 52G, I, J, K) armed with long but rather thin inner spine, about twice longer than segment; outer seta about as long as inner spine or slightly shorter; medial seta slightly longer than inner spine.

MALE (Fig. 52Q, R). Body length without caudal setae about 700 μm; caudal rami shorter than in female. Antennule 14-segmented. P1–P5 structure as in female. Rudimentary P6 armed with strong inner spine and two subequal setae.

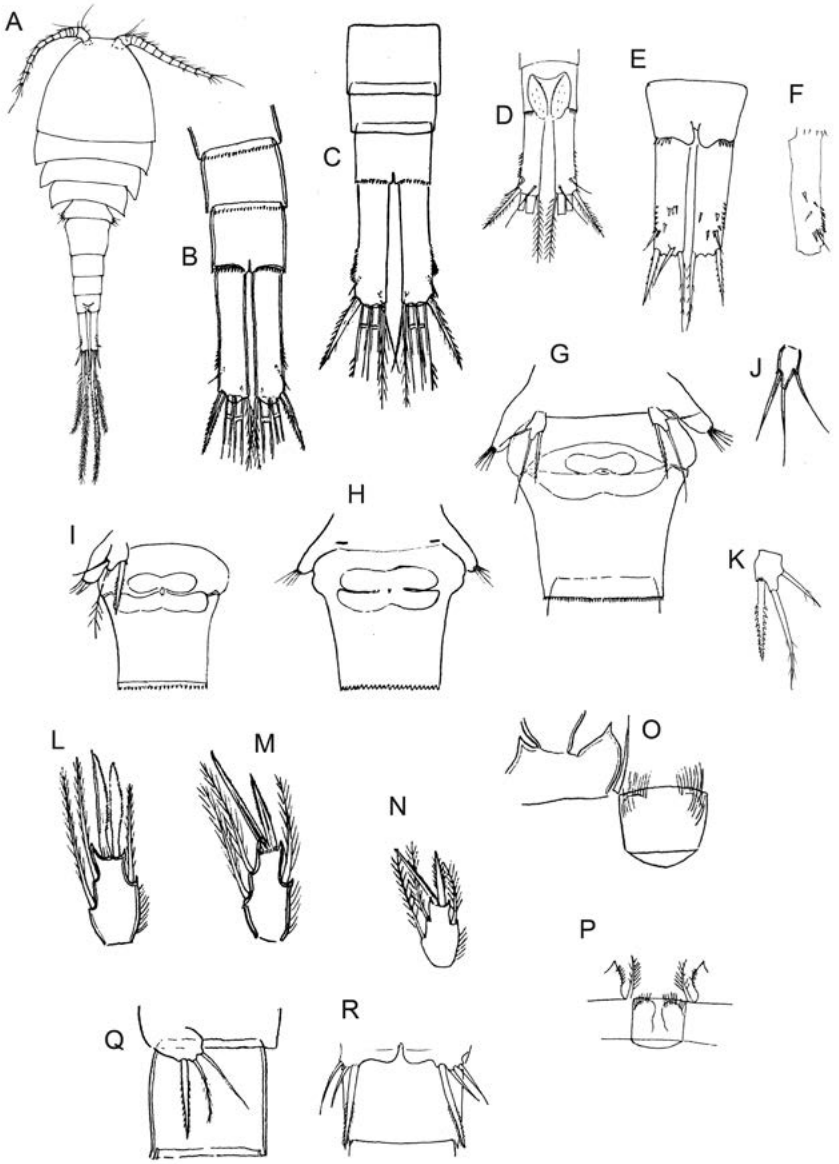

Fig. 52. *Eucyclops* (*Ciliocyclops*) *permixtus permixtus* Kiefer, 1928. A — habitus; B–F — caudal rami; G–I — Th4 and genital double somite; J, K — P5; L–N — P4 Enp3; O, P — P4 intercoxal plate; Q, R — P6. A–P — female; Q, R — male. A, F — Punjab, India, orig., slide #01054, 01057 KRC; B, G, L, O, Q — Punjab, India, after Kiefer [1928b]; C, H, J, M — Java, Indonesia, after Kiefer [1933]; D, I, N, P — Surobi, Afghanistan, after Lindberg [1959]; E, K, R — Java, Indonesia, orig., slides ##01305, 01396, 01445 KRC.

Рис. 52. *Eucyclops* (*Ciliocyclops*) *permixtus permixtus* Kiefer, 1928. A — габитус; B–F — каудальные ветви; G–I — Th4 и генитальный сомит; J, K — P5; L–N — P4 Enp3; O, P — межкоксальная пластинка P4; Q, R — P6. A–P — самка; Q, R — самец. A, F — Пенджаб, Индия, ориг., преп. #01054, 01057 KRC; B, G, L, O, Q — Пенджаб, Индия, по Kiefer [1928b]; C, H, J, M — Ява, Индонезия, по Kiefer [1933]; D, I, N, P — Суроби, Афганистан, по Lindberg [1959]; E, K, R — Ява, Индонезия, ориг., преп. #01305, 01396, 01445 KRC.

DISTRIBUTION: Asia: India, Afghanistan, Indonesia.

COMMENTS: Author suggests that this species is close to *E.* (*D.*) *euacanthus* and to *E. fragilis* (= *E.* (*E.*) *vandouwei*) in armament of P5 and wide lanceolate spines of P4. Large denticles on dorsal surface of caudal rami, not mentioned by Kiefer, but visible on specimens of holotype #01054 and paratype #01057, clearly separate this form from other congeners, with exception of *E.* (*C.*) *p. ruttneri*, which is possibly its younger synonym. Morphological redescription and molecular analysis of these taxa is required.

49. ***Eucyclops*** (***Ciliocyclops***) ***permixtus ruttneri*** Kiefer, 1933 **comb.n**. Fig. 53.

SYNONYMY: *Eucyclops ruttneri*: Kiefer, 1933; Morton, 1990; Dussart, Defaye, 2006; *Eucyclops* (*Eucyclops*) *ruttneri*: Alekseev, 2019.

TYPE LOCALITY: small pond in mountains, Sumatra, Indonesia.

HOLOTYPE PRESENCE AND STORING: Holotype female dissected on one slide and paratype male deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype #01689 and paratype #01669; descriptions and drawings of author and Morton [1990].

DESCRIPTION. FEMALE (Fig. 53A–C, E–I). Body length without caudal setae 760–950 μm. Th4 with setulae laterally. Genital double-somite slightly wider than long; *receptaculum seminis* shape typical of genus. Anal operculum round, smooth. Caudal rami slightly divergent (Fig. 53A, E, F); L/W ratio 3.0–3.6; lateral *serra* short, composed of small denticles (or sometimes absent); dorsal surface with several groups of large spinules. Outermost seta spiniform in Indonesian specimens, with denticulate outer side and hairs on inner side, 0.8 times as long as CR length (Fig. 53A); not spiniform in Australian specimens, with short hairs on both sides, 0.6 times as long as CR length (Fig. 53F). Innermost seta plumose, about as long as ramus length and 1.4–1.8 times as long as outermost seta. Lateral seta about as long as ramus width. Dorsal seta slightly shorter than outermost seta (0.8: 1) in Indonesian specimens, but subequal or slightly longer than outermost seta in Australian specimens.

Antennule 12-segmented, reaching middle of Th1; last three segments with very narrow smooth hyaline membrane (Indonesia) or without visible hyaline membrane (Australia). A2 Bas and mouth appendages not observed in holotype and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 and Exp3 spines not lanceolate. P4 IntCox (Fig. 53H) with long thin hairs at distal margin in Australian specimens, ornamentation not observable in holotype. P4 Enp3 L/W ratio 2.0–2.3; inner/outer spine ratio 1.4–1.5; inner spine 1.1–1.3 times longer than segment; distal setae reaching beyond middle of nearest spines (Fig. 53B, I). Reduced P5 (Fig. 53C, G) armed with strong but relatively short inner spine, 1.4–1.6 times as long as segment; both setae longer than spine.

MALE (Fig. 53D, J). Body length without caudal setae 600–720 μm. Caudal rami parallel, without lateral *serra*, shorter than in female with L/W ratio 2.2–3.0. Antennule 14-segmented. P1–P5 structure as in female. Rudimentary P6 armed with strong inner spine and two slightly shorter subequal setae in Indonesian specimens (Fig. 53D), but outer seta twice longer than inner spine in Australian specimens (Fig. 53J).

DISTRIBUTION: mountain areas in Indonesia and Australia.

COMMENTS: It can be distinguished from the type taxon having similar structure of caudal rami by following combination of characters: shorter caudal rami with longer innermost seta, longer segment of Enp3 P4, P5 with shorter inner spine. Presence of large denticles on dorsal surface of caudal rami is the most distinctive feature of this small species among all other congeners. At the same time, some differences between the populations of Indonesia and Australia require more thorough analysis of these populations.

50. ***Eucyclops*** (***Ciliocyclops***) ***rarispinus*** (Sars G.O., 1909) Fig. 54.

SYNONYMY: *Cyclops rarispinus*: Sars G.O., 1909; *Eucyclops rarispinus*: Lindberg, 1951a; Dussart, Defaye, 2006; *Eucyclops* (*Ciliocyclops*) *rarispinus*: Alekseev, 2019.

TYPE LOCALITY: Tanganyika, eastern shore, at Kala, Tanzania, Africa.

HOLOTYPE PRESENCE AND STORING: British Natural History Museum, London, not found.

MATERIAL STUDIED: author's description and drawings, Lindberg's [1951a] drawings.

DESCRIPTION. FEMALE (Fig. 54). Body length without caudal setae about 800 μm. Th4 with long dense lateral hairs. Genital double somite slightly wider than long; *receptaculum*

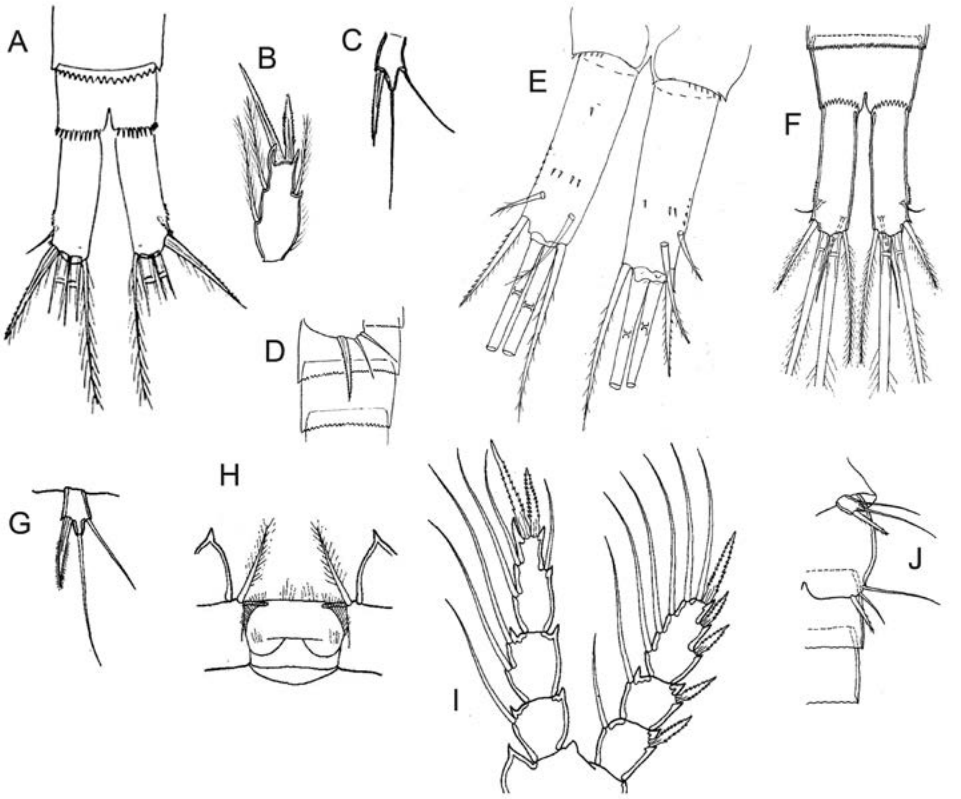

Fig. 53. *Eucyclops* (*Ciliocyclops*) *permixtus ruttneri* Kiefer, 1933 comb.n. A, E, F — caudal rami; B — P4 Enp3; C, G — P5; D, J — P6; H — P4 intercoxal plate, caudal; I — P4. A–C, E–I — female; D, J — male. A–D — Sumatra, after Kiefer [1933]; E — Australia, orig.; F–J — Australia, after Morton [1990].

Рис. 53. *Eucyclops* (*Ciliocyclops*) *permixtus ruttneri* Kiefer, 1933 comb.n. A, E, F — каудальные ветви; B — P4 Enp3; C, G — P5; D, J — P6; H — межкоксальная пластинка P4, каудально; I — P4. A–C, E–I — самка; D, J — самец. A–D — Суматра, по Kiefer [1933]; E — Австралия, ориг.; F–J — Австралия, по Morton [1990].

seminis shape typical of genus, composed of two flattened parts concaved in middle (Fig. 54C). Anal operculum round, smooth. Caudal rami subparallel, short, with L/W ratio 3.4–3.7; lateral *serra* short, composing of small spinules (Fig. 54B); inner side of ramus with proximal group of few short thin hairs. Dorsal seta subequal or slightly shorter than outermost seta (0.8–1.0: 1). Outermost seta spiniform, about 0.6 times as long as CR length, inserted without noticeable space from outer middle seta, with denticulate outer side and long hairs on inner side. Innermost seta plumose, 0.9–1.0 times as long as ramus length and 1.4–1.7 times as long as outermost seta. Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 3.9–4.6/ 6.0–7.2/ 1.4–1.7.

Antennule 12-segmented, reaching posterior margin of Th1 (Fig. 54A); three last segments with narrow finely serrated hyaline membrane. A2 Bas and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox (Fig. 54E) with short setulae near distal margin; Bas inner outgrowth with short hairs. In P4 Enp3 (Fig. 54D), segment 1.8 times as long as broad; inner spine about 1.3 times longer than outer one; distal inner seta almost reaching tips of nearest spine. Reduced P5 about twice as long as broad, with relatively weak and short inner spine, shorter than both setae; outer seta inserted almost at the same level as medial seta (Fig. 54C).

MALE: Body length without caudal setae about 610 μm. Caudal rami shorter than in female with L/W ratio about 2.6. P4 Enp3 slightly longer

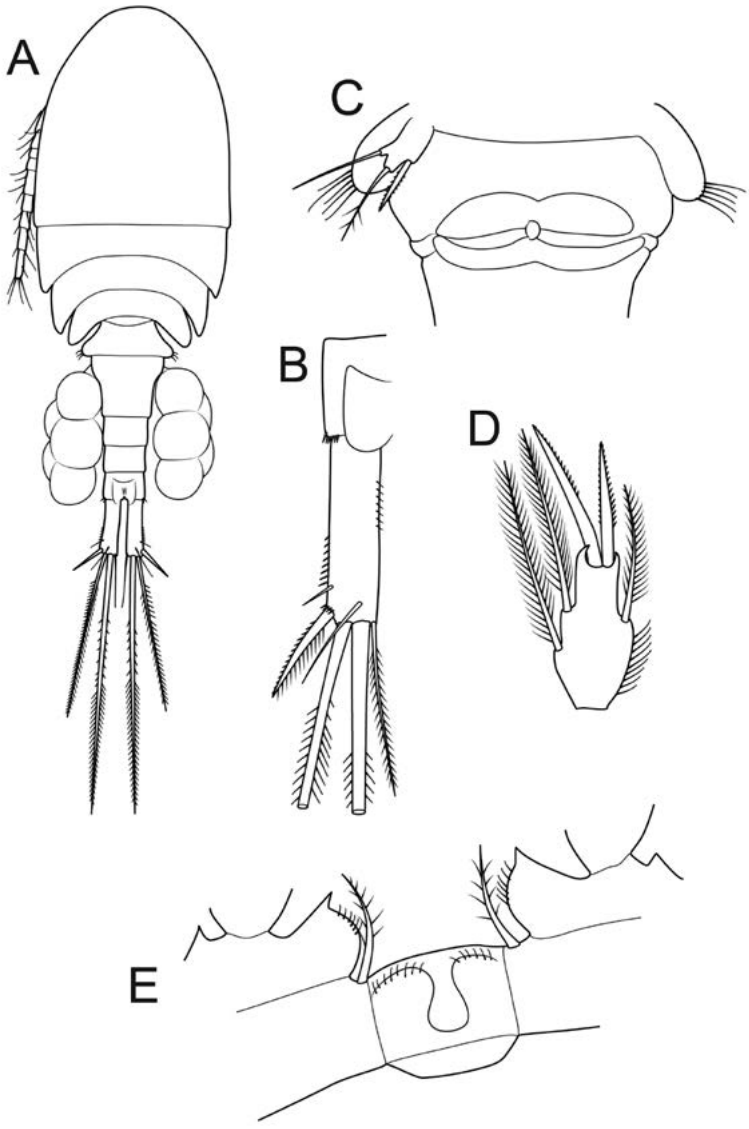

Fig. 54. *Eucyclops* (*Ciliocyclops*) *rarispinus* (Sars G.O., 1909). Female: A — habitus; B — caudal ramus, dorsal; C — Th4, genital double somite and P5; D — P4 Enp3; E — P4 intercoxal plate. Tanganyika, Tanzania. A, B — after Sars G.O. [1909]; C–E — after Lindberg [1951a].

Рис. 54. *Eucyclops* (*Ciliocyclops*) *rarispinus* (Sars G.O., 1909). Самка: A — габитус; B — каудальная ветвь, дорсально; C — Th4, генитальный сомит и P5; D — P4 Enp3; E — межкоксальная пластинка P4. Танганьика, Танзания. A, B — по Sars G.O. [1909]; C–E — по Lindberg [1951a].

than in female, with L/W ratio about 2. Rudimentary P6 with inner spine slightly shorter than two subequal setae; length ratio beginning with spine: 1.0 /1.4 /1.3.

DISTRIBUTION: known from the type locality in Lake Tanganyika and its vicinity, Central Africa.

COMMENTS: This species was found several times after description but always in *terra typica* only, so it might be a possible endemic of Tanganyika Lake. The most important morphological characters are as following: small body size, caudal rami short, L/W ratio 3.4–3.7, with reduced lateral *serra* and few proximal hairs on inner side.

51. ***Eucyclops*** (***Ciliocyclops***) ***subciliatus*** Dussart, 1984
Fig. 55.

SYNONYMY: *Eucyclops subciliatus*: Dussart, 1984a; Dussart, Frutos, 1986; Dussart, Defaye, 2006; *Eucyclops* (*Ciliocyclops*) *subciliatus*: Alekseev, 2019.

TYPE LOCALITY: pond near São Carlos city, Brazil, South America.

HOLOTYPE PRESENCE AND STORING: female holotype dissected and mounted in one slide stored in NNHN, Paris, France.

MATERIAL STUDIED: Holotype female #Cp801, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 55A–L). Body length without caudal setae about 1000 μm. Th4 with long dense hairs laterally. Genital double somite wider than long; *receptaculum seminis* typical of genus. Anal somite longer than previous one, with short hairs in anal opening, anal operculum rounded, hairless. Caudal rami slightly divergent, with L/W ratio about 4.5; lateral *serra* long, almost reaching CR base, composing of denticles, increasing distally (Fig. 55B, C). Inner side of CR with thin short numerous hairs more dense in middle-proximal part. Dorsal seta shorter than outermost seta (0.6: 1 in type specimens). Outermost seta spiniform, long, with denticulate outer side and hairs on inner side, 0.8 times as long as CR length in Brazil (Fig. 55B), but only 0.6 times as long as CR in Argentina (Fig. 55C). Innermost seta plumose, about 0.9 times as long as ramus length (Brazil) or 0.7 times as long as ramus length (Argentina) and 1.1–1.2 times as long as outermost seta. Lateral seta about as long as ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.0/ 6.0/ 1.1–1.2.

Antennule 12-segmented, reaching middle of Th1 (Fig. 55A); three distal segments with narrow smooth or finely serrated hyaline membrane. A2 Bas on caudal surface with setulae at N1, N2 positions, other groups as in Fig. 55I, J; frontal surface ornamentation as in Fig. 55K, L. Mouth appendages not observable and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, caudal surface with three rows of strong setulae (Fig. 55H). In P4 Coxa, ornamentation on caudal side with groups A–H, of longest spinules in B and E groups, and with distal dense row of short spines at C+D groups. Inner outgrowth of P4 Bas with short hairs (Fig. 55F, H); coxal seta/spine with gap on outer side. P4 Enp3 short, L/W ratio about 1.8; inner/outer spine ratio 1.2; inner spine 1.3 times as long as segment; distal setae reaching middle of nearest spines (Fig. 55F, G). Reduced P5 (Fig. 55D, E) armed with wide but rather short inner spine, about 1.6 times as long as segment and about 0.6 times as long as two setae; outer seta inserted at the same level as medial seta.

MALE (Fig. 55M). Body length of paratype about 730 μm. Caudal rami smooth on inner and outer sides except small spinules near lateral and outermost setae insertion places. Outermost seta shorter than in female, innermost/outermost setae ratio 1.7–1.8. Reduced P5 with shorter outer seta. Rudimentary P6 with strong medial spine and two weak short setae, length ratio beginning with spine: 1.0/0.4/ 0.7.

DISTRIBUTION: South America: Brazil, Argentina.

COMMENTS: From *E.* (*C.*) *neotropicus*, also inhabiting Brazil, this species can be distinguished by shorter caudal rami with long lateral *serra*.

4. SUBGENUS ***Eucyclops*** (***Denticyclops***) Alekseev, 2019

Female of variable length (700–1600 μm); caudal rami of different proportions but length/width ratio is never less than 3. Innermost caudal seta usually longer than outermost seta. Outermost seta in several taxa inserted at some distance (higher) from other terminal caudal setae. Inner surface of caudal rami smooth, lateral edge usually with rather long *serra*. Antennule 12-segmented, with denticulate hyaline membrane at least on one of distal segments. In some taxa hyaline membrane of A1 described as missing, though even in such cases line of tiny dots can be observed under high magnification. Distal setae of P4 Enp3 do not extend beyond tips of nearest spines. Reduced P5 armed with inner spine of different width and length. In the revision of 2019, there was a typo and in several places the subgenus was named "*Denticylops*". In accordance with the Code of Zoological Nomenclature 32.5.1., I indicate that the name "*Denticyclops*" should be considered as correct. I thank Dr. Chad Walter (Smithsonian Institute, Washington, USA) who kindly informed me about the typos. Subgenus includes 13 species.

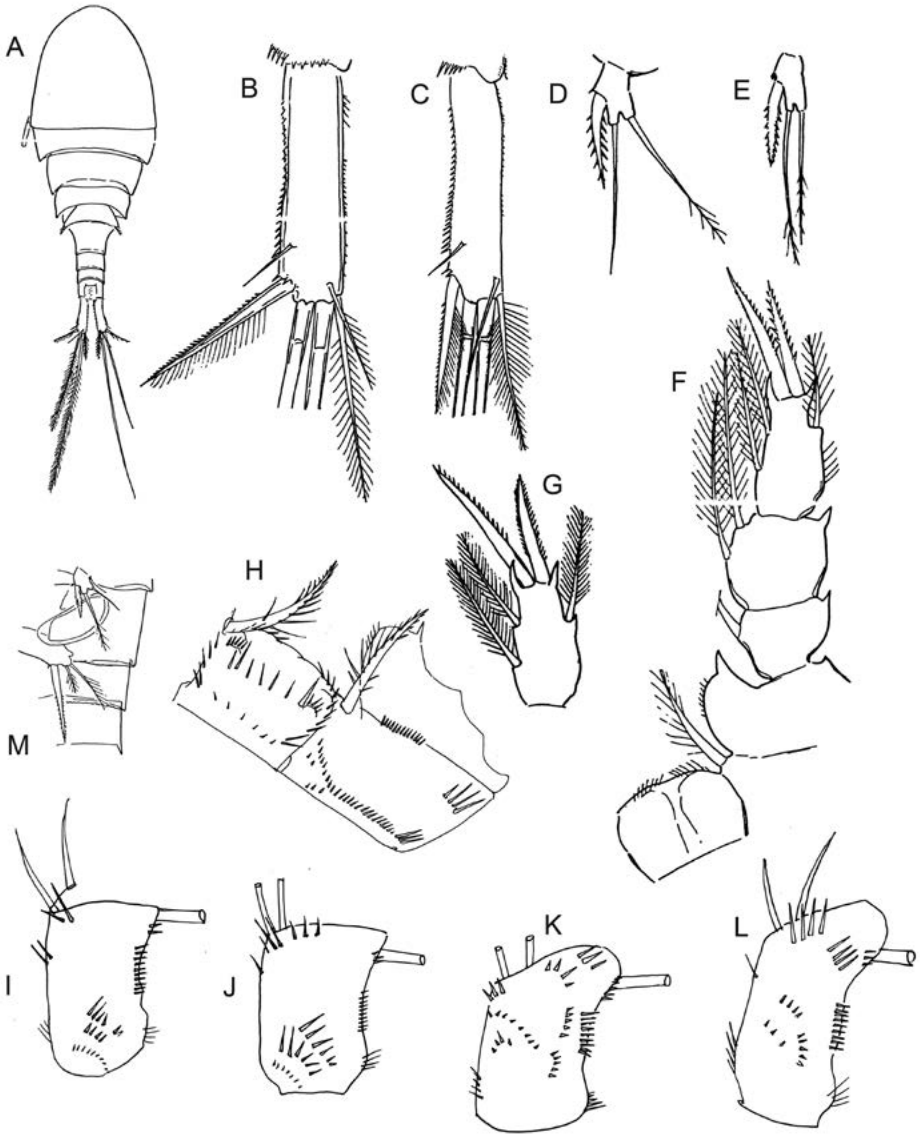

Fig. 55. *Eucyclops* (*Ciliocyclops*) *subciliatus* Dussart, 1984. A — habitus; B, C — caudal ramus, dorsal; D, E — P5; F — P4; G — P4 Enp3; H — P4 intercoxal plate, coxa and basipodite, caudal; I, J — A2 Bas, caudal; K, L — A2 Bas, frontal; M — P5 and P6. A–L — female; M — male. A, B, D, F, M — Brazil, after Dussart [1984a]; C, E, G — Argentina, after Dussart & Frutos [1986]; H, I–L — Brazil, orig.

Рис. 55. *Eucyclops* (*Ciliocyclops*) *subciliatus* Dussart, 1984. A — габитус; B, C — каудальная ветвь, дорсально; D, E — P5; F — P4; G — P4 Enp3; H — межкоксальная пластинка, кокса и базиподит P4, каудально; I, J — A2 Bas, каудально; K, L — A2 Bas, фронтально; M — P5 и P6. A–L — самка; M — самец. A, B, D, F, M — Бразилия, по Dussart [1984a]; C, E, G — Аргентина, по Dussart & Frutos [1986]; H, I–L — Бразилия, ориг.

Key to subgenus *Eucyclops* (*Denticyclops*) species

1. CR very short, with L/W ratio < 3.3 .... *E.* (*D.*) *ibleicus* Pesce et Galassi, 1987 [wells in Italy]
– CR longer, with L/W ratio > 3.3 2
2. P4 Enp3 very short, with L/W ratio about 1.7; CR long, with L/W ratio 5.6–6.8, with very reduced *serra*, composing of 4–12 small spinules, not reaching half of ramus proximally ...*E.* (*D.*) *titicacae* Kiefer, 1957 (part.) [Lake Titicaca in Peru, possibly Lake Valencia in Venezuela and laguna in Colombia]
– P4 Enp3 longer; CR with longer lateral *serra*, reaching at least half of ramus length proximally 3
3. Innermost caudal seta 0.4–0.6 times as long as ramus length 4
– Innermost caudal seta > 0.7 times as long as ramus length 6
4. Body length > 1 mm 5
– Body length < 1 mm; A1 distal segments with small denticles; P5 armed with weak but long inner spine, 2.5 times longer than segment .. *E.* (*D.*) *longispinosus* Pesce et Galassi, 1987 [wells in Italy]
5. A1 distal segments with small denticles; P5 armed with weak inner spine almost as wide as setae ....*E.* (*D.*) *macruroides* (Lilljeborg, 1901) [Palaearctic]
– A1 distal segments with rather wide almost smooth hyaline membrane, but proximal half of 12th segment finely denticulate; P5 armed with strong inner spine about 3 times wider than setae .... *E.* (*D.*) *neomacruroides* Dussart et Fernando, 1990 [North America]
6. P5 armed with weak inner spine almost as wide as setae and shorter than setae 7
– P5 armed with strong inner spine at least twice wider than setae 9
7. A1 distalmost segment proximally with large, coarse teeth (10–18), distally with much more smaller denticles .... *E.* (*D.*) *denticulatus* (Graeter, 1903) [Palaearctic]
– A1 three distal segments with equal sized tiny denticles 8
8. CR with very long outermost seta, about 0.7 times as long as ramus; innermost and outermost caudal setae with dense hairs ....*E.* (*D.*) *leptacanthus* Kiefer, 1956 [Venezuela]
– CR with shorter outermost seta; innermost and outermost caudal setae with very rare hairs or naked.....*E.* (*D.*) *euacanthus* s.lat. with 6 subspecies: *E.* (*D.*) *e. euacanthus* (Sars G.O., 1909) [Africa, SEA, Japan, Kamchatka]; *E.* (*D.*) *e. cognatus* Kiefer, 1929 [Caves in SAR]; *E.* (*D.*) *e. birmanus* Lindberg, 1949 [Myanmar]; *E.* (*D.*) *e. baylyi* Morton, 1990 [Australia]; *E.* (*D.*) *e. aequatorialis* Dussart et Fernando, 1985 comb.n. [New Guinea]; *E.* (*D.*) *e. lanceolatus* Dussart, 1974 [Ethiopia]
9. Dorsal caudal seta longer than outermost seta; A1 10th and 11th segments with denticulate membrane and 12th segment with smooth membrane ..... *E.* (*D.*) *taiwanensis* Sukhikh et Alekseev, 2015 [Taiwan]
– Dorsal caudal seta shorter than outermost seta; A1 with all three distal segments with denticulate membrane..... 10
10. P4 coxal spine homogeneously plumose on both sides; CR with lateral *serra* composing of small, dense, subequal denticles; P5 outer seta longer than inner spine ....*E.* (*D.*) *microdenticulatus* Lindberg, 1939 [India]
– P4 coxal spine with gap on outer side; CR with lateral *serra* composing of rather strong spinules; P5 outer seta subequal or shorter than inner spine.....11
11. A2 Bas without distal groups of setulae N1, N2; A1 very short, hardly reaching posterior margin of CTh..... .....*E.* (*D.*) *pseudoensifer* Dussart, 1984 [Venezuela]
– A2 Bas with one or two distal groups of setulae N1, N2; A1 longer 12
12. CR with L/W ratio > 4; lateral *serra* of rather strong, long spinules; P4 IntCox distal margin with thin hairs; P5 outer seta shorter than inner spine..... ....*E.* (*D.*) *festivus* Lindberg, 1955 [Mexico]
– CR with L/W ratio < 4; lateral *serra* of rather short spinules; P4 IntCox distal margin with long strong setulae; P5 outer seta about as long as inner spine ....*E.* (*D.*) *alekseevi* Mercado-Salas et Suarez-Morales, 2016 [Mexico]

52. *Eucyclops* (*Denticyclops*) *macruroides* (Lilljeborg, 1901)
Fig. 56.

SYNONYMY: *Cyclops macruroides*: Lilljeborg, 1901; *Leptocyclops macruroides*: Sars G.O., 1914; Lowndes, 1932; *Eucyclops macruroides*: Gurney, 1933;

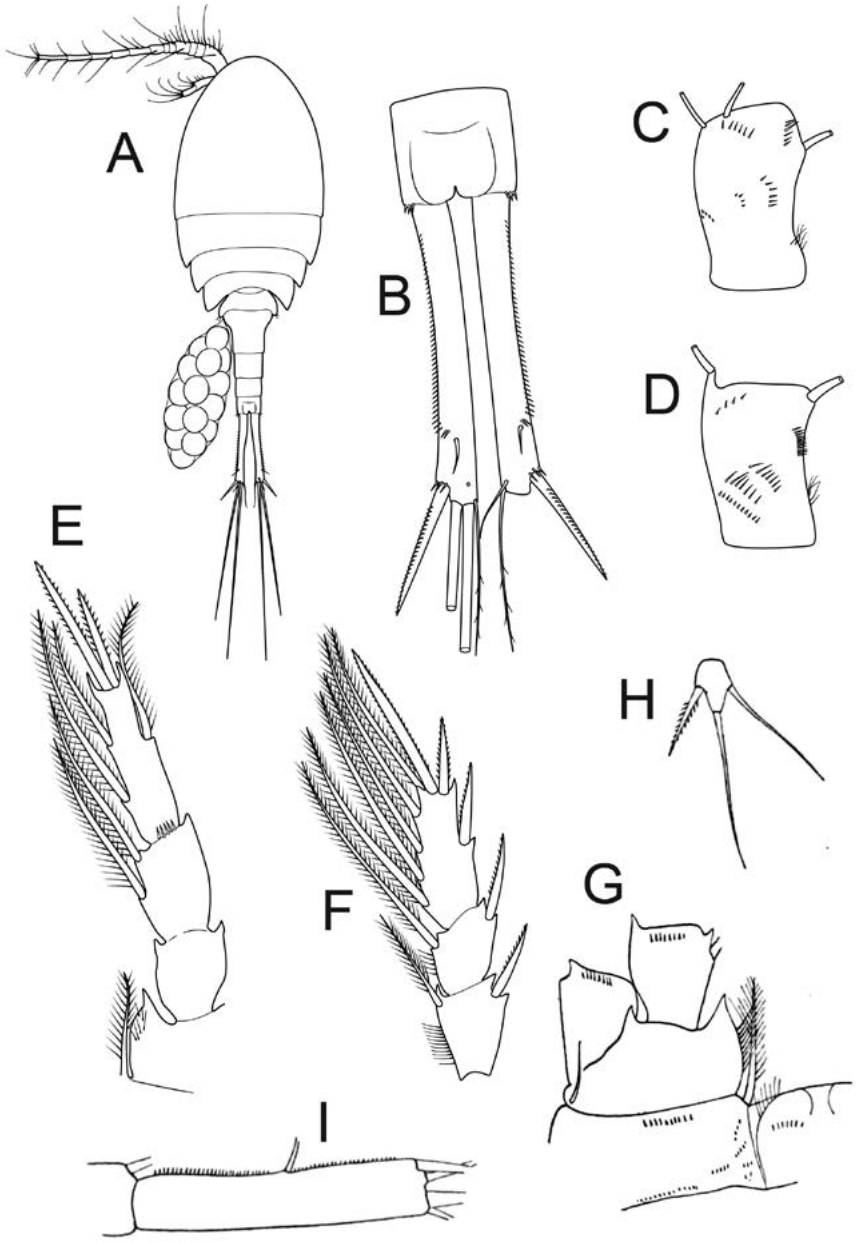

Fig. 56. *Eucyclops* (*Denticyclops*) *macruroides* (Lilljeborg, 1901). A — habitus; B — caudal rami; C — A2 Bas, frontal; D — A2 Bas, caudal; E — P4 Enp; F — P4 Exp; G — P4 intercoxal plate, coxa and basipodite, caudal; H — P5; I — A1, distal segment; J — P6. A–I — female; J — male. Europe. A — after Sars G.O. [1914]; B–F — orig., G, I — after Gurney [1933]; J — after Monchenko [1974].

Рис. 56. *Eucyclops* (*Denticyclops*) *macruroides* (Lilljeborg, 1901). A — габитус; B — каудальные ветви; C — A2 Bas, фронтально; D — A2 Bas, каудально; E — P4 Enp; F — P4 Exp; G — межкоксальная пластинка, кокса и базиподит P4, каудально; H — P5; I — A1, дистальный членик; J — P6. A–I — самка; J — самец. Европа. A — по Sars G.O. [1914]; B–F — ориг., G, I — по Gurney [1933]; J — по Monchenko [1974].

Rylov, 1948; Damian-Georgescu, 1963; Monchenko, 1974; Kiefer, 1978; *Eucyclops* (*Denticyclops*) *macruroides*: Alekseev, 2019.

TYPE LOCALITY: pond in Botanical garden of Uppsala University, Uppsala, Stockholm, Sweden.

HOLOTYPE PRESENCE AND STORING: not found. Topotype selected from the type locality, a female dissected on one slide, and a male dissected on one slide both stored in Federal collection of Zoological Institute, St.Petersburg, Russia.

MATERIAL STUDIED: topotype female and male specimens collected in the type locality; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 56A–G). Body length without caudal setae 1040–1600 µm. Th4 with long lateral setulae. Genital double somite wider than long; *receptaculum seminis* typical for genus. Anal operculum weakly developed, smooth. Caudal rami long and slender, with L/W ratio 6.8–9.0, sub-parallel, slightly narrowing in middle and expanding distally; lateral margin with *serra* of strong spinules extending almost to ramus base (Fig. 56B). Outermost caudal seta spiniform with short spinules on outer edge. Innermost seta much shorter than ramus length, 1.2–1.5 times as long as outermost seta, with rare hairs, sometimes smooth. Lateral seta placed dorsally, as long as ramus width. Dorsal seta shorter than outermost seta. Approximate length ratio of terminal setae beginning with outermost: 1.0 / 5.5–6.1 / 7.3–8.2 / 1.2–1.5.

Antennule 12-segmented, reaching middle of Th1; three distal segments with finely denticulate hyaline membrane of 18–30 tiny teeth on each segment (Fig. 56I). A2 Bas on caudal surface with small spinules at distal edge (NN1+2), other groups as in Fig. 56D; frontal surface ornamentation as in Fig. 56C. Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Medial expansion of P4 Bas with hairs. P4 IntCox with 2 rows of setulae (I–II), both with gap in middle; inner coxal spine/seta homogeneously covered with thin hairs (Fig. 56G). P4 Enp3 long, with L/W ratio 2.6–3.2; inner spine 1.4–1.5 times longer than outer one; distal setae not reaching tips of nearest spines (Fig. 56E). Reduced P5 (Fig. 56H): segment rather short, with long apical part; inner spine rather weak and short, about 1.5 times as long as segment; setae longer than spine; length ratio beginning with spine: 1.0/2.2–2.6/1.6–1.9.

MALE (Fig. 56J). Body length without caudal setae 680–1160 µm. Caudal rami sub-parallel, without lateral *serra*, shorter than in female, with L/W ratio = 5–7, outermost spiniform seta smooth knife-shaped. P1–P5 as in female. Rudimentary P6: inner spine subequal to middle seta and slightly shorter than outer seta, both setae weak and slender, when spine strong and reaching middle of next after genital somite, approximate length ratio beginning with spine: 1.0/0.8–1.0/ 1.1–1.5.

DISTRIBUTION: Europe, Asia, N.Africa?

COMMENTS: *E.* (*D.*) *macruroides* inhabits lakes, reservoirs, ponds, among littoral macrophytes and is widespread in the Palearctic. As part of complex of several common species of *Eucyclops*, such as *E.* (*E.*) *serrulatus* and *E.* (*Sp.*) *speratus*, it often can be found together with them.

53. ***Eucyclops* (*Denticyclops*) *alekseevi***
Mercado-Salas et Suarez-Morales, 2016
Fig. 57.

SYNONYMY: *Eucyclops alekseevi*: Mercado-Salas *et al*., 2016.

TYPE LOCALITY: Río Juchipila, Juchipila, Zacatecas, Mexico (21°24′37.59″N, 103°06′ 57.90″W), 1250 m above sea level.

HOLOTYPE PRESENCE AND STORING: holotype female ECO-CH-Z-04640 and paratype male AN ECOCH-Z-04641, deposited in the El Colegio de la Frontera Sur (ECO-CH-Z), in Chetumal, Mexico.

MATERIAL STUDIED: authors' description, drawings and scan photographs.

DESCRIPTION. FEMALE (Fig. 57). Body length without caudal setae about 700 µm. Th4 with long lateral setulae. Genital double somite wider than long; *receptaculum seminis* composed of two flattened parts, posterior part bulkier. Anal operculum slightly rounded, smooth. Caudal rami divergent, L/W ratio about 3.5; lateral *serra* long, extending along most of lateral margin, of strong spinules slightly increasing distally (Fig. 57A). Dorsal seta 0.5 times as long as caudal ramus, 0.8 times as long as outermost caudal seta. Outermost seta spiniform, thin and long, with denticulate outer edge and hairs on inner edge, about 0.7 times as long as ramus length. Innermost seta about 0.8–0.9 times as long as ramus length and about 1.3 times as long as outermost seta. Lateral seta longer than ramus width.

Antennule 12-segmented, long, reaching posterior margin of Th3, with finely denticulate hyaline membrane along three distalmost segments (Fig. 57F, G, H). Setation of antennular segments beginning with first: 8/4/2/6/4/2/2/3/2+I/2/3/8. A2 Enp setation: 1/9/7. A2 Bas on caudal surface with two groups of hair-setulae at N1 (long setulae)

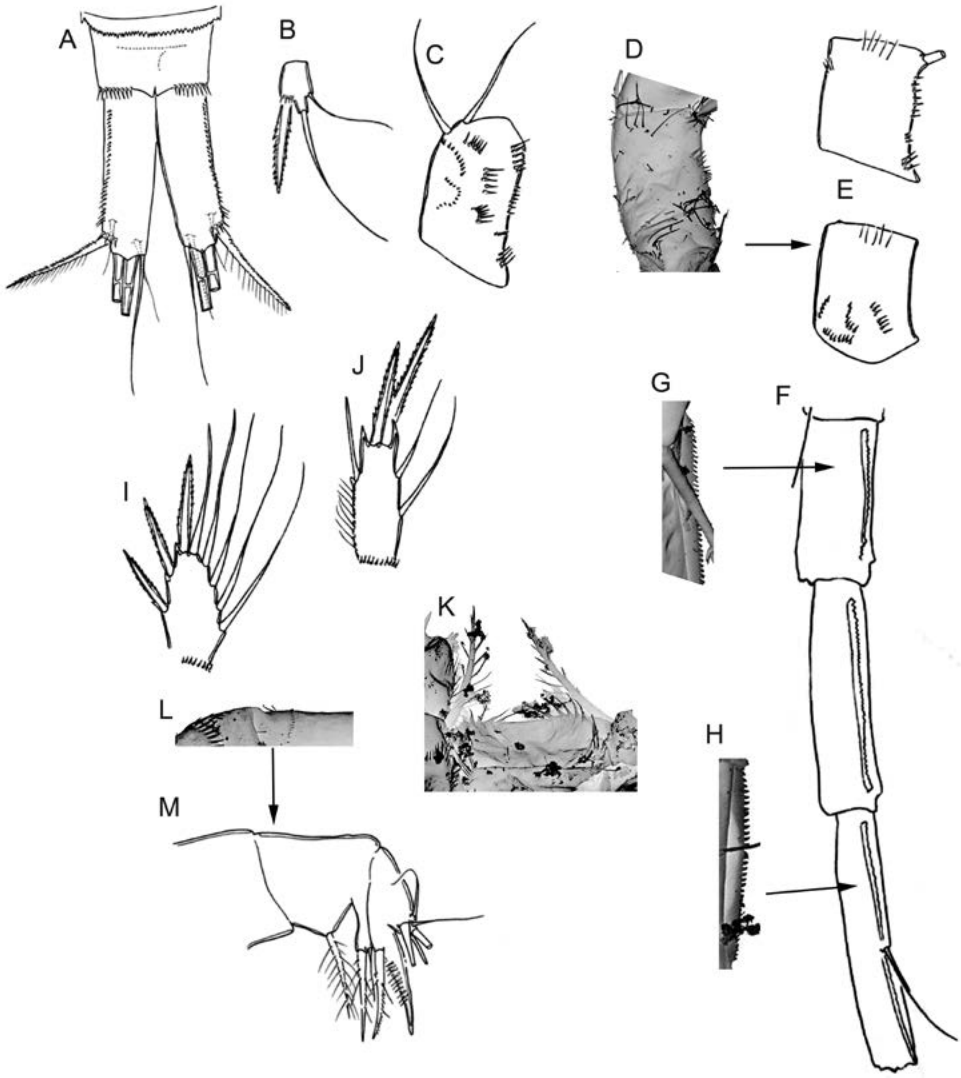

Fig. 57. *Eucyclops* (*Denticyclops*) *alekseevi* Mercado-Salas et Suarez-Morales, 2016. Female: A — caudal ramus; B — P5; C — A2 Bas, frontal; D, E — A2 Bas, caudal; F — A1, distal segments; G — A1, hyaline membrane of 10th segment; H — A1, proximal part of hyaline membrane of 12th segment; I — P4 Exp3; J — P4 Enp3; K — P4 intercoxal plate and coxal spine, caudal; L, M — maxilla. Mexico, after Mercado-Salas *et al*. [2016].

Рис. 57. *Eucyclops* (*Denticyclops*) *alekseevi* Mercado-Salas et Suarez-Morales, 2016. Самка: A — каудальная ветвь; B — P5; C — A2 Bas, фронтально; D, E — A2 Bas, каудально; F — A1, дистальные членики; G — A1, гиалиновая мембрана 10-го членика; H — A1, проксимальная часть гиалиновой мембраны 12-го членика; I — P4 Exp3; J — P4 Enp3; K — межкоксальная пластинка и коксальный шип P4, каудально; L, M — максилла. Мексика, по Mercado-Salas *et al*. [2016].

and N2 (short setulae) positions, other groups as in Fig. 57D, E; frontal surface ornamentation as in Fig. 57C. Mouth appendages typical for genus. Maxilla with spinules at lateral margin of praecoxa (according to photograps of Mercado-Salas *et al*. [2016], but not drawn) (Fig. 57L, M).

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with

three rows (I, II, III) of long, strong setulae (Fig. 57K). In P4 Bas, inner outgrowth covered with hairs; coxal spine inner margin with long proximal setulae and short distal spinules, outer margin naked proximally and with few spinules distally (see Fig. 57K). In P4 Enp3, L/W ratio about 2.5; inner/outer spine ratio 1.4; inner spine 1.2 times as long as segment; distal setae reaching middle of nearest spines (Fig. 57J). In P4 Exp3, distal spine shorter than segment (Fig. 57I). Modified setae present in both P4 Enp3 and Exp3. Reduced P5 (Fig. 57B) armed with strong inner spine, about 1.8 times as long as segment; outer seta about as long as inner spine; medial seta about 1.6 times as long as inner spine.

MALE. Body shorter and more slender than female. Caudal rami without lateral *serra*, only with few strong spinules at insertion of lateral setae, L/W ratio about 2.7; dorsal seta longer than outermost seta; innermost/outermost setae ratio about 2.2. Antennule 14-segmented. P1–P5 as in female. Rudimentary P6 armed with long and strong inner spine reaching middle of fourth urosomite, 1.8 times longer than medial seta and 1.5 times longer than outer seta.

DISTRIBUTION: Mexico.

COMMENTS: Authors wrote that *E.* (*D.*) *alekseevi* "belongs to the *serrulatus*-group" and has antennules "with smooth membrane along three distal segments" [Mercado-Salas *et al.,* 2016]. More detailed analysis of their photographs revealed that hyaline membrane of antennule is denticulate. This species should therefore be placed in subgenus *Denticyclops* close to *E.* (*D.*) *neomacruroides* Dussart et Fernando, 1990. Mexican form has smaller size, shorter caudal rami, and several other differences of external morphology. Together with large distance between Mexican and Canadian forms, this allows to save this form as a separate species.

54. ***Eucyclops* (*Denticyclops*) *denticulatus*** (Graeter, 1903) Fig. 58.

SYNONYMY: *Cyclops serrulatus* var *denticulata*: Graeter, 1903; *Leptocyclops lilljeborgi*: Sars, 1914; *Cyclops macruroides denticulatus*: Gurney, 1933; *Eucyclops macruroides* var. *denticulatus*: Rylov, 1948; *Eucyclops macruroides denticulatus*: Damian-Georgescu, 1963; *Eucyclops denticulatus*: Monchenko, 1974; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *denticulatus*: Alekseev, 2019.

TYPE LOCALITY: not specified by author, but Graeter mentions several places: "along Rhine River below Basel, especially common in Neudorfer pond" (Germany), "Baslerweiher pond" (Switzerland).

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: topotypes from Switzerland and Germany, slides identified by Kiefer in Kiefer's Reference collection (SMNK, Germany), author's description and drawings.

DESCRIPTION. FEMALE (Fig. 58A–E). Body length without caudal setae 900–1230 μm. Th4 with long setulae laterally. Genital double somite as long as broad; *receptaculum seminis* typical of genus. Anal operculum weakly developed, smooth. Caudal rami divergent, L/W ratio 4.7–7.8; lateral *serra* long, extending along most of lateral margin, of strong spinules (Fig. 58A, B). Dorsal seta shorter than outermost seta. Outermost seta spiniform, rather long, with denticulate outer edge and rare hairs (or smooth) on inner edge; about 0.6 times as long as ramus length. Innermost seta about as long as ramus length, 1.2–1.7 times as long as outermost seta, with rare hairs, sometimes smooth. Lateral seta shorter than ramus width.

Antennule 12-segmented, reaching middle of Th1; 10th and 11th segments with finely denticulate hyaline membrane; proximal part 12th segment with 8–12 rough large teeth (Fig. 58C). A2 Bas and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.9; inner spine 1.3 times longer than outer one; distal setae reaching 1/3–1/2 of nearest spines (Fig. 58E). Reduced P5 (Fig. 58D) armed with weak inner spine, about 1.6 times as long as segment, and two longer setae.

MALE (Fig. 58F). Body shorter (700–800 μm) and more slender than in female with caudal rami smooth laterally and shorter than in female: L/W ratio 5–6. Antennule 14-segmented. P1–P5 as in female. Rudimentary P6 with strong inner spine and two setae about as long as inner spine.

DISTRIBUTION: Palaearctic (?).

COMMENTS: Previously considered as subspecies of *E.* (*D.*) *macruroides*, this form has been found in many different types of continental waters. Hybridization experiments confirmed that these two forms are genetically isolated [Monchenko *et al*., 2011]. Rather specific structure of hyaline membrane of 12th segment of A1 is well-observed feature that allows to separate this species from all other congeners.

Eucyclops* (*Denticyclops*) *euacanthus s.lat.

Size of adult female less than 1mm. Caudal rami divergent, distal part of ramus wider than

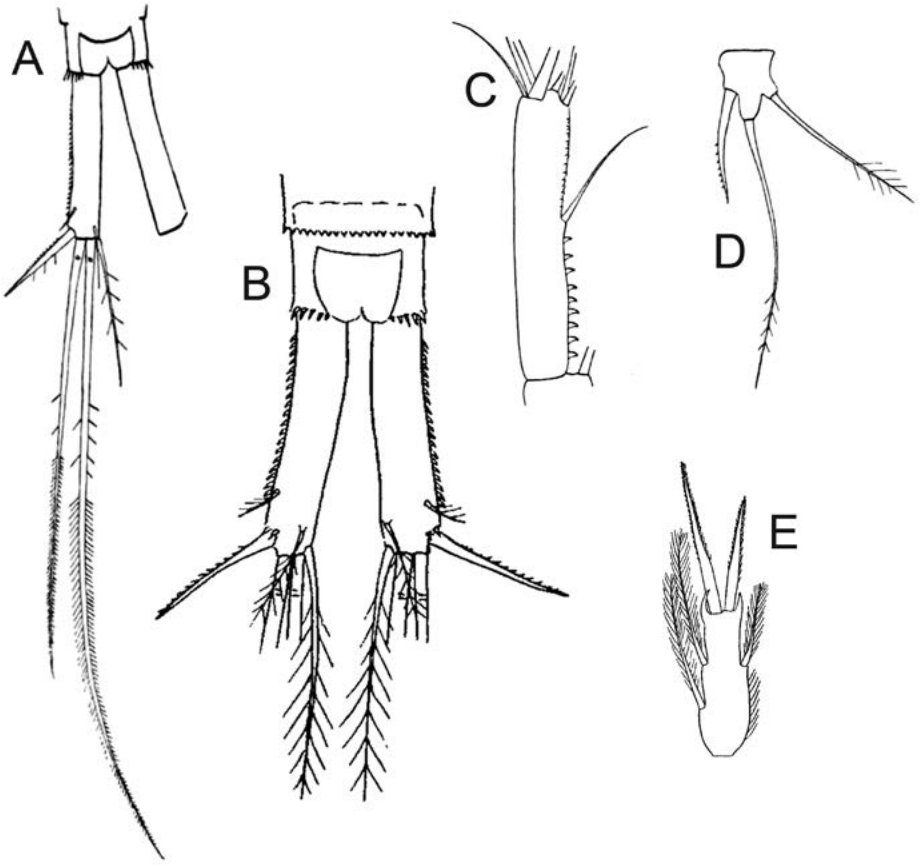

Fig. 58. *Eucyclops* (*Denticyclops*) *denticulatus* (Graeter, 1903). A, B — caudal rami; B — caudal rami; C — A1, distal segment; D — P5; E — P4 Enp3; F — P6. A–E — female; F — male. Europe. A, C, D — after Gurney [1933]; B, E, F — after Monchenko [1974].

Рис. 58. *Eucyclops* (*Denticyclops*) *denticulatus* (Graeter, 1903). A, B — каудальные ветви; B — каудальные ветви; C — A1, дистальный членик; D — P5; E — P4 Enp3; F — P6. A–E — самка; F — самец. Европа. A, C, D — по Gurney [1933]; B, E, F — по Monchenko [1974].

proximal; L/W ratio 3.4–5.7; with lateral *serra* increasing distally, proximally bending to ventral surface. Innermost caudal seta naked or with few hairs, 1.3–2.5 times longer than outermost seta. Outermost seta spiniform and often pointing almost straight outwards, inserted higher than other terminal setae; 0.5 times as long as ramus length; its outer edge with small denticles or rarely naked, inner edge naked or with rare hairs. A1 rather short, reaching posterior margin of CTh or middle of Th1; three distal segments with small denticles, sometimes hardly visible only as tiny dots. P4 Enp3 rather long, with L/W ratio more than 1.9; distal spines often wide, lanceolate. Reduced P5 armed with weak and short inner spine, usually as wide as other setae and about as long as segment (in one subspecies 1.3–1.6 times as long as segment). Includes 6 subspecies in tropical regions of Africa, Asia, Australia and large islands (Borneo, Sri Lanka, Japan, Madagascar, Taiwan, Sakhalin etc.). Northernmost boundary of range is lake on Kamchatka Peninsula, possibly associated with hot springs.

Key to subspecies *Eucyclops* (*Denticyclops*) *euacanthus* s.lat.

1. CR with very short lateral *serra*, hardly reaching middle of ramus; innermost/ outermost

caudal setae ratio about 2.5..... ..... *E.* (*D.*) *e. cognatus* Kiefer, 1929 [Caves in SAR]

– CR with longer lateral *serra*, reaching beyond middle of ramus proximally; innermost/ outermost caudal setae ratio less than 2.5..... 2

2. CR L/W ratio less than 4; innermost/ outermost caudal setae ratio about 1.3–1.8; P5 with rather long inner spine, about 1.3–1.6 times as long as segment; P4 IntCox distal margin with short setulae at sides .... *E.* (*D.*) *e. birmanus* Lindberg, 1949 [Myanmar]

– CR L/W ratio more than 4; innermost/ outermost caudal setae ratio more than 1.6; P5 with short inner spine, about as long as segment..... 3

3. Dorsal caudal seta about 1.5 times as long as outermost seta; P4 IntCox distal margin without setulae .... *E.* (*D.*) *e. baylyi* Morton, 1990 [Australia]

– Dorsal/ outermost caudal setae ratio less than 1.2 4

4. Distal spines of P4 Enp3 with normal appearance, not wide and lanceolate; P4 IntCox row I of short spinules not reaching beyond distal margin ..... *E.* (*D.*) *e. aequatorialis* Dussart et Fernando, 1985 comb.n. [New Guinea]

– Distal spines of P4 Enp3 wide and lanceolate 5

5. CR with long lateral *serra*, reaching almost to base of ramus proximally ....*E.* (*D.*) *e. euacanthus* (Sars G.O., 1909) [Africa, SE Asia, Japan, Kamchatka]

– CR with shorter lateral *serra*, not reaching about width of ramus proximally; P4 IntCox distal margin with few setulae at sides..... ..... *E.* (*D.*) *e. lanceolatus* Dussart, 1974 [Ethiopia]

55. ***Eucyclops* (*Denticyclops*) *euacanthus euacanthus*** (Sars G.O., 1909)
Fig. 59.

