Ivana Karanovic

Recent Freshwater Ostracods of the World

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Preface

Scientists have described over 1.7 million of the world's species of animals, plants, and algae, as of 2010. Invertebrates make around 77% of that number, of which the greatest species diversity exists among insects. There are more than 67,000 described living species of Crustacea, and probably five or ten times that number waiting to be discovered and named. Crustaceans have many forms and living strategies, and they have been found at all depths in every marine, brackish, and freshwater environment on Earth. Ostracods are often considered the most primitive and one of the oldest crustacean groups. The group was named in 1802 by Latreille, and the name comes from the Greek *óstrakon*, meaning shell or tile. The common name in English for ostracods is "mussel shrimp" or "seed shrimp," while in German it is "Muschelkrebse," names describing their most prominent characteristics: soft body enclosed between two valves. However, it was not Latreille who first described an ostracod species. The first ostracod is attributed to Baker, who illustrated a fossil ostracod in 1742, but Linné actually named the first species in 1746 as *Monoculus conchapedata*. Many great scientists have contributed and are still contributing to the field of ostracodology. Two hundred and sixty years of diligent work on ostracods brings us to approximately 8,000 living species described so far (Horne et al. 2000). However, the group is better known from its fossils. True ostracods first appeared in the Ordovician, about 500 million years ago (Martens et al. 1998), and more than 50,000 fossil species have been named so far. This extremely rich fossil record is a result of the well-calcified, bivalved shell and a small size. The size of adult ostracods ranges from 0.2 to 32 mm. The soft body is extremely reduced (in comparison with other crustaceans), having only up to eight pairs of appendages. These animals live in all types of water ecosystems both fresh and marine. Thanks to the rich fossil and recent diversity, and environmental plasticity, ostracods are one of the best model groups for evolutionary studies, and stand for all four pillars of evolutionary wisdom: morphology, genetics, ecology, and paleontology (Martens and Horne 2000). Trends in ostracodology today clearly favor paleontology over all the other disciplines. In a retrospective of ostracod research between the 1st (year 1963) and the 15th (penultimate one in the year 2005) International Symposia on Ostracoda, given by Matzke-Karasz et al. (2007), ecology (mostly paleoecology) was and still is the major field of investigation within ostracodology. On the other hand, taxonomy of ostracods is in a constant decline. Although taxonomy is the basis of all biological research, it is overly neglected and is in serious distress all over the world (Boero 2010). Taxonomy of living ostracods is particularly difficult because of two factors: small size and very few morphological characters. In spite of the decline of this field of study, the taxonomic literature is sometimes overwhelming. Until 1997, there were about 22,000 taxonomic references for the non-marine ostracods (both fossil and recent ones). Professor Eugen Kempf published indexes in 1980, 1991, and 1997, each year in several volumes (A, B, C, D) listing all the references (both taxonomical and non-taxonomical literature), as well as all the ostracod generic and species names ever published. Without these publications, work on ostracods would be much more difficult. However, they are only a starting point, from which an ostracodologist has to find their way around and about in identifying a species.

In 2000, Claude Meisch published the book "Freshwater Ostracods of Western and Central Europe," a thorough systematic insight which provides systematic, taxonomic, ecological, and distributional data on the ostracods from this part of the world. This meticulous work is widely used, not only by ostracodologists working on the European ostracod fauna. Several countries have their freshwater ostracod fauna published as books, which are often used as reference works, such as Hungary (Daday 1900a), Germany (Klie 1938a), Russia (Bronstein 1947), Poland (Sywula 1974b), Great Britain (Henderson 1990), etc., but in many cases the language they are published in is a limiting factor. Hartmann (1966, 1976, 1968, 1975, 1989) published five volumes on ostracods as part of the series "Klassen und Ordnungen des Tierreichs," a study of the entire class Ostracoda from morphological, anatomical, and systematic points of view. Unfortunately, this comprehensive and valuable work never was translated to English and therefore is not widely used in the modern studies. On the other hand, books such as Horne and Martens (1994) "The Evolutionary Ecology of Reproductive Modes in Non-marine Ostracoda" and Martens (1998b) "Sex and Parthenogenesis – Evolutionary Ecology of Reproductive Modes in Non-marine Ostracods" have become landmarks in studies of ostracod ecology and reproduction modes.

The present book intends to provide a practical synopsis of the recent ostracods of the world, living in all types of freshwater ecosystems. According to the latest account, there are close to 2,000 subjective species and about 200 genera of recent non-marine ostracods (Martens et al. 2007). They all belong to the order Podocopida. This book provides a diagnosis for each taxonomic unit with living freshwater representatives, keys down to the species level and illustrations of the main generic characters. Most illustrations and photographs are original, and those kindly donated by colleagues are always acknowledged in figure legends. Each species listed is given in its currently accepted systematic position and no new combinations are provided. For each species, the type locality and the repository of the type material (if known) is listed. Maps of distributions are presented for each genus, and they include all species which currently belong to the genus and their present day distribution. Most of the synonyms are also listed, as well as some taxonomical remarks, pointing out potential systematic and taxonomic problems and needs of revision. All the subfamily, generic, and species names are listed in the alphabetical order. The book should be of value to both beginners and experienced workers, in all aspects of the current trends in ostracodology. Most of all it is intended to encourage more taxonomic studies of ostracods since there are still many ostracod species to be described and contribute to the foundation of the "four pillars of evolutionary wisdom."

Hamburg, Germany Ivana Karanovic

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Part I
Introduction and Methods

Introduction

1 Classification

Depending on the view of the higher classification of Crustacea, ostracods are classified as a subclass of the class Maxillopoda (Schram 1986; Brusca and Brusca 1990) or as a separate class (Forest 1994; Martin and Davis 2001) within the subphylum Crustacea. In the first case, ostracods are grouped together with tantulocarids, branchiurans, mystacocaridans, copepods, facetotectans, rhizocephalans, ascothoracidans, acrothoracicans, and thoracicans. McKenzie et al. (1983) classify ostracods into Entomostraca, together with Branchiopoda, Cirripedia, Branchiura, and Phyllocarida. Ostracods are here accepted as a separate class within Crustacea. According to Maddocks (1982) ostracods are divided into four orders: Myodocopida Sars 1866, Platycopida Sars 1866, Palaeocopida Henningsmoen 1953, and Podocopida Sars 1866. On the other hand, Martin and Davis (2001) and Horne et al. (2002) divide the class into subclass Myodocopa (with orders Myodocopida and Halocyprida) and Podocopa (with orders Platycopida, Podocopida, and Palaeocopida). Subclass Myodocopa has only marine representatives. Within the subclass Podocopa, Platycopida has almost only marine species (a very few brackish water species), Palaeocopida is known almost exclusively from fossils, and Podocopida has representatives in both fresh and marine environments. The Order Podocopida is treated in this book and its classification presented below (Table 1) follows Martens et al. (1998), Meisch (2000), and Horne et al. (2005). Letters after the names indicate the type of environment where representatives of a certain taxon can be found: “m” for marine species, and “f” for freshwater. Those with only marine representatives or commensal species are not considered further in the systematic part of the book, but, nevertheless, a key to all podocopid superfamiles as well as their general morphology is provided in this book.

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Table 1 Classification of the recent Ostracoda (only the podocopid lineages are listed below the suborder level)

- Class Ostracoda Latreille 1802
  - Subclass Myodocopa Sars 1866 m
    - Order Myodocopida Sars 1866
      - Suborder Myodocopina Sars 1866
    - Order Halocyprida Dana 1852
      - Suborder Halocypridina Dana 1852
      - Suborder Cladocopina Sars 1866
  - Subclass Podocopa Sars 1866 m/f
    - Order Platycopida Sars 1866 m
    - Order Podocopida Sars 1866 m/f
      - Suborder Bairdiocopina Sars 1866 m
        - Superfamily Bairdioidea Sars 1866
        - Family Bairdiidae Sars 1866
        - Family Bythocyprididae Maddocks 1969
      - Suborder Cytherocopina Baird 1850 m/f
        - Superfamily Cytheroidea Baird 1850 m/f
        - Family Bythocytheridae Sars 1866 m
        - Family Cobanocytheridae Schornikov 1975 m
        - Family Cuneocytheridae Mandelstam 1959 m
        - Family Cushmanideidae Puri 1974 m
        - Family Cytherettidae Triebel 1952 m
        - Family Cytheridae Baird 1850 m
        - Family Cytherideidae Sars 1925 m/f
        - Family Cytheromatidae Elofson 1938 m
        - Family Cytheruridae Müller 1894 m
        - Family Entocytheridae Hoff 1942 f (living commensally on other crustaceans)
        - Family Eucytheridae Puri 1954 m
        - Family Hemicytheridae Puri 1953 m
        - Family Kliellidae Schäfer 1945 f
        - Family Krithidae Mandelstam 1960 m
        - Family Leptocytheridae Hanai 1957 m/f
        - Family Limnocytheridae Klie 1938a f
        - Family Loxoconchidae Sars 1925 m/f
        - Family Microcytheridae Klie 1938a m
        - Family Neocytheridae Puri 1957 m
        - Family Paracytherideidae Puri 1957 m
        - Family Paradoxostomatidae Brady and Norman 1889 m
        - Family Parvocytheridae Hartmann 1959 m
        - Family Pectocytheridae Hanai 1957 m
        - Family Psammocytheridae Klie 1938a m
        - Family Schizocytheridae Howe 1961 m
        - Family Trachyleberididae Sylvester-Bradley 1948 m
        - Family Xestoleberididae Sars 1928 f/m
        - Superfamily Terrestricytheroidea Schornikov 1969 m

(continued)

Table 1 (continued)

Family Terrestricytheridae Schornikov 1969
Suborder Darwinulocopina Sohn 1987 f
Superfamily Darwinuloidea Brady and Norman 1889
Family Darwinulidae Brady and Norman 1889
Suborder Cypridocopina Jones 1901 m/f
Superfamily Cypridoidea Baird 1845 m/f
Family Candonidae Kaufmann 1900a m/f
Family Cyprididae Baird 1845 f
Family Ilyocyprididae Kaufmann 1900a, f
Family Notodromadidae Kaufmann 1900a, f
Superfamily Macrocypridoidea Müller 1912 m
Family Macrocyprididae Müller 1912
Superfamily Pontocypridoidea Müller 1894 m
Family Pontocyprididae Müller 1894
Suborder Sigilliocopina Martens 1992c m
Superfamily Sigillioidea Mandelstam 1960
Family Sigilliidae Mandelstam 1960

2 Basic Morphology

As in many crustacean groups there is no standard terminology that is in universal use. Specialists working on Suborder Cytherocopina tend to have different terminology to the ones working on the Suborder Cypridocopina. Obviously in an overview, such as this book, a standard terminology needs to be adopted. Horne et al. (2002) already attempted to establish a consistent terminology for all ostracods. In this book, standard terms used for all other crustaceans describing a general structure of the crustacean appendage (endites, protopod, exopod, endopod, epipod, and segments) are used here as well. The terminology applied here for the ostracod limbs is a combination of the standard terms used by many modern authors in their publications. Descriptions of the limb chaetotaxy are based on the nomenclature proposed by the following authors: Broodbakker and Danielopol (1982), Martens (1987a), Meisch (1996, 2007), Rossetti and Martens (1996), and Karanovic (2007). Nomenclature used for the carapace surface structures follows Sylvester-Bradley and Benson (1971). However, not all terms defined by the latter authors are described here as they are applicable mostly for the marine taxa of the suborder Cytherocopina and are not developed on the shells of the freshwater species. General morphology and structure of the valves are the same as in Meisch (2000). In this chapter, each appendage is compared between the three superfamilies found in the freshwaters: Cytheroidea, Darwinuloidea, and Cypridoidea, with some remarks on other ostracods (Figs. 1–3).

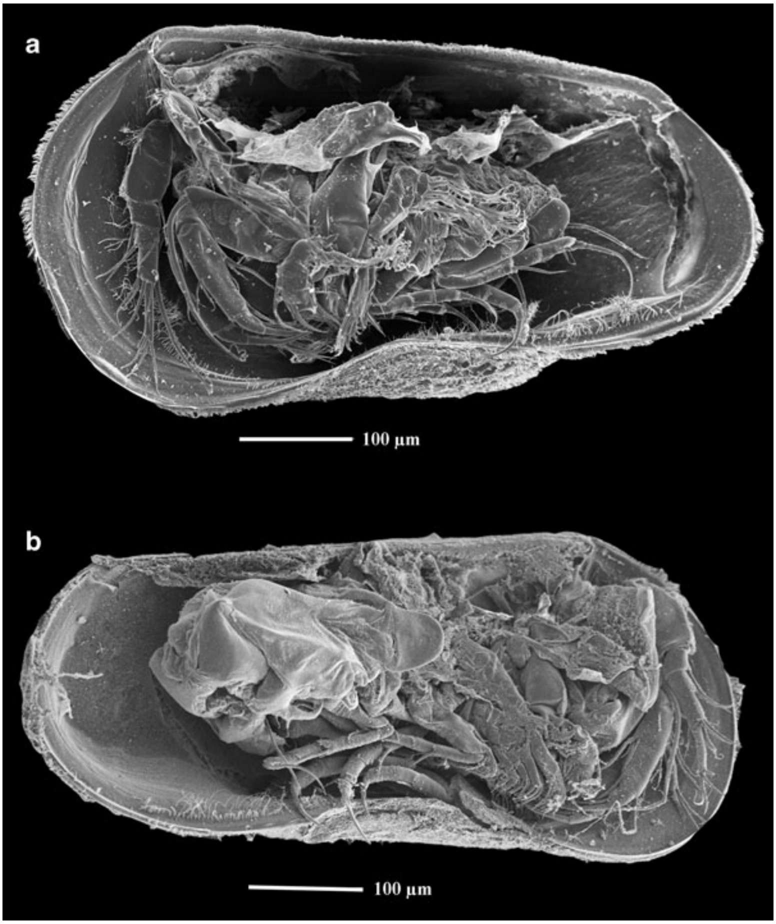

Fig. 1 *Paralimnocythere karamani* (Petkovski 1960a), SEM: (a) inside view of the adult ♀; (b) inside view of the adult ♂.

2.1 Carapace

The ostracod body is enclosed between two calcified valves that are connected in the dorsal part with simple chitinous, like in Cypridoidea, or complex calcite nonslip locking device (hinge), like in Cytheroidea. As in other crustaceans, the cuticle of the carapace is mineralized with low magnesium calcium carbonate in the form of calcite. The calcified shell consists of small crystallites embedded in a chitinous and protein matrix. The shell can be almost completely built of calcite crystals or composed of parallel chitinous lamellae together with a layer of crystallite. The carapace is an important functioning part of the ostracod anatomy, it encapsulates and protects the animal from predators, provides additional stability for the benthic way of life, and forms an integral part of the exoskeleton, providing anchorage

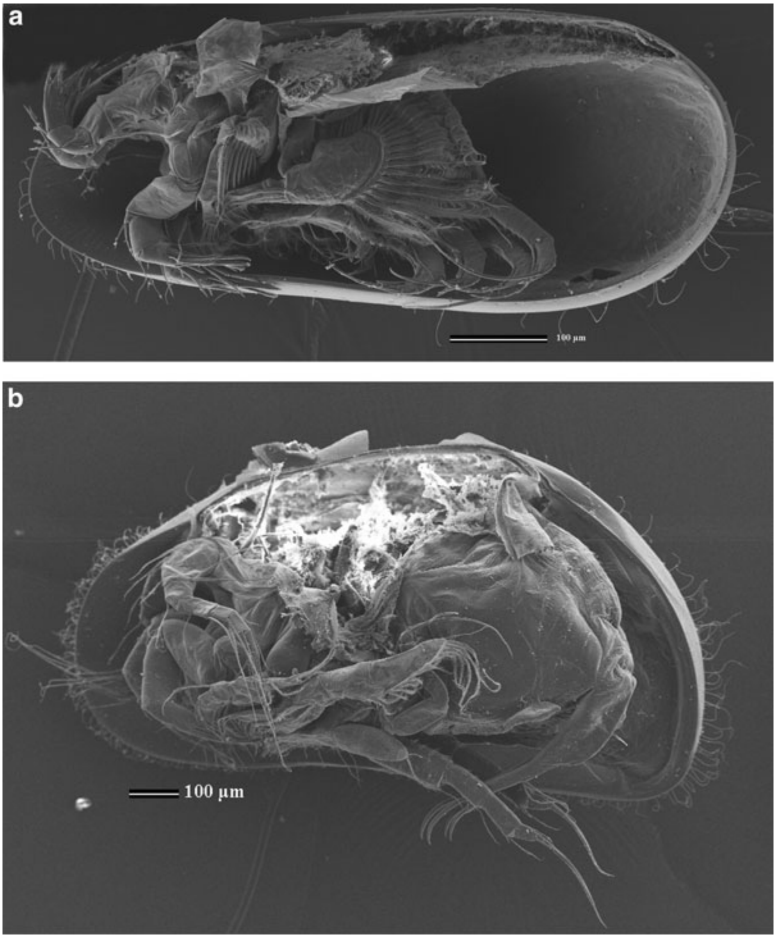

Fig. 2 *A, Darwinula stevensoni* (Brady and Robertson 1870), (a) inside view of the adult ♀; (b), *Candona lindneri* Petkovski 1969, inside view of the adult ♀.

points for some muscles of the limbs. Ostracods keep almost all their soft parts within the valves, but sometimes even substantial parts of uropodal rami, walking and cleaning legs, as well as the first and the second antenna, can be seen protruding through the valves (Fig. 4). Ostracods are enclosed in the carapace even in the first instar of their development. The carapace is formed by two lateral folds of the epidermis, originating dorsally in the head region. These folds or *duplicature* have an inner and an outer lamella. The space between the two lamellae is an extension of the body which in some taxa may house certain reproductive and digestive organs. The outer lamella is well calcified throughout, while the inner lamella has uncalcified and calcified parts (Fig. 5a). The calcified inner lamella is an extension of the calcified outer lamella, i.e., they are continuous with one another, and the only difference between the two lamellae can be found in the disposition of their cells and

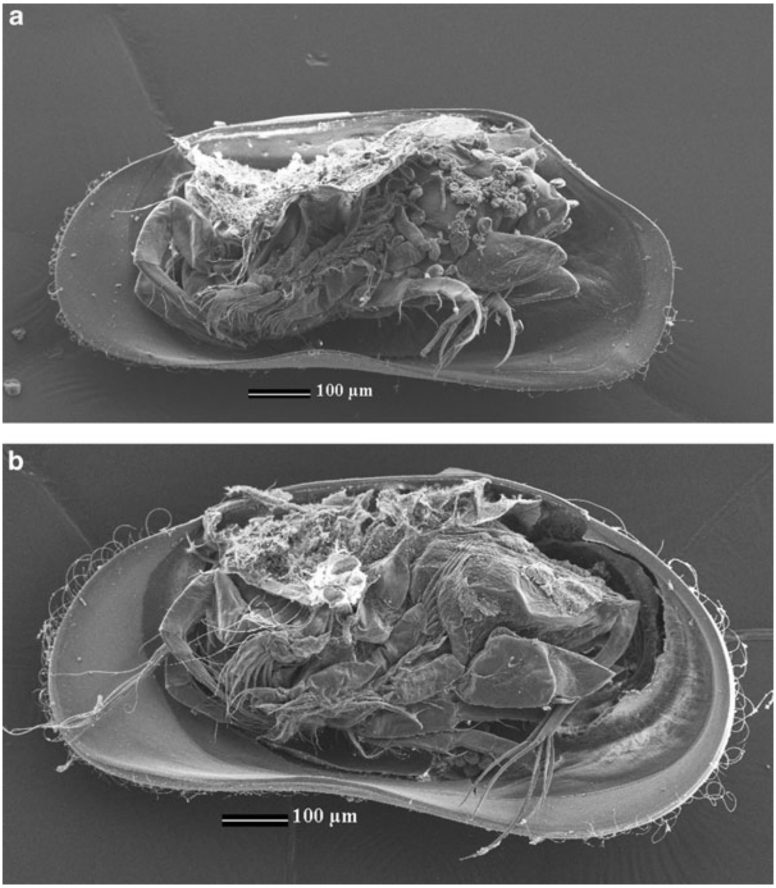

Fig. 3 SEM: *Candonopsis kingsleii* (Brady and Robertson 1870), SEM: (a) inside view of the adult ♀; (b) inside view of the adult ♂.

whether their cuticle fronts are on the outside, or face the body of the animal (Keyser 1990). The data available suggest that the inner lamella is the main organ in which osmoregulation takes place in freshwater ostracods (Keyser 1990). The calcareous components of the ostracod shell are arranged in at least two distinct layers: one thicker layer, composed of crystals of calcite with a foliated appearance, and a thinner laminated layer. The soft body of an animal is integral part of the duplicature and it is connected dorsally to the valves as well as laterally with the so-called adductor muscles, (Fig. 5b), which form a scar on the valves, and together with the mandibular scars, form central scar pattern. This is the first taxonomic character for distinguishing between different podocopid suborders as shown in Fig. 5c–f.

Looking at the carapace laying on its side, we can distinguish *anterior margin* and *anterior end*, *posterior margin* and *posterior end*, and *ventral* and *dorsal margin*. (Fig. 6a)

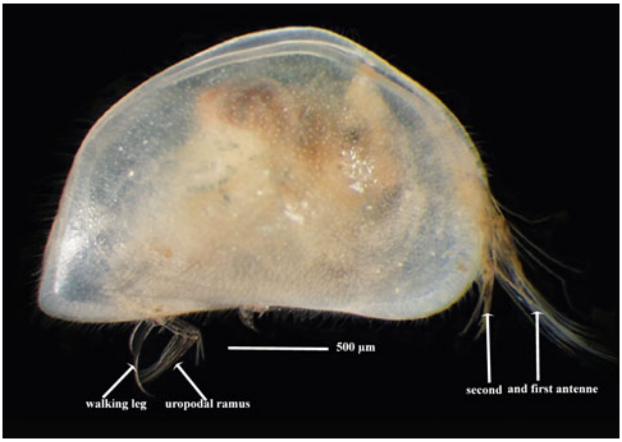

Fig. 4 *Trigonocypris globulosa* De Deckker 1978. Outside view from the right side, showing the protruding appendages. Photo: S. Halse.

On the inner lamella, we can recognize the following parts, whose structures bear important taxonomic information (Fig. 6a, c). Looking from the center toward the free margins, the first line we can see is called *inner margin* and it represents the line where inner lamella becomes calcified. After that, occasionally we can see several *inner lists* which can run continuously or only partly with the inner margin. Further on, on the *calcified inner lamella* (sometimes also called *duplicature* in the literature, but it is only a part of it and not synonymous), a zone where inner and outer lamella meet is called the *line of concrescence*, and the zone which follows and is usually transverse with canals is called the *fused zone*. The inner calcified lamella and the outer lamella may be fused throughout or there may be a space between them called *vestibulum*. *radial pore canals* are tubes, carrying nerves, passing through the fused zone between the calcified inner and outer lamellae. Sensillae protrude from pores. Sometimes radial/marginal pore canals start at the *line of concrescence* but do not run all the way through the *fused zone* (because they exit on the external surface of the valve before the outer margin), and in that case they are called *false radial/marginal pore canals*. The free extension of the calcified inner lamella is called *selvage*, and it can sometimes be inwardly displaced, in which case the free valve margin is formed by a more or less prominent extension of the outer lamella, called a *flange* (Fig. 6c).

The surface of the ostracod shell has many different features, which may have important taxonomic value. Pores appear to be the termination of pore canals which penetrate the shell and in live animals may bear a sensilla (Fig. 7), and on the surface they are called *normal pores*. In Cytheroidea many of the pores are partially closed by *sieve plates* (Fig. 7c, d). Pits on the surface of the carapace may be in the form of *punctae* (Fig. 7e) and *fossae* (Fig. 7f). Difference between punctae and fossae is in the fact that fossae are connected with walls or *muri*, which together form a *reticulum*. There can also be a “second order reticulation” inside

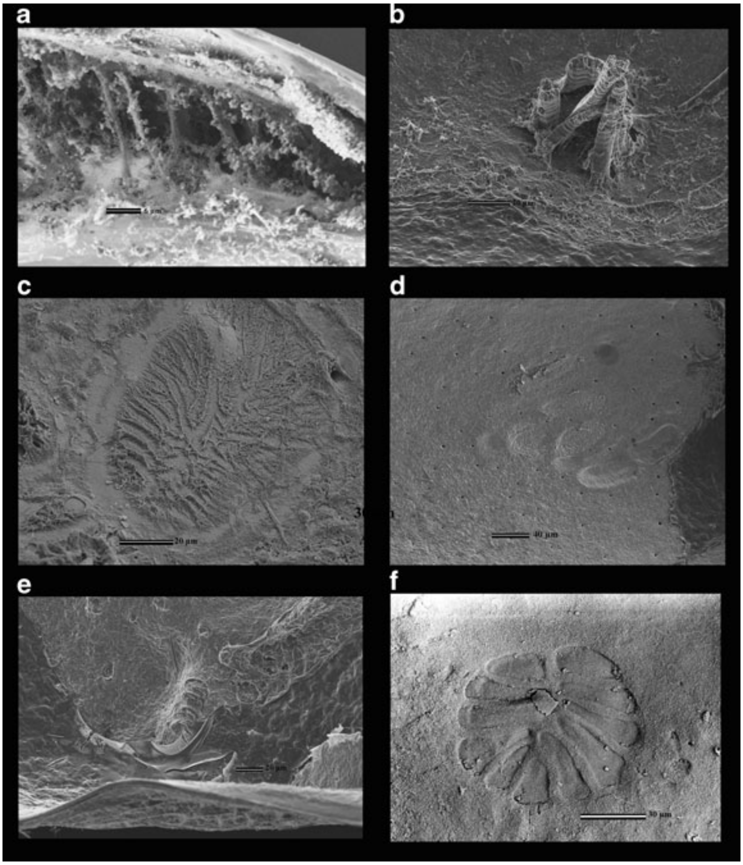

Fig. 5 SEM: (**a**, **f**) *Darwinula stevensoni* (Brady and Robertson 1870); (**b**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**c**) *Acocypris capilatta* (Vávra 1895); (**d**) *Psychrodromus fontinalis* (Wolf 1920); (**e**) *Paralimnocythere karamani* (Petkovski 1960a): (**b**) adductor muscle attachment to the shell; (**c**–**f**), imprints of the adductor muscle scars (CMS). (**f**) Photo: D. Keyser

the fossae or even walls. *Sulcus* (plural: *sulci*) is a term describing any kind of groove on the exterior of the carapace (Fig. 8a). *Tubercles* or *nodes* (Fig. 8b) are another type of carapace ornamentation. They can be simple and rounded, or they can be additionally covered with warty expressions. Observation on *Cyprideis torosa* (Jones 1850), an animal which can be found in many different salinity levels, has shown that the noding on the surface of the shell in this species is directly connected with the osmoregulation the animal employs during the molting (Keyser 2005). Special kinds of tubercles are also *clavae* (Fig. 9b). A much smaller ornament in the shape of a prickle is called *papillae* (Fig. 9a). Clavae can sometimes be enlarged and called *carinae* (or *costae*) (Fig. 9c). Wing-like expansions (both thin and pointed and fat and rounded) are called *alae* (Fig. 9d).

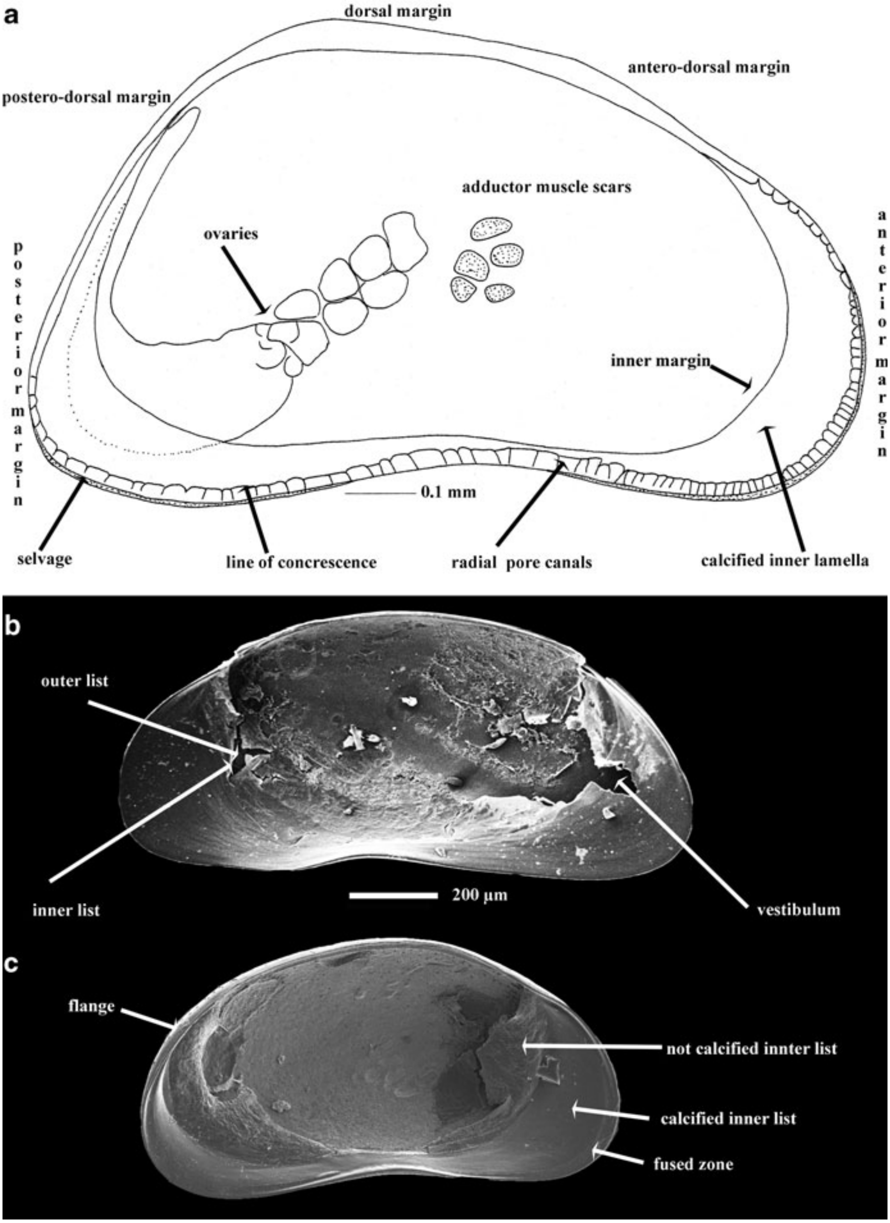

Fig. 6 (**a**) line drawings, (**b**, **c**) SEM. (**a**) *Candona sp.*; (**b**) *Humphcypris subterranea* (Hartmann 1964); (**c**) *Psychrodromus fontinalis* (Wolf 1920): (**a**) schematic view of the interior of the LV; (**b**) inside view of the RV; (**c**) inside view of the LV. (**b**) Photo: D. Keyser

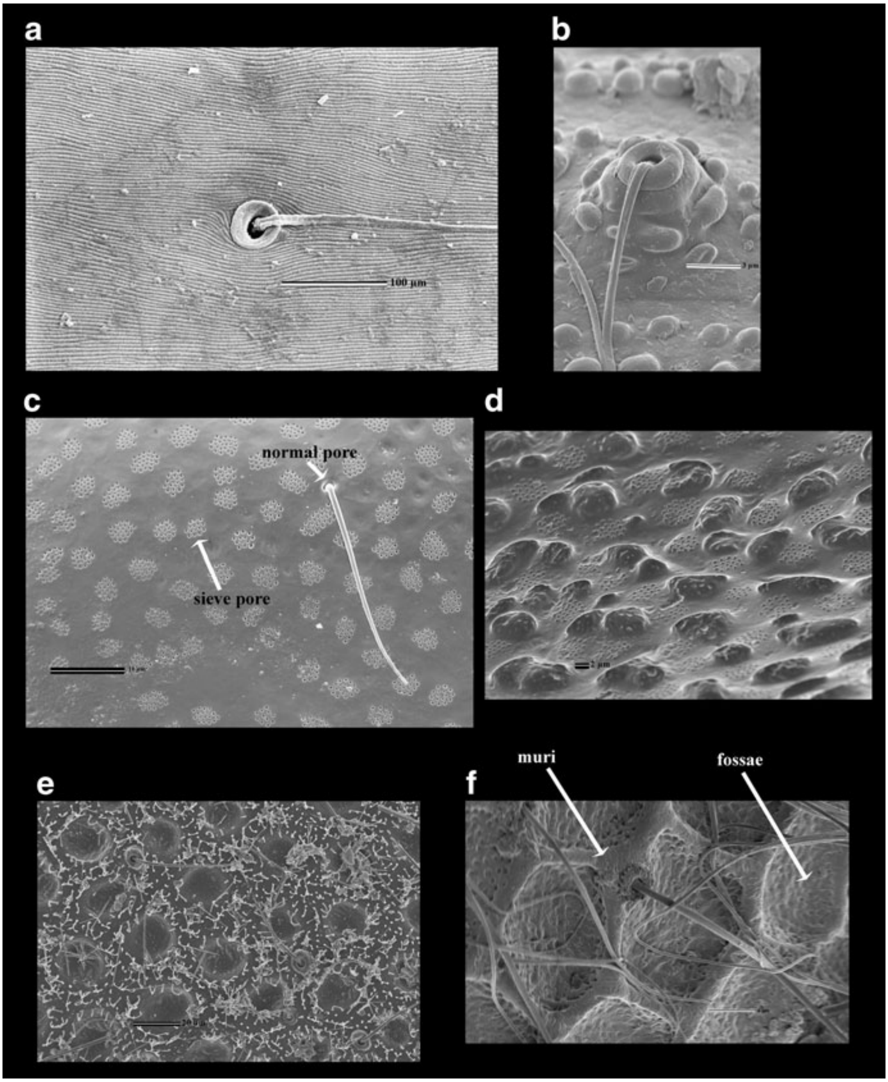

Fig. 7 SEM: (**a**) *Ilyodromus viridulus* (Brady 1886b); (**b**) *Meridiescandona facies* Karanovic 2003c; (**c**) *Gomphodella quasihirsuta* Karanovic 2009; (**d**) *Gomphodella aurea* Karanovic 2009; (**e**) *Ilyocypris brady*, Sars 1870; (**f**), *Humphreyscandona waldockae* Karanovic and Marmonier 2003: (**a**) normal pore, (**b**) detail of the surface, showing a normal pore; (**c**, **d**) detail of the surface; (**e**) detail of the surface showing rounded pits; (**f**) detail of the surface showing primary and secondary ornamentation. (**a**) Photo: D. Keyser

Ostracod shells have many different shapes. Most common shapes in the freshwater ostracods in lateral view are "kidney" or "bean" shape (Fig. 10a), elliptical (Fig. 10b), trapezoidal (Fig. 10c, g), triangular and subtriangular (Fig. 10d, e, h), or elongated (Fig. 10f), or any variation of the previous shapes. In dorsal view, the

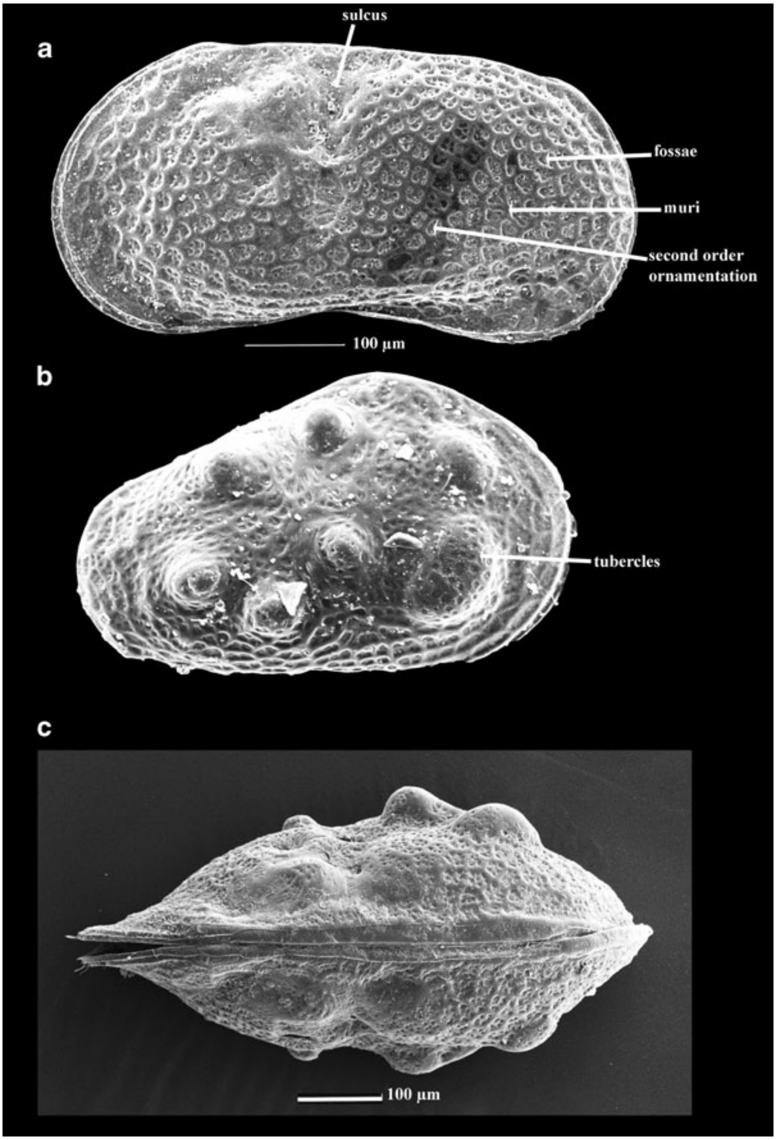

Fig. 8 SEM: (**a**) *Limnnocythere inopinata* (Baird 1843a, b); (**b**) *Cytherissa lacustris* (Sars 1863); (**c**) *Limnnocythere inopinata* (Baird 1843a): (**a**, **b**) lateral view; (**c**) dorsal view. Photos: D. Keyser

shape can be ovoid or globular (Fig. 11a), laterally compressed (Fig. 11d), kite-like (Fig. 11e), or just oblong (Fig. 11b, c).

The coloration of the shell varies from being white, as in many subterranean species (Fig. 12d), to being very vividly colored (Fig. 12a, b), sometimes with very characteristic patterns. The color is usually provided by pigments deposited within

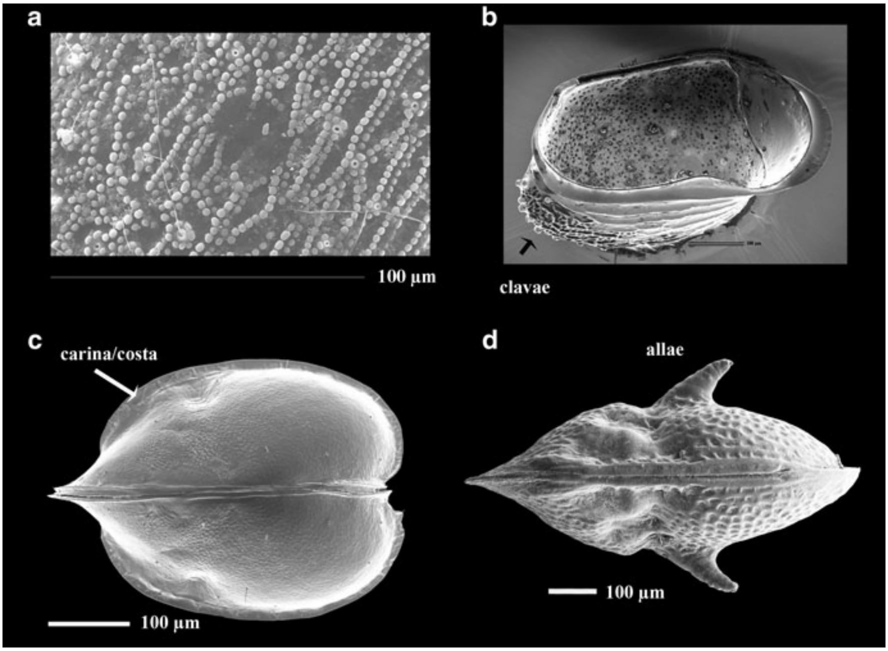

Fig. 9 SEM: (**a**) *Meridiescandona lucerna* Karanovic 2003c; (**b**) *Gomphodella martensi* Karanovic 2009; (**c**) *Gomphodella aura* Karanovic 2009; (**d**) *Limnocythere scutariense* Petkovski 1961: (**a**) detail of the surface showing papillae; (**b**) lateral view of the LV from inside; (**c**) dorsal view; (**d**) dorsal view. (**d**) Photo: D. Keyser

the epidermis of the calcified outer lamella. The color may vanish with prolonged preservation, e.g., in alcohol.

In some species, it is very difficult to distinguish between male and female carapace shape, but in others this is very easy. In some Cypridoidea, males are obviously larger than females and have an enlarged posterior chamber to accommodate a copulatory organ, while females are small and have quite a different shape. In most freshwater Cytheroidea, it is also very easy to distinguish males from females (Fig. 13a, b). In some lineages, females are much more robust, because of the brooding chamber in the posterior part of the body, where they keep eggs and early instars. Even if the brooding chamber does not exist, there is a clear difference between male and female carapace (Fig. 13c–f).

2.2 *Body Segmentation*

The usual division of an arthropod body, into head (cephalon), thorax, and abdomen, is not clearly recognizable in ostracods. Nevertheless, some authors (e.g., Tsukagoshi and Parker 2000) believe that Podocopid ostracods have a maximum

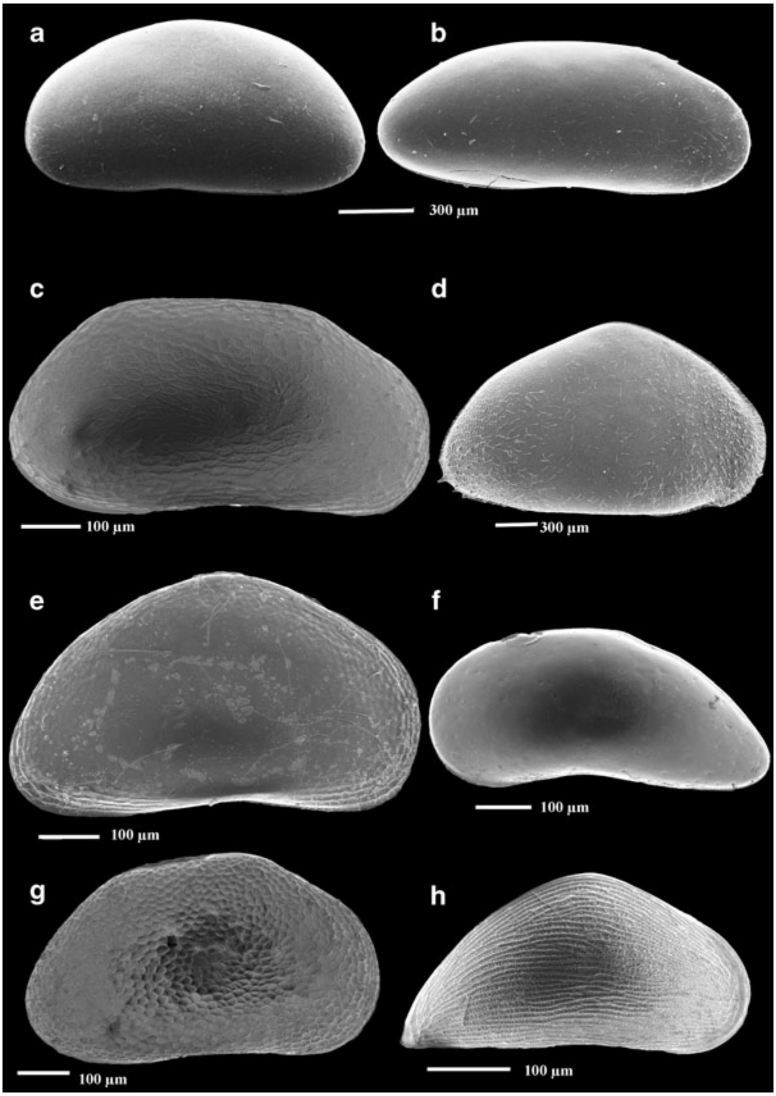

Fig. 10 SEM: (**a**) *Ilyodromus sp.*; (**b**) *Stenocypris major* (Baird 1859b); (**c**) *Meridiescandona facies* Karanovic 2003c; (**d**) *Cypris pubera* Müller 1776; (**e**) *Humphreyscandona fovea* Karanovic and Marmonier 2003; (**f**) *Origocandona inanitas* Karanovic 2005b; (**g**) *Humphreyscandona waldockae* Karanovic and Marmonier 2003; (**h**) *Pilbaracandona eberhardi* Karanovic and Marmonier 2003: (**a**) LV, outside view; (**b**, **c**, **d**, **e**, **g**, **h**) RV, outside view; (**f**) LV, outside view. (**a**, **b**, **d**) Photos: D. Keyser

of 11 trunk segments (thorax and abdomen). This is based on the observation of body segmentation in eight podocopine families (one belonging to Bairdocopina and seven to Cytherocopina). Among these families a maximum number of body segments have been found in the, presumably, most primitive of the examined lineages (Tsukagoshi

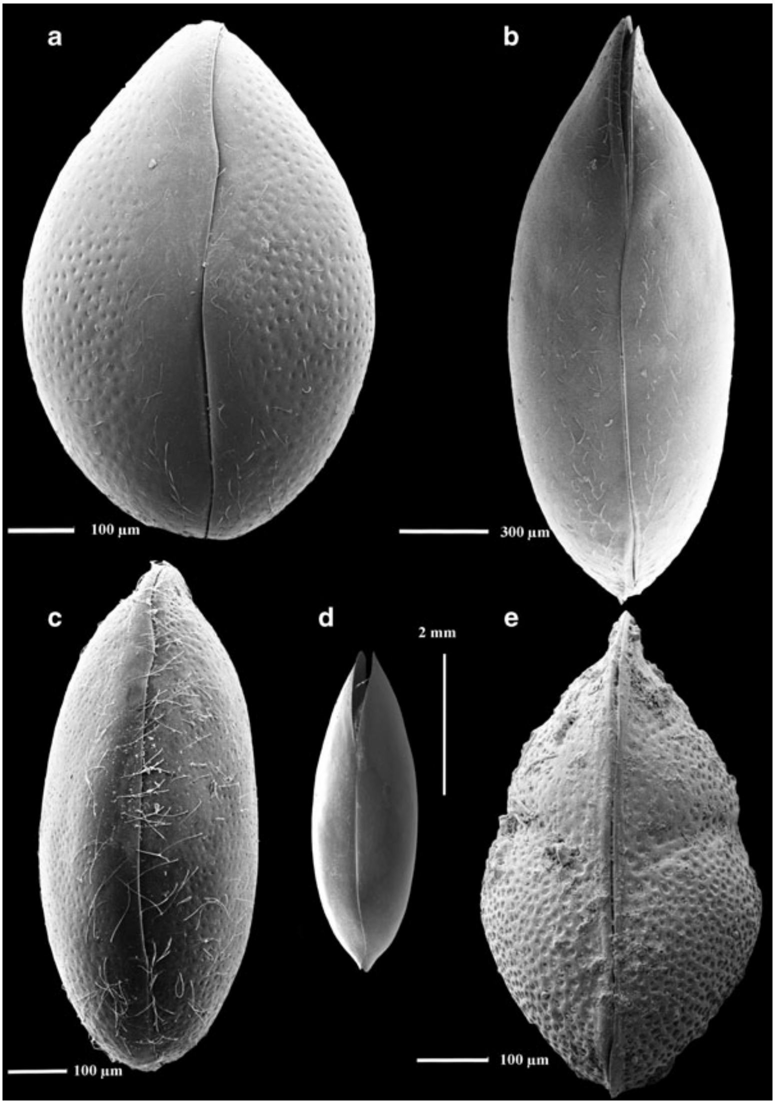

Fig. 11 SEM: (**a**) *Cypridopsis vidua* (Müller 1776), (**b**) *Trajancypris sp.;* (**c**) *Pseudocandona sp.;* (**d**) *Repandocypris austinensis* Halse and McRae 2004 (e) *Gomphocythere sp.*: dorsal views. (**a**, **b**, **c**, **e**) Photos: D. Keyser; (**d**) Photo: S. Halse

and Parker 2000), namely in the family Leptocytheridae. The number of trunk segments becomes less in more derived taxa. The same number (11) of trunk segments occurs in Platycopida (Schulz 1976). The supposed segmentation of the trunk region in all these taxa is sometimes marked by cuticular folds and/or assemblages of spines and setae (Fig. 14). It is also believed that in these lineages copulatory appendages in females are derived from segments associated with the fifth thoracic region, while those of the males with the tenth one. On the other hand, Matzke-Karasz and Martens

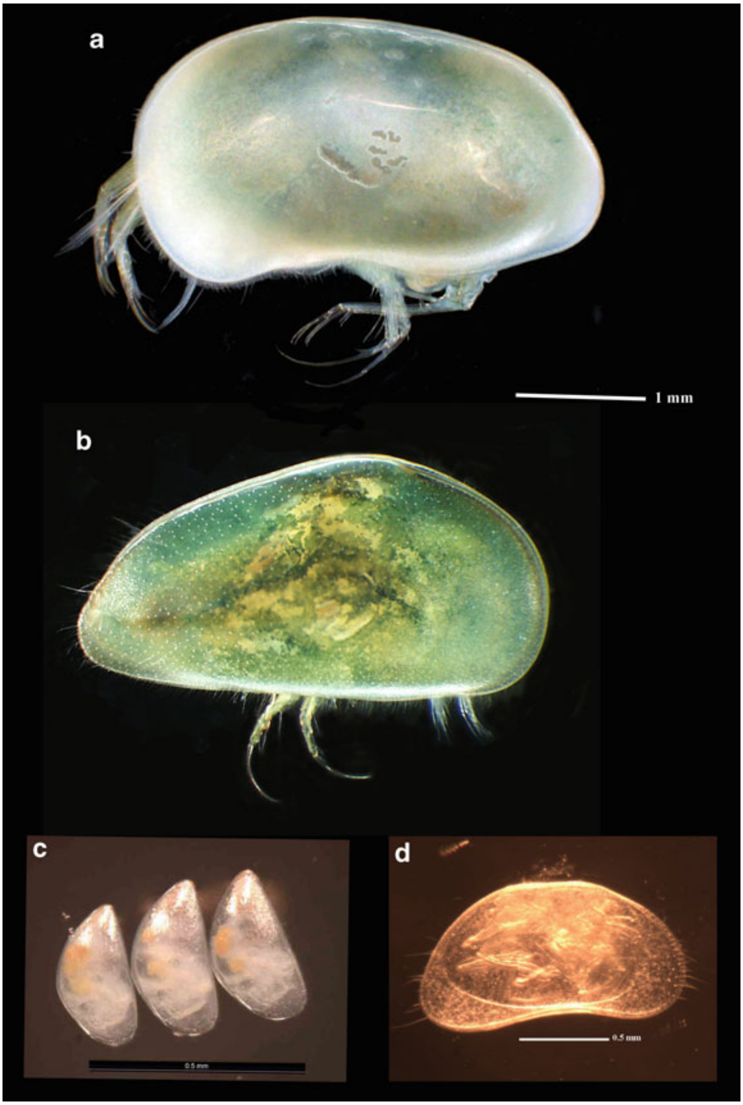

Fig. 12 Microscopic photographs: (**a**) *Australocypris beaumonti* Halse and McRae 2004; (**b**) *Lacrimicypris kumbar* Halse and McRae 2004; (**c**) *Areacandona sp.*; (**d**) *Candonopsis sp.*: (**a**) lateral view from the left side; (**b**, **d**), lateral view form the right side; (**c**) three individuals laying on the right side. (**a**, **b**) Photos: S. Halse; (**c**, **d**) Photos: T. Karanovic

(2005, 2007) consider that the female copulatory appendage is derived from more than one segment. They have based their conclusions on the morphology of a representative of the family Cyprididae, namely giant ostracods from the subfamily Liocypridinae. Females of these species have several (three, five, or six) paired appendage-like structures associated with the female genital field. Within the Myodocopa, some members of the Cladocopina have definite indications of dorsal trunk segmentation,

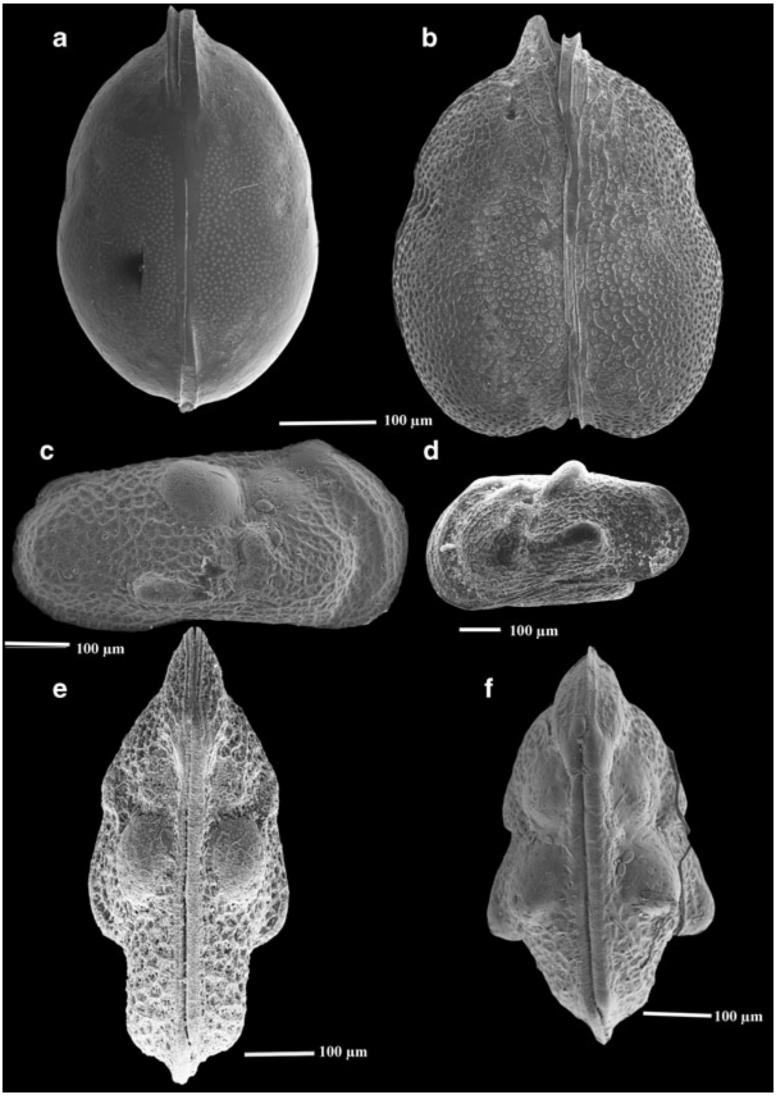

Fig. 13 SEM: (**a**, **b**) *Gomphodella sp.*; (**c**, **d**, **f**) *Paralimnocythere karamani* (Petkovski 1960a); (**e**) *Paralimnocythere sp.*: (**a**, **e**) ♂, dorsal view; (**b**, **f**) ♀, dorsal view; (**c**) ♂ lateral view form the right side; (**d**) ♀ lateral view from the left side. (**e**) Photo: D. Keyser

and remnants of dorsal trunk segmentation are visible in a few of the Halocyprid species (Cohen et al. 1998). Nevertheless, in most species of Podocopid ostracods body segmentation is completely reduced, some think as a result of paedomorphic evolution (Tsukagoshi and Parker 2000), and there are at the most seven pairs of appendages, four (or five) cephalic ones, and three (or two) thoracic ones, and no abdominal appendages. The body terminates in paired uropodal rami.

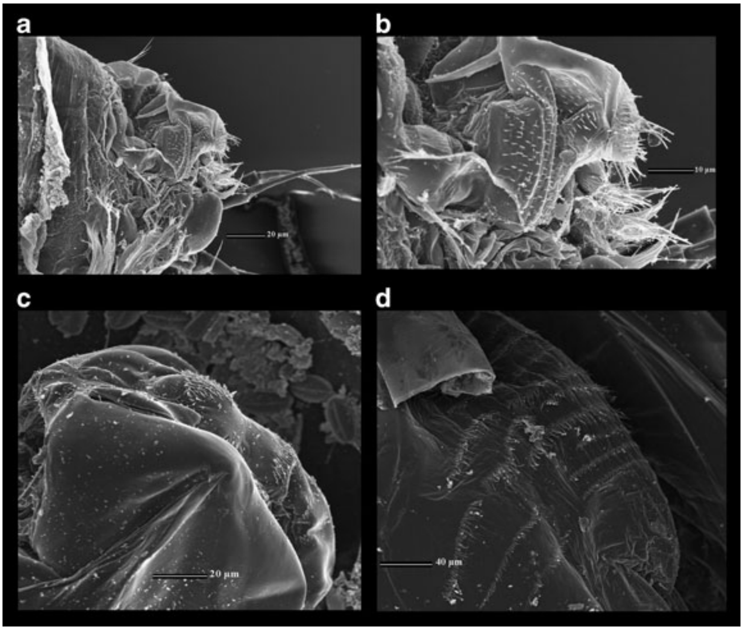

Fig. 14 SEM: (**a**, **b**) *Gomphodella quasihirsuta* Karanovic, 2009; (**c**) *Paralimnocythere karamani* (Petkovski 1960a); (**d**) *Candona lindneri* Petkovski 1969b: (**a**, **b**, **d**, ♀) posterior end of the body; (**c**, ♂) posterior end of the body

2.3 Antennula

This is the first appendage, situated in the head region. It is also called the first antenna, or "A1" (Fig. 15). It is used for locomotion and it also has a sensory function, since it is equipped with some sensory setae – aesthetascs. It is believed that this appendage is uniramous, and that it does not have any traces of the biramous appendage. This is also believed to be true for all other crustaceans (Boxshall et al. 2010). However, the first (two) segments of the antennula in Cypridoidea have sometimes been regarded as constituting a "protopod," and the rest of the limb as an "endopod," In Darwinuloidea, this goes even further, some authors labeling the group of setae on the second segment of the antennula as the "exopod" (Rossetti and Martens 1996, 1999). Karanovic (2005e) proposed a new terminology for the antennula, acknowledging the presence of all three rami on this appendage, and trying to underpin the homologous structures on the antennula between the three freshwater lineages, namely, Cypridoidea, Cytheroidea, and Darwinuloidea. This approach was not received enthusiastically among carcinologists and other ostracod workers, as it undoubtedly challenges the homology of this appendage with other crustaceans and arthropods in general, and it is strongly suggested that it should be abandoned (Boxshall and Jaume 2009; Smith and Kamiya 2008; Boxshall et al. 2010). Maddocks (2000) provided a comparative analysis of the antennula among the podocopid lineages, labeling setae numerically

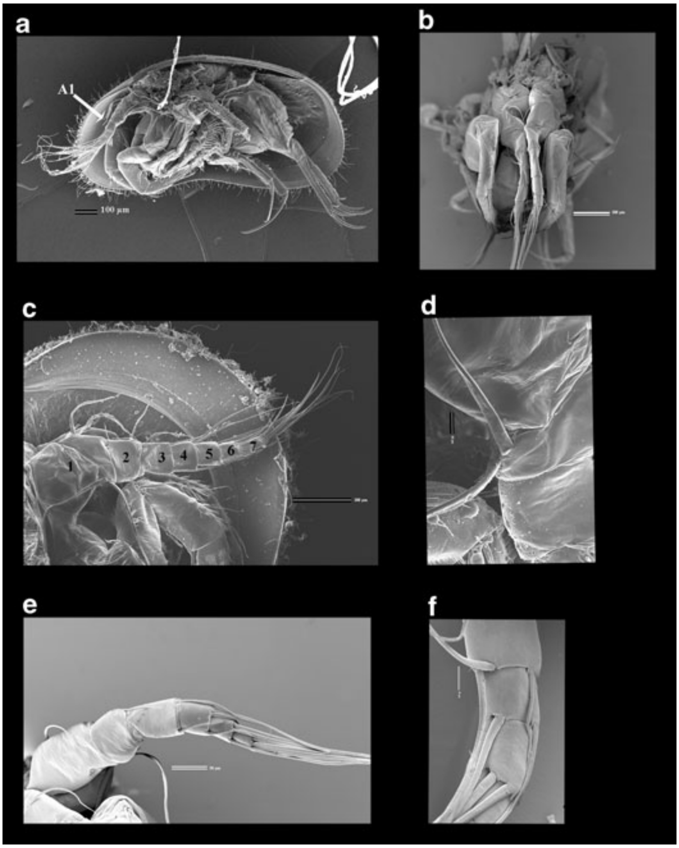

Fig. 15 SEM: (**a**) *Psychrodromus olivaceus* (Brady and Norman 1889); (**b**, **e**, **f**) *Heterocypris incongruens* (Ramdohr 1808); (**c**, **d**) *Ilyocypris brady* Sars 1870: (**a**) adult ♀ inside view; (**b**) ♀, anterior view; (**c**, **e**, **f**) A1; (**d**) postero-dorsal setae on the first segment of the A1

from the proximal to distal. Although this system may be helpful in determining the homologous structures, it is very complicated and difficult to use. In this book, the labeling of setae and segments is abandoned and only a standard description of setae according to their actual position of the appendage is applied. There is no sexual dimorphism in the morphology of the antennula in any of the Podocopan lineages. In Myodocopa, on the other hand, males usually have many transformed setae.

2.3.1 Superfamily Cypridoidea

The antennula has a maximum of eight segments (Fig. 15c). The first two segments are only partly subdivided and here they are counted together as the first segment. This segment bears a maximum of four setae: two situated on the anterior side, and the other two situated on the postero-dorsal side (Fig. 15d). The more proximal of the two anterior setae is often transformed into a sensory organ, called the Wouters organ (Smith and Matzke-Karasz 2008). This is the case in most of the representatives of the family Cyprididae and the subfamily Paracypridinae (family Candonidae). The other two subfamiles of Candonidae – Candoninae and Cyclocypridinae – do not have this organ. Instead the seta is present in this place. In many subterranean Candoninae one of the two setae is missing. Two setae on the dorsal side of the first antennular segment originate almost from the same spot and are often very long. It is very rarely that one of these setae is missing. The following segment is jointed with the previous one and it is usually the shortest of all the segments, carrying one seta anteriorly which is rarely long. Posteriorly, on the dorsal side there may be another sensory organ, called Rome organ. This organ has different shapes (Fig. 16) and it is usually present in most Cypridoidea, except for Candoninae. The third segment is also Jointed with the previous one, and it is usually the longest of all the antennular segments. All the other segments are not jointed with each other. The third segment usually only carries one seta anteriorly and one posteriorly. The fourth, fifth, and seventh segments carry a maximum of four setae each: two anterior and two posterior setae. Anterior setae are usually very long, longer than the posterior ones. Reduction in the number of setae is common, and this occurs on the posterior side rather than the anterior side. Reductions are especially common among the subterranean animals. Posterior setae also tend to transform into more claw-like structures. The sixth segment may have two anterior and two posterior setae, and, in addition, one small seta which is situated on the antero-dorsal side of the segment, called the alpha seta. This seta is often missing. With the exception of the alpha seta and the two posterior setae on the first antennular segment,

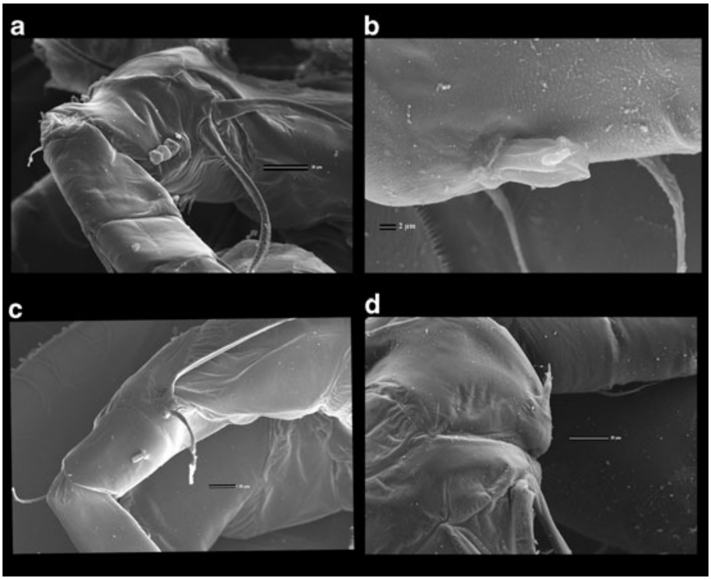

Fig. 16 SEM of Rome's organ on A1: (a) *Sarscypridopsis ochracea* (Sars 1924); (b) *Psychrodromus olivaceus* (Brady and Norman 1889): (c) *Candonocypris sp.*; (d) *Diacypris whitei* (Herbst 1958).

all the other setae on the antennula are situated on the ventral side of the appendage. The terminal segment carries a total of four setae as well, and the most posterior is always the shortest one. The most anterior seta is always transformed into aesthetasc “ya.” The length of setae varies among the species, while the number is quite often used as a generic character. The segments also may fuse with each other, most usually from the third toward the seventh, but there can also be fusions between the first and the second segment. In the case of a segment’s reduction by fusion, the setae are often still present on the fusion line. Setae on the antennula are used for locomotion, and are often feathered. The length ratio of the segments is a useful taxonomic feature.

2.3.2 Superfamily Cytheroidea

Here the antennula is much more stout and has shorter setae (Fig. 17a–d). There is no evidence of the fusion on the first segment, which is usually very long and it never carries any seta. The first segment is jointed with the following one, which can carry up to three setae, but in freshwater lineages there is most usually one posterior seta, situated medially on the dorsal side, or quite distally, on the border between this and the following segments (Fig. 17e). In contrast to Cypridoidea, this segment is elongated in Cytheroidea. It is really rare that the antennula in the superfamily Cytheroidea has seven segments, especially among the freshwater groups. There is usually a fusion between non-jointed segments and there is a maximum of six, but more often five segments altogether. Nevertheless, the setae are still present on the point of the segment fusions. The third segment is also jointed with the second one, while all the other segments are not. The third segment carries only one anterior seta. The two following segments are most often fused and they carry one or two setae antero-medially and one seta postero-medially. Distally there are also three setae anteriorly and one seta posteriorly. The terminal segment has two setae which are free, and two which are fused together proximally. The length of this fusion is an important taxonomic feature at the subfamily and tribal levels. One of the fused setae is normally developed, while the other is transformed into a chemical receptor, or aesthetasc. All setae on the antennula in this ostracod group are relatively short and often transformed into strong claws (Fig. 17f).

2.3.3 Superfamily Darwinuloidea

There is only a joint between the first and second segment, and there is a maximum of six segments altogether (Fig. 18). All of the segments are robust. The first one may carry one or two setae antero-medially. The second segment carries up to three setae postero-distally, which sometimes exit from a protrusion. The second segment has only one seta anteriorly. The third and fourth segments have one posterior and one anterior seta each. The penultimate segment has two anterior and two posterior setae, while the last segment has two setae and an aesthetasc. In some species, there is one

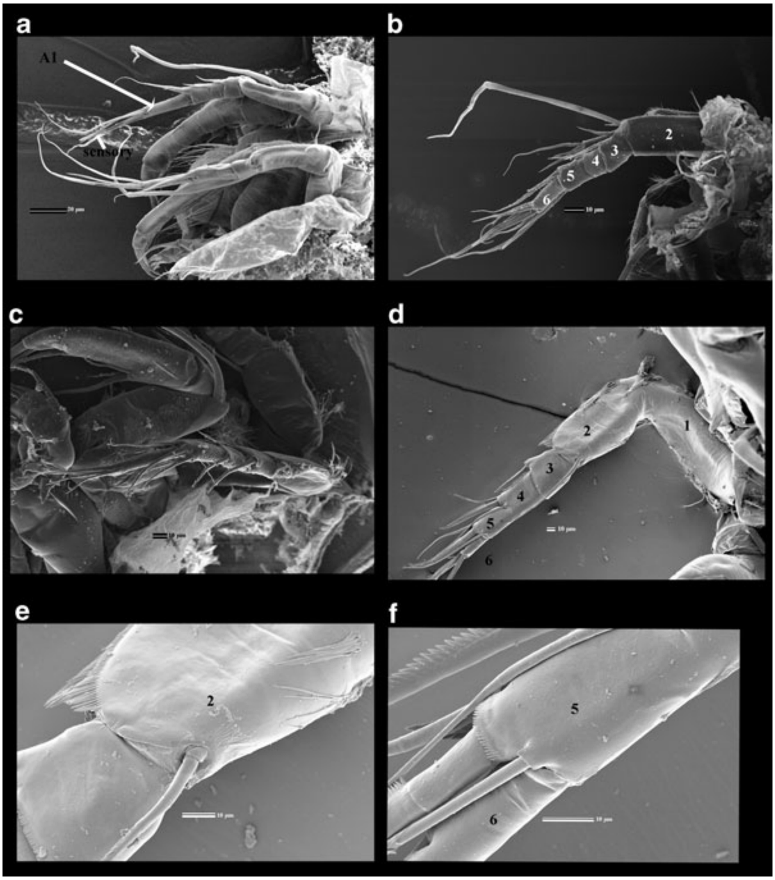

Fig. 17 SEM: (**a**, **b**) *Gomphodella quasihirsuta* Karanovic 2009; (**c**) *Paralimnocythere karamani* (Petkovski 1960a); (**e**, **f**) *Limnocythere dorsosicula* De Deckker 1982c: (**a**) position of the A1 and A2; (b, d), A1, (c, e, f), A1, details

small seta (called alpha seta) anteriorly on the fourth and fifth segments. These two setae, as well as the group of posterior setae on the second segment, are situated dorsally on the appendage, while other setae are situated ventrally. There is often reduction in the posterior and sometimes anterior setae, but never in the number of segments. Setae on the antennula are usually stiff and a couple of them transformed into claws.

2.4 Antenna

The antenna, or A2, is the second appendage originating behind the antennula (Fig. 19a, b). It has locomotory and sensory functions. Unlike the antennula, the antenna is a clearly biramous appendage in all ostracods. Nevertheless, the exopod

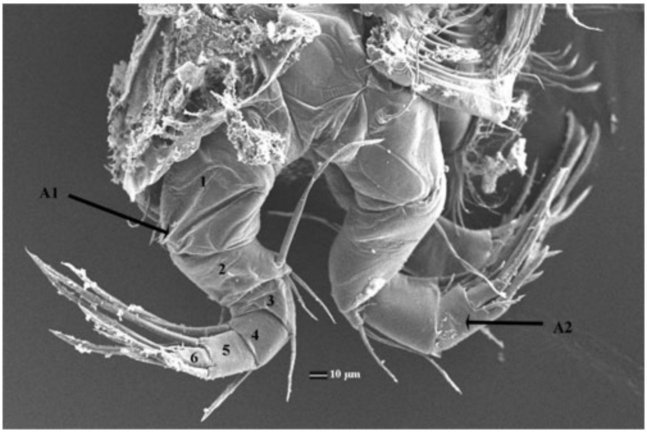

Fig. 18 SEM: *Darwinula stevensoni* (Brady and Robertson 1870): position of the A1 and A2

is much reduced in all representatives of Podocopida, while in Platycopina the exopod is almost as developed as the endopod. In Myodocopa the exopod is much larger than the endopod. It has numerous segments and long swimming setae, while the endopod is reduced to two- or three-segmented ramus with short and often transformed setae. In some myodocopid and podocopid lineages, this ramus is also sexually dimorphic. The antenna offers many taxonomically important characters and its study is essential for a proper identification on the species level.

2.4.1 Superfamily Cypridoidea

The first protopodal segment has three setae: one more proximal, situated on the external side, and two more distal setae, situated postero-laterally. The second segment on the antenna (this one is usually called the first segment in many publications) has one seta situated on the inner side of the segment. Attached to this segment is an exopod (Fig. 19c) which consists of a small plate and up to three setae: the most anterior one is the longest, followed by two considerably shorter setae. The number and length of these setae can vary in the subfamily Candoninae, especially in subterranean species, and there are cases with all three setae being short or even only two setae present. The first endopodal segment carries postero-medially an aesthetasc “Y” (Fig. 20) which can be of variable length and it is much longer in the subterranean animals than in those living in surface waters. Distally on the first endopodal segment there may be a group of up to six setae, called swimming setae. They are situated on the inner side of the appendage, and the most anterior one is always much shorter than the rest of the setae. The length of the swimming setae varies from being very long and by far exceeding the tips of the distal claws, to being very short and barely visible. If these setae are long they are usually feathered.

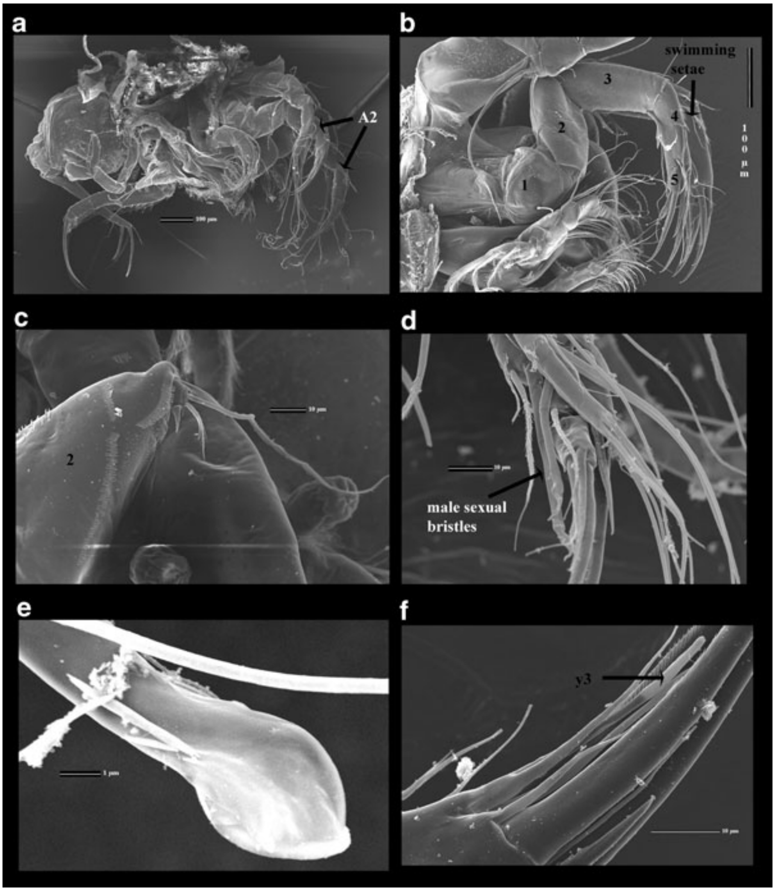

Fig. 19 SEM: (**a**) *Heterocypris reptans* (Kaufmann 1900a); (**b**) *Psychrodromus olivaceus* (Brady and Norman 1889); (**c**) *Candonopsis kingsleii* (Brady and Robertson 1869); (**d**, **e**) *Trapezicandona sp.*; (**f**) *Herpetocypris brevicaudata* Kaufmann 1900b: (**a**) view of the soft body, (**b**) A2, (**c**) exopod on the A2; (**d**) ♂ sexual bristles on the A2; (**e**) detail of the ♂ sexual bristle on the A2; (**f**) terminal segment on the A2 and "y3" aesthetasc

In some lineages of the family Cyprididae, these setae are absent, but this is really a rare case, while in the subfamily Candoninae none of the species has these setae present. The length of the swimming setae is an important taxonomical feature, and their number is a good indicator of the instar stage during the development. The first endopodal segment also carries one or two setae postero-distally, one of which is most often considerably longer than the other. The second endopodal segment in females has up to two setae situated antero-medially on the external side and up to four setae postero-medially on the inner side of the segment, called "t"-setae. Distally, on the external side this segment carries up to three setae, called "z"-setae, and up to three claws, "G1" and "G3" situated on the inner side of the

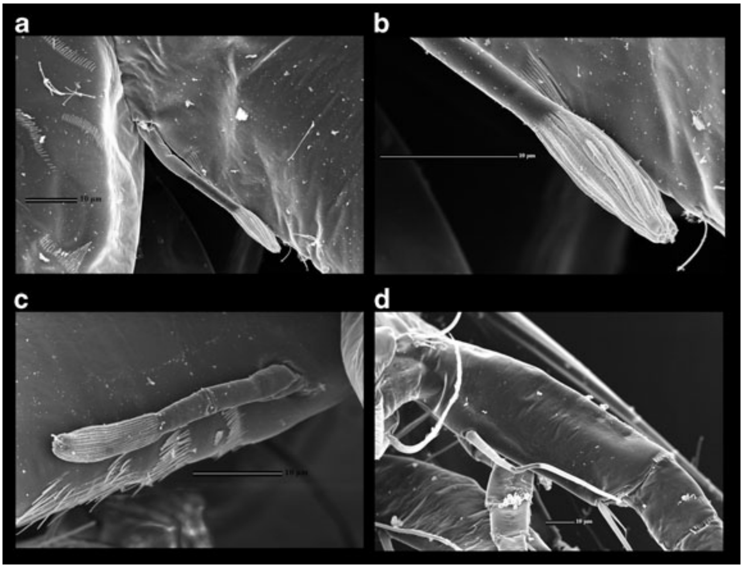

Fig. 20 SEM: (**a**, **b**) *Potamocypris fulva* (Brady 1868); (**c**) *Sarscypridopsis ochracea* (Sars 1924); (**d**) *Trapezicandona sp*.: aesthetasc "Y" on the first endopodal segment of the A2

appendage, and G2 situated laterally (Fig. 21). The first "z"-seta, "z1" may be a little bit more strongly developed than the other two. The length and number of the postero-medial setae and of the "t" setae can vary and it may be a useful taxonomic character. In males of the family Candonidae, the second endopodal segment is subdivided and two of the "t"-setae, namely "t2" and "t3," can be transformed into the male sexual bristles (Fig. 19d, e). The posterior setae on the same segment in males are often more strongly developed than the anterior ones, and sometimes even claw-like. In males of most Cypridoidea, one or two of the "z"-setae can be transformed into long claws, while claws "G2" and "G3," long in females, are reduced in males (Fig. 21a). The level of transformation in males, as well as the length of all the "z" setae and claws on the penultimate segment, in both males and females, is a very important taxonomic feature. The second endopodal segment also carries two sensory setae situated posteriorly, one medially on the segment, and the other distally. The last segment on the antenna is very short and it has two claws and three additional setae. The claw situated on the inner side of the segment is called "GM" and it is long in females, and the one situated on the exterior side is short and is called "Gm." In males, the claw on the inner side is short and the one on the exterior side is long. One of the accompanying setae on the terminal segment is a sensory seta, "y3" (Fig. 19f), which can be very long in subterranean species. The claws are usually heavily serrated and this can also be a sexually dimorphic feature. The length ratio between the segments on the antenna is a useful taxonomic feature as well. The entire appendage is often covered with fine short pseudochaetae.

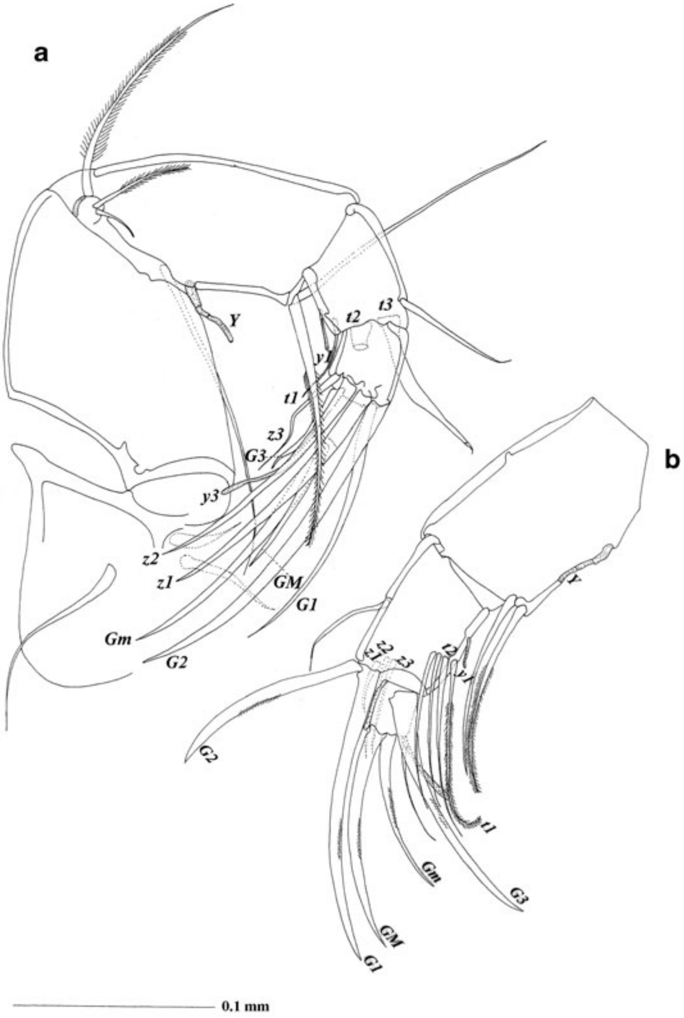

Fig. 21 Line drawings of the A2: (**a**) *Candona piercei* Turner 1895; (**b**) *Candona sigmoides*, Sharpe 1897: (**a**, ♂); (**b**, ♀)

2.4.2 Superfamily Cytheroidea

In this lineage the exopod forms a long spinneret seta (Fig. 22a), consisting of up to three segments. The protopod does not carry any setae. The endopod is three segmented and the first segment carries only one seta postero-distally. The following segment has up to two setae antero-medially and up to three setae postero-medially, one of which is an aesthetasc. The second endopodal segment has one or two setae postero-distally. These setae are usually more strongly developed. The terminal segment is very short and it carries two or three claws, and this segment

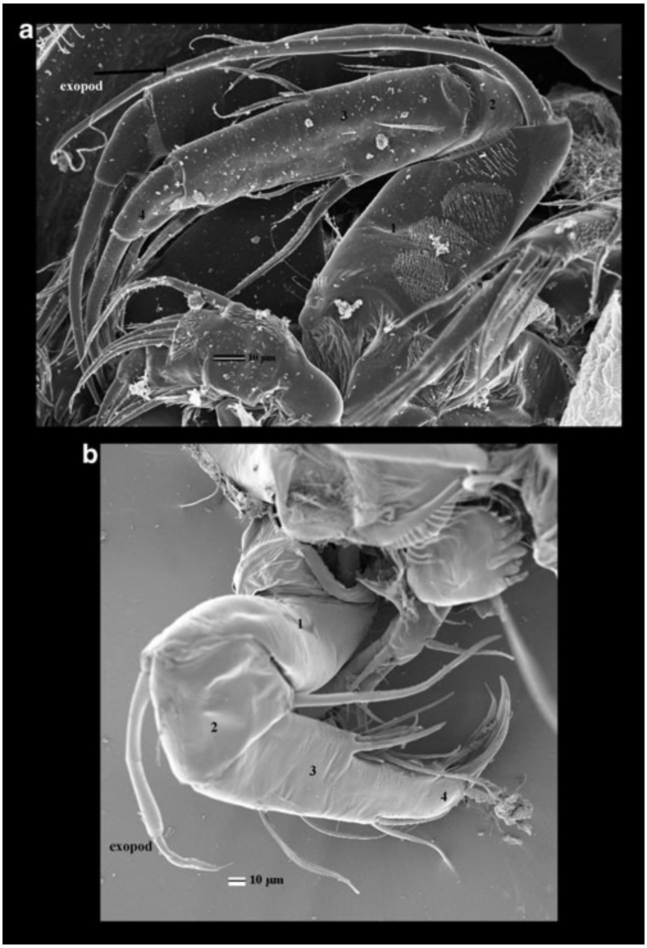

Fig. 22 SEM: (**a**) *Paralimnocythere karamani* (Petkovski 1960a); (**b**) *Limnocythere dorsosicula* De Deckker 1982c: A2

may be sexually dimorphic. The number of claws is an important taxonomic feature on the family level. The second antenna is also often covered with fine pseudochaetae, and the length ratio of the segments is an important taxonomic character. There are no swimming setae.

2.4.3 Superfamily Darwinuloidea

The antenna in darwinulids is much more similar to the one in Cypridoidea than to the one in Cytheroidea (Figs. 18 and 23). The first segment may carry up to two setae posteriorly: one (more proximal) situated on the exterior side of the appendage, and the other (more distal) on the interior side. On the anterior side of this segment, almost medially, there may be a hook-like structure. The second protopodal segment has one seta, situated medio-distally on the interior side of the segment, and a group of sensory setae situated close to this seta. The exopod in darwinulids also consists of a plate (but longer than in Cypridoidea) and a maximum of three setae (Fig. 23a, c), one of which is small and the other two subequally long. The length and number of these setae are important taxonomical features. The first endopodal segment has one or two setae postero-distally. There are no swimming setae in darwinulids. The second endopodal segment lacks the postero-medial setae, but does have the antero-medial, or “t”-setae. There is only one “z”-seta present distally on the segment, while all three claws “G1,” “G2,” and “G3” are usually well developed. The second endopodal segment also has two aesthetascs (“y1” and “y2”). The last segment has two claws, “GM” (the long one) and Gm

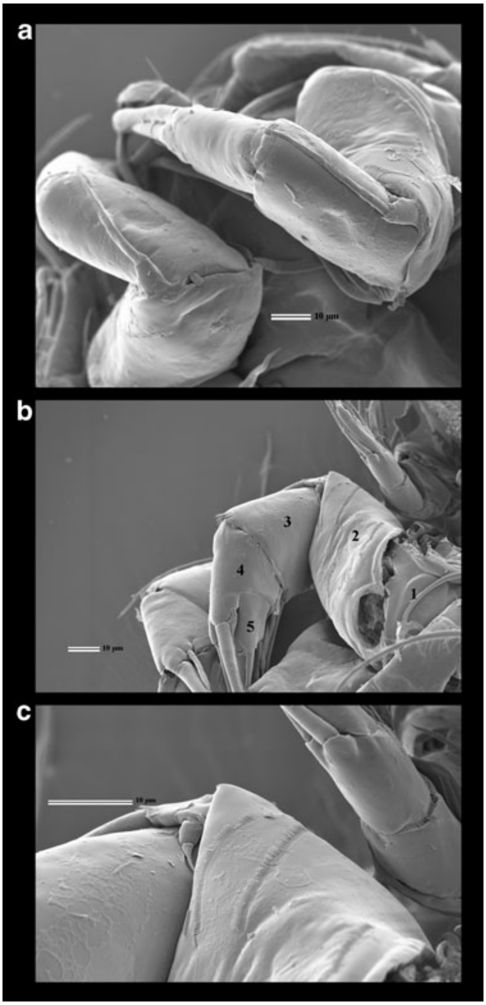

Fig. 23 SEM: *Penthesilenula brasiliensis* (Pinto and Kotzian 1961): (**a**) A2, dorsal view; (**b**) A2 lateral view; (**c**) exopod on the A2

(the short one) and the aesthetasc “y3.” The male antennae have six segments compared with five in the female and a series of putative chemical receptors originating at the extra segment boundary. In males, there are four “t” setae. Seta “t1” is transformed to a flattened disc-shaped projection. Setae “t2” and “t3” are short and broad; seta “t4” is thin. The claw “G3” is also much shorter than in females and transformed into a broad structure.

2.5 Mandibula

Mandibula, or Md, is the third head appendage used mainly for feeding (Fig. 24). In some myodocopid lineages (order Myodocopida), this appendage actually resembles a lot the podocopid antenna, while in others (order Halocyprida) it is very similar to the actual mandibula of the podocopid lineages.

2.5.1 Superfamily Cypridoidea

The appendage consists of three clear parts (Fig. 24d): coxa, branchial or vibratory plate, and the palp. The coxa is a robust part, distally equipped with strong teeth, forming a masticatory process (Fig. 24c), which is used for processing food. These strong teeth accompanied by setae. Slightly more proximally from the largest tooth, there is a single, short, and strong seta, which is also densely covered with small setules. The first segment of the palp is actually the basis of the appendage and it carries a branchial or vibratory plate (Fig. 24a, b, e). The vibratory plate represents an exopod and it is used for circulation of the fluids in the domiciliar space. There are usually around seven long pappose setae (also called rays), and only in some subterranean lineages there is a strong reduction, in which case there are only one or two setae at the most. The first segment of the palp carries posteriorly a group of four setae: two “S” setae, one short “alpha” seta, and one unnamed seta. In the family Cyprididae, one of the “S” setae is particularly long and usually bent. Both “S” setae carry a row of long setules along the inner margin. The length of the “alpha” seta may be an important taxonomic feature. The first endopodal segment, or the second segment on the palp, has a maximum of three setae anteriorly. Posteriorly on the segment there is a group of up to seven setae distally, of which the shortest one is usually plumed and is called the “beta” seta. One seta originates more medio-distally on the segment and is clearly separated from the group of three to five setae. The appearance of the “beta” seta and the number of setae in the group is an important taxonomic feature. Most of the setae are heavily pappose. The third segment on the palp has a maximum of four setae antero-distally, situated more on the exterior side of the segment. On the interior side of the segment, along the distal margin there is a row of up to four setae, the most anterior one is called the “gamma” seta; its morphology (length and presence/absence of the small setae)

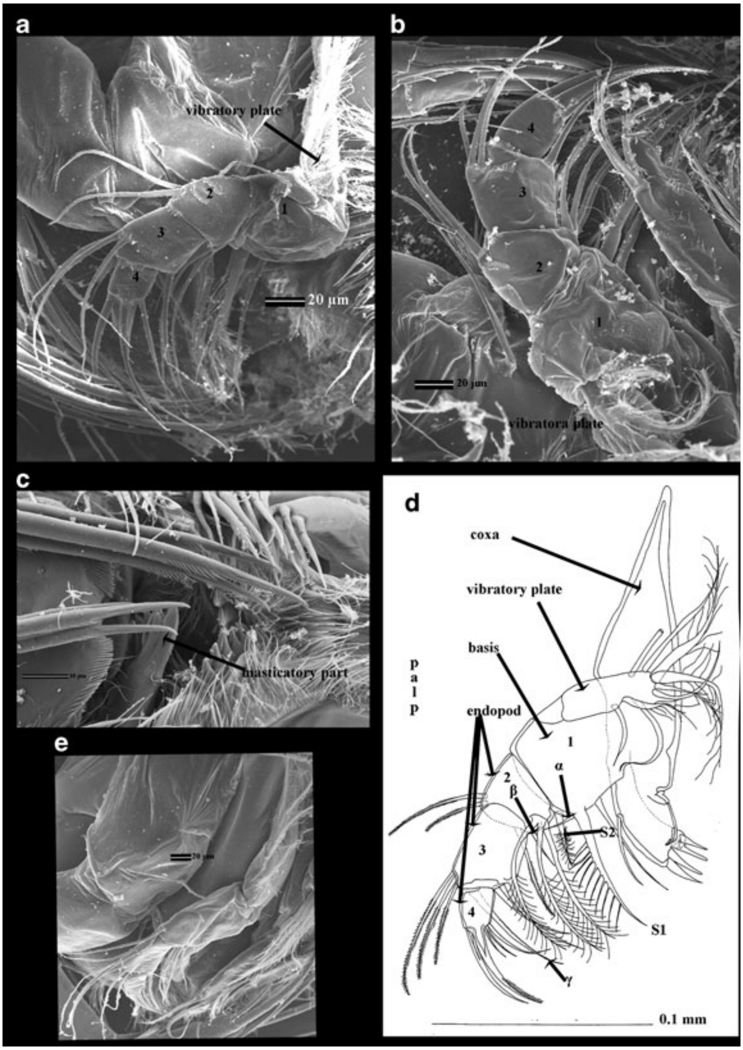

Fig. 24 (**a**, **b**, **c**, **e**) SEM; (**d**) Line drawing: (**a**) *Candona neglecta* Sars 1887; (**b**) *Candona lindneri* Petkovski 1969b; (**c**, **e**) *Psychrodromus olivaceus* (Brady and Norman 1889); (**d**) *Typhlocypris parvula* (Sars 1926): (**a**, **b**, **d**, **e**) Md; (**c**) detail of the Md from the ventral side of the body

being an important taxonomic character. On the most posterior end, there is additionally one long and one very short seta. The most distal segment of the palp has a central claw which can have a broad (like in some Candoninae lineages), or a narrow basis. This claw is accompanied on both sides with up to four setae, sometimes two of them being transformed into claws as well. The length ratio of the segments on the palp is an important taxonomic feature, especially the length of the terminal segment.

2.5.2 Superfamily Cytheroidea

In this superfamily the mandibula is similar to Cypridoidea (Fig. 25b). However, there are some clear differences. The division between the segments of the palp is often not clear, and also re are only two setae on the first segment posteriorly, and they setae are never as pappose as long as in Cypridoidea. The anterior side of the second segment also carries only one or two setae, and the group of setae posteriorly on the same segment is not as clear. There is no clear homology between the setae; therefore, "alpha," "beta," and "gamma" setae are not recognizable. The terminal segment carries only two or three claws and is never long. Some of the setae on the posterior side of the palp may be transformed and this can be an important taxonomic feature. The number of setae on the exopod varies and it can be reduced to only one seta in some lineages.

2.5.3 Superfamily Darwinuloidea

In this superfamily the coxa is very short and stout (Fig. 25a). The vibratory plate (exopod) has very short filaments. The palp is only three-segmented, of which the first segment belongs to the protopod and only two remaining ones to

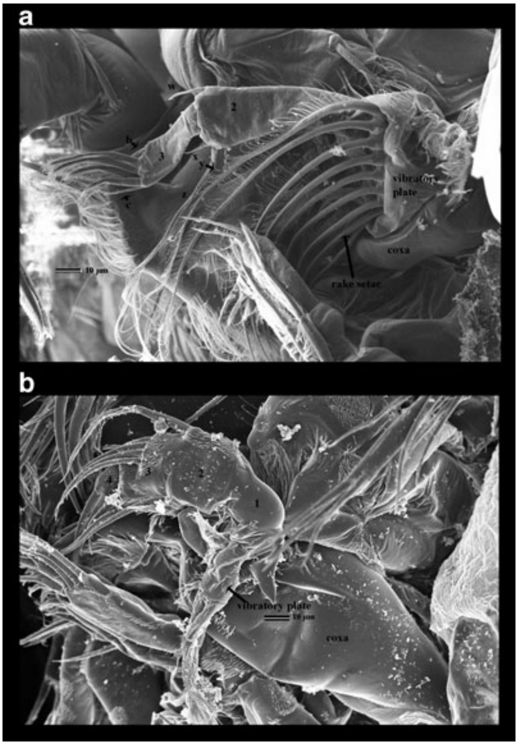

Fig. 25 SEM: (**a**) *Darwinula stevensoni* (Brady and Robertson 1870); (**b**) *Paralimnocythere karamani* (Petkovski 1960a): Md

the endopod. On the posterior side of the first segment of the palp, there is a group of setae, aligned in a row, and called rake setae. The number of these setae is indicative for the larval stage, as it increases during ontogeny after every molt; only the adults have all eight setae present. Besides the rake setae there are two additional setae on the posterior side of the first segment. The second segment of the palp may have up to two setae antero-distally (named setae “y” and “z”), one seta medially (seta “x”) and one postero-distally (seta “w”). The terminal segment is very characteristically curved and it has up to seven setae: the more posterior one is called “b” seta, and the most anterior one “c” seta. The length and number of setae on the palp are important taxonomical features.

2.6 Maxillula

Maxillula, first maxilla or Mxl, is the fourth appendage on the body (Fig. 26). Its function is almost completely in respiration and feeding. It has a relatively large vibratory plate (or branchial plate) with numerous heavily feathered setae (also known as rays), enabling the transport of fluids through the domicilar space inside the carapace. The branchial plate is missing in all Myodocopa. While in some podocopid lineages, branchial plates are also present on some post-maxillular appendages the one on the maxillula is always the largest (Smith et al. 2005). Most of the setae on the branchial plate are orientated posteriorly, with an exception of the group of clearly separated setae which are situated distally on the plate and which are orientated anteriorly; the latter setae are called “reflexed setae” and are an important taxonomic character at higher taxonomic levels. Besides the branchial plate, there are three endites and an endopod, which is usually two-segmented. The three endites and the endopod terminate in claws which have a feeding role. The branchial plate is thought to be an exopod (Horne 2005).

2.6.1 Superfamily Cypridoidea

In this superfamily, the number of rays on the branchial plate is between 20 and 30, with two to six being reflexed setae (Fig. 26a). The endopod is always two segmented (Fig. 26b). The first segment carries most of the setae antero-distally, with one seta situated more medially than the others. This seta is sometimes missing. There is a maximum of eight setae altogether on this segment and they are usually pappose. The second segment varies in shape and this is an important taxonomic feature at the genus level in the families Cyprididae and Candonidae. It can be elongated, rectangular, or spatula-like. Distally this segment carries also a different number of claws and setae, but most usually there are up to three claws and three setae. The number of claws/setae is often reduced in subterranean representatives. Of the three endites the most anterior one carries the strongest claws and there can be two to six such strong claws, accompanied with some

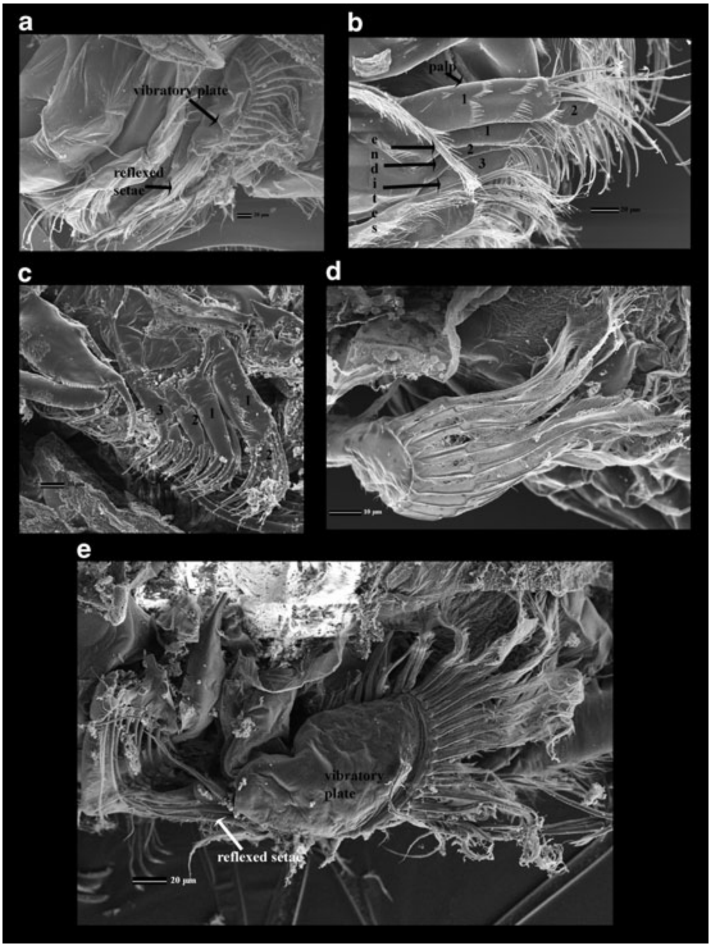

Fig. 26 SEM: (**a**, **b**) *Psychrodromus olivaceus* (Brady and Norman 1889); (**c**) *Paralimnocythere karamani* (Petkovski 1960a); (**d**) *Gomphodella quasihirsuta* Karanovic, 2009; (e) *Darwinula stevensoni* (Brady and Robertson 1870): (**a**, **d**, **e**) Mxl, showing the vibratory plate; (**b, c**) Mxl palp and endites

setae. The claws can also be feathered or serrated or smooth, and this may be a useful taxonomic feature on the species level. The other two endites carry up to eight claws, which are less developed than the ones on the first endite.

2.6.2 Superfamily Cytheroidea

In this superfamily the branchial plates are usually much smaller and there are less than 20 rays on the plate (Fig. 26d), one or two being reflexed setae. The palp can be one- or two-segmented (Fig. 26c). The three endites carry five or fewer weak claws, and there are no such well-developed claws as in Cypridoidea.

2.6.3 Superfamily Darwinuloidea

Darwinulidae often have more than 30 rays on the branchial plate, four being reflexed setae (Fig. 26e). The palp is two-segmented with five to six setae on the first segment, and two claws and two to three setae on the second segment. On the first two endites there are two or three strong claws and up to six setae. The last endite carries usually only setae, or weakly developed claws.

2.7 First Thoracopod/The Fifth Limb

This appendage has the greatest number of different names: fifth limb, first thoracopod, second maxilla, or maxilliped, and abbreviations used are T1 or L5. There are two opinions regarding whether this limb belongs to the head region or to the thoracic one. Cohen and Morin (1997) consider fourth and fifth limbs as head limbs, because in Ostracoda the maxillary excretory gland, if present, is always associated with the fifth limb. Thus, the fourth limb is termed the first maxilla and the fifth limb the second maxilla. This is certainly true for the subclass Myodocopa, but doubtful in Podocopa lineages. Smith and Martens (2000) provide several arguments for this: the fifth limb is not attached to the ventral head plate ("sternum") in Sigilliocopina, Bairdiocopina, and Cytherocopina; in many podocopids (Bairdiocopina and Cytherocopina and some Cypridocopina, like *Macrocypris),* the fifth to seventh limbs are clearly homologous walking legs with homologous segments and chaetotaxy (Meisch 1996); and during the larval development of Cypridocopina, the fifth limb changes from a walking leg in the A-4 instar to feeding appendages in the A-3 instar. However, even among Myodocopa, the appearance of the fifth limb is not the same: in Myodocopida there is a large branchial plate, three endites, and multisegmented exopod, while in Halocyprida this leg is biramous with coxa and basis, and both exopod and endopod, the second one being multisegmented. There is also a small branchial plate. Branchial plate on the fifth limb is present in some Podocopa lineages, but, again, Horne (2005) considers these to be exopods, while in Myodocopa they are epipods. In Podocopa, this leg is being used for walking and feeding and even plays a role in copulation behavior in males.

2.7.1 Superfamily Cypridoidea

In this superfamily the fifth limb is sexually dimorphic. In females, it consists of a protopod, endopod, and a small exopod (Figs. 27a, b and 28b). The exopod is a branchial plate with a maximum of six, usually strongly pappose rays. The number of rays is often reduced, and may represent an important taxonomic feature. However, because this part easily falls off during the dissection, loses some rays, or becomes folded, the number of rays is often difficult to interpret, and should be taken with caution. The endopod consists of a single segment in Notodromadidae, Cyprididae, and Candonidae, while it is two- or three-segmented in Ilyocyprididae. The protopod bears proximally two setae, called "a" and "a'" setae, and often one of them is missing. There are three more setae, situated more distally, "b," "c," and "d" setae, the presence of which is an important taxonomic feature in the family Cyprididae. The protopod terminates anteriorly with numerous pappose setae, arranged more or less in a row, representing the endites. In the males the endopod (or "palp") is transformed into a clasping organ (Figs. 27c and 28a), while in the females it is a simple elongated segment (sometimes two- or three-segmented) terminating with a couple of setae. Males use the palp for grabbing and handling the female during the copulation. In males it can be one- or two-segmented. It consists of one segment in Candoninae. The proximal part is called the body, and the distal, often curved and elongated, part is

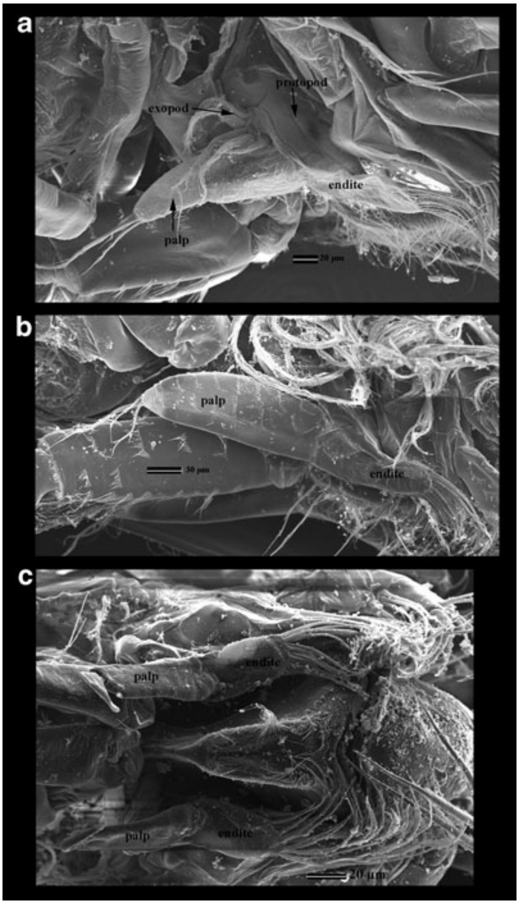

Fig. 27 SEM: (**a**) *Heterocypris reptans* (Kaufmann 1900a, b, c); (**b**) *Candona lindneri* Petkovski 1969b; (**c**) *Plesiocypridopsis newtoni* Brady and Robertson 1870: (**a**, **b**) L5, ♀; (**c**) L5, ♂, showing the position of the prehensile palps

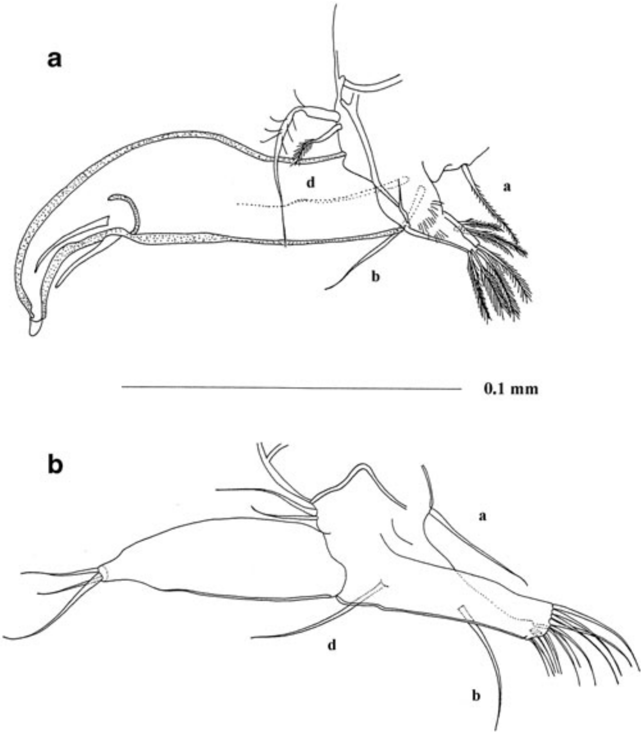

Fig. 28 Line drawings; (**a**) *Candona crogmaniana* Turner 1894; (**b**) *Typhlocypris fluviatilis* (Hoff 1942): (**a**) L5, ♂; (**b**) L5, ♀

called the finger. There are two additional structures on the point where the body and finger join, and they can be quite elaborately developed, or very thin, and often one is missing. The tip of the finger also has an additional structure, very similar to the one between the body and finger. The palps are often asymmetrical, and their appearance is a very important taxonomic character on the species level.

2.7.2 Superfamily Cytheroidea

The fifth limb in this group is a walking leg, not much different from the more posterior legs (Figs. 29a and 31a). It is, however, the smallest of all three pairs of the thoracopods and easily recognizable by the presence of two, instead of one apical seta anteriorly. On the anterior side of the protopod there are two more setae, both attached proximally. Posteriorly, there may also be one seta, attached medially or more distally, and it is often pappose. This seta is often interpreted as an exopod. The endopod is three-segmented, each segment carrying one seta anteriorly, and the apical segment terminates in a claw. In some families, this appendage may be sexually dimorphic.

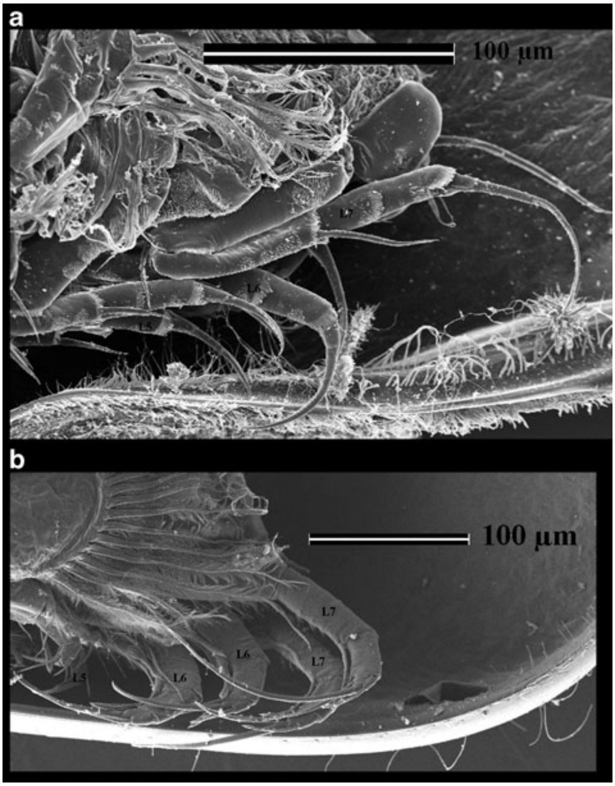

Fig. 29 SEM: (**a**) *Paralimnocythere karamani* (Petkovski 1960a); (**b**) *Darwinula stevensoni* (Brady and Robertson 1870): posterior end of the body, showing thoracopods

2.7.3 Superfamily Darwinuloidea

In this lineage, the fifth limb is sexually dimorphic as in Cypridoidea. In both males and females there is a protopod and a small branchial plate attached to it. The protopod terminates with endites, similar to Cypridoidea. The endopod is a walking leg in females, consisting of three segments and terminating with a claw (Figs. 29b and 31d, e). In males, the endopod is a clasping organ, similar to that in Cypridoidea.

2.8 Second Thoracopod/The Sixth Limb

This appendage is a walking leg in all representatives of the order Podocopida, with the branchial plate, if present, reduced to only one seta. In Platycopida males have the endopod transformed into a clasping organ, and there is a branchial plate with five to seven rays. In females belonging to this lineage there is only the branchial plate present, all other parts being completely reduced. Cladocopina lack the second thoracopod, while this appendage is a walking leg with a three-segmented endopod, and a branchial plate in Halocypridina. In all other Myodocopa the sixth appendage has a large branchial plate, and four endites, and no walking-like structures are present.

2.8.1 Superfamily Cypridoidea

There are two incompletely separated basal segments, each bearing one seta antero-distally, "d1" and "d2." The second segment has a knee joint with the endopod. One or both setae are sometimes missing (Fig. 30a), which is an important character at the genus level, as well as is the length ratio between these two setae. The endopod is four- or three-segmented (Fig. 30a, b). The first segment is the longest and it carries one seta antero-distally, the "e"-seta. This segment is jointed with the following one. The following two segments are sometimes fused. There is usually one seta antero-distally on the second segment, the "f"-seta, and two setae on the fourth segment, the longer one called the "g"-seta. The terminal segment is short and it most usually carries one long claw and two setae, or very rarely two claws and one seta. The most anterior one is called "h1," the claw is "h2," and the most posterior one is "h3." The claw is often well serrated and heavily sclerified. Length ratios between the claw and the endopodal segments, as well as the length ratios between the segments, are important taxonomic features. The appendage is often covered with pseudochaetae, especially at the joints of segments or from where the setae originate.

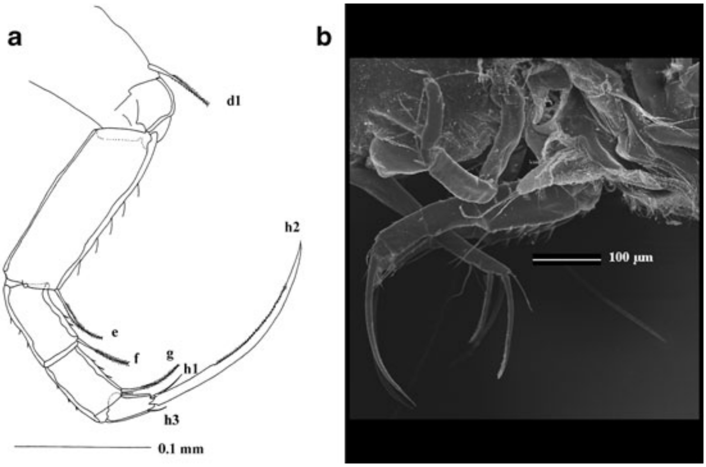

Fig. 30 (**a**) Line drawing; (**b**) SEM: (**a**) *Typhlocypris elliptica* (Furtos 1933); (**b**) *Heterocypris reptans* (Kaufmann 1900a, b): L6

2.8.2 Superfamily Cytheroidea

This appendage is very similar to the previous one in the same superfamily, with the exception that there is only one seta most distally on the protopod and that it is longer than the first thoracopod (Figs. 29a and 31b). The (knee) joint is present only between the protopodal and the first endopodal segment. The appendage is often covered with pseudochaetae, especially at the joints of segments or from where the setae originate.

2.8.3 Superfamily Darwinuloidea

In this lineage no branchial plate (like that on the first thoracopod) is present on the second thoracopod. There are three setae on the protopod anteriorly (two apically and one medially). The (knee) joint is present only between the protopodal and the first endopodal segment. The endopod is four-segmented and it has three distal setae on the first segment, one on the second, while the terminal segment is very similar to Cypridoidea (Figs. 29b and 31d, e).

2.9 Third Thoracopod/The Seventh Limb

This appendage is absent in the order Platycopida (Podocopa) and Cladocopina (Myodocopa). In all Podocopida, except for Cypridocopina, this is a walking appendage. In Cypridocopina this leg turns dorsally and often has a terminal pincer. It serves for cleaning the posterior domicilar space, and therefore is often referred as the “cleaning leg.” In Myodocopida (Myodocopa) the leg is multisegmented and worm-like, carrying few setae on some of the segments and terminating in a rather complex structure. In Halocypridina (Myodocopida) the leg is very small, consisting of a cylindrical ramus and two terminal setae.

2.9.1 Superfamily Cypridoidea

The basal segment has two setae anteriorly: “d1” and “d2,” and one posteriorly – “dp” (Fig. 32a, b). One or more of these setae are often missing, which is an important taxonomic character at the genus level. This segment is joint-connected with the endopodal segments. There are up to four endopodal segments, the first one also having a joint connection with the proceeding segment. The first endopodal segment carries one seta anteriorly – seta “e”; the following two segments are often fused and each carries one seta antero-distally: “f” and “g”. One of these three setae is often missing, which is an important taxonomic character at both generic and specific levels. The terminal segment may be normally developed, but nevertheless shorter than the preceding segments (Fig. 32d–f), or it can be almost fused with the

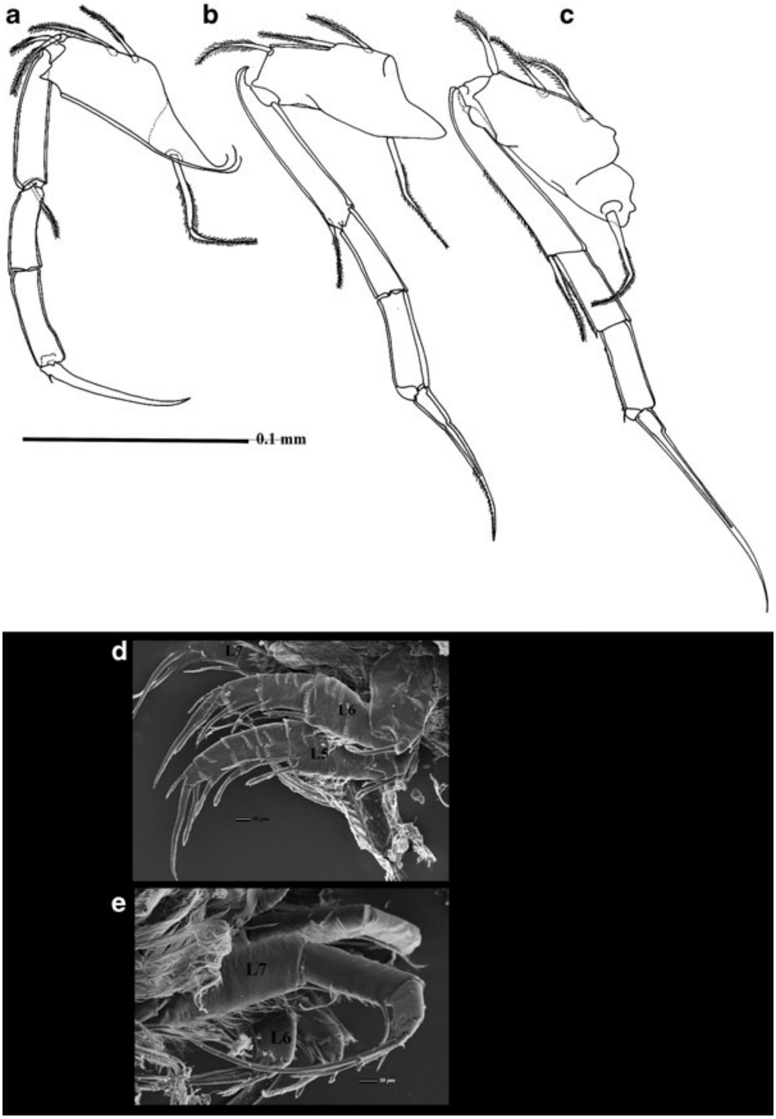

Fig. 31 (**a**–**c**), Line drawings; (**d**, **e**) SEM: (**c**) *Gomphodella quasihirsuta* Karanovic, 2009; (**d**) *Penthesilenula brasiliensis* (Pinto and Kotzian 1961); (**e**) *Darwinula stevensoni* (Brady and Robertson 1870): (a) fifth limb, (b) sixth limb; (c) seventh limb, (d,e) thoracopods.

previous segment in a structure called the "pincer" organ (Fig. 32c). On both normally developed and transformed segments, the three setae, "h1," "h2," and "h3", can be recognized. The length ratio between these setae is an important generic feature. The appendage is often covered with pseudochaetae, especially at the joints of segments or from where the setae originate.

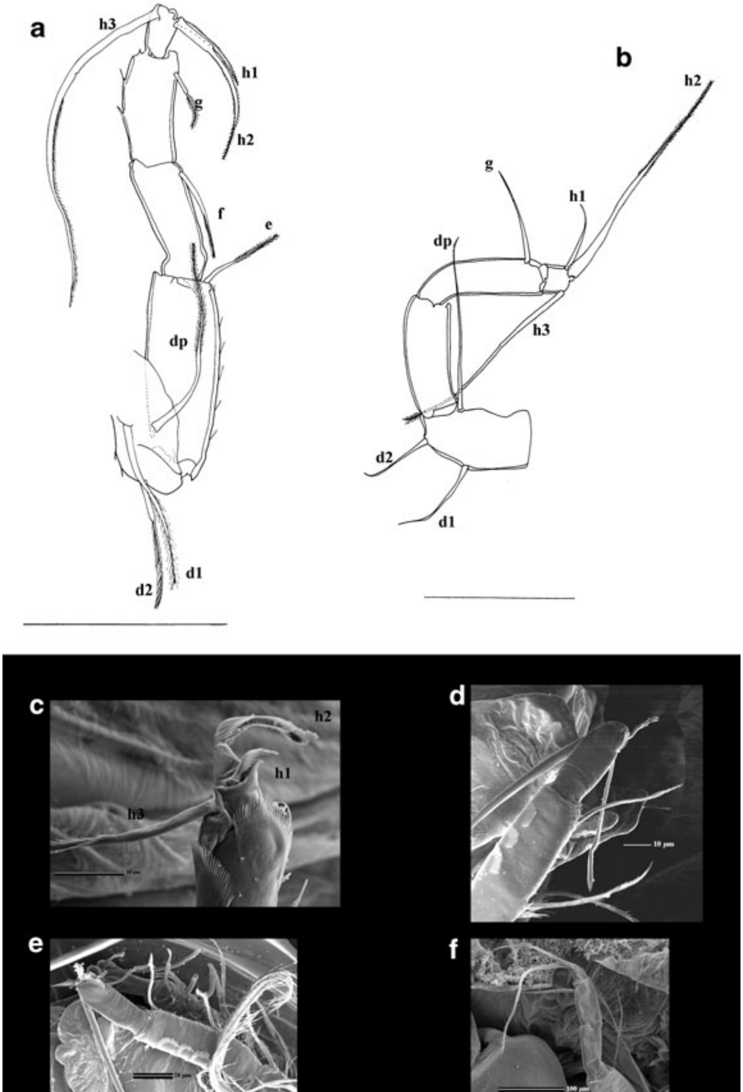

Fig. 32 (**a**, **b**) Line drawings; (**c**–**f**), SEM: (**a**) *Latinopsis patagonica* Karanovic and Datry 2009; (**b**) *Typhlocypris punctata* (Furtos 1933); (**c**) *Sarscypridopsis ochracea* (Sars 1924); (**d**, **e**) *Cyclocypris ovum* (Jurine 1820); (**f**) *Candona neglecta* Sars 1887: (**a**, **b**, **e**, **f**) L7; (**c**) pincer organ; (**d**) terminal segment of the L7

2.9.2 Superfamily Cytheroidea

In this superfamily, the seventh limb is a walking leg very similar to the sixth limb, terminating with a claw (Fig. 31c), or in some lineages the terminal segment may carry a long seta. This appendage may also be sexually dimorphic.

2.9.3 Superfamily Darwinuloidea

As in the previous superfamily, this leg is used for walking and it differs from the sixth limb only in number of setae on the protopod (two, instead of three), and the first endopodal segment (one, instead of three) (Figs. 29b and 31d, e).

2.10 Uropodal Ramus

The posterior end of the ostracod body is equipped with a pair of unarticulated appendages called uropodal rami, furca or caudal rami. Recently Meisch (2007) argued that ostracod uropodal processes are not analogous with the furca of other crustaceans as they do not originate from the telson. Instead, Meisch (2007) considers that the most posterior appendages are actually modified uropods, arising from the vibratory plates of the ancestral appendage. Their position in relation to the anal opening differs between ostracod subclasses: in Myodocopa they are positioned posterior to the anus, and in Podocopa anterior. In Myodocopa and Platycopida, these appendages look like strong plates with claw-like or seta-like appendages. Therefore, Meisch (2007) uses the term “uropodal plates/lamellae” for the most posterior appendages of these two lineages. In Podocopida, the most posterior body appendages are transformed into two elongated rami with a maximum of two/three distal claws and one to six setae. For this group, Meisch uses the term “uropodal rami,” which is accepted in this book. This appendage is used mostly for walking, but in Myodocopa and Platycopida also for feeding.

2.10.1 Superfamily Cypridoidea

In this superfamily, the uropodal rami consist of two rod-shaped structures (rami), each with two claws – one anterior and one posterior, and two setae – one anterior and one posterior (Fig. 33a). Often a number of reductions occur, and the morphology of the uropodal rami is a very important taxonomic feature on every taxonomic level in this superfamily (Fig. 33b). In some subfamilies, it is reduced to a short, whip-like ramus, or it may be completely missing. In the family Cyprididae there is often asymmetry of the two rami. Sexual dimorphism is very rare. The length ratios between the claws, between claws and rami, and between setae and claws are very important taxonomic characters. There is often a seta dorsal to the basis of the ramus, called caudal seta.

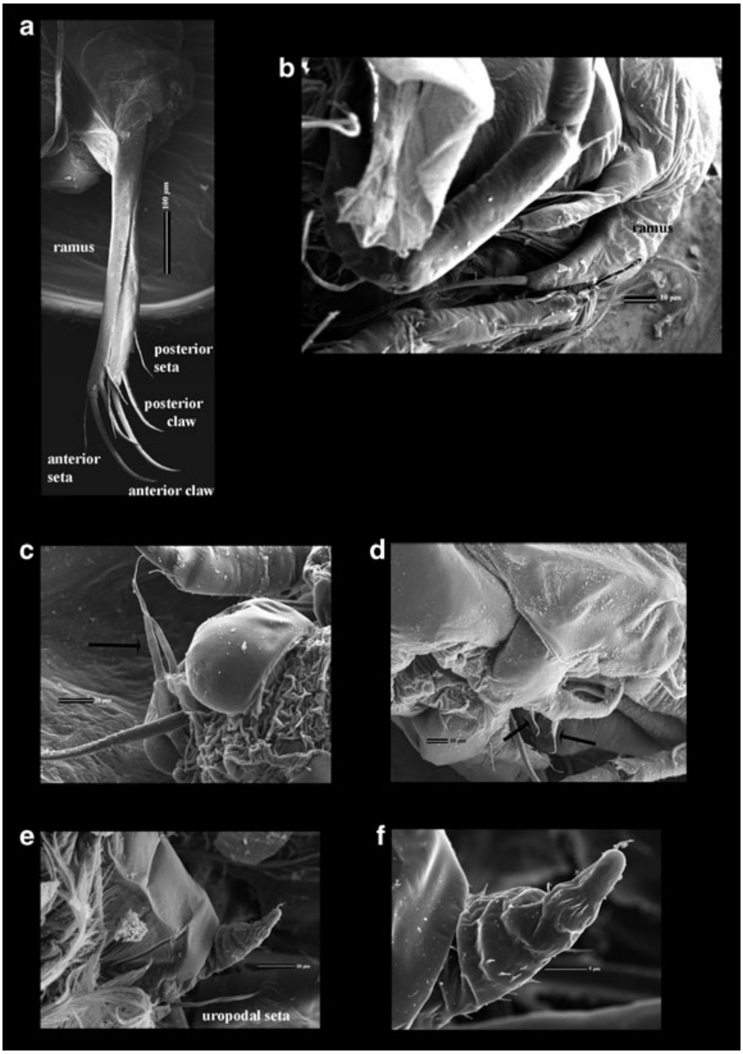

Fig. 33 SEM: (**a**) *Candonocypris sp.*; (**b**) *Sarscypridopsis ochracea* (Sars 1924); (**c**, **d**) *Paralimnocythere karamani* (Petkovski 1960a); (**e**, **f**) *Darwinula stevensoni* (Brady and Robertson 1870): (**a**–**c**) uropodal ramus; (**d**) uropodal ramus setae incorporated in hemipenis; (**e**, **f**) most posterior end of the body

2.10.2 Superfamily Cytheroidea

In this superfamily, the uropodal ramus is reduced to a short ramus and couple of setae (Fig. 33c). In males, the uropodal rami are incorporated in the hemipenis (Fig. 33d).

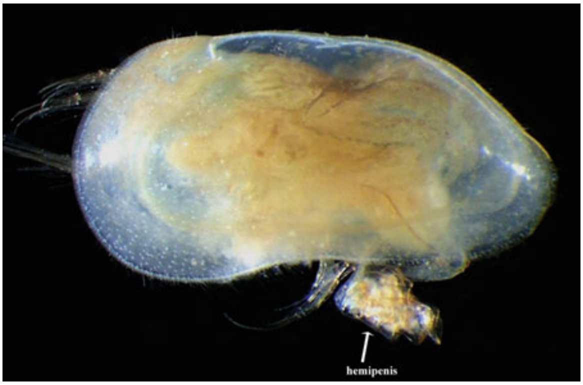

Fig. 34 Microscopic photograph: *Repandocypris austinensis* Halse and McRae 2004. Photo: S. Halse.

2.10.3 Superfamily Darwinuloidea

This appendage is also reduced to a short ramus with a distal seta, or only a seta (Fig. 33e), or completely missing in some females of Darwinuloidea. In a single male described so far, the uropodal ramus is not incorporated in the hemipenis and it is similar to the female, except being shorter. The body terminates with a so-called abdominal process (Fig. 33f).

2.11 Copulatory Appendages

In males the copulatory organ (Fig. 34) is called hemipenis and it is a paired appendage in all ostracod lineages except for Halocyprida. It is a very complex apparatus, especially in Podocopida, and it is believed to arise from several appendages fused together. The hemipenis is situated in front of the uropodal ramus and it sometimes constitutes more than a third of the ostracod body size. In Cypridocopina it is dorsally connected with the Zenker Organ (Fig. 35a). Although taxonomically very important, the structure of the hemipenis is the least understood of all the appendages, and it is still difficult to identify the homologous structures in different ostracod lineages. This may be because in different lineages the hemipenis may have arisen from a different number of body segments and therefore involved different appendages.

2.11.1 Superfamily Cypridoidea

In this superfamily one can recognize two distinct parts on the hemipenis: the chitinous “shell” called the peniferum and the internal parts (Fig. 35c, d). The chitinous shell has two or three lobes called: outer, middle, and inner lobe. The outer lobe is on

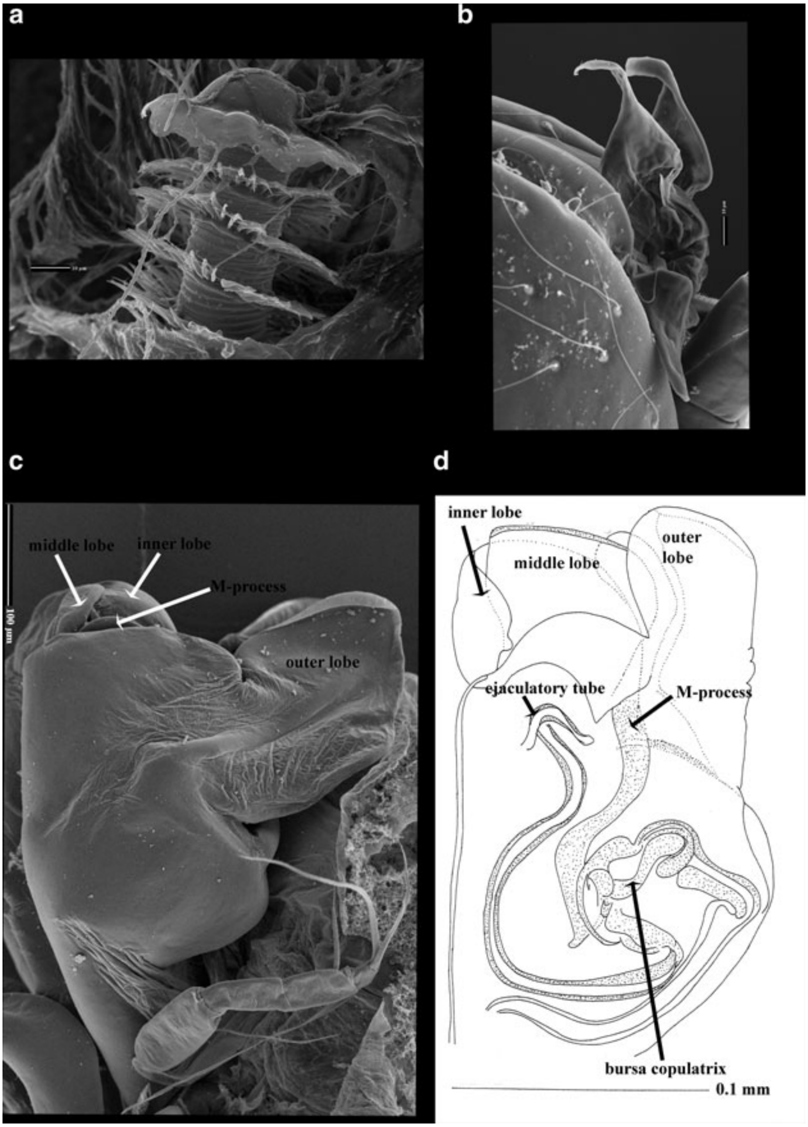

Fig. 35 (**a**–**c**) SEM; (**d**) Line drawing: (**a**, **b**) *Cypria karamani* Petkovski 1976; (**c**) *Candona neglecta* Sars 1887; (**d**) *Typhlocypris punctata* (Furtos 1933): (**a**) Zenker organ, top part; (**b**) hemipenis is erection; (**c**, **d**) hemipenis

the curved part of the hemipenis, while the inner lobe is on the more straight part of this organ. Of the internal structures the following parts can be recognized: spermiducts and the *bursa copulatrix*. Spermiducts are often coiled and making a complex labyrinth internally. Their walls are often well-chitinous as well. The spermiducts terminate distally with an ejaculatory tube. The *bursa copulatrix* is situated proximally and it is bowl-shaped. It often has a well-chitinous process, called the “M” process. Structures and shapes of both the peniferum and the internal parts are very important taxonomic features. Because the hemipenis changes shape drastically during the erection, the proper way to observe it is at rest.

