Chapter 16
Characteristics of Orders and Families with a List of European Genera and Species

16.1 Order Calanoida (Calaniformes) G. O. Sars 1903a

The order Calanoida is composed of species with 16–26-segmented antennules and biramous antennae. The leg P5 is modified into a copulatory organ in males. The abdomen is narrow and a heart is present. The order is composed of 42 families with 289 genera of which only four families are present exclusively in freshwaters and another five are freshwater and marine. Only four families and 22 genera are reported from European freshwaters (Dussart and Defaye 2001, 2002; Boxshall and Halsey 2004). The order Calanoida is a rather homogeneous group, adapted primarily to planktonic life (Park 1986). Andronov (1974) divided the order of Calanoida into nine superfamilies (based on the structure of the male A1 and legs P1–P6 in both sexes) and later Park (1986) divided them into 11 superfamilies, which was generally recognized by Boxshall and Halsey (2004). The first parsimony-based phylogeny using morphological data for the calanoid copepods was provided by Bradford-Grieve et al. (2010). Soon after, Blanco-Bercial et al. (2011) elaborated the molecular-based phylogenetic analysis. Both analyses (morphological and molecular) recover several monophyletic lineages within the Calanoida that largely conform to the superfamilies recognized in intuitive classification by Andronov (1974), Park (1986), and Boxshall and Halsey (2004).

Dussart and Defaye (2002) have used the name Calaniformes for the order Calanoida, which was proposed by Starobogatov (1988), but the name "Calaniformes" is not widely accepted.

Calanoid copepods are extremely successful inhabitants of marine, brackish, and freshwater plankton (Bradford-Grieve et al. 2010), but only one superfamily (Centropagoidea) is present in freshwaters and is considered here.

L.A. Błędzki, J.I. Rybak, *Freshwater Crustacean Zooplankton of Europe*,
DOI 10.1007/978-3-319-29871-9_16

16.1.1 Superfamily Centropagoidea Giesbrecht, 1893

The superfamily Centropagoidea was established to distinguish calanoids with a geniculate male right antennule and an extremely asymmetrical P5 greatly modified for grasping. It currently includes 11 families (Boxshall and Halsey 2004), of which four families have freshwater inhabitants. Andronov (1974) and Park (1986) listed this group of calanoids in the superfamily Centropagoidea, later renamed Diaptomoidea, as a result of the priority rule (Andronov 1991). The Diaptomoidea superfamily name has also been used by Boxshall and Halsey (2004); however, Ferrari and Ueda (2005) following the International Code for Zoological Nomenclature (from 1985) restored the precedence of the Centropagoidea, and this name has been used in more recent analyses (Bradford-Grieve et al. 2010; Blanco-Bercial et al. 2011).

16.1.1.1 Family Centropagidae Giesbrecht, 1893

Limnocalanus G. O. Sars, 1863
Boeckella Guerne (de) and Richard, 1889

The marine and freshwater family (with 14 genera and 111 species) represented in Europe by two genera. Andronov (1974) and Park (1986) placed the family Centropagidae into the superfamily Centropagoidea (listed as Diaptomoidea in Boxshall and Halsey (2004)). The history of the continental invasion (habitat shift), phylogeny, taxonomy, and morphology of Centropagidae was described by Adamowicz et al. (2010). They indicated that the majority of the phylogenetic evidence supports the current taxonomic system of this group. The family Centropagidae showed five independent continental invasions from marine into freshwaters (the earliest Cretaceous and the remaining four more recent), which is one of the highest numbers of invasions among copepod families (Adamowicz et al. 2010).

Genus *Limnocalanus* G. O. Sars, 1863

Syn. *Centropages*, Guerne, 1886, part
Limnocalanus macrurus, G.O. Sars, 1863

In Europe, the genus *Limnocalanus* is represented by one species. The genus is distributed in both coastal marine and freshwaters in the Northern Holarctic and is an example of several relatively recent independent incursions into freshwaters (invasion without speciation) during the Pleistocene, where glaciers may have been physically responsible for moving coastal lineages inland via the lakes created at the margins of ice sheets (Dooh et al. 2006; Adamowicz et al. 2010).

Genus *Boeckella* Guerne (de) and Richard, 1889

Syn. *Diaptomus*, Lubbock, 1855
Boeckia, Thomson, 1883
Centropages, Brady, 1875, part

Pseudoboeckella, Mrázek, 1901
Paraboeckella, Mrázek, 1901
Boeckellopsis, Mrázek, 1901
Boeckellina, Mrázek, 1901
Metaboeckella, Ekman, 1905
Boeckella triarticulata (Thomson, 1883)

The genus *Boeckella* is monophyletic and composed of 41 freshwater species, mostly from the Australasian and Neotropical regions of the southern hemisphere (Dussart and Defaye 2002; Adamowicz et al. 2010). One species has been reported from Europe, where it was, in the late 1980s, accidentally introduced to Northern Italy, together with the Chinese carp from the Far East (Alfonso and Belmonte 2008). Previous synonymization of the former genus *Pseudoboeckella* with *Boeckella* by Bayly (1992a) was recently confirmed by molecular evidence (Adamowicz et al. 2010).

16.1.1.2 Family Pseudodiaptomidae G.O. Sars 1903

Calanipeda Kritschagin, 1873

The freshwater family (with three genera and 75 species) represented in Europe by one genus and one species (Dussart and Defaye 2002; Boxshall and Halsey 2004). Copepods from this family are considered to be of marine origin, showing adaptations to freshwater environments (Svetlichny et al. 2012).

Genus *Calanipeda* Kritschagin, 1873

Syn. *Poppella* Richard, 1888
Siatella Labbé, 1927
Calanipeda aquaedulcis Kritschagin, 1873

The genus *Calanipeda* is represented in Europe by a single species.

16.1.1.3 Family Temoridae Giesbrecht, 1893

Eurytemora Giesbrecht, 1881
Heterocope G.O. Sars, 1863

The coastal, estuarine, brackish, and freshwater family (with four genera and 35 species) represented in Europe by two genera and 12 species.