SYNONYMY: *Cyclops euacanthus*: Sars G.O., 1909; *Eucyclops euacanthus*: Harding, 1942; Lindberg, 1951; Dussart, Defaye, 2006; Ishida, 2002; *Eucyclops semidenticulatus*: Lindberg, 1940; *Eucyclops euacanthus* f. *simplex*: Lindberg, 1952; *Eucyclops* (*Denticyclops*) *euacanthus*: Alekseev, 2019.

TYPE LOCALITY: Lofu River, tributary of Tanganyika, East Africa.

HOLOTYPE PRESENCE AND STORING: BNHM, London, not found.

MATERIAL STUDIED: topotype specimens: 3 females and one male from Tanganyika Lake (Zooplankton collection of Prof. H. Dumont, Ghent University, now in Brussels NHM, Belgium); author's description and drawings.

DESCRIPTION. FEMALE (Fig. 59A–M). Body length of holotype without caudal setae 790 µm, relatively slender, cephalothorax as long as broad with maximal width close to caudal end, cephalothorax/genital somite widths ratio about 2.6, genital double somite with L/W ratio about 0.8 (Fig. 59A). Th4 with setulae laterally. *Receptaculum seminis* typical for genus (Fig. 59H). Caudal rami (Fig. 59D, E, G, H) with L/W ratio 4.0–5.3, divergent; lateral margins with comb-like *serra* of rather strong teeth, extending almost to ramus base, proximally bending to ventral surface (Fig. 59G, H). Innermost caudal seta thin and naked (sometimes with few thin hairs), 2.1–2.3 times longer than outermost seta. Outermost seta spiniform and pointing almost straight outwards, inserted in clear seen distance from other terminal setae, its outer edge with fine spinules, inner edge naked or with rare setulae. Dorsal seta slightly shorter or subequal to outermost seta. Distal setae approximate length ratio beginning with outermost (Tanganyika specimens): 1.0/ 4.3–4.8/ 6.6–7.0/ 2.1–2.3.

Antennule 12-segmented, hardly reaching cephalothorax distal edge; 3 last segments with clearly denticulate hyaline membrane (Fig. 59B, I). A2 Bas ornamentation (Japanese specimens, Ishida [2002]) as in Fig. 59L, M.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Bas inner outgrowth with hairs. P4 IntCox caudal surface with rows I–III composed of rather short spinules (Japanese specimens, Fig. 59N). P4 Enp3 rather long, 2.5–3.2 times as long as broad, with wide lanceolate distal spines; inner spine 1.2–1.4 times longer than outer and 0.9 times as long as segment; P4 Exp3 distal spine about 0.9 times as long as segment (Tanganyika specimens, Fig. 59C). Reduced P5 (Fig. 59F, H) with small segment as long as broad, armed with short and slender inner spine subequal to segment, and two long setae; length ratio beginning with spine in Tanganyika specimen: 1.0/ 3.3/1.9.

MALE (Fig. 59N). Body length without caudal setae about 700 µm. Th4 without hairs laterally. Caudal rami shorter than in female, without lateral *serra*, only with few spinules near lateral and outermost setae. Outermost seta spiniform and smooth, not standing out. A1 14-segmented. Swimming legs and reduced P5 as in female. Rudimentary P6 with strong but short inner spine, not reaching posterior margin of second abdominal somite, and two not equal setae, their ratio

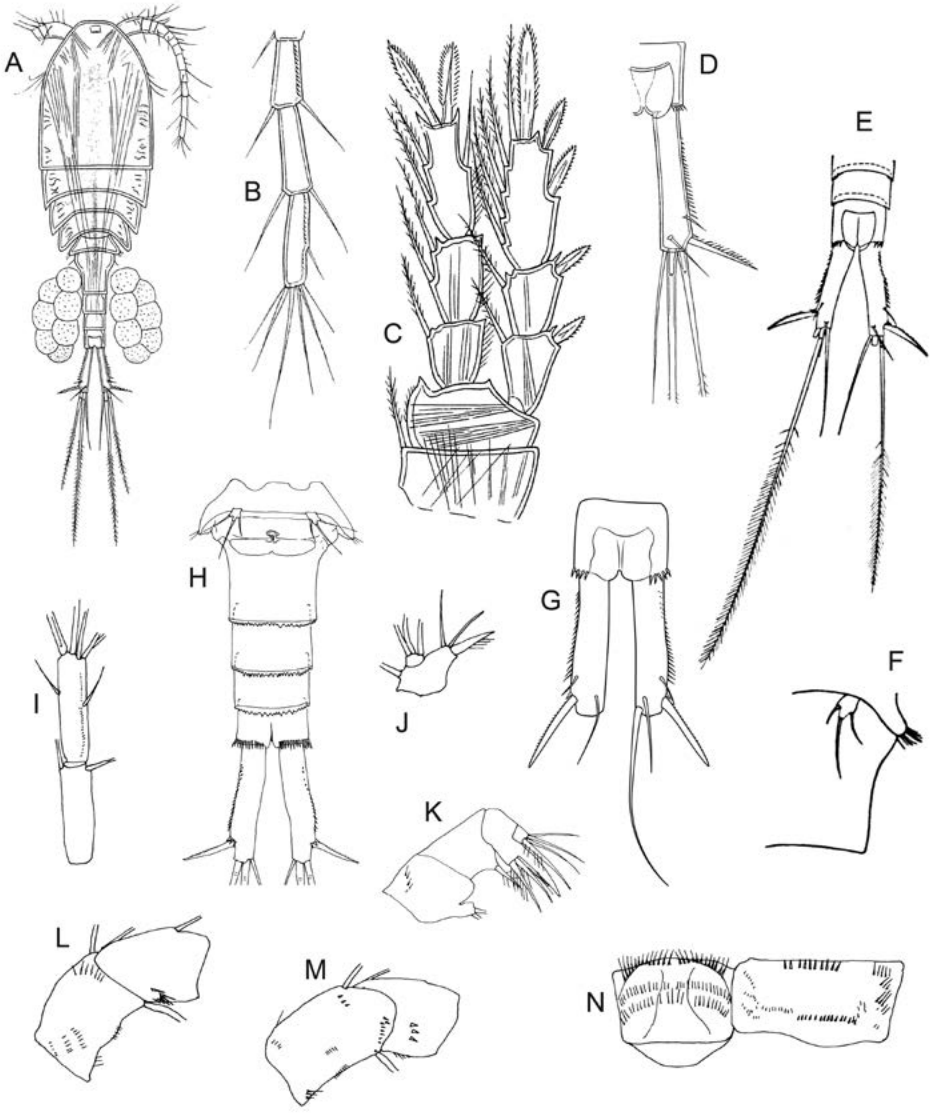

Fig. 59. *Eucyclops* (*Denticyclops*) *euacanthus euacanthus* (Sars G.O., 1909). A — habitus; B — A1, three distal segments; C — P4; D, E, G — caudal rami, dorsal; F — Th4, genital double somite and P5; H — abdomen; I — A1, two distal segments; J — maxillulary palp; K — A2 Bas, caudal; L — A2 Bas, frontal; M — P4 intercoxal plate and coxa, caudal; N — P5 and P6. A–M — female; N — male. A–D — Tanganyika, East Africa, after Sars G.O. [1909]; E, F — Tanganyika, East Africa, after Lindberg [1951]; G — South Africa, orig., slide #02749 KRC; H–M — Japan, after Ishida [2002]; N — Lake Young, East Africa, after Harding [1942].

Рис. 59. *Eucyclops* (*Denticyclops*) *euacanthus euacanthus* (Sars G.O., 1909). A — габитус; B — A1, три дистальных членика; C — P4; D, E, G — каудальные ветви, дорсально; F — Th4, генитальный сомит и P5; H — абдомен; I — A1, два дистальных членика; J — пальп максиллулы; K — A2 Bas, каудально; L — A2 Bas, фронтально; M — межкоксальная пластинка и кокса P4, каудально; N — P5 и P6. A–M — самка; N — самец. A–D — Танганьика, Восточная Африка, по Sars G.O. [1909]; E, F — Танганьика, Восточная Африка, по Lindberg [1951]; G — Южная Африка, ориг., преп. #02749 KRC; H–M — Япония, по Ishida [2002]; N — Озеро Янг, Восточная Африка, по Harding [1942].

beginning with spine: 1.0/0.6/1.0–1.6 (African specimens).

DISTRIBUTION: Species inhabiting mainly tropical, subtropical climate zones of the Old World with several local populations in Kamchatka, Sakhalin (Asia), and in Australia.

COMMENTS: *E.* (*D.*) *euacanthus* s.lat. is one of the most widespread *Eucyclops* species in tropics and subtropics. It has been redescribed several times under different names from localities in Africa and outside. Harding [1942] found it in East Africa. After description by Sars [1909] from Lake Tanganyika, this species was found in South Africa and described as *E. cognatus* Kiefer, 1929. Outside Africa, *E.* (*D.*) *euacanthus* was found in Taiwan by Harada [1931] and in Java and Sumatra by Kiefer [1933]. The gap between Africa and Far East Asia was filled by K. Lindberg [1939, 1942, 1959] who found *E.* (*D.*) *euacanthus* s.lat. in Afghanistan, India (as new species *E.* (*D.*) *semidenticulatus*) and in Burma as *E.* (*D.*) *birmanus* (=*E.* (*D.*) *e. birmanus*). Dumont and Van De Velde [1977] reported it from Nepal. Morton [1990] described similar form as *E. baylyi* (=*E.* (*D.*) *e. baylyi*) in Australia, and Dussart and Fernando [1985], as *E. birmanus aequatorialis* (=*E.* (*D*) *e. aequatorialis*) found it in New Guinea. Even African populations of *E.* (*D.*) *euacanthus* demonstrate significant variation in caudal rami L/W ratio, length of dorsal seta, innermost and outermost setae ratio. Analysis of these forms confirms that they are synonyms of *E.* (*D.*) *euacanthus* s.lat. and allows some of the above names to be retained as geographical subspecies rather than species.

56. ***Eucyclops* (*Denticyclops*) *euacanthus aequatorialis*** Dussart et Fernando, 1985 **comb.n**.

Fig. 60.

SYNONYMY: *Eucyclops birmanus aequatorialis*: Dussart, Fernando, 1985; *Eucyclops* (*Denticyclops*) *euacanthus birmanus*: Alekseev, 2019.

TYPE LOCALITY: Lake Pogera, Papua New Guinea, 5°30′S, 143°10′E.

HOLOTYPE PRESENCE AND STORING: female holotype NMC-C-1984-40 and male paratype male NMC-C-1984-41. Collected by Dr. Marcus Chambers, July 3, 1983. Deposited in the National Museum of Natural Sciences, Ottawa.

MATERIAL STUDIED: authors' descriptions and drawings.

DESCRIPTION. FEMALE (Fig. 60A–E). Body shape ovoid, length without caudal setae 850 µm; thoracic somites overlapping each other. Th4 with long lateral setulae. *Receptaculum seminis* typical for genus. Caudal rami (Fig. 60A, B) about 4.5 times as long as broad, subparallel or divergent, with wider posterior part; lateral margins with slightly reduced *serra* of rather strong teeth, proximally bending to ventral surface. Innermost caudal seta with few hairs, about 1.9 times as long as outermost seta and about 0.9 times as long as ramus length. Outermost seta spiniform and pointing almost straight outwards, inserted higher than other terminal setae, its outer edge with fine spinules, inner edge with few hairs; about 0.5 times as long as ramus length. Dorsal seta slightly longer than outermost seta. Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 6.0/ 10.0/ 1.9.

Antennule 12-segmented, reaching middle of Th1; 3 last segments without visible hyaline membrane. A2 and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with rows I–III composed of rather short spinules (Fig. 60D). In P4Enp3, L/W ratio about 2.7; inner/outer spine ratio 1.4; inner spine 1.1 times as long as segment; distal spines with normal appearance, not wide and lanceolate; distal setae reaching 1/2–2/3 of nearest spines (Fig. 60C). Reduced P5 armed with short and slender inner spine and two long subequal setae; length ratio beginning with spine: 1.0/2.7/2.4 (Fig. 60E).

MALE (Fig. 60F). More small and slender than female. Caudal rami shorter with L/W ratio 4.6, without lateral *serra*, except few spines near lateral seta base. Innermost caudal seta about 3 times as long as outermost seta which strong and naked, not standing out. A1 14-segmented. Reduced P5 as in female. Rudimentary P6 (see Fig. 60F) armed with rather strong inner spine reaching posterior margin of next abdominal somite; medial seta shorter than outer seta and spine; length ratio beginning with spine: 1.0/0.6/1.0.

DISTRIBUTION: known only from the type locality.

COMMENTS: Authors compare this form with *E.* (*E.*) *vandouwei* (Brehm, 1909) and *E. birmanus* Lindberg, 1949, but not with *E.* (*D.*) *euacanthus* (Sars G.O., 1909). In my opinion, this form is close to *E.* (*D.*) *euacanthus* s.lat., which becomes clear when comparing caudal rami, P4 and P5. Absence of denticulate hyaline membrane on A1 should be verified, as in *E. euacanthus* it may be reduced to a line of dots on three distal segments.

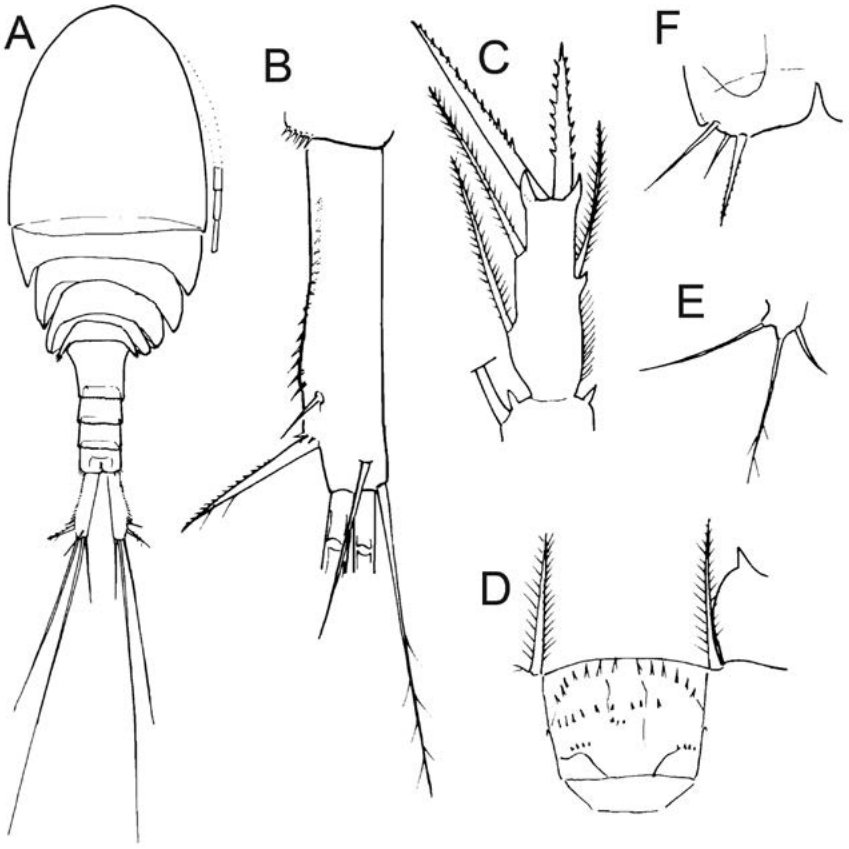

Fig. 60. *Eucyclops* (*Denticyclops*) *euacanthus aequatorialis* Dussart et Fernando, 1985. A — habitus; B — caudal ramus; C — P4 Enp3; D — P4 intercoxal plate, caudal; E — P5; F — P6. A–E — female; F — male. Papua New Guinea, after Dussart & Fernando [1985].

Рис. 60. *Eucyclops* (*Denticyclops*) *euacanthus aequatorialis* Dussart et Fernando, 1985. A — габитус; B — каудальная ветвь; C — P4 Enp3; D — межкоксальная пластинка P4, каудально; E — P5; F — P6. A–E — самка; F — самец. Папуа-Новая Гвинея, по Dussart & Fernando [1985].

57. ***Eucyclops* (*Denticyclops*) *euacanthus baylyi*** Morton, 1990
Fig. 61.

SYNONYMY: *Eucyclops baylyi*: Morton, 1990; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *euacanthus baylyi*: Alekseev, 2019.

TYPE LOCALITY: Lake Boomanjin (formerly Lake Boemingen), Fraser Island, Queensland, Australia.

HOLOTYPE PRESENCE AND STORING: female holotype and 12 paratypes, coll. I. A. E. Bayly, May 1975, deposited in Museum of Victoria, Australia.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 61). Body length without caudal setae 760–880 µm. Genital double somite about as long as broad; *receptaculum seminis* not described. Anal operculum weakly convex. Caudal rami (Fig. 61A) with L/W ratio 4.9–5.5, divergent; lateral margins with partly reduced *serra* of strong, coarse spinules, proximally bending to ventral surface. Innermost caudal seta long and thin, with rare hairs, 0.9–1.1 times as long as ramus, 1.9–2.4 times as long as outermost seta. Outermost seta spiniform, inserted with distance from other terminal setae, its outer edge with tiny

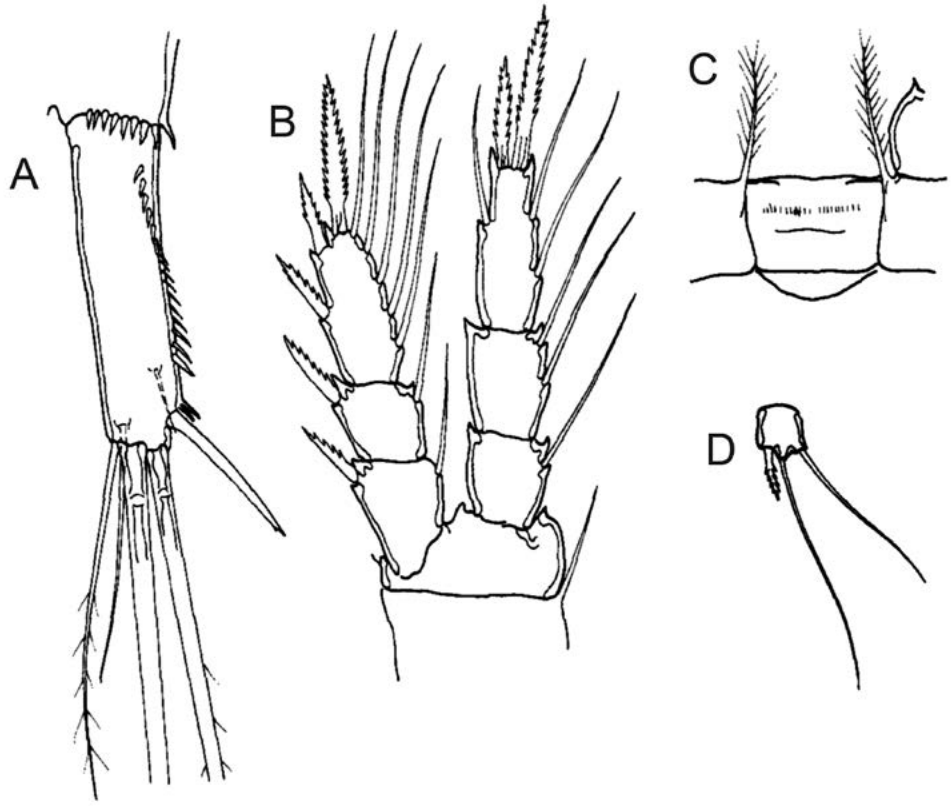

Fig. 61. *Eucyclops* (*Denticyclops*) *euacanthus baylyi* Morton, 1990. Female: A — caudal ramus; B — P4; C — P4 intercoxal plate, caudal; D — P5. Australia, after Morton [1990].

Рис. 61. *Eucyclops* (*Denticyclops*) *euacanthus baylyi* Morton, 1990. Самка: A — каудальная ветвь; B — P4; C — межкоксальная пластинка P4, каудально; D — P5. Австралия, по Morton [1990].

denticles, inner edge with few hairs distally; about 0.5 times as long as ramus length. Dorsal seta about 1.5 times longer than outermost seta. Lateral seta shorter than ramus width.

Antennule 12-segmented, hardly reaching cephalothorax distal edge; 3 last segments without visible hyaline membrane. A2 and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with middle row of short setulae, without setulae at distal margin (row I) (Fig. 61C). In P4Enp3, L/W ratio about 2.5; inner/outer spine ratio about 1.5; inner spine slightly longer than segment; distal spines with normal appearance, not wide, flattened or lanceolate; distal setae reaching 2/3–3/4 of nearest spines (Fig. 61B). In P4 Exp3, distal spine about as long as segment (Fig. 61I). Reduced P5 (Fig. 61D) with short, almost square segment armed with short and weak inner spine not longer than segment, and two long setae; length ratio beginning with spine: 1.0/4.4/3.3.

MALE unknown.

DISTRIBUTION: Australia: New South Wales, Queensland (bogs and swamps).

COMMENTS: Author considers *E.* (*D.*) *e. birmanus* Lindberg, 1949 to be closest to his new form. However, after a more comparison of his specimens with those of *E.* (*D.*) *e. birmanus*, he finds differences that allow him to describe his form as separate species. At the same time, differences among Australian, Asian and African populations, particularly in structure of caudal rami suggest that this Australian form closer to nominal taxon from Lake Tanganyika. All Asian subspecies along with *E.* (*D.*) *e. aequatorialis*, similar to this Morton's taxon, lacked visible hyaline membrane on distal segments of A1. This

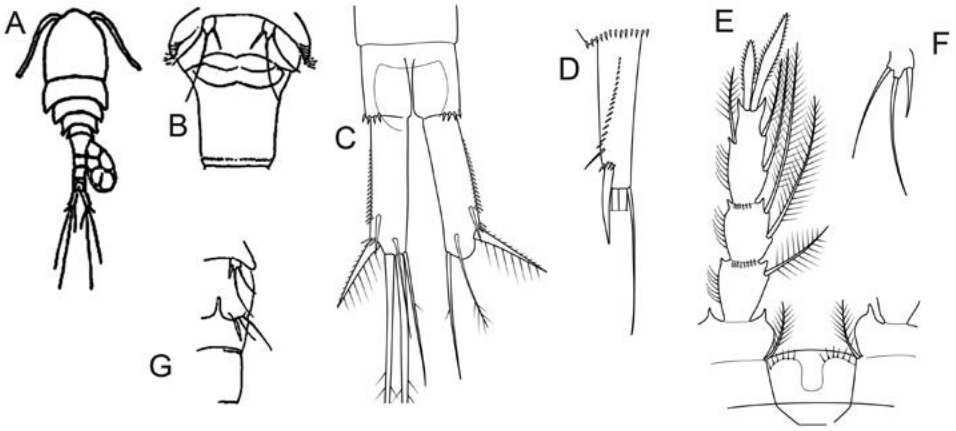

Fig. 62. *Eucyclops* (*Denticyclops*) *euacanthus birmanus* Lindberg, 1949. A — habitus; B — Th4, genital double somite and P5; C — caudal rami; D — caudal ramus, lateral; E — P4; F — P5; G — P5 and P6. A–F — female; G — male. Myanmar, after Lindberg [1949].

Рис. 62. *Eucyclops* (*Denticyclops*) *euacanthus birmanus* Lindberg, 1949. A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви; D — каудальная ветвь, латерально; E — P4; F — P5; G — P5 и P6. A–F — самка; G — самец. Мьянма, по Lindberg [1949].

structure should be re-examined using confocal or electronic microscope, since in some other species of this subgenus that have also hyaline membrane as lost, denticles marks usually remain visible as chain of tiny dots on surface of segment when viewed directly from above. In any case, this taxon should be re-described.

58. ***Eucyclops* (*Denticyclops*) *euacanthus birmanus*** Lindberg, 1949
Fig. 62.

SYNONYMY: *Eucyclops birmanus*: Lindberg, 1949; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *euacanthus birmanus*: Alekseev, 2019.

TYPE LOCALITY: water reservoir in Taunggyi (Shan state) alt. about 1460 m., Myanmar (Burma).

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 62A–F). Body length without caudal setae 760–855 μm. Th1 widened posteriorly. Th2 and Th3 also with lateral posterior expansions. Th4 with long lateral setulae; its lateral expansions embracing sides of genital double-somite. GDS about 1.2 times as long as broad; *receptaculum seminis* typical for genus (Fig. 62B). Anal operculum weakly developed, smooth. Caudal rami (Fig. 62A, C, D) with L/W ratio 3.4–3.6, divergent, sometimes parallel; lateral margins with partly reduced *serra* of dense spinules, proximally bending to ventral surface. Innermost caudal seta long and thin, with one hair at middle, about as long as ramus, 1.3–1.8 times as long as outermost seta. Outermost seta spiniform, inserted more proximally than other terminal setae, its outer edge with tiny denticles, inner edge with rare hairs; about 0.6 times as long as ramus length. Dorsal seta thin, with few hairs distally, slightly longer than outermost seta. Lateral seta about as long as ramus width. Distal setae length ratio beginning with outermost: 1.0/ 4.7–5.9/ 7.6–8.9/ 1.3–1.8.

Antennule 12-segmented, reaching posterior border of CTh or middle of Th1; 3 last segments without visible hyaline membrane. A2 and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox caudal surface with short setulae at distal margin with gap in the middle (Fig. 62E). In P4Enp3, L/W ratio 1.9–2.4; inner/outer spine ratio 1.4–1.5; inner spine 1.1 times as long as segment; distal spines lanceolate (flattened with tapering edges); distal setae reaching middle of nearest spines (see Fig. 62E). Reduced P5 with short, almost square segment armed with relatively long inner spine, little wider than setae, 1.3–1.6 as long as segment;

approximate length ratio beginning with spine: 1.0/2.5/2.0 (Fig. 62F).

MALE (Fig. 62G). Body length without caudal setae 608 μm. Caudal rami parallel without *serra*, but with few spinules near lateral seta base. Dorsal seta longer than in female. Reduced P5 more close to nominal taxon than in female, with shorter inner spine. Rudimentary P6 with short inner spine not reaching next somite distal border and two seta, both longer than spine; length ratio beginning with spine: 1.0/1.1/1.8.

DISTRIBUTION: Myanmar (Burma).

COMMENTS: Lindberg [1949] admits some similarity of his form with two African species *E.* (*E.*) *acanthoides* (Douwe, 1914) and *E.* (*D.*) *euacanthus* (Sars G.O., 1909). However he considers *E. fragilis* Kiefer (=*E.* (*E.*) *vandouwei* (Brehm, 1909) from Cameroon) to be closest to his new form. He separates them using few unreliable characters, including appearance of thoracic somites, and does not discuss similarity of this form to other taxa mentioned above. Caudal rami and P5 armament in *E.* (*D.*) *e. birmanus* are more close to *E.* (*D.*) *euacantus* s.lat. that has small denticles on distal segments of A1, probably not noticed by Lindberg in *E.* (*D.*) *e. birmanus*.

59. ***Eucyclops* (*Denticyclops*) *eucanthus cognatus*** Kiefer, 1929
Fig. 63.

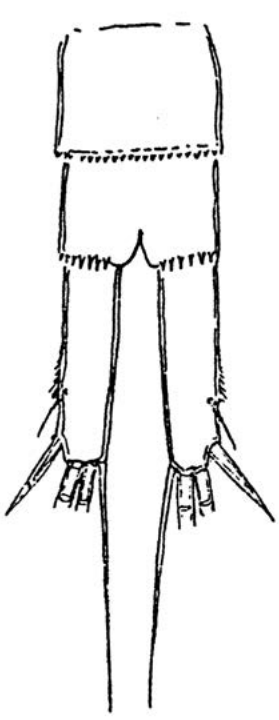

Fig. 63. *Eucyclops* (*Denticyclops*) *euacanthus cognatus* Kiefer, 1929. Female: caudal rami. South Africa, after Kiefer [1929b].

Рис. 63. *Eucyclops* (*Denticyclops*) *euacanthus cognatus* Kiefer, 1929. Самка: каудальные ветви. Южная Африка, по Kiefer [1929b].

SYNONYMY: *Eucyclops cognatus*: Kiefer, 1929b; *Eucyclops* (*Denticyclops*) *euacanthus cognatus*: Alekseev, 2019.

TYPE LOCALITY: Mpondoland, Ndwalane River, South Africa.

HOLOTYPE PRESENCE AND STORING: female holotype in bad state in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: female holotype, author's description and drawing.

DESCRIPTION. FEMALE (Fig. 63): Small cyclopid, body length less than 1 mm. Caudal rami (see Fig. 63) with L/W ratio about 5, almost parallel, wide spaced; lateral margins with short *serra* consisting of relatively fine spinules, increasing distally. Innermost caudal seta long and thin, naked, 1.2 times as long as ramus, 2.5 times as long as outermost seta. Outermost seta spiniform, inserted more proximally than other terminal setae, without hairs; about 0.5 times as long as ramus length. Lateral seta about as long as ramus width.

Antennule 12-segmented, hardly reaching posterior border of CTh; three distal segments with tiny denticles. A2 and mouth appendages not described. Spines of P1–P3 swimming legs of normal appearance, but in P4 show signs of lanceolate formation. Reduced P5 similar to *E.* (*D.*) *e. euacanthus*.

MALE unknown.

DISTRIBUTION: known from the type locality only.

COMMENTS: This form was briefly described and poorly illustrated (only caudal rami). Unfortunately, Kiefer's holotype, like many other old slides prepared in glycerin-gelatin medium, has completely dried out, so no more details can now be seen. Nevertheless, along with description it is sufficient to recognize this taxon as close to *E.* (*D.*) *euacanthus* s.lat. in such characters as: caudal rami structure with spiral *serra*, high innermost/outermost setae ratio, naked outermost and innermost caudal setae; high level of outermost seta insertion. Shortened lateral *serra* and several small details mentioned by author allow its name to be

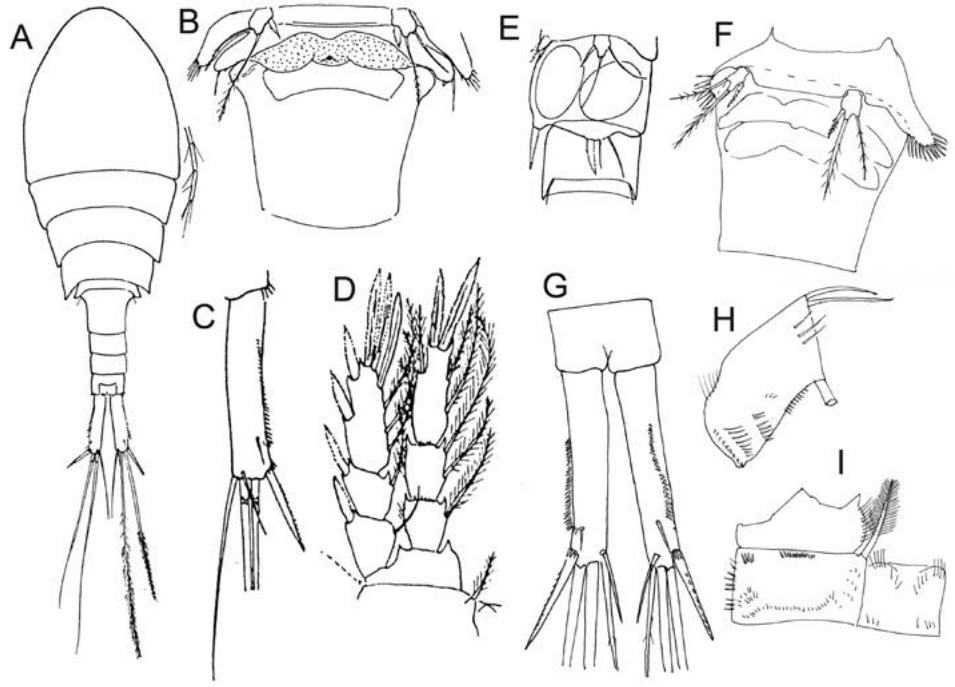

Fig. 64. *Eucyclops* (*Denticyclops*) *euacanthus lanceolatus* Dussart, 1974. A — habitus; B, F — Th4, genital double somite and P5; C, G — caudal rami; D — P4; E — P5 and P6; H — A2 Bas, caudal; I — P4 coxa and intercoxal plate, caudal. A–D, F–I — female; E — male. Ethiopia. A–E — after Dussart [1974]; F–I — orig., slide CP631 NHNM.

Рис. 64. *Eucyclops* (*Denticyclops*) *euacanthus lanceolatus* Dussart, 1974. A — габитус; B, F — Th4, генитальный сомит и P5; C, G — каудальные ветви; D — P4; E — P5 и P6; H — A2 Bas, каудально; I — кокса и межкоксальная пластинка P4, каудально. A–D, F–I — самка; E — самец. Эфиопия. A–E — по Dussart [1974]; F–I — ориг., преп. CP631 NHNM.

retained, but only as a subspecies. Re-description is required.

60. ***Eucyclops* (*Denticyclops*) *euacanthus lanceolatus*** Dussart, 1974
Fig. 64.

SYNONYMY: *Eucyclops euacanthus* f. *lanceolata* Dussart, 1974; *Eucyclops euacanthus lanceolatus*: Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *euacanthus lanceolatus*: Alekseev, 2019.

TYPE LOCALITY: pond in mountain Ethiopia, Africa.

HOLOTYPE PRESENCE AND STORING: female holotype and male paratype deposited in Copepod collection in MNHN, Paris, France.

MATERIAL STUDIED: holotype #Cp631, paratype #Cp623, author's description and drawings

DESCRIPTION. FEMALE (Fig. 64A–D, F–I). Body length without caudal setae 960 μm, very dark brown in color. Th4 with long lateral setulae. Genital double somite: L/W ratio about 1, *receptaculum seminis* typical for genus (Fig. 64B, F). Caudal rami (Fig. 64C, G) L/W ratio 5.1–5.7, slightly divergent; lateral margins with reduced spiral *serra* of rather subequal spinules, proximally bending to ventral surface. Innermost caudal seta about 1.8 times as long as outermost seta and about 1.1 times as long as ramus length, with few hairs. Outermost seta spiniform, inserted higher than other terminal setae, its outer edge with small denticles, inner edge naked; about 0.5 times as long as ramus length. Dorsal seta shorter than outermost seta (0.7–0.8: 1). Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/4.0/5.5/1.8.

Antennule 12-segmented, reaching middle of Th1; with denticles on 10th and 11th segments. A2 Bas on caudal surface with few long setulae distally (N1), other groups as in Fig. 64H, frontal

surface not visible. Mouth appendages not visible and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Bas inner outgrowth with hairs. P4 IntCox caudal surface with rather long setulae at sides of distal margin; coxal spine homogeneously plumose with thin hairs (Fig. 64I). P4 Enp3 rather long, about 2.7 times as long as broad, with wide lanceolate distal spines; inner spine 1.3 times longer than outer and about as long as segment; P4 Exp3 distal spine about 0.9 as long as segment; distal setae modified, wide (Fig. 64D). Reduced P5 (Fig. 64B, F) with small segment, armed with short inner spine subequal to segment, and two long setae longer than spine; length ratio beginning with spine: 1.0/ 2.7–4.2/2.0–2.9.

MALE (Fig. 64E). More small and slender than female. Th4 hairless laterally. Caudal rami without lateral *serra* and shorter than in female. A1 14-segmented. P1–P4 and reduced P5 similar to female. Rudimentary P6 with strong but short inner spine, slightly shorter medial seta and slightly longer outer seta.

DISTRIBUTION: found only in the type locality, Ethiopia, Africa.

COMMENTS: Author states that remark of Lindberg [1952] about large variation among *euacanthus*-like individuals does not allow him to make this form as a new species. Dussart [1974] proposes to name it "forma *lanceolata"* of *E.*. (*D.*) *euacanthus* to distinguish his taxon. In accordance with the International Codex of Zoological Nomenclature, this form should be evaluated as subspecies *E.* (*D.*) *euacanthus lanceolatus*.

61. ***Eucyclops*** (***Denticyclops***) ***festivus*** Lindberg, 1955 Fig. 65.

SYNONYMY: *Eucyclops festivus*: Lindberg, 1955a; Dussart, Defaye, 2006: *Eucyclops* (*Denticyclops*) *festivus*: Alekseev, 2019; *Eucyclops estherae*: Mercado-Salas *et al*., 2016.

TYPE LOCALITY: Prese San Pablo, Guadalupe Hidalgo, Mexico (19°50′N, 98°30′E).

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings, topotypes from Mexico, females from California, USA.

DESCRIPTION. FEMALE (Fig. 65). Body length without caudal setae 820–920 μm. Th4 with rather short lateral setulae. Genital double-somite as long as broad, with wide anterior part and cylindrical posterior part; *receptaculum seminis* typical for genus. Anal operculum weakly developed, smooth. Caudal rami slightly divergent, with L/W ratio 4.9–5.4; lateral *serra* of about 18 rather strong teeth, extending almost to ramus base, increasing distally (Fig. 65A, B). Innermost caudal seta plumose, 1.2–1.4 times longer than outermost seta, 0.7–0.8 times as long as caudal ramus length. Outermost seta spiniform, long, its outer edge with small spinules, inner edge with hairs; 0.5–0.6 times as long as caudal ramus length. Dorsal seta shorter than outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 3.7–4.0/ 6.0–7.0/ 1.2–1.4.

Antennule 12-segmented, reaching Th1 posterior edge, last three segments with fine denticles (Fig. 65E). A2 Bas ornamentation on caudal surface with two groups of setulae distally (N1, N2), other groups as in Fig. 65D; frontal surface as in Fig. 65C.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox distal margin and Bas inner outgrowth with thin hairs (Fig. 65I, J); coxal spine with long hairs proximally, inner side with shorter spinules distally, outer side naked distally (see Fig. 65I). In P4Enp3, L/W ratio 2.0–2.4; inner/outer spine ratio 1.3–1.6; inner spine 1.3–1.5 times longer than segment; distal setae long, almost reaching tips of nearest spines (Fig. 65F, G). Reduced P5 (Fig. 65K) with short almost square segment; strong inner spine almost 3 times thicker than setae and about 2.5 times longer than segment; outer seta shorter than spine; medial seta 1.4–1.8 times longer than spine.

MALE (Fig. 65H). Body length without caudal setae 760–780 μm. Caudal rami: L/W ratio = 3.8–4.0, parallel, without lateral *serra*. Innermost caudal seta 1.5–2.0 times longer than outermost. P1–P5 basically as in female. Rudimentary P6 with strong long inner spine reaching posterior margin of third abdominal somite and two much shorter and slender setae.

DISTRIBUTION: Mexico, south of USA.

COMMENTS: This species apparently has younger synonym*, E. estherae* Mercado-Salas et Suarez-Morales, 2016. Both have finely denticulate hyaline membrane on three distal segments of A1, similar structure and armament of P4 and P5, proportions and ratio of setae in caudal rami. To confirm their similarities or differences, it is necessary correctly redescribe true *E.* (*D.*) *festivus* to test morphological characteristics, by which authors of the second form distinguish these two taxa, for variability of the signs in different populations, or apply molecular-genetic analysis.

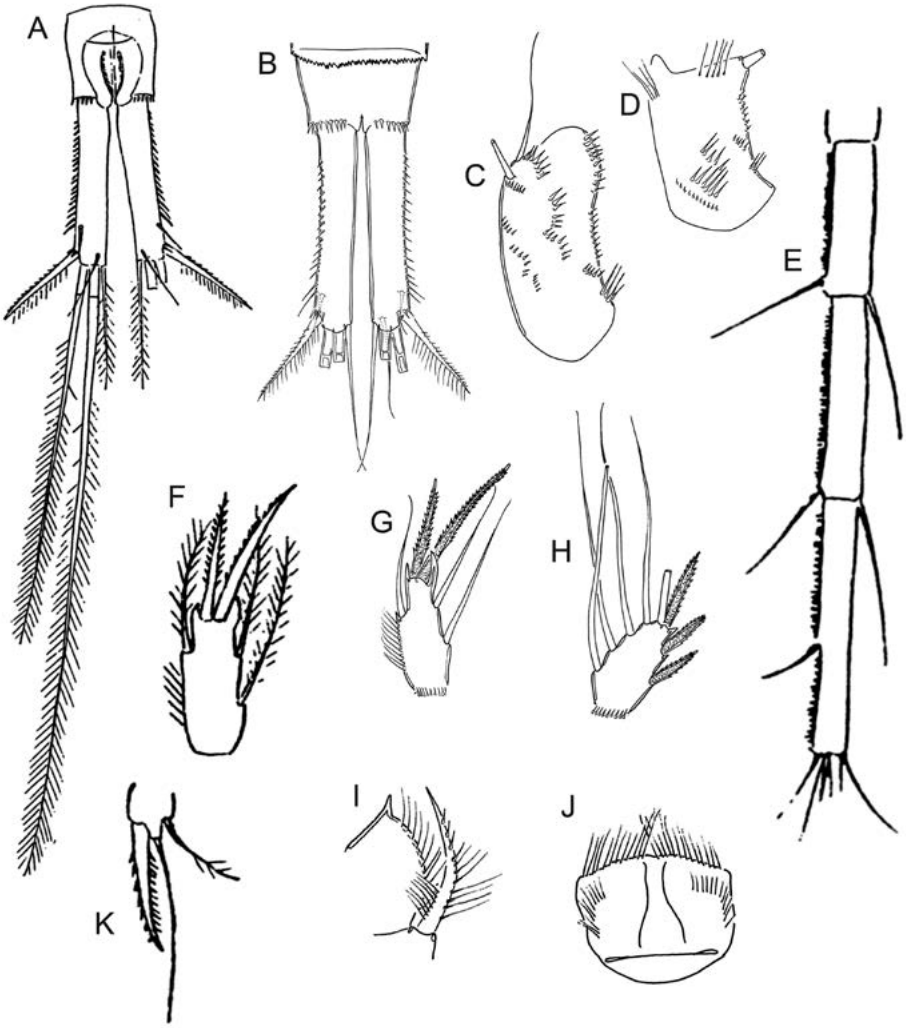

Fig. 65. *Eucyclops* (*Denticyclops*) *festivus* Lindberg, 1955. Female: A, B — caudal rami, dorsal and ventral; C — A2 Bas, frontal; D — A2 Bas, caudal; E — A1, three distal segments; F, G — P4 Enp3; H — P4 Exp3; I — P4 coxal spine; J — P4 intercoxal plate, caudal; K — P5. Mexico. A, E, F, K — after Lindberg [1955a]; B, C, D, G–J — after Mercado-Salas *et al*. [2016] as "*Eucyclops estherae*".

Рис. 65. *Eucyclops* (*Denticyclops*) *festivus* Lindberg, 1955. Самка: A, B — каудальные ветви, дорсально и вентрально; C — A2 Bas, фронтально; D — A2 Bas, каудально; E — A1, три дистальных членика; F, G — P4 Enp3; H — P4 Exp3; I — коксальный шип P4; J — межкоксальная пластинка P4, каудально; K — P5. Мексика. A, E, F, K — по Lindberg [1955a]; B, C, D, G–J — по Mercado-Salas *et al*. [2016] как "*Eucyclops estherae*".

62. ***Eucyclops* (*Denticyclops*) *ibleicus***
Pesce et Galassi, 1987
Fig. 66.

SYNONYMY: *Eucyclops ibleicus*: Pesce, Galassi, 1987; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *ibleicus*: Alekseev, 2019.

TYPE LOCALITY: freshwater well in Scoglitti, Ragusa, Sicily, Italy.

HOLOTYPE PRESENCE AND STORING: holotype female dissected, slide #Si/33.1, place not indicated by authors.

MATERIAL STUDIED: authors' description and drawings.

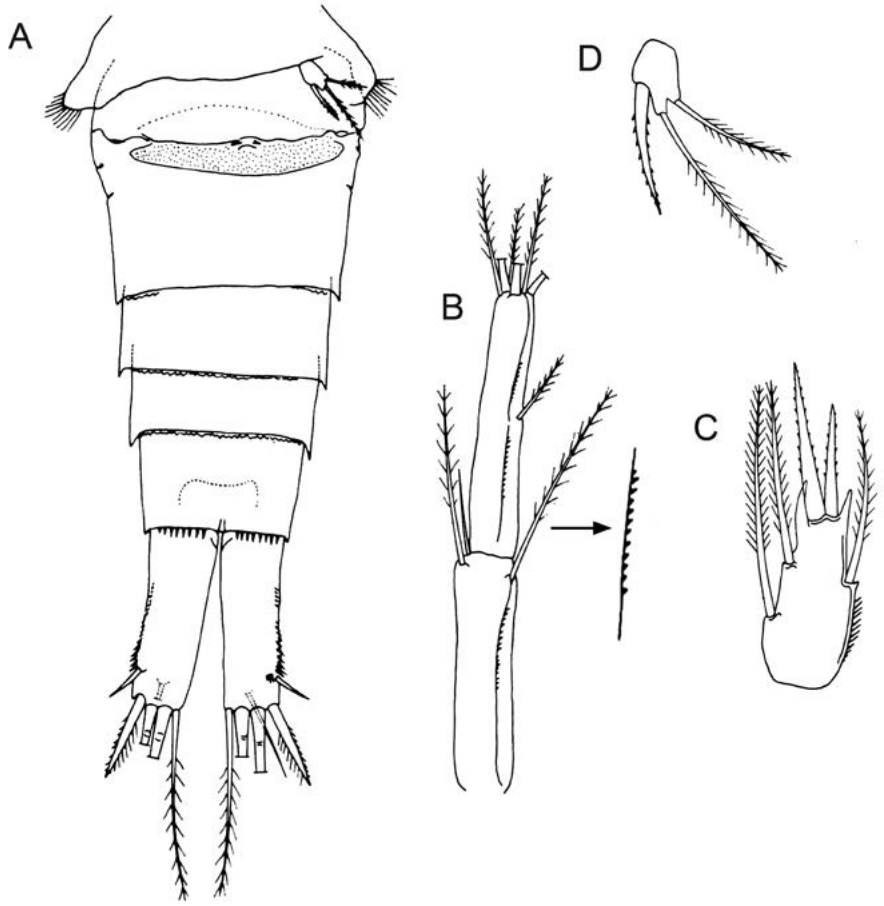

Fig. 66. *Eucyclops* (*Denticyclops*) *ibleicus* Pesce et Galassi, 1987. Female: A — abdomen; B — A1, two distal segments; C — P4 Enp3; D — P5. Italy, after Pesce & Galassi [1987].

Рис. 66. *Eucyclops* (*Denticyclops*) *ibleicus* Pesce et Galassi, 1987. Самка: A — абдомен; B — A1, два дистальных членика; C — P4 Enp3; D — P5. Италия, по Pesce & Galassi [1987].

DESCRIPTION. FEMALE (Fig. 66). Body length without caudal setae 750–800 μm; colorless. Th4 with long lateral setulae. Genital double-somite wider than long; *receptaculum seminis* typical for genus (Fig. 66A). Caudal rami short with L/W ratio about 3, slightly divergent; lateral *serra* of thin, small spinules, proximally bending to ventral surface. Innermost seta about 2 times longer that outermost seta and slightly longer than caudal ramus length (see Fig. 66A). Dorsal seta slightly longer than outermost seta. Lateral seta shorter than ramus width.

Antennule 12-segmented, short, reaching distal edge of CTh; three distal segments with small denticles (Fig. 66B). A2 Bas ornamentation and mouth appendages not studied.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 (Fig. 66C) about 2 times as long as broad; inner spine about 1.4 times longer than outer one and shorter than segment; distal setae almost reaching tips of nearest spines. P4 IntCox distal margin with setulae. Reduced P5 (Fig. 66D): elongated segment with rather strong inner spine twice wider than setae and about two times longer than segment length; outer seta about as long as inner spine; medial seta about 1.5 times longer than spine.

MALE unknown.

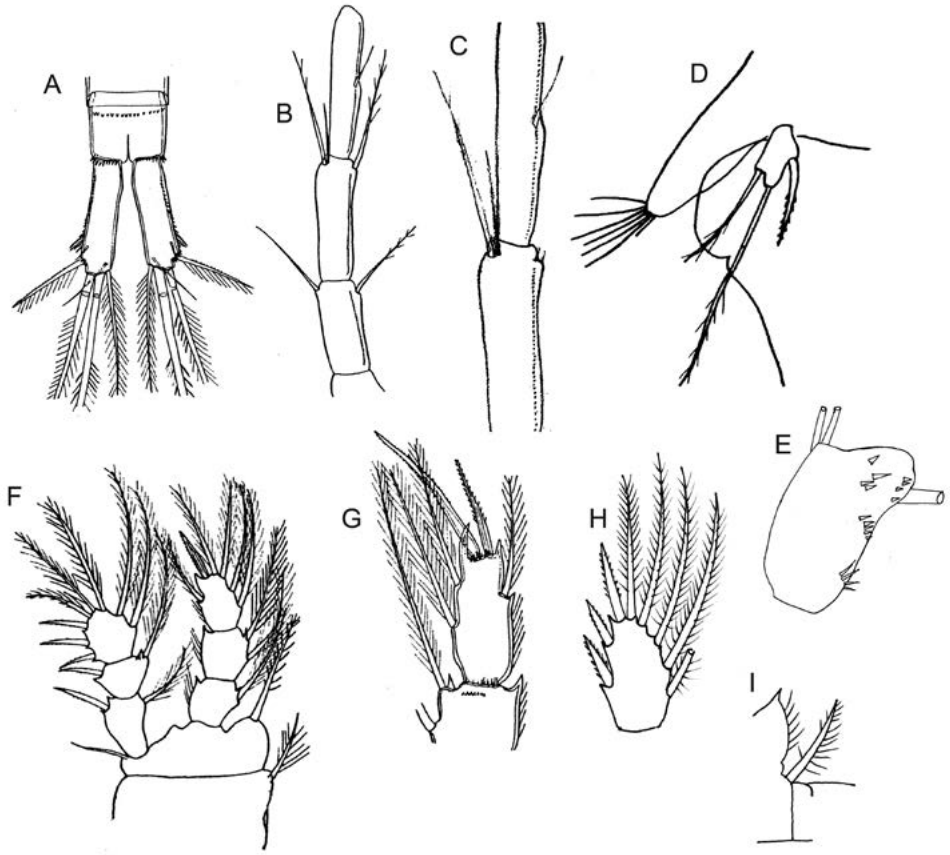

Fig. 67. *Eucyclops* (*Denticyclops*) *leptacanthus* Kiefer, 1956. Female: A — caudal rami, ventral; B, C — A1, distal segments; D — P5; E — A2 Bas, frontal; F — P1; G — P4 Enp3; H — P4 Exp3; H — P4 coxal spine. Venezuela. A, B, D, F, G — after Kiefer [1956a]; C — drawing by Kiefer, after Mercado-Salas & Suárez-Morales [2014a]; E — orig., slide #05410 KRC; H, I — orig., slide #05409 KRC.

Рис. 67. *Eucyclops* (*Denticyclops*) *leptacanthus* Kiefer, 1956. Самка: A — каудальные ветви, вентрально; B, C — A1, дистальные членики; D — P5; E — A2 Bas, фронтально; F — P1; G — P4 Enp3; H — P4 Exp3; H — коксальный шип P4. Венесуэла. A, B, D, F, G — по Kiefer [1956a]; C — Рис. Кифера, по Mercado-Salas & Suárez-Morales [2014a]; E — ориг., преп. #05410 KRC; H, I — ориг., преп. #05409 KRC.

DISTRIBUTION: known from the type locality only: well in Scoglitti, Ragusa, Sicily, Italy

COMMENTS: Not sufficiently described (missing A2 Bas and P4 ornamentation), but valid species with short caudal rami as the main character separating it from all congeners.

63. ***Eucyclops*** (***Denticyclops***) ***leptacanthus*** Kiefer, 1956
Fig. 67.

SYNONYMY: *Eucyclops leptacanthus*: Kiefer, 1956a; Dussart, Defaye, 2006; Mercado-Salas, Suárez-Morales, 2014a; *Eucyclops* (*Denticyclops*) *leptacanthus*: Alekseev, 2019.

TYPE LOCALITY: Orinoco River, Barrancos, Venezuela, South America.

HOLOTYPE PRESENCE AND STORING: female holotype deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype #05409, author's description and drawings, redescription of Mercado-Salas & Suárez-Morales [2014].

DESCRIPTION. FEMALE (Fig. 67). Body length without caudal setae 760 μm. Th4 with long lateral setulae. Anal somite longer than previous

one, anal operculum convex and smooth. Caudal rami divergent, about 4 times longer than broad; lateral *serra* extending almost entire ramus length of very small proximal denticles and very long distal spinules (Fig. 67A). Outermost seta spiniform, thin and long, inserted higher than other terminal setae, its outer edge with tiny denticles, inner edge with hairs; about 0.7 times as long as ramus length. Lateral seta shorter than ramus width, placed close to outermost seta. Dorsal seta 0.7 times as long as outermost seta. Length proportions of terminal setae in holotype, beginning with outermost:1.0/3.3/5.9/1.3.

Antennule 12-segmented, 3 distal segments with small denticles (Fig. 67B, C). A2 Bas ornamentation observed in holotype from frontal surface only and provided in Fig. 67E.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Medial expansion of P1–P4 Bas with hairs. In P1 Bas, inner spine long, reaching 1/3 of Enp3 (Fig. 67F). P4 Enp3 L/W ratio 2.1; inner spine slightly bent distally, about 1.5 times longer than outer one and 1.2 times longer than segment; distal setae reaching about 2/3 of nearest spines (Fig. 67G). In P4 Exp3, distal spine about 0.7 times as long as segment (Fig. 67H). P4 IntCox ornamentation not observable; coxal spine with gap at outer side (Fig. 67I). Reduced P5 (Fig. 67D) with elongated segment armed with rather short and slender inner spine about 1.5 times as long as segment, and two longer setae; length ratio beginning with spine:1.0/ 2.4/1.3.

MALE unknown.

DISTRIBUTION: Venezuela, ?Brazil, ?Mexico.

COMMENTS: Specimens from Mexico [Mercado-Salas *et al*., 2016] and Costa Rica [Collado *et al*., 1984] differ from Kiefer's holotype in many taxonomically important details (*serra* appearance, missing denticles at three distal segments of A1, lateral caudal seta position, etc.) and apparently belong to another possibly new or sibling species. From this form as well as from other congeners *E*. (*D*.) *leptacanthus* can be separated by the combination of characters that includes: denticulate hyaline membrane in 10–12 segments in A1, caudal *serra* with tiny denticles proximally and very long spinules distally, caudal seta proportions and armament, P5 with very slender inner spine.

64. ***Eucyclops*** (***Denticyclops***) ***longispinosus*** Pesce et Galassi, 1987
Fig. 68.

SYNONYMY: *Eucyclops longispinosus*: Pesce, Galassi, 1987; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *longispinosus*: Alekseev, 2019.

TYPE LOCALITY: freshwater well in Trecastagni, Catania, Sicilia, Italy.

HOLOTYPE PRESENCE AND STORING: holotype female dissected, slide #Si/89.1, place not indicated by authors.

MATERIAL STUDIED: authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 68). Body length without caudal setae 750–820 μm. Slightly brown-orange colored. Anal operculum convex, smooth. Caudal rami sub-parallel, 6.2 times as long as broad (Fig. 68A); lateral margins with reduced *serra*, of strong rare denticles, bending to ventral surface proximally. Innermost caudal seta plumose, rather short, 0.5–0.6 times as long as ramus, 1.3–1.5 times as long as outermost seta. Outermost seta spiniform, rather short, inserted without noticeable distance from other terminal setae, its outer edge with short setulae, inner edge with longer setulae; about 0.4 times as long as ramus length. Dorsal seta slightly longer than outermost seta. Lateral seta slightly longer than ramus width.

Antennule 12-segmented, reaching distal margin of CTh; distal segments with small denticles (Fig. 68B). A2 and mouth appendages not examined.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 L/W ratio about 2.6; inner/outer spine ratio about 1.4; inner spine slightly longer than segment; outer seta almost reaching tip of nearest spine (Fig. 68C). P4 IntCox with setulae at distal margin. Reduced P5 (Fig. 68D) with slightly elongated segment armed with weak but long inner spine, 2.5 times longer than segment; outer seta subequal to inner spine; medial seta about 1.5 times longer than inner spine.

MALE: Body length without caudal setae 755–760 μm, caudal rami shorter than in female and without lateral *serra*. P6 not described.