2.11.2 Superfamily Cytheroidea

In Cytheroidea there is no Zenker organ and the sperm is pumped with the aid of a muscular hemipenis (Fig. 36). It is still difficult to homologize parts of the hemipenis between Cytheroidea and Cypridoidea, and different terminology is often used in the literature. Nevertheless, there is a peniferum which consists of distal and lateral lobes and there is a complex clasping organ (Fig. 36b), which is protruded during the copulation. This piece has an upper ramus, a lower ramus, as well as the

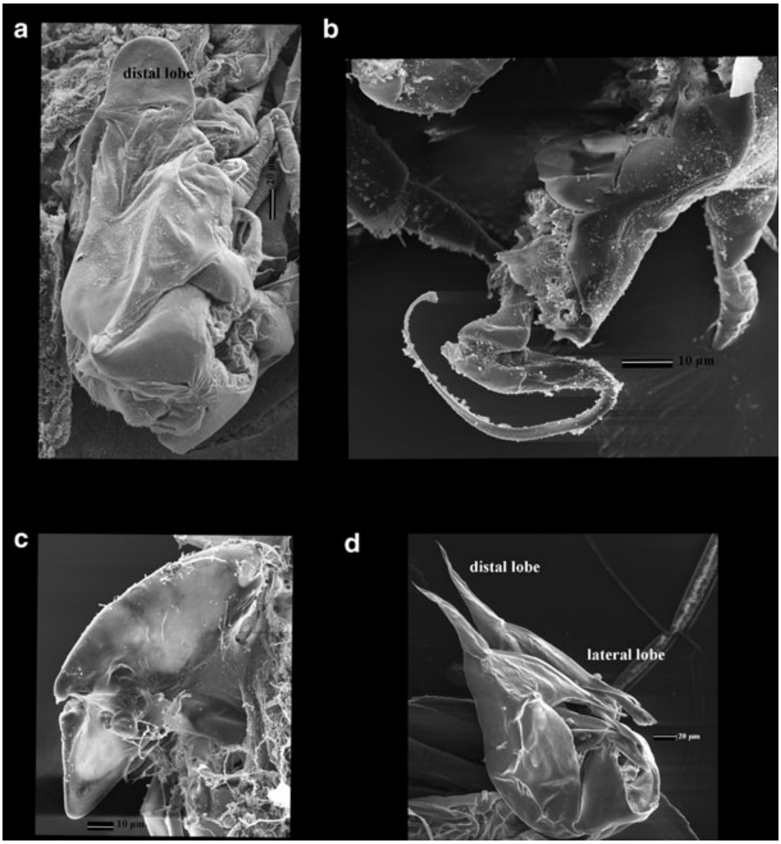

Fig. 36 SEM: (**a**, **b**) *Paralimnocythere karamani* (Petkovski 1960a); (**c**) *Gomphodella quasihirsuta* Karanovic, 2009; (**d**) *Leptocythere sp.*: (**a**, **c**, **d**) hemipenis; (b), clasping organ. (**d**) Photo: D. Keyser

copulatory process. The shape and structure of the peniferum and the clasping organ are both very important taxonomic characters.

2.11.3 Superfamily Darwinuloidea

According to the only male ever recorded, the hemipenis is more similar to Cypridoidea than Cytheroidea. There is also a dorsal structure outside the hemipenis, which may be homologous with the Zenker organ. The hemipenis also consists of three lobes and internal system of canals but no labyrinth as in Cypridoidea.

3 Anatomy of Ostracods

3.1 Exoskeleton

The head region is supported by the chitinous framework connected by a thin membrane. The following parts can be recognized (Fig. 37a–d): forehead, upper lip, and lower lip (this is in the ostracod literature often referred to as hypostome, but it is not homologous with the hypostome of other arthropods). Antennula, antenna, and eyes are situated on the forehead. Between the posterior margin of the upper lip and anterior margin of the lower lip, lies the mouth opening. Rake organ, a paired chitinous structure used for food processing, is situated in the mouth region and it is attached to the lower lip. Mandibula and maxillula are connected to the upper margin of the lower lip with chitinous supports. Other appendages in the body are also connected to the body and with each other by a network of chitinous rods. Attachment of the uropodal ramus is by far the most apparent of all other attachments in the body, and is often used in the taxonomy of freshwater ostracods (Fig. 37e, f).

3.2 Digestive System

This system starts with the mouth opening (Fig. 38a). The food is handled first with the mandibula, maxillula, and the first thoracopod, although the breaking of the food is most usually achieved by the mandibula. The ball of food is pushed with the help of mandibula and the rake organ into the oral cavity. Then, via the esophagus, the food passes into the anterior intestine. The front part of the anterior intestine is called stomach, and it is lined with secretory cells, and it receives the products of the paired digestive glands called the hepatopancreas. Following the anterior intestine, the food passes into the posterior intestine which is a straight tube leading

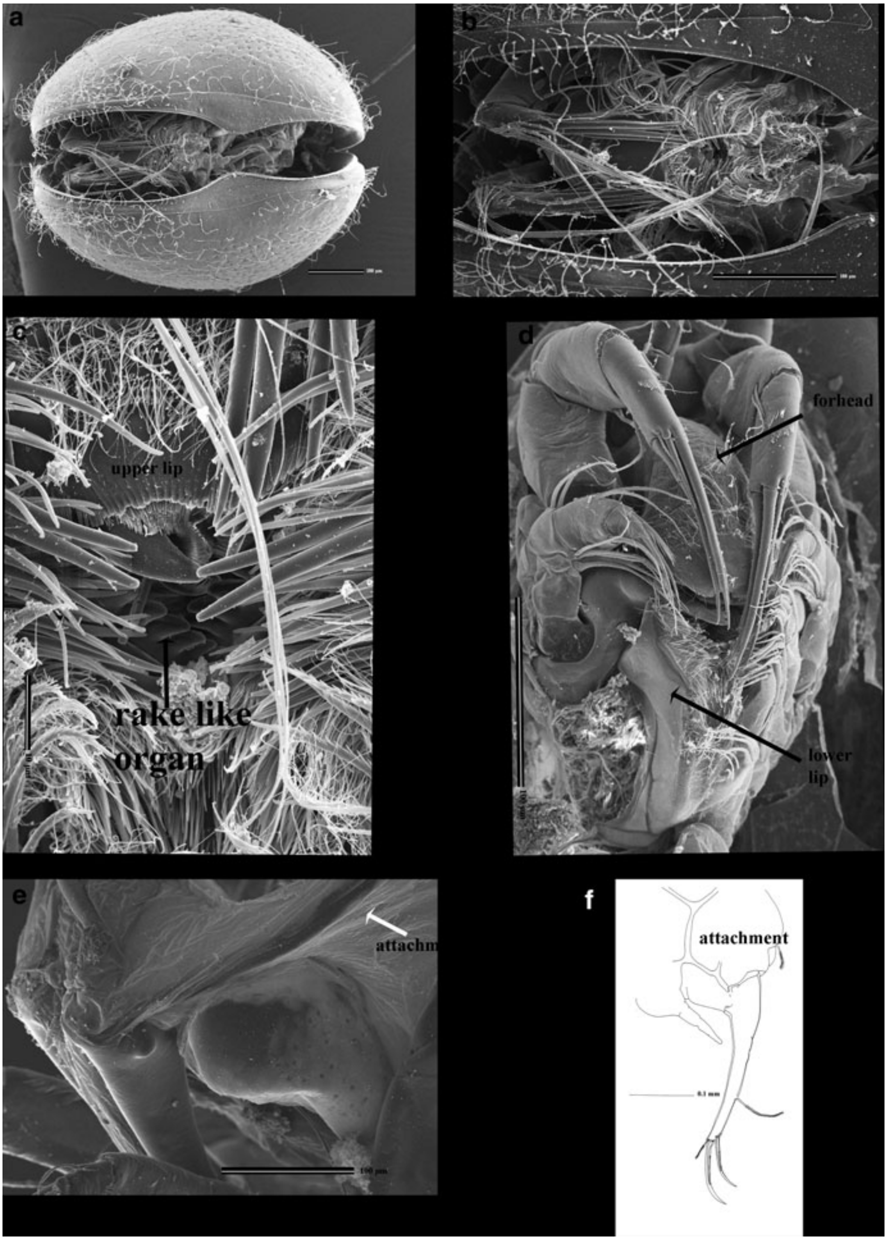

Fig. 37 (**a**–**e**) SEM; (**f**) Line drawing: (**a**–**c**) *Cypridopsis vidua* (Müller 1776); (**d**) *Psychrodromus olivaceus* (Brady and Norman 1889); (**e**) *Eucypris cf. virens* (Jurine 1820); (**f**) *Candona crogmaniana* Turner 1894: (**a**) ventral view, showing the position of the mouth; (**b**) mouth opening; (**c**) rake-like organ; (**d**) mouth region from the anterior; (**f**) attachment of the uropodal ramus; (**f**) uropodal ramus

to the anus. Peristaltic movement can often be observed in the living ostracods (McGregor 1967), by feeding ostracods with dyed food particles. Gut content is often visible through the shell (Fig. 38g). Observation of the feeding of the myodocopids (Vannier et al. 1998) reveals that these animals use the fourth limb and the uropoda lamellae in coordination to abrade and eventually tear open the protective integument of living/dead prey such as annelids. The mandibular palps are used mainly to hold the food. Food is transferred to the mouth by the fourth and the fifth limb and is passed to the esophagus by the endites (mandibles, and fourth and fifth limbs). Food is subsequently pumped up to the stomach by peristaltic contractions of the esophagus.

3.3 Respiration and Blood Circulation

Ostracods belonging to the subclass Podocopa do not have gills and the respiration is carried out across the entire body surface, with the aid of the branchial plate of the mandibula, maxillula, and the fifth limb, which, by constant fanning, provide a flow of oxygenated water and remove the CO_2. Epidermal cells of the inner lamella of the carapaces are also an important part in respiration and osmoregulation (Yamada et al. 2004). Podocopids have no heart and the circulation of the body fluids is probably achieved by a rhythmic contraction of the muscles in the body wall and gut or by general movement of the animal. Myodocopid ostracods have a circulatory system which consists of a single-chambered dorsal heart (pericardium, and myocardium with two ostia), efferent vessels (aorta and secondary arteries), and an integumental afferent network of sinuses radiating from the adductor muscle area to a peripheral channel leading to heart. The heartbeat and the linear velocity of hemolymph in sinuses range from 0.5 to 6 times s^{-1} and 200 to 1,000 $\mu m\ s^{-1}$, respectively. Hemocytes of irregular shapes occur within the circulating hemolymph. This typical open circulatory system is found in most myodocopid ostracods and other crustaceans (Abe and Vannier 1995). However, the dorsal heart, the internal vessels, and the anastomosing network of sinuses running through the carapace are not the only circulatory/respiratory organs known to occur within the group. For instance, cylindroleberidid ostracods develop paired “gill-like structures,” so-called because of overall resemblance to the gills of larger malacostracans (Vannier et al. 1996).

3.4 Nervous and Sensory System

The central nervous system consists of three parts: cerebrum, a circum-esophagal collar of fused ganglia, and a ventral chain of ganglia running antero-posteriorly (Rome 1947b; Hartmann 1967). Rome (1947b) divides the circum-esophagal collar into a protocerebrum into which the optic nerves pass, deuterocerebrum which

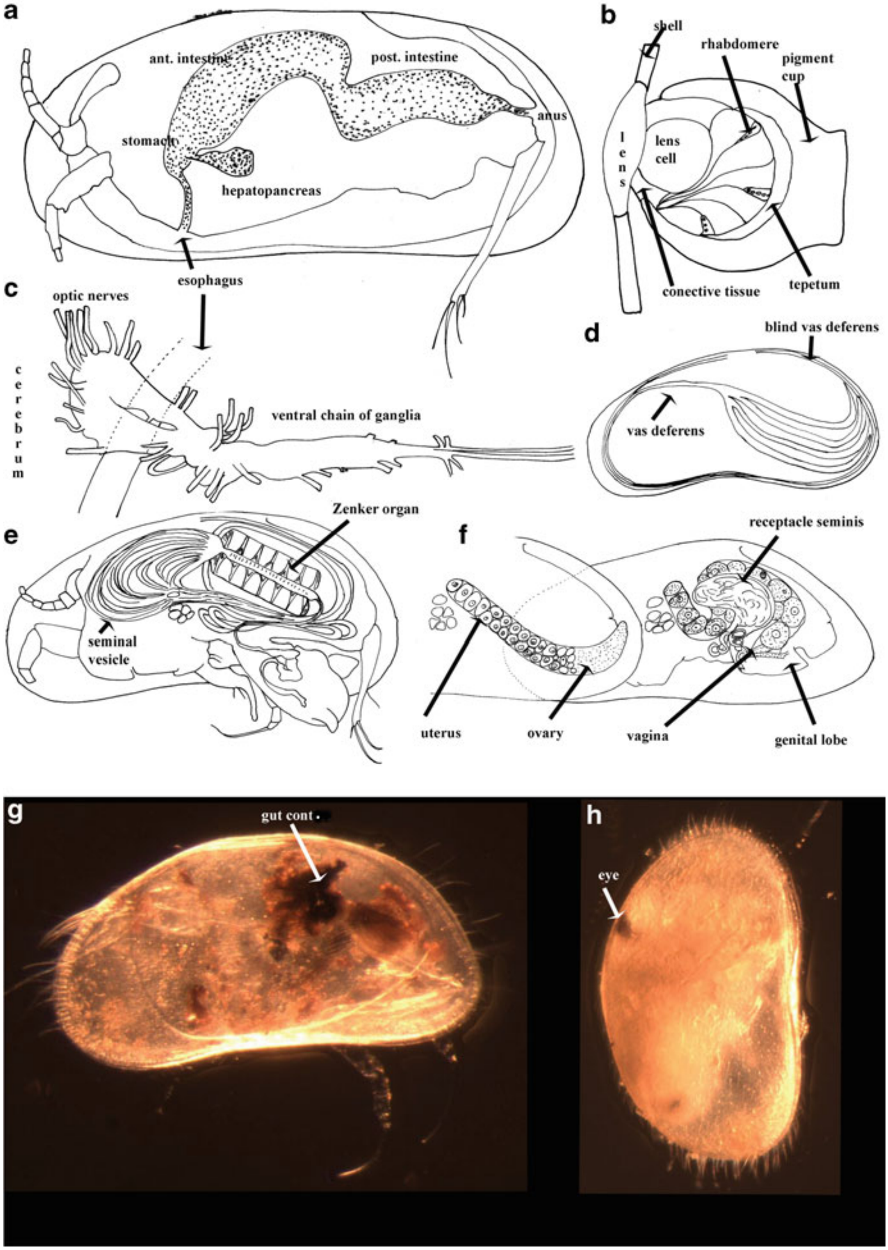

Fig. 38 (**a**–**f**) Line drawings; (**g**, **h**) Microscopic photographs: (**g**) *Candonopsis sp.*; (**h**) *Sarscypridopsis ochracea* (Sars 1924): (**a**) digestive tract; (**b**) frontal eye; (**c**) nerve system; (**d**, **e**, **f**) reproductive system; (**g**) gut content; (**h**) eye. (**a**) Modified after Henderson (1990); (**b**) modified after Tanaka (2006); (**c**) after Rome (1947b); (**d**–**f**) modified after Meisch (2000). (**g**, **h**) Photo: T. Karanovic

receives the antennula nerves, and triterocerebrum which receives the antenna nerves. Nerves from other limbs run into the chain of large ganglia (Fig. 38c).

The eyes are placed near the base of the antennulae. Some members of the subclass Myodocopa have both compound and frontal (naupliar) eyes, and Podocopa only have frontal eyes (Fig. 38h). The frontal eyes are more developed in the podocopid ostracods. The frontal eyes are tripartite: two lateral ocelli and a single ventral ocellus. Each lateral ocellus sometimes attaches to the valve and develops a cuticular lens on the valve itself (Bonaduce and Danielopol 1988). The pigmented cup is connected with the cuticular lens by the connective tissues (Fig. 38b). The three frontal eyes are situated on top or dorsal to the brain. Each of the three cups is lined with tapetal cells (tapetum), which contain the reflecting material formed as crystal-like plates. The sensory cells are usually few, varying between two to five. In addition to the sensory cells each cup has two fairly large lens cells, which bulge halfway out, from the cups. Some podocopids lack the lens cells. In podocopid ostracods, the light-gathering ability of the eye is dominantly affected by the thickness and curvature of the outer surface of the lens (Tanaka 2006). The nerves from each of the cups have separate courses to the brain. In some of the deep-sea myodocopids, the frontal eyes have reached their most elaborate structure and function in ostracods (Elofsson 2006).

Many setae play a sensory function in the ostracod body. Some of the setae on the surface of the carapace may play this role. On the soft parts, there are a number of specially modified setae in podocopid ostracods, called aesthetascs, especially on the antennula and antenna (Danielopol 1971), and they can be especially long in the species living in the subterranean waters (Danielopol 1973) (Fig. 20). Similarly, myodocopid ostracods are also well equipped with different sensory setae on their appendages, most of all on the antennula.

3.5 Reproductive Organs

In Podocopida the reproductive organs are paired in both sexes. Gonads are paired in all Myodocopa, except Cladocopida. In females there are two ovaries, and oviducts lead from ovaries to the uterine opening situated near the inner middle of the genital lobe. This lobe often bears some additional appendage-like structures which can be very helpful in taxonomy (Fig. 39c). The vaginal opening lies in front of the uterine opening and usually has well-chitinous rings. This opening is connected to the *receptaculum seminis* with a long and often coiled canal (Fig. 38f). There is no evidence for the internal connections between the seminal receptacle and the uterus; it is believed that the sperm pass from the vagina directly to the uterus to fertilize the eggs. Imprints of the ovaries can be visible on the shell (Fig. 39b).

The testes of Cypridoidea consist of four long coiled tubes on either side of the body (Fig. 39a, d). These tubes unite to form the *vas deferens*. Ventrally the *vas deferens* divides into the blind section which passes under the testes and runs

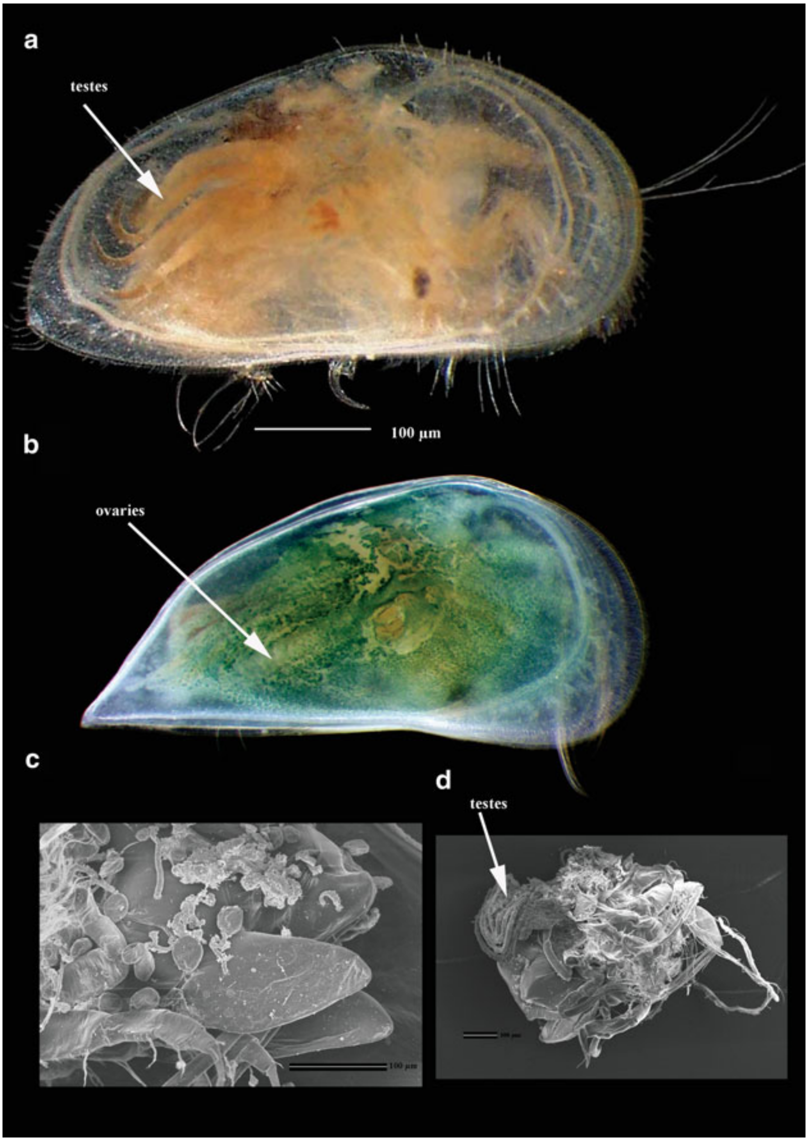

Fig. 39 (**a**, **b**) Microscopic photographs; (**c**, **d**) SEM: (**a**) *Lacrimicypris kumbar* Halse and McRae 2004; (**b**) *Mytilocypris mytiloides* (Brady 1886b); (**c**) *Fabaeformiscandona fabaeformis* (Fischer 1851); (**d**) *Notodromas persica* Gurney 1925: (**a**, **b**) lateral view showing the imprints of gonads on the carapace: (**c**) genital field in ♀; (**d**) testes tubes in ♂. (**a**, **b**) Photos: S. Halse

toward the dorsal side where it terminates. The main tube leads from the ventral side to the dorsal where it enters the body. The v*as deferens* forms many coils embracing various organs within the body before it enlarges into a *seminal vesicle* and forms the Zenker organ (Fig. 38d, e). This organ serves as a pump for spermatozoa and it consists of a number of chitinous whorls of spines and muscles. The Zenker organ is connected with a tube to the hemipenis. Wingstrand (1988) recognized eight types of sperm in ostracods. Some podocopids have proportionally the largest sperm in the animal kingdom, being 10 times longer than the entire body. Cytheroidea and Myodocopa do not have Zenker organs.

4 Biology of Ostracods

4.1 Ostracod Habitats, Endemism, and Radiation

Ostracods can be found in many different water habitats. They live in both marine and freshwater interstitial waters, temporary and permanent freshwater bodies, large and small lakes, springs (including thermal springs), streams, rivers, pools, semiterrestrial habitats, and deep subterranean waters. The marine species live from shallow waters to abyssal depths. There is no type of aquatic ecosystem on Earth, both marine and freshwater, from where ostracods have not been recorded. There are many factors influencing the ostracod biodiversity and distribution in a certain ecosystem. Physical factors that control the distribution of ostracods are temperature, substrate, sediment type, vegetation, bottom topography, depth and transparency of water, and bottom currents. Examples of relevant chemical factors are salinity, pH, total phosphate, and dissolved oxygen. Biological elements influencing the distribution of ostracods are food supply and competition with other animals. Other factors that play an important role in zoogeography of ostracods are dispersal ability, mode of reproduction, morphological adaptation, and barriers (Puri 1966; Smith and Horne 2002).

The most investigated zoogeographical region is the Palearctic, with more than 700 non-marine species, followed by the Nearctic with 300 species. The Holarctic holds half of the known non-marine ostracod biodiversity. The Afrotropical region has 450, while the Neotropical around 280. The Oriental region has approximately 200 species, while from the Australian region only 176 species are recorded so far (Martens et al. 2007) (Fig. 40). As shown in Table 2, the Afrotropical and Australian regions have the highest percentages of endemic species. All these numbers are greatly misleading as most of the other regions, excluding Holarctic, have been poorly studied and large territories are still to be surveyed for many invertebrate groups, including ostracods.

At the species level, nearly all freshwater families have an endemic rate of around 90%, meaning that only about 1/10 of all species have intercontinental distribution, and further on, calculating over all known species, close to 94% of them are known from one zoogeographical region only (Martens et al. 2007). At the genus level, around 60% of genera occur in one zoogeographic region only, while endemism on the suprageneric level is rare and known only for certain tribes of subterranean Candoninae.

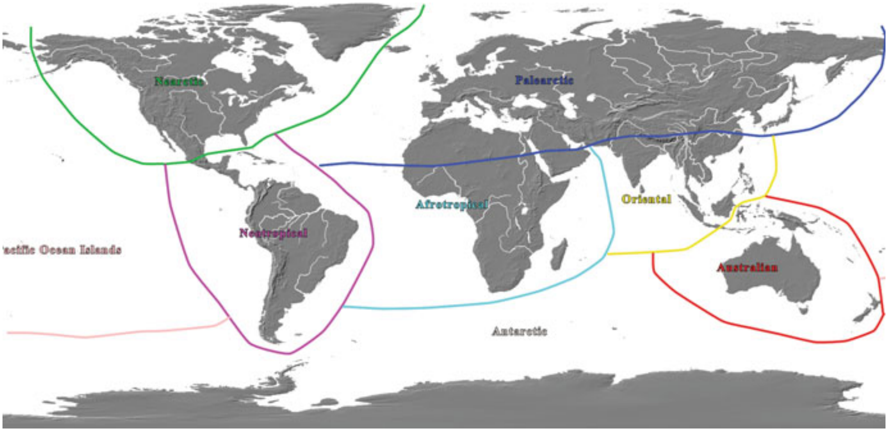

Fig. 40 Map of the zoogeographic regions of the world

Table 2 Numbers of non-marine species and endemisms in the zoogeographical regions

Zoogeog.regions	Holarctic		Afrotropical	Neotropical	Oriental	Australian
	Palearctic	Nearctic				
No of species (%of endemics)	700 (80)	300 (71)	450 (93)	280 (84)	200 (83)	176 (92)

Subterranean waters are ecosystems that often have an endemic fauna. There are a few models proposed for colonization of the subterranean habitats (Danielopol and Rouch 2004), the most common are animals escaping harsh environmental conditions on the surface (climate-relict model), animals actively colonizing the environment and adapting to it (the active colonization model), animals escaping epigean predators and/or strong competitive pressure, and various passive colonization models from animals being transported from epigean to hypogean environments during the courses of floods, to animals passively colonizing continental subterranean waters from marine interstitial during the regressive phases and progressively adapting to the inland non-marine subterranean waters. There is probably more than one factor influencing ways of colonization, subsequent (or pre-) adaptation, and the present day distribution of subterranean ostracods. Probably the way of colonization differs between ostracod lineages. Ostracod species, as any other living being, spread their area of distribution as much as possible, and colonize different environments. Even the "true" surface water ostracod, such as *Cypridopsis vidua* (Müller 1776) (Roca and Danileopol 1991), actively explores and colonizes the interstitial habitats. Ostracods are very diverse in subterranean waters, especially in some parts of the world, such as Australia, where the biodiversity in certain parts (such as arid Western Australia) is greater than in the surface waters (Karanovic 2007). Subterranean biodiversity is also well documented in the European karstic systems (Danielopol 1976, 1979, 1980a, b; Rogulj et al. 1994) and much less documented in other parts of the world (Danielopol and Hartmann 1986);

nevertheless, investigations of these less explored regions should reveal more ostracod taxa, as happened when investigations of the Australian underground waters started some 10 years ago. Subterranean ostracods display a number of morphological adaptations, such as reduction of size, loss of carapace pigmentation, and eye pigmentation; elongated segments and claws (for better gripping on the surface); strong reduction of the swimming setae on the second antenna; and increased development of sensory setae (Danielopol 1978a, b, c; Marmonier and Danilopol 1988; Marmonier et al. 1989). Some groups of ostracods are more often found in the subterranean waters than the others. The subfamily Candoninae (of the superfamily Cypridoidea) is the most common inhabitant of the subsurface waters, while other groups, such as the family Cyprididae (of the same superfamily), are only rarely found in such ecosystems, and very few species are stygobionts – i.e., species living in subterranean water. Subterranean species have more restricted distribution than the surface water species, and often are endemic to small karstic areas. Endemisms of ostracods in subterranean waters are sometimes present on taxonomic levels above the species, suggesting the old age of these faunas and their extended period of isolation. Such is the case with subterranean Candoninae of Australia (Karanovic 2007), Africa (Martens 1992c), and Central and South America (Broodbakker 1983c).

Hyporheic zones are boundaries between the shallow groundwater and the surface waters in streams and rivers and they typically house species that live in either the ground water below, or surface water above, and the species diversity is usually not very high. Biodiversity in springs and flowing water (streams and rivers) is also not very high, as ostracods generally tend to crawl on the surface of either the bottom or aquatic plants, and flowing water is a disturbing factor. In such habitats ostracods can be found in areas of rivers and streams where water stagnates and around the vegetation, especially in moss. Many species living in and around springs and spring-connected ecosystems have reduced swimming setae on the second antenna, and very powerfully developed claws on the antenna, walking leg, and uropodal ramus.

Lakes can hold a great ostracod biodiversity and species live from shallow waters around shores to the deep zones. All three non-marine lineages, Darwinulocopina, Cytherocopina, and Cypridocopina have many representatives in the continental lakes. Species of Cypridoidea living in lakes are usually good swimmers and have well-developed, long swimming setae on the second antenna, as well as long, often plumose setae on the first antenna. As for many other animal groups, ancient lakes are places which hold a large biodiversity and high endemism. Ancient lakes, mostly appearing around 7–10 million years, are deep (from 70 m (Lake Victoria) to 1.7 km (Lake Baikal)), allowing a great variety of ecological niches. The percentage of endemic species in different ancient lakes varies, but is usually very high (94% in Lake Tanganyika) and it often includes a relatively high percentage of the endemic genera (16% in Lake Tanganyika) (Martens 1994a, 1997b; Schön and Martens 2004).

Small water bodies such as rock pools, fed only by rainwater, are important temporary water habitats for ostracods all over the world, but especially in Africa (Jocque et al. 2006), and even there, some endemisms among species can be found, especially among the gigantic ostracods (Martens 1998a). Ostracods are very often associated with root systems of floating plants (pleuston) in flood plains in South America (Higuti et al. 2007). Certain groups of ostracods are known from the semiterrestrial habitats, such as leaf litter, bromeliad cups, or floating fen soil (Danielopol and Vespremeanu 1964) and are more common in South America than anywhere else in the world (Pinto et al. 2003, 2004, 2005a, b, 2008).

4.2 Reproduction

Marine ostracods most commonly reproduce sexually (Cohen and Morin 1990). All three lineages of non-marine ostracods started off from sexual ancestors. In some lineages (Cypridoidea for example) the invasion of continental waters was accompanied by an increasing importance of asexual reproduction; in Cytheroidea, parthenogenesis might have originated later (Martens 1998b). Bisexual reproduction allows for mutation, recombination, and hybridization and creates a flexible and diverse gene pool, but invests around 50% of its biomass in the production of males, these being lost for direct reproduction. Parthenogenesis, on the other hand, ensures genetic diversity by mutation and polyploidy and is less genetically plastic, but invests 100% of the biomass into direct reproduction (Martens 1994a).

Parthenogenesis is indeed a very common way of reproduction in ostracods. Until very recently it was believed that Darwinuloidea have been reproducing parthenogenetically for the last 100 Mya. In that way this lineage was often regarded as “ancient asexual”, one of the oldest on Earth (Butlin et al. 1998; Martens, 1998b; Martens et al. 2003). Smith et al. (2006) reported first males from Japan. It is not quite certain though if those males are reproductively active. In the case of *Limnocythere inopinata* (Baird 1843a), some rare, unfunctional males have been reported in otherwise parthenogenetic populations (Geiger et al. 1998). Horne (1983) calculated that of 286 species of Cypridoidea, known from Europe at that moment, 57% reproduce only parthenogenetically, as no males have yet been recorded. In Cytheroidea, of 50 European species 28% reproduce parthenogenetically. Many species belonging to Cypridoidea (most Cyprididae and some Candonidae) and some freshwater Cytheroidea have mixed reproduction, meaning that they have completely parthenogenetic populations, populations consisting of parthenogenetic females as well as sexual males and females, and bisexual populations. Another phenomenon in mode of reproduction is “geographical parthenogenesis”, i.e., some species reproducing in one part of their area of distribution parthenogenetically and in others sexually. This is known for many European non-marine species. In most cases, parthenogenetic populations are distributed in northern parts of their area, while sexuals are limited to the southern parts. There are two hypotheses for geographical parthenogenesis. One is post-glacial recolonization hypothesis: after the glaciations in Europe, parthenogenetic reproduction was favored over sexual as this ability gives a species an advantage over sexual lineages - there is no necessity for males, and a single egg is enough to start a viable population, so that parthenogens were able to colonize the newly available habitats more quickly than the sexuals. The other hypothesis is quite contrary, that in fact a stable climate during the Holocene sustained parthenogenetic populations rather than sexual (Horne and Martens 1999). The basic idea is that environmental/climatic stability favors parthenogens since they can reproduce more than the sexuals; unstable or fluctuating environmental/climatic conditions favor sexuals since with genetic mixing a population can adapt to the changing conditions. This is based on the fossil record of some bisexual populations found in the Northern Europe during the Late Glacial period and early Holocene. Nevertheless, stability of all types of aquatic habitats leads to predominance of sexuality in their faunas, such as in ancient lakes and subterranean waters (Martens 1998b).

As yet there is no clear evidence for reversals from asexual to sexual reproduction, i.e., the production of functional males from asexual females (Smith et al. 2006), and also the other way round. Studies of the karyotype of the parthenogenetic females show very unstable chromosomal structures (multiplication of sex chromosomes, and fusion of chromosomes) which may provoke the suppression of male production through chromosome disjunction or loss and explain how asexuals derive from sexuals (Schön and Martens 1998). There are many environmental factors, known in other parthenogenetic crustaceans, that may influence the switch from one mode of reproduction to another, such as temperature, availability of food, endosymbiotic microorganisms, etc. In some species, like *Metacypris cordata* (Brady and Robertson 1870), sex ratio is known to vary dramatically with a season, males being present only for a month or two in the summer (Meisch 2000), and in some species even then being very rare (Smith et al. 2006).

4.3 Reproductive Behavior

The mating process in ostracods can be divided into four phases (Horne et al. 1998): mate recognition, copulation, insemination, and the post-mating phase. The first phase can be recognition at a distance (chemical and optical sensors) or by a direct contact (by males grabbing the females with the second antenna or/and prehensile palps), provoking the females to accept the male. Six different mating positions have been recognized for podocopid ostracods so far. The copulation lasts from a few seconds to 30 min, during which time males extends the posterior extremity of the body toward ventro-posterior part of its own carapace (in some species the hemipenis rotates for 180° clockwise (McGregor and Kesling 1969)). Once a male and a female are connected, the transmission of spermatozoa into the genital organs of the female is initiated, in Cypridocopina by contraction of the Zenker organ. During the post-mating phase males and females remain active. After a few seconds, the hemipenis starts to retract inside the carapace. One male can inseminate a couple of females during a relatively short period of time (30 min). In some nektobentonic myodocopids, after copulation, females lose their swimming setae and become restricted to the benthic way of life, so that they cannot attract other males (Cohen and Morin 1990).

4.4 Ontogeny

In the subclass Myodocopa, all representatives of Myodocopida have brood care – carrying embryos within the postero-dorsal cavity of the carapace, releasing offspring as first instars. On the other hand, only a single genus of Halocyprida is known to have brooding care of embryos, while all the others release eggs directly into the sea. In Podocopa, brooding of embryos is less common and only representatives of Darwinulocopina and some families of Cytherocopina brood embryos in the posterior cavity of the shell. The number of embryos and eggs that can be retained at the same time in the brood chamber varies among species. For example, in the case of Darwinuloidea, *Darwinula stevensoni* Brady and Robertson 1885 can contain up to 10 or 15 juveniles at the same time in the brood chambers, and it releases its juveniles in the third instar, while *Penthesilenula brasiliensis* (Pinto and Kotzian 1961) carries up to six juveniles and releases them after the second instar (Pinto et al. 2007). Development in most brooders is slower than in depositors (Cohen and Morin 1990).

Ostracod growth is characterized by a number of molts which happen on the transition between the instars. The instars are usually described as first, second, third, etc., or as A, A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-8, "A" meaning an adult. The number of larval instars is fixed for certain lineages, and most of the podocopids have nine instars (eight juveniles and one adult). The first instar is already enclosed between valves and usually has three pairs of appendages. In some species, the carapace needs more than 100 h to complete its full calcification (around one week) from the time the nauplius hatches (Yamada and Keyser 2010). Prior to molting the ostracods begin producing shells by storing a huge amount of calcium phosphate granules together with chitin precursors in the outer epidermal cells. These granules release their contents into the extracellular space directly outside the epidermal cells. This material is transformed into small platelets, now made of calcium carbonate. These small platelets disintegrate into small granular structures, which are in fact amorphous calcite. This granular substance then forms the crystals, which, in connection to the chitin and proteins, build the shell of ostracods (Keyser and Walter 2004).

In Myodocopa, the ontogenic development comprises four to seven juvenile instars and a single adult instar. In contrast to Podocopa, the first instar in Myodocopa has five or even six appendages, being at the stage of metanauplius. For an easier comparison, different developmental stages for the subclass Podocopa are presented in Table 3. Ontogeny of Cypridocopina follows the model of *Eucypris virens* (Jurine 1820) described by Smith and Martens (2000). Development of *Darwinula stevensoni* (Brady and Robertson 1870), described by Smith and Kamiya (2008), is an example of the Darwinulocopina ontogeny. Ontogeny of three representatives of the suborder Cytherocopina, namely *Loxoconcha japonica* Ishizaki 1968 (Superfamily Cytheroidea, Family Loxoconchidae), *Uncinocythere occidentalis* (Kozloff and Whitman 1954) (Superfamily Cytheroidea, Family Entocytheridae), and *Terrestricythere elizabethae* Horne et al. 2004 (Superfamily

Table 3 Comparative ontogeny of the subclass Podocopa

	C	A1	A2	Md	Mxl	Mxp/L5	L6	L7	CR	other	C	A1	A2	Md	Mxl	Mxp/L5	L6	L7	CR	other
Podocopida/Cypridocopina/Cypridoidea/Cyprididae											Podocopida/Darwinulocopina/Darwinuloidea									
A-8/first instar	13%	4-sg	No ss	3-sg pl	Miss.	Miss.	Miss.	Miss.	Miss.		20%	5-sg	SA	Cx+3-sg pl 1 rs	Miss.	Miss.	Miss.	Miss.	Miss.	
A-7/second instar	20%	4-sg	No ss	SA	Anl.	Miss.	Miss.	Miss.	Anl.		25%	5-sg	SA	2 rs	Anl	Miss.	Miss.	Miss.	Anl.	
A-6/third instar	24%	4-sg	No ss	SA	usg pl	Miss.	Miss.	Miss.	Anl.		39%	5-sg	SA	3 rs	usg pl	Miss.	Miss.	Miss.	Anl.	CS
A-5/fourth instar	29%	4-sg	1 ss	SA	usg pl	Anl.	Miss.	Miss.	Anl.	rake	55%	5-sg	SA	4 rs	sg pl	Anl.	Miss.	Miss.	Anl.	
A-4/fifth instar	36%	5-sg	2 ss	SA	sg pl	4-sg WL	Anl.	Miss.	SA		45%	5-sg	SA	5 rs	SA	4-sg WL (SA)	Anl.	Miss.	Red.	
A-3/sixth instar	46%	6-sg	3 ss	SA	SA	Mxp 3-sg pl	4-sg	Anl.	SA		54%	6-sg (SA)	SA	6 rs	SA	SA	4-sg WL	Anl.	Red.	
A-2/seventh instar	58%	7-sg (SA)	4 ss	SA	SA	Mxp usg pl	5-sg (SA)	3-sg CL (SA)	SA		64%	SA	SA	7 rs	SA	SA	5-sg WL (SA)	4-sg WL	SA	
A-1/eight instar	80%	SA	5 ss	SA	SA	SA	SA	SA	SA	Cop.Anl	81%	SA	SA	8 rs (SA)	SA	SA	SA	5-sg WL (SA)	SA	Cop. Anl
Adult	100%	A	6 ss	A	A	A	A	A	A	Cop.	100%	A	A	A	A	A	A	A	A	Cop.
Podocopida/Cytherocopina/Cytheroidea/Loxoconchidae											Podocopida/Cytherocopina/Cytheroidea/Enthocytheridae									
A-8/first instar	18%	5-sg	SA	usg pl+2 claws	Miss.	Miss.	Miss.	Miss.	Anl.		/	/	/	/	/	/	/	/	/	/
A-7/second instar	23%	5-sg	SA	2-sg pl	Anl.	Miss.	Miss.	Miss.	Anl.		45%	6-sg	SA	cx+usg pl	Miss.	Miss.	Miss.	Miss.	Anl.	
A-6/third instar	29%	5-sg	SA	2-sg pl	usg pl	Miss.	Miss.	Miss.	Anl.		53%	6-sg	SA	cx+usg pl	Anl.	Miss.	Miss.	Miss.	Anl.	
A-5/fourth instar	33%	5-sg	SA	4-sg pl	sg pl	Anl.	Miss.	Miss.	Anl.		59%	6-sg	SA	SA	sg pl	Anl.	Miss.	Miss.	Anl.	
A-4/fifth instar	42%	5-sg	SA	SA	SA	3-sg WL	Anl.	Miss.	Red.		63%	6-sg	SA	SA	SA	3-sg WL	Anl.	Miss.	Anl.	
A-3/sixth instar	50%	6-sg	SA	SA	SA	3-sg WL	3-sg WL	Anl.	Red.		70%	6-sg	SA	SA	SA	3-sg WL	3-sg WL	Anl.	Red.	
A-2/seventh instar	40%?	6-sg	SA	SA	SA	4-sg WL (SA)	4-sg WL (SA)	3-sg. WL	SA		80%	6-sg	SA	SA	SA	4-sg WL (SA)	4-sg WL (SA)	Anl.	Red.	Cop. Anl.
A-1/eight instar	80%	6-sg	SA	SA	SA	SA	SA	4-sg WL (SA)	SA	Cop. Anl.	92%	7-sg (SA)	SA	SA	SA	SA	SA	4-sg WL (SA)	Miss.	Cop. Anl.
Adult	100%	5-sg	A	A	A	A	A	A	A	Cop+bo in ♂	100%	A	A	A	A	A	A	A	Miss.	Cop.
Podocopida/Cytherocopina/Terrestricytheroidea											Podocopida/Bairdiocopina/Bairdoidea									
A-8/first instar	27%	SA	SA	cx+sg pl	Miss.	Miss.	Miss.	Miss.	Anl.	Hook-like organ	/	/	/	/	/	/	/	/	/	/
A-7/second instar	31%	SA	SA	SA	Anl.	Miss.	Miss.	Miss.	Anl.	Hook-like organ disappears	15%	5-sg	4-sg	3 pm	Anl.	Miss.	Miss.	Miss.	Anl.	
A-6/third instar	35%	SA	SA	SA	sg pl	Miss.	Miss.	Miss.	Anl.		20%	5-sg	5-sg	cx+3-sg pl	SA	Miss.	Miss.	Miss.	Anl.	
A-5/fourth instar	43%	SA	SA	SA	SA	Anl.	Miss.	Miss.	Anl.		26%	5-sg	5-sg	cx+3-sg pl	SA	Anl.	Miss.	Miss.	Anl.	
A-4/fifth instar	50%	SA	SA	SA	SA	4-sg WL (SA)	Anl.	Miss.	SA		33%	5-sg	5-sg	cx+4-sg pl (SA)	SA	4-sg WL	Anl.	Miss.	SA	
A-3/sixth instar	60%	SA	SA	SA	SA	SA	4-sg WL	Anl.	SA		45%	7-sg (SA)	6-sg (SA)	SA	SA	4-sg WL	4-sg WL	Anl.	SA	
A-2/seventh instar	71%	SA	SA	SA	SA	SA	5-sg WL (SA)	4-sg WL	SA		56%	SA	SA	SA	SA	4-sg WL	5-sg WL (SA)	4-sg WL	SA	
A-1/eight instar	86%	SA	SA	SA	SA	SA	SA	5-sg WL (SA)	SA		80%	SA	SA	SA	SA	5-sg WL (SA)	SA	5-sg WL (SA)	SA	Anl. ♂ bo, Anl. Cop.
Adult	100%	A	A	A	A	A	A	A	A	Cop.	100%	A	A	A	A	A	A	A	A	Cop.
Platycopida/Cytherelloidea																				

A-8/first instar	38%	5-sg	1-sg ex 3-sg en	4 pm	Anl.	Miss.	Miss.	Miss.	Anl.	–	–	–	–	–	–	–	–	–	–	–
A-7/second instar	44%	5-sg	1-sg ex 3-sg en	4 pm	Anl.	Miss.	Miss.	Miss.	SA	–	–	–	–	–	–	–	–	–	–	–
A-6/third instar	50%	5-sg	1-sg ex 3-sg en	4 pm	SA	Anl.	Miss.	Miss.	SA	–	–	–	–	–	–	–	–	–	–	–
A-5/fourth instar	56%	5-sg	2-sg ex 4-sg en (SA)	4 pm	SA	Anl.	Miss.	Miss.	SA	–	–	–	–	–	–	–	–	–	–	–
A-4/fifth instar	64%	5-sg	SA	cx, bs, 2-sg pl (SA)	SA	Anl.	Anl.	Miss.	SA	–	–	–	–	–	–	–	–	–	–	–
A-3/sixth instar	72%	6-sg (SA)	SA	SA	SA	bs, ex, usg en	Anl.	Anl.	SA		–	–	–	–	–	–	–	–	–	–
A-2/seventh instar	83%	7-sg (SA)	SA	SA	SA	bs, ex, usg en	Anl.	Anl.	SA	Cop. Anl.	–	–	–	–	–	–	–	–	–	–
A-1/eight instar	87%	SA	SA	SA	SA	Sexually dimorphic	Sexually dimorphic	disappears	SA	Cop. Anl.	–	–	–	–	–	–	–	–	–	–
Adult	100%	SA	SA	SA	SA	A	A	/	A	Cop.	–	–	–	–	–	–	–	–	–	–

A adult; *Anl*. anlage; *bo* brushed-shape organs; *bs* basis; *CL* cleaning leg; *Cop*. copulatory appendage; *CS* caudal seta; *cx* coxa; *ep* endopod; *ex* exopod; *Miss*. missing; *pm* podomeres (meaning that there is no distinction between coxa, basis, exopod, and endopod); *pl* palp; *pp* protopod; *rake* rake-like organ; *rs* rake seta; *SA* similar to adult (meaning that some additional setae might be added, or setae and segments change their proportions, but the number of segments and/or parts is accomplished); *sg* segmented; *ss* swimming setae; *usg* unsegmented; *WL* walking leg

Terrestricytheroidea) are presented after Smith and Kamiya (2003, 2005) and Horne et al. (2004). Development of *Neonesidea oligodentata* (Kajiyama 1913) is an example for the Suborder Bairdiocopina (Smith and Kamiya 2002). Finally, ontogeny of the Order Platycopida follows Okada et al.'s (2008) description for *Keijcyoidea infralittoralis* Tsukagoshi et al. 2006. Platycopida have the first instar (A-8) already with four appendages (antennula, antenna, mandibula, and maxillula) plus the uropodal ramus, and the fifth appendage appears already at the second instar (A-7). Podocopida, Cypridocopina, and Darwinulocopina have eight juvenile instars and the anlage of the fifth appendage appearing on the fourth (A-5) (Cypridocopina), or the third (A-4) (Darwinulocopina) instar. A common characteristic of these two suborders is the absence of the anlage of the uropodal ramus on the first instar, which is present in Cytherocopina and Bairdocopina. The development of the Suborder Cytherocopina is not uniform. In most of the superfamilies there are eight instars. The only exception is the family Entocytheridae, with only seven instars. Also, in Terrestricytheroidea the fifth appendage appears already at the second instar, and in all the other Cytherocopina at the fourth. Bairdiocopina (Podocopida) also have only seven instars, and it is postulated that there is an additional instar that molts before the larva hatches (Okada et al. 2008). This suborder also has the first instar already with the anlage of the maxillula, and if there is indeed one instar before the hatching, then the anlage of the maxillula appears on the second instar.

Development time of ostracods is very closely linked to the temperature (Cohen and Morin 1990). At higher temperatures, the animals grow faster but have shorter life span. This was observed for *Heterocypris incongruens* (Ramdohr 1808; Latifa 1987), and also if they grow in lower temperatures, animals tend to become bigger (Martens 1985a). It is also known from the experiments on *Herpetocypris brevicaudata* Kaufmann 1900b that the content of calcium in the shells which have been calcified in lower temperature is lower as well (Roca and Wansard 1997). The impact of salinity on the growth of ostracods differ among different lineages and, for example, in the case of *Mytilocypris henricae* (Chapman 1966) (Cyprididae), specimens tend to be more elongated in lower salinities (Martens 1985a). van Harten (1975) found a negative correlation between mean length of *Cyprideis torosa* (Jones 1850) (Cytherideidae) and environmental salinity.

Juveniles of ostracods appear to behave like adults and occupy similar habitats, except that the swimming is limited.

4.5 Food and Predation

All freshwater and most of the marine ostracods are deposit feeders, and only a few lineages (Myodocopida, Family Cylindroleberididae and Podocopida, Family Cytherellidae) are filter feeders.

In the natural environment freshwater ostracods are defined as generalists, feeding on algae, organic detritus, dead and living plant material, invertebrate feces, and bodies of the dead animals. There are relatively few papers published on the topic, but certain species do prefer certain kind of food. Most commonly in the laboratory experiments, algae (living or dry) and commercial fish food is chosen for successful survival and growth of many ostracods (Otero et al. 1998; Mezquita et al. 1999a; Baltanás et al. 2000). Although mostly benthic organisms, laboratory observations suggest that ostracods can feed on periphyton (Roca et al. 1993). Some species (*Cypridopsis vidua* (Müller 1776)) even actively look for *Chara* beds to feed on the periphyton and to hide from predators. *Notodromas monacha* (Müller 1776) is a primarily neuston feeder (Kiss 2004). Based on the laboratory experiments, biofilms can be an important part of the ostracod diet (Lawrence et al. 2002). Cyanobacteria, like *Tolypothrix tenuis*, are a preferred food for *Eucypris virens* (Jurine 1820) over other food offered (such as other small crustaceans and some vegetables) in the experimental conditions (Schmit et al. 2007). On the other hand, some gas-vacuolate euplanctonic blue-green algae (such as *Microcystis, Ananbena, and Oscillatoria*) may have a devastating effect on ostracods, causing death within 24 h, depending on the strain (Mills and Wyatt 1974).

Fish eat ostracods, sometimes in great numbers. However, experiments with the ostracod *Cypridopsis vidua* showed that 26% of specimens eaten by small bluegill sunfish passed the intestine alive and unharmed by tightly closing their shells (Vinyard 1979). Eggs of *Heterocypris incongruens* (Ramdohr 1808) have been shown to pass the digestive tract of goldfish unharmed (Kornicker and Sohn 1971). On the other hand, the presence of ostracod can be quite disturbing for other animals. For example, presence of *Cypridopsis vidua* may drastically damage a snail culture, causing snails to retreat in their shells, while the ostracods are attacking them (Lo 1967).

4.6 Commensalism/Parasitism

The family Entocytheridae (Cytherocopina) is a diverse group which lives on other crustaceans. It has over 170 species. Species are very small and they have narrow shells, well adapted to living in the tiny spaces on the gills and thoraxes of crayfish, amphipods, and crabs. They have specially adapted thoracic limbs and antennae to grab hold of their hosts. Although the exact relationship between the entocytherids and their hosts is not clear, it is thought that they live commensally, the hosts taking benefit from the ostracods helping to keep the bodies of their hosts clean (Hart and Hart 1974). Nearly all the members of Cypridocopina are thought to be free-living, and only some genera of the marine family Pontocyprididae have been known to include commensal species living on sponges and echinoids (Maddocks 1979). In the suborder Cytherocopina, representatives of the marine family Paradoxostomatidae have highly modified mouth parts, and at least a few representatives of this group are commensal on invertebrate hosts (Horne and Whittaker 1985).

4.7 Parasites on Ostracods

A number of parasites and epibionts have been reported from freshwater ostracods, including cestodes, protozoans, helminthes, peritrichs, and acanthocephalans (Griffits and Evans 1994). In the case of a particular peritrich, *Nuchterleinella cornelia* Matthes 1990, the parasite clusters around the genitalia and uropodal ramus, but it is unknown if the presence of this particular parasite affects the viability of an ostracod. Some marine ostracods of the subclass Myodocopa are often inhabited by small crustacean ectoparasites. Vannier and Katsumi (1993) observed that these parasites cling on to the dorsal region, close to the heart of the species. However, the ostracods do not seem to remove these parasites even though they are feeding on the food debris off the host body surface or tissue fluid excretion.

4.8 Dispersal Abilities and Strategies

Ostracods are relatively low-mobile and their long distance dispersal is passive. One of the major factors for a successful dispersal and new colonization is the possession of dry-resistant eggs. An egg that is capable of remaining viable despite long-term desiccation and freezing is a major asset. It can be wind transported and survive extremely low temperatures of high altitudes. Such eggs are common in the family Cyprididae (Cypridocopina), and less common in other lineages. Martens (1989a) raised a species belonging to the family Limnocytheridae (Cytherocopina) from dried mud, opposing the long-standing assumption that no Cytherocopina lays dry-resistant eggs. Darwinulocopina do not produce such eggs. Dry-resistant eggs can remain viable up to 50 or even 100 years, and are well suited for passive dispersal (Martens 1994a, b). Ostracods use many means for passive dispersal: humans, birds, amphibians, fishes, insects, plants (floating vegetation), stratospheric air currents, and water currents. Birds are a very common way of transport for freshwater ostracods, especially for those that do not lay dry-resistant eggs, such as *Cytherissa lacustris* (in Sywula 1990). The ostracods are usually transported by being attached to the bird's feathers and legs. Due to human activities, such as rice cultivating, many tropical species of ostracods can be found today in the European rice fields. Many species disperse in a torpid (dehydrated) state (Horne 1983), a strategy used by some Cypridocopina which do not lay dry-resistant eggs. Both adults and juveniles can pass unharmed through the gut of fish, and some species have even been recorded from the lower digestive tracts and the feces of ducks (Proctor 1964). McKenzie and Hussainy (1968) carried out several experiments in order to test viability of eggs/adults of some Cytheroidea after exposure to dry conditions, and they concluded that after prolonged exposure to dry conditions (in this case 9 days was a limit), adults did not revive a normal activity after being returned to the water, but juveniles contained in the brooding chamber of these animals were still active. This experiment points out the importance of brooding for dispersal of ostracods. Brooding is therefore a main asset for a successful dispersal for all darwinulids (since all are brooders) and many cytheroids. The other strategy for a successful stretching of the area of distribution is parthenogenetic reproduction, known for many ostracods in all three freshwater lineages. In this way, the species can rely only on a single fertile female to start a new population. Many of the widely distributed freshwater species reproduce parthenogenetically. However, the species has to have a wide range of ecological tolerance to be able to survive in the new environment, especially if a new habitat has a considerably different temperature, salinity, oxygen dissolution, and other physical and chemical factors influencing the viability of an ostracod population. Danielopol et al. (1994) suggest that the present day distribution of freshwater subterranean ostracods is a result of both active and passive dispersal. They hypothesized that, due to their ecological flexibility, these ostracods can resist brief period of transportation in surface waters. Sometimes, subterranean ostracods actively disperse over large distances and within the sediments, constantly exploring their surroundings, and proliferating in suitable habitats.

The best example of rapidity of ostracod dispersal into newly available niches under favorable conditions is the European fauna. Ostracods have occupied (or reoccupied) niches that were ice-covered only a few thousand years ago (McKenzie 1971a).

Looking into paleozoogeography and present day distribution of non-marine lineages, we see that representatives of the superfamily Cypridocopina are by far the most successful, both in the aspects of their biodiversity and the number of ecological niches they have occupied. From the uppermost Jurassic (Mesozoic) to the present day they have dominated ostracod faunas in almost every non-marine environment and they are often the sole constituents of such faunas (Whatley 1990). The great rapidity of their dispersal is attributed to their ability to reproduce parthenogenetically and to lay desiccation and freezing-resistant eggs. Darwinulids are certainly the oldest lineage of non-marine ostracods, appearing in Devonian (Paleozoic), and always living in non-marine waters, but their dispersal strategies are obviously far less in numbers than in Cypridocopina. Similarly, Cytherocopina also have relatively few freshwater lineages, being, on the other hand, very diverse in marine environments, which does not require dessication resistant eggs. So, from the Triassic (Mesozoic) when they first appear in non-marine environments, the lineage was not particularly successful both in the evolution of species and niches colonization.

5 Phylogeny

The position of ostracods within Crustacea and Arthropoda, in general, is a debated question. They have been often associated with tantulocarids, branchiurans, mystacocaridans, copepods, facetotectans, rhizocephalans, ascothoracidans, acrothoracicans, and thoracicans, forming the class Maxillopoda. The definition of this class is rather broad and it includes crustaceans with five cephalic, six thoracic, and four abdominal segments, plus a telson, but reductions of this basic plan are common; thoracopods are variously fused with cephalon thoracic segments with biramous (sometimes uniramous) appendages, lacking epipods; abdominal segments lack typical appendages; carapace present or reduced; and with both simple and compound eyes, the latter being unique and defined as a "maxillopodan eye." As far as ostracods are concerned, there are many more exceptions to the definition of Maxillopoda than there are arguments in favor, so they have been excluded from the class Maxillopoda (Martin and Davis 2001; Horne 2005; Horne et al. 2002, 2005; Regier et al. 2005; Newman 2005, etc.). Ostracods are now considered one of the basal groups in the subphylum Crustacea, closely related to other "primitive" crustaceans such as Branchiopoda, Cephalocarida, Remipedia, and Mystacocarida (Newman 2005). On the other hand, data obtained from DNA cluster ostracods together with Branchiura (parasitic crustaceans), being the most basal on the phylogenetical tree of the pancrustacea (crustacea + hexapoda) (Regier et al. 2005). Ostracods have been related to Phosphatocopida (another Cambrian group of bivalved arthropods).The last group has only four pairs of head appendages, and some authors do not consider Phosphatocopida to be Crustaceans at all (Hou et al. 1996; Walossek and Müller 1998; Shu et al. 1999). But it is still a question of whether the fifth limb in podocopids belongs to the head or thoracic region. Many authors prefer the first opinion (e.g., Athersuch et al. 1989; Smith and Martens 2000). Besides being a "problematic" group, difficult to relate with other crustaceans, the ostracods are as much problematic in their own systematics and phylogeny.

A bivalved carapace enclosing the body and limbs may not be regarded as a synapomorphy of the two ostracod subclasses: Myodocopa and Podocopa. Such carapace occurs also in some lineages of Branchiopoda, and although in majority of Branchiopoda the carapace has growth lines, in Spinicaudata (Branchiopoda as well), the carapace lacks the growth lines like in ostracods. And even though in both ostracod subclasses the carapace is calcite, it shows some remarkable differences in morphology. Because of the rich fossil record much attention has been paid to the structure of the carapace in defining the phylogeny of ostracods. But as Horne et al. (2005) said, the carapace is at the same time rich in data and awash with homeomorphism. Most recently, Siveter et al. (2010) described a myodocopid ostracod from the Silurian deposits with preserved soft parts which indicate that this species belongs to the family Cylindroleberididae, but the appearance of the carapace relates it more to other families, especially Cypridinidae and Sarsiellidae, questioning the utility of the carapace alone in establishing the affinity of fossil ostracods. Some drastic discrepancies occur in carapace development and structure between present day and fossil ostracods. The species *Manawa staceyi* Swanson 1989 has recently been described as the only living representative of the otherwise extinct lineage, Palaeocopida (Podocopa). The larva of this species has a one-piece carapace (cephalic shield) and the adult has eight, instead of a maximum of seven appendages (excluding the copulatory ones and the uropodal ramus) in all other podocopids. Further, Siveter et al. (2003) described and 3D-reconstructed one fossil myodocopid species and found that adults had a one-piece carapace as well (but not otherwise very like the Manawan “shield”). Studying the development of a myodocopid ostracod Wakayama (2007) showed that the carapace in this species forms from the two buds on each side of the embryo that grow and meet dorsally into a single piece carapace which becomes hinged during further ontogeny. As for embryonic development itself, it is known that myodocopids have no less than four (most usually five) appendages already on the first instar, but in podocopids this differs largely between the lineages: some having only three appendages, some four, but never five. Looking into the soft part morphology there is even more evidence for polyphyly of the ostracods. Based on studies of the morphology and musculature of the appendages Horne (2005) suggested that the podocopid branchial plates are exopods, while those in myodocopids are epipods. In Podocopida the protopods of the post-mandibular appendages appear to be undifferentiated, consisting only of the basis, while in myodocopids they have basis, coxa, and often a precoxa as well. Also, the position of the uropodal ramus is different in two lineages: in myodocopids it is posterior and in Podocopa it is anterior to the anus (Meisch 2007). It is indeed true that there are many differences between the appendages between the two ostracod subclasses, but there is also a question if we are dealing with the homologous appendages when comparing those lineages (Horne et al. 2002). Ostracods went through so many reductions after having developed the bivalved carapace, and it is highly possible that in different lineages different appendages became reduced, and ultimately disappeared. A cladistic analysis of the extant superfamilies of the two ostracod subclasses performed using only the morphology of the soft part shows a good resolution of the phylogeny of the myodocopid superfamiles, but not in the podocopids (Horne et al. 2005). Not only morphological data suggest the polyphyly of ostracods. Using different genes and different representatives, ostracods came out on the tree as polyphyletic. On the tree obtained using 18S rDNA, podocopids are associated with pentastomatids and branchiurans, while myodocopids with copepods (Spears and Abele 1997). Using three genes (elongation factor-1 alpha, the largest subunit of RNA polymerase II, and elongation factor-2) branchiurans cluster with podocopids and myodocopids: they group with podocopids by amino acids and with myodocopids by nucleotides (Regier et al. 2005). However, all three groups: myodocopids, podocopids, and branchiurans stand at the base of the crustacean trees. Yamaguchi and Endo (2003) and Oakley and Cunningham (2002) also used 18S as a marker to test phylogenetical relationships within ostracods, using outgroups Branchiura, Copepoda, Cirripedia, Mystacocarida, Malacostraca, Branchiopoda, Cephalocarida, Insecta, and Chelicerata in the first analysis, and only copepods and branchiopods as outgroups for the second analysis. The results confirm polyphyly, but they also show that the phylogenic relationships among ostracod superfamilies in both subclasses (Podocopa and Myodocopa) are not resolved. This may be because of the marker used, as 18S is used to test the crustacean relationships and it may not be suitable for lower level units.

6 Practical Methods in Studying Ostracods

Here, only the qualitative methods for collecting the recent freshwater ostracods are described. Quantitative methods are reviewed in Danielopol et al. (2002).

6.1 Collecting

Ostracods live in every type of the freshwater ecosystem and there are several different kinds of equipment that are used for their collecting. However, at the base of all equipment is a net of an appropriate mesh size. To ensure the collection of small ostracods, including juvenile stages the recommended mesh size is 75 μm. The net is sewed to a metal frame (Fig. 41a) which has a handle. It is recommended to have the net protected with a thick material not to be damaged by pulling over the sediments. Nets constructed in this way are used for collecting ostracods from small ponds, puddles, rivers, and springs. It is also useful to have a coarse mesh over the mouth of the net to stop large stones, bits of wood, etc., from getting in and damaging the net. Also, sediment and water can be extracted with a bucket and then poured through the net. This also works well with aquatic macrophytes, which can be placed immediately in a bucket held under the water, then extracted and torn up and/or agitated to dislodge animals, and the residue then poured through a sieve.

For collecting in larger water bodies from standing on the shore, nets with a larger diameter and longer handles are used. The net is pulled over the surface and also close to the bottom. Before collecting close to the bottom, the sediment should be disturbed. Ostracods are also collected close to the vegetation on the river banks or ponds, and by rinsing the moss in the springs. Sometimes, if the water body is particularly small a rubber pipette can be used to suck in water. This kind of pipette is also useful for collecting in caves from small water bodies and also for sucking the dripping water from stalactites. Samples from wells can be taken with the Cvetkov net (Cvetkov 1968) (Fig. 41b, c). It is attached at the top to a length of rope or cable by a link and is then lowered to the bottom of a well or borehole. Once on the bottom, the net is jerked up and down several times and the weight suspended from the bottom of the net disturbs the sediment causing it to become suspended in the water, along with any fauna that might be present. The net is then drawn rapidly up through the water column to capture the specimens. The net also has a detachable filter that screws into a collar, attached to the bottom of the net, enabling the easy removal of specimens. The Bou–Rouch pump (Bou and Rouch 1967) is used for collecting in interstitial waters. The equipment consists of a zinced iron pipe, 2–3 cm in diameter and 1.5–1.8 m in length. At one end is a spiked tip, with rows of holes above this. At the other end is a lip or thread. The pipe is driven into sediments with a hammer and once at the desired depth a piston pump is fitted on the end for pumping up the water, which is then either pumped into a storage tank or through a sieve/net. Another way to collect the animals from the interstitial waters is

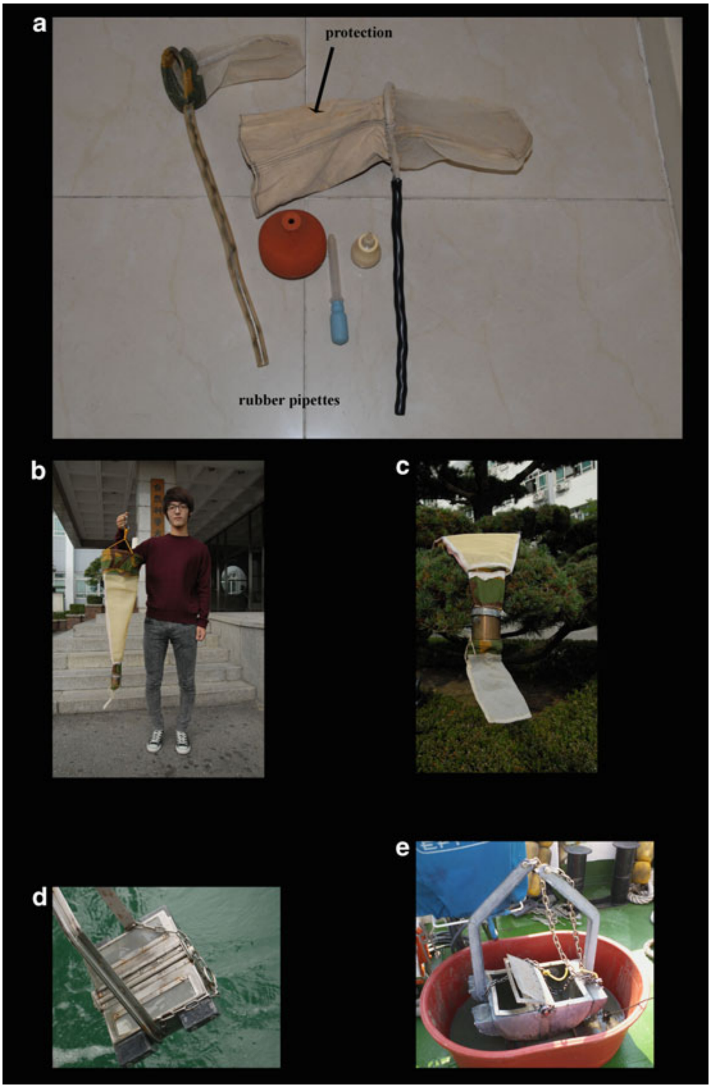

Fig. 41 Photographs of the collecting equipment: (**a**) plankton nets and pumps; (**b**) Cvetkov net; (**c**) lower part of the Cvetkov net, (**d**, **e**) Eckman drage. (**a**–**c**) Photos: T. Karanovic; (**d**, **e**) Photos: K.C. Kim

Karaman–Chappuis method (Karaman1935; Chappuis 1942). A hole is dug on the shore, until the water level is reached. Then the water which accumulates in it is collected with a dish and immediately passed though the net. For collecting from the larger water bodies such as lakes, besides a small net which is useful for collecting ostracods along the banks and close to the water vegetation, different equipment is used. The "Ekman Grab" (Fig. 41d, e) is used for soft bottoms

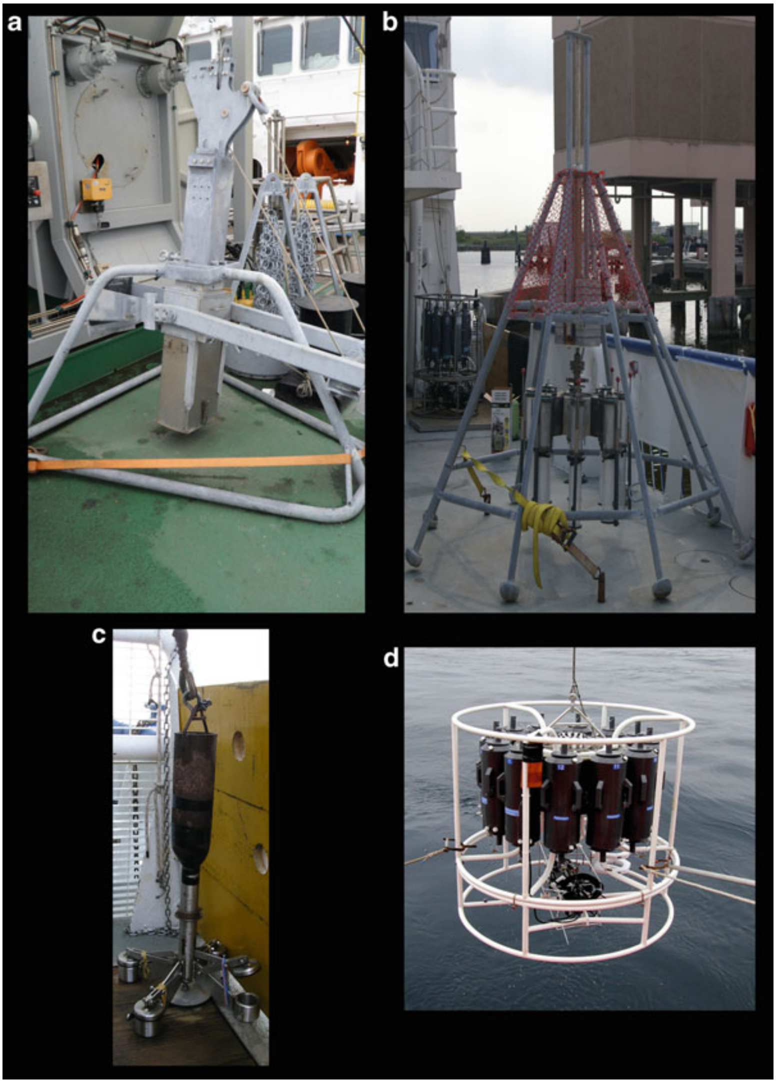

Fig. 42 Photographs of the collecting equipment: (**a**) box corer; (**b**) Multiple corer; (**c**) Kayak corer; (**d**) Niskin bottles. Photos: K. C. Kim

that are free of vegetation, such as sticks and decayed leaves (or with short, erect vegetation only) as well as intermixtures of sand, stones, and other coarse debris. Its specialized function is the taking of quantitative and qualitative samples. It is not recommended for rocky or sandy bottoms or moderate macrophyte growth because small pebbles or macrophyte stems prevent proper jaw closure. It consists of two halves of a relatively small box. The grab is placed onto the bottom sediment, then closed, and pulled up to retrieve a sample. A two-way mechanism prevents accidental closure while the dredge is dropping. The impact of the dredge on the bottom surface triggers the spring-loaded release mechanism without using a messenger. After mechanism closure, the dredge is pulled up to retrieve the sample. There are a number of Box Core Samplers available for deep lake, which can be deployed up to 6,000 m (Fig. 42a). During descent, insertion, and sampling, the top of the sample tube remains open allowing a free flow of water. This prevents pressure buildup and following disturbance of the sediment surface. After landing on the bottom an automatic mechanism releases the closing shovel. The shovel is drawn into vertical position so that the bottom of the tube is closed and the sample is kept inside. On withdrawal from the bottom, the top of the sample tube is closed and sealed by a hinged flap with a soft rubber packing. Other types of corers are Kayak corer (Fig. 42c) and multicorer (Fig. 42b). The last has an advantage of taking several core samples at one time and it is usually equipped with computer measuring systems for the water temperature and quality. Niskin bottles are used for collecting water at specific depths (Fig. 42d). The bottles are lowered into the water on a wire cable to the specified sampling depth. A messenger is then sent down the wire to quickly close the top and bottom of the bottles, trapping water inside the bottles. The bottles are then brought to the surface where the water is let out through a plastic tube into other sample collection bottles. Sometimes it is useful to collect animals with the aid of a trap: jars or plastic bottles are left with a bait (fish, liver, and smelly (non-processed) cheeses) in place for 24 h and certainly not longer than 48 h, as the bait itself can become a pollutant in the water if left for too long.

6.2 Fixing and Sorting

The samples can be fixed in 75% ethyl alcohol or in 96% (non-denaturated, pure) ethyl alcohol in case the material is also needed for the DNA, or the ostracods can be picked while alive and then fixed. In the case that the sample is used for DNA extracting, it is best to place the sample in a freezer. For only morphological taxonomy it is helpful to fix the animals first in about 30% alcohol, so that they die with the valves gaping open (this makes opening for dissection later on much easier) and then store in 75%. Once the sample is ready for sorting, part of it is placed in a Petri dish and ostracods are separated under the dissecting/field microscope using a pipette. The samples are also sorted and preserved in 75/95% alcohol. It should be noted that glycerin or formaldehyde must never be used as they decalcifie the shell.

6.3 Studying

Ostracods are best observed on a cavity slide and in propylene glycol. This medium very slowly evaporates and does not damage the tissue in case it is needed for DNA analysis. Ostracods are first observed under the dissecting microscope and

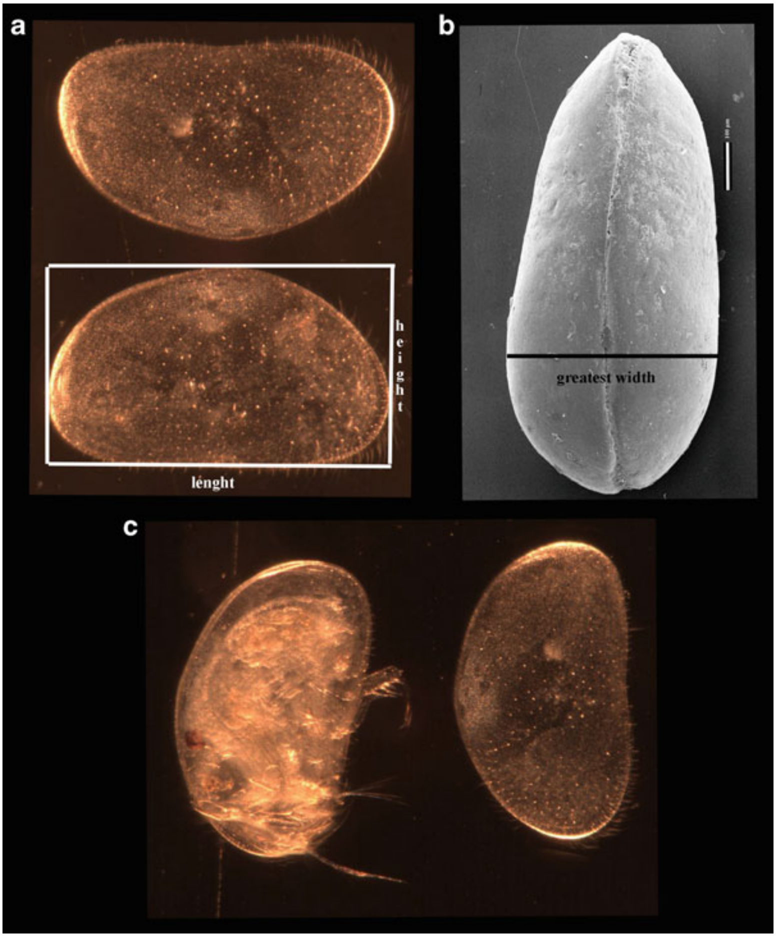

Fig. 43 (**a**, **c**) Microscopic photographs; (**b**) SEM: (**a**, **c**) *Sarscypridopsis ochracea* (Sars 1924); (**b**) *Cyprideis sp.*: (**a**) measuring length and height of an ostracod shell; (**b**) measuring width of an ostracod shell; (**c**) open shell. (**a**, **c**) Photos: T. Karanovic: (**b**) Photo: D. Keyser

measured with the aid of ocular micrometers. A specimen is then studied in detail. This is done with a compound microscope. The shell is first drawn from the outside (both with the animal laying on the left and right sides). It is also important to draw a dorsal and ventral view of the shell. This can be done by placing a very small amount of cotton wool on a slide in a drop of medium and then manipulating the shell and trying to place it between two cotton threads. All these aspects are necessary for measuring the length, height, and the width of an animal (Fig. 43a, b). After all external outlines are examined and drawn the shell needs to be opened. This can be achieved by inserting a very fine (usually entomological) dissecting needle (entomological pins mounted in pin chucks are very effective) ventrally between the valves. This is one of the most complicated stages in handling the animal as the valves can sometimes be very tightly closed. When the valves are open, the soft parts need to be separated from the shell (Fig. 43c). Sometimes, the adductor muscle scars are quite strong, so they need to be broken on the other side of the shell as well. Once the soft body is out, the inside appearance of the valves needs to be examined and drawn as well. The shell can be stored on the micropaleontological slides, or kept in a separate vial in alcohol. For detail observation of the fine structures of the shell a Scanning Electron Microscope (SEM) can be used. Special preparation procedures are required for SEM work. Specimens must be metal-coated using standard SEM techniques, or if using SEMs with environmental chambers no coating is required. The soft body is dissected on a normal microscope slide, either in a drop of a permanent mounting medium or glycerin. If the soft body is dissected in the latter medium, after the examination the parts need to be mounted on a separate slide in a permanent medium. This can cause the loss of some appendages, so it is recommended to dissect the animal directly in a permanent medium. Among others the following media are used for making permanent slides: Fore’s medium or Hydro Matrix. The soft body is

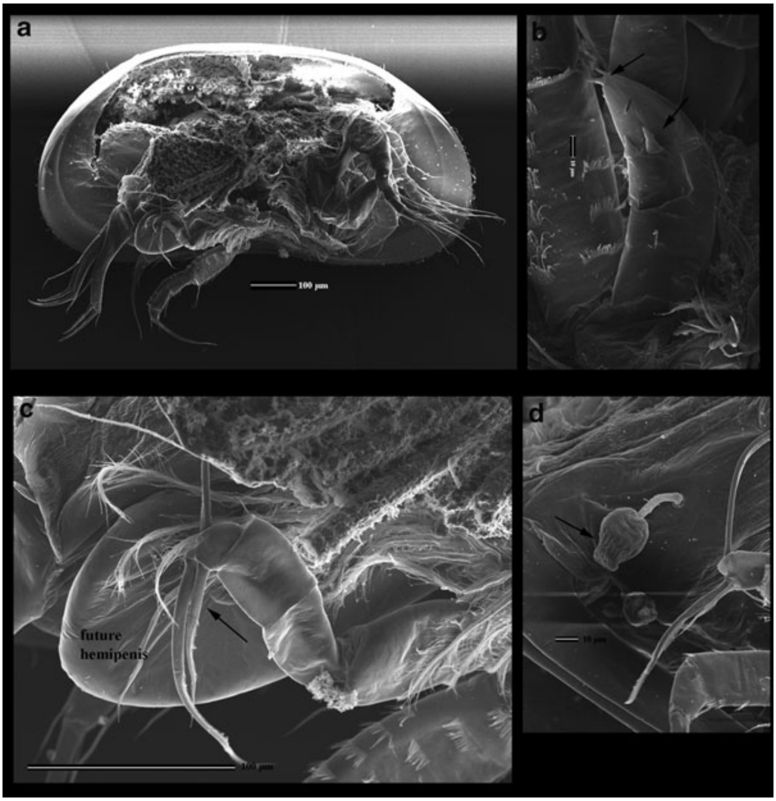

Fig. 44 SEM, (**a**–**c**) *Candona neglecta* Sars 1887; (**d**) *Candonopsis kingsleii* (Brady and Robertson 1870): (**a**) juvenile ♂ inside view; (**b**) prehensile palp in juvenile ♂; (**c**) setae on a juvenile; (**d**) epiphyte attached on the genital field

dissected with fine entomological needles. Dissected soft parts are covered with a coverslip. The soft parts are then observed under the high power microscope and drawn in detail with the aid of a camera lucida, or a drawing tube attachment. The soft body can also be observed with the SEM. For this purpose, animal goes thought the critical drying point (CDP) procedure. This can be done on the whole animal (while the soft parts are still in the shell), on the animal taken out from the shell but not dissected, or on dissected appendages. In the first two scenarios, animals need to be dissected when mounted on an SEM stub. The methods depend on the purpose of the SEM.

For a proper taxonomic identification it is necessary to ensure that one is dealing with adult specimens. To distinguish between juveniles and adults, the data in Table 1 can be used. In Darwinulids only the adult has all rake setae present on the Md. In species with swimming setae it is also easy to distinguish adults from juveniles, as only adults have all swimming setae present. In all ostracods, juveniles can be distinguished from adults by the special “plumed” appearance of setae (Fig. 44c) and also by incomplete development of the copulatory appendages and prehensile palps in males (Fig. 44a–c). Where the carapace is concerned, juveniles have much narrower calcified inner lamella than adults (Yamada 2007). When studying ostracods it is necessary to illustrate as much as possible, even if some characters do not appear to be taxonomically important. However, since we are still learning about the ostracod phylogeny and trying to identify homologous structures, it might be useful for future studies to collect as much information as possible from all investigated species.

7 Trends and Application of Ostracods

In the light of recent concerns regarding climate change issues, ostracods have been intensively used as palaeoecological and palaeoclimatological indicators of the past environmental conditions and climatic changes and events. Analysis of ostracod assemblages can yield important information regarding the environmental conditions of a certain deposit, biostratigraphy, taphonomic processes, paleoclimate, palaeoceanography, and palaeobiogeography (Griffiths and Evans 1992; Wansard et al. 1997; Frenzel and Boomer 2005; Boomer et al. 2003; Danielopol et al. 2008, etc.). Ostracods are also often used to indicate and reconstruct past human activity (Palacios-Fest 1997; Palacios-Fest et al. 2002). All this is possible thanks to the chemical composition of the ostracod shell. The utility of ostracod shells has been brought forward especially with the development of the physical and chemical analyses. Inductively Coupled Plasma Spectrometry opened opportunities such as analyzing the Mg/Ca ratio in the ostracod shell, as an indicator of palaeotemperature; Sr/Ca ratio as an indicator of salinity; oxygen isotopes for salinity and temperature; and carbon isotope analysis as an indicator of the ecosystem productivity. The proportion of the ^{14}C in the ostracod shell can provide information of the age of the assembly. Apart from its chemical composition, the ostracod shell provides ecological information based on the level of calcification and ornamentation as well.

Although to a lesser extent, the ecological studies involve not only palaeo-assemblages, but also recent ostracods as indicators of pollution or seasonal changes (Wansard and Mezquita 2001; Mezquita et al. 1999b, 2001, etc.).

Ostracods were one of the first aquatic invertebrate groups to be studied with the allozyme electrophoresis techniques (Sywula and Lorenc 1982; Sywula 1989, 1992; Sywula et al. 1991, 1995). More recently, DNA sequencing has also been applied to ostracods, but not with great success, comparing with other groups. But, nevertheless, some DNA work has been done with different approaches: reproductive modes, population genetics, phylogeny, evolution of vision, and biogeography (Schön and Martens 2003).

The number of ostracod taxonomists is constantly decreasing because the major funding requires applied research where there is little or no space for taxonomy based on morphology. Also, because the field of ostracodology is dominated by paleontologists the importance of the looking in the soft part morphology in order to identify taxa is underestimated. Nevertheless, the finding of the well-preserved soft parts in fossils is increasing interest in the taxonomy based on the soft part morphology. Some remarkable discoveries which underpin the discrepancy between the taxonomy based on shell and taxonomy based on shell and soft parts, when interpreting phylogeny and zoogeography, may push forward ostracod taxonomy again. The increasing concern about global biodiversity issues, such as the disappearance of habitats and species, can play a positive role in giving taxonomy a new impetus.

8 Key to Ostracod Subclasses, Orders, and Suborders

1. A2 biramous: endopod reduced (1–3 segments), exopod strongly developed (up to nine segments). UR posterior to the anus . . . . . subclass Myodocopa (2)

– A2 biramous: endopod strongly developed (three to four segments), exopod moderate or greatly reduced (1–3 segments). UR anterior to the anus . . . subclass Podocopa (4)

2. Anterior rostrum on the carapace well developed; Md without large teeth on the coxa; Mxl and L5 both short and not leg like; L7 vermiform with numerous; annulations; male copulatory organ paired . . . order Myodocopida/suborder Myodocopina

– Anterior rostrum on the carapace well developed or absent; Md coxa with well-developed teeth; L5 leg like; L7 reduced or absent; male copulatory organ not paired . . . . suborder Halocypridina (3)

3. L5 and L6 leg like; L7 reduced . . . . suborder Halocypridina

– L5 leg like; L6 and L7 missing . . . . suborder Cladocopina

4. A2 exopod 2-segmented. . . . . .order Platycopida/suborder Platycopina

– A2 exopod strongly reduced. 5

5. Mxl with large branchial plate; only three postmaxillular appendages present (excluding UR and copulatory organ). . . . . .order Podocopida (6)

– Mxl without branchial plate, endopod leg like, there are four postmaxillular appendages (excluding UR and copulatory organ) . . . order Palaeocopida/suborder Kirkbyocopina

6. Zenker organ absent, sperm pump incorporated in copulatory organ. 7

– Zenker organ present 8

7. Branchial plate on L5 reduced and carrying maximum of four setae . . . suborder Cytherocopina

– Branchial plate on L5 well developed with many unreflexed and four reflexed setae. . . . . .suborder Bairdiocopina

8. L7 walking leg. 9

– L7 cleaning leg . . . . suborder Cypridocopina

9. UR well developed, each ramus with three to four terminal claws and one seta . . . Suborder Sigilliocopina

– UR reduced to seta(e) or absent . . . . .suborder Darwinulocopina

Material and Methods

The material that has been examined in order to provide illustrations for this book is listed below, but many more freshwater ostracods have been studied during the 15 years I have been working on the freshwater ostracod fauna.

1 List of the Species Examined

1. *Acocypris capillata* (Vávra 1895). Zanzibar, Tanzania. ZMH – K 27619a.
2. *Acocypris stenocyproides* (Klie 1938c). N Kivu, DR Congo. ZMK – CR-1505.
3. *Afrocythere rostrata* (Klie 1935a). Senegal. ZMK – CR-305a.
4. *Alicenula serricaudata* (Klie 1935a). Ivory Coast, ZMK – CR-292a.
5. *Amphtritecandona prima* Karanovic 2007. Eel Creek, Pilbara region, WA, Australia, 20°36′S 120°16′E, 30/09/2003; coll. M Scanlon and J Cocking.
6. *Areacandona akatallele* Karanovic 2007. Spring Bore, T182B, Pilbara region, WA, Australia, 21°49′S 118°54′E, 10/06/2005, coll. H Barron and J Cocking.
7. *Areacandona astrepte* Karanovic 2007. G707301104, Pilbara region, WA, Australia, 21°34′S 115°50′E, coll. M Scanlon, J Cocking and H Barron.
8. *Areacandona iuno* Karanovic 2007. MBSLK400A, West Stralley River, Pilbara region, WA, Australia, 20°36′S 119°07′E, 13/06/2003, coll. M Scanlon and J Cocking.
9. *Areacandona korallion* Karanovic 2007. Minson Well, Pilbara region, WA, Australia, 21°10′S 117°47′E, coll. M Scanlon and J Cocking.
10. *Areacandona triangulum* Karanovic 2007. Yarraloola well, Pilbara region, WA, Australia, 21°45′S 116°13′E, 05/04/2003, coll. M Scanlon and J Cocking.
11. *Bennelongia sp.* Heritage Claypan, WA, Australia, coll. Outback Ecology.
12. *Bradleystrandesia obliqua* (Brady 1868). Greece, coll. L Pesce.
13. *Bradleystrandesia parva* (Hartmann 1964). Kanhery, Salzette Island, Mumbai, India, collection of ZMH – K-27468.
14. *Candona acutula* Delorme 1967. Elfers Poll, Florida, USA, collection of SM – 138231.

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DOI 10.1007/978-3-642-21810-1_2,

15. *Candona caudata* Kaufmann 1900a. Lake Washington, Washington, USA, collection of SM – 180440.
16. *Candona crogmaniana* Turner 1894. Temporary pond, Medina, USA, collection of the SM – 67893.
17. *Candona lindneri* Petkovski 1969b. Spring Pavkovac, Lezimir, Fruska Gora, Serbia, 45°07′24″N 19°34′13″E, 14/10/1995, coll. I Karanovic.
18. *Candona neglecta* Sars 1887. River Sitnica, Beri, Montenegro, 42°26′N 19°11′E, 24/05/1997, coll. I Karanovic.
19. *Candona ohioensis* Furtos 1933. Bass Lake, USA, collection of SM – 67874.
20. *Candona piercei* Turner 1895. Lake Erie, Ohio, USA, collection of SM – 67870.
21. *Candona sigmoides* Sharpe 1897. Lake Erie, Ohio, USA, collection of SM – 67876.
22. *Candonocypris novaezelandiae* (Baird 1843b). South Mill Bore, Barrambie, Murchison region, WA, Australia, 27°26′S 119°07′E, 12/03/2010, coll. Outback Ecology.
23. *Candonopsis dedeckkeri* Karanovic 2007. Borehole well, Noreena 14, Pilbara region, WA, Australia, 09/07/2005, 22°24′S 120°20′E, coll. M Scanlon and J Cocking.
24. *Candonopsis kingsleii* (Brady and Robertson 1870). Periodical stream on the road for Tunjevo, Montenegro, 42°37′45″N 19°01′03″E, 01/05/1997, coll. I Karanovic.
25. *Candonopsis pilbarae* Karanovic 2007. Turee Creek Bore Field, Pilbara region, WA, Australia, 21°05′S 119°21′E, 20/05/2004, coll. M Scanlon and J Cocking.
26. *Caribecandona ansa* Broodbakker 1983a, b, c. Well, Dessalines, Haiti, 29/09/1979; collection of ZMA – Ost. 150800, types.
27. *Cryptocandona dudichi* (Klie 1930b). Collection of ZMK – CR-340.
28. *Cyclocypris ovum* (Jurine 1820). Resorvoir Slano, Niksic, Montenegro, 42°46′N 18°56′E, 11/06/1997, coll. T Karanovic.
29. *Cypretta cf. seurati* Gauthier 1929. Jones Creek Well, Millstream Aquifer, Pilbara region, WA, Australia, 21°35′S 117°04′E, 17/10/1996, coll. W Humphreys.
30. *Cypretta lemurensis* (Vávra 1895). Zanzibar, Tanzania, collection of ZMH – 1007.
31. *Cypria brevisetigera* Cole 1965. Spring Branch, Stokes Lane, Davidson County, Tennessee, USA, collection of SM – 120555.
32. *Cypria inversa* Klie 1941b. Lake Dorjan, Macedonia, collection of ZMK – CR-523.
33. *Cypria karamani* Petkovski 1976. Freshwater well, Peloponnesus, road Ghition-Kalamata, Kambos, Greece, 36″56′21.11″N 22°12′21.88″E, coll. GL Pesce, 11/04/1978.
34. *Cypria kerkyrensis* Klie 1936c. Korfu, Greece, collection of ZMK – CR-539.
35. *Cypria ophtalmica* (Jurine 1820). Well, Beri, Montenegro, 42°26′N 19°11′E, 27/09/1994, coll. T Karanovic.
36. *Cypria pusilla* Sars 1896a. Sydney, Australia, collection of NHMO – F11601.

37. *Cypria pustulosa* Sharpe 1897. Boehmins Cave, Medina County, Texas, USA, collection of SM – 11402.
38. *Cyprideis inermis* Klie 1939g. Type locality unknown. Collection of the ZMK – CR-92a.
39. *Cypridopsis vidua* (Müller 1776). Resorvoir Slano, Niksic, Montenegro, 42°46′N 18°56′E, 11/06/1997, coll. T Karanovic.
40. *Cyprinotus cingalenis* Brady 1886a. Government well, Pilbara region, WA, Australia, 23°51′49"S 120°09′02.4"E, 21/06/2004; coll. M Scanlon and J Cocking.
41. *Cypris busingiziensis* Klie 1938c. Busingizi, North Kiwu, DR Congo, collection of ZMK – CR-1047.
42. *Cytheridella damasi* Klie 1944. Kibuga Lake, Uganda, ZMK – 300a.
43. *Danielocandona lieshoutae* Broodbakker 1983c. Open well, Calabozo, Venezuela, ZMA – Ost.150.792.
44. *Darwinula stevensoni* (Brady and Robertson 1870). Skadar Lake, Montenegro, 42°14′25″N 19°06′27″E, 02/10/1994, coll. I Karanovic; mud around the reeds, S basin of the Lake Biwa, Shiga, Japan, 35°04′20.9″N 135°56′07.5″E, 14/11/2005, coll. R Smith.
45. *Deminutiocandona aenigma* Karanovic 2007. G707301104, Robe River, 21°34′S 115°14′E, 14/11/2002, coll. M Scanlon and J Cocking.
46. *Deminutiocandona atope* Karanovic 2007. Cane River Bore field, Pilbara region, WA, Australia, 21°40′S 115°22′E, 02/06/2005, coll. M Scanlon and J Cocking.
47. *Deminutiocandona stomachosa* Karanovic 2007. Turee Creek Bore Field, Pilbara region, WA, Australia, 23°22′S 117°57′E, 20/05/2004, coll. M Scanlon and J Cocking.
48. *Diacypris whitei* (Herbst 1958). Lake Carey, Murchison region, WA, Australia, 29°05′S 122°15′E, coll. Outback Ecology.
49. *Diaphanocypris meridana* (Furtos 1936b). Aiude Canna Fistula, Brazil, collection of ZMH – 1509.
50. *Entocythere donnaldsonensis* Klie 1931a. Collection of the ZMK – 312a, b.
51. *Eucandona rectangulata* (Alm 1914a, b, c). Canal S of Columbus, USA, collection of SM – 67868.
52. *Eucypris cf. virens* (Jurine 1820). Spring on the hill above the village, Gornja Seoca, Montenegro, 42°18′N 18°55′E, 21/01/1997, coll. T Karanovic.
53. *Eucypris pigra* (Fischer 1951). River Ribnica, Skadar Valley, Montenegro, 42°26′N 19°15′E, 07/07/1995, coll. T Karanovic.
54. *Fabaeformiscandona fabaeformis* (Fischer 1851). Periodical stream, Tunjevo, Niksic, Montenegro, 42°37′N 19°01′E, 01/05/1997, coll. T Karanovic.
55. *Globocypris trisetosa* Klie 1939a. Omo-Expedition, Nairobi, Kenya, collection of ZMH – 1503.
56. *Gomphocythere angulata* Lowndes 1932a. Collection of the ZMH – 309 b.
57. *Gomphodella aurea* Karanovic 2009. Dunny Bore, YAN13, Pilbara region, WA, Australia, 21°36′S 118°34′E, 09/06/2005, coll. J Cocking and H Barron.

58. *Gomphodella glomerosa* Karanovic 2006a, b. Lake Violet goldfield area, Wiluna, Murchison region, WA, Australia, 26°36′03″S 120°13′23″E, 18/05/1999, coll. W Humphreys.
59. *Gomphodella hirsuta* Karanovic 2006a. W126, Newman Borefield area, Pilbara region, WA, Australia, 23°23′44″S 119°44′12″E, 12/11/1998, coll. S Eberhard.
60. *Gomphodella martensi* Karanovic 2009. Ballards Well, GFS004, Pilbara region, WA, Australia, 22°55′S 115°42′E, 13/08/2004, coll. J Cocking and H Barron.
61. *Gomphodella quasihirsuta* Karanovic 2009. UAR002, Round Well, Pilbara region, WA, Australia, 22°53′S 115°28′E, 10/08/2004, coll. J Cocking and H Barron.
62. *Herpetocypris chevreuxi* (Sars 1896b). Spring Pavkovac, Lezimir, Fruska Gora, Serbia, 45°07′N 19°34E, 14/10/1995, coll. I Karanovic; Spring Barice, Bay of Boka Kotorska, Montenegro, 19/02/1995, coll. T Karanovic.
63. *Heterocypris incongrunes* (Ramdohr 1808). Spring, Ciganski Logor, Fruska Gora, Serbia, 45°11′N 19°43′E, 13/09/1994, coll. I Karanovic.
64. *Heterocypris reptans* (Kaufmann 1900a). Spring Tocurak, Gornji Crnci, Piperi, Montenegro, 42°31′N 19°14′E, 29/05/1994, coll. T Karanovic.
65. *Humphcypris chappuisi* (Klie 1935a, b, c, d). Man, Ivory Coast, 07°24′N 07°32′W, collection of ZMK – CR-960.
66. *Humphreyscandona capillus* Karanovic 2007. Eel Creek, Pilbara region, WA, Australia, 20°36′S 120°16′E, 03/09/2003, coll. M Scanlon and J Cocking.
67. *Humphreyscandona ventosa* Karanovic 2007. NWSLK58, House Creek, Pilbara region, WA, Australia, 15/05/2005, coll. M Scanlon and J Cocking.
68. *Humphreyscandona waldockae* Karanovic and Marmonier 2003. Ebathacalby Well, Fortescue River, Pilabara region, WA, Australia, 22°14′S 118°44′E, 25/07/1997; coll. W Humphreys and S Eberhard.
69. *Hungarocypris madaraszi* (Örley 1886). Wolgou, Ostraiboum, collection of ZMH – 1508.
70. *Ilodromus sp.* Paroo Station, Jarvie Well, Wiluna, WA, Australia, 26°36′S 120°13′E, 25/06/1998, coll. S Eberhard.
71. *Ilyocypris bradyi* Sars 1890. Mareza Spring, Podgorica, Montenegro, 42°26′N 19°15′E, 13/03/1998, coll. I Karanovic.
72. *Ilyocypris gibba* (Ramdohr 1808). Kapetanovo Lake, Montenegro, 42°48′53″N 19°13′54″E, 24/07/1997, coll. I Karanovic.
73. *Indocandona nagarjuna* Karanovic and Ranga Reddy 2008. Bore-well at Block II in Acharya Nagarjuna University Campus, Nagarjunanagar, 13 km ENE of Guntur Town, state of Andhra Pradesh, India, 16°18′N 80°29′E, 96/2005, coll. Y Ranga Reddy.
74. *Isocypris beauchampi* (Paris 1920b). Holstein, Germany, collection of ZMH – 763.
75. *Kempfcyclocypris australis* Karanovic 2011. TR14 (B). NSW, Australia, 31°18′S 151°09′E, 10/02/2006, coll. P Hancock.

76. *Kencandona harleyi* Karanovic 2007. Box Soak well, Pilbara region, WA, Australia, 20°56′S 119°57′E, 06/05/2005, coll. H Barron and M Scanlon.
77. *Kencandona verrucosa* Karanovic 2007. Robe 1A, Pilbara region, WA, Australia, 21°34′S 115°52′E, 11/11/2004, coll. M Scanlon and J Cocking.
78. *Keysercypria affinis* (Klie 1933b). Pos di Tanki Onima, Bonaire, Netherlands Antilles, collection of ZMH – 538.
79. *Keysercypria deformis* (Klie 1940e). Lagoa do Alto Branco. Brazil, collection of ZMH – 550.
80. *Keysercypria obtusa* (Klie 1940e). Casa Forte, Brazil, Collection of ZMH – 524.
81. *Klieopsis horai* (Klie 1927a). Kangra Valles, Punjab, India, collection of ZMH – 10952.
82. *Kovalevskiella rudjakovi* (Danielopol 1970). Lesbos, Greece, coll. L Pesce.
83. *Latinopsis patagonica* Karanovic and Datry 2009. Magallanes and Antártica Chilena Region, Madre de Dios Archipelago, Pacific cave area, 50°22′35″S 75°27′24″W, 25/01/2006, coll. T Datry.
84. *Leicacandona halsei* Karanovic 2007. Carlinda station, Pilbara region, WA, Australia, 20°48′S 119°29′E, coll. M Scanlon and J Cocking.
85. *Leicacanodna carinata* Karanovic 2007. Stuart Wells, Pilbara region, WA, Australia, 21°57′S 119°39′E, coll.J Cocking and H Barron.
86. *Leptocythere pseudoproboscidea* Karanovic and Petkovski 1999a. Mareza spring, Tolosi, Podgorica, Montenegro, 42°26′N 19°15′E, 08/12/1997, coll. I Karanovic.
87. *Limnocyhtre neotropica* Klie 1934a. Rio de la Plata, Argentina, collection of the ZMH – 762a.
88. *Limnocythere coelebs* Klie 1944. Lake Edward, collection of the ZMH – 71a.
89. *Limnocythere dorsosicula* De Deckker 1982c. Yardie pool, Cape range, WA, Australia, 22°06′09″S 113°53′22″E, 13/08/1997, coll. S Eberhard and W Humphreys.
90. *Loxoconcha dimorpha* Hartmann 1959. Collection of the ZMH – 28132b.
91. *Martenscypridopsis materia* Karanovic and Pesce 2000a. Freshwater well, Tindouf, Algeria, 05/12/1973, coll. L Pesce.
92. Martens K, Svatenalintop S (2011) A subjective checklist of the Recent, free-living, non-marine Ostracoda (Crustacea). Zootaxa, Monograph 2855:1–79.
93. *Megalocypris durbani* (Baird 1862). Porth Elizabeth, South Africa, collection of ZMH – 1507.
94. *Meischcandna boitanii* Karanovic 2001. Sangna River, Mali, 17°00′N 04°00′W, 09/12/1993, coll. GL Pesce.
95. *Meridiescandona facies* Karanovic 2003c. Yandicoogina Mine, Pilbara region, WA, Australia, 22°49′S 119°16′E, 04/08/1999, coll. S Anstee.
96. *Meridiescandona lucerna* Karanovic 2003a, b, c. Battle Hill Well, Roy Hill Station, Pilbara region, WA, Australia, 22°44′S 120°08′E, 08/09/2000, coll. W Humphreys and J Waldock.
97. *Meridiescandona marillanae* Karanovic 2007. Marillana, Pilbara region, WA, Australia, 22°47′S 119°15′E, coll. J Cocking and H Barron.

98. *Mytilocypris mytiloides* (Brady 1886b). Albany, WA, Australia, 35°01S′ 117°53′E, 07/09/2007.
99. *Nealecypris obtusa* (Klie 1933a). Weetexreden W. Pan, South Africa, collection of ZMK – CR-1071a.
100. *Neozonocypris congensis* Klie 1944. Type locality unknown, collection of the ZMK – CR-1155.
101. *Newnhamia patagonica* (Vávra 1898). Pond at Torres del Paine National Park, Magallanes y Antártica Chilena, South Patagonia, Chile, 50°58′S 72°57′W, coll. T Datry.
102. *Newnhamia thomseni* Klie 1935c. Montevideo, Uruguay, 34°50′S 56°10′W, collection of the ZMK – CR-608.
103. *Notacandona boultoni* Karanovic and Marmonier 2003. Weeli Willi, Pilbara region, WA, Australia, 16/11/1998, coll. S Eberhard.
104. *Notacandona modesta* Karanovic and Marmonier 2003. Road to Area C, Pilbara region, WA, Australia, 23°00′S 119°07′E, 17/11/2003, coll. M Scanlon and J Cocking.
105. *Notodromas persica* Gurney 1921. Otranto, Puglia, Italy, 40°08′52″N 18°29′52″E, 01/06/1975, coll. GL Pesce.
106. *Oncocypris chappuisi* Klie 1939a. Type locality unknown, collection of the ZMK – CR-1454.
107. *Origocandona gromikae* Karanovic 2007. Near Newman Mountains, Pilbara region, WA, Australia, 23°14′S 119°33′E, July/2003, coll. M Scanlon and J Cocking.
108. *Origocandona inanitas* Karanovic 2005b. Bore T401, Newman Borefield Area, Pilbara region, WA, Australia, 23°16′S 119°52′E, coll. WF Humphreys, J Bradbury, and K Armstrong.
109. *Paralimnocythere karamani* (Petkovski 1960a). Matica Rijeka, Baloci, Cemovsko Polje, Montenegro, 42°26′53″N 19°15′34″E, 28/02/1994, coll. I Karanovic.
110. *Paralimnocythere ochridense* (Klie 1934a). Collection of the ZMH – 73a.
111. *Pelocypris lenzi* Klie 1939c. Acuda Piaba, Brazil, collection of ZMK – CR-767.
112. *Penthesilenula brasiliensis* (Pinto and Kotzian 1961). The Tunnel, Lake Cave, Margaret River, WA, Australia, 33°57′04″S 115°04′27″E, 09/04/2002, coll. S Eberhard.
113. *Physocypria capensis* (Sars 1895). Omo National Park, water hole near the Farm Blaine Petrival, Ethiopia, 06°00′N 35°50′E, coll. PA Chappuis, 19/11/1932, ZMH – 541.
114. *Physocypris bullata* (Vávra 1897). Parc National de Virunga, DR Congo, coll. Damas, 13/01/1936, ZMH – 1242.
115. *Pierrecandona posteriorrecta* Karanovic 2007. Six Mile Well, Pilbara region, WA, Australia, 22°01′S 116°06′E, 11/08/2004, coll. M Scanlon and J Cocking.
116. *Pilbaracandona eberhardi* Karanovic and Marmonier 2003. Bore W260, Pilbara region, WA, Australia, 23°17′S 119°52′E, 13/10/2004, coll. H Barron and J Cocking.

117. *Pilbaracandona kosmos* Karanovic 2007. At Production Bore, Pilbara region, WA, Australia, 23°17′S 119°52′E, 08/05/2005, coll. M Scanlon and J Cocking.
118. *Pioneercandonopsis hancocki* Karanovic 2005c. Bore, Pioneer Valley, Queensalnd, Australia, 21°08′S 148°35′E, 26/06/2003, coll. P Hancock.
119. *Platicypris baueri* Herbst 1957. Albany, WA, Australia, 35°01S′ 117°53′E, 07/09/2007.
120. *Plesiocypridopsis newtoni* Brady and Robertson 1870. Freshwater well, farm Panareo, Agro di Veglie, Apulia, Italy, 41°15′N 16°15′E, 27/12/1975, coll. GL Pesce.
121. *Potamocypris arcuata* (Sars 1903b). Well, Beri, Montenegro, 42°26′N 19°11′E, 17/09/1997, coll. T Karanovic.
122. *Potamocyris fulva* (Brady 1868). Spring Jablan, Korjeni, Montenegro, 15/06/1997, coll. I Karanovic.
123. *Prionocypris zenkeri* (Chyzer and Toth 1858). Plavsko Jezero, Montenegro, collection of ZMH – 1573.
124. *Pseudocypridopsis clathrata* (Klie 1937a). Vrtlog, spring before the bridge, Zeta river, Podgorica, Montenegro, 42°26′N 19°15′E, 27/05/1994, coll. T Karanovic.
125. *Pseudolimnocythere hartmanni* Danielopol 1979. Spring near the beach, Ag. Nicolaos, Korinth, Greece, 37°56′17″N 22°55′56″S, 09/04/1974, coll. GL Pesce.
126. *Pseudostrandesia striatoreticulata* (Klie 1932). Toba Gyct T.33, Sumatra, collection of ZMH – 837.
127. *Psychrodromus fontinalis* (Wolf 1920). Spring above Dradovica Polje, Moracka Kapa, Montenegro, 42°51′N 19°19′E, 14/06/1997, coll. I Karanovic.
128. *Psychrodromus olivaceus* (Brady and Norman 1889). Ivanova Korita spring, Lovcen, Montenegro, 42°22′N 18°50′E, 12/05/1998, coll. I Karanovic.
129. *Riocypris hinzeae* Karanovic 2008a. Friday Well, Murchison region, WA, Australia, 28°04′S 120°04′E, 28/06/2000; coll. W Humphreys.
130. *Sarscypridopsis ochracea* (Sars 1924). Albany Well. Yeelirrie Station, Murchison region, WA, Australia, 27°17′S 120°06′E, coll. Subterranean Ecology.
131. *Sclerocypris jenkinae* Klie 1933c. Elgore, East Africa, collection of ZMH – 996.
132. *Sclerocypris sarsi* Martens 1986. Eliazar Pan, South Africa, collection of ZMH – 770.
133. *Stenocypris bolieki* Ferguson 1962. Cadgewarinna well, Jule River Water Corporation, Pilbara region, WA, Australia, 25/10/1996, coll. W Humphreys.
134. *Strandesia kimberleyi* Karanovic 2005a. Argyle Diamond mine, Kimberley region, WA, Australia, 16°42′S 128°27′E, 10/10/2002, coll. W Humphreys.
135. *Tanycypris pellucida* (Klie 1932). Sumatra, collection of ZMH – 1070.
136. *Terrestricandona minuta* Danielopol and Betsch 1980. Leaf litter, Massif du Marojezy, 1,450 m, Madagascar, collection of NHMP – Os.35 (type material).

137. *Trajancandona particula* Karanovic 1999b. Sutimska Jama, Beri, Montenegro, 42°26′N 19°11′E, 03/02/1997, coll. T Karanovic.
138. *Trapezicandona sp*. Greece, coll. GL Pesce.
139. *Typhlocypris annae* (Méhes 1914). Cape Code, Massachusetts, USA, collection of SM – 71421.
140. *Typhlocypris elliptica* (Furtos 1933). South Bass Island, Ohio, USA, collection of the SM – 67869.
141. *Typhlocypris fluviatilis* (Hoff 1942). Ford County, USA, collection of the SM – 81066.
142. *Typhlocypris parvula* (Sars 1926). Temporary pond, Ohio, USA, collection of the SM – 67871. Marbling Brook, WA, Australia, 31°29′S 116°12′E, 19/12/2000, coll S Schmidt.
143. *Typhlocypris punctata* (Furtos 1933). Bass Lake, Ohio, USA, collection of the SM – 67875.
144. *Vestalenula sp*. Weeli Wolli Spring, surface pool, Pilbara region, WA, Australia, 23°54′09″S 118°42′44″E, 16/11/1998, coll. S Halse.
145. *Vestalenula matildae* Martens and Rossetti 2002. Horrigan Pool, TCS002, Pilbara region, WA, Australia, 23°33′06″S 118°15′16.7″E, coll. S Halse.
146. *Zonocypris glabra* Klie 1944. DR Congo, collection of ZMH – 10952.

2 Taxonomic Methods

For each taxonomic unit there is a diagnosis provided. It is based on the most recent publications dealing with the taxon, in most cases amended in this book. The genera and species are listed in the alphabetical order. The list of species contains information on the type locality and the repository of the type material, if known. The information regarding the repository locations comes from the publications or from people in different museums who kindly sent me these data (see the acknowledgments). The keys to species are created based on the original descriptions or the most recent redescription of the taxon. There are only a couple of cases where the keys down to species level are not provided, mostly due to the unresolved systematic problems. All the species that are not included in the key are also listed, and in most cases, their most similar congeners, most probably senior synonyms, are quoted as well. Since the key provides only a limited number of characters it is important to compare the species one wants to identify with all similar congeners in order to avoid wrong identification, and in case the character used in the key proves to be variable in the future. The species list were created also with the aid of the Kempf database (Kempf 1980a, b, c, d, 1991, 1997a, b, c, d) and the most recent check list of the recent non-marine ostracods (Martens and Savatenalinton 2011).

3 Map Creation

The maps of distributions are created using the Map Creator (http://www.primap.com/en/). The dots on the map are mostly the localities from where the species has been described. Not all the records of a certain species have been plotted on the map. There are two reasons: one is that the maps would be unreadable, and some species would need to have maps on their own, and the other is that in many cases the record of the species is not accompanied by a description or illustration, so the authenticity of the finding may be doubtful. Geographic distribution of some species that are known from wide areas, such as Palearctic, Holarctic, and Cosmopolitan, is marked with a line. In the case when species was recorded from two far away localities, for example Europe and Africa, both dots would be given on the map. However, if the species was recorded from many localities in, for example, southern part of Africa, then only the type locality would be plotted. In any case, the distribution maps in this book are intended to give a general overview of the genus distribution and to be as clear as possible.

4 Abbreviations for the Repositories

AM	Albany Museum, Grahamstown, South Africa
AMS	Australian Museum, Sydney
BM	British Museum/British Museum of Natural History/Natural History Museum, London
CASG	Museum of the Department of Geology, Panjab University, Chandigarh, India
CM	Canterbury Museum, UK
CPC	Commonwealth Palaeontological Collection, Canberra, Australia
DAIE	Department of Agrobiology, Institute of Ecology, Polish Academy of Science
DBSMU	Department of Biological Sciences, Madurai University, India
DGOUB	Department of Geology and Oceanography, University of Bordeaux, France
DGUG	Department of Genetics, University of Gdańsk, Poland
DGUK	Department of Geology, University of Kansas, Lawrence, USA
DPS–ASM	Department of Paleontology and Stratigraphy, Academy of Sciences of Moldova, Chisinau
EHSLT	Ecology of Hydrosystems Laboratory, University Paul Sabatier, Toulouse, France
FIB	Fisheries Institute Barcelona, Spain
GIP	Geological Institute, Prague, Czech Republic

GMUS	Geological Museum, University of Saskatchewan, Saskatoon, Canada
GSC	Geological Survey of Canada
HM	Hancock Museum (Great North Museum), Newcastle upon Tyne, UK
HMNH	Hungarian Museum of Natural History, Budapest
HU	Heilongjiang University, Harbin, China
HUJ	Hebrew University, Jerusalem, Israel
IBIW–RAS	Institute of the Biology of Inland Waters, Russian Academy of Science, Borok
ICN–MHN	Institute of Natural Science, Museum of Natural History, National University of Colombia, Bogota
IHB-CAS	Institute of Hydrobiology, Chinese Academy of Science, Wuhan, China
IMB–RAS	Institute of Marine Biology, Russian Academy of Science, Vladivostok
ISER	Institute of Speleology “Emil Rakovitza”, Cluj–Napoka, Romania
ISGS	Illinois State Geological Survey, Urbana, USA
IZUP	Institute of Zoology, University of Parma, Italy
LMUBA	Laboratory of Micropaleontology, Faculty of Exact and Natural Sciences, University of Buenos Aires, Argentina
LBM	Lake Biwa Museum, Kusatsu, Japan
LIM	Limnological Institute Mondsee, Austria
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge
MNHL	Museum of Natural History, Luxemburg
MNHV	Museum of Natural History, Verona, Italy
MNSS	Museum of Natural Sciences, Split, Croatia
MNZ	Museum of New Zealand Te Papa Tongarewa (former National Museum of New Zealand), Wellington
MZUSP	Zoological Museum, University of São Paulo, Brazil
NHMB	Natural History Museum, Basel, Switzerland
NHMBU	Natural History Museum, Bukarest/“Grigore Antipa” National Museum of Natural History, Romania
NHMF	Natural History Museum, Florence, Italy
NHMG	Natural History Museum, Geneva, Switzerland
NHMLP	Natural History Museum, La Plata, Argentina
NHMM	Natural History Museum, Madrid, Spain
NHMO	Natural History Museum, Oslo, Norway
NHMP	Natural History Museum, Paris/National Museum of Natural History, France
NHMS	Natural History Museum, Skopje, Macedonia/Prirodonaucen Muzej na Makedonija
NHMV	Natural History Museum, Vienna, Austria

NMNSO	National Museum of Natural Science/Canadian Museum of Nature, Ottawa
NMV	National Museum Victoria, Melbourne, Australia
NSMT	Natural Science Museum, Tokyo, Japan
NZGSW	New Zealand Geological Survey, Wellington
OMD	Otago Museum, Dunedin, New Zealand
PAU	Department of Zoology, Punjab Agricultural University, India
PCUA	Paleontological Collection, University of Akron, Ohio, USA
PM–UFRGS	Paleontological Museum, University of Rio Grande do Sul, Brazil
QM	Queensland Museum, Brisbane, Australia
RBINS	Royal Belgian Institute of Natural Science
RIS	Research Institute Senckenberg/Senckenberg Museum
RMCA	Royal Museum for Central Africa (former Musée Royal du Congo Belge), Tervuren, Belgium
SAFM	South African Museum, Cape Town
SAM	South Australian Museum, Adelaide
SJU	Shujitsu Joshi University, Okayama, Japan
SM	Smithonian National Museum of Natural History (former US National Museum), Washington DC, USA
SMNH	Swedish Museum of Natural History/Naturhistoriska Riksmuseet
SMS	State Museum of Natural History, Stuttgart, Germany
SMW	State Museum of Windhoek, Namibia
SNM	Slovakian National Museum, Bratislava
TMAG	Tasmanian Museum and Art Gallery, Hobart, Australia
UFRGS	Federal University of Rio Grande do Sul, Porto Alegre, Brazil
UH	University of Hull, UK
UMT	University Museum, Tokyo, Japan
WAM	Western Australian Museum, Perth
ZIANP	Zoological Institute “Dr Augusto Nobre”, Faculty of Science, Porto, Portugal
ZIHU	Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan
ZIPAS	Zoological Institute, Polish Academy of Science, Poznań
ZISP	Zoological Institute, Russian Academy of Science, St. Petersburg
ZIUAS	Zoological Institute, Ukrainian Academy of Science, Kiev
ZIUC	Zoological Institute, University of Cagliari, Italy
ZMU	Zoological Museum/Museum of Evolution (former Natural History), Uppsala University, Sweden
ZMA	Zoological Museum Amsterdam, Netherlands
ZMB	Zoological Museum Berlin/Humboldt University Natural History Museum/Institute for Systematic Zoology (former Royal Zoological Museum of Berlin), Germany
ZMC	Zoological Museum Copenhagen, Denmark
ZMG	Zoological Museum, University of Greifswald, Germany

ZMH	Zoological Museum Hamburg, Germany
ZMK	Zoological Museum, University of Kiel, Germany
ZML	Zoological Museum, Lund University, Sweden
ZSI	Zoological Survey of India, Kolkata

5 Abbreviations Used in Text and Figures

A1 antennula; *A2* antenna; *CMS* central muscle scars; *CIL* calcified inner lamella; *H* height; *L* length; *L5* fifth limb; *L6* sixth limb; *L7* seventh limb; *LV* left valve; *Md* mandibula; *MPC* marginal pore canals; *Mxl* maxillula; *P-abd* postero-abdomen in Darwinuloidea; *UR* uropodal ramus; *W* width.

Part II
Systematics

Superfamily Cytheroidea Baird 1850 (Suborder Cytherocopina Gründel 1967)

According to Liebau (2005), the suborder Cytherocopina is subdivided into two infraorders: Archaeocytherinina Liebau 1991 and Nomocytherinina Liebau 1991. However, at least three superfamilies cannot fit into either of the proposed infraorders, so this systematic division is not widely accepted and will not be considered here.

Suborder Cytherocopina contains about 15 superfamilies, most of which are known only after fossils, and only the superfamily Cytheroidea has representatives in freshwater ecosystems.

Diagnosis (after Horne et al. 2002): Carapace mostly 1 mm long or less, shape extremely variable (elongate, quadrate, round, etc.) (Figs. 1 and 2). Valves smooth or strongly ornamented with spines, nodes, ridges, alae, etc. (Figs. 1–3). Valves usually with well-developed fused zone and CIL, often with selvages and lists. Hinge well developed, complex, and rarely adont (Fig. 4). CMS pattern consists of four or five scars in a vertical row (Figs. 5a, b and 6b). Sieve pores present (Fig. 6a) or absent. Females with seven pairs of appendages, UR reduced. A1 5- to 7-segmented (Figs. 8 and 6e). Exopod on A2 representing a segmented or unsegmented spinneret seta connected to a gland at the base of the limb, sometimes sexually dimorphic (Fig. 7). Md vibratory plate with up to seven setae (Fig. 9). Mxl with a large vibratory plate (Fig. 10) bearing .unreflexed setae and up to four reflexed setae. Male brush-shaped organ present (Fig. 11d). L5, L6, and L7 walking legs, sometimes sexually dimorphic (Figs. 12 and 6c, d, g). Hemipenis with sperm pump incorporated (no Zenker organ) (Figs. 13, 14, 6d). In males, UR incorporated in hemipenis. Females sometimes with extended posterior brood chamber.

The following families are represented in the freshwater ecosystems: Cytherideidae, Entocytheridae, Kliellidae, Leptocytheridae, Limnocytheridae, and Loxoconchidae. In the publication of Martens et al. (2007), families Cytheruridae and Xestoleberididae were included in the list of ostracod families with recent freshwater representatives. However, all these species have been found in highly saline waters, such as marine bays, estuarine waters, mangroves, and at the most brackish waters; therefore, they are not included in this book.

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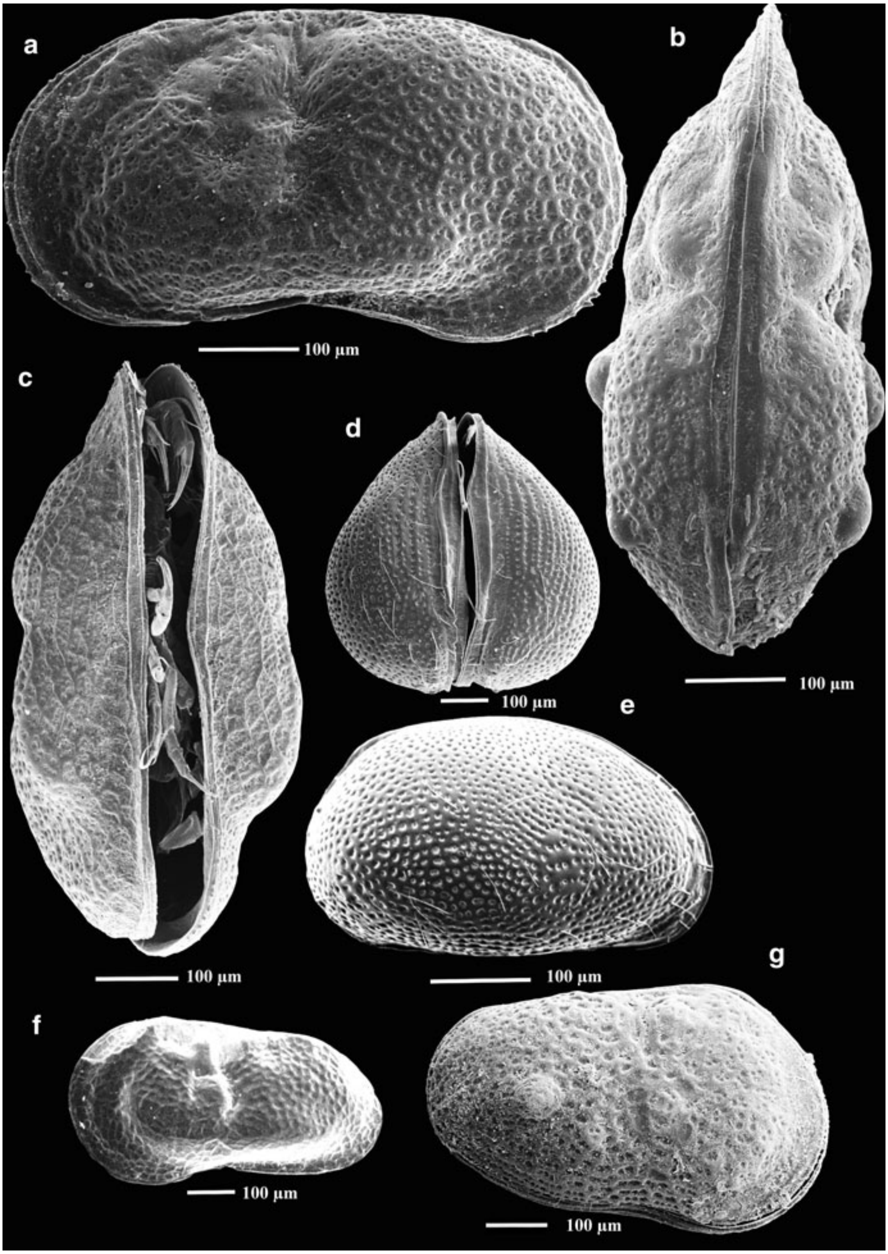

Fig. 1 SEM: (**a**, **b**, **c**) *Limnocythere inopinata* (Baird 1843a); (**d**, **e**) *Metacypris cordata* Brady and Robertson 1870; (**f**) *Leucocythere mirabilis* Kaufmann 1892; (**g**) *Cytherissa lacustris* Sars 1863: (**a**, **f**) lateral view from the left side; (**b**) dorsal view; (**c**, **d**) ventral view; (**e**, **g**) lateral view from the right side. Photos: D. Keyser

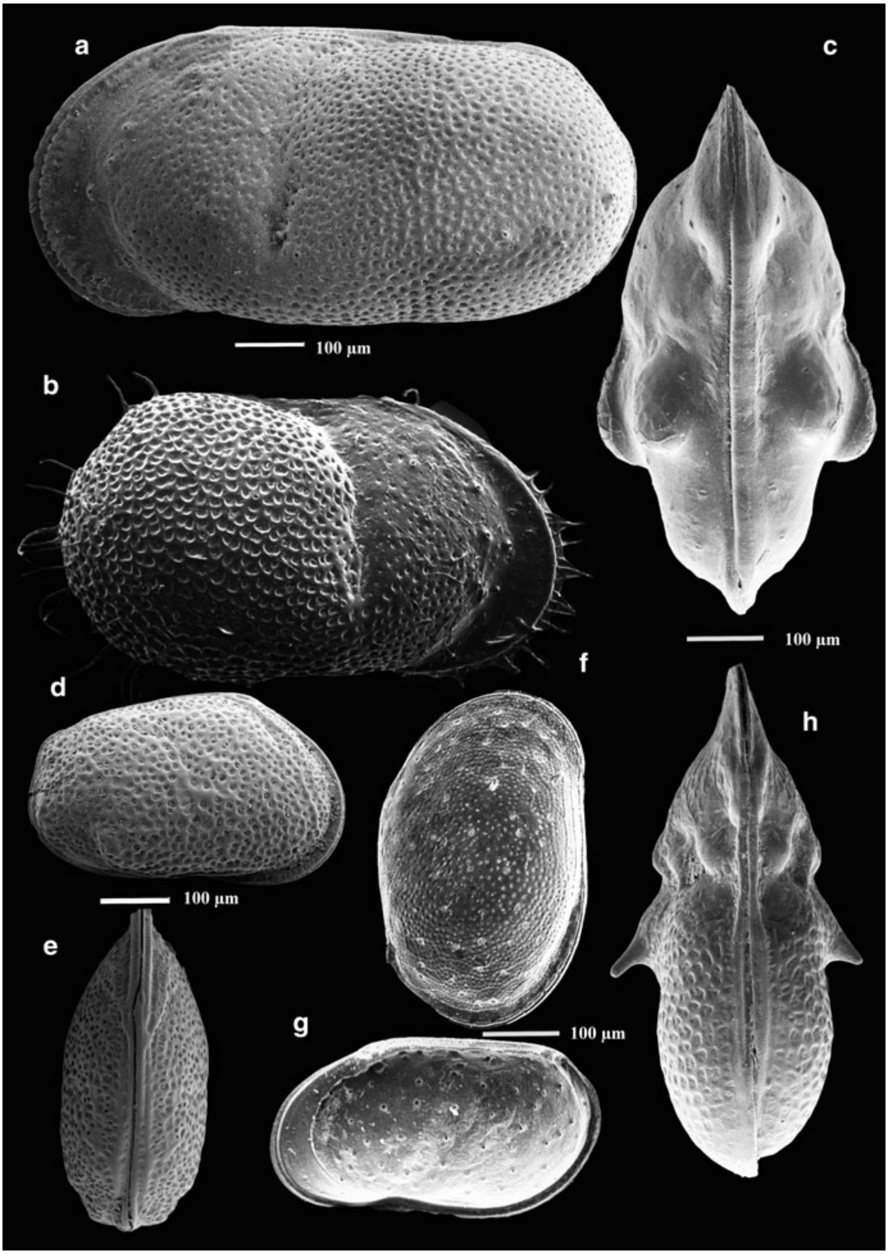

Fig. 2 SEM: (**a**) *Gomphocythere sp*.; (**b**) *Cytheridella sp*.; (**c**) *Paralimnocythere karamani* (Petkovski 1960a); (**d**, **e**) *Cytheromorpha fuscata* (Brady 1869); (**f**, **g**) *Loxoconcha elliptica* Brady 1868; (**h**) *Limnocythere scutariense* Petkovski 1961: (**a**) LV, outside view; (**b**, **d**, **f**) RV, outside view; (**c**, **e**, **h**) dorsal view; (**d**), RV, inside view. Photos: D. Keyser.