Genus *Eurytemora* Giesbrecht, 1881

Syn. *Cyclopsina* (part), Fisher, 1853
Temora (part), Lilljeborg, 1853
Temorella, Claus, 1881
Eurytemora affinis (Poppe, 1880)
Eurytemora americana Williams, 1906

Eurytemora canadensis Marsh 1920
Eurytemora grimmi (G.O. Sars, 1897)
Eurytemora gracilis (G.O. Sars 1898)
Eurytemora lacustris (Poppe, 1887)
Eurytemora raboti Richard, 1897
Eurytemora velox (Lilljeborg, 1853)

The genus represented by 22 species worldwide and by eight species in Europe, showing postglacial continental radiations (Adamowicz et al. 2010). The morphological diversity of several *Eurytemora* species was recently elaborated by Dodson et al. (2010) through the use of ordination analyses. The discordant rates of morphological differentiation, molecular evolution, and reproductive isolation were described for the *E. affinis* complex (Lee and Frost 2002), which has been considered the model organism. It was found that the genus *Eurytemora* constitutes a highly evolvable genus with respect to salinity, where the *Eurytemora affinis* clade residing primarily near shore and salt marshes has been shown to repeatedly invade freshwater habitats (Lee and Gelembiuk 2008).

Genus *Heterocope* G.O. Sars, 1863

Syn. *Cyclopsina* (part), Fisher, 1851
Diaptomus (part), Lilljeborg, 1863
Heterocope appendiculata G.O. Sars, 1862
Heterocope borealis (Fischer, 1851)
Heterocope caspia Sars, 1897
Heterocope saliens (Lilljeborg, 1863)

The genus of large predacious copepods is represented by six species worldwide off which four species were reported from Europe. The genus has not been reviewed for an extended period of time with the exception of *H. appendiculata*, which was recently redescribed by Samchyshyna (2001). Several *Heterocope* species are considered as invasive in Europe (Grigorovich et al. 2002).

16.1.1.4 Family Diaptomidae Baird 1850

Subfamily Diaptominae Kiefer, 1932

Acanthodiaptomus Kiefer, 1932
Arctodiaptomus Kiefer, 1932
Arctodiaptomus (*Arctodiaptomus*) Kiefer, 1932
Arctodiaptomus (*Rhabdodiaptomus*) Kiefer, 1932
Arctodiaptomus (*Mesodiaptomus*) Borutzky 1991
Copidodiaptomus Kiefer 1968
Diaptomus Westwood, 1836
Diaptomus Westwood, 1836 (*Chaetodiaptomus*) Kiefer 1978
Diaptomus Westwood, 1836 (*Diaptomus* s.str.) Kiefer 1978

Dussartius Kiefer 1978
Eudiaptomus Kiefer, 1932
Hemidiaptomus G. O. Sars 1903
Hemidiaptomus G. O. Sars 1903 (*Gigantodiaptomus*) Kiefer, 1932
Hemidiaptomus G. O. Sars 1903(*Hemidiaptomus*) G. O. Sars 1903
Hemidiaptomus G. O. Sars 1903 (*Occidodiaptomus*) Borutzky 1991
Leptodiaptomus Light, 1938
Mixodiaptomus Kiefer, 1932
Sinodiaptomus Kiefer, 1932
Skistodiaptomus Light, 1939
Spelaeodiaptomus Dussart, 1970
Stygodiaptomus Petkovski 1981

Subfamily Paradiaptominae Kiefer, 1932

Metadiaptomus Methuen, 1910
Neolovenula Gauthier, 1958

Subfamily Speodiaptominae Borutzky 1962

Speodiaptomus Borutzky 1962
Troglodiaptomus Petkovski 1978

The freshwater family Diaptomidae currently consists of three recognized subfamilies, 59 genera, and 454 species and is represented in Europe by 17 genera and 80 species. The family Diaptomidae and its subfamilies were most recently diagnosed and described by Borutzky et al. (1991), Rayner (1999), Dussart and Defaye (2001), and Boxshall and Halsey (2004). The phylogenetic relationship among the North American Diaptomidae genera, elaborated a long time ago by Marsh (1929), was resolved recently by Thum (2004) and Thum and Harrison (2009). Thum (2004) found that *Leptodiaptomus*, which is claimed to be endemic to North America (but is circumpolar and also reported from Iceland), is a derived member of the *Hesperodiaptomus* group (endemic to North America). Thum and Harrison (2009) used phylogenies of *Skistodiaptomus* to test the Pleistocene divergence and speciation within the genus. Thum and Derry (2008) discussed the deep genetic divergence among several populations (lineages) of *Skistodiaptomus* (which may indicate that several geographically distinct glacial refugia served as sources for the lineages). The subfamily Microdiaptominae Elias-Gutiérrez and Suarez-Morales 1998, with one genus and one species, *Microdiaptomus cokeri* Osorio-Tafall, 1942 that is not represented in Europe (Elias-Gutiérrez and Suarez-Morales 1998), is in question and recently was placed into the subfamily Speodiaptominae (Brancelj 2005).

Subfamily Diaptominae Kiefer, 1932

The subfamily is represented in Europe by 13 genera and 71 species.

Genus *Acanthodiaptomus* Kiefer, 1932

Acanthodiaptomus denticornis (Wierzejski 1887)
Acanthodiaptomus tibetanus (Daday, 1908)

The genus is represented in Europe by two species, with three species found worldwide. Smirnov found a slight difference in his *A. tibetanus* sample collection and described *A. tibetanus* var. *septentrionalis*, but following another examination Kiefer concluded that it is a typical *A. tibetanus* (Smirnov 1930; Kiefer 1932b; Walseng et al. 1996). The latest genus description was provided by Kiefer (1978) and Borutzky et al. (1991).

Genus *Arctodiaptomus* **Kiefer, 1932**

Subgenus *Arctodiaptomus* **Kiefer, 1932**

Arctodiaptomus (*A.*) *acutulus* (Brian, 1927)
Arctodiaptomus (*A.*) *byzantinus* Mann 1940
Arctodiaptomus (*A.*) *dentifer* (Smirnov, 1928)
Arctodiaptomus (*A.*) *dudichi* (Kiefer, 1932)
Arctodiaptomus (*A.*) *fischeri* (Rylov, 1922)
Arctodiaptomus (*A.*) *kerkyrensis* (Pesta, 1935)
Arctodiaptomus (*A.*) *laticeps* (G.O. Sars, 1862) 1863
Arctodiaptomus (*A.*) *osmanus* Kiefer 1974
Arctodiaptomus (*A.*) *pectinicornis* (Wierzejski 1887)
Arctodiaptomus (*A.*) *piliger* (Brehm 1955)
Arctodiaptomus (*A.*) *similis* (Baird, 1859)
Arctodiaptomus (*A.*) *steindachneri* (Richard, 1897)
Arctodiaptomus (*A.*) *stephanidesi* (Pesta, 1935)
Arctodiaptomus (*A.*) *wierzejskii* (Richard, 1888)

Subgenus *Rhabdodiaptomus* **Kiefer, 1932**

Arctodiaptomus (*R.*) *acutilobatus* (G.O. Sars, 1903)
Arctodiaptomus (*R.*) *alpinus* (Imhof, 1885)
Arctodiaptomus (*R.*) *bacillifer* (Koelbel, 1885)
Arctodiaptomus (*R.*) *niethammeri* (Mann 1940)
Arctodiaptomus (*R.*) *salinus* (Daday, 1885)
Arctodiaptomus (*R.*) *spinosus* (Daday, 1890)

Subgenus *Mesodiaptomus* **Borutzky 1991**

Arctodiaptomus (Mesodiaptomus) belgrati Mann 1940

The most specious European calanoid genus represented in Europe by three subgenera with 21 species and six subgenera and 49 species found worldwide. The genus was revised by Kiefer (1974b, 1978) and most recently by Reddy (1994).