DISTRIBUTION: known from the type locality only: well in Trecastagni, Catania, Sicilia, Italy.

COMMENTS: Insufficiently described taxon from underground habitat but can be easy separated from congeners by short A1 and elongated but weak inner spine in P5.

65. ***Eucyclops*** (***Denticyclops***) ***microdenticulatus*** Lindberg, 1939
Fig. 69.

SYNONYMY: *Eucyclops microdenticulatus*: Lindberg, 1939, 1940; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *microdenticulatus*: Alekseev, 2019.

TYPE LOCALITY: small pond near stream in Kodaikanal (Palani Hills), Southern India, coll. in January.

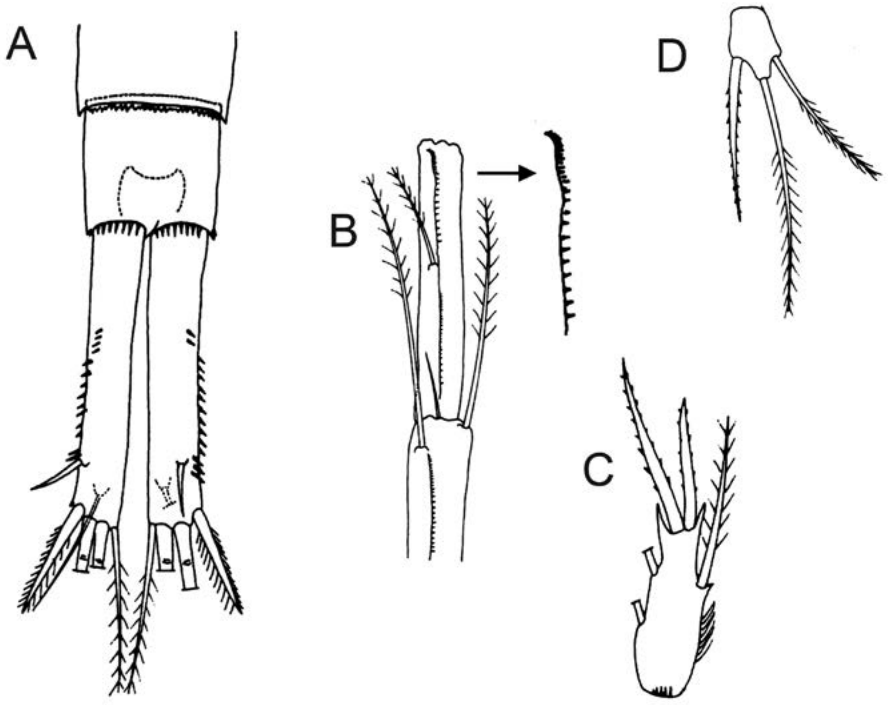

Fig. 68. *Eucyclops* (*Denticyclops*) *longispinosus* Pesce et Galassi, 1987. Female: A — caudal rami, ventral; B — A1, two distal segments; C — P4 Enp3; D — P5. Italy, after Pesce & Galassi [1987].

Рис. 68. *Eucyclops* (*Denticyclops*) *longispinosus* Pesce et Galassi, 1987. Самка: A — каудальные ветви, вентрально; B — A1, два дистальных членика; C — P4 Enp3; D — P5. Италия, по Pesce & Galassi [1987].

HOLOTYPE PRESENCE AND STORING: not found/existing.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 69A-D). Body length without caudal setae 830–1080 μm, Th4 with short lateral setulae. Genital double-somite as long as broad, sometimes covered with rows of tiny denticles ventrally, *receptaculum seminis* typical for genus (Fig. 69A). Anal operculum weakly convex. Caudal rami with L/W ratio 4.0–5.7, divergent; lateral margins with long *serra* of small denticles (up to 36), proximally bending to ventral surface (Fig. 69B). Innermost caudal seta with dense hairs, 0.9–1.1 times as long as ramus, 1.2–1.7 times as long as outermost seta. Outermost seta spiniform, long, its outer edge with small denticles, inner edge with dense hairs; 0.5–0.6 times as long as ramus length. Dorsal seta shorter than outermost seta.

Antennule 12-segmented, reaching distal edge of Th1; three distal segments with wide hyaline membrane with finely denticulate edge (Fig. 69C). A2 and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox with rather long setulae at distal margin (Fig. 69D). In P4Enp3, L/W ratio 2.2–2.7; inner/outer spine ratio 1.3–1.5; inner spine slightly longer than segment or subequal; distal spines slightly lanceolate; distal setae reaching middle of nearest spines (see Fig. 69D). Reduced P5 armed with strong inner spine and two longer setae (see Fig. 69A).

MALE (Fig. 69E). Body length without caudal setae 740–790 μm. Caudal rami parallel, shorter than in female, with L/W ratio 3.3–3.8, lateral *serra* missing. P4 distal spines more strongly lanceolate than in female. P5 with shorter inner spine. Rudimentary P6 armed with strong but short inner spine, not reaching posterior margin of next somite; spine about as long as outer seta and slightly longer than medial seta.

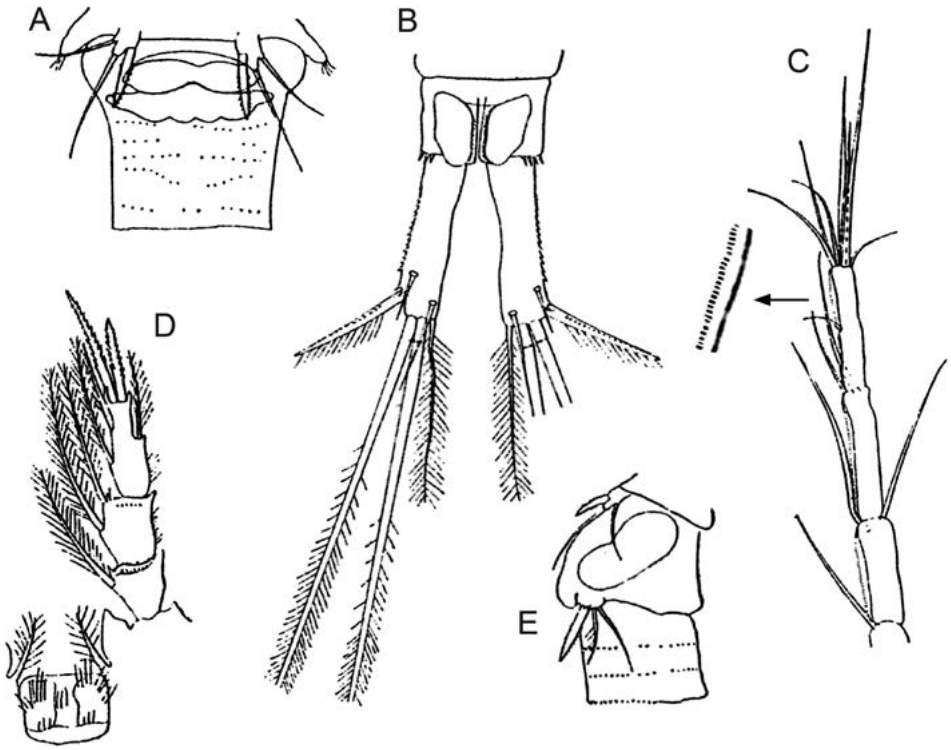

Fig. 69. *Eucyclops* (*Denticyclops*) *microdenticulatus* Lindberg, 1939. A — Th4, genital double somite and P5; B — caudal rami, dorsal; C — A1, three distal segments; D — P4 intercoxal plate and Enp, caudal; E — P5 and P6. A–D — female; E — male. India, after Lindberg [1940].

Рис. 69. *Eucyclops* (*Denticyclops*) *microdenticulatus* Lindberg, 1939. A — Th4, генитальный сомит и P5; B — каудальные ветви, дорсально; C — A1, три дистальных членика; D — межкоксальная пластинка P4 и Enp, каудально; E — P5 и P6. A–D — самка; E — самец. Индия, по Lindberg [1940].

DISTRIBUTION: common in lakes and ponds of Southern and West-Central India (near Kodaikanal, Ooty, Nadiad).

COMMENTS: *E.* (*D.*) *microdenticulatus* and *E.* (*D.*) *euacanthus* s.lat. are closely related forms. In both species P6 in males armed with spine and setae of similar proportions. Females of some populations of *E.* (*D.*) *euacanthus* from Sumatra have a reduced caudal *serra* and innermost/outermost caudal seta ratio less than 2 [Kiefer, 1933]. Nevertheless, *E.* (*D.*) *microdenticulatus* differs from *E.* (*D.*) *euacanthus* by a much wider A1 membrane, shorter innermost caudal seta, minute size of teeth on caudal *serra*, and by length of hairs on free edge of connective coxal plate in P4. The most important difference between these possibly close related taxa is in P5 armament: in *E.* (*D.*) *microdenticulatus* inner spine stronger and longer.

66. ***Eucyclops*** (***Denticyclops***) ***neomacruroides*** Dussart et Fernando, 1990
Fig. 70.

SYNONYMY: *Eucyclops neomacruroides*: Dussart, Fernando, 1990; Dussart, Defaye, 2006; *Eucyclops* (*Denticyclops*) *neomacruroides*: Alekseev, 2019.

TYPE LOCALITY: West Blue Lake, Manitoba, Canada.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: topotype from lakes and streams in Quebeck Prov., Canada, authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 70A–F). Body length without caudal setae about 1400 µm. Th4 with lateral setulae. Genital double somite about as long as broad; *receptaculum seminis* typical for genus. Anal somite shorter than previ-

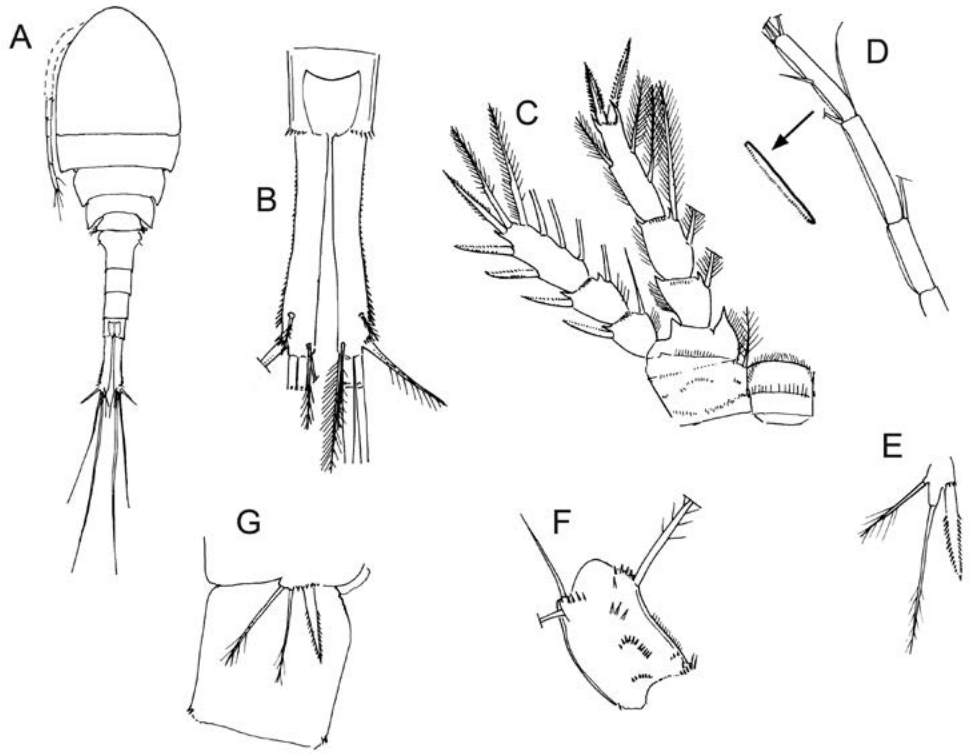

Fig. 70. *Eucyclops* (*Denticyclops*) *neomacruroides* Dussart et Fernando, 1990. A — habitus; B — caudal rami, dorsal; C — P4, caudal; D — A1, three distal segments; E — P5; F — A2 Bas, frontal; G — P6. A–F — female; G — male. Canada, after Dussart & Fernando [1990].

Рис. 70. *Eucyclops* (*Denticyclops*) *neomacruroides* Dussart et Fernando, 1990. A — габитус; B — каудальные ветви, дорсально; C — P4, каудально; D — A1, три дистальных членика; E — P5; F — A2 Bas, фронтально; G — P6. A–F — самка; G — самец. Канада, по Dussart & Fernando [1990].

ous one. Caudal rami divergent, 6–8 times longer than broad, with lateral *serra* of small teeth (about 36), increasing distally, extending almost to ramus base (Fig. 70B). Innermost caudal seta about 1.2 times as long as outermost seta. Outermost seta spiniform with denticulate outer edge and hairs on inner edge. Dorsal seta shorter than outermost seta.

Antennule 12-segmented, rather long, reaching middle of Th2; 2 distal segments with rather wide almost smooth hyaline membrane, but proximal half of 12th segment finely denticulate (Fig. 70D). In A2, Bas ornamentation on caudal side not described; on frontal surface as in Fig. 70F.

Swimming legs P1–P4 distal exopodite spine formula: 3/4/4/3/. P4 Enp3 very long, with L/W ratio about 3.6; inner spine about 1.3 times as long as outer one and shorter than segment; distal setae reaching 1/4–2/3 of nearest spines (Fig. 70C). P4 IntCox with rather long setulae at distal free edge. Reduced P5 (Fig. 70E) with elongated segment armed with strong inner spine, subequal to outer seta and 0.7 times as long as medial seta.

MALE (Fig. 70G). Smaller than female, with body length about 940 μm. Caudal rami parallel, shorter than in female, without lateral *serra*. Rudimentary P6 (see Fig. 70G) armed with strong but short inner spine, not reaching posterior border of next somite; two subequal setae slightly longer than spine.

DISTRIBUTION: ponds, swamps and bogs in Quebec, Manitoba and Ontario, Canada, USA (?), Mexico (?), North America.

COMMENTS: Janet Reid after comparing of this species individuals collected in Ontario with *E.* (*E.*) *elegans* from USA does not find difference between them. My own sampling in Quebec prov-

ince of both species living together revealed that these two taxa are different. Separating characters are as follows: denticles size of caudal *serra* larger in *E.* (*E.*) *elegans*; reduced P5 spine/segment ratio (2 in *E.* (*D.*) *neomacruroides* versus 3 in *E.* (*E.*) *elegans);* length of anal somite in comparision with previous one (longer in *E.* (*D.*) *neomacruroides*), finally *E.* (*E.*) *elegans* belongs to another subgenus having smooth hyaline membrane in A1.

67. ***Eucyclops*** (***Denticyclops***) ***pseudoensifer*** Dussart, 1984
Fig. 71.

SYNONYMY: *Eucyclops pseudoensifer*: Dussart, 1984b; Dussart, Defaye, 2006; Suárez-Morales, Walsh, 2009; Mercado-Salas, Suárez-Morales, 2021; *Eucyclops* (*Denticyclops*) *pseudoensifer*: Alekseev, 2019.

TYPE LOCALITY: high mountain laguna Mucubaji, Venezuela.

HOLOTYPE PRESENCE AND STORING: NHM Paris, not obtained.

MATERIAL STUDIED: author's description and drawings; Suárez-Morales, Walsh [2009]; Mercado-Salas, Suarez-Morales [2021]

DESCRIPTION: FEMALE (Fig. 71A–E, G–K). Body length without caudal setae about 770 µm. Th4 with lateral setulae. Genital double somite as long as broad. Caudal rami with L/W ratio about 4; lateral margin with long *serra* of rather sparse strong spinules increasing distally (Fig. 71B, C). Dorsal seta about 0.5 times as long as outermost seta. Outermost seta spiniform, its outer edge with fine spinules, inner edge with hairs. Innermost seta slightly longer than outermost one.

Antennule 12-segmented, short, hardly reaching posterior margin of CTh, with finely denticulate hyaline membrane on last three segments (Fig. 71G). A2 Bas ornamentation on caudal surface without distal groups N1, N2, other groups as in Fig. 71K; frontal surface as in Fig. 71J.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox distal margin with long setulae; coxal spine with long setulae proximally, inner side with shorter spinules distally, outer side with long gap (Fig. 71H, I). P4 Enp3 about 2.2 times longer than broad; inner/outer spine ratio 1.3; inner spine 1.1 times longer than segment; distal setae long, almost reaching tips of nearest spines. Reduced P5 (Fig. 71D, E) with strong inner spine and two setae; approximate length ratio beginning with spine: 1.0/ 1.5 /0.5–0.8.

MALE (Fig. 71F). Smaller than female with shorter caudal rami; lateral *serra* absent; innermost caudal seta relatively longer than in female. A1 14-segmented. P1–P5 as in female. Rudimentary P6 (see Fig. 71F): with strong and long inner spine (55 µm in paratype) and two subequal setae.

DISTRIBUTION: Venezuela, ?Mexico.

COMMENTS: Closely related to *Eucyclops* (*D.*) *pseudoensifer* form was discovered in North America by Suarez-Morales & Walsh [2009], but with some differences in A1 construction. *E.* (*D.*) *pseudoensifer* distinguished from other congeners by following set of characters: small body size, short A1 not reaching distal edge of CTh, distal segments in A1 with finely denticulate hyaline membrane, short caudal rami with long lateral *serra*.

68. ***Eucyclops*** (***Denticyclops***) ***taiwanensis*** Sukhikh et Alekseev, 2015
Fig. 72.

SYNONYMY: *Eucyclops taiwanensis*: Sukhikh, Alekseev, 2015; *Eucyclops* (*Denticyclops*) *taiwanensis*: Alekseev, 2019.

TYPE LOCALITY: Abvil Lake, Taiwan (25.0333°N, 121.6333°W).

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male and females deposited in Federal collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: holotype #55090, paratypes #55091, authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 72A–F). Body length without caudal setae about 1000 µm. Th4 with lateral setulae. Genital double somite as long as broad, *receptaculum seminis* typical for genus (Fig. 72B). Caudal rami slightly divergent, about 4.2 times as long as broad; with lateral *serra*, extending almost to ramus base (Fig. 72C). Innermost caudal seta plumose, about 1.5 times longer than outermost seta, about 0.8 times as long as caudal ramus length. Outermost seta spiniform, its outer edge with small spinules, inner edge with hairs; 0.5 times as long as caudal ramus length. Dorsal seta longer than outermost seta. Lateral seta longer than ramus width.

Antennule 12-segmented, rather long, reaching posterior margin of Th2 (Fig. 72A); with denticulate hyaline membrane on 10th and 11th segments and smooth hyaline membrane on 12th segment (Fig. 72E). A2 Bas ornamentation on caudal surface with N1 and N2 groups of few setulae, other groups as in Fig. 72D.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox with long hairs; coxal spine homogeneously plumose (Fig. 72F). In

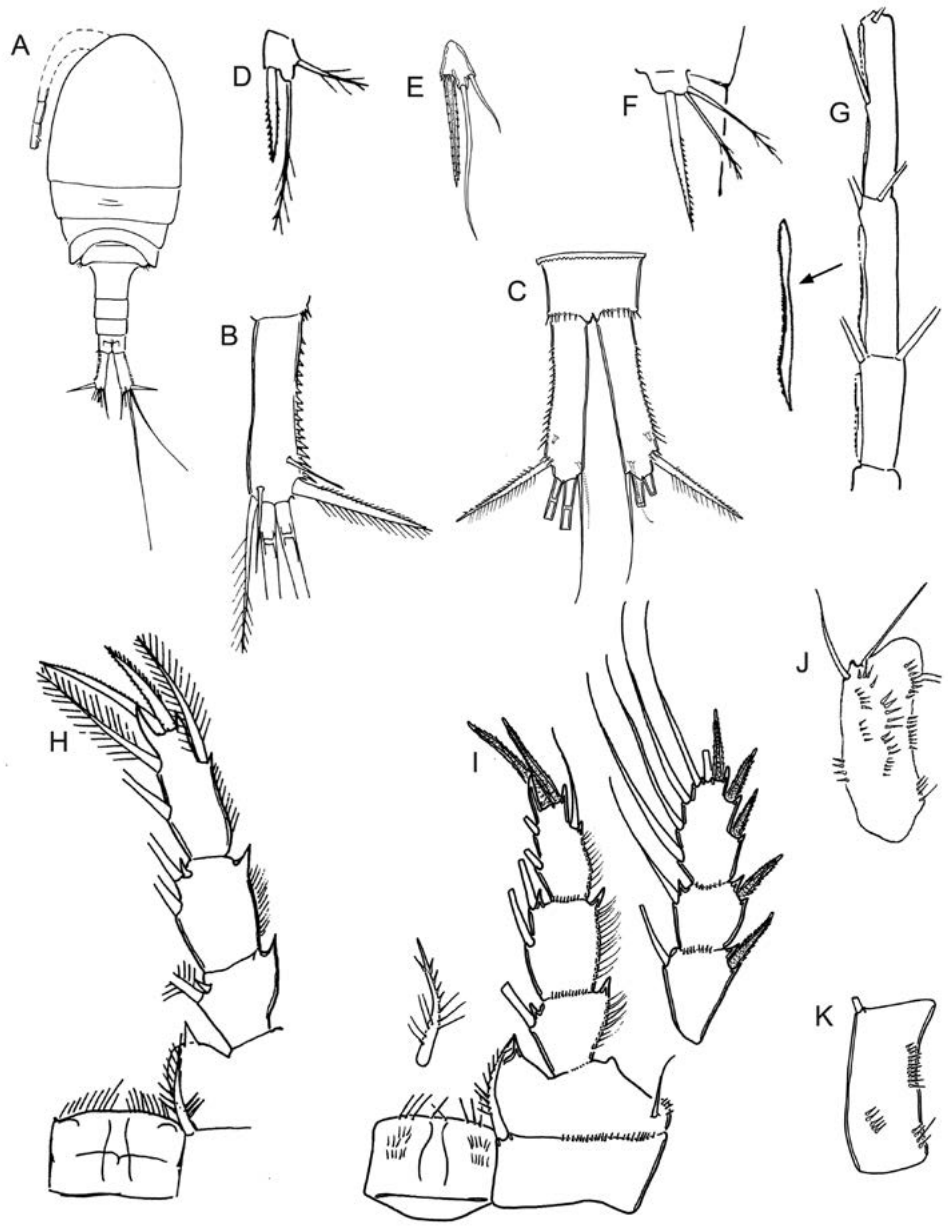

Fig. 71. *Eucyclops* (*Denticyclops*) *pseudoensifer* Dussart, 1984. A — habitus; B, C — caudal rami; D, E — P5; F — P6; G — A1, three distal segments; H, I — P4; J — A2 Bas, frontal; K — A2 Bas, caudal. A–E, G–K — female; F — male. Venezuela. A, B, D, F–H — after Dussart [1984b]; C, I–K — after Mercado-Salas & Suárez-Morales [2021]; E — after Suárez-Morales & Walsh [2009].

Рис. 71. *Eucyclops* (*Denticyclops*) *pseudoensifer* Dussart, 1984. A — габитус; B, C — каудальные ветви; D, E — P5; F — P6; G — A1, три дистальных членика; H, I — P4; J — A2 Bas, фронтально; K — A2 Bas, каудально. A–E, G–K — самка; F — самец. Венесуэла. A, B, D, F–H — по Dussart [1984b]; C, I–K — по Mercado-Salas & Suárez-Morales [2021]; E — по Suárez-Morales & Walsh [2009].

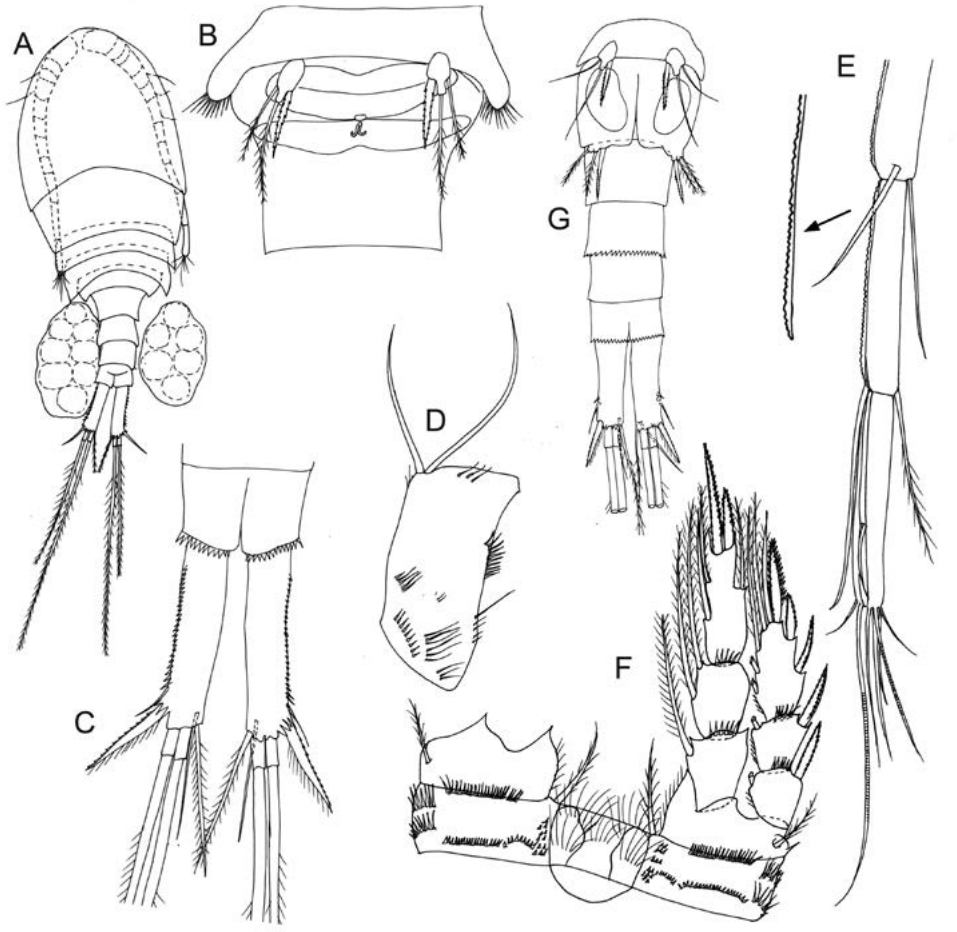

Fig. 72. *Eucyclops* (*Denticyclops*) *taiwanensis* Sukhikh et Alekseev, 2015. A — habitus; B — Th4, genital double somite and P5; C — caudal rami, ventral; D — A2 Bas, caudal; E — A1, three distal segments; F — P4, caudal; G — abdomen. A–F — female; G — male. Taiwan, orig.

Рис. 72. *Eucyclops* (*Denticyclops*) *taiwanensis* Sukhikh et Alekseev, 2015. A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви, вентрально; D — A2 Bas, каудально; E — A1, три дистальных членика; F — P4, каудально; G — абдомен. A–F — самка; G — самец. Тайвань, ориг.

P4Enp3 L/W ratio about 2.7; inner/outer spine ratio about 1.7; inner spine about as long as segment. P5 (Fig. 72B) armed with strong inner spine and two setae; outer seta slightly longer than spine; medial seta about 1.5 times longer than inner spine.

MALE (Fig. 72G). Body length without caudal setae about 720 μm. Caudal rami L/W ratio about 3, without lateral *serra*. Slender innermost caudal seta about 2.3 times as long as spine-like outermost caudal seta. Antennule 14-segmented. P1–P5 basically as in female. Rudimentary P6 with strong but rather short inner spine and two slightly shorter subequal setae.

DISTRIBUTION: Taiwan (endemic?).

COMMENTS: Presence of setulae on A2 Bas in position N1–2 in *E.* (*D.*) *taiwanensis* reflects its close relationship with species of subgenus *E.* (*Eucyclops*). All females studied had A1 with wide hyaline membrane on 3 distal segments. On 12th segment, the membrane always smooth and on 11th–10th segments clearly denticulate.

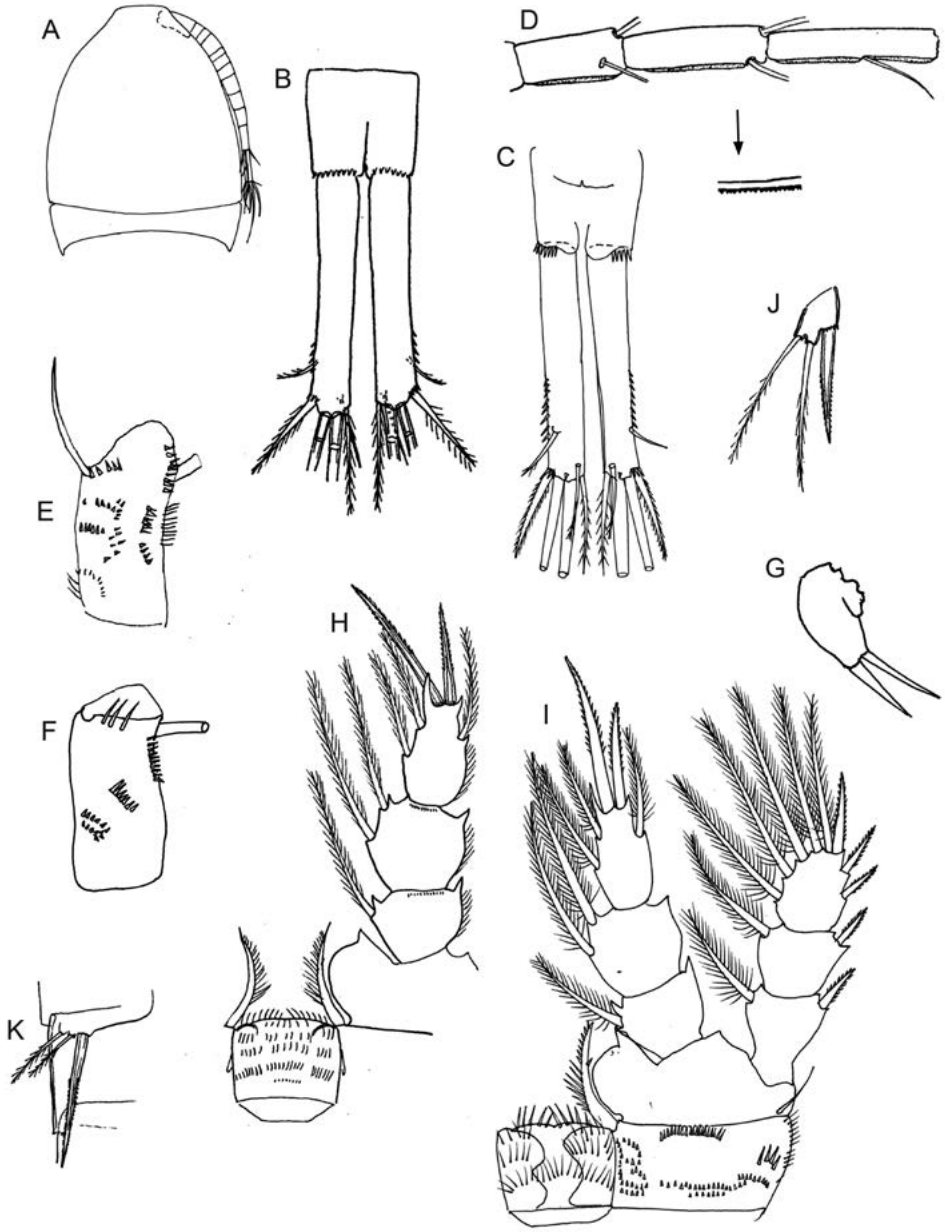

Fig. 73. *Eucyclops* (*Denticyclops*) *titicacae* Kiefer, 1957. A — A1 and cephalothorax; B, C — caudal rami; D — A1, distal segments; E — A2 Bas, frontal; F — A2 Bas, caudal; G — maxillulary palp; H, I — P4, caudal; J — P5; K — P6. A–J — female; K — male. Lake Titicaca, South America. A, C, E, F, G, I — orig., slides #05752, 05753, 06242 KRC; B, D, H, J, K — after Kiefer [1957a].

Рис. 73. *Eucyclops* (*Denticyclops*) *titicacae* Kiefer, 1957. A — A1 и цефалоторакс; B, C — каудальные ветви; D — A1, дистальные членики; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — пальп максиллулы; H, I — P4, каудально; J — P5; K — P6. A–J — самка; K — самец. Озеро Титикака, Южная Америка. A, C, E, F, G, I — ориг., преп. #05752, 05753, 06242 KRC; B, D, H, J, K — по Kiefer [1957a].

69. ***Eucyclops*** (***Denticyclops***/***Eucyclops***) ***titicacae*** Kiefer, 1957
Fig. 73.

SYNONYMY: *Eucyclops neumani titicacae*: Kiefer, 1957a; Dussart, Defaye, 2006; *Eucyclops titicacae*: Fuentes, Suarez-Morales, 2014; *Eucyclops* (*Denticyclops*) *titicacae*: Alekseev, 2019; *E. alticola*: Kiefer, 1957b.

TYPE LOCALITY: Lake Titicaca, Peru.

HOLOTYPE PRESENCE AND STORING: Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype female #05752 and paratypes #05753, 05754; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 73A–J). Body length without caudal setae 1270 µm in holotype and 980–1300 µm in other specimens. Th4 with lateral setulae. Anal somite longer than previous one; anal operculum weakly developed, with central incision (in some specimens). Caudal rami sub-parallel (Fig. 73B, C) with L/W ratio 5.6–6.8; lateral margins with short (about 25% of ramus length) *serra* of 4–12 small spinules. Dorsal caudal seta shorter than outermost seta; lateral seta longer than ramus width. Outermost seta spiniform, often with equal setulae on both sides. Innermost caudal seta slightly longer than outermost seta and about 0.4 times as long as ramus length.

Antennule 12-segmented, short, hardly reaching posterior edge of CTh (Fig. 73A); three distal segments with finely denticulate hyaline membrane (Fig. 73D). A2 Bas ornamentation on caudal side with few setulae at N1, other groups as in Fig. 73F; frontal surface as in Fig. 73E. Maxillulary palp naked (Fig. 73G).

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Distal spines/ setae not modified. P4 Enp3 rather short, about 1.7 times as long as broad; inner spine about 1.5 times as long as outer spine and about 1.5 times as long as segment; distal setae not reaching tips of nearest spine (Fig. 73H, I). P4 Coxa caudal ornamentation as in Fig. 73I; strong, curved coxal spine/seta with setulae on inner side and practically naked on outer side. P4 IntCox with spinules at distal edge. Reduced P5 with short segment armed with strong and rather long inner spine and two longer subequal setae; outer seta inserted about at the same level as medial seta (Fig. 73J).

MALE (Fig. 73K). Body smaller than in female, length without caudal setae about 850 µm. Caudal rami without lateral *serra*, terminal setae proportions similar to female. P4 Enp3 longer than in female, with L/W ratio about 2.1. Reduced P5 similar to female. Rudimentary P6 with strong long inner spine (about 85 µm in paratype specimens) and two much shorter setae.

DISTRIBUTION: Lake Titicaca, Peru; ?Venezuela; ?Colombia.

COMMENTS: This form was described as subspecies of *E. neumani,* which also has reduced caudal *serra*, but A1 with not denticulate membrane and male P6 with stronger and longer inner spine. Among paratypes in Kiefer's collection, there are individuals attributed to *E. neumani titicacae*, but with smooth hyaline membrane in A1. Both groups have A2 Bas with setulae N1 and P4 coxal spine with large gap. This combination of characters places this species in intermediate position between subgenera *Eucyclops* and *Denticyclops.* It is possible meanwhile that in ancient Lake Titicaca two sibling species coexist together. Until this issue is resolved, in this guide *E.* (*D.*) *titicacae* is included in the identification keys for both subgenera. *E. alticola* Kiefer, 1957, described in same year from Lake Titicaca, corresponds to *E.* (*D.*) *titicacae* in all taxonomically significant characters with minor variations, as Kiefer [1957a] himself pointed out, and is recognized here as its younger synonym.

5. SUBGENUS ***Eucyclops*** (***Macrurocyclops***) Alekseev, 2019

Caudal rami naked or with almost reduced lateral *serra*. Reduced P5 with short inner spine, not more than 1.5 times as long as segment length or even shorter (*E.* (*M.*) *dubius*) and always shorter than outer seta. Antennules 12-segmented, relatively short, in most species just reaching to the first free thoracic somite or shorter, with narrow or even missing hyaline membrane usually smooth or finely serrated. The subgenus includes 9 species with distribution in warm climatic zones or abundant in summer time. Some of them are possible endemics of Tanganyika Lake of Africa, 3 taxa inhabit Ponto-Caspian region and possibly related with Paratethys Sea faunistic complex. Range of the type for subgenus species *E.* (*M.*) *macrurus* (Sars G.O., 1863) described from Scandinavia covers Holarctic [Dussart, Defaye, 2006]. Its finding in Northern America meanwhile could be a resent human mediated invasion, which should be verified with molecular analysis.

Key to species of *Eucyclops* (*Macrurocyclops*)

1. Innermost caudal seta shorter than outermost seta ..... *E.* (*M.*) *dubius* (Sars G.O., 1909) [Tanganyika]

– Innermost caudal seta as long as outermost seta or longer 2
2. P5 inner spine very weak and short, not more than half of segment length 3
– P5 inner spine at least as long as segment length or longer 6
3. CR L/W about 3.3 .... *E.* (*M.*) *neocaledoniensis* Dussart, 1984 [New Caledonia (Endemic?)]
– CR L/W about 5–9 4
4. CR L/W about 5–6; innermost caudal seta about twice longer than outermost caudal seta .... *E.* (*M.*) *madagascariensis* (Kiefer, 1926) [Madagascar, Central Africa]
– CR L/W about 6–9; innermost caudal seta 1.0–1.2 times as long as outermost caudal seta 5
5. Dorsal caudal seta slightly longer than outermost seta; CR L/W ratio 6–7; P3–P4 spines modified, blunt, with spatulated hyaline membrane; P4 Enp3 inner spine 2 times as long as outer spine ....*E.* (*M.*) *laevimargo* (Sars G.O., 1909) [Tanganyika]
– Dorsal caudal seta slightly shorter than outermost seta; CR L/W ratio 7–9; P4 Enp3 inner spine 2.6 times as long as outer spine..... ..... *E.* (*M.*) *angustus* (Sars G.O., 1909) [Tanganyika]
6. Innermost caudal seta about as long as CR length 7
– Innermost caudal seta about 0.5 times as long as CR length..... 8
7. P5 medial seta about as long as outer seta ....*E.* (*M.*) *miurai* Ito, 1952 [Japan]
– P5 medial seta about 1.5 times longer than outer seta ..... *E.* (*M.*) *persistens* s.lat. with 2 subspecies *E.* (*M.*) *persistens persistens* Monchenko, 1978 [Caucasus rivers, tributaries of Black Sea] and *E.* (*M.*) *p. tauricus* Monchenko et Sopova, 1984 [wells in Crimea]
8. CR L/W ratio about 8–10; dorsal caudal seta shorter than outermost caudal seta..... ..... *E.* (*M.*) *macrurus* (Sars G.O., 1863) [Palaearctic, Holarctic?]
– CR L/W ratio about 6.5–7.5; dorsal caudal seta longer than outermost caudal seta ....*E.* (*M.*) *orthostylis* Lindberg, 1952 [Volga River Delta]

70. ***Eucyclops*** (***Macrurocyclops***) ***macrurus*** (Sars G.O., 1863) Fig. 74.

SYNONYMY: *Cyclops macrurus*: Sars G.O., 1863; *Leptocyclops macrurus*: Sars G.O., 1914; *Eucyclops macrurus*: Gurney, 1933; Rylov, 1948; Damian-Georgescu, 1963; Monchenko, 1974; Kiefer, 1978; Dussart, Defaye, 2006; *Eucyclops* (*Macrurocyclops*) *macrurus*: Alekseev, 2019; *Eucyclops serrulatus baicalocorrepus*: Mazepova, 1955 (part.); *Eucyclops macruroides baicalensis*: Mazepova, 1978.

TYPE LOCALITY: pond in Botanical garden, University of Bergen, Norway.

HOLOTYPE PRESENCE AND STORING: Museum of Bergen University, Norway, not found.

MATERIAL STUDIED: topotype specimens from Botanical Garden in Bergen University, specimens identified by Sars and Kiefer, slides in Kiefer's Reference collection (SMNK, Germany), specimens from across Palaearctic (more than 30 populations from USSR, Mongolia, China, Finland, France, Germany, Sweden, Spain, Italy, Slovenia, Northern Macedonia, Tunis, Egypt, Turkey).

DESCRIPTION. FEMALE (Fig. 74A–H). Body length without caudal setae 1100–1300 μm. Th4 and sometimes Th3 with lateral setulae (Fig. 74A). Genital double-somite 1.1 times as long as broad, *receptaculum seminis* typical for genus (Fig. 74C). Caudal rami long, 8–10 times as long as broad, parallel or slightly divergent, without lateral *serra* but with oblique row of 4–6 small spinules near lateral seta insertion place (Fig. 74B). Lateral seta about as long or longer than ramus width, inserted noticeably higher than dorsal seta. Dorsal seta shorter than outermost seta. Outermost seta spiniform, but naked; rather short, about 0.3 times as long as ramus length. Innermost seta about 0.5 times as long as ramus length, 1.5–2.0 times as long as outermost seta, with rare hairs, sometimes smooth.

Antennule 12-segmented, short, not reaching posterior margin of CTh; 3 distal segments with tiny thin denticles (Fig. 74D). A2 Bas on caudal side with few long hairs in position N1, other ornamentation as in Fig. 74G; frontal side as in Fig. 74H.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio 2.4–3.0; inner spine 1.1–1.3 times longer than outer one (Fig. 74E, F). P4 Exp3 distal spine longer than segment; distal seta not reaching beyond distal spine. P4 IntCox caudal surface with three rows of rather short setulae; coxal spine/seta homogeneously covered with long fine hairs. Reduced P5 armed with relatively short and slender inner spine and two longer setae (see Fig. 74C).

MALE (Fig. 74I). Body length without caudal setae 800–900 μm. Caudal rami shorter than in female, 6.2–7.5 times as long as broad. Caudal setae length ratio similar to female. Ornamentation of antennal basipodite similar to female but with

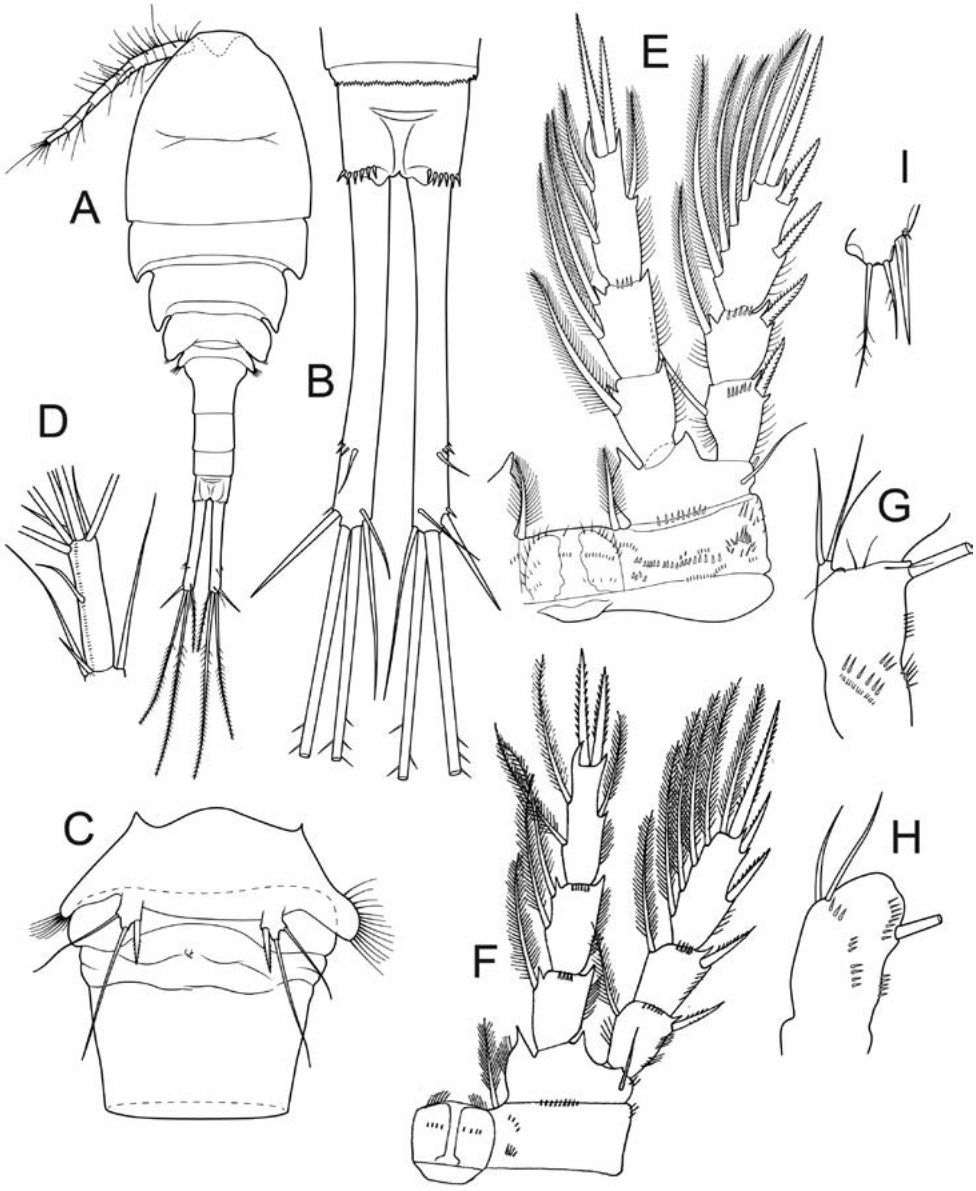

Fig. 74. *Eucyclops* (*Macrurocylops*) *macrurus* (Sars G.O., 1863). A — habitus; B — caudal rami, dorsal; C — Th4, genital double somite and P5; D — A1, distal segment; E, F — P4, caudal; G — A2 Bas, caudal; H — A2 Bas, frontal; I — P6. A–H — female; I — male. A–E, G, H — Germany, orig.; F, I — England, after Gurney [1933].

Рис. 74. *Eucyclops* (*Macrurocylops*) *macrurus* (Sars G.O., 1863). A — габитус; B — каудальные ветви, дорсально; C — Th4, генитальный сомит и P5; D — A1, дистальный членик; E, F — P4, каудально; G — A2 Bas, каудально; H — A2 Bas, фронтально; I — P6. A–H — самка; I — самец. A–E, G, H — Германия, ориг.; F, I — Англия, по Gurney [1933].

less number of setulae in each group. P1–P4 as in female but in P4 Enp3 outer apical spine relatively shorter. Reduced P5 as in female. Rudimentary P6 (see Fig. 74I): armed with strong inner spine and 2 setae; middle seta slightly shorter than spine; outer seta slightly longer than spine.

DISTRIBUTION: Palearctic; Nearctic (as invader or close species?).

COMMENTS: This species is *very* common in the litoral zones of lakes and rivers in continental waterbodies of Palaearctic with maximal density usually in summer time. It often coexists with several other *Eucyclops* species (*E.* (*E.*) *serrulatus*, *E.* (*Sp.*) *speratus*, *E.* (*D.*) *macruroides*, *E.* (*D.*) *denticulatus*) and can easy be separated from them as well as from other congeners by a combination of characters: long body size, long and naked caudal rami, short A1, P5 with weak inner spine. Described from lake Baikal *Eucyclops serrulatus baicalocorrepus* Mazepova, 1972 fits in most details except slightly shorter caudal rami to *E.* (*M.*) *macrurus* and is its younger synonym or regional subspecies. More profound study on these two forms is required.

71. ***Eucyclops*** (***Macrurocyclops***) ***angustus*** (Sars G.O., 1909) Fig. 75.

SYNONYMY: *Cyclops angustus*: Sars G.O., 1909; *Eucyclops angustus*: Kiefer, 1956b; Dussart, Defaye, 2006; *Eucyclops* (*Macrurocyclops*) *angustus*: Alekseev, 2019.

TYPE LOCALITY: Kala, eastern shore of Lake Tanganyika, Africa.

HOLOTYPE PRESENCE AND STORING: Natural History Museum, London, not found.

MATERIAL STUDIED: author's description and drawings; Kiefer's [1956] description and drawings.

DESCRIPTION. FEMALE (Fig. 75A–H). Body length without caudal setae about 820 μm. Th4 with short lateral setulae. Genital double somite about as long as broad; *receptaculum seminis* typical for genus. Last abdomenal somite longer than previous one; anal operculum weakly developed, smooth. Caudal rami (Fig. 75A–C) slightly divergent, long, widened in distal part, with L/W ratio 7–9; lateral *serra* absent except 3–4 small spinules inserted above lateral seta as short transversal row. Lateral seta shorter than ramus width, inserted only slightly higher than dorsal seta. Innermost caudal seta plumose, about as long as outermost seta or slightly shorter. Dorsal seta slightly shorter than outermost seta.

Antennule 12-segmented, short, hardly reaching posterior margin of CTh; 3 last segments short, with tiny denticles (Fig. 75D, E).

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 rather short, about 2 times as long as broad, with very short outer spine more than twice shorter than inner spine (Fig. 75F). Reduced P5 (Fig. 75G, H): segment as long as broad armed with very short inner spine, clearly shorter than segment, and two long subequal setae. Rudimentary P6 placed in lateral dorsal position and equipped with 2 short spines and long bent outer seta.

MALE (Fig. 75I). Body and caudal rami shorter than in female. Antennules 14-segmented. P1–P5 structure similar to female. Rudimentary P6 (see Fig. 75I). with strong, but short inner spine, and two longer setae; length ratio beginning with spine: 1.0/1.7/5.4.

DISTRIBUTION: Lakes Tanganyika and Nyasa, Rift Valley, Africa.

COMMENTS: Sars [1909] finds this form very close to *E.* (*M.*) *macrurus*, also described by him from Scandinavia, but with following differences: more thin antennules, caudal rami with shorter innermost seta, transversal row of short spinules above lateral seta, lateral seta located closer to dorsal seta. Along with long caudal rami, very short outer spine of P4 Enp3 and very short inner spine of P5 this combination clearly distinguishes *E.* (*M.*) *angustus* from congeners.

72. ***Eucyclops*** (***Macrurocyclops***) ***dubius*** (Sars G.O., 1909) Fig. 76.

SYNONYMY: *Cyclops dubius*: Sars G.O., 1909; *Eucyclops dubius*: Fryer, 1957; Dussart, Defaye, 2006; *Eucyclops* (*Macrurocyclops*) *dubius*: Alekseev, 2019.

TYPE LOCALITY: Anchorage Bay, Lake Tanganyika, Nyasa, Africa.

HOLOTYPE PRESENCE AND STORING: Natural History Museum, London, not found.

MATERIAL STUDIED: author's description and drawings; Fryer's [1957] description and drawings.

DESCRIPTION. FEMALE (Fig. 76A–H). Body length without caudal setae 620 μm. Th4 with unusually long and thin setulae laterally (Fig. 76B). Genital double somite weakly expanded laterally, more than 1.3 times as long as broad; *receptaculum seminis* with bulky anterior part (Fig. 76B). Caudal rami (Fig. 76C, D) with L/W ratio 5.0–6.0, divergent; both sides without any spinules. Lateral seta shorter than ramus width,

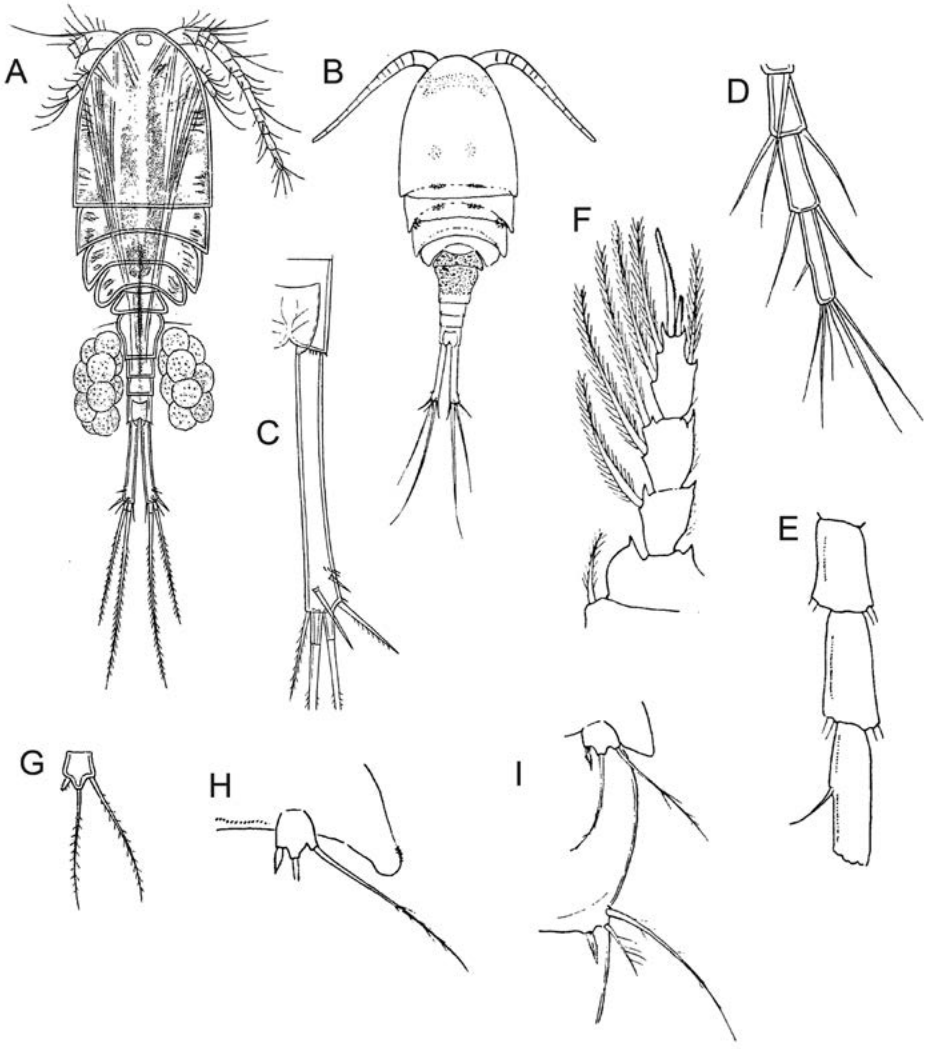

Fig. 75. *Eucyclops* (*Macrurocyclops*) *angustus* (Sars G.O., 1909). A, B — habitus; C — caudal ramus; D, E — A1, three distal segments; F — P4 Enp; G, H — P5; I — P5 and P6. A–H — female; I — male. Tanganyika, East Africa. A, C, D, G — after Sars G.O. [1909]; B, E, F, H, I — after Kiefer [1956b].

Рис. 75. *Eucyclops* (*Macrurocyclops*) *angustus* (Sars G.O., 1909). A, B — габитус; C — каудальная ветвь; D, E — A1, три дистальных членика; F — P4 Enp; G, H — P5; I — P5 и P6. A–H — самка; I — самец. Танганьика, Восточная Африка. A, C, D, G — по Sars G.O. [1909]; B, E, F, H, I — по Kiefer [1956b].

inserted only slightly higher than dorsal seta. Innermost caudal seta shorter than outermost seta. Dorsal seta about as long as outermost seta.

Antennule 12-segmented, short, not reaching distal edge of CTh; 3 last segments short, without visible hyaline membrane (Fig. 76E). A2 and mouth appendages not described. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 2.2 times as long as broad; inner spine about 2 times as long as outer spine (Fig. 76G). Reduced P5 armed with short naked appendages (Fig. 76B, H).