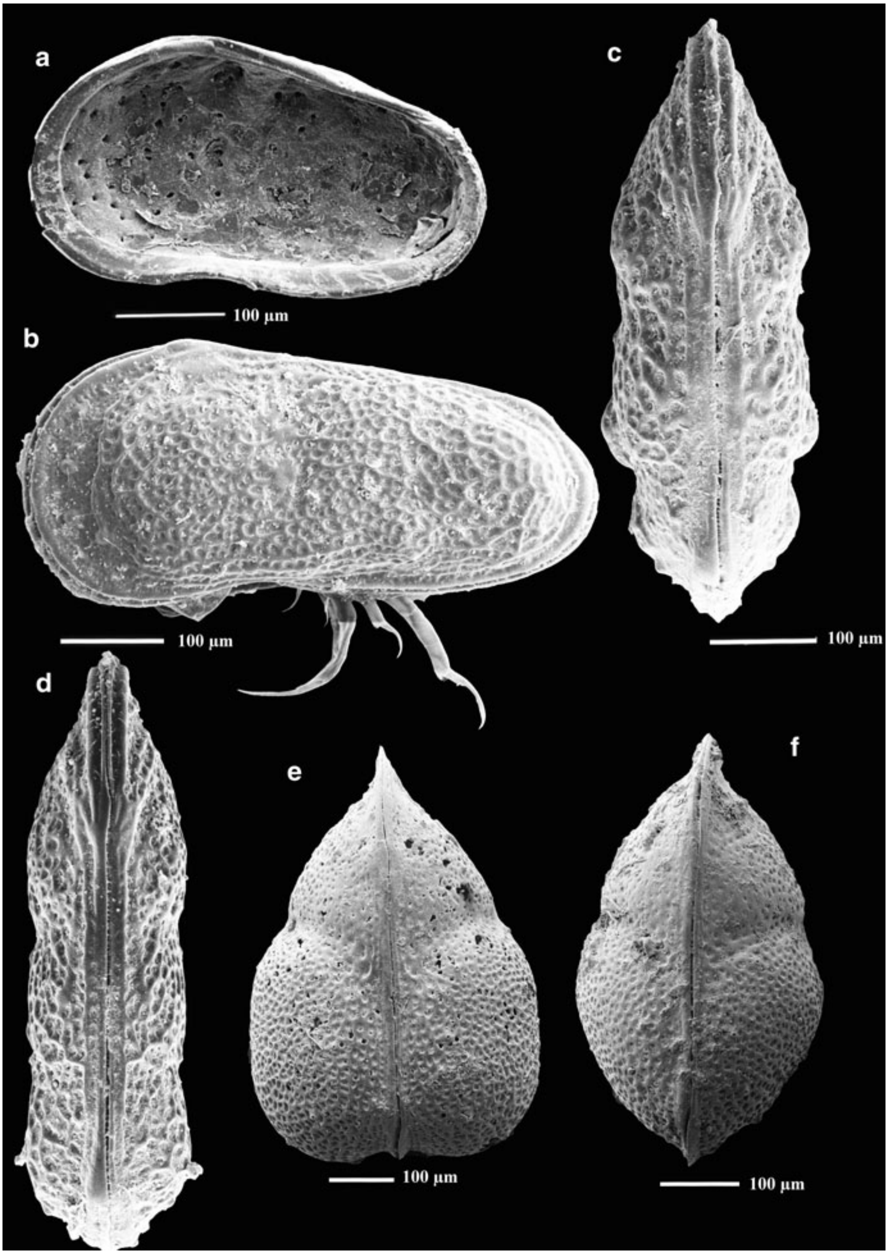

Fig. 3 SEM: (**a**) *Cytherissa lacustris* Sars 1863; (**b**–**d**) *Leptocythere ostrovskensis* Petkovski and Keyser 1992; (**e**, **f**) *Gomphodella sp.*: (**a**) RV, inside view; (**b**) lateral view from the right side; (**c**, **e**) dorsal view, ♀; (**d**, **f**) dorsal view, ♂. Photos: D. Keyser

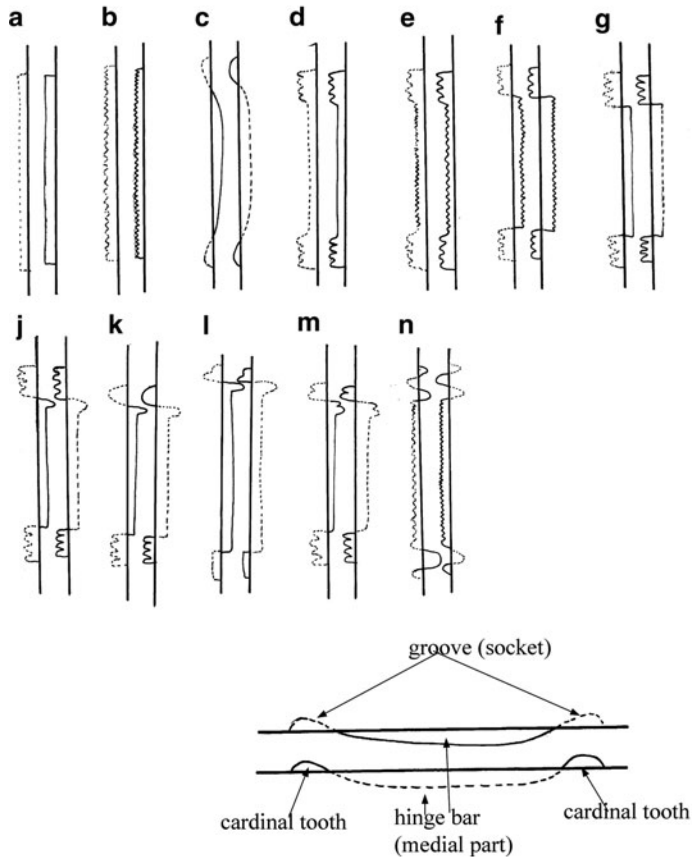

Fig. 4 Hinge types (**a**) adont; (**b**) prionodont; (**c**) lophodont; (**d**)–(**g**) merodont types; (**h**) entomodont; (**i**) lobodont; (**k**)–(**l**) amphidont types; (**m**) schizodont; (**n**) gongylodont. Modified after Scott (1961)

Key to the families with freshwater representatives

1. Male L6 asymmetrical, those on the left side normally developed, on the right side transformed .... Cytherideidae Sars 1925

– Male L6 not asymmetrical, but sometimes transformed 2

2. Mxl with only one masticatory lobe (Fig. 10e) ...... Entocytheridae Hoff 1942

– Mxl with three masticatory lobes (Fig. 10c) 3

3. Mxl vibratory plate reduced and with only two or three setae...Kliellidae Schäfer 1945

– Mxl vibratory plate not reduced and with numerous setae (Fig. 10f) 4

4. Terminal segment of A2 with three claws (Fig. 7a, d) ... Limnocytheridae Klie 1938a

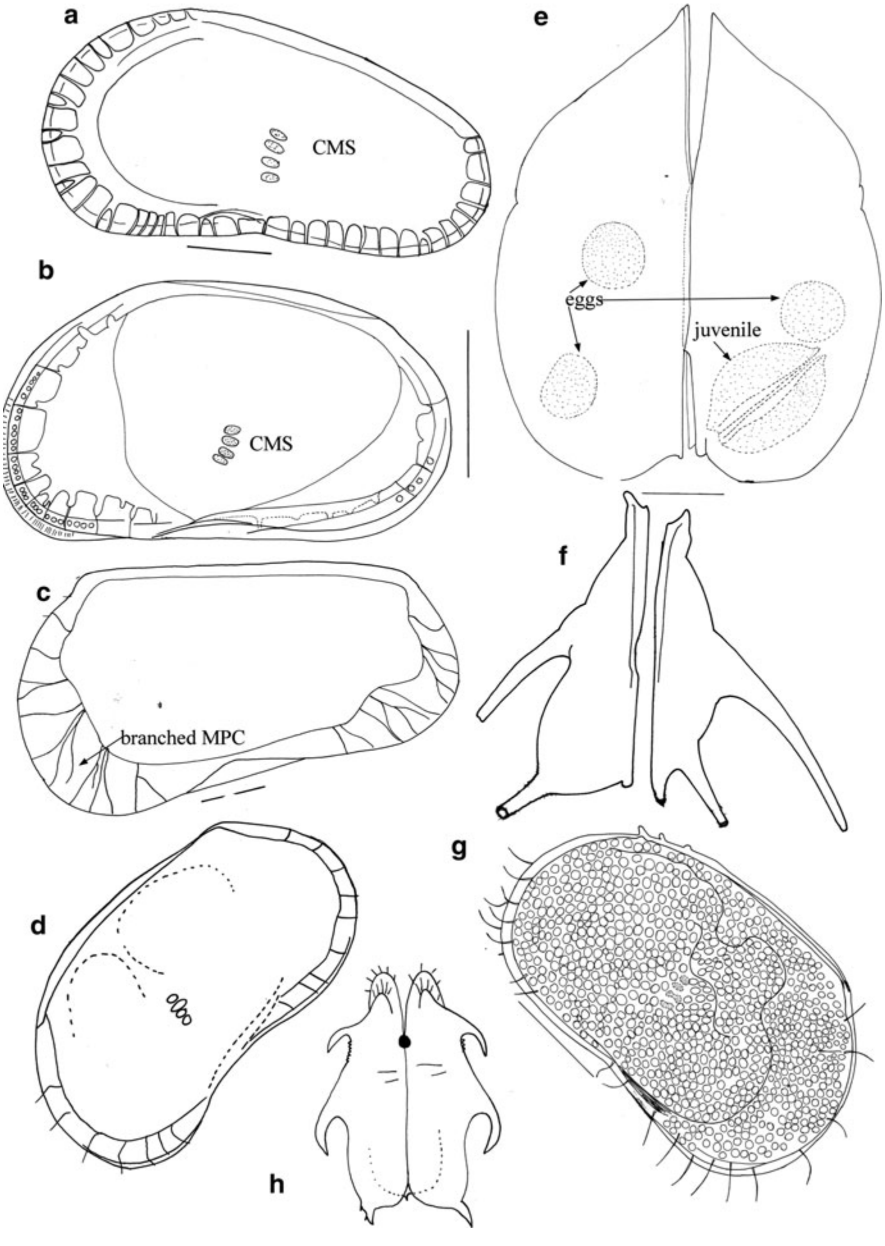

Fig. 5 Line drawings: (**a**) *Leptocythere pseudoproboscidea* Karanovic and Petkovski 1999a; (**b**) *Pseudolimnocythere hartmanni* Danielopol 1979; (**c**) *Paralimnocythere karamani* (Petkovski 1960a); (**d**) *Koranocythere ugiensis* Martens 1996; (**e**) *Gomphodella hirsuta* Karanovic 2006a; (**f**) *Kovalacythereis braconensis* Wouters 1979; (**g**) *Limnocythere dorsosicula* De Deckker 1982c; (**h**) *Neolimnocythere hexaceros* Delachaux 1927: (**a**–**c**) RV inside view; (**d**, **g**) carapace outside view; (**e**, **f**, **h**) carapace, dorsal view. Scales = 0.1 mm. (**d**) modified after Martens (1996): p. 57, Fig. 3a; (**f**) modified after Wouters and Martens (2000): p. 214, Plate 4, Fig. 5; (**h**) modified after Delachaux 1928: p. 73, Fig. 46

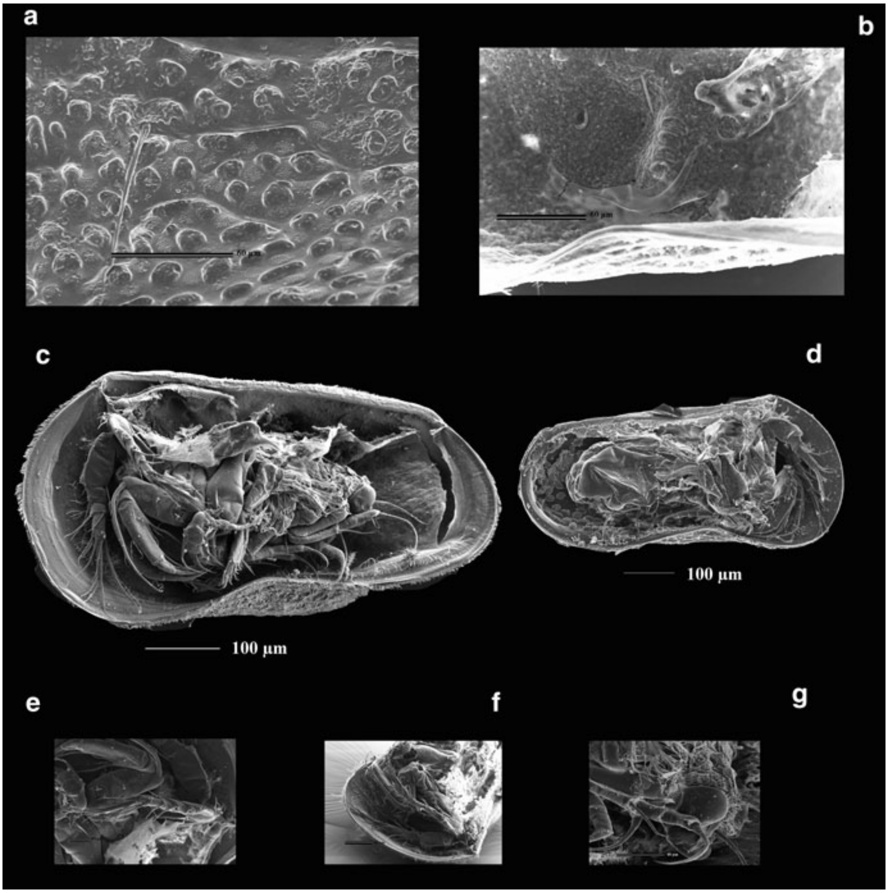

Fig. 6 SEM: (**a**) *Gomphodella aurea* Karanovic 2009; (**b**–**g**) *Paralimnocythere karamani* (Petkovski 1960a): (**a**) detail of the surface; (**b**) CMS; (**c**) ♀, inside view; (**d**) ♂, inside view; (**e**) A1; (**b**) frontal view; (**g**) genital field of ♀

– Terminal segment of A2 with two claws (Fig. 7g) 5

5. Md vibratory plate with only two setae ....Leptocytheridae Hanai 1957

– Md vibratory plate with four setae ....Loxoconchidae Sars 1925

1 Family Cytherideidae Sars 1925

Diagnosis (after Hartmann and Puri 1974 and Meisch 2000): Carapace ovate, reniform, or quadrate. Valves heavily calcified, often ornamented. Vestibulum sometimes absent. MPC numerous, straight or bifurcate, often long. Four CMS

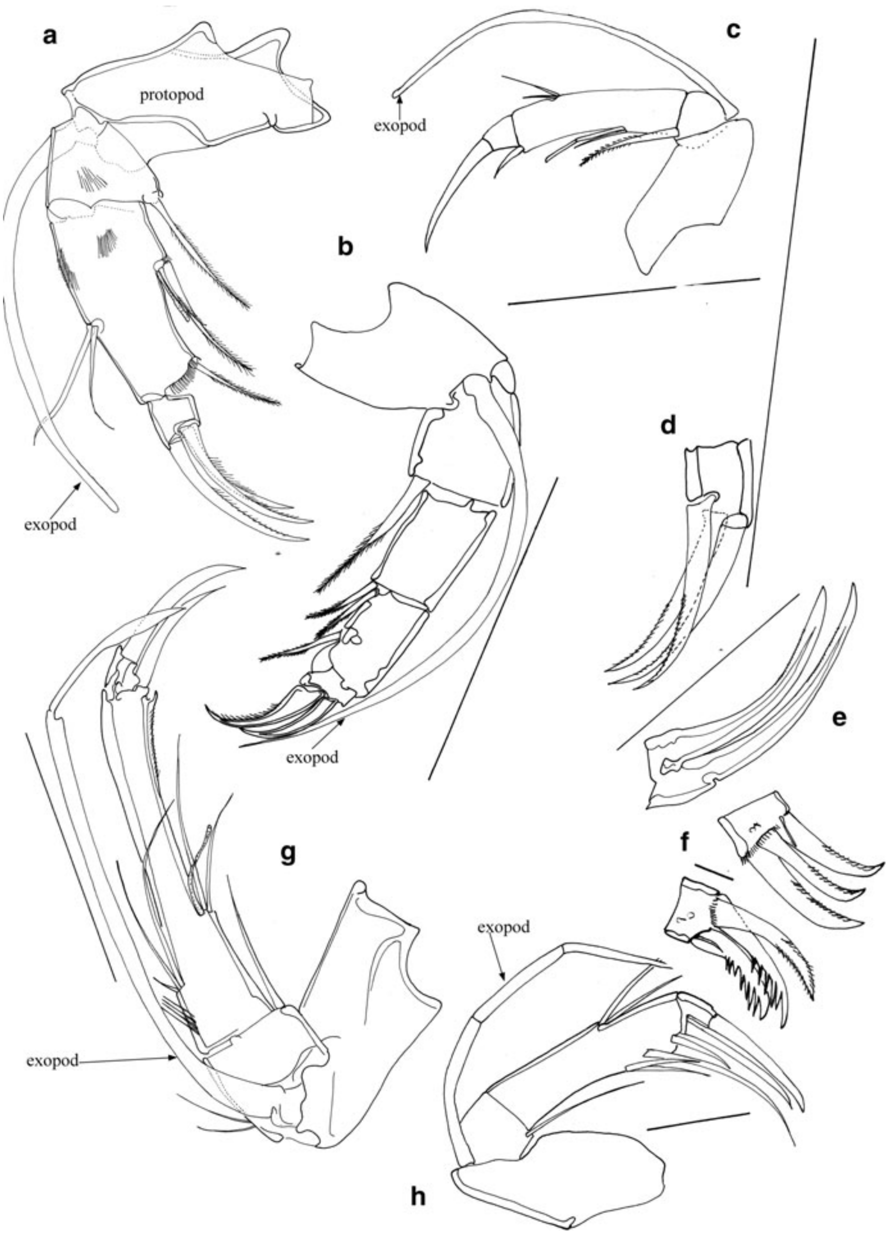

Fig. 7 Line drawings: **(a)** *Limnocythere dorsosicula* De Deckker 1982a, b, c; **(b)** *Entocythere donnaldsonensis* Klie 1931a, b; **(c)** *Dolekiella europea* Gidó et al. 2007; **(d)** *Gomphodella glomerosa* Karanovic 2006a; **(e)** Cyprideis inermis Klie 1939a, b, c, d, e, f, g; **(f)** *Intrepidocythere ibipora* Pinto et al. 2008; **(g)** *Loxoconcha dimorpha* Hartmann 1959; **(h)** *Archeocyprideis tuberculata* Ducasse and Carbonel 1994: A2. Scales: a, b, d, e, g = 0.1 mm; c ¼ 0.05 mm; f = 10 mm; h = 50 mm. (c) modified after Gidó et al. (2007): p. 112, Fig. 4b; (**f**) modified after Pinto et al. (2008): p. 34, Fig. 2b, c; (**h**) modified after Wouters and Martens (2000): p. 209, Plate 1, Fig. 4

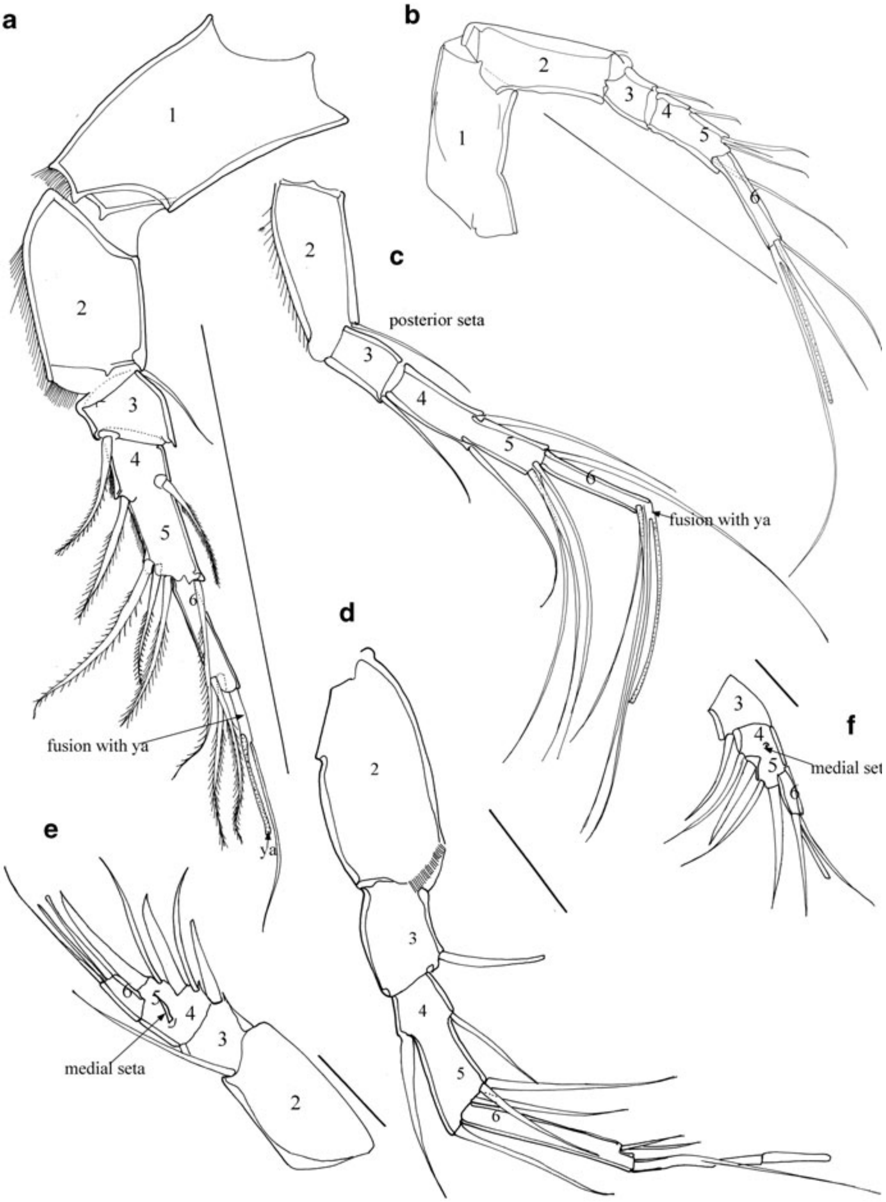

Fig. 8 Line drawings: **(a)** *Limnocythere dorsosicula* De Deckker 1982a, b, c; **(b)** *Gomphodella glomerosa* Karanovic 2006a; **(c)** *Pseudolimnocyhtere hartmanni* Danielopol 1979; **(d)** *Kiwicythere anneari* Martens 1992a, b, c; **(e)** *Romecytheridea longior* Wouters and Martens 1999; **(f)** *Tanganyikacythere fulgens* Wouters and Martens 2007: A1. Scales: a–c = 0.1 mm; d = 29 mm; e, f = 50 mm. (**d**) modified after Martens (1992a, b, c): p. 150, Fig. 14c; (**e**) modified after Wouters and Martens (1999): p. 69, Plate 1, Fig. 3; (**f**) modified after Wouters and Martens (2007): p. 149, Plate 1, Fig. 3

Fig. 9 Line drawings: (**a**) *Gomphodella glomerosa* Karanovic 2006a; (**b**) *Gomphocythere angulata* Lowndes 1932a; (**c**) *Kovalevskiella rudjakovi* (Danielopol 1970); (**d**) *Afrocythere rostrata* Klie 1935a; (**e**) *Entocythere donnaldsonensis* Klie 1931a. **a**, **e**, Md; **b**, **c**, **d**, Md-palp. Scales = 0.1 mm

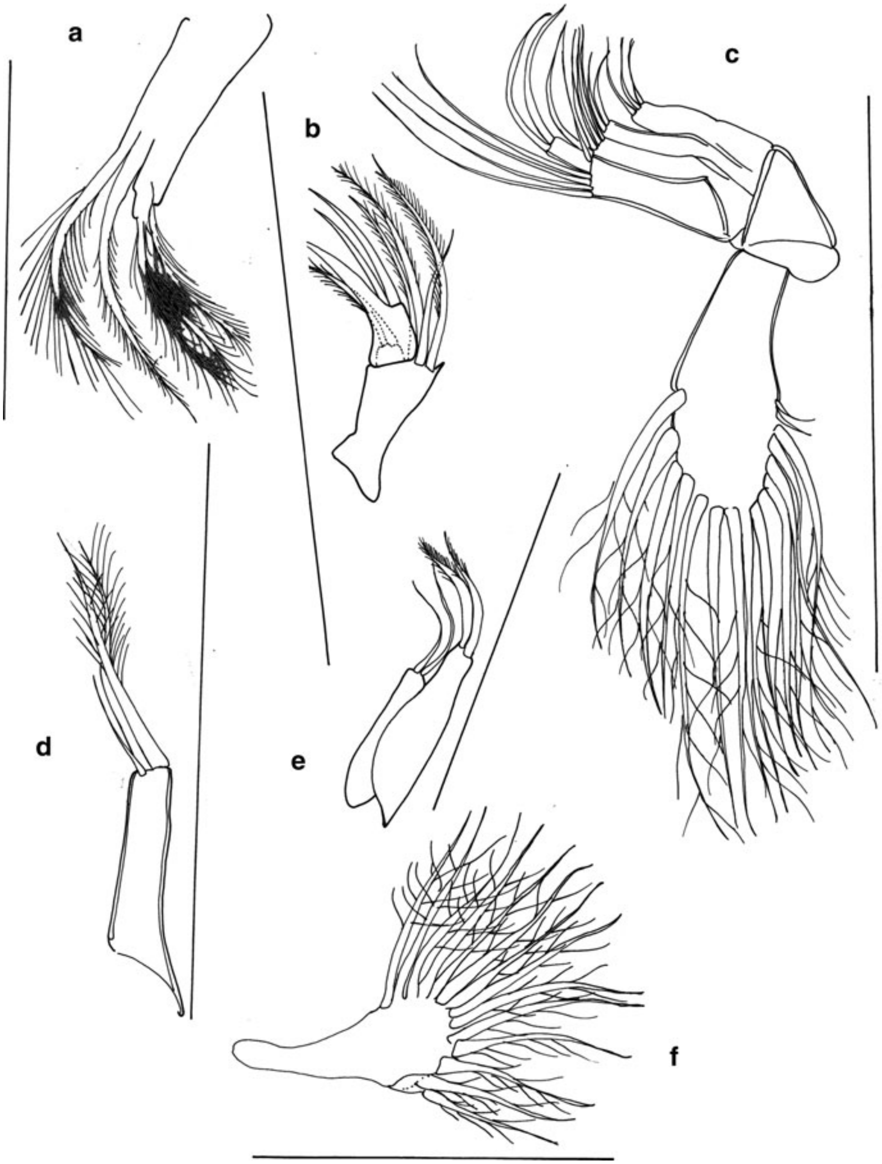

Fig. 10 Line drawings: (**a**) *Gomphocythere angulata* Lowndes 1932a; (**b**) *Limnocythere dorsosicula* De Deckker 1982c; (**c**) *Pseudolimnocythere hartmanni* Danielopol 1979; (**d**) *Kovalevskiella rudjakovi* (Danielopol 1970); (**e**) *Entocythere donnaldsonensis* Klie 1931a; (**f**) *Leptocythere pseudoproboscidea* Karanovic and Petkovski 1999a. **a**, **b**, **d**, Mxl-palp; **d**, Mxl; **e**, Mxl-palp and masticatory process; **f**, branchial plate. Scales = 0.1 mm

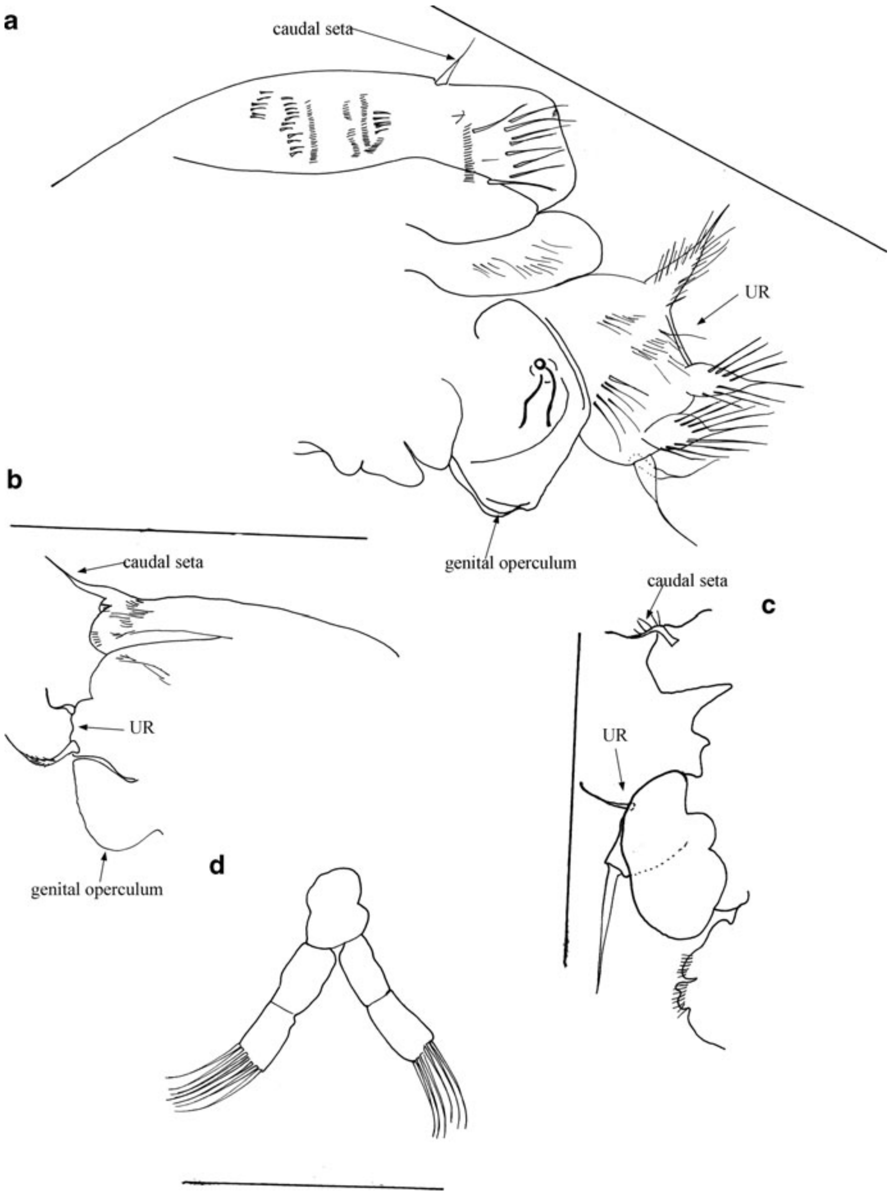

Fig. 11 Line drawings: (**a**) *Gomphodella glomerosa* Karanovic, 2006a; (**b**) *Leptocythere pseudoproboscidea* Karanovic and Petkovski 1999a; (**c**, **d**) *Paralimnocythere karamani* (Petkovski 1960a): (**a**, **b**, **c**) UR and posterior part of the body, ♀; (**d**) brush organ, ♂. Scales = 0.1 mm

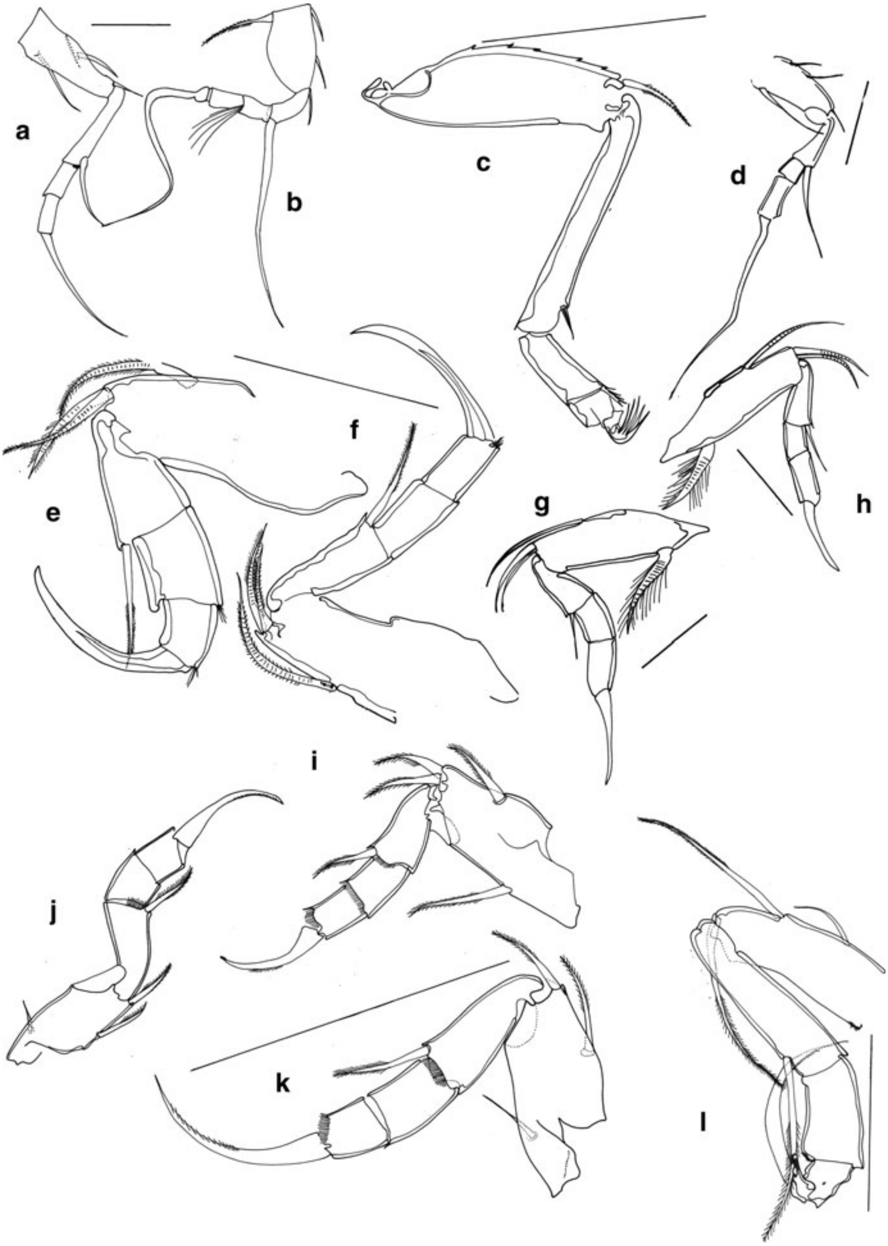

Fig. 12 Line drawings: (**a**, **b**) *Leucocythere mirabilis* Kaufmann 1892; (**c**) *Entocythere donnaldsonensis* Klie 1931a; (**d**) *Ovambocythere milani* Martens 1989a; (**e**, **f**) *Cyprideis inermis* Klie 1939g; (**g**, **h**) *Archeocyprideis tuberculata* Ducasse and Carbonel 1994; (**i**, **j**, **k**) *Limnocythere dorsosicula* De Deckker 1982c; (**l**) *Cytheridella damasi* Klie 1944: **a**, **l**, L7 ♀; **b**, **c**, **d**, L7, ♂; **e**, **f**, **g**, **h**, left and right L5, ♂; **i**, **j**, **k**, L5-L7, ♀. Scales: **a**, **b** = 83 μm; **c**, **e**, **f**, **i**, **j**, **k** = 0.1 mm; **d** = 31 μm; **g**, **h** = 50 μm. (**a**, **b**) modified after Danielopol et al. (1989): p. 83, Fig. 19c, g; (**d**) modified after Martens (1989a): p. 382, Fig. 2c; (**g**, **h**) modified after Wouters and Martens (2000): p. 209, Plate1, Figs. 7, 8

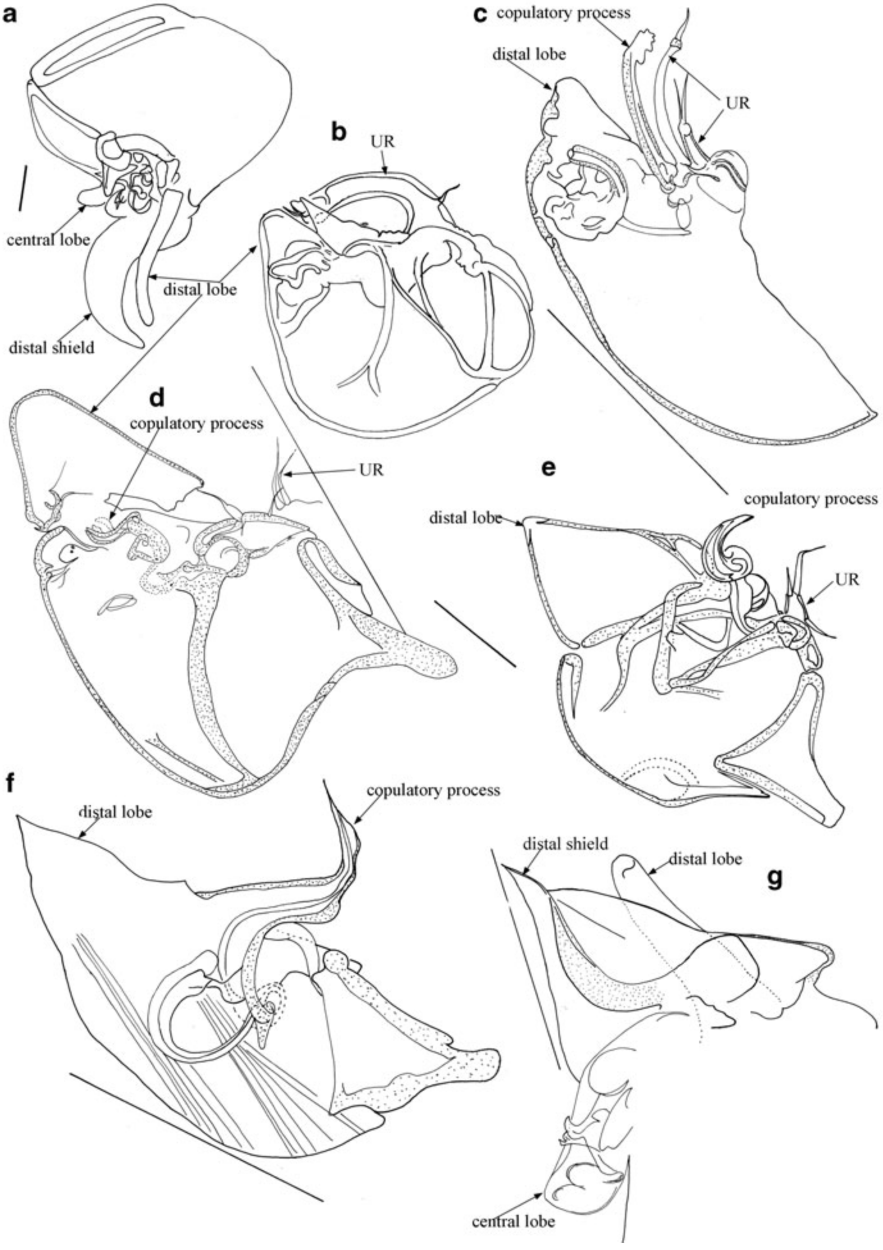

Fig. 13 Line drawings: (**a**) *Tanganyikacythere fulgens* Wouters and Martens 2007; (**b**) *Paracythereis impudica* Delachaux 1928; (**c**) *Entocythere donnaldsonensis* Klie 1931a; (**d**) *Gomphodella hirsuta* Karanovic 2006a; (**e**) *Koranocythere ugiensis* Martens 1996; (**f**) *Leptocythere pseudoproboscidea* Karanovic and Petkovski 1999a; (**g**) *Cyprideis inermis* Klie 1939g: Hemipenis. Scales: **a** = 50 μm; **c**, **d**, **f**, **g** = 0.1 mm; **e** = 33 μm. (**a**) modified after Wouters and Martens (2007): p. 149, Plate 1, Fig. 11; (**b**) modified after Delachaux (1928): p. 77, Fig. 14; (**e**) modified after Martens (1996): p. 57, Fig. 3f

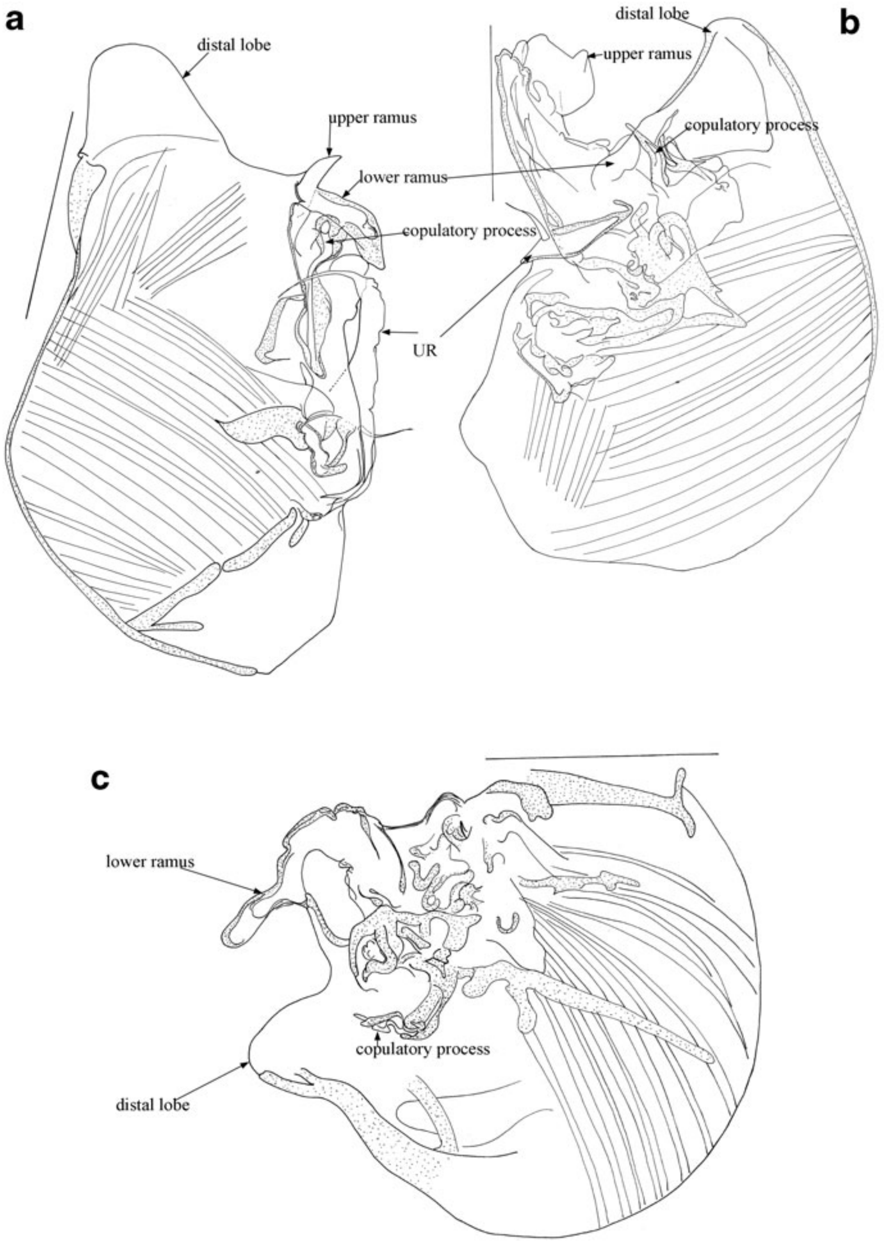

Fig. 14 Line drawings: (**a**) *Paralimnocythere ochridense* (Klie 1934a); (**b**) *Limnocythere neotropica* Klie 1934a (**c**) *Limnocythere coelebs* Klie 1944: Hemipenis. Scales = 0.1 mm

arranged in a vertical row. A1 5-segmented. A2 with exopod well developed. Md-palp 3-segmented. UR small. Females of some genera with brooding pouch. Male L6 asymmetrical; those on the left side of the body normally developed and those on the right side transformed. Hemipenis with large basal capsule and a bilobate distal process.

Type genus: *Cytheridea* Bosquet 1852

Systematics
According to Hartmann and Puri (1974), the family is divided into three subfamilies: Cytherideinae Sars 1925, Schulerideinae Mandelstam 1959, and Cuneocytherinae Mandelstam 1960. Only the first subfamily has living representatives and will be dealt with further in the book.

1.1 Subfamily Cytherideinae Sars 1925

Diagnosis: Since this is the only subfamily of the family Cytherideidae that has living representatives, its diagnosis is the same as that for the family.

Type genus: *Cytheridea* Bosquet 1852

Other genera: There are approximately 50 genera assigned to this subfamily, most of which are from Tertiary and Mesozoic, or inhabit only brackish and marine environments. Only the following genera can be found in freshwater ecosystems: *Archeocyprideis* Ducasse and Carbonel 1994, *Cyprideis* Jones 1857, *Cytherissa* Sars 1925, *Kavalacythereis* Wouters 1979, *Mesocyprideis* Wouters and Martens 1992, *Romecytheridea* Wouters 1988, *Romeis* Sywula 1970a, and *Tanganyikacythere* Ducasse and Carbonel 1993.

Ecology and distribution
Representatives of the subfamily Cytherideinae live in both marine and continental waters. They live on various substrates from fine-grained sediments to coarse sand (Danielopol and Tetart 1990). With the exception of a couple of species from the genera *Cyprideis* Jones 1857 and *Cytherissa* Sars 1925, species inhabit lakes, being especially diverse in ancient lakes such as Baikal and Tanganyika (Mazepova 1990; Wouters and Martens 1992, 1994, 1999, 2000, 2001, 2007).

Key to the genera

1. Terminal segment of A2 with three claws .... *Cytherissa* Sars 1925

– Terminal segment of A2 with two claws (Fig. 7e) 2

2. Left and right L5 in males indistinctly asymmetrical (Fig. 12g, h) 3

– Left and right L5 in males distinctly asymmetrical (Fig. 12e, f) 5

3. Valves smooth with distinct lateral long projections (Fig. 5f) . . . *Kavalacythereis* Wouters 1979

– Valves sometimes smooth but never with long lateral projections 4

4. Exopod of A2 2-segmented . . . .*Mesocyprideis* Wouters and Martens 1992

– Exopod on A2 3-segmnted (Fig. 7h) . . . *Archeocyprideis* Ducasse and Carbonel 1994

5. Medial seta on fourth segment on A1 medium size (about half L of terminal segment) (Fig. 7e) . . . . *Romecytheridea* Wouters 1988

– Medial seta on the fourth segment on A1 very small (1/10–1/15 of L of terminal segment) (Fig. 8f) 6

6. Hemipenis with central lobe small and hook like (Fig. 13a) . . . *Tanganyikacythere* Ducasse and Carbonel 1993

– Hemipenis with central lobe large and club shaped (Fig. 13g) . . . *Cyprideis* Jones 1857

***Archeocyprideis* Ducasse and Carbonel 1994**

Diagnosis (after Wouters and Martens 2000): Valves elongated with bluntly pointed, triangular posterior margin; hinge tripartite, median element bipartite with short antero-median element; valve surface ornamented with pits and nodes, or smooth; vestibulum absent; medial seta on the fourth segment of A1 medium size; exopod of A2 3-segmented, terminal segment short (Fig. 7h). L5 in males weakly asymmetrical, right one being only slightly broader than the left one (Fig. 12g, h). Distal shield of hemipenis with anvil-shaped terminal margin; central lobe club shaped.

Type (and only) species: *A. tuberculata* Ducasse and Carbonel 1994

Species list with type locality and type material

A. tuberculata Ducasse and Carbonel 1994. Mutanbala River mouth, Burton Bay, Lake Tanganyika, DR Congo, 04°19′S 29°05′E: Repository of the type material unknown.

Remarks, Ecology, and Distribution

This monospecific genus seems to be endemic to Lake Tanganyika. The original description was based on the subfossil specimens (Ducasse and Carbonel 1994). Later on, Wouters and Martens (2000) collected more material from different localities in Lake Tanganyika and described the soft parts of the species. They have also collected one more new species from the same genus, which has not been described so far.

Cyprideis Jones 1857

Diagnosis (after Wouters and Martens 1999): Rounded valves, hinge tripartite, medial element bipartite, valves smooth to ornamented with pits and/or nodes. Medial seta on fourth segment of A1 very small (1/10–1/15 L of terminal segment). Exopod on A2 3-segmented (Fig. 7e). Asymmetry in male L5 very strong, with large subquadrate terminal segments on the right leg (Fig. 12e, f). Female carapace with a weakly inflated posterior brood chamber.

Type species: *C. torosa* (Jones 1850)

Species list with type locality and type material

1. *C. aciculata* Wouters and Martens 2007. W of Sumbu, Chimba, Lake Tanganyika, Zambia, 08°25′29″S 30°27′27″E: Holotype (♂), RBINS – O.C. 2946a, 2946b.
2. *C. loricata* Wouters and Martens 2001. Gitaza, Lake Tanganyika, Burundi, 03°37′02″S 29°20′46″E: Holotype (♂), RBINS – O.C. 2314a, 2314b, 2314c.
3. *C. mastai* Wouters and Martens 1994. Delta of the River Nyengwe, Lake Tanganyika, Burundi, 04°10’50″S, 29°30’20″E: Holotype (♂), RBINS – O.C. 1753b.
4. *C. profunda* Wouters and Martens 1999. Bay S of Cape Kibwesa, Lake Tanganyika, Tanzania, 06°30′01″S 29°57′19″E; Holotype (♂), RBINS – O.C. 2263a, 2263b.
5. *C. rumongensis* Wouters and Martens 1994. Delta of River Dama, near Rumoge, Lake Tanganyika, Burundi, 03′58″21″S 29°26′15″E: Holotype (♂), RBINS – O.C. 1765a.
6. *C. spatula* Wouters and Martens 1999. Village Kaparamsenge, Tanzania, Lake Tanganyika, 05°48′32″S 29°56′43″E: Holotype (♂), RBINS – O.C. 2249a, 2249b.
7. *C. torosa* (Jones 1850). England, UK. No more details on the locality. Repository of the type material unknown.
   Syn.: *C. littoralis* (Brady 1870b); *C. padaschenkoi* (Daday 1909); *C. aegyptiaca* (Daday 1910b).

Key to the species

1\. Valves strongly ornamented 2

– Valves smooth or at the most pitted 3

2\. Dorsal and ventral margin tapering toward the posterior end ... *C. loricata* Wouters and Martens 2001

– Dorsal and ventral margin almost parallel .... *C. aciculata* Wouters and Martens 2007

3\. RV with postero-ventral spine .... *C. torosa* (Jones 1850)

– RV without postero-ventral spine 4

4. Valves strongly pitted ....*C. profunda* Wouters and Martens 1999
– Valves finely pitted or smooth 5
5. Dorsal and ventral margin parallel .....*C. spatula* Wouters and Martens 1999
– Dorsal and ventral margin tapering 6
6. Valves subtrapezoidal ....*C. mastai* Wouters and Martens 1994
– Valves elongated ....*C. rumongensis* Wouters and Martens 1994

Remarks
Cyprideis torosa (Jones 1850) is a very variable species. Some specimens bear nodes and some are without nodes on their carapace. There are two opinions regarding the cause of the nodes. One is that this is genetically influenced, and the other that it is influenced by the change in the salinity (nodes develop in less saline waters). For a detail discussion on the problem, see Meisch (2000) and Keyser (2005).

Ecology and Distribution (Fig. 15)
Cyprideis torosa (Jones 1850) can be found in a wide salinity range, but it mainly occurs in high saline and brackish waters, although it can be found in pure freshwater lakes (Klie 1938a). Other species of the genus live in freshwater lakes. *Cyprideis torosa* has a wide distribution, while the rest of the species are endemic to Lake Tanganyika.

Fig. 15 Distribution of *Cyprideis* Jones 1857: Numbers correspond to the species list. *Note*: Wide range of distribution of Cyprideis torosa (Jones 1850) not shown

Cytherissa Sars 1925

Diagnosis (after Meisch 2000): Carapace wedge shaped in lateral view, anteriorly higher than posteriorly (Figs. 1g and 3a). Valves strongly calcified, and surface strongly ornamented. Terminal segment of A2 with two claws. Medial and lateral processes on the hemipenis short. UR with two short setae. Female genital lobe prominent. Carapace of female lacking brood chamber.

Type species: *C. lacustris* (Sars 1863)

Species list with type locality and type material

The repository of the type material of the *Cytherissa* Sars 1925 species from the Baikal Lake is not known.

Other species: *C. angustimarginata* Mazepova, 1990; *C. anisoptera* Mazepova, 1990; *C. attenuata* Mazepova, 1984; C. *baikalensis* Bronstein, 1930; *C. bisetosa* Mazepova, 1984; C. *burchani* Mazepova, 1990; *C. calva* Mazepova, 1990; *C. compta* Mazepova, 1990; *C. confilis* Mazepova, 1990; *C. crepera* Mazepova, 1990; *C. cymulata* Mazepova, 1984; *C. cytheriformis* Bronstein, 1947; *C. derupta* Mazepova, 1990; *C. dextima* Mazepova, 1984; *C. donquixotei* Mazepova, 1990; *C. dubitabilis* Bronstein, 1947; *C. elongata* Bronstein, 1947; *C. excelsa* Mazepova, 1990; *C. excelsiformis* Mazepova, 1990; C. *fuscata* Bronstein, 1947; *C. galyschkinae* Mazepova, 1990; *C. glomerata* Mazepova, 1990; *C. interposita* Bronstein, 1947; *C. lata* Bronstein, 1930; *C. latirecta* Mazepova 1985; *C. latiundata* Mazepova, 1985; *C. magna* Mazepova, 1990; *C. microexculpta* Mazepova, 1984; *C. minor* Mazepova, 1990; *C. mirabilis* Bronstein, 1947; *C. multipora* Mazepova, 1984; *C. nana* Mazepova, 1984; *C. neobaikaliensis* Mazepova, 1984; *C. ovata* Bronstein, 1947; *C. parallela* Bronstein, 1947; *C. parva* Mazepova, 1984; *C. pennata* Mazepova, 1990; *C. placida* Mazepova, 1990; *C. pusilla* Mazepova, 1985; *C. pterygdota* Bronstein, 1947; *C. puscharevi* Mazepova, 1990; *C. sernovi* Bronstein, 1930; *C. cinistra* Mazepova, 1984; *C. sinistrodentata* Bronstein, 1930; *C. ssorensis* Mazepova, 1990; *C. tenella* Mazepova, 1984; *C. triangulata* Bronstein, 1947; *C. truncta* Bronstein, 1930; *C. tuberculata* Bronstein 1930; *C. ushkani* Mazepova, 1990; *C. uvaeformis* Mazepova, 1990; C. *verrucosa* Mazepova, 1990.

Remarks, Ecology, and Distribution

With the exception of *Cytherissa lacustris* (Sars 1863), all the other species are endemic to Lake Baikal. Most of the Baikal species are described only on the basis of the carapace appearance, and a key to their identification is provided in Mazepova (1990). The differences between some species are sometimes really small, but in some cases it is obvious that the author was dealing with more than one species. Therefore, it is very hard to provide an accurate key to the species of the genus without a thorough revision on the type material. Based on molecular data, Schön et al. (2000) suggested the presence of at least two separate lineages in Lake Baikal, which are not congruent with those postulated by Danielopol et al.

(1990) based on morphological data. On the contrary, *C. lacustris* is widely distributed in the sublittoral and profundal zones of cold deep lakes, shallow ponds, and swamps. It can also be found in slightly saline waters. It is generally distributed in the Holarctic.

Kavalacythereis Wouters 1979

Diagnosis (after Wouters and Martens 2000): Medium-sized to large valves with postero-dorsal and ventro-lateral hollow spines (Fig. 5f); large anterior and posterior vestibulum; numerous compound MPC; hinge tripartite. Brood pouch of female elongate. Anterior flange strongly developed. Spiky hairs on anterior and posterior margin absent. A2 exopod 3-segmented; medial seta on the fourth segment of A1 short to medium size; dimorphism between left and right male L5 indistinct. Hemipenis with elongate triangular dorsal shield, small copulatory process, and hook-like central lobe.

Type (and only) species: *K. braconensis* Wouters 1979

Species list with type locality and type material

K. braconensis Wouters 1979. Bracone Bay, Kavala Island, Lake Tanganyika, DR Congo, 05°39’S 29°25’E: Holotype (♂, RV), RBINS – O.C. 1048.

Ecology and Distribution

The species was collected from several localities in Lake Tanganyika (Wouters 1979; Wouters and Martens 2000).

Mesocyprideis Wouters and Martens 1992

Diagnosis (after Wouters and Martens 2001): Valves subtrapezoidal, ornamented with pits or nodes; caudal process and ventro-lateral ala more or less developed; hinge mostly tripartite. Medial seta on the fourth segment of A1 very long (three times L of terminal segment). Exopod of A2 2-segmented. Male L5 almost symmetrical. Female with a brood chamber.

Type species: *M. irsacae* (Kiss 1959a)

Species list with type locality and type material

1. *M. irsacae* (Kiss 1959a). Shallow water between emerging macrophytes, opposite beach at Uvira, Lake Tanganyika, DR Congo, 03°24′23″S 29°08′06″E: Holotype was not designated, type material (syntypes) contains various specimens dissected on three slides and deposited at RMCA – RC.05329.
2. *M. nitida* Wouters and Martens 2001. River Mitumba, Ngombe National Park, Lake Tanganyika, Tanzania, 04°38′22″S 29°37′45″E: Holotype (♂), RBINS – O.C. 2326a, 2326b.
3. *M. pila* Wouters and Martens 1999. Bay S of Karema, Lake Tanganyika, Tanzania, 06°52′S 30°32′E: Holotype (♂), RBINS – O.C. 2272a, 2272b.

Key to the species

1. Valves very lightly ornamented, distal shield of hemipenis very large with a prolonged triangular extremity .... *M. nitida* Wouters and Martens 2001

– Valves heavily calcified and strongly ornamented, hemipenis without a prolonged triangular extremity 2

2. Caudal process on the valves in dorsal view very well developed ... *M. pila* Wouters and Martens 1999

– Caudal process on the valves in dorsal view very small ... *M. irsacae* (Kiss 1959a)

Ecology and Distribution (Fig. 16)
The species are endemic to Lake Tanganyika.

***Romecytheridea* Wouters 1988**

Diagnosis (after Wouters and Martens 2001): Elongated valves, hinge tripartite, median element bipartite; valve surface ornamented with pits or nodes. Anterior marginal rim present in some species. Medial seta on the fourth segment of A1 medium sized (approximately ½ L of terminal segment) (Fig. 8e). L5 in males symmetrical. Female with a brood chamber.

Type species: *R. tenuisculpta* (Rome 1962)

Species list with type locality and type material

1. *R. ampla* Wouters 1988. Bay of Bracone, Isle of Kavala, Lake Tanganyika, DR Congo, 05°39′S 29°22′E: Holotype (♀), RBINS – O.C. 1295.

Fig. 16 Distribution of *Mesocyprideis* Wouters and Martens 1992: Numbers correspond to the species list

2. *R. bacata* Wouters and Martens 2007. Chimba, W of Sumbu, Lake Tanganyika, Zambia, 08°25′29″S 30°27′27″E: Holotype (♂), RBINS – O.C. 2966a, 2966b.
3. *R. belone* Wouters and Martens 2001. Punda Point, Kipili mainland, Lake Tanganyika, Tanzania, 07°26′39″S 30°35′32″E: Holotype (♂), RBINS – O.C. 2291a, 2291b.
4. *R. longior* Wouters and Martens 1999. Village Karonda, Lake Tanganyika, Burundi, 04°04′33″S 29°29′30″E: Holotype (♂), RBINS – O.C. 2240a, 2240b.
5. *R. plegma* Wouters and Martens 2001. Mtosi Bay, Lake Tanganyika, Tanzania, 07°35′S 30°39′E: Holotype (♂), RBINS – O.C. 2303a, 2303b.
6. *R. tenuisculpta* (Rome 1962). Kalemie, 1 km from the coast of Lake Tanganyika, DR Congo, 05°56′S 29°11′E: Holotype (♀, carapace), RBINS – O.C. 1295.

Key to the species

1. Postero-ventral hollow tubercles absent in female 2

– Postero-ventral hollow tubercles present in female 3

2. Anterior marginal rim absent .... *R. longior* Wouters and Martens 1999

– Anterior marginal rim present .... *R. plegma* Wouters and Martens 2001

3. MPC not branched .... *R. bacata* Wouters and Martens 2007

– MPC branched 4

4. Dorsal shield of hemipenis with needle-shaped process. . .*R. belone* Wouters and Martens 2001

– Dorsal shield of hemipenis distally rounded 5

5. Vestibulum very poorly developed (almost absent), MPC long, nodes on the carapace poorly developed .... *R. tenuisculpta* (Rome 1962)

– Vestibulum clearly visible, MPC short, nodes on the carapace well pronounced .... *R. ampla* Wouters 1988

Ecology and Distribution (Fig. 17)
The species are endemic to Lake Tanganyika.

***Romeis* Sywula 1970a**

Diagnosis (modified after Sywula 1970a): Female carapace club shaped, with distinct eye spot, and sides undulated. Surface of the carapace with ridges, reticulated or pitted; several postero-ventral spines present. MPC simple. A1 5-segmented. Terminal segment of A2 with only two claws. One pair of appendages inserted between and somewhat behind Mxl: these appendages are 2-segmented, distally with several claws and one long seta. Penultimate segment of L5 subdivided. UR with two setae.

Type (and only) species: *R. rivulorum* (Rome 1970)

Fig. 17 Distribution of *Romecytheridea* Wouters 1988: Numbers correspond to the species list

Species list with type locality and type material
R. rivulorum (Rome 1970). Stream, Enfants Noyés, Boitsfort, Belgium, 50°48′36″N 04°24′12″E: Holotype (♀), RBINS – I.G. 13421.

Remarks
Romeis rivulorum (Rome 1970) was originally described in the genus *Cythereis* Jones 1849 from a freshwater body in Belgium (Rome 1943). Meisch (2000) argues that the species was probably erroneously introduced by Dr Rome from marine material into one of his freshwater samples. When erecting the genus, Sywula (1970a) was not certain if it belongs to the subfamily Cytherideinae at all.

Tanganyikacythere Ducasse and Carbonel 1993

Diagnosis (after Wouters and Martens 1994): Valves spherical. Hinge on the RV completely positive or with maximum 2–3 small sockets in the anterior part of the median element. Fused zone with many long, sometimes branched pore canals. Female with small UR. L5 and L6 in males extremely asymmetrical. Hemipenis with central lobe small and hook like (Fig. 13a).

Type species: *T. burtonensis* Ducasse and Carbonel 1993

Species list with type locality and type material

1. *T. burtonensis* Ducasse and Carbonel 1993. Burton Bay, Lake Tanganyika, Zaire, 04°19′S 29°05′E: Holotype (carapace), DGOUB – C.O. 4895.

   Syn.: *T. mondegueri* Ducasse and Carbonel 1993

2. *T. caljoni* Wouters and Martens 1994. Bay in front of Koronda Village, Lake Tanganyika, Burundi, 04°05′13″S 29°29′41″E: Holotype (♂), RBINS – O.C. 1748a, 1748b.

Fig. 18 Distribution of *Tanganyikacythere* Ducasse and Carbonel 1993: Numbers correspond to the species list

3. *T. fulgens* Wouters and Martens 2007. Chimba, W of Sumbu, Lake Tanganyika, Zambia, 08°25′29″S 30°27′27″E: Holotype (♂), RBINS – O.C. 2930a, 2930b.

Key to the species

1. Hinge completely positive in the RV and completely negative in the LV 2
– Hinge not completely positive in the RV or completely negative in the LV ... *T. caljoni* Wouters and Martens 1994
2. Central lobe of the hemipenis has a suboval shape and is slightly curved ... *T. fulgens* Wouters and Martens 2007
– Central lobe of hemipenis hook like ... *T. burtonensis* Ducasse and Carbonel 1993.

Ecology and Distribution (Fig. 18)
The species are endemic to Lake Tanganyika.

2 Family Entocytheridae Hoff 1942

Diagnosis (after Hartmann and Puri 1974 and Meisch 2000): Carapace reniform to elliptical in lateral view, laterally compressed in dorsal view. Carapace weakly calcified. Carapace with or without protuberances, and with or without submarginal setae. Eyes, when present, fused and pigmented. A1 6- or 7-segmented. A2 endopod 4-segmented with two claws on the terminal segment (Fig. 8b). Md-palp 2-segmented (all segments fused, except the distal one) (Fig. 9e). Mxl with only one masticatory lobe. L5, L6, and L7 walking legs, each terminating in large curved claws (Fig. 12c). Hemipenis complex with a clasping apparatus, two lobes, and a flagellum (Fig. 13c).

Type genus: *Entocythere* Marshall 1903

Systematics
According to Hartmann and Puri (1974), the family is divided into four subfamilies: Entocytherinae Hoff 1942; Sphaeromicolinae Hart 1962; Microsyssitrinae Hart et al. 1967; and Notocytherinae Hart and Hart 1967.

Ecology
All entocytherids are symbionts on the body and appendages of isopods, amphipods, and decapods living in fresh, brackish, or marine waters. They feed on food debris of their hosts.

3 Family Kliellidae Schäfer 1945

Diagnosis (after Hartmann and Puri 1974): Valves elongated, chitinous or very weakly calcified. Anterior end broader than posterior. Surface smooth or with fine ribs. CIL is narrow or completely absent. MPC not visible. Hinge is adont or lophodont. A1 6- or 5-segmented, and A2 4-segmented with small exopod. Md-palp 3-segmented. Vibratory plate on Md reduced, and that of Mxl with only one or two lateral setae. L5–L7 symmetrical and without setae. UR and brush-shaped organ missing.

Type genus: *Kliella* Schäfer 1945

Systematics
The family has only two recent genera: *Kliella* Schäfer 1945 and *Nannokliella* Schäfer 1945.

Key to the genera
1. A1 5-segmented .... *Kliella* Schäfer 1945
– A1 6-segmented .... *Nannokliella* Schäfer 1945

Ecology and Distribution
The only two representatives of this family so far have been collected only once from the subterranean waters of Greece.

***Kliella* Schäfer 1945**
Diagnosis (modified after Schäfer 1945): Carapace elongated, smooth. No eyes present. A1 5-segmented. Endopod A2 4-segmented. Terminal segment with two claws and one seta.

Type (and only) species: *K. hyaloderma* Schäfer 1945

Species list with type locality and type material
K. hyaloderma Schäfer 1945. Well in the village Armeni, Greece, 35°25′N 24°09′E: Repository of the type material unknown.

***Nannokliella* Schäfer 1945**
Diagnosis (modified after Schäfer 1945): Carapace elongated, ornamented with longitudinal ridges. A1 6-segmented. Endopod A2 3-segmented, terminal segment with two claws.

Type (and only) species: *N. dictyoconcha* Schäfer 1945

Species list with type locality and type material
N. dictyoconcha Schäfer 1945. Well in the village Armeni, Greece, 35°25′N 24°09′E: Repository of the type material unknown.

4 Family Leptocytheridae Hanai 1957

Diagnosis (after Hartmann and Puri 1974): Elongated carapace, well calcified, with smooth or ornamented surface (Fig. 3b–d). CMS consisting of four scars in a row and the fifth V-shaped in front. CIL broad but irregular. MPC long and branched (Fig. 5a). Hinge merodont to entomodont. A1 5-segmented. A2 with two terminal claws. Exopod well developed. Vibratory plate on Md with one main and one secondary seta. Md-palp short, penultimate segment not longer than other segments. Vibratory plate of Mxl (Fig. 10f) with only one type of setae. L5–L7 walking legs, progressively enlarging from L5 to L7. Anterior margin of basal segment with only one seta. UR with two setae (Fig. 11b). Distal part of hemipenis with two lobes (Fig. 13f).

Type genus: *Leptocythere* Sars 1928

Systematics
The family has only four extant genera: *Callistocythere* Ruggieri 1953, *Cluthia* Neale 1973, *Leptocythere* Sars 1928, and *Tanella* Kingma 1948.

Ecology and Distribution
Most of the species of the family live in brackish and marine waters, with the exception of *Leptocythere* Sars 1928 which has some species that are found in freshwater ecosystems. The family has a worldwide distribution.

***Leptocythere* Sars 1928**
Diagnosis: Carapace oblong, elongate, moderately compressed laterally; anterior end broadly rounded, posterior end postero-ventrally rounded, subacute postero-

dorsally. Dorsal margin slightly convex to almost straight, ventral margin distinctly sinuous. Maximum H anteriorly, and equal to less than half L. Carapace smooth or ornamented. CIL widest anteriorly and postero-ventrally. Anterior CIL well developed. Marginal pore canals few, typically branching (bi-, tri-, or polyfurcate). A1 5-segmented. A2 with two terminal claws. Exopod well developed. Vibratory plate on Md with one main and one secondary seta. Md-palp short, penultimate segment not longer than other segments. Vibratory plate of Mxl with only one type of setae. L5–L7 walking legs, progressively enlarging from L5 to L7. Anterior margin of basal segment with only one seta. UR with two setae. Distal part of hemipenis with two lobes.

Type species: *L. pellucida* (Baird 1850) (a marine species)

Freshwater species list with type locality and type material

1. *L. angulata* Klie 1939b. Ohrid Lake, Macedonia, 41°02′N 20°42′E: Syntypes, ZMK – UR-41.
2. *L. fluviatilis* Klie 1939b. Novo Mesto, River Krka, Slovenia, 45°48′19″N 15°10′15″E: Syntypes, ZMK – UR-37.
3. *L. karamani* Klie 1939b. Ohrid Lake, Macedonia, 41°02′N 20°42′E: Syntypes, ZMK – UR-39.
4. *L. ostrovskensis* Petkovski and Keyser 1992. Lake Ostrovo, Greece, 40°44′N 21°48′E: Holotype (♀), NHMS – collection number unknown; Paratypes, ZMH – K-35 297.
5. *L. prespensis* Petkovski 1959a. Lake Prespa, Macedonia, 40°54′N 21°02′E: Repository of the type material unknown.
6. *L. proboscidea* Klie 1939b. Ohrid Lake, Macedonia, 41°02′N 20°42′E: Syntypes, ZMK – UR-36.
7. *L. pseudoproboscidea* Karanovic and Petkovski 1999a. Spring Mareza, Podgorica, Skadar Valley, Montenegro, 42°26′N 19°16′E: Holotype (♂), ZMH – K-42 378.

Key to the species

1. Valve surface sculptured with wide, deep, and clearly outlined pits 2

– Valve surface sculptured with much smaller, not very deep and not clearly outlined pits 3

2. Females in dorsal view with quadrate posterior end ... *L. angulata* Klie 1939b

– Females in dorsal view with rounded posterior end ... *L. karamani* Klie 1939b

3. Females in dorsal view with a clear caudal process 4

– Females in dorsal view without a caudal process .....*L. fluviatilis* Klie 1939b

4. Females in dorsal view with clear lateral extremities (nodes) (on the anterior and posterior third of carapace) ....*L. ostrovskensis* Petkovski and Keyser 1992

Fig. 19 Distribution of *Leptocythere* Sars 1928: Numbers correspond to the species list

– Females in dorsal view without lateral extremities 5

5. Proximal part of the distal lobe of the hemipenis with a long, distally rounded projection .... *L. prespensis* Petkovski 1959a

– Proximal part of the distal lobe of the hemipenis with a very small distally pointed projection, or without projection at all 6

6. Females in dorsal view constricted on the first and the last third ... *L. proboscidea* Klie 1939b

– Females in dorsal view constricted only medially ... *L. pseudoproboscidea* Karanovic and Petkovski 1999a

Ecology and Distribution (Fig. 19)
With an exception of *L. pseudoproboscidea* Karanovic and Petkovski 1999a, which has been found in a spring (Karanovic and Petkovski 1999a), and *L. fluviatilis* Klie 1939b, which was collected in the river (Klie 1939b), all the other species have so far been found in lakes (Klie 1939b; Petkovski 1959a, b; Petkovski and Keyser 1992). All the species are endemic to the Balkan Peninsula and have a restricted distribution.

5 Family Limnocytheridae Klie 1938a

Diagnosis (after Hartmann and Puri 1974 and Meisch 2000): Valves reniform in lateral view, elliptical, and sometimes slender. Valves relatively weakly ornamented with tubercles, pits, horn-like processes, and weak reticulation. MPC sometimes very long and branched. CMS consisting of a vertical row of four scars.

A1 5- or 6-segmented. Terminal aesthetasc basally fused with the neighboring seta. A2 with three claws on the terminal segment. Md-palp straight. L5–L7 walking legs, 4-segmented. Male copulatory tube very short. Females with a brood chamber (Timiriaseviinae) or without a brood chamber (Limnocytherinae).

Type genus: *Limnocythere* Brady 1867

Systematics
The family is divided into two subfamilies: Limnocytherinae Klie 1938a and Timiriaseviinae Mandelstam 1960.

Key to the subfamilies

1. Valve shape slender (no brooding chamber), terminal segment on A1 long, distal part of hemipenis immobile (Figs. 5g, 8a, 14b, c) .... Limnocytherinae

– Valves swollen (brooding chamber present), terminal segment of A1 short, distal part of hemipenis moveable (Figs. 5e, 8b, 13d) .... Timiriaseviinae

5.1 Subfamily Limnocytherinae Klie 1938a

Diagnosis (after Meisch 2000): Valves with one or two dorso-median transverse groves, with or without more or less well-developed tubercles (Figs. 1a–c, f and 2c, h). Male carapace often larger than female and/or expanded posteriorly; brood chamber absent in females. Terminal segment of A1 long (longer than penultimate); fused part of the terminal aesthetasc with the neighboring seta on A1 long (longer than the W of aesthetasc) (Fig. 8a).

Systematics
The subfamily is divided into three tribes: Limnocytherini Klie 1938a, Leucocytherini Danielopol and Martens 1989 (in Danielopol et al. 1989), and Dinarocytherini Krstić 1987. The last tribe comprises exclusively fossil taxa. The genus *Korannocythere* Martens 1996 was originally included in the tribe Limnocytherini (Martens 1996), but later on, Martens (2000) excluded it from this tribe because of the peculiar combination of the soft part morphology (resembling Leucocytherini) and hinge structure (Limnocytherini). *Korannocythere* is here also kept separately.

Key to the (recent) tribes and one genus

1. Hinge bar crenulated .... Leucocytherini Danielopol and Martens 1989

– Hinge bar smooth 2

2. Clasping organ on hemipenis absent (Fig. 13e) ... *Korannocythere* Martens 1996

– Clasping organ on hemipenis present (Fig. 14)..... Limnocytherini Klie 1938a

Korannocythere Martens 1996

Diagnosis (after Martens 1996): Valves almost without sexual dimorphism, hinge nearly adont (anterior cardinal tooth in RV absent, posterior cardinal tooth in RV minute or absent, hinge bar in LV smooth) (Fig. 5d). Surface of the valves often sculptured. MPC few, short and straight. Exopod A2 shorter in males than in females. Hemipenis simple, no clasping organ present. UR with short base and three setae. Copulatory process simple.

Type species: *K. devriesi* Martens 1996

Species list with type locality and type material

1. *K. devriesi* Martens 1996. Sandstone rock pools, top of Korannaberg, Excelcior district, Eastern Free State, South Africa, 28°51′13″S 27°13′51″E: Holotype (♂), AM – OST1A.
2. *K. hamerae* Martens 1996. Echibini minor, Loteni, KwaZulu-Natal, South Africa, 29°23′01″E 29°32′29″: Holotype (♂), AM – OST2A.
3. *K. ugiensis* Martens 1996. Rock pool on top of Prentjiesberg, near Ugie, S Drakensberg, Eastern Cape, South Africa, 31°12′S 28°14′E: Holotype (♂), AM – ECR.160A.

Key to the species

1. Apical seta on the second segment of A1 absent ... *K. hamerae* Martens 1996

– Apical seta on the second segment of A1 present 2

2. Exopod A2 in females reaching tip of penultimate segment, tip of copulatory process on hemipenis dilated .... *K. devriesi* Martens 1996

– Exopod A2 in females reaching tip of terminal segment, tip of copulatory process on hemipenis pointed .... *K. ugiensis* Martens 1996

Ecology and Distribution (Fig. 20)
All three species have been found in temporary rock pools, and they are endemic to southern Africa.

5.1.1 Tribe Leucocytherini Danielopol and Martens 1989 (in Danielopol et al. 1989)

Diagnosis (after Danielopol et al. 1989 and Martens 1996): Carapace with two sulci near CMS and one sulcus in the anterior third. Hinge lophodont with crenulate hinge bar. MPC straight and simple. A1 and L7 (Fig. 12a, b) often sexually dimorphic. Copulatory process on the hemipenis spirally shaped.

Type genus: *Leucocythere* Kaufmann 1892

Fig. 20 Distribution of *Korannocythere* Martens 1996: Numbers correspond to the species list

Other (recent) genera: *Athalocythere* Schornikov 1986, *Ovambocythere* Martens 1989a, and *Potamocythere* Schornikov 1986.

Key to the genera

1. L7 sexually dimorphic (Fig. 12a, b) .... *Leucocythere* Kaufmann 1892

– L7 not sexually dimorphic 2

2. Terminal claw of L7 in males long and transformed in flagellum (Fig. 12g) ... *Ovambocythere* Martens 1989a

– Terminal claw of L7 in males normally developed ... *Potamocythere* Schornikov 1986

Remarks

The genus *Athalocythere* Schornikov 1986, from Lake Khanka in Russia (Schornikov 1986), was described only on the basis of the female, and therefore the possible sexual dimorphism in the appearance of the L7 is not known. This genus is indeed very closely related to the genus *Leucocythere* Kaufmann 1892, and further revisions might find that it is its junior synonym.

***Athalocythere* Schornikov 1986**

Diagnosis (modified after Schornikov 1986): Frontal end of carapace wide, caudal end narrow. Anterior cardinal tooth on the hinge absent. CIL narrow, MPC short and straight. Carapace with several nodes.

Type (and only) species: *A. chankensis* Schornikov 1986

Species list with type locality and type material

A. chankensis Schornikov 1986. Lake Kanka, Russia, 44°56′N 132°24′E: Holotype (♀), ZISP – 54640.

Ecology and Distribution
The species has been found only in its type locality.

Leucocythere **Kaufmann 1892**

Diagnosis (after Danielopol et al. 1989): Carapace weakly calcified (Fig. 1f) with sexual dimorphism in size and shape. Females with pedomorphic shape and of smaller size than males. Sexual dimorphism present in the appearance of both A1 and L7. Hemipenis with reduced clasping organs.

Type species: *L. mirabilis* Kaufmann 1892

Species list with type locality and type material

1. *L. algeriensis* Martens 1989 (in Danielopol et al. 1989). Drying pool in temporary river system, Oued Tesselata, Tassili-n-Ajjer, Algeria, 26°03′N 08°20′E: Holotype (♂), RBINS – O.C. 1471.
2. *L. helenae* Martens 1991a. Semi-permanent pool, Jameson Dam, Eastern Cape Province, South Africa, 33°19′20″ 26°27′05″E: Holotype (♂), RBINS – LEN.21A.
3. *L. mirabilis* Kaufmann 1892. Lake Geneva, Switzerland, 46°25′N 06°30′E: Repository of the type material unknown.

Key to the species

1. A group of long setae on the third segment of the male L7 present . . . *L. mirabilis* Kaufmann 1892
– A group of long setae on the third segment of the male L7 absent 2
2. More distal seta (“furcal seta”) on the hemipenis strong and long . . . *L. algeriensis* Martens 1989 (in Danielopol et al. 1989)
– More distal seta (“furcal seta”) on the hemipenis short and weak . . . *L. helenae* Martens 1991a

Ecology and Distribution (Fig. 21)
While both *L. algeriensis* Martens 1989 (in Danielopol et al. 1989) and *L. helenae* Martens 1991a have been collected from their type localities only, *L. mirabilis* Kaufmann 1892 has a much wider distribution, and it has been found usually in lakes.

Ovambocythere **Martens 1989a**

Diagnosis (after Martens 1989a): Valves with pronounced sexual dimorphism. Valves surface pitted. Hinge anti-merodont, but with bar of the RV weakly crenulated and the bar of the LV set with shallow vertical depression, both posterior and anterior teeth prominent. L7 without sexual dimorphism except that, terminal claw flagellum

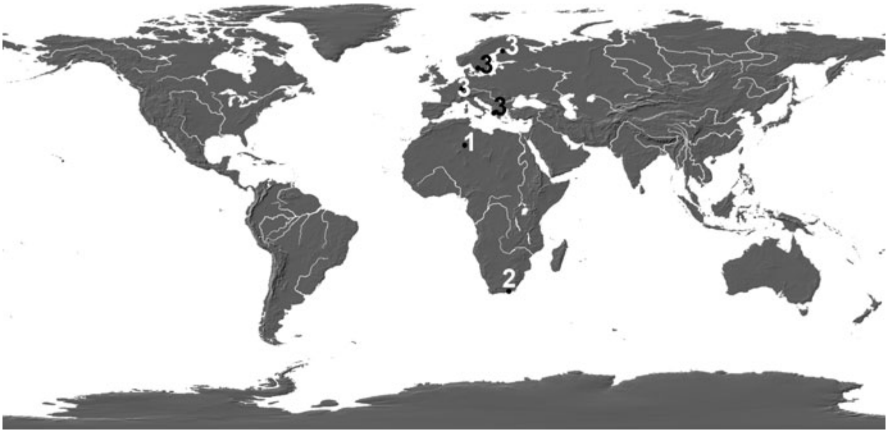

Fig. 21 Distribution of *Leucocythere* Kaufmann 1892: Numbers correspond to the species list

like in males. Hemipenis large, with UR consisting of two setae and a hook-like structure. Movable trabecule present.

Type (and only) species: *O. milani* Martens 1989a

Species list with type locality and type material
O. milani Martens 1989a. Temporary pool, next to the road Oshakati – Tsumeb, Namibia, 18°29′S 16°50′E: Holotype (♂), SMW – 51353–4.

Ecology and Distribution
The species has been collected only once from its type locality. Description of the species is based on animals raised from dried mud samples (Martens 1989a).

Potamocythere Schornikov 1986

Diagnosis (after Schornikov 1986): Sexual dimorphism not clearly pronounced. Valve surface covered with deep pits. Hinge anti-merodont. L7 without sexual dimorphism, terminal claw normally developed in both sexes. Movable trabecule on hemipenis not observed.

Type (and only) species: *P. murgabensis* Schornikov 1986.

Species list with type locality and type material
P. murgabensis Schornikov 1986. River Murgab, Tajikistan, 38°97′N 73°51′E: Holotype (♂), ZISP – 54639.

Ecology and Distribution
The species has been collected from River Murgab (Tajikistan) and its tributaries.

5.1.2 Tribe Limnocytherini Klie 1938a.

Diagnosis (after Danielopol et al., 1989 and Martens, 2000): Carapace strongly calcified, sexually dimorphic in lateral view (Fig. 6c, d). Females without brooding chamber. Hinge anti-merodont, hinge bar smooth. Copulatory process never spiraled.

Type genus: *Limnocythere* Brady 1867

Other genera: *Galolimnocythere* Schornikov 1973, *Kiwicythere* Martens 1992a, *Limnocytherina* Negadaev-Nikonov 1967, *Neolimnocythere* Delachaux 1928, *Paracythereis* Delachaux 1928, and *Paralimnocythere* Carbonnel 1969.

Key to the genera

1. MPC branched (Fig. 5c) 2
– MPC straight 3
2. Apical seta on the second segment of A1 absent (Fig. 8d) . . . *Kiwicythere* Martens 1992a
– Apical seta on the second segment of A1 present . . . *Paralimnocythere* Carbonnel 1969
3. UR on hemipenis large to very large over passing tip of distal lobe 4
– UR on hemipenis sometimes enlarged, but not that much (Fig. 14) . . . *Limnocythere* Brady 1867, *Limnocytherina* Negadaev-Nikonov 1967, and *Galolimnocythere* Schornikov 1973
4. Carapace with lateral projections (Fig. 5h) . . . *Neolimnocythere* Delachaux 1928
– Carapace without lateral projections. . . . . *Paracythereis* Delachaux 1928

Remarks

Danielopol et al. (1989) revised the systematics of the subfamily Limnocytherinae and recognized *Limnocytherina* Negadaev-Nikonov 1967 as a subgenus of *Limnocythere* Brady 1867. The authors pointed out some very important characters of the hemipenis as distinguishing features between the two subgenera. Later on, Martens (1996, 2000) elevated *Limnocytherina* to the rank of genus based on the same hemipenis characters. However, the author did not make any new combinations for the species already described in the genus *Limnocythere* with a clear, *Limnocytherina* type of the hemipenis. Because of this, I am here giving one key for both genera. This complex needs revision, since it is not always clear if the enlarged parts of hemipenis drawn by the authors represent upper ramus or lower ramus. Transformed UR setae on the hemipenis are not always described, and many species are known only after females. Since in this book I refrain from new systematic rearrangements, I am not proposing any new combination, but I am sure, based on the morphology and geographical distribution, that both genera will undergo systematic revisions in the future. The genus *Galolimnocythere* Schornikov 1973 is also described originally as a subgenus of *Limnocythere*, and elevated to the genus rank by Martens (1996, 2000). The differences are not quite clear, but Schornikov (1973) points out that L7 in males is the shortest of all thoracopods, while in females both L6 and L7 are of the same size. Schornikov (1973) further claims that in the genus *Limnocythere*, L7 is the largest limb, which is not always true, as in the *L. stationis* Vávra 1891, the L7 is the shortest limb, but in contrast to *Galolimnocythere*, in *L. stationis*, both males and females have this leg shorter than L6. It is worth noticing that in *Limnocythere sanctipatricii* (Brady and Robertson 1869), which has been assigned to the genus *Limnocytherina* Negadaev-Nikonov 1967, the L7 is the longest in both sexes. The soft part morphology of the entire subgenus *Limnocytherina* was based on the redescription of this species by Danielopol et al. (1989). However, these authors and many after them (Martens 1990, 1992a, 1996, 2000) consider the appearance of hemipenis as the distinguishing feature between *Limnocythere* and *Limnocytherina*. It is, therefore, obvious that the entire complex *Limnocytherina–Limnocythere–Galolimnocythere* needs a revision and reevaluation of the characters.

***Galolimnocythere* Schornikov 1973**

Diagnosis: In lateral view, anterior end is broader than posterior one. CIL narrow, MPC short and straight. A1 5-segmented. Posterior seta on the second segment of A1 present. No sexual dimorphism in appearance of thoracopods. L7 in males being the shortest of all thoracopods, in females this thoracopod is same as L6. UR on hemipenis small.

Type species: *G. sarsi* Schornikov 1973

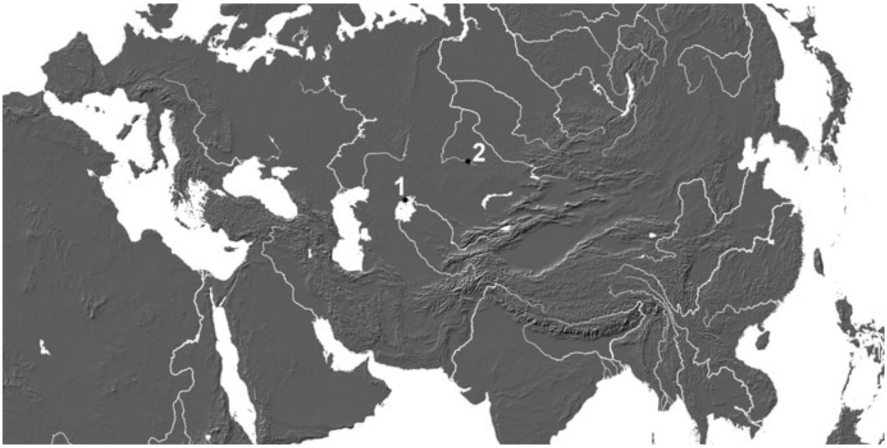

Fig. 22 Distribution of *Galolimnocythere* Schornikov 1973: Numbers correspond to the species list

Species list with type locality and type material

1. *G. aralensis* Schornikov 1973. Aral Sea, 46°12′N 59°54′E: Holotype (♀), *IMB-RAS* – 476–477.
2. *G. sarsi* Schornikov 1973. Lake, Akmolinsk, Kazakhstan, 51°09′N 71°27′E: Holotype (♂), *IMB-RAS* – 54331.

Key to the species

1. Carapace ornamented with very large pits .... *G. aralenis* Schornikov 1973
– Carapace smooth .... *G. sarsi* Schornikov 1973

Remarks

According to the drawings provided by Schornikov (1973), *G. aralensis* Schornikov 1973 has a crenulated hinge bar, what would place it in the tribe Leucocytherini (Danielopol et al. 1989). This, and the fact that there is already a genus *Korannocythere* Martens 1996 without a clear position in either of the two tribes, suggests that the subfamily Limnocytherinae needs a revision.

Ecology and distribution

The species have only been found from their respective type localities (Fig. 22).

***Kiwicythere* Martens 1992a**

Diagnosis (after Martens 1992a): MPC branched. A1 without posterior seta on the second segment (Fig. 8d). Respiratory plate of Mxl elongated. L5 very small. Hemipenis without additional lobes near distal lobe. Distal lobe large; UR extremely long, with separate top on one of the setae. Upper ramus elongated lobe, copulatory process small.

Type species: *K. anneari* Martens 1992a

Species list with type locality and type material

1. *K. anneari* Martens 1992a. Lake Tenants, Chatham Island, New Zealand, 43°50′S 175°26′E: Holotype (♂), New Zealand Geological Survey (New Zealand, Lower Hut) – 1169/1-2.
2. *K. vulgaris* (McKenzie and Swanson 1981). Limestone pit, SE end of the Crown Terrace, Kawarau Gorge, South Island, New Zealand, 45°00′S 168°54′E: Holotype (carapace), NZGSW – TO 1135.2–15.

Key to the species

1. Dorsal margin asymmetrically arched (RV having almost straight dorsal margin, LV having arched/rounded dorsal margin) ... *K. vulgaris* (McKenzie and Swanson 1981)
– Dorsal margin symmetrically arched .... *K. anneari* Martens 1992a

Ecology and distribution (Fig. 23)

Both species are only known from their type localities.

Fig. 23 Distribution of *Kiwicythere* Martens 1992a: Numbers correspond to the species list

Limnocythere Brady 1867 [Syn: *Limnicytheridea* G.W. Müller 1912; *Acanthopus* Vernet 1878]

Diagnosis (after Martens 1990): Valves elongated, with apparent sexual dimorphism in valve shape (males more elongated and often expanded posteriorly and mostly longer than females), with radial pore canals not branched. In dorsal view, carapace with anterior end compressed, sometimes building a rostrum; posterior side always with LV overlapping RV. Hemipenis with three setae on UR, lower ramus consisting of a lateral process and a prominent, hook-like process, with upper ramus either reduced to an elongated tentacle or completely absent and with a movable trabecule. A1 and L6 without special features.

Type species: *L. inopinata* (Baird 1843a)

Species list with type locality and type material

1. *L. aethiopica* Klie 1934a. Banaghar Pan 3, Lake Chrissie area, Mpumalanga, South Africa, 25°21′39″S 30°22′39″E: Lectotype (♂), ZMK – UR-77.
2. *L. africana* Klie 1939a. Lake Turkana, Kenya, 03°38′20″N 36°00′E: Holotype (♂), ZMK – UR-78.
3. *L. arthuri* Löffler 1961a. Puddle, Villarica, Chile, 39°16′46″S 72°13′33″W: Holotype not originally designated, NHMV – collection numbers unknown.
4. L. *aspera* Henry 1923. Byron Bay, NSW, Australia, 28°38′35″S 153°36′43″E: Holotype, AMS – P.6117.

5. *L. atacamae* Brehm 1935: Chiu-Chiu, W Atacama, Peru, 22°00′40″S 68°35′49″W. Holotype not originally designated, repository of the type material unknown.
6. *L. baikalensis* Martens and Mazepova 1992. Chivyrkui Bay, Cape Irkana, N basin of Lake Baikal, Russia, 55°51′17″N 111°13′58″E: Holotype (♂), RBINS – O.C. 1561.
7. *L. balatonica* Daday 1900. Lake Balaton, Hungary, 46°49′N 17°44′E: Holotype is not designated. A couple of type specimens are deposited in HMNH – IV-414. List of other specimens can be found in Forró et al. (1987).
8. *L. borisi* Martens 1990. Lake (Hora) Abijata, Ethiopia, 07°36′58″N 38°36′E: Holotype (♂), RMCA – 56.657.
9. *L. camera* Delorme 1967: Rocky Lake, Saskatchewan Lakes, Canada, 45°04′N 82°27′W: Holotype (♀), GMUS – Ao-319.
10. *L. ceriotuberosa* Delorme 1967: Rocky Lake, Saskatchewan Lakes, Canada, 45°04′N 82°27′W: Holotype (♀), GMUS – Ao-320.
11. *L. coelebs* Klie 1944. Lake Edward, near Kamande, Zaire, 00°35′17″S 29°17′23″E: Lectotype (♂), ZMK – UR-71.
12. *L. conifera* Brehm 1950. Cleveland Lagoon, Tasmania, Australia, 41°47′S 147°22′. Holotype not designated, repository of the type material unknown.
13. *L. cyphoma* Smith and Janz 2009. Lake Biwa, E side of the N basin, Japan, 35°09′52.0″N 136°03′44.2″E: Holotype (♂), LBM – 1430003517.
14. *L. dadayi* Martens 1990. Lake Rukwa, Tanzania, 07°59′30″S 32°17′06″E: Holotype (♂), HMNH – IV/P.393.
15. *L. dorsosicula* De Deckker 1981c. Lake Terangpom, W of Lake Corangamite, W Victoria, Australia, 38°09′51″S 143°24′04″E. Holotype (♂), NMV – J1134-1162.
16. *L. dubiosa* Daday 1903. İsnik-Gölü, Bursa, Turkey, 40°26′N 29°31′E: Holotype is not designated. A couple of type specimens are deposited in HMNH – IV-416. List of other specimens can be found in Forró et al. (1987).
17. *L. fijiensis* Brady 1890. Between tide-marks on Luvuka Island (formerly Levuka Island), Western Fiji Islands, 17°39′S 177°16′E: Syntypes, HM – NEWHM:1.18.28.
18. *L. floridensis* Keyser 1975. Everglades National Park, Florida, USA, 25°17′N 80°53′W: Holotype (♂), ZMH – K30 334.
19. *L. friabilis* Benson and Macdonald 1963. Holocene deposits, Lake Erie, North America, 42°10′N 80°51′W: Holotype not designated, repository of the type material unknown.
    Syn.: *L. chippewaensis* Staplin 1963a
20. *L. fude* Smith and Janz 2009. Lake Biwa, N basin off W shore, Japan, 35°17′09.3″N 136°01′58.5″E: Holotype (♂), LBM – 1430003507.
21. *L. gibbosa* Sywula 1970b. Jebbel Mara, Deriba Lakes, Sudan, 12°58′N 24°16′E: Holotype (♂), ZIPAS – collection number unknown.
22. *L. hungarica* Daday 1900. Bugac, Hungary, 46°41′12″N 19°41′E: Holotype is not designated. A couple of type specimens are deposited in HMNH – IV-419. List of other specimens can be found in Forró et al. (1987).

23. *L. inopinata* (Baird 1843a). Type locality not clearly marked. Baird (1843a, b) said that the species occurs in Middlesex (51°30′N 00°22′W), England, UK. Holotype not designated, repository of the type material not known.
    Syn.: *L. incisa* Dahl 1888; *L. balatonica* Daday 1900a; *L. mongolica* Daday 1901a; *L. sappaensis* Staplin 1963a.
24. *L. iowensis* Danforth 1948. Clay County, Iowa, USA, 43°07′37″N 95°07′00″W: Holotype (?), SM – 90721.
25. *L. itasca* Cole 1949. Lake Itasca, Clearwater County, Minnesota, USA, 47°13′01″N 95°12′27″W: Holotype (♂), SM – 88500.
26. *L. jocquei* Martens 1990. Lake Malawi, near Chintcheche village, Malawi, 11°50′09″S 34°10′29″E: Holotype (♂), RMCA – 56.667.
27. *L. kamiyai* Smith and Janz 2009. Lake Biwa, E shore, Japan, 35°02′01.5″N 135°54′36.5′E: Holotype (♂), LBM – 1430003503.
28. *L. levigatus* Smith and Janz 2009. Lake Biwa, E side of N basin, Japan, 35°13′54.1″N 135°57′49.6″E: Holotype (♂), LBM – 1430003509.
29. *L. michaelseni* Daday 1910a: Lake Rikwa, Tanzania, 07°59′30″S 32°17′06″E: Lectotype (♂), HMNH – IV/P.380.
30. *L. milta* De Deckker 1981a: Lake Werowrap, Red Rock area, near Colac, W Victoria, Australia, 38°15′23″S 143°29′35″E: Holotype (♀), NMV – J1134-J1162.
31. *L. minor* Lindroth 1953. Lake Turkana, Kenya, 03°38′20″N 36°00′E: Holotype not designated, type material deposited in ZMU.
32. *L. mongolica* Daday 1901a. Chermin(?) Tsagaan Nuur, Mongolia, coordinates unknown: Holotype is not designated. A couple of type specimens are deposited in HMNS – IV-429. List of other specimens can be found in Forró et al. (1987).
33. *L. mowbrayensis* Chapman 1914. Late Pleistocene deposit at Mowbray swamp, NE Tasmania, Australia, 40°50′55″S 145°04′56″E: Lectotypes, NMV – collection numbers unknown.
34. *L. neotropica* Klie 1934a. Barra St. Lucia, Rio de la Plata, Argentina, 34°12′51″S 59°04′44″W: Syntypes, ZMK – UR-762.
35. *L. notodonta* Vávra 1906. Garut, West Java, Indonesia, 07°14′54″S 107°54′34″E: Holotype not designated, repository of the type material unknown.
36. *L. opesta* (Brehm 1939c). Petén Lake, Guatemala, 16°58′N 89°49′W: Holotype not designated, repository of the type material unknown.
37. *L. ornata* Furtos 1933. East Harbor, Lake Erie, Ohio, USA, 41°32′20″N 82°48′05″W: Holotype not designated, paratypes deposited in SM – 67892.
38. *L. oughtoni* Tressler 1957. Goulet Island, Great Slave Lake, Canada, 61°46′N 113°58′W: Holotype (♀), SM – 100871.
39. *L. paranensis* Ferguson 1967a. Laguna Los Espejos, Santa Fe, Argentina, 31°38′S 60°42′W: Holotype (♂), SM – 112990.
40. *L. paraornata* Delorme 1971. Saskatchewan Lakes, Canada, 45°04′N 82°27′W: Holotype (♀), GMUS – 27527.

41. *L. parascutarense* Delorme 1971. Saskatchewan Lakes, Canada, 45°04′N 82°27′W: Holotype (♀), GMUS – 27535.
42. *L. porphyretica* De Deckker 1981a. Roadside pool, 2.5 km W of Lake Grace township, WA, Australia, 33°06′12″S 118°25′24″E: Holotype (♂), AMS – P.28625.
43. *L. posterolimba* Delorme 1967. Rocky Lake, Saskatchewan Lakes, Canada, 45°04′N 82°27′W: Holotype (♀), GMUS – Ao-348.
44. *L. pseudoreticulata* Staplin 1963a. Havana Quadrangle, Fulton County, Illinois, USA, 40°29′28″N 89°35′48″W: Holotype was illustrated in Staplin (1963a), but repository and collection numbers are unknown.
45. *L. reticulata* Sharpe, 1897. Urbana, Illinois, USA, 40°06′57″N 88°13′82W: Holotype not designated, repository of type material unknown.
46. *L. robusta* Delorme 1967. Rocky Lake, Saskatchewan Lakes, Canada, 45°04′N 82°27′W: Holotype (♀), GMUS – Ao-354.
47. *L. royi* Hartmann 1959. Lake Nicaragua, Granada, Nicaragua, 11°37′51″N 85°21′39″W: Syntype (?), ZMH – K-28 235.
48. *L. sanctipatricii* (Brady and Robertson 1869). Lough Moher, Mayo, Ireland, 53°58′N 09°29′W. Holotype not designated, repository of type material unknown.
49. *L. scutariense* Petkovski 1961. Skadar Lake, Montenegro, 42°11′17″N 19°18′54″E. Holotype not designated, NHMS – collection numbers unknown.
50. *L. sharpei* Staplin 1963a. Havana Quadrangle, Fulton County, Illinois, USA, 40°29′28″N 89°35′48″W: Holotype was illustrated in Staplin (1963a, b), but repository and collection numbers are unknown.
51. *L. staplini* Gutentag and Benson 1962. Meade County, Kansas, USA, 37°16′N 100°21′W: Holotype (valves), DGUK – 717563.
52. *L. stationis* Vávra 1891. Czech Republic (49°51′N 13°34′E). Holotype not designated, repository of the type material unknown.
53. *L. thomasi* Martens 1990. Lake Zway, Ethiopia, 07°59′58″N 38°50′E: Holotype (♂), RMCA – 56.661.
54. *L. titicaca* Lerner-Seggev 1973. Lake Titicaca, Huarina, Bolivia, 16°11′49″S 68°36′14″W: Holotype (♀), SM – 137487.
55. *L. tudoranceai* Martens 1990. Dam near the village Eunda, Omusati, Namibia, 17°30′58″S 14°37′51″E: Holotype (♂), SMW – 51394.
56. *L. varia* Staplin 1963a. Havana Quadrangle, Fulton County, Illinois, USA, 40°29′28″N 89°35′48″W: Holotype was illustrated in Staplin (1963a, b) but repository and collection numbers are unknown.
57. *L. verrucosa* Hoff 1942. West Loon Lake, Lake County, Illinois, USA, 42°29′21″N 87°18′36″W: Holotype (♂), SM – 81986.

Key to the species

1. In lateral view, one or both valves with distinct spines on the postero-dorsal margin 2

– In lateral view, no distinct spines present on the postero-dorsal margin 6

2. L7 the largest thoracopod .... *L. dorsosicula* De Deckker 1981c

– L7 the smallest thoracopod 3

3. Carapace smooth, or very poorly ornamented ... *L. levigatus* Smith and Janz 2009

– Carapace harshly ornamented 4

4. Distal lobe of hemipenis triangular .... *L. stationis* Vávra 1891

– Distal lobe on hemipenis different 5

5. Distal lobe on hemipenis with flat distal margin, quadriform appearance ... *L. kamiyai* Smith and Janz 2009

– Distal lobe on hemipenis with lateral elongation ... *L. fude* Smith and Janz 2009

6. Females with inflated postero-ventral margin on valves 7

– Postero-ventral margin on valves not inflated in females 12

7. Greatest H behind the middle 8

– Greatest H in the middle or in front of the middle 9

8. Carapace smooth or very lightly ornamented .... *L. aethiopica* Klie 1934a

– Carapace harshly ornamented .... *L. borisi* Martens 1990

9. Greatest H clearly marked and being situated frontally, and dorsal margin sloping gradually toward posterior end .... *L. jocquei* Martens 1990

– Greatest H not clearly pronounced on valves and dorsal margin almost flat ... 10

10. Lateral lobe of hemipenis sickle shaped, reaching up to or beyond the tip of the hemipenis .... *L. michaelseni* Daday 1910a

– Lateral lobe shorter 11

11. UR seta f1 longer than lateral lobe and almost reaching the tip of the hemipenis .... *L. dadayi* Martens 1990

– UR seta f1 much shorter .... *L. thomasi* Martens 1990

12. Postero-ventral margin clearly serrated .... *L. inopinata* (Baird 1843a)

– Postero-ventral margin not serrated 13

13. UR setae on hemipenis very strongly developed, strongly sclerified, and prominent 14

– UR setae on hemipenis small, not so prominent and not strongly sclerified . 27

14. In females, in lateral view, greatest H lying behind the middle 15

– In females, in lateral view, greatest H lying in front or in the middle 16

15. Dorsal margin of LV highly arched ... *L. staplini* Gutentag and Benson 1962

– Dorsal margin of LV not highly arched ..... *L. parascutarense* Delorme 1971

16. Carapace smooth (or very poorly ornamented) 17

– Carapace well ornamented 21

17. In lateral view, male valve with posterior end of valves being much higher than anterior, and dorsal margin posteriorly highly arched 18

– In lateral view, both anterior and posterior ends are equally high 19

18. Postero-ventral margin in male enlarged ....*L. royi* Hartmann 1959

– Postero-ventral margin in male not enlarged ... *L. titicaca* Lerner-Seggev 1973

19. Distal lobe of hemipenis being very small and rounded ... *L. dubiosa* Daday 1903

– Distal lobe of hemipenis being prominent and triangular 20

20. Lower ramus of hemipenis distally inflated and enlarged ... *L. neotropica* Klie 1934a

– Lower ramus of hemipenis rounded distally, but not inflated ... *L. arthuri* Löffler 1961a

21. In dorsal view, several bumps are present which extend laterally beyond the margins of the carapace 22

– In dorsal view, sometimes bumps are present, but being very small and not extending beyond the margins of the carapace 26

22. Some of the bumps are transformed into alae, which are distally pointed ... 23

– All bumps rounded 25

23. Lower ramus on hemipenis very prominent and extending far beyond hemipenis...24

– Lower ramus on hemipenis quite small..... *L. mowbrayensis* Chapman 1914

24. Lower ramus on hemipenis bent downward and lateral alae quite small ... *L. ornata* Furtos 1933

– Lower ramus on hemipenis turned upward and lateral alae very long ... *L. scutariense* Petkovski 1961

25. Distal lobe of the hemipenis triangular .... *L. verrucosa* Hoff 1942

– Distal lobe of the hemipenis quadriform ... *L. porphyretica* De Deckker 1981a

26. In lateral view, ventral margin considerably concave around the mouth region and MPC frontally all equally long . . . *L. sanctipatricii* (Brady and Robertson 1869)

– In lateral view, ventral margin almost straight around the mouth region, MPC unequally long frontally . . . . *L. floridensis* Keyser 1975

27. In lateral view, dorsal margin in females slightly rounded in the frontal part . . . 28

– In lateral view, dorsal margin in females flat 29

28. In dorsal view, anterior end beak like and extended . . . *L. gibbosa* Sywula 1970b

– In dorsal view, anterior end pointed, but not extended . . . *L. cyphoma* Smith and Janz 2009

29. Carapace poorly ornamented . . . . *L. africana* Klie 1939a

– Carapace strongly ornamented 30

30. Ventral margin in males not inflated . . . *L. baikalensis* Martens and Mazepova 1992

– Ventral margin in males inflated 31

31. In dorsal view, posterior end of carapace inflated in males . . . *L. tudoranceai* Martens 1990

– In dorsal view, male carapace more slender 32

32. Glans complex on hemipenis consisting of different lobes and a dorsal hook . . . *L. minor* Lindroth 1953

– Glans complex on hemipenis small . . . . *L. coelebs* Klie 1944

Remarks

Many of the species described from North America were transferred in the subgenus *Limnocytherina* Negadaev-Nikonov 1967 by Delorme (1971). The author has provided very brief descriptions and affiliations and has presented each species with photographs of the soft parts, which are insufficient for most of them to be properly identified.

Species not included in the key:
L. aspera Henry 1923; *L. atacamae* Brehm 1935; *L. balatonica* Daday 1900; *L. conifera* Brehm 1950; *L. camera* Delorme 1967; *L. ceriotuberosa* Delorme 1967; *L. friabilis* Benson and Macdonald 1963; *L. hungarica* Daday 1900; *L. iowensis* Danforth 1948; *L. itasca* Cole 1949; *L. milta* De Deckker 1981a; *L. mongolica* Daday 1901a; *L. notodonta* Vávra 1906; *L. opesta* Brehm 1939c; *L. oughtoni* Tressler 1957; *L. paranensis* Ferguson 1967a; *L. paraornata* Delorme 1971;

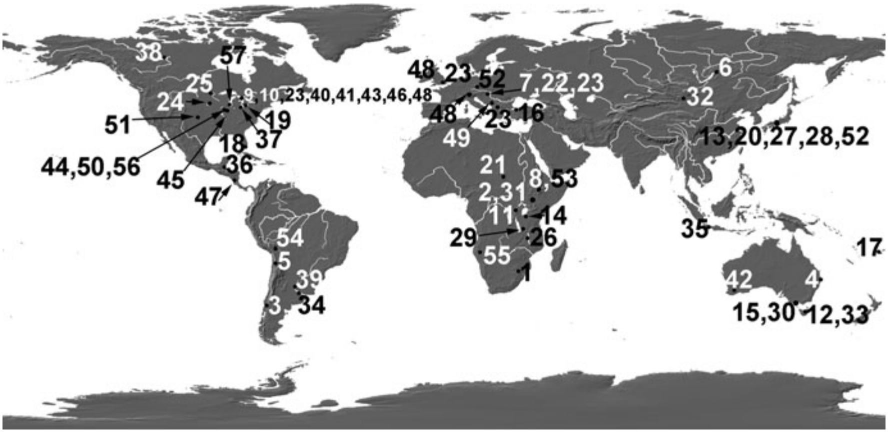

Fig. 24 Distribution of *Limnocythere* Brady 1867: Numbers correspond to the species list

L. posterolimba Delorme 1967; *L. reticulata* Sharpe 1897; *L. pseudoreticulata* Staplin 1963a; *L. robusta* Delorme 1967; *L. sharpei* Staplin 1963a; *L. staplini* Gutentag and Benson 1962; and *L. varia* Staplin 1963a.

Ecology and distribution (Fig. 24)
The species can most commonly be found in lakes and permanent small water bodies. Most of the species have restricted distribution, with the exception of *L. inopinata* (Baird 1843a), *L. stationis* Vávra 1891, and *L. sanctipatrici* (Brady and Robertson 1869) which have a Holarctic distribution.

***Neolimnocythere* Delachaux 1928**
Diagnosis: MPC straight, carapace with many lateral projections. UR on hemipenis strongly developed, with setae reaching the tip of distal lobe on hemipenis.

Type species: *N. hexaceros* Delachaux 1928

Species list with type locality and type material

1. *N. erinacea* Delachaux 1928. Lake Heron, Peru, 11°01′22″S 76°25′43″W: Holotype not designated, repository of the type material unknown.
2. *N. hexaceros* Delachaux 1928. Lake Heron, Peru, 11°01′22″S 76°25′43″W: Holotype not designated, repository of the type material unknown.

Key to the species

1. Carapace with six lateral projections . . . . *N. hexaceros* Delachaux 1928
– Carapace with numerous small, spine-like projections . . . *N. erinacea* Delachaux 1928

Ecology and distribution
Both species have been found so far only in the type locality.

Paracythereis Delachaux 1928

Diagnosis: MPC straight, carapace without lateral projections. UR on hemipenis strongly developed, with setae reaching the tip of distal lobe on hemipenis.

Type (and only) species: *P. impudica* Delachaux 1928

Species list with type locality and type material
P. impudica Delachaux 1928. Lake Heron, Peru, 11°01′22″S 76°25′43″W: Holotype not designated, repository of the type material unknown.

Ecology and distribution
The species has been found so far only in the type locality.

Paralimnocythere Carbonnel 1969

Diagnosis (according to Martens 1992a): MPC branched, inner margin running regularly. RV with both anterior and posterior cardinal teeth present or with hinge completely adont. Surface of the valves with prominent ridges, tubercles, and ala. A1 with apical seta on the second segment. Mxl-palp with rectangular terminal segment. L5, L6, and L7 with very small or absent ventral setae on the basal segments. Hemipenis with one or two additional lobes near distal lobe. Distal lobe relatively small.

Type species: *P. bouleigensis* Carbonnel 1965 (fossil)

Species list with type locality and type material

1. *P. alata* (Klie 1939b). Lake Ohrid, Macedonia, 41°06′N 20°43′E: Syntypes, ZMK – UR-76.
2. *P. compressa* (Brady and Norman 1889). Whitefield Lock, Wigtownshire, Scotland, UK, 52°28′N 01°54′W: Lectotype (♂), BM – 1992.61.
3. *P. diebeli* (Petkovski 1969a). Belimbegovo near Skopje, Macedonia, 41°59′N 21°26′E: Holotype not designated, NHMS – collection numbers unknown.
4. *P. georgevitschi* (Petkovski 1960a). Lake Ohrid, Macedonia, 41°06′N 20°43′E: Holotype not designated, NHMS – collection numbers unknown.
5. *P. karamani* (Petkovski 1960a). Type locality is not clearly designated, Petkovski (1960a, b) mentions both Prespa and Ohrid Lake, not clearly saying which one of the lakes is the type locality. Holotype not designated, NHMS – collection numbers unknown.
6. *P. messanai* Martens 1992a. River sediments in Torrente Mugnone, Firenze, Italy, 43°48′13″N 11°14′49″E: Holotype (♂), RBINS – MF.1307.
7. *P. ochridensis* (Klie 1934a). Lake Ohrid, Macedonia, 41°06′N 20°43′E: Syntypes, ZMK – UR-73.
8. *P. psammophila* (Flössner 1965). Großer Stechlinsee, Germany, 53°08′59″N 13°02′E: Holotype not designated, repository of the type material unknown.

9. *P. relicta* (Lilljeborg 1863). Uppsala, Sweden, 59°53′N 17°36′E: Lectotype (♀), BM – M.3401. The lectotype was never designated, but Martens (1992a) suggested that the material deposited in BM should be a name-bearing type. The original material labeled as types is deposited in ZMU (3386) but contains only very poorly preserved specimens (Martens 1992a).
10. *P. slavei* (Petkovski 1969a). Lake Ohrid, Macedonia, 41°06′N 20°43′E: Holotype not designated, NHMS – collection numbers unknown.
11. *P. umbonata* (Klie 1939b). Lake Ohrid, Macedonia, 41°06′N 20°43′E: Syntypes, ZMK – UR-72 and 74.

Key to the species

1. In dorsal view, both females and males with prominent lateral projections (alae) which are almost at right angle with the central axis of the carapace (not sloping) .... *P. umbonata* (Klie 1939b)

– In dorsal view, alae absent, or, if present in both males and females always sloping toward the anterior end, and extending toward the posterior end 2

2. In dorsal view, no lateral projections so that both lateral margins slope gently toward the anterior and posterior ends 3

– In dorsal view, lateral projections are prominent so that both lateral margins slope more or less gently toward the anterior end, but with a clear cut-off at the end of the projection toward the posterior end 5

3. Additional distal lobe on hemipenis present 4

– Additional distal lobe on hemipenis absent ... *P. messanai* Martens 1992a

4. Main distal lobe with rounded distal margin and with additional lobe bulb like .... *P. diebeli* Petkovski 1969a

– Main distal lobe with straight distal margin and additional lobe triangular ... *P. slavei* Petkovski 1969a.

5. In dorsal view, females with two lateral projections on each side 6

– In dorsal view, females with one lateral projection on each side 9

6. Additional distal lobe on hemipenis below the main one (on the side of the copulatory process) present .... *P. ochridense* (Klie 1934a)

– Additional distal lobe on hemipenis below the main one (on the side of the copulatory process) absent 7

7. Species less than 0.6 mm long and short (L less than two times H) ... *P. compressa* (Brady and Norman 1889)

– Species more than 0.61 mm long and elongated (L more than 2.2 times H) ... 8

8. In dorsal view, anterior and posterior end elongated, thin and narrow… *P. psammophila* (Flossner 1965)

– In dorsal view, both ends much shorter and not so thin … *P. karamani* (Petkovski 1960a)

9. Distal lobe on hemipenis with evenly rounded distal margin ………… 10

– Distal lobe with triangular distal margin ……… *P. relicta* (Lilljeborg 1863)

10. In dorsal view, each valve with one rounded bulge (which not extending lateral margins) present on the last third of carapace L … *P. georgevitschi* (Petkovski 1960a)

– In dorsal view, each valve with one rounded bulge (which not extending lateral margins) present on the last third of carapace L……… *P. alata* (Klie 1939b)

Remarks
Although *P. relicta* (Lilljeborg 1863) and *P. diebeli* (Petkovski 1969a) should be easily separated based on the carapace appearance, the first one having more cuneiform anterior end of carapace in dorsal view, while the hemipenis is extremely similar in both species. Martens (1992a) redescribed *P. relicta,* and the illustration of the hemipenis he provided is similar to the one provided by Petkovski (1969a) for *P. diebeli*. On the contrary, Petkovski (1969a) illustrated the hemipenis of *P. relicta*, which is different from the one illustrated by Martens (1992a). Since Martens (1992a) was dealing with the type material, there is no doubt regarding the species he illustrated. It is possible that the drawings in Petkovski (1969a) were erroneously labeled, and the problem should be resolved by checking the type material of *P. diebeli* and the material of *P. relicta* Petkovski (1969a) used for the illustration.

Ecology and distribution (Fig. 25)
The species can be found in open water bodies, like lakes, or in springs and rivers, and are restricted to Europe.

5.2 Subfamily Timiriaseviinae Mandelstam 1960

Diagnosis (after Martens 2003a): Carapace with important sexual dimorphism, i.e., females strongly inflated posteriorly in dorsal view, forming externally visible brooding chamber (Fig. 3e, f). Hinge adont or (inverse) lophodont. A1 with terminal segment shorter than penultimate one (Fig. 8b). Fused part of A1 aesthetasc short. Md-palp either straight or knee like (Fig. 9a–d). Mxl-palp weakly sclerified, mostly undivided and with a reduced number of apical and lateral setae (Fig. 10a, d). L7 is the largest thoracopod. Distal lobe on hemipenis moveable (Fig. 13d).

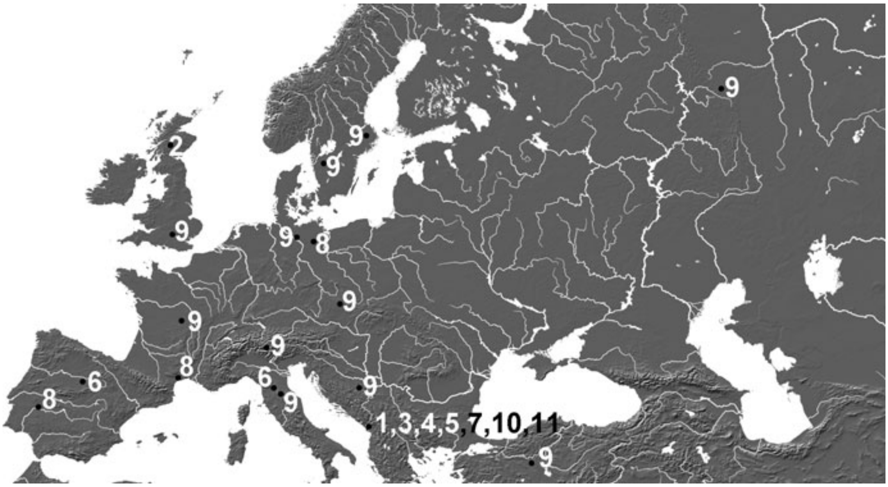

Fig. 25 Distribution of *Paralimnocythere* Carbonnel 1969: Numbers correspond to the species list

Type genus: *Timiriasevia* Mandelstam 1947 (fossil genus)

Key to the genera

1. Md-palp with only two distinct segments, penultimate one very broad (knee-like type) (Fig. 9d) 2

– Md-palp with last three segments normally developed (straight type) (Fig. 9a–c) 3

2. L7 transformed, curved, and shorter than that in the other two thoracopods (Fig. 12l) ....*Cytheridella* Daday 1905

– L7 not transformed, being the longest of the three thoracopods ... *Afrocythere* Klie 1935a

3. Terminal segment of A2 with only one claw (Fig. 42c of chapter "Introduction")... *Dolekiella* Gidó, Artheau, Colin, Danielopol, and Marmonier 2007

– Terminal segment of A2 with three claws (Fig. 42c of chapter "Introduction")... 4

4. Posterior seta on the second segment of A1 absent (Fig. 8b) ... *Gomphodella* De Deckker 1981b

– Posterior seta on the second segment of A1 present 5

5. Hinge inverse lophodont 6

– Hinge lophodont 7

6. Terminal segment of Md-palp normally developed, Mxl-palp with more than two papoose setae (Fig. 10a) ....*Gomphocythere* G. O. Sars 1924

– Terminal segment of Md-palp very small, Mxl-palp with only two papoose setae (Fig. 10d) ....*Kovalevskiella* Klein 1963

7. A2 sexually dimorphic (most posterior of distal claws strongly serrated in males), both sexes with two additional setae on distal segment of the same appendage (Fig. 7f) 8

– A2 not sexually dimorphic and without two additional setae on distal segment ....*Metacypris* Brady and Robertson 1870

8. Male A2 with only one claw on terminal segment strongly serrated ... *Elpidium* Müller 1880

– Male A2 with all three claws on the terminal segment strongly serrated ... *Intrepidocythere* Pinto et al. 2008

***Afrocythere* Klie 1935a**

Diagnosis (modified after Martens 1995): Hinge adont; Md-palp with only two distinct segments, penultimate one very broad (knee-like type) with bifurcate setae. L7 being the longest of legs.

Type (and only) species: *A. rostrata* Klie 1935a

Species list with type locality and type material

A. rostrata Klie 1935a. Tambacounda (original name Botou), Senegal, 13°49’N 13°35’W: Syntypes (♀), ZMK – UR-305, 306.

Ecology and distribution

The species was collected from a lake and was also found in the localities in the proximity of the type locality (Klie 1935a).

***Cytheridella* Daday 1905 [Syn: *Onychocythere* Tressler 1939]**

Diagnosis (modified after Martens 1995): Hinge adont; Md-palp with only two distinct segments, penultimate one very broad (knee-like type); L7 transformed, curved, and shorter than that in the other two thoracopods.

Type species: *C. ilosvayi* Daday 1905

Species list with type locality and type material

1. *C. damasi* Klie 1944. Kibuga Lake, Uganda, 00°53′04″N 31°44′03″E: Syntypes (♀), ZMK – UR-300.

2. *C. ilosvayi* Daday 1905. Villa Sana, Baches Paso Ita, Paraguay, 22°49′S 57°05′W: Type (?), HMNH – IV/P-182.
3. *C. monodi* Klie 1936a. Crater lake Mfou, near Bafoussam, Cameroon, 05°28′N 10°25′E: Syntypes, ZMK – UR-301.
4. *C. tepida* Victor 1987. Wikki warm springs, Yankari Game Reserve, Bautchi State, N Nigeria, 09°45′N 10°31′E: Holotype (♀), BM – 1985, 382.

Key to the species

1. UR absent 2

– UR present 3

2. Distal lobe of hemipenis pointed; upper ramus of clasping organ small, not extending or overlapping distal lobe................. *C. monodi* Klie 1936a

– Distal lobe of hemipenis blunt; upper ramus of clasping organ elongated, overlapping, and surpassing distal lobe .... *C. tepida* Victor 1987

3. Ventral side of distal lobe of hemipenis with a long flagellum-like extension ... *C. ilosvayi* Daday 1905

– Ventral side of distal lobe of hemipenis without a long flagellum-like extension .... *C. damasi* Klie 1944

Ecology and Distribution (Fig. 26)
The species live in open water bodies and are distributed only in Africa and South America.

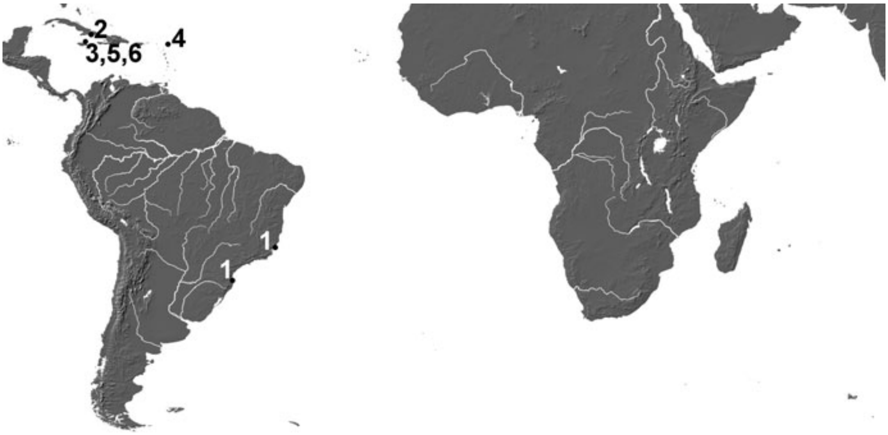

Fig. 26 Distribution of *Cytheridella* Daday 1905: Numbers correspond to the species list

Dolekiella Gidó, Artheau, Colin, Danielopol, and Marmonier 2007

Diagnosis (modified after Gidó et al. 2007): Hinge lophodont. Terminal segment of A2 with only one claw. Terminal segment of the Md-palp bearing a claw which is transformed in a serrated spatula-shaped process.

Type (and only) species: *D. europea* Gidó, Artheau, Colin, Danielopol, and Marmonier 2007

Species list with type locality and type material
D. europea Gidó, Artheau, Colin, Danielopol, and Marmonier 2007. Calmeilles village, Languedoc-Roussillon, S France, 42°33′05″N 02°40′17″E: Holotype (♂), NHMV – 20711.

Ecology and distribution
The species is a stygobiont and is found in wells in southern France.

Elpidium Müller 1880

Diagnosis (modified after Colin and Danielopol 1980): Valves weakly ornamented. Hinge adont or lophodont. A2 sexually dimorphic; in males, distal claws strongly serrated. Md-palp normally developed.

Type species: *E. bromeliarum* Müller 1880

Species list with type locality and type material

1. *E. bromeliarum* Müller 1880. Itajaí, Santa Catarina, Brazil, 26°55′S 48°40′W: Neotype (♀), Paleontological Museum UFRGS – MP-0-277.
2. *E. inaequivalvis* Danielopol 1980a, b (in Colin and Danielopol 1980). Gran Piedra, Cuba, 20°00′17″N 75°37′35″W: Holotype not designated, NHMV.
3. *E. laesslei* (Tressler 1956). St. Andrews Parish, Blue Mountains, Jamaica, 18°41′38″N 76°40′08″W: Holotype (♀), SM – 99387.
4. *E. maricaoensis* (Tressler 1941). Maricao National Forest, Puerto Rico, 18°11′05″N 60°59′01″W: Holotype (♀), SM – 80029.
5. *E. pintoi* Danielopol 1980 (in Colin and Danielopol 1980). Rio Indio, Cuba, 20°00′N 75°37′W: Holotype not designated, NHMV.
6. *E. purperi* Danielopol 1980a, b (in Colin and Danielopol 1980). Siboney, Cuba, 20°00′N 75°37′W: Holotype not designated, NHMV.

Key to the species

1. In dorsal view, valves asymmetrical … *E. inaequivalvis* Danielopol 1980a, b (in Colin and Danielopol 1980)

– Valves symmetrical in dorsal view 2

2. Distal lobe of hemipenis triangular 3

– Distal lobe of hemipenis square shaped 5

3. Carapace surface pitted ....*E. laesslei* (Tressler 1956)
– Carapace surface smooth 4
4. Distal lobe of hemipenis narrow, with narrow and pointed tip ... *E. purperi* Danielopol 1980 (in Colin and Danielopol 1980)
– Distal lobe of hemipenis wide ... *E. pintoi* Danielopol 1980a, b (in Colin and Danielopol 1980)
5. Distal lobe of hemipenis with rounded margins . . *E. bromeliarum* Müller 1880
– Distal lobe of hemipenis with pointed margins and somewhat elongated tips ... *E. maricaoensis* (Tressler 1941)

Ecology and distribution (Fig. 27)
The species live predominantly in the water retained in bromeliad cups and are distributed in the Central and South America.

***Gomphocythere* Sars 1924**
Diagnosis (modified after Martens 2003a): Hinge inverse lophodont with posterior cardinal tooth on LV mostly larger than anterior one. Ventral side of carapace in most species set with ridges. CIL narrow. L7 is the longest and most elongated walking leg. Posterior part of female abdomen with one or two caudal complexes, each consisting of two setae and three setose lobes, and dorsally with a plump caudal seta. Hemipenis with a large, articulated distal lobe, without a lateral seta.

Type species: *G. obtusata* (Sars 1910)

Species list with type locality and type material

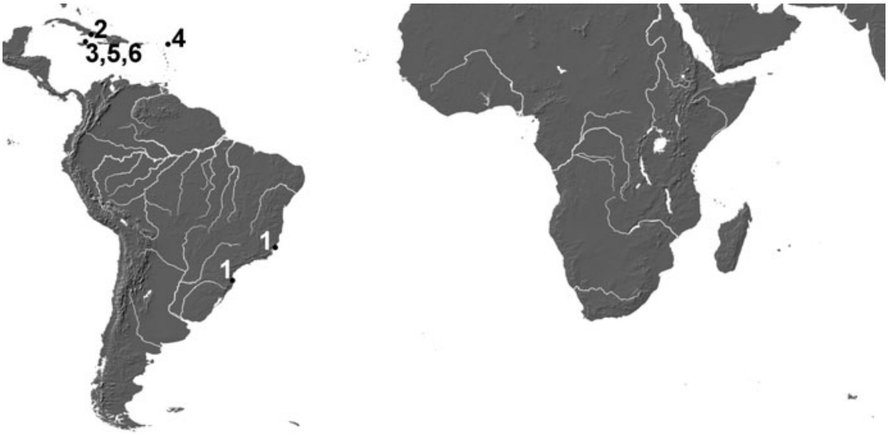

Fig. 27 Distribution of *Elpidium* Müller 1880: Numbers correspond to the species list

1. G. *aethiopsis* Rome 1970. Lake Biete Mengest, near Debre Zeit, S of Addis Abeba, Ethiopia, 09°01′N 38°45′E: Holotype not designated, repository of type material unknown.
2. G. *alata* Rome 1962. Burton Bay, Lake Tanganyika, DR Congo, 04°19′S 29°05′E: Holotype (♂), RBINS – 525037, 525038.
3. G. *angulata* Lowndes 1932a. Lake Ziway, Ethiopia, 08°00′N 38°49′E: Holotype not designated, repository of type material unknown.
4. G. *angusta* Klie 1939a. Elgon, Koitobos, Kenya, 01°22′25″S 35°44′22″E: Syntypes, ZMK – UR-308, 310, 311.
5. G. *australica* Hussainy 1969. Lake Purumbete, Victoria, Australia, 38°16′56″S 143°14′03″E: Holotype (♀), NMV – J-194.
6. G. *capensis* (Müller 1914). Chapmans Bay, Kapland, South Africa, 34°04′S 18°21′E: Holotype not designated, repository of the type material unknown.
7. G. *coheni* Park and Martens 2001. Delta of Dama River, near Rumonge, Lake Tanganyika, Burundi, 03°58′18″S 29°26′15″E: Holotype (♂), RBINS – O.C. 2347.
8. G. *cristata* Rome 1962. Kalemie, Lake Tanganyika, DR Congo, 05°55′47″S 29°10′33″E: Holotype (♂), RBINS – O.C. 659.
9. G. *curta* Rome 1962. Shore of Edith Bay, Lake Tanganyika, Tanzania, 06°29′57″S 29°57′09″E: Holotype (♀), RBINS – O.C. 670.
10. G. *downingi* Park and Martens 2001. Bay S of Karema, Lake Tanganyika, Tanzania, 06°52′S 30°32′E: Holotype (♂), RBINS – O.C. 2332.
11. G. *duffi* (Hornibrook 1955). Pyramid Valley Swamp, Canterbury, New Zealand, 42°58′04″S 172°36′04″E: Holotype (♀, valves only), NZGSW – collection number unknown.
12. G. *emrysi* Martens 2003a. SE arm of Lake Malawi, Malawi, 14°18′395″S 35°09′149″E: Holotype (♂), RBINS – O.C. 2452.
13. G. *huwi* Martens 2003a. Domira Bay, Lake Malawi, Malawi, 13°26′307″S 34°22′530″E: Holotype (♂), RBINS – O.C. 2480.
14. G. *irvinei* Martens 2003a. Metangula, Lake Malawi, Mozambique, 12°38′531″S 34°46′685″E: Holotype (♂), RBINS – O.C. 2460.
15. G. *lenis* Rome 1962. Burton Bay, Lake Tanganyika, DR Congo, 04°19′S 29°05′E: Holotype (♀), RBINS – O.C. 668.
16. G. *lisae* Martens 2003a. Metangula, Lake Malawi, Mozambique, 12°38′531″S 34°46′685″E: Holotype (♂), RBINS – O.C. 2490.
17. G. *obtusata* (Sars 1910). Bukobe, Lake Victoria, Tanzania, 01°19′20″S 31°48′28″E: Holotype not designated, NHMO.
18. G. *ortali* Martens 1993. Nahal Dan, spring and river, N Israel, 35°37′33″N 33°15′29″E: Holotype (♂), RBINS – O.C. 1698.
19. G. *parcedilatata* Rome 1977 (in Rome and De Decker 1977). Ishungu Basin, DR Congo, 02°17′00″S 28°57′00″E: Holotype (♂), RBINS – O.C. 773.
20. G. *piriformis* Martens 2003a. Metangula, Lake Malawi, Mozambique, 12°38′537″S 34°46′345″E: Holotype (♂), RBINS – O.C. 2470.

21. *G. problematica* (Brehm 1932a). Waimate Gorge, Canterbury, New Zealand, 44°44′25″S 171°02′30″E. Holotype not designated, repository of the type material unknown.
22. *G. simplex* Rome 1962. Sumbu Bay, Lake Tanganyika, Zambia, 08°29′S 30°28′E: Holotype (♀), RBINS – O.C. 667.
23. *G. wilsoni* Park and Martens 2001. Bay S of Karema, Lake Tanganyika, Tanzania, 06°52′S 30°32′E: Holotype (♂), RBINS – O.C. 2345.
24. *G. woutersi* Park and Martens 2001. Bay S of Karema, Lake Tanganyika, Tanzania, 06°52′S 30°32′E: Holotype (♂), RBINS – O.C. 2358.

Key to the species

1. Ventro-lateral expansions on carapace present (sometimes visible as distinct alae in dorsal view) 2

– Ventro-lateral expansions on carapace absent 10

2. In lateral view, ventro-lateral expansions triangular, and overlapping ventral margins .... *G. alata* Rome 1962

– In lateral view, ventro-lateral expansions rounded and sometimes overlapping ventral margin 3

3. Female with posterior end of body with four hirsute UR lobes ... *G. coheni* Park and Martens 2001

– Female with posterior end of body with three hirsute UR lobes 4

4. Distal lobe of hemipenis without a thumb-like protrusion on dorsal side 5

– Distal lobe of hemipenis with a thumb-like protrusion on dorsal side 6

5. Dorsal margin of carapace rounded .... *G. duffi* (Hornibrook 1955)

– Dorsal margin of carapace straight .... *G. cristata* Rome 1962

6. Distal lobe of hemipenis quite narrow, especially in its most distal part, and with a steep dorsal margin .... *G. downingi* Park and Martens 2001

– Distal lobe of hemipenis wide in its most distal part and with a more flat dorsal margin 7

7. Thumb-like protrusion on distal lobe of hemipenis curved 8

– Thumb-like protrusion on distal lobe of hemipenis straight ... *G. emrysi* Martens 2003a

8. Dorsal margin of distal lobe of hemipenis serrated (ridged) in the area between thumb-like process and apex .... *G. angulata* Lowndes 1932a

– Dorsal margin of distal lobe of hemipenis smooth 9

9. A1 with incompletely divided penultimate segment ... *G. parcedilatata* Rome 1977 (in Rome and De Decker 1977)

– A1 with a completely divided penultimate segment … *G. aethiopsis* Rome 1970

10. In lateral view, dorsal margin of both valves rounded ….*G. lenis* Rome 1962

– In lateral view, dorsal margin of both valves straight or slightly concave in the middle …………………………………………………… 11

11. Carapace ornamented with pits and small nodules all over the surface … *G. woutersi* Park and Martens 2001

– Carapace without nodules on the surface ……………………………… 12

12. Distal lobe of hemipenis with a very narrow distal part and a steep dorsal margin ……………………………………… *G. australica* Hussainy 1969

– Distal lobe of hemipenis with a broad distal part and a flat dorsal margin … 13

13. Brood chamber prominent and sexual dimorphism clear ………………… 14

– Brood chamber not so prominent and sexual dimorphism not clear ……… 15

14. Penultimate segment of A1 completely divided ………………………… 16

– Penultimate segment of A1 not divided or partially divided …………… 17

15. Thumb-like process on hemipenis not distinct … *G. piriformis* Martens 2003a

– Thumb-like process on hemipenis prominent ……… *G. obtusata* (Sars 1910)

16. Two distal setae on anterior side of penultimate segment of A claw like … *G. irvinei* Martens 2003a

– Two distal setae on anterior side of penultimate segment of A1 thin … *G. capensis* (Müller 1914)

17. Penultimate segment of A1 not completely divided …………………… 18

– Penultimate segment of A1 divided …………………………………… 20

18. Thumb-like structure on distal lobe of hemipenis well developed … *G.angusta* Klie 1939a

– Thumb-like structure on distal lobe of hemipenis not developed ………… 19

19. Distal setae on penultimate segment of A1 thin …….*G. ortali* Martens 1993

– Distal setae on penultimate segment of A1 claw like … *G. wilsoni* Park and Martens 2001

20. Lower ramus of the clasping organ of hemipenis blunt … *G. lisae* Martens 2003a

– Lower ramus of the clasping organ of hemipenis pointed … *G. huwi* Martens 2003a

Species not included in the key

The following three species have not been included in the key: *G. simplex* Rome 1962, *G. curta* Rome 1962, and *G. problematica* (Brehm 1932a). The former two species were described from Lake Tanganyika (Rome 1962). The New Zealand species, *G. problematica*, closely resembles *G. australica*, but their possible synonymy needs to be examined further, because males of *G. problematica* have not been described (Brehm 1932a).

Ecology and distribution (Fig. 28)

Species of this genus live mostly in lakes, and most of them are endemic to Lake Tanganyika. Africa is the center of the genus' biodiversity. The northernmost point of the genus' distribution is Israel.

***Gomphodella* De Deckker 1981b**

Diagnosis (modified after Karanovic 2006a): Hinge lophodont, surface of the carapace usually heavily ornamented and hirsute. Second segment of A1 without posterior seta. Vibratory plate of Md with three setae. Setae on the penultimate and terminal segments of Md-palp transformed into thick claws. Females with two UR. Distal lobe of hemipenis prominent, triangular, and movable.