Genus *Copidodiaptomus* **Kiefer 1968**

Copidodiaptomus numidicus (Gurney, 1909)
Copidodiaptomus steueri (Brehm, 1904)

The genus established by Kiefer (1968) is represented by two species in Europe and worldwide.

Genus *Diaptomus* Westwood, 1836

Syn. *Monoculus* (part), Linné, 1758, Jurine, 1820
Cyclops (part), Müller, 1776
Glaucea, Koch, 1835
Ometia, Templeton, 1838
Cyclopsina (part), Milne-Edwards, 1840

Subgenus *Diaptomus* Westwood, 1836, (Chaetodiaptomus) Kiefer 1978

Diaptomus (*C.*) *cyaneus* Gurney, 1909
Diaptomus (*C.*) *falsomirus* Kiefer 1972
Diaptomus (*C.*) *glacialis* Lilljeborg, 1889
Diaptomus (*C.*) *rostripes* Herbst, 1955
Diaptomus (*C.*) *serbicus* Gjorgjewič, 1907
Diaptomus (*C.*) *zografi* Kortschagin, 1887

Subgenus *Diaptomus* Westwood, 1836 (Diaptomus) Kiefer 1978

Diaptomus (*D.*) *castaneti* Burckhardt, 1920
Diaptomus (*D.*) *castor* (Jurine, 1820)
Diaptomus (D.) *kenitraensis* Kiefer, 1926

The genus with two subgenera is represented by nine species in Europe, with 11 species found worldwide (+23 "*Diaptomus*" species waiting for a revision or *incertae sedis* species). Records of *D. mirus* Lilljeborg, 1889 from Ukraine are doubtful, as this is a Far East (Siberian) species (Stepanova 2008; Samchyshyna 2011). The genus *Diaptomus* was described and revised by Kiefer (1972, 1974a, 1978), who divided the genus into two subgenera (*Diaptomus* s.str and *Chaetodiaptomus*). Later, Stepanova (2008) provided a key to the part of the subgenus *Chaetodiaptomus*.

Genus *Dussartius* Kiefer 1978

Dussartius baeticus (Dussart 1967)

The genus established by Kiefer is represented by a single species worldwide. *Dussartius baeticus* was originally placed into *Eudiaptomus* (by Dussart), then Kiefer moved it into *Copidodiaptomus* and later established a new monospecific genus, named in recognition of Dussart's contribution to the study of copepods (Kiefer 1978; Fidalgo and Monteiro 2003).

Genus *Eudiaptomus* Kiefer, 1932

Syn. *Diaptomus* (part): Sars 1903a; Rylov, 1930
Kuznetzovia, Rylov (Smirnov, 1960)
Eudiaptomus arnoldi (Siewerth, 1928)
Eudiaptomus drieschi (Poppe and Mrázek, 1895)
Eudiaptomus gracilis (Sars, 1863)
Eudiaptomus graciloides (Lilljeborg, 1888)

Eudiaptomus hadzici (Brehm, 1933)
Eudiaptomus intermedius (Steuer, 1897)
Eudiaptomus padanus (Burckhardt, 1900)
Eudiaptomus siewerthi (Smirnov 1936)
Eudiaptomus transylvanicus (Daday, 1891)
Eudiaptomus vulgaris (Schmeil, 1898)
Eudiaptomus zachariasi (Poppe, 1886)

Eudiaptomus is one of the most specious European calanoid genera, represented by 11 species in Europe and 16 species worldwide. The most recent revision of the genus *Eudiaptomus* was done by Kiefer (1968, 1978), who pointed out that the current level of knowledge does not make it feasible to provide a female key, as there is lack of characters that would allow for proper identification of all species. As a result, we only provide a key based on male individuals, which fortunately are very frequently found in samples. Recent research shows a promising possibility of the use of mass spectrophotometry for the identification of zooplankton species, which has been successful in three *Eudiaptomus* species (Riccardi et al. 2012).

Genus *Hemidiaptomus* **G. O. Sars 1903**

Subgenus *Hemidiaptomus* **G. O. Sars 1903**

Hemidiaptomus (*H.*) *brehmi* Mann 1940
Hemidiaptomus (*H.*) *gurneyi* Roy, 1927
Hemidiaptomus (*H.*) *rylovi* Charin, 1928
Hemidiaptomus (*H.*) *sostarici* (Krmpotić, 1925)
Hemidiaptomus (*H.*) *tracicus* (Chichkoff, 1924)

Subgenus *Gigantodiaptomus* **Kiefer, 1932**

Hemidiaptomus (*G.*) *amblyodon* (Marenzeller, 1873)
Hemidiaptomus (*G.*) *hungaricus* Kiefer, 1933
Hemidiaptomus (*G.*) *superbus* (Schmeil, 1895)

Subgenus *Occidodiaptomus* **Borutzky 1991**

Hemidiaptomus (*O.*) *ingens* (Gurney, 1909)
Hemidiaptomus (*O.*) *maroccanus* Kiefer, 1954
Hemidiaptomus (*O.*) *roubaui* (Richard, 1888)

Hemidiaptomus is one of the most specious European calanoid genera, represented in Europe by 11 species and 18 species worldwide. The genus was recently reviewed by several authors (Borutzky et al. 1991; Dussart and Defaye 2002; Stepanova 2005; Marrone et al. 2010, 2013). Borutzky et al. (1991) and Dussart and Defaye (2002) organized the genus into three subgenera. Stepanova (2005) proposed a rearrangement of the genus *Hemidiaptomus* and assigned *Occidodiaptomus* into the rank of an independent genus, including two subgenera (*Occidodiaptomus* and *Balcanodiaptomus*). Later, Marrone et al. (2013), based on the comprehensive molecular research of *Occidodiaptomus*, rejected Stepanova's proposition and confirmed the monophyly of *Hemidiaptomus*. They found that the *Hemidiaptomus*

subgenera are not clearly resolved, but they should not be considered as independent genera and most infrageneric taxonomical ranks have to be assigned to *Hemidiaptomus* s.str, *Gigantodiaptomus,* and *Occidodiaptomus*, which mirror the taxonomical arrangement proposed earlier by Borutzky et al. (1991). Marrone et al. (2013) also found that *Hemidiaptomus* (*Gigantodiaptomus*) s*uperbus* did not group with any of the known subgenera, which confirmed previous doubts expressed by Einsle (1993) and Marrone et al. (2011). It is also worth mentioning that *H. amblyodon* exhibits a morphological and molecular constancy throughout the European range of its distribution (Marrone et al. 2010).