MALE (Fig. 76I). Smaller than female with shorter caudal rami. Swimming legs and P5 struc-

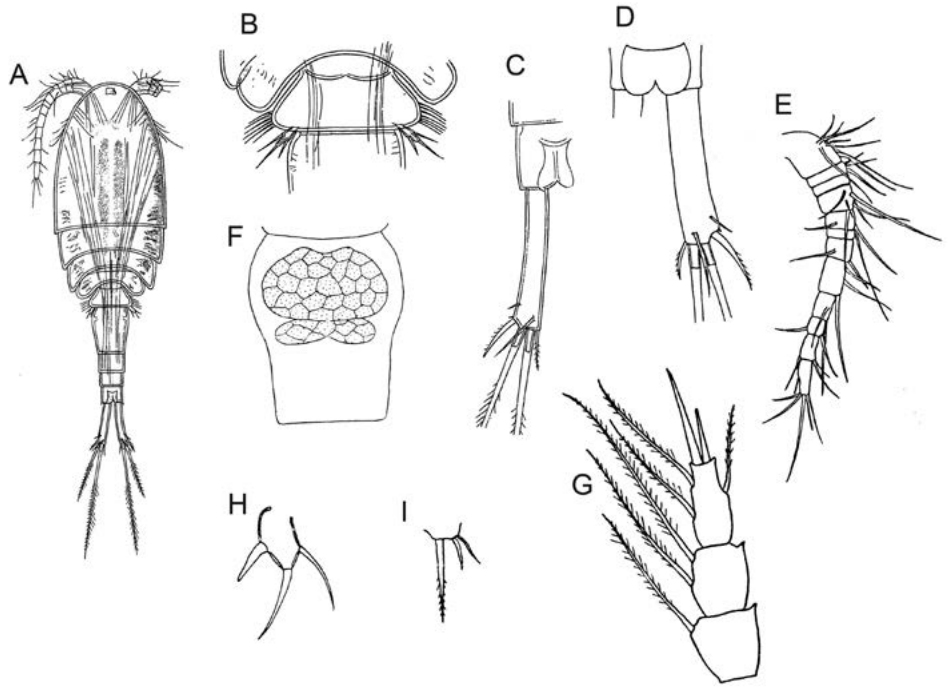

Fig. 76. *Eucyclops* (*Macrurocyclops*) *dubius* (Sars G.O., 1909). A — habitus; B — last thoracic somites and P5; C, D — caudal ramus, dorsal; E — A1; F — genital double somite; G — P4 Enp; H — P5; I — P6. A–H — female; I — male. East Africa. A–C — Lake Tanganyika, after Sars G.O. [1909]; D–I — Lake Nyasa, after Fryer [1957].

Рис. 76. *Eucyclops* (*Macrurocyclops*) *dubius* (Sars G.O., 1909). A — габитус; B — последние торакальные сомиты и P5; C, D — каудальная ветвь, дорсально; E — A1; F — генитальный сомит; G — P4 Enp; H — P5; I — P6. A–H — самка; I — самец. Восточная Африка. A–C — озеро Танганьика, по Sars G.O. [1909]; D–I — озеро Ньяса, по Fryer [1957].

ture as in female. P6 armed with strong long inner spine and two twice shorter setae.

DISTRIBUTION: Lake Tanganyika, Africa (endemic?).

COMMENTS: Sars [1909] finds this tiny species as a quite unusual form in the *serrulatus*-group. Apart from its small size, it can distinguished from congeners by its very short innermost caudal seta and unusual structure of P5.

73. ***Eucyclops*** (***Macrurocyclops***) ***laevimargo*** (Sars G.O., 1909) Fig. 77.

SYNONYMY: *Cyclops laevimargo*: Sars G.O., 1909; *Eucyclops laevimargo*: Dussart, Defaye, 2006; *Eucyclops laevimargo laevimargo*: Kiefer, 1952; *Eucyclops* (*Macrurocyclops*) *laevimargo*: Alekseev, 2019.

TYPE LOCALITY: Lake Tanganyika, near Karema, Central Africa.

HOLOTYPE PRESENCE AND STORING: Natural History Museum, London, not found.

MATERIAL STUDIED: specimens from Kiefer's Reference collection, SMNK, Germany (#05947, 05948, 05950, Burton Bay of Lake Tanganyika); author's description and drawings.

DESCRIPTION. FEMALE (Fig. 77A–I, K–M). Body length without caudal setae 850 μm. Th4 with dense long hairs laterally. Caudal rami slightly divergent or subparallel; L/W ratio 6–7; lateral *serra* absent, only 1–2 small setulae present above lateral seta base and outermost seta (Fig. 77B, C); lateral seta as long as ramus width. Dorsal seta about as thick as outermost seta, longer than outermost seta, but shorter than innermost seta. Innermost seta about 1.1–1.2 times as long as outermost seta; of medial terminal seta inner seta just about 25% longer than outer one. Approximate length ratio of terminal setae beginning with outermost: 1.0/5.5/7.0/1.1–1.2.

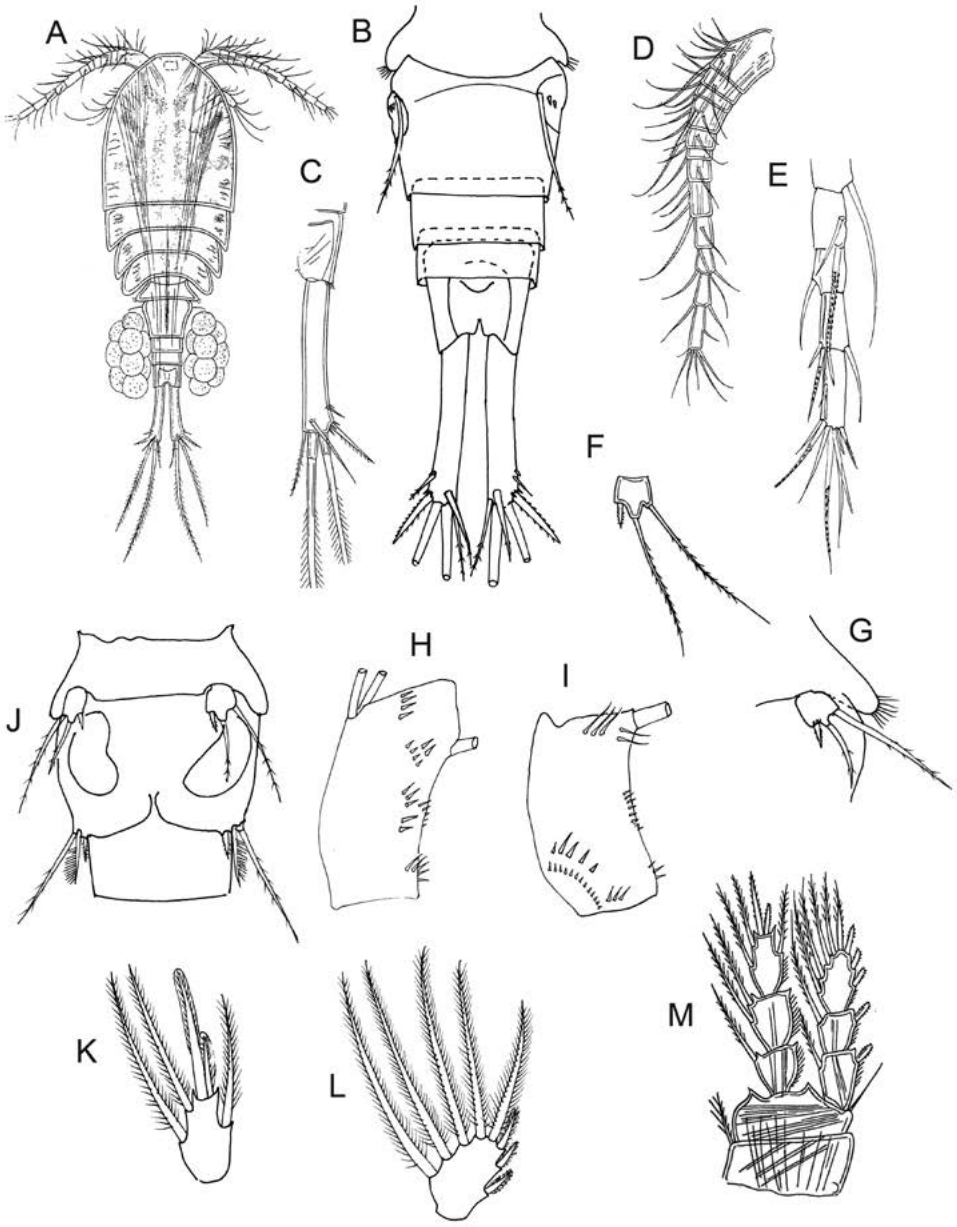

Fig. 77. *Eucyclops* (*Macrurocyclops*) *laevimargo* (Sars G.O., 1909). A — habitus; B — abdomen; C — caudal ramus, dorsal; D, E — A1; F, G — P5; H — A2 Bas, frontal; I — A2 Bas, caudal; J — P5 and P6; K — P4 Enp3; L — P4 Exp3; M — P4. A–I, K–M — female; J — male. Lake Tanganyika, East Africa. A, C, D, F, M — after Sars G.O. [1909]; B, E, G–L — orig., slides #05947, 05948, 05950 KRC.

Рис. 77. *Eucyclops* (*Macrurocyclops*) *laevimargo* (Sars G.O., 1909). A — габитус; B — абдомен; C — каудальная ветвь, дорсально; D, E — A1; F, G — P5; H — A2 Bas, фронтально; I — A2 Bas, каудально; J — P5 и P6; K — P4 Enp3; L — P4 Exp3; M — P4. A–I, K–M — самка; J — самец. Озеро Танганьика, Восточная Африка. A, C, D, F, M — по Sars G.O. [1909]; B, E, G–L — ориг., преп. #05947, 05948, 05950 KRC.

Antennule 12-segmented, short, not reaching distal margin of cephalothorax, with very narrow, smooth hyaline membrane along three distal segments (Fig. 77E). A2 Bas ornamentation on caudal side with N1 group, other groups as in Fig. 77I; on frontal side as in Fig. 77H. Mouth appendages not examined.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P3–P4 spines modified, blunt, with spatulated hyaline membrane. P4 Enp3 (Fig. 77K, M) short, L/W ratio about 1.7; inner spine twice longer than outer spine; inner spine longer than segment; distal inner seta reaching tip of nearest spine. P4 Exp3 distal spine twice shorter than segment (Fig. 77L, M). Reduced P5: segment as long as broad (Fig. 77F, G) with weak, short inner spine and two long setae. P6 with very long outer seta, reaching beyond posterior margin of GS (Fig. 77B).

MALE (Fig. 77J). Body shorter and slender than in female, length without caudal setae about 750 μm. Lateral edge of Th4 smooth, anal somite longer than previous one. Caudal rami parallel or slightly divergent, longer than 2 last abdominal somites. Rudimentary P6 (see Fig. 77J) with weak and short inner spine, not reaching middle of next somite and two longer setae, length ratio beginning with spine: 1/2/4.

DISTRIBUTION: Lake Tanganyika, possibly endemic.

COMMENTS: This species can be distinguished from its closest congeners from Africa and Madagascar with short inner spine in P5 by following combination of characters: short antennules, long caudal rami (L/W ratio more than 6), complete absence of lateral *serra*, distal spines ratio in P4 Enp3 more than 2, P3–P4 with "spatulate" spines, P5 armed with short and weak inner spine along with very long outer seta.

74. ***Eucyclops*** (***Macrurocyclops***) ***madagascariensis*** (Kiefer, 1926)
Fig. 78.

SYNONYMY: *Cyclops madagascariensis*: Kiefer, 1926b; *Eucyclops laevimargo madagascariensis*: Kiefer, 1952; *Eucyclops madagascariensis*: Lindberg, 1951b; Dussart, 1982; Dussart, Defaye, 2006; *Eucyclops* (*Macrurocyclops*) *madagascariensis*: Alekseev, 2019; *Eucyclops congolensis*: Lindberg, 1951c.

TYPE LOCALITY: pond in 4 km to south from Tananarive, Madagascar.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male deposited in Kiefer's Reference collection, NHMK, Germany.

MATERIAL STUDIED: holotype #00551, paratype #00573; author's descriptions and drawings.

DESCRIPTION. FEMALE (Fig. 78A–F). Body length without caudal setae 925–950 μm. Th4 with lateral setulae. Genital double somite as long as broad, *receptaculum seminis* typical of genus. Caudal rami (Fig. 78A, B) parallel, 5.0–5.5 times as long as broad, lateral *serra* absent except few spinules above lateral seta. Innermost caudal seta longer than ramus length and 2.5 times longer than outermost seta. Dorsal seta slightly longer than outermost seta. Lateral seta shorter than ramus width. Approximate length ratio of terminal setae beginning with outermost: 1.0/5.0/9.0/2.5.

Antennules 12-segmented, short, not reaching distal margin of CTh, with smooth narrow hyaline membrane on three distal segments. A2 ornamentation not seen in holotype and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 (Fig. 78C, D) 2.3 times as long as broad; inner spine shorter than segment and about 1.5 times as long as outer spine; distal setae reaching middle of nearest spines. In P4 Coxa, inner spine/seta homogeneously plumose, just reaching tip of inner outgrowth of basipodite that densely covered with short hairs. P4 IntCox (Fig. 78C) with 3 rows of short setulae (I–III). Reduced P5 (Fig. 78E, F): segment as long as broad; armed with short inner spine (half of segment) and two long setae.

MALE (Fig. 78G). Body length without caudal setae 700–800 μm, more slender than female with shorter caudal rami. Swimming legs and reduced P5 similar to female. Rudimentary P6 (see Fig. 78G) with strong but short inner spine not reaching middle of next abdominal somite and 2 unequal setae; outer seta longer than spine, middle seta shorter than spine, length ratio beginning with spine: 1.0/0.6/1.7.

DISTRIBUTION: Madagascar Island (endemic?).

COMMENTS: Kiefer [1952] after the first description synonymizes this form with *E.* (*M.*) *laevimargo* (Sars G.O., 1909) and changes its name to *E. laevimargo madagscarensis.* Lindberg [1951b] and Dussart [1982] working with own material from Madagascar disagreed with him and restored it status to species level. Dussart [1982] suggests following differences between these two forms: caudal rami structure and distal setae proportions, ratio of P5 appendages, modification of setae and spines of swimming legs.

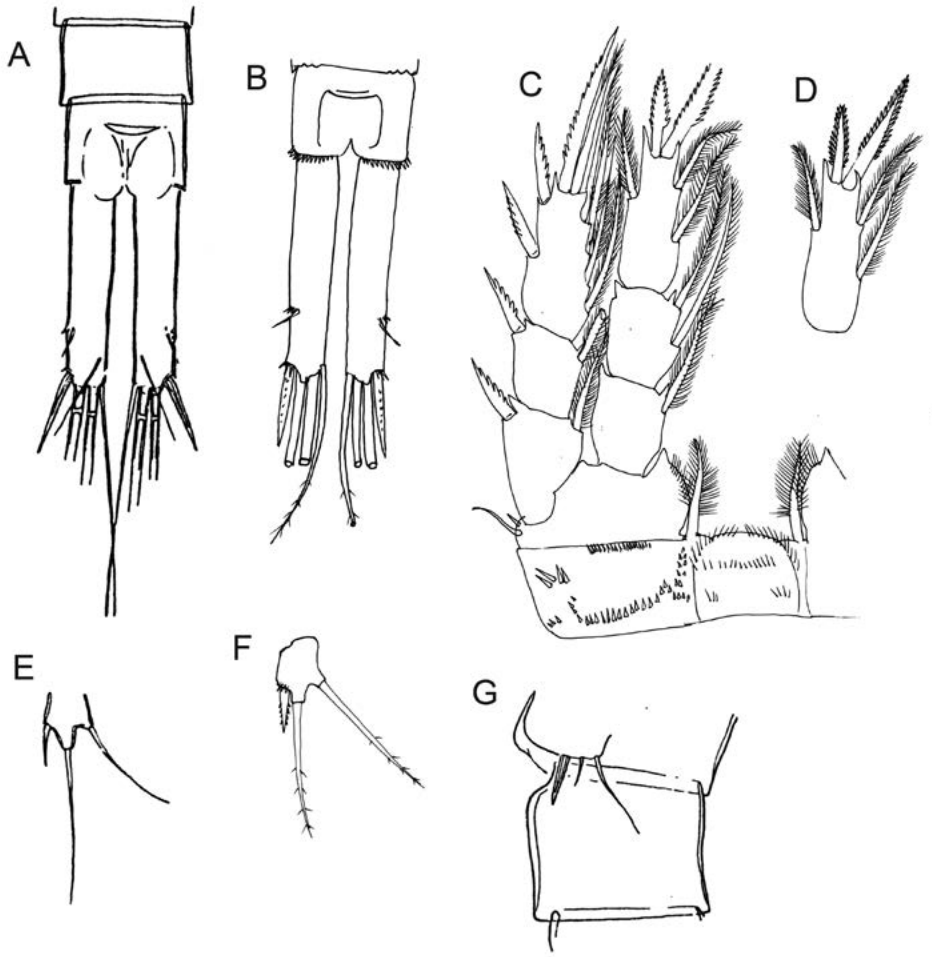

Fig. 78. *Eucyclops* (*Macrurocyclops*) *madagascariensis* (Kiefer, 1926). A, B — caudal rami; C — P4, caudal; D — P4 Enp3; E, F — P5; G — P6. A–F — female; G — male. Madagascar. A, E, G — after Kiefer [1926b]; B, C, D, F — orig., slide #05020 KRC.

Рис. 78. *Eucyclops* (*Macrurocyclops*) *madagascariensis* (Kiefer, 1926). A, B — каудальные ветви; C — P4, каудально; D — P4 Enp3; E, F — P5; G — P6. A–F — самка; G — самец. Мадагаскар. A, E, G — по Kiefer [1926b]; B, C, D, F — ориг., преп. #05020 KRC.

75. ***Eucyclops*** (***Macrurocyclops***) ***miurai*** Ito, 1952 **comb.n.**
Fig. 79.

SYNONYMY: *Eucyclops miurai*: Ito, 1952; *Eucyclops subterraneus miurai*: Petkovski, 1971; *Eucyclops* (*Mrazekicyclops*) *miurai*: Alekseev, 2019.

TYPE LOCALITY: a well in Himejil City, West Japan, Asia.

HOLOTYPE PRESENCE AND STORING: NHM, Tokyo, not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 79A–D). Body length without caudal setae 650–860 μm, white color, naupliar eye absent. Th4 with short hairs laterally. Genital double somite as long as broad; *receptaculum seminis* typical of genus (Fig. 79B). Anal somite as long as previous one. Caudal rami subparallel (Fig. 79A); L/W ratio about 5; lateral *serra* absent except few small spinules in-

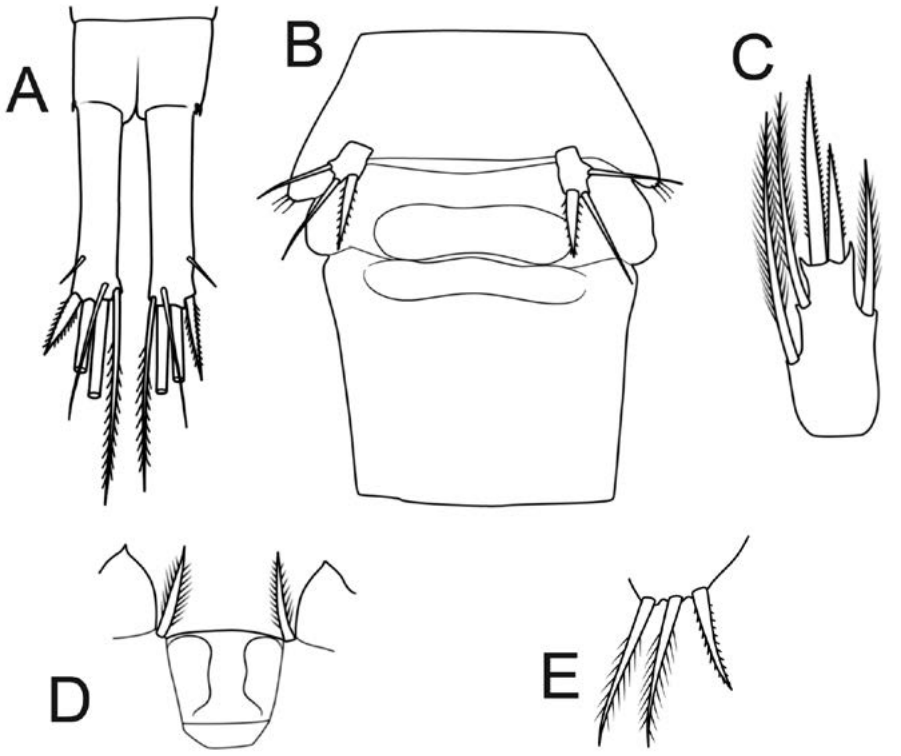

Fig. 79. *Eucyclops* (*Macrurocyclops*) *miurai* Ito, 1952 comb.n. A — caudal rami; B — Th4, genital double somite and P5; C — P4 Enp3; D — P4 intercoxal plate; E — P6. A–D — female; E — male. Japan, after Ito [1952].

Рис. 79. *Eucyclops* (*Macrurocyclops*) *miurai* Ito, 1952 comb.n. A — каудальные ветви; B — Th4, генитальный сомит и P5; C — P4 Enp3; D — межкоксальная пластинка P4; E — P6. A–D — самка; E — самец. Япония, по Ito [1952].

serted above lateral seta; lateral seta about as long as ramus width. Outermost spiniform seta short but strong, inserted close to outer middle setae; distal seta ratio beginning with outermost: 1.0 /6.0 /8.7/ 2.2–2.7; dorsal seta nearly twice longer than outermost spiniform seta; innermost seta about as long as ramus length.

Antennule 12-segmented, short, just reaching distal edge of CTh; 3 distal segments without visible hyaline membrane. Antenna and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 (Fig. 79C) twice longer than broad; inner/outer spine ratio about 1.6; distal setae almost reaching tips of nearest spines; coxal spine/seta homogeneously covered with short setulae (Fig. 79D); P4 IntCox distal margin without setulae. Reduced P5 (Fig. 79B) armed with strong but rather short inner spine and two slightly longer setae.

MALE (Fig. 79E). Body length without caudal setae 530–700 μm, white colored, more slender than in female. Th4 without lateral setulae. Caudal rami shorter than in female with L/W ratio 3.6–4.8, innermost caudal seta longer than ramus. P1–P5 as in female. Rudimentary P6 with relatively short inner spine and two subequal setae 1.4 times longer than spine.

DISTRIBUTION: known only from the type locality: well in Himejil City, West Japan, Asia.

COMMENTS: Author compares this species with *E.* (*Mr.*) *inarmatus* Kiefer, 1932, which differs from it in 11-segmented antennules. My previous assignment of this form to subgenus *Mrazekicyclops* [Alekseev, 2019] was caused by poor quality of figures in copy of Ito's drawing and absence of original text of the paper by Ito [1952] in our academic library. Thanks to kind help of Dr. Hiroshi Ueda, who sent me PDF of Ito's article, this mistake has been corrected.

76. ***Eucyclops*** (***Macrurocyclops***) ***neocaledoniensis*** Dussart, 1984 **comb.n.** Fig. 80.

SYNONYMY: *Eucyclops neocaledoniensis*: Dussart, 1984c; Dussart, Defaye, 2006; *Eucyclops* (*Sarsicyclops*) *neocaledoniensis*: Alekseev, 2019.

TYPE LOCALITY: "Lac en Huit" Lake, south-east of New Caledonia.

HOLOTYPE PRESENCE AND STORING: holotype female dissected on one slide, paratypes female and males in alcohol, in Dussart's collection, MNHN, Paris, France.

MATERIAL STUDIED: holotype female #Cp690, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 80A–I). Body length without caudal setae about 740 μm. Cephalothorax shortened with L/W ratio about 0.9. Th4 with long lateral setulae. Genital double somite short, gradually tapering, with L/W ratio about 0.9 (Fig. 80A); *receptaculum seminis* typical for genus. Anal operculum weakly developed, convex, smooth. Caudal rami parallel, short, widely spaced (see Fig. 80A), with L/W ratio about 3.2; lateral *serra* reduced and present as short transversal row of 4–5 long spinules above lateral seta (Fig. 80B). Dorsal seta slightly longer than outermost seta. Outermost seta strong, spiniform, but almost smooth. Innermost seta long, 1.5 times as long as ramus length and 2.4 times as long as outermost seta. Lateral seta shorter than ramus width. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.0/ 8.0/ 2.4.

Antennule 12-segmented, short, hardly reaching distal margin of CTh; last three segments with narrow smooth hyaline membrane (Fig. 80C). A2 Bas ornamentation poorly visible, with setulae at positions N1+2 (Fig. 80D, E).

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox (Fig. 80I, J), distal row with few setulae at sides; coxal spine homogeneously plumose on both sides. P4 Enp3 rather short, with L/W ratio about 2; inner/outer spine ratio 1.2; inner spine shorter than segment; distal setae reaching 2/3 of nearest spines (Fig. 80H). Reduced P5 relatively wide; inner spine weak, shorter than segment; both setae longer than spine; outer seta about 0.6 times as long as medial seta (Fig. 80F, G).

MALE (Fig. 80J, K). Body length without caudal setae 540 μm; with shorter caudal rami. Innermost seta relatively longer than in female, 3.3 times as long as outermost seta. Antennule 14-segmented. P1–P5 as in female. Rudimentary P6 (see Fig. 80K) armed with strong but short inner spine, slightly shorter medial seta and longer outer seta.

DISTRIBUTION: known only from the type locality in New Caledonia

COMMENTS: Females of this species combine characteristics of two subgenera, *Macrurocyclops* (naked caudal rami) and *Sarsicyclops* (P5 with short and weak inner spine), so at first it was assigned to the second one [Alekseev, 2019]. After additional study of morphology this form was transferred to subgenus *E.* (*Macrurocyclops*).

77. ***Eucyclops*** (***Macrurocyclops***) ***orthostylis*** Lindberg, 1952 Fig. 81.

SYNONYMY: *Eucyclops orthostylis*: Lindberg, 1952; Dussart, Defaye, 2006; *Eucyclops* (*Macrurocyclops*) *orthostylis*: Alekseev, 2019.

TYPE LOCALITY: Caspian Sea near River Volga delta, Russia-Kazakhstan, Asia.

HOLOTYPE PRESENCE AND STORING: Zoological Museum in Lund, Sweden, not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 81). Body length without caudal setae 855–915 μm. Th4 with short lateral setulae. Genital double somite as long as broad, *receptaculum seminis* with narrow arms (Fig. 81B). Anal somite longer than previous one; anal operculum weakly developed. Caudal rami long and slender, with L/W ratio 6.4–7.5, parallel, very close to each other, without lateral *serra*. Lateral seta about 1.5 times longer than ramus width. Dorsal seta subequal to outermost caudal seta; outermost caudal seta not spiniform, similar to other terminal setae. Innermost seta thin and naked, 1.2–1.3 times as long as outermost seta.

Antennule 12-segmented short, just reaching CTh distal margin; three distal segments without visible hyaline membrane. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2; inner/outer spine ratio 1.4; inner spine/segment ratio 1.2. Reduced P5 construction and proportion as in *E.* (*M.*) *macrurus,* details not described.

MALE unknown.

DISTRIBUTION: Northern Caspian Sea (endemic?).

COMMENTS: Lindberg [1952] describes this species by examining Sars's collection. Two undissected females of this species were found by him on working place of Sars, named as *Eucyclops ortostylis.* Lindberg kept this name and did his own brief description of this taxon. Unfortunately, sev-

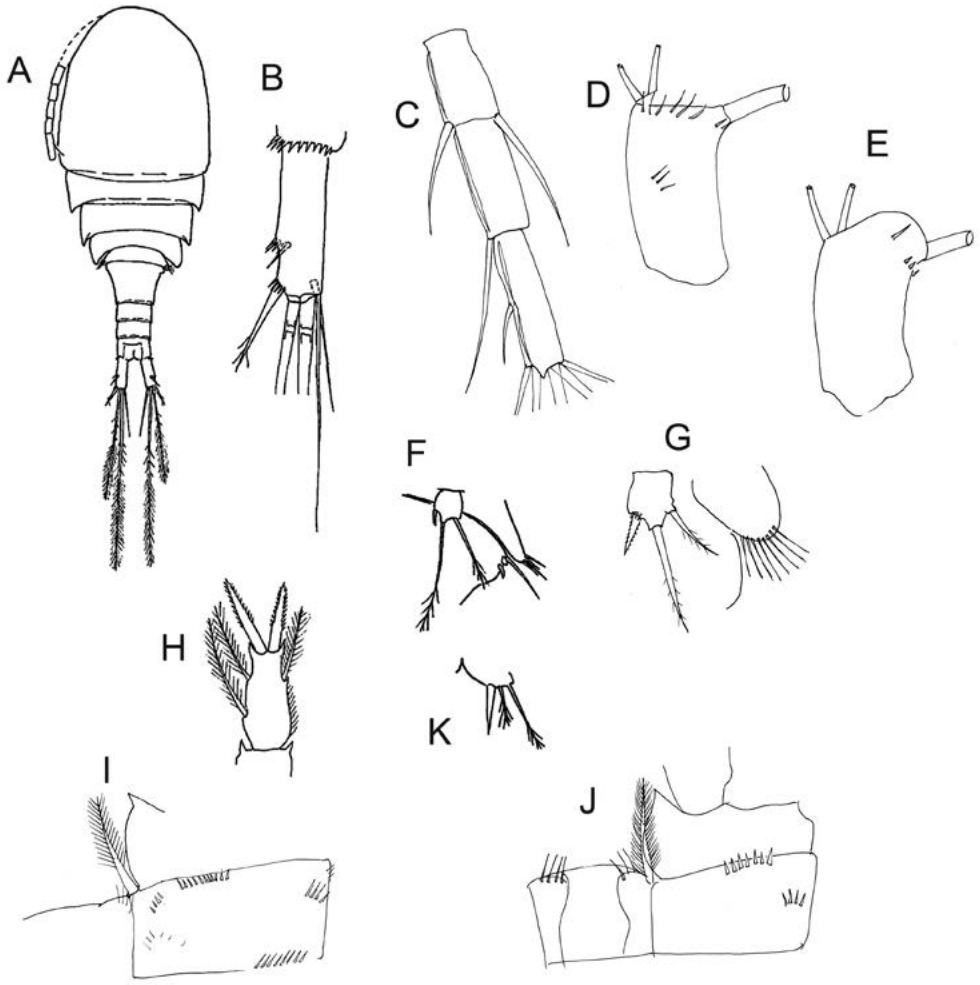

Fig. 80. *Eucyclops* (*Macrurocyclops*) *neocaledoniensis* Dussart, 1984 comb.n. A — habitus; B — caudal ramus, ventral; C — A1, three distal segments; D — A2 Bas, caudal; E — A2 Bas, frontal; F, G — P5; H — P4 Enp3; I, J — P4 intercoxal plate and coxa, caudal; K — P6. A–I — female; J, K — male. New Caledonia. A, B, F, H, K — after Dussart [1984c]; C–E, G, I, J — orig., type slides.

Рис. 80. *Eucyclops* (*Macrurocyclops*) *neocaledoniensis* Dussart, 1984 comb.n. A — габитус; B — каудальная ветвь, вентрально; C — A1, три дистальных членика; D — A2 Bas, каудально; E — A2 Bas, фронтально; F, G — P5; H — P4 Enp3; I, J — межкоксальная пластинка и кокса P4, каудально; K — P6. A–I — самка; J, K — самец. Новая Каледония. A, B, F, H, K — по Dussart [1984c]; C–E, G, I, J — ориг., типовые препараты.

eral taxonomically important characters remained undescribed, including P5 structure. Lindberg finds this form close to *E.* (*M.*) *macrurus,* that is why I include it in this subgenus. After Lindberg [1952], *E.* (*M.*) *orthostylis* can be separated from *E.* (*M.*) *macrurus* by longer inner spine in P4 Enp3 that 1.15 times longer than segment and 1.5 times longer than outer spine.

Eucyclops* (*Macrurocyclops*) *persistens s.lat.

Medium-sized cyclopid with body length in female 750–950 μm. Caudal rami 4.1–5.3 times as long as broad, innermost caudal seta twice longer than outermost one, lateral *serra* practically missing. *Receptaculum seminis* with widely expanded

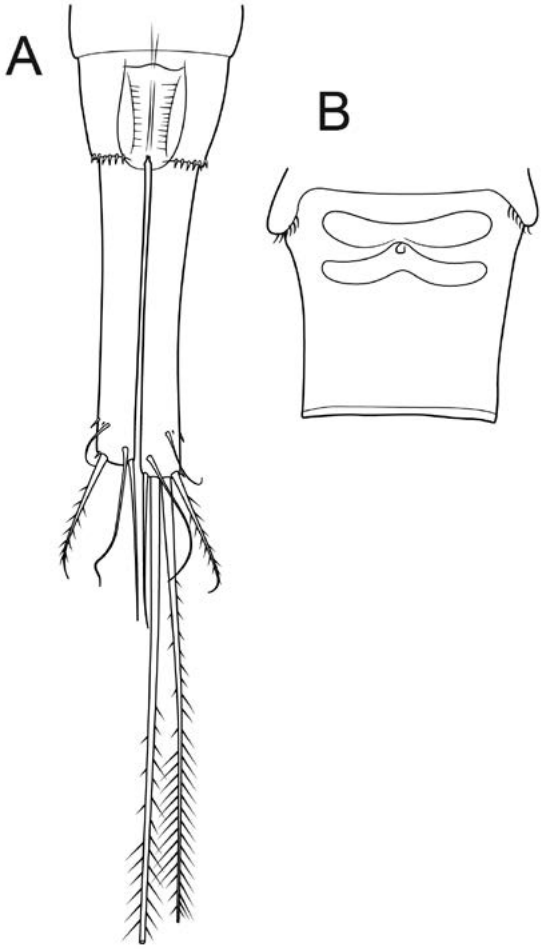

Fig. 81. *Eucyclops* (*Macrurocyclops*) *orthostylis* Lindberg, 1952. Female: A — caudal rami; B — Th4 and genital double somite. North Caspian Sea, after Lindberg [1952].

Рис. 81. *Eucyclops* (*Macrurocyclops*) *orthostylis* Lindberg, 1952. Самка: A — каудальные ветви; B — Th4 и генитальный сомит. Северный Каспий, по Lindberg [1952].

wings, "butterfly-like". Two subspecies inhabiting coastal area of Black Sea, small Caucasian rivers and wells in Crimean Peninsula.

Key to subspecies *Eucyclops* (*Macrurocyclops*) *persistens* s.lat.

1. Dorsal caudal seta shorter than outermost seta; lateral *serra* presented as short transverse row of spinules above lateral seta .... *E.* (*M.*) *persistens persistens* Monchenko, 1978

– Dorsal caudal seta about as long as outermost seta or slightly longer; lateral *serra* presented as oblique row of spinules above lateral seta .....*E.* (*M.*) *p. tauricus* Monchenko et Sopova, 1984

78. ***Eucyclops* (*Macrurocyclops*) *persistens persistens*** Monchenko, 1978
Fig. 82.

SYNONYMY: *Eucyclops persistens*: Monchenko, 1978; Dussart, Defaye, 2006; *Eucyclops persistens persistens*: Gaponova, Holynska, 2019; *Eucyclops* (*Macrurocyclops*) *persistens*: Alekseev, 2019.

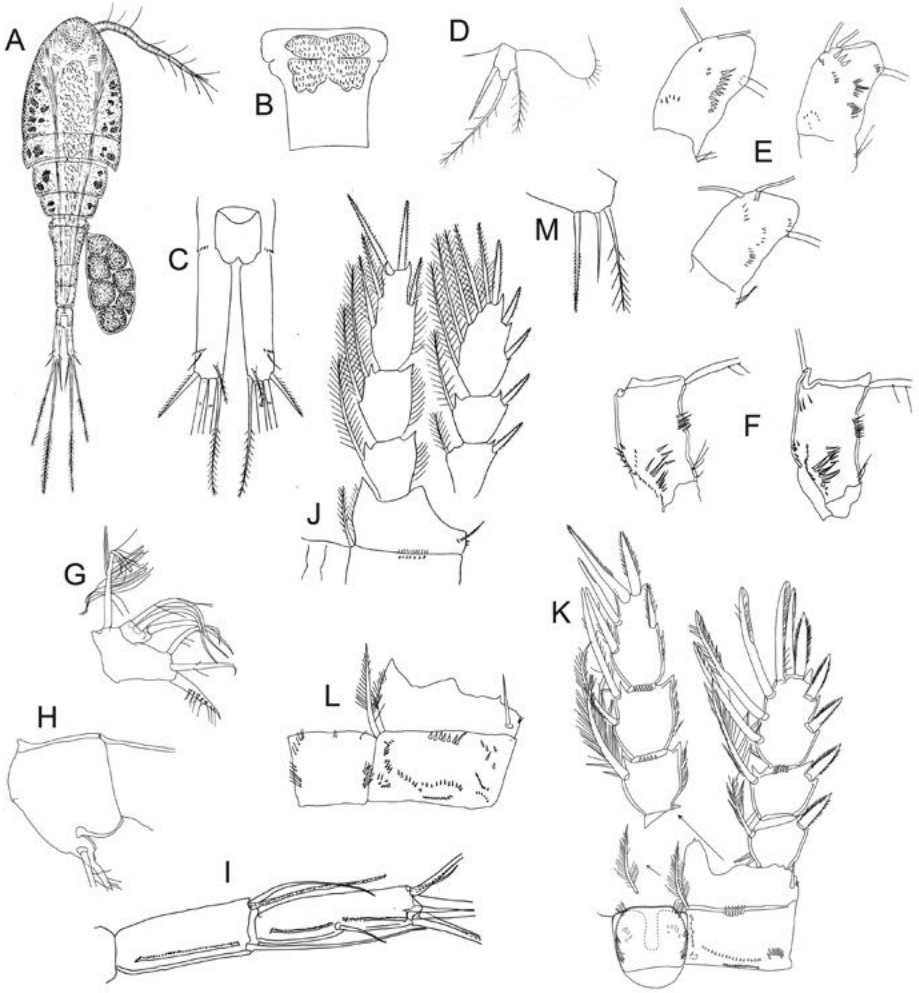

Fig. 82. *Eucyclops* (*Macrurocyclops*) *persistens persistens* Monchenko, 1978. A — habitus; B — genital double somite; C — caudal rami, dorsal; D — P5; E — A2 Bas, frontal; F — A2 Bas, caudal; G — maxillulary palp; H — maxilla praecoxa; I — A1, two distal segments; J–L — P4, caudal; M — P6. A–L — female; M — male. Georgia. A–D, J, M — after Monchenko [1978]; E–I, K, L — after Gaponova & Holynska [2019].

Рис. 82. *Eucyclops* (*Macrurocyclops*) *persistens persistens* Monchenko, 1978. A — габитус; B — генитальный сомит; C — каудальные ветви, дорсально; D — P5; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — пальп максиллулы; H — прекокса максиллы; I — A1, два дистальных членика; J–L — P4, каудально; M — P6. A–L — самка; M — самец. Грузия. A–D, J, M — по Monchenko [1978]; E–I, K, L — по Gaponova & Holynska [2019].

TYPE LOCALITY: Kintrishi River liman, river bank, interstitial water, near Kobuleti city, Adjaria, Georgia (41°80′N 41°77′E). Paratypes: Russia, Kransnodarskiy Kray, Lazarevskoye, Psezuapse river bank, interstitial (43°92′N 39°33′E).

HOLOTYPE PRESENCE AND STORING: holotype and paratype deposited in IZNAN, Kiev, Ukraine.

MATERIAL STUDIED: author's description and drawings; Gaponova & Holynska [2019] redescription of paratypes.

DESCRIPTION. FEMALE (Fig. 82A–L). Body length without caudal setae 781–915 μm. Th4 with short rare lateral setulae. Genital double somite (Fig. 82B) about as long as broad; *receptaculum seminis* with wide, extended distal part. Anal operculum convex, strongly developed. Caudal rami nearly parallel, 4.4–5.3 times as long as broad; lateral *serra* presented as short transverse row of spinules above lateral seta (Fig. 82C). Dorsal seta shorter than spiniform outermost seta. Lateral seta shorter than ramus width. Innermost caudal seta 2.0–2.2 times longer than outermost seta and about as long as ramus length.

Antennule 12-segmented, short, just reaching distal margin of CTh; 3 distal segments with very narrow and smooth hyaline membrane. Setation of antennular segments: 8/4/2/6/4/2/2/3/2+I/2/2+I/7+I. A2 setation: 1/9/7. A2 Bas ornamentation of paratype specimens as in Fig. 82E, F; caudal surface with few thin long spinules N2 in some specimens. Mouth appendages typical of genus; maxillulary palp naked (Fig. 82G); maxilla without spinules at lateral margin of praecoxa (Fig. 82H).

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 IntCox distal margin with few short setulae at sides (Fig. 82K, L); caudal Coxa ornamentation with distal row A+C short, group F absent; Bas inner outgrowth with hairs; coxal spine with gap on outer side. P4 Enp3 L/W ratio 1.9–2.3; inner/outer spine ratio 1.3–1.5; inner spine 0.9–1.1 times as long as segment; distal setae modified, spatulate. Reduced P5 (Fig. 82D) with elongated segment; inner spine rather long but weak, twice longer than segment; length ratio beginning with spine: 1.0/1.6–1.8/0.9–1.0.

MALE (Fig. 82M). Body length without caudal setae 676–725 μm. Caudal rami with L/W ratio 3.5–4.8; distal setae approximate length ratio beginning with outermost: 1.0/ 6.0/ 11.0/ 1.9–2.3; dorsal seta 1.1–1.3 times as long as outermost seta. A2 Bas with distal group N1 of hair-setulae. Maxilla with small spinules at lateral margin of praecoxa. P4 IntCox with three rows of short setulae with gap in middle, not rising above distal margin. P5 as in female. P6 armed with weak inner spine and two setae; length ratio beginning with spine: 1.0/ 0.7–0.9/ 1.0–1.3.

DISTRIBUTION: Caucasus rivers, watershed of Black Sea, Georia and Russia.

COMMENTS: In Ponto-Caspian area, at least 4 taxa of this subgenus occur: *E.* (*M.*) *macrurus*, *E.* (*M.*) *orthostylis*, *E.* (*M.*) *persistens persistens* and *E.* (*M.*) *persistens tauricus*. The last two possibly are separate species as having very different A2Bas ornamentation after Gaponova & Holynska [2019]

79. ***Eucyclops* (*Macrurocyclops*) *persistens tauricus*** Monchenko et Sopova, 1984
Fig. 83.

SYNONYMY: *Eucyclops persistens tauricus*: Monchenko, Sopova, 1984 ; Gaponova, Holynska, 2019.

TYPE LOCALITY: well in Zarechnoye village, Simferopol vicinity, Crimean Peninsula, Europe (44°51′N 34°16′E).

HOLOTYPE PRESENCE AND STORING: deposited in Institute of Zoology, NAN, Kiev, Ukraine.

MATERIAL STUDIED: authors' description and drawings; Gaponova & Holynska redescription [2019].

DESCRIPTION. FEMALE (Fig. 83A–F). Body length 950 μm. Th4 free somite with short hairs laterally. Genital double somite as in nominal taxon. Caudal rami 4.1–5.1 times as long as broad; with short, oblique row of spinules above lateral seta (Fig. 83A, B); lateral caudal seta about 1.3 times longer than ramus width. Innermost caudal seta as long as ramus length and twice longer than outermost seta. Dorsal seta slightly longer than outermost seta. All setae plumose. Terminal seta ratio beginning with outermost:1.0/5.0–5.9/7.7–8.6/ 2.1–2.2.

Antennule 12-segmented similar to nominal taxon, 10–12 distal segments with narrow finely serrated hyaline membrane. A2 Bas ornamentation on frontal side as in Fig. 83C; caudal side with few hair-setulae at N2. Swimming legs and P5 as in nominal taxon (Fig. 83D, E, F).

MALE (Fig. 83G). Body length without caudal setae 880 μm. Th4 naked laterally. Caudal rami 3.1–4.2 times as long as broad, lateral *serra* absent except few setulae near lateral seta base. Terminal seta ratio beginning with outermost:1.0/7.0/11.0/2.2–2.7. Innermost caudal seta longer than ramus length. Antennule 14-segmented. Antenna structure and ornamentation as in female. P1–P5 basically as in female. Rudimentary P6 (Fig. 83G) with weak inner spine and 2 subequal setae; length ratio, beginning with spine: 1.0/0.9–1.0/1.0–1.2.

DISTRIBUTION: Crimean Peninsula, Europe (endemic?).

COMMENTS: *E.* (*M.*) *persistens tauricus* differs from *E.* (*M.*) *persistens persistens* by relative length of dorsal seta and appearance of reduced lateral *serra.* They may also differ in presence of N2 group of setulae on A2 caudal side after Gaponova & Holynska [2019]. If so, they possibly are different species belonging to different subgenera, but these characters have to be studied in more specimens/populations for both taxa.

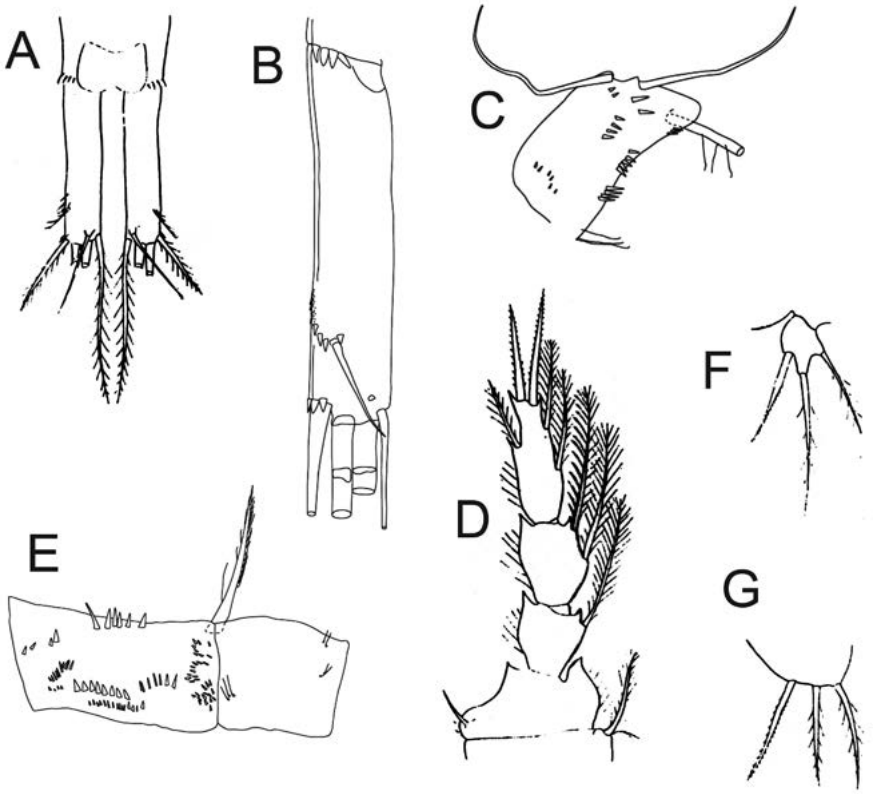

Fig. 83. *Eucyclops* (*Macrurocyclops*) *persistens tauricus* Monchenko et Sopova, 1984. A, B — caudal rami; C — A2 Bas, frontal; D — P4 Enp; E — P4 intercoxal plate and coxa, caudal; F — P5; G — P6. A–F — female; G — male. Crimea, Eastern Europe. A, D, F, G — after Monchenko & Sopova [1984]; B, C, E — after Gaponova & Holynska [2019].

Рис. 83. *Eucyclops* (*Macrurocyclops*) *persistens tauricus* Monchenko et Sopova, 1984. A, B — каудальные ветви; C — A2 Bas, фронтально; D — P4 Enp; E — межкоксальная пластинка и кокса P4, каудально; F — P5; G — P6. A–F — самка; G — самец. Крым, Восточная Европа. A, D, F, G — по Monchenko & Sopova [1984]; B, C, E — по Gaponova & Holynska [2019].

6. SUBGENUS ***Eucyclops*** (***Mrazekicyclops***) Alekseev, 2019

Small and medium size cyclopids, female body length about 600–1080 μm. Female antennule 11-segmented and short; 3 distal segments without visible hyaline membrane. Caudal rami subparallel, short, L/W ratio about 2.5–4.0, with reduced or absent lateral *serra*. Three African species demonstrate short setulae on mediodorsal surface of CR, usually organized in 2–3 rows. P4 Enp3 with rather long distal setae, reaching from middle to distal tip of nearest spine, but not farther. Reduced P5 with rather weak inner spine, 1–2 times longer than segment; two setae longer than spine. These species possibly include sets of sister species; one can predict such species to be discovered in Australia, South America and South East Asia, possibly in ground waters. Subgenus *Mrazekicyclops* includes 4 species, of which 3 species from Africa and Madagascar, and 1 species from underground water in Europe.

Key to species of *Eucyclops* (*Mrazekicyclops*)

1. Caudal rami naked, L/W ratio about 4; Th4 without lateral setulae..... ..... *E.* (*Mr.*) *inarmatus* Kiefer, 1932 [caves in Slovenia]

– Caudal rami with partly reduced lateral *serra* and short setulae on mediodorsal surface; L/W ratio about 3; Th4 with lateral setulae 2
2. P5 with rather weak inner spine, about as long as segment or shorter and more than twice shorter than outer seta 3
– P5 with stronger and longer inner spine 4
3. Innermost caudal seta shorter than outermost one; outermost seta 0.8–0.9 times as long as ramus length; P4 IntCox distal margin with few setulae at sides .... *E.* (*Mr.*) *stuhlmanni stuhlmanni* (Mrazek, 1898) [Tanzania]
– Innermost caudal seta longer than outermost one; outermost seta about 0.7 times as long as ramus length; P4 IntCox distal margin without setulae ..... *E.* (*Mr.*) *s. minor* Kiefer, 1952 [Congo]
4. Body length about 850–950 μm; CR with L/W ratio 3.0–3.5; P4 coxal spine with naked outer side..... *E.* (*Mr.*) *echinatus* (Kiefer, 1926) [Madagascar, Central-East Africa]
– Body length about 600; CR with L/W ratio about 2.5; P4 coxal spine with plumose outer side..... *E.* (*Mr.*) *tepidus* Kiefer, 1952 [hot mountain spring in Kenia]

80. ***Eucyclops*** (***Mrazekicyclops***) ***stuhlmanni stuhlmanni*** (Mrazek, 1898) Fig. 84.

SYNONYMY: *Cyclops stuhlmanni:* Mrazek, 1898; *Eucyclops stuhlmanni*: Dussart, Defaye, 2006; *Eucyclops* (*Mrazekicyclops*) *stuhlmanni*: Alekseev, 2019.

TYPE LOCALITY: Bukoba, Lake Victoria, Tanzania, East Africa.

HOLOTYPE PRESENCE AND STORING: holotype female NHM, Berlin, Germany, practically destroyed due to desiccation (after Kiefer [1952]).

MATERIAL STUDIED: author's description and drawings; Kiefer [1952] drawing of topotype, female topotype slide #06235, Kiefer's Reference collection (SMNK, Germany).

DESCRIPTION. FEMALE (Fig. 84A–E). Body length without caudal setae about 800 μm. Genital double somite elongated, gradually tapering posteriorly; *receptaculum seminis* typical of genus (Fig. 84B). Th4 with lateral setulae. Anal operculum weakly convex. Caudal rami subparallel with branches placed widely, short, with L/W ratio about 3.2; on medio-dorsal surface with two rows of spinules; inner side with hair-setulae; lateral s*erra* short, occupies less than half of lateral margin, composing of strong spinules increasing in size distally (Fig. 84C). Lateral seta longer than ramus width. Dorsal seta subequal to outermost seta. Outermost seta thin and long, 0.8–0.9 times as long as ramus length. Innermost seta slightly shorter than outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/5.0/8.5/0.9.

Antennule 11-segmented short, not reaching distal edge of CTh (Fig. 84D); three distal segments without visible hyaline membrane. A2 and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, distal margin with few setulae at sides (Fig. 84E). P4 Enp3 rather long, with L/W ratio about 2.7; inner/outer spine ratio 1.3; inner spine 1.1 times as long as segment; distal setae almost reaching tips of nearest spines. P4 Exp3 distal spine twice shorter than segment. Reduced P5 (Fig. 84B): segment with L/W ratio about 1, armed with weak and short inner spine subequal or shorter than segment; medial seta 1.4 times longer than outer seta.

MALE (Fig. 84F). More short and slender than female. Caudal rami with three rows of spinules on medio-dorsal surface; lateral *serra* absent except few short spinules above lateral seta; lateral seta about as long as ramus width; outermost seta shorter than in female. Antennules 14-segmented. P5 with longer inner spine than in female. Rudimentary P6 (see Fig. 84G) with strong long inner spine, median seta shorter than spine and outer seta subequal to spine; length ratio beginning with spine:1.0/0.7/1.1.

DISTRIBUTION: known from the type locality only.

COMMENTS: Kiefer [1952] accepts Mrazek's description of *E.* (*Mr.*) *stuhlmanni* but finds his drawings as containing many mistakes. Among those he mentions too short P5 spine and much widely placed caudal rami. He ignores these characters and believes that they are in reality the same as in his taxon *E.* (*Mr.*) *echinatus* described from Madagascar and also widely (13 localities) distributed in East Africa. As result he unites these two taxa as two subspecies of *E.* (*Mr.*) *stuhlmanni* s.lat. At the same time even if Mrazek [1895] made some mistakes with drawing of spine length, caudal rami and P5 in female and P6 in male both forms look too different to be in the same species. Among these 13 localities where Kiefer [1952] finds his subspecies, there is no the *terra typica* for Mrazek's taxon. I guess that Mrazek's description from Lake Victoria belongs to a quite rare for East Africa species possibly endemic of the lake, while Kiefer describes another species *E.* (*Mr.*) *echinatus* which is widely distributed in East Africa (Rift

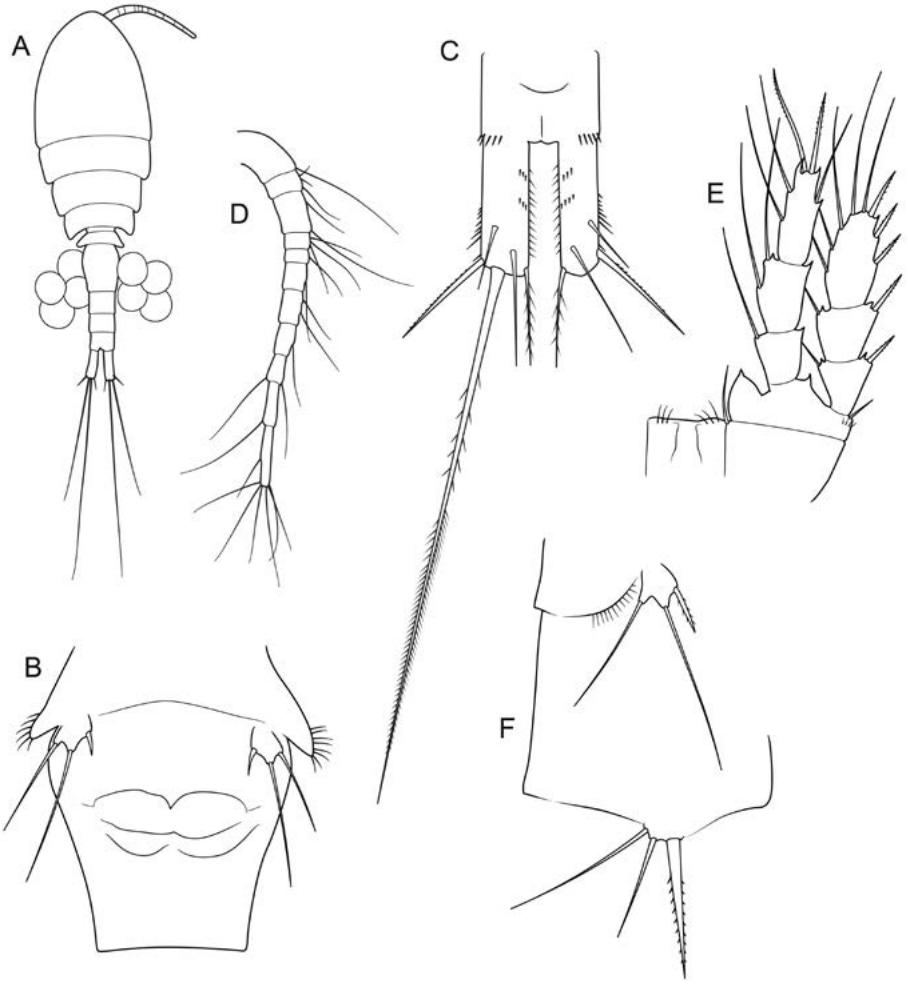

Fig. 84. *Eucyclops* (*Mrazekicyclops*) *stuhlmanni stuhlmanni* (Mrazek, 1898). A — habitus; B — Th4, genital double somite and P5; C — caudal rami, dorsal; D — A1; E — P4; F — P5 and P6. A–E — female; F — male. Lake Victoria, East Africa, after Mrazek [1898].