Type species: *G. maia* De Deckker 1981b

Species list with type locality and type material

1. *G. aura* Karanovic 2009. Weelamurra Creek, Pilbara region, WA, Australia, 22°05′46″S 117°42′23″E: Holotype (♀), WAM – C35715.
2. *G. glomerosa* Karanovic 2006a. Pump 1, Lake Violet borefield, Willuna, Murchison region, WA, Australia, 26°40′S 120°14′E: Holotype (♀), WAM – C28377.

Fig. 28 Distribution of *Gomphocythere* G. O. Sars 1924: Numbers correspond to the species list

3. *G. hirsuta* Karanovic 2006a. Newman bore near W126, Newman borefield, Pilbara region, WA, Australia, 23°15'S 119°53'E: Holotype (♀), WAM – C28386.
4. *G. martensi* Karanovic 2009. Bore GFS004, Ballards Well, Pilbara region, WA, Australia, 22°55′49.2″S 115°42′33.9″E: Holotype (♂), WAM – C35716.
5. *G. maia* De Deckker 1981b. Fresh Dip Lake, near Robe, SA, Australia, 35°15′42″S 139°48′42″E: Holotype (♂), SAM – collection number unknown.
6. *G. pilbarensis* Karanovic 2009. Bore MBSLK 316, Bamboo Creek, Pilbara region, WA, Australia, 20°56′06.8″S 119°51′03″E: Holotype (♀), WAM – C35717.
7. *G. quasihirsuta* Karanovic 2009. Bore UAR002, Round Well, Pilbara region, WA, Australia, 22°53′14.2″S 115°28′44.9″E: Holotype (♂), WAM – C35719.
8. *G. yandii* Karanovic 2006a. Bore MS-10, Yandi, Murchison region, WA, Australia, 27°45′S 114°49′E: Holotype (♀), WAM – C33469.

Key to the species

1. Posterior seta on the fourth segment of A1 (segment sometimes fused with the fifth) present .... *G. maia* De Deckker 1981b

– Posterior seta on the fourth segment of A1 (segment sometimes fused with the fifth) absent 2

2. L6 and L7 without seta on the second segment 3

– L6 and L7 with one seta on the second segment 4

3. In lateral view, each valve with a flat, wide wing that overlaps the ventral margin, which has a peripheral channel dividing the wing into two ledges ... *G. yandii* Karanovic 2006a

– No lateral wings, ventral margin clearly visible ... *G. pilbarensis* Karanovic 2009

4. In dorsal view, carapace with a broad, transparent aura ... *G. aura* Karanovic 2009

– No aura on carapace present 5

5. Carapace in dorsal view with a well-chitinized frame ... *G. glomerosa* Karanovic 2006a

– No chitinized frame on carapace present 6

6. Surface of carapace with square-shaped protuberances situated along the lateral margins .... *G. martensi* Karanovic 2009

– No such protuberances present 7

7. UR with two lobes .... *G. quasihirsuta* Karanovic 2009

– UR with three lobes .... *G. hirsuta* Karanovic 2006a

Fig. 29 Distribution of *Gomphodella* De Deckker 1981b: Numbers correspond to the species list

Ecology and distribution (Fig. 29)
Except for the type species of the genus which has been found in open water bodies and in caves, all the other species live in the subterranean waters. All the species are endemic to Australia, and only *G. maia* De Deckker 1981a has been found outside Western Australia.

Intrepidocythere Pinto, Rocha, and Martens 2008

Diagnosis (modified after Pinto et al. 2008): Carapace smooth, hemipenis with fusion of several structures (including the copulatory process and triangular distal lobe). First segment of A1 bearing a subapical expansion with a tuff of tiny setules on dorsal margin. A2 sexually dimorphic: in males, two of three claws strongly serrated. In both sexes, terminal segment of A2 with a small hyaline lobe.

Type (and only) species: *I. ibipora* Pinto, Rocha, and Martens 2008

Species list with type locality and type material
I. ibipora Pinto, Rocha, and Martens 2008. Parque Estadual da Serra do Mar Núcleo Cunha/Indaiá, Municipality of Cunha, São Paulo State, Brazil, 23°14′03.3″S 45°01′23″W: Holotype (♂), MZUSP – 18479.

Ecology and distribution
The species has been found only once, in a semi-terrestrial habitat (leaf litter).

Kovalevskiella Klein 1963

Diagnosis: Small animals with heavily ornamented valves. Hinge inverse lophodont. One sulcus present on carapace, situated medially. No sexual dimorphism in the morphology of A2. Mxl-palp with only two papoose setae. Terminal segment of Md-palp minute.

Type species: *K. turianensis* Klein 1963 (fossil species)

Species list with type locality and type material

1. *K. bulgarica* (Danielopol 1970). Well in village Simitli, Blagoevgrad, Bulgaria, 41°53′25″N 23°06′49″E: Holotype (not designated), NHMV.
2. *K. cvetkovi* (Danielopol 1969b). Village Sinemoretz, Burgas, Bulgaria, 42°29′48″N 27°28′23″E: Holotype (not designated), NHMV.
3. *K. dani* Karanovic 2003a. Freshwater well, village Petra, Lesbos, Greece, 39°19′38″N 26°10′38″E: Holotype (♀), WAM C28375.
4. *K. phreaticola* (Danielopol 1965). Cave Vadu Crişului, Romania, 46°59′15″N 22°30′58″E: Holotype (♀), BM – 1965 4.5.2.
5. *K. rudjakovi* (Danielopol 1969b).Krasnoalexandrovskaia, Tuapse, Transcaucasia, Russia, 44°06′10″N 39°04′31″E: Holotype not designated, repository of the type material unknown.

Key to the species

1. A1 5-segmented ....*K. rudjakovi* (Danielopol 1969b)

– A1 6-segmented 2

2. Second segment of Md-palp without setae ....*K. dani* Karanovic 2003a

– Second segment of Md-palp with one seta 3

3. A2 on the second segment with two setae antero-medially ... *K. bulgarica* (Danielopol 1970)

– A2 on the second segment with only one antero-medial seta 4

4. Fourth segment of A1 with two posterior setae ... *K. cvetkovi* (Danielopol 1970)

– Fourth segment of A1 with one posterior seta ... *K. phreaticola* (Danielopol 1965)

Ecology and distribution (Fig. 30)

All the species described so far are found in the subterranean waters. Their distribution is limited to the Balkan Peninsula and Transcaucasia.

Metacypris Brady and Robertson 1870 [Syn:*Thaicythere* Savatenalinton, Borgonie and Martens 2008]

Diagnosis (modified after Colin and Danielopol 1980): Valves moderately ornamented (Fig. 1d, e). Hinge adont or lophodont. A2 not sexually dimorphic. Md-palp normally developed. L7 is the largest leg; posterior part of female abdomen with two caudal rami, each bearing two setae and three lobes.

Type species: *M. cordata* Brady and Robertson 1870

Fig. 30 Distribution of *Kovalevskiella* Klein 1963: Numbers correspond to the species list

Species list with type locality and type material

1. *M. cordata* Brady and Robertson 1870. Bed of sluggish flowing River Nene, between Peterborough and Whittlesey, Cambridgeshire, England, UK, 52°34′N 00°11′W: Types in the Brady Collection, HM – collection numbers unknown.
2. *M. digitiformis* Smith and Hiruta 2004. Marshland in Kushiro, Shitsugen National Park, Hokkaido, Japan, 43°06′10″N 144°20′30″E: Holotype (♂), ZIHU – 2063.
3. *M. srisumonae* (Savatenalinton, Borgonie, and Martens 2008). Nalao natural spring, Chaiyaphum Province, Thailand, 16°15′52.5″N 100°16′53.3″E: Holotype (♂), RBINS – O.C. 2924.

Key to the species

1. Upper ramus on hemipenis well developed 2

– Upper ramus on hemipenis reduced ... *M. srisumonae* (Savatenalinton, Borgonie, and Martens 2008)

2. Upper ramus triangular, with short tip ... *M. cordata* Brady and Robertson 1870

– Upper ramus triangular, with elongated tip ... *M. digitiformis* Smith and Hiruta 2004

Ecology and distribution (Fig. 31)

The species can be found in diverse type of freshwater bodies. The type species has been found in several localities in Europe, and it is a typical inhabitant of marginal vegetation and root masses on the edge of small lakes. The other two species are known only from their respective type localities.

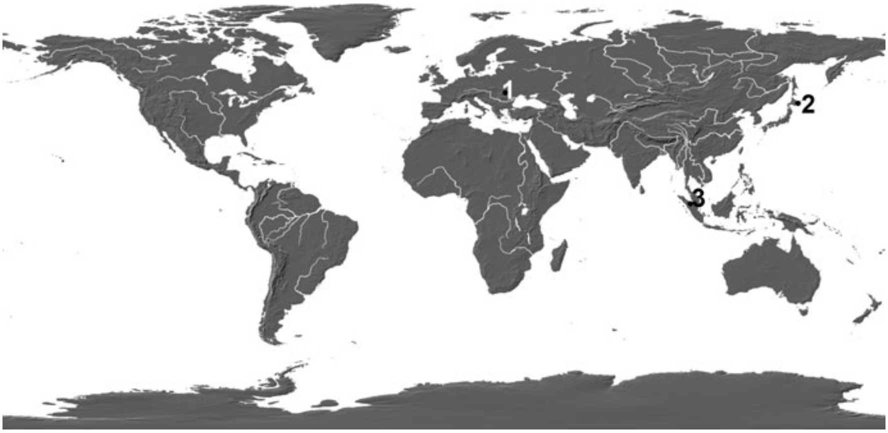

Fig. 31 Distribution of *Metacypris* Brady and Robertson 1870: Numbers correspond to the species list

6 Family Loxoconchidae Sars 1925

Diagnosis (after Savatenalinton and Martens 2009a): Carapace in lateral view reniform, ovate, rhomboidal, quadrate, rectangular, or subtriangular, sometimes with a caudal process (Fig. 2d–g). Valves smooth, pitted, or reticulated, sometimes with tubercles/or alae. Inner lamella relatively broad; MPC few, usually simple but occasionally branching; anterior and posterior vestibule usually present. Muscle scar pattern set with a vertical and arcuate row of four CMS, frontal scars U-, V-, Y-, C-shaped or subtriangular, sometimes with a second small, rounded scar in front; sometimes Md scars are visible. A1 with five or six segments. Endopod A2 2- or 3-segmented, two terminal claws on distal segment (Fig. 42g of chapter "Introduction"). Exopod of A2 mostly 2-segmented. Vibratory plate on Md-palp with four setae. Vibratory plate on Mxl with a single aberrant seta. L5–L7 slender. UR with two or three setae.

Type genus: *Loxoconcha* Sars 1866

Other (freshwater) genera: *Cytheromorpha* Hirschmann 1909, *Pseudolimnocythere* Klie 1938b, and *Sanyuania* Zhao and Han 1980.

Remarks
According to Savatenalinton and Martens (2009a), family Loxoconchidae has 22 recent genera, most of which live only in marine and brackish waters. The only exceptions are the four genera listed above. Even these genera have most representatives in marine and brackish environments, and only six species are known so far from the freshwater ecosystems.

Key to the genera with freshwater representatives (valid only for the freshwater species)

1. Penultimate segment of A1 divided .... *Cytheromorpha* Hirschmann 1909

– Penultimate segment of A1 not divided (Fig. 8c) 2

2. Terminal segment of A1 with four setae..... *Pseudolimnocythere* Klie 1938b

– Terminal segment of A1 with three setae 3

3. Second segment of A2 with two posterior setae and one aesthetasc (Fig. 7g) ... *Loxoconcha* Sars 1866

– Second segment of A2 with one posterior seta and one aesthetasc ... *Sanyuania* Zhao and Han 1980

Cytheromorpha Hirschmann 1909

Diagnosis: Carapace elongated. Penultimate segment of A1 subdivided, no posterior medial setae on the penultimate segment of A1, terminal segment with three setae. Exopod on A2 divided. Second endopodal segment of A2 posteriorly with two setae and aesthetasc, same segment anteriorly with two setae.

Type species: *C. fuscata* (Brady 1869)

Species list with type locality and type material
C. fuscata (Brady 1869). River Scheldt, Belgium, 51°17′N 03°49′E: Holotype not designated, repository of the type material unknown.

Ecology and distribution
Only the type species can be found in fresh water. This species has a Holarctic distribution, and lives in brackish waters as well.

Loxoconcha Sars 1866

Diagnosis: Carapace rhomboidal, ovate, or elongate, mostly with rather inflated valves. Anterior end rounded, posterior end upwardly rounded, in some forms with clear caudal process. Surface smooth or pitted. Inner lamella wide anteriorly, less wide in posterior and ventral regions. CIL moderately wide anteriorly, narrow posteriorly. Line of concrescence running subparallel to outer margin. MPC simple, straight, and widely (more or less evenly) spaced. Hinge of aberrant amphidont type. Normal pores of sieve type. Penultimate segment of A1 undivided, terminal segment with four setae.

Type species: *L. rhomboidea* (Fischer 1855) (marine species)

Species list with type locality and type material

1. *L. elliptica* Brady 1868. Arnold's pools, Guernsey, 49°27′25″N 02°33′42″W: Lectotype, HM – NEWHM:1.14.11.
2. *L. galilea* Lerner-Seggev 1968. Lake Tiberias, Israel, 32°47′59″N 35°35′00″E: Holotype not designated, repository of the type material unknown.

Key to the species

1. Exopod of A2 divided .... *L. galilea* Lerner-Seggev 1968

– Exopod of A2 undivided .... *L. elliptica* Brady 1868

Ecology and distribution

Loxoconcha galilea Lerner-Seggev 1968 has been so far found only in Lake Tiberias (=Sea of Galilee), while *L. elliptica* Brady 1868 is distributed in the northern Europe, mostly living in the brackish waters but occasionally recorded in coastal freshwater.

***Pseudolimnocythere* Klie 1938b**

Diagnosis (modified after Danielopol 1979): Small animals (0.3–0.4 mm), no sexual dimorphism. Carapace ornamented with rounded pits. CIL wide, MPC branched. A1 5-segmented; exopod of A2 undivided. Second segment of A2 posteriorly with two setae and one aesthetasc, anteriorly with two setae.

Type species: *P. hypogea* Klie 1938b

Species list with type locality and type material

1. *P. hartmanni* Danielopol 1979. Well, Agios Georgios, Euboea, Greece, 38°05′32″N 24°34′42″E: Holotype (♂), LIM – collection number unknown.
2. *P. hypogea* Klie 1938b. Well, Bari, Italy, 41°07′32″N 16°52′09″E: Syntypes, ZMK – UR-86, 87.

Key to the species

1. Exopod of A2 exceeding distal segment .... *P. hypogea* Klie 1938b

– Exopod of A2 only slightly exceeding penultimate segment ... *P. hartmanni* Danielopol 1979

Ecology and distribution (Fig. 32)

Both species live in the subterranean, sometimes slightly brackish waters. *Pseudolimnocythere hypogea* Klie 1938b is endemic to the Apennine Peninsula; *P. hartmanni* Danielopol 1979 is endemic to Greece.

***Sanyuania* Zhao and Han 1980** Diagnosis (after Savatenalinton and Martens 2009a): Carapace small (0.28–0.35 mm), in lateral view subovate to subtriangular, anterior margin broadly rounded, posterior margin rounded to bluntly pointed. In dorsal view, laterally compressed and with pointed ends. Valve surface smooth or pitted. A1 5- or 6-segmented.

Fig. 32 Distribution of *Pseudolimnocythere* Klie 1938b: Numbers correspond to the species list

Type species: *S. parodies* Zhao and Han 1980 (fossil species)

Other (freshwater, recent) species: *S. segersi* Savatenalinton and Martens 2009a

Species list with type locality and type material

S. segersi Savatenalinton and Martens 2009a. Lopburi River, Muang District, Lopburi Province, Thailand, 14°47′55.5″N 100°38′29.8″E: Holotype (♀), RBINS – O.C. 3014.

Ecology and distribution

Known only from the type locality.

Superfamily Darwinuloidea Brady and Norman 1889 (Suborder Darwinolocopina Brady and Norman 1889)

Diagnosis (after Horne et al. 2002, amended for male characters after Smith et al. 2006): Carapace mostly 0.8 mm long or less, shape elongate, subquadrate, or oval (Figs. 1 and 8a–c). Valves smooth, or rarely finely reticulated). CIL narrow, without selvage or continuous lists. Some groups with narrow ventro-caudal keel (Figs. 1c and 8b) or with internal ventral or caudal teeth in one valve (Fig. 1b). Hinge adont. CMS consisting of tight "rosette" of 5–10 scars (Figs. 1a, b and 8a), arranged radially; the rosette sometimes vertically elongated to give the appearance of a double vertical row. Normal pores simple. Females with brooding chamber posteriorly (Fig. 1a). Seven pair of appendages present. UR absent or reduced to 1–2 short setae (Fig. 7b). A2 sexually dimorphic, in male second segment of protopod subdivided, 2 setae (t2 and t3) transformed. Md vibratory plate small. Mxl with large vibratory plate bearing many unreflexed and four reflexed rays (Fig. 5). L5 endopod with 3 segments, protopod with vibratory plate (Fig. 6a). In males protopod transformed into prehensile palps. L6, L7 walking legs (Figs. 6b, 8e, h and 7a). Hemipenis laterally compressed and with three lobes. Internally hemipenis with striations in distal third.

The superfamily has six families of which only the family Darwinulidae has living representatives.

1 Family Darwinulidae Brady and Norman 1889 [Syn.: Microdarwinulidae Kashevarova and Neustrueva 1982]

Diagnosis (after Rossetti and Martens 1998): Small- to medium-size ostracods, elongate, subsquarish, or rounded in lateral view. Hinge adont or with medial groove, anterior and posterior cardinal teeth on RV, cardinal ridge and sockets on LV, and valve margins without selvages or continuous inner lamella. Fused zones very narrow with few and very short MPC. Sometimes ventro-caudal keel on RV, or

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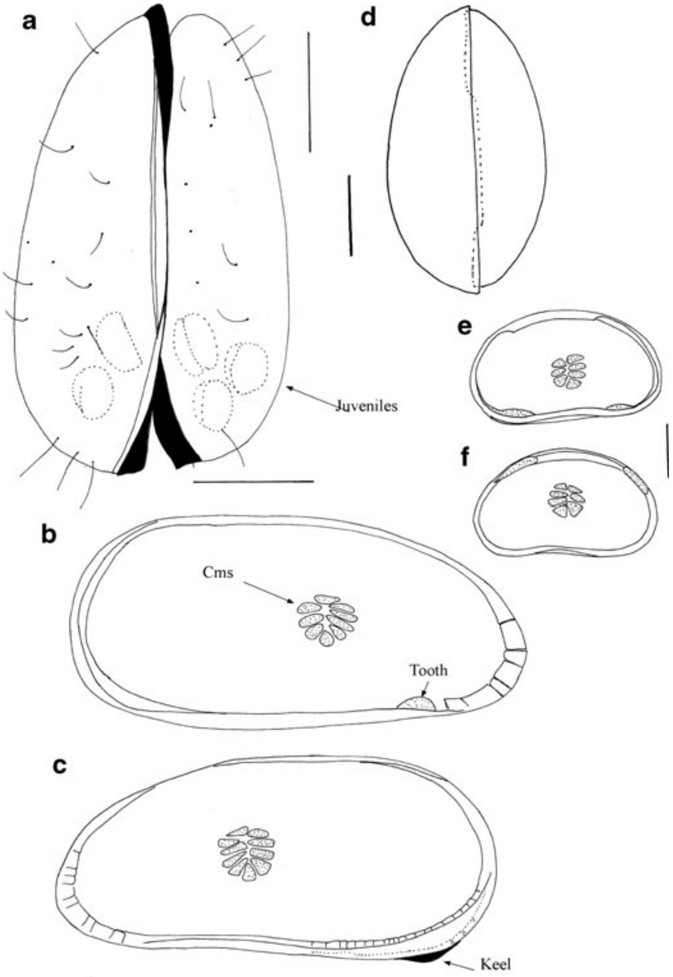


Fig. 1 Line drawings: (**a**–**c**) *Vestalenula sp.*; (**d**–**f**) *Microdarwinula zimmeri* (Menzel 1916): (**a**) dorsal view of the carapace with brooding chamber and juveniles: (**b**) LV, inside view; (**c**) RV, inside view; (**d**) dorsal view; (**e**) LV, inside view; (**f**) RV, inside view. Scales = 0.1 mm. (**d**–**f**) modified after Danielopol (1968a, b)

with internal ventral or caudal teeth on LV. A2 without swimming setae (Figs. 3 and 8e, i). P5 with 3-segmented protopod, transformed into clasping organ in male. UR if present reduced to single seta (Fig. 7b). P-abd present or absent (Figs. 7c, 8j). Brooding chamber present. Hemipenis laterally compressed and with three lobes.

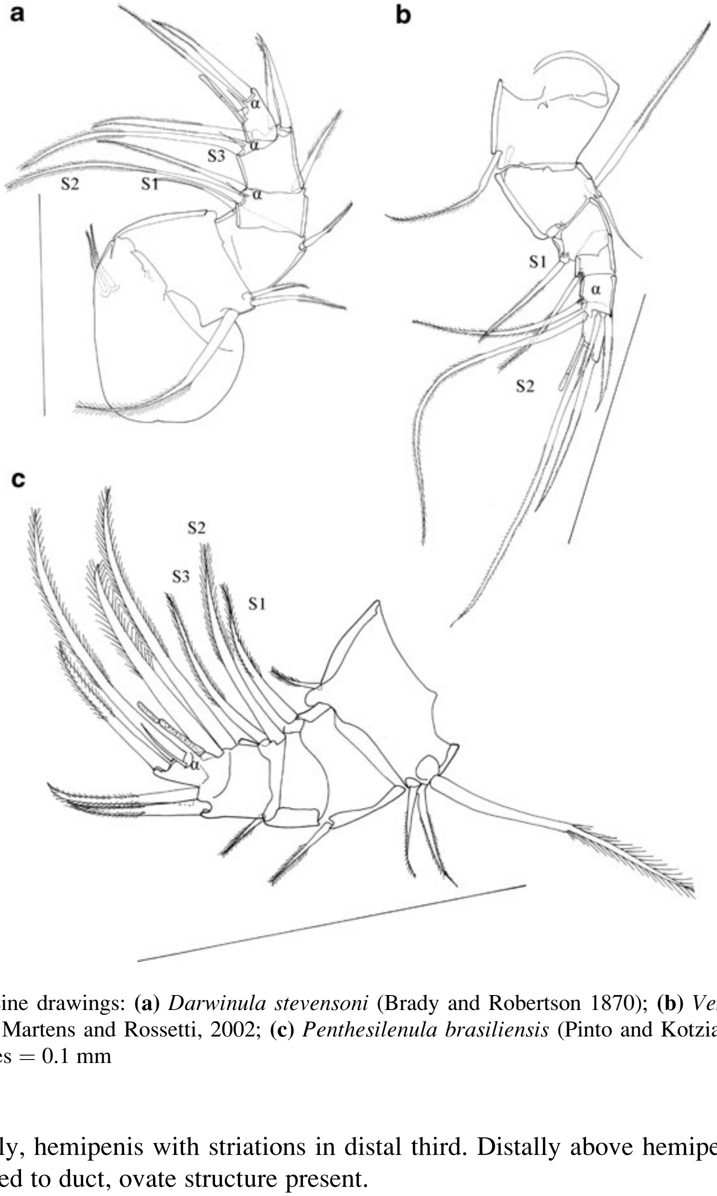


Fig. 2 Line drawings: **(a)** *Darwinula stevensoni* (Brady and Robertson 1870); **(b)** *Vestalenula matildae* Martens and Rossetti, 2002; **(c)** *Penthesilenula brasiliensis* (Pinto and Kotzian 1961): A1. Scales = 0.1 mm

Internally, hemipenis with striations in distal third. Distally above hemipenis and connected to duct, ovate structure present.

Type genus: *Darwinula* Brady and Robertson 1885

Other genera: *Alicenula* Rossetti and Martens 1998; *Microdarwinula* Danielopol 1968; *Penthesilenula* Rossetti and Martens 1998; *Vestalenula* Rossetti and Martens 1998.

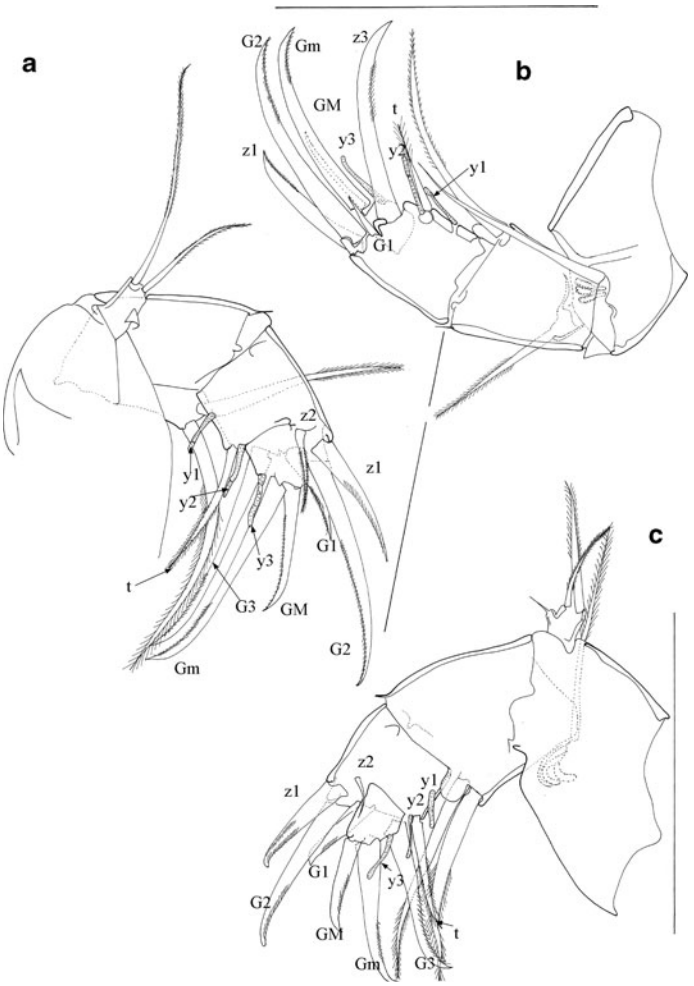


Fig. 3 Line drawings: **(a)** *Darwinula stevensoni* (Brady and Robertson 1870); **(b)** *Vestalenula matildae* Martens and Rossetti 2002; **(c)** *Penthesilenula brasiliensis* (Pinto and Kotzian 1961): A2. Scales = 0.1 mm

Remarks: There are approximately 30 living species. Of the nine non-marine ostracod lineages survived today Darwinulidae were probably the first having appeared in non-marine habitats over 350 million years ago (Smith and Kamiya 2008). Due to the lack of males in living populations and in fossil assemblages from the Mesozoic onward, it has been claimed that the group has been asexual for over 200 million years (Martens et al. 2003; Van Doninck et al. 2004; Martens et al. 2005). This has been questioned with the discovery of rare males of *Vestalenula cornelia* Smith et al. 2006. Since the males are much smaller than females, it has been postulated that they could be overlooked (perhaps mistaken for juveniles) in samples (Smith et al. 2006). The lack of the Zenker organ and the possession of a

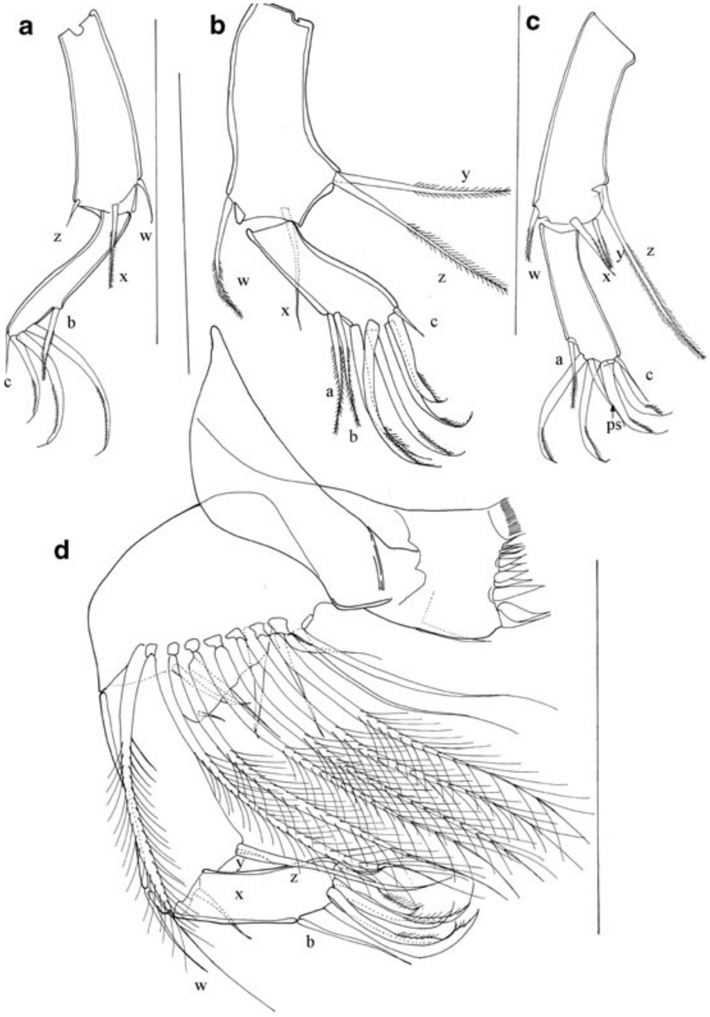


Fig. 4 Line drawings: **(a)** *Alicenula serricaudata* (Klie 1935); **(b)** *Penthesilenula brasiliensis* (Pinto and Kotzian 1961); **(c)** *Darwinula stevensoni* (Brady and Robertson 1870); **(d)** *Vestalenula matildae* Martens and Rossetti, 2002: Md. Scales = 0.1 mm

"rake" of setae (for filter feeding) on the mandibular palp, place Darwinulidae close to the Terrestricytheroidea (a superfamily of Cytherocopina), what has also been suggested using cladistic analysis (Horne et al. 2005). However, Cypridoidea and Darwinuloidea share two characters: presence of the vibratory plate on the L5 (which is absent in Terrestricytheroidea), and 2-segmented palp on the same appendage (4-, 5-segmented in Terrestricytheroidea). Nevertheless, the appearance of all other appendages, including the partly muscular hemipenis, places Darwinulidae indeed much closer to Cytheroidea than to Cypridoidea.

Fig. 5 Line drawings: *Vestalenula matildae* Martens and Rossetti 2002: Mxl. Scale = 0.1 mm

Key to the genera of Darwinulidae (after Rossetti and Martens 1998)

1. Carapace rounded in lateral view, no externally visible brood pouch (Fig. 1d–f)... *Microdarwinula* Danielopol 1968

– Carapace elongated or subsquarish in lateral view, with brood pouch recognizable by considerably inflated posterior end of carapace (Figs. 1a–c and 8a–c) 2

2. RV without postero-ventral keel; LV with or without internal teeth. A1 with two dorsal setae on first segment (Fig. 2c); second segment with one dorso-apical seta and three ventral setae. A2 exopod with two setae and a spine (Fig. 3c) . 3

– RV with postero-ventral keel (Fig. 1c); LV with antero-ventral internal tooth (Figs. 1b and 8b). A1 with one dorsal seta on first segment; second segment with two ventral setae and dorso-apical seta absent (Fig. 2b). A2 exopod with one seta and a spine (Fig. 3b) . . . . *Vestalenula* Rossetti and Martens 1998

3. LV without internal teeth. Last segment of Md-palp with less than five claws (3 or 4); penultimate segment with seta y short or absent (Fig. 4a, c) 4

– LV with internal teeth. Last segment of Md-palp with five claws; penultimate segment with *y* seta long (Fig. 4b) . . . *Penthesilenula* Rossetti and Martens 1998

4. RV overlapping LV. Fourth segment of A1 with two large dorsal setae (Fig. 2a). Md-palp, penultimate segment with seta *z* long, seta *y* short; last segment with

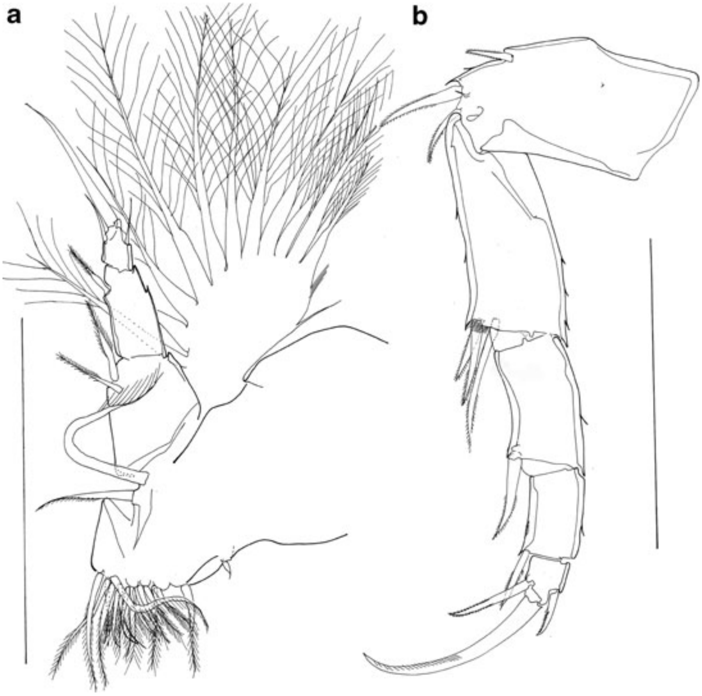


Fig. 6 Line drawings: *Vestalenula matildae* Martens and Rossetti 2002: (a) L5; (b) L6. Scales = 0.1 mm

"poil stevensoni", setae *a* and *b* present (Fig. 4c)… *Darwinula* Brady and Robertson 1885

– RV overlapping LV, or LV overlapping RV. Md-palp penultimate segment with seta *z* short, seta *y* absent, last segment without "poil stevensoni", seta *a* absent (Fig. 4a). . . . .*Alicenula* Rossetti and Martens 1998

Alicenula Rossetti and Martens 1998.

Diagnosis (after Rossetti and Martens 1998): LV overlapping RV. Elongate darwinulids, without internal teeth on the LV, and without ventral keel on the RV. Dorsal margin evenly sloping. Large brooding chamber present. First segment of A1 with two dorsal setae, second segment with one dorso-apical seta, and three ventral setae. A2 with two long setae and a spine on exopod. Seta *y* on penultimate segment of Md-palp absent. Adults with CR. P-abd mostly large and spinous.

Type species: *A. serricaudata* (Klie 1935a)

Species list with type locality and type material

1. *A. furcabdominis* (Keyser 1975). North River, Everglades National Park, Florida, USA, 80°54′20″W, 25°20′30″N: Holotype (♀), ZMH – K-30 328.

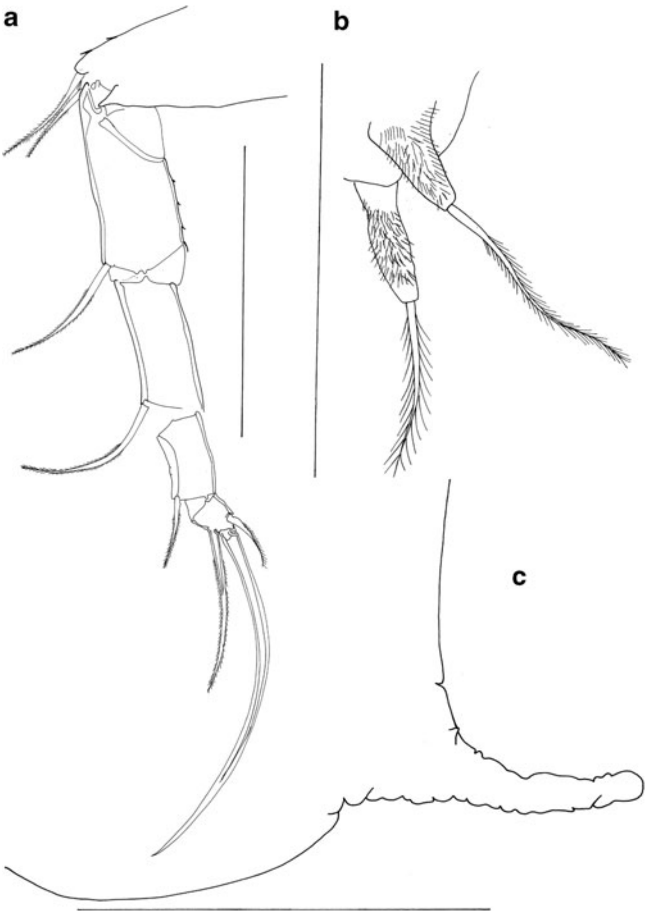


Fig. 7 Line drawings: *Vestalenula matildae* Martens and Rossetti 2002: **(a)** L7; **(b)** UR; **(c)** P-abd. Scales = 0.1 mm

2. *A. inversa* (Martens and Rossetti 1997). Dolomitic spring at Marico Oog, Molopo Oog area, North West Province (formerly Transvaal), South Africa, 25°47′30″S 26°22′10″E: Holotype (♀), AM – TDW-7A.
3. *A. serricaudata* (Klie 1935a): Different localities in Ivory Coast (Tourni, Danané, Man), 09°34′N 07°31′W: Syntypes, ZMK – CR-292.

Key to the species

1. Last segment of Md-palp with three apical claws, seta *c* present. 2
– Last segment of Md-palp with four apical claws, and seta *c* absent . . . *A. furcabdominis* (Keyser 1975)

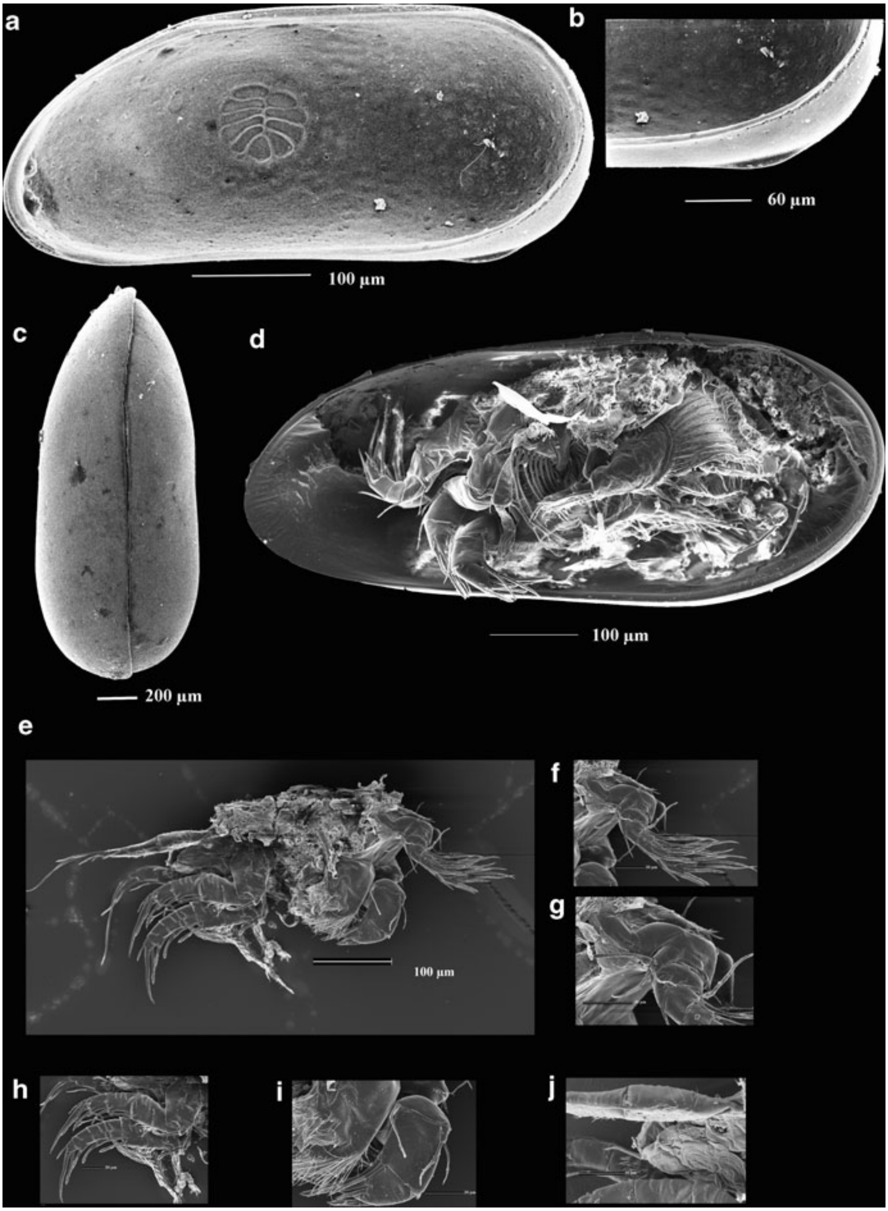


Fig. 8 SEM: **(a–c)** *Vestalenula paglioli* (Pinto and Kotzian 1961), **(d)** *Darwinula stevensoni* (Brady and Robertson 1870); **(e–j)** *Penthesilenula brasiliensis* (Pinto and Kotzian 1961): **(a)** RV, inside view; **(b)** inside view; **(c)** dorsal view; **(d)** body inside the valve; **(e)** whole body; **(f)** A1; **(g)** second segment of A1; **(h)** L5 and L6; **(i)** A2; J, P-abd. (a, c) Photos: D. Keyser

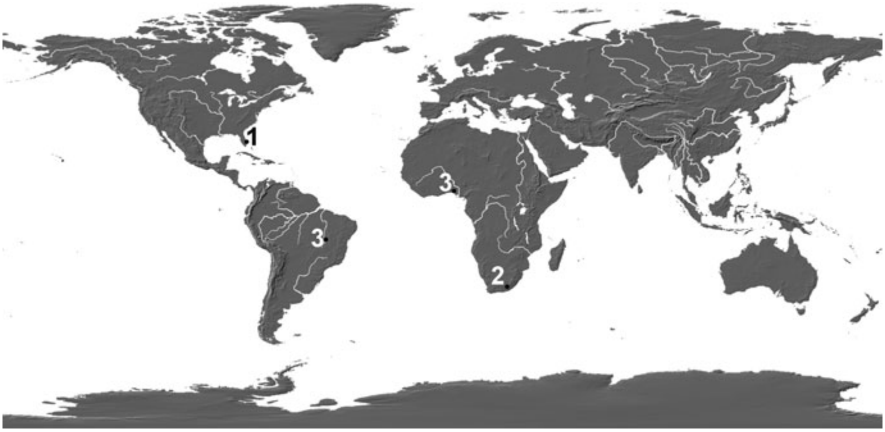


Fig. 9 Distribution of the genus *Alicenula* Rossetti and Martens 1998: Numbers correspond to the species list

2. LV overlapping RV . . . . *A. serricaudata* (Klie 1935a)
– RV overlapping LV . . . . *A. inversa* (Martens and Rossetti 1997)

Ecology and distribution (Fig. 9)
Species can be found in rivers (*Alicenula serricaudata* and *A. furcabdominis*), mosses (*A. serricaudata*) and springs (*A. inversa*). Species have restricted distribution, and have been found so far only from their type localities with an exception of *A. serricaudata* (Klie 1935a) which has been recorded from the Paraná River in Brazil (Pinto and Kotzian 1961; Higuti et al. 2009a), and Ivory Coast (Klie 1935a).

***Darwinula* Brady and Robertson 1885.**
Diagnosis (after Rossetti and Martens 1998): RV overlapping LV on all sides except at the hinge. Brood chamber present. Shell elongate, greatest H in the posterior quarter, posterior margin more broadly rounded than the anterior one, ventral margin almost straight. First segment of A1 with two dorsal setae and one ventro-apical seta; second segment with one dorsal and three ventral setae; fourth segment with two large dorsal setae. Exopod A2 with unequal setae, one ½ as long as the other. Second segment of Md-palp with four terminal setae. Third segment with four apical claws, two subterminal, and two terminal setae. UR absent in adult specimens, P-abd conical, vermiform.

Type species: *D. stevensoni* Brady and Robertson 1885

Species list with synonyms, type locality, and type material

1. *D. stevensoni* (Brady and Robertson 1885). Somerton Board, Norfolk, England, UK, 52°36′41″N 00°54′50″E: Lectotype (♀ carapace), NEWHM:1.56.08.

Syn.: *Argilloecia aurea* Brady and Robertson 1870; *D. improvisa* Turner 1895; *Argilloecia aurea* Brady and Robertson 1870; *D. protracta* Rome 1953; *D. variabilis* Tagliasacchi-Masala 1968; *D. sphenoides* Rome 1977 (in Rome and De Deckker 1977)

Ecology and Distribution

The species can be found in all freshwater water bodies, including interstitial waters and slightly saline environments (up to maximum 15‰) (Meisch 2000). The species is cosmopolitan; it has been found on all continents, except Antarctica.

***Microdarwinula* Danielopol 1968.**

Diagnosis (after Rossetti and Martens 1998): Small (<0.4 mm) animals, with rounded carapace, without externally visible brooding chamber. Carapace with LV/RV overlap. Hinge with prominent but smooth ridge on LV; RV with groove and prominent anterior and posterior cardinal teeth. RV without keel; LV with large antero- and postero-ventral internal teeth. A1 with two dorsal setae on the first segment; one dorsal seta and three ventral setae on the second segment. A2 with two long setae and a spine on exopod; first segment of endopod with two long ventro-apical setae. Setae *y* and *z* on penultimate segment of Md-palp long and subequal; terminal segment with six claws. UR and P-abd absent in adults and also in juveniles.

Type species: *M. zimmeri* (Menzel 1916)

Species list with type locality and type material

1. *M. inexpectata* Pinto et al. 2005a. Caetetus Ecological Station, Municipality of Gália, São Paulo State, Brazil, 22°22′42.9″S 49°41′17.2″W: Holotype (♀), MZUSP – 16591.
2. *M. zimmeri* (Menzel 1916). E Usambara, Amani, Tanzania, 04°44′59″S 38″29′59″E: Repository of type material unknown (see Rossetti and Martens 1998). Danielopol (1968a, b) deposited the material he examined of this species into the following institutions: ISER, NHMBU, BM, RIS, and NHMS.

Key to the species

1. Shape more elongate in lateral view, postero-ventral tooth more ventrally positioned, *y1* aesthetasc absent on the penultimate segment of A2 . . . *M. inexpectata* Pinto et al. 2005a

– Shape more oblong in lateral view, postero-ventral tooth more caudally positioned, *y1* aesthetasc present on the penultimate segment of A2 . . . *M. zimmeri* (Menzel 1916)

Ecology and distribution (Fig. 10)

Species can be found in interstitial waters and semiterrestrial habitats (Pinto et al. 2005a).

Microdarwinula zimmeri (Menzel 1916) has a wide distribution, and has been found so far on all continents, except South America and Antarctica (Pinto et al. 2005a). *Microdarwinula inexpectata* Pinto et al. 2005a has been found so far only in South America (Pinto et al. 2005a).

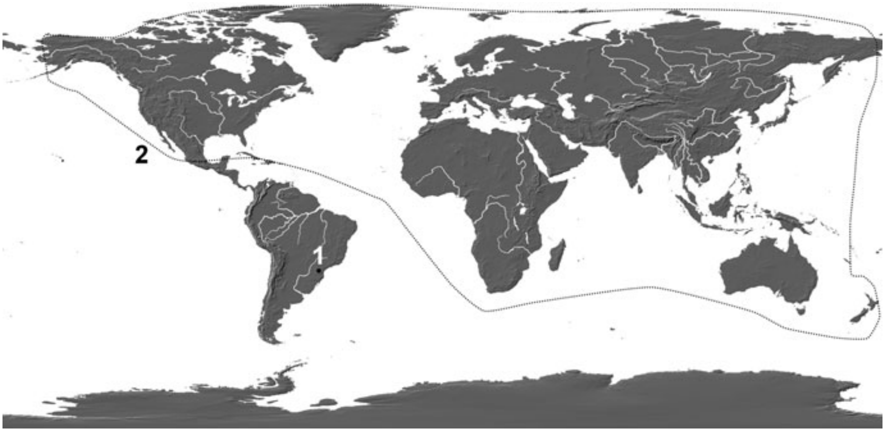


Fig. 10 Distribution of the genus *Microdarwinula* Danielopol 1968: Numbers correspond to the species list

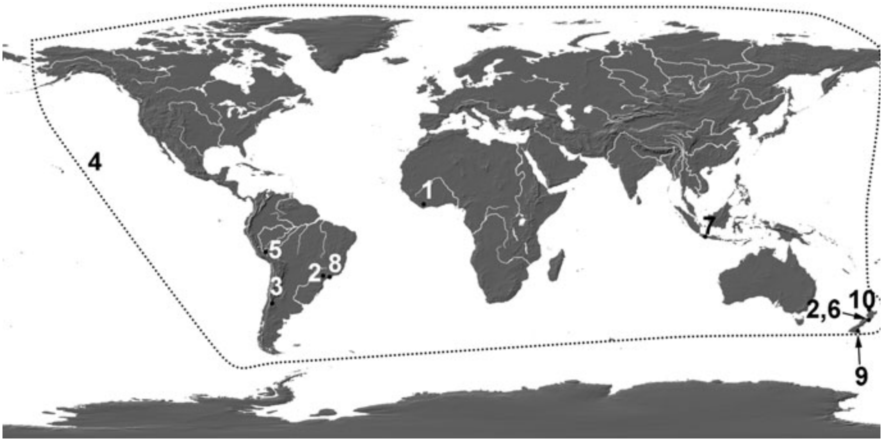


Fig. 11 Distribution of the genus *Penthesilenula* Rossetti and Martens 1998: Numbers correspond to the species list

Penthesilenula Rossetti and Martens 1998.

Diagnosis (after Rossetti and Martens 1998): Small (0.4 mm) to relatively large (0.8 mm) animal, subsquarish in lateral view, with dorsal margin straight over at least part of its L, anterior margin narrowly rounder, and posterior margin nearly straight. Hinge adont. Large caudal brooding chamber visible externally. In frontal view, LV and RV almost symmetrical, not oblique. LV generally overlapping RV on all sides except dorsally. LV either with rounded internal teeth (antero-ventral and postero-ventral in *africana*-group) or with one pointed caudal internal tooth (*incae*-group). RV without postero-ventral keel. First segment of A1 with two dorsal setae; second segment with three ventral and one dorsal seta. Exopod of

A2 with two long setae and a spine; first segment of endopod with two ventro-apical setae. Setae *y* and *z* on penultimate segment of Md-palp both long, subequal.

Type Species: *P. incae* (Delachaux 1928)

Species list with synonyms, type locality, and type material

1. *P. africana* (Klie 1935a). Moss spring at 21 km on road from Man to Touba, Ivory Coast, 07°24′19″N 07°32′35″W: Holotype (♀), ZMK – CR 291.
2. *P. aotearoa* (Rossetti et al. 1998). Small swamp overflowing into Karori Stream, Kinnoull Station, Wellington, New Zealand, 41°19′S 164°41′E: Holotype (♀), RBINS – O.C. 2143.
3. *P. araucana* (Löffler 1961a). Region of Villarica and Puyehue, Central Chile, 40°43′03″S 72°12′13″W: Repository of the type material unknown.
4. *P. brasiliensis* (Pinto and Kotzian 1961). Riverine pools at km 119.5 on road from Pôrto Alegre to Tramandai, Rio Grande do Sul, Brazil, 30°05′41″S 50°10′28″W: Holotype (♀), UFRGS – MP-0-11.
5. *P. incae* (Delachaux 1928). Lake Huaron, Region of Huancavelica, Department of Jurin, Peru, 13°23′S 72°15′W: Repository of the type material unknown. Rossetti et al. (1996) have examined a couple of specimens from the type locality and deposited the material in RBINS – O.C. 1791–1796.
6. *P. kohanga* (Rossetti et al. 1998). Small swamp overflowing into Karori Stream, Kinnoull Station, Wellington, New Zealand, 41°19′S 174°41′E: Holotype (♀), RBINS – O.C. 2151.
7. *P. malayica* (Menzel 1923). Moss springs along the road from Cibodas to Gede at 2,100 m a.s.l., West Java, Indonesia, 07°05′48″S 107°30′51″E: Repository of the type material unknown.
8. *P. reidae* Pinto et al. 2004. Boracéia Biological Station, Municipality of Salesópolis, São Paulo State, Brazil, 23°40′00.7″S 45°54′08.9″W: Holotype (♀), MZUSP – 15851.
9. *P. repoa* (Chapman 1963). Ross Creek, Dunedin, New Zealand: Holotype (♀), OMD – collection number unknown.
10. *P. sphagna* (Barclay 1968). *Sphagnum* swamp, Ardmore, Auckland district, New Zealand, 37°01′58″S 174°58′35″E.: Holotype (♀), MNZ – collection number unknown.

Key to the species (after Rossetti and Martens 1998)

1. LV with internal tooth along posterior margin, no postero-ventral tooth (*incae*-group) 2

– LV with postero-ventral internal tooth, no caudal tooth (*africana*-group) 6

2. LV overlapping RV . . . . *P. araucana* (Löffler 1961a)

– RV overlapping LV 3

3. Size >0.7 mm 4

– Size <0.7 mm 5

4. L/H ratio <2.2, P-abd absent . . . . *P. incae* (Delachaux 1928)
– L/H ratio >2.2, P-abd present . . . .*P. kohanga* (Rossetti et al. 1998)
5. In lateral view, dorsal margin distinctly slanting forward, anterior end slender . . . *P. aotearoa* (Rossetti et al. 1998)
– In lateral view, dorsal margin slightly curved, anterior end rounded . . . *P. sphagna* (Barclay 1968)
6. L/H ration 2.15–2.29, valves being more elongated . . . *P. reidae* Pinto et al. 2004
– L/H ration 1.94–2.13, valves being less elongated 7
7. Fourth segment of A1 with one large dorsal seta . . . *P. malayca* (Menzel 1923)
– Fourth segment of A1 with two large dorsal setae 8
8. Fourth segment of A1 with ventro-apical seta . . . *P. brasiliensis* (Pinto and Kotzian 1961)
– Fourth segment of A1 without ventro-apical seta . . . . *P. africana* (Klie 1935a)

Remarks
The genus was divided into two species groups: *incae*- and *africana*-group. Some additional differential characters have been pointed out by Pinto et al. (2004), which have been observed on *Penthesilenula brasiliensis* (Pinto and Kotzian 1961), *P. reidae* Pinto et al. (2004), and *P. aotearoa* (Rossetti et al. 1998). The asymmetry between two setae on the exopod of A2 is more pronounced in the *incae*-group, and, the aesthetasc *y1* on A2 is pointed (seta-like) in *africana*-group, and has a rounded tip in *incae*-group. Most of the species in the genus have a very stable morphology of the soft parts. There is only a variability in the L of the carapace, while the shape (especially the L/H ratio) remains stable in all populations of all the species, even two populations of *P. aotearoa*, one from New Zealand (Rossetti et al. 1998) and the other from South America (Pinto et al. 2004). The only exception is *P. brasiliensis*, which shows a great variability in the wide area of its distribution (Fig. 11), and it is possible that it is a junior synonym of *P. africana* (Klie 1935a).

Species not included in the key
Penthesilenula repoa (Chapman 1963) described from New Zealand is not included in the key to the species of the genus *Penthesilenula* Rossetti and Martens 1998 because of the insufficient description. Rossetti and Martens (1998) even questioned the position of the species in the genus. *Penthesilenula setosa* (Daday 1902) was described from Argentina, but was considered as a junior synonym of *P. incae* (Delachaux 1928) by Rossetti and Martens (1998).

Ecology and distribution (Fig. 11)
The species of this genus have been collected from springs, rivers, and from both saturated and nonsaturated terrestrial habitats (Pinto et al. 2004). Most of the species have a restricted distribution, with the exception of *P. brasiliensis* (Pinto and Kotzian 1961), which has been collected from all continents, excluding Antarctica.

Pinto et al. (2004) reported *P. aotearoa* (Rossetti et al. 1998) from South America; the species was previously known only from New Zealand (Rossetti et al. 1998).

Vestalenula Rossetti and Martens 1998.

Diagnosis (after Rossetti and Martens 1998): U Valves elongated or short and subquadrate. RV with postero-ventral external keel, which is short or elongated. LV with long or short internal antero-ventral tooth. Valves with L/R overlap. Dorsal margin straight over part of its L. Brooding chamber visible. First segment of A1 with one dorsal seta; second segment with two ventral setae; fourth segment without ventro-apical seta. Exopod of A2 with one long seta and a spine on exopod. Seta *y* on penultimate segment of Md-palp short; terminal segment with five apical claws. Adults mostly with UR, P-abd smooth or absent.

Type species: *V. boteai* (Danielopol 1970)

Species list with type locality and type material

1. *V. boteai* (Danielopol 1970). Interstitial of the river Mraconia, 2 km from confluence with river Danube, at 25 km of Orsova, Department Caras-Severin, Romania, 44°42′N 22°20′E: Holotype was not designated; some material is deposited in ISER, NHMBU, BM, and RBINS.
2. *V. botocuda* Pinto et al. 2003. Sítio da Colônia, Mulungu, near Araçoiaba da Serra, São Paulo State, Brazil, 23°32′02″S 47°39′41″W: Holotype (♀), MZUSP – 15041.
3. *V. carveli* Artheau 2007. Hyporheic zone of Font Calda spring, Reynes River, surroundings of village Reynès, Languedoc-Roussillon, France, 42°28′N 02°42′E: Holotype (♀), NHMP – MNHN-Os972.
4. *V. cornelia* Smith et al. 2006. Coastal area at Yudomari, S Yakushima Island, Kagoshima Prefecture, Japan, 30°13′48.7″N 130°28′50.5″E: Holotype (♀), LBM – 1430000876.
5. *V. cuneata* (Klie 1939a). Moss spring at the foot of Kikuyu, near Maji ya Moto, Kenya, 01°15′S 36°40′E: Holotype (♀), ZMK – CR-294.
6. *V. cylindrica* (Straub 1952). Type locality is "Miocene deposits" in Germany. Recent material has been collected from Lake Biwa (Japan) and deposited at LBM – 1430003528.
7. *V. danielopoli* (Martens et al. 1997). In calcareous silt sediment (Holocene, Subatlanticum) at Mücheln, Geiseltal, 45 km W of Leipzig, Saxony-Anhalt, Germany, 51°18′11″N 11°50′25″E: Holotype, RBINS – O.C. 2085.
8. *V. daps* (Harding 1962). Stomach of the fish *Eleotis fusca*, Lake Te-Nggano, Rennel Island, Solomon Islands, 11°42′S 160°25′E: Holotype (♀), ZMC – CRU-2651.
9. *V. inconspicua* (Klie 1935a). Rocky banks of Bandama River, Ivory Coast, 06°13′N 02°44′E: Holotype (♀), ZMK – CR-293.
10. *V. irajai* Pinto et al. 2003. Tamoios Road, near Paraibuna, São Paulo State, Brazil, 23°31′9.6″S 45°32′21″W: Holotype (♀), MZUSP – 15049.

11. *V. lundi* (Neale and Victor 1978). Sandy river bank in Sabaragamuwa Province, Sri Lanka, 06°49′N 80°22′E: Holotype (♀), BM – 1977.76.
12. *V. marlieri* (Kiss 1959a). Luhanga stream, N part of Lake Tanganyika, Zaire, 03°30′S 29°15′E: Holotype (♀), RMCA – R.G. 50330.
13. *V. marmonieri* Rossetti and Martens 1999. A tributary of Diahot River, close to the village of Ouegoa, Province North, New Caledonia, 27°20′S 164°25′E: Holotype (♀), RBINS – O.C. 2219.
14. *V. matildae* Martens and Rossetti 2002. Government well 027, Ashburton River valley, Pilbara region, WA, Australia, 22°29′S 115°23′E: Holotype (♀), WAM – C28868-GR401.
15. *V. molopoensis* (Martens and Rossetti 1997). Molopo Oog area, North West Province (formerly Transvaal), South Africa, 25°46′40″S, 26°26′00″E: Holotype (♀), AM – TDW-26A.
16. *V. paglioli* (Pinto and Kotzian 1961). Riverine pools at 119.5 km on road from Pôrto Alegre to Tramandai, Rio Grande do Sul, Brazil, 30°01′S 51°13′W: Holotype (♀), UFRGS – MP-0-8.

Key to the species (modified after Rossetti and Martens 1998)

1. External keel on the RV elongate … *V. lundi* Neale and Victor 1978; *V. danielopoli* Martens et al. 1997; *V. matildae* Martens and Rossetti 2002; *V. cornelia* Smith et al. 2006

– External keel on the RV short 2

2. P-abd present. 3

– P-abd absent 9

3. P-abd with seta . . . . *V. botocuda* Pinto et al. 2003

– P-abd without seta 4

4. Third segment of A1 with one ventro-apical seta … *V. paglioli* (Pinto and Kotzian 1961); *V. irijai* Pinto et al. 2003

– Third segment of A1 without any ventro-apical setae. 5

5. L/H ratio >2.2. 6

– L/H ratio <2.2. 7

6. Dorsal margin in lateral view rounded . . . . *V. marlieri* (Kiss 1959a)

– Dorsal margin in lateral view straight . . . . *V. cylindrica* (Straub 1952)

7. Basis of UR carrying seta, very elongated ($L = 3 \times W$) … *V. boteai* (Danielopol 1970)

– Basis of UR carrying seta, short ($L = 1.5 \times W$). 8

8. P-abd very long and almost cylindrical … *V. marmonieri* Rossetti and Martens 1999

– P-abd conical and not elongated . . . *V. malopensis* (Martens and Rossetti 1997)

9. Size > 0.6 mm. . . . . *V. daps* (Harding 1962)

– Size <0.6 mm 10

10. Penultimate segment of Md-palp with seta *z* short; terminal segment with seta *c* . . . . *V. inconspicua* (Klie 1935a)

– Penultimate segment of Md-palp with seta *z* long; terminal segment with seta *c*. . . . . *V. cuneata* (Klie 1939a)

Remarks

When the genus was described, it was divided into two species groups: *boteai*-group and *danielopoli*-group (Rossetti et al. 1998). The groups were distinguished based on the carapace characters: the keel on the RV is short in *boteai*-group, and elongate in *danielopoli*-group. The only representative of the latter group was a subfossil species, *V. danielopoli* Martens et al. 1997, described from German Holocene deposits. Later on, Martens and Rossetti (2002) described *V. matildae* Martens and Rossetti 2002 from Australia, with the same properties of the carapace as *V. danielopoli.* As the Australian species was described after the soft parts as well, it was thought that the presence of seta on the P-abd is also a distinguishing character of the *danielopoli*-group. However, description of *V. botocuda* Pinto et al. 2003, from the semiterrestrial habitats in Brazil (Pinto et al. 2003), has changed the previous taxonomy of the genus and its division into two groups. The Brazilian species has a carapace of the *boteai*-group and the soft parts (the presence of the seta on the P-abd) of the *danielopoli*-group. Most recent papers (Smith et al. 2006; Smith and Janz 2009) still retain the division of the genus into two species group, acknowledging only the carapace character as a distinguishing feature between them. The species belonging to the *danielopoli*-group could not be distinguished in the key as they differ in carapace characters (L, position of the keel, shape of the margins) which are not well defined by their respectful authors. When comparing their species the authors have described these differences as “slightly more”/ “slightly less” or just “more” or “less”; therefore they are very hard to use in the key. When distinguishing between the species, one should be extra cautious, and rely on the original drawings and descriptions (Neale and Victor 1978; Martens et al. 1997; Martens and Rossetti 2002; Smith et al. 2006; and Smith and Janz 2009). In the key to the species of the genus *Vestalenula* Rossetti and Martens 1998, given by Rossetti and Martens (1998), *V. lundi* (Neale and Victor 1978) has been placed in the *boteai*-group, as the authors only had decalcified carapaces and were unable to evaluate the appearance of the external keel on the RV. However, Smith and Janz (2009) have examined material they identified as *V. lundi* from Lake Biwa and have shown that the species actually belongs to the *danielopoli*-group. In the *boteai*-group, it is difficult to distinguish between the following species: *V. paglioli* (Pinto and Kotzian 1961) and *P. irajai* Pinto et al. 2003 both described from Brazil (Pinto and Kotzian 1961; Pinto et al. 2003). According to Pinto et al. (2003) *V. irijai* is more elongated with nearly straight dorsal and ventral margins, which

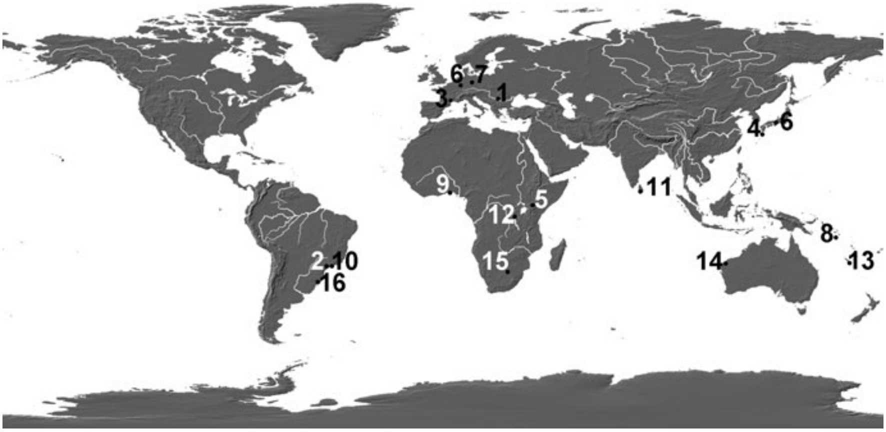


Fig. 12 Distribution of the genus *Vestalenula* Rossetti and Martens 1982: Numbers correspond to the species list

furthermore run parallel to each other. Unfortunately, this difference is not clearly evident in the original illustrations of Pinto and Kotzian (1961, p. 47, Figs. 1 and 4) nor in the SEM of this species provided by Rossetti and Martens (1998, p. 100, Fig. 28a, b).

Ecology and distribution (Fig. 12)
Vestalenula matildae has been found in subterranean waters only (Martens and Rossetti 2002). Some Brazilian species have been described from semiterrestrial habitats (Pinto et al. 2003), while most of the species live in springs, swamps, and lakes (Martens and Rossetti 1997, 1998, 1999; Smith et al. 2006; Smith and Janz 2009). The species have pretty much restricted distribution, being found only in their type locality or the area surrounding it. With an exception of *V. boteai* (Danielopol 1970), *V. cornelia* Smith et al. 2006, *V. cylindrica* (Straub 1952), and *V. danielopoli* (Martens et al. 1997), which are known from the northern hemisphere, species of this genus are distributed in the southern hemisphere. The localities of the species *V. cylindrica,* presented on the map, are records of living representatives of this species (Smith and Janz 2009), while the species was described from Miocene deposits in Germany.

Superfamily Cypridoidea Baird 1845 (Suborder Cypridocopina Jones 1901)

The suborder Cypridocopina is divided in three superfamilies: Macrocypridoidea Müller 1912, Pontocypridoidea Müller 1894, and Cypridoidea Baird 1845. Only the last superfamily has representatives in the freshwater ecosystems.

Key to superfamilies

1. CMS a loosely aggregated group of about nine scars with a further three above and slightly separated, male brush organ present . . . . Superfamily Macrocypridoidea

– CMS a typical "paw print," male brush organ absent 2

2. L5 without branchial plate, endopod 3-segmented, more than two setae present on the posterior margin of UR . . . . superfamily Pontocypridoidea

– L5 with branchial plate (rarely missing), endopod maximum 2-segmented; maximum two setae present on the posterior margin of UR . . . . . superfamily Cypridoidea

Diagnosis (after Meisch 2000 and Horne et al. 2002): Carapace can be very small (0.3 mm), but sometimes large (8 mm), variable in shape and structure (Figs. 1–4). Calcification usually weak. Valves overlap variable. CMS consist of a basic "pawprint" pattern of an actuate row of three scars in front of a fourth scar; some scars can be subdivided to give a more complex pattern (Fig. 3c). A1 usually 8-segmented. A2 exopod reduced into a small plate bearing mostly three setae. Second segment of the same appendage with utmost six swimming setae; these setae are partially or totally reduced. L5 transformed into maxilliped, with endopod in females being 1–3 segmented, and in males modified into a clasping organ. L6 walking leg; L7cleaning leg. UR rod shaped or flagelliform, rarely completely missing. Anus situated posteriorly to the UR. Testes and ovaries usually situated within the duplicature (between the outer and inner lamellae), more rarely within the body. Zenker organ present.

I. Karanovic, *Recent Freshwater Ostracods of the World*,
DOI 10.1007/978-3-642-21810-1_5,

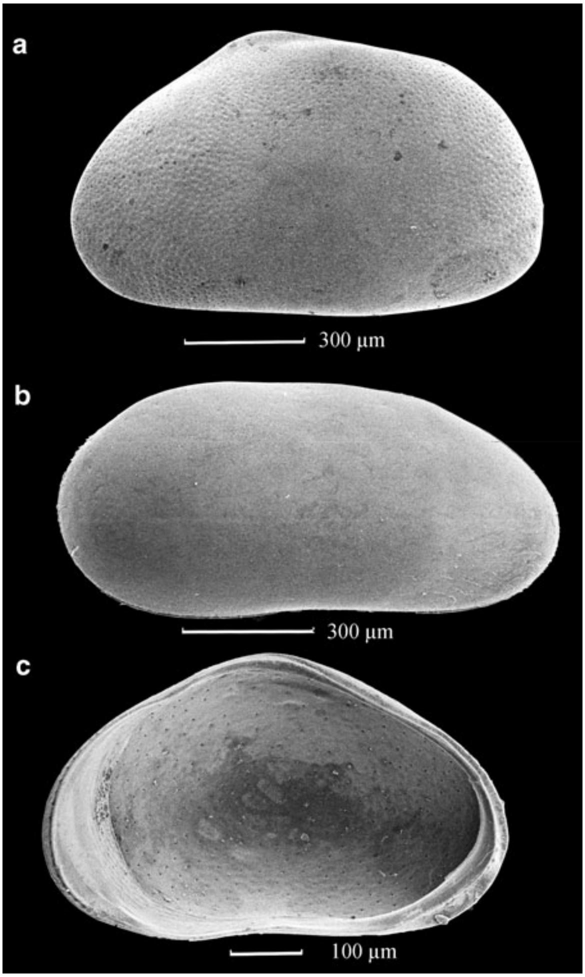


Fig. 1 SEM: (**a**) *Cyprinotus cingalensis* Brady 1886a; (**b**) *Ilyodromus viridulus* (Brady 1886b); (**c**) *Cypridopsis vidua* (O.F. Müller 1776): (**a**) LV, outside view; (**b**) RV, outside view; (**c**) RV, inside view. Photos: D. Keyser

Key to the families

1. Eyes separated: two eye spots visible in dorsal view (one exception) (Fig. 4a); third masticatory process of the Mxl with six teeth-like setae Notodromadidae

– Eyes fused with single (eye cup sometimes visible in dorsal view) (Fig. 4b). Third masticatory process of the Mxl with two teeth-like setae 2

2. Terminal segment of L7 not cylindrical and not distinctly separated from the penultimate one, forming with the latter a "pincer organ" with a short claw-like seta (Fig. 5c, d) . . . . Cyprididae

– Terminal segment of L7 clearly separated from penultimate segment and bearing three setae (Fig. 5a, b) 3

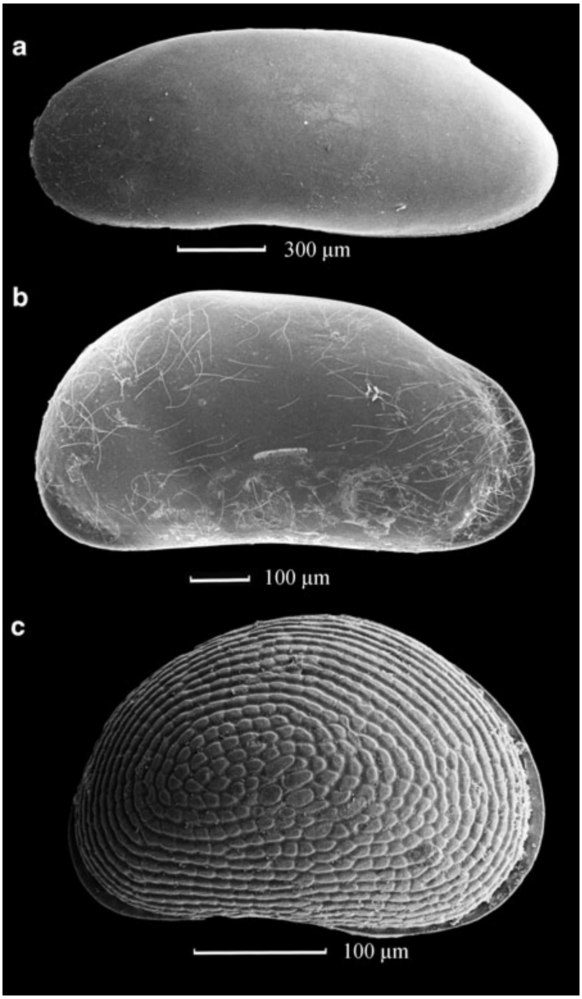


Fig. 2 SEM: (**a**) *Stenocypris bolieki* Ferguson 1962; (**b**) *Typhlocypris compressa* (Koch 1838); (**c**) *Neozonocypris mirabilis* Rome 1962: LV, outside view; (**b**, **c**) RV, outside view. Photos: D. Keyser

3. Valves with one or two transverse grooves (sulci) extending from the dorsal margin to about the CMS. Basal segment of L7 with only one seta (Figs. 3a and 4c) . . . . Ilyocyprididae

– Valves with no grooves (Figs. 2b and 4e), basal segment of L7 with 2–3 setae Candonidae

1 Family Notodromadidae Kaufmann 1900a

Diagnosis (after Meisch 2000): Nauplii of the entire family and adults of some subfamilies (Notodromadinae and Centrocypridinae) with two distinctly separate eyes (Fig. 6c). Rake-like organ with small pointed teeth. Third masticatory process

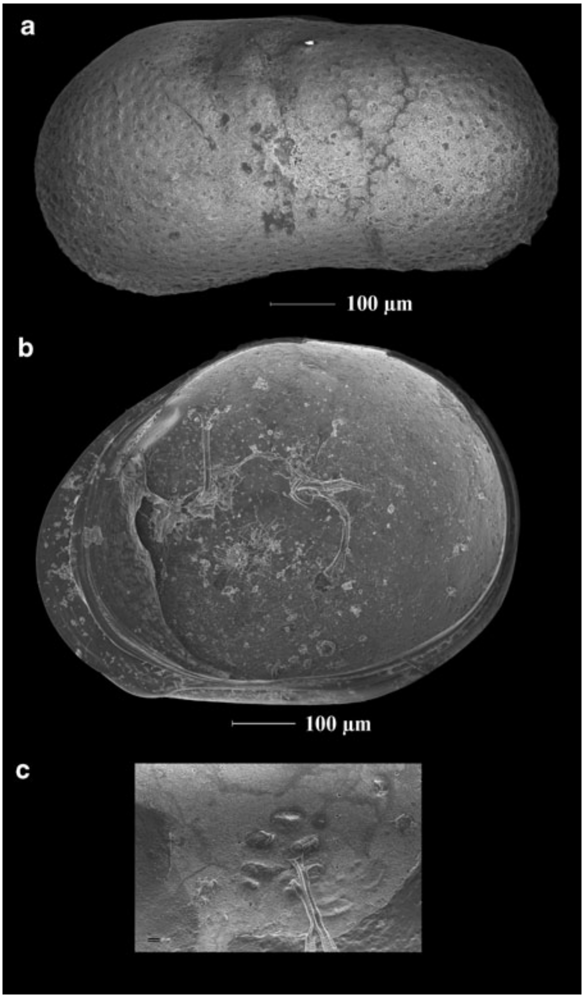


Fig. 3 SEM: (**a**) *Ilyocypris brady* Sars 1870; (**b**) *Notodromas persica* Gurney 1921; (**c**) *Candonocypris sp.*: (**a**) LV, outside view; (**b**) RV, inside view; (**c**) CMS

of the Mxl with more than two (except in the genus *Neozonocypris* Klie 1944) teeth-like setae (Fig. 7g). L5 transformed into maxiliped, palps on male L5 transformed into clasping organs. L7 with terminal segment fully developed and with three setae (with the exception of Centrocypridinae and Cyproidinae). Zenker organ long and slender, both extremities funnel shaped; spines not arranged in separate rings.

Type genus: *Notodromas* Lilljeborg 1853

Systematics

The family is divided into four subfamilies: Centrocypridinae Hartmann and Puri 1974, Cyproidinae Hartmann 1963, Notodromadinae Kaufmann 1900a,

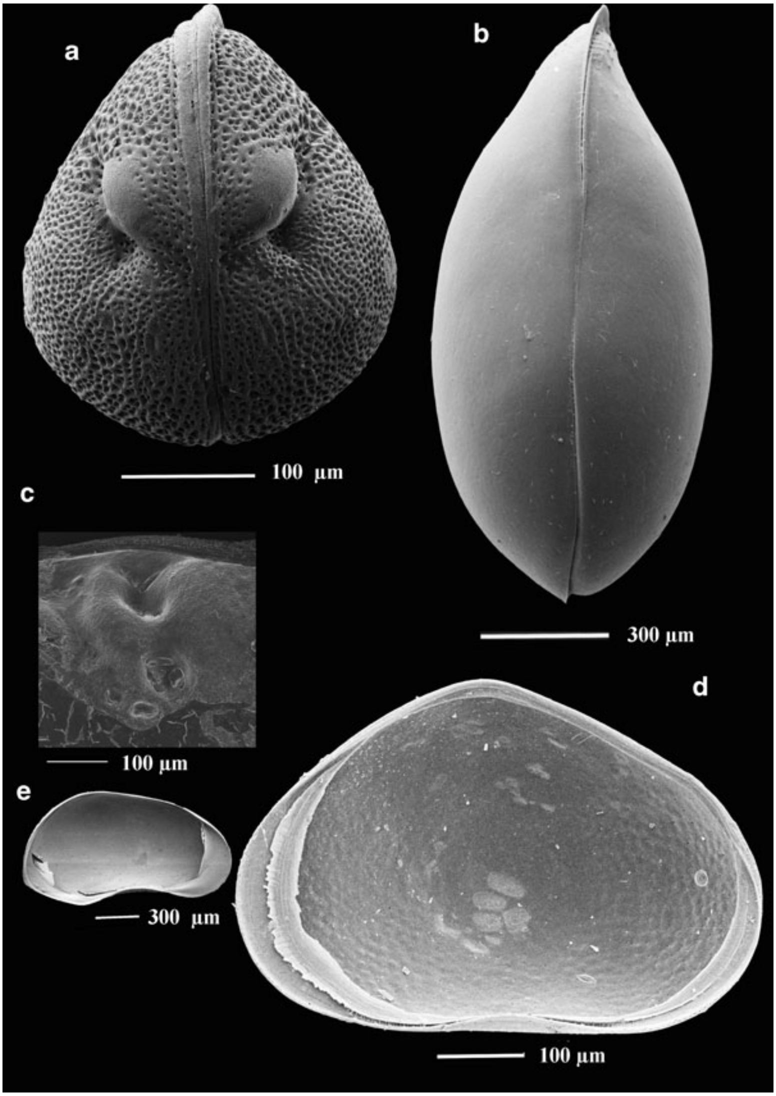


Fig. 4 SEM: (**a**) *Oncocypris mulleri* (Daday 1910); (**b**) *Heterocypris barbara* (Gauthier and Brehm 1928); (**c**) *Ilyocypris brady* Sars 1870; (**d**) *Sarscypridopsis aculeata* (Costa 1847); (**e**) *Candona angulata* Müller 1900a: (**a**, **b**) dorsal view; (**c**) sulcus; (**e**) LV, inside view; (**d**) RV, inside view. (**a**, **b**, **d**, **e**) Photos: D. Keyser

and Oncocypridinae De Deckker 1979a. The fact that in two subfamiles terminal segment on L7 is transformed into the pincer organ, like in the family Cyprididae, may indicate that the family Notodromadidae is polyphyletic and further study of the group is necessary to better understand the phylogenetical relationships.

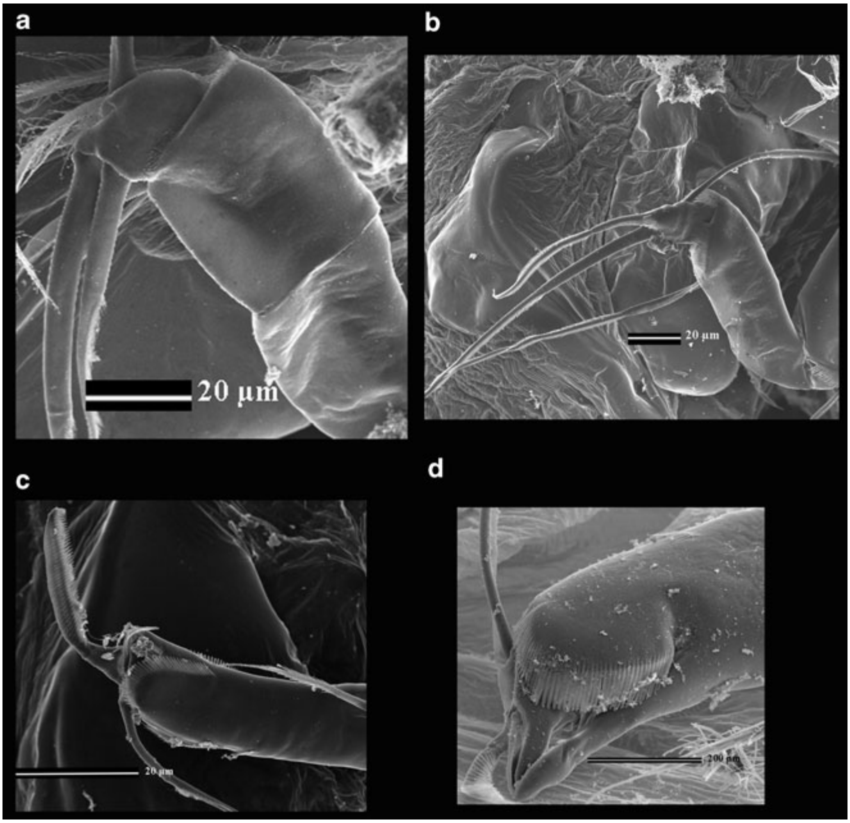


Fig. 5 SEM: (**a**) *Candona neglecta* Sars 1887; (**b**) *Ilyocypris brady* Sars 1870; (**c**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**d**) *Psychrodromus olivaceus* (Brady and Norman 1889): (**a**) terminal segment of L7; (**b**) L7, (**b**) distal part of L7; (**d**) pincer organ

Key to the Subfamilies

1. Terminal segment of L7 with pincer-like ending (Fig. 7d) 2

– Terminal segment of L7 normally developed and with three distinct setae (Figs. 8b, 9d, 7b, and 10h) 3

2. Adults with separated eye capsules . . . . Centrocypridinae

– Adults with fused eye capsules . . . . Cyproidinae

3. UR rod like (Figs. 8c, 9e, and 10f, h) . . . . Notodromadinae

– UR whip like . . . . Oncocypridinae

1.1 Subfamily Centrocypridinae Hartmann and Puri 1974

Diagnosis (modified after Hartmann and Puri 1974): Valves short and stout. Surface usually covered with small tubercles or spine-like processes. Calcification weak.

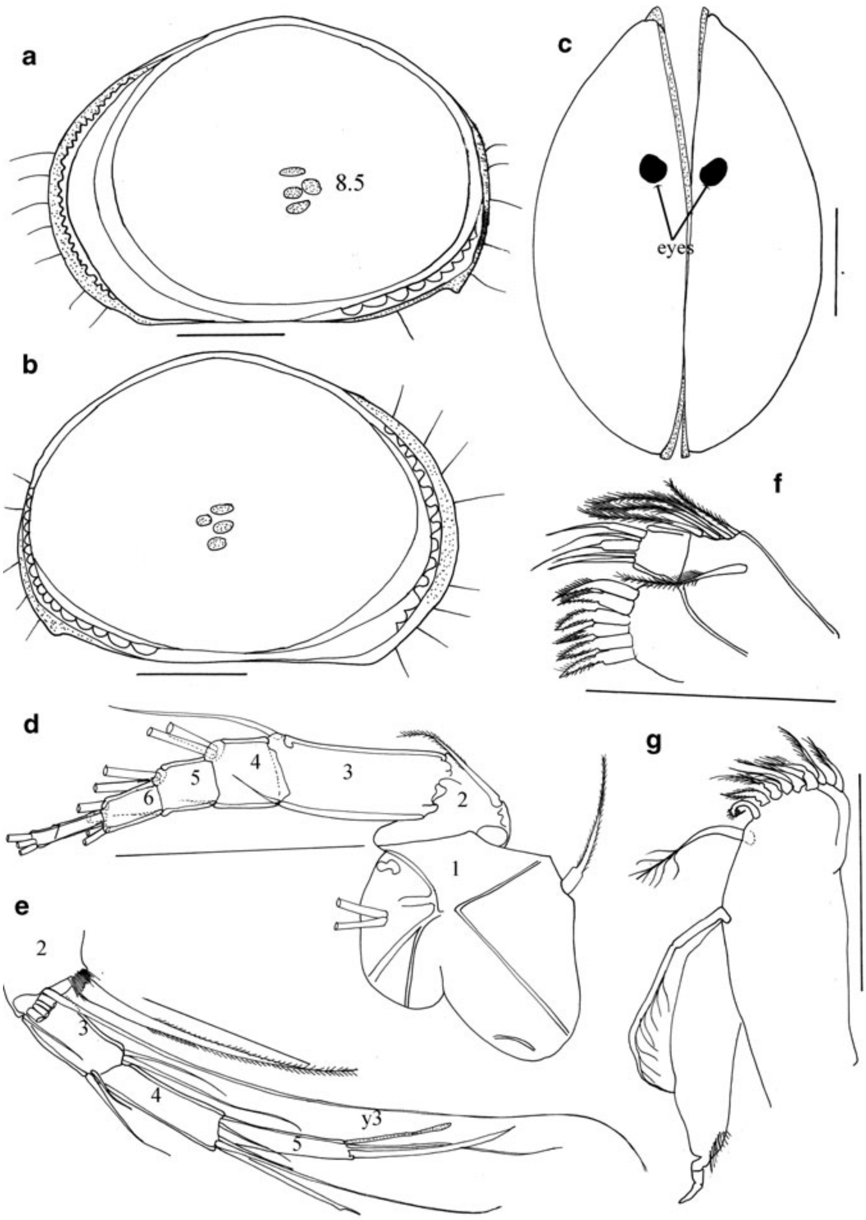


Fig. 6 Line drawings: *Notodromas persica* Gurney 1921, ♀: (**a**) RV, inside view; (**b**) LV, inside view; (**c**) carapace, dorsal view; (**d**) A1; (**e**) A2 (first and second segments not drawn); (**f**) Mxl palp and third masticatory process; (**g**) L5. Scales = 0.1

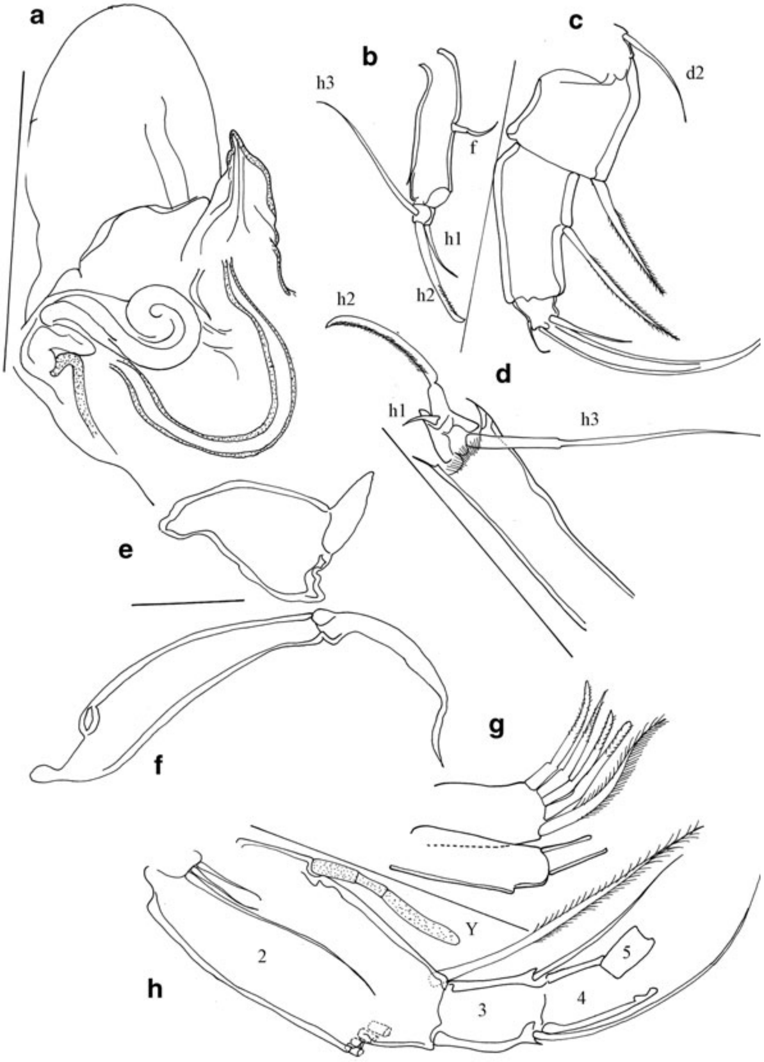


Fig. 7 Line drawings: (**a**) *Newnhamia thomseni* Klie 1935c; (**b**, **c**) *Neozonocypris congensis* Klie 1944; (**d**) *Cyprois marginata* (Straus 1821); (**e**, **f**) *Gurayacypris kangraensis* Battish 1987; (**g**, **h**) *Oncocypris chappuisi* Klie 1939a: (**a**) hemipenis; (**b**) L7 (first and second segments not drawn); (**c**) L6; (**d**) L7 (first and second segments not drawn); (**e**) right prehensile palp; (**f**) left prehensile palp; (**g**) Mxl palp (incomplete) and third endite of Mxl; (**h**) A2 (incomplete). Scales = 0.1 mm. (**e**, **f**) Modified after Battish (1987)

CIL broad anteriorly and narrow posteriorly. MPC not visible. Swimming setae on A2 long. Penultimate segment of A2 subdivided in both sexes. Third masticatory process of Mxl with four or six teeth-like setae. Terminal segment of L7 transformed into pincer organ. UR slender.

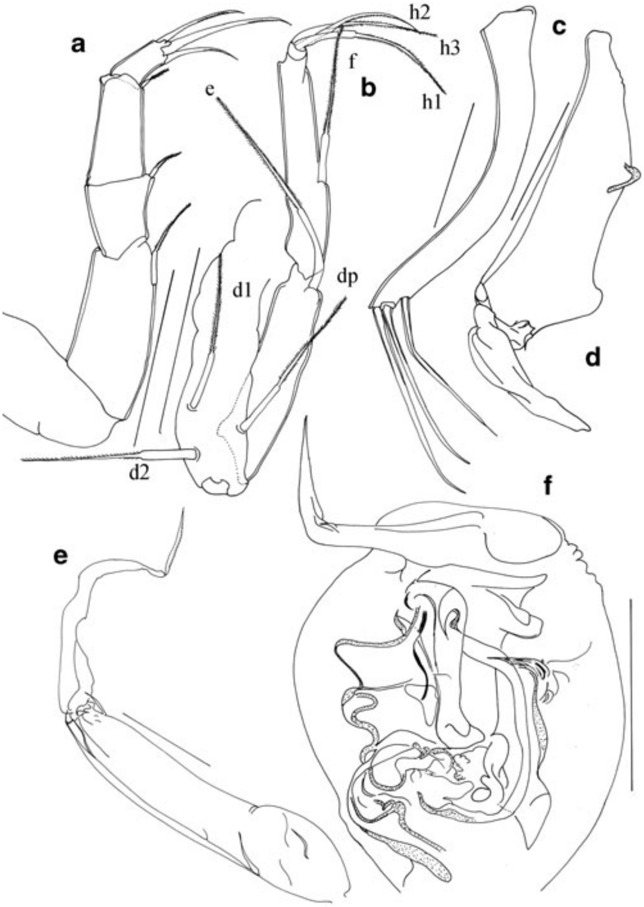


Fig. 8 Line drawings: *Notodromas persica* Gurney 1921, **a–c**, ♀; **d–f**, ♂: (**a**) L6; (**b**) L7; (**c**) UR: (**d**) right prehensile palp; (**e**) left prehensile palp; (**f**) hemipenis. Scales = 0.1 mml

Type (and only) genus: *Centrocypris* Vávra 1895

Centrocypris **Vávra 1895**
Diagnosis: Same as that for the subfamily.

Type species: *C. horrida* (Vávra 1895)

Species list with type locality and type material

1. *C. bhagirathiae* Battish 1981a. Small roadside ditch near village Sanet (Ludhiana), Ludhiana–Ferozepur road, Punjab, India, 06°55′39″N 79°50′53″E: Holotype (♀), PAU – 0.102 F.
2. *C. horrida* (Vávra 1895a, b). Puddle, Wege, Zanzibar, 06°11′S 39°21′E: Type material not designated, repository unknown.

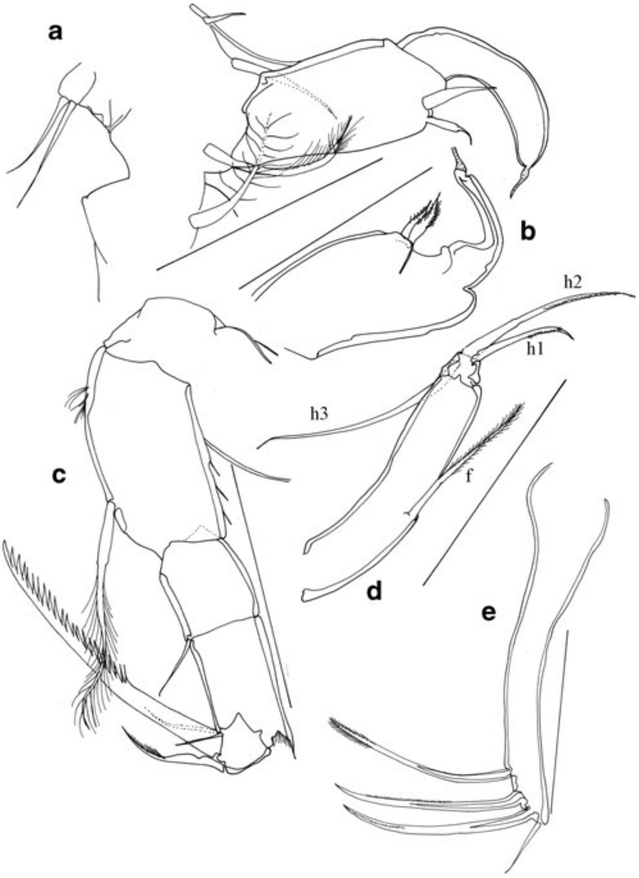


Fig. 9 Line drawings: *Newnhamia thomseni* Klie 1935c, ♂: (**a**) right prehensile palp; (**b**) left prehensile palp; (**c**) L6; (**d**) L7 (first and second segments not shown); (**e**) UR. Scales = 0.1 mm

3. *C. indica* Gupta 1991. Pond, Sadikpur Mathia, Siwan, Bihar, India, 26°13′N 84°21′E: Holotype (♀), ZSI – 5a, 5b.
4. *C. jakubskii* Grochmalicki 1913. Puddle, Usangi, Tanzania, 03°41′S 37°39′E: Type material not designated, repository unknown.
5. *C. madani* Battish 1981a. Pond Gora Toba, Lalton, Pakhowal–Ludhiana road, India, 30°50′31″N 74°46′45″E: Holotype (♀), PAU – 0.103 F_2.
6. *C. margaritifera* Müller 1898. Mahajanga, Madagascar, 15°43′02″S 46°19′06″E: Type material not designated, repository unknown.
7. *C. matthai* (Arora 1931). Lahore
8. *C. viridis* Neale 1976b. Tank, Ma-Eliya, Battuluoya, Sri Lanka, 07°48′N 79°55′E: Holotype (♀), UH – HU.250.R.1.

Key to the species

1. Posterior claw on the UR very slender, almost seta like and plumed 2
– Posterior claw on the UR distinctly claw like 3

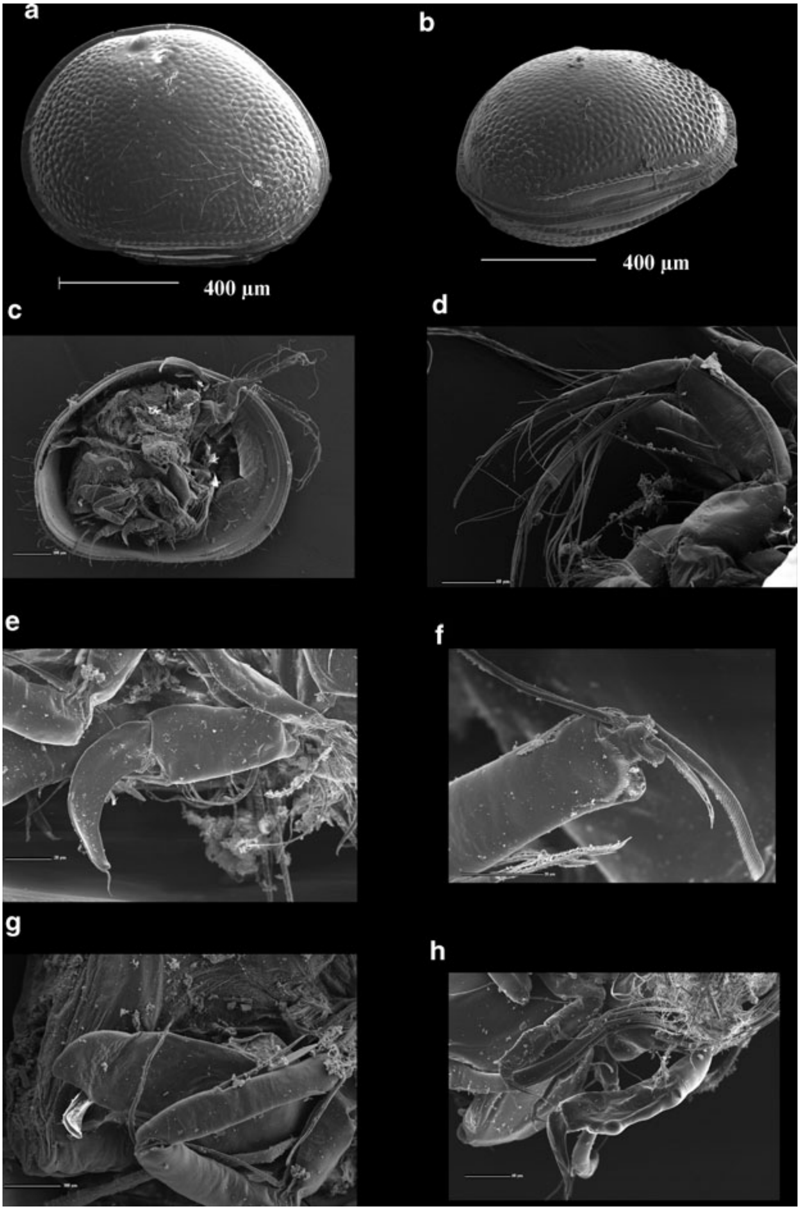


Fig. 10 SEM: (**a**–**g**) *Newnhamia patagonica* (Vávra, 1898); (**h**) *Notodromas persica* Gurney 1921: (**a**) lateral view from the right side; (**b**) latero-ventral view; (**c**) ♂, inside view; (**d**) ♂, A2; (**e**) ♂, prehensile palp; (**f**) distal part of L7; (**g**) hemipenis; (**h**) ♂, prehensile palp

2. Anterior and posterior claws on UR same L . *C. jakubskii* Grochmalicki 1913
– Posterior claw on the UR shorter than the anterior one *C. viridis* Neale 1976b
3. Ventral margin in lateral view striate 4
– Ventral margin in lateral view without striae 5
4. Spines present on the entire surface of the carapace . . . . *C. margaritifera* Müller 1898
– Only a couple of spines present anteriorly and posteriorly on the carapace *C. horrida* (Vávra 1895)
5. Second segments on both prehensile palps narrowing toward distal end and palps almost symmetrical 6
– Second segment on the right prehensile palps wide distally and palps clearly asymmetrical 7
6. Outer lobe on hemipenis evenly rounded . . . . *C. indica* Gupta 1991
– Outer lobe on hemipenis subtriangular . . . . *C. madani* Battish 1981a
7. Second segment of the right prehensile palp evenly wide . . . *C. bhagirathiae* Battish 1981a
– Second segment of the right prehensile palp wider distally than proximally *C. matthai* (Arora 1931)

Ecology and distribution (Fig. 11)

The species are mostly found in stagnant freshwater. The genus is restricted to East Africa and India.

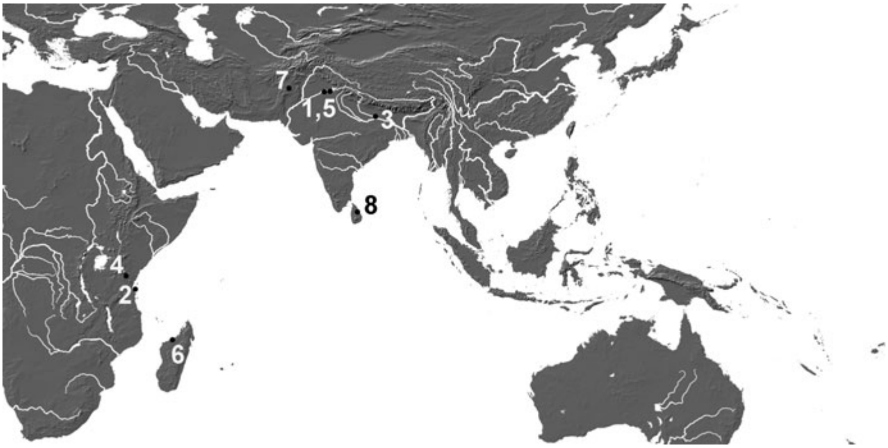


Fig. 11 Distribution of *Centrocypris* Vávra 1895: Numbers correspond to the species list

1.2 Subfamily Cyproidinae Hartmann 1963

Diagnosis (after Meisch 2000): Carapace stout in lateral view. Eyes separate in the nauplii, fused in adults. A2 5-segmented in both sexes. Third masticatory process of the Mxl with six teeth-like setae. L5 with well-developed vibratory plate. Terminal segment of L7 transformed into pincer organ. Posterior seta on the UR long, claw like, and inserted close to the terminal claws.

Type (and only) genus: *Cyprois* Zenker 1854

***Cyprois* Zenker 1854**
Diagnosis: Same as that for the subfamily.

Type species: *C. marginata* (Straus 1821)

Species list with synonyms, type locality, and type material

1. *C. occidentalis* Sars 1926. Pools at Billings Bridge, Ottawa, Ontario, Canada, 45°53′51″N 82°14′03″W: Holotype not designated, repository of the type material unknown.
2. *C. marginata* (Straus 1821). Surrounding of Paris, France, 48°51′N 02°21′E: Type material not designated, repository unknown.

   Syn.: *C. dispar* Fischer 1851; *C. flava* Zaddach 1844

Key to the species

1. Left prehensile palp with elongated second segment (finger) . . *C. occidentalis* Sars 1926
– Left prehensile palp with stocky second segment (finger) . . . . . *C. marginata* (Straus 1821)

Ecology and distribution
The species can be usually found in temporary pools and ditches with pure water and much vegetation. *Cyprois marginata* (Straus 1821) has a Holarctic distribution, while *C. occidentalis* Sars 1926 was found only in North America (Fig. 12).

1.3 Subfamily Notodromadinae Kaufmann 1900a

Type genus: *Notodromas* Lilljeborg 1853

Other genera: *Gurayacypris* Battish 1987; *Kennethia* De Deckker 1979a; *Newnhamia* King 1855.

Diagnosis (after Meisch 2000): Carapace stout, dorsally rounded (Fig. 6c), never elongated in lateral view; anterior and posterior margins broadly rounded

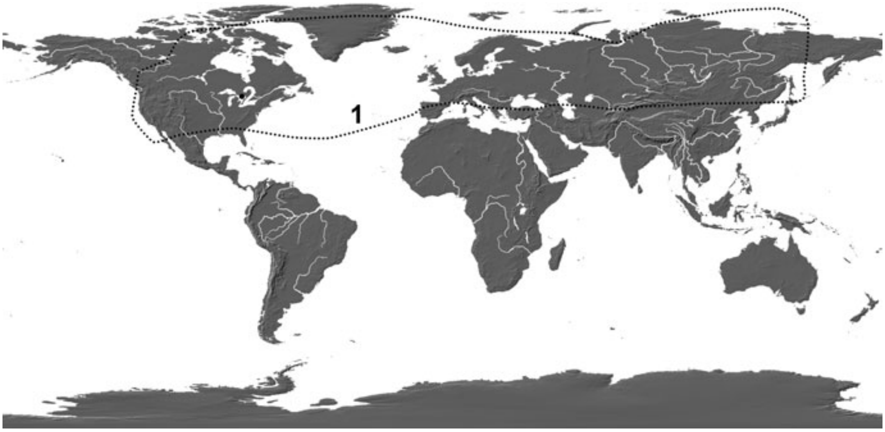


Fig. 12 Distribution of *Cyprois* Zenker 1854: Numbers correspond to the species list

(Figs. 6a, b, 13c, 14a, and 10a, c). Ventral valve surface flattened (Figs. 14b–d and 10b), with or without longitudinal ridges. Eye cups of both nauplii and adults separated (Fig. 6a), each with a distinct convex lens. CIL and marginal zone narrow. A1 7-segmented (Fig. 6d) and A2 5-segmented (Figs. 6e, 15a, 7h, and 10d). Mxl endite with six claws (Fig. 6f). Vibratory plate on L5 reduced or absent (Fig. 6g). Terminal segment of L7 separated from penultimate one and carrying three distal setae (Figs. 8b, 9d, and 10f). Posterior seta on UR claw like, inserted close to the posterior terminal claw (Figs. 8c and 9e).

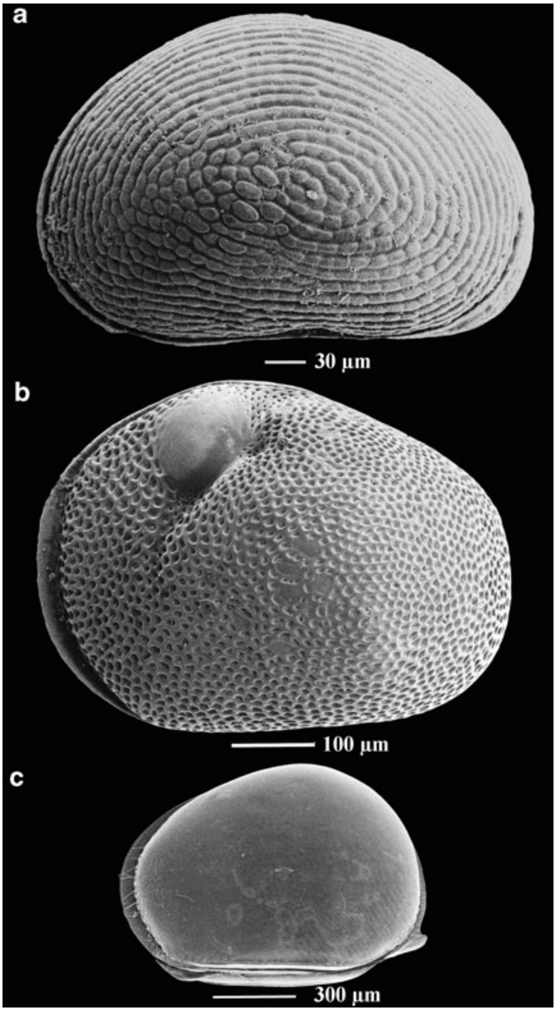
Key to the genera

1. Prehensile palps strongly asymmetrical; first segment on the right palp robust (almost square), on the left palp elongated (Fig. 7e–f) . . . *Gurayacypris* Battish 1987
– Prehensile palp not so strongly asymmetrical and both palps with elongated first segments (Figs. 8d, e, 9a, b, and 10e, h) 2
2. Eye tubercles not clearly pronounced (Fig. 13c) *Notodromas* Lilljeborg 1853
– Eye tubercles clearly pronounced (Fig. 10a) 3
3. Carapace oval in shape in anterior view . . . . *Newnhamia* King 1855
– Carapace triangular in shape in anterior view . . *Kennethia* De Deckker 1979a

Remarks

There are little differences between the genus *Kennethia* De Deckker 1979a and *Newnhania* King 1855. When describing the genus from Australia, De Deckker (1979a) did not give clear differences between his new genus and *Newnhania*, and he paid little attention to the soft part morphology, which might prove to be important for distinguishing between the two genera.

Fig. 13 SEM: (**a**) *Neozonocypris mirabilis* Rome 1962; (**b**) *Oncocypris sp.*; (**c**) *Notodromas monacha* (OF Müller 1776): outside view from the left side. Photos: D. Keyser



Gurayacypris Battish 1987

Diagnosis (after Battish 1987): In dorsal view, carapace subovate with narrow anterior and posterior margins, flattened ventral area of the carapace serrated, and line of concrescence scalloped; eye tubercles not prominent. Prehensile palps strongly asymmetrical.

Type (and only) species: *G. kangraensis* Battish 1987

Species list with type locality and type material
G. kangraensis Battish 1987. Pool, 2 km from the village Mankhandi, Kangra–Hoshiarpur road, India, 31°35′N 75°57″E: Holotype (♂), ZSI – 0-154 M1.

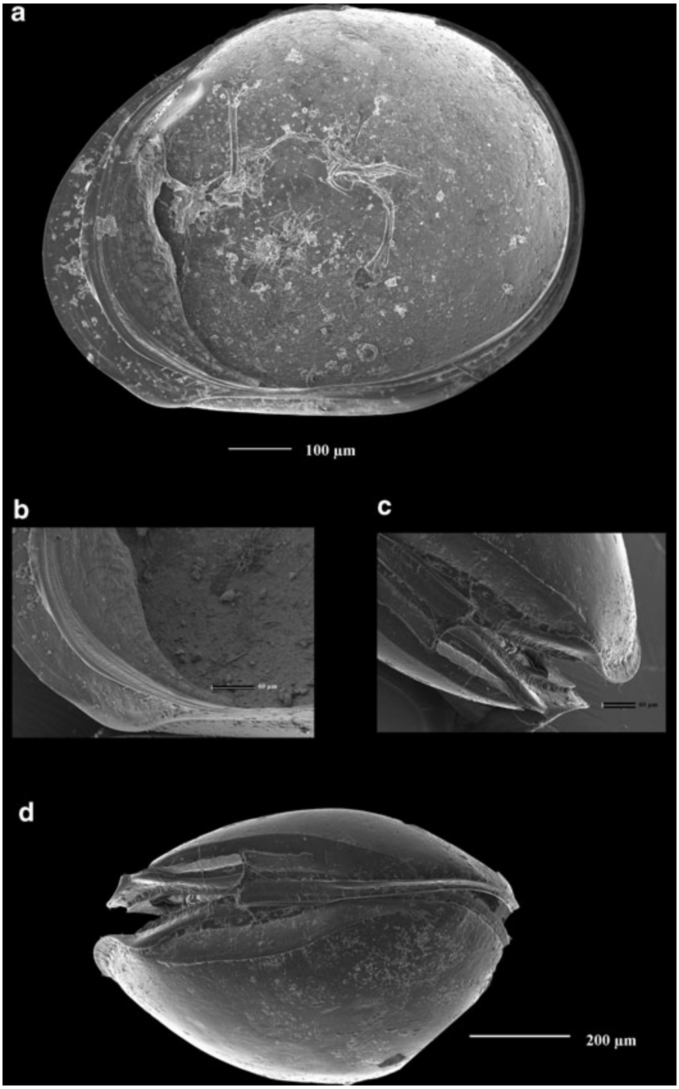


Fig. 14 SEM: *Notodromas persica* Gurney 1921: (**a**) RV, inside view; (**b**) RV, antero-ventral margin; (**c**) carapace antero-ventral part; (**d**) carapace, ventral view

Kennethia De Deckker 1979a

Diagnosis (after De Deckker 1979a): Carapace with polygonal elevations. Carapace triangular in shape when viewed from the anterior. Ventral area of the carapace ridged and surrounded on the side by a broad list. Broad and ribbed outer lamella on LV in dorsal area. Eye tubercles small.

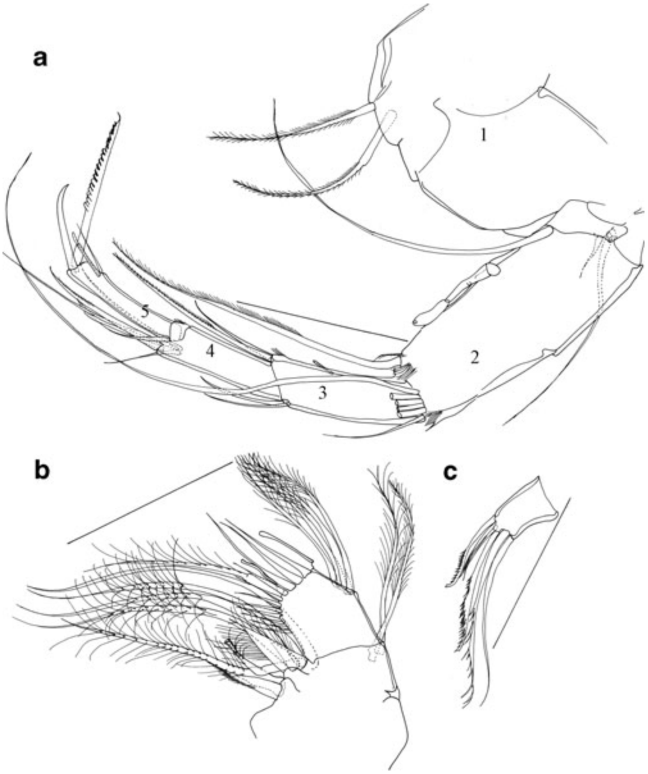


Fig. 15 Line drawings: *Newnhamia thomseni* Klie 1935c, ♂: (**a**) A2; (**b**) Md palp without terminal segment, (**c**) terminal segment of Md palp. Scales = 0.1 mm

Type species: *K. cristata* De Deckker 1979a

Species list with type locality and type material

1. *K. cristata* De Deckker 1979a. Sweepwash Lagoon, Victoria, Australia, 38°08′S 141°11′E : Holotype (♂), NHMS – Xe10806.
2. *K. major* (Méhes 1939). Lake near Canala, New Caledonia, 21°31′13″S 165°57′10″E: Holotype not designated. Repository of the type material unknown, but De Deckker (1979a) examined a couple of specimens identified as *K. major* and deposited at the BM originating from Lekin, Uvea, Loyalty Islands, New Caledonia.

Key to the species

1. The largest lobe on hemipenis (lobe “a”) narrow, curved, and elongated *K. cristata* De Deckker 1979a

– The largest lobe on hemipenis (lobe “a”) very small . *K. major* (Méhes 1939)

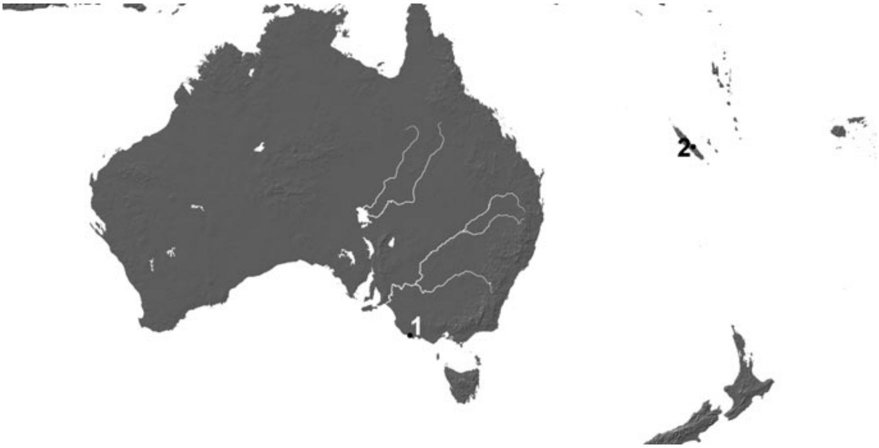


Fig. 16 Distribution of *Kennethia* De Deckker 1979a: Numbers correspond to the species list

Ecology and distribution (Fig. 16)
The species can often be found in water bodies with higher salinity, such as salt lakes. The genus is known only from Australia and New Caledonia.

***Newnhamia* King 1855**
Diagnosis (modified after George and Martens 2004b): Valves rounded, covered with polygonal elevation and rounded or pointed tubercles (Fig. 10a, b). Ventral side of the carapace with anterior lip-like expansion of valve margin. Large part of ventral surface plate like, set with 2–3 rows of rounded elevations, and bordered by an elevated outer list. Eye tubercles clearly pronounced. L6 without basal setae (Fig. 9c). Hemipenis with rounded outer lobe (Fig. 7a).

Type species: *N. fenestrata* King 1855

Species list with synonyms, type locality, and type material

1. *N. dumonti* George and Martens 2004b. Chalakkudy River, Arangalikadavu, Kadukkuty, Kerala, India, 10°18′N 76°22′E: Holotype (♀), RBINS – O.C. 2419.
2. *N. fenestrata* King 1855. Swamp 2 km east of Princetown, near Port Campbell, Victoria, Australia, 38°41′S 142°09′E: Neotypes (♂, ♀), NHMS – Xe 19841, 19842.

   Syn: *N. gulielmi* King 1855

3. *N. fuscata* (Brady 1886b). Condong, NSW, Australia, 28°19′S 153°26′E: Types at HM.
4. *N. insolita* De Deckker 1979a. Pond, Dog Rocks State Forest, Rockley, NSW, Australia, 33°41′S 149°39′E: Holotype (♂), NHMS – Xe10835.

5. *N. patagonica* (Vávra 1898). Berg lake, Punta Arenas, South Patagonia, Chile, 53°09′S 70°55′W: Repository of the type material unknown.

   Syn: *N. petiola* De Deckker 1979a

6. *N. thomseni* Klie 1935c. Dump soil in the Eucalyptus wood near Montevideo, Uruguay, 34°49′S 56°10′W: Syntype (♂), ZMK – UR-608.

Key to the species

1. Posterior margin of the carapace straight *N. dumonti* George and Martens 2004b
– Posterior margin of the carapace rounded 2
2. Carapace very faintly ornamented 3
– Carapace strongly ornamented 4
3. Anterior seta on the UR absent . . . . *N. fuscata* (Brady 1886b)
– Anterior seta on the UR present . . . . *N. thomseni* Klie 1935c
4. Eye tubercles small . . . . *N. insolita* De Deckker 1979a
– Eye tubercles large 5
5. Prehensile palps symmetrical . . . . *N. fenestrata* King 1855
– Prehensile palps asymmetrical . . . . *N. patagonica* (Vávra 1898)

Remarks

George and Martens (2004b) gave additional description of *N. fenestrata* King 1855 from Australia and they have found a considerable variability between populations of this species. Further study of this genus is necessary, because now the distinguishing characters between Australian species are very limited and may even be the result of intraspecific variability. Drawings provided by De Deckker (1979a) are very poore, but further studies of the material may prove that some of the characters (thick terminal claw on L6, L ration between setae on the terminal segment of the same appendage, L of the terminal segment of L7, etc.) drawn by De Deckker (1979a) are sufficient for distinguishing between species.

Ecology and distribution (Fig. 17)

The species prefer open stagnant water bodies, and sometimes can be found in slightly saline water. The genus is distributed in Australia, India, and South America.

Notodromas Lilljeborg 1853

Diagnosis (after Meisch 2000): Carapace stout in lateral view. Ventral flattened area well developed, spindle shaped, and with longitudinal ridges. Basal segment of L6 without setae (Fig. 8a). UR without anterior seta, posterior seta claw like. Hemipenis with conspicuous outer lobe (Fig. 8f).

Type species: *N. monacha* (OF Müller 1776)

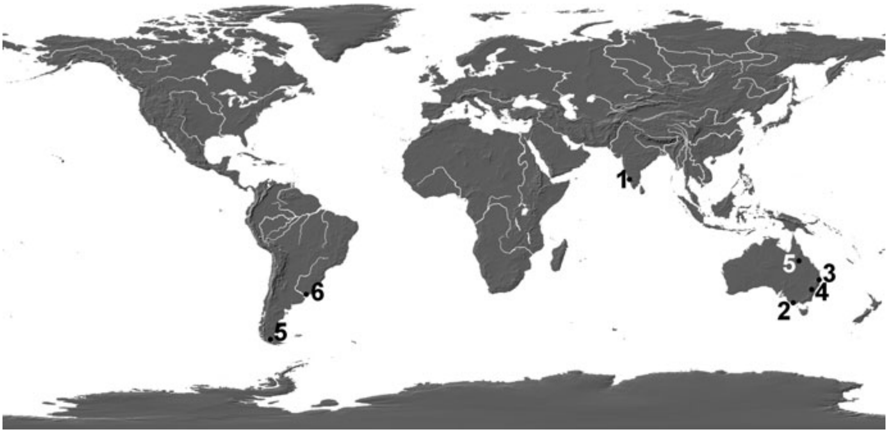


Fig. 17 Distribution of *Newnhamia* King 1855: Numbers correspond to the species list

Species list with synonyms, type locality, and type material

1. *N. monacha* (OF Müller 1776). Type locality and repository of the type material unknown.

   Syn.: *Cypris bimuricata* Koch 1837b; *C. nubilosa* Koch 1837c

2. *N. oculata* Sars 1903a. Sumatra. Exact type locality unknown, the species was raised from dried mud. Sars (1903a) mentioned two provinces in Sumatra: Deli and Langkat. Repository of the type material unknown.
3. *N. persica* Gurney 1921. Rasht, N.W. Iran, 37°16′57″N 49°35′02″E: Holotype not designated, repository of the type material unknown.

   Syn.: *N. entzi* Daday 1898

4. *N. serrata* Deb 1984. Pond at Gobindpur, Dhanbad district, Jharkhand (formerly southern Bihar), India, 23°50′N 86°31′E: Holotype (♀), ZSI – C1355/2
5. *N. sinensis* Neale and Zhao 1991. Lake near Daqing City, Heilongjiang, China, 46°25′N 125°20′E: Holotype (♂), HU – 318.R.6a, b.

Key to the species

1. Animals smaller than 0.6 mm . . . . *N. oculata* Sars 1903a
– Animals larger than 0.6 mm 2
2. Extension of the hemipenis very narrow and sharply pointed . . . . . *N. persica* Gurney 1921
– Extension of the hemipenis more stout and wide, not sharply pointed 3
3. Second segment of the right prehensile palp very thin and long . . *N. monacha* (OF Müller 1776)
– Second segment of the right prehensile palp stout and short *N. sinensis* Neale and Zhao 1991

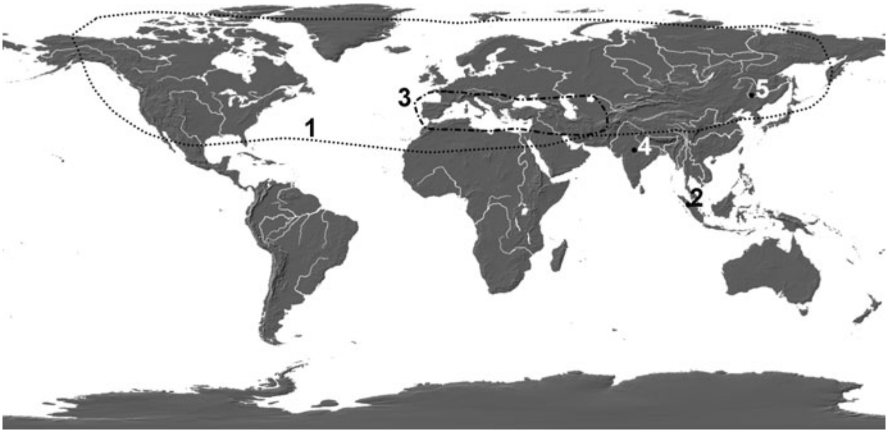


Fig. 18 Distribution of *Notodromas* Lilljeborg 1853. Numbers correspond to the species list

Species not included in the key
The only species not included in the key is *N. serrata* Deb 1984, described from India. Due to a poore description, it is impossible to distinguish it from other representatives of the genus.

Ecology and distribution (Fig. 18)
The species live in both permanent and temporary water bodies, and prefer shallow water with rich vegetation such as ponds and littoral of lakes. *Notodromas monacha* (OF Müller 1776) has a Holarctic distribution, *N. persica* Gurney 1921 circum-mediterranean, while the other three species have a more restricted distribution.

1.4 Subfamily Oncocypridinae De Deckker 1979a

Diagnosis (modified after De Deckker 1979a): Carapace stout, dorsally rounded, and ventral valve surface flattened. Eye cups in nauplii separated (Fig. 13b), while in adults fused (Fig. 10a), each with a distinct convex lens. A2 4- or 5-segmented (Fig. 7h). Terminal segment of L7 separated from penultimate one (Fig. 7b) and carrying three distal setae, one of which is transformed into a claw. Basal segment of L6 with basal seta (Fig. 7c), UR reduced and whip like.

Type genus: *Oncocypris* Müller 1898

Other genera: *Neozonocypris* Klie 1944; *Neocypridopsis* Klie 1940b

Key to the genera

1. A2 5-segmented (Fig. 7h) . . . . *Oncocypris* Müller 1898
– A2 4-segmented 2
2. Carapace strongly ornamented (Fig. 13a) . . . . *Neozonocypris* Klie 1944
– Carapace not so strongly ornamented . . . . *Neocypridopsis* Klie 1940b

Remarks

At the moment, there are no clear differences between genera *Neozonocypris* Klie 1944 and *Neocypridopsis* Klie 1940b. In the first genus, species are more ornamented, but even in the latter genus, some species are also ornamented. The problem is that most of the species assigned to the genus *Neocypridopsis* were described long time ago, so some details of their morphology is still obscure. It is, however, obvious that this genus needs a revision since there is no doubt that it is polyphyletic. One example is the spatula-like terminal segment of the Mxl palp in *N. montevidea* (Vávra 1898), while in many other species assigned to this genus, this segment is cylindrical (unfortunately, this detail was not described in all species).

Neocypridopsis was considered as a member of Cypridopsinae, but the complete development of the terminal segment of L7 excludes it from this subfamily.

***Neocypridopsis* Klie 1940b [Syn.: *Notiocypridopsis* De Deckker 1981d]**
Diagnosis: Carapace sometimes ornamented. A2 4-segmented. Third masticatory process of Mxl with only two claw-like setae. L7 with seta “h2” transformed into a strong claw. Terminal segment of the same appendage clearly separated from the penultimate one. UR whip like.

Type species: *N. debilis* Klie 1940b

Species list with type locality and type material

1. *N. albida* (Sars 1901). Raised from dried mud, São Paulo, Brazil, 23°32′S 46°37 W: Types, NHMO – F11572 Mp. 498.
2. *N. costata* (Daday 1910a). Mbasi creek, close to where it flows into Lake Nyasa, Tanzania, 09°35′S 33°56′E: ZMK – UR-1132.
3. *N. debilis* Klie 1940b. Cachoeira Paulo Alfonso, Alagoas, Brazil, 09°34′S 36°46′W: Syntypes, ZMK – UR-1159.
4. *N. frigogena* (Graf 1931). Freshwater pond fed by a spring above Grytviken, S. Georgia, 54°16′S 36°30′W: Repository of the type material unknown, but some material collected on later dates (De Deckker 1981d) and deposited at BM.
5. *N. granulosa* (Daday 1902). St. Cruz, Amenkelt, Patagonia, Chile, 34°37′S 71°21′W: Types, HMNH – IV-475.
6. *N. inaudita* (Furtos 1936b). Campeche, Champoton, Mexico, 19°56′N 90°31′W : Holotype (♀), SM – 67955.
7. *N. mexicana* (Furtos 1938). Yunchen Cave, Libre Unión, Yucatán, Mexico, 20°42′N 88°49′W: Types, SM – collection numbers unknown.

8. *N. montevidea* (Vávra 1898). Tank, Montevideo, Uruguay, 34°49′S 56°10′W: Repository of the type material unknown.
9. *N. nana* (Sars 1901). Raised from dried mud, Itatiba, Brazil, 23°00′S 46°50′W: Repository of the type material unknown.
10. *N. paradisea* (Vávra 1898). Stream, Valparaiso, Chile, 33°03′S 71°36′W: Repository of the type material unknown.
11. *N. yucatanensis* (Furtos 1936b). Xix Cenote, Chichen Itza, Mexico, 20°40′N 88°34′W: Holotype (♀), SM – 67961.

Key to the species

1. Swimming setae on A2 short, not exceeding middle of the penultimate segment *N. albida* (Sars 1901)

– Swimming setae on A2 long, exceeding tip of terminal claws 2

2. In lateral view, posterior end protruding 3

– Posterior margin normally rounded 4

3. Carapace in lateral view subtrapezoidal . . . . *N. frigogena* (Graf 1931)

– Carapace subtriangular to elongated . . . . *N. inaudita* (Furtos 1936b)

4. Dorsal margin flat . . . . *N. paradisea* (Vávra 1898)

– Dorsal margin rounded 5

5. Septae present on the valve margins . . . . *N. costata* (Daday 1910a)

– No septae developed 6

6. Dorsal margin evenly rounded, greatest H lying in the middle from which point margin slopes evenly toward anterior and posterior ends 7

– Dorsal margin not evenly rounded, greatest H lying more toward anterior end, from which point margin slopes steeply toward posterior end . . *N. granulosa* (Daday 1902)

7. Carapace surface smooth 8

– Carapace surface ornamented . . . . *N. yucatanensis* (Furtos 1936b)

8. Terminal segment of the Mxl palp cylindrical . . . . *N. debilis* Klie 1940b

– Terminal segment of the Mxl palp spatula like . . *N. montevidea* (Vávra 1898)

Species not included in the key
The only species not included is *N. nana* (Sars 1901) described from South America. Sars (1901) described only carapace of this species and no details of the internal part morphology are known.

Ecology and distribution (Fig. 19)
The species live in permanent and semi-permanent freshwater bodies and most of them are distributed in South America.

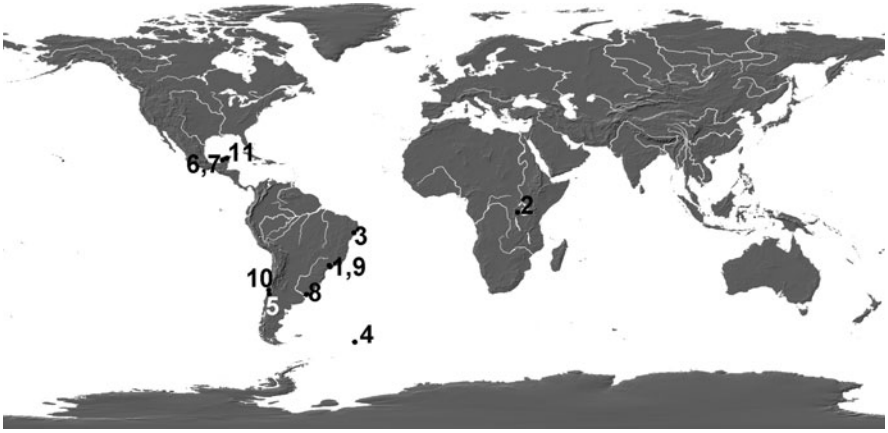


Fig. 19 Distribution of *Neocypridopsis* Klie 1940b: Numbers correspond to the species list

Neozonocypris Klie 1944

Type species: *N. congensis* Klie 1944

Diagnosis: Carapace strongly ornamented. A2 4-segmented. Third masticatory process of Mxl with only two claw-like setae. Vibratory plate of L5 reduced. L7 with seta h2 transformed into a strong claw. Terminal segment of the same appendage clearly separated from the penultimate one. UR whip like.

Species list with type locality and type material

1. *N. congensis* Klie 1944. Ndalaga Lake, Albert National Park, DR Congo, 01°24′30″S 29°12′E: Syntypes, ZMK – UR-1155.
2. *N. globosa* Rome 1962: Kalemie (Kalumbe, in front of camp Jaques), DR Congo, 05°56′S 29°11′E: Holotype (♀), RBINS – O.C. 650a, b.
3. *N. mirabilis* Rome 1962: Bangwe Bay, Tanzania, 04°55′S 29°41′E: Holotype (♀), RBINS – O.C. 648a, b.