Genus *Leptodiaptomus* **Light, 1938**

Leptodiaptomus minutus (Lilljeborg, 1889)

The genus described by Light comprised of small- to medium-sized calanoids, with 22 currently known nominal species, of which only one has been reported from Europe (Iceland). The seven Neotropical species were recently reviewed by Silva-Briano and Suarez-Morales (2010).

Genus *Mixodiaptomus* **Kiefer, 1932**

Mixodiaptomus incrassatus (G.O. Sars 1903)
Mixodiaptomus kupelwieseri (Brehm, 1907)
Mixodiaptomus laciniatus (Lilljeborg, 1889)
Mixodiaptomus lilljeborgi (Guerne and Richard, 1888)
Mixodiaptomus ortizi Alonso 1984
Mixodiaptomus tatricus (Wierzejski, 1883)
Mixodiaptomus theeli (Lilljeborg, 1889)

The genus is represented in Europe and worldwide by seven species. The genera has not been revised since the original erection by Kiefer, however four species occurring in Spain were revised by Alonso (1984).

Genus *Sinodiaptomus* **Kiefer, 1932**

Subgenus *Sinodiaptomus* **Kiefer, 1932**

Sinodiaptomus (*Sinodiaptomus*) *sarsi* (Rylov, 1923)

The subgenus *Sinodiaptomus* consists of three recognized valid species of which one is reported from Europe (from a fish tank that is no longer in existence). Recent molecular research has shown that *S. sarsi* and *S. valkanovi* (previously described as a subspecies of *S. sarsi*) are different congeneric species, which supports an earlier conclusion based on morphological descriptions (Ueda and Ohtsuka 1998; Makino et al. 2010).

Genus *Skistodiaptomus* **Light, 1939**

Syn. *Diaptomus* (*Skistodiaptomus*) Light, 1939
Skistodiaptomus pallidus (Herrick, 1879)

The genus consists of eight recognized species native to North America, of which *S. pallidus* was recently introduced to Europe (Brandorff 2011; Suarez-Moraes and Arroyo-Bustos 2012). Thum (2007) described the reproductive interference and Thum and Harrison (2009) elaborated the molecular phylogenies of *Skistodiaptomus*, testing the Pleistocene divergence and speciation within this genus.

Genus *Spelaeodiaptomus* **Dussart, 1970**

Spelaeodiaptomus rouchi **Dussart, 1970**

The genus consists of only one described species known from a cave in France (Brancelj and Dumont 2007).

Genus *Stygodiaptomus* **Petkovski 1981**

Stygodiaptomus ferus Karanovic, 1999b, (male only)
Stygodiaptomus kieferi Petkovski 1981
Stygodiaptomus petkovskii Brancelj 1991

The genus consists of three recognized stygobiotic species reported from Europe.

Subfamily Paradiaptominae Kiefer, 1932

Metadiaptomus Methuen, 1910
Neolovenula Gauthier, 1938

The subfamily Paradiaptominae is represented by four genera and 24 species worldwide, of which two genera with two species have been recorded in Europe. The subfamily Paradiaptominae is a small group of freshwater calanoids endemic to Africa (with the exception of four species, two of which have a European distribution), which was reviewed recently by Rayner (1999). The generic composition of the subfamily Paradiaptominae is controversial and awaiting a detailed analysis (Dussart and Defaye 2001).

Genus *Metadiaptomus* **Methuen, 1910**

Metadiaptomus chevreuxi (De Guerne and Richard, 1894)

The genus, established by Methuen in 1910 and redescribed by Rayner in 1999, is a group of copepods endemic to Africa, with two exceptions, of which one is reported from Europe (*M. chevreuxi*) and the second from Asia (*M. asiaticus*) (Rayner 1999). In total, 11 *Metadiaptomus* species are known (Dussart and Defaye 2002).

Genus *Neolovenula* **Gauthier, 1938**

Syn. *Lovenula* (*Neolovenula*) Kiefer, 1932
Neolovenula alluaudi (De Guerne and Richard, 1890)

The subgenus *Neolovenula* (with the single species *Diaptomus alluaudi*) was created by Kiefer in 1932a, b and was later raised to the generic status, because it lacks four of the most highly weighted characters of the genus *Lovenula* (Rayner 1999).

Subfamily Speodiaptominae Borutzky 1962

Genus *Speodiaptomus* **Borutzky 1962**

Speodiaptomus birsteini Borutzky 1962

Genus *Troglodiaptomus* **Petkovski 1978**

Troglodiaptomus sketi Petkovski 1978

The subfamily Speodiaptominae is represented in Europe by two genera (four genera worldwide). The genus *Troglodiaptomus* was originally placed in the subfamily Speodiaptominae (based on the reduction of the swimming legs as an adaptation to the troglobious life style) (Petkovski 1978). Later, *Troglodiaptomus* was moved to the newly erected subfamily Microdiaptominae (based on the unique segmentation of the P1–P4; Exp/Enp 2/1) (Elias-Gutiérrez and Suarez-Morales 1998). Recently, after a detailed analysis, the genus *Troglodiaptomus* was placed back into the subfamily Speodiaptominae (Brancelj 2005). All four stygobitic genera (*Hadodiaptomus*, *Microdiaptomus*, *Speodiaptomus*, *Troglodiaptomus*) share enough common characters and should be placed in a common subfamily Speodiaptominae (Brancelj 2005), thereby erasing the subfamily Microdiaptominae. A detailed DNA analysis would help with this determination. The genus *Speodiaptomus* is represented in Europe by only one species reported from a subterranean lake in Crimea, Ukraine (Borutzky et al. 1991; Dussart and Defaye 2002).

16.2 Order Cyclopoida (Cyclopiformes) Burmeister, 1835

The order Cyclopoida is comprised of species with 9–17-segmented antennules and uniramous antennae. The leg P5 is reduced and identical in both sexes. The abdomen is narrow and the heart is not present. Two gonophores are usually situated subdorsally on each side of the receptaculum seminis. Two egg sacs contain a variable number of eggs. Cyclopoid classification is still in the state of flux and largely unresolved. The order is composed of 88 families (this includes 61 Poecilostomatoida families), of which four families and 17 genera are represented in freshwaters, with only one family reported from European freshwaters (Dussart and Defaye 2001, 2006; Boxshall and Halsey 2004).