Рис. 84. *Eucyclops* (*Mrazekicyclops*) *stuhlmanni stuhlmanni* (Mrazek, 1898). A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви, дорсально; D — A1; E — P4; F — P5 и P6. A–E — самка; F — самец. Озеро Виктория, Восточная Африка, по Mrazek [1898].

Lake Valley area) and in Madagascar. That is why I separate them in two species [Alekseev, 2019].

81. ***Eucyclops* (*Mrazekicyclops*) *stuhlmanni minor*** Kiefer, 1952
Fig. 85.

SYNONYMY: *Eucyclops stuhlmanni* forma *minor*: Kiefer, 1952; *Eucyclops* (*Mrazekicyclops*) *stuhlmanni minor*: Alekseev, 2019.

TYPE LOCALITY: Kibunga, Virunga park, Congo, Africa.

HOLOTYPE PRESENCE AND STORING: female holotype on slides #04762, 04763 and male paratype on slides #05000, 05001 in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype, paratype, author's description.

DESCRIPTION. FEMALE (Fig. 85A, B). Body length excepting caudal setae 560–600 μm.

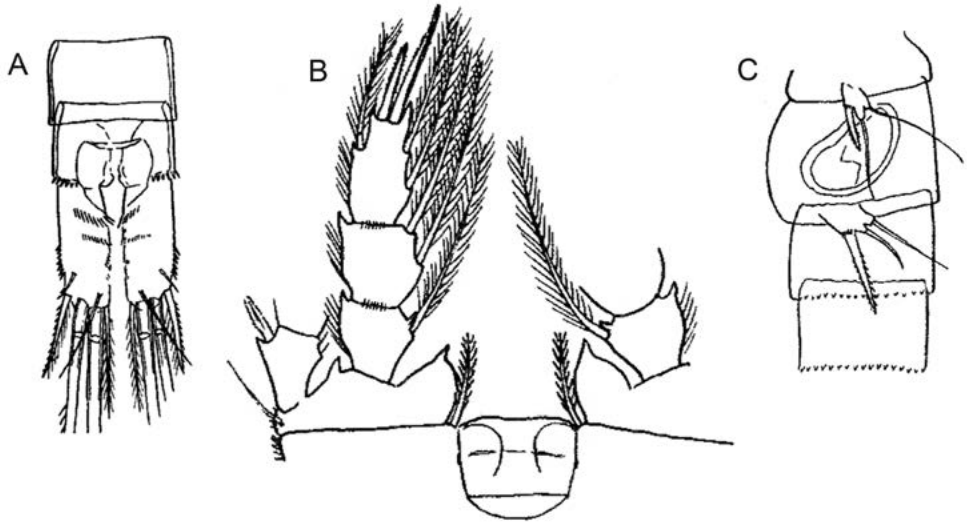

Fig. 85. *Eucyclops* (*Mrazekicyclops*) *stuhlmanni minor* Kiefer, 1952. A — caudal rami; B — P4; C — P5 and P6. A, B — female; C — male. East Congo, after Kiefer [1952].

Рис. 85. *Eucyclops* (*Mrazekicyclops*) *stuhlmanni minor* Kiefer, 1952. A — каудальные ветви; B — P4; C — P5 и P6. A, B — самка; C — самец. Восточное Конго, по Kiefer [1952].

Th4 with lateral setulae. Caudal rami subparallel (Fig. 85A), short, with L/W ratio about 2.7; on medio-dorsal surface with 2 rows of setulae; lateral seta short, composing of subequal denticles; lateral seta not longer than ramus width (Fig. 85A). Outermost seta spiniform, with denticulate outer side and hairs on inner side, about 0.7 times as long as CR length. Dorsal seta slightly longer than outermost seta. Innermost seta about 1.3 times longer than outermost seta.

Antennule 11-segmented, short, not reaching distal edge of CTh; hyaline membrane on 3 distalmost segments invisible.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, distal edge without setulae (Fig. 85B). P4 Enp3 rather short, L/W ratio about 1.7; inner/outer spine ratio 1.5; inner spine 1.2 times as long as segment; distal setae reaching tips of nearest spines. Reduced P5 armed with inner spine about as long as segment and with two long setae.

MALE (Fig. 85C). Body length without caudal setae 500 µm. Caudal rami of same proportions and armament as in female with rows of spinules on medio-dorsal surface; lateral *serra* absent. Antennules 14-segmented. P1–P5 as in female. Rudimentary P6 (see Fig. 85C) with strong long inner spine, reaching beyond distal border of next somite, and two unequal setae. Length ratio beginning with spine:1.0/0.6/1.0.

DISTRIBUTION: It is known from the type locality only, Rep. of Congo, Africa.

COMMENTS: Kiefer describes *E.* (*Mr.*) *stuhlmanni minor*, as resembling Mrazek's taxon in most details but very small in size.

82. ***Eucyclops* (*Mrazekicyclops*) *echinatus*** (Kiefer, 1926)
Fig. 86.

SYNONYMY: *Cyclops echinatus*: Kiefer, 1926b; *Eucyclops echinatus*: Kiefer, 1929b; *Eucyclops stuhlmanni echinatus*: Kiefer, 1952; Dussart, 1982; *Eucyclops* (*Mrazekicyclops*) *echinatus*: Alekseev, 2019.

TYPE LOCALITY: rice field between the capital and Ambatomanga, Madagascar.

HOLOTYPE PRESENCE AND STORING: female holotype and male paratype dissected, deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype #00547 and paratype #00579 specimens; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 86A–D). Body length without caudal setae 850–950 µm. Th4 with lateral setulae. Genital double somite

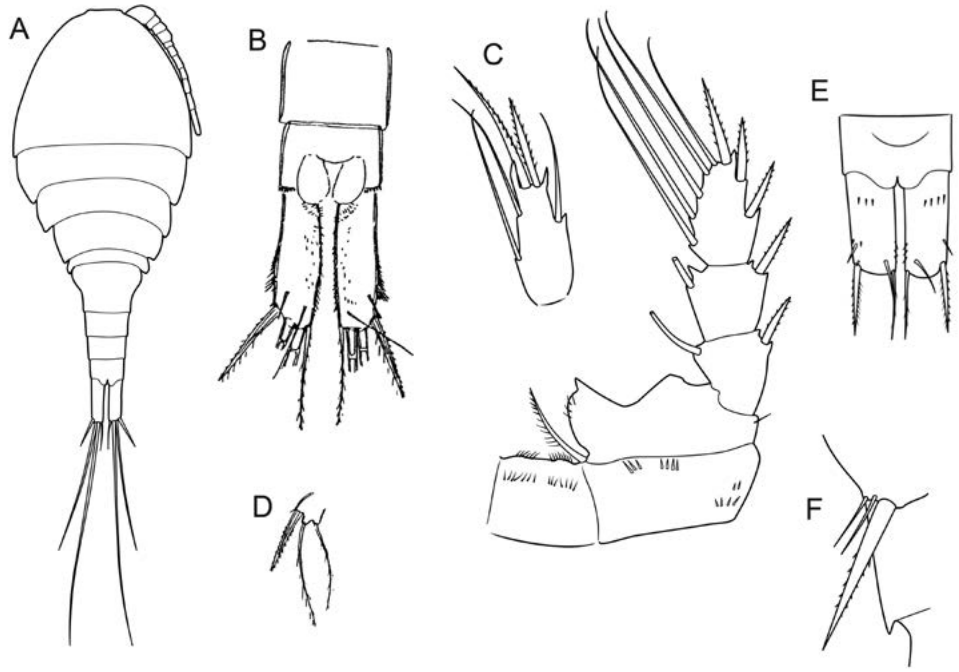

Fig. 86. *Eucyclops* (*Mrazekicyclops*) *echinatus* (Kiefer, 1926). A — habitus; B, E — caudal rami, dorsal; C — P4, caudal; D — P5; F — P6. A–D — female; E, F — male. Madagascar. B, D — after Kiefer [1926b]; A, C, E, F — orig., type slides.

Рис. 86. *Eucyclops* (*Mrazekicyclops*) *echinatus* (Kiefer, 1926). A — габитус; B, E — каудальные ветви, дорсально; C — P4, каудально; D — P5; F — P6. A–D — самка; E, F — самец. Мадагаскар. B, D — по Kiefer [1926b]; A, C, E, F — ориг., типовые препараты.

wider than long; *receptaculum seminis* typical of genus. Anal operculum convex. Caudal rami subparallel or slightly divergent (Fig. 86A, B); L/W ratio about 3.2–3.5; with many short setulae on medio-dorsal surface; lateral *serra* short, occupies about half of lateral margin, composing of strong spinules increasing in size distally. Lateral seta shorter than ramus width. Dorsal seta slightly shorter than outermost seta. Outermost seta spiniform, about 0.7 times as long as CR length. Innermost seta about 1.0–1.1 times longer than outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/4.5/7.5/1.0–1.1.

Antennule 11-segmented, short, almost reaching distal edge of CTh; 3 distal segments without visible hyaline membrane. A2 and mouth appendages not observable and not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, distal margin with setulae at sides (Fig. 86C); coxal spine naked on outer side. P4 Enp3 with L/W ratio about 2.3; inner/outer spine ratio 1.5; inner spine 1.2 times as long as segment; distal setae almost reaching tips of nearest spines. P4 Exp3 distal spine about 0.8 times as long as segment. Reduced P5 (Fig. 86D) armed with long inner spine twice longer than segment; two setae longer than spine; length ratio beginning with spine: 1.0/1.6/1.3.

MALE (Fig. 86E, F). Body length without caudal setae 740–820 μm. Caudal rami shorter than in female, with L/W ratio 2.2–2.5; lateral *serra* absent, only with few small setulae above lateral seta; dorsal and inner surfaces with few rows of short setulae (Fig. 86E). Antennule 14-segmented. Swimming legs and reduced P5 structure basically as in female. Rudimentary P6 (Fig. 86F) armed with strong long inner spine and twice shorter setae.

DISTRIBUTION: bogs and shallow ponds in Madagascar, East Africa.

COMMENTS: This species seems like a common form in East Africa, but it lives in rarely studied habitats such as bogs, littoral zone of lakes and rivers [Kiefer, 1952]. After description author synonymized it with Mrazek's taxon and changed its name to *E. stuhlmanni echinatus*. Afrer compa-

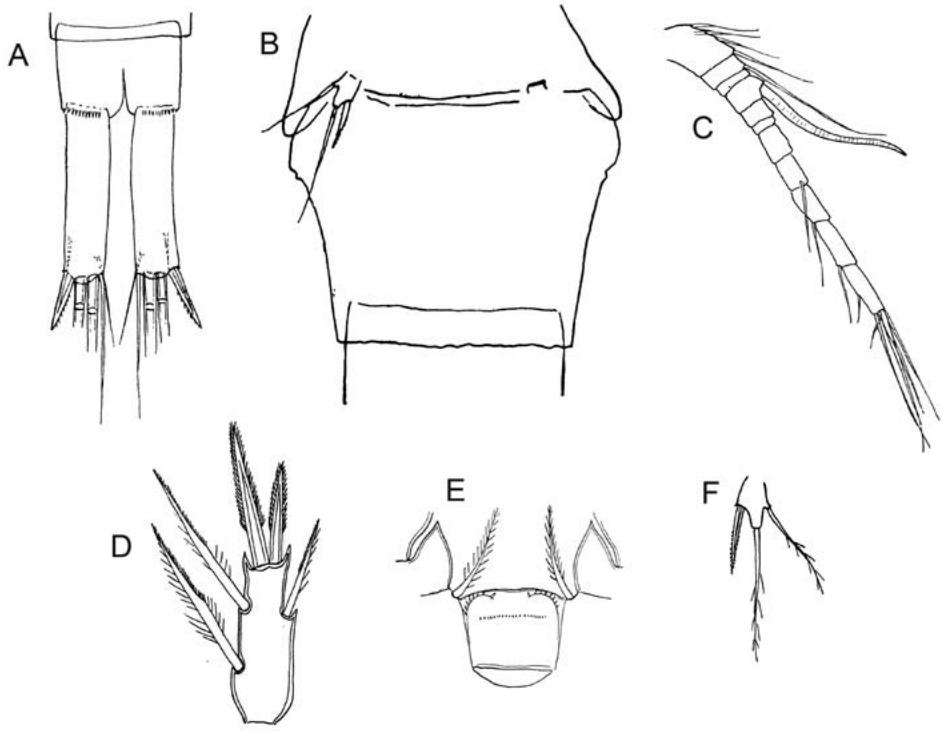

Fig. 87. *Eucyclops* (*Mrazekicyclops*) *inarmatus* Kiefer, 1932. Female: A — caudal rami; B — Th4, genital double somite and P5; C — A1; D — P4 Enp3; E — P4 intercoxal plate; F — P5. Croatia, Southeast Europe, after Kiefer [1932a].

Рис. 87. *Eucyclops* (*Mrazekicyclops*) *inarmatus* Kiefer, 1932. Самка: A — каудальные ветви; B — Th4, генитальный сомит и P5; C — A1; D — P4 Enp3; E — межкоксальная пластинка P4; F — P5. Хорватия, Юго-Восточная Европа, по Kiefer [1932a].

rision of the holotypes of these two taxa I separated them again [Alekseev 2019]. *E.* (*Mr.*) *stuhlmanni* has shorter A1, another relative length of P5 appendages, longer outermost and dorsal caudal setae, longer lateral seta than Kiefer's taxon.

83. ***Eucyclops*** (***Mrazekicyclops***) ***inarmatus*** Kiefer, 1932
Fig. 87.

SYNONYMY: *Eucyclops inarmatus*: Kiefer, 1932a; Dussart, Defaye, 2006; *Eucyclops* (*Mrazekicyclops*) *inarmatus* Alekseev, 2019.

TYPE LOCALITY: Viaterniza Cave, 1.5 km from Dubrovnik, Slovenia, Europe.

HOLOTYPE PRESENCE AND STORING: holotype and one paratype females dissected, deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype female #00972 and paratype female #00973, author's description.

DESCRIPTION. FEMALE (Fig. 87). Body length without caudal setae 1080 μm. Th4 without lateral setulae. Genital double somite wider than long; gradually tapering posteriorly; *receptaculum seminis* not observable. Caudal rami subparallel, short, with L/W ratio about 4; without any spinules on inner or outer sides; lateral seta about as long as ramus width. Outermost spiniform seta strong but short, only 0.3 times as long as ramus length. Innermost seta twice longer than outermost seta. Dorsal seta longer than outermost seta.

Antennule 11-segmented **(**Fig. 87C), short, not reaching distal edge of CTh; 3 distal segments without visible hyaline membrane; 4th segment with long and thick seta. A2 basipodite ornamentation and mouth appendages not described.

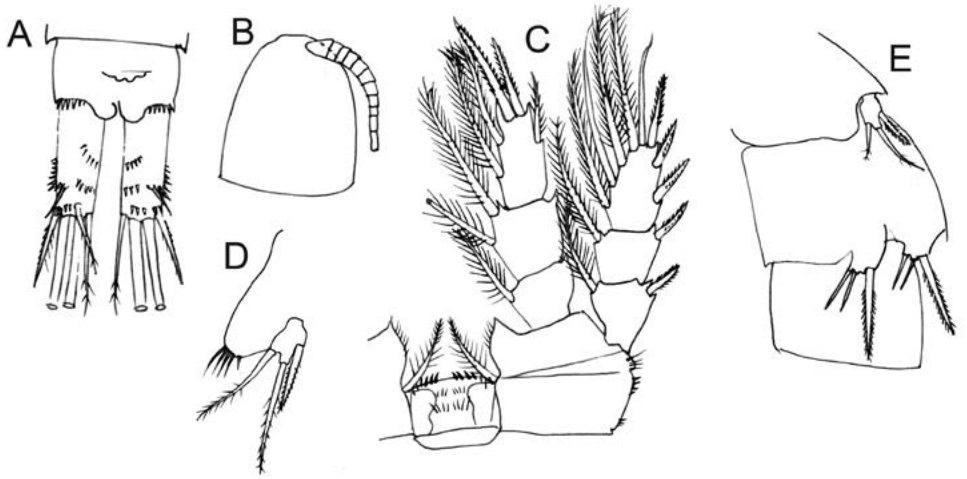

Fig. 88. *Eucyclops* (*Mrazekicyclops*) *tepidus* Kiefer, 1952 stat.n. A — caudal rami, dorsal; B — A1 and cephalothorax; C — P4, caudal; D — Th4 and P5; E — P5 and P6. A–D — female; E — male. Kenya, East Africa, orig., slide #02269 KRC.

Рис. 88. *Eucyclops* (*Mrazekicyclops*) *tepidus* Kiefer, 1952 stat.n. A — каудальные ветви, дорсально; B — A1 и цефалоторакс; C — P4, каудально; D — Th4 и P5; E — P5 и P6. A–D — самка; E — самец. Кения, Восточная Африка, ориг., преп. #02269 KRC.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3; with modified distal setae (Fig. 87D). P4 IntCox with row I of short setulae not rising above distal margin (Fig. 87E). P4 Enp3 rather long, with L/W ratio about 2.5; inner/outer spine ratio 1.4; inner spine 0.9 times as long as segment; distal setae reaching 1/2 – 2/3 of nearest spines. Reduced P5 **(**Fig. 87F) with elongated segment armed with rather weak inner spine, 1.3 times longer than segment; two setae longer than spine; length ratio beginning with spine: 1.0/1.9/1.5.

MALE unknown.

DISTRIBUTION: known only from the type locality in Slovenia, Europe.

COMMENTS: Kiefer [1932a] compares this form with two other European *Eucyclops* known at that time from underground environments, *E.* (*Sub.*) *graeteri* (Chappuis, 1927) and *E.* (*Sub.*) *subterraneus* (Graeter, 1907). He finds that they possibly are synonyms. However in several characters they do not fit well to above described species (for two above mentioned underground forms there were: presence of lateral spinules on CR, longer and not modified distal setae of swimming legs, 12-segmented A1 etc.). Detailed redescription of this interesting taxon is necessary.

84. ***Eucyclops* (*Mrazekicyclops*) *tepidus*** Kiefer, 1952 **stat.n.** Fig. 88.

SYNONYMY: *Eucyclops stuhlmanni* forma *tepidus* Kiefer, 1952; *Eucyclops* (*Mrazekicyclops*) *stuhlmanni tepidus*: Alekseev, 2019.

TYPE LOCALITY: hot mountain spring (29 °C) in Kenya, Majiya Moto (1900 m a.s.l.), East Africa.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male dissected, deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype #01972 and paratype #01973 specimens named by Kiefer as *E. stuhlmanni tepidus*; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 88A–D). Body length, without caudal setae, 600 µm. Th4 with lateral setulae. Caudal rami subparallel, short, L/W ratio about 2.5; lateral *serra* short, occupies less than half of lateral margin, composing of strong spinules slightly increasing distally; mediodorsal surface with three rows of short setulae. Dorsal seta slightly shorter than outermost seta. Outermost spiniform seta 0.6–0.7 times as long

as ramus length. Innermost seta 1.2 times longer than outermost seta.

Antennule 11-segmented, short, not reaching distal edge of CTh; 3 distal segments without visible hyaline membrane.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. In P4 IntCox, distal margin with short setulae with small gap in middle (Fig. 88C); coxal spine with long setulae proximally and short denticles distally, without gap. P4 Enp3 rather short, with L/W ratio about 1.9; inner/outer spine ratio 1.3; inner spine 1.2 times as long as segment; outer seta reaching middle of outer spine. P4 Exp3 distal spine 0.8–0.9 times as long as segment. Reduced P5 (Fig. 88D): inner spine about 1.6 times longer than segment; two setae longer than spine; length ratio beginning with spine: 1.0/1.6/1.5.

MALE (Fig. 88E). More short and slender than female. Caudal rami with three rows of spinules on medio-dorsal surface; lateral *serra* absent except few short spinules above lateral seta; lateral seta about as long as ramus width; outermost seta shorter than in female. Antennule 14-segmented. P1–P4 as in female. Reduced P5 with shorter outer seta than in female. Rudimentary P6 (see Fig. 88E): armed with strong long inner spine and twice shorter setae.

DISTRIBUTION: Kenya, East Africa.

COMMENTS: This small taxon of *Eucyclops* with 11-segmented antennules was found in a warm spring in East Africa, so its small size and shortened caudal rami may be a consequence of its hot environment. Kiefer practically does not describe it, only mentioning name and size, interpreting it as a form of the *echinatus-stulhmanni* complex [Kiefer, 1952]. The good quality of dissected specimens I found in Kiefer's collection allowed me to redescribe this taxon as a valid species rather than as a "forma *tepidus*".

7. SUBGENUS ***Eucyclops*** (***Sarsicyclops***) Alekseev, 2019

Cyclopids of variable body length and caudal rami proportions; body length 700–1200 μm and CR L/W ratio 2.7–8.4, with long or partly reduced lateral *serra*. Antennule 12-segmented, distal segments with smooth or denticulated hyaline membrane. Reduced P5 with weak and rather short inner spine, not wider than 1.5 of median seta, shorter than outer seta. It is somewhat similar to subgenus *Macrurocyclops*, in which females often have weak spine of P5 but lack lateral *serra*, which makes it easy to distinguish species of these two subgenera. In all known representatives of this subgenus, P6 males are characterized by inner spine noticeably longer than setae. The subgenus comprises 4 species, mostly inhabiting tropics.

Key to species of *Eucyclops* (*Sarsicyclops*)

1. CR short, L/W ratio about 3; lateral *serra* composed of 5–6 tiny denticles ....*E.* (*S.*) *thienemanni* Kiefer, 1930 [Java]
– CR longer 2
2. Caudal rami with L/W ratio not more than 6.. .....*E.* (*S.*) *semiserratus* (Sars G.O., 1909) [Lake Tanganyika]
– Caudal rami long with L/W ratio 6–7 or even longer 3
3. Length of adult females more than 1 mm, caudal rami with tiny spinules along lateral edge, innermost caudal seta 1.2 times longer than outermost one..... .....*E.* (*S.*) *porrectus* Kiefer, 1932 [Lake Ohrid, Northern Macedonia and Eastern Albania]
– Length of adult females less than 0.9 mm, caudal rami with strong lateral spinules, innermost caudal seta sub equal or shorter than outermost one ... *E.* (*S.*) *crassispinosus* s.lat. with 2 subspecies*: E.* (*S.*) *crassispinosus crassispinosus* Kiefer, 1932 [Burkina Faso, Africa] and *E.* (*S.*) *c.* subsp. 1 [Ethiopia, Africa]

85. ***Eucyclops*** (***Sarsicyclops***) ***semiserratus*** (Sars G.O., 1909) Fig. 89.

SYNONYMY: *Cyclops semiserratus*: Sars G.O., 1909; *Eucyclops semiserratus*: Lindberg, 1951a (part.); *Eucyclops* (*Sarsicyclops*) *semiserratus*: Alekseev, 2019.

TYPE LOCALITY: Lake Tanganyika, Africa.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: topotype female from Lake Tanganyika, collected by Prof. H. Dumont; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 89). Body length without caudal setae about 860 μm. Cephalothorax about as long as broad (Fig. 89A). Th4 with thin lateral hair-setulae. Genital double somite wider than long; gradually tapering posteriorly (Fig. 89B). Anal somite longer than preceding one, anal operculum weakly developed, convex. Caudal rami with L/W ratio about 5.5–6.0, slightly divergent, slightly widening at distal end; lateral *serra* partly reduced, occupying about half of ramus length, composed of strong spinules increas-

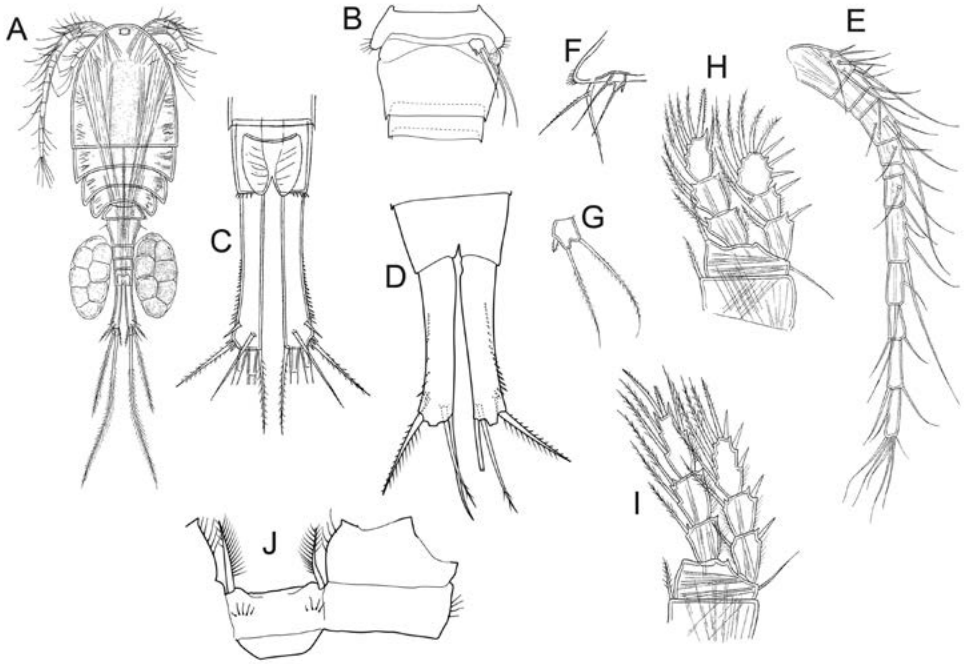

Fig. 89. *Eucyclops* (*Sarsicyclops*) *semiserratus* (Sars G.O., 1909). Female: A — habitus; B — Th4, genital double somite, P5 and P6; C, D — caudal rami, dorsal and ventral; E — A1; F — P5 and P6; G — P5; H — P1; I, J — P4. Lake Tanganyika, East Africa. A, C, E–I — after Sars G.O. [1909]; B, D, J — orig.

Рис. 89. *Eucyclops* (*Sarsicyclops*) *semiserratus* (Sars G.O., 1909). Самка: A — габитус; B — Th4, генитальный сомит, P5 и P6; C, D — каудальные ветви, дорсально и вентрально; E — A1; F — P5 и P6; G — P5; H — P1; I, J — P4. Озеро Танганьика, Восточная Африка. A, C, E–I — по Sars G.O. [1909]; B, D, J — ориг.

ing distally (Fig. 89C, D). Lateral seta not longer than ramus width, attached slightly above dorsal seta level. Outermost long and thin spiniform seta inserted close to outer middle seta, about 0.5 times as long as ramus length. Innermost and dorsal setae 1.1–1.2 times as long as outermost seta. Medial inner seta abruptly bends outwards at middle. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.5/ 8.0/ 1.1–1.2.

Antennule 12-segmented (Fig. 89A, E), relatively long, reaching distal border of Th1. A2 and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 L/W ratio about 2.3; inner/outer spine ratio about 2.0; inner spine about as long as segment; distal setae long, reaching tips of nearest spines (Fig. 89I). P4 coxal spine with naked proximal part of outer side (Fig. 89J). P4 Exp3 distal spine short, about 0.5 times as long as segment; distal seta modified, with shortened hairs. Reduced P5 (Fig. 89B, F, G) with short segment; inner spine weak, hardly reaching beyond segment distal tip; outer seta longer than medial one. Reduced P6 (Fig. 89B) armed with two small spines and one long outer seta, about as long as outer seta of P5.

MALE unknown.

DISTRIBUTION: Lake Tanganyika (endemic?).

COMMENTS: Specimens used by Lindberg [1951a] for redescription of this taxon seem like doubtful to be Sars's taxon due to clear seen differences between small and large females identified by him as the same species; also because he was describing male that was not taken from the same stations as females. That is why I do not include here his description of female and male.

Eucyclops (*Sarsicyclops*) *crassispinosus* s.lat.

Small cyclopids, length of female less than 1 mm, caudal rami rather long, subparallel, placed close to each to other, with long lateral *serra* of rather short denticles. Innermost caudal seta thin and short, subequal to spiniform outermost seta

(0.9–1.1 : 1). Antennules short just reaching to distal margin of CTh, 10–12th distal segments with smooth narrow hyaline membrane. P4 with wide, spatulate spines. Reduced P5 with weak inner spine shorter than segment; medial seta 1.5 times longer than outer one. Along with *E.* (*S.*) *crassispinosus crassispinosus* Kiefer, 1932 one more subspecies *E.* (*S.*) *c.* subsp. 1 is described hereafter on description and drawings of a specimen found by Bernard Dussart in Ethiopia and identified as *Eucyclops spatharum* Harding, 1942.

KEY TO SUBSPECIES *EUCYCLOPS* (*SARSICYCLOPS*) *CRASSISPINOSUS* S.LAT.

1. Innermost caudal seta naked; outermost caudal seta 0.5 times as long as ramus length; dorsal seta about as long as outermost one (0.9:1).. .....*E.* (*S.*) *c. crassispinosus* Kiefer, 1932
– Innermost caudal seta plumose; outermost caudal seta 0.4 times as long as ramus length; dorsal seta shorter, only about 0.7 times as long as outermost one ..... *E.* (*S.*) *c.* subsp. 1

86. ***Eucyclops* (*Sarsicyclops*) *crassispinosus crassispinosus*** Kiefer, 1932 Fig. 90.

SYNONYMY: *Eucyclops crassispinosus*: Kiefer, 1932b; Dussart, Defaye, 2006; *Eucyclops* (*Sarsicyclops*) *crassispinosus*: Alekseev, 2019.

TYPE LOCALITY: lake in Botou, Burkina Faso, West Africa.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male, dissected, deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype #01878 and paratype #01879; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 90A–F). Body length without caudal setae about 840 µm. Th4 with lateral setulae. Genital double somite with L/W ratio about 1; *receptaculum seminis* not observable in holotype. Caudal rami parallel, closely spaced (Fig. 90A, B), L/W ratio about 6.8, with long lateral *serra* almost reaching base of ramus, composing of subequal denticles slightly increasing distally. Lateral seta about as long as ramus width. Outermost spiniform seta inserted noticeably higher than outer middle seta, about 0.5 times as long as ramus length. Innermost and dorsal setae about 0.9 times as long as outermost seta.

Antennule 12-segmented, short, just reaching distal margin of CTh; with very narrow smooth hyaline membrane along three distalmost segments. Antenna basipodite ornamentation and mouth appandages not observable in holotype.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Spines are wide and lanceolate, especially in P4 (Fig. 90D, E). P4 IntCox distal margin with several setulae at sides; coxal spine homogeneously plumose (Fig. 90C). P4 Enp3 rather short, L/W ratio about 1.9; inner/outer spine ratio about 1.3; inner spine 1.3 times longer than segment; distal setae long, outer seta almost reaching and inner seta reaching beyond tips of adjacent spines (Fig. 90D). P4 Exp3 distal spine rather long, 1.1 times longer than segment (Fig. 90E). Reduced P5 (Fig. 90F): segment short and broad, armed with weak and short inner spine, shorter than segment; two setae longer than spine; medial seta 1.5 times longer than outer one.

MALE (Fig. 90G). Body length without caudal setae about 700 µm, slender than in female with shorter caudal rami. CR without lateral *serra*. Antennule 14-segmented. P1–P5 similar to female. Rudimentary P6 (see Fig. 90G) armed with long strong inner spine, reaching middle of 3rd abdominal somite, and two much shorter setae; length ratio beginning with spine:1.0/0.4/0.3.

DISTRIBUTION: found in the type locality only.

COMMENTS: Author of the taxon soon after description synonymized it with *E.* (*E.*) *acanthoides* (Douwe, 1909), and in Kiefer's collection holotype label keeps trace of this name change. There are several taxonomically important differences supporting separation of these two species that include: antennule length, P5 appendages proportions and caudal rami relative length. That is why I am confirming validity of *E.* (*S.*) *crassispinosus* Kiefer, 1932. Long caudal rami along with short innermost caudal seta and weak inner spine of P5 separate it from other congeners. Redescription, especially of A2 Bas, is required.

87. ***Eucyclops* (*Sarsicyclops*) *crassispinosus*** subsp. 1 Fig. 91.

SYNONYMY: *Eucyclops spatharum*: Dussart, 1974.

TYPE LOCALITY: River Omo, Ethiopia, East Africa.

HOLOTYPE PRESENCE AND STORING: the slide under another name "*Eucyclops spatharum*"is possibly stored in Dussart's collection in NHNM, Paris (see comments), not found yet.

MATERIAL STUDIED: Dussart [1974] description and drawings.

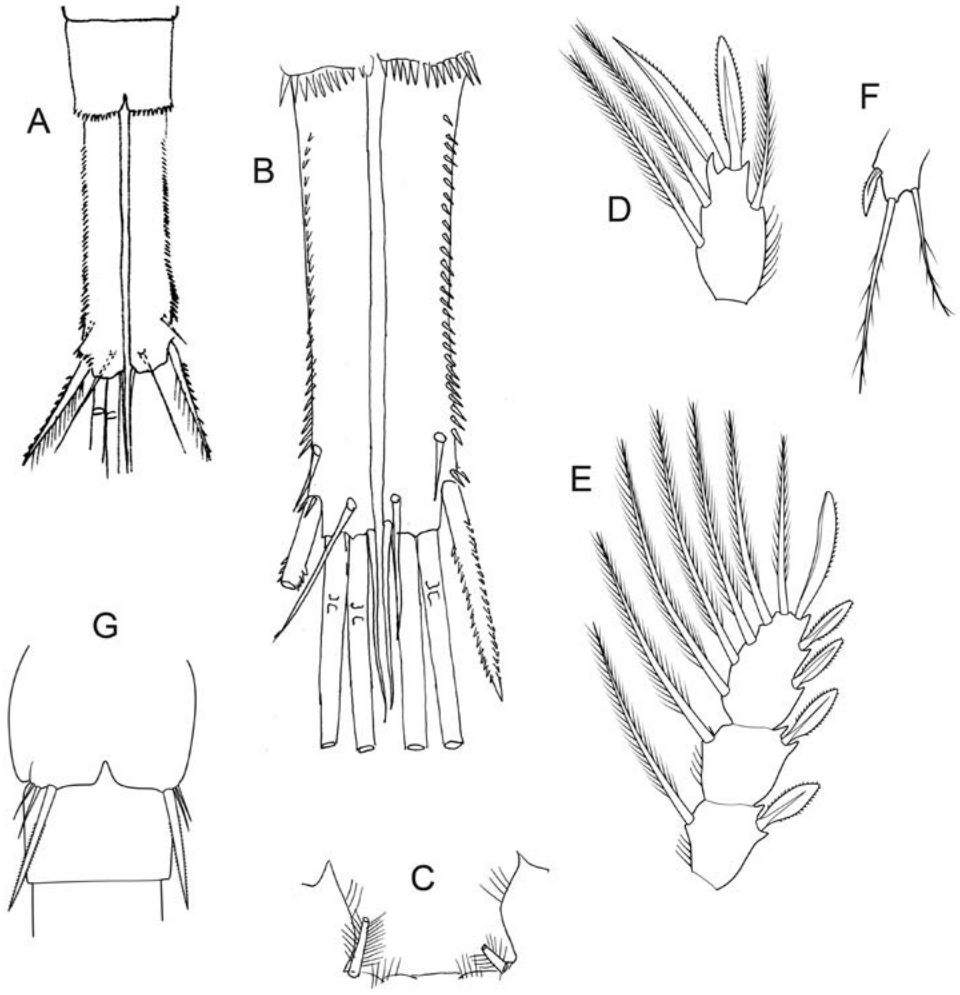

Fig. 90. *Eucyclops* (*Sarsicyclops*) *crassispinosus crassispinosus* Kiefer, 1932. A, B — caudal rami; C — P4 intercoxal plate; D — P4 Enp3; E — P4 Exp3; F — P5; G — P6. A–F — female; G — male. Burkina Faso, West Africa. A, D–G — after Kiefer [1932b]; B, C — orig., slides #01878, 01879 KRC.

Рис. 90. *Eucyclops* (*Sarsicyclops*) *crassispinosus crassispinosus* Kiefer, 1932. A, B — каудальные ветви; C — межкоксальная пластинка P4; D — P4 Enp3; E — P4 Exp3; F — P5; G — P6. A–F — самка; G — самец. Буркина-Фасо, Западная Африка. A, D–G — по Kiefer [1932b]; B, C — ориг., преп. #01878, 01879 KRC.

DESCRIPTION. FEMALE (Fig. 91). Body length without caudal setae 850 μm. Cephalothorax elongated: L/W ratio about 1.2 (Fig. 91A). Th4 with setulae laterally. Genital double somite shorten, with L/W ratio about 0.9; r*eceptaculum seminis* typical of genus, with smaller anterior part (Fig. 91B). Anal operculum weakly developed, convex. Caudal rami subparallel, with L/W ratio about 6, with long lateral *serra* of short but strong spinules gradually increasing in size distally (Fig. 91C). Lateral caudal seta about as long as ramus width. Outermost seta spiniform, long and thin, with denticulate outer edge and hairs on inner edge, about 0.4 times as long as caudal ramus length; inserted noticeably higher than outer middle seta. Dorsal seta about 0.7 times as long as outermost seta. Weakly plumose innermost seta about as long as outermost one or slightly shorter. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.5/ 7.5/ 0.9–1.0.

Antennule 12-segmented, not reaching distal edge of CTh; with narrow smooth hyaline mem-

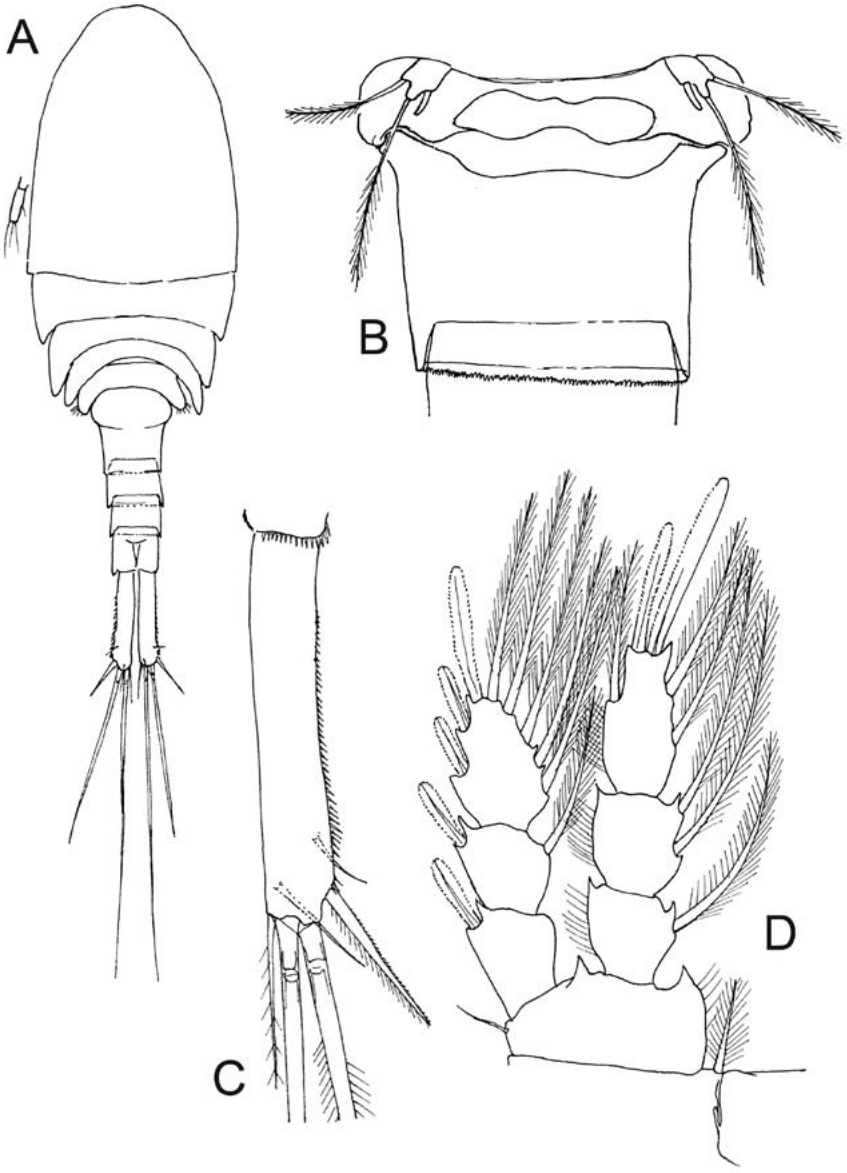

Fig. 91. *Eucyclops* (*Sarsicyclops*) *crassispinosus* subsp.1. Female: A — habitus; B — Th4, genital double somite and P5; C — caudal ramus, ventral; D — P4. Ethiopia, East Africa. A, D–G — after Dussart [1974].

Рис. 91. *Eucyclops* (*Sarsicyclops*) *crassispinosus* subsp.1. Самка: A — габитус; B — Th4, генитальный сомит и P5; C — каудальная ветвь, вентрально; D — P4. Эфиопия, Восточная Африка. A, D–G — по Dussart [1974].

brane along three distalmost segments. Antenna and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Spines are wide and lanceolate, especially in P4 (Fig. 91D). P4 Enp3 L/W ratio about 1.9; inner/outer spine ratio about 1.4; inner spine 1.3 times longer than segment; distal setae almost reaching tips on nearest spines. P4 Exp3 distal spine as long as segment. P4 IntCox not described; coxal spine homogeneously plumose.

Reduced P5 (Fig. 91B): segment short and broad, armed with weak and short inner spine, shorter than segment; two setae longer than spine; medial seta 1.5 times longer than outer one.

MALE unknown.

DISTRIBUTION: Ethiopia, East Africa.

COMMENTS: This form, after obtaining material that is possibly saved at MNHN copepod collection in Paris, will allow to establish the holotype and described it as a new taxon. It is planned to name it as *bernardi* after Prof. Bernard Dussart who made such a significant contribution in African Copepod fauna investigation. In female specimen found in Ethiopia, he observed short A1, long caudal rami slightly widen in distal end, short innermost seta and identified it as *Eucyclops spatharum* Harding, 1942. Harding's species meanwhile has strong inner spine and short setae in P5 and several other characters of subgenus *Eucyclops* (*Eucyclops*). Based on P5 construction (short and weak spine) and long caudal rami with long lateral *serra*, this form belongs to subgenus *Eucyclops* (*Sarsicyclops*) and is close to *E.* (*S.*) *crassispinosus* s.str. Redescription is required, especially of ornamentation of A2 Bas and P4.

88. ***Eucyclops* (*Sarsicyclops*) *porrectus***
Kiefer, 1932
Fig. 92.

SYNONYMY: *Eucyclops porrectus*: Kiefer, 1932a; Dussart, Defaye, 2006; *Eucyclops* (*Sarsicyclops*) *porrectus*: Alekseev, 2019.

TYPE LOCALITY: Lake Ohrid, Southeastern Europe.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male, dissected, deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype female #01979 and paratype male #01986; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 92A, B). Body length without caudal setae 1200 μm. Habitus similar to *E.* (*D.*) *macruroides*. Th4 with long lateral setulae. Genital double somite wide anteriorly, then sharply narrows; r*eceptaculum seminis* typical of genus. Posterior borders of abdominal somites strongly serrated. Caudal rami subparallel, long, with L/W ratio 8.0–8.4, with long lateral *serra* of short subequal spinules. Lateral caudal seta about as long as ramus width, inserted much higher than dorsal seta. Outermost seta strong, spiniform, with denticulate outer edge and naked on inner edge, about 0.4 times as long as caudal ramus length; inserted close to outer middle seta. Dorsal seta about as long as outermost seta. Innermost seta about 1.3 times as long as outermost one.

Antennule 12-segmented, reaching middle of Th1; with narrow smooth hyaline membrane along three distalmost segments. Antenna and mouth appendages not observed. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. Spines and setae of normal appearance. P4 Enp3 rather long, with L/W ratio about 2.5; inner/outer spine ratio about 1.4; inner spine slightly longer than segment. Reduced P5 (Fig. 92B): segment rather short; inner spine weak, curved, 1.3 times longer than segment; both setae longer than spine; length ratio beginning with spine: 1.0/2.0/ 1.4.

MALE (Fig. 92C–F). Body length without caudal setae 900 μm. Th4 without lateral setulae. Caudal rami shorter than in female (Fig. 92C), with L/W ratio nearly 6.9–7.3, lateral *serra* absent excluding few short setulae above lateral seta. Antennule 14-segmented. P4 Enp3 shorter than in female, with L/W ratio about 2.3; inner/outer spine ratio as in female; inner spine 1.3 times longer than segment. P4 Coxa caudal ornamentation as in Fig. 92E. P5 armed with weak inner spine about as long as segment. Rudimentary P6 (Fig. 92F) armed with very short appendages; length ratio beginning with spine: 1.0/0.4/0.6.

DISTRIBUTION: known only from the type locality: Lake Ohrid, N.Macedonia/Albania, Southeastern Europe.

COMMENTS: Proportions of habitus and weak inner spine of P5 in this taxon remind *Eucyclops* (*D.*) *macruroides* (Lilljeborg, 1901), but *E.* (*S.*) *porrectus* clearly stands separate from the last by smooth hyaline membrane on distal segments of A1. Redescription of it is required.

89. ***Eucyclops* (*Sarsicyclops*) *thienemanni***
Kiefer, 1930
Fig. 93.

SYNONYMY: *Eucyclops thienemanni*: Kiefer, 1930; Dussart, Defaye, 2006.

TYPE LOCALITY: pond in Jakarta, island Java, Indonesia, Asia.

HOLOTYPE PRESENCE AND STORING: female holotype and 3 paratypes deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: female holotype #01786 and male paratype #01788; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 93A–H). Body length without caudal setae 700–800 μm.

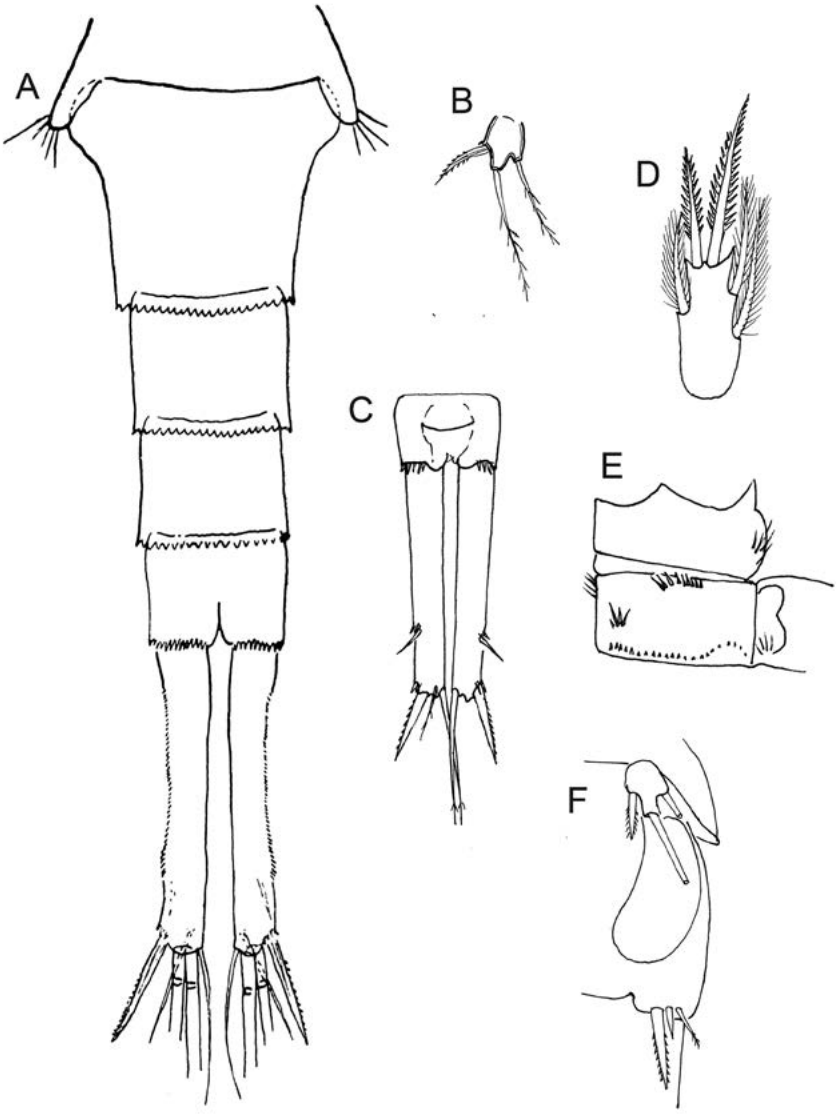

Fig. 92. *Eucyclops* (*Sarsicyclops*) *porrectus* Kiefer, 1932. A — abdomen; B — P5; C — caudal rami; D — P4 Enp3; E — P4 coxa, basipodite and intercoxal plate, caudal; F — P5 and P6. A, B — female; C–F — male. Lake Ohrid, Southeastern Europe. A, B — after Kiefer [1932a] C–F — orig., slide #01986 KRC.

Рис. 92. *Eucyclops* (*Sarsicyclops*) *porrectus* Kiefer, 1932. A — абдомен; B — P5; C — каудальные ветви; D — P4 Enp3; E — кокса, базиподит и межкоксальная пластинка P4, каудально; F — P5 и P6. A, B — самка; C–F — самец. Охридское озеро, Юго-Восточная Европа. A, B — по Kiefer [1932a]; C–F — ориг., преп. #01986 KRC.

Th4 with lateral setulae. Genital double somite slightly wider than long; *receptaculum seminis* typical of genus. Caudal rami subparallel, short (Fig. 93B, C); L/W ratio 2.7–2.9, with short lateral *serra* of tiny denticles. Lateral seta not longer than caudal ramus width, inserted slightly higher than dorsal seta. Dorsal seta slightly shorter than outermost seta. Outermost seta spiniform, with denticulate outer side and hairs on inner side, about 0.8 times as long as caudal ramus length; inserted close to outer middle seta. Innermost seta plumose, about 1.2 times as long as outermost one. Distal

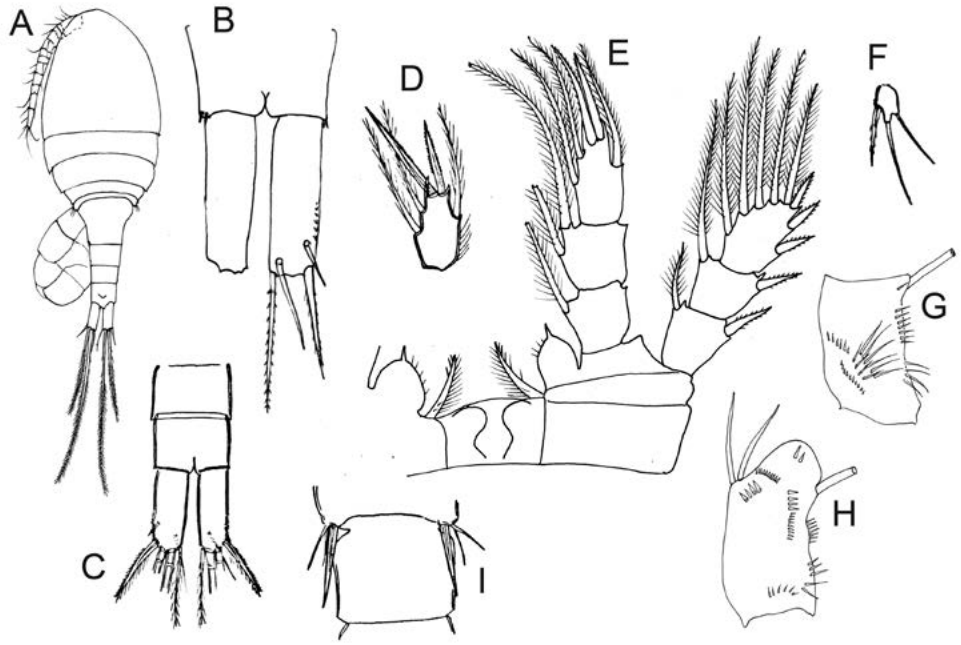

Fig. 93. *Eucyclops* (*Sarsicyclops*) *thienemanni* Kiefer, 1930. A — habitus; B, C — caudal rami; D — P4 Enp3; E — P4; F — P5; G — A2 Bas, caudal; H — A2 Bas, frontal; I — P6. A–H — female; I — male. Java, Asia. A, B, E, G, H — orig., slides #01786, 01787 KRC; C, D, F, I — after Kiefer [1930].

Рис. 93. *Eucyclops* (*Sarsicyclops*) *thienemanni* Kiefer, 1930. A — габитус; B, C — каудальные ветви; D — P4 Enp3; E — P4; F — P5; G — A2 Bas, каудально; H — A2 Bas, фронтально; I — P6. A–H — самка; I — самец. Ява, Азия. A, B, E, G, H — ориг., преп. #01786, 01787 KRC; C, D, F, I — по Kiefer [1930].

setae approximate length ratio beginning with outermost: 1.0/ 6.0/ 10.5/ 1.2.

Antennule 12-segmented, short, just reaching distal edge of CTh; 3 distal segments with very narrow smooth hyaline membrane. A2 Bas without distal groups N1, 2; group N3 presented by very long setulae; other groups as in Fig. 93H, G.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 short, with L/W ratio about 1.6–1.8; inner/outer spine ratio 1.3–1.4; inner spine 1.3–1.5 as long as segment; distal setae long, reaching tips of nearest spines. P4 Exp3 distal spine short, about 0.5 times as long as segment, not longer than other spines. P4 IntCox ornamentation not observable in holotype; coxal spine with naked proximal part of outer side. Reduced P5 (Fig. 93F) armed with rather weak inner spine, about 1.6 times longer than segment and about as long as outer seta; medial seta 1.4 times longer than spine.

MALE (Fig. 93I). Body length without caudal setae slightly shorter than in female, 660–720 µm. Th4 without lateral seta. Caudal rami L/W ratio 2.3–2.6, without lateral *serra*. P1–P4 as in female. P5 similar to female, but with shorter inner spine. Rudimentary P6 (See Fig. 93I) armed with strong inner spine, almost reaching distal margin of next somite; both subequal setae about 0.6 times as long as spine.

DISTRIBUTION: Indonesia, Australia (?).

COMMENTS: In some respects (elongated setae in P4 Enp3 and strongly reduced caudal serra) this species is close to *Subterrocyclops*. I had hoped to redescribe this small form from the type locality, but intensive sampling of waterbodies in Jakarta (Java) was unfortunately unsuccessful. This rare species needs to be redescribed and possibly moved to another subgenus.

8. SUBGENUS ***Eucyclops*** (***Speratocyclops***) Alekseev, 2019

Medium cyclopids from 700 to 1400 µm. Antennule 12-segmented, reaching distal margin of CTh or Th1, with smooth hyaline membrane on three distal segments. Th4 with group of long setulae laterally. Genital double-somite about as

long as broad. Caudal rami of different length with L/W ratio from 3.2 to 9, with more or less developed lateral *serra* of rather short spinules. A2 Bas without distal groups of long setulae N1, 2. P4 Enp3 rather long, with L/W ratio 2.2–2.5, distal setae not reaching beyond tips of nearest spines. P5 with strong inner spine. The subgenus includes 9 taxa, inhabiting Palaearctic and Tropics of The Old World. Subgenera *Eucyclops* and *Speratocyclops* are close (A1 with smooth hyaline membrane, strong inner spine of P5, caudal rami with rather long *serra*). The main difference that separates these subgenera is missing or presence of hair-like setulae in A2 Bas distally (groups N1, 2). Some species show intermediate appearance of this character such as *E.* (*E.*) *pectinifer* (Cragin, 1883) and several other taxa from North America which have group N1 of hairs and N2 as of short spinules. In most taxa of *Speratocyclops*, groups N1 and N2 are missing or can be reduced to short setulae. Subgenus includes 8 species.