Key to the species

1. UR conical, narrowing gradually from proximal to distal end so that the distal seta appears completely as a part of the ramus 2
– UR with distinct ramus and distal seta . . . . *N. mirabilis* Rome 1962
2. Tubercles present along carapace margins . . . . *N. congensis* Klie 1944
– Tubercles absent along carapace margins . . . . *N. globosa* Rome 1962

Remarks

Klie (1932) described the genus *Pseudocypretta* from Sumatra and Java. The genus still has only one species, *P. maculata* Klie 1932. It is very closely related to the *Neozonocypris*, having normally developed terminal segment on L7, whip-like UR,

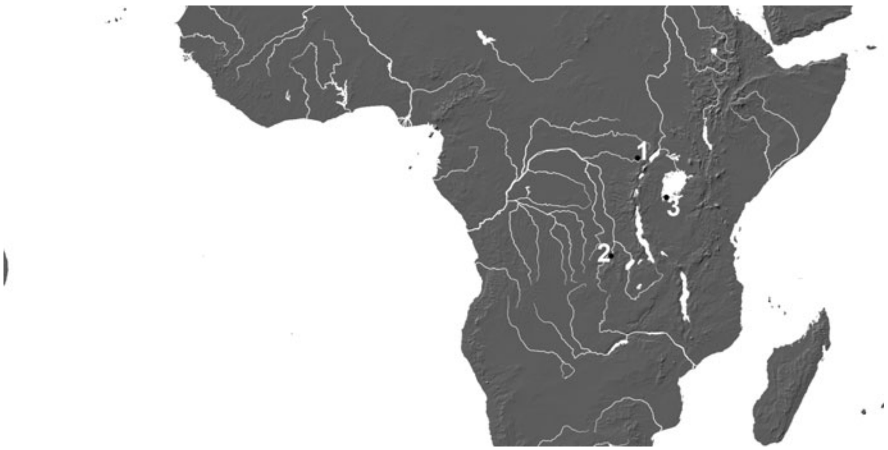


Fig. 20 Distribution of *Neozonocypris* Klie 1944: Numbers correspond to the species list

and a 4-segmented A2. However, they differ in the presence of the marginal septae on RV (absent on LV), being very similar to the genus *Cypretta* Vávra 1895. *Cypretta* belongs to the family Cyprididae and has septae on both valves as well as pincer organ on the terminal segment of L7 and a fully developed UR. The position of *Pseudocypretta* is, therefore, doubtful and needs further clarification.

Ecology and distribution (Fig. 20)
The species have only been found so far in lakes, and all three are known only from and around African great lakes.

***Oncocypris* Müller 1898 [Syn.: *Oncocypria* Daday 1908]**
Diagnosis: Carapace strongly ornamented (Fig. 13b). A2 5-segmented. Third masticatory process of Mxl with six claw-like setae (Fig. 7g). Vibratory plate of L5 reduced. L7 with seta h2 transformed into a strong claw. Terminal segment of the same appendage clearly separated from the penultimate one. UR whip like.

Type species: *O. voeltzkowi* Müller 1908

Species list with type locality and type material

1. *O. bhatiai* Battish 1982a. Freshwater Tank, Una, Himachal Pradesh, Punjab, India, 32°05′N 77°32′E: Holotype (♀), PAU – 0–101 F$_4$.
2. *O. chappuisi* Klie 1939a, Kinangop, Kenya, 00°37′S 36°41′E: Syntypes, ZMK – UR-1454-5.
3. *O. debundshae* Green 1973. Crater Lake, Cape Debundsha, West Cameroon, 04°06′N 08°58′E: Holotype not designated, repository of the type material unknown.
4. *O. euglypha* Rome 1962. Small bay south of Cap Tembwe, Lake Tanganyika, DR Congo, 06°31′S 29°29′E: Holotype (♀), RBINS – O.C. 656a, b.

5. *O. mulleri* (Daday 1910a). Firyano, Ethiopia, 09°06′N 40°29′E: Holotype not designated, but some material deposited at HMNH – IV/P-301-306.

   Syn.: *O. worthingtoni* Lowndes 1936; *O. omercooperi* Lowndes 1932a

6. *O. schoutedeni* Klie 1938c. Bas Uelé, Kotili, DR Congo, 02°52′N 24°31′E: Syntypes, ZMK – UR-1202; 1450–1; 1263.
7. *O. voeltzkowi* Müller 1898. Mahajanga, Madagascar, 15°43′S 46°18′E: Holotype not designated, but some material deposited at HMNH – IV/P-310–311.

   Syn.: *O. pustulosa* Gurney 1916; *O. brehmii* Tressler 1937

Key to the species

1. L6 4-segmented (penultimate segment undivided) 2
– L6 5-segmented (penultimate segment divided) 4
2. In lateral view, dorsal margin evenly rounded, surface covered with pits, but ornamentation not so strong . . . . *O. chappuisi* Klie 1939a
– In lateral view, dorsal margin not evenly rounded, surface covered with strong ornamentation 3
3. UR with wide basis, distal margin of lobe "a" on hemipenis concave medially *O. voeltzkowi* Müller 1898
– UR with narrow, elongated basis, and distal margin of lobe "a" on hemipenis straight . . . . *O. bhatiai* Battish 1982a
4. In dorsal view, carapace with rounded frontal end . . *O. mulleri* (Daday 1910a)
– In dorsal view, frontal end elongated (cuneiform) 5
5. Carapace area around eyes (eye capsule) bulging 6
– Carapace area around eyes (eye capsule) not bulging *O. debundshae* Green 1973
6. Concentric ridges pronounced all over carapace surface . . . . *O. euglypha* Rome 1962
– No concentric ridges on the carapace surface . . . . *O. schoutedeni* Klie 1938c

Ecology and Distribution (Fig. 21)
The species can be found in stagnant freshwater bodies and are not widely distributed.

2 Family Ilyocyprididae Kaufmann 1900

Diagnosis (after Meisch 2000): Carapace more or less 1.0 mm long, usually subrectangular in outline (Figs. 22b, c, 23a, b, and 24a). Sulcus present on the valve (Figs. 22a and 24a, b). MPC short and straight (Fig. 24c). Valves rarely smooth, usually covered with pits (Fig. 24a, b), and often with lateral projections (Fig. 25c). LV overlaps RV ventrally. A1 7-segmented (Fig. 22d). Swimming setae on A2 present, sometimes reduced (Fig. 22e). Male A2 with subdivided penultimate segment, but without sexual bristles. Md with 3-segmented palp (Fig. 26b). Palp

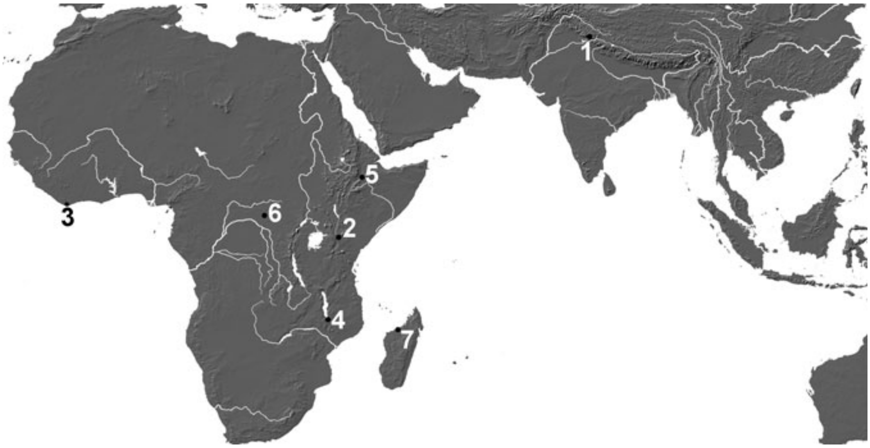


Fig. 21 Distribution of *Oncocypris* Müller 1898: Numbers correspond to the species list

of L5 in female leg like, and 2- or 3-segmented (Fig. 26c), in males transformed into 2-segmented clasping organ (Fig. 25d, e, g, h). L6 with basal seta (Fig. 26d). Terminal segment of L7 cylindrical with three terminal setae (Fig. 25a). UR rod shaped and well developed (Fig. 25b). Zenker organ with 15–20 chitinous spines not arranged in rosettes.

Type genus: *Ilyocypris* Brady and Norman 1889

Systematics
The family is divided into two subfamilies: Ilyocypridinae Kaufmann 1900 and Pelocypridinae Triebel 1962. Type, and the only recent genus of the latter subfamily: *Pelocypris* Klie 1939c has a completely different appearance of L5 and L7, more like the representatives of the family Cyprididae, and will be discussed under this family. The subfamily Ilyocypridinae has only two recent genera: *Ilyocypris* Brady and Norman 1889 and *Indiacypris* Hartmann 1964.

Key to the genera

1. Prehensile palps asymmetrical (Fig. 25g, h) . . . . *Indiacypris* Hartmann 1964
– Prehensile palps symmetrical (Fig. 25d, e) *Ilyocypris* Brady and Norman 1889

Ilyocypris Brady and Norman 1889 [Syn.: *Ilyocyprella* Daday 1900; *Ilyocyprois* Masi 1906]

Diagnosis: Subquadrate valves, not highly asymmetrical, and LV overlapping RV on all sides. CIL very narrow (Fig. 24c). Swimming setae on both A1 and A2 usually long, sometimes reduced on A2. Mxl palp stout, with first segment distally not distinctly dilated, and second segment short and broad (Fig. 26a). L5 palp in ♀

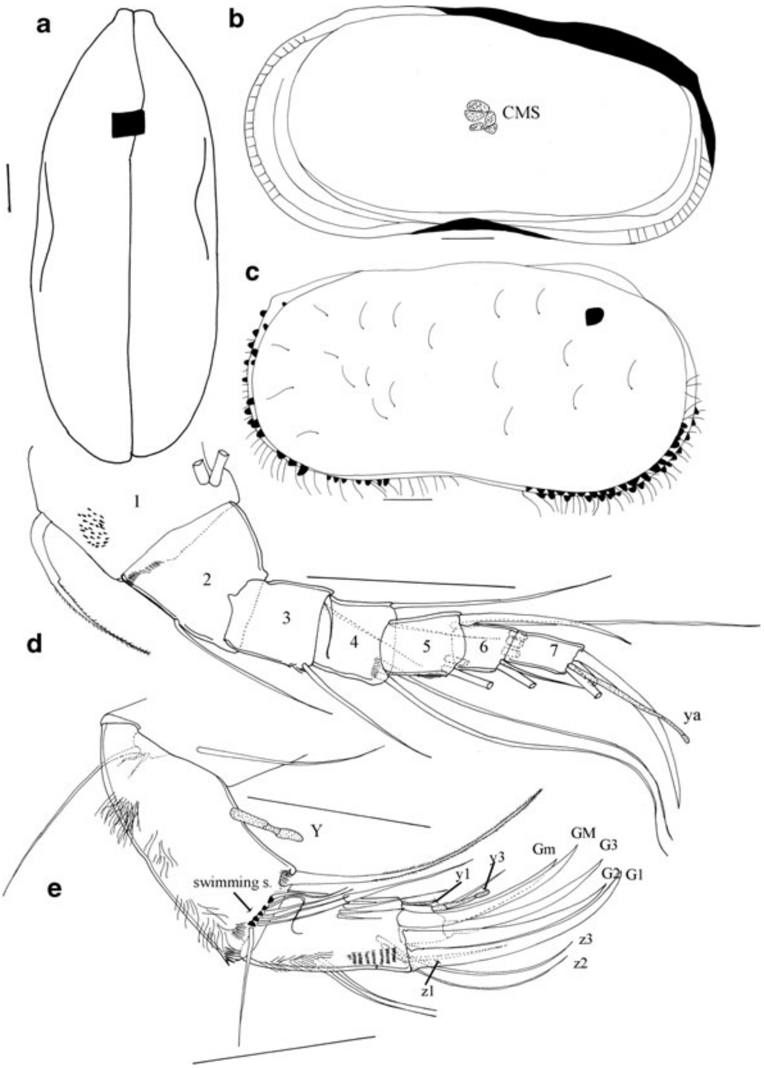


Fig. 22 Line drawings: *Ilyocypris bradyi* Sars 1890, ♀: (**a**) carapace, dorsal view; (**b**) LV, inside view; (**c**) carapace, lateral view from the right side; (**d**) A1; (**e**) A2. Scales = 0.1 mm

divided, prehensile palps symmetrical and 2-segmented. Hemipenis with all three lobes present (Fig. 25f).

Type species: *Ilyocypris gibba* (Ramdohr 1808)

Species list with synonyms, type locality, and type material

1. *I. australiensis* Sars 1889: Gracemere Lagoon, Gracemere, Queensland, Australia, 23°26′S 150°26′E: Repository of the type material unknown.

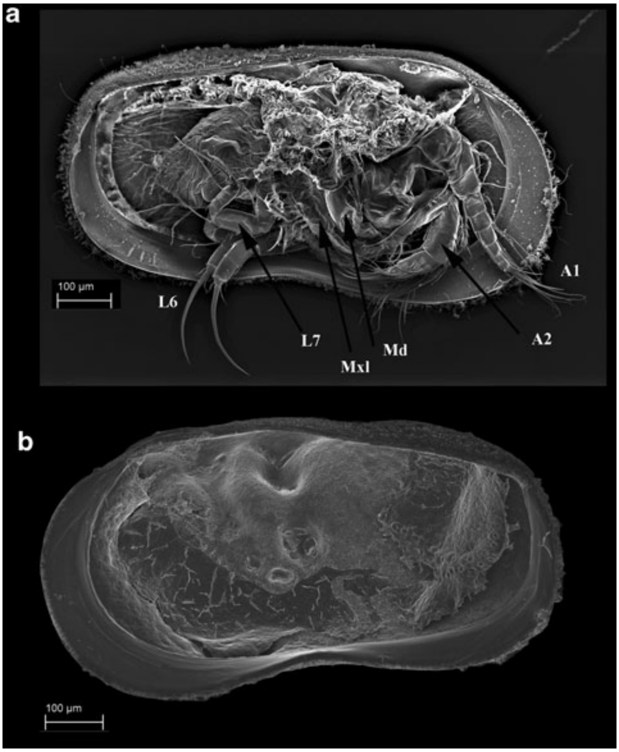


Fig. 23 SEM: *Ilyocypris bradyi* Sars 1890: (**a**) ♀, inside view; (**b**) RV, inside view

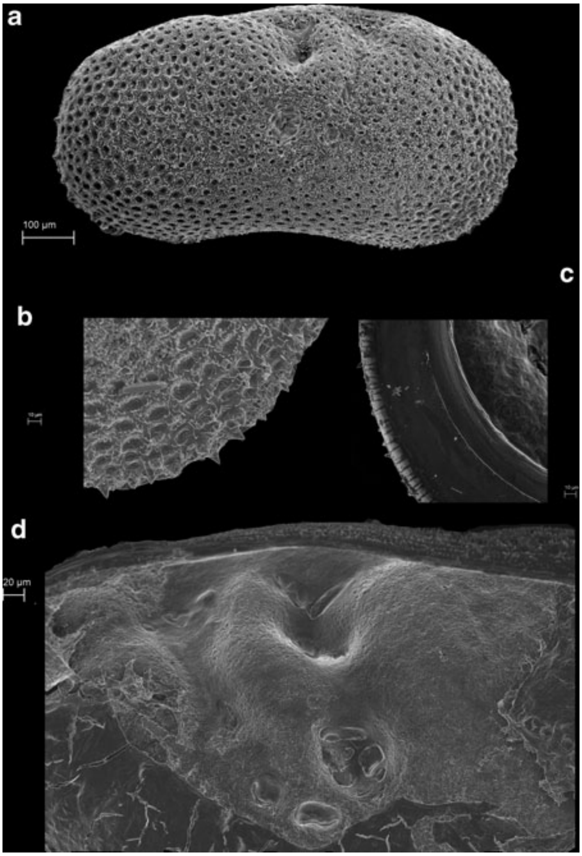
2. *I. alta* Sars 1910. Kala, Lake Tanganyika, 05°27′S, 29°28′E: Type, BM – 1910.11.16.45.
3. *I. botniensis* Kovalenko 1972. River Botna, Bender, Moldavia, 46°49′35″N 29°28′03″E: Holotype (♀), DPS-ASM – S-10-2.
4. *I. bradyi* Sars 1890. Type locality unknown: Types, BM – 1911.11.8.32044-32063

   Syn.: *Ilyocyprella repens* Daday 1900

5. *I. brehmi* Schäfer 1952. Ilgar Lake, Turkey, 37°09′N 38°13′E: Type material not designated, repository unknown.
6. *I. carinata* Kovalenko 1970. Between villages Okoty and Isakievicy, Dniester, Moldavia, Holotype (♀), DPS-ASM – collection numbers unknown.
7. *I. decipins* Masi 1905a. Rome, Italy, 41°53′18″N 12°30′01″E: Type material not designated, repository unknown.

   Syn.: *I. iners* Kaufmann 1900b; *I. almi* Sywula 1968

Fig. 24 SEM: *Ilyocypris bradyi* Sars 1890: (**a**) RV, outside view; (**b**) RV, anterior margin; (**c**) RV, anterior, MPC; (**d**) RV, sulcus, and CMS



8. *I. dentifera* Sars 1903a. Fishponds and rice fields, neighborhood of Pucheng, China – type locality plurivalent. Lectotype (♀), NHMO – F12245.
9. *I. divisa* Klie 1926a. Rivulet Sasanka, Saratov, Russia, 51°32′10″N 46°02′17″E: Syntype (♀), ZMK – UR-595.
10. *I. fallax* Brehm 1928a. Motukurara, Gebbies Pass, Banks Peninsula, New Zealand, 43°43′39″S 172°36′13″E: Type material not designated, repository unknown.
11. *I. getica* Masi 1906. Romania, type locality unknown, type material not designated, repository unknown.
12. *I. gibba* (Ramdohr 1808).
13. *I. hartmanni* Lerner-Seggev 1968. Lake Tiberias, Israel, 32°47′58″N 35°34′52″E: Syntypes, HUJ – OS-12.
14. *I. haterumensis* Okubo 1992 (in Okubo and Terauchi 1992). Island Hateruma-jima, Okinawa, Japan, 24°02′59″N 123°43′00″E: Holotype (♂), SJU (?) – FO795.
15. *I. inermis* Kaufmann 1900b. St. Gallen, Switzerland, 47°25′36″N 9°22′29″E: Type material not designated, repository unknown.

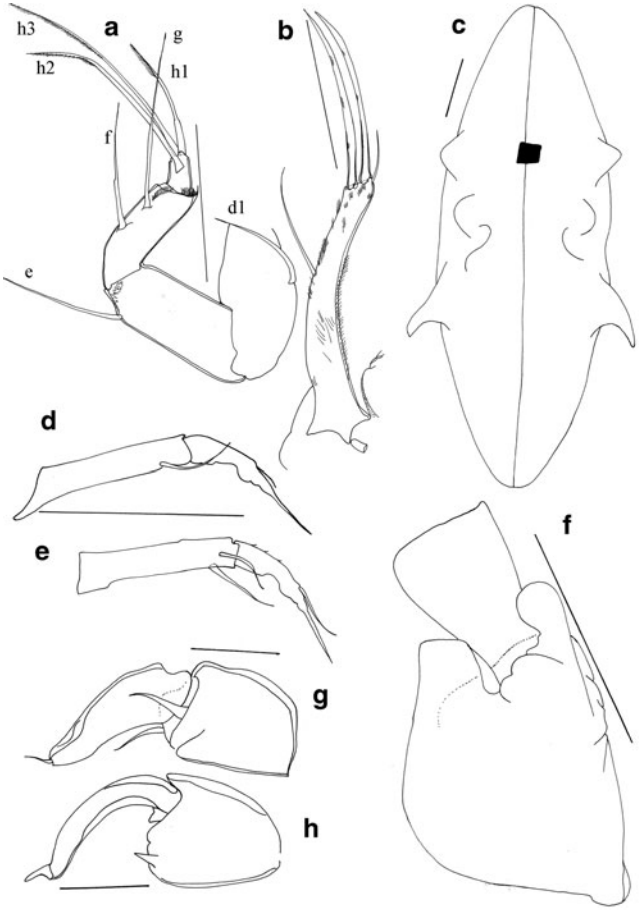


Fig. 25 Line drawings: (**a**, **b**) *Ilyocypris brady* Sars, 1890, ♀; (**c**–**f**) *Ilyocypris gibba* (Ramdohr, 1808), ♂; (**g**, **h**) *Indiacypris chalakkudensis* George and Martens 2004b: (**a**) L7; B, UR; (**c**) carapace, dorsal view; (**d**) right prehensile palp; (**e**) left prehensile palp; (**f**) hemipenis (outline); (**g**) left prehensile palp; (**h**) right prehensile palp. Scales = 0.1 mm. Scales = 0.1 mm. (**g**, **h**) modified after George and Martens (2004b)

16. *I. japonica* Okubo 1990a. Paddy fields, Gunma Prefecture, Japan, 36°02′N 139°28′E: Holotype (♂), SJU (?) – FO 651–652.
17. *I. lacustris* Kaufmann 1900b. Bieler Lake, Switzerland, 47°03′36″N 07°06′14″E: Type material not designated, repository unknown.
18. *I. mckenzie* Bhatia and Mannikeri, 1974. Gadisar Lake near Jaisalmer, Rajasthan, India, 26°54′30″N 70°55′17″E: Holotype (♀), CASG – CASGMF 1223.
19. *I. mongolica* Martens 1991b. Saline ditch in flood area of River Kerulen, near camp, central Aimak, 45 km east of Somon Bajandelger, Mongolia, 48°10′N 96°51′E: Holotype (♂), Martens (1991a) gave the abbreviation “KM” for type material repository, but there is no explanation for the abbreviation.

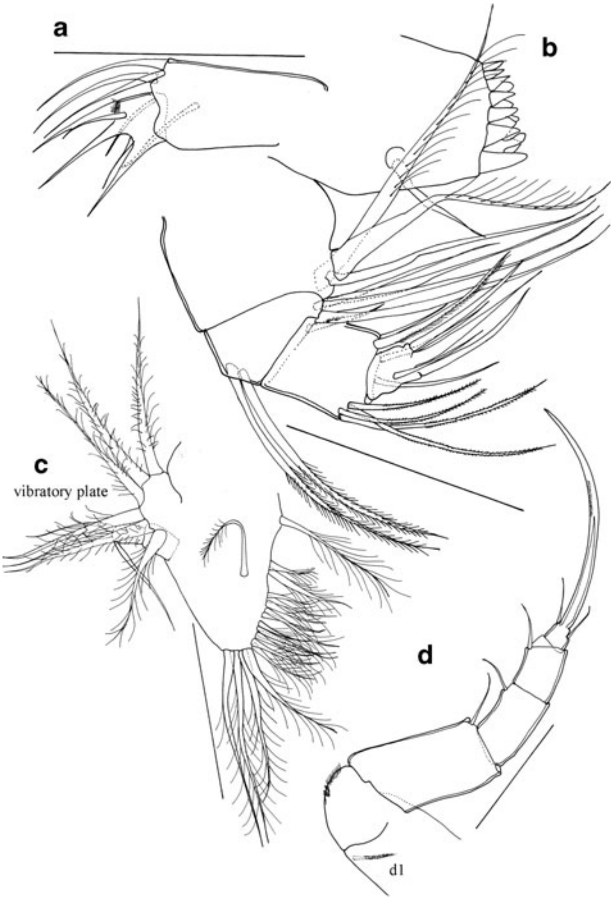


Fig. 26 Line drawings*: Ilyocypris bradyi* Sars 1890, ♀: (**a**) Mxl palp; (**b**) Md palp with a distal part of coax showing; (**c**) L5; (**d**) L6. Scales = 0.1 mm

20. *I. monstrifica* (Norman 1862). Canal at Fleckney, Leicestershire, England, UK, 52°38′N 1°08′W: Topotypes, BM – 1973.306-307.

    Syn.: *I. tuberculata* Daday 1900; *I. ambigua* Lowndes 1931b

21. *I. nagamalaiensis* Victor and Michael 1975. Pond, Department of Biological Sciences, Madurai, India, 09°54′55″N 78°07′25″E: Holotype (♀), DBSMU – Slide No. 8.
22. *I. nitida* Lerner-Seggev 1968. Lake Tiberias, Israel, 32°47′58″N 35°34′52″E: Syntypes, HUJ – OS-13.
23. *I. perigundi* De Deckker 1981b. Warrawenia Lake, south of Menindie, NSW, Australia, 33°29′30″S 141°44′30″E: Holotype (♂), AMS – collection number unknown.

24. *I. propinqua* Sars 1910. Anchorage Bay, Lake Malawi, Malawi, 11°58′S 34°18′E: Type, BM – 1910.11.16.44.
25. *I. taprobanensis* Neale 1976a. Estate pond in coconut plantation, Battuluoya, Sri Lanka, 07°42′N 79°48′E: Holotype (♀), UH – HU.242.R.1.

Key to the species

1. L7 with no (?) setae on penultimate segment . . . . . *I. nagamalaiensis* Victor and Michael 1975
– L7 with one or more setae on the penultimate segment 2
2. L7 with one seta on the penultimate segment 3
– L7 with two or three setae on the penultimate segment 4
3. Second segment of male prehensile palp without any seta . . . . *I. fallax* Brehm 1928a
– Second segment of male prehensile palp with one dorsal seta . . . . *I. haterumensis* Okubo 1992 (in Okubo and Terauchi 1992)
4. L7 with two (third sometimes present, but very small) setae on the penultimate segment 5
– L7 with three (all long) setae on the penultimate segment 17
5. Swimming setae on A2 reaching at the most basis of the terminal claws . . 6
– Swimming setae on A2 exceeding basis of the terminal claws 7
6. Swimming setae on A2 reaching middle of the penultimate segment *I. bradyi* Sars 1890
– Swimming setae very short, barely visible . . . . . *I. inermis* Kaufmann 1900b and *I. nitida* Lerner-Seggev 1968
7. L5 palp in females non-segmented . . . . *I. perigundi* De Deckker 1981b
– L5 palp in females 2- or 3-segmented 8
8. Swimming setae on A2 reaching at the most tip of terminal claws . *I. australiensis* Sars 1889
– Swimming setae on A2 extending beyond the tip of terminal claws 9
9. Penultimate segment of L5 palp in female with one seta 10
– Penultimate segment of L5 in female without any seta 11
10. In dorsal view posterior end of female with triangular alae . *I. dentifera* Sars 1903a
– In dorsal view posterior end of female with rounded extensions of carapace *I. carinata* Kovalenko 1970
11. L5 palp in female 3-segmented . . . . *I. brehmi* Schäfer 1952
– L5 palp in female 2-segmented 12
12. Swimming setae on A2 reaching and slightly exceeding the tip of terminal claws 13
– Swimming setae on A2 by far exceeding the tip of terminal claws 14

13. Valve margins strongly denticulated ..... *I. hartmanni* Lerner-Seggev 1968
– No denticulation along margins .... *I. decipiens* Masi 1905a
14. Dorsal margin sloping down gradually toward posterior end 15
– Dorsal margin straight 16
15. L6 5-segmented .... *I. monstifica* (Norman 1862)
– L6 4-segmented .... *I. gibba* (Ramdohr 1808)
16. Posterior seta on the UR very long, by far exceeding distal end of posterior margin .... *I. mongolica* Martens 1991b
– Posterior seta on the UR short, reaching half way to the end of posterior margin *I. divisa* Klie 1926a and *I. botniensis* Kovalenko 1972
17. L6 4-segmented .... *I. lacustris* Kaufmann 1900b
– L6 5-segmented .... *I. getica* Masi 1906

Species not included in the key
Ilyocypris alta Sars 1910 and *I. propinqua* Sars 1910, both described from Lake Tanganyika, have only carapaces and UR described, while the chaetotaxy of all other appendages remains unknown. *Ilyocypris mckenziei* Bhatia and Mannikeri 1974 was described from freshwater in Rajasthan (India), but only after valves (Bhatia and Mannikeri 1974). *Ilyocypris taprobanenesis* Neale 1976a was described from Sri Lanka, and Neale (1976a) described shell and male prehensile palps. He compares it with *I. divisa* Klie 1926a, as the most similar species, but only briefly, so it is not clear if the chaetotaxy of other appendages is the same in the two species. *Ilyocypris nitida* Lerner-Seggev 1968 described from Lake Tiberius (Israel) was included in the key, but this species keys together with *I. inermis* Kaufmann 1900b. The latter species was described only after females, and although Lerner-Seggev (1968) pointed out some differences in the carapace shape (posterior margin being narrower in Israel species) and some small differences in the L ration between the claws on the UR and the ramus itself, they are not prominent enough, and it is quite possible that *I. nitida* is a junior synonym of *I. inermis*. *Ilyocypris botniensis* Kovalenko 1972 keys out together with *I. divisa* Klie 1926a, so the validity of Kovalenko species might come into question as there are no clear differences between the two species. Delorme (1970a) described *Pelocypris alatobulbosa* Delorme 1970a from Canada. The author described L7 as having "pincer" developed at the last segment (like in the family Cyprididae), but looking at the microphotographs of this appendage (Delorme 1970a: Fig. 32), it looks like a normally developed segment, just like in the genus *Ilyocypris*. Identity of this species needs to be checked on the original material. *Ilyocypris japonica* Okubo 1990a was described from Japan, but the description lacks the appearance of L7 and, therefore, the species could not be included in the key.

Ecology and Distribution (Fig. 27)
The species can be found in small and shallow permanent water bodies as well as in big ones such as lakes. Some species are also recorded from springs and brooks and can tolerate a slightly higher salinity. Most of the species have a wide distribution; the genus has been recorded from all continents, except Antarctica and South America.

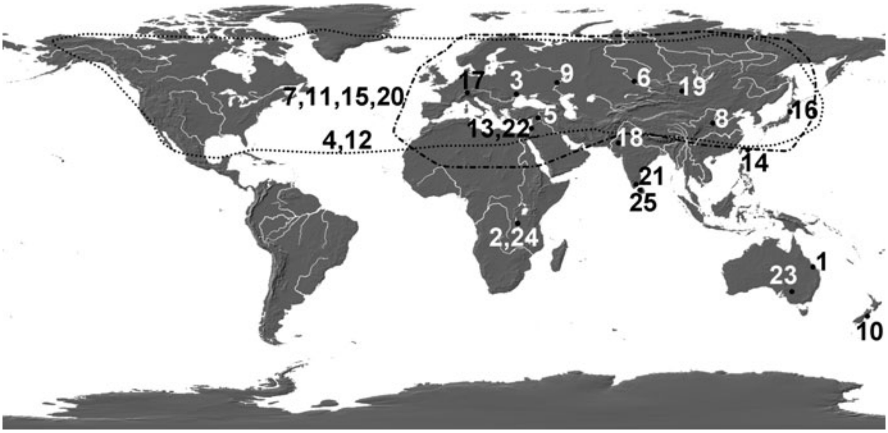


Fig. 27 Distribution of *Ilyocypris* Brady and Norman 1889: Numbers correspond to the species list

Indiacypris Hartmann 1964

Diagnosis (after George and Martens 2004b): Subquadrate valves, highly asymmetrical, LV overlapping RV on all sides. CIL very narrow. Swimming setae on both A1 and A2 medium L. Mxl palp stout, with the first segment distally dilated, and the second segment short and broad. L5 palp in ♀ weakly divided, and prehensile palps asymmetrical and 2-segmented. Hemipenis with three lobes, one boot-shaped, internal spermiduct with additional post-labyrinthal coils.

Type species: *I. dispar* Hartmann 1964

Species list with type locality and type material

1. *I. chalakkudensis* George and Martens 2004b. Chalakkudy River, Kannankuzhi Thodu, Kerala, India, 10°18′N 76°35′E: Holotype (♀), RBINS – OC 2427.
2. *I. dispar* Hartmann 1964. Well, Palmi-Bergen, South Madras, India, 13°03′N 80°15′E: Syntype, ZMH – K-27 672.
3. *I. luxata* (Brady 1886a). Colombo, Sri Lanka, 06°55′39″N 79°50′53″E: Holotype (♂), HM – collection number unknown.

Key to the species

1. Penultimate segment on L7 almost as long as the second segment of the same appendage . . . . *I. luxata* (Brady 1886a)

– Penultimate segment on L7 much shorter (half as long) than the second segment of the same appendage 2

2. Outer lobe on hemipenis boot shaped . . . . *I. chalakkudensis* George and Martens 2004b

– Outer lobe on hemipenis (lobe “a”) evenly rounded *I. dispar* Hartmann 1964

Fig. 28 Distribution of *Indiacypris* Hartmann 1964: Numbers correspond to the species list

Ecology and distribution (Fig. 28)
The species are mostly found in rivers, with some exceptions of *I. dispar* Hartmann 1964 which was also collected from the subterranean waters (Hartmann 1964). The genus is known only from India and South East Asia.

3 Family Candonidae Kaufmann 1900

Diagnosis (after Meisch 2000): Carapace variable in size (from 0.3 mm to 1.5 mm), shape, and structure. Surface smooth or ornamented to different degrees. CMS comprises an elongated scar beneath which an anterior row of three scars and a posterior row of two scars are situated. CIL and fused zone broad or narrow. Swimming setae on A2 well developed, reduced to completely absent. L5 transformed into maxilliped; endopod in ♀ unsegmented and in ♂ transformed into clasping organ, 1- or 2-segmented. L6 walking leg. L7 with normally developed terminal segment. UR usually rod shaped, sometimes reduced. Zenker organ with at the most eight rings of chitinous spines.

Type genus: *Candona* Baird 1845

Systematics
This is the second most diversified family of the freshwater ostracods. It comprises three subfamiles: Candoninae Kaufmann 1900a, Cyclocypridinae Kaufmann 1900a, and Paracypridinae Sars 1923. The last subfamily comprises mostly marine and brackish water species and will not be dealt with here.

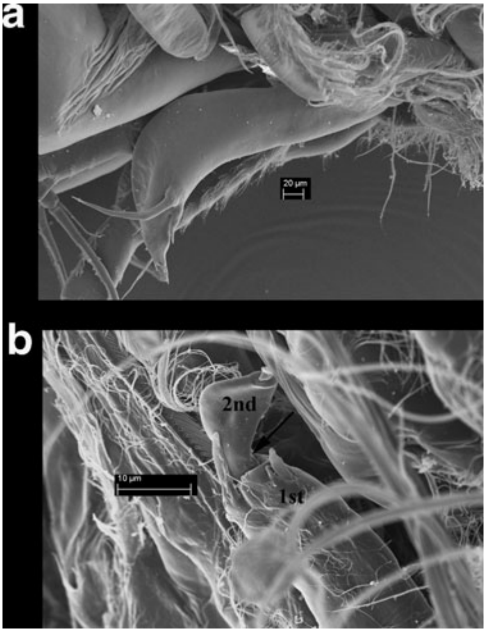


Fig. 29 SEM: (**a**) *Candona neglecta* Sars 1887; (**b**) *Cyclocypris ovum* (Jurine 182): ♂ prehensile palps

Key to the freshwater subfamilies

1. Prehensile palps 2-segmented (Fig. 29b) . . . Cyclocypridinae Kaufmann 1900
– Prehensile palps 1-segmented (Fig. 29a) . . . . . . Candoninae Kaufmann 1900

3.1 *Subfamily Candoninae Kaufmann 1900a*

Diagnosis: Carapace of variable shape (Fig. 30). LV overlaps RV ventrally. Six CMS of almost equal size present (Fig. 31). Rome organ on A1 absent (Fig. 32b). Swimming setae on A2 absent (Fig. 32c and 33a, c). A2 sexually dimorphic: sometimes setae “t2” and “t3” transformed into sensory setae in males (Fig. 32d), and both setae and claws on the penultimate and terminal segments differently developed in males and females (Fig. 34b, e). Vibratory plate of L5 reduced and having only two or three setae (Fig. 34d). Prehensile palps 1-segmented and often asymmetrical (Figs. 35a, b, 36a, 37b, c). Basal segment of L6 with only one seta, or seta absent (Fig. 37d). L7 with well-developed terminal segment and with three terminal setae of unequal L (Fig. 38b, c). UR often with one of the claws or setae reduced (Fig. 36c, d). Zenker organ with five to eight rows of chitinized rosettes.

Type genus: *Candona* Baird 1845

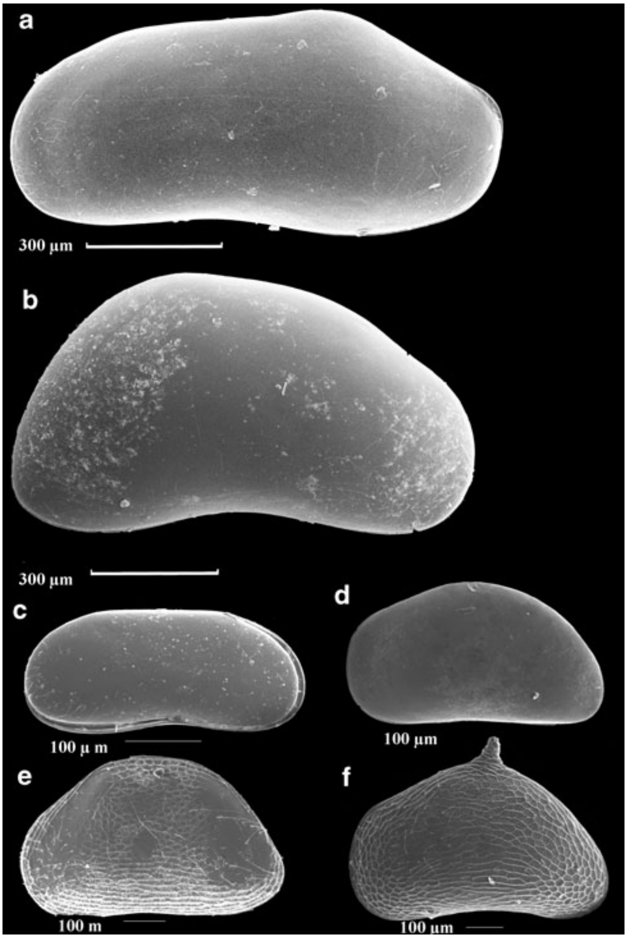


Fig. 30 SEM: (**a**) *Fabaeformiscandona fabaeformis* (Fischer 1851); (**b**) *Candona candida* (OF. Müller 1776); (**c**) *Areacandona astrepte* Karanovic 2007; (**d**) *Areacandona iuno* Karanovic 2007; (**e**) *Areacandona korallion* Karanovic 2007; (**f**) *Humphreyscandona ventosa* Karanovic 2007. (**a**, **b**) Photos: D. Keyser

Other genera: *Acandona* Karanovic 2003b; *Amphitritecandona* Karanovic 2007; *Areacandona* Karanovic 2005b; *Baicalocandona* Mazepova 1976; *Candonopsis* Vávra 1891; *Caaporacandona* Pinto et al. 2005b; *Caribecandona* Broodbakker 1983c; *Cryptocandona* Kaufmann 1900a; *Cubacandona* Broodbakker 1983c; *Danielocandona* Broodbakker 1983c; *Deminutiocandona* Karanovic 2003c; *Eucandona* Daday 1900; *Fabaeformiscandona* Krstić 1972; *Humphreyscandona* Karanovic and Marmonier 2003; *Indocandona* Gupta 1984; *Kencandona* Karanovic 2007; *Latinopsis* Karanovic and Datry 2009; *Leicacandona* Karanovic

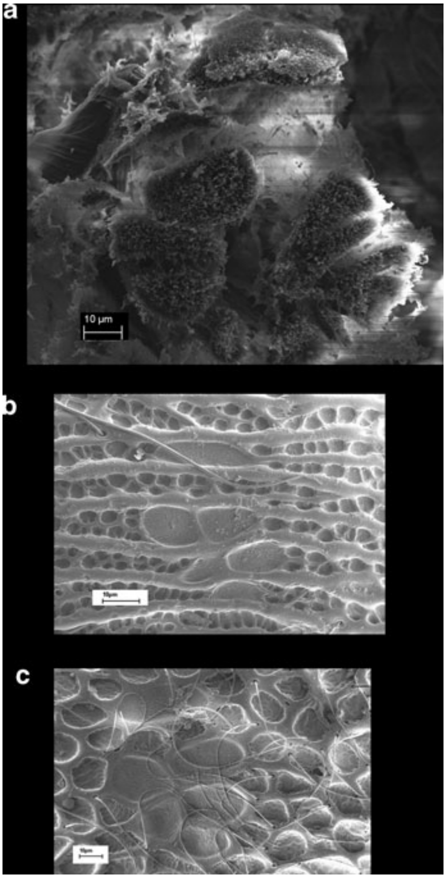


Fig. 31 SEM: (**a**) *Candona neglecta* Sars 1887; (**b**) *Pilbaracandona eberhardi* Karanovic and Marmonier 2007; *Humphreyscandona waldockae* Karanovic and Marmonier 2003: CMS

2007; *Marococandona* Marmonier et al. 2005; *Meischcandona* Karanovic 2001; *Meridiescandona* Karanovic 2003c; *Namibcypris* Martens 1992c; *Nannocandona* Ekman 1914; *Notacandona* Karanovic and Marmonier 2003; *Origocandona* Karanovic 2005b; *Paracandona* Hartwig 1899a; *Phreatocandona* Danielopol 1973; *Pierrecandona* Karanovic 2007; *Pilbaracandona* Karanovic and Marmonier 2003; *Pioneercandonopsis* Karanovic 2005c; *Pseudocandona* Kaufmann 1900a; *Schellencandona* Meisch 1996; *Terrestricandona* Danielopol and Betsch 1980; *Terrestricypris* Schornikov 1980; *Trajancandona* Karanovic 1999b; *Trapezicandona* Schornikov 1969; *Typhlocypris* Vejdovsky 1882.

Remarks

The genus *Pseudocandona* is here retained only because of the several species described from the Baikal Lake, and because of some species described in the last five years that are still assigned to this genus. This is done in order to avoid creating new combinatons. *Pseudocandona* is only a subgenus of the genus *Typhlocypris*.

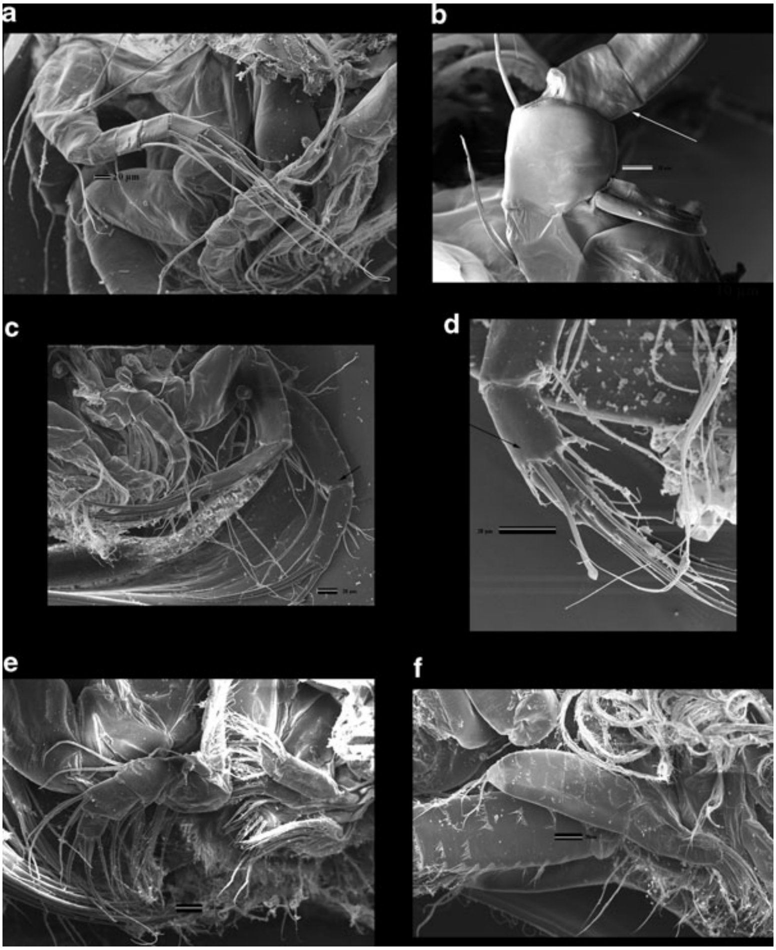


Fig. 32 SEM: (**a**, **b**, **e**, **f**) *Candona neglecta* Sars 1887; (**c**) *Candonopsis kingsleii* (Brady and Robertson 1887); (**d**) *Trapezicandona sp.*: (**a**) A1; (**b**) detail of A1 showing the distal part of the first segment and the second segment; (**c**) A2; (**d**) A2, showing ♂ sexual bristles; (**e**) Md and Mxl; (**f**) L5

Candoninae from the Baikal Lake need to be revised as they probably belong to a separate phylogenetic lineage.

Systematics

The subfamily is at the moment divided into eight tribes: Candonini Kaufmann 1900; Candonopsini Karanovic 2004; Cryptocandonini Karanovic 2007; Danielocandonini Karanovic 2007; Humphreyscandonini Karanovic 2005b; Namibcypridini Martens 1992c; Terrestricypridini Pinto et al. 2005b; and Trapezicandonini Karanovic 2007.

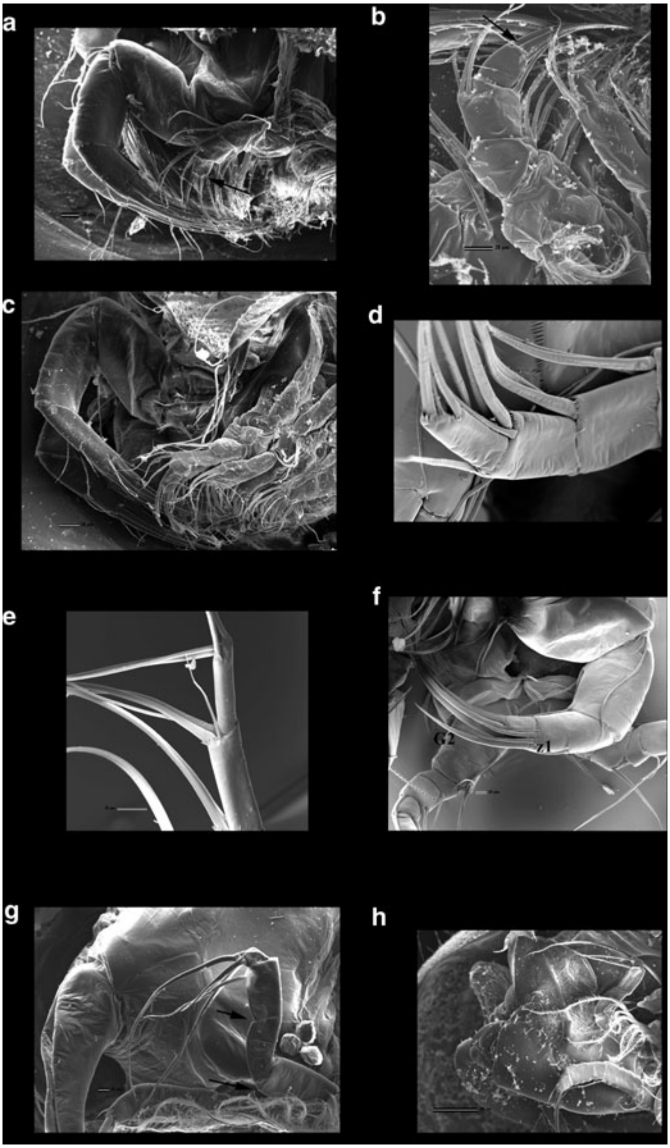


Fig. 33 SEM: (**a**, **b**, **f**–**h**) *Candona neglecta* Sars 1887; (**c**) *Fabaeformiscandona fabaeformis* (Fischer 1851); (**d**, **e**) *Typhlocypris parvula* (Sars 1926): (**a**, **c**, **f**) A2; (**b**) Md palp; (**d**, **e**) detail of A1; (**g**) L7, showing the absence of "e" and "f" setae; (**h**) hemipenis

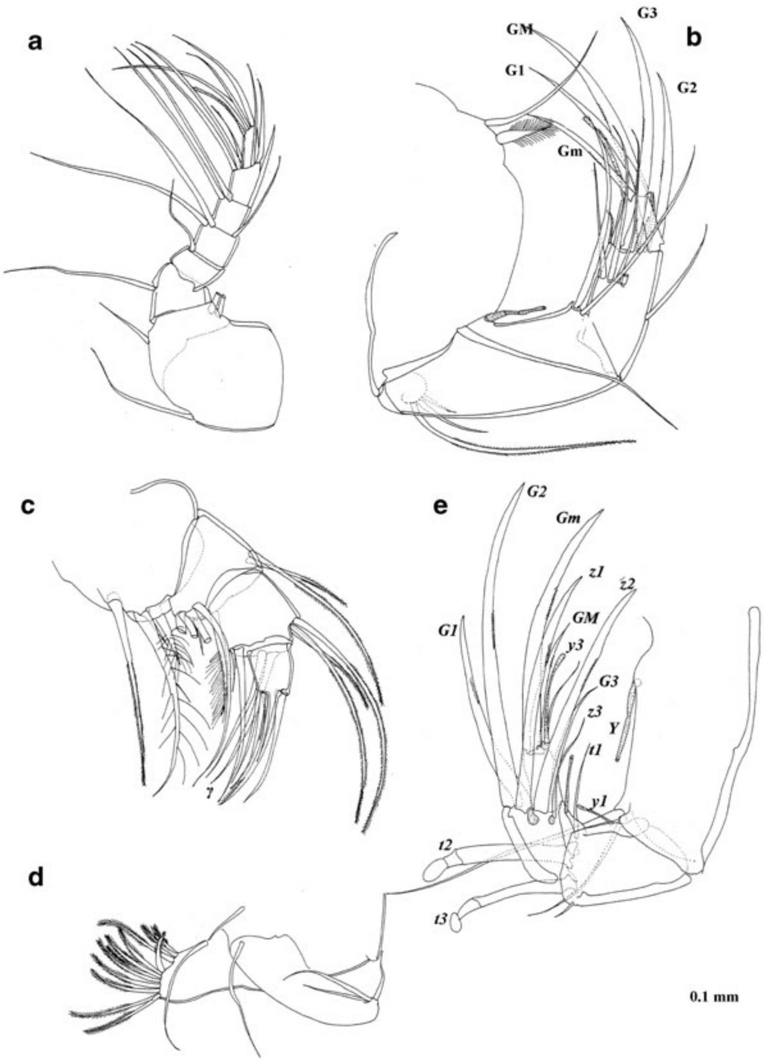


Fig. 34 Line drawings: (**a**,**b**) *Candona caudata* Kaufmann 1900; **c**, **d**, *Candona acutula* Delorme 1967; (**e**) *Candona ohioensis* Furtos 1933: (**a**) A1; (**b**) A2 ♀; (**c**) Md; (**d**) L5; (**e**) A2, ♂. Scale = 0.1 mm

Key to the tribes

1. Terminal segment of T3 with one long claw (Fig. 38a) . . . Terrestricypridini
– Terminal segment of T3 without long claw (Fig. 38b, c) 2
2. Terminal segment of T3 with two long and one short setae (Figs. 38b and 35c) 3
– Terminal segment of T3 with two short and one long setae (Figs. 38c and 35d, e) 5

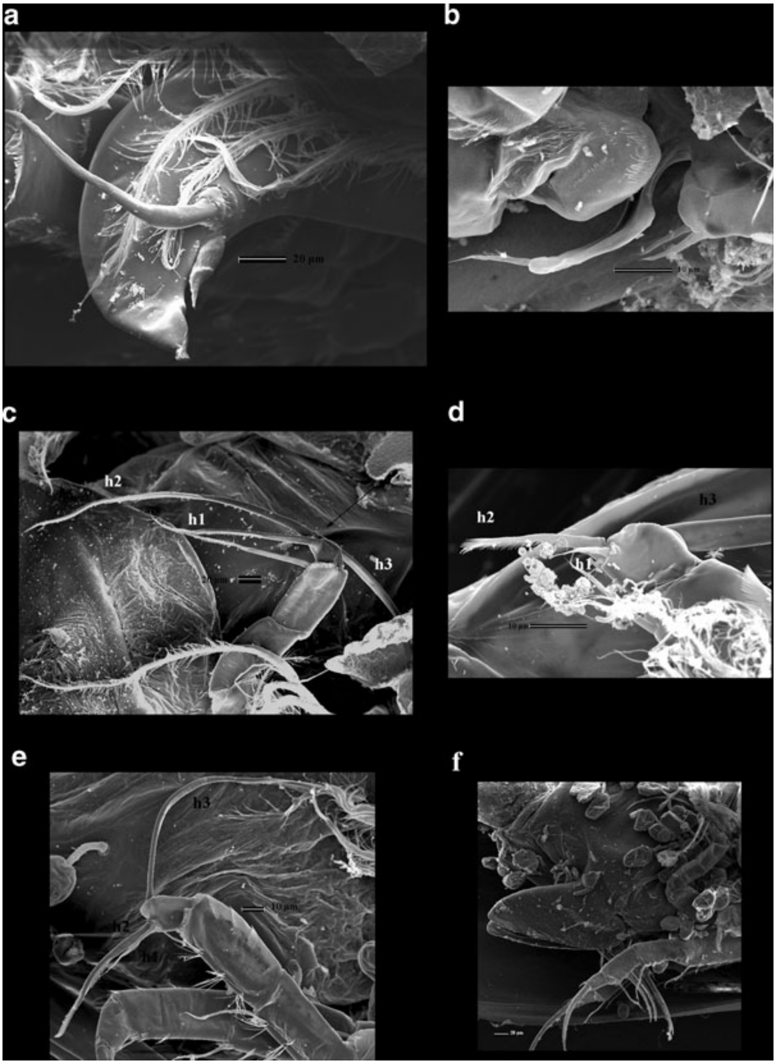


Fig. 35 SEM: (**a**,**c**) *Candona neglecta* Sars 1887; (**b**, **d**) *Trapezicandona sp*.; (**e**, **f**) *Candonopsis kingsleii* (Brady and Robertson 1887): (**a**, **b**) prehensile palp; (**c**, **d**, **e**) L7, showing the L ration of the terminal setae; (**f**) ♀, genital field

3. Posterior seta on the UR present (Fig. 38d) . . . . Candonini

– Posterior seta on the UR absent (Fig. 38e) 4

4. Zenker organ without any rows of spines, marginal pore canals branched Namibcypridini

– Zenker organ with rows of spines, marginal pore canals straight and short (Fig. 39a, b) . . . . Candonopsini

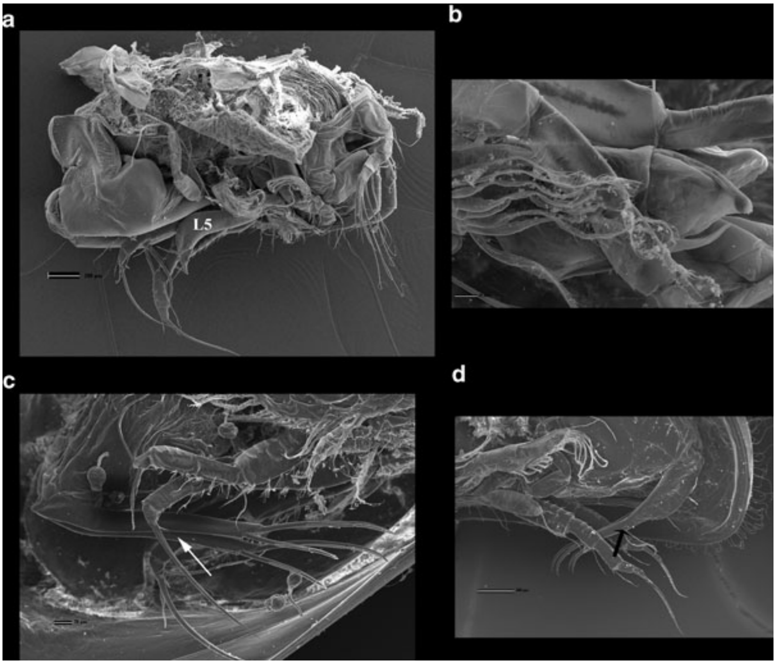


Fig. 36 SEM: (**a**) *Candona neglecta* Sars 1887; (**b**) *Trapezicandona sp.*; (**c**) *Candonopsis kingsleii* (Brady and Robertson 1887); (**d**) *Candona lindneri* Petkovski 1969b: (**a**) ♂, soft parts; (**b**) hemipenis; (**c**) posterior part of the body, showing the absence of the posterior seta on UR; (**d**) ♀, posterior part of the body showing the presence of the posterior seta on the UR

5. Chitinized projection on the inner lobe of hemipenis present (Fig. 39c) Humphreyscandonini
– Chitinized projection on the inner lobe of hemipenis absent (Fig. 39d). 6
6. A1 5-segmented (Fig. 40a) . . . . Danielocandonini
– A1 7-segmented (Fig. 40b) 7
7. Basal seta on L6 present, outer lobe on hemipenis robust (Fig. 40d) Cryptocandonini
– Basal seta on L6 absent (Fig. 40c), outer lobe on the hemipenis thin (Figs. 40e and 36b) . . . . Trapezicandonini

3.1.1 Tribe Candonini Kaufmann 1900 (Fig. 41)

Diagnosis: Carapace of all different shapes: triangular, trapezoidal, elongated, and very often ornamented (Figs. 42–44). A1 (Figs. 41b, 32a, and 34a) 7-, 6-, or 5-segmented. A2 with or without (Fig. 45a) male sexual bristles. Terminal segment

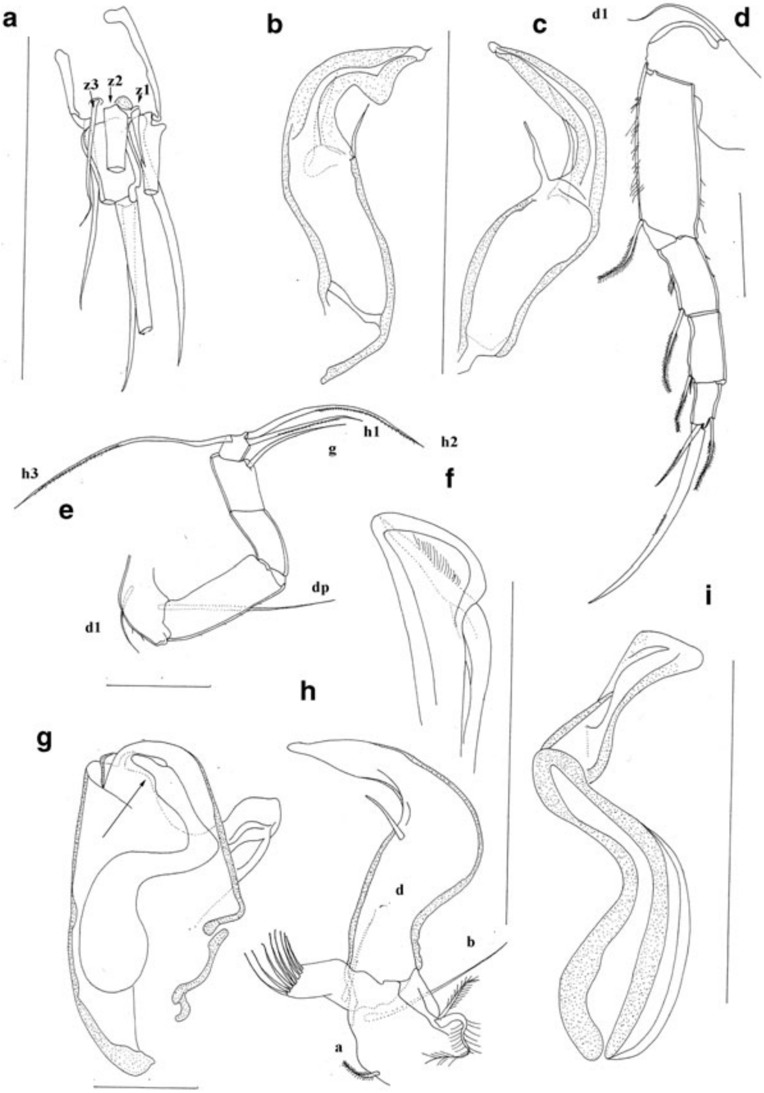


Fig. 37 Line drawings: (**a**) *Eucandona rectangulata* (Alm 1914b); **c**, **c**, **g**, *Candona ohioensis* Furtos 1933; **d**, **e**, *Candona caudata* Kaufmann 1900a; **f**, **h**, **i**, *Candona peircei* Turner 1895; A2. distal part od A2; (**b**, **c**) prehensile palps; (**d**) L6; (**e**) L7; (**f**) distal part of "M" peace on the hemipenis; (**g**) hemipenis; (**h**) L5; (**I**), "M"-peace. Scales = 0.1 mm

of Md palp with narrowly fused central claw (Figs. 32e, 33b, and 34c). Mxl palp with elongated penultimate segment (Fig. 45e). Both subterminal sclerified structures on the prehensile palps well developed. On L5, only one "a" seta present and two setae in vibratory plate (Figs. 32f, 34d, and 37h). L6 with or without basal

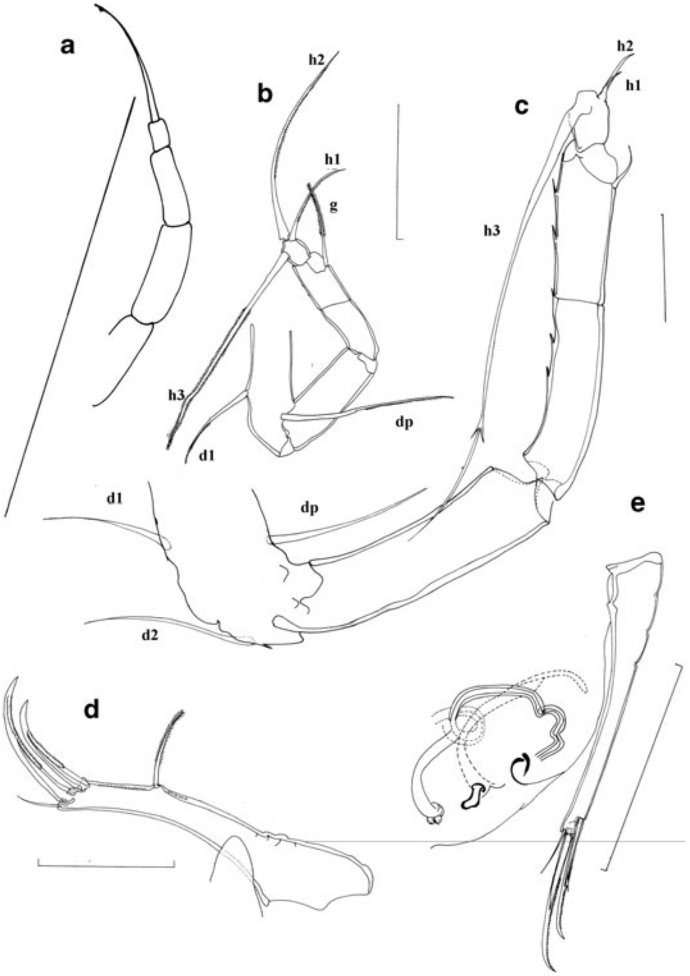


Fig. 38 Line drawings: (**a**) *Terrestricandona minuta* Danielopol and Betsch 1980; (**b**, **d**) *Candona acutula* Delorme 1967; (**c**) *Leicacandona pinkajartinyi* Karanovic and McKay 2010; (**e**) *Candonopsis dedeckkeri* Karanovic 2007: (**a**–**c**) L7; (**d**, **f**) UR. Scales = 0.1 mm

seta. L7 without "e" seta, "f "seta rarely present (Fig. 33g). Terminal segment with two long ("h2" and "h3") and one short seta ("h1") (Fig. 37e). UR with both claws and setae present, only posterior claws sometimes slightly reduced (Fig. 36d). Zenker organ with six or seven whorls of spines.

Type genus: *Candona* Baird 1845
Other genera: *Acandona* Karanovic 2003b; *Baicalocandona* Mazepova 1976; *Eucandona* Daday 1900; *Fabaeformiscandona* Krstić 1972; *Paracandona* Hartwig 1899a; *Phreatocandona* Danielopol 1973; *Schellencandona* Meisch 1996; *Trajancandona* Karanovic 1999b; *Typhlocypris* Vejdovsky 1882.

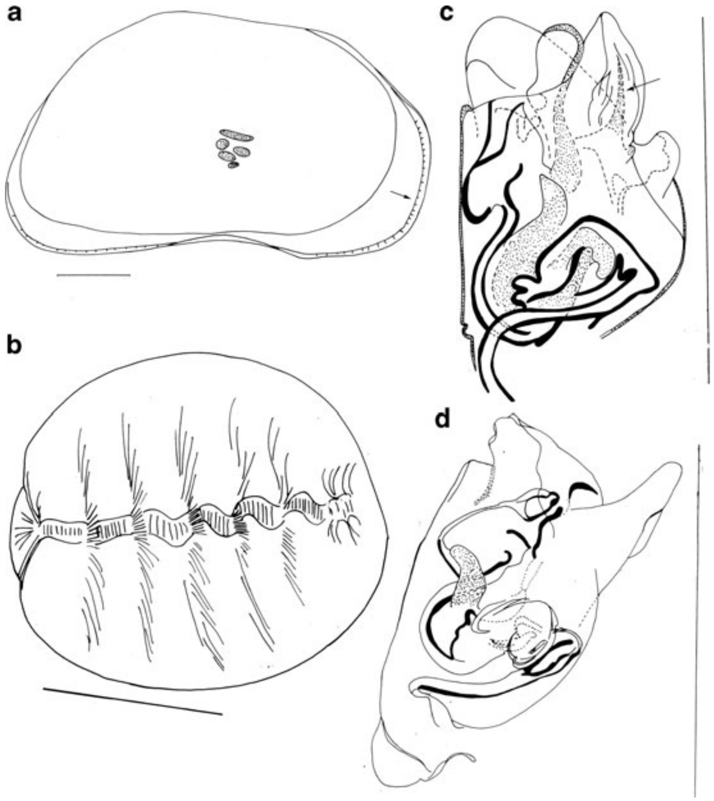


Fig. 39 Line drawings: (**a**) *Candonopsis dedeckkeri* Karanovic 2007; (**b**) *Caribecandona ansa* Broodbakker 1983c; (**c**) *Areacandona akatallele* Karanovic, 2007; *Leicacandona halsei* Karanovic 2007: (**a**) LV, inside view; (**b**) Zenker organ; (**c**) (**d**) hemipenis. Scales = 0.1 mm

Key to the genera

1. “f” seta on L7 present 2

– “f” seta on L7 absent (Figs. 37e and 45f) 3

2. Carapace strongly ornamented . . . . *Paracandona* Hartwig 1899a

– Carapace smooth . . . . *Acandona* Karanovic 2003b

3. Posterior claw on UR reduced and G2 on female A2 very short, not reaching the distal end of the penultimate segment . . . . *Phreatocandona* Danielopol 1973

– Posterior claw on UR not reduced (Figs. 38d and 45c) and G2 on female A2 exceeding the distal end of the penultimate segment (Fig. 33f) 4

4. Basal seta L6 present (Figs. 37d and 45i) 5

– Basal seta L6 absent . . . . *Trajancandona* Karanovic 1999b

5. Zenker organ with seven whorls of spines 6

– Zenker organ with six whorls of spines (Fig. 45b) 9

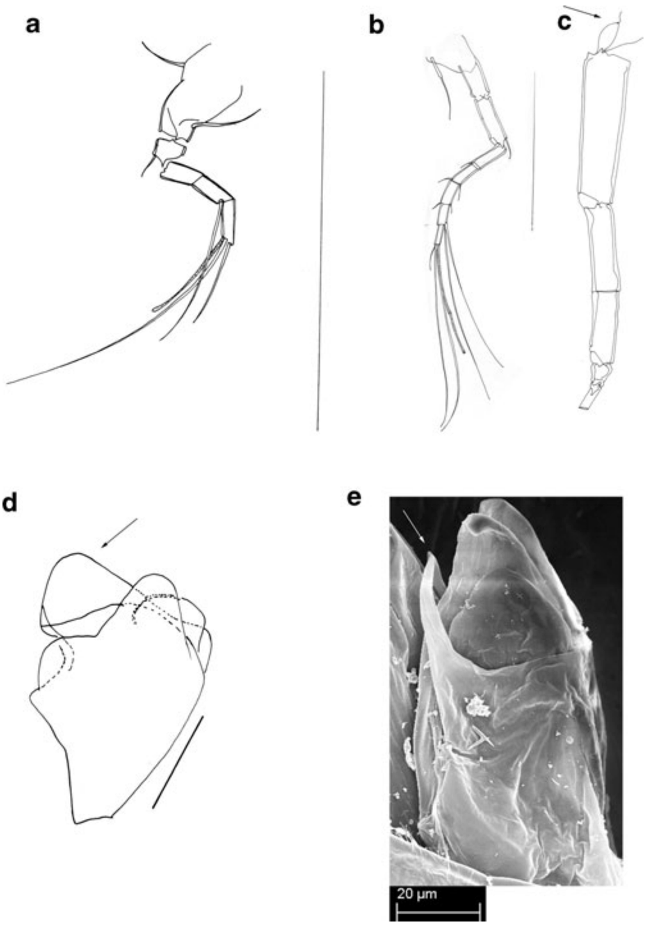


Fig. 40 (**a**–**d**) Line drawings; (**e**) SEM: (**a**, **c**) *Indocandona nagarjuna* Karanovic and Ranga Reddy 2008; (**b**) *Deminutiocandona aenigma* Karanovic 2007; (**d**) *Cryptocandona dudichi* (Klie 1930b): (**a**, **b**) A1; (**c**) L5; (**d**, **e**) hemipenis. Scales for **a**–**d** = 0.1 mm

6. Seta "d2" on L7 present (Fig. 45f), part "M" on hemipenis weakly sclerified (Fig. 45g) . . . . *Typhlocypris* Vejdovsky 1882

– Seta "d2" on L7 absent (Fig. 37e), part "M" on hemipenis strongly sclerified (Fig. 37g, f, i) 7

7. Most posterior seta on the penultimate segment of A1 absent (Figs. 33d, e and 45h), right prehensile palp extremely helmet shaped, and left one with dorsal bumps . . . . *Fabaeformiscandona* Krstić 1972

– Most posterior seta on the penultimate segment of A1 present (Fig. 34a), right prehensile palp not extremely helmet shaped, and left one without dorsal bumps (Fig. 37b, c) 8

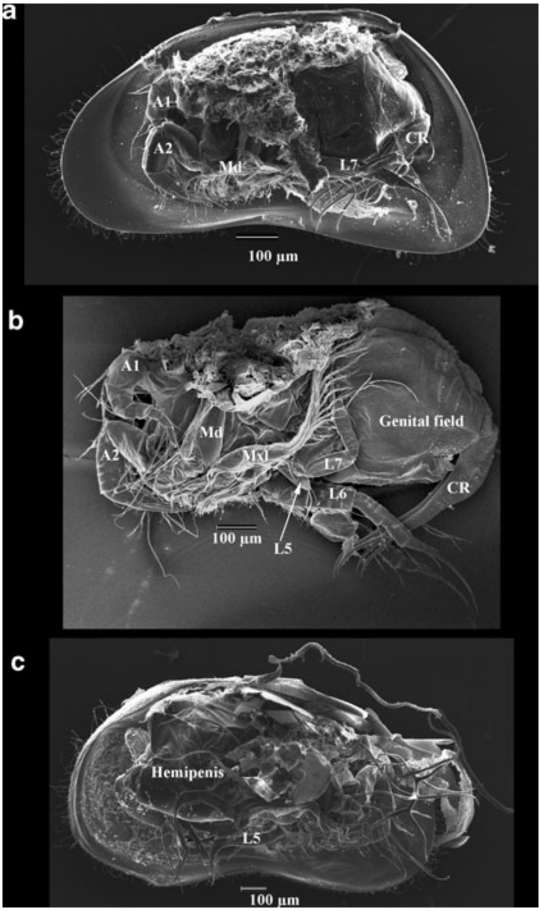


Fig. 41 SEM: *Candona neglecta* Sars 1887: (**a**) ♀, inside view valve; (**b**) ♀, soft parts out of the shell; (**c**) ♂, inside view

8. Male A2 with "z1" short, "z2" long and claw like (Fig. 37a), medial lobe on the hemipenis absent . . . . *Eucandona* Daday 1900
– Male A2 with both "z1" and "z2" long and claw like (Fig. 34e), medial lobe on the hemipenis present . . . . *Candona* Baird 1845
9. Carapace strongly ornamented . . . . *Baicalocandona* Mazepova 1976
– Carapace not ornamented . . . . *Schellencandona* Meisch 1996

Acandona Karanovic 2003b

Diagnosis (after Karanovic 2003b): Carapace subtriangular to triangular. LV overlaps RV dorsally with flange. Valves asymmetrical. Valve surface smooth. A1 7-segmented. Male A2 with developed sexual bristles. Exopod of the appendage with two short and one long setae. Md palp with 3 + 2 setae in bunch on the second segment, same segment externally with two setae; penultimate segment with three

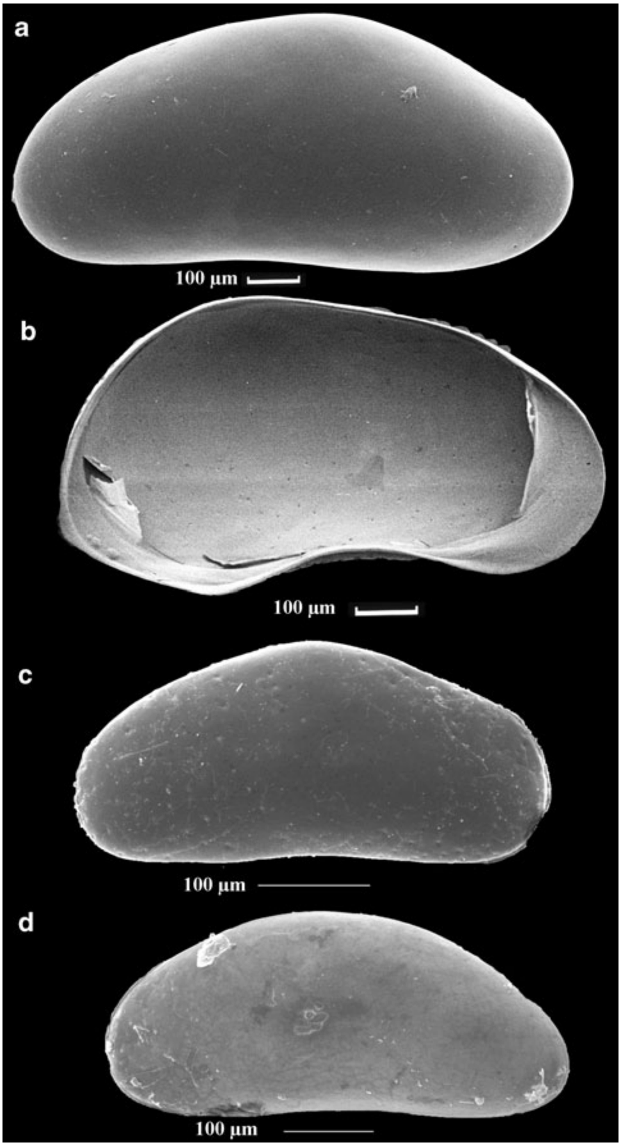


Fig. 42 SEM: (**a**) *Fabaeformiscandona protzi* (Hartwig 1898a, b); (**b**) *Candona angulata* Müller 1900a (**c**) *Areacandona triangulum* Karanovic 2007; *Deminutiocandona atope* Karanovic 2007: (**a**, **d**) LV, outside view; (**b**) LV, inside view. (**c**) RV, outside view. (**a**, **b**) Photos: D. Keyser

setae externally and four setae distally to intero-distally; gamma seta being smooth. Terminal segment with central claw fused with segment, which is short. Mxl palp with rectangular terminal segment and six appendages (two claw like and four seta like). Male prehensile palps strongly asymmetrical, right one being robust; both

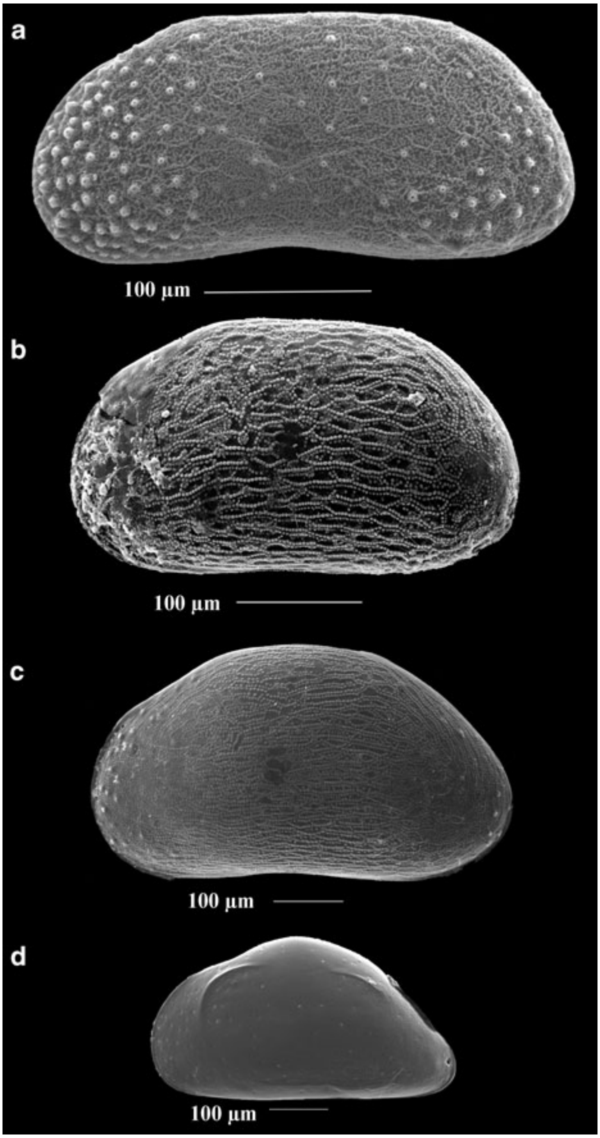


Fig. 43 SEM: (**a**) *Kencandona verrucosa* Karanovic 2007; (**b**) *Meridiescandona lucerna* Karanovic 2003c; (**c**) *Meridiescandona facies* Karanovic 2003c; (**d**) *Leicacandona carinata* Karanovic 2007: LV, outside view

palps with two subterminal sclerotized structures well developed. Vibratory plate on L5 with two setae. Same appendage with one "a" seta present on protopod as well as "b" and "d" setae. L6 5-segmented; basal segment with seta. L7 5-segmented; basal segment with all three setae, or seta "d2" missing. Penultimate segment clearly divided, and with "f" seta present or absent; terminal segment with setae "h2" and "h3" long, while seta "hl" short. UR with all setae and claws developed. Hemipenis with outer lobe subdivided into two lobes, one outer lobe triangular and extended from the rest of hemipenis's parts, and the other rounded. "M" process

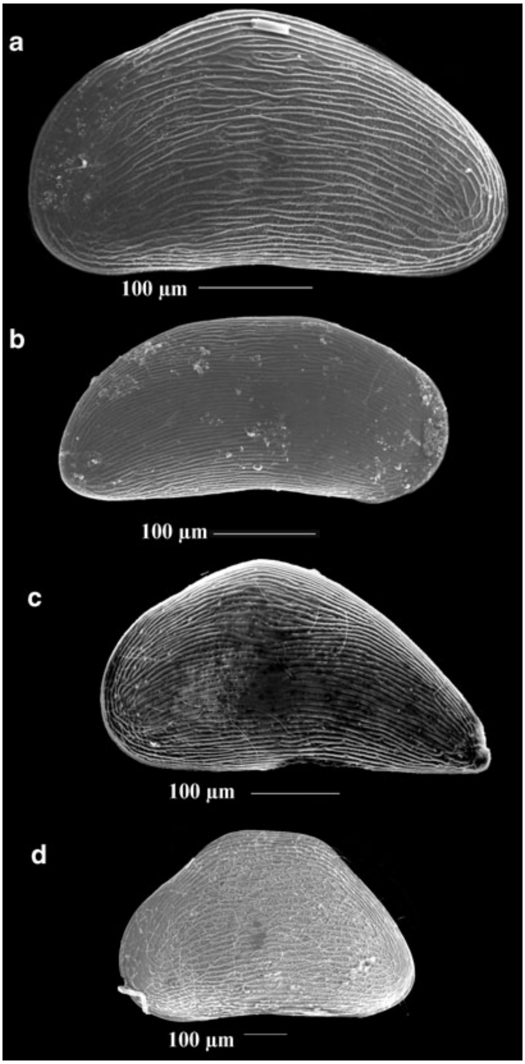


Fig. 44 SEM: (**a**) *Notacandona modesta* Karanovic and Marmonier 2003, (**b**) *Origocandona gromikae* Karanovic 2007; (**c**) *Pilbaracandona ebrehardi* Karanovic and Marmonier 2003; (**d**) *Pilbaracandona kosmos* Karanovic 2007: (**a**, **c**, **d**) LV, outside view; (**b**) RV, outside view

very weakly sclerotized. Middle and inner lobes present. Zenker organ with seven rows of spines.

Type species: *A. admiration* Karanovic 2003b

Species list with type locality and type material

1. *A. admiration* Karanovic 2003b. Tiffanys Lake, Easter Cave, Margaret River, WA, Australia, 34°16′40″S 115°06′09″E: Holotype (♂), WAM – C 28395.
2. *A. memoria* Karanovic 2003b.Upper Brockman, unused water bore on river terrace, Yilgarn Craton, WA, Australia, 31°21′S 116°07′E: Holotype (♂), WAM – 28404.

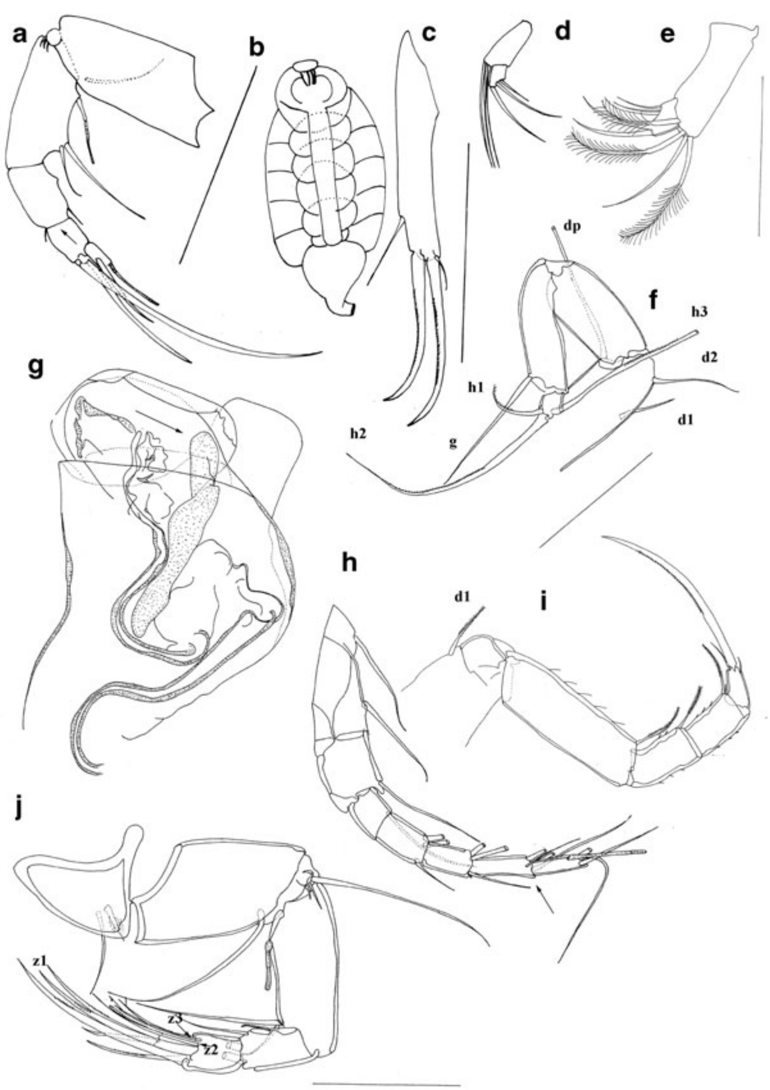


Fig. 45 Line drawings: **a–d**, *Trajancandona particula* Karanovic 1999b; (**e**) *Typhlocypris punctata* (Furtos 1933); (**f**, **g**, **i**) *Typhlocypris elliptica* (Furtos 1933); (**h**, **j**) *Typhlocypris annae* (Méhes 1914): (**a**,**j**) A2; (**b**) Zenker organ; (**c**) UR; (**d**, **e**) Mxl palp; (**f**) L7; (g) hemipenis; (**h**) A1; (**i**) L6. Scales = 0.1 mm

Key to the species

1. "f "seta on L7 present . . . . *A. admiratio* Karanovic 2003b
– "f "seta on L7 absent . . . . *A. memoria* Karanovic 2003b

Fig. 46 Distribution of *Acandona* Karanovic 2003: Numbers correspond to the species list.

Ecology and distribution (Fig. 46)
The species live in subterranean waters, and the genus is endemic to Australia.

***Baicalocandona* Mazepova 1976**
Diagnosis: Carapace ornamented, rarely smooth, trapezoidal. A1 7-, 6-, or 5-segmented. Male A2 with or without sexual bristles. Exopod consists of a plate with one long and two short setae. Md palp with 4+2 setae in the bunch. Prehensile palps asymmetrical without basal chitinous bump on the left palp. Male A2 with z1 and z2 transformed into claws, or only z1 transformed. L6 5-segmented with seta "d1"; L7 4- or 5-segmented, without setae "d2," "f,"and "e." Terminal segment with two long and one short setae. UR with both claws and setae developed. Genital field with or without appendages. Zenker organ with six whorls of spines.

Type species: *B. bivia* Mazepova 1976

Other species: *B. ambagiosa* Mazepova 1976; *B. aspiranti* Mazepova 1984; *B. borutskii* Mazepova 1985; *B. bronsteini* Mazepova 1976; *B. dorsoconcava* Mazepova 1976; *B. dorsoconcava* Mazepova 1976; *B. navitarum* Mazepova 1976; *B. profunda* Mazepova 1976; *B. ushkani* Mazepova 1984; *B. zenkevichi* Mazepova 1976.

Remarks
All the species are endemic to the Baikal Lake. Repository of the type material is unknown. Candoninae described from the Baikal Lake need to be revised and redescribed as there are certainly more than two phylogenetical lines, although all species at the moment belong to the genera *Candona, Baicalocandona,* or

Pseudocandona. Until this revision is done, it is impossible to provide an accurate key to the species.

Candona **Baird 1845**

Diagnosis (after Karanovic 2006b): Carapace subtriangular, subreniform, or subtrapezoidal. Valve surface not ornamented, but covered with pronounced warts from which setae originate. CIL always narrow, i.e., never more than 20% of total L. LV overlaps RV. MPC short, straight, and never branched. A1 7-segmented. Most posterior seta on the penultimate segment of A1 present, alpha seta present (Fig. 34a). A2 sexually dimorphic: in male, protopod 4-segmented and in female, 3-segmented (Fig. 34b, e). Male sexual bristles present. Claws G1 and G3 in male reduced, seta "z2" transformed into claw, seta "z1" most usually also transformed into claw (which is subequally long as "z2," or at the most ⅔ of its L). Sometimes "zl" is seta like, but much longer than terminal segment; "z3" always seta like. Md palp with a total of eight rays on vibratory plate; palp 4-segmented with two setae externally on the second and three setae on the penultimate segment. Second segment internally with 4 + 2 or 5 + 2 setae. Terminal segment with two claws, central one narrowly fused with segment. Gamma seta plumed or smooth (Fig. 34c). Terminal segment on Mxl palp rectangular. Vibratory plate on L5 with two rays (Fig. 37h). Male with transformed palps (Fig. 37b, c). L6 5-segmented (Fig. 37d). Basal segment with one seta. L7 4- or 5-segmented (Fig. 37e). Basal segment with two setae ("d1" and "dp"); terminal segment with two long ("h2" and "h3") and one short ("h1") setae, which is never shorter than the terminal segment itself. UR with both claws and both setae present. Posterior seta always at least reaches the distal end of posterior margin, usually being much longer. Part "M" on hemipenis well sclerified (Fig. 37f, i). All three lobes present (Fig. 33h). Zenker organ with seven whorls of spine. Female genital lobe with or without extension (Fig. 33g).

Type species: *C. candida* (OF Müller 1776)

Species list with synonyms, type locality, and type material

1. *C. acuta* Hoff 1942. Champaign County, Illinois, USA, 40°06′N 88°14′W: Holotype (♀), SM – 81074.
2. *C. acutula* Delorme 1967. Kitako Lake, Saskatchewan, Canada, 52°28′N 104°13′W: Holotype (♀), GMUS – Ao-219.
3. *C. albida* (Dana 1849). Valparaiso, Chile, 33°02′S 71°37′W: Repository of the type material unknown.
4. *C. alta* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-390, 392.
5. *C. altoides* Petkovski 1961. Lake Skadar (Scutari), Montenegro, 42°14′N 19°14′E: Types, NHMS – collection numbers unknown.
6. *C. amanda* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
7. *C. anceps* Ekman 1914. Lake Tenhultsjön, Jönköping, Sweden, 57°46′N 14°09′E: Repository of the type material unknown.

8. *C. angulata* Müller 1900a. Ryck River, Greifswald, Germany, 54°06′ 13°23′E: Repository of the type material unknown.
9. *C. angustissima* Ekman 1914. A spring at Lagan River, Berga parish, S Småland, Sweden, 57°18′N 15°03′E: Repository of the type material unknown.
10. *C. aotearoa* Chapman 1963. Pool and swamps, Sutton, Otago, New Zealand, 45°35′S 169°55′E: Types, OMD – collection numbers unknown.
11. *C. araucana* Löffler 1961d. Lake Llanquihue, Chile, 41°08′S 72°48′W: Types, LIM – collection numbers unknown.
12. *C. arenosa* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
13. *C. bertrandi* (Margalef 1958). Lago de Andara, Santander, Cantabria, Spain, 43°27′N 03°48′W: Types, FIB – collection numbers unknown.
14. *C. bimucronata* Klie 1937a. Plavsko Jezero (Lake), Montenegro, 42°35′N 19°55′E: Syntypes, ZMK – UR-413.
15. *C. birsteini* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
16. *C. bradyi* Hartwig 1898a. Collected from several localities in UK.
17. *C. caledoniae* Brady 1910b. Lakes, Dumfries, Scotland, UK, 55°04′N 03°33′W: Repository of the type material unknown.
18. *C. candida* (OF Müller 1776). Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.

   Syn.: *C. studeri* Kaufmann 1900a; *C. candida* var. *humilis* Ekman 1914

19. *C. camelus* Schornikov 1966. Caspian Sea, 39°37′N 52°07′E: Repository of the type material unknown.
20. *C. cristatella* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-395.
21. *C. crogmaniana* Turner 1894. Ponds, South River, Atlanta, Georgia, USA, 34°45′S 56°30′W: Repository of the type material unknown.
   Syn*:* *C. reflexa* Sharpe 1897; *C. reticaudata* Sharpe 1897
22. *C. dadayi* Müller 1912. Lake Balaton, Hungary, 46°50′N 17°45′E: Types, HMNH – IV/P-28-29.
23. *C. dalmatina* Petkovski et al. 2002. Limnocrene stream, Nin, Zadar, Croatia, 43°35′N 15°09′E: Holotype (♀), NHMS – Ost. 108/1.
24. *C. decora* Furtos 1933. Temporary pond, Marengo, Ohio, USA, 40°24′N 82°48′W: Paratype (♂), SM – 67867.

   Syn: *C. facetus* Delorme 1970c; *C. fossulensis* Hoff 1942

25. *C. dedelica* Petkovski 1969b. Lake Dojran, Macedonia, 41°03′N 22°44′E: (Syn)types, NHMS – collection numbers unknown.
26. *C. delawarensis* Turner 1894 ("Incertae sedis"). St. Jones River (formerly Jones' Creek), Kent County, Delaware, USA, 39°10′N 75°31′W: Repository of the type material unknown.

27. *C. deltoides* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
28. *C. demissa* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
29. *C. depressa* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-386.
30. *C. diaphana* Brady and Robertson 1870. Whittlesea, England, UK, 52°32′N 00°07′W: Repository of the type material unknown.
31. *C. directa* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
32. *C. dryschenkoy* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
33. *C. dybowskii* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
34. *C. elegans* Bronstein 1928. Lake Goluboe, Kabardino-Balkarsk, Russia, 51°47′N 127°58′E: Repository of the type material unknown.
35. *C. elongata* Brady and Norman 1889. Lough Neagh, North Ireland, UK, 54°37′ 06°25′W: Types, MB – 1911.11.8.M2943
36. *C. elpatiewskyi* (Daday 1906). Lake Kosogol (Hövsgöl Nuur), Mongolia, 51°00′N 100°30′W: Types, HMNH – IV/P-203.
37. *C. falcata* Alm 1914b. Dudinskoje, Siberia, Russia, 59°10′N 34°04′E: Types, SMNH – 1295.
38. *C. fasciolata* Petkovski 1961. Lake Ohrid, Macedonia, 41°00′N 20°45′E: NHMS – collection numbers unknown.
39. *C. flava* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
40. *C. fluctigera* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
41. *C. forma* (Karanovic 1999c). Spring Malo Oko, Sotonici, Lake Skadar, Montenegro, 42°14′N 19°02′E: Holotype (♂), RBINS – O.C. 2289.
42. *C. fossiliformis* Mazepova 1970. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
43. *C. foviolata* Dobbin 1941. Deception Pass, Washington, USA, 47°35′N 121°08′W: Lectotype (♂), SM – 1134528.
44. *C. godlewskii* Mazepova, 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
45. *C. gracilenta* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
46. *C. granulata* Daday 1893. Danube-Tisa Channel, Dabas, Hungary, 47°11′N 19°19E: Repository of the type material unknown.
47. *C. grizea* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
48. *C. hadzistei* Petkovski et al. 2002. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Repository of the type material unknown.

49. *C. hartmanni* Petkovski 1969b. Lake Ohrid, Macedonia, 41°00′N 20°45′E: (Syn)types, NHMS – collection numbers unknown.
50. *C. holmesi* Petkovski 1960b. Lake Ohrid, Macedonia, 41°00′N 20°45′E: NHMS – collection numbers unknown.
51. *C. houghi* Staplin 1963b. Lake Michigan, Illinois, USA, 42°09′N 87°45′W: Holotype (subfossils), ISHS – collection number unknown.
52. *C. humilis* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
53. *C. hungarica* (Daday 1900). Bugac, Bács-Kiskun, Hungary, 46°41′N 19°40′E: Types, HMNH – IV-189.
54. *C. ikpikpukensis* Swain 1963. Lake Ikpikpuk, Alaska, USA, 70°49′N 154°18′W: Holotype (subfossil), SM – collection number unknown.
55. *C. improvisa* Ostermeyer 1937. Garden pool, Schkopau, Saxony-Anhalt, Germany, 51°24′N 11°59′E: Syntypes, ZMK – UR-412.

    Syn.: *C. devexa* Kaufmann 1900c

56. *C. inaequivalvis* Sars 1899. Surroundings of Verkhoyansk, Russia, 67°33′N 133°22′E: Repository of the type material unknown.
57. *C. incarum* (Moniez 1889). Lake Titicaca, Bolivia, 15°48′S 69°24′W: Repository of the type material unknown.
58. *C. inexpecta* Chapman 1963. Pond at 33 Ashgrove Terrace, Cashmere, Christchurch, New Zealand, 43°32′S 172°38′E: Types, OMD – collection numbers unknown.
59. *C. inopinata* Furtos 1933. Pond, Mount Vernon, Ohio, USA, 40°23′N 82°29′W: Paratype (♀), SM – 67872.

    Syn: *C. indigena* Hoff 1942; *C. truncata* Furtos 1933

60. *C. insularis* Mazepova 1985. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
61. *C. intermedia* Furtos 1933. Cold spring run, Newark, Ohio, USA, 40°02′N 82°25′W: Holotype (♀), SM – 67873.
62. *C. intermedia* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
63. *C. intersita* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
64. *C. ivanowi* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
65. *C. jordeae* Petkovski et al. 2002. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Types, NHMS – collection numbers unknown.
66. *C. keiseri* Bronstein 1929. Lake Issyk-Kul, N coast at Charpokopy village, Kyrgyzstan, 42°25′N 77°15′E: Repository of the type material unknown.
67. *C. korjakovi* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
68. *C. krochini* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.

69. *C. laciniata* Ekman 1908. Torne, Sweden, 65°44′N 24°03′E: Repository of the type material unknown.
70. *C. lactea* Baird 1850
71. *C. lamakini* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
72. *C. larvaeformis* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
73. *C. lepnevae* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
74. *C. limosa* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
75. *C. limpid*a Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
76. *C. lindneri* Petkovski, 1969b. Spring rills next to the Poggensee, N of Bad Oldesloe, Schleswig-Holstein, Germany, 53°49′N 10°23′E: (Syn)types, NHMS – collection numbers unknown.
77. *C. lingulata* Cole 1965. Woodland Pond, Kingston Springs, Cheatam County, Tennessee, USA, 36°06′N 87°06′W: Holotype (♀), SM – 120553.
78. *C. longiformis* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
79. *C. longula* Mazepova 1985. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
80. *C. lucens* (Baird 1835). Berwickshire, Scotland, UK, 55°45′N 02°30′W: Repository of the type material unknown.
81. *C. lucida* Petkovski 1969b. Lake Ohrid, Macedonia, 41°00′N 20°45′E: (Syn) types, NHMS – collection numbers unknown.
82. *C. lychnitis* Petkovski 1969b. Lake Ohrid, Macedonia, 41°00′N 20°45′E: (Syn) types, NHMS – collection numbers unknown.
83. *C. marginata* Klie 1942. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK –UR-387.
84. *C. marginatoides* Petkovski 1960c. Lake Prespa, Macedonia, 40°55′N 21°00′E: Types, NHMS – collection numbers unknown.
85. *C. media* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes ZMK – UR-389.
86. *C. meerfeldiana* Scharf 1983. Meerfelder Maar, Rhineland-Palatinate, Germany, 50°06′N 06°45′E: Holotype (♀), ZMH – K-32166.
87. *C. memoranda* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
88. *C. microdorsoconcava* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
89. *C. modesta* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
90. *C. montenigrina* Petkovski 1961. Lake Skadar, Montenegro, 42°14′N 19°14′E: Types, NHMS – collection numbers unknown.

91. *C. muelleri* Hartwig 1899b. Brandenburg, Germany. Repository of the type material unknown.
92. *C. muriformis* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
93. *C. natronophilla* Petkovski 1969b. Lake Rusanda, Zrenjanin, Serbia, 45°31′N 20°18′E: (Syn)types, NHMS – collection numbers unknown.
94. *C. neglecta* Sars 1887. Lago di Garda, Italy, 45°40′N 10°41′E: Syntypes, NHMO – F4317.

Syn.: *C. scharfi* Hahn 1990; *C. vasconica* Margalef 1953

95. *C. oblonga* Sars 1899. Surroundings of Verkhoyansk, Russia, 67°33′N 133°22′E: Repository of the type material unknown.
96. *C. ohioensis* Furtos 1933. Bass Lake, Ohio, USA, 39°49′N 84°03′W: Paratype (♂), SM – 67874.
97. *C. ohrida* Holmes 1937a. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Repository of the type material unknown.
98. *C. orbiculata* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
99. *C. paionica* Petkovski 1958. Lake Dojran, Macedonia, 41°03′N 22°44′E: Types, NHMS – collection numbers unknown.
100. *C. paloskii* Petkovski et al. 2002. Limnocrene Stream, Village Pestani, Lake Ohrid, Macedonia, 41°09′N 20°51′E: Holotype (♀), NHMS – Ostr. 106/1.
101. *C. paraohioensis* Staplin 1963b. About 90 m from the S fork of Lick Creek, ca. 3 km E of Pekin, Peoria Quadrangle, Tazewell County, Illinois, USA, 40°35′N 89°36′W: Holotype (♀, subfossil), ISHS – collection number unknown.
102. *C. parva* Daday 1905. Irrigation Fields, Aregua, Paraguay, 25°18′S 57°25′W: Types, HMNH – IV-11.
103. *C. pedropalensis* Méhes 1914. Laguna Pedropalo, Columbia: Repository of the type material unknown.
104. *C. peircei* Turner 1895. Large millpond near Fayetteville, Georgia, USA, 33°26′N 84°27′W: Repository of the type material unknown.

Syn.: *C. eriensis* Furtos 1933

105. *C. picta* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
106. *C. prava* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
107. *C. procera* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
108. *C. quadrata* Alm 1914a. Delsbo, Hälsingland, Sweden, 61°48′N 16°33′E: Repository of the type material unknown.
109. *C. quasiincavum* Karanovic and Datry 2009. Condor Lake Area, Madre de Dios Archipelago, Chile, 50°17′S 75°15′W: Holotype (♀), TMAG – G5901.
110. *C. rara* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.

111. *C. rupestris* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
112. *C. sanociensis* Sywula 1971a. Two neighboring springs on a glade, Wroczeń Mountain slope near Srogów Górny, Rzeszów Province, Sanok District, Poland, 49°37′N 22°08′E: Types, ZIPAS – collection numbers unknown.

  Syn.: *C. dancanui* Danielopol 1973

113. *C. schweyeri* Schornikov 1964. Caspian Sea, 43°38′N 49°12E: Repository of the type material unknown.
114. *C. semilunaris* Bronstein 1930. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
115. *C. sensibilis* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
116. *C. sharpei* Hoff 1942. Norma, McLean County, Illinois, USA, 40°30′N 88°59′W: Repository of the type material unknown.
117. *C. sibirica* Müller 1912. New Siberian Islands, Russia, 75°45′N 138°44′E: Repository of the type material unknown.
118. *C. sigmoides* Sharpe 1897. Havana, Illinois, USA, 40°18′N 90°03′W: Repository of the type material unknown.

  Syn.: *C. scopulosa* Furtos 1933; *C. simpsoni* Sharpe 1897

119. *C. similis* Baird 1846. Pond at Clapham Common, England, UK, 51°27′N 00°08′W: Repository of the type material unknown.
120. *C. sinaidae* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
121. *C. spicata* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
122. *C. stankovici* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
123. *C. strumicae* Petkovski 1959b. Sring, Bansko, Strumice, Macedonia, 41°26′N 22°38′E: Types, NHMS – collection numbers unknown.
124. *C. subacuminata* Delorme 1970c. Temporary ponds, Canadian prairies, Canada. No more details on the locality. Holotype (♀), GSC – C-26791.
125. *C. subgibba* Sars 1926. Brackish pond, Teller, Port Clarence, Alaska, USA, 65°14′N 166°40′W: Repository of the type material unknown.
126. *C. subtriangulata* Benson and Macdonald 1963. Pleistocene sediments, Lake Michigan, NE USA, 41°53′N 87°36′W: Repository of the type material unknown.
127. *C. suburbana* Hoff 1942. Bussey's Pasture, Urbana, Champaign County, Illinois, USA, 40°06′N 88°12′W: Holotype (♂), SM – 81073.
128. *C. tahoensis* Ferguson 1966. Lake Tahoe, Nevada, USA, 39°10′N 119°53′W: Holotype (♂), SM – 113015.
129. *C. thermalis* (Daday 1900). Püspökfürdo, Hungary: Types, HMNH – IV/P-30.
130. *C. thienemanni* Klie 1932. Leaf litter from the shore of Lake Singkarak, West Sumatra, Indonesia, 00°36′S 100°32′E: Syntypes, ZMK – UR-348.

131. *C. trapeziformis* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-393.
132. *C. triangulata* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-492.
133. *C. uliginosa* Furtos 1933. Temporara marsh, Chesterland, Ohio, USA, 41°31′N 81°20′W: Repository of the type material unknown.

     Syn.: *C. hoffi* Ferguson 1953

134. *C. unguiculata* Bronstein 1930. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
135. *C. unimoda* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
136. *C. uschunica* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
137. *C. vidua* Klie 1942. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-385.
138. *C. virescens* Brady 1864. Shallow weedy pond, Ashburn, Sunderland, England, UK, 54°54′N 01°22′W: Repository of type material unknown.
139. *C. virgata* Mazepova 1985. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
140. *C. walukani* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
141. *C. wasilievae* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
142. *C. wedgewoodi* Lowndes 1932b. Puddles formed by the outflow of a tub in the underground quarries at Corsham, England, UK, 51°25′N 02°11′W: Repository of the type material unknown.
143. *C. weltneri* Hartwig 1899c. Scharmützel Lake, Fürstenwalde, Brandenburg, Germany, 52°22′N 14°04′E: Repository of the type material unknown.

Remarks

Candona is by far the most specious genus of the freshwater ostracods. At the moment, it comprises several lineages. Only the Lake Baikal holds more than one distinct lineage, which will eventually be raised on the rank of a separate genus. However, at the moment, they are still members of the genus *Candona*. The genus is divided into two subgenera: *Candona* and *Neglectocandona* Krstić 1995. Karanovic (2006b) revised the North American Candoninae and stressed a couple of morphological characters of the soft parts that can be used to separate the two subgenera. At this stage, description of many species currently belonging to *Candona* is insufficient to divide them clearly between the two subgenera, which can only be done after the revision of the genus *Candona*. A key to the species is not provided in this book, and a key to the North American species with some taxonomic notes on the genus can be found in Karanovic (2006b).

Ecology and distribution
The species are most often found in lakes and springs. The genus is mostly distributed in the Northern Hemisphere. There are no records from Australia. The map is not provided because of the numerous species, what will make the map unreadable.

***Eucandona* Daday 1900**

Diagnosis (after Karanovic 2006b): Carapace subreniform, or subtrapezoidal, often with truncate extension. Valve surface not ornamented. CIL always narrow, i.e., never more than 20% of total L. LV overlaps RV. MPC straight, never branched. A1 7-segmented. Most posterior seta on the penultimate segment of A1 present (this segment contains four ventral setae and sometimes one dorsal (alpha) seta). A2 sexually dimorphic: in male protopod 4-segmented and in female 3-segmented. Male sexual bristles present. Claws G1 and G3 in male reduced, seta “z2” transformed into claw, seta “zl” very short and not exceeding the distal end of the terminal segment; “z3” always seta like (Fig. 37a). In both sexes, exopod is transformed in plate with one long and two short setae. Md with a total of eight rays in vibratory plate; palp 4-segmented with two setae externally on the second and three setae on the penultimate segment. Second segment internally with 3 + 2, 4 + 2, or 5 + 2 setae. Terminal segment with two claws, central one narrowly fused with the segment. Terminal segment on Mxl palp rectangular. Vibratory plate on L5 with two rays. Male with transformed palps: right one stocky, but with hook-shaped finger; left palp with elongated finger. L6 5-segmented. Basal segment with one seta. L7 4- or 5-segmented. Basal segment with two setae (“d1” and “dp”); terminal segment with two long (“h2” and “h3”) and one short (“h1”) setae, which is never shorter than the terminal segment itself. UR with both claws and both setae present. Posterior seta reaches at least distal end of posterior margin, usually being much longer. Part "M" on hemipenis well sclerified. Medial lobe absent. Zenker’s organ with seven whorls of spine. Female genital lobe with or without extension, often this lobe is strongly chitinized all around its margins.

Type species: *E. balatonica* Daday 1894

Species list with synonyms, type locality, and type material

1. *E. balatonica* Daday 1894. Balaton, Hungary, 46°50′N 17°45′E: Types, HMNH – IV/P-7-8.

   Syn.: *Candona reniformis* Hartwig 1900a

2. *E. biangulata* (Hoff 1942). Will County, Illinois, USA, 41°26′N 87°58′W: Holotype (♀), SM – 81067.

   Syn: *Candona orangeburgensis* Ferguson 1958; *Candona wegelini* Petkovski 1962

3. *E. fabella* (Nüchterlein 1969). Spring, Regnitz-Niederung, Eltersdorf, Bavaria, Germany, 49°33′N 10°59′E: Type material in Nüchterlein’s private collection.
4. *E. lapponica* (Ekman 1908). Brook, Abisko, Sweden, 68°20′N 18°49′E: Repository of the type material unknown.

5. *E. obtusa* (Bronstein 1947). Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.

   Syn.: *Candona rawsoni* Tressler 1957

6. *E. patzcuaro* (Tressler 1954). Lago de Pátzcuaro, Mexico, 19°35′N 101°35′W: Holotype (♀), SM – 96048.

   Syn.: *Candona michoa* Tressler 1954

7. *E. pedata* (Alm 1914b). Korga, Jenisej, Russia, 67°43′N 48°46′E: Types, SMNH – 1296.
8. *E. pennaki* (Marmonier and Ward 1990). Interstitial habitats of South Platte River, Waterton Canyon, Colorado, USA, 39°00′N 105°44′W: Holotype (♀), SM – 193908.
9. *E. rectangulata* (Alm 1914b). Sarpiursak, Greenland, 72°00′N 40°00′W: Types, SMNH – 1298.

   Syn.: *Candona distincta* (Furtos 1933)

Key to the species

1. Seta "t4" on A2 missing, genital process minute . *E. pennaki* (Marmonier and Ward 1990)

– Genital lobe well developed 2

2. Genital process foot like, ventrally concave 3

– Genital process different 4

3. Outer lobe on the hemipenis very high above other parts, triangular in shape *E. pedata* (Alm 1914b)

– Outer lobe on the hemipenis lower than other lobes, elliptical in shape *E. rectangulata* (Alm 1914b)

4. Carapace in lateral view with rounded dorsal margin, posterior margin also evenly rounded 5

– Carapace with posterior margin not evenly rounded 6

5. Genital field finger shaped . . . . *E. balatonica* Daday 1894

– Genital field triangular . . . . *E. lapponica* (Ekman 1908)

6. Anterior margin of the UR short (almost as long as anterior claw) . . *E. fabella* (Nüchterlein 1969)

– Anterior margin of the UR long (much longer than anterior claw) 7

7. Posterior seta on the UR short (much shorter than posterior claw) *E. biangulata* (Hoff 1942)

– Posterior seta on the UR long (as long as posterior claw) . . . . *E. obtusa* (Bronstein 1947) and *E. patzcuaro* Tressler 1954

Remarks

In the genus *Eucandona* Daday 1900, middle lobe on the hemipenis is absent, and only the seta “z2” is transformed into a long claw, while “z1” is very short and does not reach the distal margin of the terminal segment. These are the two main differences between the genera *Candona* and *Eucandona* (Karanovic 2006b). Appearance of the genital process varies, and it can be well developed and chitinized, well developed but not chitinized, or very small, even flat. In addition, the number of setae in the bunch on the mandibular palp can be 3 + 2, 4 + 2 or 5 + 2. For now, only eight species have been officially transferred to this genus, mostly from the genus *Candona*. A number of species assigned to the genus *Fabaeformiscandona* should be transferred to the genus *Eucandona*, but this needs revision of both *Candona* and *Fabaeformicsandona*.

Ecology and distribution (Fig. 47)

The species prefer cold water bodies and are often found in springs and interstitial waters. The genus is distributed in the Holarctic.

Fabaeformiscandona Krstić 1972

Diagnosis: Species with a very low carapace; the most posterior seta on the penultimate segment of A1 absent. Right prehensile palp extremely helmet shaped, stocky, and with finger not pronounced, while the left palp has pronounced finger, and also several bumps and intrusions. Setae “zl” and “z2” on the male A2 both claw like. Basal segment of L7 with “d1” and “dp” setae. All the lobes on hemipenis present. Genital process well expressed, triangular (Fig. 35f), and with a rounded tip and broad base.

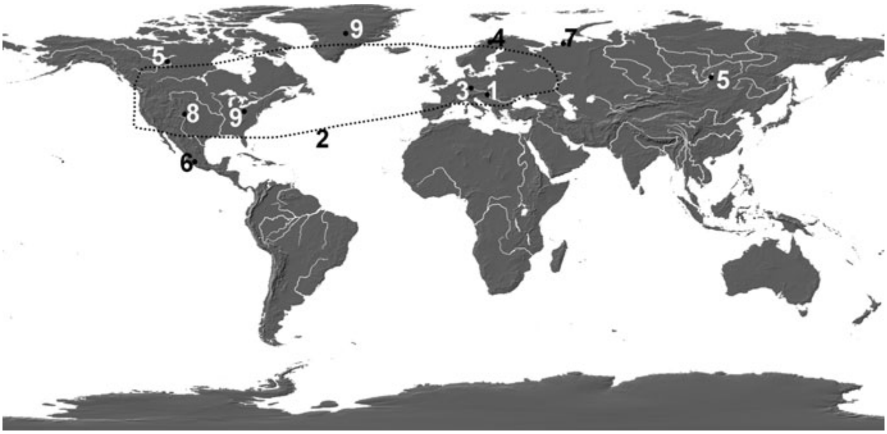


Fig. 47 Distribution of *Eucandona* Daday 1900: Numbers correspond to the species list

Type species: *F. fabaeformis* (Fischer 1851)

Species list with synonyms, type locality, and type material

1. *F. acuminata* (Fischer 1851). Surroundings of Castle Fall near Tallinn, Estonia, 59°26′N 24°45′E: Repository of the type material unknown.
2. *F. aemonae* (Klie 1935d). Podpečka Jama, Near Ljubljana, Slovenia, 46°03′N 14°30′E: Syntypes, ZMK – UR-487.
3. *F. akaina* Smith and Janz 2008. SW margin of the N basin, Lake Biwa, Japan, 35°10′32″N 135°59′47″E: Holotype (♂), LBM – 1430003326.
4. *F. alexandri* (Sywula 1981). Otomińskie Lake, Gdansk District, Poland, 54°18′N 18°30′E: Holotype (♂), DGUG – collection number unknown.
5. *F. angusta* (Ostermeyer 1937). Spring, Schierke, Saxony-Anhalt, Germany, 51°46′N 10°40′E: Repository of the type material unknown.
6. *F. bilobata* (Klie 1938e). Well, lower Maintal, Hesse, Germany, 50°09′N 08°50′E: Syntypes, ZMK – UR-488, 1399, 1400.
7. *F. bilobatoides* (Löffler 1961b). Interstitial, Danube, Möhringen, Baden-Württemberg, Germany, 48°44′N 09°09′E: Types, LIM – collection numbers unknown.
8. *F. breuili* (Paris 1920a). Cave, San Roman de Candámo, Candámo, Spain, 43°27′N 06°03′E: Repository of the type material unknown.

   Syn.: *Candona hertzogi* Klie 1938f; *Candona spelaea* Klie 1941b

9. *F. brevicornis* (Klie 1925). Alder–headwater–swamp, springs near the Kellersee, Schleswig-Holstein, Germany, 54°11′N 10°36′E: Syntypes, ZMK – UR-475-5, 1407–8.

   Syn.: *Candona limnocrenica* Sywula 1971b

10. *F. brisiaca* (Klie 1938f). Well, N Feldkirch, Baden-Württemberg, Germany, 47°56′N 07°39′E: Syntypes, ZMK – UR-439.
11. *F. caucasica* (Bronstein 1928). Sevan Lake, Armenia, 40°21′N 45°20′E: Repository of the type material unknown.
12. *F. caudata* (Kaufmann 1900a). Lake Geneva, Switzerland, 46°25′N 06°30′E: Repository of the type material unknown.
13. *F. condylea* Smith and Janz 2008. E shore of N basin of Lake Biwa, Japan, 35°13′57″N 136°10′06″E: Holotype (♂), LBM – 1430003303.
14. *F. danielopoli* Yin and Martens 1997. Lake Erhai, Daotang River, just before entering Lake Qinghai, China, 37°28′N 97°53′E: Holotype (♂), RBINS – O.C. 2093.
15. *F. dolabella* Smith and Janz 2008. N Basin, Lake Biwa, Japan, 35°08′26″N 136°00′27″E: Holotype (♂), LBM – 143003309.
16. *F. dorsobiconcava* (Bronstein 1947). Sevan Lake, Armenia, 40°21′N 45°20′E: Repository of the type material unknown.
17. *F. fabaeformis* (Fischer 1851). Surroundings of Castle Fall near Tallinn, Estonia, 59°26′N 24°45′E: Repository of the type material unknown.

Syn.: *Candona fuhrmanni* Thiebaud 1908

18. *F. fragilis* (Hartwig 1898b). Near Berlin, Germany, 52°31′N 13°24′E: Repository of the type material unknown.
19. *F. groenlandica* (Brehm 1911). Lake, Stormkap, Greenland, 76°48′N 19°02′W: Repository of the type material unknown.
20. *F. holtzkampfi* (Hartwig 1900b). Oderberg, Brandenburg, Germany, 52°51′N 14°02′E: Repository of the type material unknown.

Syn.: *Eucandona csikii* var *pannonica* Daday 1903

21. *F. hyalina* (Brady and Robertson 1870). Whittlesea Mere, England, UK, 52°33′N 00°07′W: Repository of the type material unknown.
22. *F. japonica* (Okubo 1990a). Okayama, Japan, 34°39′N 133°55′E: Holotype (♂), SJU – FO-11.
23. *F. krstici* (Petkovski 1969b). Border Littoral/Sublittoral, Ohrid Lake, Macedonia, 41°00′N 20°45′E: Types, NHMS – collection numbers unknown.
24. *F. latens* (Klie 1940d). Möhrendorf, Bavaria, Germany, 49°38′N 11°00′E: Syntypes, ZMK – UR-490-1, 493, 1401.
25. *F. levanderi* (Hirschmann 1912). Hitis, Finland, 59°53′N 22°31′E: Repository of the type material unknown.

Syn.: *Pseudocandona elongata* Holmes 1937b

26. *F. myllaina* Smith and Kamiya 2007. Shinkai Pond, Kakuma, Kanazawa, Ishikawa Prefecture, Japan, 36°32′31″N 136°42′12″E: Holotype (♂), LBM – 1430000913.
27. *F. nishinoae* Smith and Janz 2008. S part of the N Basin, Lake Biwa, Japan, 35°14′00″N 136°01′05″E: Holotype (♂), LBM – 1430003321.
28. *F. okuboi* Smith and Janz 2008. E side of the S part of the N basin, Lake Biwa, Japan, 35°14′22″N 135°58′13″E: Holotype (♂), LBM – 143003292.
29. *F. paterea* Smith and Janz 2008. E side of the S part of the N basin, Lake Biwa, Japan, 35°14′22″N 135°58′13″E: Holotype (♂), LBM – 143003287.
30. *F. pedana* Smith and Janz 2008. E coast of the N basin, Lake Biwa, Japan, 35°13′54″N 135°57′49″E: Holotype (♂), LBM – 1430003316.
31. *F. protzi* (Hartwig 1898b). Ditch, Zoological Garden, Berlin, Germany, 52°30′N 13°20′E: Repository of the type material unknown.
32. *F. pyrenaica* (Margalef 1952). Vall del Toré, near Maranges, Girona, Catalonia, Spain, 42°26′N 01°47′E: Repository of the type material unknown.
33. *F. siliquosa* (Brady 1910b). Lake Hickling Broad, Norfolk, England, UK, 52°44′N 01°34′E: Repository of the type material unknown.
34. *F. slesiniaca* (Sywula 1974a). Jezioro Ślesińskie Lake, Poland, 52°23′N 18°20′E: Repository of the type material unknown.
35. *F. svetozari* (Petkovski and Karanovic 2004). Phreatic Pump, Village Katlanovo near Skopje, Macedonia, 41°53′N 21°40′E: Holotype (♀), NHMS – 111/1.
36. *F. tora* Smith and Kamiya 2007. Takao, Kanazawa, Ishikawa Prefecture, Japan 36°30′15″N 136°38′53″E: Holotype (♂), LBM – 1430000899.

37. *F. tyrolensis* (Löffler 1963b). Wells, Tyrol, Austria, 47°15′N 11°20′E: Types, LIM – collection numbers unknown.
38. *F. velifera* Smith and Janz 2008. E side of the S part of the N basin, Lake Biwa, Japan, 35°09′52″N 136°39′44″E: Holotype (♂), LBM – 1430003298.
39. *F. yajimae* Smith and Janz 2008. N shore of N Basin, Lake Biwa, Japan, 35°26′37″N 136°08′41″E: Holotype (♂), LBM – 1430003314.

Key to the species

1. Setal group on the second segment of Md palp with 3 + 2 setae, carapace slender (laterally compressed) in dorsal view (*fabaeformis* group) 2
– Setal group on the second segment of Md palp with 4 + 2 setae (*acuminata* group) 20
2. Genital field in females rounded and without protruding appendages 3
– Genital field in female with protruding appendages of different shape 6
3. L7 4-segmented . . . . *F. brisiaca* (Klie 1938f)
– L7 5-segmented 4
4. Posterior seta on the UR not reaching distal end of the ramus *F. okuboi* Smith and Janz 2008
– Posterior seta on the UR exceeding distal end of the ramus 5
5. Ventro-distal margin of the LV sinusoid . . *F. dolabella* Smith and Janz 2008
– Ventro-distal margin of LV rounded/straight . . *F. angusta* (Ostermeyer 1937)
6. Genital field with a very small appendage, which is blunt distally . . . . *F. aemonae* (Klie 1935d)
– Genital field with a prominent appendage 7
7. The appendage on the genital field elongated and finger shaped 8
– The appendage on the genital field different 10
8. Prehensile palps with typical “fabaeformis” appearance – right one extremely helmet shaped, and left one with bumps on its finger 9
– Right prehensile palp with evenly rounded dorsal margin, left one with short finger without any bumps . . . . *F. condylea* Smith and Janz 2008
9. Outer lobe on the hemipenis with straight distal margin . . . . *F. tora* Smith and Kamiya 2007
– Outer lobe on the hemipenis with inclined distal margin . . . . *F. yajimae* Smith and Janz 2008
10. Left prehensile palp with a peculiar and big “hump” on the base of the finger . . . . *F. fragilis* (Hartwig 1898b)
– No such prominent hump present 11
11. Two crests present dorsally on the finger of the left prehensile palp 12
– One or no crests present on the finger of the left prehensile palp 13

12. Outer lobe on the hemipenis distally pointed . . . *F. japonica* (Okubo 1990a)
– Outer lobe on the hemipenis distally rounded *F. holtzkampfi* (Hartwig 1900b)
13. Genital field with broad and rounded appendage, “fist like” . . . . . *F. paterea* Smith and Janz 2008
– Genital field with somewhat elongated appendage, triangular or foot like . . . 14
14. Part “M” on the hemipenis distally subdivided and “V” shaped 15
– Part “M” on the hemipenis distally not “V” shaped 16
15. Posterior inner margin parallel to the outer margin . . . . *F. svetozari* (Petkovski and Karanovic 2004)
– Posterior inner margin following the outline of the outer margin *F. fabaeformis* (Fischer 1851)
16. Distal end of “M” part broad and fist like 17
– Distal end of “M” process not fist like 18
17. Distal end of outer lobe of hemipenis pointed *F. velifera* Smith and Janz 2008
– Distal end of outer lobe of hemipenis rounded *F. pedana* Smith and Janz 2008
18. Distal end of “M” process flat . . . . *F. krstici* (Petkovski 1969b)
– Distal end of “M” process rounded 19
19. Distal end of “M” process with additional small thumb-like extension *F. alexandri* (Sywula 1981)
– No thumb-like extension . . . . *F. myllaina* Smith and Kamiya, 2007
20. Penultimate segment on L7 completely fused 21
– Penultimate segment on L7 completely or partly segmented 23
21. Dorsal margin of the female carapace straight or slightly rounded *F. breuili* (Paris 1920a)
– Dorsal margin of the female carapace strongly arched 22
22. Left prehensile palp with a long finger, which is almost perpendicularly attached . . . . *F. bilobatoides* (Löffler 1961b)
– Left prehensile palp with a short finger lying almost in line with the main body . . . . *F. bilobata* (Klie 1938e)
23. Genital field of females rounded and with no appendages . . . *F. brevicornis* (Klie 1925)
– Genital field of females with some additional appendages 24
24. Genital field projection very small (from the base to its tip equaling only 10% of anterior UR margin) . . . . *F. latens* (Klie 1940d)
– Genital field projection much bigger (from the base to its tip equaling more than 40% of anterior UR margin) 25

25. Genital field projection broad (almost triangular) 26
– Genital field projection slender (almost finger shaped) 27
26. Dorsal base of the UR with a row of small denticles . . . . *F. caudata* (Kaufmann 1900a)
– No such denticles present . . . . *F. hyalina* (Brady and Robertson 1870)
27. Outer lobe of hemipenis terminating in a tapering pointed and narrow tip 28
– Lobe “a” on the hemipenis rounded 29
28. Outer lobe of hemipenis laterally subdivided with a small intrusion . . . . . *F. levanderi* (Hirschmann 1912)
– Outer lobe of hemipenis not subdivided and almost square . . . *F. acuminata* (Fischer 1851)
29. Transformed setae “z1” and “z2” on males A2 subequally long 30
– Seta “z1” considerably shorter than “z2” . . . *F. akaina* Smith and Janz 2008
30. Margins of outer lobe of hemipenis gradually narrowing before the tapering pointed end . . . . *F. nishinoae* Smith and Janz 2008
– Margins of outer lobe of hemipenis almost parallel so that the proximal part of the hemipenis has almost a square appearance in front of the tapering point . . . . *F. danielopoli* Yin and Martens 1997

Remarks
At the moment, the genus *Fabaeformiscandona* comprises species which, according to the generic diagnosis, clearly do not belong to it. A number of species currently described from the Lake Biwa should belong to either *Candona* or *Eucandona*, instead to *Fabaeformiscandona* (having the most posterior seta on the penultimate segment of A1 like *Candona*/*Eucandona*; having only “z1” seta transformed into a claw, like *Eucandona*; and lacking the typical “*fabaeformis*” appearance of the prehensile palps). The same is true for many European species, but this needs to be done in a separate publication. The key provided above includes only species with a good description. In some cases (i.e., *F. siliquosa* (Brady 1910b)), species have been omitted from the key because the males have not been described. When identifying ostracods belonging to the complex *Candona–Eucandona–Fabaeformiscandona,* all three lists of species should be consulted.

Ecology and distribution (Fig. 48)
The species live in all types of freshwater bodies (both temporary and permanent ones). A couple of representatives can also be found in subterranean waters. The genus is mostly distributed in the Northern Hemisphere.

***Paracandona* Hartwig 1899a**
Diagnosis (after Meisch 2000): Surface of valves covered with fine polygonal reticulum. Terminal claws on A2 very long, penultimate segment not subdivided

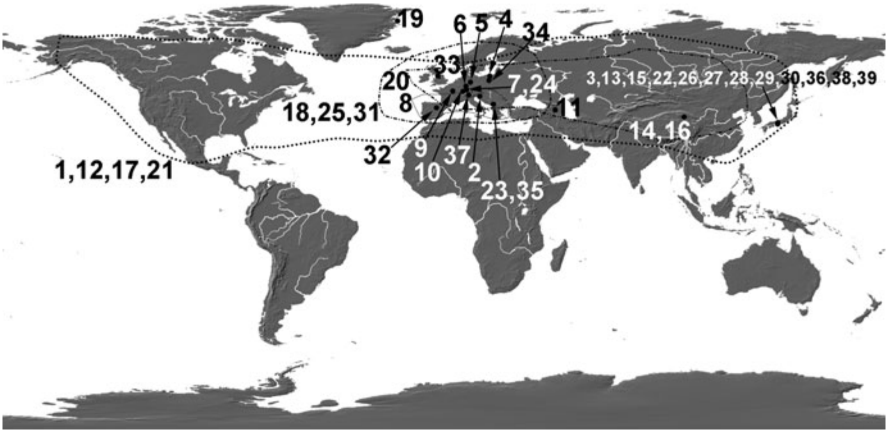


Fig. 48 Distribution of *Fabaeformiscandona* Krstić 1972: Numbers correspond to the species list

in males and without male bristles. Seta "f" on L7 present. Zenker organ with 5 + 2 rows of spines.

Type (and only) species: *Paracandona euplectella* (Robertson 1889)

Species list with type locality and type material
Paracandona euplectella (Robertson 1889). Clydesdale, Scotland, UK, 55°42′N 03°50′W: Repository of the type material unknown.

Ecology and distribution
The species prefers small water bodies with a swampy or boggy bottom. It has been recorded throughout the Holarctic.

Phreatocandona Danielopol 1973

Diagnosis: Valves subtriangular, posterior end elongated and narrow. Exopod on A2 with all three setae short. Second segment of the Md palp externally without any seta. Basal segment of L6 without any seta. Seta on the penultimate segment ("g" seta) very long (almost reaching middle L of terminal claw). Basal segment of L7 with only "d1" and "dp" setae present, penultimate segment not subdivided, setae "h1" and "h2" equally long. Posterior claw on UR reduced, other claw and both setae normally developed.

Type (and only) species: *Phreatocandona motasi* Danielopol 1973

Species list with type locality and type material
Phreatocandona motasi Danielopol 1973. Well, Jiblea near Calimansti, Olt (river) Valley, Romania, 45°14′N 24°22′E: LIM – collection numbers unknown.

Ecology and distribution

This is a stygobiont species, known only from its type locality.

***Schellencandona* Meisch 1996**

Diagnosis (after Meisch 1996): Carapace small, 0.4–0.6 mm long. Valves smooth or with shallow pits. Second segment on the Md palp with 3 + 2 setae. Basal segment of L6 with only setae "d1" and "dp" present. Zenker organ with 4 + 2 rows of spines.

Type species: *S. schellenbergi* (Klie 1934b)

Species list with type locality and type material

1. *S. belgica* (Klie 1937c). Well, Waha, Belgium, 50°13′N 05°20′E: Syntypes, ZMK – UR-430.
2. *S. insueta* (Klie 1938f). Well, Hugstetten, Baden-Württemberg, Germany, 48°03′N 07°47′E: Syntypes, ZMK – UR-441.
3. *S. schellenbergi* (Klie 1934b). Phreatic pump, Lauterach, Bregenz, Austria, 48°15′N 09°34′E: Syntypes, ZMK – UR-440.
4. *S. simililampadis* (Danielopol 1978a). Cave, Vidourle, Gard, France, 43°32′N 04°08′E: Holotype (♂), LIM – collection number unknown.
5. *S. triquetra* (Klie 1936b). Well, Basel, Switzerland, 47°34′N 07°36′E: Syntypes, ZMK – UR-425-427.
6. *S. yakushimaensis* Smith and Kamiya 2006. Narrow crack in bedrock, near Nakama, SW Yakushima Island, Kagoshima, Japan, 30°15′37″N 130°25′35"E: Holotype (♀), UMT – 28885.

Key to the species

1. In lateral view, dorsal margin of carapace straight or arched, sometimes rounded, but not triangular 2
– In lateral view, dorsal margin of carapace triangular *S. triquetra* (Klie 1936b)
2. Posterior seta on the UR short, reaching at the most distal end of posterior margin . . . . *S. schellenbergi* (Klie 1934b)
– Posterior seta on the UR longer 3
3. Genital field rounded, weakly protruding 4
– Genital lobe with pointed process . . . . *S. belgica* (Klie 1937c)
4. Valves trapezoidal and RV higher than LV . . . . *S. simililampadis* (Danielopol 1978a)
– Valves not trapezoidal and not asymmetrical 5
5. In lateral view, dorsal margin straight . . . . *S. insueta* (Klie 1938f)
– In lateral view, dorsal margin rounded . . . . *S. yakushimaensis* Smith and Kamiya 2006

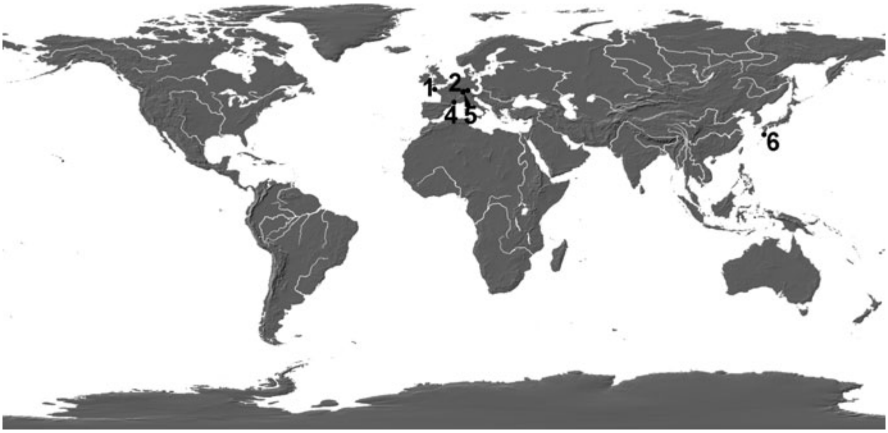


Fig. 49 Distribution of *Schellencandona* Meisch 1996: Numbers correspond to the species list

Ecology and distribution (Fig. 49)
Most of the species have been found in the subterranean waters of Europe, with the exception of *S. yakushimaensis* Smith and Kamiya 2006 which was described from temporary water body in Japan.