16.2.1 Family Cyclopidae Rafinesque, 1815

16.2.1.1 Subfamily Halicyclopinae Kiefer, 1927[1]

Subfamily Eucyclopinae Kiefer, 1927

[1] Subfamily Halicyclopinae is not represented in European freshwaters but reported only from European estuarine, brackish and marine coastal waters, not considered here.

Austriocyclops Kiefer 1964
Ectocyclops Brady, 1904
Eucyclops Claus, 1893
Macrocyclops Claus, 1893
Ochridacyclops Kiefer, 1937
Paracyclops Claus, 1893
Tropocyclops Kiefer, 1927

Subfamily Cyclopinae Kiefer, 1927

Acanthocyclops Kiefer, 1927
Alloocyclops Kiefer, 1932[2]
Caspicyclops Monchenko, 1986[2]
Cryptocyclops G. O. Sars, 1927
Cyclops O. F. Müller, 1776 (s. str. Kiefer, 1939)
Diacyclops Kiefer, 1927
Graeteriella Brehm, 1926
Kiefieriella Lescher-Moutoué, 1976[2]
Megacyclops Kiefer, 1927
Mesocyclops G. O. Sars, 1914
Metacyclops Kiefer, 1927
Microcyclops Claus, 1893
Reidcyclops Karanovic, 2000[2]
Speocyclops Kiefer, 1937[2]
Thermocyclops Kiefer, 1927

Family divided into three subfamilies, with 57 genera and around 475 species and represented in Europe by 17 genera with around 210 species (not including Halicyclopinae). The subfamily Eucyclopinae is comprised of ten genera, of which seven genera and 22 species have been reported from surface freshwaters in Europe. The subfamily Cyclopinae is comprised of 42 genera, of which ten genera with 46 species have been reported from surface freshwaters in Europe.

Cyclopoid classification is in a state of flux (Boxshall and Halsey 2004). The phylogenetic relationship within the Cyclopidae family needs to be revised and elaborated in depth with the support of molecular analysis. The ornamentation of the basipodite of the antennae was reviewed and added to the diagnostic characters of Cyclopidae (Van de Velde 1984; Fiers and Van de Velde 1984).

The diagnostic characters of the subfamily Eucyclopinae were discussed recently by Hartmann et al. (1993), Pospisil and Stoch (1997), Monchenko and von Vaupel Klein (1999), and Dussart and Defaye (2006). Pospisil and Stoch (1997) suggested that the new taxonomic traits (shape and location of the aesthetascs on the male antennule and the ornamentation pattern on the antennal basipodite) must be taken into account as diagnostic characters of Eucyclopinae. The genus *Austriocyclops*

[2] Genera not reported from European continental surface freshwaters but were found in caves, wells or ground waters in Europe and are not considered here.

was included into this subfamily (previously it belonged to the subfamily Cyclopinae).

The diagnostic characters of the subfamily Cyclopinae were revised by Pesce (1996), Dussart and Defaye (2001, 2006), and Boxshall and Halsey (2004). Pesce (1996) divided the subfamily Cyclopinae into six morphological groups based on the antennule segmentation and the structure of the P1–P5 legs. Later, the genus *Austriocyclops* was moved to the subfamily Eucyclopinae (Pospisil and Stoch 1997) and new genera was erected (Dussart and Defaye 2006). One of the poorly elaborated problems within the subfamily Cyclopinae is the division between *Acanthocyclops* and *Diacyclops*, as several species have been transferred back and forth between these genera multiple times and a proper revision of these groups would require a redescription of around 200 species (Karanovic et al. 2013). Similarly, several species were recently transferred from *Diacyclops* into the newly established genera *Reidcyclops* (Karanovic 2000).

Subfamily Eucyclopinae Kiefer, 1927

Genus *Austriocyclops* **Kiefer 1964**

Austriocyclops vindobonae Kiefer 1964

The genus represented by one species collected from the Danube floodplain in Vienna and originally described by Kiefer was later transferred into the subfamily Eucyclopinae (from the subfamily Cyclopinae) (Kiefer 1964; Pospisil and Stoch 1997; Karaytug 1999; Dussart and Defaye 2001, 2006).

Genus *Ectocyclops* **Brady, 1904**

Syn. *Cyclops* (part): Claus, 1863; Schmeil, 1892; Gurney, 1933
Paracyclops (part) Claus, 1893
Platycyclops (part) G.O. Sars, 1914
Ectocyclops phaleratus (Koch, 1838)

The genus represented by a single species in Europe and 14 species worldwide. The genus was reviewed by Kiefer (1929) and later by Fryer (1955).

Genus *Eucyclops* **Claus, 1893**

Syn. *Cyclops* (part) Fischer, 1851; Schmeil, 1892; Claus, 1893; Gurney, 1933
Leptocyclops G.O. Sars 1918

Subgenus *Eucyclops* **s.str. Kiefer, 1957; Pleşa, 1971**

Eucyclops (*E.*) *agiloides* (G.O. Sars, 1909)[3]–*serrulatus*-group
Eucyclops (*E.*) *albuferensis* Alekseev 2008–*serrulatus*-group
Eucyclops (*E.*) *arcanus* Alekseev, 1990[3]–*serrulatus*-group

[3] Species not reported from European continental surface freshwaters (found in caves, wells or ground waters) and not considered here. The index of *serrulatus*-group—after Alekseev and Defaye (2011).

Eucyclops (*E.*) *denticulatus* (Graeter, 1903)
Eucyclops (*E.*) *graeteri* (Chappuis, 1927)[3]
Eucyclops (*E.*) *ibleicus* Pesce and Galassi, 1987[3]
Eucyclops (*E.*) *inarmatus* Kiefer, 1932[3]
Eucyclops (*E.*) *leschermoutouae* Alekseev and Defaye 2004[3]
Eucyclops (*E.*) *longispinosus* Pesce and Galassi, 1987[3]
Eucyclops (*E.*) *macruroides* (Lilljeborg, 1901)
Eucyclops (*E.*) *macrurus* (G. O. Sars, 1863)
Eucyclops (*E.*) *miracleae* Alekseev 2010–*serrulatus*-group
Eucyclops (*E.*) *orthostylus* Lindberg, 1953[3]
Eucyclops (*E.*) *persistens* Monchenko, 1978[3]
Eucyclops (*E.*) *porrectus* Kiefer, 1932
Eucyclops (*E.*) *romaniensis* Alekseev 2010–*serrulatus*-group
Eucyclops (*E.*) *serrulatus* (Fischer, 1851)–*serrulatus*-group
Eucyclops (*E.*) *speratus* (Lilljeborg, 1901)
Eucyclops (*E.*) *subterraneus* (Chappuis, 1927)[3]