Key to subgenus *Eucyclops* (*Speratocyclops*) species

1. Caudal rami long, L/W ratio about 6 and more 2
– CR with L/W ratio less than 6..... 3
2. P4 IntCox distal margin with dense long hairs; P4 Exp3 distal spine subequal or longer than segment ..... *E.* (*Sp.*) *speratus speratus* (Lilljeborg, 1901) [Palaearctic]
– P4 IntCox distal margin with rare short hairs; P4 Exp3 distal spine shorter than segment ... . *E.* (*Sp.*) *productus* Kiefer, 1939 [Northern India, Tibetan Plateau]
3. CR with innermost seta shorter than outermost seta ..... *E.* (*Sp.*) *leschermoutouae* Alekseev et Defaye, 2004 [well in Balearic Islands, Europe]
– CR with innermost seta subequal or longer than outermost seta 4
4. CR with innermost seta slightly longer than outermost one, length ratio about 1.0–1.2 . 5
– CR with innermost seta more longer than outermost one, length ratio about 1.4–1.6 6
5. CR subparallel; P4 IntCox distal margin with rare short hairs .... *E.* (*Sp.*) *speratus azorensis* Defaye et Dussart, 1991 comb.n.[Azores]
– CR divergent; P4 IntCox distal margin with dense strong spinules . *E.* (*Sp.*) *arcanus* s.lat. with 2 subspecies: *E.* (*Sp.*) *arcanus arcanus* Alekseev, 1990 [Eastern Siberia, Mongolia, Far East of Russia, Northern China] and *E.* (*Sp.*) *a. arcticus* Alekseev, 2022 [Arctic zone of Eurasia,]
6. CR with long outermost spine, spine/ramus length ratio about 0.8; P4 Bas inner outgrowth without visible hairs..... .....*E.* (*Sp.*) *dumonti* Alekseev, 2000 [Eastern Siberia, Mongolia, China, Thailand]
– CR with shorter outermost spine, spine/ramus length ratio about 0.5–6; P4 Bas inner outgrowth with hairs 7
7. P4 IntCox distal margin with dense long hair-setulae without central gap ....*E.* (*Sp.*) *biwensis* s.lat. with 2 subspecies: *E.* (*Sp.*) *b. biwensis* Ishida, 1998 [Lake Biwa endemic?] and *E.* (*Sp.*) *b. ohtakai* Ishida, 2000 comb.n. [Japan]
– P4 IntCox distal margin with short spinules which may not rise above distal margin 8
8. Lateral *serra* composed of small short teeth of equal size; P4 coxal spine with dense thin hairs ..... *E.* (*Sp.*) *troposperatus* Alekseev et Yusoff, 2013 [Indonesia]
– Lateral *serra* composed rather strong spinules, increasing in size distally; P4 coxal spine with strong setulae on both sides, long proximally and decreasing in length distally ....*E.* (*Sp.*) *delongi* Alekseev, Abramova et Chaban, 2019 [East Siberia]

Eucyclops* (*Speratocyclops*) *speratus s.lat.

Medium size cyclopids with female body length about 800–1400 μm. CR with lateral *serra* composed of tiny, subequal denticles; *serra* length even within the same population or even in the same individual (bilateral asymmetry) variable. Innermost caudal seta 1.2−1.5 times longer than outermost one, dorsal seta shorter than outermost seta. P4 coxal spine/seta without gap on outer side. Reduced P5 with long inner spine twice longer than segment and subequal or longer than outer seta. Species inhabits Palaearctic and comprises two geographically isolated subspecies *E.* (*Sp.*) *speratus speratus* (Lilljeborg, 1901), *E.* (*Sp.*) *s. azorensis* Dussart et Defaye, 1991 comb.n.

90. ***Eucyclops* (*Speratocyclops*) *speratus speratus*** (Lilljeborg, 1901)
Fig. 94.

SYNONYMY: *Cyclops varius* var. *speratus* Lilljeborg, 1901; *Cyclops agilis speratus*: Gurney, 1933; *Leptocyclops speratus*: Sars G.O., 1914; *Eucyclops serrulatus* var *speratus*: Rylov, 1948; *Eucyclops speratus*: Monchenko, 1974; Einsle, 1993; Alekseev *et al*., 2006;

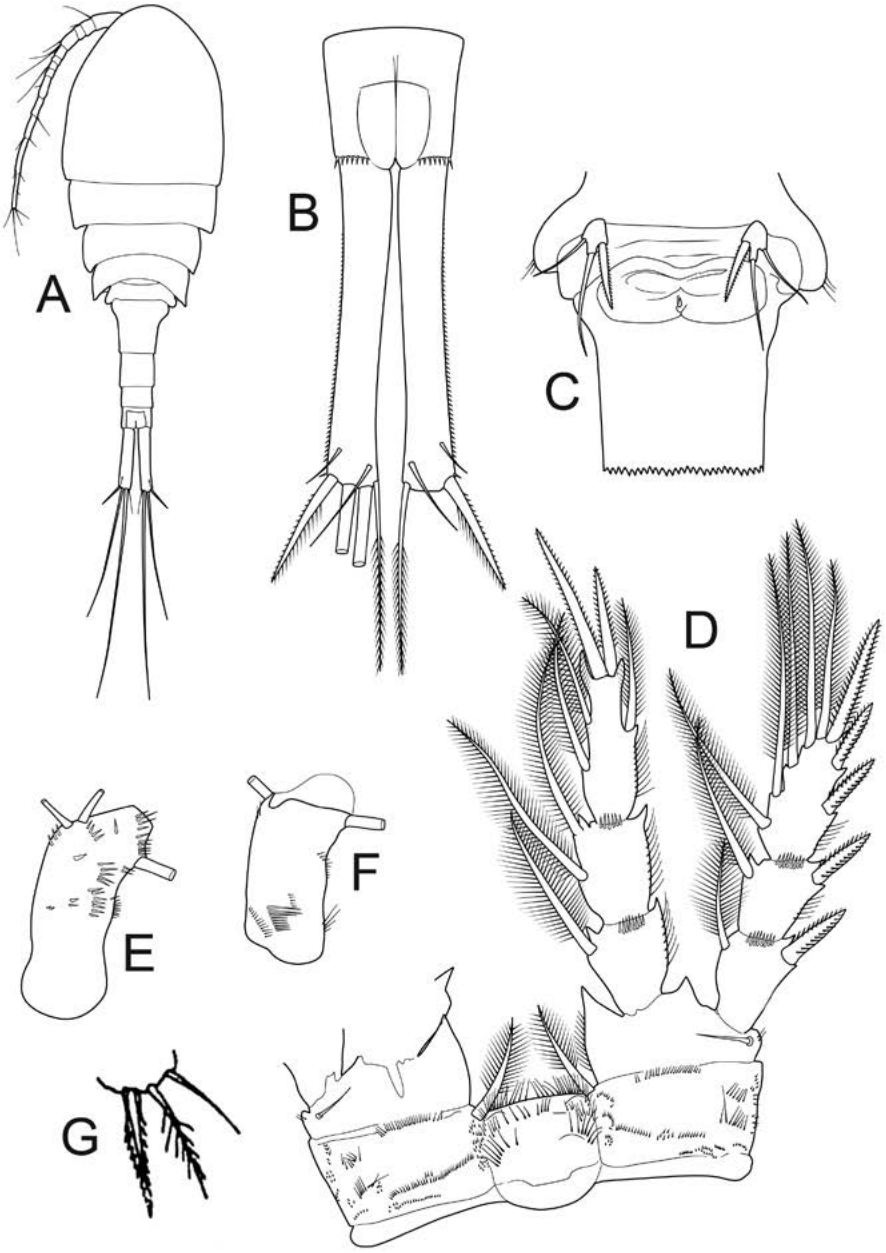

Fig. 94. *Eucyclops* (*Speratocyclops*) *speratus speratus* (Lilljeborg, 1901). A — habitus; B — caudal rami, dorsal; C — Th4, genital double somite and P5; D — P4, caudal; E — A2 Bas, frontal; F — A2 Bas, caudal; G — P6. A–F — female; G — male. Northern Europe. A–F — orig., G — after Einsle [1993].

Рис. 94. *Eucyclops* (*Speratocyclops*) *speratus speratus* (Lilljeborg, 1901). A — габитус; B — каудальные ветви, дорсально; C — Th4, генитальный сомит и P5; D — P4, каудально; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — P6. A–F — самка; G — самец. Северная Европа. A–F — ориг., G — по Einsle [1993].

Dussart, Defaye, 2006; *Eucyclops* (*Speratocyclops*) *speratus*: Alekseev, 2019.

TYPE LOCALITY: small river in vicinity of Lund, Sweden.

HOLOTYPE PRESENCE AND STORING: NHM of Lund, Sweden holotype from Lilljeborg's collection not found

MATERIAL STUDIED: specimens from the type locality, various populations across Eurasia, including specimens identified by F. Kiefer from KRC, Karlsruhe, Germany.

DESCRIPTION. FEMALE (Fig. 94). Body length without caudal setae 1000–1400 μm. Cephalosome as long as broad (Fig. 94A). Th4 with lateral setulae. Genital double somite as long as broad, wide anteriorly then sharply narrows; *receptaculum seminis* typical of genus (Fig. 94C). Anal operculum weakly developed, almost straight. Caudal rami (Fig. 94B) subparallel or slightly divergent, with L/W ratio about 7 (6–8); with lateral *serra* of variable length (even in one population) composed of small subequal spinules. Lateral seta about as long as ramus width. Outermost spiniform seta strong and relatively short, inserted close to outer middle seta, about 0.4 times as long as ramus length; with denticulate outer edge and hairs on inner edge. Dorsal seta 0.7–0.8 times as long as outermost seta. Innermost seta plumose, about 1.5 times as long as outermost one. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.5/ 7.0/ 1.5.

Antennule 12-segmented, reaching posterior border of Th1, with smooth hyaline membrane on 3 distal segments. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 94F; frontal surface as in Fig. 94E. Mouth appendages typical of genus; maxillulary palp with short row of denticles.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.5; inner spine 1.4 times longer than outer one and 1.1 times longer than segment; distal setae reaching 2/3 of nearest spines (Fig. 94D). In population from type locality, distal setae of P4 Enp and Exp modified, with shortened setulae distally. P4 Exp3 distal spine 1.1 times longer than segment; distal seta reaching beyond distal spine. P4 IntCox caudal surface with three rows of long, thin hairs, distal row without gap in middle; coxal spine/seta homogeneously plumose. Coxa caudal surface as in Fig. 94D. P1–P4 Bas inner outgrowth with long thin hairs.

Reduced P5 (Fig. 94C) with elongated segment armed with strong and rather long inner spine and two setae; inner spine twice longer than segment; outer seta about as long as spine or shorter; medial seta about 1.3 times longer than spine (type locality).

MALE (Fig. 94G). Body length without caudal setae 750–900 μm. Caudal rami shorter than in female with L/W ratio 4–6, without lateral *serra*. Antennules 14-segmented. Reduced P5 as in female. Rudimentary P6 with strong inner spine and 2 weak setae about as long as spine.

DISTRIBUTION: Europe, Northern Africa and Asia: Siberia, Japan, Mongolia, China (Hopei), Iran, Turkey, possibly, all Palaearctic and partly in tropical Asia (India, as an invader?).

COMMENTS: At first, this taxon was described as a subspecies of *E.* (*E.*) *serrulatus* but Sars [1914] defines it as a valid species. Monchenko [1974] and Einsle [1993] follow him, while others including Gurney [1933] and Rylov [1948] support its subspecies status. The final solution came from hybridization experiments that show isolation of it from *E.* (*E.*) *serrulatus* [Monchenko *et al*., 2011]. After recent revision these two *Eucyclops* species became members of different subgenera [Alekseev, 2019]. Missing of two groups of hairs on antennal basipodite in position N1 and N2, homogeneously plumose inner coxal spine/seta in P4, smooth hyaline membrane in 10–12 segments of antenna, strong inner spine in P5 and long caudal rami with lateral *serra* of tiny equal in size spinules — this complex of characters separates this taxon from other congeners.

91. ***Eucyclops* (*Speratocyclops*) *speratus azorensis*** Defaye et Dussart, 1991 **comb.n**. Fig. 95.

SYNONYMY: *Eucyclops agiloides azorensis*: Defaye, Dussart, 1991; *Eucyclops* (*Eucyclops*) *agiloides azorensis*: Alekseev, 2019; *Eucyclops azorensis*: Holynska *et al*., 2021.

TYPE LOCALITY: small pond on Azores islands, Portugal.

HOLOTYPE PRESENCE AND STORING: female holotype and numeral adult paratypes in Dussart's collection NHHM, Paris.

MATERIAL STUDIED: holotype and paratypes, authors' description and drawings, redescription of Holynska *et al*. [2021].

DESCRIPTION. FEMALE (Fig. 95A–I). Body length without caudal setae 780−1120 μm. Th4 with lateral setulae (Fig. 95C). Genital double somite as long as or slightly shorter than broad, wide anteriorly then sharply narrows; *receptaculum seminis* typical for genus (Fig. 95C). Abdominal somites often with shallow pits (Fig. 95A).

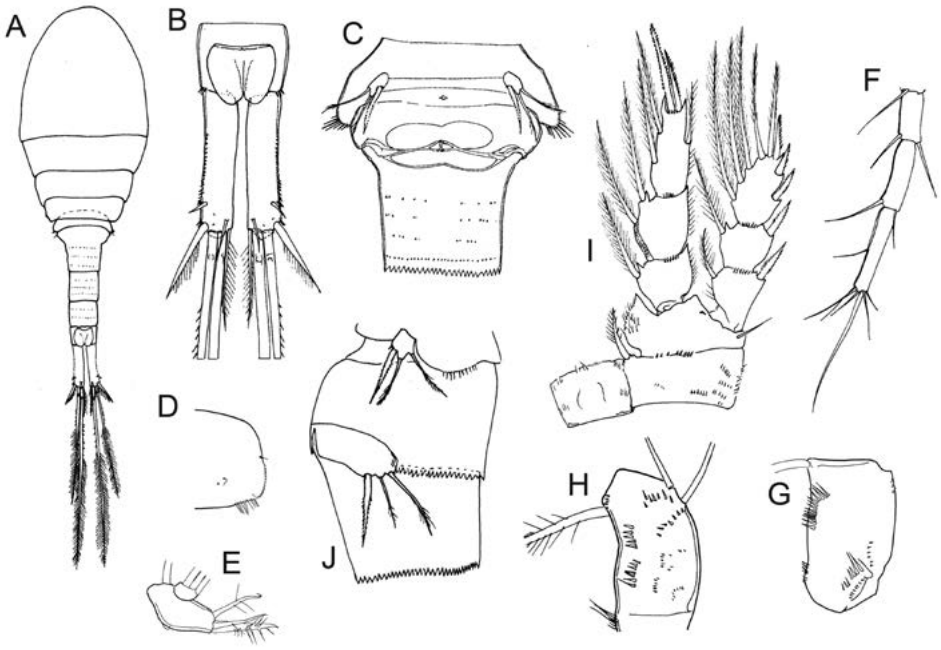

Fig. 95. *Eucyclops* (*Speratocyclops*) *speratus azorensis* Defaye et Dussart, 1991 comb.n. A — habitus; B — caudal rami; C — Th4, genital double somite and P5; D — Th3 lateral edge; E — maxillulary palp; F — A1, three distal segments; G — A2 Bas, caudal; H — A2 Bas, frontal; I — P4, caudal; J — P5 and P6. A–I — female; J — male. Azores. A–C, F, I, J — after Defaye & Dussart [1991]; D, E, G, H — after Holynska *et al*. [2021].

Рис. 95. *Eucyclops* (*Speratocyclops*) *speratus azorensis* Defaye et Dussart, 1991 comb.n. A — габитус; B — каудальные ветви; C — Th4, генитальный сомит и P5; D — латеральный край Th3; E — пальп максиллулы; F — A1, три дистальных членика; G — A2 Bas, каудально; H — A2 Bas, фронтально; I — P4, каудально; J — P5 и P6. A–I — самка; J — самец. Azores. A–C, F, I, J — по Defaye & Dussart [1991]; D, E, G, H — по Holynska *et al*. [2021].

Anal operculum weakly developed, nearly straight. Caudal rami (Fig. 95B) slightly divergent, with L/W ratio 3.5−4.5; with lateral *serra* extending to anterior 1/3−1/5 of ramus, composed of small subequal denticles. Lateral seta not longer than ramus width. Outermost spiniform seta inserted close to outer middle seta, 0.6−0.7 times as long as ramus length; with denticulate outer edge and hairs on inner edge. Dorsal seta shorter than outermost seta. Innermost seta plumose, about 1.2 times as long as outermost one. Distal setae approximate length ratio beginning with outermost: 1.0/ 5.5/ 8.5/ 1.2.

Antennule 12-segmented, extending slightly beyond distal edge of CTh; with smooth hyaline membrane on 3 distal segments. A2 Enp setation: 1, 9, 7. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 95G; frontal surface as in Fig. 95H. Mouth appendages typical of genus; maxillulary palp without denticles.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.2; inner spine 1.4–1.5 times longer than outer one and 1.1 times longer than segment; distal setae not reaching beyond tips of nearest spines (Fig. 95I). P4 Exp3 distal spine short, only about 0.6 times as long as segment. P4 IntCox caudal surface with rare thin short hairs at distal margin (row I) and few hairs at sides near coxal segments (II–III); coxal spine on inner margin with long setulae proximally and shorter spinules distally, outer margin with short setulae.

Reduced P5 (Fig. 95C) with elongated segment armed with strong and rather long inner spine and two setae; inner spine twice longer than segment; medial and outer setae about as long as spine.

MALE (Fig. 95J). Body length without caudal setae 690–890 μm. Caudal rami shorter than in female, parallel and without *serra* except few

denticles above lateral seta. P1–4 similar to female. Reduced P5 similar to female, but both setae slightly shorter than inner spine. Rudimentary P6 with strong inner spine, but not reaching distal margin of next abdominal somite, and two plumose setae; medial seta shorter than spine (0.7–0.8: 1), outer seta subequal to spine.

DISTRIBUTION: Azores islands, Madeira?

COMMENTS: Authors describe their taxon as subspecies of *Eucyclops* (*E.*) *agioides* and separate it from nominal species as well as from *E. serrulatus* based on habitus shape, length of the last antennular segment, width of inner spine in P5, and size of denticles composing lateral *serra*. All these characters as well as their combination are common among many *Eucyclops* (*Eucyclops*) taxa. Caudal rami L/W ratio is also known to be variable in *serrulatus*-group. More significant character separating their taxon from *E.* (*E.*) *serrulatus* is inner coxal spine structure with absence of gap among setulae on outer side. Holynska *et al*. [2021] observed the type material of this form and described A2 Bas as missing distal groups NN1, 2. After checking holotype and paratype specimens stored in Dussart's collection in NHHM in Paris, I found the same. Which is the reason to move this taxon to subgenus *Eucyclops* (*Speratocyclops*). Comparing this form with *E.* (*Sp.*) *speratus* and several other species of this subgenus, I find the nominal taxon as closest to it, and not *E.* (*Sp.*) *leschermoutouae*, as Holynska *et al*. [2021] suggested. The last taxon due to so significant peculiarity as innermost caudal seta shorter than outermost seta as well as several other differences is separated both from *E.* (*Sp.*) *s. azorensis* and *E.* (*Sp.*) *s. speratus.* These details are discussed below in comments to *E.* (*Sp.*) *leschermoutouae*. At the same time, the specimens from Algeria used in Holynska et al. redescription [2021] are, in my opinion, too different to be considered as the same species.

Eucyclops* (*Speratocyclops*) *arcanus s.lat.

Females of moderate size with body length without caudal setae about 1.0 mm. *Receptaculum seminis* with wide lateral lobes. Caudal rami divergent and relatively short with L/W ratio about 3.2−3.7. Innermost caudal seta subequal or slightly longer than outermost one. Dorsal seta shorter than outermost seta. Antennule 12-segmented, long, reaching Th2; 3 distal segments with smooth hyaline membrane. A2 Bas on caudal side without hair-setulae in positions N1, 2. Coxal spine P4 homogeneously covered with rare strong setulae. It includes two geographically separated subspecies.

KEY TO *EUCYCLOPS* (*SPERATOCYCLOPS*) *ARCANUS* S.LAT. SUBSPECIES

1. P4 Enp3 distal setae rather short, reaching middle of nearest spines; P4 Exp3 distal spine slightly longer than segment and about as long as distal seta .... *E.* (*Sp.*) *arcanus arcanus* Alekseev, 1990 [Central and Eastern Siberia, Kamchatka]
– P4 Enp3 setae longer and nearly reaching tips of nearest spines; P4 Exp3 distal spine shorter than segment and almost twice shorter than distal seta .... *E.* (*Sp.*) *a. arcticus* Alekseev, 2022 [Arctic zone in Russia]

92. ***Eucyclops* (*Speratocyclops*) *arcanus arcanus*** Alekseev, 1990
Fig. 96.

SYNONYMY: *Eucyclops arcanus*: Alekseev, 1990; Dussart, Defaye, 2006; *Eucyclops* (*Speratocyclops*) *arcanus*: Alekseev, 2019.

TYPE LOCALITY: forest lake Saga-Nur in Baikal vicinity, Eastern Siberia, Russia.

HOLOTYPE PRESENCE AND STORING: holotype female dissected in one slide #54968, male paratype #54969 deposited in Federal collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: holotype and paratype specimens #34969, author's description and drawings, specimens from other localities in Siberia (Lena River delta, Bolshezemelskaya tundra, Russia).

DESCRIPTION. FEMALE (Fig. 96A–D, F, G). Body length without caudal setae about 1000 μm, brownish color. Cephalothorax close to oval. Th4 with strong long lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical for genus (Fig. 96A). Abdominal somites on ventral side with serrated posterior margin. Anal operculum weakly developed, slightly convex. Caudal rami divergent, rather short with L/W ratio about 3.5 (3.3−3.7); lateral *serra* produced by dense spinules of almost equal size, slightly increasing in length distally, proximally bending to ventral surface. Lateral seta about as long as ramus width. Spiniform outermost seta inserted close to outer middle seta and quite long (0.7 times as long as ramus length). Innermost seta relatively short, 1.0−1.2 times as long as outermost seta. Dorsal seta about 0.8 times as long as outermost seta.

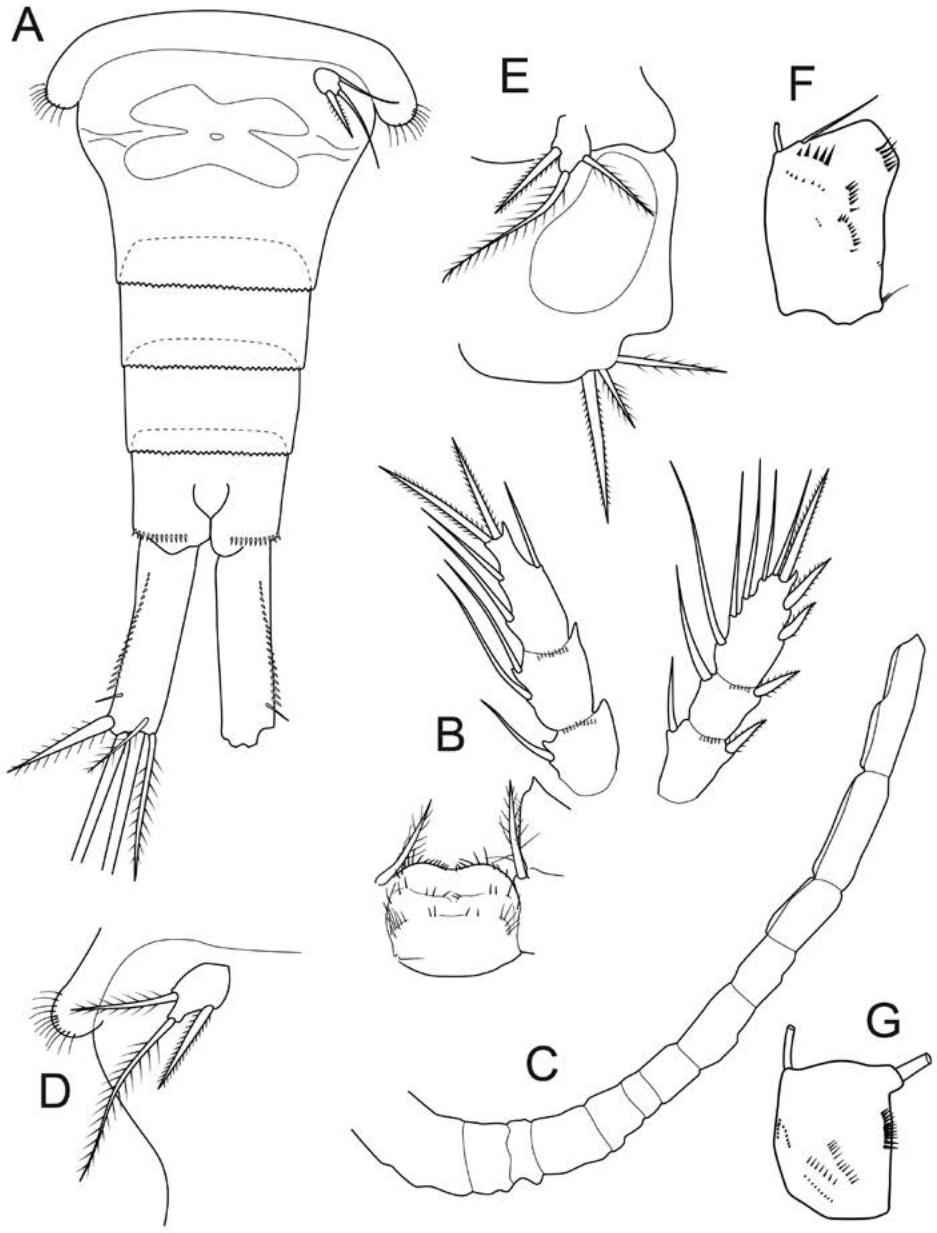

Fig. 96. *Eucyclops* (*Speratocyclops*) *arcanus arcanus* Alekseev, 1990. A — abdomen; B — P4; C — A1; D — P5; E — P5 and P6; F — A2 Bas, frontal; G — A2 Bas, caudal. A–D, F, G — female; E — male. Eastern Siberia, Russia. A–E — after Alekseev [1990]; F, G — orig., holotype.

Рис. 96. *Eucyclops* (*Speratocyclops*) *arcanus arcanus* Alekseev, 1990. A — абдомен; B — P4; C — A1; D — P5; E — P5 и P6; F — A2 Bas, фронтально; G — A2 Bas, каудально. A–D, F, G — самка; E — самец. Восточная Сибирь, Россия. A–E — по Alekseev [1990]; F, G — ориг., голотип.

Antennules 12-segmented, reaching Th2; 3 distal segments with smooth hyaline membrane. A2 Bas without distal groups N1, 2 (Fig. 96G). Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.5; inner spine 1.1–1.2 times longer than outer one and subequal to segment; distal setae reaching middle of nearest spines. P4 Exp3 distal spine longer than more proximal spines and about 1.1 times as long as segment; distal seta about as long as distal spine. P4 IntCox caudal surface with three rows of spinules (Fig. 96B); coxal spine with strong setulae on both sides, long proximally and decreasing in length distally; Bas inner outgrowth with rare short hairs. Reduced P5 (Fig. 96D): segment elongated, L\W ratio 1.3; inner spine strong, about 1.7 times longer than segment and about as long as outer seta; medial seta 1.3–1.7 times as long as inner spine. Rudimentary P6 presented with bent seta and 2 short spines.

MALE (Fig. 96E). Body length without caudal setae about 700 μm. Caudal rami shorter than in female with L/W ratio about 3. Antennule 14-segmented. P1–P5 similar to female. Rudimentary P6 (see Fig. 96E) with strong inner spine about as long as outer seta, medial seta shorter than spine.

DISTRIBUTION: East Asia: Baikal vicinity, River Lena Delta, Sakhalin, Kamchatka? Northern Ural Mts (Vorkuta distr.); Arctic belt of Eurasia?

COMMENTS: This species was found at first in Eastern and Central Siberia, but later on Ishida [2002] identified it in Kamchatka. Morphologically all the local and distant populations were very close.

93. ***Eucyclops*** (***Speratocyclops***) ***arcanus arcticus*** Alekseev, 2022
Fig. 97

SYNONYMY: *Eucyclops* (*Speratocyclops*) *arcanus arcticus*: Alekseev, 2022; *Eucyclops arcanus*: Alekseev, 1990 (part.); *Eucyclops* (*Speratocyclops*) *arcanus*: Alekseev, 2019 (part.).

TYPE LOCALITY: small lake in tundra near Vorkuta, northwestern Russia.

HOLOTYPE PRESENCE AND STORING: female holotype #54969a and 2 female paratypes #55613 and #55614 deposited in Federal collection of Zoological Institute, St. Petersburg, Russia.

MATERIAL EXAMINED: type specimen, author's description and drawings.

DESCRIPTION. FEMALE (Fig. 97). Body length without caudal setae about 1000 μm, yellowish color. Th4 with lateral setulae. Genital double somite as long as broad; *receptaculum seminis* with wide upper part (Fig. 97A). Caudal rami divergent, short, with L/W ratio about 3.2, with long *serra* of spinules, increasing in size distally (see Fig. 97A). Caudal setae proportions similar to *E.* (*Sp.*) *a. arcanus*.

Antennule 12-segmented, reaching Th2, with smooth hyaline membrane on three distal segments. A2 Bas without distal groups N1, 2 (Fig. 97F). Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.2; inner spine 1.1 times longer than outer one and slightly longer than segment; distal setae almost reaching tips of nearest spines. P4 Exp3 distal spine longer than more proximal spines and slightly shorter than segment; distal seta almost twice longer than distal spine. P4 IntCox caudal surface with three rows of setulae: distal one of strong curved spinules, middle and proximal ones with central gap (Fig. 97D); coxal spine homogenously plumose; Bas inner outgrowth with rare short hairs. Reduced P5 (see Fig. 97A) elongated; inner spine about 1.6 times longer than segment, slightly shorter or subequal to outer seta; medial seta about twice longer than inner spine.

MALE unknown.

DISTRIBUTION: Arctic zone of Eurasia.

COMMENTS: This form was found in a tundra lakelet, almost frozen, so it must be well adapted to such unusual for *Eucyclops* conditions [Alekseev, 1990]. Some morphological features in females (enlarged *receptaculum seminis*, long setae in swimming legs) seem like reflect their adaptation to underground conditions.

Eucyclops (***Speratocyclops***) ***biwensis*** s.lat.

Medium sized cyclopids, with female length 690−1140 μm. Caudal rami relatively short, with L/W ratio 3.6–5.3, with reduced or full lateral *serra* of subequal small spinules. A1 12-segmented, reaching middle or distal edge of Th1, with smooth hyaline membrane on 3 distal segments. A2 Bas caudal surface without distal groups N1, 2 of setulae. Reduced P5 with rather long, but not strong spine, not more than 1.5 times wider than medial seta. Two taxa described in Japan.

Key to *Eucyclops* (*Speratocyclops*) *biwensis* s.lat. subspecies

1. Dorsal seta shorter than outermost seta; lateral *serra* reaching beyond middle of ramus proximally ....*E.* (*Sp.*) *b. ohtakai* Ishida, 2000 comb.n.

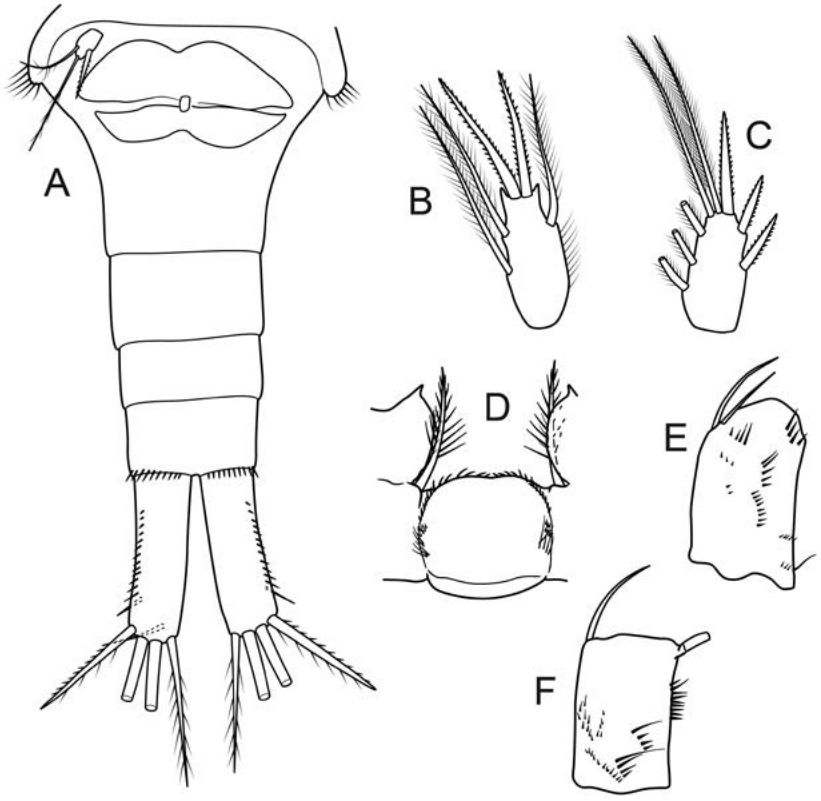

Fig. 97. *Eucyclops* (*Speratocyclops*) *arcanus arcticus* Alekseev, 2022. Female: A — abdomen; B — P4 Enp3; C — P4 Exp3 ; D — P4 intercoxal plate, caudal; E — A2 Bas, frontal; F — A2 Bas, caudal. Northwestern Russia. A–C — after Alekseev [2022]; D–F — orig., paratype.

Рис. 97. *Eucyclops* (*Speratocyclops*) *arcanus arcticus* Alekseev, 2022. Самка: A — абдомен; B — P4 Enp3; C — P4 Exp3; D — P4 межкоксальная пластинка, каудально; E — A2 Bas, фронтально; F — A2 Bas, каудально. Северо-Запад России. A–C — по Alekseev [2022]; D–F — ориг., паратип.

– Dorsal seta longer than outermost seta; lateral *serra* not reaching beyond middle of ramus proximally.*E.* (*Sp.*) *b. biwensis* Ishida, 1998

94. ***Eucyclops* (*Speratocyclops*) *biwensis biwensis*** Ishida, 1998
Fig. 98.

SYNONYMY: *Eucyclops biwensis*: Ishida, 1998; Dussart, Defaye, 2006; *Eucyclops* (*Speratocyclops*) *biwensis*: Alekseev, 2019.

TYPE LOCALITY: Lake Biwa, Japan.

HOLOTYPE PRESENCE AND STORING: type specimens deposited in National Science Museum of Tokyo, Lake Biwa Museum and Smithsonian National Museum of Natural History.

MATERIAL EXAMINED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 98). Body length without caudal setae 780−1140 μm. Th4 with lateral setulae. Genital double somite L/W ratio 1; *receptaculum seminis* shape typical for genus (Fig. 98D). Anal operculum convex. Caudal rami slightly divergent; L/W ratio 4.2−5.3, with short lateral *serra* of small subequal denticles (Fig. 98B, C). Outermost spiniform seta about 0.5 times as long as ramus length; with denticulate outer edge and hairs on inner edge. Dorsal seta slightly longer than outermost seta. Innermost seta plumose, about 1.5 times as long as outermost one.

Antennules 12-segmented, reaching distal edge of Th1; 3 distal segments with smooth hya-

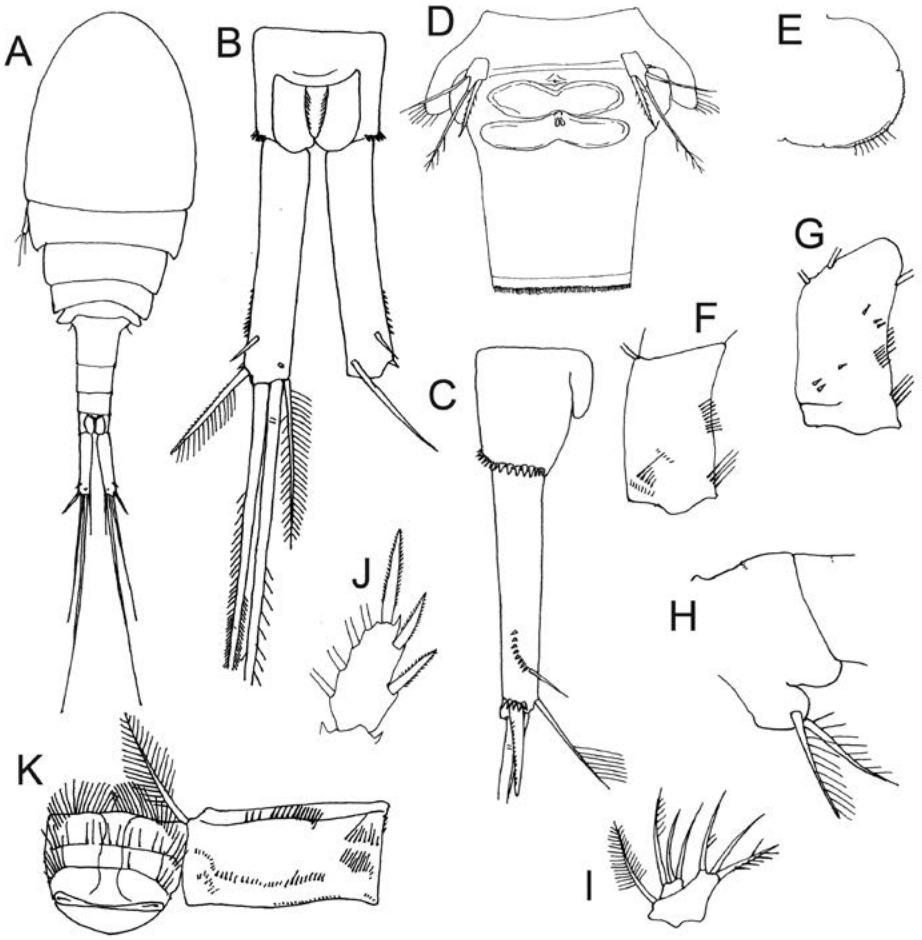

Fig. 98. *Eucyclops* (*Speratocyclops*) *biwensis biwensis* Ishida, 1998. Female: A — habitus; B — caudal rami, dorsal; C — caudal ramus, lateral; D — Th4, genital double somite and P5; E — Th3 lateral edge; F — A2 Bas, caudal; G — A2 Bas, frontal; H — maxilla praecoxa; I — maxillulary palp; J — P4 Exp3; K — P4 intercoxal plate and coxa, caudal. Japan, after Ishida [1998].

Рис. 98. *Eucyclops* (*Speratocyclops*) *biwensis biwensis* Ishida, 1998. Самка: A — габитус; B — каудальные ветви, дорсально; C — каудальная ветвь, латерально; D — Th4, генитальный сомит и P5; E — латеральный край Th3; F — A2 Bas, каудально; G — A2 Bas, фронтально; H — прекокса максиллы; I — пальп максиллулы; J — P4 Exp3; K — межкоксальная пластинка и кокса P4, каудально. Япония, по Ishida [1998].

line membrane. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 98F; frontal surface with rather sparse ornamentation (Fig. 98G). Mouth appendages typical of genus; maxillulary palp without denticles; Mx praecoxa with short spinules at lateral margin.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Exp3 distal spine slightly shorter than segment. P4 IntCox caudal surface with three rows of long hair-setulae (I–III); coxal spine homogeneously plumose (Fig. 98K). Reduced P5 (Fig. 98D): inner spine long and narrow, 1.7–1.8 times as long as segment and about 0.8 times as long as outer seta; medial seta about 1.5 times longer than inner spine.

MALE unknown.

DISTRIBUTION: Lake Biwa, Japan.

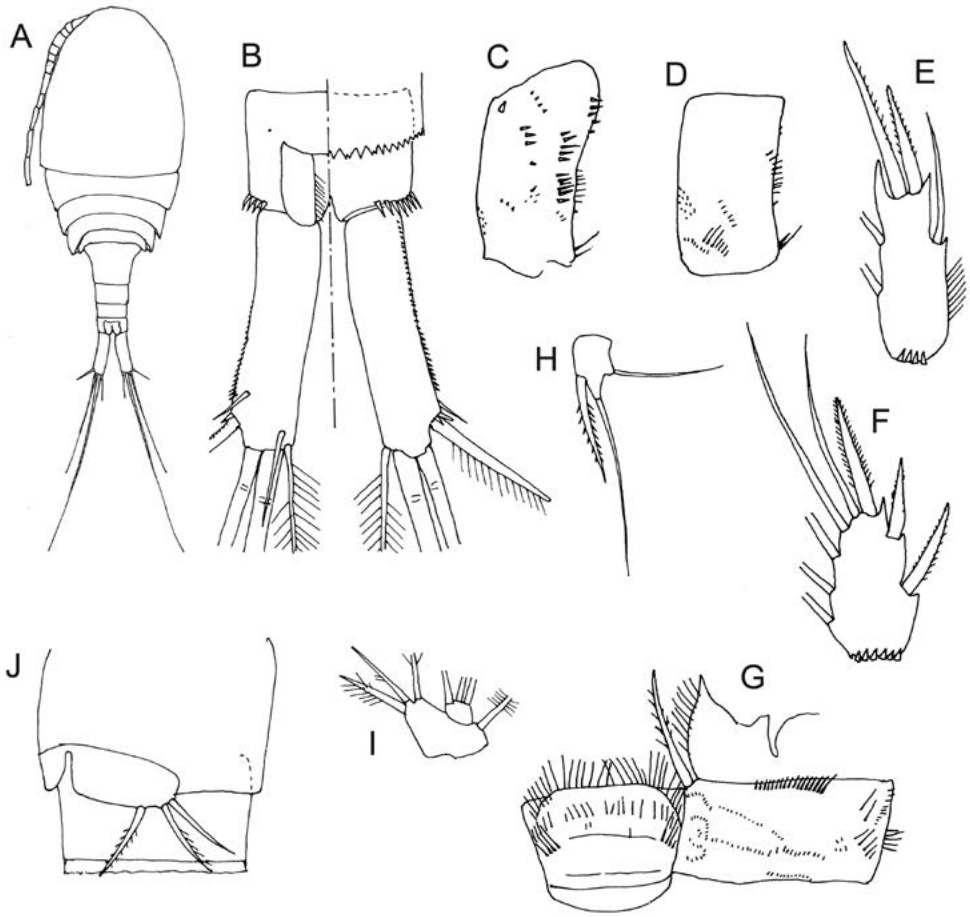

Fig. 99. *Eucyclops* (*Speratocyclops*) *biwensis ohtakai* Ishida, 2000 comb.n. A — habitus; B — caudal rami, dorsal and ventral; C — A2 Bas, frontal; D — A2 Bas, caudal; E — P4 Enp3; F — P4 Exp3; G — P4 intercoxal plate and coxa, caudal; H — P5; I — maxillulary palp; J — P6. A–I — female; J — male. Japan, after Ishida [2000].

Рис. 99. *Eucyclops* (*Speratocyclops*) *biwensis ohtakai* Ishida, 2000 comb.n. A — габитус; B — каудальные ветви, дорсально и вентрально; C — A2 Bas, фронтально; D — A2 Bas, каудально; E — P4 Enp3; F — P4 Exp3; G — межкоксальная пластинка и кокса P4, каудально; H — P5; I — пальп максиллулы; J — P6. A–I — самка; J — самец. Япония, по Ishida [2000].

COMMENTS: Many morphological features in *E.* (*Sp.*) *biwensis* s.str. including micropatterns of antennal basipodite and P4 intercoxal plate resemble *E.* (*Sp.*) *b. ohtakai.* Characters separating them include: CR with reduced lateral *serra*, longer caudal rami and longer dorsal caudal seta.

95. ***Eucyclops* (*Speratocyclops*) *biwensis ohtakai*** Ishida, 2000 **comb.n.** Fig. 99.

SYNONYMY: *Eucyclops ohtakai* Ishida, 2000; Dussart, Defaye, 2006.

TYPE LOCALITY: Lake Ikeda, Kagoshima Pref., Kyushu, Japan.

HOLOTYPE PRESENCE AND STORING: female dissected on one slide deposited in NHM Tokyo, Japan.

MATERIAL EXAMINED: paratype (Ishida's donation to VA), author's description and drawings.

DESCRIPTION. FEMALE (Fig. 99). Body length without caudal setae 690–820 μm in type population. Th4 with lateral setulae. Genital double somite L/W ratio 0.9, wide anteriorly then sharply narrows; *receptaculum seminis* typical for

genus. Posterior margins of abdominal somites with serrated hyaline frills. Anal operculum convex. Caudal rami divergent (Fig. 99A), with L/W ratio 3.6–3.8 in type population; with lateral *serra* extending to ramus base proximally, composed of rather small subequal spinules slightly increasing distally. Outermost spiniform seta inserted higher than outer middle seta, 0.6 times as long as ramus length; with denticulate outer edge and hairs on inner edge. Innermost seta about 1.6 times as long as outermost one. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.1/ 7.5/ 1.6.

Antennule 12-segmented, reaching middle of Th1; with smooth hyaline membrane on 3 distal segments. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 99D; frontal surface as in Fig. 99C. Mouth appendages typical of genus; maxillulary palp without denticles; Mx praecoxa with short spinules at lateral margin.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.4; inner spine about 1.5 times longer than outer one and subequal to segment; distal setae not reaching beyond tips of nearest spines (Fig. 99E). P4 Exp3 distal spine slightly shorter than segment. P4 IntCox caudal surface with thin long hairs at distal margin without gap (row I), middle row II of shorter setulae and row III of long setulae at sides (Fig. 99G). Reduced P5 (Fig. 99C) with rather short segment; inner spine about 1.8 times longer than segment and about as long as outer seta; medial seta about 1.6 times longer than spine.

MALE: unknown (?) see comments.

DISTRIBUTION: Japan.

COMMENTS: This form is close to *E.* (*Sp.*) *speratus* (Lilljeborg, 1901). Author possibly selected as male paratype specimens of another species. This is evident from differences in A2 Bas ornamentation (hairs in position NN 1, 2 missing in female). This male fits more to *E.* (*E.*) *agiloides roseus* Ishida, 1997 common in Japan. That is why I do not include it in the species description.

96. ***Eucyclops*** (***Speratocyclops***) ***delongi*** Alekseev, Abramova et Chaban, 2019 Fig. 100.

SYNONYMY: *Eucyclops delongi*: Alekseev *et al*., 2019; *Eucyclops* (*Speratocyclops*) *delongi*: Alekseev, 2019.

TYPE LOCALITY: small bog in hills, near Titary village, the River Lena delta, eastern Siberia, Russia (71°58′01″N, 127°05′20″E).

HOLOTYPE PRESENCE AND STORING: holotype female #55456, paratype male #55457, deposited in Federal collection, Zoological Institute, St. Petersburg, Russia.

DESCRIPTION. FEMALE (Fig. 100). Body length without caudal setae about 1100 μm; orange color. Cephalosome robust (Fig. 100A). Th4 with lateral setulae. Genital double somite as long as broad; *receptaculum seminis* of regular shape, with wide arms (Fig. 100C). Anal operculum rather strongly developed, convex, slightly serrated in holotype, with central incision. Caudal rami (Fig. 100B) slightly divergent, 4.5–4.7 as long as broad, lateral margins with long *serra* of teeth rather short and thin, slightly increasing distally, proximally not reaching base at length of about 1 ramus width. Lateral seta not longer than ramus width. Outermost spiniform seta thin, inserted close to outer middle seta, 0.5−0.6 times as long as ramus length; with denticulate outer edge and long hairs on inner edge. Dorsal seta shorter than outermost seta. Innermost seta with long hairs, about 1.6 times as long as outermost one.

Antennule 12-segmented (Fig. 100F), reaching middle of Th1; with smooth hyaline membrane on 3 distal segments. A2 Bas caudal surface without distal groups N1, 2 of setulae (Fig. 100E); frontal surface as in Fig. 100D. Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 rather long, with L/W ratio about 2.5; inner spine 1.3 times longer than outer one and slightly shorter than segment; distal setae rather long, almost reaching tips of nearest spines (Fig. 100G). P4 Exp3 distal spine rather short, about 0.7–0.8 times as long as segment and about twice shorter than distal seta. P4 IntCox caudal surface with 3 rows of setulae: distal row I of short spinules without central gap, middle row II of short spinules at sides with long central gap, posterior row III of long setulae at sides with long central gap; frontal surface with semicircular rows of setulae at sides; coxal spine with strong setulae on both sides, long proximally and decreasing in length distally. P4 Bas inner outgrowth with very short and very thin rare hairs. Reduced P5: segment L/W ratio 1.5; inner spine strong and long, about twice longer than segment; outer seta subequal to spine or slightly longer; medial seta about twice longer than inner spine.

MALE: Body length about 800 μm. Caudal rami about 4 times as long as broad, without *serra* on lateral edge, innermost seta about twice as long as outermost seta and longer than ramus length. Dorsal seta placed near insertion of innermost

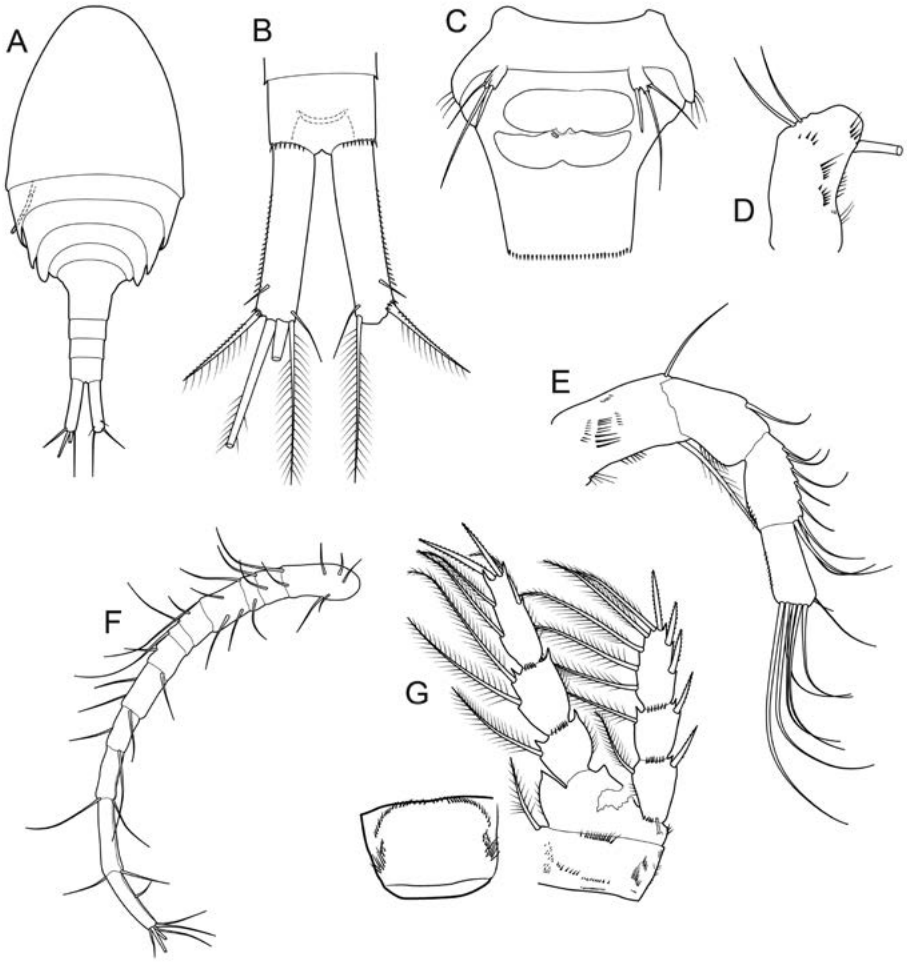

Fig. 100. *Eucyclops* (*Speratocyclops*) *delongi* Alekseev, Abramova et Chaban, 2019. Female: A — habitus; B — caudal rami; C — genital somite and P5; D, E — A2 Bas; F — A1; G — P4. Eastern Siberia, Russia, after Alekseev *et al*. [2019].

Рис. 100. *Eucyclops* (*Speratocyclops*) *delongi* Alekseev, Abramova et Chaban, 2019. Самка: A — габитус; B — каудальные ветви; C — генитальный сомит и P5; D, E — A2 Bas; F — A1; G — P4. Восточная Сибирь, Россия, по Alekseev *et al*. [2019].

seta, about as long as outermost seta. Antennule 14-segmented. A2 as in female. P1–5 as in female. Rudimentary P6 with short appendages; middle seta about half of spine length and outer seta as long as spine.

DISTRIBUTION: River Lena Delta, Arctic Siberia and Far East of Russia.

COMMENTS: *E.* (*Sp.*) *delongi* belongs to *speratus*-complex due to absence of gap on outer side of P4 coxal spine, as well as missing of distal groups of hairs N1, 2 on A2 Bas. It differs from *E.* (*Sp.*) *speratus* in having shorter diverging caudal rami, short spinules at distal margin of P4 and short rare hairs on P4 Bas outgrowth. Another member of the same complex *E.* (*Sp.*) *arcanus* inhabits the same Arctic area and sometimes (at least in the River Lena delta) coexists with *E.* (*Sp.*) *delongi*. They can be distinguished by CR L/W ratio, rela-

tive length of innermost caudal seta and relative length of P4 Exp3 distal spine. The third species of the same group *E.* (*Sp.*) *dumonti* from Eastern Siberia, Mongolia and Northern China has shorter and more divergent caudal rami with longer outermost spine and rather long setulae at distal margin of P4 IntCox. *E.* (*Sp.*) *delongi* possibly is a member of the Beringian (East Siberian) faunistic complex of *Eucyclops*.

97. ***Eucyclops* (*Speratocyclops*) *dumonti*** Alekseev, 2000 Fig. 101.

SYNONYMY: *Eucyclops dumonti*: Alekseev, 2000; Dussart, Defaye, 2006; *Eucyclops* (*Speratocyclops*) *dumonti*: Alekseeev, 2019.

TYPE LOCALITY: lake Bur-Nuur, 100 km N. of Ulan Bator, Central Mongolia.

HOLOTYPE PRESENCE AND STORING: female #55021, male paratype #55022 deposited in Federal collection, Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: Holotype, paratypes; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 101A–G). Body length without caudal setae about 900 μm, habitus similar to *E.* (*Sp.*) *arcanus* (Fig. 101A), brown in color. Th4 with lateral setulae. Genital double somite wider than long; *receptaculum seminis* typical for genus (Fig. 101B). Anal operculum rounded. Caudal rami divergent, short, about 3.5 times as long as wide; with lateral *serra* almost reaching ramus base, of spinules noticeably increasing distally (Fig. 101C). Outermost spiniform seta strong and long, inserted close to outer middle seta, about 0.8 times as long as ramus length; with denticulate outer edge and hairs on inner edge. Innermost seta plumose, about 1.4 times as long as outermost one. Dorsal seta shorter than outermost seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.2/ 6.5/ 1.4.

Antennule 12-segmented, reaching middle of Th1; with smooth hyaline membrane on 3 distal segments (Fig. 101E). A2 Enp setation: 1/ 9/ 7. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 101F; frontal surface as in Fig. 101G. Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.5; inner spine about 1.3 times longer than outer one and subequal to segment; distal setae reaching middle of nearest spines. P4 Exp3 distal spine slightly shorter than segment and shorter than distal seta. P4 Bas inner outgrowth not covered with hairs. P4 IntCox caudal surface with rather long strong setulae at distal margin without gap in middle; coxal spine with strong setulae on both sides, long proximally and decreasing in length distally (Fig. 101D). Reduced P5 (see Fig. 101B): inner spine strong and long, twice longer than segment and about as long as outer seta; medial seta about 1.4 times longer than spine.

MALE (Fig. 101H) Body length without caudal setae 766 μm. Th4 without lateral setulae. Caudal rami L/W ratio about 3.2. Antennule 14-segmented. P1–P4 as in female, but in contrast to female P4 Bas inner outgrowth with dense and long hairs. Reduced P5 structure like in female. Rudimentary P6 armed strong and rather long inner spine and two shorter setae; length ratio beginning with spine: 1.0/ 0.7/ 0.8.

DISTRIBUTION: Central Mongolia (Bur-Nuur Lake, near Ulan-Bator). Northern China, Central Siberia (vicinity of lake Baikal), Lena River delta (?), North-Eastern Asia (?).

COMMENTS: Short caudal rami and missing hairs on P4 Bas inner outgrowth along with ornamentation of P4 IntCox and relative length of P4 Exp3 distal spine separate it from other members of this subgenus.

98. ***Eucyclops* (*Speratocyclops*) *leschermoutouae*** Alekseev et Defaye, 2004 Fig. 102.

SYNONYMY: *Eucyclops leschermoutouae*: Alekseev, Defaye, 2004; Dussart, Defaye, 2006; *Eucyclops* (*Speratocyclops*) *leschermoutouae*: Alekseev, 2019.