***Trajancandona* Karanovic 1999b**

Diagnosis (after Karanovic 1999b): Relatively small ostracods with slightly trapezoidal valve form. CIL narrow, MPC short, A2 with or without male bristles, exopodite on A2 is clearly visible plate with three short setae (Fig. 45a). Second segment on Md palp externally without setae. Same segment internally with 2 + 2 setae. Terminal segment of Mxl palp square shaped, bearing only thee appendages: two strong apical setae ("claws") and one lateral, shorter seta (Fig. 45d). Basal segment on L6 without setae, L7 4-segmented and with two setae on basal segment. UR with short ramus (anterior margin at the most as long as anterior claw); attachment simple. Zenker organ with 4 + 2 whorls of spines. Hemipenis without middle lobe, part "M" weakly sclerotized and hardly visible.

Type species: *T. natura* Karanovic 1999b

Species list with type locality and type material

1. *T. natura* Karanovic 1999b. Cave, Cetinje, Montenegro, 42°23′N 18°54′E: Holotype (♂), ZMH – K-42338
2. *T. particula* Karanovic 1999b. Cave Sutimska Jama, Beri, Podgorica, Montenegro, 42°26′N 19°11′E: Holotype (♂), ZMH – 42339.

Key to the species

1. Male bristles on A2 present . . . . *T. natura* Karanovic 1999b
– Male bristles on A2 absent . . . . *T. particula* Karanovic 1999b

Ecology and distribution
Both species have only been found in their type localities, and both are stygobiont.

Typhlocypris Vejdovsky 1882 [Syn.: *Pseudocandona* Kaufmann 1900a; *Metacandona* Bronstein 1930; *Cavernocandona* Hartmann 1964]

Diagnosis (after Karanovic 2005d): Carapace variable in shape: trapezoidal, triangular, or reniform. Surface smooth or ornamented, covered with long, stiff and perpendicularly attached setae. LV overlaps RV ventrally. A1 7-segmented. Penultimate segment always without most posterior seta (Fig. 45h). A2 with one segmented protopod; exopod consists of plate and three setae (two short and one long). Second endopodal segment with one seta externo-medially. Male sexual bristles sometimes absent. In males "z1" seta transformed into strong claw, while claw G3 reduced to seta (Fig. 45j). Md palp 4-segmented, with two setae externo-distally on second and three setae on penultimate segment. Second segment with variable number of setae internally: 3 + 2, 4 + 2, or 5 + 2. Terminal segment with two claws: one fused with same segment. Mxl palp with trapezoidal terminal segment. L5 with two bristles on the vibratory plate, and one "a" seta. Male prehensile palps asymmetrical: right stronger than left. L6 5-segmented and with one seta on basal segment. L7 4- (Fig. 45f) or 5-segmented. Basal segment sometimes lacks "d2" seta. Setae "e" and "f" always absent. Terminal segment with three setae. Seta "h2" and "h3" always long, while "h1" vary in L. UR well developed, with all claws and setae present. Zenker organ with 5 + 2 rows of spines. Hemipenis with poorly clarified "M" process (Fig. 45g). Outer lobe square shaped and not extended. No loops on the internal hemipenis ductus. Female sometimes with developed genital processes on genital field.

Type species: *T. eremita* (Vejdovsky 1882)

Systematics
The genus is at the moment subdivided into two subgenera: *Typhlocypris* Vejdovsky 1882 and *Pseudocandona* Kaufmann 1900a. Vejdovsky (1882) established the subgenus *Typhlocypris* for the species *Cypris (Typhlocypris) eremita* Vejdovsky 1882, collected in a well near Prague. The description was based only on female specimens. Several years later, Kaufmann (1900a) described the genus *Pseudocandona* for a single species – *Candona insculpta* Müller 1900a. This species was found to be a junior synonym of *Cypris pubescens* Koch 1837b, but *P. insculpta* was already designated as the type species of the genus *Pseudocandona* by monotypy and the name *Candona pubescens* has been rarely used since the early 1900s. Kaufmann (1900a) distinguished *Pseudocandona* from *Candona* Baird 1845 by the absence of male sexual bristles on the antenna. For a long time, *Pseudocandona* was a monospecific genus, until Bronstein (1947) included some species from Lake Baikal with the same peculiar morphology of the male antenna. Triebel (1963) considered *Pseudocandona* to be only a subgenus of the genus *Candona* and he included in it the species belonging to the *rostrata* and *compressa* groups. The same author, like many other paleontologists (Sharpe 1918;

Krstić 1972; Sokac 1972), recognized the subgenus *Typhlocypris* for the *eremita*-like species. Sywula (1974a), on the contrary, included in this subgenus the recent *Candona*-like species not only with triangular, but also with reniform and elliptical valve shapes, based on the great similarity in the morphology of their soft parts. The species he assigned to this subgenus are members of the *rostrata* and *compressa* groups. Petkovski (1969b) followed Triebel (1963), but he considered *Pseudocandona* as a separate genus. He also, for the first time, included in this genus the species *Typhlocypris eremita,* which was supported by the close phylogenetic relationships with other *Pseudocandona* species. Danielopol (1978a) followed Petkovski (1969b), but indicated that *Typhlocypris* is a senior synonym. However, he decided to maintain the name *Pseudocandona* because of the following three reasons: (1) the type material of *Typhlocypris eremita* was lost, (2) the type locality has been destroyed, and (3) the description of the species is poor and based on a parthenogenetic population. On the contrary, Danielopol (1978a) indicated that *Pseudocandona insculpta* (Müller 1900a) is a better described species, widely distributed, and with bisexual populations. Danielopol nevertheless apparently accepted that the species *eremita* was adequately described and valid. In addition, none of Danielopol's (1978a) arguments follow the recommendations of the Code of the Zoological Nomenclature (Fourth Edition, article 23). Many modern authors followed Danielopol (l978a) (Broodbakker 1983c; Martens 1992c; Meisch 1996, 2000) and accepted the division of the genus *Pseudocandona* into the following species groups: *zschokkei, eremita, rostrata, compressa, caribbeana*, and *prespica.* This division is based on the carapace shape and the number of setae in the group on the second segment of the Md palp. Meisch (2000) accepted the possibility that species of the *eremita* group might belong to a separate genus, i.e., *Typhlocypris.* A number of species are still assigned to the genus *Pseudocandona* and they are listed below, most of them Baikal Lake endemics. The entire candonind fauna of this lake needs to be reassessed. Other *Pseudocandona* species have been described recently and their authors prefer to use junior synonym, *Pseudocandona.*

Subgenus *Typhlocypris* Vejdovsky 1882

Diagnosis (after Karanovic 2005d): Md palp with 3 + 2 or 4 + 2 setae on the second segment setal group. Male A2 only with "zl" seta transformed into claw, "z2" seta like. L7 4- or 5-segmented; seta "hl" very short (not more than 1.5 times longer than terminal segment) and hook like, or same seta longer (not more than 2.5 times longer than terminal segment) in which case penultimate segment undivided. The subgenus is divided into the following four species groups: *eremita, caribbeana, rostrata,*and *prespica.*

Type species: *T. eremita* (Vejdovsky 1882)

Subgenus *Pseudocandona* Kaufmann 1900a

Diagnosis: Carapace reniform, with greatest H situated well behind middle, and dorsal margin flat or inclined toward anterior end. Carapace smooth. Setae "zl" and "z2" on male A2 both claw like, or only "zl" claw like. Md with 5 + 2 setae in the group on the second segment. L7 5-segmented, seta "h1" long (more than 2.5 times longer than terminal segment).

Type species: *T. (P.) insculpta* Müller, 1900a.

Species list with synonyms, type locality, and type material (both subgenera listed together)

1. *T. (P.) albicans* (Brady 1864). Freshwater near Sunderland, England, UK, 54°54′N 01°22′W: Repository of the type material unknown.

   Syn.: *Candona parallela* Müller 1900a; *Candona profundicola* Löffler 1960; *Candona pseudoparallela* Löffler 1961b; *Candona altoalpina* Löffler 1963b

2. *T. (T.) annae* (Méhes 1914). Puddle near Bogota, Columbia, 04°36′N 74°04′W: Repository of the type material unknown.

   Syn.: *Pseudocandona antilliana* Broodbakker 1983c

3. *T. (T.) arcuata* (Klie 1932). Spring near Cemorosewu, Sarangan, Central Java, Indonesia, 07°26′S 110°28′E: Syntypes, ZMK – UR-422.
4. *T. (T.) capsularis* (Klie 1935c). Barr Santa Lucia, Uruguay, 34°45′S 56°30′W: Syntypes, ZMK – UR-423.
5. *T. (T.) caribbeana* (Broodbakker 1983c). Interstitial water of the river Brays, Jamaica, 18°15′13″N 76°48′06″W: Holotype (♀), ZMA – 150.802.
6. *T. (T.) cavicola* (Klie 1935d). Krška Jama, Slovenia, 45°52′N 14°46′E: Syntypes, ZMK – UR-417.

   Syn.: *Pseudocandna pretneri* Danielopol 1982a

7. *T. (P.) compressa* (Koch 1838). Ditch along Nürnberger Straße, Erlangen, Germany, 49°35′N 11°00′E: Repository of the type material unknown.

   Syn.: *Candona fallax* Müller 1900a; *Candona crispata* Klie 1926b

8. *T. (T.) cubensis* (Broodbakker 1983c). Pools, Cueva de la Represas, Gran Caverna de Santo Tomas, Pinal del Rio, Cuba, 22°23′N 83°57′W: Holotype (♀), ZMA – 150.809.
9. *T. (T.) delormei* Karanovic 2006b. Lake Winnipeg, Manitoba, Canada, 52°07′N 97°15′W: Holotype (♂), GSC – 2677.
10. *T. (T.) dispar* (Hartmann 1964). Cave, Erekli, Khodja Ali, Turkey, 41°17′N 31°25′E: Syntypes, ZMH – K-27446-7.
11. *T. (T.) elliptica* (Furtos 1933). East Harbor, Lakeside, Ohio, USA, 41°32′N 82°48′W: Paratypes, SM – 67869.
12. *T. (T.) eremita* (Vejdovsky 1882). Well, Prague, Czech Republic, 50°05′N 14°25′E: Repository of the type material unknown.

    Syn.: *Candona pannonicola* Löffler 1964; *Pseudocandona szoecsi* (Farkas 1858b); *Pseudocandona serbani* Danielopol 1982a

13. *T. (T.) fluviatilis* (Hoff, 1942). Ford Caunty, Illinois, USA, 40°35′N 88°15′W: Syntypes, SM – 81066.
14. *T. (T.) hartwigi* (Müller 1900a). Grunewald Lake, Berlin, Germany, 52°28′N 13°16′E: Repository of the type material unknown.

    Syn.: *C. absoloni* Caraion 1976; *Candona cronebergi* Hartwig 1899d

15. *T. (T.) illiesi* (McKenzie 1971c). Lake Peunde, Mt. Wilhelm, Papua New Guinea, 05°40′S 144°53′E: Holotype (♂), BM – 1969.12.3.2.
16. *T. (P.) insculpta* (Müller 1900a). Grunewald Lake, Berlin, Germany, 52°28′N 13°16′E: Repository of the type material unknown.

    Syn.: *Candona pubescens* Koch 1837b

17. *T. (T.) jeanneli* (Klie 1931a). Marengo Cave, Marengo, Indiana, USA, 38°22′N 86°20′W: Syntypes, ZMK – UR-431, 1236.
18. *T. (T.) lobipes* (Hartwig 1900c). Königs-Wusterhausen, Brandenburg, Germany, 52°17′N 13°37′E: Repository of the type material unknown.

    Syn.: *Candona brevis* Müller 1900a

19. *T. (T.) marchica* (Hartwig 1899d). Grunewald Lake, Berlin, Germany, 52°28′N 13°16′E: Repository of the type material unknown.

    Syn.: *Candona rostrata* Müller 1900a

20. *T. (T.) marengoensis* (Klie 1931a). Marengo Cave, Marengo, Indiana, USA, 38°22′N 86°20′W: Syntypes, ZMK – UR-432, 1235.
21. *T. (T.) morimotoi* (McKenzie 1972). Jongdam-gul Cave, Byeolli-dong, South Korea, 35°34′N 129°26′E: Paratypes, BM – 1970.2.10.1.
22. *T. (T.) parvula* (Sars 1926). Pool on fields in beaver meadow, near Ottawa, Canada, 45°24′N 75°41′W: Repository of the type material unknown.

    Syn.: *Pseudocandona exilis* (Furtos 1933); *Typhlocypris (T.) geratsi* (Broodbakker 1983c)

23. *T. (T.) paedropalensis* (Méhes 1914). Lagoon Pedropalo, Columbia, 04°42′N 74°25′W: Repository of the type material unknown.
24. *T. (T.) pescei* Karanovic 2005d. Freshwater well, Arta, Epirus, Greece, 39°09′N 20°59′E: Holotype (♂), WAM – 33451.
25. *T (P.). pratensis* (Hartwig 1901a). Königs-Wusterhausen, Brandenburg, Germany, 52°17′N 13°37′E: Repository of the type material unknown.

    Syn.: *Candona pubscens* Müller 1900b

26. *T. (T.) prespica* (Petkovski 1959b). Prespa Lake, Macedonia, 40°55′N 21°00′E: Types, NHMS – collection numbers unknown.
27. *T. (T.) pumilis* (Würdig and Pinto 1999). Cerquinha Lagoon, Tramandai, Rio Grande do Sul, Brazil, 30°15′S 50°16′W: Holotype (♀), UFRGS – Mp-O-845.
28. *T. (T.) punctata* (Furtos 1933). Bass Lake, Ohio, USA, 39°49′N 84°03′W: Paratypes, SM – 67875.

29. *T. (T.) puteana* (Klie 1931b). Well, Skopje, Macedonia, 42°00′N 21°26′E: Syntypes, ZMK – UR-434, 1237–8.
30. *T. (P.) regisnikolai* (Karanovic and Petkovski 1999b). Gornje Malo Blato, Lake Skadar, Montenegro, 42°20′N 19°10′E: Holotype (♂), ZMH – K-42340.
31. *T. (T.) renoensis* (Gutentag and Benson 1962). Subfossil, Cragin Quarry locality, Big Springs Ranch, SW% sec. 17, T. 32 S., R. 28 W., Meade County, Kansas, USA, Holotype (LV of ♀), DGUK – 613571.
32. *T. (T.)rostrata* (Brady and Norman 1889). Baron Loch near Peebles, Scotland, UK, 55°38′N 03°11′W: Types, BM – 1911.11.8.M2971, M2975.
33. *T. (T.) sarsi* (Hartwig 1899d). Oslo, Norway, 59°54′N 10°44′E: Repository of the type material unknown.

    Syn.: *Candona dentata* Müller 1900a

34. *T. (T.) semicognita* (Schäfer 1934). Stream on the N of Slawskie Lake, Poland, 51°54′N 16°00′E: Repository of the type material unknown.
35. *T. (T.) skadari* Karanovic 2005d. Well, Golubovci, Skadar Valley, Montenegro, 42°19′N 19°12′E: Holotype (♀), WAM – C33453.
36. *T. (T.) slavei* Petkovski 1969b: Stream out of Lake Ohrid, NE part, Macedonia, 41°00′N 20°45′E: Types, NHMS – collection numbers unknown.
37. *T. (T.) stagnalis* (Sars 1890). Ditches and swamps around Oslo, Norway, 59°54′N 10°44′E: Repository of the type material unknown.

    Syn.: *Candona rara* Müller 1900a

38. *T. (P.) sucki* (Hartwig 1901b). Pool, Treptower Wiesen, Görlitzer Bahn, Brandenburg, Germany, 53°40′N 13°15′E: Repository of the type material unknown.
39. *T. (T.) trigonella* (Klie 1931b). Small lake, Postojna Cave, Slovenia, 45°46′N 14°13′E: Syntypes, ZMK – UR-429.
40. *T. (T.) zschokkei* (Wolf 1920). Well, Basel, Switzerland, 47°34′N 07°36′E: Repository of the type material unknown.

    Syn.: *Pseudocandona delamarei* Danielopol 1973; *Pseudocandona rouchi* Danielopol 1973

Key to the species

1\. With 3 + 2 setae on second segment setal group on the Md palp 2

– With 4 + 2 or 5 + 2 setae on second segment setal group on the Md palp . 33

2\. "h1" seta is short and hook like 3

– "h1" seta longer, and not hook like (*caribbeana*-group) 18

3\. LV always overlaps RV with a flange, which could be more or less developed. Carapace triangular, trapezoidal or reniform. When reniform, dorsal margin always evenly rounded, and without flat part. Carapace is often well ornamented with pits (*eremita*-group) 4

– Reniform carapace shape, dorsal margin fiat and inclined toward anterior end, valves are symmetrical in the lateral view (*rostrata*-group) 13

4. Valves strongly ornamented 5
– Valves smooth 7
5. Male sexual bristles on A2 present . . . . *T. (T.)dispar* (Hartmann 1964)
– Male sexual bristles on A2 absent 6
6. Male G1 claw short (⅓ of G2) . . . . *T. (T.) zschokkei* (Wolf 1920)
– Male G1 claw long (as long as G2) . . . . *T. (T) pescei* Karanovic 2005d
7. Female with rounded genital field 8
– Female with additional appendage on the genital field 9
8. L7 5-segmented 11
– L7 4-segmented . . . . *T. (T.) trigonella* (Klie 1931b)
9. Flange on LV strongly developed, H equals 67% of L *T. (T.) skadari* Karanovic 2005d
– Flange on LV not strongly developed, H equals 50% of L 10
10. Male sexual bristles on A2 present . . . . *T. (T.) puteana* (Klie 1931b)
– Male sexual bristles on A2 absent . . . . *T. (T.) illiesi* (McKenzie 1971c)
11. L7 5-segmented . . . . *T. (T.) cavicola* (Klie 1935d)
– L7 4-segmented 12
12. Middle lobe on the hemipenis rounded, higher than inner lobe, females with genital process . . . . *T. (T.) eremita* (Vejdovsky 1882)
– Middle lobe on the hemipenis slightly triangular, lower than inner lobe, female without genital processes . . . . *T. (T.) slavei* (Petkovski 1969b)
13. L7 4-segmented . . . . *T. (T) lobipes* (Hartwig 1900c)
– L7 5-segmented 14
14. Posterior UR claw in male much shorter than anterior one (less than ½ L) *T. (T.) marchica* (Hartwig 1899d)
– Posterior UR claw in male longer 15
15. Middle lobe on the hemipenis broadly rounded *T. (T.) sarsi* (Hartwig 1899d)
– Middle lobe on the hemipenis rectangular 16
16. Anterior UR margin in male very curved and posterior UR claw almost straight *T. (T.) hartwigi* (Müller 1900a)
– Anterior UR margin in male not curved and posterior UR claw curved . . 17
17. Setae on endopod L6 very short (at the most one-third of the following segments), G2 in females more than two times longer than terminal segment, lobe "h" on hemipenis more elongated . . . . *T. (T.) marimotoi* (McKenzie 1972)
– Setae on endopod L6 longer (reaching distal margin of the following segments), G2 in female maximum 1.5 times longer than terminal segment, lobe "h" on hemipenis more rectangular . . . . *T. (T.) rostrata* (Brady and Norman 1889)

18. Carapace trapezoidal and ornamented 19

– Carapace different 24

19. Valves very asymmetrical in lateral view, ornamented with pits, antero-distal seta on the first segment of A1 absent . . . . . . *T. (T.) punctata* (Furtos 1933)

– Valves symmetrical in lateral view, antero-distal seta on A1 present 20

20. Surface covered with pits 21

– Surface different 22

21. Basal segment of L7 with two setae . . *T. (T.) cubensis* (Broodbakker 1983c)

– Basal segment of L7 with three setae *T. (T.) caribbeana* (Broodbakker 1983c)

22. Surface covered with circular bumps . . . . *T. (T.) fluviatilis* (Hoff 1942)

– Surface covered with reticulated patterns 23

23. Greatest $W<35\%$ of L . . . . *T. (T.) jeanneli* (Klie 1931a)

– Greatest $W>35\%$ of L . . . . *T. (T.) marengoensis* (Klie 1931a)

24. Carapace with highly arched dorsal margin, greatest H in middle, almost triangular appearance, $H = 57\%$ of L . . . . *T. (T.) arcuata* (Klie 1932)

– Carapace different 25

25. Carapace reniform in lateral view, dorsal margin acutely sloping toward frontal margin, greatest $H > 55\%$ of L 26

– Carapace reniform or elliptical in lateral view, dorsal margin gently sloping toward frontal margin, greatest $H \leq 50\%$ of L 30

26. Lobe “a” tongue like 27

– Lobe “a” different 28

27. Inner margin of CIL not following outer margin . . . . *T. (T.) renoensis* (Gutentag and Benson 1962)

– Inner margin of CIL following outer margin *T. (T.) delormei* Karanovic 2006b

28. Outer lobe on the hemipenis snail-foot shaped, greatest $H = 57\%$ of L *T. (T.) capsularis* (Klie 1935c)

– Outer lobe on the hemipenis square shaped, greatest $H = 55\%$ of L 29

29. Fingers on prehensile palps stocky . . . . *T. (T.) stagnalis* (Sars 1890)

– Fingers on prehensile palps elongated . . . . *T. (T.) semicognita* Schäfer 1934

30. Middle lobe on the hemipenis triangular 31

– Middle lobe on the hemipenis rounded 32

31. Carapace reniform, dorsal extension of lobe “a” clearly separated from the rest of hemipenis, same extension clearly lower than other lobes . . . . *T. (T.) annae* (Méhes 1914)

– Carapace elliptical, dorsal extension of the outer lobe on the hemipenis closely attached to the hemipenis, same extension almost as high as other parts . . . . *T. (T.) pedropalensis* (Méhes 1914)

32. Carapace elliptical, inner lobe on the hemipenis not double-folded, longest seta on penultimate segment on L6 shorter than same segment . . . . . *T. (T.) elliptica* (Furtos 1933) and *T. (T.) pumilis* (Würdig and Pinto 1999)
– Carapace reniform, inner lobe on the hemipenis double-folded, longest seta on penultimate segment of L6 longer than same segment . . . *T. (T.) parvula* (Sars 1926)
33. Md palp with 4 + 2 setae in the setal group, L7 with incompletely divided penultimate segment, and "h1" is as long as in the *caribbeana*-group (*prespica*-group) . . . . *T. (T.) prespica* (Petkovski 1959b)
– Md with 5 + 2 setae in the group on second segment. L7 5-segmented, "h1" long (more than 2.5 times longer than terminal segment) (*compressa*-group, subgenus *Pseudocandona* Kaufmann 1900a) 34
34. Male bristles on A2 absent 35
– Male bristles on A2 present 36
35. Valve surface pitted, middle lobe on the hemipenis rounded . . . . *T. (P.) insculpta* (Müller 1900a)
– Valve surface smooth, middle lobe on the hemipenis pointed . . . . . . *T. (P.) regisnikolai* (Karanovic and Petkovski 1999b)
36. Female genital lobe with two processes, carapace elongated laterally *T. (P.) sucki* (Hartwig 1901b)
– Female genital lobe rounded 37
37. Female G2 much shorter than terminal segment, carapace anteriorly usually more or less beak shaped in dorsal view . . . . *T. (P.) compressa* (Koch 1838)
– Female G2 much longer than terminal segment 38
38. Male "z2" claw like, carapace subovate in dorsal view, anteriorly distinctly beak shaped . . . . *T. (P.) pratensis* (Hartwig 1901a)
– Male "z2" seta like, carapace slender in dorsal view, anteriorly usually simply pointed . . . . *T. (P.) albicans* (Brady 1864)

Species not included in the key
Typhlocypris (T.) elliptica (Furtos 1933) and *T. (T.) pumilis* (Würdig and Pinto 1999) key together, and the later is probably a junior synonym of the former species. *Pseudocandona abei* Smith and Janz 2008 is very similar to *T. (T.) parvula* (Sars 1926) but it has a much longer seta "h1", and the dorsal margin of the carapace is more rounded. Unfortunately, it was described only after females and is not included in the above key. *Pseudocandona marmonieri* Namiotko and Danielopol 2004; *Pseudocandona danubialis* Lepure et al. 2007; *Pseudocandona sywulai* Namiotko et al. 2004; and *Pseudocandona transylvanica* Lepure et al. 2007 are all very similar to *T. (T.) eremita* (Vejdovsky 1882) and the original descriptions should be followed for distinguishing these five species. Two species described by Brehm (1953a, b), *Pseudocandona dichtliae* (Brehm 1953a) and *Pseudocandona*

ruttneri (Brehm 1953b) are very poorly described and are, therefore, left out from the key. *Pseudocandona mira* (Sywula 1976) and *Pseudocandona triquetroides* (Sywula 1974b) most probably belong to the genus *Schellencandona* Meisch 1996. All other species listed below are Baikal Lake endemics, and their actual position within the subfamily Candoninae should be reassessed.

List of species presently assigned to the genus *Pseudocandona* – with synonyms, type locality, and type material

1. *Pseudocandona abei* Smith and Janz 2008. S basin of Lake Biwa, N shore of Karasuma Peninsular, Japan, 35°04′21″N 135°56′08″E: Holotype (♀), LBM – 1430003332.
2. *Pseudocandona academica* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
3. *Pseudocandona alta* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
4. *Pseudocandona artuta* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
5. *Pseudocandona bazlikova* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
6. *Pseudocandona bispinosa* (Bronstein 1930). Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
7. *Pseudocandona capitata* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
8. *Pseudocandona ceratina* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
9. *Pseudocandona complexiva* Mazepova 1985. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
10. *Pseudocandona corniculata* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
11. *Pseudocandona danubialis* Lepure, Namiotko and Danielopol 2007. Well, Ada-Kaleh Island, Mehedinti Caunty, Romania, 44°43′N 22°27′E: Holotype (♂), NHMV – 20705.
12. *Pseudocandona dichtliae* (Brehm 1953a). Wells, Salzburg, Austria, 47°47′N 13°02′E: Repository of the type material unknown.
13. *Pseudocandona dorsoconcava* (Bronstein 1947). Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
14. *Pseudocandona gajewskajae* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
15. *Pseudocandona glauci* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
16. *Pseudocandona grumifera* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
17. *Pseudocandona herbigrada* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.

18. *Pseudocandona inaequivalvis* (Bronstein 1930). Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
19. *Pseudocandona lukini* Mazepova 1985. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
20. *Pseudocandona malomorica* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
21. *Pseudocandona marmonieri* Namiotko and Danielopol 2004. Cave Amiel, Plateau d'Anglars-Amiel, Penne, Department of Tarn, Midi-Pyrénées, Massif des Causses, France, 43°50′N 02°00′E: Holotype (♂), LIM – collection number unknown.
22. *Pseudocandona mira* (Sywula 1976). Well, Rajeza Kukukow, District Zywiec, Poland, 49°41′N 19°13′E: Holotype (♀), DAIE – collection number unknown.
23. *Pseudocandona olchonica* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
24. *Pseudocandona onduotoryensis* Mazepova 1984. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
25. *Pseudocandona parvispinosa* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
26. *Pseudocandona pseudosetosa* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
27. *Pseudocandona renalis* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
28. *Pseudocandona ruttneri* (Brehm 1953b). Well, Salzburg, Austria, 47°47′N 13°02′E: Repository of the type material unknown.
29. *Pseudocandona saxatilis* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
30. *Pseudocandona scita* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
31. *Pseudocandona setosa* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
32. *Pseudocandona sywulai* Namiotko et al. 2004. Cave Đuredina, near village Dugopolje, Split, Croatia, 43°34′N 16°36′E: Holotype (♀), MNSS – 1001.
33. *Pseudocandona transylvanica* Lepure, Namiotko and Danielopol 2007: Well, Suncuius Village, Bihor County, Romania, 46°56′N 22°32′E: Holotype (♂), NHMV – 20707.
34. *Pseudocandona triquetroides* (Sywula 1974b). Olszowy stream, Mt. Turbacz, Poland, 49°32′N 20°07′E: Holotype (♀), ZIPAS – collection number unknown.
35. *Pseudocandona tuberculata* Bronstein 1947. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
36. *Pseudocandona valosa* Mazepova 1982. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
37. *Pseudocandona valosiformis* Mazepova 1990. Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.
38. *Pseudocandona werestschagini* (Bronstein 1930). Lake Baikal, Russia, 54°00′N 109°00′E: Repository of the type material unknown.

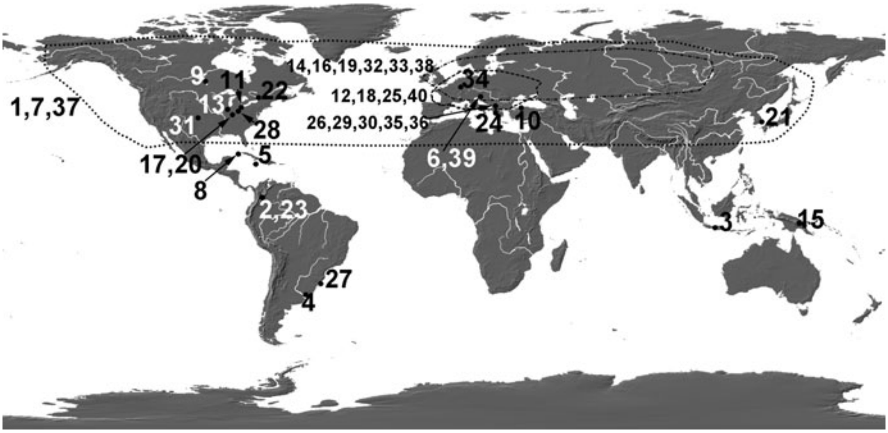


Fig. 50 Distribution of *Typhlocypris* Vejdovsky 1882: Numbers correspond to the species list

Ecology and distribution (Fig. 50)
The species can be found in permanent freshwater bodies and are often found in the subterranean waters. The genus has a world-wide distribution; however, most of the species have been described from the Holarctic.

3.1.2 Tribe Candonopsini Karanovic 2004 (Fig. 51a, b)

Diagnosis (after Karanovic 2004): Carapace shape various (reniform, elongated, trapezoidal), ornamentation possible, hinge adont. CMS conforming to general pattern of Candoninae. A1 7-segmented (Fig. 52d) or the number of segments reduced (Fig. 52c). Male sexual bristles on A2 present (Fig. 52b) or absent. Terminal claw of Md palp broadly fused with the apical segment (Fig. 53c), externally accompanied with one distinctly weaker claw; vibratory plate with eight filaments (Fig. 51d). Penultimate segment of Mxl palp dilated (Fig. 51c). L5 with one or two “a” setae (Fig. 54d). Vibratory plate of the same appendage with one, two or three rays. Prehensile palps with only one subterminal sclerotized structure being well developed (other one small or completely absent) (Fig. 53d, e). L6 5-segmented (Fig. 54a, b), L7 5-segmented (Fig. 54c). Terminal segment of L7 with two long and one short setae (Figs. 51f and 53a). UR without posterior seta, posterior claw well developed, reduced or missing (Fig. 55c). Hemipenis with triangular and extended outer lobe, inner lobe flat, middle lobe very small or absent (Figs. 51e and 55b). Sometimes two outer lobes present (Fig. 55a). Female genital field without processes. Zenker organ well developed and stocky in appearance, with seven whorls of spines.

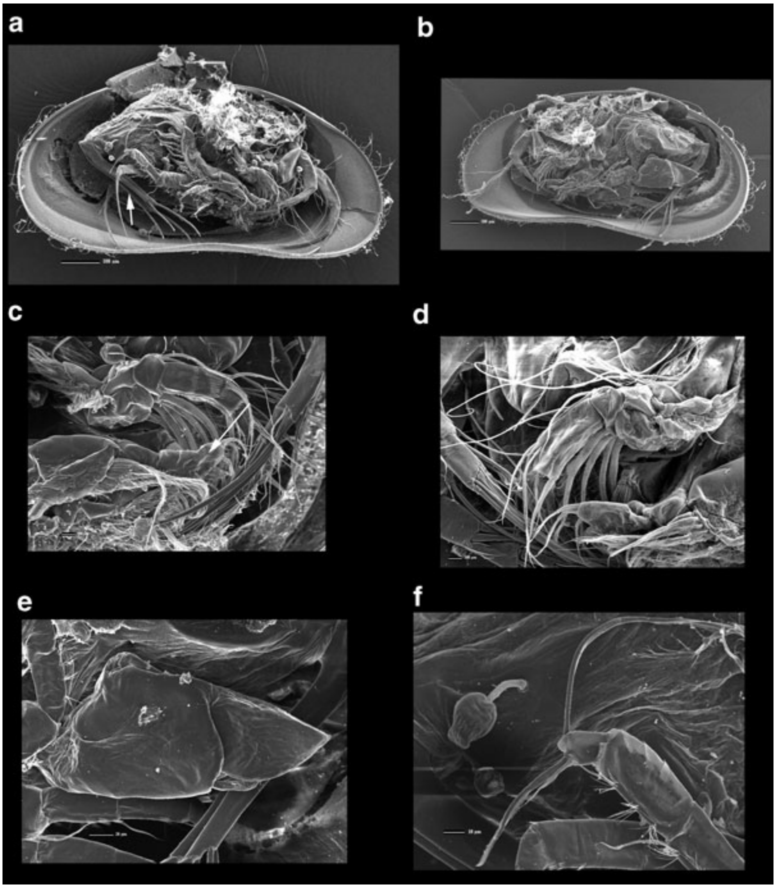


Fig. 51 SEM: *Candonopsis kingsleii* (Brady and Robertson 1887): (**a**) ♀, inside view, showing the absence of the posterior seta on the UR; (**b**) ♂, inside view; (**c**) Md and Mxl, showing the enlarged first segment of the palp; (**d**) Md palp; (**e**) hemipenis; (**f**) distal part of L7

Type genus: *Candonopsis* Vávra 1891

Other genera: *Caribecandona* Broodbakker 1983c; *Cubacandona* Broodbakker 1983c; *Marococandona* Marmonier et al. 2005; and *Pioneercandonopsis* Karanovic 2005c.

Key to the genera

1. Outer lobe on the hemipenis with two dorsal projections (Fig. 55a) 2
– Outer lobe on the hemipenis with only one dorsal projection (Fig. 55b) . . . 4
2. A1 7-segmented . . . . *Cubacandona* Broodbakker 1983c
– A1 with reduced number of segments 3

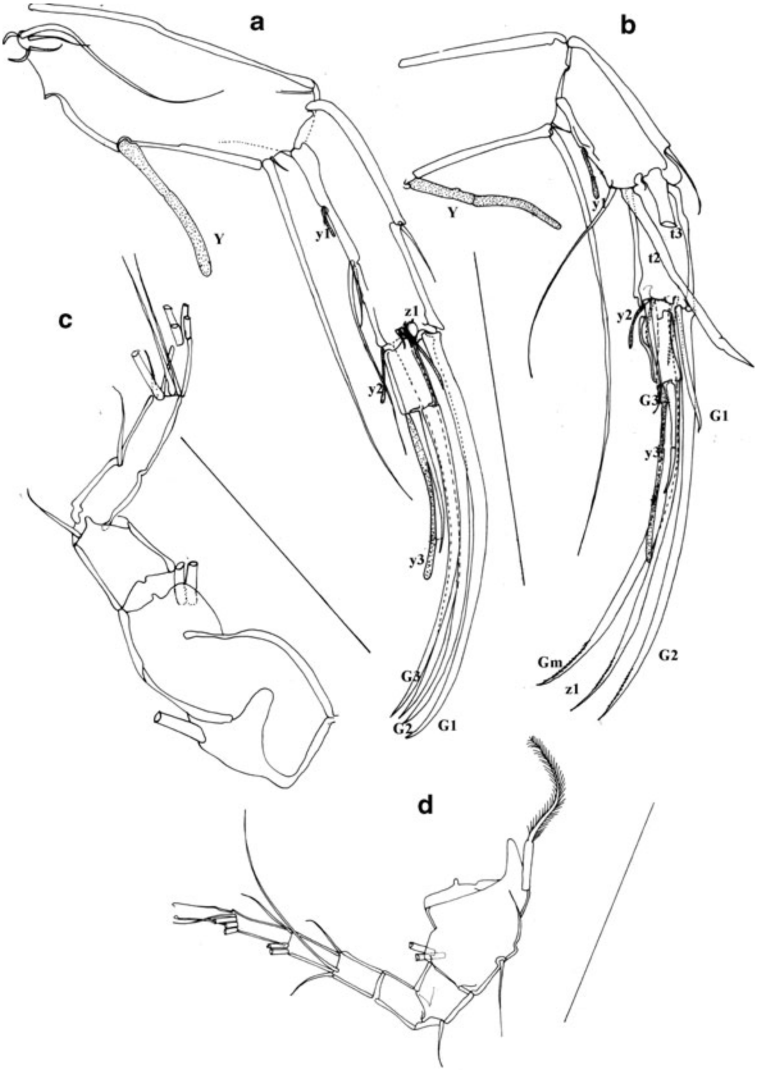


Fig. 52 Line drawings: (**a**, **b**) *Candonopsis pilbarae* Karanovic 2007; (**c**) *Pioneercandonopsis hancocki* Karanovic 2005c; (**d**) *Candonopsis dedeckkeri* Karanovic 2007: (**a**) A2, ♀; (**b**) A2, ♂; (**c**, **d**) A1. Scales = 0.1 mm

3. A1 6-segmented, posterior claw on UR reduced . . . . *Caribecandona* Broodbakker 1983c

– A1 4-segmented (Fig. 52c) posterior UR claw present . . . . *Pioneercadnondonopsis* Vávra 1891

4. Seta “d1” on L6 present (Fig. 54a) 5

– Seta “d1” on L6 absent . . . . *Marococandona* Marmonier et al. 2005

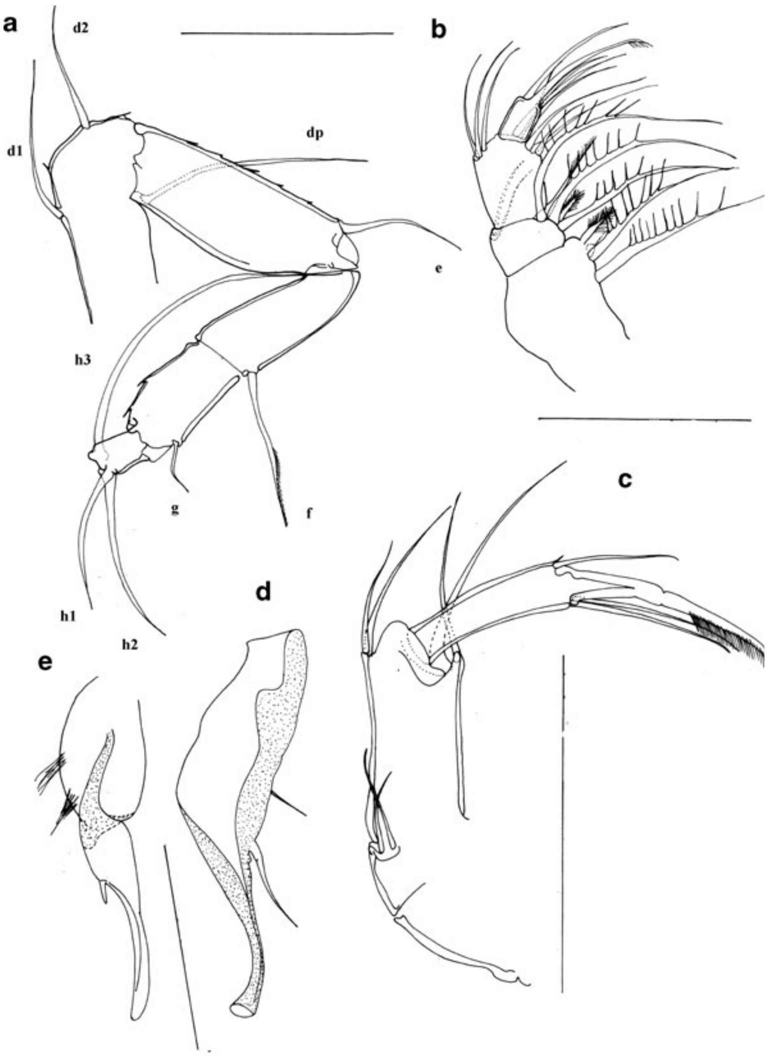


Fig. 53 Line drawings: (**a**, **b**) *Latinopsis patagonica* Karanovic and Datry 2009; (**c**–**e**) *Candonopsis pilbarae* Karanovic 2007: (**a**) L7; (**b**) C, Md palp; (**d**, **e**) prehensile palps. Scales = 0.1 mm

5. Terminal segment of the Md palp more than three times longer than broad (Fig. 53c) . . . . *Candonopsis* Vávra 1891
– Terminal segment almost square (Fig. 53b) . . . . *Latinopsis* Karanovic and Datry 2009

Candonopsis Vávra 1891

Systematics

The genus is divided into two subgenera: *Candonopsis* Vávra 1891 and *Abcandonopsis* Karanovic 2004.

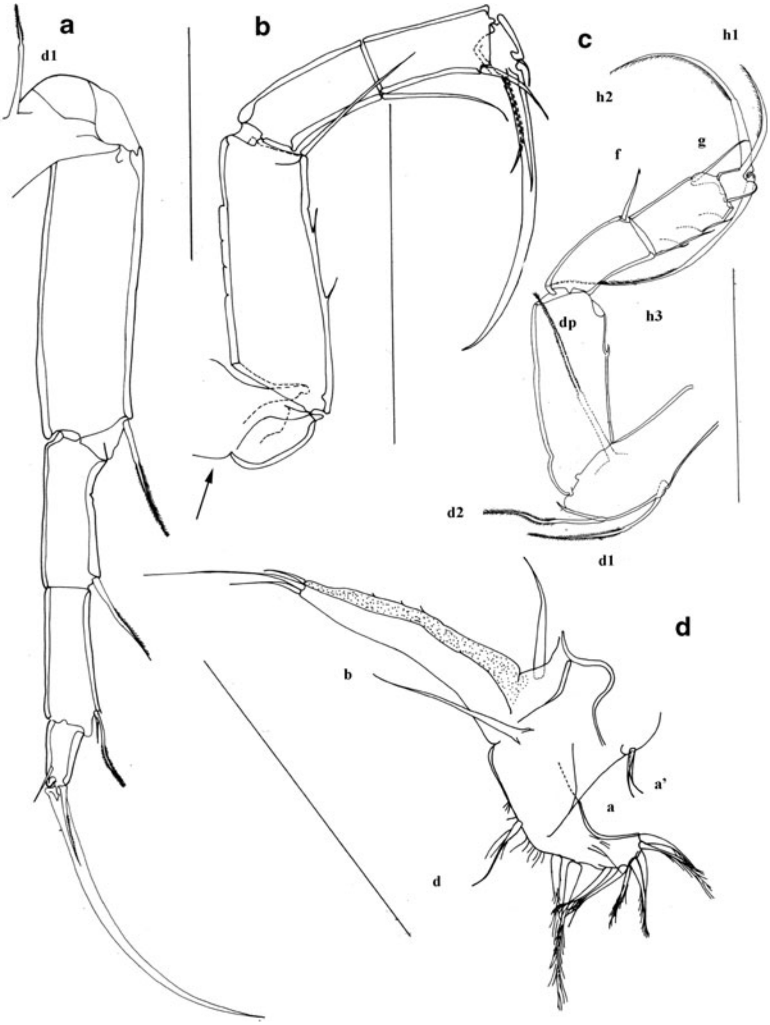


Fig. 54 Line drawings: (**a**) *Latinopsis patagonica* Karanovic and Datry 2009; (**b**, **d**) *Candonopsis dedeckkeri* Karanovic 2007; (**c**) *Candonopsis pilbarae* Karanovic 2007: (**a**, **b**, L6, showing the absence of the basal seta; (**c**) L7; (**d**) L5. Scales = 0.1 mm

Key to the subgenera

1. Basal segment of L6 with one seta . . . . *Candonopsis* Vávra 1891
– Basal segment without any seta . . . . *Abcandonopsis* Karanovic 2004

Subgenus *Abcandonopsis* Karanovic 2004

Diagnosis (after Karanovic 2004): Carapace reniform, smooth. In dorsal view, female carapace strongly asymmetrical. MPC short, straight, and dense. A1 7-segmented. A2 with 3-segmented endopodite in females (Fig. 52a), and 4-segmented

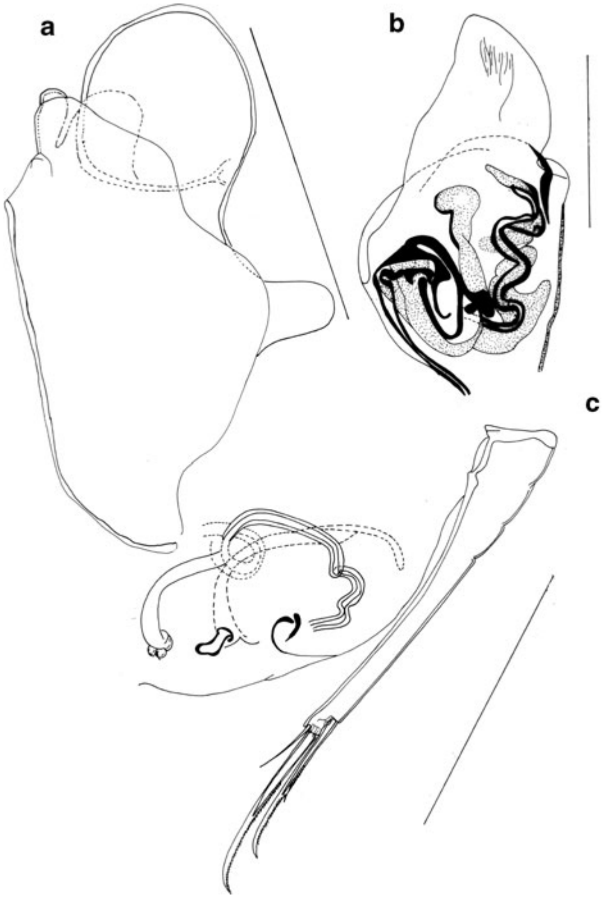


Fig. 55 Line drawings: *Pioneercandonopsis hancocki* Karanovic 2005c; (**b**) *Candonopsis pilbarae* Karanovic 2007; (**c**) *Candonopsis dedeckkeri* Karanovic 2007: (**a**, **b**) hemipenis; C, UR

in males (Fig. 52b)(male sexual bristles developed). Terminal segment of Md palp three times longer than wide, apical claw broadly fused with segment (Fig. 53c). Penultimate segment of Mxl palp dilated. Male prehensile palps asymmetrical, right one more stocky. Both palps with only one sclerotized seta. L6 5-segmented; basal segment without any seta (Fig. 54b). L7 5-segmented; basal segment sometimes with only "d1" and "dp" setae present, endopodal seta "e" and "f "sometimes missing. Terminal segment of same appendage with two long and one short seta. Posterior UR seta absent, posterior claw absent or well developed. Hemipenis: outer lobe more or less triangular, but always distinctly higher than the other two lobes. Female genital field without any appendages.

Type species: *C.* (*A.*) *williami* Karanovic and Marmonier 2002

Species list with type locality and type material

1. *C.* (*A.*) *aula* Karanovic 2004. Bore 13, Argyle Diamond Mine, Kimberley, WA, Australia, 16°43′S 128°24′E: Holotype (♀), WAM – C28442.
2. *C.* (*A.*) *dedeckkeri* Karanovic 2007. Borehole Well, NOREENA14, Pilbara Region, WA, Australia, 22°24′51″S 120°20′27″: Holotype (♀), WAM – C33473.
3. *C.* (*A.*) *inafecta* Karanovic 2007. HD3/00, Harding Dam, Pilbara Region, WA, Australia, 20°58′13″S 117°05′25″E: Holotype (♀), WAM – C33474.
4. *C.* (*A.*) *indoles* Karanovic 2004. Bore MB 30 S, Argyle Diamond Mine, Kimberley, WA, Australia, 16°41′S 128°27′E: Holotype (♀), WAM – C28446.
5. *C. (A.) linnaei* Karanovic 2008b. Bore NLV, Lake Way, Murchison Region, WA, Australia, 26°50′4″S 120°19′38″E: Holotype (♂), WAM – C35715.
6. *C.* (*A.*) *pilbarae* Karanovic 2007. NPM02, Mickey's Well, Pilbara Region, WA, Australia, 21°05′49″S 119°21′6″: Holotype (♂), WAM – C33475.
7. *C.* (*A.*) *williami* Karanovic and Marmonier 2002. GSWA 15, Paroo Station, Wiluna, Murchison Region, WA, Australia, 26°20′S 119°47′E: Holotype (♂), WAM – C28303.

Key to the species

1. A1 6-segmented . . . . *C. linnaei* Karanovic 2008b
– A1 7-segmented 2
2. UR with only one claw . . . . *C. aula* Karanovic 2004
– UR with two claws 3
3. Seta "d2" on basal segment of L7 absent 4
– Seta "d2" on basal segment of L7 present 6
4. Carapace ornamented ventrally, and the greatest H in front of the middle . . *C. inaffecta* Karanovic 2007
– Carapace smooth and greatest H around the middle or behind 5
5. Dorsal margin of the carapace straight, lobe "a" on the hemipenis rounded, second and third endopodal segments of L7 incompletely divided . . *C. indoles* Karanovic 2004
– Dorsal margin of the carapace rounded, outer lobe of the hemipenis pointed distally, second and third endopodal segments on L7 completely divided . . *C. williami* Karanovic and Marmonier 2002
6. Seta "f" on L7 absent . . . . *C. dedeckkeri* Karanovic 2007
– Seta "f" on L7 present . . . . *C. pilbarae* Karanovic 2007

Ecology and distribution

The subgenus is known only from the subterranean waters and it is endemic to Australia (Fig. 56).

Fig. 56 Distribution of *Abcandonopsis* Karanovic 2004: Numbers correspond to the species list

Subgenus *Candonopsis* Vávra 1891

Diagnosis: Carapace shape variable, but mostly reniform, surface smooth or ornamented. A1 7-segmented. A2 with 3-segmented endopod in females, and 4-segmented in males (male sexual bristles developed). Terminal segment of Md palp more than three times longer than wide, apical claw broadly fused with segment. Penultimate segment of Mxl palp dilated. Male prehensile palps extremely asymmetrical, right one considerably inflated in comparison to the left one. Both palps with only one sclerotized seta. L6 5-segmented; basal segment with one seta. L7 5-segmented; basal segment with all three setae present. Both setae "e" and "f" usually present. Terminal segment of same appendage with two long and one short seta. Posterior seta on the UR absent, posterior claw reduced or well developed. Hemipenis: outer lobe more or less triangular, but always distinctly higher than the other two lobes. Female genital field without any appendages.

Type species: *C. kingsleii* (Brady and Robertson 1870)

Species list with synonyms, type locality, and type material

1. *C.* (*C.*) *africana* Klie 1944. Ngoma, Lake Kiwu, DR Congo, 01°40′S 29°13′E: Syntypes, ZMK – UR-1229–31; 1366.
2. *C.* (*C.*) *anteroacuta* Rome 1962. Edith By, Tanzania, 06°30′S 29°55′E: Holotype (♂), RBINS – O.C. 507.
3. *C.* (*C.*) *boui* Danielopol 1978c. Well, Albi, Midi-Pyrénées, France, 43°56′N 02°09′E: Holotype (♂), LIM – collection number unknown.
4. *C.* (*C.*) *brasiliensis* Sars 1901. Dried mud samples, Sao Paulo, Brazil, 23°32′S 46°38′W: Repository of the type material unknown.
5. *C.* (*C.*) *bujukuensis* Löffler 1968. Bujuku Stream, Uganda, 00°22′N 29°58′E: Types, LIM – collection numbers unknown.
6. *C.* (*C.*) *dani* Karanovic and Marmonier 2002. GWMB next to Pump 1, Lake Violet Borefield, Wiluna, Murchison Region, WA, Australia, 26°40′S 120°14′E: Holotype (♂), WAM – C28282.

7. C. (C.) *fessleri* Löffler 1968. Mawezi Tarn, Tanzania, 03°05′S 37°27′E: Types, LIM – collection numbers unknown.
8. C. (C.) *hummelincki* Broodbakker 1983c. S 78/119, Open half-natural well near post office of Spanish Town, Virgin Gorda, British Virgin Islands,18°26′42″N 64°26′26″W: Holotype (♀), ZMA – Ost.150.582.
9. C. (C.) *kimberleyi* Karanovic and Marmonier 2002. Wagon Pass drill hole NRD 114, Kimberley, WA, Australia, 17°10′31″S 124°37′56″E: Holotype (♂), WAM – C28359.
10. C. (C.) *kingsleii* (Brady and Robertson 1870). River Nene, England, UK, 52°48′N 00°13′E: Repository of the type material unknown.
11. C. (C.) *mareza* Karanovic and Petkovski 1999b. Mareza Spring, Podgorica, Montenegro, 42°28′N 19°11′E: Holotype (♂), ZMH – K-42341.
12. C. (C.) *murchisoni* Karanovic and Marmonier 2002. Old Cue water supply bores, Murchison Region, WA, Australia, 27°16′S 117°54′E: Holotype (♂), WAM – C28272.
13. C. (C.) *nama* Daday 1913. Standpipe, between Berseba and Bethanie, Karas, Namibia, 26°00′S 17°50′E: Repository of the type material unknown.
14. C. (C.) *navicula* Daday 1910a. Kilimanjaro, Tanzania, 03°45′S 37°45′E: Types, HMNH – IV/P-36.

    Syn.: C. (C.) *depressa* Rome 1962; C. (C.) *dorsorecta* Rome 1962

15. C. (C.) *putealis* Klie 1932. Well in house Tjikomoh (Cikomoh?) 10, Bogor, West Java, Indonesia, 06°35′S 106°47′E: Syntypes, ZMK – UR-323.
16. C. (C.) *scourfieldi* Brady 1910b. Catfield Fen, Norfolk, England, UK, 52°44′N 01°32′E: Repository of the type material unknown.

    Syn.: C. *parva* Sywula 1968; C. *stammeri* Nüchterlein 1969

17. C. (C.) *solitaria* Vávra 1895a, b. Zanzibar, Tanzania, 06°09′S 39°11′E: Repository of the type material unknown.
18. C. (C.) *sumatrana* Klie 1932. Lake Singkarak, West Sumatra, Indonesia, 00°36′S 100°32′E: Syntypes, ZMK – UR-322.

    Syn.: C. (C.) *calva* Harding 1962

19. C. (C.) *tenuis* (Brady 1886b). Condong, NSW, Australia, 28°20′S 153°25′E: Repository of the type material unknown.
20. C. (C.) *thienemanni* Schäfer 1945. Well, Armenion, Greece, 39°29′N 22°42′E: Repository of the type material unknown.
21. C. (C.) *transgrediens* Brehm 1923b. Marsh, Canton, China, 23°07′N 113°15′E: Repository of the type material unknown.
22. C. (C.) *trichota* Schäfer 1945. Well, Armenion, Greece, 39°29′N 22°42′E: Repository of the type material unknown.
23. C. (C.) *urmilae* Gupta 1988. Well, Belan Bazar, Monghyr, Bihar, India, 25°23′N 86°28′E: Holotype (♂), ZSI – A-1032.
24. C. (C.) *westaustraliensis* Karanovic and Marmonier 2002. Bore at shearing quarters, Depot Springs Station, Murchison Region, WA, Australia, 27°56′S 120°05′E: Holotype (♂), WAM – C28364.

Key to the species (after Karanovic and Marmonier 2002)

1. Posterior UR claw reduced 2
– Both UR claws developed, and well sclerotized 3
2. Posterior UR claw reduced into thin, long seta (more than 1/2 L of anterior claw) . . . . *C. thienemani* Schäfer 1945
– Posterior furcal claw reduced into swollen, papoose and short seta (less than ⅓ L of anterior) . . . . *C. westaustraliensis* Karanovic and Marmonier 2002
3. Seta “f” missing . . . . *C. kimberleyi* Karanovic and Marmonier 2002
– Seta “f” present 4
4. Anterior claw on UR shorter than ramus 5
– Anterior claw on UR clearly longer than ramus . . . . . *C. urmilae* Gupta 1988
5. Valves strongly asymmetrical: dorsally RV overlaps LV with flange 6
– RV equally high, or lower than LV 7
6. Claws on UR of subequal L, or anterior claw slightly longer than posterior one (at the most 1.2 times) . . . . . *C. murchisoni* Karanovic and Marmonier 2002
– Anterior claw on UR always markedly longer than posterior one (at least 1.4 times) . . . . *C. dani* Karanovic and Marmonier 2002
7. L: W ratio of terminal segment of Md palp 7:1 or less 8
– L: W ratio of terminal segment of Md palp 9:1 . *C. anteroacuta* Rome 1962
8. Setae “e” and “f” on L7 extremely short . . . . *C. navicula* Daday 1910a
– Same setae at least reaching ⅓ of following segments 9
9. Neither of UR claws carries spine 10
– At least one of furcal claws with distinct spine 14
10. Carapace subtriangular 11
– Carapace reniform to subreniform, elongated 12
11. Anterior and posterior ends of carapace covered with long, stiff, spine-like hairs, posterior and anterior UR claws equally long . . . . . . *C. trichota* Schäfer 1945
– Anterior and posterior ends of carapace with fine hairs, posterior UR claw shorter . . . . *C. mareza* Karanovic and Petkovski 1999b
12. L: W ratio of terminal segment of Md palp less than 4:1 13
– L: W ratio of terminal segment of Md palp 5:1 up to 6:1 . . . . *C. kingsleii* (Brady and Robertson 1870)
13. Outer lobe of hemipenis more triangular and pointed *C. boui* Danielopol 1978c
– Same lobe more squarish and oblong . . . . *C. scourfieldi* Brady 1910b
14. Anterior UR seta missing . . . . *C. putealis* Klie 1932
– Anterior UR seta present 15
15. L of carapace between 0.55 mm and 0.65 mm . . *C. solitaria* Vávra 1895a, b
– L. of carapace always more than 0.75 mm 16
16. Anterior UR claw with strong spine, while on posterior claw spine sometimes weaker 17

– Posterior claws always with strong spine, while spine on anterior claw very weak 19

17. All t-setae in female on A2 developed 18

– Just two t-setae present . . . . *C. tenuis* (Brady 1886b)

18. L of carapace more than 0.85 mm, L:W ratio of terminal segment of Md palp 6:1 . . . . *C. africana* Klie 1944

– L of carapace less than 0.7 mm and L:W ratio of terminal segment of Md palp 7:1 . . . . *C. hummelincki* Broodbakker 1983c

19. In lateral view, dorsal margin equally rounded, with greatest H around middle 20

– In lateral view, greatest H on the last third, from which point margin rounded toward posterior, and inclined toward anterior end . . . *C. sumatrana* Klie 1932

20. Seta “h2” 1.5 times longer than “h1” . . . . *C. nama* Daday 1913

– Seta “h2” more man 2.5 times longer than “h1” . . *C. bujukuensis* Löffler 1968

Species not included in the key

Three species are not included in the key: *C.* (*C.*) *fessleri* Löffler 1968 and *C.* (*C.*) *transgrediens* Brehm 1923b and *C. (C.) brasiliensis* Sars 1901. The first species is very similar to *C. bujukuensis* Löffler 1968 and it was originally described as its subspecies. The later two species are insufficiently described and are hard to distinguish from the other representatives of the genus.

Ecology and distribution (Fig. 57)

The species of the subgenus *Candonopsis* usually live in the permanent freshwater bodies, occasionally in the subterranean waters, the subgenus has a wide distribution, but mostly in the Southern Hemisphere.

***Caribecandona* Broodbakker 1983c**

Diagnosis: Carapace shape trapezoidal or triangular (with trapezoidal valves). A1 6-segmented. A2 sexually dimorphic, t-setae transformed in males. The third segment of the Md palp 2.7 times L of the fourth segment. Male prehensile palps

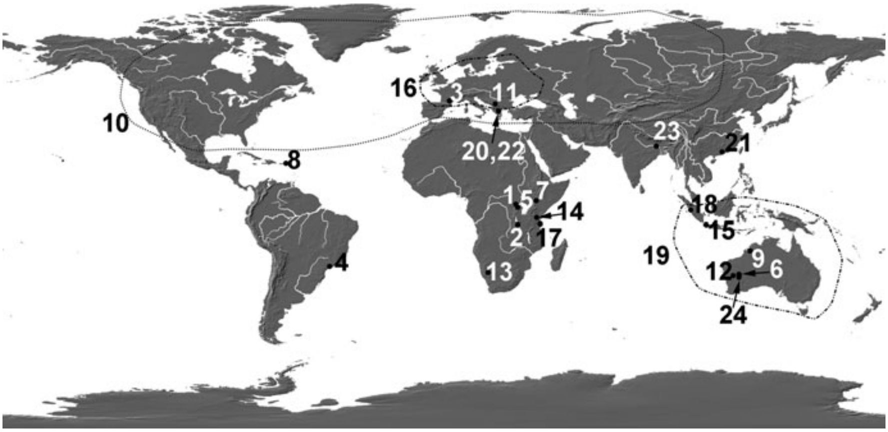


Fig. 57 Distribution of *Candonopsis* Vávra 1891: numbers correspond to the species list

asymmetrical, longitudinally twisted, with a strong subterminal claw accompanied by a small spine, and terminate in soft claws. Basal segment of L6 with basal seta. Basal segment of L7 with all three setae present, setae “e,” “f,” and “g” also present. The outer lobe of the hemipenis divided. Posterior claw of the UR reduced.

Type species: *C. trapezoidea* Broodbakker 1983c

Species list with type locality and type material

1. *C. ansa* Broodbakker 1983c. Not covered well of Gaby Gabriel, at Dessalines (Street Jacques Ier), Dépt de l′ Artibonite, Haiti, 19°15′36″N 72°31′01″W: Holotype (♀), ZMA – Ost.150.800.
2. *C. auricularia* Broodbakker 1983c. Well of Mrs. Tissé-Coriolan, at Dumonet, between Caiman and Debas, about 200 m of the "Trou Caiman," a large karst spring, Dépt de l’Ouest, Haiti, 18°38′58″N 72°06′58″W: Holotype (♀), ZMA – Ost.150.797.
3. *C. trapezoidea* Broodbakker 1983c. Round covered well near a house in Gressier, N side of road D 200, Dépt de l’Ouest, Haiti, 18°32′23″N 72°31′13″W: Holotype (♀), ZMA – Ost.150.794.

Key to the species

1. LV with rounded dorsal protuberance (or comb) 2
– LV without such protuberance . . . . *C. trapezoidea* Broodbakker 1983c
2. Lobe “a′” on the hemipenis elongated, dorsal margin on LV straight on all its L *C. ansa* Broodbakker 1983c
– Lobe “a′” short, dorsal margin straight only in the middle, inclined toward both ends . . . . *C. auricularia* Broodbakker 1983c

Fig. 58 Distribution of *Caribecandona* Broodbakker 1983c: numbers correspond to the species list

Ecology and distribution (Fig. 58)
The species live mainly in the subterranean waters and are endemic to the Caribbean.

Cubacandona Broodbakker 1983c

Diagnosis: A1 7-segmented. Male A2 without t-setae transformed. The third segment of the Md palp 2.7 times L of the fourth segment. Male prehensile palps asymmetrical, longitudinally twisted, with a strong subterminal claw accompanied by a small spine, and terminate in soft claws. Basal segment of L6 with basal seta. Basal segment of L7 with all three setae present. The outer lobe of the hemipenis divided. Posterior claw of the UR normally developed.

Type and only species: *C. cubensis* Danielopol 1978c. Bore in a tunnel, Cayo Caguanes Island, Las Villas, Cuba, 22°23′N 79°08′W: Holotype (♂), LIM – collection number unknown.

Ecology and distribution
The species have so far been found in subterranean water, but also in surface, open water bodies. The genus is endemic to Central and South America.

Latinopsis Karanovic and Datry 2009

Diagnosis (after Karanovic and Datry 2009): Valves in lateral view reniform/subreniform. Valve surface smooth, only covered with small setae. LV overlapping RV on all free margins, postero-dorsally often with postero-dorsal flange. CIL narrow on both ends. MPC short and straight, posteriorly barely visible. A1 7-segmented. Male A2 with setae t2 and t3 transformed into sexual bristles; seta z1 seta like, z2 transformed into a claw, z3 seta like. Claws G1 and G3 reduced, latter one seta like. In female, G2 claw as long as other claws on penultimate segment. Terminal segment on Md palp short, only 1.5 times longer than wide. Terminal segment of Mxl palp rectangular. Prehensile palps almost symmetrical with left one being more elongated. L6 with basal seta. L7 with three setae on basal segment, “e,” “f,” and “g” setae present, terminal segment with two long and one short setae. UR without posterior seta, anterior and posterior claws both well developed. Hemipenis with one outer and one inner lobe. Inner lobe prominent and distinctly separated from the outer one. Genital lobe in the female rounded, or with small processes.

Type species: *L. patagonica* Karanovic and Datry 2009

Species list with type locality and type material

1. *L. anisitsi* (Daday 1905). Inundation of a brook that crosses the way from Areguá to Ypacarai Lagoon, Central, Paraguay, 25°18′S 57°14′W: Types, HMNH – IV/P-33–35.
2. *L. columbiensis* (Méhes 1914). Pool, Sabana, Bogota, Columbia, 10°29′N 75°18′W: Repository of the type material unknown.

3. *L. falklandica* (Vávra 1898). Freshwater pool, Stanley, East Falkland, Falkland Islands, 51°42′S 57°51′W: Repository of the type material unknown.
4. *L.patagonica* Karanovic and Datry 2009. PAC BEN2 (locality code), Pacific cave area, Madre de Dios Archipelago, Chile, 50°22′35″S 75°27′24″W. Holotype (♂), TMAG – G5897.

Key to the species

1. Carapace subtrapezoidal, dorsal margin straight in the middle .... *L. anisitsi* (Daday 1905)

– Carapace subreniform, dorsal margin rounded 2

2. Greatest H situated in the middle 3

– Greatest H situated behind middle .... *L. columbiensis* (Méhes 1914)

3. Inner lobe of the hemipenis, with sinusoid distal margin, but rounded ventral margin .... *L. falklandica* (Vávra 1898)

– Ventral margin of the inner lobe pointed (forming a triangle) ... *L. patagonica* Karanovic and Datry 2009

Ecology and distribution (Fig. 59)
The genus is mostly found in open freshwater bodies. It is endemic to South America.

Marococandona Marmonier et al. 2005

Diagnosis (after Marmonier et al. 2005): Carapace rectangular in lateral view, compressed in dorsal view, LV overlapping RV, no significant sexual dimorphism except size. A1 with reduced chaetotaxy (lack of seta on the third article) and

Fig. 59 Distribution of *Latinopsis* Karanovic and Datry 2009: Numbers correspond to the species list

number of article in some species (third article fused with the fourth). A2 with elongated Y aesthetasc, penultimate segments fused without male bristles, number of "t" setae reduced to one or zero. Two terminal segments of Md palp conspicuously elongated. L5 with only one "a" seta and a vibratory plate with two to three filaments. Basal segment of L6 without seta. Basal segment of L7 with two setae, "e" and "f" setae missing, one short and two long setae on the terminal segment. UR without posterior seta, in some species UR reduced to a ramus and a single claw. Prehensile palp weakly sclerotized, strongly asymmetric, with a triangular section and a stocky distal part. Hemipenis, outer lobe elongated, roundly pointed, with a distal orientation.

Type species: *M. danielopoli* Marmonier et al. 2005

Species list with type locality and type material

1. *M. danielopoli* Marmonier et al. 2005. Well, Seyad-Noum Catchment, Guelmin Area, Morocco, 28°59′N 10°03′W: Holotype (♂), RBINS – O.C. 2893.
2. *M. nicolae* Marmonier et al. 2005. Well near Agadir, W part of Souss valley, on right side of Oued Souss, Morocco, 30°25′N 09°35′W: Holotype (♂), RBINS – O.C. 2899.

Key to the species

1. A1 6-segmented .... *M. nicolae* Marmonier et al. 2005
– A1 7-segmented .... *M. danielopoli* Marmonier et al. 2005

Ecology and distribution (Fig. 60)
The species prefer subterranean waters. The genus is endemic to Morocco.

Fig. 60 Distribution of *Marococandona* Marmonier et al. 2005: numbers correspond to the species list

Pioneercandonopsis Karanovic 2005c

Diagnosis (after Karanovic 2005c): Carapace subreniform, surface smooth. CIL narrow posteriorly, wider anteriorly. A1 4-segmented (Fig. 52c). Male sexual bristles on A2 present. Claws G1 and G3 in male A2 reduced into setae; "z1" and "z2" setae transformed into claws, former one considerably shorter; "z3" seta like. Terminal segment of Md palp with broadly fused central claw; L:W of same segment equals 1.1:1. Mxl palp with rectangular terminal segment. Prehensile palps symmetrical. L6 5-segmented, basal segment without any seta. L7 5-segmented; basal segment with all setae (dp, dl, and d2); setae "e" and "g" present, while seta "f" missing. Both claws on UR present and long. Hemipenis with all lobes developed, and the outer one divided (Fig. 55a).

Type and only species: *P. hancocki* Karanovic 2005c

Species list with type locality and type material

P. hancocki Karanovic 2005c. Bore No. 125004B, Pioneer Valley, Qld, Australia, 21°08′39″S 148°35′24″E: Holotype (♂), QM – W27255.

Ecology and distribution

The species is a stygobiont and is endemic to Australia.

3.1.3 Tribe *Cryptocandonini* Karanovic 2007 (Fig. 61)

Diagnosis (after Karanovic 2007): Candoninae of a medium size, often laterally compressed. A1 7-segmented, A2 always with male sexual bristles. Prehensile palps asymmetrical, robust. L6 with basal seta, L7 with all basal setae always present, terminal segment with two short and one long setae. UR never reduced. Posterior seta always present. Female genital field without any projections, Hemipenis robust with big dorsal projection of lobe ″a″. Zenker organ with 7 whorls of spines.

Type (and only) genus: *Cryptocandona* Kaufmann 1900a

Cryptocandona Kaufmann 1900b

Diagnosis: Same as for the tribe.

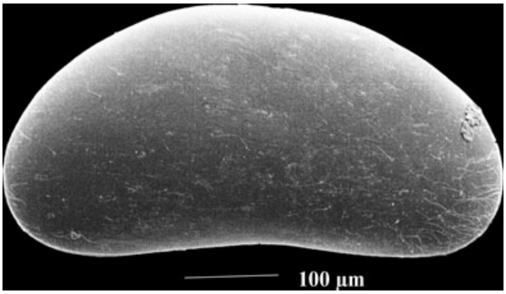


Fig. 61 SEM: *Cryptocandona vavrai* Kaufmann 1900: RV, outside view. Photo: D. Keyser

Type species: *C. vavrai* Kaufmann 1900b

Species list with synonyms, type locality, and type material

1. *C. angustissima* (Ekman 1914). Spring at Lagan River, Berga parish, S Småland, Sweden, 56°33′N 12°56′E: Repository of the type material unknown.
2. *C. brehmi* (Klie 1934b). Pond in a cave, Hirowagara, Province Shinano, Japan, 36°48′N 138°18′E: Syntypes, ZMK – UR-342.
3. *C. cyproides* (Daday 1905). Pond at railway, between Luque (Lugua) and Areguá, Central, Paraguay, 25°15′S 57°25′W: Types, HMNH – IV/P-198.
4. *C. dudichi* (Klie 1930b). Well, Nagykallo, Szabolcs-Szatmár-Bereg, Hungary, 47°52′N 21°50′E: Syntypes, ZMK – UR-340, 1332.
5. *C. kieferi* (Klie 1938f). Well, Salzburg, Austria, 47°47′N 13°02′E: Syntypes, ZMK – UR-327-9, 1392–6.

   Syn.: *C. juvavi* Brehm 1953b

6. *C. leruthi* (Klie 1936b).Well, Hermalle, Wallonia, Belgium, 50°43′N 05°41′E: ZMK – UR-341.
7. *C. longipes* (Ekman 1908). Wet moor near River Abiskojokk, birch-zone of Torneträsk area, Norrbotten, Sweden, 68°21′N 18°46′E: Repository of the type material unknown.
8. *C. matris* (Sywula 1976). Interstitial waters, River San, 1 km downstream from mouth of Hoczewka stream, Poland, 49°26′N 22°20′E: Holotype (♂), DAIE – collection number unknown.
9. *C. phreaticola* (Klie 1927b). Well, Nagykallo, Szabolcs-Szatmár-Bereg, Hungary, 47°52′N 21°50′E: Syntypes, ZMK – UR-344.
10. *C. pygmaea* (Ekman 1908). Wet moor near River Abiskojokk, lower part of birch-zone, Torneträsk area, Norrbotten, Sweden, 68°21′N 18°46′E: Repository of the type material unknown.
11. *C. reducta* (Alm 1914c). Spring, Renö, Finnmarken, Norway, 69°56′N 19°42′E: Repository of the type material unknown.
12. *C. vavrai* Kaufmann 1900b. Marshy area, Gentilino, W of Lugano, Switzerland, 46°00′N 08°57′E: Repository of the type material unknown.

Key to the species

1. Greatest H situated around middle, carapace slightly triangular in lateral view 2
– Greatest H situated on last third of L, dorsal margin sloping down toward anterior end, and rounded toward posterior end 8
2. Outer lobe on the hemipenis with thorn-like process ventro-distally *C. matris* (Sywula 1976)
– Outer lobe on the hemipenis without such process 3
3. Posterior margin with small rounded protuberance . . . . *C. angustissima* (Ekman 1914)
– Posterior margin without small rounded protuberance 4

4. Chaetotaxy of left and right A1 asymmetrical . . . . . . *C. brehmi* (Klie 1934b)
– Chaetotaxy of left and right A1 symmetrical 5
5. Ventral conical protrusion on lobe ″b″ present . . *C. phreaticola* (Klie 1927b)
– Ventral conical protrusion absent 6
6. L ratio of terminal and third segment on A1 less than 1.5 . . . . *C. reducta* (Alm 1914c)
– L ratio of terminal and third segment on A1 equal to 1.5 7
7. Inner lobe on the hemipenis pointed . . . . *C. dudichi* (Klie 1930b)
– Inner lobe on the hemipenis rounded . . . . *C. leruthi* (Klie 1936b)
8. “h1” seta hook like and bent downward . . . . *C. vavrai* Kaufmann 1900b
– “h1” seta straight and upright . . . . *C. kieferi* (Klie 1938f)

Species not included in the key
Cryptocandona longipes (Ekman 1908) is not included in the key because of the great similarity in the carapace appearance and the shapes of UR and genital field with *Cryptocandona vavrai* Kaufmann 1900c, and these two species might be synonyms. *Cryptocandona longipes* was described only after females, and therefore it was hard to place it in the above key. *Cryptocandona pygmaea* (Ekman 1908) stands apart from the rest of Cryptocandonini by a well-developed projection on the genital field and also by the presence of two long and one short setae on the terminal segment of L7. This species more likely belong to the tribe Candonini, but it also stands apart from the other species of this tribe by the presence of the “f” seta on L7. *Cryptocandoan cyproides* (Daday 1905) stands apart from the other representatives of the genus by a claw-like posterior seta on the UR, which is in addition positioned very low. It also has a spatula like terminal segment on the Mxl palp and both “h1” and “h2” setae unusually long. Considering these morphological characters, the position of *C. cyproides* in the genus and the tribe is doubtful. Unfortunately, no males have been reposted.

Ecology and distribution (Fig. 62)
The species are most often associated with springs and subterranean waters, but can also be found in more open water bodies, such as ponds and marshes. The genus is distributed in Eurasia, and the only record from South America is of the species *Cryptocandona cyproides* (Daday 1905), which position within the genus is doubtful.

3.1.4 Tribe *Danielocandonini* Karanovic 2007

Diagnosis (after Karanovic 2007): A small Candoninae, usually with soft carapaces (Figs. 63a, b, 64a, b, and 65a, b). Typical Candoninae muscle scar patterns. Short, straight marginal pore canals. A1 5-segmented (Fig. 63c), rarely 6-segmented. L6 with (Fig. 66a) or without basal seta (Fig. 65e). Terminal claw on the Md broadly

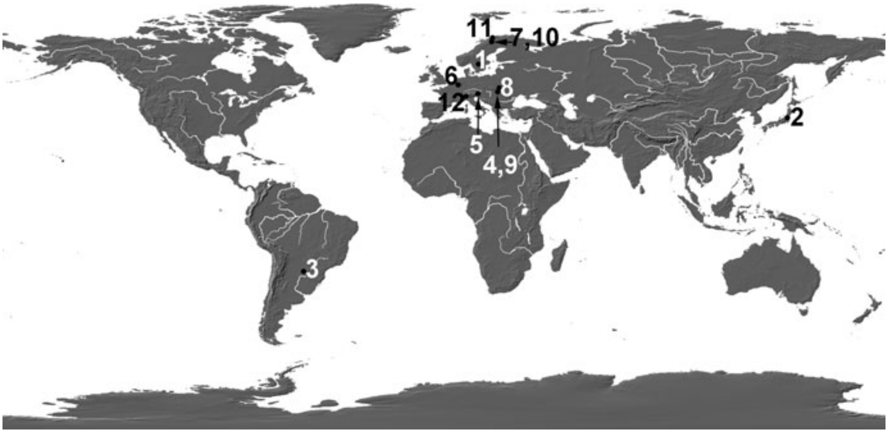


Fig. 62 Distribution of *Cryptocandona* Kaufmann 1900: numbers correspond to the species list.

fused with the segment (Fig. 63f). L7 distal segment carrying two short and one long setae (Fig. 66b, d). Only "g" seta present on penultimate segment. UR with or without reductions (Figs. 66c, e and 67a, d). Hemipenis modest and without prominent chitinized parts on it (Fig. 67e). Zenker organ often with reduced rows of spines (Fig. 67b, c).

Type genus: *Danielocandona* Broodbakker 1983c

Other genera: *Deminutiocandona* Karanovic 2003c, *Kencandona* Karanovic 2007, *Leicacandona* Karanovic 2007, and *Meischcandona* Karanovic 2001.

Key to the genera

1. Basal seta on L6 present (Fig. 66a) . . . . *Kencandona* Karanovic 2007
– Basal seta on L6 absent (Fig. 65e) 2
2. UR reduced to one short ramus and only one claw, other claw completely missing as well as both setae (Fig. 67d) *Danielocandona* Broodbakker 1983c
– Posterior claw sometimes reduce but always present, posterior seta always present (Figs. 66c and 67a) 3
3. Terminal segment of Mxl palp hardly visible, overlapped with penultimate one (Fig. 63e) . . . . *Deminutiocandona* Karanovic 2003c
– Terminal segment of Mxl palp normal (Fig. 63d) 4
4. Penultimate segment of L7 divided (Fig. 66b) *Leicacandona* Karanovic 2007
– Penultimate segment of L7 completely fused and short (Fig. 66d) *Meischcandona* Karanovic 2001

Danielocandona Broodbakker 1983c

Diagnosis: Carapace small and trapezoidal. A1 5-segmented. Setae "t2" and "t3" on the male A2 transformed into sexual bristles. Terminal segment of the Mxl palp elongated with only one central claw and two accompanied setae (Fig. 63g).

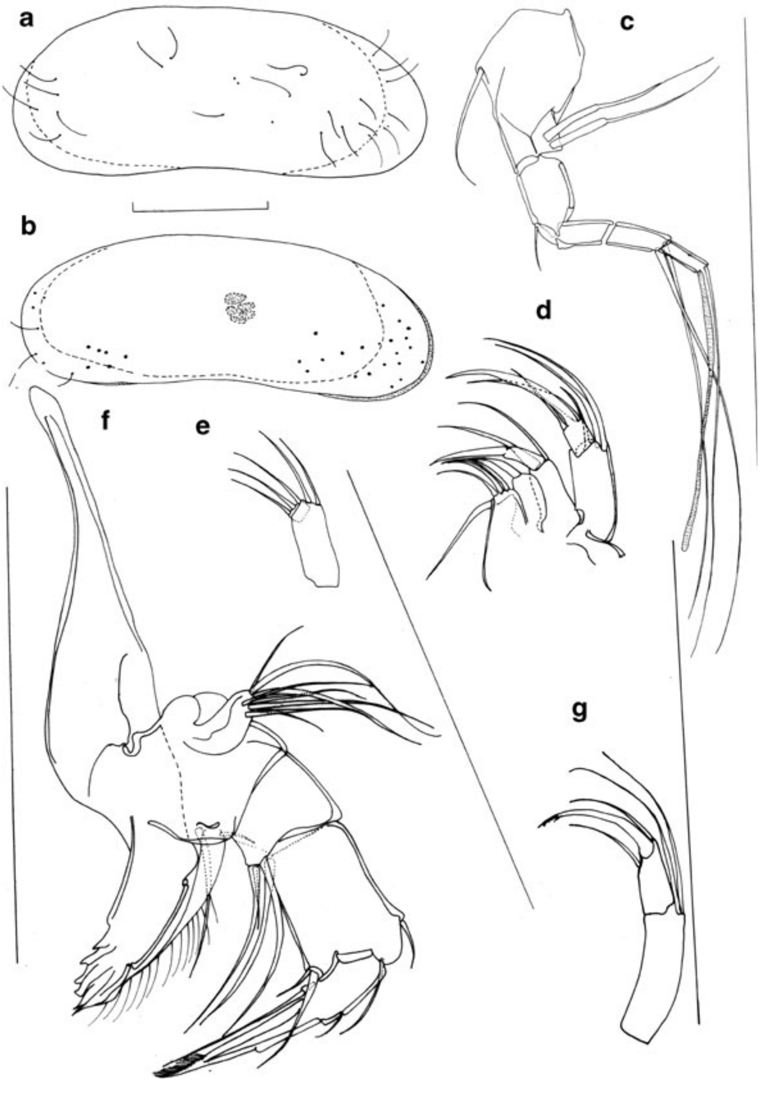


Fig. 63 Line drawings: (**a**, **b**, **e**) *Deminutiocandona aenigma* Karanovic 2007; (**c**, **d**) *Leicacandona halsei* Karanovic 2007; (**f**) *Kencandona harleyi* Karanovic 2007; (**g**) *Danielocandona lieshoutae* Broodbakker 1983c: (**a**) ♀, outside view; (**b**) ♂ outside view; (**c**) A1; (**d**) Mxl palp and endites; (**e**, **g**) Mxl palp; (**f**) Md. Scales = 0.1 mm

Terminal segment of the Md palp short and central claw broadly fused with the segment. Male prehensile palps almost symmetrical. Basal seta on L6 missing. Only “d1” seta present on the basal segment of L7, same appendage 4-segmented. UR strongly reduced on one short ramus and one distal claw, which completely fused with the ramus (Fig. 67d). Hemipenis with two inner lobes. Zenker organ reduced, and with 4 + 2 whorls of spines.

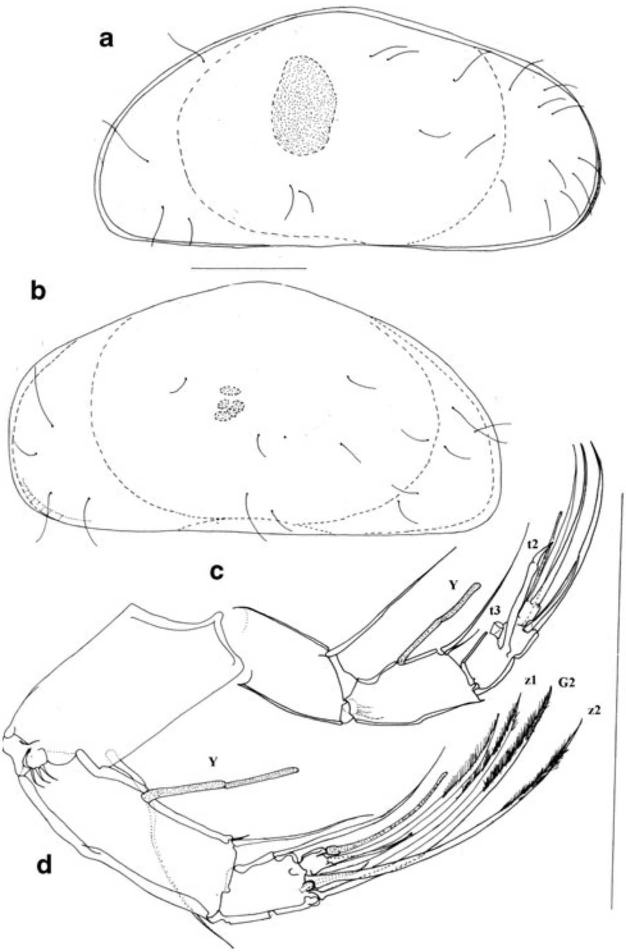


Fig. 64 Line drawings: (**a**, **b**, **d**) *Leicacandona halsei* Karanovic 2007: (**c**) *Deminutiocandona aenigma* Karanovic 2007: (**a**) ♀, outside view; (**b**) ♂, outside view; (**c**, **d**) A2. Scales = 0.1 mm

Type (and only) species: *D. lieshoutae* Broodbakker 1983c

Species list with type locality and type material

D. lieshoutae Broodbakker 1983c. Round open well of Nancy de Venega, Calabozo, quarter Mision, Venezuela, 08°55′17″N 67°27′00″W: Holotype (♀), ZMA – Ost.150.792.

Ecology and distribution

This is stygobiont species has so far been found only in Venezuela.

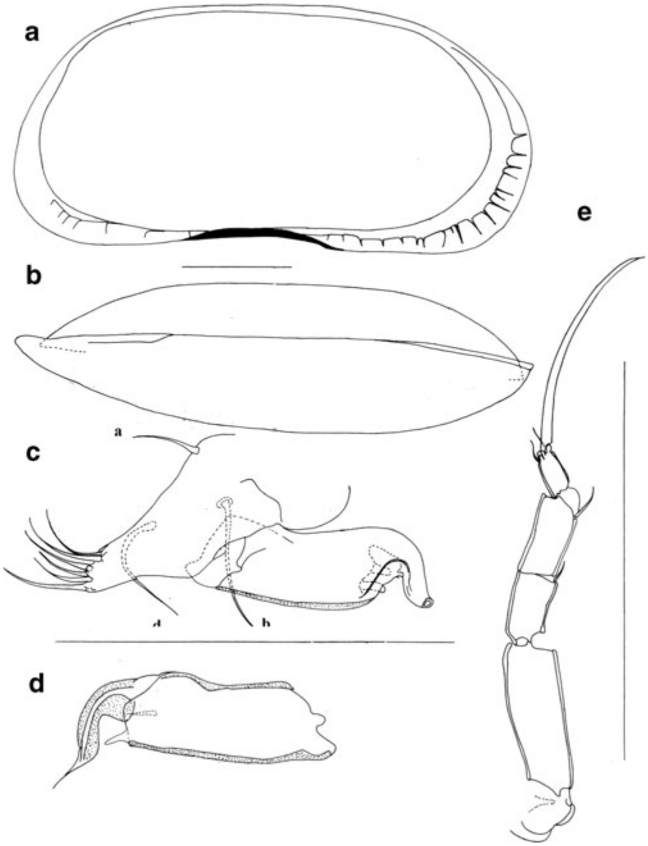


Fig. 65 Line drawings: (**a**, **b**) *Kencandona harleyi* Karanovic 2007; (**c**, **d**) *Leicacandona halsei* Karanovic 2007; (**e**) *Deminutiocandona aenigma* Karanovic 2007: (**a**) LV, inside view; (b) dorsal view; (**c**) L5; (d), palp; (**e**) L6. Scales = 0.1 mm

Deminutiocandona Karanovic 2003c

Diagnosis (after Karanovic 2007): Carapace loaf like, reniform or subtriangular. Surface usually smooth, rarely ornamented. Zone of concrescence rarely wide, marginal pore canals short, not branched. A1 5-, rarely 6-segmented. Male A2 with sexual bristles (Fig. 64c), claws G1 and G3 reduced, “z1” and “z2” setae transformed into long claws, sometimes only “z1” seta transformed. Mandibular vibratory plate with numerous rays, palp 4-segmented, 3+2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp very tiny, hardly visible, overlapped with penultimate one (Fig. 63e). Prehensile palps symmetrical. Basal segment of L6 without any seta, this appendage 5-segmented. L7 4/5-segmented, “e” and “f” setae absent. UR with posterior seta, posterior claw sometimes reduced, but always claw like, never reduced into seta. Exit of anterior seta well pronounced and chitinized. Inner lobe on the hemipenis without chitinized dorsal projections, outer lobe with dorsal projection

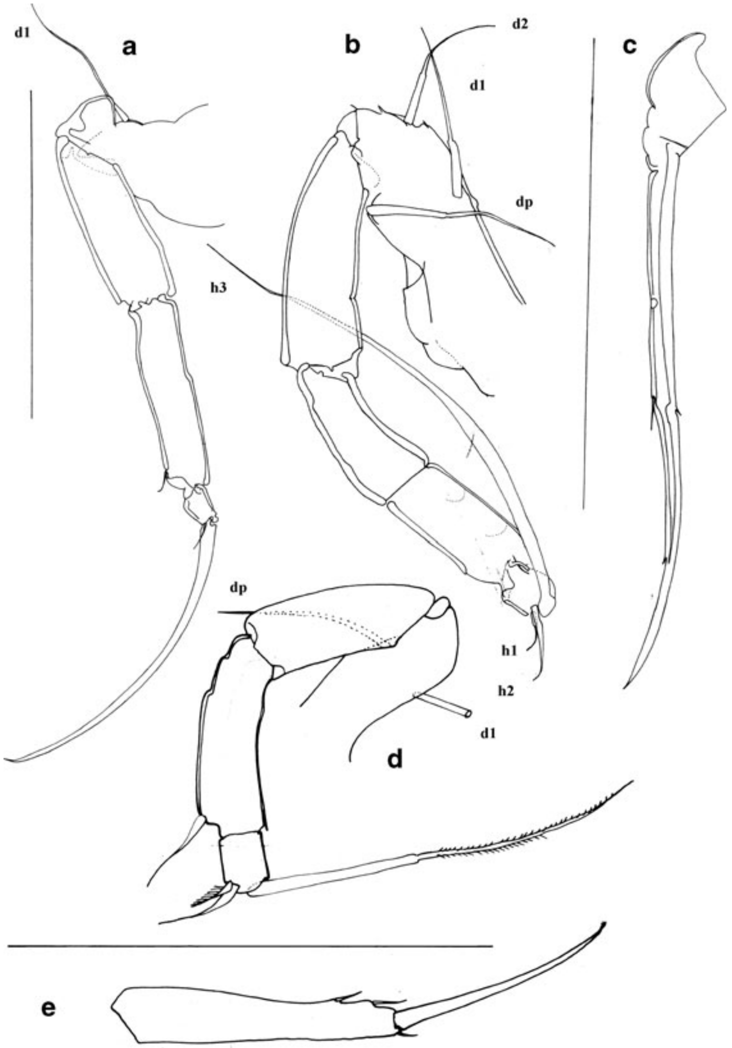


Fig. 66 Line drawings: (**a**, **c**) *Kencandona harleyi* Karanovic 2007; (**b**) *Leicacandona halsei* Karanovic 2007; (**d**, **e**) *Meischcandona boitanii* Karanovic 2001: (**a**) L6; (**b**, **d**) L7; (**c,e**) UR. Scales = 0.1 mm

extending from rest of hemipenis body, no internal coils. Zenker organ with 5 + 2 rows of spines, rarely with 4 + 2 rows. Genital field rounded.

Type species: *D. mica* Karanovic 2003c

Species list with type locality and type material

1. *D. aenigma* Karanovic 2007. Bore G70730102, Robe 2A, Pilbara Region, WA, Australia, 21°34′53″S 115°52′14″E: Holotype (♂), WAM – C35612.

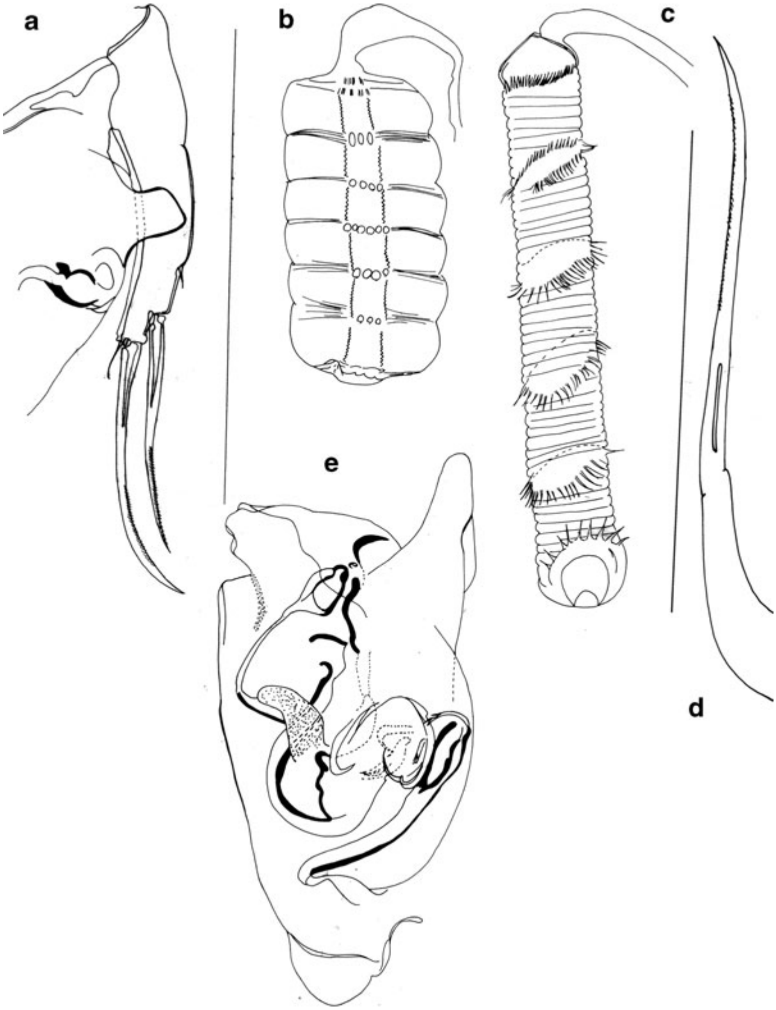


Fig. 67 Line drawings: (**a**, **c**, **e**) *Leicacandona halsei* Karanovic 2007; (**b**) *Deminutiocandona stomachosa* Karanovic 2007; (**d**) *Danielocandona lieshoutae* Broodbakker 1983c: (**a**, **d**) UR; (**b**, **c**) Zenker organ; (**e**) hemipenis. Scales = 0.1 mm

2. *D*. *aporia* Karanovic 2007. Bore, PFO9-4, Turee Creek Bore Field, Pilbara Region, WA, Australia, 23°22′06″S 117°57′35″E: Holotype (♂), WAM – C35615.
3. *D*. *apposita* Karanovic 2007. WYL003, Hardey Bore, Pilbara Region, WA, Australia, 22°49′49″S 116°16′57″E: Holotype (♂), WAM – C36618.
4. *D*. *atope* Karanovic 2007. CR2/82, Cane River Bore Field, Pilbara Region, WA, Australia, 21°40′37″S 115°22′02″E: Holotype (♂), WAM – C35621.
5. *D*. *bicauda* Karanovic 2007. VERNON1, Esrwell 15, Pilbara Region, WA, Australia, 24°21′57″S 118°33′16″E: Holotype (♂), WAM – C35624.

6. *D. mica* Karanovic 2003c. Weeli Wolli Spring (Bou-Rouch pump), Pilbara Region, WA, Australia, 22°55′S, 119°11′E: Holotype (♂), WAM – C28420.
7. *D. murrayi* Karanovic 2007. NAN001, Mount Murray Well, Pilbara Region, WA, Australia, 22°29′21.5″S 115°37′04″E: Holotype (♂), WAM – C35625.
8. *D. neara* Karanovic 2007. VERNON3, 9 Mile Well, Pilbara Region, WA, Australia, 24°16′31″S 118°22′57″E: Holotype (♂), WAM – C35628.
9. *D. quasimica* Karanovic 2007. UAR002, Round Well, Pilbara Region, WA, Australia, 22°53′14″S 115°28′45″E: Holotype (♂), WAM – C35630.
10. *D. stomachosa* Karanovic 2007. PFO9-4, Turee Creek Bore Field, Pilbara Region, WA, Australia, 23°22′06″S 117°57′35″E: Holotype (♂), WAM – C35634.

Key to the species (after Karanovic 2007)

1. Carapace ornamented with shallow, wide pits *D. stomachosa* Karanovic 2007
– Carapace smooth 2
2. Anterior and posterior margins on LV pointed . . . *D. bicauda* Karanovic 2007
– Anterior margin broadly rounded 3
3. Dorsal margin flat . . . . *D. aenigma* Karanovic 2007
– Dorsal margin arched or rounded 4
4. Posterior claw on UR reduced and much shorter than anterior one . . . . *D. quasimica* Karanovic 2007
– Posterior claw on UR equal or slightly shorter than anterior one 5
5. Distance between anterior and posterior claws of UR prominent: at least as long as distance between posterior claw and posterior seta) . . . . *D. aporia* Karanovic 2007
– Distance between anterior and posterior claws not long 6
6. Carapace almost triangular, dorsal margin highly arched 7
– Carapace more elongated, dorsal margin evenly rounded 9
7. Anterior claw of UR longer than anterior margin . . *D. neara* Karanovic 2007
– Anterior claw of UR shorter than anterior margin 8
8. Dorsal margin pointed at greatest H (outer lobe on the hemipenis broadly rounded, Zenker organ with 5 + 2 rows of spines) . . . . . . *D. murrayi* Karanovic 2007
– Dorsal margin rounded on point of greatest H (outer lobe on the hemipenis triangular, Zenker organ with 4 + 2 rows of spines) . . . . . *D. mica* Karanovic 2003c
9. Posterior end of carapace elongated, posterior margin of UR without rows of spines (outer lobe on the hemipenis finger like) . . . . *D. apposita* Karanovic 2007

– Posterior end of carapace not elongated, posterior margin of UR with row of spines (outer lobe on the hemipenis triangular and sharply pointed) *D. atope* Karanovic 2007

Ecology and distribution (Fig. 68)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

***Kencandona* Karanovic 2007**
Diagnosis (after Karanovic 2007): Carapace rectangular, sometimes ornamented. Zone of concrescence wide, marginal pore canals long, not branched (Fig. 65a). A1 4-segmented. Mandibular vibratory plate with several long rays, palp 4-segmented, 3 + 2 setae on second segment, and central claw on terminal segment fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Prehensile palps modest and symmetrical. Basal segment of L6 with one seta (Fig. 66a), appendage 4/5-segmented. L7 with all three basal setae present, appendage 5-segmented, "e" seta absent, terminal segment with two short and one long seta. UR with posterior seta, posterior claw reduced. Inner lobe on the hemipenis rounded without dorsal chitinized projection, middle lobe present, part "M" well inside hemipenis body, and no internal coils. Zenker organ with 5 + 2 rows of spines.

Type species: *K. harleyi* Karanovic 2007

Species list with type locality and type material

1. *K. harleyi* Karanovic 2007. BCR1, Box Soak Well, Pilbara Region, WA, Australia, 20°56′16″S 119°57′36.5″E: Holotype (♂), WAM – C35645.
2. *K. verrucosa* Karanovic 2007. PANNASLK24, Yarraloola Well, Pilbara Region, WA, Australia, 21°39′50″S 116°08′14″E: Holotype (♀), WAM – C35648.

Fig. 68 Distribution of *Deminutiocandona* Karanovic 2003c: Numbers correspond to the species list

Key to the species

1. Carapace ornamented with prominent bumps (L6 5-segmented) . . . . *K. verrucosa* Karanovic 2007
– Carapace smooth (L6 4-segmented) . . . . *K. harleyi* Karanovic 2007

Ecology and distribution (Fig. 69)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Leicacandona Karanovic 2007

Diagnosis (after Karanovic 2007): Carapace subtriangular or reniform, sometimes ornamented. Zone of concrescence narrow, marginal pore canals not branched. A1 5-segmented. Male A2 without sexual bristles (Fig. 64d), claws G1 and G3 reduced, "z1" and "z2" setae transformed into long claws. Mandibular vibratory plate with several long rays, palp 4-segmented, 3 + 2 setae on second segment, and central claw on terminal segment fused with segment. Terminal segment of Mxl palp prominent. Prehensile palps with stout bodies and short hook-like fingers (Fig. 65c, d). Basal segment of L6 without any seta, appendage 4/5-segmented. L7 usually with all three basal setae present, appendage 4/5-segmented, "e" seta absent, terminal segment with two short and one long setae. UR very short and stout, posterior claw only rarely reduced. Posterior seta present. Inner lobe on the hemipenis rounded without dorsal chitinized projection, middle lobe present, part "M" well inside hemipenis body, and no internal coils. Zenker organ with 4+2 rows of spines. Female often with appendage developed on genital field.

Fig. 69 Distribution of *Kencandona* Karanovic 2007: Numbers correspond to the species list

Type species: *L. halsei* Karanovic 2007

Species list with type locality and type material

1. *L. carinata* Karanovic 2007. HILLSIDE4, Stewarts Well, Pilbara Region, WA, Australia, 21°57′06″S 119°39′28″E: Holotype (♀), WAM – C35650.
2. *L. gyralea* Karanovic 2007. GNHSLK1696, De Grey Station, Pilbara Region, WA, Australia, 20°18′59″S 119°25′35″E: Holotype (♀), WAM – C35651.
3. *L. halsei* Karanovic 2007. MBSLK356A, Carlinde Station, Pilbara Region, WA, Australia, 20°48′31.5″S 119°29′31″E: Holotype (♂), WAM – C35652.
4. *L. jimi* Karanovic 2007. MBSLK344, Pear Creek, Pilbara Region, WA, Australia, 20°50′22.5″S 119°36′26″E: Holotype (♂), WAM – 35655.
5. *L. lite* Karanovic 2007. NPM04, Camp 5, Pilbara Region, WA, Australia, 21°06′12″S 119°24′27.5″E: Holotype (♂), WAM – C35657.
6. *L. makra* Karanovic 2007. BCR1, Box Soak Well, Pilbara Region, WA, Australia, 20°56′16″S 119°57′36.5″E: Holotype (♂), WAM – C35659.
7. *L. mookae* Karanovic 2007. T38B, Mooka Siding, Pilbara Region, WA, Australia, 20°36′32″S 118°39′49″E: Holotype (♂), WAM – C35662.
8. *L. quasihalsei* Karanovic 2007. SS1, Skull Springs, Pilbara Region, WA, Australia, 21°52′07″S 121°00′26″E: Holotype (♂), WAM – C35665.
9. *L. quasimookae* Karanovic 2007. YWB17, Eel Creek, Pilbara Region, WA, Australia, 20°36′18.5″S 120°16′09″E: Holotype (♂), WAM – C35666.
10. *L. yandagoogeae* Karanovic 2007. RRYC, Yandagooge Creek, Pilbara Region, WA, Australia, 22°17′05″S 122°06′23″E: Holotype (♀), WAM – C35669.

Key to the species

1. Carapace with a keel 2

– Carapace without a keel 3

2. Keel being long, extending almost along entire L of carapace, L7 5-segmented *L. carinata* Karanovic 2007

– Keel only on caudal end of carapace, L7 4-segmented *L. jimi* Karanovic 2007

3. Posterior claw of UR considerably shorter than anterior one 4

– Posterior claw of UR equal or slightly shorter than anterior one 6

4. L6 5-segmented . . . . *L. quasihalsei* Karanovic 2007

– L6 4-segmented 5

5. Medial seta on fused second and third endopodal segments of L6, if present, reaching distal margin of penultimate segment; anterior claw of UR with spine, ramus curved . . . . *L. yandagoogeae* Karanovic 2007

– Medial seta on fused second and third endopodal segments of L6, if present, being much shorter; anterior claw of UR without spine, ramus straight . *L. lite* Karanovic 2007

6. Carapace ornamented with longitudinal stripes, both ends of carapace elongated *L. makra* Karanovic 2007

– Carapace smooth, ends of carapace not elongated 7

7. Carapace globular, point of greatest H not well pronounced 8

– Carapace triangular or subtriangular, point of greatest H better pronounced . . . 9

8. Genital field without projection . . . . *L. gyralea* Karanovic 2007

– Genital field with nicely pronounced projection . . *L. quasimookae* Karanovic 2007

9. Carapace subtriangular, greatest H in front of mid L, posterior margin narrower than anterior one (outer lobe on the hemipenis triangular, but bluntly pointed, genital field with a bunch of setae) . . . . *L. mookae* Karanovic 2007

– Carapace triangular, greatest H in mid L, posterior and anterior margins equally wide (outer lobe on the hemipenis triangular, but sharply pointed, genital field without a bunch of setae) . . . . *L. halsei* Karanovic 2007

Ecology and distribution (Fig. 70)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Meischcandona Karanovic 2001

Diagnosis (after Karanovic 2001): Carapace small, trapezoidal, distinctly laterally compressed in dorsal view. A1 5-segmented. Exopodite of A2 a clearly visible plate with two short and one long setae. Setal group of second segment of Md palp with 3 + 1 setae on inner side, and with two setae on outer side. Terminal segment of Mxl palp subquadrate and with only three setae, one of which is claw like. Vibratory plate of L5 with two filaments. L6 5-segmented. L7 4-segmented and with two setae ("d1" and "dp") on the basal segment, and seta "g" on penultimate segment; terminal segment bearing one extremely long ("h3") and two short ("hl" and "h2") setae (Fig. 66d). UR with only anterior claw completely developed, posterior claw reduced to short seta; both anterior and posterior setae present (Fig. 66e).

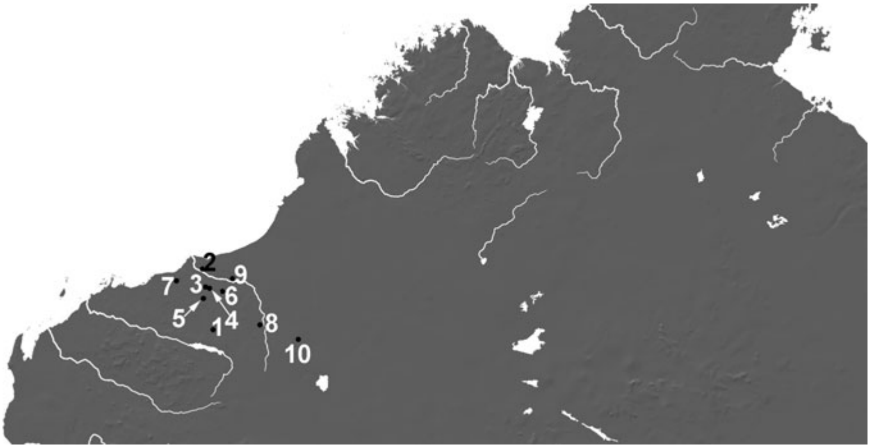


Fig. 70 Distribution of *Leicacandona* Karanovic 2007: Numbers correspond to the species list

Type (and only) species: *M. boitanii* Karanovic 2001

Species list with type locality and type material
M. boitanii Karanovic 2001. Sangna River, Mali, 17°00′N 04°00′W: Holotype (♀), RBINS – O.C. 2383.

Ecology and distribution
This species has been collected only once from its type locality.

3.1.5 Tribe Humphreyscandonini Karanovic 2005b

Diagnosis (after Karanovic 2005b): Carapace shape variable (loaf like, triangular, trapezoidal, subreniform), ornamentation (consisting of pits and/or ridges) possible, hinge adont (Fig. 71). CIL wide on both ends. CMS conforming to general pattern of Candoninae. A1 5- (Fig. 72a) or 6-segmented. Male A2 without sexual bristles (Fig. 72b). Terminal claw of Md palp broadly fused with the segment, and externally accompanied with one clearly weaker claw (Fig. 72c). Terminal segment of the Mxl palp prominent (Fig. 72l). L6 without basal seta (Fig. 73b, e). Terminal segment of L7 with two short and one long setae (Fig. 73c, d). UR completely developed or with reduced posterior claw and posterior seta (Fig. 74a, c). Genital field in female without extensions. Inner lobe on the hemipenis with characteristic, sharply pointed chitinous part, dorsally projected (Fig. 74e, f). Zenker organ well developed, and with 5 + 2 whorls of spines (Fig. 74b, d).

Type genus: *Humphreyscandona* Karanovic and Marmonier 2003

Other genera: *Amphitritecandona* Karanovic 2007; *Areacandona* Karanovic 2005b; *Pierrecandona* Karanovic 2007; *Pilbaracandona* Karanovic and Marmonier 2003; *Notacandona* Karanovic and Marmonier 2003; *Meridiescandona* Karanovic 2003c; *Origocandona* Karanovic 2005b.

Key to the genera

1. Vibratory plate of Md palp with numerous rays 2
– Vibratory plate of Md palp with only one or two rays (Fig. 72c) *Areacandona* Karanovic 2005b
2. Both claws on UR well developed (Fig. 74a) 3
– Posterior claw on UR reduced (Fig. 74c) 7
3. Posterior seta on UR absent (Fig. 74a) . *Amphitritecandona* Karanovic 2007
– Posterior seta on UR present 4
4. A1 6-segmented . . . . *Meridiescandona* Karanovic 2003c
– A1 with less than 6-segmented 5
5. Penultimate segment of L6 completely divided (Fig. 73a) 6

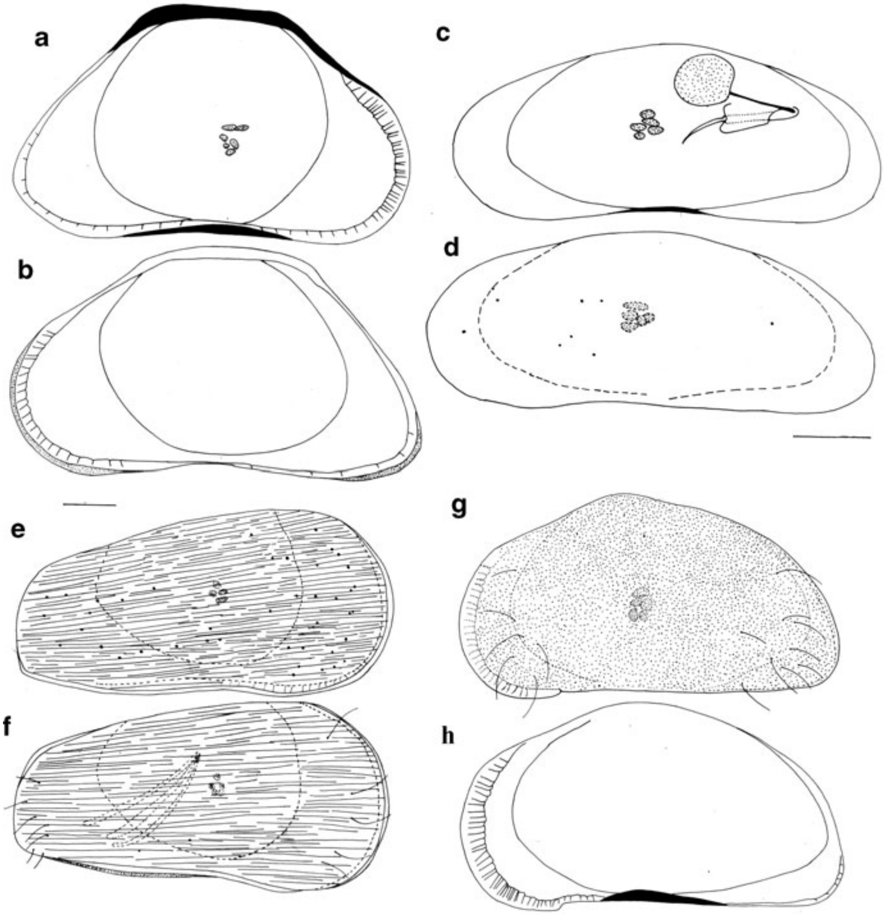


Fig. 71 Line drawings: (**a**, **b**) *Pilbaracandona kosmos* Karanovic 2007; (**c**, **d**) *Areacandona akatallele* Karanovic 2007; (**e**, **f**) *Pierrecandona posteriorrecta* Karanovic 2007; (**g**, **h**) *Amphtritecandona prima* Karanovic 2007: valves

– Penultimate segment on L6 incompletely divided . . *Origocandona* Karanovic 2005b

6. Prehensile palps asymmetrical (Fig. 72h, i) . . . . *Notacandona* Karanovic and Marmonier 2003

– Prehensile palp symmetrical (Fig. 72f, g) . . . *Pierrecandona* Karanovic 2007

7. Seta “g” on L7 long (Fig. 73d) *Humphreyscandona* Karanovic and Marmonier 2003

– Seta “g” on L7 very short (Fig. 73c) *Pilbaracandona* Karanovic and Marmonier 2003

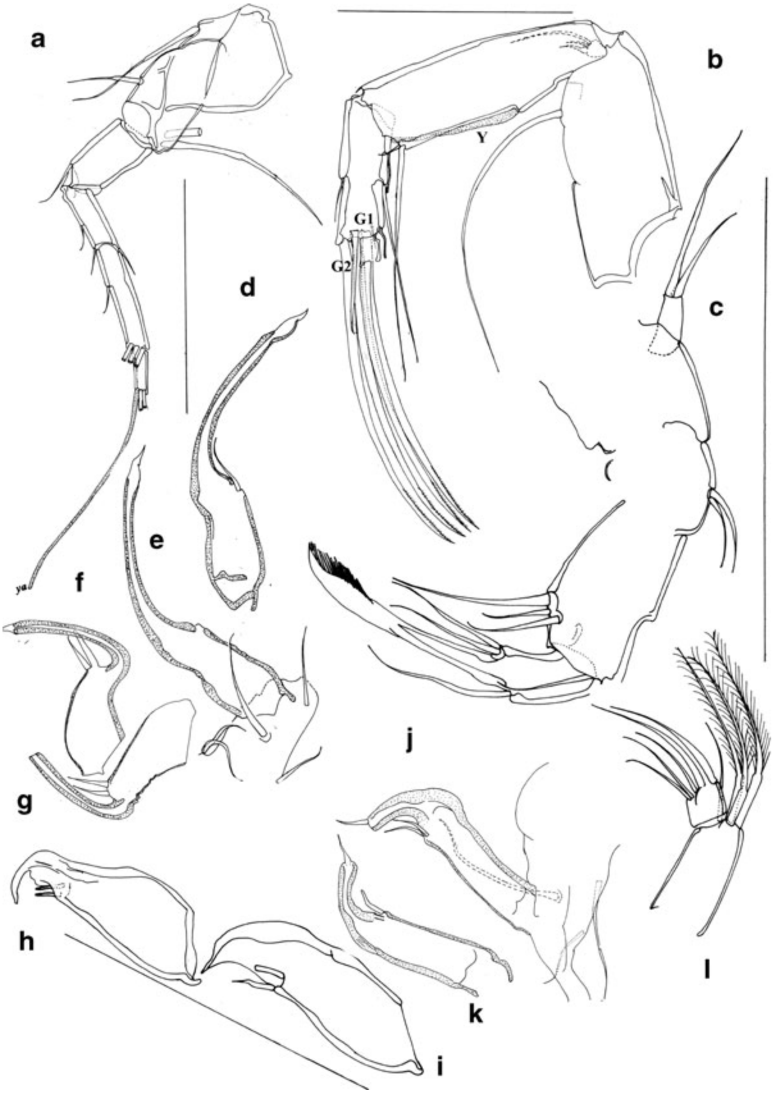


Fig. 72 Line drawings: (**a**, **b**, **j**, **k**) *Pilbaracandona kosmos* Karanovic 2007; (**c**–**e**) *Areacandona akatallele* Karanovic 2007; (**f**, **g**) *Pierrecandona posteriorrecta* Karanovic 2007; (**h**, **i**) *Notacandona boultoni* Karanovic and Marmonier 2003; (l) *Meridiescandona marillanae* Karanovic 2007: (**a**) A1; (**b**) A2; (**c**) Md palp; (**d**–**k**) prehensile palps; (**l**) Mxl palp. Scales = 0.1 mm

Amphitritecandona Karanovic 2007

Diagnosis (after Karanovic 2007): Carapace subtriangular, ornamented (Fig. 71g, h). Zone of concrescence wide, MPC, not branched. Small lip-like protrusion developed on antero-ventral margin. A1 6-segmented. Exopod A2 consisting of plate and

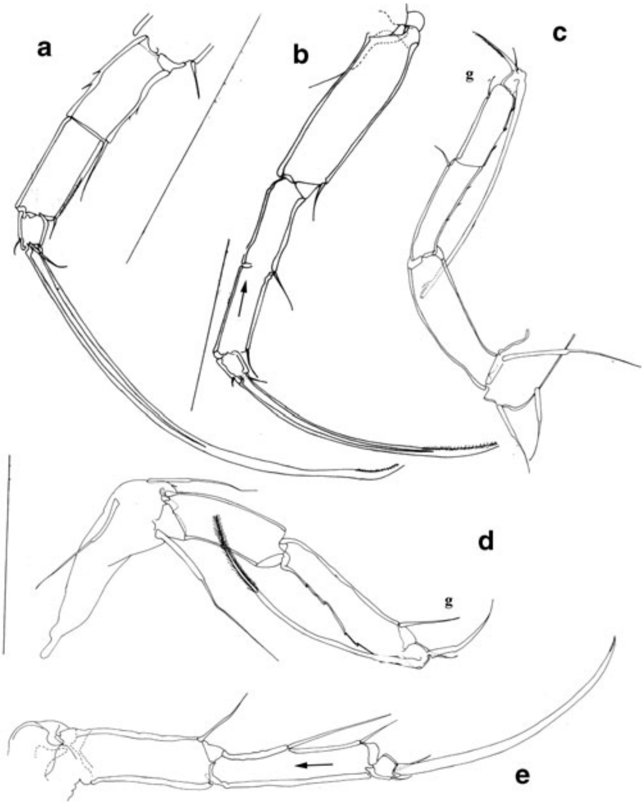


Fig. 73 Line drawings: (**a**) *Pierrecandona posteriorrecta* Karanovic 2007; (**b**, **c**) *Pilbaracandona kosmos* Karanovic 2007; (**d**, **e**) *Humphreyscandona capillus* Karanovic 2007: (**a**, **b**, **e**) L6, showing incomplete division of the penultimate segment; (**c**, **d**) L7. Scales = 0.1 mm

only two short setae. Male A2 without sexual bristles, claws G1 and G3 reduced, "z1" and "z2" setae transformed into long claws. Mandibular vibratory plate with several long rays, palp 4-segmented, 3 + 2 setae on second segment, terminal segment noticeably square shaped and with two prominent claws – central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Prehensile palps robust and hook like. Basal segment of L6 without any seta, appendage 4-segmented. L7 with all three basal setae present, appendage 5-segmented, "e" seta absent. UR without posterior seta, both claws well developed. Inner lobe most prominent on hemipenis, with one dorsal tubular process, outer lobe modest, middle lobe absent, part "M" well inside hemipenis body, no internal coils. Zenker organ with 5 + 2 rows of spines, proximal part very robust, balloon like.

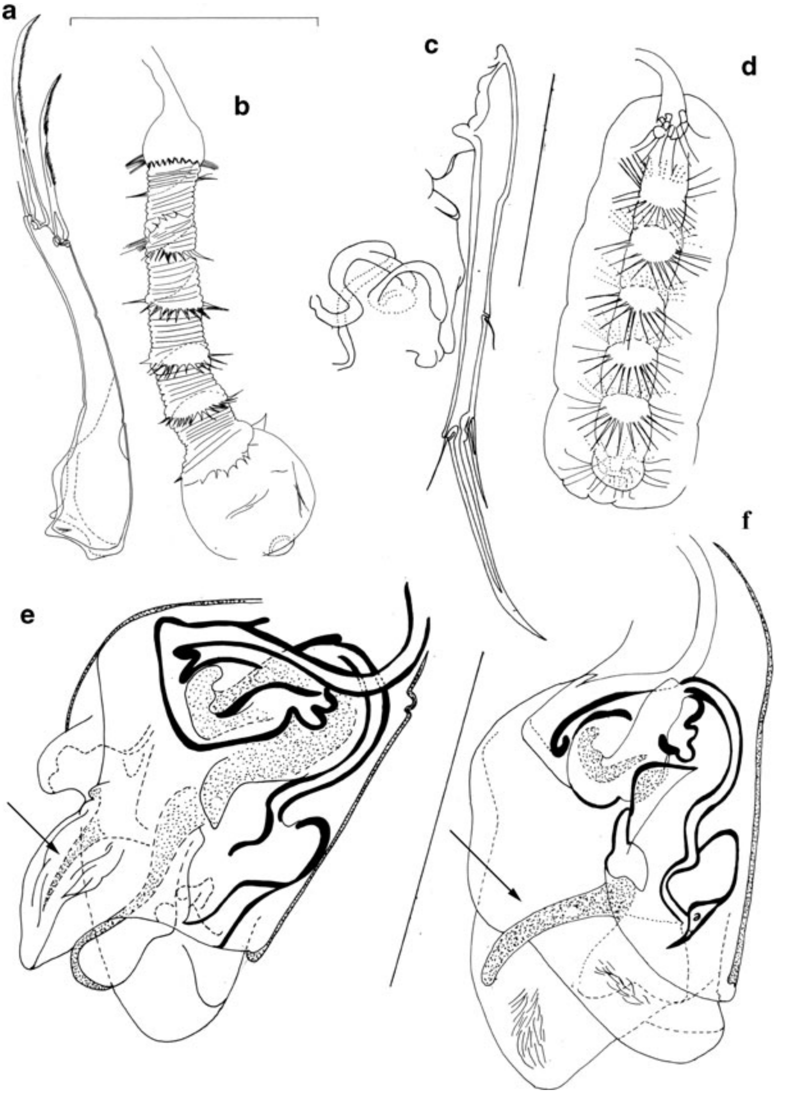


Fig. 74 Line drawings: (**a**, **b**) *Pierrecandona posteriorrecta* Karanovic 2007; (**c**, **d**, **f**) *Pilbaracandona kosmos* Karanovic 2007; (**e**) *Areacandona akatallele* Karanovic 2007: (**a**, **c**) UR; (**b**, **d**) Zenker organ; (**e**, **f**) hemipenis, showing sclerified part of the medial lobe. Scales = 0.1 mm

Type species: *A. prima* Karanovic 2007

Species list with type locality and type material

1. *A. prima* Karanovic 2007. YWB17, Eel Ck, Pilbara Region, WA, Australia, 20°36′18″S 120°16′09″E: Holotype (♂), WAM – C33482.
2. *A. secunda* Karanovic 2007. MBSLK 316, Bamboo Creek, Pilbara Region, WA, Australia, 20°56′07″S 119°51′03″E: Holotype (♂), WAM – C33485.

Key to the species

1. Carapace strongly ornamented with long ridges, posterior end of carapace elongated and pointed .... *A. secunda* Karanovic 2007
– Carapace covered only with dots, posterior end of carapace not pointed *A. prima* Karanovic 2007

Ecology and distribution (Fig. 75)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Areacandona Karanovic 2005b [Syn.: *Neocandona* Karanovic 2005b]

Diagnosis (after Karanovic 2007): Carapace subtriangular, reniform or elongated. Surface ornamented or smooth (Fig. 71c, d). Zone of concrescence not wide, MPC, not branched. A1 5-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, "z1" and "z2" setae transformed into long claws. Mandibular vibratory plate with 2/1 rays (Fig. 72c), palp 4-segmented, 3 + 2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Prehensile palps symmetrical (Fig. 72d, e) or asymmetrical. Basal segment of L6 without any seta, appendage 3/4-segmented. L7 4/5-segmented, "e" seta absent, "f" seta sometimes present, terminal segment with two short and one long setae. UR with posterior seta, posterior claw reduced. Outer lobe on the hemipenis with two dorsal projections: one sharp and well-chitinized, other blunt lower and sometimes not well pronounced no internal coils (Fig. 74e). Zenker organ with 5 + 2 rows of spines. Genital field rounded, rarely with projections.

Fig. 75 Distribution of *Amphtritecandona* Karanovic 2007: Numbers correspond to the species list

Type species: *A. mulgae* Karanovic 2005b

Species list with type locality and type material

1. *A. akatallele* Karanovic 2007. T182B, Spring Bore, Pilbara Region, WA, Australia, 21°49′13″S 118°54′50″E: Holotype (♂), WAM – C33486.
2. *A. ake* Karanovic 2007. COOL1, near Tampathanna Pool, Pilbara Region, WA, Australia, 21°42′11″S 117°45′13″E: Holotype (♂), WAM – C33489.
3. *A. arteria* Karanovic 2005b. Calamina Well, Mulga Downs Station, Pilbara Region, WA, Australia, 22°11′S 118°28′E: Holotype (♀), WAM – C28440.
4. *A. astrepte* Karanovic 2007. G70730104, Robe 4A, Pilbara Region, WA, Australia, 21°34′06″S 115°50′06″: Holotype (♀), WAM – C33490.
5. *A. atomus* Karanovic 2007. PF09-4, Turee Creek Bore Field, Pilbara Region, WA, Australia, 23°22′06″S 117°57′35″E: Holotype (♀), WAM – C33492.
6. *A. bluffi* Karanovic 2007. NAN002, Bluff Well, Pilbara Region, WA, Australia, 22°31′32″S 115°42′56″E: Holotype (♂), WAM – C33493.
7. *A. brookanthana* Karanovic 2007. HOOLEY8, Brookanthana Well, Pilbara Region, WA, Australia, 21°56′47″S 118°17′15″E: Holotype (♂), WAM – C33494.
8. *A. cellulosa* Karanovic 2007. HOOLEY5, Cheedy Well, Pilbara Region, WA, Australia, 21°49′23″S 118°13′13″E: Holotype (♂), WAM – C33500.
9. *A. clementia* Karanovic 2007. G70830032, Fortescue 29, Pilbara Region, WA, Australia, 21°04′54″S 116°00′36″E: Holotype (♂), WAM – C35569.
10. *A. cognata* Karanovic 2007. COOL1, near Tampathanna Pool, Pilbara Region, WA, Australia, 21°42′11″S 117°45′13.4″E: Holotype (♂), WAM – C35571.
11. *A. cylindrata* Karanovic 2007. G70730102, Robe 2A, Pilbara Region, WA, Australia, 21°34′53″S 115°52′14″E: Holotype (♀), WAM – C35572.
12. *A. dec* Karanovic 2007. YAN13, Dunny Bore, Pilbara Region, WA, Australia, 21°36′37″S 118°34′43″E: Holotype (♂), WAM – C33498.
13. *A. fortescueiensis* Karanovic 2007. G70830103, Fortescue 2B, Pilbara Region, WA, Australia, 21°11′40″S 116°04′26″E: Holotype (♂), WAM – C35573.
14. *A. incogitata* Karanovic 2007. GNHSLK 1664, Ord Range, Pilbara Region, WA, Australia, 20°20′20″S 119°07′25.5″E: Holotype (♂), WAM – C35575.
15. *A. iuno* Karanovic 2007. MBSLK 400A, West Strelley River, Pilbara Region, WA, Australia, 20°36′10″S 119°07′24″E: Holotype (♂), WAM – C35578.
16. *A. jessicae* Karanovic 2007. GNHSL 1552, Turner River West, Pilbara Region, WA, Australia, 20°46′40″S 118°31′31.5″E: Holotype (♂), WAM – C35581.
17. *A. korallion* Karanovic 2007. PYRAMID6, Minson River, Pilbara Region, WA, Australia, 21°10′24″S 117°47′02″E: Holotype (♂), WAM – C35578.
18. *A. krypte* Karanovic 2007. YROB1, Yule River Bore Field, Pilbara Region, WA, Australia, 20°33′29″S 118°14′29″E: Holotype (♂), WAM – C35585.
19. *A. lepte* Karanovic 2007. HD2/81, Harding Dam, Pilbara Region, WA, Australia, 20°57′47″S 117°05′55″E: Holotype (♂), WAM – C35585.
20. *A. mulgae* Karanovic 2005b. Yampire Bore, Mulga Downs Station, Pilbara Region, WA, Australia, 22°15′S 118°34′E: Holotype (♂), WAM – C28434.

21. *A. nammuldi* Karanovic 2007. NA1M2, Nammuldi, Pilbara Region, WA, Australia, 22°25′29″S 117°18′37″E: Holotype (♂), WAM – C35589.
22. *A. newmani* (Karanovic 2005b). Bore W222, Newman Borefield Area, Pilbara Region, WA, Australia, 23°20′S 119°51′E: Holotype (♀), WAM – C28425.
23. *A. novitas* (Karanovic 2005b). SWLlO, Hamersley Range, Pilbara Region, WA, Australia, 22°14′10″S 117°07′24″E: Holotype (♀), WAM – C28428.
24. *A. quasilepte* Karanovic 2007. COOL1, near Tampathanna Pool, Pilbara Region, WA, Australia, 21°42′11.5″S 117°45′13″E: Holotype (♂), WAM – C35592.
25. *A. scanloni* Karanovic 2007. PYRAMID4, Benmore Well, Pilbara Region, WA, Australia, 21°02′46″S 117°39′50″E: Holotype (♀), WAM – C35595.
26. *A. stefani* Karanovic 2007. HOOLEY5, Cheedey Well, Pilbara Region, WA, Australia, 21°49′23″S 118°13′13″E: Holotype (♂), WAM – C35597.
27. *A. triangulum* Karanovic 2007. JWO11A, Jimmawarranda, Pilbara Region, WA, Australia, 21°45′48″S 116°13′44″E: Holotype (♂), WAM – C35600.
28. *A. undulata* Karanovic 2007. ONSLOWSLK58, Peed 1, Pilbara Region, WA, Australia, 21°48′12″S 115°06′25″E: Holotype (♂), WAM – C35603.
29. *A. weelumurrae* Karanovic 2007. FRWW, Weelumurra Well, Pilbara Region, WA, Australia, 22°05′46″S 117°42′15″E: Holotype (♂), WAM – C35606.
30. *A. yuleae* Karanovic 2007. YROB1, Yule River Bore Field, Pilbara Region, WA, Australia, 20°33′29″S 118°14′29″E: Holotype (♂), WAM – 35609.