Subgenus *Stygocyclops* **Pleşa, 1971[3]**

Eucyclops (*S.*) *teras* (Graeter, 1907)[3]

Eucyclops is the largest genus of the subfamily Eucyclopinae, occurring as planktonic or littoral epibenthic forms in ponds, lakes or ground waters, wells, and caves. Around 110 species and subspecies are known worldwide and 20 species were reported from Europe, of which nine were reported from surface waters and 11 from caves, wells, or ground waters (not considered here). Recent taxonomic exploration revealed the discovery of several new European species and three forms (types A, B, C) within *E. serrulatus* (Alekseev and Defaye 2004; Alekseev et al. 2006; Alekseev 2008, 2010), following which the newest description of the *serrulatus*-group was provided (Alekseev and Defaye 2011). Currently, about 19 valid species belong to the *serrulatus*-group (indexed in the above list as "*serrulatus*-group"), of which six have been reported from Europe. The remaining species comprise the non-*serrulatus* group (Alekseev et al. 2006; Alekseev 2008; Alekseev and Defaye 2011; Gutierrez-Aguirre et al. 2013). The most recent definition of the *serrulatus*-group describes the individuals as having a "12-segmented antennule, with a smooth hyaline membrane at the distal three segments, caudal rami 3.5–7 times as long as wide, with a longitudinal row of spinules (serra) along most of the outer edge of each ramus, but partly reduced in some taxa inhabiting subterranean or spring environments and never with hair-like setules or denticles on the dorsal or ventral surfaces, P5 with strong inner spine" (Alekseev and Defaye 2011). Recently, it was found that the distribution of *E. serrulatus* sensu stricto is restricted to the Palearctic region and records of this species from Japan, Indonesia, Australia, North America, and other zoogeographical zones could be the result of recent invasions, possibly via human activities in relation to ship transport (Alekseev and Defaye 2011; Alekseev et al. 2013). The most recent evaluation of the genus and its dispersion capabilities show that among 36 analyzed European populations of the *E. ser-*

rulatus species complex, there are eight deeply divergent lineages, evolutionarily relatively young, as most studied mountain lakes were unavailable for colonization before the end of the last glaciation, around 8000 years ago (Hamrova et al. 2012). This conclusion indicates that *E. serrulatus* is in need of further evaluation and morphospecies description of several new species.

Genus *Macrocyclops* **Claus, 1893**

Syn. *Monoculus* (part) Jurine, 1820
Cyclops (part) Schmeil, 1892
Cyclops (*Macrocyclops*) Claus, 1893
Pachycyclops Sars 1918
Macrocyclops albidus (Jurine, 1820)
Macrocyclops distinctus Richard, 1887
Macrocyclops fuscus (Jurine, 1820)

The genus is represented by three species in Europe and five species worldwide. The recent molecular analysis of *M. albidus* showed the presence of the same haplotype in the highly disjunct populations in Australia, Europe, and N. America, which cannot be explained by any model of dispersion other than anthropogenic translocation, indicating the homogenization of copepod fauna (Karanovic and Krajicek 2012b).

Genus *Ochridacyclops* **Kiefer, 1937**

Ochridacyclops arndti Kiefer, 1937

The genus is represented by one species in Europe and eight species worldwide. A new diagnosis and key was provided by Karaytug (1999) and Dussart and Defaye (2001, 2006).

Genus *Paracyclops* **Claus, 1893**

Syn. *Cyclops* (part) Schmeil, 1892; (part) Claus, 1893
Platycyclops (part) G. O. Sars, 1914
Paracyclops affinis (G. O. Sars, 1863)
Paracyclops chiltoni (Thomson, 1882)
Paracyclops dilatatus Lindberg, 1952
Paracyclops fimbriatus (Fischer, 1853)
Paracyclops imminutus (Kiefer 1929)
Paracyclops poppei (Rehberg, 1880)

The genus is represented by six species in Europe and 27 species worldwide. The genus was revised and a number of species was redescribed, indicating new species separated from the *P. fimbriatus*complex (Karaytug 1999; Dussart and Defaye 2006).

Genus *Tropocyclops* **Kiefer, 1927**

Syn. *Cyclops* (*Eucyclops*) part, Claus, 1893

Eucyclops (part), Claus, 1893
Leptocyclops (part), G. O. Sars 1913
Eucyclops (*Tropocyclops*), Kiefer, 1927
Cyclops (*Tropocyclops*), Gurney, 1933; Rylov, 1948/1963
Tropocyclops prasinus (Fischer, 1860)

The genus is in need of a revision and is currently represented by 21 species worldwide, of which and one is found in Europe. Several species have great morphological variability, which has already led to the description of many subspecies in three of the species, of which *T. prasinus* was found to contain 12 subspecies, but only one of them was reported from Europe (Dussart and Defaye 2006; Lee and Chang 2007).

Subfamily Cyclopinae Dana, 1853

Genus *Acanthocyclops* Kiefer, 1927[4]

Syn. *Cyclops* (*Acanthocyclops*) Kiefer, 1927
Megacyclops (part.) Pesta, 1969
Acanthocyclops americanus (Marsh, 1892)
Acanthocyclops capillatus (Sars, 1863)
Acanthocyclops robustus (G. O. Sars, 1863)
Acanthocyclops venustus (Norman and Scott, 1906)
Acanthocyclops vernalis (Fischer, 1853)

The genus is represented by five species (in surface waters) in Europe and 52 species (in all habitats) worldwide, with a mainly Holarctic distribution. Several authors recently contributed to the knowledge of the genus (Einsle 1996a; Caramujo and Boavida 1998; Dodson et al. 2003; Mirabdullayev and Defaye 2002, 2004; Dussart and Defaye 2006; Alekseev et al. 2002), but it is still in need of revision and its diagnostic characters should be clearly defined. However, several taxonomical problems have already been resolved. The most important of those was the long-standing taxonomic problem regarding the *Acanthocyclops robustus-vernalis* complex which has finally been resolved based on molecular genetic analysis (Miracle et al. 2013). This research allows for the reestablishment of *A. americanus* as a valid species and the synonymization of the recently described species *A. trajani* with *A. americanus*, and *A. einslei* with *A. robustus*.