TYPE LOCALITY: well in vicinity of town Soller, Balearic Islands, Mallorca, Spain.

HOLOTYPE PRESENCE AND STORING: holotype female MNHN-Cp2158, deposited at the Muséum National d'Histoire Naturelle, Paris.

MATERIAL STUDIED: holotype and paratypes, authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 102). Body length without caudal setae about 880 μm. Th4 with lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical for genus (Fig. 102B). Caudal rami about 5 times as long as broad, with long lateral *serra* of 20–22 fine spinules slightly increasing in size distally (Fig. 102C). Outermost spiniform seta strong and blunt, 0.4–0.5 times as long as ramus length; naked proximally, with denticulate outer edge and short rare hairs on inner edge distally. Innermost seta with short rare hairs, about 0.9 times as long as outermost one. Dorsal seta shorter than outermost

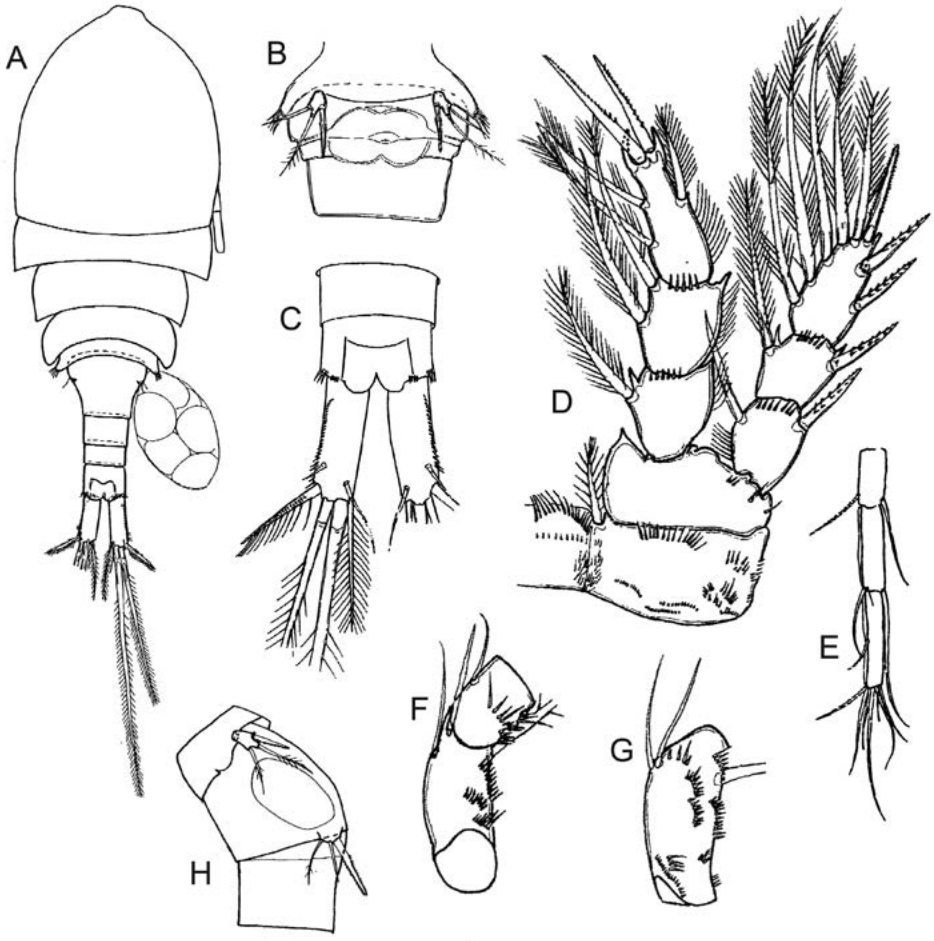

Fig. 101. *Eucyclops* (*Speratocyclops*) *dumonti* Alekseev, 2000. A — habitus; B — Th4, genital double somite and P5; C — caudal rami, dorsal; D — P4, caudal; E — A1, three distal segments; F — A2 Bas, caudal; G — A2 Bas, frontal; H — P5 and P6. A–G — female; H — male. Mongolia, after Alekseev [2000].

Рис. 101. *Eucyclops* (*Speratocyclops*) *dumonti* Alekseev, 2000. A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви, дорсально; D — P4, каудально; E — A1, три дистальных членика; F — A2 Bas, каудально; G — A2 Bas, фронтально; H — P5 и P6. A–G — самка; H — самец. Монголия, по Alekseev [2000].

seta. Distal setae approximate length ratio beginning with outermost: 1.0/ 6.1/ 9.6/ 0.9.

Antennule 12-segmented, reaching posterior margin of Th1; with smooth hyaline membrane on 3 distal segments. A2 Enp setation: 1/ 9/ 7. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 102F; frontal surface as in Fig. 102E. Mouth appendages typical of genus; maxillulary palp without denticles.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.2; inner spine about 1.3 times longer than outer one and segment; distal setae reaching middle of nearest spines (Fig. 102D). P4 Exp3 distal spine slightly longer than segment and shorter than distal seta; distal setae modified, with short setulae distally. P4 Bas inner outgrowth covered with hairs. P4 IntCox caudal surface with 3 rows (I–III) of rather long setulae with long central gap; coxal spine bearing strong setulae on inner side and short setules with gap on outer side. Reduced P5 (Fig. 102G) armed with wide and long inner spine; outer

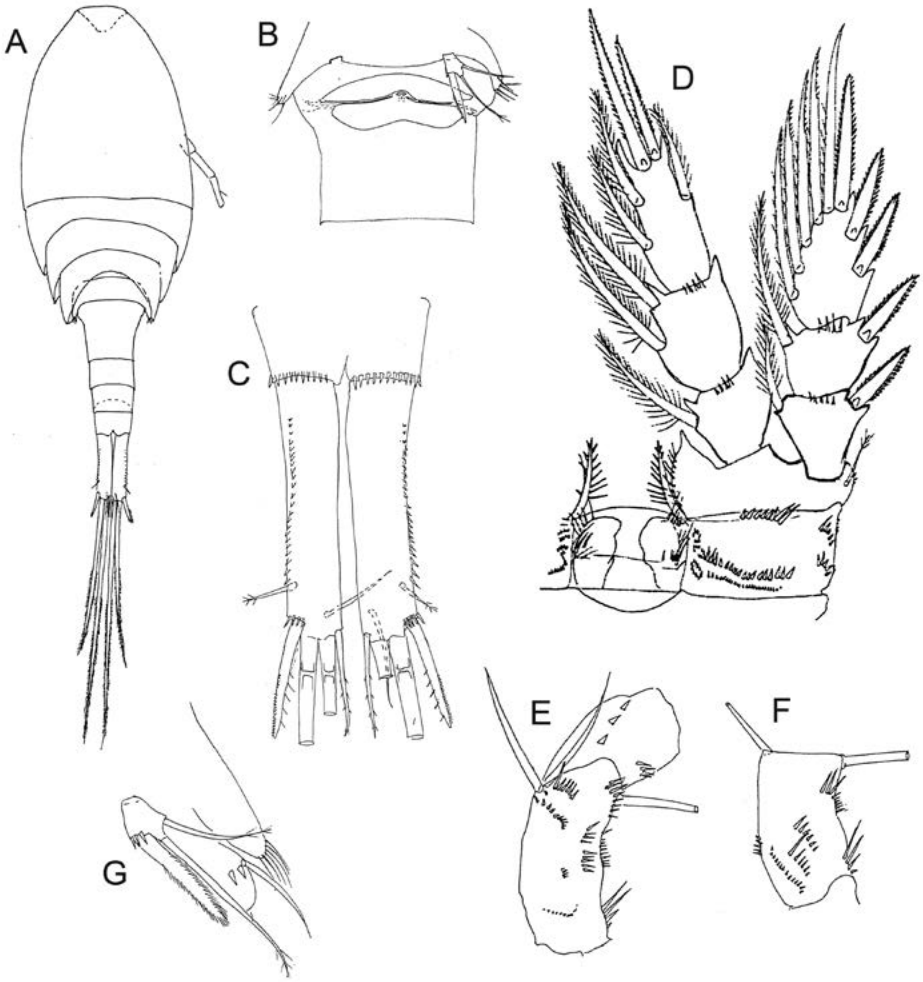

Fig. 102. *Eucyclops* (*Speratocyclops*) *leschermoutouae* Alekseev et Defaye, 2004. Female: A — habitus; B — Th4, genital double somite and P5; C — caudal rami, ventral; D — P4, caudal; E — A2 Bas, frontal; F — A2 Bas, caudal; G — Th4, P5 and P6. Mallorca, Spain, after Alekseev & Defaye [2004].

Рис. 102. *Eucyclops* (*Speratocyclops*) *leschermoutouae* Alekseev et Defaye, 2004. Самка: A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви, вентрально; D — P4, каудально; E — A2 Bas, фронтально; F — A2 Bas, каудально; G — Th4, P5 и P6. Майорка, Испания, по Alekseev & Defaye [2004].

seta shorter than spine; medial seta about 1.6 times as long as spine.

MALE unknown.

DISTRIBUTION: Mallorca (Balearic Islands), Northern Africa (?).

COMMENTS: Based on ornamentation of A2 Bas (missing groups N1 and N2), this species belongs to *speratus*-group. Short innermost caudal seta clearly separates it from closely related congeners such as *E.* (*Sp.*) *speratus speratus* and *E.* (*Sp.*) *speratus azorensis*. This character is quite stable within the taxon and does not overlap with two other taxa. That is why I do not support suggestion of Maria Holynska to synonymize *E.* (*Sp.*) *leschermoutouae* and *E.*(*Sp.*) *speratus azorensis* [Holynska *et al*., 2021], although "*E. azorensis*" from Algeria described in that paper demonstrates more similarity with *E.* (*Sp.*) *leschermoutouae*.

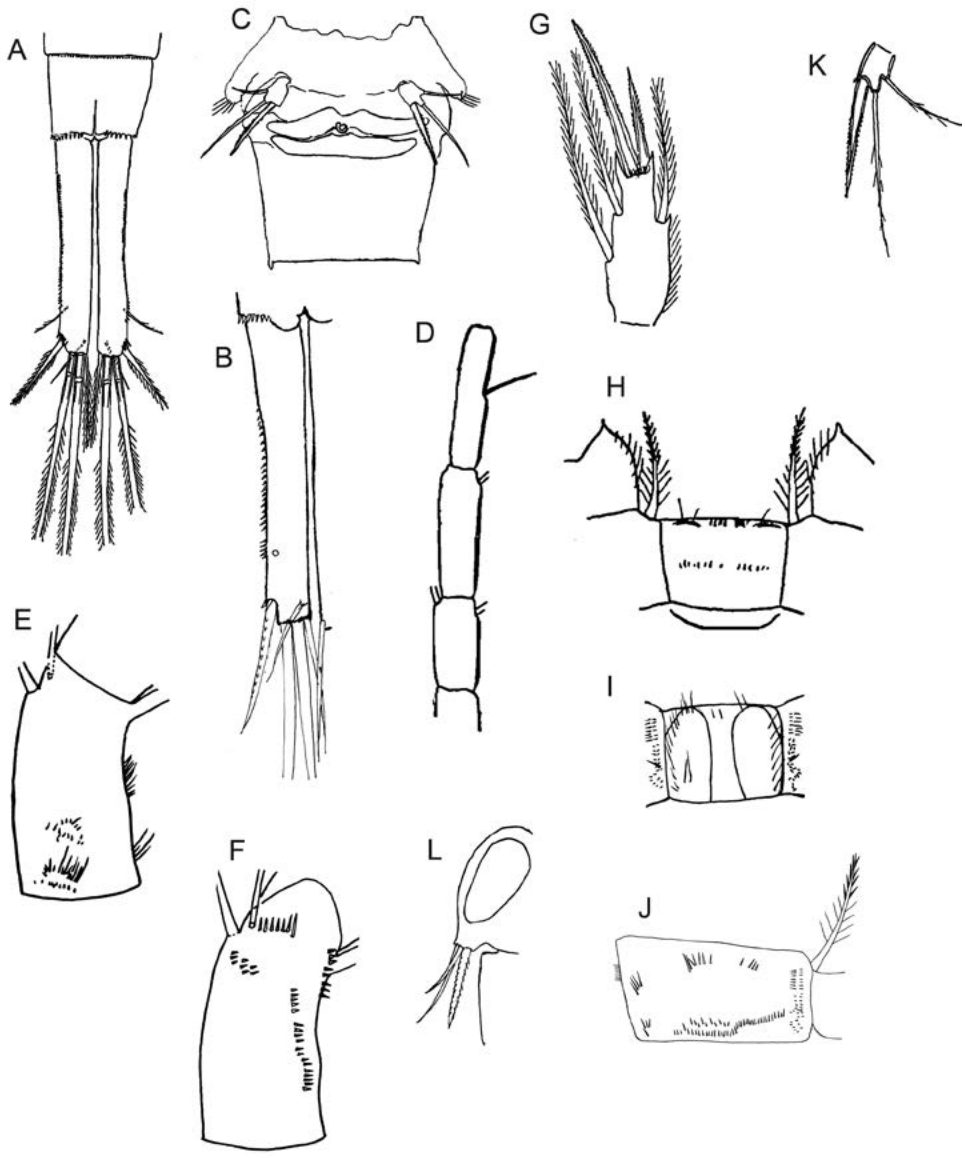

Fig. 103. *Eucyclops* (*Speratocyclops*) *productus* Kiefer, 1939. A, B — caudal rami; C — Th4, genital double somite and P5; D — A1, three distal segments; E — A2 Bas, caudal; F — A2 Bas, frontal; G — P4 Enp3; H, I — P4 intercoxal plate; J — P4 coxa; K — P5; L — P6. A–K — female; L — male. Tibetan Plateau. A, D, G, H, K — after Kiefer, [1939a]; B, C, L — orig., slides #02151, 02718, 02719 KRC; E, F, I, J — after Ding *et al*. [2022].

Рис. 103. *Eucyclops* (*Speratocyclops*) *productus* Kiefer, 1939. A, B — каудальные ветви; C — Th4, генитальный сомит и P5; D — A1, три дистальных членика; E — A2 Bas, каудально; F — A2 Bas, фронтально; G — P4 Enp3; H, I — межкоксальная пластинка P4; J — кокса P4; K — P5; L — P6. A–K — самка; L — самец. Тибетское нагорье. A, D, G, H, K — по Kiefer, [1939a]; B, C, L — ориг., преп. #02151, 02718, 02719 KRC; E, F, I, J — по Ding *et al*. [2022].

Morphologically, two other species from Mediterranean springs, *E.* (*E.*) *serrulatus hadjebensis* (Morocco) and *E.* (*E.*) *romaniensis* (Valencia, Spain), appear close to *E.* (*Sp.*) *leschermoutouae*, but both have in A2 Bas hair-setulae in positions N1 and N2 and therefore belong to subgenus *Eucyclops*.

99. ***Eucyclops* (*Speratocyclops*) *productus*** Kiefer, 1939 Fig. 103.

SYNONYMY: *Eucyclops productus*: Kiefer, 1939a: *Eucyclops* (*Speratocyclops*) *productus*: Alekseev, 2019; Ding *et al*., 2022.

TYPE LOCALITY: Chushul, North India, Tibetan Plateau.

HOLOTYPE PRESENCE AND STORING: holotype female, paratype male, Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: holotype female #02151, paratype male #02152, redescription [Ding *et al*., 2022], author's description and drawings.

DESCRIPTION. FEMALE (Fig. 103A–K). Body length without caudal setae 1300 μm, Th4 with lateral setulae. Genital double somite as long as broad, wide anteriorly then gradually narrows; *receptaculum seminis* typical for genus, with narrow lateral arms (Fig. 103C). Caudal rami (Fig. 103B) subparallel, closely placed, long, with L/W ratio 8−9; lateral *serra* produced by small spinules of equal size, partly reduced. Lateral seta longer than ramus width (1.4−1.6: 1), placed noticeably higher than dorsal seta. Outermost seta rather short, 0.4 times as long as ramus length; with denticulate outer edge and hairs on inner edge. Dorsal seta shorter than outermost seta. Innermost seta about 1.2 times as long as outermost one.

Antennules 12-segmented, short, just reaching distal margin of CTh; 3 distal segments with narrow smooth hyaline membrane. A2 Enp setation: 1, 9, 7. A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 103E; frontal surface as in Fig. 103F. Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.4; inner spine 1.6 times longer than outer one and 1.1 times longer than segment; distal setae almost reaching tips of nearest spines (Fig. 103G). P4 Exp3 distal spine longer than more proximal spines and about 0.7 times as long as segment. P4 IntCox distal margin with rare short hairs; coxal spine with long hairs proximally and short denticles distally. Reduced P5 (Fig. 103C, K): segment with rather short central process; inner spine strong and long, 2.2–2.5 times longer than segment, and longer than outer seta; medial seta 1.2–1.4 times longer than inner spine.

MALE (Fig. 103L). More short and slender than female with shorter caudal rami (L/W ratio about 7.5), without lateral *serra* except few spinules above lateral seta. Caudal setae proportions similar to female, but outermost seta naked. P1–P5 similar to female except P4 Enp3 slightly shorter, with L/W ratio 2.1. Rudimentary P6 (Fig. 103L) with strong inner spine reaching 2/3 of next abdominal somite and two shorter setae.

DISTRIBUTION: Northern India, Tibetan Plateau.

COMMENTS: This species is well distinguished from other congeners by its long caudal rami and large body size. Kiefer compares it with two taxa, *E.* (*E.*) *elegans* and *E.* (*S.*) *porrectus*, which also have such long caudal rami and smooth hyaline membrane on distal segments of A1. Besides its longer antennules, *E.* (*E.*) *elegans* has distal groups N1, 2 on A2 Bas and belongs to subgenus *Eucyclops*. *E.* (*S.*) *porrectus* has a weak inner spine of P5, as well as shorter lateral and longer dorsal caudal setae and belongs to subgenus *Sarsicyclops*.

100. ***Eucyclops* (*Speratocyclops*) *troposperatus*** Alekseev et Yusoff, 2013 Fig. 104.

SYNONYMY: *Eucyclops troposperatus*: Alekseev *et al*., 2013; *Eucyclops* (*Speratocyclops*) *troposperatus*: Alekseev, 2019.

TYPE LOCALITY: city pond in Dumen, Sumatra, Indonesia.

HOLOTYPE PRESENCE AND STORING: holotype female #55070 deposited in Federal collection, Zoological Institute, St. Petersburg, Russia.

MATERIAL STUDIED: type specimens; authors' description and drawings.

DESCRIPTION. FEMALE (Fig. 104). Body length without caudal setae about 1080 μm; slender, yellowish in colour. Th4 with long lateral setulae. Genital double somite as long as broad; *receptaculum seminis* typical for genus (Fig. 104C). Caudal rami (Fig. 104A, B) slightly divergent, 4.3–4.5 times as long as broad; with lateral *serra* of 35–40 fine spinules, slightly increasing in size distally. Lateral seta not longer than ramus width. Outermost spiniform seta strong, inserted close to outer middle seta, about 0.6 times as long as ramus length; with denticulate outer edge and dense hairs

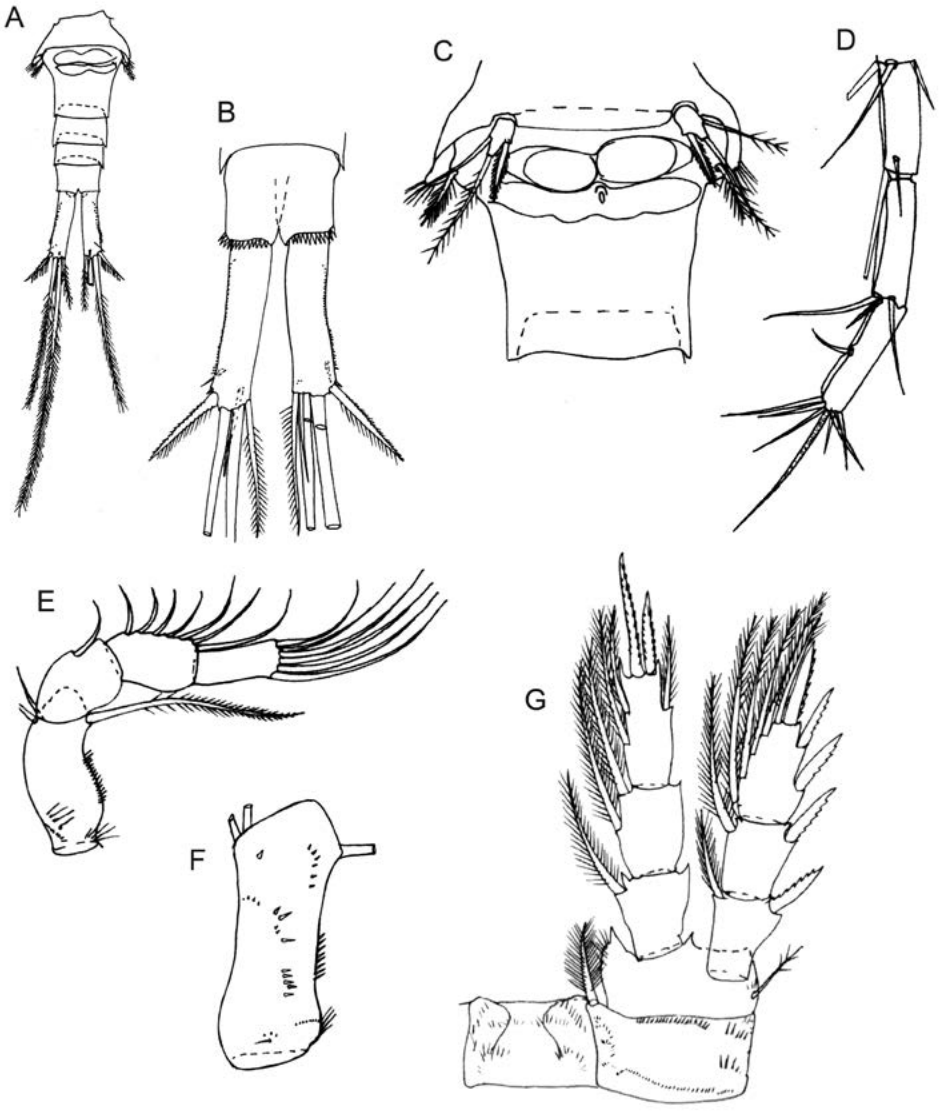

Fig. 104. *Eucyclops* (*Speratocyclops*) *troposperatus* Alekseev et Yusoff, 2013. Female: A — abdomen; B — caudal rami, ventral; C — Th4, genital double somite and P5; D — A1, three distal segments; E — A2 Bas, caudal; F — A2 Bas, frontal; G — P4, caudal. Indonesia, after Alekseev *et al*. [2013].

Рис. 104. *Eucyclops* (*Speratocyclops*) *troposperatus* Alekseev et Yusoff, 2013. Самка: A — абдомен; B — каудальные ветви, вентрально; C — Th4, генитальный сомит и P5; D — A1, три дистальных членика; E — A2 Bas, каудально; F — A2 Bas, фронтально; G — P4, каудально. Индонезия, по Alekseev *et al*. [2013].

on inner edge. Innermost seta with dense hairs, about 1.5 times as long as outermost one. Dorsal seta slightly shorter than outermost seta or subequal (0.9–1: 1). Distal setae approximate length ratio beginning with outermost: 1.0/ 4.0/ 6.5/ 1.5.

Antennule 12-segmented, reaching distal margin of Th1; with smooth hyaline membrane on 3 distal segments (Fig. 104D). A2 Bas caudal surface without distal groups N1, 2 of setulae, other groups as in Fig. 104E; frontal surface with

rather sparse ornamentation (Fig. 104F). Mouth appendages typical of genus; maxillulary palp without denticles.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 elongated, with L/W ratio about 2.4; inner spine about 1.5 times longer than outer one and slightly longer than segment; distal setae reaching 1/2–2/3 of nearest spines (Fig. 104G). P4 Exp3 distal spine slightly shorter than segment and shorter than distal seta. P4 Bas inner outgrowth covered with hairs. P4 IntCox caudal surface with 3 rows (I–III) of short setulae, not rising above distal margin; coxal spine homogenously plumose with dense thin hairs. Reduced P5 (see Fig. 104C): inner spine about 1.5 times longer than segment and shorter than two other setae.

MALE unknown.

DISTRIBUTION: Sumatra (Indonesia), South-East Asia?

COMMENTS. The species can be separated from the closely related *E.*(*Sp.*) *speratus* by shorter caudal rami, naked distal margin of P4 IntCox, and weaker inner spine of P5. As the only species of this subgenus found outside Palearctic it must be studied more carefully with molecular analysis as a possible human-mediated invader from Europe or Northern Asia.

9. SUBGENUS ***Eucyclops*** (***Subterrocyclops***) Alekseev, 2019

Cyclopids of moderate size with body length 700–1200 μm. Last thoracic somite can be with naked lateral sides. Caudal rami parallel or slightly divergent, L/W 3–6, lateral edge with absent or very reduced lateral *serra,* extending not higher than half of ramus proximally. Distal segment of P4 Enp with long distal setae, reaching tips of nearest spines. Antennule 12-segmented, short, with very narrow, smooth hyaline membrane or without it. Subgenus comprising 11 species inhabiting mostly underground water or similar habitats (springs, wells etc.). Some taxa probably are commensals of sponges and/or mollusks. Insufficiently described *Eucyclops propinquus* Kiefer, 1932, previously included in the subgenus [Alekseev, 2019], during the current revision was assigned to the genus *Afrocyclops* as Kiefer recommended.

Key to subgenus *Eucyclops* (*Subterrocyclops*) species

1. Last thoracic somite without setulae laterally 2
– This somite with setulae laterally..... 3
2. Swimming legs with distal exopodite spine formula 3/4/4/3; CR with L/W ratio about 6, with transverse row of about 7 spinules above lateral seta; inner spine of P4 Enp3 longer than outer spine..... ..... *E.* (*Sub.*) *graeteri* (Chappuis, 1927) [caves, Europe]
– Distal exopodite spine formula 3/4/3/3; CR with L/W ratio about 4, with only 1–2 small spinules above lateral seta; inner spine of P4 Enp3 shorter than outer spine ....*E.* (*Sub.*) *linderi* Lindberg, 1948 [caves, Australia]
3. Innermost caudal seta subequal to outermost seta or slightly longer (1.0–1.1: 1)..... 4
– Innermost caudal seta subequal to outermost seta or slightly longer 5
4. P4 coxal spine without gap on outer side; P4 Enp3 inner spine about 1.8 times longer than outer spine.....*E.* (*Sub.*) *nudus* Kiefer, 1935 [mountains, Kenya]
– P4 coxal spine with gap on outer side; P4 Enp3 inner spine about 1.4 times longer than outer spine.....*E.* (*Sub.*) *glaber* Kiefer, 1935 [mountains, Kenya]
5. P4 IntCox with setulae at distal margin ..... *E.* (*Sub.*) *elburziensis* Lindberg, 1941 [Iran]
– P4 IntCox with naked distal margin..... 6
6. CR with short lateral *serra* of longitudinal row small equal spinules..... 7
– CR without lateral *serra* except 1–3 small spinules above lateral seta 9
7. CR with innermost/outermost setae length ratio less than 1.4; P4 Enp3 inner/outer spines length ratio less than 1.5 ....*E.* (*Sub.*) *nagasakai* Ueno, 1934 [caves, Japan]
– CR with innermost/outermost setae length ratio more than 1.4; P4 Enp3 inner/outer spines length ratio more than 1.5..... 8
8. CR with L/W ratio 5–6; P4 Enp3 rather long, with L/W ratio more than 2; P5 with short medial seta, about 1.2 times longer than inner spine..... *E.* (*Sub.*) *subterraneus* (Graeter, 1907) [caves, Central Europe]
– CR shorter, with L/W ratio 3.6–4.6; P4 Enp3 shorter, with L/W ratio less than 2; P5 with longer medial seta, 1.5–1.7 times longer than inner spine..... .....*E.* (*Sub.*) *intermedius* Damian, 1955 [mountain springs, Northern Macedonia]
9. Inner spine of P5 thin and seta-like, about twice longer than segment..... 10

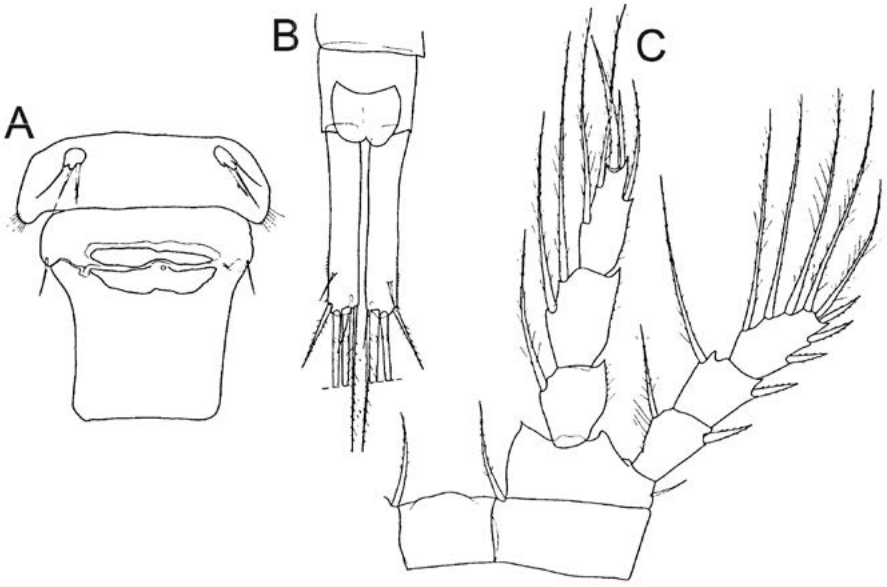

Fig. 105. *Eucyclops* (*Subterrocyclops*) *subterraneus* (Graeter, 1907). A — Th4, genital double somite and P5; B — caudal rami, dorsal; C — P4. Switzerland, after Plesa [1971].

Рис. 105. *Eucyclops* (*Subterrocyclops*) *subterraneus* (Graeter, 1907). A — Th4, генитальный сомит и P5; B — каудальные ветви, дорсально; C — P4. Швейцария, по Plesa [1971].

– Inner spine of P5 wider than setae, only about 1.5 times longer than segment .... *E.* (*Sub.*) *chivahensis* Lindberg, 1960 [mountain springs, Afghanistan]

10. A2 and maxilliped distal setae short but strong, transformed into hook-like structures ..... *E.* (*Sub.*) *maritimus* Alekseev et Monchenko, 2011 [Northern Caspian Sea]

– A2 and maxilliped distal setae of usual structure ..... *E.* (*Sub.*) *naphaeus* Petkovski, 1971 [mountain springs, Northern Macedonia]

101. ***Eucyclops* (*Subterrocyclops*) *subterraneus*** (Graeter, 1907) Fig. 105.

SYNONYMY: *Cyclops macrurus* var. *subterranean*: Graeter, 1907; *Eucyclops graeteri*: Rylov, 1948 (part.); *Eucyclops subterraneus*: Plesa, 1971; Monchenko, 1974 (part.); *Eucyclops* (*Subterrocyclops*) *subterraneus*: Alekseev, 2019.

TYPE LOCALITY: Cave Motie, underground waters of Switzerland, Central Europe.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description; redescription by Plesa [1971].

DESCRIPTION. FEMALE (Fig. 105). Body length without caudal setae 1182 μm. Body elongated, transparent, colorless nauplial eye. Th4 with lateral setulae (Fig. 105A). Genital double somite as long as broad, *receptaculum seminis* mouth-shaped, typical of genus. Caudal rami subparallel, relatively long, 5–6 times as long as broad, with very short lateral *serra* of about 5–6 small equal denticles above lateral seta insertion (Fig. 105B). Lateral seta about as long as ramus width or slightly longer, inserted noticeably higher than dorsal seta. Dorsal seta slightly shorter than outermost seta. Outermost seta thin, inserted close to outer middle seta, about 0.4 times as long as ramus length; with setulae on both sides. Innermost seta plumose, twice longer than outermost one.

Antennule 12-segmented, reaching posterior margin of Th1; 3 distal segments without visible hyaline membrane. Antenna and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2.3; inner spine 1.7 times longer than outer one and 1.2 times longer than segment; distal setae long, reaching beyond tips of nearest spines (Fig. 104C). P4 Exp3 distal spine rather short, not longer than proximal ones, twice shorter than segment. P4

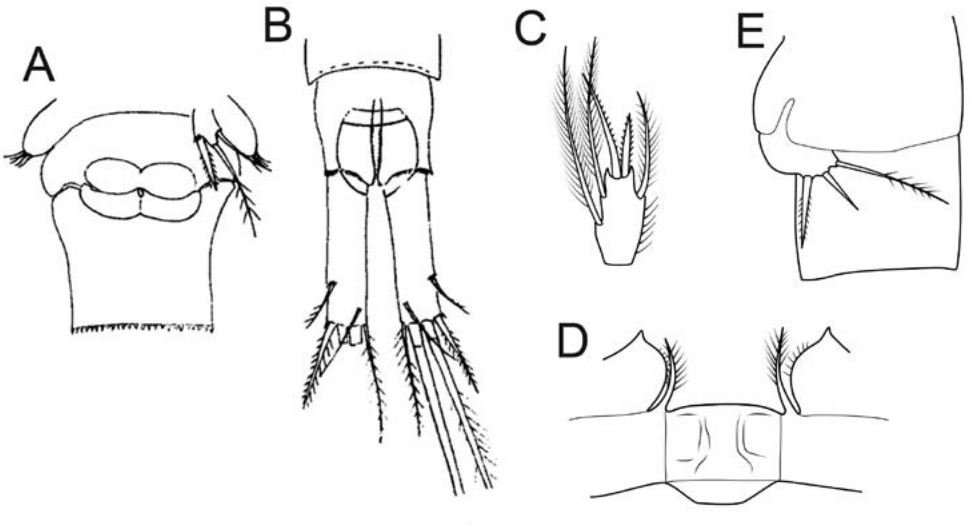

Fig. 106. *Eucyclops* (*Subterrocyclops*) *chivahensis* Lindberg, 1960. A — Th4, genital double somite and P5; B — caudal rami, dorsal; C — P4 Enp3; D — P4 intercoxal plate; E — P6. A–D — female; E — male. Northeastern Afghanistan, after Lindberg [1960].

Рис. 106. *Eucyclops* (*Subterrocyclops*) *chivahensis* Lindberg, 1960. A — Th4, генитальный сомит и P5; B — каудальные ветви, дорсально; C — P4 Enp3; D — межкоксальная пластинка P4; E — P6. A–D — самка; E — самец. Северо-Восточный Афганистан, по Lindberg [1960].

IntCox without setulae at distal margin. Reduced P5 (Fig. 105G, H): segment with rather short apical process; inner spine weak, about as wide as setae or slightly wider; about 1.5 times longer than segment; outer seta about as long as spine; medial seta about 1.2 times longer than spine.

MALE: unknown

DISTRIBTUTION: ground water in Europe.

COMMENTS: Rylov [1948], Monchenko [1974] consider this species to be synonymous with *E.* (*Sub.*) *graeteri*, since both of these *Eucyclops* taxa have long caudal rami, highly reduced lateral *serra*, P5 with weak inner spine and naupliar eye without pigment. In my opinion, there is a set of taxonomically important characters that clearly separate these two species, including: presence vs absence of lateral setulae on Th4; reduced lateral *serra* with longitudinal vs transverse row of spinules; relative length of P4 Enp3 and its spines; relative length of dorsal caudal seta.

102. *Eucyclops* (*Subterrocyclops*) *chivahensis* Lindberg, 1960
Fig. 106.

SYNONYMY: *Eucyclops chivahensis*: Lindberg, 1960; Dussart, Defaye, 2006; *Eucyclops* (*Subterrocyclops*) *chivahensis*: Alekseev, 2019.

TYPE LOCALITY: spring in The Pamir Mountains (2500 m a.s.l.), near Doavi, Chiva province, Afghanistan, Central Asia.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 106A–D). Body length without caudal setae 780–875 μm. Th4 with few short strong lateral setulae. Genital double somite (Fig. 106A) about as long as broad; *receptaculum seminis* mouth-shaped, typical of genus. Abdominal somites with serrated posterior margin ventrally. Anal somite slightly shorter than previous one; anal operculum weakly developed, slightly convex; anal opening with short hairs. Caudal rami subparallel or slightly divergent (Fig. 106B), rather short, with L/W ratio 3.7–3.9; lateral *serra* absent except 2–3 small denticles above lateral seta. Lateral seta about 1.3 times as long as ramus width. Dorsal seta subequal or slightly shorter than outermost seta. Outermost seta inserted close to outer middle seta, rather thin; about 0.6 times as long as ramus length; with setulae on both sides. Innermost seta plumose, 1.2–1.4 times longer than outermost one.

Antennule 12 segmented, short, almost reaching distal edge of CTh; 3 distal segments

with very narrow, smooth hyaline membrane. A2 basipodite ornamentation and mouth appendages not studied.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3; spine of normal appearance. P4 Enp3 rather short, with L/W ratio 1.7–1.9; inner spine 1.6–1.9 times longer than outer one and 1.2–1.4 times longer than segment; distal setae long, reaching beyond tips of nearest spines (Fig. 106C). P4 IntCox without setulae at distal margin; Bas inner outgrowth with short hairs. Reduced P5 (Fig. 106A): segment elongated with L/W ratio 1.5; inner spine strong, about twice wider than setae, and about 1.5 times longer than segment; outer seta slightly longer than spine; medial seta about 1.7 times longer than spine.

MALE (Fig. 106E). Body length without caudal setae 700–775 μm. Caudal rami parallel, shorter than in female, with L/W ratio 3.2–3.5. Dorsal seta much shorter than outermost seta. Innermost seta 1.3–1.6 times longer than outermost one. Antennule 14-segmented. P1–P5 as in female. Rudimentary P6 (see Fig. 106E): inner spine strong but relatively short, not reaching distal edge of next abdominal somite, medial seta shorter and outer seta longer than spine (1.0/0.7/1.6).

DISTRIBUTION: known from the type locality only.

COMMENTS: This species, as its author also notes, is similar to African mountain species *E.* (*Sub.*) *glaber* and *E.* (*Sub.*) *nudus*, but differs from them primarily in absence of setulae on distal margin of P4 IntCox.

103. ***Eucyclops*** (***Subterrocyclops***) ***elburziensis*** Lindberg, 1941
Fig. 107.

SYNONYMY: *Eucyclops ruttneri* forma *elburziensis*: Lindberg, 1941; *Eucyclops elburziensis*: Dussart, Defaye, 2006; *Eucyclops* (*Subterrocyclops*) *elburziensis*: Alekseev, 2019.

TYPE LOCALITY: pond in Darband, 1350 m a.s.l., 14 km north of Teheran, Iran.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings

DESCRIPTION. FEMALE (Fig. 107A–D). Body length without caudal setae 760–940 μm. Th4 with strong lateral setulae. Genital double somite about as long as broad; *receptaculum seminis* typical of genus, with narrow lateral arms (Fig. 107A, B). Anal operculum slightly convex, anal opening with short hairs. Caudal rami slightly divergent (Fig. 107C), short, with L/W ratio 3–4; with short lateral *serra* produced by few short spinules. Lateral seta not longer than ramus width. Dorsal seta slightly shorter than outermost seta. Outermost seta thin, inserted close to outer middle seta, rather long, about 0.7 times as long as ramus length; with setulae on both sides. Innermost seta plumose, 1.2–1.4 times longer than outermost one. Distal setae length ratio beginning with outermost: 1.0/ 4.6–4.9/ 7.3–8.9/ 1.2–1.4.

Antennule 12-segmented, reaching distal margin of CTh; with narrow smooth hyaline membrane on 3 distal segments. A2 basipodite ornamentation and mouth appendages not studied.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio 1.9–2.1; inner spine 1.6–1.8 times longer than outer one and 1.2–1.3 times longer than segment; distal setae reaching beyond tips of nearest spines (Fig. 107D). P4 IntCox distal margin with few setulae at sides with gap in middle. Reduced P5 (see Fig. 107A, B) armed with strong inner spine about 1.6–1.9 times longer than segment length and two setae; outer seta 1.0–1.2 times as long as spine; medial seta about 1.6–2.0 times longer than spine.

MALE (Fig. 107E). Body length without caudal setae 675–760 μm, slender than in female. Caudal rami parallel, shorter than in female, with L/W ratio 2.9; innermost seta 1.8–1.9 times longer than outermost seta. Antennule 14-segmented. P1–P5 as in female. Rudimentary P6 (see Fig. 107E) armed with strong inner spine as long as next abdominal somite, and two setae subequal to spine.

DISTRIBUTION: Iran, Central Asia.

COMMENTS: This form was found only by author, holotype is not found yet so it requires more detailed redescription.

104. ***Eucyclops*** (***Subterrocyclops***) ***glaber*** Kiefer, 1935
Fig. 108.

SYNONYMY: *Eucyclops glaber*: Kiefer, 1935, 1939b; Dussart, Defaye, 2006; *Eucyclops* (*Macrurocyclops*) *glaber*: Alekseev, 2019.

TYPE LOCALITY: Mount Kinangop, Aberdare Range, Kenya.

HOLOTYPE PRESENCE AND STORING: holotype female and paratype male deposited in Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: type slide #02252; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 108A–G). Body length without caudal setae 1000–1100 μm.

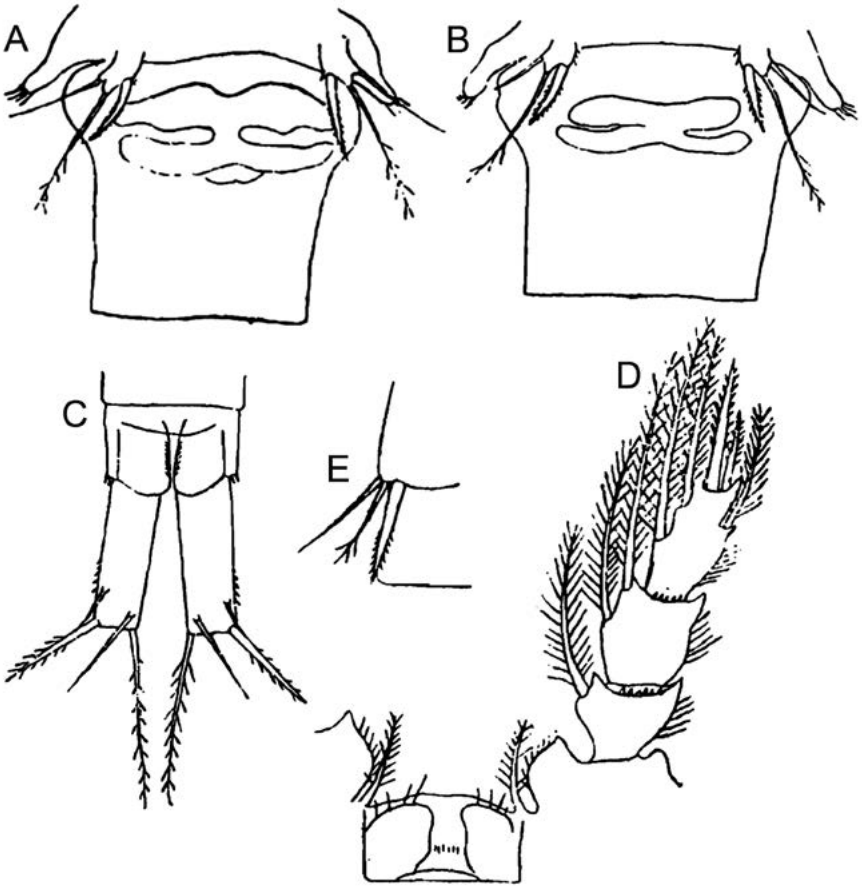

Fig. 107. *Eucyclops* (*Subterrocyclops*) *elburziensis* Lindberg, 1941. A, B — Th4, genital double somite and P5; C — caudal rami, dorsal; D — P4; E — P6. A–D — female; E — male. Iran, after Lindberg [1941].

Рис. 107. *Eucyclops* (*Subterrocyclops*) *elburziensis* Lindberg, 1941. A, B — Th4, генитальный сомит и P5; C — каудальные ветви, дорсально; D — P4; E — P6. A–D — самка; E — самец. Иран, по Lindberg [1941].

Th4 with lateral setulae. Genital double-somite rather short, narrows gradually and moderately, L/W ratio 0.9; *receptaculum seminis* typical for genus (Fig. 108A, B). Anal operculum weakly developed, with central incision. Caudal rami (Fig. 108B, C) with L/W ratio 4.3, straight, parallel; without lateral *serra*, only with 1–2 small denticles at lateral and outermost setae. Lateral seta as long as ramus width. Outermost, innermost and dorsal setae differ only slightly in length. Distal setae approximate length ratio beginning with outermost: 1.0/ 6.5/ 10.0/ 1.0–1.1.

Antennule 12-segmented, rather short, reaching slightly beyond distal edge of CTh; 3 distal segments with very narrow, smooth hyaline membrane. A2 Bas ornamentation and mouth appendages not observable in holotype.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Bas inner outgrowth with short hairs. P4 IntCox caudal surface with three rows of short setulae, rows I and II without central gap; coxal spine with long setulae proximally and short spinules distally, outer side with gap (Fig. 108D, E). Coxa P4 on caudal side ornamented with all groups except F (Fig. 108E). P4 Enp3 twice longer than wide; inner spine 1.4 times longer than outer one and about as long as segment; distal setae reaching slightly beyond tips of nearest spines (Fig. 108F). P4 Exp3 distal spine shorter than segment (Fig. 108G). Reduced

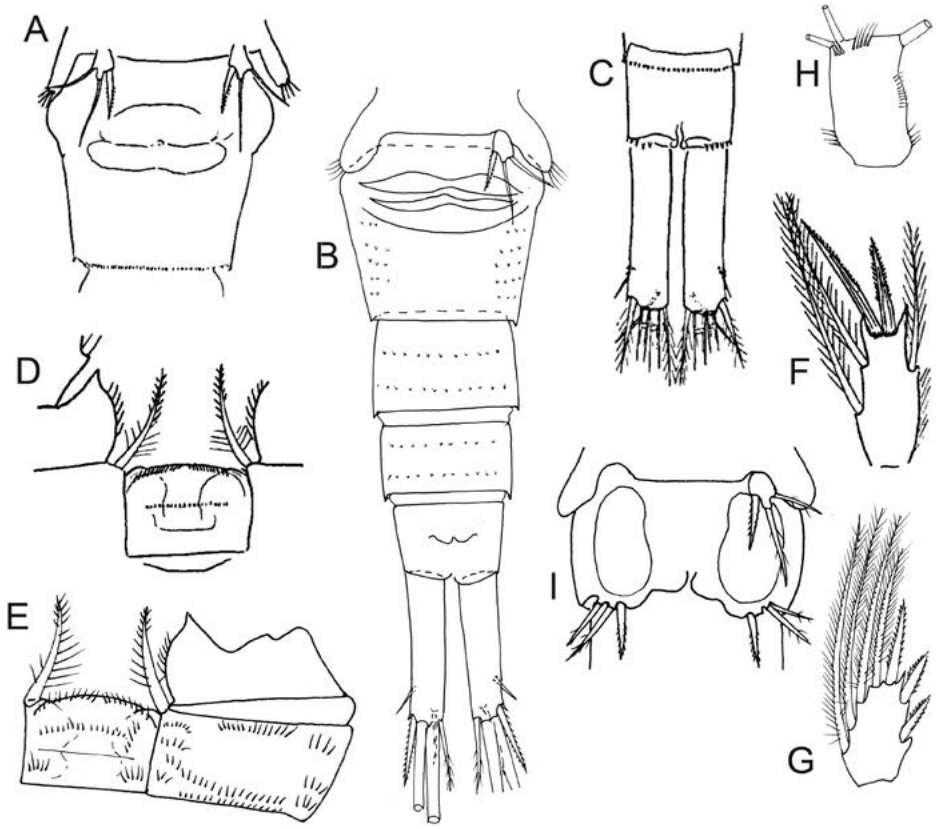

Fig. 108. *Eucyclops* (*Subterrocyclops*) *glaber* Kiefer, 1935. A — Th4, genital double somite and P5; B — abdomen; C — caudal rami, ventral; D, E — P4 intercoxal plate, caudal; F — P4 Enp3; G — P4 Exp3; H — A2 Bas, caudal; I — P5 and P6. A–G — female; H, I — male. Kenya. A, C, D, F — after Kiefer [1939b]; B, E, G, H, I — orig., slide #02252 KRC.

Рис. 108. *Eucyclops* (*Subterrocyclops*) *glaber* Kiefer, 1935. A — Th4, генитальный сомит и P5; B — абдомен; C — каудальные ветви, вентрально; D, E — межкоксальная пластинка P4, каудально; F — P4 Enp3; G — P4 Exp3; H — A2 Bas, каудально; I — P5 и P6. A–G — самка; H, I — самец. Кения. A, C, D, F — по Kiefer [1939b]; B, E, G, H, I — ориг., преп. #02252 KRC.

P5 (Fig. 108A, B) armed with rather weak inner spine (not more than twice wider than setae) and slightly longer setae; inner spine about 1.5 times longer than segment.

MALE (Fig. 108H, I). Body slightly shorter than in female, 900–1000 μm. Th4 without lateral setulae. Caudal rami shorter than in female, with L/W ratio about 4; caudal setae as in female. Antennule 14-segmented. A2 Bas ornamentation partly visible, on caudal surface with distal groups N1 and N2 (Fig. 108H). P1–P5 similar to female. Rudimentary P6 (Fig. 108I) with weak and short inner spine, about as long as two setae.

DISTRIBUTION: known from the type locality only.

COMMENTS: This form in some taxonomically important details (presence of hairs in positions N1, 2 in A2 Bas, gap among hairs in P4 coxal spine, A1 with smooth hyaline membrane etc) is close to *E.* (*E.*) *serrulatus* s.lat. It seems like it occupies morphologically intermediate position between two subgenera.

105. ***Eucyclops*** (***Subterrocyclops***) ***graeteri*** (Chappuis, 1927)

Fig. 109.

SYNONYMY: *Cyclops graeteri*: Chappuis, 1927; *Eucyclops graeteri*: Lescher-Moutoué, 1975; Dussart,

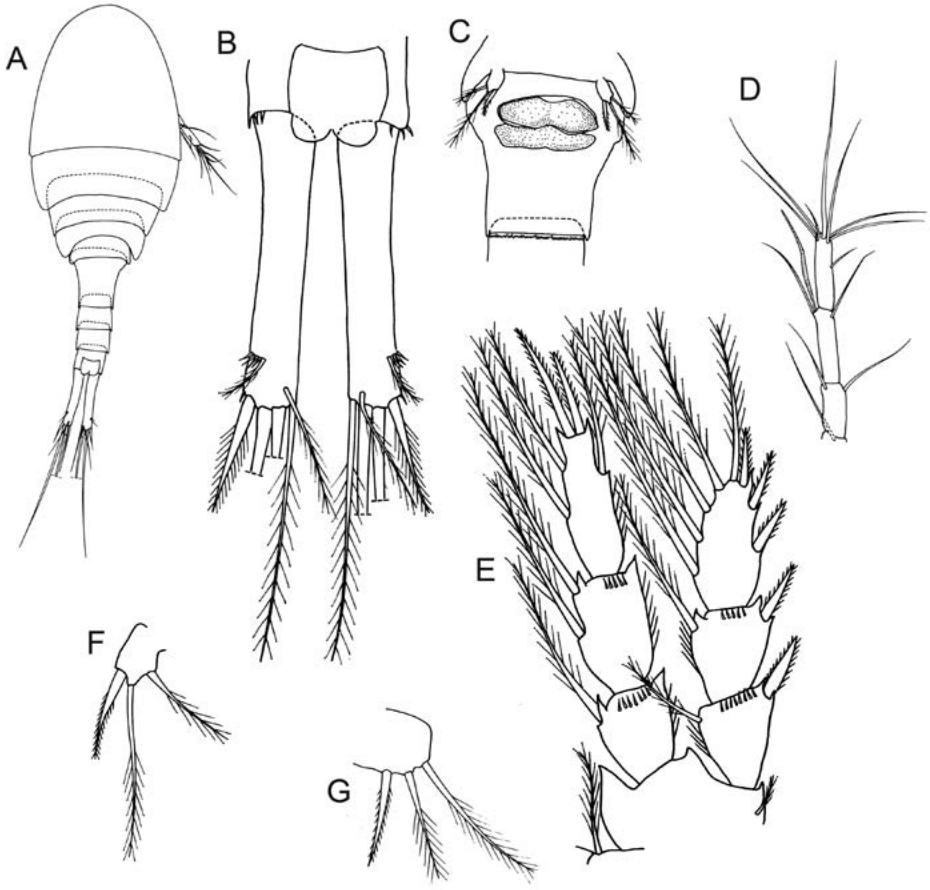

Fig. 109. *Eucyclops* (*Subterrocyclops*) *graeteri* (Chappuis, 1927). A — habitus; B — caudal rami, dorsal; C — Th4, genital double somite and P5; D — A1, three distal segments; E — P4; F — P5; G — P6. A–F — female; G — male. Switzerland, after Lescher-Moutoué [1975].

Рис. 109. *Eucyclops* (*Subterrocyclops*) *graeteri* (Chappuis, 1927). A — габитус; B — каудальные ветви, дорсально; C — Th4, генитальный сомит и P5; D — A1, три дистальных членика; E — P4; F — P5; G — P6. A–F — самка; G — самец. Швейцария, по Lescher-Moutoué [1975].

Defaye, 2006; *Eucyclops* (*Subterrocyclops*) *graeteri* Alekseev, 2019.

TYPE LOCALITY: Cave Jan-Jaque, Motie vicinity, Switzerland.

HOLOTYPE PRESENCE AND STORING: not found/existing.

MATERIAL STUDIED: author's description, redescription of Lescher-Moutoué [1975] from the type cave.

DESCRIPTION. FEMALE (Fig. 109A–F). Body length without caudal setae 968–1143 μm. Cephalothorax L/W ratio about 1 with maximal width at posterior margin. Th4 without lateral setulae. Genital double somite with L/W ratio about 1; *receptaculum seminis* mouth-shaped, typical of genus (Fig. 109C). Abdominal somites with serrated posterior margins. Anal operculum weakly developed. Caudal rami (Fig. 109A, B) L/W ratio about 6; lateral *serra* absent, except transverse row of about 7 spinules above lateral seta. Lateral seta slightly shorter than ramus width. Dorsal seta longer than outermost seta. Outermost seta inserted close to outer middle seta, about 0.4 times as long as ramus length; with subequal setulae on both sides. Innermost seta plumose, twice longer than outermost one.

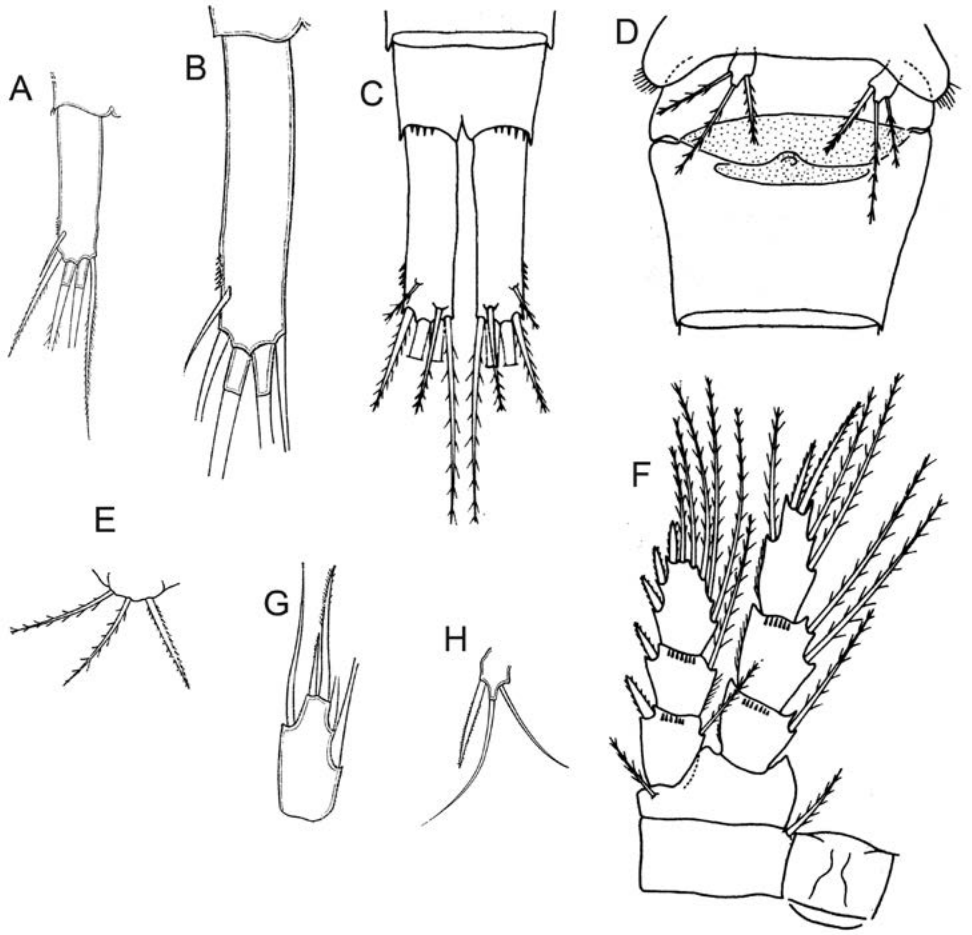

Fig. 110. *Eucyclops* (*Subterrocyclops*) *intermedius* Damian, 1955 stat.n. A–C — caudal rami, dorsal; D — Th4, genital double somite and P5; E — P6; F — P4; G — P4 Enp3; H — P5. A–D, F–H — female; E — male. A, B, G, H — Romania, after Damian [1955]; C–F — Italy, after Pesce [1978].