Key to the species

1. L6 clearly 5-segmented (second and third endopodal segments completely divided) 2

– L2 4-segmented (second and third segments completely fused, or with tiny intrusions marking points of their fusion) 26

2. Seta on penultimate segment very long (reaching mid L of apical claw) . . . 3

– Seta on penultimate segment short (at most exceeding distal margin of terminal segment) 9

3. Valves asymmetrical: LV overlapping RV with a prominent dorsal flange . . *A. arteria* Karanovic 2005b

– Valves not asymmetrical 4

4. Dorsal margin rounded 5

– Dorsal margin flat 6

5. L7 with “f” seta present, “g” seta long, postero-medial seta on penultimate segment of A2 present . . . . *A. clementia* Karanovic 2007

– L7 with “f” seta absent, “g” seta short, postero-medial seta on penultimate segment of A2 absent . . . . *A. lepte* Karanovic 2007

6. Postero-medial seta on penultimate segment of A2 present 7

– Postero-medial seta on penultimate segment of A2 absent 8

7. “f” seta on L7 absent, antero-distal seta on the first segment of A1 absent, dorsal margin undulated . . . . *A. undulata* Karanovic 2007

– L7 with “f”seta present, antero-distal seta on the first segment of A1 present, dorsal margin straight . . . . *A. mulgae* Karanovic 2005c

8. Seta on second endopodal segment of L6 reaching distal end of penultimate segment . . . . *A. yuleae* Karanovic 2007

– Seta on second endopodal segment of L6 not reaching middle of penultimate segment . . . . *A. scanloni* Karanovic 2007

9. Carapace ornamented 10

– Carapace smooth 12

10. Carapace ornamented with longitudinal ridges, L7 with completely divided penultimate segment . . . . *A. stefani* Karanovic 2007

– Carapace differently ornamented, penultimate segment of L7 incompletely divided 11

11. Carapace trapezoidal, ornamented with a honeycomb pattern . . . *A. korallion* Karanovic 2007

– Carapace triangular, ornamented with wide, irregular and shallow pits . . . . . *A. cellulosa* Karanovic 2007

12. Posterior end of carapace elongated, narrow, greatest H in front of mid L, from that point dorsal margin sloping toward posterior end 13

– Posterior and anterior ends of carapace similar, greatest H lying behind or in middle 15

13. Anterior margin of UR longer than anterior claw . . . *A. atomus* Karanovic 2007

– Anterior margin of UR equal or shorter than anterior claw 14

14. Posterior claw of UR seta like . . . . *A. brookanthana* Karanovic 2007

– Posterior claw claw like, equaling 1/3 of anterior one *A. ake* Karanovic 2007

15. UR enormous compared to other body parts . . *A. cylindrata* Karanovic 2007

– UR normally developed 16

16. Dorsal margin flat 17

– Dorsal margin arched or rounded 18

17. Exopod of A2 carrying one long and two short setae . . . . *A. astrepte* Karanovic 2007

– Exopod of A2 carrying only two or three short setae *A. krypte* Karanovic 2007

18. Greatest H behind middle . . . . *A. fortescueiensis* Karanovic 2007

– Greatest H around middle 19

19. Posterior end of carapace lifted upward . . . . *A. dec* Karanovic 2007

– Posterior end of carapace normal 20

20. Dorsal margin arched (carapace triangular) 21

– Dorsal margin rounded (carapace reniform) 24

21. Exopod of A2 carrying one long and two short setae . . . . *A. quasilepte* Karanovic 2007
– Exopod of A2 carrying only two or three short setae 22
22. LV much higher than RV . . . . *A. cognata* Karanovic 2007
– Valves equally H 23
23. Penultimate segment of L7 incompletely divided (prehensile palps asymmetrical: one robust, other slender) . . . . *A. triangulum* Karanovic 2007
– Penultimate segment of L7 completely divided (prehensile palps symmetrical) *A. incogitata* Karanovic 2007
24. “g” seta on L7 very short, not reaching proximal margin of terminal segment (at least one of prehensile palps with a long finger) 25
– “g” seta considerably longer, exceeding distal margin of terminal segment (both prehensile palps with short, fat fingers) . . . . . *A. iuno* Karanovic 2007
25. Carapace elongated (prehensile palp symmetrical, both with very long fingers: much longer than body) . . . . *A. akatallele* Karanovic 2007
– Carapace more compact (prehensile palp asymmetrical, left much smaller than right one, fingers elongated, but shorter than body) *A. jessicae* Karanovic 2007
26. L7 4-segmented (genital field with a projection) . . . . *A. weelumurrae* Karanovic 2007
– L7 5-segmented (genital field without a projection) 27
27. Exopod of A2 carrying one long and two short setae, medial seta on posterior side of A2 present . . . . *A. newmani* (Karanovic 2005c)
– Exopod of A2 carrying three short setae, medial seta on posterior side of A2 absent 28
28. Dorsal margin straight, anterior and posterior ends of carapace equally wide . . . *A. nammuldi* Karanovic 2007
– Dorsal margin inclined toward posterior end, posterior end much narrower than anterior one 29
29. Carapace ornamented . . . . *A. novitas* (Karanovic 2005c)
– Carapace smooth . . . . *A. bluffi* Karanovic 2007

Ecology and distribution (Fig. 76)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

***Humphreyscandona* Karanovic and Marmonier 2003**
Diagnosis (after Karanovic 2007): Carapace triangular, trapezoidal or subreniform. Surface usually heavily ornamented, very rarely smooth. Zone of concrescence wide, marginal pore canals short, not branched. A1 5/6-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, “z1” and “z2” setae transformed into long claws. Mandibular vibratory plate with numerous rays, palp 4-segmented, 3 + 2 setae on second segment, terminal segment noticeably 0.5 times wider than

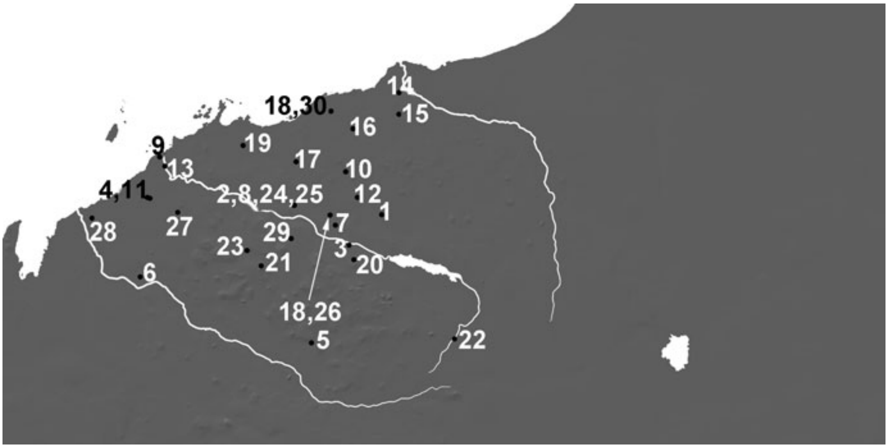


Fig. 76 Distribution of *Areacandona* Karanovic 2005: Numbers correspond to the species list

longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Prehensile palps often symmetrical. Basal segment of L6 without any seta, endopod 3/4-segmented (Fig. 73e). L7 4/5-segmented, "e" seta absent, "f "seta usually present, terminal segment with two short and one long setae (Fig. 73d). UR with or without posterior seta, posterior claw reduced. Inner lobe on the hemipenis with one dorsal projections: sharp and well chitinized. Dorsal projection of the outer lobe with inclined most dorsal margin, part "M" protruding between lobes, no internal coils. Zenker organ with 5 + 2 rows of spines. Genital field rounded.

Type species: *H. adorea* Karanovic and Marmonier 2003

Species list with type locality and type material

1. *H. adorea* Karanovic and Marmonier 2003. Bore PI, Palm Springs, Millstream Aquifer, Pilbara Region, WA, Australia, 21°34′24″S 116°57′59″E: Holotype (♂), WAM – C28210.
2. *H. akaina* Karanovic 2007. REED004, Telephone Bore, Pilbara Region, WA, Australia, 21°56′21″S 115°53′19″E: Holotype (♂), WAM – C35635.
3. *H. capillus* Karanovic 2007. Ragged Hills Mine, Pilbara Region, WA, Australia, 21°17′51″S 121°08′45″E: Holotype (♂), WAM – C35638.
4. *H. fovea* Karanovic and Marmonier 2003. Old Well in Marrapikurrinyu, Port Hedland, Pilbara Region, WA, Australia, 20°19′32″S 118°37′59″E: Holotype (♂), WAM – C28222.
5. *H. imperfecta* Karanovic 2005b. Two Mile Well, Mardie Station, Pilbara Region, WA, Australia, 21°09′46″S 115°59′33″E: Holotype (♀), WAM – C28433.
6. *H. janeae* Karanovic 2007. HIRAIL5, WARP, Pilbara Region, WA, Australia, 22°02′15″S 117°40′20″E: Holotype (♂), WAM – C35641.

7. *H. pilbarae* Karanovic and Marmonier 2003. Bilanoo Pool (Karaman-Chappuis), Fortescue River, Pilbara Region, WA, Australia, 21°17′43″S 116°08′27″E: Holotype (♂), WAM – C28223.
8. *H. ventosa* Karanovic 2007. NWSLK58, House Creek, Pilbara Region, WA, Australia, 22°27′52.5″S 116°02′11″E: Holotype (♂), WAM – C35642.
9. *H. waldockae* Karanovic and Marmonier 2003. Calamina Well, Mulga Downs Station, Fortescue River Valley, Pilbara Region, WA, Australia, 22°11′ S 118°28′E: Holotype (♂), WAM – C28232.
10. *H. woutersi* Karanovic and Marmonier 2003. GWMB, 56A, Millstream Aquifer, Pilbara Region, WA, Australia, 21°47′18″S 116°44′23″E: Holotype (♂), WAM – C28229.

Key to the species

1. L7 4-segmented 2
– L7 5-segmented 9
2. Posterior seta on UR absent 3
– Posterior seta on UR present 6
3. Carapace with elongated posterior end, surface not ornamented . . . . *H. imperfecta* Karanovic 2005b
– Carapace with more rounded posterior end, surface ornamented 4
4. RV overlapping LV with a flange . . . . *H. akaina* Karanovic 2007
– RV not overlapping LV 5
5. LV overlapping RV with a triangular flange . . . . *H. ventosa* Karanovic 2007
– Valves almost symmetrical . . . . *H. woutersi* Karanovic and Marmonier 2003
6. Carapace trapezoidal, LV overlapping RV with a prominent flange 7
– Carapace reniform or triangular 8
7. Carapace ornamented only with longitudinal ridges on subventral side, "f" seta on L7 present . . . . *H. adorea* Karanovic and Marmonier 2003
– Carapace heavily ornamented with irregular, wide pits . . . . *H. capillus* Karanovic 2007
8. Carapace triangular . . . . *H. fovea* Karanovic and Marmonier 2003
– Carapace reniform . . . . *H. pilbarae* Karanovic and Marmonier 2003
9. Carapace ornamented with longitudinal ridges, anterior claw of UR with prominent spine . . . . *H. waldockae* Karanovic and Marmonier 2003
– Carapace ornamented with irregular, shallow pits, anterior claw lacks a spine . . . *H. janeae* Karanovic 2007

Ecology and distribution (Fig. 77)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Fig. 77 Distribution of *Humphreyscandona* Karanovic and Marmonier 2003: Numbers correspond to the species list

Meridiescandona Karanovic 2003c

Diagnosis (after Karanovic 2007): Carapace triangular, or subtrapezoidal. Surface ornamented with small bumps. Zone of concrescence not wide, marginal pore canals short, not branched. A1 6-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, only "z1" seta transformed into long claw. Mandibular vibratory plate with numerous rays, palp 4-segmented, 3+2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent. Prehensile palps almost symmetrical. Basal segment of L6 without any seta, endopod 4-segmented. L7 5-segmented, setae "e," "f," and "g" present and long, terminal segment with two short and one long setae. UR with posterior seta, posterior claw well developed. Inner lobe on the hemipenis with two dorsal projections: one sharp and well chitinized, other blunt lower and sometimes not well pronounced, no internal coils. Zenker organ with 5 + 2 rows of spines. Genital field rounded.

Type species: *M. lucerna* Karanovic 2003c

Species list with type locality and type material

1. *M. facies* Karanovic 2003c. Bore at Yandicoogina Mine (along Marillana Creek), 80 km N of Newman, Pilbara Region, WA, Australia, 22°49′S 119°16′E: Holotype (♂), WAM – C28417.
2. *M. lucerna* Karanovic 2003c. The Battle Hill Well, Roy Hill Station, Fortescue River Valley, Pilbara Region, WA, Australia, 22°44′S 120°08′E: Holotype (♂), WAM – C28412.
3. *M. marillanae* Karanovic 2007. YJDD239, Marillana, Pilbara Region, WA, Australia, 22°47′25″S 119°15′10″E: Holotype (♂), WAM – C35670.

Key to the species

1. Valves asymmetrical, LV overlapping RV with a triangular flange .... *M. marillanae* Karanovic 2007
– Valves symmetrical 2
2. Surface ornamented with a web like pattern, distal most seta on the first segment of A1 present .... *M. lucerna* Karanovic 2003c
– Surface ornamented with a linear pattern, distal most seta on the first segment of A1 absent .... *M. facies* Karanovic 2003c.

Ecology and distribution (Fig. 78)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Notacandona Karanovic and Marmonier 2003

Diagnosis (after Karanovic 2007): Carapace triangular, or subtriangular. Surface ornamented or smooth. Zone of concrescence wide, MPC, not branched. A1 5-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, "z1" and "z2" setae transformed into long claw, or only "z1" seta transformed. Mandibular vibratory plate with numerous rays, palp 4-segmented, 3+2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Basal segment of L6 without any seta, the appendage 5-segmented. L7 5-segmented, setae "e," "f," and "g" present, or "e" seta missing, terminal segment with two short and one long setae. UR with posterior seta, posterior claw well developed. Inner lobe of the hemipenis with one dorsal projection: sharp and well-chitinized, no internal coils. Zenker organ with 5+2 rows of spines. Genital field rounded.

Fig. 78 Distribution of *Meridiescandona* Karanovic 2003c: Numbers correspond to the species list

Type species: *N. modesta* Karanovic and Marmonier 2003

Species list with type locality and type material

1. *N. boultoni* Karanovic and Marmonier 2003. Weeli Wolli Spring (B-R), Pilbara Region, WA, Australia, 22°55′S 119°11′E: Holotype (♂), WAM – C28266.
2. *N. gratia* (Karanovic 2005b). Bore W230, Newman Borefield Area, Pilbara Region, WA, Australia, 23°13′S 119°54′E: Holotype (♂), WAM – C28430.
3. *N. modesta* Karanovic and Marmonier 2003. Weeli Wolli Spring (B-R), Pilbara Region, WA, Australia, 22°55′S 119°11′E: Holotype (♂), WAM – C28262.

Key to the species

1. Carapace with elongated, very narrow posterior end *N. boultoni* Karanovic and Marmonier 2003

– Posterior end not elongated 2

2. Greatest H greater than ½ L, carapace ornamented *N. modesta* Karanovic and Marmonier 2003

– Greatest H less than ½ L, carapace smooth . . . . *N. gratia* (Karanovic 2005b)

Ecology and distribution (Fig. 79)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Origocandona Karanovic 2005b

Diagnosis (after Karanovic 2007): Carapace subtrapezoidal or elongated. Surface ornamented or smooth. Zone of concrescence wide, MPC short, not branched. A1 5-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, "z1" and "z2" setae transformed into long claw. Mandibular vibratory plate with numerous

Fig. 79 Distribution of *Notacandona* Karanovic and Marmonier 2007: Numbers correspond to the species list

rays, palp 4-segmented, 3 + 2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Basal segment of L6 without any seta, appendage 5-segmented. L7 5-segmented, "e," "f," and "g" setae present or "e" seta missing, terminal segment with two short and one long setae. UR with posterior seta, posterior claw well developed. Inner lobe of the hemipenis with one dorsal projections: sharp and well chitinized, no internal coils. Zenker organ with 5 + 2 rows of spines. Genital field rounded.

Type species: *O. inanitas* Karanovic 2005b

Species list with type locality and type material

1. *O. ballardi* Karanovic 2007. GFS004, Ballards Well, Pilbara Region, WA, Australia, 22°55′49″S 115°42′34″E: Holotype (♂), WAM – C35673.
2. *O. grommike* Karanovic 2007. GNHSLK1192, near Mt. Newman, Pilbara Region, WA, Australia, 23°14′31.5″S 119°33′12″E: Holotype (♂), WAM – C35676.
3. *O. inanitas* Karanovic 2005b. Bore W262, Newman Borefield Area, Pilbara Region, WA, Australia, 23°17′08″S 119°52′02″E: Holotype (♂), WAM – C28426.

Key to the species

1. Valves asymmetrical, LV overlaps RV with triangular flange .... *O. ballardi* Karanovic 2007
– Valves symmetrical 2
2. Posterior end elongated, carapace smooth ..... *O. inanitas* Karanovic 2005b
– Posterior end rounded, carapace ornamented ... *O. grommike* Karanovic 2007

Ecology and distribution (Fig. 80)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

Pierrecandona Karanovic 2007

Diagnosis (after Karanovic 2007): Carapace subrectangular (Fig. 71e, f). Surface ornamented. A1 5-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, "z1" and "z2" setae transformed into long claws. Mandibular vibratory plate with numerous rays, palp 4-segmented, 3 + 2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Basal segment of L6 without any seta, appendage 5-segmented. L7 5-segmented, "e" seta missing, "f" present, terminal segment with two short and one long setae. UR with posterior seta, posterior claw well developed. Anterior claw with unusually long spine. Inner lobe on the hemipenis with two dorsal projections:

Fig. 80 Distribution of *Origocandona* Karanovic 2005b: Numbers correspond to the species list

one sharp and well chitinized, other blunt, no internal coils. Zenker organ with 5 + 2 rows of spines. Genital field rounded.

Type (and only) species: *P. posteriorrecta* Karanovic 2007

Species list with type locality and type material
P. posteriorrecta Karanovic 2007. REED001, Six Mile Well, Pilbara Region, WA, Australia, 22°01′52″S 116°06′19″E: Holotype (♂), WAM – C35678.

Ecology and distribution
This genus comprises only a single stygobiont species, endemic to the Pilbara Region of Western Australia.

Pilbaracandona Karanovic and Marmonier 2003

Diagnosis (after Karanovic 2007): Carapace triangular, or trapezoidal (Fig. 71a, b). Surface heavily ornamented. Zone of concrescence wide, MPC short, not branched. A1 5-segmented. Male A2 without sexual bristles, claws G1 and G3 reduced, “z1” and “z2” setae transformed into long claw (Fig. 72b). Mandibular vibratory plate with numerous rays, palp 4-segmented, 3+2 setae on second segment, terminal segment noticeably 0.5 times wider than longer, and with central claw fused with segment. Terminal segment of Mxl palp prominent: two times longer than wider. Prehensile palps slightly asymmetrical (Fig. 72j, k). Basal segment of L6 without any seta, appendage 4- or 5-segmented (Fig. 73b). L7 5-segmented, all endopodal setae present or “e” seta absent, terminal segment with two short and one long setae (Fig. 73c). UR with posterior seta, posterior claw reduced (Fig. 74c). Inner lobe on the hemipenis with dorsal projection: sharp and well chitinized, no internal coils (Fig. 74f). Zenker organ with 5 + 2 rows of spines (Fig. 74d). Genital field rounded.

Type species: *P. eberhardi* Karanovic and Marmonier 2003

Species list with type locality and type material

1. *P. colonia* Karanovic and Marmonier 2003. From OB 23, sample No. 33.2, Bore W262, Pilbara Region, WA, Australia, 23°17′08″S 119°52′02″E: Holotype (♂), WAM – C28259.
2. *P. eberhardi* Karanovic and Marmonier 2003. From EX 895, Newman Borefield area, Pilbara Region, WA, Australia, 23°19′S 119°52′E: Holotype (♂), WAM – C28240.
3. *P. kosmos* Karanovic 2007. W260, at Production Bore K31, Pilbara Region, WA, Australia, 23°17′31″S 119°52′12″E: Holotype (♂), WAM – C35681.
4. *P. rhabdote* Karanovic 2007. Knuckleduster Bore, Pilbara Region, WA, Australia, 22°44′09″S 119°55′45″E: Holotype (♂), WAM – C35684.
5. *P. rosa* Karanovic 2007. G70830104, Fortescue 3A, Pilbara Region, WA, Australia, 21°12′57″S 116°02′32″E: Holotype (♀), WAM – C35688.
6. *P. temporaria* Karanovic 2007. W20, at Production Bore K31, Pilbara Region, WA, Australia, 23°17′31″S 119°52′12″E: Holotype (♂), WAM – C35620.

Key to the species

1. Carapace ornamented 2
– Carapace smooth . . . . *P. rosa* Karanovic 2007
2. Carapace with elongated, pointed posterior end . . . . *P. colonia* Karanovic and Marmonier 2003
– Posterior end not elongated 3
3. LV much higher than RV 4
– Valves almost equally high 5
4. Carapace trapezoidal . . . . *P. kosmos* Karanovic 2007
– Carapace triangular . . . . *P. rhabdote* Karanovic 2007
5. Dorsal margin highly arched, carapace triangular *P. eberhardi* Karanovic and Marmonier 2003.

Ecology and distribution (Fig. 81)
This genus comprises only stygobiont species, all endemic to the Pilbara Region of Western Australia.

3.1.6 Tribe Namibcypridini Martens 1992c

Diagnosis (modified after Martens 1992c): Elongated and laterally compressed carapaces, with ornamented surface. CIL wide. MPC few but long and prominent, some branched. A1 5-segmented. Exopod of A2 with only two short setae. Male sexual bristles not present. Vibratory plate on Md with only one ray. Terminal segment of Mxl palp elongated with only three appendages. Prehensile palps symmetrical.

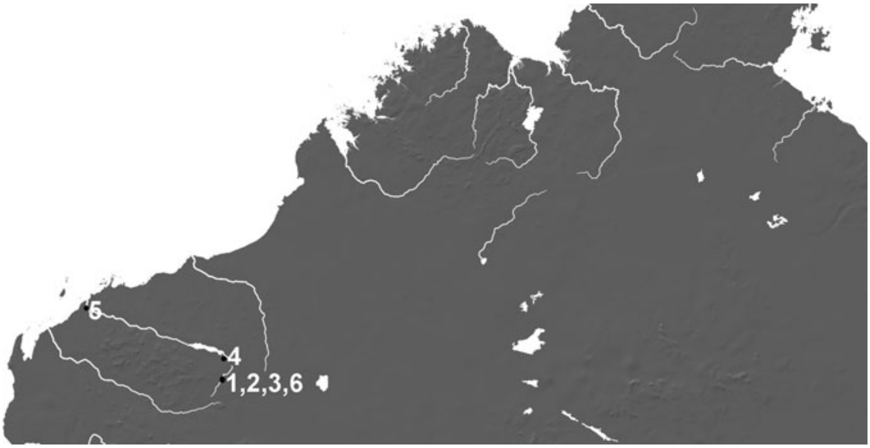


Fig. 81 Distribution of *Pilbaracandona* Karanovic and Marmonier 2003: Numbers correspond to the species list.

Basal seta on L6 missing, same appendage 4-segmented. L7 without any setae on the basal segment, appendage 4-segmented. Terminal segment with one short and two conspicuously long setae. UR reduced to a short and thin ramus and a terminal seta.

Type (and only) genus: *Namibcypris* Martens 1992c

***Namibcypris* Martens 1992c**
Diagnosis. Same as that for the tribe.

Type (and only) species: *N. costata* Martens 1992c

Species list with type locality and type material
N. costata Martens 1992c. Spring pool at Zesfontein, boarder of Kaokoland and Namibia, 19°07′02″S 13°36′34″E: Holotype (♂), SMW – 51567.

Ecology and distribution
The species is known only from its type locality, and according to the morphology of the soft parts it may be a stygobiont.

3.1.7 Tribe *Terrestricypridini* Schornikov 1980

Diagnosis (after Pinto et al. 2005b): Small ($L = 0.3$–0.4 mm) candonids, with reniform valves in lateral view and narrow carapace with straight margins in dorsal view. All limbs with some aspect of reduced chaetotaxy (fusion of segments, loss of setae) to varying degrees in different genera. A1 with five segments (Fig. 82d), with various segments fused in the different genera; endopodal segments one and 2 + 3 in L7 devoid of setae (Fig. 82e). Terminal segment of L7 with one seta transformed into a long claw.

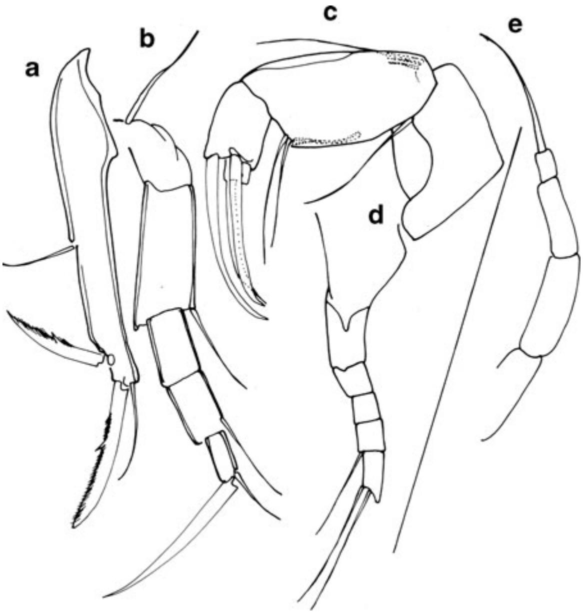


Fig. 82 Line drawings: *Terrestricandona minuta* Danielopol and Betsch 1980: (**a**) UR; (**b**) L6; (**c**) A2; (**d**) A1; (**e**) L7. Scale = 0.1 mm

Type genus: *Terrestricypris* Schornikov 1980

Other genera: *Caaporcandona* Pinto et al. 2005b; *Nannocandona* Ekman 1914; *Terrestricandona* Danielopol and Betsch 1980.

Key to the genera

1. Two additional setae present on terminal segment of L7 2
– No additional setae present on terminal segment of L7 3
2. Terminal segment of Md palp with two strong claws . . . . *Nannocandona* Eckman 1914
– Only one claw present on terminal segment of Md palp . . . *Caaporacandona* Pinto et al. 2005b
3. A1 6-segmented . . . . *Terrestricandona* Danielopol and Betsch 1980
– A1 5-segmented . . . . *Terrestricypris* Schornikov 1980

Caaporacandona Pinto et al. 2005b

Diagnosis (after Pinto et al. 2005b): Carapace narrow in dorsal view, reniform in lateral view. A1 5-segmented, with segments 1 + 2 fused, segment three separate, segments 4 + 5 and 6 + 7 fused. Penultimate segment of A2 with two ventro-lateral setae and with claw G2 about half the size of G1. Md palp with seta “s2” small. Distal segment of L7 with one apical claw and two setae. UR with posterior seta distally inserted, i.e., close to the posterior claw.

Type species: *C. shornikovi* Pinto et al. 2005b

Species list with type locality and type material

1. *C. iguassuensis* Pinto et al. 2005b. Parque Nacional do Iguaçu, Municipality of Foz do Iguaçu, Paraná State, Brazil, 25°33′S 54°31′W: Holotype (♀), MZSUP – 1638.
2. *C. shornikovi* Pinto et al. 2005b. Boracéia Biological Station, Municipality of Salesópolis, São Paulo State, Brazil, 23°38′16.9″S 45°50′24.5″W: Holotype (♀), MZSUP – 16370.

Key to the species

1. Third segment on A1 with a long dorso-apical seta; medio-dorsal seta on penultimate segment of A2 present .... *C. shornikovi* Pinto et al. 2005b
– Third segment on A1 with short dorso-apical seta; medio-dorsal seta on penultimate segment of A2 absent .... *C. iguassuensis* Pinto et al. 2005b

Ecology and distribution (Fig. 83)
The genus is endemic to Brazil.

Nannocandona Eckman 1914

Diagnosis: Carapace subtrapezoidal in lateral view. Surface finely ornamented. MPC short and straight. CIL relatively narrow. A1 5-segmented. Exopod of A2 with one long and one short setae. Terminal segment of the Md palp with two prominent claws. Terminal segment of Mxl palp with two prominent claws and 3–4 setae. Same segment rectangular. Basal segment of L6 without seta, same appendage 5-segmented. Basal segment of L7 with "d1" and "dp" setae present, same

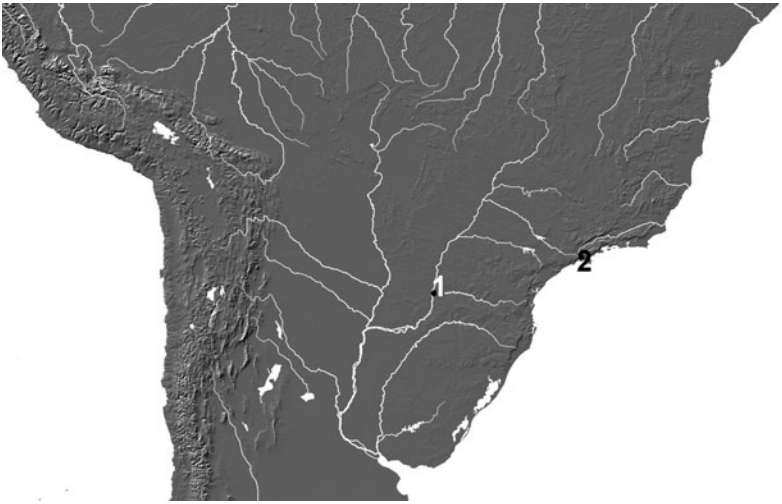


Fig. 83 Distribution of *Caaporacandona* Pinto et al. 2005b: Numbers correspond to the species list

appendage 4-segmented. Terminal segment with all three setae very strongly developed, and "h1" transformed into a claw. UR with a short and stout ramus and both claws and setae present. Posterior seta situated very close to the basis of the ramus.

Type species: *N. faba* Eckman 1914

Species list with type locality and type material

1. *N. faba* Eckman 1914. Lake Östra Skälsjön, Bagga, Västmanland, Sweden, 59°56′N 15°33′E: Repository of the type material unknown.
2. *N. stygia* Sywula 1976: Interstitial waters of Bystrzyca Dusznicka stream, Szczytna, Sudetes, Poland, 50°25′N 16°39′E: Holotype (♀), DAIE – collection number unknown.

Key to the species

1. Dorsal margin straight . . . . *N. stygia* Sywula 1976
– Dorsal margin slightly concave . . . . *N. faba* Eckman 1914

Ecology and distribution (Fig. 84)
The genus is known from the subterranean waters and it has been found in Europe and North America.

Terrestricandona **Danielopol and Betsch 1980**

Diagnosis: Carapace small, CIL narrow, MPC short and straight. A1 6-segmented (Fig. 82d) (segment three not fused to one and two); penultimate segment of A2 with three distal claws (Fig. 82c) (claw G2 present). Basal segment of L6 with seta (Fig. 82b); same appendage 5-segmented. L7 4-segmented (Fig. 82e), no basal setae

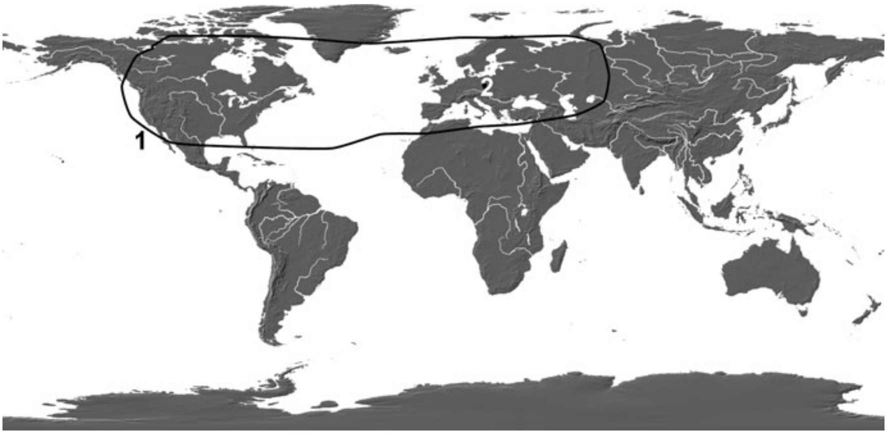


Fig. 84 Distribution of *Nannocandona* Ekman 1914: Numbers correspond to the species list

present, terminal segment with only one claw-like seta. UR with both claws and setae present, posterior seta positioned very high on the ramus (Fig. 82a).

Type (and only) species: *T. minuta* Danielopol and Betsch 1980

Species list with type locality and type material
T. minuta Danielopol and Betsch 1980. Leaf litter, Mt. Marojezy, Madagascar, 14°26′S 49°44′E: Holotype (♀), NHMP – RCP. Mad. 4002.

Ecology and distribution (Fig. 85)
The species is only known from Madagascar and it lives in semi-terrestrial environment, such as leaf litter.

Terrestricypris Schornikov 1980

Diagnosis (after Pinto et al. 2005b): Carapace narrow in dorsal view, reniform in lateral view. A1 5-segmented, with segments 1–3 and 4 + 5 fused. A2 with claw G2 missing. Md palp with seta "S1" small. L6 with apical claw only. UR with proximal seta inserted close to the mid length of the ramus.

Type species: *T. arborea* Schornikov 1980

Species list with type locality and type material

1. *T. arborea* Schornikov 1980. Leaf litter, Bio Island, Solomon Island, 07°31′S 158°41′E: Holotype (♀), IMB-RAS – 1744–1745.
2. *T. wurdigae* Pinto et al. 2005a. Boracéia Biological Station, Municipality of Salesópolis, São Paulo State, Brazil, 23°38′16.9″S 45°50′24.5"W: Holotype (♀), MZUSP – 16363.

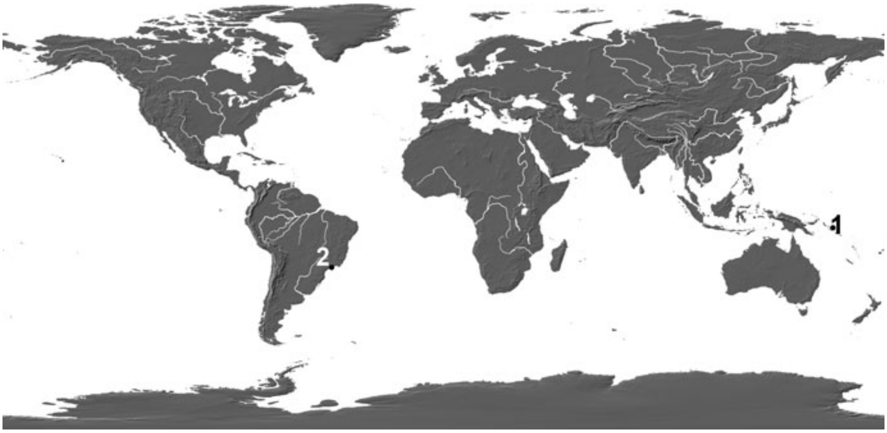


Fig. 85 Distribution of *Terrestricypris* Schornikov 1980: Numbers correspond to the species list

Key to the species

1. Valves elongated (L/H ratio = 2.23–2.33), L5-palp with 3 apical setae . . . . *T. wurdigae* Pinto et al. 2005b
– Valves less elongated (L/H ratio = 2.0–2.10), L5-palp with 2 apical setae . *T. arborea* Schornikov 1980

Ecology and distribution (Fig. 85)
Both species live in the leaf litter and the genus is distributed in South America and West Pacific.

3.1.8 Tribe Trapezicandonini Karanovic 2007 (Fig. 86a)

Diagnosis (after Karanovic 2007): Relatively small Candoninae often characterized by a laterally compressed carapace. A1 7-segmented, A2 with (Fig. 86b) or without

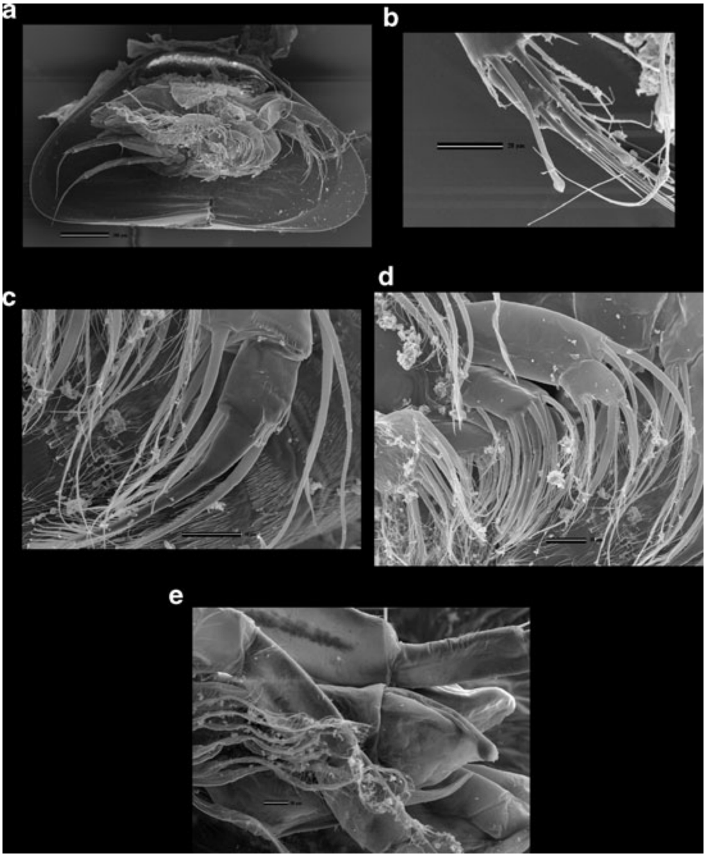


Fig. 86 SEM: *Trapezicandona sp.*: (**a**) ♂, inside view; (**b**) sexual bristles on A2; (**c**) terminal segment of the Md palp; (**d**) Mxl palp; (**e**) hemipenis

sexual bristles. Central claw on the terminal segment of the Md palp broadly fused with the segment (Fig. 86c). Terminal segment of the Mxl palp rectangular, and the penultimate segment not distally dilated (Fig. 86d). Prehensile palps symmetrical (Fig. 87b, c). L6 without a basal seta. L7 with two short and one long setae on the terminal segment. UR normally developed (Fig. 87a) or strongly reduced (Fig. 87d). Female genital field without any projections. Hemipenis with tiny dorsal projection of the outer lobe (Fig. 86e). No chitinized projections of any sort on hemipenis. Zenker organ rarely with less than seven whorls of spines (Fig. 87e).

Type genus: *Trapezicandona* Schornikov 1969

Other genera: *Indocandona* Gupta 1984

Key to the genera

1. Posterior claw on UR well developed (Fig. 87a) .... *Trapezicandona* Schornikov 1969
– Posterior claw on UR reduced (Fig. 87d) .... *Indocandona* Gupta 1984

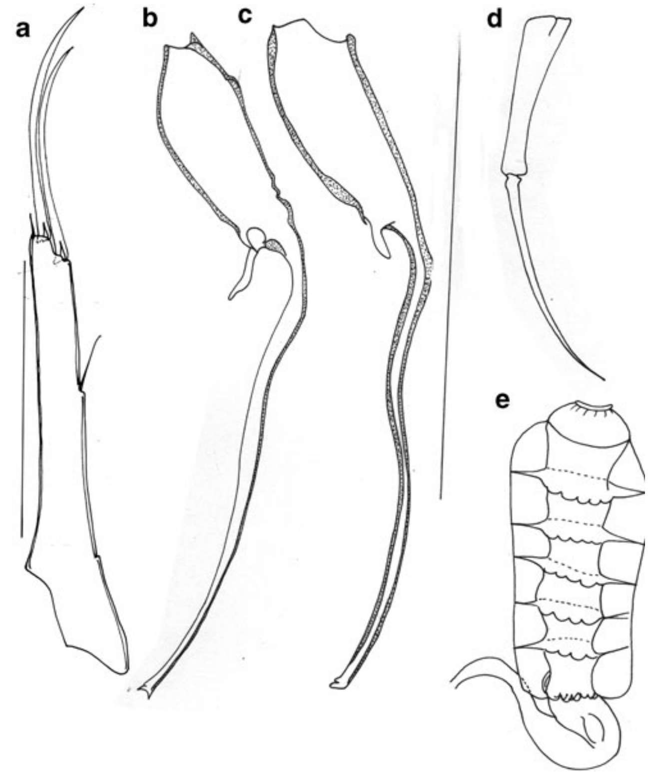


Fig. 87 Line drawings: (**a**, **e**) *Trapezicandona sp.*; (**b**–**d**) *Indocandona nagarjuna* Karanovic and Ranga Reddy 2008: (**a**, **d**) UR; (**b**, **c**) prehensile palps; (**e**) Zenker organ. Scales = 0.1 mm

Indocandona Gupta 1984

Diagnosis (after Karanovic and Ranga Reddy 2008): A1 7-segmented. A2 in male with sexual bristles. Md with numerous rays on vibratory plate; terminal segment of palp square shaped and with central claw broadly fused with the segment. Mxl with rectangular terminal segment, carrying two claws and four setae. Prehensile palps symmetrical. L6 5-segmente; basal segment without any setae. Terminal segment of L7 with two short and one long setae. UR strongly reduced, with only ramus and one claw present. Genital field without any projections. Hemipenis with outer and inner lobes well developed; outer lobe dorsally extending. Part "M" not strongly chitinized. Zenker's organ with five visible rows of spines.

Type species: *I. krishnakanti* Gupta 1984

Species list with type locality and type material

1. *I. krishnakanti* Gupta 1984. Well, Belan Bazar, Monghyr, Bihar, India, 25°23′N 86°28′E: Holotype (♂), ZSI – A1013.
2. *I. nagarjuna* Karanovic and Ranga Reddy 2008. Bore-well at Block II on Acharya Nagarjuna University campus, Nagarjunanagar, 13 km ENE of Gunter Town in Andhra Pradesh State, India, 16°18′N 80°29′E: Holotype (♂), WAM – C35711.

Key to the species

1. UR strongly reduced with only one terminal claw, fingers on the prehensile palps very long . . . . *I. nagarjuna* Karanovic and Ranga Reddy 2008
– UR reduced, but with one distal claw and one distal seta, prehensile palp with short fingers . . . . *I. krishnakanti* Gupta 1984

Ecology and distribution (Fig. 88)
The genus is found so far only in the subterranean waters of India.

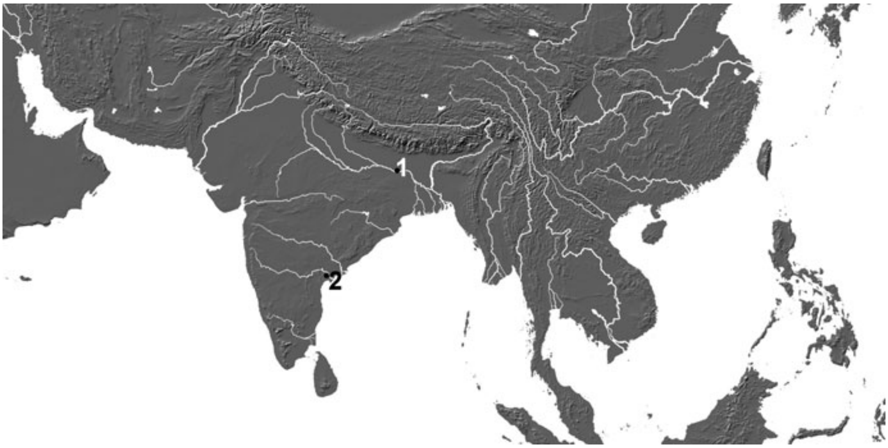


Fig. 88 Distribution of *Indocandona* Gupta 1984: Numbers correspond to the species list

***Trapezicandona* Schornikov 1969 [Syn.: *Mixtacandona* Klie 1938f]**
Diagnosis (after Karanovic and Pesce 2000b): Valve shape trapezoidal (Fig. 86a), triangular or elongated. Valve surface smooth or slightly ornamented. A1 7-segmented. A2 of male with or without male bristles. Aesthetasc (Y) on same appendage very long (more than 60% of first endopodal segment). Exopod of A2 consisting of a plate, one long and two small setae. Vibratory plate of L5 with three setae, prehensile palps slightly asymmetrical. Basal segment of L6 without any seta. Same appendage 5-segmented. Basal segment of L7 with three setae. L7 4- or 5-segmented. Seta "f" often present, terminal segment consisting of two short and one long setae. UR with very short posterior seta (Fig. 87a). Genital field without appendages. Zenker organ with seven whorls of spines (Fig. 87e). Hemipenis typical with dorsal projection of the outer lobe very thin compared with other lobes (Fig. 86e).

Type species: *T. taurica* (Schornikov 1969)

Species list with synonyms, type locality, and type material

1. *T. botosaneanui* (Danielopol 1973). Cave Zamonita in Mt. Munţii Almaj (Almajului), Jud. Caras Severin, Romania, 44°44′N 22°09′E: Holotype (♀), ISER – collection number unknown.
2. *T. chappuisi* (Klie 1943b). Well, village Dragan, Romania, 46°56′N 22°51′E: Syntypes, ZMK – UR-496, 1389–91.
3. *T. coineauae* (Rogulj and Danielopol 1993). Carstic spring at entrance of cave La Clamouse, near Pont du Diable (Herault), France, 43°40′N 03°30′E: Holotype (♂), LIM – collection number unknown.
4. *T. cottarelli* (Danielopol 1982b). Alluvial sediments, River Liscia, Sardinia, Italy, 41°11′N 09°19′E: Holotype (♂), MNHV – collection number unknown.
5. *T. elegans* (Danielopol and Cvetkov 1979). Water pump, Zvezdec, Bulgaria, 42°07′N 27°25′E: Holotype (♂), LIM – collection number unknown.
6. *T. hvarensis* (Danielopol 1969a). Well, Hvar Island, Croatia, 43°08′N 16°43′E: Holotype not designated.
7. *T. italica* Karanovic and Pesce 2000b. Freshwater well along main road Foggia-Manfredonia, Puglia, Italy, 41°37′N 15°54′E: Holotype (♂), MNHV – collection number unknown.
8. *T. juberthieae* (Danielopol 1978b). Artificial gallery, Sauve-Majeure, Sauve, France, 44°46′N 00°19′W: Holotype (♀), LIM – collection number unknown.
9. *T. laisi* (Klie 1938f). Well, house number 68, between Grezhausen and Gündlingen, Baden-Württemberg, Germany, 47°59′N 07°38′E: Syntypes, ZMK – CR-400–500.

   Syn.: *Candona stammeri* Klie 1938b

10. *T. lattingerae* (Rogulj and Danielopol 1993). Opatovina, Gravel Bar at River Sava, near Zagreb, Croatia, 45°48′N 15°58′E: Holotype (♀), LIM – collection number unknown.

11. *T. loeffleri* (Danielopol 1973). Well, Ada-Kaleh Island, Mehedinti, Romania, 44°43′N 22°27′E: Holotype (♀), LIM – collection number unknown.
12. *T. ljovuschkini* (Rudjakov 1963). Krasnoaleksandrovskaya Cave, Ashe, Tuapse, Russia, 43°57′N 39°15′E: Repository of the type material unknown.
13. *T. peliaca* (Schäfer 1945). Pump well, Armenion, W stream of Karla Lake, Greece, 39°32′N 22°45′E: Repository of the type material unknown.
14. *T. pietrosanii* (Danielopol and Cvetkov 1979). Well, village Pietrosani, Romania, 45°25′N 23°22′E: Holotype (♂), LIM – collection number unknown.
15. *T. pseudocrenulata* (Schäfer 1945). Pump well, S of Larissa, Greece, 39°38′N 22°25′E: Repository of the type material unknown.
16. *T. riongessa* (Bronstein 1947). Caves, railway tunnel, Rionges, Kutaisi, Georgia, 42°15′N 42°42′E: Repository of the type material unknown.
17. *T. spandli* (Rogulj and Danielopol 1993). Bou-Rouch pump, wetland area of Danube, Vienna, Austria, 48°12′N 16°22′E: Holotype (♂), LIM – collection number unknown.
18. *T. tabacarui* (Danielopol and Cvetkov 1979). Well, some 100 m from coast of the Black Sea, village Două (2) Mai, close to the Romanian–Bulgarian border, S Dobrodgea, Romania, 43°47′N 28°34′E: Holotype (♂), LIM – collection number unknown.
19. *T. taurica* (Schornikov 1969). Skelskaya Cave, Crimea, Ukraine, 45°11′N 33°21′E: Holotype (♀), IMB-RAS – 131–132.
20. *T. transleithanica* (Löffler 1960). Well, Burgenland, Austria, 47°52′N 16°40′E: Types, LIM – collection numbers unknown.

Key to the species

1. Carapace elongated with pointed posterior margin and greatest H situated on first third of L 2

– Carapace shape different 3

2. In dorsal view, LV much longer than RV . . . . *T. elegans* (Danielopol and Cvetkov 1979)

– In dorsal view, both valves subequally long . *T. ljovuschkini* (Rudjakov 1963)

3. Carapace triangular in lateral view 4

– Carapace trapezoidal or subreniform in lateral view 10

4. LV triangular, RV trapezoidal, LV overlaps RV with strongly developed, triangular flange . . . . *T. tabacarui* (Danielopol and Cvetkov 1979)

– Both LV and RV triangular, flange, if present very small 5

5. “f” seta missing 6

– “f” seta present 7

6. Posterior claw on UR very short . . . *T. spandli* (Rogulj and Danielopol 1993)

– Both claws subequally long . . . . *T. hvarensis* (Danielopol 1969a)

7. Inner lobe on the hemipenis much lower than the outer lobe, inner lobe broadly rounded . . . . *T. riongessa* (Bronstein 1947)

– Inner lobe on the hemipenis equally high or much lower than the outer one, also inner lobe slightly pointed 8

8. “f” seta absent . . . . *T. coineaue* (Rogulj and Danielopol 1993)

– “f” seta present 9

9. Middle lobe on the hemipenis pointed . . . . *T. pietrosanii* (Danielopol and Cvetkov 1979)

– Middle lobe on the hemipenis rounded . . . . *T. latingerae* (Rogulj and Danielopol 1993)

10. Carapace clearly trapezoidal and finely ornamented 11

– Carapace more reniform and smooth 14

11. LV overlaps RV with strongly developed flange, ventral margin convex . . *T. italica* Karanovic and Pesce 2000

– Flange very small, if developed, ventral margin concave 12

12. Inner lobe on the hemipenis with flat distal margin, outer lobe higher or equal with inner one, penultimate segment of T3 indistinctly divided 13

– Inner lobe on the hemipenis subtriangular, outer lobe lower than the inner one, penultimate segment completely divided . . . . . *T. taurica* (Schornikov 1969)

13. Male sexual bristles on A2 absent . . . . . . *T. juberthieae* (Danielopol 1978b)

– Male sexual bristles on A2 present . . . . . . *T. cottarellii* (Danielopol 1982b)

14. Dorsal margin rounded 15

– Dorsal margin flat in middle 17

15. Greatest H on last third of L . . . . *T. peliaca* (Schäfer 1945)

– Greatest H situated medially 16

16. Fingers on left prehensile palp “S” shaped, with ventral bump . . . . *T. pseudocrenulata* (Schäfer 1945)

– Fingers on right prehensile palp not “S” shaped . . . . *T. transleithanica* (Löffler 1960)

17. A2 on penultimate segment with two externo-medial setae . *T. botosaneanui* (Danielopol 1973)

– A2 with one externo-medial seta 18

18. Finger on left prehensile palp without ventral bump . . . *T. laisi* (Klie 1938f)

– Finger on left prehensile palp with ventral bump 19

19. Outer lobe on the hemipenis lower than, or as high as inner one, greatest H more than 50% of L . . . . *T. loffleri* (Danielopol 1973)

– Outer lobe on the hemipenis higher than inner one, greatest H less than 50% of L . . . . *T. chappuisi* (Klie 1943b)

Ecology and distribution (Fig. 89)
The genus is distributed in the subterranean waters of Europe.

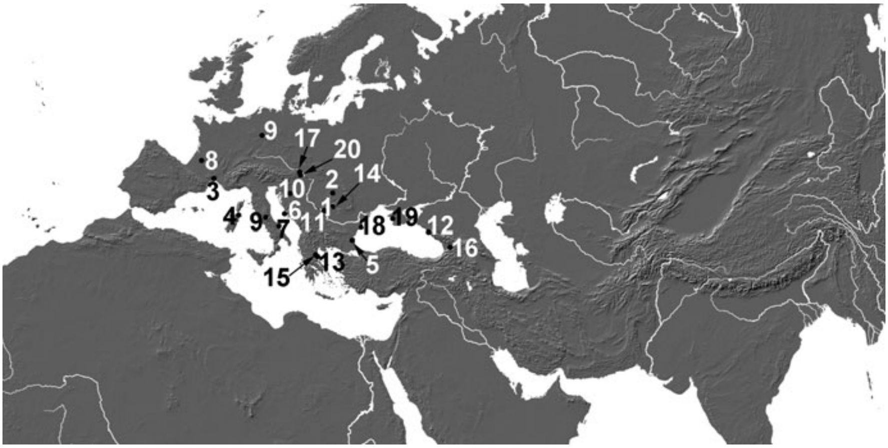


Fig. 89 Distribution of *Trapezicandona* Schornikov 1969: Numbers correspond to the species list

3.2 Subfamily Cyclocypridinae Kaufmann 1900a (Fig. 90)

Diagnosis (after Meisch 2000): Carapace short (less than 1 mm), usually relatively stout in lateral view (Figs. 90 and 91a, b), moderately compressed to ovate in dorsal view. CMS of Candonidae type (Fig. 92d). A1 usually 7-segmented (Figs. 93a and 91d). Rome organ present (Fig. 93b). Male sexual bristles on A2 present (Fig. 91c) or absent (Fig. 91g), swimming setae usually well developed (Fig. 91f), rarely absent (Fig. 91e). Endopod of female L5 normally developed (Fig. 93c), in males transformed into palps (Fig. 94c), vibratory plate usually with six rays. Prehensile palps 2-segmented (Fig. 92e). L7 always 4-segmented (Fig. 95f–h), terminal segment of the same appendage with two short and one long setae (Fig. 93d, f). Proximal part (entrance) of Zenker organ spherically enlarged (not funnel shaped). UR not reduced (Fig. 93h).

Type genus: *Cyclocypris* Brady and Norman 1889

Other genera: *Allocypria* Rome 1962; *Cypria* Zenker 1854; *Kempfcyclocypris* Karanovic in press; *Keysercypria* Karanovic 2011; and *Physocypria* Vávra 1897.

Key to the genera

1. Terminal segment of L7 elongated, more than two times longer than wide (Fig. 93f), seta “g” on the same appendage long (Figs. 93e and 95f), exceeding distal end of terminal segment 2

– Terminal segment of L7 much shorter (Figs. 93d and 95g, h), less than two times longer than wide, seta “g” tiny, sometimes even missing 3

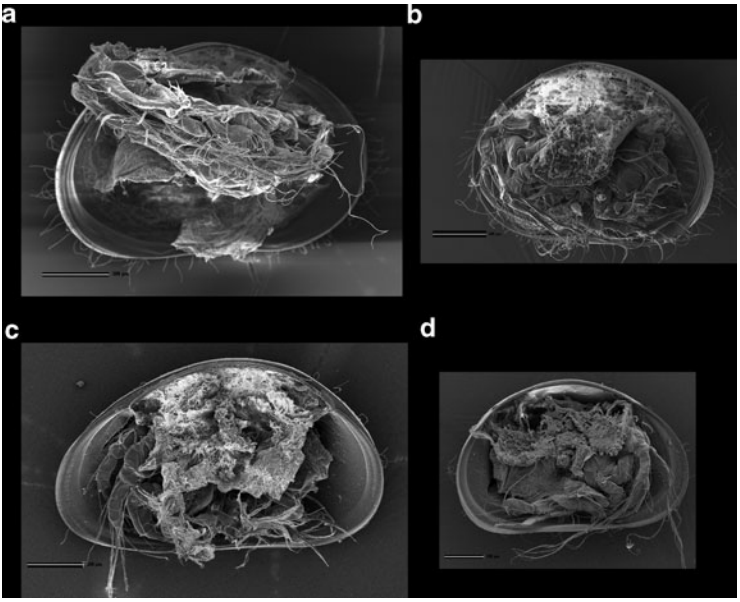


Fig. 90 SEM: (**a**, **b**) *Cyclocypris ovum* (Jurine 1820); (**c**, **d**) *Cypria ophtalmica* (Jurine 1820): (**a**, **c**, **d**) ♀ inside view: (**b**) ♂, inside view

2. A1 6-segmented, swimming setae on A2 missing (Fig. 91g, e) . . . *Kempfcyclocypris* Karanovic 2011
– A1 7-segmented, swimming setae on A2 present (Fig. 90b) *Cyclocypris* Brady and Norman 1889
3. Basal seta on L6 present (Fig. 94d) 4
– Basal seta on L6 absent (Fig. 95a–c) 5
4. End of ovaries curved downward (Fig. 91a) . . . . . . *Physocypria* Vávra 1897
– End of ovaries curved upward . . . . *Allocypria* Rome 1962
5. Setae “e” and “f” on L7 very short, seta “h2” considerably longer than “h1” (Fig. 95h) . . . . *Keysercypria* Karanovic 2011
– Setae “e” and “f” on L7 long, setae “h2” and “h1” subequally long (Fig. 95g) *Cypria* Zenker 1854

Allocypria Rome 1962

Diagnosis: Carapace reniform, often with elongated posterior end, and sometimes terminating with sharply pointed postero-ventral margin. Ends of ovaries curved upward. A1 7-segmented, male A2 with subdivided penultimate segment and with male sexual bristles developed. Swimming setae on A2 long, well exceeding distal end of terminal claws. Terminal segment of Md usually square, sometimes with L: W ratio more than 2:1. Terminal segment of Mxl palp square, endites usually with

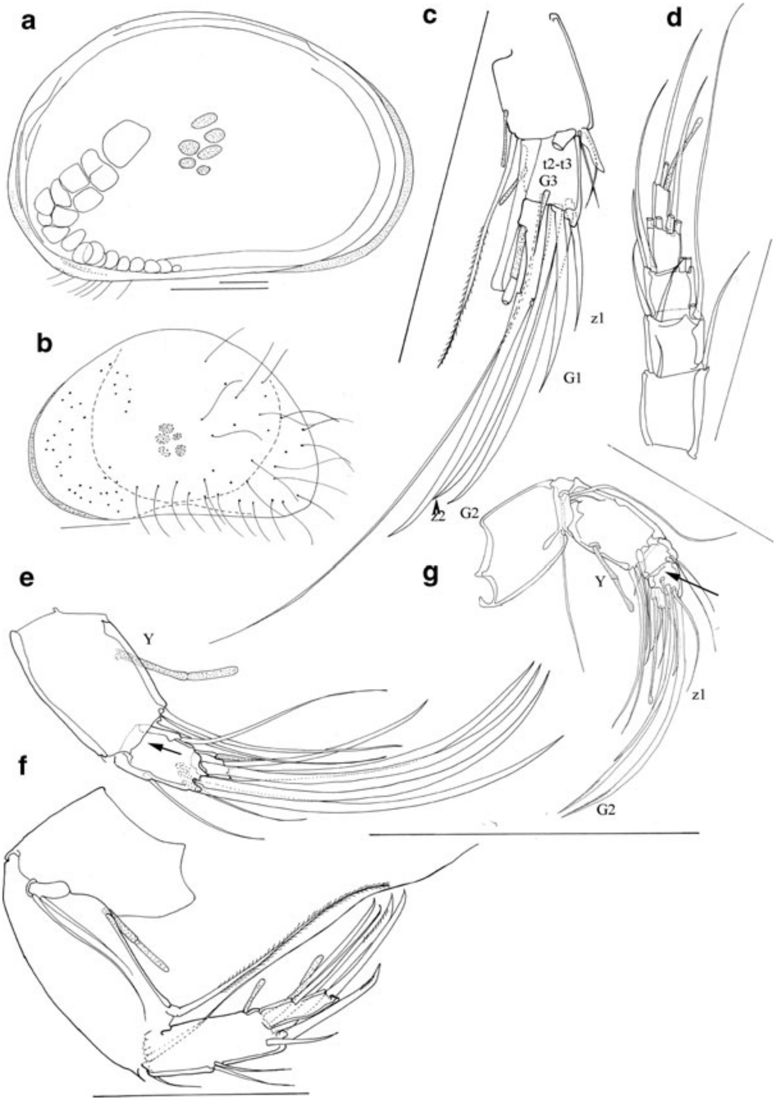


Fig. 91 Line drawings: (**a**) *Physocypria capensis* (Sars 1895); (**b**, **e**, **g**) *Kempfcyclocypris australis* Karanovic 2011; (**c**) *Keysercypria deformis* (Klie 1940e); (**d**) *Physocypria bullata* (Vávra 1897); (**f**) *Cypria pusilla* Sars 1896: (**a**) LV, inside view; (**b**) LV, outside view; (**c**, **e**, **f**, **g**) A2; (**d**) A1. Scales = 0.1 mm

strongly serrated teeth. Prehensile palps asymmetrical. L6 with basal seta ("d1"). L7 4-segmented with basal segment carrying all setae ("d1," "d2," and "dp"). Setae "e" and "f" long, reaching half L of the proceeding segments; seta "g" very short. Terminal segment short, with short "h1" and "h2" setae and long "h3" seta. UR

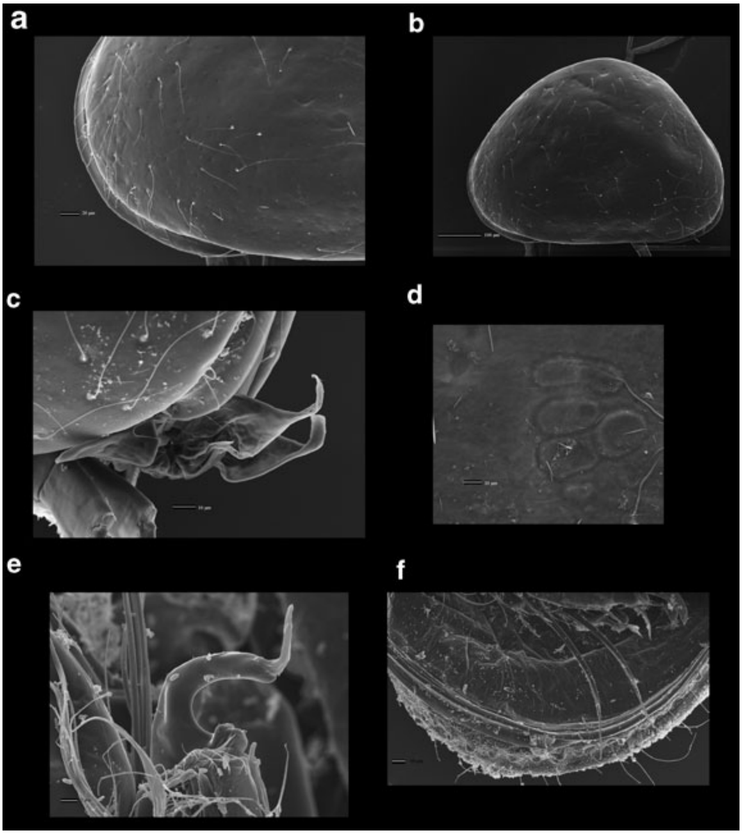


Fig. 92 SEM: (**a**–**e**) *Cypria karamani* Petkovski 1976; (**f**) *Physocypria bullata* (Vávra 1897): (**a**) anterior margin; (**b**) lateral view from the right side; (**c**) protruding hemipenis; (**d**) CMS; (**e**) prehensile palp; (**f**) posterior margin of RV

completely developed. Hemipenis with two lobes (outer and inner) both being quite thin and elongated; Zenker organ with seven whorls of spines. Genital field in female without any extensions.
Type species: *A. inclinata* Rome 1962

Species list with type locality and type material

1. *A. aberrans* Rome 1962. Edith Bay, Lake Tanganyika, Tanzania, 06°30′S 29°55′E: Holotype (♂), RBINS – O.C. 559.
2. *A. curta* (Sars 1910). Sumbu, Lake Tanganyika, DR Congo, 04°50′S 15°11′E: Repository of the type material unknown.
3. *A. claviformis* (Sars 1910). Sumbu, Lake Tanganyika, DR Congo, 04°50′S 15°11′E: Repository of the type material unknown.
4. *A. flexuosa* (Sars 1910). Sumbu, Lake Tanganyika, DR Congo, 04°50′S 15°11′E: Repository of the type material unknown.

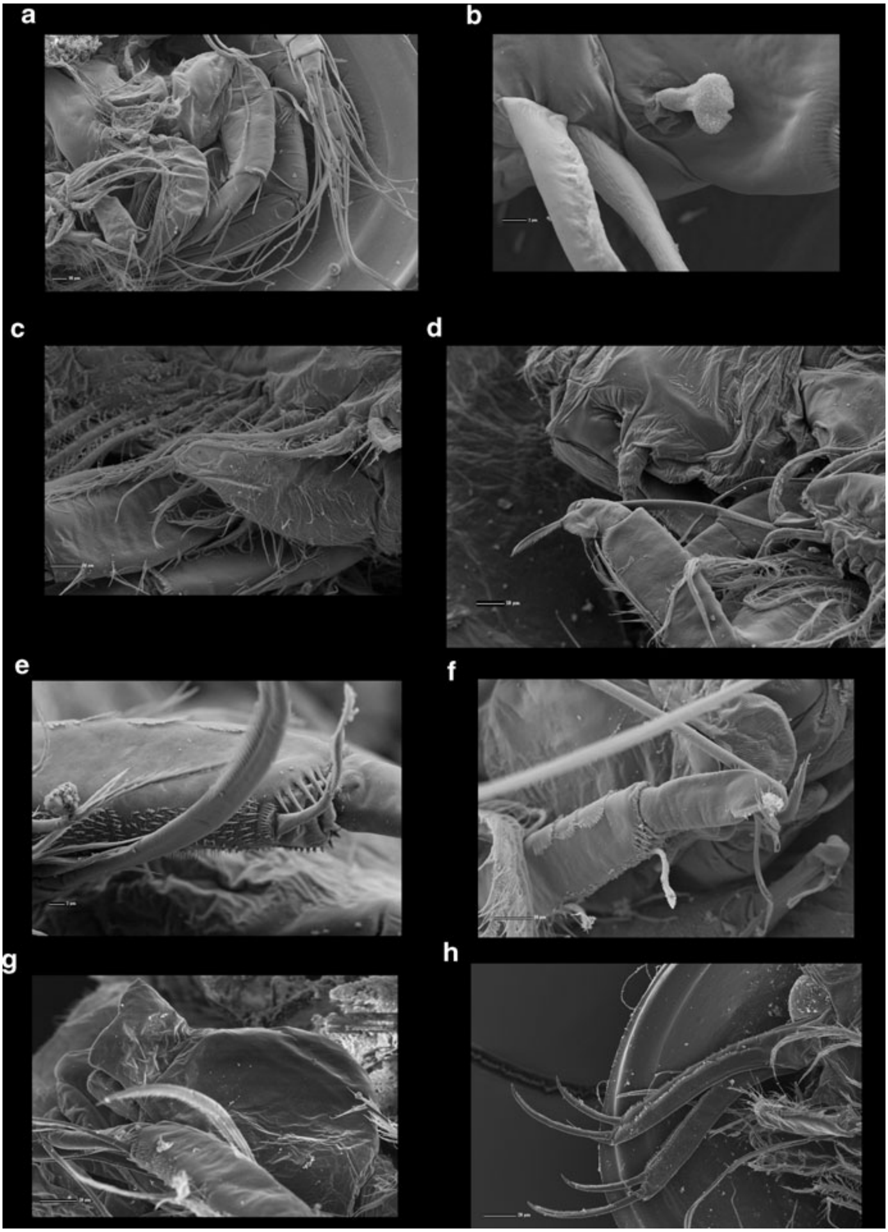


Fig. 93 SEM: (**a**–**d**) *Cypria ophtalmica* (Jurine 1820); (**e**–**h**) *Cyclocypris ovum* (Jurine 1820): (**a**) detail of A1 and A2; (**b**) Rome organ on A1; (**c**) L5; (**d**–**f**) L7; (**g**) hemipenis; (**h**) UR

5. *A. humilis* (Sars 1910). Sumbu, Lake Tanganyika, DR Congo, 04°50′S 15°11′E: Repository of the type material unknown.
6. *A. inclinata* Rome 1962. Tebmwe, Lake Tanganyika, DR Congo, 06°30′S 29°22′E: Types RBINS – O.C. 547.

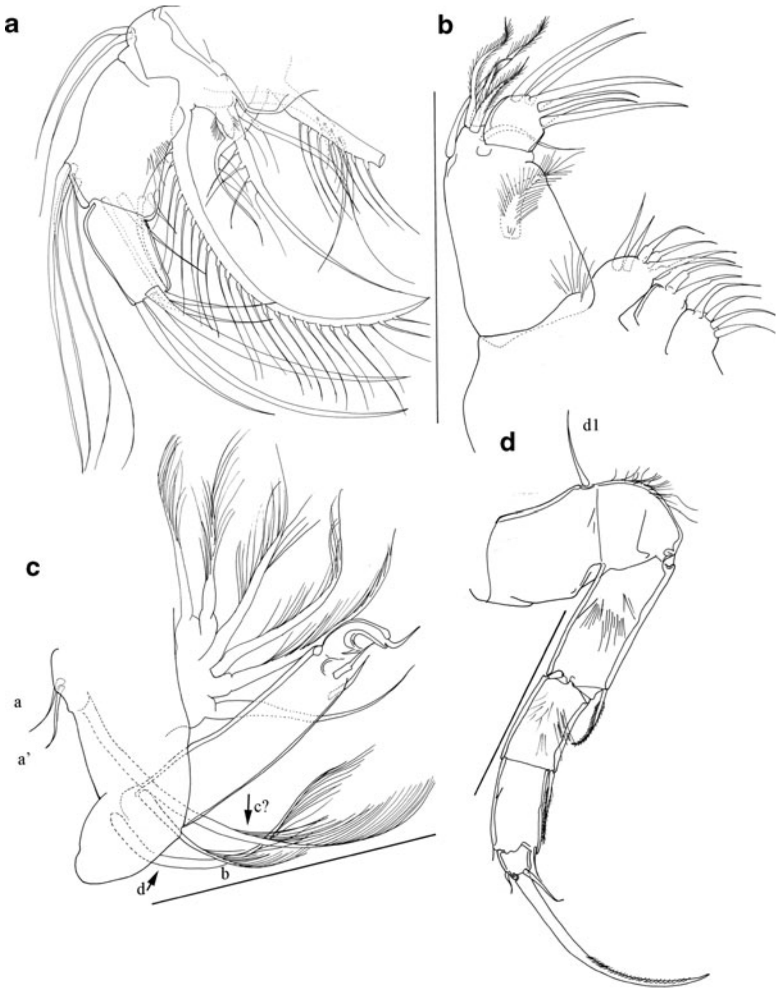


Fig. 94 Line drawings: *Physocypria bullata* (Vávra 1897): (**a**) Md palp; (**b**) Mxl palp and endites; (**c**) L5; (**d**) L6. Scales = 0.1 mm

7. *A. mucronata* Rome 1962. Edith Bay, Lake Tanganyika, Tanzania, 06°30′S 29°55′E: Holotype (♂), RBINS – O.C. 556.
8. *A. navicula* Rome, 1962. Tebmwe, Lake Tanganyika, DR Congo, 06°30′S 29°22′E: Holotype (♂), RBINS – O.C. 550.
9. *A. reniformis* (Sars 1910). Kala, Lake Tanganyika, Tanzania, 08°07′S 30°58′E: Repository of the type material unknown.

Key to the species

1. Postero-ventral margin of carapace pointed 2
– Postero-ventral margin of the carapace rounded 3

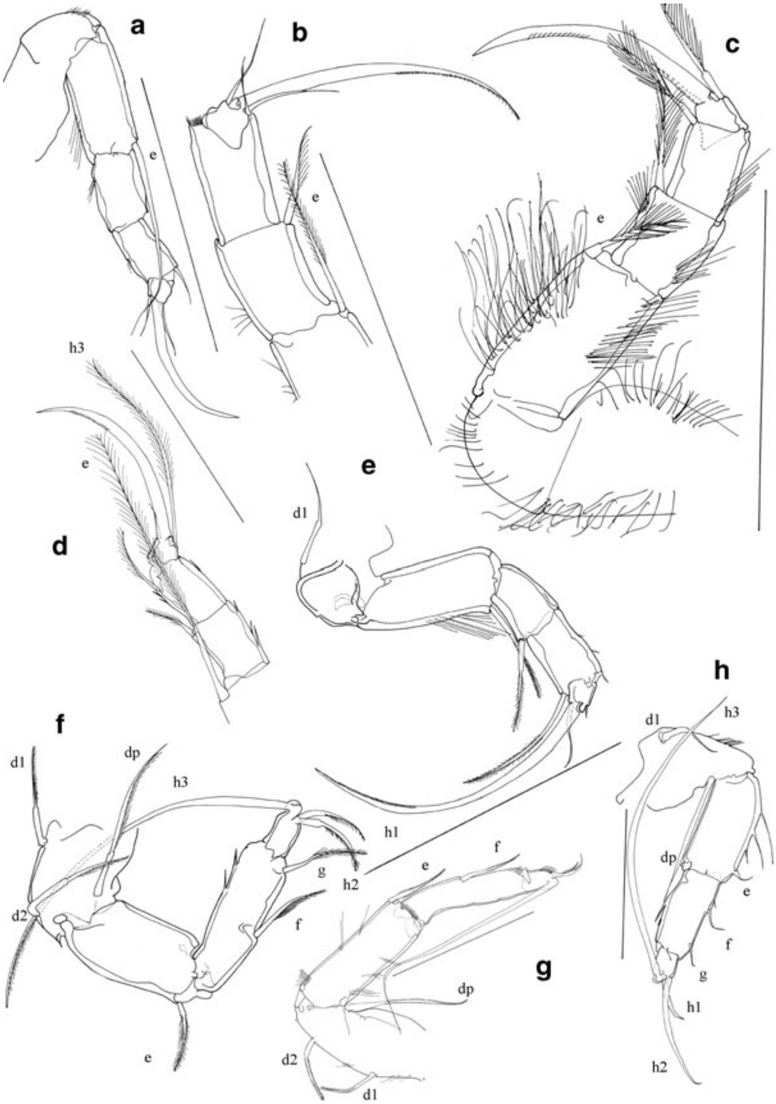


Fig. 95 Line drawings: (**a**) *Cypria inversa* Klie 1941; (**b**) *Cypria kerkyrensis* Klie 1936; (**c**) *Keysercypria obtusa* (Klie 1940e); (**d**) *Keysercypria deformis* (Klie 1940e); (**e**, **f**) *Kempfcyclocypris australis* Karanovic 2011; (**g**) *Physocypria bullata* (Vávra 1897); (**h**) *Keysercypria affinis* (Klie 1933b): (**a**–**e**) L6; (**f**–**h**) L7. Scales = 0.1 mm

2. In lateral view, posterior margin evenly rounded . . . *A. mucronata* Rome 1962
– In lateral view, posterior margin bulging . . . . *A. claviformis* (Sars 1910)
3. Anterior and posterior margins equally wide, dorsal margin almost flat
   A. humilis (Sars 1910)

– Posterior margin narrower, dorsal margin not flat 4

4. Dorsal margin evenly rounded, valves kidney shaped 5

– Dorsal margin not evenly rounded, valves more triangular 6

5. Posterior seta on the UR very short . . . . *A. flexuosa* (Sars 1910)

– Posterior seta on the UR long, exceeding distal margin of the ramus *A. reniformis* (Sars 1910)

6. Claws on the endites of Mxl smooth . . . . *A. aberrans* Rome 1962

– Claws on the endites of Mxl strongly serrated 7

7. Greatest H situated in the middle . . . . *A. inclinata* Rome 1962

– Greatest H situated toward anterior part of the carapace *A. navicula* Rome 1962

Ecology and distribution
All species are endemic to the Lake Tanganyika.

***Cyclocypris* Brady and Norman 1889 [Syn.: *Cyclocypria* Dobbin 1941]**
Diagnosis: Carapace short when seen laterally, ovate in dorsal view, with greatest H and W exceeding ½ L (Fig. 90b, d) LV overlaps RV both dorsally, frontally and ventrally, or RV overlaps LV. A1 7-segmented. Penultimate segment of A2 in male subdivided, but "t2" and "t3" setae not transformed into sexual bristles. Terminal segment of Md palp rather short, L:W ratio being 2:1. Terminal segment of Mxl palp square. Prehensile palps slightly asymmetrical. L6 with basal seta, ("d1") present, same appendage 5-segmented. L7 4-segmented. Basal segment with "d1," "d2," and "dp" setae developed. Penultimate segment not subdivided, "e," "f," and "g" setae long. Terminal segment elongated more than three times longer than wide. Setae "h1" and "h2" short, "h3" long (Fig. 93e, f). UR completely developed (Fig. 93h), hemipenis with all three lobes developed. Outer and inner lobes being short and stubby (Fig. 93g). Genital field without any extensions. Zenker organ with seven whorls of spines.

Type species: *C. globosa* (Sars 1863)

Species list with synonyms, type locality, and type material

1. *C. ampla* Furtos 1933. Blue Hole Spring, Castalia, Ohio, USA, 41°24′N 82°48′W: Paratypes, SM – 67878.
2. *C. brevisetosa* Bronstein 1928. Dyn'iol River, Mylv, Pechora River, Russia, 68°16′N 54°22′E: Repository of the type material unknown.
3. *C. diebeli* Absolon 1973. Brook Pschovka, Maly Ujezd, Melnik, Czech Republic, 50°19′N 14°31′E: Holotype (LV), GIP – collection number unknown.
4. *C. globosa* (Sars 1863). Lake Mjøsa, Oppland, Norway, 60°40′N 11°00′E: Repository of the type material unknown.

   Syn.: *C. dispera* Müller 1912; *Cypris cinerea* Brady 1868

5. *C. forbesi* Sharpe 1897. Pond in the woods near Bloomington, Illinois, USA, 40°29′N 88°59′W: Repository of the type material unknown.

Syn.: *C. washingtoniensis* Dobbin 1941

6. *C. laevis* (OF Müller 1776). Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.
7. *C. mediosetosa* Meisch 1987. Les Eyzies-de-Tayac-Sireuil, Dordogne, Aquitaine, France, 44°56′N 01°00′E: Types, NHML – collection numbers unknown.
8. *C. modesta* (Herrick 1887). Type locality not explicitly given, possibly Mobile Bay area, Alabama, USA, 30°26′N 88°00′W: Repository of the type material unknown.
9. *C. nahcotta* Dobbin 1941. Lake Washington, Washington, USA, 47°37′N 122°15′W: Lectotype (♂), SM – 1134521.
10. *C. ovum* (Jurine 1820). Surroundings of Geneva, Switzerland, 46°12′N 06°08′E: Types, NHMG – collection numbers unknown.

Syn.: *C. impressopunctata* Hirschmann 1909; *C. pygmaea* Croneberg 1894

11. *C. pusilla* Sars 1895. Knysna, South Africa, 34°02′S 23°02′E: Types, NHMO – F4320.
12. *C. scrobiculata* Klie 1936c. Puddles, Corfu, Greece, 39°40′N 19°45′E: Syntypes, ZMK – UR-564.
13. *C. serena* (Koch 1838). Tank within a garden, In der Bombach (old street name or "in the creek Bombach"), Zweibrücken, Rhineland-Palatinate, Germany, 49°15′N 07°22′E: Repository of the type material unknown.
14. *C. sharpei* Furtos 1933. Bass Lake, Ohio, USA, 39°49′N 84°03′W: Syntypes, SM – 67879.

Syn.: *C. cruciata* Furtos 1935

15. *C. vinyardi* Külköylüoğlu 2008. Cane Spring, Humboldt County, Nevada, USA, 38°13′N 116°11′W: Holotype (♂), SM – 1099661.

Key to the species

1. In dorsal view, LV overlaps RV anteriorly 2
– In dorsal view, RV overlaps LV anteriorly 6
2. Posterior seta on the UR long, i.e. exceeding distal margin . . . *C. scrobiculata* Klie 1936c
– Posterior seta on the UR short, i.e. not reaching distal margin, or even absent 3
3. Posterior seta on the UR absent . . . . *C. sharpei* Furtos 1933
– Posterior seta on the UR short 4
4. Seta "e" on L6 long, exceeding terminal segment . . *C. nahcotta* Dobbin 1941
– Seta "e" on L6 not reaching distal end of penultimate segment 5
5. Anterior margin of RV with a row of small rectangular plates . . . . . *C. diebeli* Absolon 1973
– No such plates present . . . . *C. laevis* (OF Müller 1776)

6. Swimming setae on A2 not reaching tips of terminal claws 7
– Swimming setae on A2 by far exceeding tips of terminal claws 8
7. Swimming setae on A2 reaching only distal end of penultimate segment *C. brevisetosa* Bronstein 1928
– Swimming setae on A2 reaching middle of terminal claws . . *C. mediosetosa* Meisch 1987
8. Carapace elongated, posterior end narrower than anterior . . . . . . *C. modesta* (Herrick 1887)
– Carapace globular, posterior end as wide as anterior end 9
9. Terminal segment of the L7 five times longer than wide *C. pusilla* Sars 1895
– Terminal segment on the L7 less than five times longer than wide 10
10. Body of prehensile palps medially constricted 11
– Body of prehensile palps not medially constricted 12
11. Dorsal margin highly arched . . . . *C. vinyardi* Küllöylüoğlu 2008
– Dorsal margin evenly rounded . . . . *C. forbesi* Sharpe 1897
12. Finger of the right prehensile palp with a long dorsal margin, having almost square appearance . . . . *C. globosa* (Sars 1863)
– Finger of the right prehensile palp with short and rounded dorsal margin 13
13. The shortest seta on terminal segment of L7 (seta h1) “S” shapes . . *C. ovum* (Jurine 1820)
– The shortest seta on terminal segment of L7 (seta h1) only slightly curved 14
14. Outer lobe on the hemipenis quadrangular . . . . *C. serena* (Koch 1838)
– Outer lobe on the hemipenis triangular . . . . *C. ampla* Furtos 1933

Species not included in the key

Species *Cyclocypria kincaidia* Dobbin 1941 and *Cyclocypris wyomingensis* Ferguson 1966 were not included in the key to the species of the genus *Cyclocypris*. The first species was described from Lake Washington (Dobbin 1941), as the type and the only species of the genus *Cyclocypria* Dobbin 1941. However, the species was described after juvenile specimens, and the differential diagnosis is an artifact of species being an early instar. The original description and drawings of *C. wyomingensis* simply do not have enough information to give this species a correct phylogenetical position within the genus, and it extremely resembles *C. laevis* (OF Müller 1776). Henry (1923) described *Cyclocypris tenuissima* Henry 1923 from an unknown locality in New South Wales. The species description is very short and the drawings imprecise, but it is very easy to draw a conclusion that the species Henry (1923) was dealing with does not belong in to the subfamily Cyclocypridinae. The posterior seta on the UR is in this species positioned very close to the distal margin, a feature not present in the subfamily. Beside, the UR itself is very thin and long. It is more likely that this species belongs to some of the genera of the family Cyprididae.

Cyclocypris castanea Brady 1913 has a conspicuously long marginal pore canals and has a highly arched dorsal margin on the carapace, but further study of the material is important to properly evaluate this species. Klugh (1923) described two *Cyclocypris* species from Canada: *C. castanea* Klugh 1923 and *C. lutea* Klugh 1923. The first one is a homonym, but since the taxonomic position of both Canadian species is doubtful, they are only listed here. *Cyclocypris helokrenica* Fuhrmann and Pietrzeniuk 1990 is very closely related to *C. ovum* and more research is needed to confirm or invalidate the taxonomic validity of this species. *Cyclocypris drastichi* Jancarik 1949 also needs further studies.

Ecology and distribution (Fig. 96)
Species of this genus can usually be found in open freshwater bodies, such as lakes and puddles, but also in springs and spring-connected habitats. The genus is mainly distributed in the Northern Hemisphere.

***Cypria* Zenker 1854 [Syn.: *Candocypria* Furtos 1933; *Bentocypria* Kovalenko 1987]**

Diagnosis: Carapace short, laterally compressed. Margins of both valves smooth (Fig. 92a) or sometimes with tubercles. Ends of ovaries curved upward. A1 7-segmented. A2 in males with “t2” and “t3” setae transformed into sexual setae. Terminal segment of Md palp several times longer than broad. Terminal segment of Mxl palp square. Prehensile palps asymmetrical. Basal segment of L6 without “d1” seta, same appendage with short or long “e” seta (Fig. 95a, b). L7 with all three setae present on basal segment, setae “e” and “f” long, seta “g” very short (Fig. 93d). Terminal segment not more than two times longer than broad, same segment with two short (“h1” and “h2”) and one long (“h3”) setae. UR completely developed, hemipenis with only two lobes (outer and inner) (Fig. 92c), genital field in females often with processes (Fig. 97a, c). Zenker organ with seven whorls of spines.

Type species: *C. exsculpta* (Fischer 1855)

Species list with synonyms, type locality, and type material

1. *C. bicolor* Petkovski and Meisch 1994. Izice spring, near Ig, 10 km S of Ljubljana, Slovenia, 45°57′N 14°31′E: Holotype (♀), NHMS – collection number unknown.
2. *C. biwaense* Okubo 1990b. Lake Biwa, Japan, 35°15′N 136°05′E: Holotype (♂), SJU – FO-513.
3. *C. brevisetigera* Cole 1965. Spring Branch, Stones Lake, Davidson County, Tennessee, USA, 05°26′N 86°25′W: Holotype (♀), SM – 120555.
4. *C. cavernae* Wagenleitner 1990. Cave near St. Giovanni di Duino, Italy, 45°47′N 13°36′E: Holotype (♀), LIM – collection number unknown.
5. *C. crenulata* Sars 1903a. Helvetic Estate, Deli, North Sumatra, Indonesia, 03°28′N 98°41′E: Syntypes, NHMO – FO-11758.

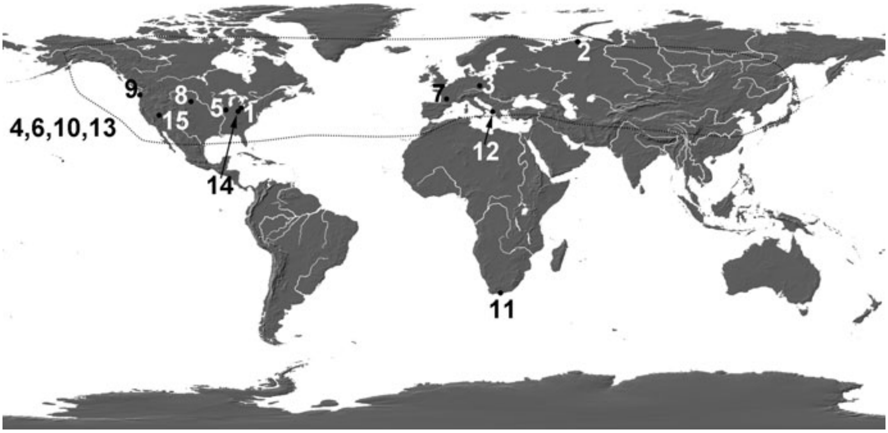


Fig. 96 Distribution of *Cyclocypris* Brady and Norman 1889: Numbers correspond to the species list

6. *C. curvifurcata* Klie 1923. Kostroma, Russia, 57°46′N 40°56′E: Syntypes, ZMK – UR-527, 1520–21.

   Syn.: *C. lata* Dubowsky 1929

7. *C. denticulata* Daday 1905. Puddles next to railway, between Areguá and Luque (Lugua), Central, Paraguay, 25°15′S 57°25′W: Types, HNHM – IV/105.
8. *C. dentifera* Sharpe 1897. Zoological Gardens, Cincinnati, Ohio, USA, 39°08′N 84°30′W: Repository of the type material unknown.
9. *C. devai* Arora 1931. Temporary pool in front of the Central Jail, Lahore, Punjab, Pakistan, 31°32′N 74°20′E: Repository of the type material unknown.
10. *C. dumonti* (Martens 1982). Well near village Maas, Somalia, 04°23′N 46°05′E: Repository of the type material unknown.
11. *C. exsculpta* (Fischer 1855). Type locality unknown. Repository of the type material unknown.
12. *C. exquisita* Furtos 1936a. Seminole City, Florida, USA, 27°50′N 82°46′W: Holotype (♀), SM – 71389.
13. *C. furfuracea* (Brady 1886a). Colombo, Sri Lanka, 06°55′N 79°50′E: Repository of the type material unknown.
14. *C. gibbera* Furtos 1936a. Elfers Pool, Florida, USA, 29°01′N 79°50′W: Holotype (♀), SM – 71391.
15. *C. globula* Furtos 1933. Bass Lake, Ohio, USA, 39°49′N 84°03′W: Syntypes, SM – 67880.
16. *C. granadae* (Hartmann 1959). Beach S of Granada, Nicaragua, 11°45′N 86°03′W: Repository of the type material unknown.
17. *C. inequivalva* Turner 1893. Mill Creek bottom, Tusculum, Clifton, Cincinnati, Ohio, USA, 39°07′N 84°25′W: Repository of the type material unknown.
18. *C. inflata* (Furtos 1933). Lake Side, East Harbour, Ohio, USA, 41°06′N 80°38′W: Syntypes, SM – 67881.

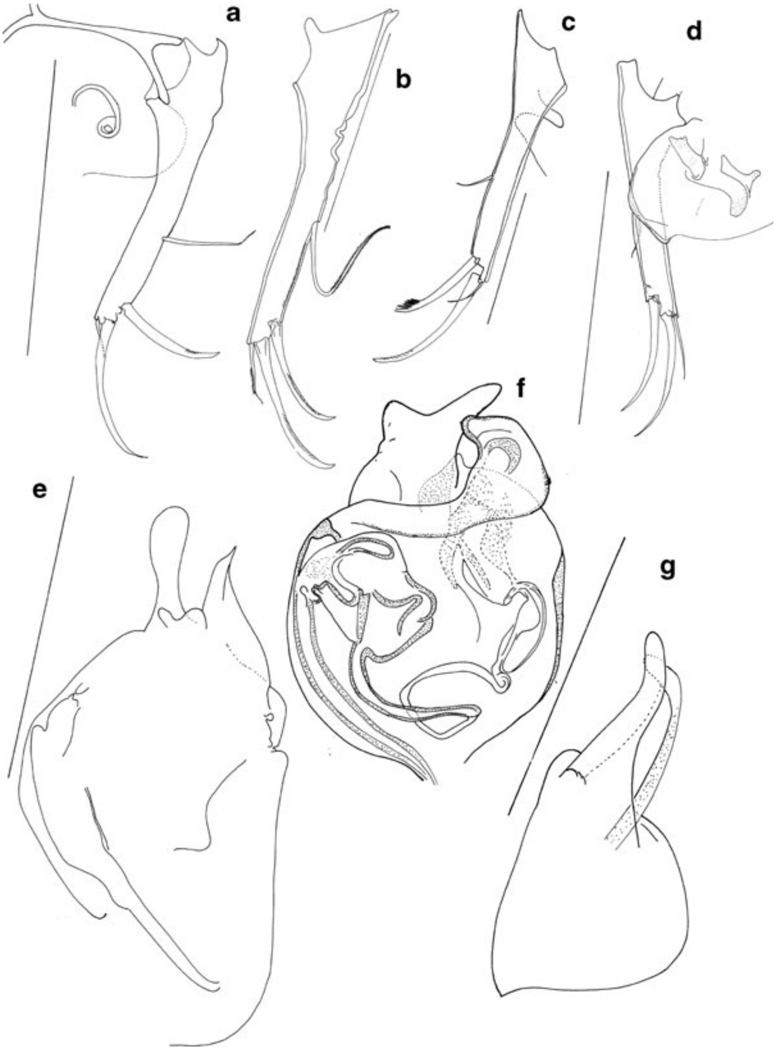


Fig. 97 Line drawings: (**a**) *Cypria pusilla* Sars 1896a; (**b**) *Physocypria bullata* (Vávra 1897); (**c**) *Cypria pustulosa* Sharpe 1897; (**d**, **f**) *Kempfcyclocypris australis* Karanovic 2011; (**e**) *Keysercypria affinis* (Klie 1933b); (**g**) *Cypria brevisetigera* Cole 1965: (**a**–**d**) UR; (**e**–**g**) hemipenis. Scales = 0.1 mm

19. *C. inversa* Klie 1941b. Lake Dojran, Macedonia, 41°13′N 22°44′E: Syntypes, ZMK – UR-523.
20. *C. javana* Müller 1906a. Citayam, West Java, Indonesia, 06°27′S 106°47′E: Syntypes, ZMH – K-19039.
21. *C. karamani* Petkovski 1976. Well, Bitola, Macedonia, 41°01′N 21°20′E: Types, NHMS – collection numbers unknown.

22. *C. kerkyrensis* (Klie 1936c). Well, Corfu Island, Greece, 39°37′N 19°55′E: Syntypes, ZMK – UR-1004.
23. *C. konishii* Smith and Kamiya 2006. Small trickle flowing in crack of rock, area near Yudomari, S Yakushima Island, Japan, 30°13′48.0″N 130°28′51.9″E: Holotype (♀), NSMT – 28878.
24. *C. kraepelini* (Müller 1903). Norderelbe, Hamburg, Germany, 53°32′N 09°56′E: Repository of the type material unknown.
25. *C. larensis* (Hartmann 1964). Water cistern, Lar, Iran, 38°24′N 46°13′E: Syntypes, ZMH – K-27666.
26. *C. lubeziensis* Kovalenko 1982. Lake Ljuobez', Volynskyi, Ukraine, 50°35′N 27°28′E: Holotype (♀), ZIUAS – 65, 66.
27. *C. maculata* Hoff 1942. Henry County, Illinois, USA, 41°21′N 90°09′W: Holotype (♀), SM – 81083.
28. *C. matzkeae* Smith and Janz 2008. SW part of N basin of Lake Biwa, Japan, 35°13′54.1″N 135°57′49.6″E: Holotype (♂), LBM – 1430003340.
29. *C. mediana* Hoff 1942. Marion County, Illinois, USA, 38°39′N 88°56′W: Holotype (♀), SM – 81081.
30. *C. minicapensis* (Green 1962). River Sokoto, Nigeria, 13°03′N 04°43′E: Repository of the type material unknown.
31. *C. minuta* (Victor and Michael 1975). Well, Bibikulam, Madurai, India, 09°56′N 78°07′E: Holotype (♀), DBSMU – slide no. 7.
32. *C. mons* (Chambres 1877). Pond on Mt. Elbert, Colorado, USA, 39°07′N 106°26′W: Repository of the type material unknown.
33. *C. obesa* Sharpe 1897. Havana, Illinois, USA, 40°18′N 90°03′W: Repository of the type material unknown.
34. *C. nipponica* (Okubo 1990b). Paddy fields, Kyushu, Japan, 33°00′N 131°00′E: Holotype (♂), SJU – FO-524.
35. *C. obliqua* Klie 1939e. Lake Ohrid, Macedonia, 41°00′N 20°45′E: Syntypes, ZMK – UR-530.
36. *C. ophtalmica* (Jurine 1820). Pond of Crevin near Geneva, Switzerland, 46°12′N 06°08′E: Types, NHMG – collection numbers unknown.

    Syn.: *C. lacustris* Lilljeborg 1890

37. *C. osburni* (Furtos 1933). Cold Spring Run, Newark, Ohio, USA, 40°33′N 81°07′W: Paratypes, SM – 67866.

    Syn.: *C. fontana* Cole 1965

38. *C. palustera* Furtos 1935. Marsh, between Barnstable and East Sandwich, Massachusetts, USA, 41°42′N 70°17′W: Holotype (♀), SM – 71409.
39. *C. polessica* Kovalenko 1982. Lake Ljuobez′, Volynskyi, Ukraine, 50°35′N 27°28′E: Holotype (♀), ZIUAS – 59, 60.
40. *C. posterotuberculata* Furtos 1935. Palmers Pond, Falmouth, Massachusetts, USA, 41°33′N 70°36′W: Holotype (♀), SM – 71412.
41. *C. pseudocrenulata* Furtos 1936a. On the road to Tarpon, ca. 3 km from Dunedin, Florida, USA, 28°01′N 82°46′W: Holotype (♀), SM – 71385.

42. *C. pusilla* Sars 1896a. Waterloo Swamps, Sydney, NSW, Australia, 32°30′S 143°22′E: Types, NHMO – F11601.
43. *C. pustulosa* Sharpe 1897. Biological Station, Havana, Illinois, USA, 40°18′N 90°03′W: Repository of the type material unknown.
44. *C. reptans* Bronstein 1928. Moss, fourth creek, Redant Valley at the Georgian Military Road, North-Caucasia, Russia, 45°43′N 38°31′E: Repository of the type material unknown.

    Syn.: *C. stygia* Klie 1935d

45. *C. sharmai* Battish 1985. Pond, Ladhowal, Punjab, India, 30°54′N 75°51′E: Holotype (♀), PAU – 0.46.
46. *C. sketi* Petkovski 1976. Swamp, Bokanjac, near Zadar, Croatia, 44°08′N 15°14′E: Types, NHMS – collection numbers unknown.
47. *C. spinifera* Tressler 1937. Laguna de Bay, Cavite, Luzon Island, Philippines, 14°28′N 120°55′E: Type (♂), SM – 71504.
48. *C. subsala* Redeke 1936. Schokland, Netherlands, 52°38′N 05°46′E: Repository of the type material unknown.
49. *C. sywulae* Meisch 2000. Permanent swamp, Otomin, Poland, 54°19′N 18°31′E: Repository of the type material unknown.
50. *C. turneri* Hoff 1942. Massac County, Illinois, USA, 37°14′N 88°44′W: Holotype (♀), SM – 81078.

Key to the species

1. RV without tubercles along margins 2
– RV with tubercles along margins 24
2. Swimming setae on A2 not reaching tip of the terminal claws 3
– Swimming setae on A2 by far exceed tip of the terminal claws 9
3. In lateral view, dorsal margin arched 4
– In lateral view, dorsal margin almost straight 7
4. Swimming setae on A2 exceeding distal end of terminal segment 5
– Swimming setae on A2 at the most reach distal end of penultimate segment 6
5. Finger of the right prehensile palp elongated . . . . . *C. reptans* Bronstein 1928
– Finger of the right prehensile palp short and stocky . *C. curvifurcata* Klie 1923
6. Greatest H behind middle . . . . *C. konishii* Smith and Kamiya 2006
– Greatest H in the middle . . . . *C. polessica* Kovalenko 1982
7. Swimming setae reaching distal end of terminal segment . . . *C. brevisetigera* Cole 1965
– Swimming setae reaching at the most middle of penultimate segment 8
8. Posterior seta on UR exceeding distal end of the ramus . . . . *C. bicolor* Petkovski and Meisch 1994

– Posterior seta on UR short not reaching distal end of the ramus . . *C. osburni* (Furtos 1933)

9. Carapace ornamented with longitudinal striae 10

– Carapace smooth 13

10. Inner lobe on the hemipenis broadly rounded and much lower than lobe “a” shape . . . . *C. exsculpta* (Fischer 1855)

– Both lobes on the hemipenis elongated and of the same height 11

11. Inner lobe on the hemipenis with an almost tapering distal part . . . *C. turneri* Hoff 1942

– Inner lobe on the hemipenis curved at the top, but not with the tapering part *C. matzkeae* Smith and Janz 2008

12. Carapace elongated with greatest H on the first third of L . . . . . *C. mediana* Hoff 1942

– Carapace rounded with greatest H around middle 13

13. Carapace highly asymmetrical 14

– Both valves of more of less same H 17

14. RV higher than LV . . . . *C. inversa* (Klie 1941b)

– LV higher than RV 15

15. Seta “e” on L6 very long, exceeding distal margin of the terminal claw . . *C. pusilla* Sars 1896a

– Seta “e” on L6 short, not exceeding distal end of the third segment 16

16. LV with flat medial part of dorsal margin . . . . *C. obliqua* Klie 1939e

– LV with rounded medial part of dorsal margin . . . *C. karamani* Petkovski 1976

17. Marginal pore canals wide and thick . . . . . *C. pseudocrenulata* Furtos 1936a

– Marginal pore canals very narrow and thin 18

18. Posterior claws on the UR with prominent teeth, much strongly developed than on the anterior claw . . . . *C. maculata* Hoff 1942

– Posterior claw sometimes with teeth but less developed and not strongly developed than on the anterior claw 19

19. Seta “e” on L6 very long, exceeding distal end of penultimate segment . . 20

– Seta “e” on L6 not long, only reaching distal end of third segment 21

20. Seta “e” not exceeding distal end of terminal segment *C. palustera* Furtos 1935

– Seta “e” by far exceeding distal end of terminal segment 22

21. Genital field in ♀ finger shaped . . . . *C. spinifera* Tressler 1937

– Genital field conical . . . . *C. javana* Müller 1906a

22. Genital field with a conical process, directed posteriorly . . . . *C. subsala* Redeke 1936

– Genital field with different processes 23

23. 23 Genital field with two processes, posterior triangular, anterior shorter and distally rounded . . . . *C. sywulae* Meisch 2000
– Genital field with one or two finger shaped, setulae bearing processes . . . . *C. ophtalmica* (Jurine 1820) s.l.
24. Posterior seta on the UR very short, not reaching distal margin of the ramus 25
– Posterior seta on the UR long, by far exceeding distal margin of the ramus 34
25. Valves asymmetrical in lateral view 26
– Valves symmetrical in lateral view 29
26. RV dorsally overlapping LV with a broad flange 27
– LV dorsally overlapping RV with a broad flange 28
27. Finger on the right prehensile palp inflated . . . . *C. kerkyrensis* (Klie 1936c)
– Finger on the right prehensile palp elongated . . . . . *C. gibbera* Furtos 1936a
28. Left valve in lateral view with two humps . . . . *C. inflata* (Furtos 1933)
– Dorsal margin of LV evenly rounded . . . . *C. pustulosa* (Sharpe 1897)
29. Carapace ornamented 30
– Carapace smooth 31
30. Carapace ornamented with longitudinal striae *C. minicapensis* (Green 1962)
– Carapace ornamented with clear pits . . . . *C. exquisita* (Furtos 1936a)
31. In lateral view, ventral margin convex . . . . *C. globula* (Furtos 1933)
– In lateral view, ventral margin straight 32
32. First segment of the prehensile palps short and stout . . . . *C. denticulata* (Daday 1905)
– First segment of prehensile palps elongated 33
33. Outer lobe on the hemipenis shorter than the inner one and with pointed distal end . . . . *C. granadae* (Hartmann 1959)
– Outer lobe on the hemipenis longer than the inner one and with rounded distal end . . . . *C. kraepelini* (Müller 1903)
34. Greatest H well behind the middle L 35
– Greatest H around the middle 36
35. Left valve with a well-developed flange and marginal pore canals clearly visible . . . . *C. crenulata* (Sars 1903a)
– Left valve without a well-developed flange and marginal pore canals minute *C. larensis* (Hartmann 1964)
36. Tip of the inner lobe on the hemipenis bended ventrally . . . . . *C. furfuracea* (Brady 1886a)
– Tip of the inner lobe on the hemipenis not bended *C. dumonti* (Martens 1982)

Species not included in the key

The variability of *Cypria ophtalmica* (Jurine 1820) in the appearance of the carapace, genital field in females and hemipenis in males, has already been pointed out by Meisch (2000). This species has a very wide distribution range and, in addition to *C. lacustris* Lilljeborg 1890, which has already been considered as a junior synonym of *C. ophtalmica,* there are a number of other species that, according to the original descriptions fall in the range of variability of this species. These species are: *C. biwaense* Okubo 1990b; *C. cavernae* Wagenleitner 1990; *C. lubeziensis* Kovalenko 1982; *C. maculata* Hoff 1942; *C. palustera* Furtos 1935; and *C. sketi* Petkovski 1976. The second species has been described in great detail (Wagenleitner 1990) from a cave in northern Italy. However, the only difference between this species and *C. ophtalmica* is the discoloration of the carapace and the absence of eye pigmentation in *C. cavernae*, which is a consequence of the life in the subterranean environment. If this is a separate species, it is hard to tell based on the morphological characters alone. Also, *C. ophtalmica* has been collected many times from the wells in other parts of its area of distribution. *Cypria sketi* Petkovski 1976, described from several subterranean localities in Croatia and Herzegovina (Petkovski 1976), also falls within the range of the variability of *C. ophtalmica*. This species has a very high carapace, similar to *C. karamani* Petkovski 1976, but this has also been reported in some populations of *C. ophtalmica*.

Cypria koenikei Daday 1910a was described from the Jippe Lake (Kilimanjaro) (Daday 1910a). This species should be excluded from the subfamily Cyclocypridinae as the Zenker organ has numerous whorls of spines and the hemipenis is more similar to the family Cyprididae that Candonidae.

A number of other species here assigned to the genus *Cypria* are not included in the key to the species (*Cypria biwaense* Okubo 1990b; *C. inequivalva* Turner 1893; *C. lubeziensis; C. mons* (Chambres 1877); *C. nipponica* (Okubo 1990b); *C. obesa* Sharpe 1897; *C. posterotuberculata* Furtos 1935; *C. sketi* Petkovski 1976; *C. dentifera* Sharpe 1897; *C. devai* Arora 1931; *C. minuta* (Victor and Michael 1975); and *C. sharmai* (Battish 1985)) because there are not enough distinguishing characters to separate these species from their congeners and not enough arguments to synonymize them as well.

Ecology and distribution (Fig. 98)

The species can be found in all sorts of open water bodies, and also in the subterranean waters. It has a global distribution.

Kempfcyclocypris Karanovic 2011

Diagnosis: Carapace ovoid to subtriangular in lateral view (Fig. 91b). LV overlaps RV ventrally, anteriorly, and posteriorly. Surface of carapace smooth, covered with long hairs. Selvage peripheral anteriorly and posteriorly on both valves. A1 6-segmented. A2 in male 5-segmented, penultimate segment divided but “t2” and “t3” setae not transformed into sexual bristles (Fig. 91g). A2 sexually dimorphic: G1 and G3 claws in males reduced, “z2” seta transformed into claw, “z1” and “z3” being seta like. Swimming setae completely missing (Fig. 91g, e). Terminal

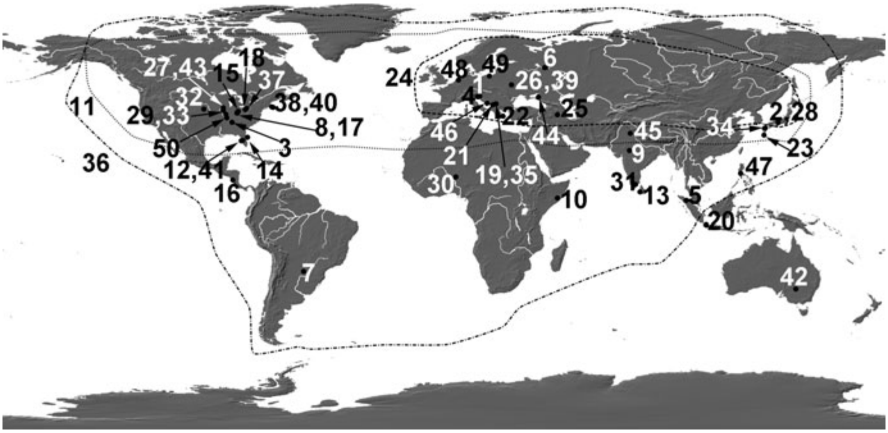


Fig. 98 Distribution of *Cypria* Zenker 1854: Numbers correspond to the species list

segment of Md palp elongated, but not more than two times longer than wide. Terminal segment of Mxl palp square. Prehensile palps very slightly asymmetrical. L6 with basal seta (Fig. 95e). Basal segment of L7 with "d2" seta (Fig. 95f). Setae "e," "f," and "g" not short. Seta "h1" and "h2" subequally long. UR with all setae and claws present and normally developed (Fig. 97d). Hemipenis with both lobes well developed (Fig. 97f). Zenker organ with seven whorls of spines. Genital field rounded.

Type (and only) species. *K. australis* Karanovic 2011

Species list with type locality and type material
K. australis Karanovic 2011. Bore TR14 (B), 93025, SE of Woolomin, NSW, Australia, 31°18′13.644″S 151°09′13.896″W: Holotype (♂), AMS – P.83570.

Ecology and distribution
This species is so far known only from the subterranean waters of New South Wales, Australia.

Keysercypria **Karanovic 2011**

Diagnosis: Carapace usually ovoid in lateral view. LV overlaps RV ventrally, anteriorly, and posteriorly. RV sometimes overlapping LV dorsally. Surface of carapace smooth, sometimes covered with long hairs. Selvage peripheral anteriorly on both valves and sometimes inwardly displaced on RV. A1 7-segmented (Fig. 91d). A2 in male 5-segmented, penultimate segment divided and with "t2" and "t3" setae transformed into sexual bristles. A2 sexually dimorphic: G1 and G3 claws in males reduced, "z1" and "z2" setae transformed into claws, "z1" being shorter, while "z3" seta like and exceeding tips of terminal claws (Fig. 91c). Swimming seta long, the most external seta completely reduced. Terminal segment of Md palp elongated, more than five times longer than wide. Terminal segment of

Mxl palp square. Prehensile palps asymmetrical. L6 without basal seta. Basal segment of L6 without seta, seta "e" on the second endopodal segment short or long (Fig. 95c, d). Basal segment of L7 without "d2" seta (Fig. 95h). Setae "e," "f," and "g" very short. Seta "h1" at least two times shorter than seta "h2," seta "h3" very long (Fig. 95h). UR with all setae and claws present and normally developed. Hemipenis with two both lobes well developed and positioned far apart from each other (Fig. 97e). Outer lobe often having a rounded, boxing glow-like distal end. Zenker organ with seven whorls of spines. Genital field rounded.

Type species: *K. affinis* (Klie 1933b)

Species list with type locality and type material
1. *K. affinis* (Klie 1933b). Small water pit behind the central dam, Pos di Tanki Onima, Bonaire, Netherlands Antilles, 12°15′N 68°19′W: Syntypes, ZMK – UR-538.
2. *K. circinata* (Würdig and Pinto 1993b). Lagoon, Lagoa do Paso, Rio Grande do Sul, Brazil, 28°15′S 52°24′W: Holotype (♀), UFRGS – MP-O-860.
3. *K. deformis* (Klie 1940e). Small pond, Açude Conceição, Brazil, 07°13′S 35°52′W: Syntypes, ZMK – UR-549, 550.
4. *K. longiseta* (Klie 1930a). Swamp, W of Makthlawaiya, Gran Chaco, Paraguay, 23°00′S 60°00′W: Syntypes, ZMK – UR-536-7.
5. *K. obtusa* (Klie 1940e). Casa Forte, Pernambuco, Brazil, 08°02′S 34°55′W: Syntypes, ZMK – UR-524.
6. *K. pellucida* (Sars 1901). Raised from dried mud, Itatiba, São Paulo, Brazil, 23°00′S 46°47′W: Types, NHMO – F11534.
7. *K. sanctaeannae* (Margalef 1961). Small puddle under drain of the road, Santa Ana, Isla de Margarita, Nueva Esparta, Venezuela, 11°04′N 63°55′W: Type (♀), FIB – collection number unknown.
8. *K. schubarti* (Farkas 1858a). Açude, Lagoa Bom Successo, Jaicos, Pernambuco, Brazil, 07°21′S 41°08′E: Repository of the type material unknown.
9. *K. xanabanica* (Furtos 1936b). Xanabe Cenore Grande, Chichen Itza, Yucatán, Mexico, 20°40′N 88°34′W: Holotype (♀), SM – 67977.

Key to the species of the genus *Keysercypria* Karanovic 2011

1. Tubercles on RV barely visible or absent 2
– Tubercles clearly visible 4
2. Posterior seta on UR exceeding distal margin . . . . *K. obtusa* (Klie 1940e)
– Posterior seta on UR shorter 3
3. LV with "lifted" postero-ventral margin *K. circinata* (Würdig and Pinto 1993b)
– LV with "normal" postero-ventral margin . . . . *K. pellucida* (Sars 1901)
4. Posterior seta on the UR reaching half way to the distal margin of the ramus 5
– Posterior seta on the UR reaching or exceeding distal margin of the ramus . 6

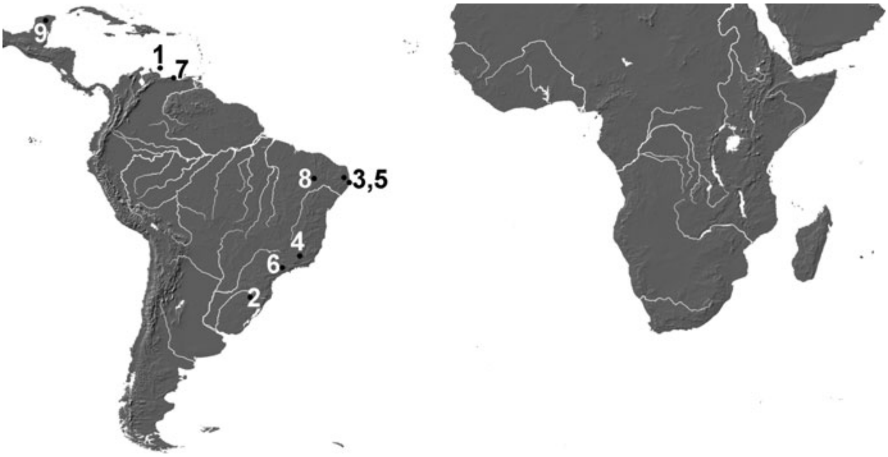


Fig. 99 Distribution of *Keysercypria* Karanovic 2011: Numbers correspond to the species list

5. Anterior claw on UR distally curved, almost loop like *K. deformis* (Klie 1940e)
– Anterior claw on UR distally not so prominently curved . . . . . *K. xanabanica* (Furtos 1936b)
6. Outer lobe on the hemipenis completely reduced . . . . *K. sanctaeannae* (Margalef 1961)
– Outer lobe on the hemipenis not reduced 7
7. Dorsal margin of right prehensile palp with a little horn . . . . *K. longiseta* (Klie 1930a)
– Dorsal margin of right prehensile palp with clear "angular" appearance *K. affinis* (Klie 1933b)

Species not included in the key
The only species not included in the key is *K. schubarti* (Farkas 1858a) because it is very hard to distinguish it from *K. affinis*. Both species have very similar carapace shape and the appearance of the hemipenis and prehensile palps.

Ecology and distribution (Fig. 99)
The species are found in open freshwater bodies, both temporary and permanent. The genus is endemic to the Central and South America.

Physocypria Vávra 1897 [_Mecynocypria_ Rome 1962]
Diagnosis: Carapace usually ovoid in lateral view. LV overlaps RV ventrally, anteriorly, and posteriorly. RV sometimes overlapping LV dorsally. Surface of carapace smooth, sometimes covered with long setae. Selvage peripheral anteriorly on both valves and sometimes displaced internally on RV. Tubercles along the margins usually present (Fig. 92f). End of ovaries curved downward and toward anterior part (Fig. 91a). A1 7-segmented. A2 in male 5-segmented, penultimate

segment divided and with ″t2″ and ″t3″ setae transformed into sexual bristles. A2 sexually dimorphic: G1 and G3 claws in male reduced, “z1” and “z2” setae transformed into claws, “z1” being shorter, while “z3” seta like and exceeding tips of terminal claws. Swimming seta long, the most external seta completely reduced. Terminal segment of Md from three to five times longer than wide (Fig. 94a). Terminal segment of Mxl palp square (Fig. 94b). Prehensile palps asymmetrical. L6 with basal seta (Fig. 94d). Basal segment of L7 with “d2” seta (Fig. 95g). Setae “e,” “f” long, “g” very short. Setae “h1” and “h2” subequal or “h2” being slightly longer. UR with all setae and claws present and normally developed (Fig. 97b). Hemipenis with two lobes well developed, both thin (Fig. 97g). Zenker organ with seven whorls of spines. Genital field rounded.

Type species: *P. bullata* Vávra 1897

Species list with type locality and type material

1. *P. armata* (Müller 1898). Mahajanga, Madagascar, 15°43′S 46°19′E: Repository of the type material unknown.
2. *P. bullata* Vávra 1897. Ugogo, Tanzania, 06°07′S 35°30′E: Type (♀), ZMB – 10011.
3. *P. capensis* (Sars 1895). Mud from pools on Green Point Common, Cape Town, South Africa, 33°54′S 18°24′E: Repository of the type material unknown.
4. *P. castanea* (Brady 1904). Lake Nyasa, 12°00′S 34°30′E: Repository of the type material unknown.
5. *P. complanata* (Sars 1910). Kaboge, Lake Tanganyika, DR Congo, 03°49′S 29°07′E: Repository of the type material unknown.
6. *P. denticulata* (Daday 1910a). Swamp, Kilimanjaro, Tanzania, 03°45′S 37°45′E: Types, HNHM – IV/P-40-41.
7. *P. declivis* (Sars 1910). Niamkolo, Lake Tanganyika, Zambia, 08°45′S 31°07′E: Repository of the type material unknown.
8. *P. deflexa* (Sars 1910). Kituta Bay, Lake Tanganyika, Zambia, 08°45′S 31°11′E: Repository of the type material unknown.
9. *P. emaciata* (Rome 1962). Kungwe Bay, Lake Tanganyika, Tanzania, 05°42′S 29°52′E: Holotype (♀), RBINS – O.C. 542.
10. *P. granulata* Rome, 1965a. Lake Upemba, DR Congo, 08°36′S 26°26′E: Holotype (♀), RBINS – O.C. 698
11. *P. lata* (Rome 1962). Mtoto, Tanzania, 02°14′S 33°01′E: Holotype (♂), RBINS – O.C. 531.
12. *P. lenticularis* (Müller 1898). Mahajanga, Madagascar, 15°43′S 46°19′E: Syntypes, ZMG – 24570.
13. *P. limnalis* (Rome 1965a). Lake Upemba, DR Congo, 08°36′S 26°26′E: Holotype (♀), RBINS – O.C. 696.
14. *P. obtusa* (Sars 1910). Kituta Bay, Lake Tanganyika, Zambia, 08°45′S 31°11′E: Repository of the type material unknown.

15. *P. opaca* (Sars 1910). Kituta Bay, Lake Tanganyika, Zambia, 08°45′S 31°11′E: Repository of the type material unknown.
16. *P. ovata* (Rome 1962). Kalemie Point, DR Congo, 05°56′S 29°11′E: Holotype (♂), RBINS – O.C. 538.
17. *P. parvula* (Rome 1962). Edith Bay, Lake Tanganyika, Tanzania, 06°30′S 29°55′E: Holotype (♂), RBINS – O.C. 543.
18. *P. perlonga* (Rome 1962). Mtoto, Tanzania, 02°14′S 33°01′E: Repository of the type material unknown.
19. *P. stricta* (Rome 1962). Edith Bay, Lake Tanganyika, Tanzania, 06°30′S 29°55′E: Holotype (♂), RBINS – O.C. 515.
20. *P. subangulata* (Sars 1910). Niamkolo, Lake Tanganyika, Zambia, 08°45′S 31°07′E: Repository of the type material unknown.
21. *P. tumidosa* (Rome 1962). Kungwe Bay, Lake Tanganyika, Tanzania, 05°42′S 29°52′E: Holotype (♀), RBINS – O.C. 540.

Key to the species

1. Valves with beak-like extension on the antero-ventral margin . . . *P. perlonga* (Rome 1962)
– No beak-like extension present 2
2. Valves asymmetrical in lateral view; RV overlapping LV dorsally 3
– Valves symmetrical in lateral view; RV same or lower than LV in dorsal view 5
3. Posterior seta on the UR absent . . . . *P. lenticularis* (Müller 1898)
– Posterior seta on the UR present 4
4. Inner lobe on the hemipenis with long and thin neck ending in a beak-like process . . . . *P. bullata* Vávra 1897
– Inner lobe on the hemipenis with short neck and not ending in a beak-like process . . . . *P. denticulata* (Daday 1910a)
5. In lateral view, dorsal margin evenly rounded or flat, anterior and posterior margins equally wide 6
– In lateral view, dorsal margin not evenly rounded (inclined more toward anterior or posterior end), and posterior margin clearly more narrow than anterior one, or posterior margin straight with posterior and ventral margin merging almost at the right angle 11
6. Dorsal margin flat 7
– Dorsal margin rounded 9
7. Left valve with tubercles . . . . *P. armata* (Müller 1898)
– Left valve without tubercles 8
8. Left prehensile palp with developed subterminal structures, inner lobe on the hemipenis only slightly shorter than the outer lobe and curved at the top . . . . . *P. tumidosa* (Rome 1962)
– Left prehensile palp without developed subterminal structures, inner lobe considerably shorter that the outer lobe and not curved at the top . . . *P. lata* (Rome 1962)

9. Posterior seta on the UR only reaching distal margin of the ramus .... *P. capensis* (Sars 1895)
– Posterior seta on the UR by far exceeding distal margin of the ramus ... 10

10. Carapace tumid in lateral view .... *P. limnalis* (Rome 1965a)
– Carapace more elongated in lateral view .... *P. castanea* (Brady 1904) and *P. obtusa* (Sars 1910)

11. Posterior seta on the UR very short 12
– Posterior seta on the UR long (by far exceeding distal margin of the ramus) 15

12. Posterior end of carapace elongated and posterior margin very narrow ... *P. declivis* (Sars 1910)
– Posterior end of carapace not elongated and posterior margin not so narrow 13

13. Terminal segment of Md palp at least 3 times longer than wide ... *P. opaca* (Sars 1910)
– Terminal segment of Md palp only 1.5 times longer than wide 14

14. In lateral view, postero-dorsal margin inclined and posterior end slightly protruding .... *P. stricta* (Rome 1962)
– In lateral view, postero-dorsal margin rounded and posterior end not protruding .... *P. parvula* (Rome 1962)

15. Antero-ventral margin rounded 16
– Antero-ventral margin square .... *P. subangulata* (Sars 1910)

16. In lateral view, posterior margin elongated and much narrower than anterior one .... *P. complanata* (Sars 1910)
– In lateral view, posterior margin not elongated 17

17. Greatest H in the middle, marked with a clear angle on dorsal margin, posterior margin rounded .... *P. ovata* (Rome 1962)
– Greatest H not marked with a clear angle on dorsal margin, posterior margin almost straight 18

18. Setae “h1” and “h2” on the terminal segment of L7 equal in size ... *P. deflexa* (Sars 1910)
– Seta “h1” shorter than “h2” .... *P. emaciata* (Rome 1962)

Species not included in the key
Only two species, *P. granulata* (Rome 1965a) and *P. conoidea* (Sars 1910), were not included in the key, because they do not have enough distinguishing characters to be separated from the other representatives of the genus.

Ecology and distribution (Fig. 100)
The species occur in fresh open water bodies, most usually lakes. The genus is distributed only in Africa.

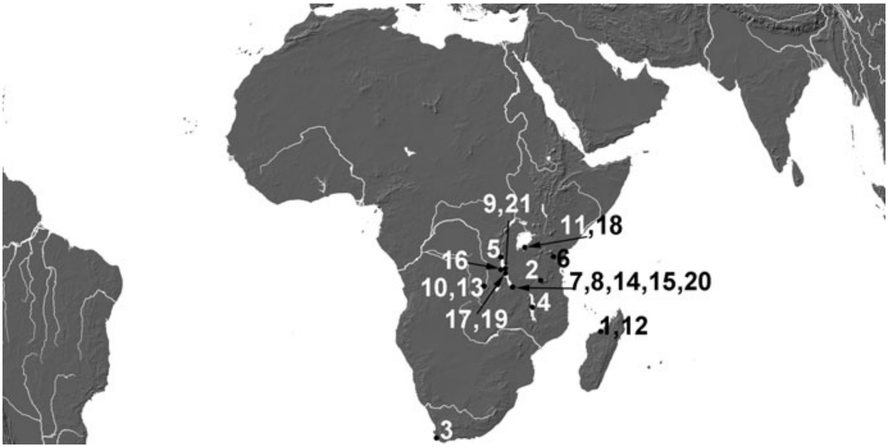


Fig. 100 Distribution of *Physocypria* Vávra 1897: Numbers correspond to the species list

4 Family Cyprididae Baird 1845

Diagnosis (after Meisch 2000): Carapace variable in size (from 0.3 to 7 mm), shape and structure. Surface smooth or ornamented to different degrees. Marginal zone variable in structure, in some subfamilies with various supporting elements such as radial septae or vertical pillars. CIL and fused zone broad or narrow. Selvage peripheral or inwardly displaced. MPC also variable, rare or numerous. Swimming setae on A2 usually well developed, completely absent only in a couple of genera. L5 transformed into maxilliped, endopod in ♀ unsegmented, in ♂ transformed into clasping organ. L6 walking leg. L7 with transformed terminal segment into pincer organ (except in Callistocypridinae). UR rod- or whip-shaped. Zenker organ with at least nine rings of chitinous spines.

Type genus: *Cypris* Müller OF 1776

Systematics
This is the most diversified family of the freshwater ostracods. It comprises 25–30 subfamilies, but not all have recent representatives. Distinguishing characters between certain subfamilies are unclear, and the family Cyprididae needs a revision.

Key to the Subfamilies
1. Septae present on the one or both valve margins 2
– No septae present on valve margins 3
2. Anterior marginal zone with incomplete septa neither reaching nor traversing the line of concrescence; postero-ventral margin with four of five

incomplete septae ... Cyprettinae Hartmann 1963 Batucyprettinae Victor and Fernando 1981a

3. Adult females with a series of additional paired appendages associated with the genital operculum ... Liocypridinae Martens 2003b
– No additional appendages present in females 4
4. Caudal part of valves with postero-ventral locking system consisting of inner lists and selvage in RV, inner lists in LV ... Callistocypridinae Schornikov 1980
– Caudal part of valves different 5
5. A2 completely lacking swimming setae ... Herpetocyprellinae Bronstein 1947
– A2 with swimming setae, which sometimes strongly reduced 6
6. UR strongly reduced, flagellum like in females and missing in males (in some genera even in females) . . . . Cypridopsinae Kaufmann 1900
– UR never flagellum like, but rod-like (sometimes with reduced claws/setae) ... 7
7. UR very slender and with only one terminal claw, other reduced into a seta. The posterior seta short . . . . Rudjakoviellinae Triebel 1973
– Both terminal claws present on the UR 8
8. UR posteriorly with two long setae . . . . Hungarocypridinae Bronstein 1947
– Only one posterior seta present on the UR 9
9. Seta on the terminal segment of L6 transformed into a strong claw .. Limanocypridinae Hartmann and Puri 1974
– Seta on the terminal segment of L6 normal 10
10. Posterior seta of UR long, situated on the proximal third of the UR ... Pelocypridinae Triebel 1962
– Posterior seta on the UR sometimes long, but situated medially on the ramus or, more often, closer to the posterior claw 11
11. Four rows of seminal vesicles forming V-shape in postero-ventral area and forming two loops, one clockwise in dorsal area around central muscle field, the other anticlockwise in postero-dorsal area . . . . Ngarawinae De Deckker 1979b
– Seminal vesicles normally developed 12
12. UR with ramus and claws short and stout . . . . . . Scottiinae Bronstein 1947
– UR with ramus and claws being more slender 13
13. Segments on A1 very small . . . . Diacypridinae McKenzie 1978b
– Segments on A1 not very small 14
14. A1with flagellated claws . . . . Megalocypridinae Rome 1965a
– Claws on A1 not flagellated 15
15. Posterior CIL either narrow or completely absent Isocypridinae Rome 1965b
– Posterior CIL not narrow, and clearly visible 16
16. Attachment of the caudal ramus with Triebel's loop . . . . Cypricercinae McKenzie 1971b
– No Triebel's loop on the attachment 17

17. Attachment with very characteristic basal triangular reinforcement ... Herpetocypridinae Kaufmann 1900
– No triangular reinforcement present 18
18. Seta “c” on the protopod of L5 present ...... Eucypridinae Bronstein 1947
– This seta absent 19
19. Carapace large (1.5–3 mm L), subovate to globular in dorsal view. Hemipenis with 8-shaped spermiducts .... Cypridinae Baird 1845
– Carapace sometimes large, but not globular, and no 8-shaped spermiducts on the hemipenis 20
20. Carapace long 1–7 mm, and elongated (H < 1/2 L), laterally compressed ... Dolerocypridinae Triebel 1961
– Carapace sometimes over 3 mm, but usually smaller, valves reniform or subtriangular and not laterally compressed 21
21. Large carapace (+3 mm), subrectangular to subtriangular in lateral view ... Mytilocypridinae De Deckker 1974
– Carapace up to 1.5 mm .... Cyprinotinae Bronstein 1947

4.1 Subfamily Batucyprettinae Victor and Fernando 1981a

Diagnosis (after Victor and Fernando 1981a): Carapace moderately inflated, LV overlaps RV on all free margins. In lateral view, valves subovate with broadly rounded anterior and posterior margins. Anterior marginal zone with incomplete septa neither reaching not traversing the line of concrescence; postero-ventral margin with four of five incomplete septae (Fig. 101). MPC numerous, short, unbranched, and simple. Swimming setae well developed. Distal segment of Mxl palp cylindrical. Prehensile palps asymmetrical. L6 4-segmented; L7 with distinct terminal segment without pincer. UR with long ramus and very short claws. Zenker organ with at least 10 rows of spines.

Type (and only) genus: *Batucypretta* Victor and Fernando 1981a

Batucypretta Victor and Fernando 1981a
Diagnosis: Same as for subfamily.

Type (and only) species: *B. paradoxa* Victor and Fernando 1981a.

Species list with type locality and type material
B. paradoxa Victor and Fernando 1981a. Batu Caves, Selangor, Malaysia, 05°40′N 108°30′E: Holotype (♀), NMNSO – C-1980-448.

Ecology and distribution
The genus is known only after one species, which has been found so far only in its type locality, a cave in Malaysia. However, the species does not appear to be a stygobiont since it has an eye and the cave from where it was collected is artificially illuminated.

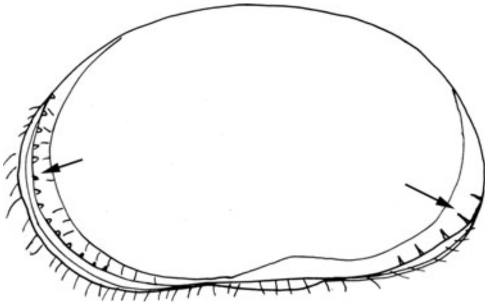


Fig. 101 Line drawing: *Batucypretta paradoxa* Victor and Fernando, 1981a: RV, inside view, showing septae. Modified after Victor and Fernando (1981a)

4.2 Subfamily Callistocypridinae Schornikov 1980

Diagnosis (after Pinto et al. 2005b): Carapace small, wide in dorsal view, oval in lateral view. Caudal part of valves with postero-ventral locking system consisting of inner lists and selvage in RV, inner lists in LV. LV overlapping RV on all free margins. Surface smooth to lightly pitted. Fused zone narrow with only a few straight MPC. A2 with one very short swimming seta and only one more accompanying seta. Protopod of L5 with only two setae. UR consisting of a ramus and only one terminal claw.

Type (and only) genus: *Callistocypris* Schornikov 1980

Remarks
erminal segment of L7 is not fused with the penultimate one, and does not form a pincer-like organ, like in the rest of the representatives of the family Cyprididae. The position of this subfamily within Cyprididae is, therefore, questionable and temporary. Unfortunately, males have not been described for neither of the three species, so the number of rosette and their arrangements in the Zenker organ are not known.

Callistocypris Schornikov 1980
Diagnosis: Same as for the subfamily.

Type species: *C. zlotini* Schornikov 1980

Species list with type locality and type material

1. *C. mckenzie* Pinto et al. 2005b. Parque Estadual da Serra do Mar Núcleo Cunha-Indaiá, Municipality of Cunha, São Paulo State, Brazil, 23°14′03″S 45°01′23″W: Holotype (♀), MZUSP – 16339.
2. *C. rossettii* Pinto et al. 2005b. Boracéia Biological Station, Municipality of Salesópolis, São Paulo State, Brazil, 23°38′17″S 45°50′24″W: Holotype (♀), MZUSP – 16356.
3. *C. zlotini* Schornikov 1980. Bio Island, Solomon Islands, 10°10′S 161°40′E: Holotype (♀), IMB-RAS – 1746–1747.

Key to the species

1. A2 with two z-setae . . . . *C. zlotini* Schornikov 1980
– A2 with three z-setae 2
2. RV caudally with three inner lists . . . . *C. rossettii* Pinto et al. 2005b
– RV caudally with two inner lists . . . . *C. mckenzie* Pinto et al. 2005b

Ecology and distribution (Fig. 102)
All species have so far been found in semi-terrestrial habitats, such as leaf litter. The genus is known only from the Solomon Islands and Brazil.

4.3 Subfamily Cyprettinae Hartmann 1964

Diagnosis: Carapace relatively small (around 1 mm), globulose (Figs. 91, 103a, 104a, b, c, e). Surface of the carapace smooth, or ornamented. Marginal Zone conspicuous, and with septae developed along anterior margin in adults (Figs. 105a, b and 104d). A1 7-segmented and with Rome organ present (Fig. 103b, c). Swimming setae on A2 usually well developed. Distal segment of Mxl palp cylindrical. L6 5-segmented (Fig. 108b). Terminal segment of L7 not clearly separated from the penultimate one and pincer organ developed (Fig. 108a). UR rod shaped but very thin and with two narrow claws (Fig. 103e).

Type genus: *Cypretta* Vávra 1895

Other genera: *Paracypretta* Sars 1924: *Bradycypris* Sars 1924; *Zonocypretta* De Deckker 1981a.