Genus *Cryptocyclops* G. O. Sars, 1927

Syn. *Cyclop*s (part): Kiefer 1929, Yeatman, 1944
Microcyclops (part), Rylov, 1948/1963
Cryptocyclops bicolor (G. O. Sars, 1863)
Cryptocyclops linjanticus (Kiefer 1928)

[4] Here, listed are only species recorded in European continental surface waters. Species from wells, groundwater, interstitial water, caves, etc. are not considered.

The genus is represented by two species in Europe and 18 species worldwide, but it has not been reviewed for a long time.

Genus *Cyclops* O. F. Müller, 1776 (s. str. Kiefer, 1939)

Syn. *Monoculus* (part.), Linné, 1758
Microcyclops (part.), Claus, 1893
Graeteriella (part.), Brehm, 1925
Cryptocyclops (part.), Sars, 1927
Cyclops abyssorum (s.l.) G. O. Sars, 1863
Cyclops ankyrae Mann 1940
Cyclops bohater Koźmiński 1933
Cyclops furcifer (Claus, 1857)
Cyclops heberti Einsle 1996
Cyclops insignis Claus, 1857
Cyclops kikuchii Smirnov, 1932
Cyclops kolensis Lilljeborg, 1901
Cyclops lacustris G. O. Sars, 1863
Cyclops ochridanus Kiefer, 1932
Cyclops scutifer G. O. Sars, 1863
Cyclops stagnalis Einsle 1996
Cyclops strenuus Fischer, 1851
Cyclops vicinus Uljanin, 1875

The genus is represented by 14 species in Europe and 25 species worldwide. Most recently, the genus was revised in 1996 by Einsle, but it awaits for a modern revision using a combination of taxonomical characteristics (morphological using microcharacters like the ornamentation of the coupler and coxa of P4, and morphometric, molecular, crossbreeding, chromatin diminution, and enzyme electrophoresis analysis) (Einsle 1996a; Hołyńska and Dahms 2004; Dussart and Defaye 2006). The genus consists of several species complexes (*C. abyssorum*, *C. furcifer*, *C. strenuus*), which should be revised and redescribed, thereby adding more new species to the genus. *C. abyssorum* is composed of a number of phenotypes (about 18) and ecotypes which cannot be described or defined exclusively by morphological or morphometric criteria (Einsle 1996b). The most recent addition to the knowledge of the *C. abyssorum* group was provided by Hołyńska (2008) and *C. singularis* Einsle 1996a, b was synonymized with *C. abyssorum divergens* Lindberg, 1936 (Hołyńska 2008). Recent chromatin diminution studies showed that a large-scale rearrangement of the genome of several species (*C. insignis*, *C. kolensis*, *and C. strenuus*) has arisen without any morphological changes (Grishanin 2014).

Genus *Diacyclops* Kiefer, 1927[5]

Syn. *Cyclops* (part.), Sars 1918

[5] Here listed are only species recorded in European continental surface waters. Species exclusively from wells, groundwater, interstitial water, caves, etc. are not considered

Graeteriella (part.), Brehm, 1925
Cyclops (*Diacyclops*) (part.) Kiefer, 1927; Lindberg, 1941; Yeatman, 1944
Diacyclops (*Diacyclops*) Pesta, 1928
Cyclops (*Acanthocyclops*) (part.) Gurney, 1933
Acanthocyclops (part.) Rylov 1948; Damian-Georgescu 1963; Mazepova, 1978
Megacyclops (*Diacyclops*) Pleşa, 1969
Diacyclops abyssicola (Lilljeborg, 1901)
Diacyclops bicuspidatus (Claus, 1857)
Diacyclops bisetosus (Rehberg, 1880)
Diacyclops crassicaudis (G. O. Sars, 1863)
Diacyclops disjunctus (Thallwitz, 1927)
Diacyclops languidoides (Lilljeborg, 1901)
Diacyclops languidus (G. O. Sars, 1863)
Diacyclops limnobius Kiefer 1978
Diacyclops nanus (G. O. Sars, 1863)

The genus is represented by nine species in Europe (in surface waters) and 93 species worldwide (in surface and underground waters). The genus *Diacyclops* is the largest genus of the Cyclopidae, reviewed recently by Morton (1985), Pesce (1994), Karanovic (2000), Stoch (2001), Mirabdullayev and Rustamova (2007), and Karanovic et al. (2013), but it is still awaiting a major review. The current general agreement among Copepoda taxonomists is that the genus should be split into several monophyletic lineages (Karanovic et al. 2013). Various morphological characters (segmentation of natatory legs and antennule) have been used to define the following groups:

languidus-languidoides group: *D. abyssicola*, *D. disjunctus*, *D. hibernicus*, *D. ichnusoides*, *D. languidoides*, *D. languidus*
bicuspidatus group: *D. bicuspidatus*, *D. bisetosus*, *D. limnobius*, *D. thomasi*
c*rassicaudis* group: *D. crassicaudis*
ekmani-stygius group: not reported from surface waters and not considered here
virginianus group: with one species (*D. eulitoralis*) not reported from Europe

The groupings have been proposed by several authors, but were most recently reviewed by Pesce (1994), Dussart and Defaye (2006), and Karanovic et al. (2013). It should be mentioned that the differentiation of the *D. languidus*-group from the *D. languidoides* group is based essentially on the segmentation pattern of the female antennule (16-segmented in the *D. languidus*-group, 11-segmented in the *D. languidoides*-group with segments 7-8-9 and 11-12-13 fused together). However, in *D. disjunctus* some of the segments are incompletely divided, and for this reason, the distinction between the two species groups may be fictitious (Stoch and Pospisil 2000).

Genus *Graeteriella* Brehm, 1926

Syn. *Cyclops* (*Diacyclops*) (part.), Kiefer, 1927, 1928; 1929

Subgenus *Graeteriella* Brehm, 1926

Graeteriella (*G.*) *boui* Lescher-Moutoué, 1974[6]
Graeteriella (*G.*) *brehmi* Lescher-Moutoué, 1968[6]
Graeteriella (*G.*) *rouchi* Lescher-Moutoué, 1968[6]
Graeteriella (*G.*) *unisetigera* (Graeter, 1908)

Subgenus *Paragraeteriella* **Rylov 1948**

Graeteriella (*P.*) *bertrandi* Lescher-Moutoué, 1974[6]
Graeteriella (*P.*) *gelyensis* Lescher-Moutoué, 1978[6]
Graeteriella (*P.*) *laisi* (Kiefer, 1936)[6]
Graeteriella (*P.*) *vandeli* Lescher-Moutoué, 1974[6]

The genus (divided into two subgenera) is represented by eight species exclusively in Europe, of which only one species was reported also from surface waters and seven species were reported exclusively from caves, wells, or ground waters (not considered here).