Рис. 110. *Eucyclops* (*Subterrocyclops*) *intermedius* Damian, 1955 stat.n. A–C — каудальные ветви, дорсально; D — Th4, генитальный сомит и P5; E — P6; F — P4; G — P4 Enp3; H — P5. A–D, F–H — самка; E — самец. A, B, G, H — Румыния, по Damian [1955]; C–F — Италия, по Pesce [1978].

Distal setae approximate length ratio beginning with outermost: 1.0/ 5.3/ 9.9/ 2.0.

Antennule 12-segmented, reaching Th1; 3 distal segments without visible hyaline membrane; 11th segment with very long aestetasc (Fig. 109D). A2 Bas ornamentation not studied. Mouth appendages typical of genus.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 long, with L/W ratio about 2.7; inner spine about 1.4 times longer than outer one and 0.8 times as long as segment; distal setae reaching slightly beyond tips of nearest spines (Fig. 109E). P4 Exp3 distal spine short, not longer than proximal ones, twice shorter than segment. Reduced P5 (Fig. 109F): segment rectangular in shape, apical outgrowth short; inner spine about 1.5 times longer than segment length; outer seta slightly longer than spine; medial seta almost twice longer than spine.

MALE (Fig. 109G). Body length without caudal setae 815–912 µm. Caudal rami shorter than in female with L/W ratio 4.6–5.7. Antennule 14-segmented. P1–P5 similar to female. Rudimentary P6 (see Fig. 109G) armed with inner

spine about as long as medial seta, but shorter than outer seta.

DISTRIBUTION: underground waters of Central Europe.

COMMENTS: From the nearest *E.* (*Sub.*) *subterraneus* (Graeter, 1907), which also poses quite long naked caudal rami, this species is clear separated by missing of setulae on lateral edges of Th4, transverse row of spinules on CR instead of short lateral *serra,* longer dorsal caudal seta and longer P4 Enp3.

106. *Eucyclops* (*Subterrocyclops*) *intermedius* Damian, 1955 **stat.n**. Fig. 110.

SYNONYMY: *Eucyclops macrurus* var *intermedius*: Damian, 1955; *Eucyclops macrurus intermedius*: Damian-Georgescu, 1963; *Eucyclops subterraneus intermedius:* Pesce, 1978.

TYPE LOCALITY: spring in Apuseni Mountains, Romania.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings; description of Italian population, Pesce [1978].

DESCRIPTION. FEMALE (Fig. 110A–D, F–H). Body length without caudal setae about 870–990 μm (Italy). Th4 with lateral setulae (Fig. 110D). Genital double somite as long as broad, *receptaculum seminis* mouth-shaped, typical of genus. Caudal rami subparallel, with L/W ratio 3.6–4.6, with very short lateral *serra* of 3–7 small equal denticles above lateral seta insertion (Fig. 110A–C). Lateral seta about 1.1–1.3 times longer than ramus width, inserted slightly higher than dorsal seta. Dorsal seta about as long as outermost seta (Italy, not described in type locality). Outermost seta thin, inserted close to outer middle seta, about 0.8 (Romania) or 0.6 (Italy) times as long as ramus length; with short setulae on both sides. Innermost seta plumose with short setulae, about 1.5 (Romania) or 1.9 (Italy) times longer than outermost one.

Antennule 12-segmented, reaching posterior margin of Th1; 3 distal segments without visible hyaline membrane. Antenna and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 1.9; inner spine twice longer than outer one and 1.1 times longer than segment (Romania) or shorter (Italy); distal setae long, reaching beyond tips of nearest spines (Fig. 110G, F). P4 IntCox without setulae at distal margin (Italy). Reduced P5 (Fig. 110D, H): inner spine about 1.8 times longer than segment; outer seta slightly longer than spine; medial seta about 1.5–1.7 times longer than spine.

MALE (Fig. 110E). (Italy) Body shorter than in female with shorter caudal rami. P1–P5 similar to female. Rudimentary P6 (see Fig. 110E) armed with three subequal appendages.

DISTRIBUTION: ground water of Romania and Italy.

COMMENTS: Damian [1955] describes this form as subspecies of *E.* (*M.*) *macrurus,* then it was assigned to subspecies of *E.* (*Sub.*) *subterraneus* [Pesce, 1978]. Following set of characters clearly separates them meanwhile: shorter caudal rami with longer lateral seta*,* shorter P4 Enp3 and longer medial seta of P5. At the same time, all these forms require redescription.

107. *Eucyclops* (*Subterrocyclops*) *linderi* Lindberg, 1948 Fig. 111.

SYNONYMY: *Eucyclops linderi*: Lindberg, 1948; Dussart, Defaye, 2006; *Eucyclops* (*Subterrocyclops*) *linderi*: Alekseev, 2019.

TYPE LOCALITY: Umpherston Cave, Mount Gambier, South Australia.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 111). Body length without caudal setae 688 μm. Th4 weakly extended laterally, naked. Genital double somite longer than wide, gradually narrows; *receptaculum seminis* poorly visible, approximately drawn on Fig. 111B. Abdominal somites without visible serration on posterior margins. Anal operculum weakly convex, very wide. Caudal rami parallel, short, with L/W ratio 3.7; without lateral *serra* except 1–2 small spinules inserted above lateral seta (Fig. 111A). Lateral seta long, about 1.8 times as long as ramus width. Dorsal seta longer than outermost seta. Outermost seta inserted close to outer middle seta, thin; about 0.6 times as long as ramus length; with short setulae on both sides. Innermost seta about 1.6 times longer than outermost one, with hair-setulae on one side. Distal setae approximate length ratio beginning with outermost: 1.0/ 4.3/ 6.0/ 1.6.

Antennule 12-segmented, reaching distal margin of CTh; with narrow smooth hyaline membrane on 2 distal segments. A2 basipodite ornamentation and mouth appendages not studied.

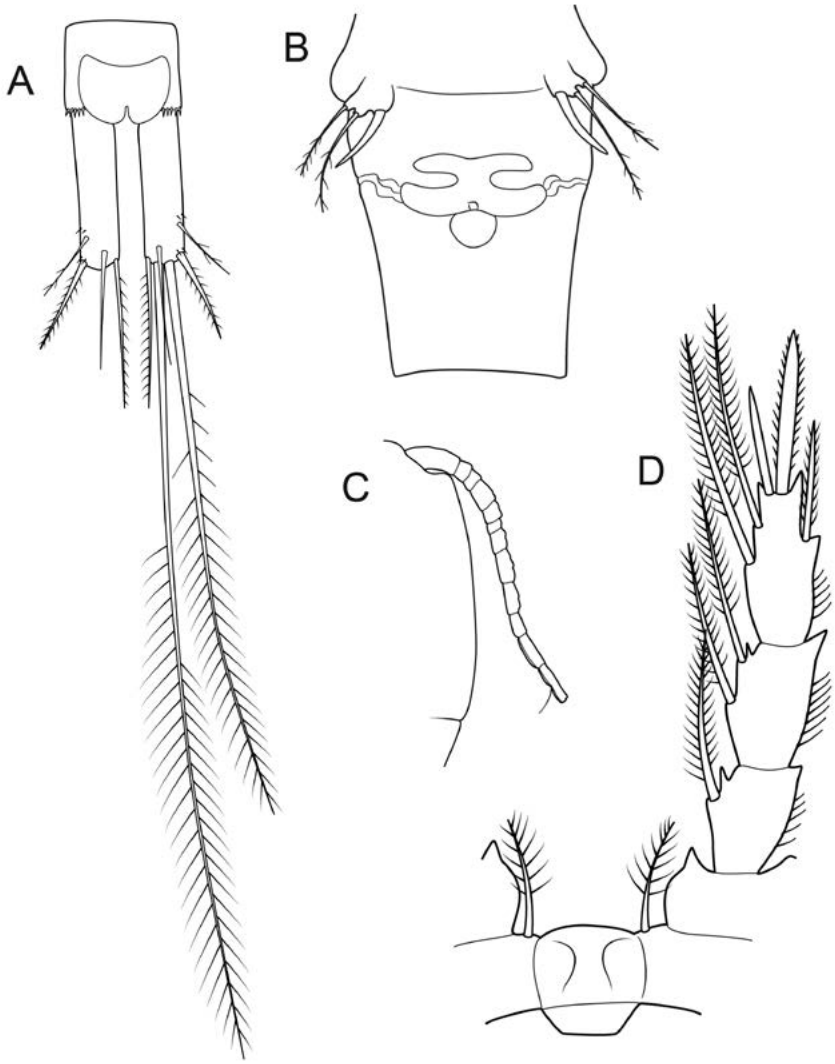

Fig. 111. *Eucyclops* (*Subterrocyclops*) *linderi* Lindberg, 1948. Female: A — caudal rami, dorsal; B — Th4, genital double somite and P5; C — A1; D — P4. South Australia, after Lindberg [1948].

Рис. 111. *Eucyclops* (*Subterrocyclops*) *linderi* Lindberg, 1948. Самка: A — каудальные ветви, дорсально; B — Th4, генитальный сомит и P5; C — A1; D — P4. Южная Австралия, по Lindberg [1948].

Swimming legs P1–P4: distal exopodite spine formula 3/4/3/3. Distal setae of P3 and P4 modified (not drawn). P4 Enp3 with L/W ratio about 2; inner spine weakly developed, without denticles, about 0.7 times as long as outer spine; outer seta short, reaching middle of nearest spine; distal inner spine long, reaching beyond tips of both spines. P4 IntCox distal margin without setulae; coxal spine setiform, homogenously plumose on both sides, reaching beyond tip of basepodite inner outgrowth. Reduced P5 (see Fig. 111B) with wide and short segment, apical process weakly

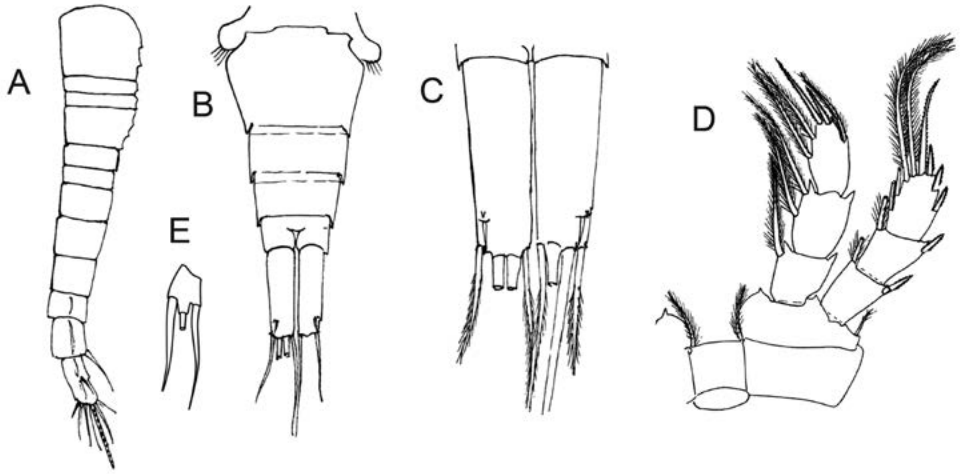

Fig. 112. *Eucyclops* (*Subterrocyclops*) *maritimus* Alekseev et Monchenko, 2011. Female: A — A1; B — abdomen; C — caudal rami; D — P4; E — P5. North Caspian Sea, after Alekseev & Monchenko [2011].

Рис. 112. *Eucyclops* (*Subterrocyclops*) *maritimus* Alekseev et Monchenko, 2011. Самка: A — A1; B — абдомен; C — каудальные ветви; D — P4; E — P5. Северный Каспий, по Alekseev & Monchenko [2011].

developed; inner spine strong, bent, twice longer than segment length; medial seta about 1.6 times longer than spine; outer seta about 1.2 times longer than spine.

MALE unknown.

DISTRIBUTION: known only from the type locality.

COMMENTS: Particular structure of P4 Enp3, which has naked inner spine shorter than outer spine, makes it easy to separate this form from other congeners.

108. ***Eucyclops* (*Subterrocyclops*) *maritimus*** Alekseev et Monchenko, 2011 Fig. 112.

SYNONYMY: *Eucyclops orthostylis maritimus*: Alekseev, Monchenko, 2011.

TYPE LOCALITY: Northern Caspian Sea, near River Ural and River Emba, Kazakhstan.

HOLOTYPE PRESENCE AND STORING: holotype female dissected in one slide, deposited in Federal collection of Zoological Institute, St.Petersburg, Russia.

MATERIAL STUDIED: holotype #55059, authors' description and figures.

DESCRIPTION. FEMALE (Fig. 112). Body length without caudal setae 725 μm. Th4 with lateral setulae. Genital double somite wider than long, gradually narrows, *receptaculum seminis* not observable. Caudal rami (Fig. 112B, C), closely spaced, parallel, L/W ratio about 3.8; lateral *serra* absent, except 1–2 small spinules inserted above lateral seta; lateral seta shorter than ramus width. Outermost setiform seta inserted close to outer middle seta, thin; about 0.6 times as long as ramus length; with hairs on both sides. Innermost seta about as long as ramus length and almost 1.5 times longer than outermost one; with hairs on both sides. Dorsal seta slightly shorter than outermost seta.

Antennule 12-segmented, short, just reaching distal end of CTh; 3 distal segments with narrow smooth hyaline membrane (Fig. 112A). A2 with 8 short, but strong setae on distal endopodial segment; setae partly transformed in hook-like structures, possibly for better attaching to substate (sponges?). Mandibles also shorten, with 6 strong teeth and several sensitive setae distally. Maxillule strong with well-developed palp missing any ornamentation on surface. Maxilla typical for genus. Maxilliped 4-segmented, distal segment with 2 strong bent setae, adopted for attaching to substrate.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 (Fig. 112D) quite short, about 1.8 times as long as broad, inner/outer spine ratio nearly 2; inner spine slightly longer than segment; distal setae reaching beyond tips of nearest spines. Distal spine of P4 Exp3 short, about twice shorter than segment; distal seta modified. P4 IntCox without visible ornamentation; inner

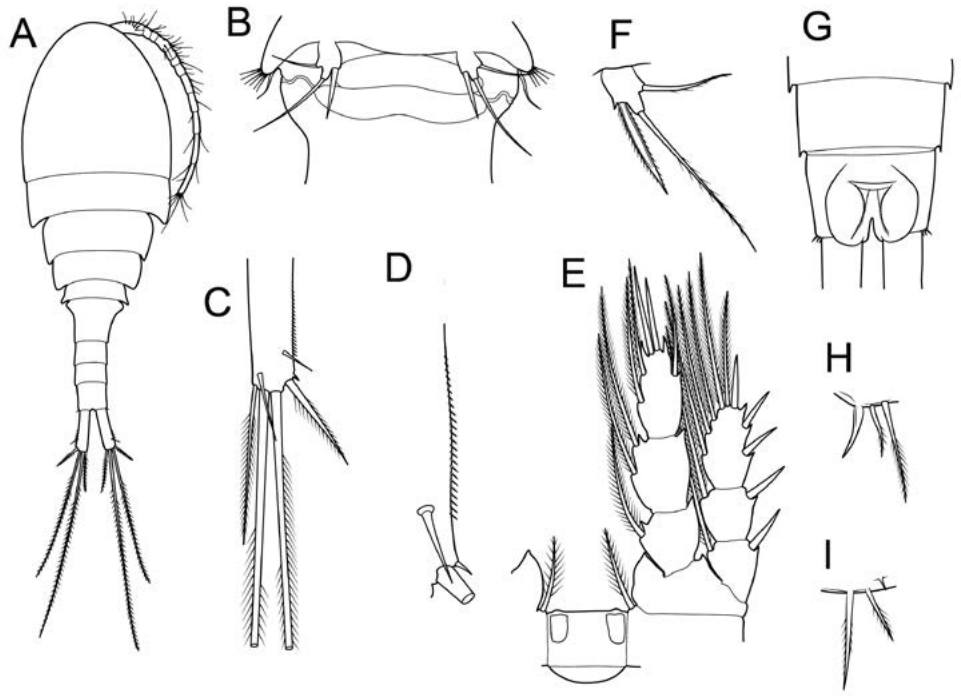

Fig. 113. *Eucyclops* (*Subterrocyclops*) *nagasakai* Ueno, 1934. A — habitus; B — Th4, genital double somite and P5; C, D — caudal ramus; E — P4; F — P5; G — anal segment; H, I — P6. A–H — female; I — male. Japan, after Ueno [1934].

Рис. 113. *Eucyclops* (*Subterrocyclops*) *nagasakai* Ueno, 1934. A — габитус; B — Th4, генитальный сомит и P5; C, D — каудальная ветвь; E — P4; F — P5; G — анальный сомит; H, I — P6. A–H — самка; I — самец. Япония, по Ueno [1934].

coxal spine/seta homogeneously covered with thin long dense hairs. Reduced P5: elongated segment with well-developed inner spine twice longer than segment and subequal to it and also strong outer seta (Fig. 112E).

MALE unknown.

DISTRIBUTION: North Caspian Sea, Kazakhstan.

COMMENTS: This form differs well from other congeners by transformation of distal endopodial setae of A2 into hooks and modified mouth appendages. Some of these features may indicate adaptations of this form to commensal or parasitic modus of life (commensal of Caspian sponges?).

109. ***Eucyclops* (*Subterrocyclops*) *nagasakai*** Ueno, 1934
Fig. 113.

SYNONYMY: *Eucyclops nagasakai*: Ueno, 1934; Dussart, Defaye, 2006*; Eucyclops* (*Subterrocyclops*) *nagasakai*: Alekseev, 2019.

TYPE LOCALITY: subterranean pool ("Miwatari-ike") in cave at Hirogawara, Taguchimura, eastern part of Shinano, Japan.

HOLOTYPE PRESENCE AND STORING: not found/exist.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 113A–H). Body length without caudal setae 1200 μm, transparent, colorless nauplial eye. Cephalothosome with L/W ratio nearly 1. Th4 with setulae laterally. Genital double somite with L/W ratio about 1; *receptaculum seminis* mouth-shaped, typical of genus (Fig. 113B). Anal somite longer than previous one; anal operculum slightly convex (Fig. 113G). Caudal rami slightly divergent (Fig. 113A) with L/W ratio about 4; lateral *serra* reduced, with variable length, often only with few small spinules above lateral seta, or longer, but not extending above middle of caudal rami proximally (Fig. 113C, D). Lateral seta not longer than ramus

width. Dorsal seta shorter than outermost seta. Outermost seta about 0.6 times as long as ramus length; setulae on both sides. Innermost seta plumose, about 1.3 times longer than outermost one. Distal setae approximate length ratio beginning from outermost: 1.0/ 5.0/ 7.5/ 1.3.

Antennule 12-segmented, reaching middle of Th1; without visible hyaline membrane on 3 distal segments. A2 basipodite ornamentation and mouth appendages not studied.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 twice longer than wide; inner spine about 1.2 times longer than outer one and about 1.1 times longer than segment; distal setae reaching slightly beyond tips of nearest spines (Fig. 113E). P4 Exp with rather long spines; distal spine not longer than other spines and about 0.6 times as long as segment. P4 IntCox with naked distal margin; coxal spine rather long, reaching beyond tip of inner basipodial outgrowth. Reduced P5 (Fig. 113F): elongated shape with L/W ratio about 1.5; inner spine about 1.9 times longer than segment; outer seta subequal to spine; medial seta about 1.8 times longer than spine. Rudimentary P6 (Fig. 113I) armed with two unequal setae and one small spine.

MALE (Fig. 113H). Body length without caudal setae about 800 μm, transparent, colorless nauplial eye. Caudal rami shorter than in female, with L/W ratio about 3, without lateral *serra*. Antennule 14-segmented. P1–P5 similar to female. Rudimentary P6 (see Fig. 113H): inner spine weak and short subequal to medial seta, and about half of outer seta with length ratios beginning with spine: 1/1/2.

DISTRIBUTION: underground water of Japan.

COMMENTS: Ueno describes this species as close to *E.* (*E.*) *serrulatus* and *E.* (*Sp.*) *speratus*. He separates *E.* (*Sub.*) *nagasakai* from these two taxa as having shorter caudal rami with reduced s*erra*. Long distal setae of swimming legs distinguish this species as well and place it in different subgenus *Subterrocyclops*.

110. ***Eucyclops* (*Subterrocyclops*) *naphaeus*** Petkovski, 1971
Fig. 114.

SYNONYMY: *Eucyclops subterraneus naphaeus*: Petkovski, 1971; Dussart, Defaye, 2006; *Eucyclops* (*Subterrocyclops*) *naphaeus*: Alekseev, 2019.

TYPE LOCALITY: mountain spring, Northern Macedonia, South Europe.

HOLOTYPE PRESENCE AND STORING: not found.

MATERIAL STUDIED: author's description and drawings.

DESCRIPTION. FEMALE (Fig. 114A–F). Body length without caudal setae 750–820 μm. Th4 with dense strong lateral setulae. Genital double somite longer than broad; *receptaculum seminis* mouth-shaped, typical of genus (Fig. 114B). Anal operculum wide, convex. Caudal rami slightly divergent, relatively short, (Fig. 114C) with L/W ratio about 3.6–3.7; lateral *serra* absent, only 1–2 spinules inserted above lateral seta. Lateral seta about 1.3 times longer than ramus width. Dorsal seta shorter than outermost seta. Outermost seta thin, inserted close to outer middle seta, rather long, about 0.7 times as long as ramus length; with hair-setulae on both sides. Innermost seta plumose, about 1.3 times longer than outermost one.

Antennule 12-segmented, short, hardly reaching posterior edge of CTh; 3 distal segments without visible hyaline membrane (Fig. 114E). Antenna and mouth appendages not described.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 with L/W ratio about 2; inner spine about 1.8 times longer than outer one and 1.1 times longer than segment; distal setae long, reaching beyond tips of nearest spines. P4 Exp3 distal spine about 0.6 times as long as segment. P4 IntCox without setulae at distal margin. Reduced P5 (see Fig. 114F): segment short and wide with L/W about 1.3; inner spine weak, setiform, but rather long, about twice longer than segment; outer seta slightly longer than spine; medial seta about 1.7 times as long as spine.

MALE (Fig. 114G). Body length without caudal setae about 700 μm. Caudal rami shorter than in female, with L/W ratio about 2.9; caudal setae similar to female. Antennule 14-segmented. Swimming legs P1–P5 similar to female. Rudimentary P6 (see Fig. 114G) armed with long, but thin inner spine, and two shorter setae.

DISTRIBUTION: groundwater of North Macedonia.

COMMENTS: Petkovski [1971] described this form as subspecies of *E.* (*Sub.*) *subterraneus*. The following characters separate *E.* (*Sub.*) *naphaeus* from *E.* (*Sub.*) *subterraneus* and other congeners: small body length, short caudal rami, innermost/outermost caudal setae ratio less than 1.5, long lateral seta.

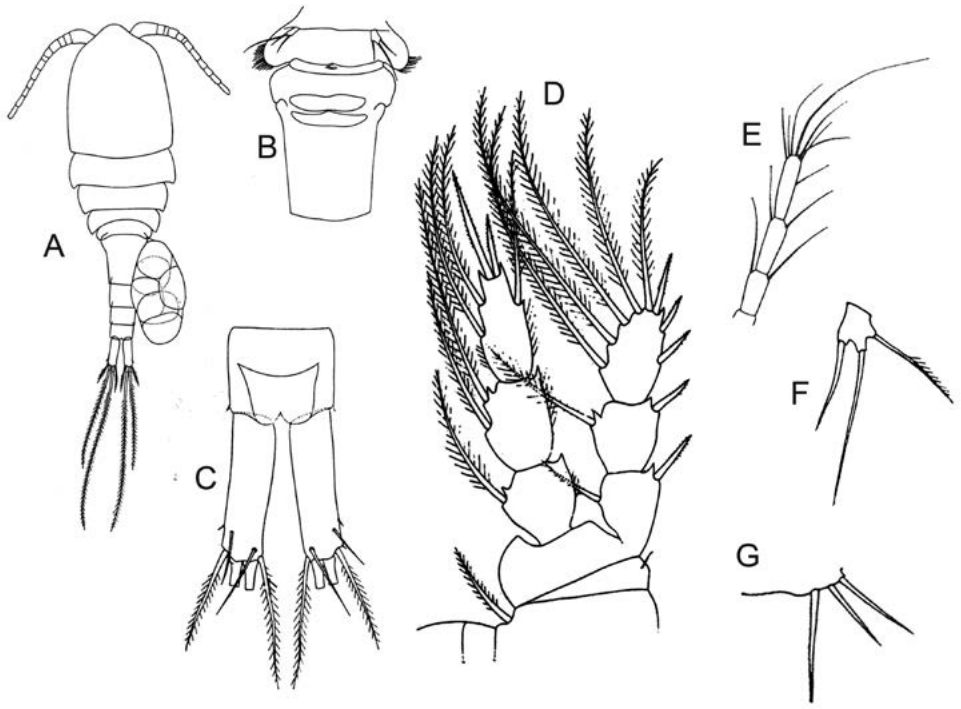

Fig. 114. *Eucyclops* (*Subterrocyclops*) *naphaeus* Petkovski, 1971. A — habitus; B — Th4, genital double somite and P5; C — caudal rami, dorsal; D — P4; E — A1, three distal segments; F — P5; G — P6. A–F — female; G — male. (Sar Mountains, North Macedonia, after Petkovski [1971]).

Рис. 114. *Eucyclops* (*Subterrocyclops*) *naphaeus* Petkovski, 1971. A — габитус; B — Th4, генитальный сомит и P5; C — каудальные ветви, дорсально; D — P4; E — A1, три дистальных членика; F — P5; G — P6. A–F — самка; G — самец. Горы Сар, Северная Македония, по Petkovski [1971].

111. ***Eucyclops* (*Subterrocyclops*) *nudus*** Kiefer, 1935 Fig. 115.

SYNONYMY: *Eucyclops nudus*: Kiefer, 1935; Dussart, Defaye, 2006.

TYPE LOCALITY: Cherang'any Hills, Kenya, Central-East Africa.

HOLOTYPE PRESENCE AND STORING: Kiefer's Reference collection, SMNK, Germany.

MATERIAL STUDIED: female holotype #02248 specimen; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 115). Body length without caudal setae 940 µm. Th4 with strong lateral setulae. Genital double somite short L/W ratio less than 1, narrows gradually and moderately (Fig. 115A); *receptaculum seminis* mouth-shaped, typical of genus. Abdominal somites with serrated posterior margins. Anal operculum convex. Caudal rami parallel (Fig. 115B, C), short, with L/W ratio about 3.2; lateral *serra* absent except 2–3 small denticles above lateral seta. Lateral seta shorter than ramus width. Dorsal seta slightly shorter than outermost seta. Outermost seta inserted close to outer middle seta, 0.5–0.6 times as long as ramus length; with subequal short setulae on both sides. Innermost seta weak and short, subequal or slightly longer than outermost one.

Antennule 12-segmented, reaching Th1; 3 distal segments with very narrow, hardly visible, smooth hyaline membrane. A2 Bas ornamentation and mouth appendages not described and not seen in holotype.

Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 relatively short, with L/W ratio about 1.9; inner spine about 1.8

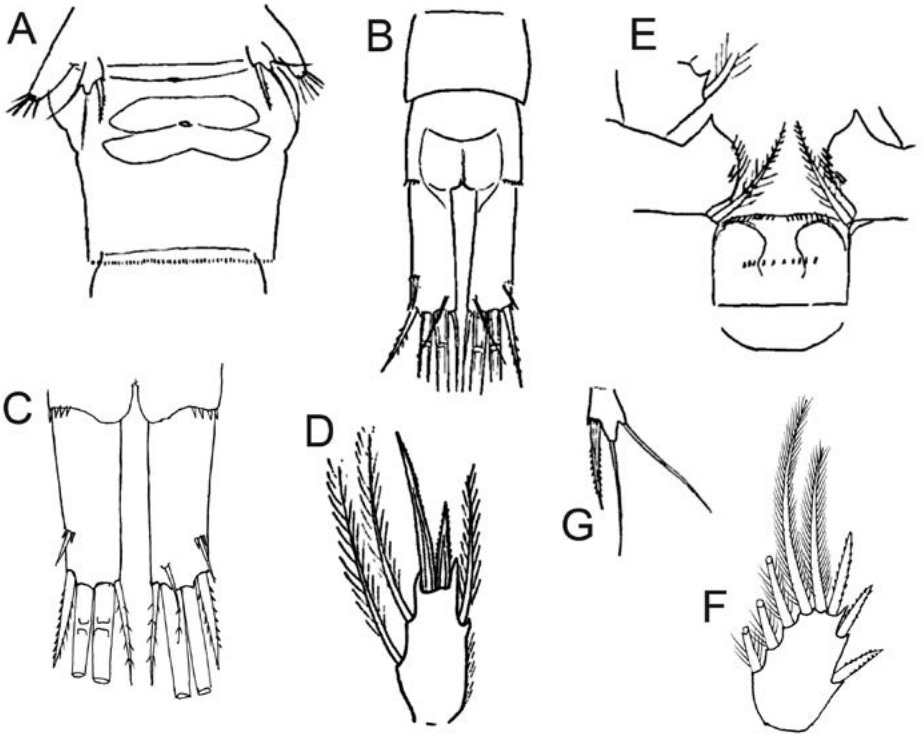

Fig. 115. *Eucyclops* (*Subterrocyclops*) *nudus* Kiefer, 1935. Female: A — Th4, genital double somite and P5; B, C — caudal rami, dorsal; D — P4 Enp3; E — P4 intercoxal plate; F — P4 Exp3; G — P5. Kenya. A, B, D, E, G — after Kiefer [1935]; C, F — orig., slide #02248 KRC.

Рис. 115. *Eucyclops* (*Subterrocyclops*) *nudus* Kiefer, 1935. Самка: A — Th4, генитальный сомит и P5; B, C — каудальные ветви, дорсально; D — P4 Enp3; E — межкоксальная пластинка P4; F — P4 Exp3; G — P5. Кения. A, B, D, E, G — по Kiefer [1935]; C, F — ориг., преп. #02248 KRC.

times longer than outer one and 1.2 times longer than segment; distal setae reaching tips of nearest spines. P4 Exp3 distal spine short, only slightly longer than proximal ones, about 0.7 times as long as segment. P4 IntCox with distal row of short setulae; coxal spine with long setulae proximally and short spinules distally. P4 Bas inner outgrowth with short hairs. Reduced P5 (Fig. 115G): elongated segment with L/W ratio 1.6; inner spine rather strong and about 1.7 times longer than segment; two setae longer than spine, length ratio beginning with spine: 1.0/ 1.3/ 1.4.

MALE unknown.

DISTRIBUTION: known only from the type locality.

COMMENTS: This species similar to *E.* (*Sub.*) *glaber* Kiefer, 1935, as author also pointed out, but there are some differences primarily in shorter CR and presence of gap among setulae on outer side of P4 coxal spine.

Genus ***Isocyclops*** Kiefer, 1957

Small genus (2 taxa), endemic of Rift Valley in Central Africa. The type species: *I. caparti* (Lindberg, 1951).

Body length in females about 900 μm. Th4 with long setulae laterally. Genital somite wide anteriorly and narrows gradually and moderately posteriorly. Caudal rami divergent, with absent or very reduced lateral *serra*. Lateral seta naked, very long, at least twice longer than ramus width and about as long as outermost seta. Outermost seta inserted close to outer middle seta, weak, setiform, plumose with hairs on both sides. Dorsal seta about as long as outermost seta. Innermost

seta 1.5–2.0 times longer than outermost seta, subequal or longer than ramus length. Antennules short, reaching CTh distal edge only, with smooth hyaline membrane. Swimming legs with 3-segmented exopodite and endopodite, distal exopodite spine formula: 3/4/4/3. P4 Enp3 oval shaped with almost equal distal processes; inner spine longer than outer one; distal setae long, reaching tips of nearest spines. P4 Bas inner outgrowth round with small angular protrusion directed medially. P5 segment elongated, armed with inner spine and two setae.

Males shorter than female. CR shorter than in female, caudal setae ratios basically as in female. A1 14-segmented. P1–P5 similar to female. P6 armed with inner spine and two setae.

Genus comprises two species: *I. caparti* (Lindberg, 1951) and *I. paucidenticulatus* (Lindberg, 1951), both are endemics of lake Tanganyika (Africa).

1. ***Isocyclops caparti*** (Lindberg, 1951) Fig. 116.

SYNONYMY: *Eucyclops caparti*: Lindberg, 1951a; *Eucyclops* (*Isocyclops*) *caparti*: Kiefer 1957b; Dussart, Defaye, 2006.

TYPE LOCALITY: collected in two localities, Tembwe Bay Cape Tembwe Kigoma and Slip Basin of Lake Tanganyika, Democratic Republic of the Congo.

HOLOTYPE PRESENCE AND STORING: holotype not selected by author, paratypes (syntypes) deposited in Royal Zoological Museum, in the I.R.S.N.B. collections Brussels, Belgium.

MATERIAL STUDIED: female topotype (#06114) deposited in Kiefer's Reference collection, SMNK, Germany; author's description and drawings.

DESCRIPTION. FEMALE (Fig. 116A–D). Body length without caudal setae 920–940 μm. Lateral edges of Th4 with few long setulae. Genital double somite wide anteriorly, narrows gradually and moderately posteriorly; *receptaculum seminis* with narrow anterior and posterior parts (Fig. 116A). Anal operculum slightly convex. Caudal rami with divergent branches, 4.0–4.2 as long as broad; lateral *serra* absent, except two small spinules at level of lateral seta (Fig. 116B). Lateral seta inserted only slightly above dorsal seta, naked, very long, 2.2–2.4 times longer than ramus width and about as long as outermost seta. Dorsal seta slightly longer than outermost seta. Outermost seta inserted close to outer middle seta, 0.6 times as long as ramus length; plumose with hairs on both sides. Innermost seta 1.6–1.8 times as long as outermost seta. Distal setae length ratio beginning with outermost: 1.0/ 3.5–3.8/ 5.3–5.9/ 1.6–1.8.

Antennule 12-segmented, short, reaching slightly beyond posterior edge of CTh; distal segment with wide smooth hyaline membrane. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 very short, with L/W ratio about 1.4; inner spine 1.2 times longer than outer one and segment; distal setae reaching beyond tips of nearest spines (Fig. 116D). P4 Bas inner outgrowth round with short hairs (Fig. 116C). P4 IntCox with three rows of short setulae; coxal spine homogeneously plumose, reaching slightly beyond Bas inner outgrowth tip. P5 elongated; inner spine weak, about as wide as outer seta and only slightly longer than segment; length ratio beginning with spine: 1.0/1.2/1.8.

MALE (Fig. 116E). Body length without caudal setae 646–684 μm. Caudal rami shorter than in female with L/W ratio 2.3–2.5. Lateral seta noticeably long, but relatively shorter than in female, 1.8 times longer than ramus width and 0.8 times as long as outermost seta, naked. Dorsal seta as long as outermost seta. Innermost seta 1.8–2.0 times as long as outermost seta. P4 generally as in female, but exopodite spines stronger, with almost blunt tips; P4 Enp3 longer, with L/W ratio 1.7–1.9; inner spine 1.1–1.5 times longer than outer one. Reduced P5 with stronger and longer inner spine; length ratio beginning with spine: 1.0/ 1.1/ 1.1. Rudimental P6 with strong inner spine, reaching posterior border of next abdominal somite; appendages length ratio beginning with spine:1.0/ 0.6–0.9/ 0.8–0.9.

DISTRIBUTION: endemic of Tanganyika lake.

COMMENTS: Main characteristics of *Isocyclops caparti* are as following: rather short caudal rami without lateral *serra*, with remarkably long lateral seta, very short segment of P4 Enp3 with long distal setae, and weak inner spine in P5. Inner spine of P5 in described male appears too long for this form, probably this specimen was mistakenly identified as *I. caparti* and rather should be assigned to *I. paucidenticulatus*, its redescription is required.

2. ***Isocyclops paucidenticulatus*** (Lindberg, 1951) Fig. 117.

SYNONYMY: *Eucyclops paucidenticulatus* Lindberg, 1951; *Eucyclops* (*Isocyclops*) *paucidenticulatus*: Kiefer, 1957b: Dussart, Defaye, 2006.

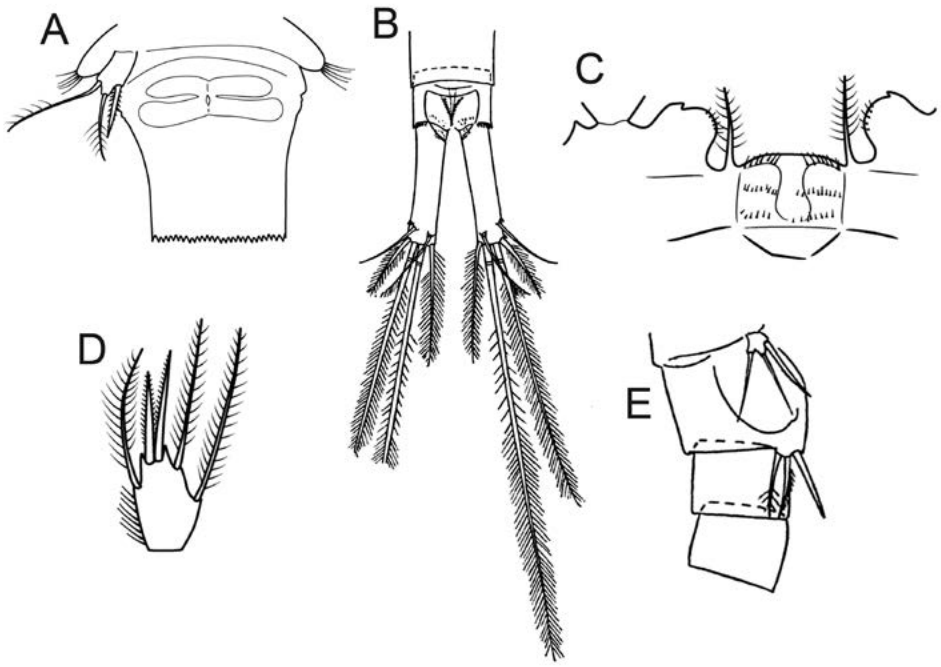

Fig. 116. *Isocyclops caparti* (Lindberg, 1951). A — Th4, genital double somite and P5; B — caudal rami, dorsal; C — P4 intercoxal plate; D — P4 Enp3; E — P5 and P6. A–D — female; E — male. Lake Tanganyika, East Africa, after Lindberg [1951a].

Рис. 116. *Isocyclops caparti* (Lindberg, 1951). A — Th4, генитальный сомит и P5; B — каудальные ветви, дорсально; C — межкоксальная пластинка P4; D — P4 Enp3; E — P5 и P6. A–D — самка; E — самец. Озеро Танганьика, Восточная Африка, по Lindberg [1951a].

TYPE LOCALITY: Edith Bay, East coast of Tanganyika Lake, Tanzania, Africa.

HOLOTYPE PRESENCE AND STORING: holotype not selected by author, paratypes (syntypes) deposited in Royal Zoological Museum, in the I.R.S.N.B. collections Brussels, Belgium.

MATERIAL STUDIED: authors description and drawings.

DESCRIPTION. FEMALE (Fig. 117A–C). Body length without caudal setae 855 µm. Th4 with lateral setulae. Genital double somite wide anteriorly, narrows gradually and moderately posteriorly; *receptaculum seminis* with narrow anterior and posterior parts (Fig. 117B). Anal operculum weakly convex with short hairs at opening. Caudal rami divergent, with L/W ratio 3.6; lateral *serra* present, but very reduced, of 6–8 small equal spinules (Fig. 117A). Lateral seta naked, long, 2.5 times longer than ramus width and equal in length to outermost seta. Dorsal seta longer than outermost seta (1.4: 1). Outermost seta inserted close to outer middle seta, 0.7 times as long as ramus length; plumose with hairs on both sides. Innermost seta 1.9 times as long as outermost seta. Distal setae length ratio beginning with outermost: 1.0/ 4.5/ 6.7/ 1.9.

Antennule 12-segmented, short, reaching slightly beyond posterior edge of CTh; distal segments with narrow smooth hyaline membrane. Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 more slender than in *I. caparti*, with L/W ratio about 2.4; inner spine 1.3–1.4 times longer than outer one and 1.1 times longer than segment; distal setae reaching tips of nearest spines (Fig. 117C). Reduced P5 with elongated segment, similar to that of *I. caparti,* but armed with longer inner spine; length ratio beginning with spine: 1/0.8/0.9 (see Fig. 117B).

MALE (Fig. 117D). Body length without caudal setae 655 µm. Caudal rami shorter than in female, with L/W ratio 2.5. Lateral seta relatively shorter than in female, 2.1 times longer than ramus

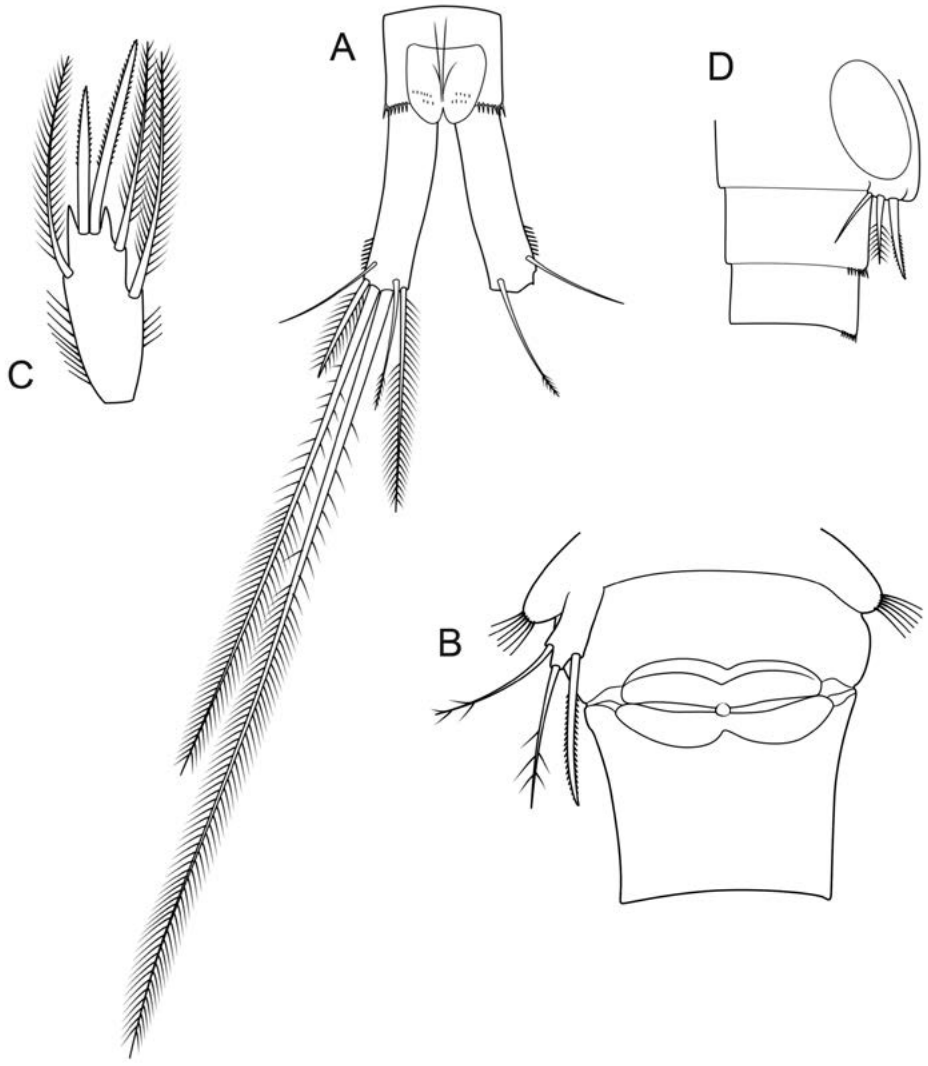

Fig. 117. *Isocyclops paucidenticulatus* (Lindberg, 1951). A — caudal rami, dorsal; B — Th4, genital double somite and P5; C — P4 Enp3; D — P6. A–C — female; D — male. Lake Tanganyika, East Africa, after Lindberg [1951a].

Рис. 117. *Isocyclops paucidenticulatus* (Lindberg, 1951). A — каудальные ветви, дорсально; B — Th4, генитальный сомит и P5; C — P4 Enp3; D — P6. A–C — самка; D — самец. Озеро Танганьика, Восточная Африка, по Lindberg [1951a].

width and 0.9 times as long as outermost seta, naked. Dorsal seta 1.1 times as long as outermost seta. Innermost seta 2.0 times as long as outermost seta. P4–P5 not described. Rudimental P6 with strong inner spine, reaching posterior border of next abdominal somite; appendages length ratio beginning with spine:1.0/ 0.9/ 0.9.

DISTRIBUTION: endemic of Tanganyika lake.

COMMENTS: Author says that this species closely resembles *I. caparti* and is undoubtedly very close to it. The main differences between them are as following: presence of lateral *serra* of CR, longer P4 Enp3, longer P5 inner spine. Identity

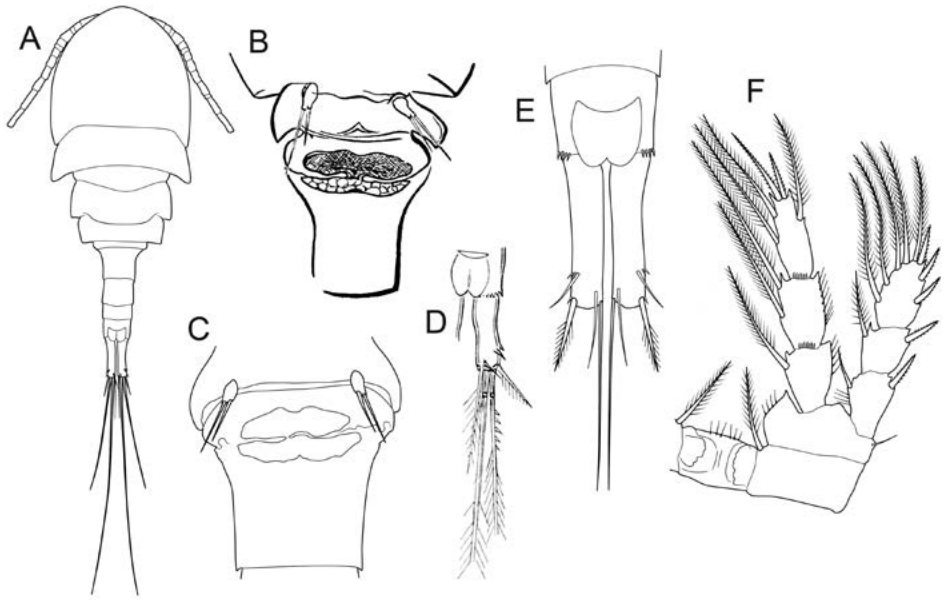

Fig. 118. *Stygocyclops teras* (Graeter, 1907). Female: A — habitus; B, C — Th4, genital double somite and P5; D, E — caudal rami, dorsal; F — P4. Switzerland. A, C, E, F — after Plesa [1971]; B, D — after Graeter [1907].

Рис. 118. *Stygocyclops teras* (Graeter, 1907). Самка: A — габитус; B, C — Th4, генитальный сомит и P5; D, E — каудальные ветви, дорсально; F — P4. Швейцария. A, C, E, F — по Plesa [1971]; B, D — по Graeter [1907].

male descriptions for both species indicates that the males were most likely misidentified for one of the species; redescription is required.

Genus ***Stygocyclops*** Plesa, 1971

Monotypic genus presented with only one species *S. teras* (Grater, 1907) found in underground water of Switzerland. Type species: *S. teras* (Graeter, 1907).

Female body length about 1 mm. Habitus elongated. Th4 without lateral setulae. Genital double somite wide anteriorly and narrowing posteriorly; *receptaculum seminis* mouth-shaped. Caudal rami L/W ratio about 4.0, subparallel, without lateral *serra;* caudal setae as in *Eucyclops*. Antennule 12-segmented, short, reaching slightly beyond CTh. Swimming legs P1–P4 as in *Eucyclops*, P4 Enp3 distal setae long, reaching beyond tips of nearest spines. Reduced P5 very characteristic, composed of single article armed with two long, straight, naked setae; inner seta inserted subapically, outer seta inserted apically.

MALE. Shorter and more slender than female. Antennule composed of 14 segments. P1–P5 as in female. P6 armed with 3 appendages.

Stygocyclops teras (Graeter, 1907)
Fig. 118.

SYNONYMY: *Cyclops teras*: Graeter, 1907; *Eucyclops teras*: Rylov, 1948; *Eucyclops* (*Stygocyclops*) *teras*: Plesa, 1971; Dussart, Defaye, 2006; *Stygocyclops teras*: Alekseev, 2019.

TYPE LOCALITY: Hölloch cave in Switzerland.

HOLOTYPE PRESENCE AND STORING: holotype not selected, one females and one male deposited at Natural History Museum in Geneva (not found, possibly lost).

MATERIAL STUDIED: author's description and drawings; Plesa [1971] redescription.

FEMALE (Fig. 118). Body length without caudal setae 900–990 μm. Th4 without lateral setulae. Genital double somite about as long as broad; *receptaculum seminis* with narrow posterior part (Fig. 118B). Anal operculum rather strongly developed, convex, without setulae at opening. Caudal rami L/W ratio about 4.0, subparallel, without lateral *serra,* only with some small spinules at lateral and outermost setae (Fig. 118D, E). Outer middle seta about half of inner middle seta or even shorter. Innermost seta longer than ramus length

and 2.0–2.5 times as long as outermost seta; dorsal seta about as long as outermost seta; lateral seta slightly longer than ramus width.

Antennule 12-segmented, short, hardly reaching middle of Th1 (Fig. 118A). Swimming legs P1–P4: distal exopodite spine formula 3/4/4/3. P4 Enp3 elongated (L/W ratio about 2.3); outer/ inner spine ratio 1.6; distal setae reaching beyond distal tips of nearest spines (Fig. 118F). P4 Exp3 distal spine short, twice shorter than segment; distal seta reaching beyond distal spine. P4 IntCox distal edge with few long setulae; coxal spine longer than Bas inner outgrowth. Rudimental P5 elongated, armed with two naked setae, inner seta shorter than outer seta (see Fig. 118B, C).

MALE. Body length without caudal setae 870 μm. Shape more slender than in female. Antennule 14-segmented. P1–P5 as in female. P6 with strong inner spine and two weak shorter setae, outer seta slightly longer than medial seta.

DISTRIBUTION: underground waters of Europe.

COMMENTS: Graeter [1907] in his first description of this species indicates its intermediate position between subfamilies Cyclopinae with 2 appendages in P5 (Bifida group of cyclopids) and Eucyclopinae with 3 appendages (Trifida group) and decides to leave this very particular form in the genus *Eucyclops.* Plesa [1971] on the base of P5 structure and naked last thoracic somite separated it in subgenus *Stygocyclops*. The unique construction of P5, specific to morphological structure of genus, makes it possible to raise status of *Stygocyclops* to genus level. At the same time, the question posed by Graeter [1907], whether *S. teras* is ancient intermediate form survived in underground waters, or whether its Bifida-group features (2 setae in P5, missing lateral setulae in Th4, absence of caudal *serra*) are the result of living in very special underground environment, has not yet been resolved.

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List of synonyms and nomina nuda

Eucyclops abdelkader Dumont et Pensaert, 1979 = *Eucyclops* (*Eucyclops*) *serrulatus* Fischer, 1853

Eucyclops agilis (Koch, 1838) = *nomen nudum*

Eucyclops alticola Kiefer, 1957 = *Eucyclops* (*Denticyclops*) *titicacae* Kiefer, 1957

Eucyclops ariguanabensis Brehm, 1949 = *nomen nudum*

Eucyclops serrulatus baicalocorrepus Mazepova, 1955 (part.) = *Eucyclops* (*Macrurocyclops*) *macrurus* s.lat.

Eucyclops macruroides baicalensis Mazepova, 1978 = *Eucyclops* (*Macrurocyclops*) *macrurus* (Sars G.O., 1863).

Eucyclops brevifurcatus (Grandori, 1925) = *nomen nudum*

Eucyclops chihuahuensis Suárez-Morales et Walsh, 2009 = *Eucyclops* (*Eucyclops*) *pectinifer pectinifer* (Cragin, 1883)

Eucyclops curticornis Kiefer, 1932 = *Afrocyclops curticornis* (Kiefer, 1932)

Eucyclops defayeae Mercado-Salas et Suarez-Morales, 2016 = *Eucyclops* (*Eucyclops*) *serrulatus* (Fischer, 1853) (invasive Palearctic form?)

Eucyclops doryphorus Kiefer, 1935 = *Afrocyclops doryphorus* (Kiefer, 1935)

Eucyclops estherae: Mercado-Salas et Suarez-Morales, 2016 = *Eucyclops* (*Denticyclops*) *festivus* Lindberg, 1955

Eucyclops extensus Kiefer, 1931 = *Tropocyclops extensus* (Kiefer, 1931)

Eucyclops serrulatus extensus Hsiao, 1950 = *Eucyclops* (*Eucyclops*) *agiloides roseus* Ishida, 1997

Eucyclops fragilis (Kiefer, 1926) = *Eucyclops* (*Eucyclops*) *vandouwei* (Brehm, 1909)

Eucyclops indicus Kiefer, 1927 = *Tropocyclops indicus* (Kiefer, 1927)

Eucyclops lilljeborgi (Sars G.O., 1918) = *Eucyclops* (*Denticyclops*) *denticulatus* (Graeter, 1903)

Eucyclops miser Brehm, 1953 = *Tropocyclops miser* (Brehm, 1953)

Eucyclops multicolor Lindberg, 1935 = *Tropocyclops multicolor* (Lindberg, 1935)

Eucyclops nigroviridis Harada, 1931 = *Tropocyclops nigroviridis* (Harada, 1931)

Eucyclops parvus Kiefer, 1931 = *Tropocyclops parvus* (Kiefer, 1931)

Eucyclops propinquus Kiefer, 1932 = *Afrocyclops propinquus* (Kiefer, 1932)

Eucyclops semidenticulatus Lindberg, 1940 = *Eucyclops* (*Denticyclops*) *euacanthus euacanthus* (Sars G.O., 1909)

Eucyclops schubarti Kiefer, 1935 = *Tropocyclops schubarti schubarti* (Kiefer, 1935)

Eucyclops euacanthus f. *simplex* Lindberg, 1952 = *Eucyclops* (*Denticyclops*) *euacanthus euacanthus* (Sars G.O., 1909)

Eucyclops solitarius Herbst, 1959 = *Eucyclops* (*Eucyclops*) *elegans elegans* (Herrick, 1884)

Eucyclops speratus var. *tasmanica* Brehm, 1953 = *Eucyclops* (*Eucyclops*) *spatulatus* Morton, 1990

Eucyclops varius var. *speratus* (Lilljeborg, 1901) = *Eucyclops* (*Speratocyclops*) *speratus speratus* (Lilljeborg, 1901)

Index of Latin names

Content

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