Genus *Megacyclops* **Kiefer, 1927**

Syn. *Cyclops* (*Megacyclops*) Kiefer, 1927
Cyclops (*Acanthocyclops*) (part.) Gurney, 1933
Acanthocyclops (part.): Rylov, 1948/1963; Damian-Georgescu 1963
Acanthocyclops (*Megacyclops*) Dussart, (1969; Monchenko 1974)
Megacyclops brachypus (Kiefer, 1954)[6]
Megacyclops dussarti (Pesce and Maggi 1977)[6]
Megacyclops gigas (Claus, 1857)
Megacyclops latipes (Lowndes, 1927)
Megacyclops viridis (Jurine, 1820)

The genus is represented by five species in Europe and eight species worldwide. The genus was revised using morphometric and enzyme electrophoresis analysis by Einsle (1988, 1996a). *M. dussarti*, endemic to Greece and recorded from underground waters, was placed into the genus *Acanthocyclops* by Pesce and Maggi (1977, 1981), but later was moved into the *Megacyclops* by Einsle (1996a). This move may require further research, as it was indicated by Dussart and Defaye (2006), see page 142 in the World directory of Copepoda. It was found that *M. viridis* and *Acanthocyclops* were separated from a common ancestor approximately 21.0–22.6 MYA (Million Years Ago) (Blaha et al. 2010).

Genus *Mesocyclops* **(G. O. Sars, 1914)**

Syn. *Cyclops*, (part.) (Claus, 1893; Schmeil, 1892)
Bifida Chaetophora (Graeter, 1903)
Cyclops (*Mesocyclops*) (Rylov, 1948/1963)

[6] Species not reported from European continental surface freshwaters (found in caves, wells or ground waters) and not considered here.

Mesocyclops leuckarti (Claus, 1857)[7]

The genus Mesocyclops is one of the largest (and most difficult) genera in the family Cyclopidae, represented by one species in Europe and 75 species worldwide. The genus was revised in the last several decades by Kiefer (1978), as later summarized in his major work (Kiefer 1978). Later Van de Velde (1984) introduced microcharacters into the diagnostic, indicating the pattern and number of spinules on the antennary basipodite, and finally Hołyńska et al. (2003) provided the latest major revision. Later, Hołyńska (2006) proposed the first phylogenetic analysis of the entire genus, based on 81 morphological characters. Most recently, the phylogeny of the genus based on combined molecular and morphological data, with notes on biogeography was provided by Wyngaard et al. (2010). The recent progress of the research using modern techniques places the genus *Mesocyclops* among the best-elaborated groups of Copepoda.

Genus ***Metacyclops*** **(Kiefer, 1927)**

Syn. *Microcyclops* (part.) (Claus, 1893; Rylov, 1948/1963; Damian-Georgescu 1963)
Mesocyclops (*Metacyclops*) (Kiefer, 1927)
Cyclops (*Metacyclops*) (Kiefer 1928; Yeatman, 1944)
Cryptocyclops (part.) (Sars 1918)
Metacyclops gasparoi (Stoch, 1987)[6]
Metacyclops gracilis (Lilljeborg, 1853)
Metacyclops lusitanus (Lindberg 1961)
Metacyclops minutus (Claus, 1863)
Metacyclops planus (Gurney, 1909)
Metacyclops problematicus (Dumont 1973)
Metacyclops stammeri (Kiefer, 1935)[8]
Metacyclops subdolus (Kiefer, 1938)[6]
Metacyclops trisetosus (Herbst, 1957)[6]

The genus is represented by nine species in Europe (but only five from surface waters) and 58 species worldwide. The genus was redefined by Lindberg (1961) and later several authors discussed its validity (Pleşa 1981; Reid 1987; Fiers 2001 and Karanovic 1999a, 2004a, b). Dussart and Defaye (2006) indicated the need for a revision and suggested that it may need to be divided in several separate genera. The genus is polyphyletic and several subterranean Australian species (not reported from Europe) were already moved from *Metacyclops* into the new genus *Pescecyclops* (Karanovic et al. 2011). Based on the spine formula of legs P1–P4 there are four recognized groups of *Metacyclops* species: where the first follows the 3443 spine formula (with 54 species, the only group represented in Europe), the

[7] Note, that *Mesocyclops bodanicola* Kiefer, 1929 has been considered as a pelagic ecotype of *M. leuckarti* (Dussart 1969; Hołyńska et al. 2003), but this opinion should be confirmed by molecular analysis.

[8] The not European records of *M. stammeri* from reservoirs in Algeria and Turkey (Amar et al. 2012; Dorak et al. 2013) are doubtful and should be verified.

second follows the 3442 spine formula (with *M. mortoni*, from Australia), the third group follows the 3433 spine formula (with *M. cushae*, from North and South America), and the fourth *trispinosus*-group with 3333 spine formula (with two species *M. trispinosus* and *M. margaretae* from Africa and Asia, respectively) (Karanovic 2004a, b; Dussart and Defaye 2006; Mercado-Salas et al. 2013).

Genus *Microcyclops* **(Claus, 1893)**

Syn. *Cyclops* (*Mikrocyclops*) (Claus, 1893b)
Cryptocyclops (part.) (G.O. Sars, 1927)
Cyclops (*Microcyclops*) (Kiefer 1929, 1929; Gurney, 1933)
Cyclops (*Diacyclops*) (part) (Kiefer, 1927)
Microcyclops (*Microcyclops*) (Kiefer, 1939)
Microcyclops postoinae (Brancelj, 1987)[6]
Microcyclops rubellus (Lilljeborg, 1901)
Microcyclops sanfilippoi (Brian, 1951)[6]
Microcyclops varicans (G. O. Sars, 1863)

The genus is represented by four species in Europe (but only two from surface waters) and 48 species worldwide. The most recent revision of the morphological characters of the genus was provided by da Rocha (1998), but it was based only on the Brazilian species.

Genus *Thermocyclops* **(Kiefer, 1927)**

Syn. *Cyclops* (part.) (Schmeil, 1892)
Mesocyclops (part.) (G.O. Sars 1918)
Mesocyclops (*Thermocyclops*) (Kiefer, 1927)
Cyclops (*Mesocyclops*) (Gurney, 1933)
Thermocyclops crassus (Fischer, 1853)
Thermocyclops dalmaticus (Petkovski, 1956)[6]
Thermocyclops dybowskii (Landé, 1890)
Thermocyclops oithonoides (G. O. Sars, 1863)

The genus is represented by three species in Europe (three from surface waters) and 50 species worldwide. Recently, the genus was reviewed by Mirabdullayev et al. (2003).