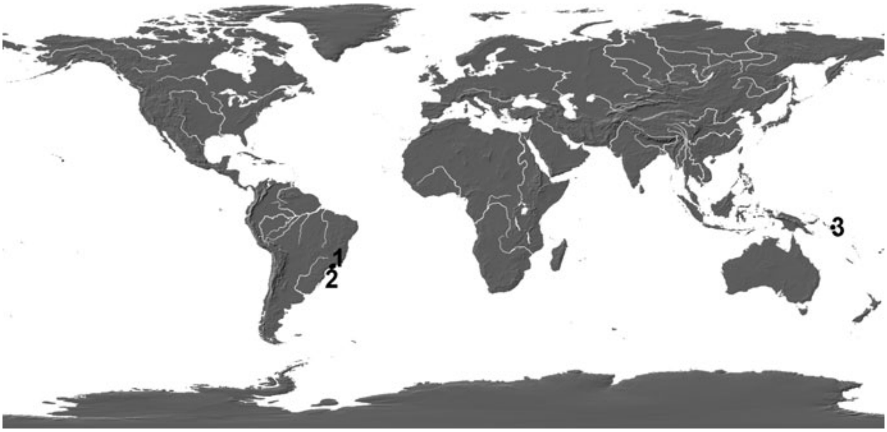


Fig. 102 Distribution of *Callistocypris* Schornikov 1980: Numbers correspond to the species list

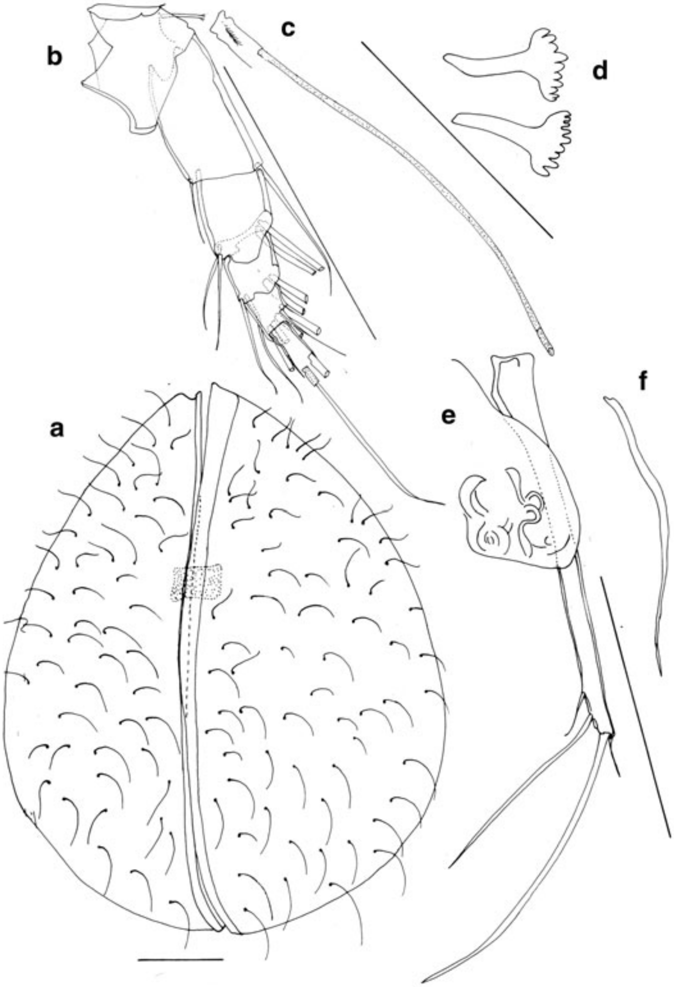


Fig. 103 Line drawings: *Cypretta* cf. *seurati* Gauthier 1929: (**a**) carapace, dorsal view; (**b**) A1; (**c**) terminal segment of A1 with aesthetasc "ya"; (**d**) rake-like organ; (**e**) UR; (**f**) UR attachment. Scales = 0.1 mm

Key to the genera

1. Carapace ornamented with longitudinal ridges 2
– Carapace if ornamented, ornamentation consists only of pits (Fig. 104b) . . . 3
2. Septae present only on RV . . . . *Zonocypretta* De Deckker 1981a
– Septae present on both valves . . . . *Paracypretta* Sars 1924
3. Septae present only on RV (Fig. 104c) . . . . *Bradycypris* Sars 1924
– Septae present on both valves (Fig. 105) . . . . *Cypretta* Vávra 1895

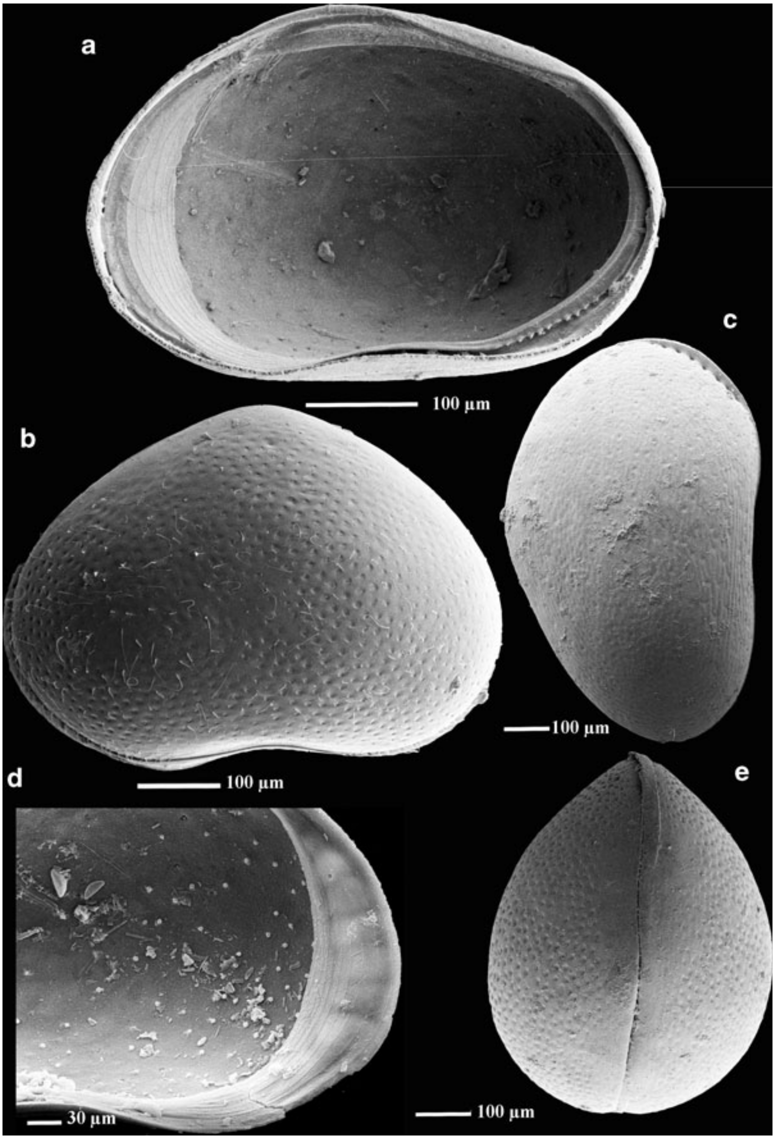


Fig. 104 SEM: (**a**, **b**, **d**, **e**) *Cypretta murati* Gauthier 1939; **(c)** *Bradycypris sp.*: (**a**) RV, inside view; (**b**) LV, outside view; (**c**) RV, outside view; (**d**) LV, anterior margin; (**e**) carapace, dorsal view. Photos: D. Keyser

Remarks

McKenzie (1971b) divided the subfamily into two tribes: Bradycypridini and Cyprettini, based on the presence of marginal septae on both (Cyprettini) or only on RV (Bradycypridini). Nominal tribe included genus *Cypretta*, while the other

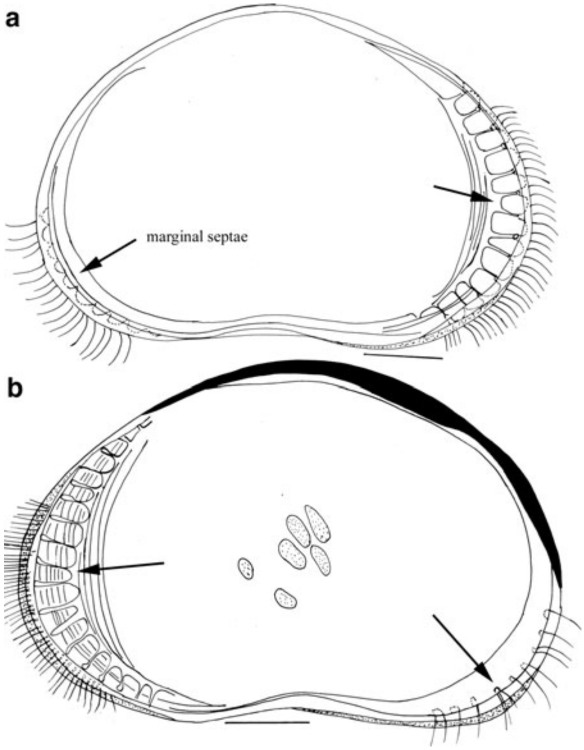


Fig. 105 Line drawings: *Cypretta* cf. *seurati* Gauthier 1929: (**a**) LV, inside view; (**b**) RV, inside view. *Arrows* showing the septae. Scales = 0.1 mm

tribe includes genera *Paracypretta* and *Bradycypris*. This systematic division is not followed here. The above key should be used with caution as Martens (1984a) showed that some of the *Paracypretta* species may have septae on one or on both valves. The entire subfamily needs a revision and the characters used in the key to the genera and to the species are only provisional.

Bradycypris Sars 1924

Diagnosis (modified after Sars 1924): Shell globular, LV overlapping RV on all free margins. Only RV with marginal septae developed. Surface of the carapace smooth or ornamented, swimming setae on A2 well developed. Terminal segment of the Mxl palp cylindrical. Male prehensile palps asymmetrical. L6 5-segmented. L7 with pincer organ on the terminal segment. UR with slender and long ramus and long, thin claw. Both posterior and anterior setae present.

Type species: *B. intumenscens* (Brady 1907a)

Species list with type locality and type material

1. *B. intumenscens* (Brady 1907a). Somkele, NW of Mtubatuta, KwaZulu-Natal, South Africa, 28°45′S 30°35′E: Holotype not designated, type material deposited in HM.
2. *B. radiata* (Müller 1908). Zeekoevlei, Plumstead, Simon's Town, Western Cape, South Africa, 34°11′S 18°26′E: Syntypes, ZMB – ZMBln 13160.

3. *B. strigata* Klie 1939a. Stagnant water of one stream, Kinangop, Kenya, 00°43′S 36°39′E: Syntypes ZMK – UR-768.

Key to the species

1. Carapace striated . . . . *B. strigata* Klie 1939a
– Carapace smooth *B. intumenscens* (Brady 1907a) and *B. radiata* (Müller 1908)

Remarks

Bradycypris intumenscens (Brady 1907a) and *B. radiata* (Müller 1908) are very similar species, and their difference is in the carapace appearance: carapace being more elongated in *intumenscens* (Brady 1907a) than in *Bradycypris radiata* (Brady 1907a). Based on the original descriptions it is hard to underline any other difference between the two species.

Ecology and distribution (Fig. 106)

The species have been so far found in open water bodies, and the genus is restricted to South Africa.

Cypretta Vávra 1895b

Diagnosis (modified after Sohn and Kornicker 1973): Animals relatively small (around 1 mm), globulose. Surface of the carapace smooth, or ornamented. Marginal zone conspicuous, and with septae developed along anterior margin in adults on both valves (Fig. 105). Swimming setae on A2 usually well developed (Fig. 107a). Md with stout coxa (Fig. 108c). Distal segment of Mxl palp cylindrical (Fig. 107c). Prehensile palps asymmetrical (Fig. 109b, c). Vibratory plate on L5 with six rays (Fig. 107b). L6 5-segmented (Fig. 108b). Terminal segment of L7 not clearly separated from the penultimate one and pincer organ developed (Fig. 108a). Zenker organ with square shape dorsal projection of the outer lobe (Fig. 109a). UR rod shaped but very thin and with two narrow claws (Fig. 103e). Attachment simple (Fig. 103f).

Fig. 106 Distribution of *Bradycypris* Sars 1924: Numbers correspond to the species list

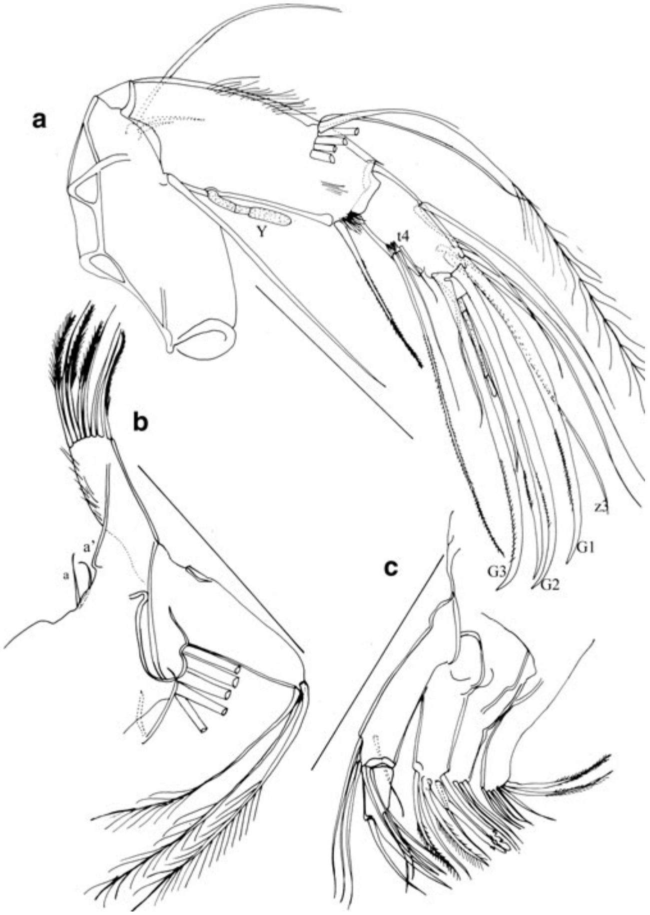


Fig. 107 Line drawings: *Cypretta* cf. *seurati* Gauthier 1929: (**a**) A2; (**b**) L5; (**c**) Mxl palp and endites. Scales = 0.1 mm

Type species: *C. tenuicaudata* (Vávra 1895)

Species list with type locality and type material

1. *C. alagarkoilensis* Victor and Michael 1975. Water pool, Alagarkoil, Madurai, India, 09°58′N 78°10′E: Holotype (♀), DBSMU – Slide No. 10.
2. *C. baylyi* McKenzie 1966a. Ca.16 km W of Inverway, NT, Australia, 12°29′S 131°00′E: Holotype (♀), NMV – J32.
3. *C. brevisaepta* Furtos 1934. Ca. 0.8 km E of the railroad station, Buckingham, Florida, USA, 26°35′N 81°51′W: Paratypes, SM – 68158, 68159.
4. *C. brevispina* Farkas 1959 (replace name for *C. reticulate* Danforth 1948). Iowa, USA.
5. *C. bilicis* Furtos 1936a. Roadside pool, ca. 6.5 km from Miakka toward Fruitville, Florida, USA, 27°19′N 82°16′W: Holotype (♀), SM – 71377.

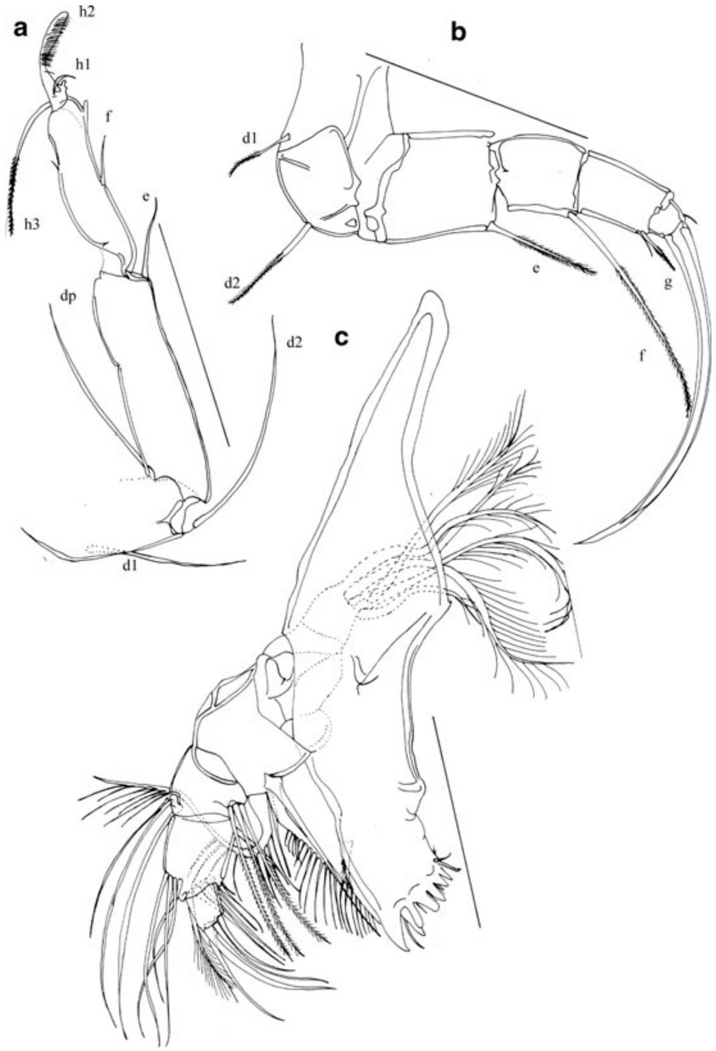


Fig. 108 Line drawings: *Cypretta* cf. *seurati* Gauthier 1929: (**a**) L7; (**b**) L6; (**c**) Md. Scales = 0.1 mm

6. *C. comitisroseni* (Brehm 1924). Laguna de Junín, Junín, Peru, 11°02′S 76°06′W: Repository of the type material unknown.
7. *C. cordata* Klie 1938c. Panga, DR Congo, 04°21′S15°19′E: Syntype, ZMK – UR-999.
8. *C. costata* Müller 1898. Mahajanga, Madagascar, 15°43′S 46°19′E: Syntypes, ZMG – 24566.
9. *C. devexa* (Daday 1910a). Kilimanjaro, Tanzania, 03°00′S 37°00′E: Holotype not designated, material deposited at HMNH – IV/P-70.

Fig. 109 Line drawings: *Cypretta lemurensis* (Vávra 1895): (**a**) hemipenis; (**b**, **c**) prehensile palps. Scales = 0.1 mm

10. *C. dubiosa* (Daday 1901b). Sagomoor, Lemien, Papua New Guinea, 06°14′S 143°55′E: Holotype not designated, some material deposited at HMNH – IV/P-71-72.
11. *C. fontinalis* Hartmann 1964. Palni, Tamil Nadu, S India, 10°27′N 77°30′E: Syntypes, ZMH – K-27 678.
12. *C. foveata* Hartmann 1964. Djunaghar, Girna, Halbinsel Kathiavar, India, 21°11′N 70°21′E: Syntypes, ZMH – K-27 677.
13. *C. gargi* Deb 1983. Temporary pond at Kerala, S of Lonavala, India, 18°44′N 73°24′E, Holotype (♀), ZSI – 1089/2.
14. *C. globosa* (Brady 1886a). Sri Lanka, 07°48′N 80°49′E: Lectoype, HM – NEWHM:1.20.23.

15. *C. globula* (Sars 1889). Lagoon near Racecower, Rockhampton, Qld, Australia, 23°22′S 150°30′E: Holotype not designated, repository of type material unknown.
16. *C. globulosa* (Sharpe 1910). Madison, Wisconsin, USA, 43°04′N 89°23′W: Lectotypes, SM – 39514.
17. *C. hirsuta* Henry 1923. Kosciusko, NSW, Australia, 33°46′S 150°38′E: Holotype, AMS – P.6121.
18. *C. infesta* Klie 1941a. Huayuri stream, S Peru, 14°32′S 75°18′W: Syntypes, ZMK – UR-1003.
19. *C. intonsa* Furtos 1936a. Kissimmee River, Florida, USA, 27°30′N 81°04′W: Holotype (♀), SM – 71380.
20. *C. judayi* Tressler 1937. Pinelang Pond, Sulawesi, Indonesia, 01°53′S 120°33′E: Holotype (♀), SM – 71517.
21. *C. kawatai* Sohn and Kornicker 1972. Aquaria in the Johns Hopkins University, Baltimore, Maryland, USA, 39°19′22″N 73°37′14″W: Holotype (♀), SM – 139850.
22. *C. kenyensis* Klie 1939a. Swamp, Nairobi, Kenya, 01°17′S 36°49′E: Syntypes, ZMK – UR-1004.
23. *C. lemurensis* (Vávra 1895). Marshes in Zanzibar, Tanzania, 06°09′S 39°11′E: Holotype not designated, repository of type material unknown.
24. *C. lindbergi* Hartmann 1964. Brackish water pool, Kangan, Iran, 27°50′N 52°04′E: Syntypes, ZMH – K-27 679.
25. *C. longidactyla* Victor and Fernando 1981b. Rice field in Pasig, Luzon, Philippines, 14°35′N 121°03′E: Holotype (♀), NMNSO – 21631.
26. *C. lutea* McKenzie 1966a. Ca. 16 km W of Inverway, NT, Australia, 12°29′S 131°00′E: Holotype (♀), NMV – J29.
27. *C. margalefi* Brehm 1949. Laguna de Ariguanabo, NW of Havana, La Habana, Cuba, 22°56′N 82°33′W: Repository of the type material unknown.
28. *C. minna* (King 1855). Ponds, Sydney, NSW, Australia, 33°51′S 151°12′E: Holotype not designated, repository of type material unknown.
29. *C. murati* Gauthier 1939. Abéché, Oum Hadjer, Chad, 13°17′N 19°41′E: Holotype not designated, repository of type material unknown.
30. *C. nigra* Furtos 1936a. Roadside pool, ca. 6.5 km from Miakka toward Fruitville, Florida, USA, 27°19′N 82°16′W: Holotype (♀), SM – 71379.
31. *C. nukuhivana* Furtos 1934. Vaihakameama pond, Nuku Hiva Island, French Polynesia, 08°52′S 140°06′W: Paratypes, SM – 68066.
32. *C. obfuscate* Victor and Fernando 1981b: Drainage Ditch, Kepala Batas, Kedah, Malaysia, 06°12′N 100°24′E: Holotype (♀), NMNSO – 21633.
33. *C. oxyuris* Daday 1910a. Bura, Kenya, 01°06′S 39°56′E: Holotype not designated, material deposited in HMNH – IV/P-50.
34. *C. papuana* Vávra 1901. Bismarck Archipelago, Papua New Guinea, 05°00′S 150°00′E: Holotype not designated, repository of type material unknown.
35. *C. patialensis* Battish 1982a. Moti Bagh Lake, Patiala, Punjab, India, 30°20′N 76°24′E: Holotype (♀), PAU – 0-12 F_1.

36. *C. raciborskii* (Grochmalicki 1915). Citayam pond near Depok, West-Java, Indonesia, 06°26′S 106°48′E: Repository of the type material unknown.
37. *C. ramai* Deb 1984. Well at Kotalpukur, Santhāl Parganas, Jharkhand (formerly southern Bihar), India, 24°44′N 87°49′E: Holotype (♀), ZSI – C1352/2.
38. *C. remota* (Vávra 1906). Sumatra, Indonesia, 00°33′S 101°21′E: Holotype not designated, repository of type material unknown.
39. *C. reticulata* Lowndes 1932a. Mt. Ch'ilalo Terara, Oromīıa, Ethiopia, 07°55′N 39°16′E: Holotype not designated, repository of type material unknown.
40. *C. rotunda* Ghetti 1972. Lakes in Tasköprü and Rasht, Turkey, 41°28′N 34°11′E: Holotype (♀), IZUP – collection numbers unknown.
41. *C. sarsi* Brady 1902. Saint Thomas Island, US Virgin Islands, USA, 18°20′N 64°55′W: Holotype not designated, repository of type material unknown.
42. *C. schubarti* Farkas 1959. Pernambuco, Acude Boqueirao, Brazil, 08°51′S 36°32′W: Holotype (♂), HMNH – UR.297.
43. *C. seurati* Gauthier 1929. Tin Tahart, Algeria, 22°55′N 05°05′E: Holotype not designated, repository of type material unknown.
44. *C. tenuicaudata* (Vávra 1895). Unknown lake in Zanzibar, Tanzania, 06°09′S 39°11′E: Syntypes HM – NEWHM : 1.57.31/2.
45. *C. turgida* (Sars 1896a). Sydney, NSW, Australia, 33°51′S 151°12′E: Holotype not designated, repository of the type material unknown.
46. *C. viridis* (Thomson 1879). Dunedin, New Zealand, 45°52′S 170°30′E: Holotype not designated, repository of type material unknown.
47. *C. vivacis* Würdig and Pinto 1993a. Lagoa Caieira, Osório County, Rio Grande do Sul, Brazil, 23°42′S 46°28′W: Holotype (♀), UFRGS – MP-O-859.
48. *C. yapinga* De Deckker 1982b. Billabong along Magela Creek, Mudginberri Lagoon, NT, Australia, 12°36′S 132°52′E: Holotype (♂), AMS – P.32557.
49. *C. fossulata* (Daday 1910a). Lumbira (formerly Langenburg), Lake Malawi, Tanzania, 09°35′S 34°08′E: Holotype not designated, some material deposited in the HMNH – IV/P-73.

Key to the species

1. In dorsal view, LV clearly overlaps RV 2
– In dorsal view, valves almost the same or RV clearly overlaps LV 5
2. Posterior claw on the UR longer than ½ L of anterior claw . . . . *C. reticulata* Lowndes 1932a
– Posterior claw on the UR at the most ½ as long as the anterior one, but usually shorter 3
3. Posterior seta on the UR as long as posterior claw . *C. schubarti* Farkas 1959
– Posterior seta on the UR much shorter than posterior claw 4
4. Valves uniformly dark pigmented . . . . *C. nigra* Furtos 1936a
– Valves with patchy pigmentation . *C. brevisaepta* Furtos 1934 and *C. bilicis* Furtos 1936a

5. Two posterior setae present on the UR .... *C. judayi* Tressler 1937
– One or none posterior seta present on the UR 6
6. No posterior seta on the UR 7
– One posterior seta present on the UR 8
7. Only one claw present on the UR .... *C. oxyuris* Daday 1910a
– Both claws present on the UR .... *C. sarsi* Brady 1902
8. In lateral view, dorsal margin with a clear hump ... *C. yapinga* De Deckker 1982b.
– In lateral view, dorsal margin more evenly rounded 9
9. Posterior seta on the UR exceeding ½ L of posterior claw 10
– Posterior seta on the UR much shorter than ½ L of posterior claw 15
10. Seta on the penultimate segment of L6 reaching at the most distal end of terminal segment 11
– Seta on the penultimate segment of L6 by far exceeding distal end of terminal segment 12
11. Surface of the carapace strongly ornamented and medial seta on the penultimate segment of L7 missing .... *C. fossulata* (Daday 1910a)
– Surface not strongly ornamented and medial seta on the penultimate segment of L7 present .... *C. devexa* (Daday 1910a)
12. In dorsal view, posterior margin almost flat .... *C. raciborskii* (Grochmalicki 1915)
– In dorsal view, posterior margin rounded 13
13. Posterior seta on UR as long as posterior claw 14
– Posterior seta on UR shorter than posterior claw ... *C. obfuscate* Victor and Fernando 1981b
14. Surface of the carapace covered with pits and very hairy .... *C. intonsa* Furtos 1936a
– Surface of the carapace more or less sculptured but not with pits ... *C. vivacis* Würdig and Pinto 1993a
15. Posterior claw on UR as long as anterior one .... *C. alagarkoilensis* Victor and Michael 1975
– Posterior claw on UR shorter than anterior one 16
16. In lateral view, valves globular with both margins equally wide and the greatest H lying around the middle 17
– In lateral view, valves more elongated with margins not equally wide and the greatest H lying more toward anterior or posterior end 20
17. Posterior seta on the UR reaching only distal end of UR 18
– Posterior seta on the UR clearly exceeding distal end 21

18. Anterior claw on the UR longer than ramus 19

– Anterior claw on the UR shorter than ramus . . . . *C. hirsuta* Henry 1923

19. Medial seta on the penultimate segment of L7 missing . . . . . . *C. patialensis* Battish 1982a

– Medial seta on the penultimate segment of L7 present *C. longidactyla* Victor and Fernando 1981b

20. Carapace strongly pitted . . . . *C. baylyi* McKenzie 1966a

– Carapace weakly pitted . . . . *C. lutea* McKenzie 1966a

21. Posterior claw on UR less than ½ L of anterior one 22

– Posterior claw on UR more than ½ L of anterior one 25

22. Ventral margin in lateral view with a lip-like projection around the mouth region . . . . *C. globulosa* (Sharpe 1910)

– Ventral margin straight or slightly concave around the mouth region 23

23. Anterior seta on UR missing . . . . *C. papuana* Vávra 1901

– Anterior seta on UR present 24

24. Posterior claw on UR normally developed . . . . *C. remota* (Vávra 1906)

– Posterior claw on UR more with seta-like appearance *C. infersta* Klie 1941a

25. Anterior seta on UR missing 26

– Anterior seta on UR present 30

26. Ramus of UR very short (shorter than anterior claw) . . . . . . *C. tenuicaudata* (Vávra 1895)

– Ramus longer 27

27. Surface of the carapace covered with distinctive pits 28

– Surface of the carapace covered with tiny pits or smooth 29

28. H more than 70% of W . . . . *C. costata* Müller 1898

– H less than 70% of W . . . . *C. foveata* Hartmann 1964

29. Carapace with granular appearance . . . . *C. nukuhivana* Furtos 1934

– Carapace smooth . . . . *C. lindbergi* Hartmann 1964

30. Dorsal margin evenly rounded 31

– Dorsal margin with a small angle at the point of the greatest H 34

31. Posterior and anterior claws almost equally long . . . . *C. gargi* Deb 1983

– Posterior claw clearly shorter than anterior one (reaching last 1/3 of the anterior claw) 32

32. Ramus of UR straight 33

– Ramus of UR wide curved . . . . *C. cordata* Klie 1938c

33. Anterior and posterior margins equally wide . . . *C. lemurensis* (Vávra 1895)

– Posterior margin narrower than anterior one . . . . *C. dubiosa* (Daday 1901b)

34. Posterior seta on UR reaching 1/3 of posterior claw *C. globosa* (Brady 1886a)
– Posterior seta on UR shorter 35
35. Posterior seta on UR curved . . . . *C. turgida* (Sars 1896a)
– Posterior seta on UR straight 36
36. CIL with numerous lists 37
– CIL without lists 38
37. Anterior claw on UR only slightly shorter than ramus *C. seurati* Gauthier 1929
– Anterior claw on UR considerably longer than ramus . . . . . *C. kawatai* Sohn and Kornicker 1972
38. Ramus of UR straight . . . . *C. murati* Gauthier 1939
– Ramus on UR curved 39
39. Surface pitted . . . . *C. kenyensis* Klie 1939a
– Carapace smooth . . . . *C. fontinalis* Hartmann 1964

Species not included in the key

C. brevisaepta Furtos 1934 and *C. bilicis* Furtos 1936a key together because the only difference between the two species is the distribution of color patches on the carapace, and this can be very variable. The following species have not been included in the key due to the insufficient descriptions: *C. brevispina* Farkas 1959; *C. comitisroseni* (Brehm 1924); *C. globula* (Sars 1889); *C. margalefi* Brehm 1949; *C. minna* (King 1855); *C. ramai* Deb 1984; *C. rotunda* Ghetti 1972; *C. viridis* (Thomson 1879).

Remarks

The genus *Cypretta* is at the moment in need of revision. The above key tended to include as many species as possible, but for many species descriptions are limited to the carapace outline and the appearance of the UR. Therefore the key is based only on those characters. Future studies on the genus should pay more attention on the chaetotaxy of L6 and L7. Since many characters were not known from in the original descriptions the above key should be used with caution when identifying animals.

Ecology and distribution (Fig. 110)

Species live in the open water bodies, sometimes even with a slightly higher salinity. They are mostly distributed in the southern hemisphere.

***Paracypretta* Sars 1924**

Diagnosis (modified after Martens 1984a): Shell tumid, W at least ½ L, LV overlapping RV posteriorly and ventrally and by much at the anterior extremity. Surface of both valves closely set with longitudinal ridges. CIL in both valves broad. A2 slender, claws long and narrow. Md palp with α-seta short and fine; β-seta stout, broad, and densely set with long setulae; and γ-seta long and stout. Terminal segment of Mxl palp cylindrical. UR slender, with two claws and two setae.

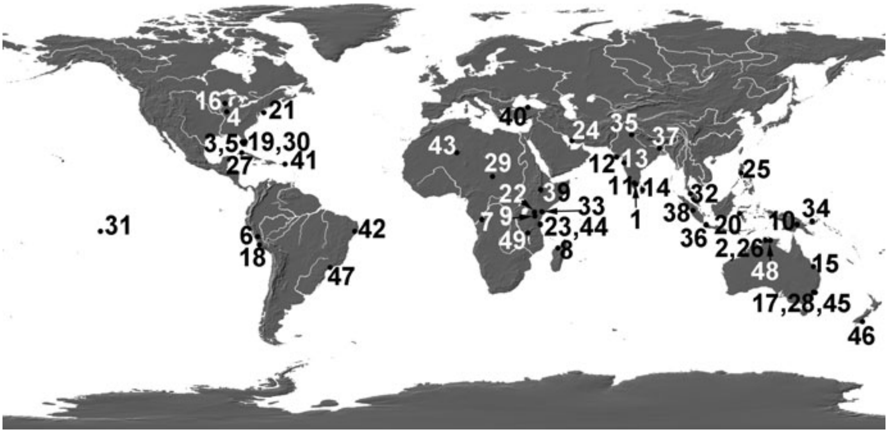


Fig. 110 Distribution of *Cypretta* Vávra 1895: Numbers correspond to the species list

Type species: *P. ampullacea* Sars 1924

Species list with synonyms, type locality, and type material

1. *P. acanthifera* Sars 1924. Cape Town, South Africa, 33°55′S 18°25′E: Holotype not designated, some material deposited in the SAFM – A11135, 11276, 11277, 11280, 11747.
2. *P. amati* Martens 1984a. Chor Amat, Red Sea Hills, Sudan, 19°34′N 37°10′E: Holotype (♀), RMCA – collection number unknown.
3. *P. ampullacea* Sars 1924. Green Point Common, South Africa, 33°54′S 18°24′E: Holotype not designated, some material deposited in SAFM – A11161, A11748, A11895.
4. *P. aratra* (Brady 1904). Greytown, Natal, South Africa: 29°03′S 30°35′E: Holotype not designated, material deposited at HM – collection numbers unknown.
5. *P. minor* (Müller 1914). Freshwater pond between Fish Hoek and Chapmans Bay, South Africa, 34°07′S 18°27′E: Holotype not designated, repository of the type material unknown.

   Syn.: *P. rubra* Sars 1924

6. *P. syngramma* (Müller 1908). Zeekoevlei, Fish Hoek, South Africa, 34°03′S 18°30′E: Holotype not designated, some material deposited at ZMB – 13141, 1704.

Key to the species (modified after Martens 1984a)

1. Shell W less than ¾ L 2

– Shell W equal to or larger than ¾ of L 3

2. UR attachment with bifurcated dorsal branch, forming an incomplete eyelet with ventral branch; W/L ratio of carapace about 0.60–0.65 *P. amati* Martens 1984a

– UR attachment with undivided dorsal and ventral branches; W/L ratio of carapace about 0.70; color of live animals greyish-green . . *P. aratra* (Brady 1904)
3. W/L ratio of carapace equal to about 0.75 4
– W almost equal to L . . . . *P. ampullaceal* Sars 1924
4. Shell surface with spines . . . . *P. acanthifera* Sars 1924
– Shell surface without spines 5
5. Shell densely covered with long hair, color of live animals reddish/brown . . . *P. minor* (Müller 1914)
– Shell scarcely covered with hair, color of live animals green or brown . . . . . . *P. syngramma* (Müller 1908)

Ecology and distribution (Fig. 111)
Species inhabit open freshwater and are restricted to Africa.

Zonocypretta De Deckker 1981a

Diagnosis (after De Deckker 1981a): Shell sculptured with longitudinal lines all over the surface; areas between these lines divided by small transverse ridges. RV slightly larger than LV and overlapping it anteriorly and ventrally; internal posteroventral on the RV with a row of five denticles. Prehensile palps asymmetrical. UR with claws of almost equal length and two setae at base of claws.

Type (and only) species: *Z. kalima* De Deckker 1981a.

Species list with type locality and type material
Z. kalimna De Deckker 1981a. Dam at Waskey Well, near Nallan, 21 km NE of Cue, WA, Australia, 118°09′06″E 27°16′54″S: Holotype (♂), AMS – P.28620.

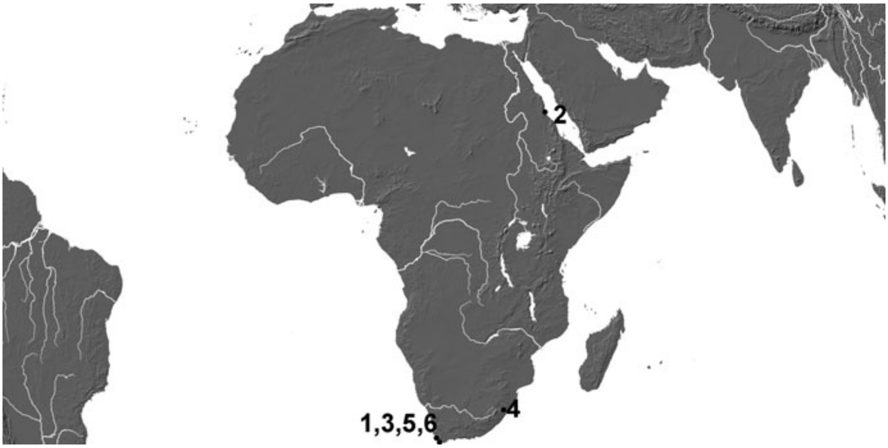


Fig. 111 Distribution of *Paracypretta* Sars 1924: Numbers correspond to the species list

4.4 Subfamily Cypricercinae McKenzie 1971b

Diagnosis (after Savatenalinton and Martens 2009c): Carapace shape highly diverse, surface smooth or ornamented with pits, setae or fine spines, hinge adont (Fig. 112). false pore canals absent. A1 without flagellated claws. A2 with both Rome and Wouters organs either small or large, depending on lineage (Fig. 113a). Mxl with terminal palp segment either spatulate or rectangular (Fig. 114c). L5 without "c"-

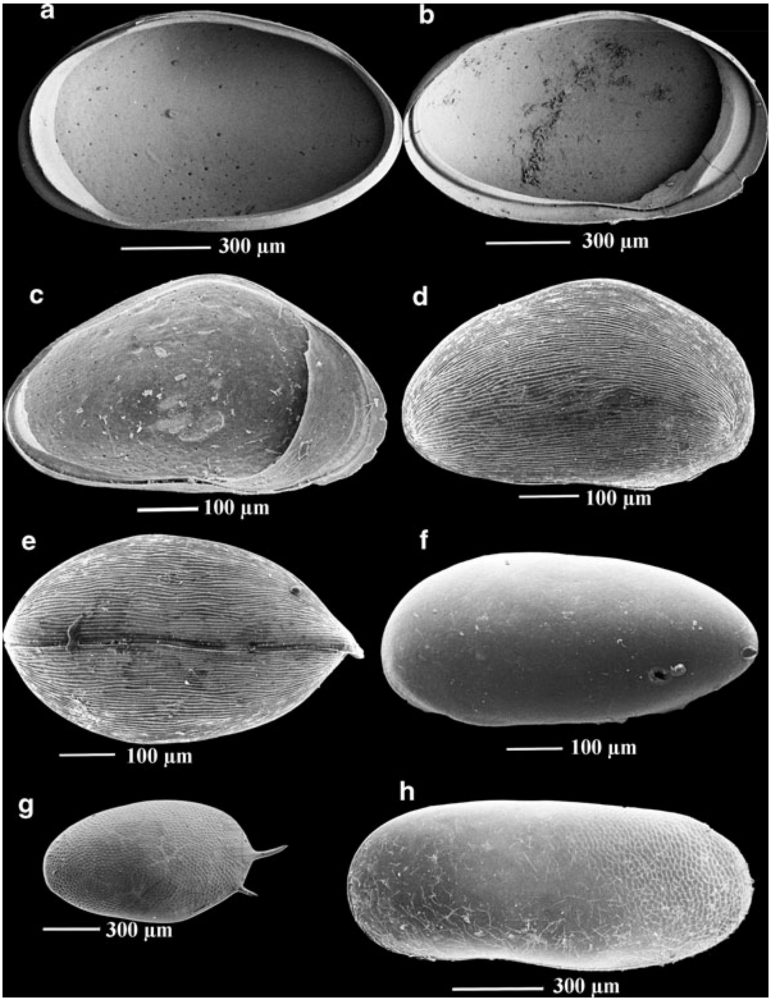


Fig. 112 SEM: (**a**, **b**) *Strandesia vavraii* (G.W.Müller 1898); (**c**–**e**) *Strandesia sp.*; (**f**) *Strandesia elongata* Hartmann, 1964; (**g**) *Strandesia spinifera* Hartmann 1964; (**h**) *Tanycypris pellucida* (Klie, 1932). Photos: D. Keyser

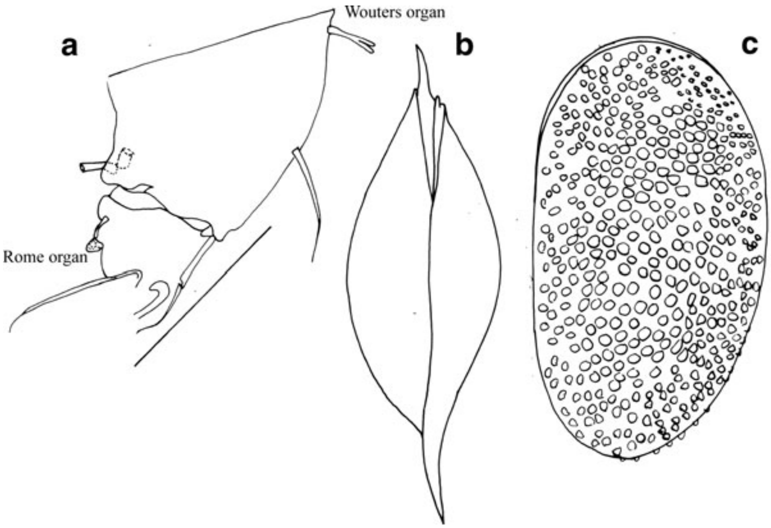


Fig. 113 Line drawings: (**a**) *Bradleycypris obliqua* (Brady1868); (**b**) *Bradleystrandesia weberi* (Moniez 1892): (**c**) *Spirocypris horrida* (Sars 1926): (**a**) first two segments of A1; (**b**) carapace dorsal view; (**c**) LV, outside view. (**b**) modified after Savatenalinton and Martens (2010a); (**c**) modified after Savatenalinton and Martens (2009b). Scale = 0.1 mm. (**b**, **c**) not to scale

seta (Figs. 114a and 115). Penultimate segment of L6 divided, seta “d2” never longer than seta “d1” (subequal, shorter or absent) (Figs. 114b and 116a, b). Terminal segment of L7 transformed into pincer (Fig. 116e). UR generally slender (Fig. 116c, d); attachment of the caudal ramus with Triebel’s loop, but without triangular basal structure (Fig. 117). Female reproductive organ without additional appendages. Male hemipenis without spiraled or 8-shaped post-labyrinthal loops of the inner spermiduct.

Type genus: *Cypricercus* Sars 1895
Other genera: *Astenocypris* Müller 1912; *Bradleycypris* McKenzie 1982a; *Bradleystrandesia* Broodbakker 1983a; *Bradleytriebella* Savatenalinton and Martens 2009b; *Diaphanocypris* Würdig and Pinto 1990; *Nealecypris* Savatenalinton and Martens 2009b; *Pseudostrandesia* Savatenalinton and Martens 2009b; *Spirocypris* Sharpe 1903; *Strandesia* Stuhlmann 1888; *Tanycypris* Triebel 1959.

Systematics
The subfamily is divided into three tribes: Bradleystrandesini Savatenalinton and Martens 2009b, Cypricercini McKenzie 1971b, and Nealecypridini Savatenalinton and Martens 2009b. The present account is based on the most recent papers (Savatenalinton and Martens 2009b, c, 2010) which deal with the revision of the subfamily Cypricercinae. These papers need to be consulted when identifying Cypricercinae.

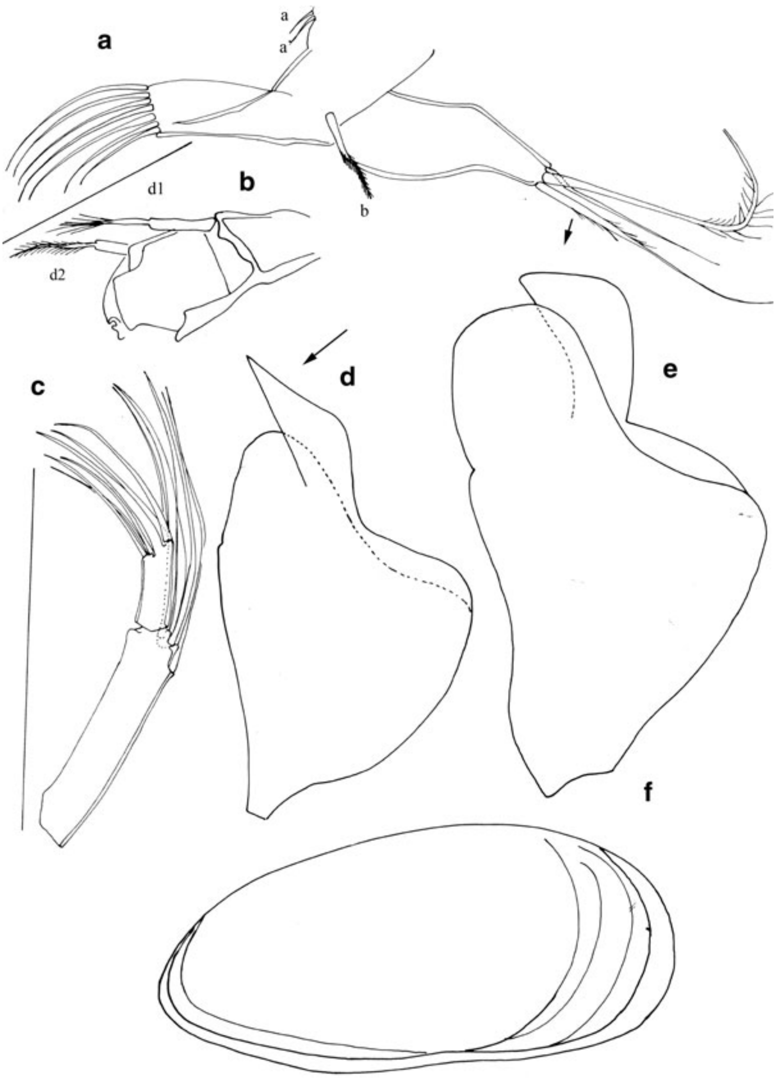


Fig. 114 Line drawings: (**a**, **b**) *Pseudostrandesia striatoreticulata* (Klie 1932); (**c**) *Strandesia kimberleyi* Karanovic 2005a; (**d**) *Bradleycypris vittata* (Sars 1903a): (**e**, **f**) *Cypricercus cuneatus* Sars 1895: (**a**) L5; (**b**) basal segment of L6; (**c**) Mxl palp; (**d**, **e**) hemipenis, showing the shape of the outer lobe: (**e**) LV, inside view. (**d**) modified after Savatenalinton and Martens (2010a); (**e**, **f**) modified after Savatenalinton and Martens (2009c). Scales = 0.1 mm. (**d**–**f**) not to scale

Key to the tribes

1. Triebel's loop situated on the dorsal branch of the caudal ramus (Fig. 117c) Bradleystrandesini Savatenalinton and Martens 2009b

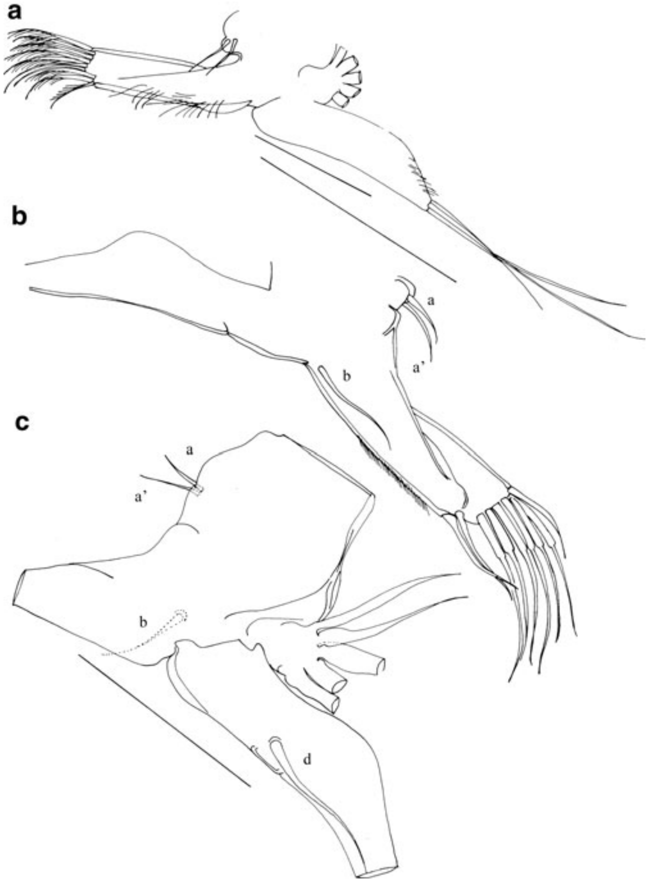


Fig. 115 Line drawings: (**a**) *Diaphanocypris meridana* (Furtos 1936b); (**b**) *Nealecypris obtusa* (Klie 1933a); (**c**) *Tanycypris pellucida* (Klie, 1932): L5. Scales = 0.1 mm

– Triebel's loop situated at the middle of the distal part of the main UR attachment (Fig. 117a, b) 2

2. Ventral branch of UR weakly developed (Fig. 117b) . . . . Nealecypridini Savatenalinton and Martens 2009b

– Ventral branch of UR well developed (Fig. 117a) Cypricercini McKenzie 1971b

4.4.1 Tribe Cypricercini McKenzie 1971b

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in dorsal view subovate, elliptical (Figs. 114f and 112a–g); LV in internal view with a groove, anterior CIL with or without inner list(s); "d" seta on L5 absent or present; UR stout, claws serrated; UR attachment with Triebel loop in the middle of the distal part of the main branch, dorsal and ventral branches both well developed.

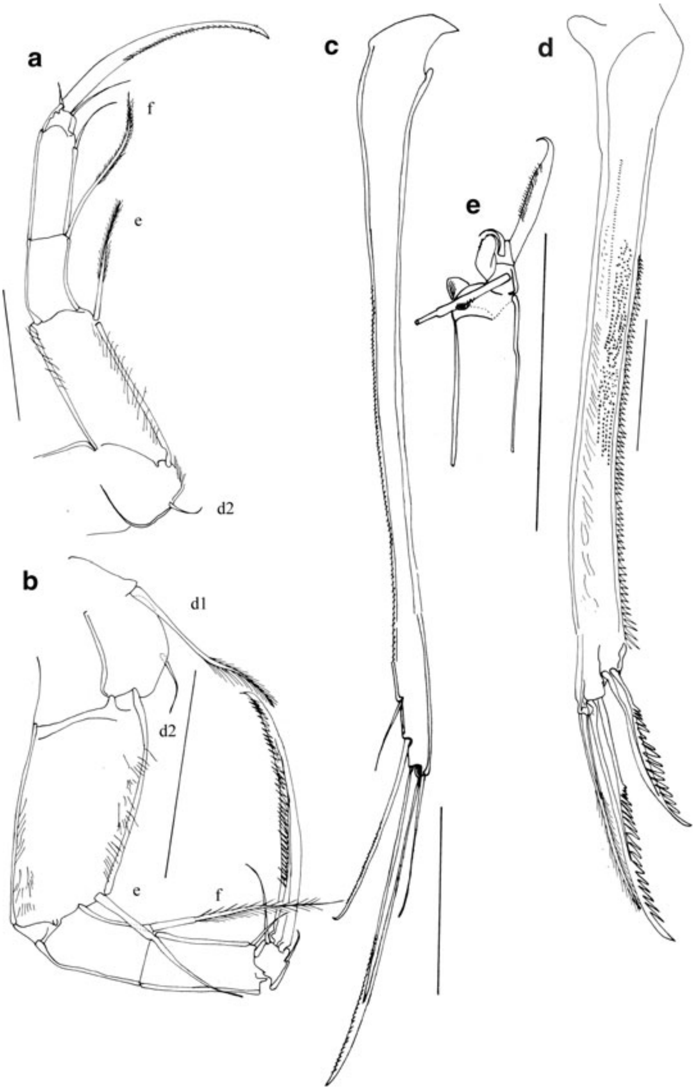


Fig. 116 Line drawings: (**a**) *Diaphanocypris meridana* (Furtos 1936b); (**b, c**) *Nealecypris obtusa* (Klie 1933a); (**d**, **e**) *Tanycypris pellucida* (Klie 1932): (**a**, **b**) L6; (**c**, **d**) UR; (**e**) distal part of L7. Scales = 0.1 mm

Type genus: *Cypricercus* Sars 1895

Other genera: *Bradleycypris* McKenzie 1982a, *Pseudostrandesia* Savatenalinton and Martens 2009b, and *Strandesia* Stuhlmann 1888.

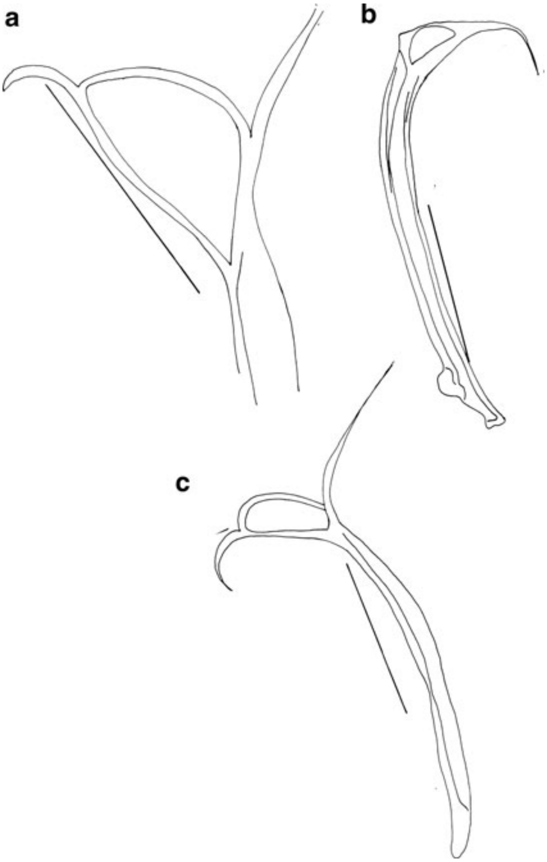


Fig. 117 Line drawings: (**a**) *Bradleycypris obliqua* (Brady1868); (**b**) *Nealecypris obtusa* (Klie 1933a); (**c**) *Bradleystrandesia parva* (Hartmann 1964): UR attachments

Key to the genera (modified after Savatenalinton and Martens 2009b**)**

1. d-seta on L5 absent (Fig. 114a) *Pseudostrandesia* Savatenalinton and Martens 2009b

– d-seta on L5 present 2

2. Anterior CIL on LV without lists, hemipenis with triangular outer lobe (Fig. 114d) . . . . *Bradleycypris* McKenzie 1982a

– Anterior CIL on LV with or without lists, hemipenis with different outer lobe 3

3. Carapace in lateral view elliptical, subovate, elongated (L $<$ 2 $\times$ H) (Fig. 112a–g), hemipenis with large wing-like outer lobe . . . . *Strandesia* Stuhlmann 1888

– Carapace in lateral view elongated ($L > 2 \times H$) (Fig. 114f), hemipenis with small, subquadrate outer lobe (Fig. 114e) . . . . *Cypricercus* Sars 1895

Bradleycypris McKenzie 1982a

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in dorsal view ovate, in caudal view oblique; LV with internal groove along valve margin, CIL without inner list; d-seta on L5 present; hemipenis with small, pointed, subtriangular outer lobe and with one large post-labyrinthal spermiduct loop. Zenker organ with cone-shaped chitinous sheets at both proximal and distal ends.

Type species: *B. obliqua* (Brady 1868)

Species list with synonyms, type locality, and type material

1. *B. obliqua* (Brady 1868). Loughrigg Tarn, Westmoreland, England, UK, 54°25′N 03°00′W. Types, BM – 1911.11.8.M2826.

   Syn.: *Cypricercus alacer* Meisch 1979; *Strandesia mulargie* Anichini 1967

2. *B. vittata* (Sars 1903a). Fish ponds and rice fields, neighborhood of Pucheng, China – type locality plurivalent. Lectotypes, NHMO – F12240a/b.

Key to the species

1. In dorsal view, carapace with rounded anterior end . . . *B. vittata* (Sars 1903a)
– In dorsal view, carapace with beak-like anterior end . *B. obliqua* (Brady 1868)

Ecology and distribution

Both species are found in permanent or temporary water bodies. *Bradleycypris obliqua* has generally a Holarctic distribution, *B. vittata* was found in China and South-East Asia.

Cypricercus Sars 1895

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in dorsal view elliptical; in lateral view elongated (L more than twice the H); in frontal view LV and RV subequal, not oblique; LV with internal groove along valve margin and with one or two inner lists; d-seta on L5 present; hemipenis with small, subquadrate outer lobe and with two post-labyrinthal spermiduct loops; Zenker organ with distal end plate, forming crown of petal-like structure.

Type species: *Cypricercus cuneatus* Sars 1895

Species list with type locality and type material

1. *C. acanthigera* (Müller 1912). São Paulo, Brazil, 23°32′S 46°38′W: Holotype not designated, repository of type material unknown.

   Syn.: *Neocypris mucronata* Sars 1901

2. *C. ariariensis* (Roessler 1986a). Temporary ponds, River Ariaria, Departamento del Meta, Columbia, 03°16′N 73°04′W: Holotype (♀), ICN-NMH – UR-141-84.

3. *C. centrurus* (Klie 1940a). Cachoeira de Paulo Afonso, Alagoas State, Brazil, 09°36′S 37°07′W: Syntypes, ZMK – UR-863.
4. *C. cheboyganensis* Ferguson 1957. Reece's Bog, Near Burt Lake, Cheboygan County, Michigan, USA, 45°26′N 84°42′W: Holotype (♀), SM – 99351.
5. *C. cuneatus* Sars 1895. Cape of Good Hope, South Africa, 34°21′S 18°28′E: Lectotype (♂), SAFM – A11140.
6. *C. elegans* (Roessler 1986a). Temporary Pools, Departamento del Meta, Colombia, 03°16′N 73°04′W: Holotype (♀), ICN-NMH – UR-131-84.
7. *C. episphaenus* Müller 1908. Zeekoevlei, Plumstead, Simon's Town, Fish Hoek, South Africa, 34°11′S 18°25′E: Syntypes, ZMG – 24711.
8. *C. indrani* Deb 1983. Rain water pond, Mahabaleswar Panchgani Road, Mahabaleswar, India, 17°55′N 73°39′E: Holotype (♀), ZSI – C1166/2.
9. *C. inermis* (Brady 1904). Greytown, KwaZulu-Natal, South Africa, 29°03′S 30°35′E: Lectotype (♀), HM – SS485.
10. *C. maculatus* Müller 1908. Zeekoevlei, Plumstead, Simon's Town, Fish Hoek, South Africa, 34°11′S 18°25′E: Syntypes, ZMB – 13147.
11. *C. munshii* Deb and Nasar 1977. Freshwater pond, Bhagalpur, Bihar, India, 25°15′N 87°02′E: Holotype not designated, repository of the type material unknown.
12. *C. rotundus* Tressler 1950. Lake Let, Rio de Janeiro, Brazil, 22°59′S 43°17′W: Holotype (♀), SM – 83006.
13. *C. sanguineus* Chapman 1963. Outram, Dunedin, New Zealand, 45°51′S 170°13′E: Type material deposited at OMD – collection numbers unknown.
14. *C. setosus* Farkas 1857. S Kerala (formerly Travancore), S India, 11°00′N 76°57′E: Holotype not designated, material deposited at HMNH.
15. *C. unicornis* De Deckker 1981c. Granite Poole, Newmann's Rock, Norseman, WA, Australia, 32°11′S 121°46′E: Holotype (♂), NMV – J 1153.
16. *C. variabilis* (Roessler 1986b). Puddles near Turbo, Colombia, 08°05′N 76°43′W: Holotype (♀), ICN-MHN – UR-116-83.
17. *C. vietsi* Farkas 1957. Karumandi, India, 10°53′N 77°04′E: Holotype not designated, material deposited at HMNH.
18. *C. xhosa* Savatenalinton and Martens 2009c. Rhino Ridge Pool 6, Thomas Basin Natural Reserve, Grahamstown, Eastern Cape, South Africa, 33°23′42″S 26°30′10″E: Holotype (♂), AM – 20 C.

Key to the species

1. Posterior spine-like protuberances present 2
– Posterior spine-like protuberances absent 7
2. Protuberances present on both valves . . . . *C. xhosa* Savatenalinton and Martens 2009c
– Protuberances present only on RV 3
3. Protuberance very pointed at the end 4
– Protuberance oblong at the end 5

4. In dorsal view, carapace narrowing toward posterior end, i.e., the greatest W laying in front of the middle . . . . *C. centrurus* (Klie 1940a)

– In dorsal view, greatest W lying in the middle . . . . *C. ariariensis* (Roessler 1986a)

5. Anterior seta on the UR very long, longer than 2/3 of the anterior claw 6

– Anterior seta on the UR much shorter, not reaching middle of anterior claw . . . *C. unicornis* De Deckker 1981c

6. Dorsal margin in lateral view sloping down gently from the middle toward posterior end . . . . *C. episphaenus* Müller 1908

– Dorsal margin in lateral view straight until the last ¼ of its L than sloping toward posterior margin . . . . *C. variabilis* (Roessler 1986b)

7. Outer lobe of hemipenis with elongated distal end . . . . *C. inermis* (Brady 1904)

– Outer lobe of hemipenis not with elongated distal end 8

8. Both prehensile palps with elongated, thin fingers . *C. maculatus* Müller 1908

– Right prehensile palp with much wider finger, which almost triangular . . . *Cypricercus cuneatus* Sars 1895

Species not included in the key

The following species have not been included in the key because of their uncertain status with the subfamily Cypricerinae and the genus *Cypricercus*: *C. acanthigera* (Müller 1912) *C. adustus* (Koch 1837a); *C. cheboyganensis* Ferguson 1957; *C. elegans* (Roessler 1986a); *C. indrani* Deb 1983; *C. munshii* Deb and Nasar 1977; *C. rotundus* Tressler 1950; *C. sanguineus* Chapman 1963; *C. setosus* Farkas 1957; *C. testudinarius* (Sharpe 1897); *C. vietsi* Farkas 1957.

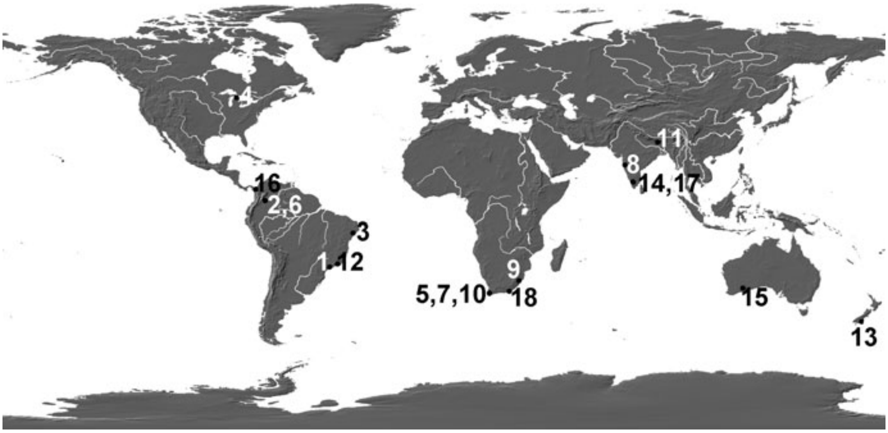


Fig. 118 Distribution of *Cypricercus* Sars 1895: Numbers correspond to the species list

Ecology and distribution (Fig. 118)
Species mostly live in open freshwater bodies, very often in temporary ones. The genus is generally distributed in the southern hemisphere.

Pseudostrandesia Savatenalinton and Martens 2009b

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in dorsal view elliptical, in lateral view elongated, in caudal view position of LV and RV equal or slightly unequal; LV with internal groove along valve margin, CIL with one inner list; d-seta on L5 absent; L6 with “d1” larger and longer than “d2” (Fig. 114b).

Type species: *P. striatoreticulata* (Klie 1932)

Species list with synonyms, type locality, and type material

1. *P. asymmetros* (Rome 1962). Ujiji, Kigoma, Tanzania, 04°54′S 29°40′E: Holotype (♀), RBINS – 573a.
2. *P. calapanensis* (Tressler 1937). Mindoro Island, Calapan, Philippines, 13°21′N 121°11′: Type (♀), SM – 71511.

   Syn.: *Strandesia uenoi* Klie 1938d

3. *P. chondropherus* (Rome 1969). Ganza, DR Congo, 07°05′S 29°30E: Holotype (♀), RBINS – 705a.
4. *P. gaetani* Savatenalinton and Martens 2010. Nong Nari Swamp, Muang District, Phetchabun Province, Thailand, 16°26′23″N 101°08′29″E: Holotype (♀), RBINS – O.C. 3133.
5. *P. mamirilorum* (Victor and Fernando 1981c). Guiguinto Malalos, Bulacan, Philippines, 14°47′N 120°52′E: Holotype (♀), NMNSO – 21623, 21624.
6. *P. ovata* Savatenalinton and Martens 2010. Roadside canal, Wat Boht District, Phitsanulok Province, Thailand, 17°01′51″N 100°18′49″E: Holotype (♀), RBINS – O.C. 3137.
7. *P. phetchabunensis* Savatenalinton and Martens 2010. Nong Nari Swamp, Muang District, Phetchabun Province, Thailand, 16°26′23″N 101°08′29″E: Holotype (♀), RBINS – O.C. 3139.
8. *P. striatoreticulata* (Klie 1932). Bogor, West Java, Indonesia, 06°35 S 106°47′E: Syntypes, ZMK – UR-873-4.
9. *P. thailandensis* Savatenalinton and Martens 2010. Nalao Natural Spring, Konsarn District, Chaiyaphum Province, Thailand, 16°35′22″N 101°53′49″E: Holotype (♀), RBINS – O.C. 3135.
10. *P. vinciguerrae* (Masi 1905b). Lake Fondi, Latium, Italy, 41°21′N 13°25′E: Holotype not designated, repository of the type material unknown.

    Syn.: *Strandesia anterotundata* Rome 1977 (in Rome and De Decker 1977)

Key to the species

1. In dorsal view, anterior end beak like 2
– In dorsal view, anterior end rounded 3
2. In dorsal view, posterior margin rounded . . . . *P. gaetani* Savatenalinton and Martens 2010
– In dorsal view, posterior end narrowing and clearly separated by a light constriction . . . . *P. striatoreticulata* (Klie 1932)
3. Ventral margin with enlargement around the mouth region . . . *P. asymmetros* (Rome 1962)
– Ventral margin more or less straight, but without a pronounced enlargement . . . 4
4. In dorsal view, LV strongly overlapping RV both anteriorly and posteriorly . . . *P. thailandensis* Savatenalinton and Martens 2010
– In dorsal view, only anterior overlap (if present) strong 5
5. In lateral view, posterior margin much narrower than anterior one, carapace being elongated 6
– In lateral view, both margins more or less the same W, or posterior narrower but never elongated 7
6. Posterior end of carapace lifted up from the horizontal axes . . . . *P. calapanensis* (Tressler 1937)
– Posterior end of carapace lying almost flat on the horizontal axes . . . . *P. phetchabunensis* Savatenalinton and Martens 2010
7. Dorsal margin with greatest H lying around the middle 8
– Dorsal margin with greatest H clearly situated on the first ⅓ . *P. mamirilorum* (Victor and Fernando 1981c)
8. Dorsal margin evenly rounded, and posterior end of valves lifted up from the horizontal axes . . . . *P. chondropherus* (Rome 1965a)
– Dorsal margin with middle part making a light elevation, posterior end of carapace lying almost flat on the horizontal axes . *P. ovata* Savatenalinton and Martens 2010

Species not included in the key
The only species currently assigned to the genus not included in the key is *P. vinciguerrae* (Masi 1905b).

Ecology and distribution (Fig. 119)
Like the other representatives of the subfamily, species of the genus *Pseudostrandesia* can be found in both permanent and temporary freshwater water bodies. The genus has a scattered distribution, but most species have been recorded from the South-East Asia.

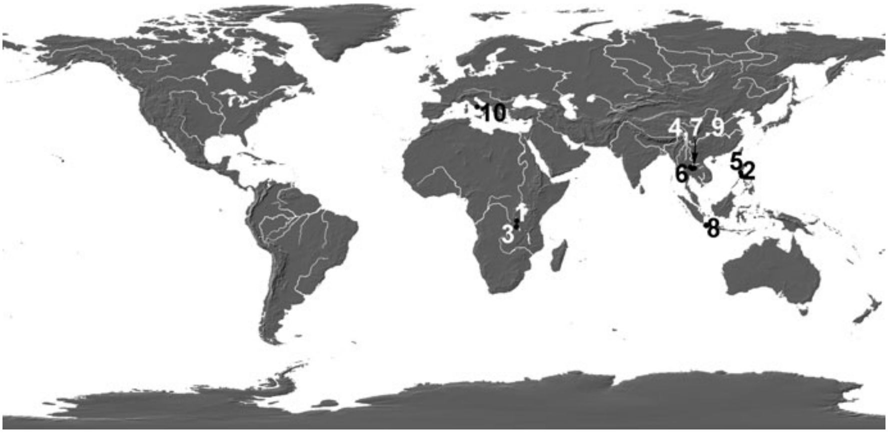


Fig. 119 Distribution of *Pseudostrandesia* Savatenalinton and Martens 2009b: Numbers correspond to the species list

Strandesia Stuhlmann 1888 [Syn.: *Acanthocypris* Claus 1892; *Neocypris* Sars 1901]

Diagnosis (after Sevatenalinton and Martens 2009b): Carapace in lateral view diverse in shape: subovate, elliptical, moderately elongated with L less than twice the H, in frontal view, position of LV and RV equal or slightly unequal; LV with internal groove along valve margin in inner view, CIL without inner list or with one inner list; d-seta on L5 present; hemipenis with large, wing-like outer lobe and with one post-labyrinthal spermiduct loop; Zenker organ with cone-shaped chitinous sheet at both proximal and distal ends.

Type species: *S. mercatorum* (Vávra 1895)

Species list with type locality and type material

1. *S. antetuberculata* Hartmann and Petersen 1985. Ditch, Sikkim, India, 27°43′N 88°38′E: Syntypes, ZMH – K-27 472.
2. *S. bicornuta* Hartmann 1964. Well in Goa, India, 15°25′N 73°58′E: Lectotype (♀), ZMH – K-27 462a.
3. *S. bicuspis* (Claus 1892). Venezuela. No more details on the locality. Holotype not designated, repository of the type material unknown.

   Syn.: *Neocypris gladiator* Sars 1901

4. *S. biwaensis* Okubo 2004. Lake Biwa, Shiga, Hoshu, Japan, 35°00′45″N 135°56′00″E: Repository of the type material unknown.
5. *S. botosaneanui* Broodbakker 1983a. Village La Patana, Baracoa, Cueva la Patana, Cuba, 20°11′N 74°08′W: Holotype (♀), ZMA – Ost. 150.837A.
6. *S. brteki* Rybecky 1988. Thermal spring, Bojnice, Kreis Prievidza, Slovakia, 48°46′79″N 18°35′2.54″E: Holotype (♀), SNM – 470.

7. S. *canadensis* (Sars 1926). Small brook, tributary to Middle fork, Old Man River, Alberta, Canada, 53°55′N 116°34′W: Holotype not designated, repository of the type material unknown.
8. S. *carteri* Klie 1930a. Small village Makthlawaiya, ca. 200–250 km N of Asunción, Gran Chaco, Paraguay, 23°25′S 58°19′W: Syntypes, ZMK – UR-895.
9. S. *caudata* Klie 1939a. Marsh on stream, Nairobi, Kenya, 01°16′S 36°49′E: Syntypes, ZMK – UR-859–860, 876, 1278, 1511.
10. S. *cavernicola* Broodbakker 1983a. Shallow limestone pool, near village Mathias, Cueva Banega, Cuba, 20°16′N 76°19′W: Holotype (♀), ZMA – Ost. 150.834A.
11. S. *clorocelis* Anichini 1967. Alto Flumendosa, Villanova Strisaili, Sardenia, Italy, 39°56′N 09°26′E: Holotype, ZIUC – collection number unknown.
12. S. *complexa* Victor and Fernando 1981c. Lily pond, Delmonte Country Club, Cagayan, Lake Tugut, Mindanao, Philippines, 07°51′N 124°50′E: Holotype (♀), NMNSO – 21617, 21618.
13. S. *cyprinotoides* Klie 1938c. Near Lake Kivu, Rwanda, 01°54′S 29°11′E: Syntypes, ZMK – UR-878.
14. S. *denticulata* Tressler 1950. Reservoir near Porto Alegre, Rio Grande do Sul, Brazil, 30°01′S 51°13′W: Holotype (♀), SM – 83032.
15. S. *diversicolor* Klie 1938c. Pool near Panga, DR Congo, 01°50′N 26°23′E: Syntypes, ZMK – UR-877, 1277.
16. S. *donnetii* (Baird 1850). Freshwater ponds at Coquimbo, Chile, 29°57′S 71°20′W: Types, BM – collection numbers unknown.
17. S. *dorsolonga* Rome 1962. Fizi, DR Congo, 04°18′S, 28°56′E: Holotype (♀), RBINS – O.C. 578a
18. S. *dorsoviridis* McKenzie 1966a. About 100 km W of Mt. House, WA, Australia, 17°07′S 125°45′: Holotype (♀), NMV – J19, J20.
19. S. *elatior* (Vávra 1897). Ugogo, Tanzania, 06°07′S 35°30′E: Holotype not designated, repository of the type material unknown.
20. S. *elliptica* (Sars 1901). Itatiba, Brazil, 23°00′S 46°50′W: Lectotype, NHMO – F19402a1/2.
21. S. *elongata* Hartmann 1964. Pond near Kārikāl, Pondicherry, India, 10°55′N 79°50′E: Syntypes, ZMH – K-27 463.
22. S. *evae* Gauthier 1951. Poull Bourgou, Tambacounda, Senegal, 13°46′N 13°40′W: Holotype not designated, repository of the type material unknown.
23. S. *ewaldi* Karanovic 2005a. Temporary pools, San Juan de Arama, Columbia, 03°26′N 73°45′W: Holotype (♀), ICN-MHN – UR-1151.
24. S. *feuerborni* Klie 1932. Peninsula Samosir, Lake Toba, North Sumatra, Indonesia, 02°34′N 98°49′E: Syntypes, ZMK – UR-879.
25. S. *flavescens* Klie 1932. Temporary pond, Pangururan, North Sumatra, Indonesia, 02°36′N 98°45′E: Syntypes, ZMK – UR-868.
26. S. *freyi* Victor and Fernando 1981c. Lake Lanao, Bocolod Chico, W of Marwi City, Mindanao, Philippines, 07°51′N 124°50′E: Holotype (♀), NMNSO – 21619, 21620.

27. S. *gopinathani* George and Martens 1993a. Semi permanent pond at Perumballoor, 5 km from Muvatupuzha town in Ernakulam District, Kerala, India, 10°11′N 76°27′E: Holotype (♀), RBINS – O.C. 1686.
28. S. *hancocki* (Lowndes 1931a). Lake Elgol, Uganda, 01°18′N 34°35′E: Holotype not designated, repository of the type material unknown.
29. S. *hartmanni* Victor and Fernando 1980. Pond in the paddy fields in Chirackal, 15 km S of Trichur town, Kerala, India, 10°30′N 76°12′E: Holotype (♀), NMNSO – 21603.
30. S. *hornei* Savatenalinton and Martens 2010. Huai Prasatyai reservoir, Konsarn district, Nakhon Ratchasima Province, Thailand, 15°07′22.7″N 101°33′22.8″E: Holotype (♀), RBINS – O.C. 3129.
31. S. *hystrix* (Furtos 1933). Temporary pond, Columbus, Ohio, USA, 39°57′N 82°59′W: Syntype (♀), SM – 67890.
32. S. *indica* Hartmann 1964. Pond near Ernakulam, Kerala, India, 10°00′N 76°18′: Syntypes, ZMH – K-27 465.
33. S. *inornata* (Sars 1901). São Paulo, Brazil, 23°32′S 46°38′W: Holotype not designated, repository of the type material unknown.
34. S. *intrepida* Furtos 1936b. Halal Aguada, Mérida, Mexico, 20°58′N 89°37′W: Holotype (♀), SM – 67980.
35. S. *itapeva* Tressler 1950. Lagoa Itapeva, Rio Grande do Sul, Brazil, 29°30′S 49°55′W: Holotype (♀), SM – 83029.
36. S. *kilimensis* (Daday 1910a). Kilimanjaro, Tanzania, 03°03′S 37°21′E: Holotype not designated, some material deposited at HNMH – IV/P-229.
37. S. *kimberleyi* Karanovic 2005a. Bore MB29D, Argyle Diamond Mine, Kimberley, WA, Australia, 16°42′S 128°27′E: Holotype (♀), WAM – C33463.
38. S. *kraepelini* (Müller 1906a). Citayam, West Java, Indonesia, 06°26′S 106°47′E: Holotype not designated, repository of the type material unknown.
39. S. *labiata* Hartmann 1964. Rain puddle, near Kodikanal, Palni Mountains, Tamil Nadu, India, 10°14′N 77°29′E: Syntypes, ZMH – K-27 466.
40. S. *laticauda* (Daday 1910a). Lumbira, Tanzania, 09°34′S 34°08′E: Holotype not designated, some material deposited at HNHM – IV/P-230.
41. S. *longula* Broodbakker 1983a. Well between Gressier and Léogâne, Haiti, 18°32′27″N 72°33′50″W: Holotype (♀), ZMA – Ost. 150.816A.
42. S. *marmorata* (Brady 1886a, b). Colombo, Sri Lanka, 06°55′N 79°50′E: Types in the Brady Collection, HM – collection numbers unknown.
43. S. *mercatorum* (Vávra 1895). Zanzibar, Tanzania, 06°09′S 39°11′E: Types, ZMH – K-19 114, 19 115.
44. S. *minuta* Klie 1936a. Crater Lake, Bafoussam, Cameroon, 05°29′N 10°24′E: Syntypes, ZMK – UR-866.
45. S. *mulargiae* Anichini 1967. Mulargia Lake, Sardenia, Italy, 39°37′N 09°13′E: Holotype (♀), ZIUC – collection number unknown.
46. S. *mutica* (Sars 1901). Itatiba, Brazil, 23°00′S 46°50′W: Lectotype, NHMO – F19400a1/2.

47. *S. obliqua* Klie 1940a. Maceío, Alagoas, Brazil, 09°39′S 35°43′W: Syntypes, ZMK – UR-870, 872.
48. *S. obtusata* (Sars 1901). Itatiba, Brazil, 23°00′S 46°50′W: Lectotype, NHMO – F19401a1/2.

    Syn.: *S. itapeva* Tressler 1950

49. *S. odiosa* (Moniez 1892). Luwu, South Sulawesi, Indonesia, 01°50′S 120°31′E: Lectotype, ZMA – Ost. 150.711B.
50. *S. ovalis* Tressler 1950. Near Porto Alegre, Rio Grande do Sul, Brazil, 30°01′S 51°13′W: Holotype (♀), SM – 83028.
51. *S. pedroensis* Tressler 1950. Sao Pedro, Acude Umary, S Ceara, Brazil, 29°35′S 50°04′W: Holotype (♀), SM – 83008.
52. *S. perakensis* Victor and Fernando 1981c. Pond, Bagan Serai, Perak, Malaysia, 04°48′N 100°48′E: Holotype (♀), NMNSO – 21625, 21626.
53. *S. phoenix* De Deckker 1981c. Coastal dune lake at Evans Head, SW of Lismore, NSW, Australia, 29°06′57″S 152°25′40″E: Holotype (♀), SAM – collection number unknown.
54. *S. pistrix* Broodbakker 1983a. Carst spring along the road from Cayes to Camp-Perrin, Haiti, 18°14′44″N 73°45′52″W: Holotype (♀), ZMA – Ost. 150.842A.
55. *S. postica* Rome 1962. Kaluwe pond, on the crest of Ubwari peninsula, opposite to Baraka, Lake Tanganyika, DR Congo, 04°10′S 29°11′E: Holotype (♀), RBINS – O.C. 575a.
56. *S. prava* Klie 1935a. Orombokoko, Ivory Coast, 06°33′N 05°01′W: Syntypes, ZMK – UR-861-862.
57. *S. psittacea* (Sars 1901). São Paulo, Brazil, 23°32′S 46°38′W: Holotype not designated, repository of the type material unknown.
58. *S. puncticulata* (Daday 1910a). Kilimanjaro, Tanzania, 03°03′S 37°21′E: Holotype not designated, some material deposited at HNMH – IV/P-233.
59. *S. purpurascens* (Brady 1886a). Colombo, Sri Lanka, 06°55′N 79°50′E: Types, HM – collection numbers unknown.
60. *S. quasirotunda* Hartmann and Petersen 1985. Pitt, Mumbai, India, 19°01′N 72°51′E: Syntypes, ZMH – K-27 469.
61. *S. regularis* Rome 1962. Baie de Burton, opposite of Musabah, DR Congo, 04°20′S 29°08′E: Holotype (♀), RBINS – O.C. 577a.
62. *S. reticulata* (Daday 1898). Swamps, vicinity of Lake Kala Wewa, Sri Lanka, 08°01′N 80°33′E: Types, HMNH – IV-59.
63. *S. riograndensis* Tressler 1950. Near Porto Alegre, Rio Grande do Sul, Brazil, 30°01′S 51°13′W: Holotype (♀), SM – 83030.
64. *S. rouxi* Méhes 1939. Lake near Koné, New Caledonia, 21°03′S 164°51′E: Holotype not designated, repository of the type material unknown.
65. *S. saetosa* Hartmann 1964. Malabār Coast, Kerala, India, 09°01′N 72°51′E: Syntypes, ZMH – K-27 471.

66. *S. sanoamuangae* Savatenalinton and Martens 2010. Nalao natural spring, Konsarn district, Chaiyaphum Province, Thailand, 16°35′22″N 101°53′50″E: Holotype (♀), RBINS – O.C. 3127.
67. *S. sphaeroidea* Broodbakker 1983a. Swampy area, Vangout, Rivière du Vieux Fort, Marie-Galante, Cuba, 15°55′23″N 61°15′76″W: Holotype (♀), ZMA – Ost.150.826A.
68. *S. stocki* Broodbakker 1983a. Well, village Marigot, Haiti, 18°13′51″N 72°19′43″W: Holotype (♀), ZMA – Ost. 150.829A.
69. *S. strandesioides* (Müller 1898). Mahajanga, Madagascar, 15°43′S 46°19′E: Syntypes, ZMG – 24710.
70. *S. trichosa* Roessler 1990a. Puerto López, Columbia, 04°04′N 72°57′W: Holotype (♀), ICN-MHN – 1160.
71. *S. unicolor* Klie 1944. Eduard Lake, Kayanza, Burundi, 02°55′S 29°37′W: Syntypes, ZMK- UR-1280-1.
72. *S. variegata* (Sars 1901). São Paulo, Brazil, 23°32′S 46°38′W: Lectotype, NHMO – F19405a1/2.
73. *S. vavrai* (Müller 1898). Morondava, Madagascar, 20°17′S 44°19′E: Syntypes, ZMG – 24712.

Remarks

It is almost impossible to give a key to the species of the genus *Strandesia*. Although Savatenalinton and Martens (2009b, c, 2010) provided a major revision of the entire subfamily, the genus *Strandesia* remains still poorly resolved. The authors list around 30 species belonging into *Strandesia s.str.*, but then another 50 species that belong to *Strandesia* s.sl. Therefore, a key will not be presented here.

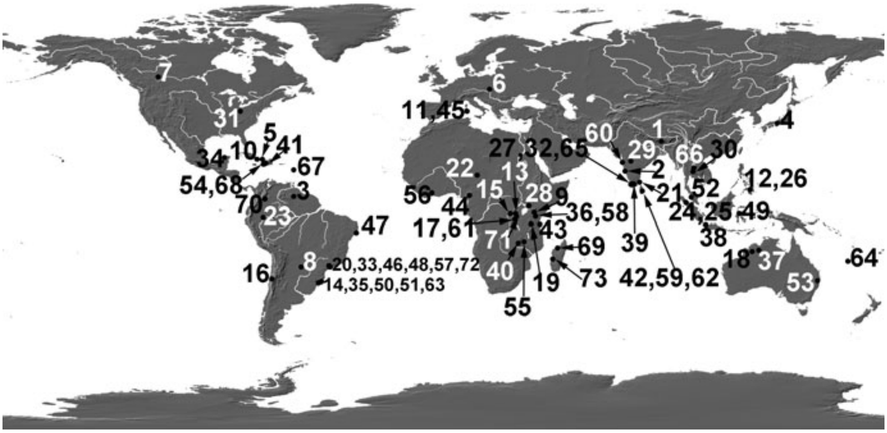


Fig. 120 Distribution of *Strandesia* Stuhlmann 1888: Numbers correspond to the species list

Ecology and distribution (Fig. 120)
The species of this large genus can be found in all sorts of freshwater bodies, from small puddles to the subterranean waters. The genus is distributed all around the world with majority of species known from the southern hemisphere.

4.4.2 Tribe Bradleystrandesini Savatenalinton and Martens 2009b

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in dorsal view subovate, elliptical; LV internal view with or without groove, anterior CIL with inner list; d-seta on L5 absent or present; Wouters organ absent or present; UR slender, claws weakly serrated; UR attachment with Triebel's loop on dorsal branch, dorsal branch and ventral branch slim.

Type genus: *Bradleystrandesia* Broodbakker 1983a

Other genera: *Bradleytriebella* Savatenalinton and Martens 2009b; *Spirocypris* Sharpe 1903.

Key to the genera

1. L5 without "d" seta . . . . . *Bradleytriebella* Savatenalinton and Martens 2009b
– L5 with "d" seta 2
2. In dorsal view, carapace tumid, valves strongly ornamented with tubercles (Fig. 113c) . . . . *Spirocypris* Sharpe 1903
– In dorsal view, carapace elliptical (Fig. 113b), subovate, valves not ornamented with tubercles . . . . *Bradleystrandesia* Broodbakker 1983a

***Bradleystrandesia* Broodbakker 1983a**
Diagnosis (after Savatenalinton and Martens 2009b): Carapace in lateral view subovate, elliptical; LV in internal view with or without groove along valve margin, CIL with one list; Wouters organ absent; d-seta on L5 present; UR slender, claws weakly serrated; UR attachment slim, with Triebel's loop on dorsal branch, ventral branch thin, not well developed; outer lobe of hemipenis elongated, with blunt tip, hemipenis internally with one post-labyrinthal spermiduct loop. Zenker organ with distal end plate, forming crown of petal-like structure.

Type species: *B. fuscata* (Jurine 1820)

Species list with synonyms, type locality, and type material

1. *B. dani* (George and Martens 1993a). Paddy fields on both sides of Chalakudy River, near Railway Bridge at Chalakudy, Trichur District, Kerala, India, 10°18′N 76°22′E: Holotype (♂), RBINS – O.C. 1677.
2. *B. deltoidea* (Delorme 1970b). Saskatchewan, Canada, 52°56′N 106°26′W: Holotype (♀), GMUS – 24290.

3. *B. fuscata* (Jurine 1820). Surroundings of Geneva, Switzerland, 46°12′N 06°08′E: Types, NHMG – collection numbers unknown.
4. *B. gigantica* (Furtos 1933). Centerburg, Ohio, USA, 40°18′N 82°41′W: Syntype (♀), SM – 67942.
5. *B. parva* (Hartmann 1964). Kanhery, Salzette Island, Mumbai, India, 19°01′N 72°51′E: Syntypes, ZMH – K-27 468.
6. *B. reticulata* (Zaddach 1844). Ditch near Kaliningrad, Russia, 54°42′N 20°30′E: Repository of the type material unknown.

   Syn.: *Cypris tessellata* Fischer 1851; *C. affinis* Fischer 1851

7. *B. splendida* (Furtos 1933). Temporary pond, Chardon, Ohio, USA, 41°34′N 81°12′W: Syntype (♀), SM – 57883
8. *B. tolimensis* (Roessler 1990b). Temporary pools, Tolima, Columbia, 04°40′N 75°19′S: Holotype (♀), ICN-MNH – UR-146-85.
9. *B. trichurensis* (Victor et al. 1980). Paddy field, Chirackal, Trichur, Kerala, India, 10°24′N 76°10′E: Holotype (♀), NMNSO – 21596.
10. *B. umbonata* (Victor and Fernando 1981c). Mining pool, Batu Gajah, Perak, Malaysia, 04°28′N 101°02′E: Holotype (♀), NMNSO – 21627.
11. *B. weberi* (Moniez 1892). Luwu, Sulawesi, Indonesia, 01°50′S 120°31′E: Types, ZMA – collection numbers unknown.

Key to the species

1. Carapace covered with spines-like setae 2

– No spine like setae 3

2. Spine-like setae very long and there are only around 10 such setae on each valve *B. trichurensis* (Victor et al. 1980)

– Spine-like seta much shorter and numerous *B. dani* (George and Martens 1993a)

3. RV and LV each with terminal spines . . . . *B. weberi* (Moniez 1892)

– No terminal spines on neither of valves 4

4. In lateral view, point of the greatest H strongly pronounced, carapace almost subtriangular, ventral margin with well developed enlargement (lip-like projection) in front of the middle 5

– Dorsal margin more evenly rounded, ventral margin flat or with very small, hardly visible enlargement 6

5. Anterior UR seta reaching middle of anterior claw *B. parva* (Hartmann 1964)

– Anterior UR seta not reaching middle of anterior claw, being much shorter . . . . *B. umbonata* (Victor and Fernando 1981c)

6. Carapace surface covered with small tubercles (wart-like tubercles) 7

– Carapace surface smooth 9

7. Anterior seta on the UR reaching middle of anterior claw 8

– Anterior seta on the UR shorter . . . . *B. fuscata* (Jurine 1820)

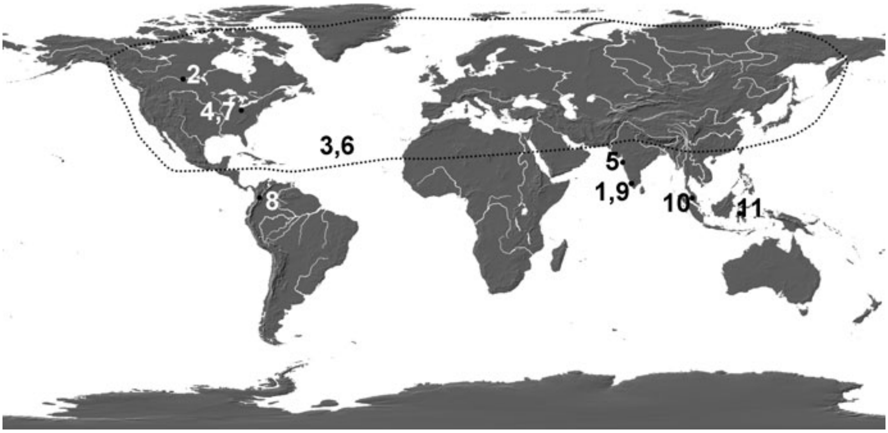


Fig. 121 Distribution of *Bradleystrandesia* Broodbakker 1983a: Numbers correspond to the species list

8. Ventral margin on both valves flat . . . . *B. splendida* (Furtos 1933)

– Ventral margin on RV concave around the middle . . . . *B. gigantica* (Furtos 1933)

9. Carapace very tumid in lateral view . . . . *B. tolimensis* (Roessler 1990b)

– Carapace more elongated in lateral view 10

10. In dorsal view, carapace narrow posteriorly almost as much as anteriorly and anterior overlap not so pronounced . . . . *B. deltoidea* (Delorme 1970b)

– In dorsal view, carapace much wider posteriorly and anterior overlap clearly pronounced . . . . *B. reticulata* (Zaddach 1844)

Ecology and distribution (Fig. 121)
The genus can be found in both permanent and temporary water bodies. Some species have very wide distribution, like *B. fuscata* (Jurine 1820) and *B. reticulata* (Zaddach 1844), others are much more restricted.

Bradleytriebella **Savatenalinton and Martens 2009b**

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in lateral view subtriangular, in dorsal view subovate; LV in inner view with groove, CIL with one inner list; Wouters organ present; d-seta on L5 absent; UR slender, claws weakly serrated; UR attachment slim, with Triebel's loop on dorsal branch, ventral branch well developed.

Type species: *B. tuberculata* (Hartmann 1964)

Species list with type locality and type material

1. *B. lineata* (Victor and Fernando 1981c). Roadside ditch, Petakas, Lake Lanao, Mindanao, Philippines, 07°53′N 124°15′E: Holotype (♀), NMNSO – 21621.

2. *B. trispinosa* (Pinto and Purper 1965). Porto Alegre-Tramandaí, Brazil, 30°01′S 51°13′W: Holotype (♀), PM-UFRGS – MP-0-181.
3. *B. decorata* (Sars 1903a). Fishponds and rice fields, neighborhood of Pucheng, China – type locality plurivalent. Repository of the type material unknown.
4. *B. tuberculata* (Hartmann 1964). Sikkim, India, 27°43′N 88°38′E: Syntypes, ZMH – K-27 472.

Key to the species

1. RV with one posterior spine, LV with two posterior spines, RV overlapping LV with a flange . . . . *B. trispinosa* (Pinto and Purper 1965)

– No spines on carapace, RV not overlapping LV with flange 2

2. Carapace smooth, without any tubercles, or linear ornamentation . . . *B. decorata* (Sars 1903a)

– Carapace ornamented 3

3. Carapace ornamented only with linear ridges . . . . *B. lineata* (Victor and Fernando 1981c)

– Carapace ornamented dorsally with linear ridges, reticulated on the rest of the surface, and there are also one conspicuous tubercula anteriorly on each valve . . . . *B. tuberculata* (Hartmann 1964)

Ecology and distribution (Fig. 122)
Like all the other representatives of the subfamily, species of this genus are most commonly found in open water bodies. Most of the species were found in South-East Asia.

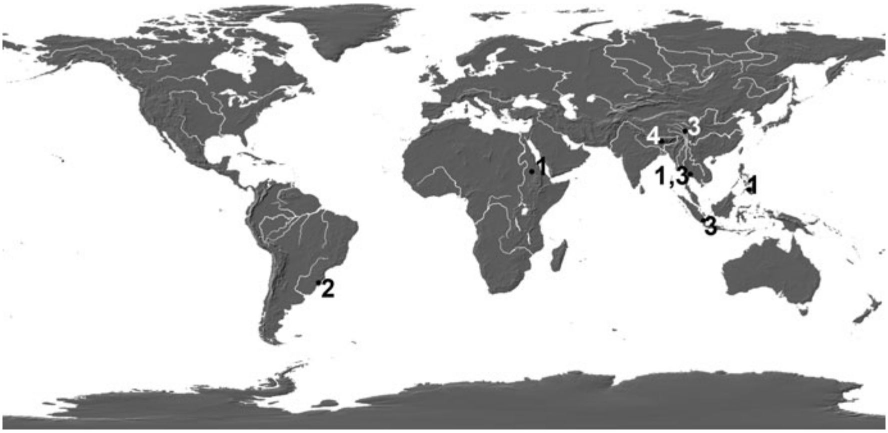


Fig. 122 Distribution of *Bradleytriebella* Savatenalinton and Martens 2009b: Numbers correspond to the species list

Spirocypris Sharpe 1903

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in lateral view subovate, in dorsal view tumid; valves with clear external tuberculated ornamentation; LV in internal view with a groove along valve margins, CIL with one inner list; d-seta on L5 present; UR slender; UR attachment slim, with Triebel's loop on dorsal branch, dorsal branch and ventral branch thin, not well developed.

Type species: *S. passaica* Sharpe 1903 (fossil species)

Species list with type locality and type material

1. *S. horrida* (Sars 1926). Rideau canal, Ottawa, Ontario, Canada, 45°24′N 75°40′W: Repository of the type material unknown.
2. *S. passaica* Sharpe 1903. Passaic, New Jersey, USA, 40°51′N 74°07′W: Types, SM – 43894.
3. *S. tuberculata* Sharpe 1908. Swampy pond, Jackson Park, Chicago, Illinois, USA, 41°46′N 87°34′W: Types, SM – 38345.

Key to the species

1. In dorsal view, LV overlaps RV anteriorly .... *S. horrida* (Sars 1926)
– In dorsal view, RV overlaps LV anteriorly ..... *S. tuberculata* Sharpe 1908

Ecology and distribution (Fig. 123)
Species live in water pools and ditches. The genus is restricted to the North America.

4.4.3 Tribe Nealecypridini Savatenalinton and Martens 2009b

Diagnosis (after Savatenalinton and Martens 2009b): Carapace in dorsal view narrow, in lateral view elongated. UR stout, claws strongly serrated; UR attachment

Fig. 123 Distribution of *Spirocypris* Sharpe 1903: Numbers correspond to the species list

distally with. Triebel's loop in the middle, dorsal and ventral branches not well developed (short or absent).

Type genus: *Nealecypris* Savatenalinton and Martens 2009b

Other genera: *Astenocypris* Müller 1912; *Diaphanocypris* Würdig and Pinto 1990; *Tanycypris* Triebel 1959.

Key to the genera

1. Seta "b" on L5 absent (Fig. 115a) 2
– Seta "b" on L5 present (Fig. 115b, c) 3
2. Setae "d1" on L6 present . . . . *Astenocypris* Müller 1912
– Setae "d1" on L6 absent (Fig. 116a) . . . *Diaphanocypris* Würdig and Pinto 1990
3. Seta "d" on L5 absent (Fig. 115b) . . . . *Nealecypris* Savatenalinton and Martens 2009b
– Seta "d" on L5 present (Fig. 115c) . . . . *Tanycypris* Triebel 1959

Astenocypris Müller 1912

Diagnosis (after Savatenalinton and Martens 2009b): Carapace narrow in dorsal view, with thin valves; LV in internal view without a marginal groove; anterior CIL relatively wide, without inner list, posterior CIL narrower; Wouters organ present; seta "d1" on L6 large; UR stout, strongly serrated; UR attachment with Triebel loop in the middle of the distal part, dorsal branch short, pointed, ventral branch short and stout.

Type (and only) species: *A. papyracea* (Sars 1903a)

Species list with type locality and type material
A. papyracea (Sars 1903a). Area of Deli and Langkat, northern Sumatra, Indonesia: Syntype (♀), NHMO – F11814.

Ecology and distribution
The species can be found in open water bodies (both permanent and temporary). It is distributed in the South-East Asia.

Diaphanocypris Würdig and Pinto 1990

Diagnosis (after Savatenalinton and Martens 2009b): Carapace narrow in dorsal view, LV in internal view without a groove, anterior CIL without an inner list; Wouters organ present; L6 without setae "d1" and "d2"; UR stout, serrated; UR attachment with Triebel's loop in the middle of the distal part, but without ventral branch.

Type (and only) species: *D. meridana* (Furtos 1936b)

Species list with synonyms, type locality, and type material
D. meridana (Furtos 1936b). Merida, Halal Aguada, near Merida, Yucatán, Mexico, 20°58′N 89°37′W: Holotype (♀), SM – 67974.

Syn.: *Dolerocypris sagitta* Klie 1939f; *Herpetocypris bonettoi* Ferguson 1967a; *Herpetocypris muhitis* Tressler 1950

Ecology and distribution
Permanent and semi-permanent water bodies. The species is distributed in Central and South America.

Nealecypris **Savatenalinton and Martens 2009b**

Diagnosis (after Savatenalinton and Martens 2009b): Carapace narrow in dorsal view, with thin valves; LV in internal view without a marginal groove; Wouters organ present; seta "d" on L5 absent; seta "d1" on L6 large (Fig. 116b); UR slender; UR attachment with Triebel's loop in the middle of the distal part, dorsal branch short, pointed, ventral branch absent.

Type (and only) species: *N. obtusa* (Klie 1933a)

Species list with type locality and type material
N. obtusa (Klie 1933a). West Pan, Transvaal, Lake 24°41′S 26°19′E: Syntype (♀), ZMK – UR-1071.

Ecology and distribution
The species lives in permanent freshwater bodies. It is endemic to South Africa.

Tanycypris **Triebel 1959**

Diagnosis (after Savatenalinton and Martens 2009b): Carapace elongated in lateral view, narrow in dorsal view; LV internal view with groove along valve margins, anterior CIL with or without inner list; Wouters organ absent; UR stout, serrated (Fig. 116d); UR attachment with Triebel's loop at middle, ventral branch stout, short.

Type species: *T. madagascarensis* (Müller 1898)

Type locality and type species
1. *T. camaguinensis* (Tressler 1937). Camiguin Island, Misamis Oriental, Philippines, 19°15′N 121°28′E: Type (♀), SM – 71512.
2. *T. clavigera* (Müller 1898). Mahajanga, Madagascar, 15°42′S 46°19′E: Repository of type material unknown.
3. *T. bonettoi* (Ferguson 1967a). Parana Basin, Argentina, 31°44′S 60°30′W: Holotype (♀), SM – 112986.
4. *T. madagascarensis* (Müller 1898). Mahajanga, Madagascar, 15°42′S 46°19′E: ZMG – 24626.
5. *T. marina* (Hartmann 1965). Chile (?): Paratypes, ZMH – K-27 603.
6. *T. pellucida* (Klie 1932). Pangururan, Samosir Island, Lake Toba, North Sumatra, Indonesia, 02°36′N 98°42′E: Syntypes, ZMK – UR-1070.
7. *T. siamensis* Savatenalinton and Martens 2009b.Maepeum Reservoir, Maejai district, Phayao Province, Thailand, 19°02′28.6″N 99°51′44.6″E: Holotype (♀), RBINS – O.C. 3099.

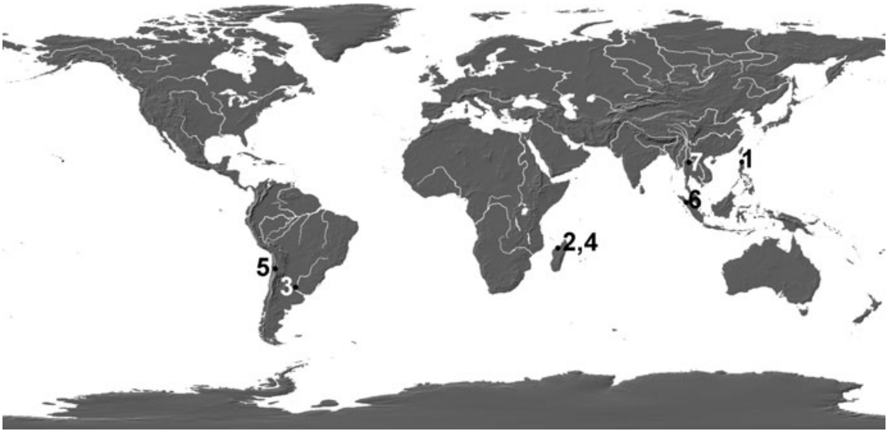


Fig. 124 Distribution of *Tanycypris* Triebel 1959: Numbers correspond to the species list

Key to the species

1. LV larger than RV .... *T. madagascarensis* (Müller 1898)
– LV and RV subequal .... *T. siamensis* Savatenalinton and Martens 2009b

Species not included in the key
Only two species have been recognized to belong to the genus *Tanycypris* Triebel 1959: *T. madagascarensis* (Müller 1898) and *T. siamensis* Savatenalinton and Martens 2009b. All the other species are insufficiently described and their position in the genus needs to be confirmed.

Ecology and distribution (Fig. 124)
The species can be found in both permanent and semi-permanent water bodies. The genus is mostly distributed in the South-East Asia.

4.5 Subfamily Cypridinae Baird 1845

Diagnosis (after Meisch 2000): Carapace large (1.5–3 mm L), subovate to globular in dorsal view (Fig. 125). Valves smooth or weakly sculptured. Selvage on RV or on both valves inwardly displaced. Second segment on Mxl palp cylindrical (Fig. 126d). Terminal segment on L7 transformed into pincer organ (Fig. 127d). Prehensile palps asymmetrical (Fig. 126f, g). Hemipenis with 8-shaped spermiducts (Fig. 127a). L6 4- or 5-segmented (Fig. 128a, b).

Type genus: *Cypris* OF Müller 1776

Other genera: *Globocypris* Klie 1939a; *Mnementh* Martens 2007; *Pseudocypris* Daday 1910a; *Ramotha* Martens 1992b.

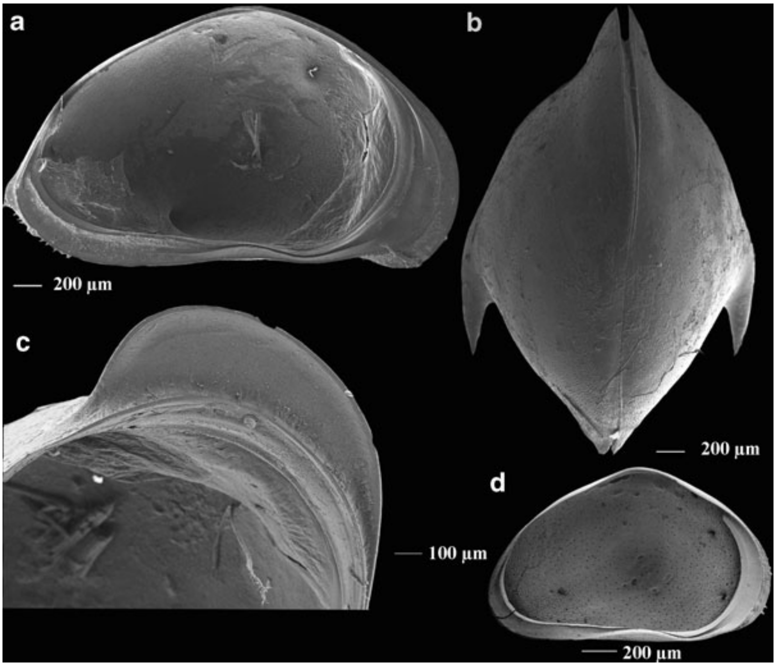


Fig. 125 SEM: (**a**–**c**) *Cypris bispinosa* Lucas 1849; (**d**) *Cypris pubera* OF Müller 1776: (**a**, **d**) LV, inside view; (**b**) dorsal view; (**c**) RV, anterior margin. Photos: D. Keyser

Key to the genera

1. L6 4-segmented (Fig. 128a) 2
– L6 5-segmented (Fig. 128b) 3
2. Seta "d2" on L6 missing . . . . *Pseudocypris* Daday 1910a
– Seta "d2" on L6 present (Fig. 128a) . . . . *Cypris* OF Müller 1776
3. Both valves with selvages inwardly displaced . . . . . *Globocypris* Klie 1939a
– Only RV with inwardly displaced selvage 4
4. LV and RV with large anterior and posterior inner list, both parallel to valve margin (Fig. 126a, c) . . . . *Ramotha* Martens 1992b
– LV with posterior inner list with aberrant shape (not parallel to valve margin) (Fig. 126b) . . . . *Mnementh* Martens 2007

Systematics

The subfamily is divided into tribes, but only one of them, Cypridini, has been named and comprises all the above genera. Most of the other genera that were classified in the subfamily (*Afrocypris* Sars 1924; *Riocypris* Klie 1935c; *Chlamydotheca* Saussure1858; and *Bennelongia* De Deckker and McKenzie 1981) have been transferred to other subfamilies, or are left in the open nomenclature. Therefore, keeping the tribe Cypridini has no sense from the nomenclature and

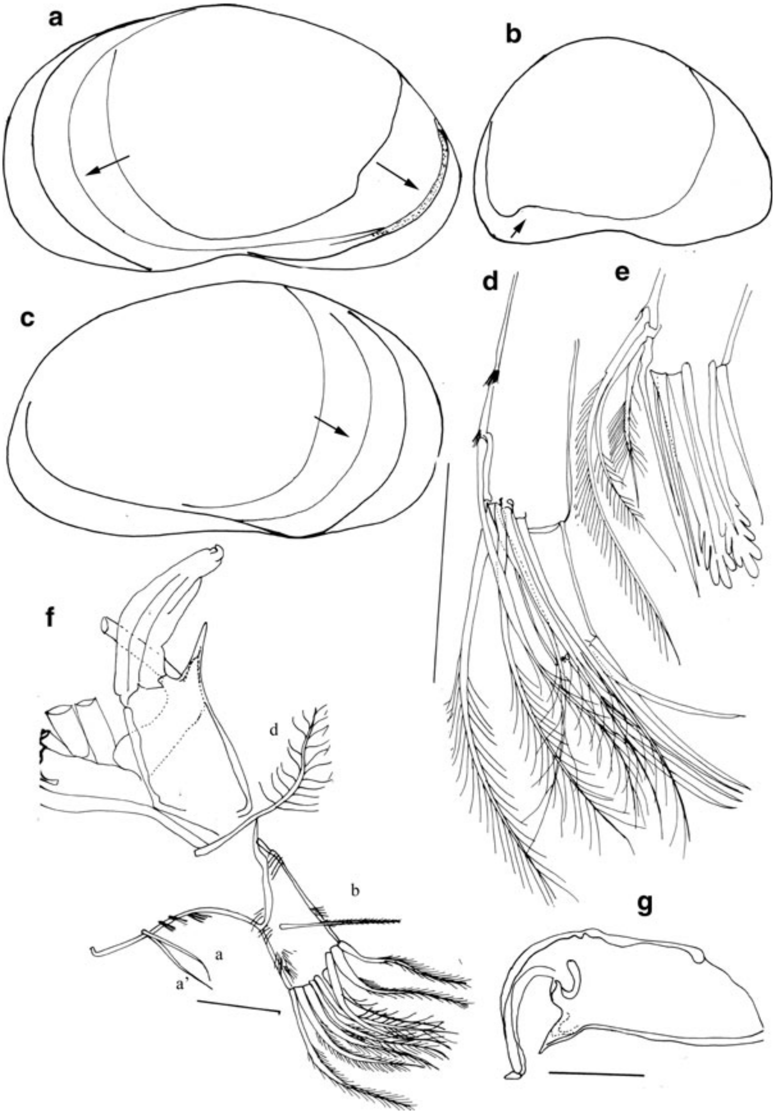


Fig. 126 Line drawings: (**a**, **c**) *Ramotha purcelli* (Sars 1924); (**b**) *Mnementh brennei* Martens 2007; (**d**–**g**) *Cypris busingiziensis* Klie 1938c: (**a**) RV, inside view; (**b**, **c**) LV, inside view; (**d**) Mxl palp; (**e**) third endite on Mxl; (**f**) L5; (**g**) prehensile palp. Scales = 0.1 mm. (**a**, **c**) modified after Martens (1992b); (**b**) modified after Martens (2007a). (**a**–**c**) not to scale

systematic point of view. Further study of the family Cyprididae in general may bring more clarification to the systematic status of Cypridini as well as of the genera left without any subfamily assignment.

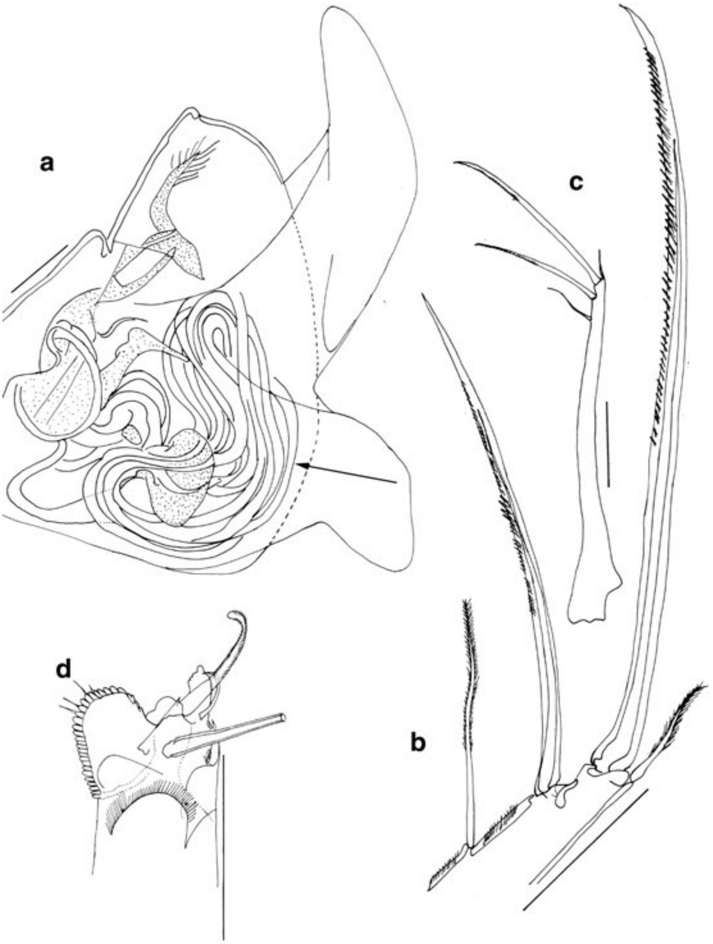


Fig. 127 Line drawings: *Cypris busingiziensis* Klie 1938c: (**a**) hemipenis; (**b**) UR, detail; (**c**) UR; (**d**) distal part of L7. Scales = 0.1 mm

Cypris of Müller 1776

Diagnosis (after Meisch 2000): Anterior selvage on both valves largely displaced inward (Fig. 125a, c, d). LV anteriorly with well-developed inner list. Antero-ventral margin of RV with lip-like projection. LV overlapping RV posteriorly and ventrally. L6 4-segmented. UR slender (Fig. 127b, c)

Type species: *C. pubera* OF Müller 1776

Species list with synonyms, type locality, and type material

1. *C. albuquerquensis* Turner 1895. Albuquerque, New Mexico, USA, 35°05′N 106°39′W: Repository of the type material unknown.

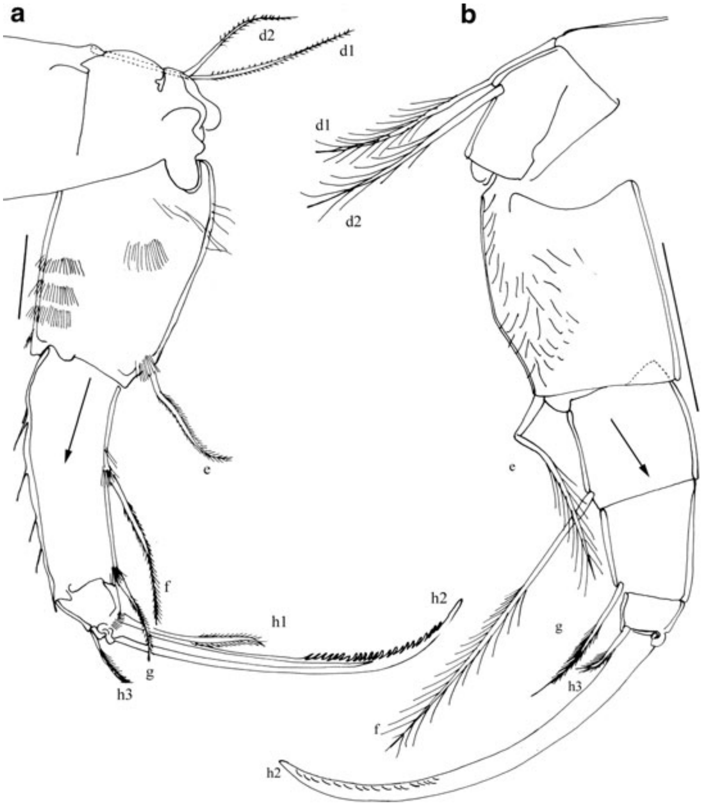


Fig. 128 Line drawings: (**a**) *Cypris busingiziensis* Klie 1938c; (**b**) *Globocypris trisetosa* Klie, 1939a: L6, *arrow* showing the fusion/division of the penultimate segment. Scales = 0.1 mm

2. *C. aratra* Brady 1904. Pools in the neighborhood of Greytown, KwaZulu-Natal, South Africa, 29°03′S 30°36′E: Repository of the type material unknown.
3. *C. bispinosa* Lucas 1849. Algeria. No more details on the locality. Repository of the type material unknown.
4. *C. busingiziensis* Klie 1938c. Busingizi, N Kivu Lake, 01°43′S 29°08′E: Syntypes, ZMK – UR-1047.
5. *C. decaryi* Gauthier 1933a. Androy, Madagascar, 23°40′S 44°02′E: Type material is according to Martens (1990a) lost. He suggested specimens of *C. labiata* Rome 1962 to be syntypes, since he synonymized this species with *C. decaryi*. Syntypes, RBINS – O.C. 568.

   Syn.: *Cypris labiata* Rome 1962

6. *C. debi* Deb1983. Rain water pond, 6 km from Karad, Bangalore Road, India, 17°17′N 74°10′E: Holotype (♀), ZSI – C1115/2.

7. C. *dravidensis* Victor and Fernando 1979. Static pond in front of Court, Madurai city, Tamil Nādu, S India, 09°54′N 78°07′E: Holotype (♀), DBSMU – Slide No. 4.
8. C. *elburensis* Martens 1990. Subterranean water body at El Bur, Somalia, 04°40′N 46°37′E: Holotype (♀), NHMF – 1306.
9. C. *elongata* Deb 1983. Pond inside Sātāra Fort, Sātāra, Mahārāshtra, India, 17°36′N 74°24′E: Holotype (♀), ZSI – C1119/2.
10. C. *floridensis* Ferguson 1964a. Plantation Canal, Broward County, Florida, USA, 26°11′N 80°21′W: Holotype (♀), SM – 109328.
11. C. *galefensis* Martens 1990. Subterranean water body at Gal Ef, Somalia, 04°12′07″N 46°28′10″E: Holotype (♂), NHMF – 1304.
12. C. *globosa* Deb 1983. Pond near inspection bungalow, Sātāra, Mahārāshtra, India, 17°36′N 74°24′E: Holotype (♀), ZSI – C1139/2.
13. C. *kaiapoinensis* Chapman 1963. Marley's Pond near Christchurch, New Zealand, 43°31′S 172°38′E: Types, OMD – collection numbers unknown.
14. C. *kumari* (Arora, 1931). Lahore, Punjab, Pakistan, 31°32′N 74°20′E: Repository of the type material unknown.
15. C. *latissima* (Müller 1898). Morondava, Menabe, Toliara, Madagascar, 20°17′S 44°19′E: Paratypes, ZMG – collection numbers unknown.

   Syn.: *Eurycypris neumanni* Müller 1900b; *Cypris inflata* Daday 1910a; *Cypris connica* Lowndes 1936

16. C. *magnifica* Brehm 1923a. Ciliwung Canal, Jakarta, Java, Indonesia, 06°07′S 106°48′W: Repository of the type material unknown.
17. C. *ovalis* Sars 1903b. Ponds at Baroldushty, ca. 21.5 km N of Luch-sume, Eastern Mongolia. Types, ZISP – collection numbers unknown.
18. C. *protubera* Victor and Fernando 1978a. Temporary pool in Chokkikulum, Madurai, India, 09°54′N 78°07′E: Holotype (♀), NMNSO – 21576.
19. C. *puertoricoensis* Ferguson 1967b. Between Hatillo and Arecibo reefs, Puerto Rico, 18°26′N 66°47′W: Holotype (♀), SM – 11337.
20. C. *pubera* OF Müller 1776. Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.

   Syn.: *Cypris maculosa* Bronstein 1925

21. C. *puberoides* Vávra 1897. Ugogo, Tanzania, 06°07′S 35°30′E: Lectotype (♂), ZMB – 4140–2.
22. C. *ravenala* Brehm 1934. Paramaribo, Guayana, Surinam, 05°52′N 55°09′W: Syntypes, ZMH – K-26 268.
23. C. *striata* (Jurine 1820). Ponds at Geneva-Châtelaine, Switzerland, 46°12′N 06°06′E: Types, NHMG – collection numbers unknown.
24. C. *subglobosa* Sowerby 1840.

   Syn.: *Cypris granulata* Daday 1898

Key to the species

1\. Valves with large spines 2

– No large spines 3

2\. Spines present only laterally . . . . *C. bispinosa* Lucas 1849

– Spines present anteriorly and posteriorly . . . . *C. magnifica* Brehm 1923a

3\. Valve surface sculptured or with longitudinal ridges, but no lateral ala 4

– Valve surface smooth or set with smaller and shallower pits 5

4\. Valve surface covered with longitudinal ridges . . . . . *C. striata* (Jurine 1820)

– Valve surface conspicuously sculptured . . . . . . *C. subglobosa* Sowerby 1840

5\. Valve margin caudally with 3–5 conspicuous spines . . . . . . *C. pubera* OF Müller 1776

– No caudal spines 6

6\. Valves with conspicuously protruding posterior end . . *C. elongata* Deb 1983

– Posterior end narrower than anterior but not protruding 7

7\. $W/L = 0.75$–0.90. Lateral ala present, mostly carrying minute spines 8

– $W/L = 0.65$–0.80. No lateral ala or spines 9

8\. $W/L > 0.80$; in external view, ala prominent over more than 1/2 the length of the valve (circumtropical) . . . . *C. latissima* (Müller 1898)

– $W/L < 0.80$; ala prominent over less than ¼ of the length of the valve
C. puberoides Vávra 1897

9\. $L > 2.5$ mm . . . . *C. busingiziensis* Klie 1938c

– $L = <2.2$ mm 10

10\. Valves in internal view subtriangular, i.e., with nearly straight ventral margin and without an angle between dorsal and posterior margin . . . *C. elburensis* Martens 1990.

– Valves always with an angle between dorsal and posterior margin 11

11\. Valves highly arched ($H/L > 0.60$), LV posteriorly without a row of tubercles between selvage and inner margin . . . . *C. decaryi* Gauthier 1933a

– Valves elongated ($H/L < 0.60$), LV posteriorly, with a conspicuous row of tubercles between selvage and inner margin . . . *C. galefensis* Martens 1990

Species not included in the key

Cypris albuquerquensis Turner 1895, described from New Mexico is not included in the key because the valves don't have a typical inwardly displaced selvage and the penultimate segment on L6 is not subdivided. This species may belong to the subfamily Eucypridinae. The New Zealand species, *C. kaiapoinensis* Chapman 1963 looks very much alike *C. pubera* OF Müller 1776, having the same denticles along outer margin. Two Indian species, *C. debi* Deb 1983 and *C. globosa* Deb 1983, look very much alike and are both very similar to *C. subglobosa* Sowerby 1840. Description of the species from Florida, *C. floridensis* Ferguson 1964a does not contain details of the carapace and L6 morphology, and its belonging to the

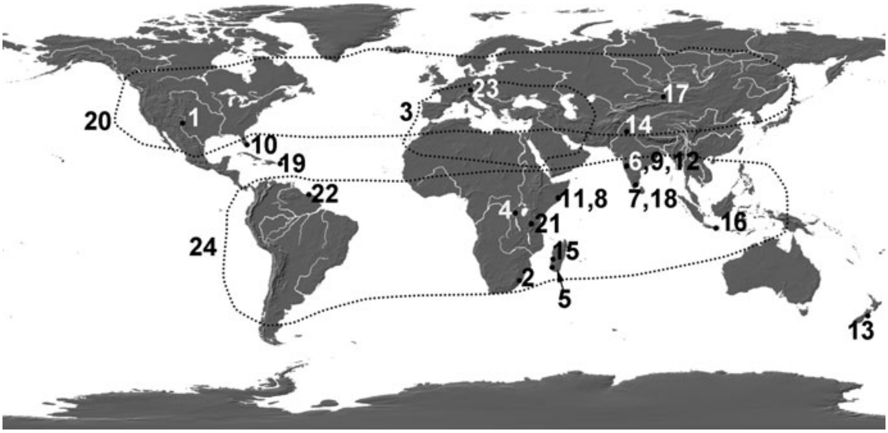


Fig. 129 Distribution of *Cypris* Müller 1776: Numbers correspond to the species list

genus *Cypris* OF Müller 1776 is questionable. It is the same case with the species *C. aratra* Brady 1904, described from South Africa, and *C. ovalis* Sars 1903b, described from Central Asia. In addition, the following five species are left out from the key because of the lack of distinguishing characters and all of these species should be redescribed: *C. dravidensis* Victor and Fernando 1979; *C. kumari* (Arora 1931); *C. protubera* Victor and Fernando 1978a; *C. puertoricoensis* Ferguson 1967b and *C. ravenala* Brehm 1934.

Ecology and distribution (Fig. 129)
The genus has almost global distribution and the species can be found in a variety of freshwater bodies.

***Globocypris* Klie 1939a**

Diagnosis (after Martens 1990): Globular species, with a largely inwardly displaced anterior selvage in both valves; RV furthermore with this selvage sunk into the interior of the valve and with an inwardly displaced posterior selvage. LV with a large anterior inner list and with antero-ventral valve margin also lip-like produced. L6 with penultimate segment divided, setae “d1” and “d2” subequal.

Type (and only) species: *G. trisetosa* Klie 1939a

Species list with type locality and type material
G. trisetosa Klie 1939a. Pools near Nairobi, Kenya, 01°16′S 36°48′E: Lectotype (♀), ZMK – UR-1503.

Ecology and distribution
The species prefers temporary freshwater bodies. It is distributed in the east and south Africa.

Mnementh Martens 2007

Diagnosis (after Martens 2007): Carapace globular and large. RV with anterior and posterior selvage marginally inwardly displaced, and with anterior valve margin not ventrally protruding; ventro-caudal part of CIL linearly elevated, not running parallel to valve margin. LV without inwardly displaced selvage and without large inner list. L6 with penultimate segment divided and with seta "d1" two to three times as long as seta "d2". Hemipenis with ventral protuberance on the middle lobe.

Type (and only) species: *M. brennei* Martens 2007

Species list with type locality and type material
M. brennei Martens 2007. Dam near Blinkvlei, Van Rhynsdorp area, Western Cape, South Africa, 31°43′29″S 18°55′28″E: Holotype (♂), RBINS – O.C. 2913.

Ecology and distribution
The species lives in temporary and permanent freshwater bodies. It is endemic to the south Africa.

Pseudocypris Daday 1910a

Diagnosis (after Martens 1990): Both valves with anterior selvage submarginal; valve margins often serrated; at least LV anteriorly with a large inner list. Most species with exterior, lateral ala. L6 with penultimate segment fused, seta "d2" completely missing. Hemipenis generally with 6–8 "8"-shaped loops of the inner spermiducts.

Type species: *P. bouvieri* Daday 1910a

Species list with synonyms, type locality, and type material
1. *P. acuta* (Müller 1914). Freshwater pool between Fishoek and Chapmans Bay near Plumstead, South Africa, 34°06′S 18°24′E: Repository of the type material unknown.

   Syn.: *P. testudo* Sars 1924

2. *P. bouvieri* Daday 1910a. Lake Rukwa, Tanzania, 08°00′S 32°15′E: Lectotype (♂), HMNH – IV-511.
3. *P. circularis* Sars 1924. Onambeke, Oshikoto, Namibia, 18°01′S 16°11′E: Holotype not designated, some material deposited in NHMO – F11584.
4. *P. expansa* Sars 1924. Kimberley, Northern Cape, South Africa, 28°44′S 24°45′E: Holotype (♂), SAFM – A 11934.
5. *P. gibbera* Sars 1924. Otjituuo, Otjozondjupa, Namibia, 19°50′S 18°50′E: Lectotypes, SAFM – A11204-11207.
6. *P. patialaensis* Battish 1977. Shallow ditch near Rouni, Patiala-Nabha, Punjab, India, 30°22′N 76°08′E: Holotype (♀), in Battish's private collection – slide no. 0–43 F.
7. *P. spinosa* (Methuen 1910). Small reed pan near Lake Chrissie, Mpumalanga, South Africa, 26°19′S 30°12′E: Repository of the type material unknown.

8. *P. triquetra* Sars 1924. Kimberley, Northern Cape, South Africa, 28°44′S 24°45′E: Holotype not designated, some material deposited in SAFM – A 11876.

Key to the species

1. Valves elongated, set with long and stout spines . . *P. spinosa* (Methuen 1910)
– No long spines on valves 2
2. No lateral ala (only traces) in the center in dorsal view 3
– Lateral ala more prominent 5
3. Traces of ala present in the centre in dorsal view . . . . *P. triquetra* Sars 1924
– No traces of ala 4
4. In lateral view, postero-ventral margin narrow (angular) *P. gibbera* Sars 1924
– In lateral view, postero-ventral margin rounded . . *P. patialaensis* Battish 1977
5. Ala prominent and evenly rounded on entire surface 6
– Ala prominent in the centre only, concavely curved toward posterior and anterior extremities . . . . *P. expansa* Sars 1924
6. $L = 1.6$ mm lateral shield of hemipenis with outer margin evenly rounded *P. bouvieri* Daday 1910a.
– $L = 3.0$ mm lateral shield of hemipenis with more angular outer margin . . 7
7. Valves elongated in lateral view ($H/L < 1/2$) . . . . *P. acuta* (Müller 1914)
– Valves higher ($H/L > 3/5$) . . . . *P. circularis* Sars 1924

Ecology and distribution (Fig. 130)
The species can be found in both permanent and temporary freshwater bodies. Most of the species have been described and recorded from Africa.

Ramotha Martens 1992b

Diagnosis (after Martens 1992b): Large (2–3 mm) and globular species. RV with anterior and posterior selvage inwardly displaced over a large distance, but with

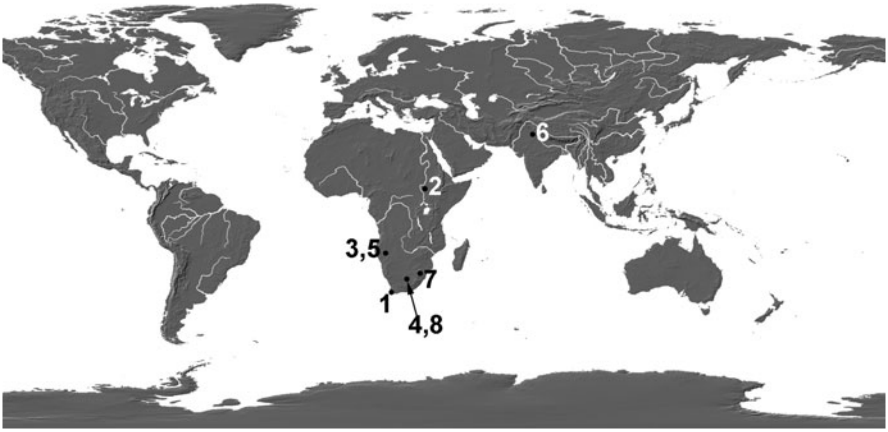


Fig. 130 Distribution of *Pseudocypris* Daday 1910a: Numbers correspond to the species list

anterior valve margin ventrally not with lip-like extension. LV without inwardly displaced selvage, but with a large inner list, situated in the centre of a wide anterior CIL and on the posterior inner margin; ventrally with a conspicuous outer list. L6 with penultimate segment divided and with seta "d1" 2–3 times as long as seta "d2".

Type species: *R. hirta* (Sars 1924)

Species list with type locality and type material

1. *R. capensis* (Müller 1908). Zeekoevlei, Plumstead, Simon's Town, Western Cape, South Africa, 34°04′S 18°30′E: Lectotype (♀), ZMG – 24627b, c.
2. *R. corpulenta* (Sars 1895). Swamp near Knysna, E of Cape of Good Hope, South Africa, 34°02′S 23°03′E: Lectotype (♀), SAFM – A11114.
3. *R. crassa* (Klie 1939a). Small lake, Elgon, Kenya, 01°06′S 34°35′E: Lectotype (♀), ZMK – UR 871a/1.

Syn.: *Cypris dromedarius* Fischer 1851; *Eucypris bouilloni* Kiss 1959b

4. *R. curtisae* Martens 1992b. Small farm dam, Joyec, Gobabis district, Namibia, 21°52′32″S 18°18′02″E: Holotype (♂), SMW – 51250.
5. *R. hirta* (Sars 1924). Pond on Green Point Common, Cape Town, South Africa, 33°54′S 18°24′E: Lectotype (♀), SAFM – A 40043.
6. *R. kenyensis* (Lindroth 1953). Shallow lake, Teleki Valley, Mt. Kenya, Kenya, 00°09′S 37°14′E: Lectotype (♀), ZMU – 601 (n. 1–2).
7. *R. montana* (Lindroth 1953). Shallow temporary water on Mt. Meru, Algeria, 29°26′N 01°29′W: Lectotype (♀), ZMU – 228 (g. 1–2).
8. *R. producta* (Sars 1924). Vlei (seasonal lake) near Port Elizabeth, South Africa, 33°57′S 25°36′E: Lectotype (♀), SAFM – A40040.
9. *R. purcelli* (Sars 1924). Pond at Ashton, Robertson Division, South Africa, 33°49′S 20°03′W: Lectotype (♀), SAFM – A40046.
10. *R. trichota* (Müller 1908). Zeekoevlei, Plumstead, Simon's Town, South Africa, 34°04′S 18°30′E: Holotype not designated, some material deposited in ZMG – 25133 (7 g).
11. *R. trigona* (Sars 1895). Swamp near Knysna, E of Cape of Good Hope, South Africa, 34°02′S 23°03′E: Syntypes, NHMO – F4339.

Key to the species

1\. Length of ♀ more than 2.5 mm . . . . *R. trichota* (Müller 1908)

– Length of ♀ less than 2.5 mm 2

2\. Ventral margin (including selvage on RV and inner list on LV) conspicuously produced in the first third, especially in the ♀; carapace very hairy . . *R. hirta* (Sars 1924)

– Carapace less hairy, ventral margin not conspicuously produced in the first third . 3

3\. W/L ratio >2/3; in dorsal view, anterior end conspicuously beak like 4

– W/L ratio <1/2; in dorsal view, anterior end less produced 5

4\. Valves in lateral view with a nearly evenly rounded dorsal margin, a nearly straight ventral margin and with anterior and posterior margins nearly evenly rounded . . . . *R. corpulenta* (Sars 1895)

– Valves in lateral view more elongated, with curved ventral margin and with anterior margin more broadly rounded than posterior one . . . *R. capensis* (Müller 1908)

5. Valves sub-triangular 6

– Valves elongated, not sub-triangular 7

6. Carapace in dorsal view with concavely produced beak *R. trigona* (Sars 1895)

– Carapace in dorsal view anteriorly and posteriorly convexly rounded *R. curtisae* Martens 1992b

7. $L =$ c. 1.75 mm . . . . *R. crassa* (Klie 1939a)

– L = c. 2 mm 8

8. Anterior margins of isolated valves broadly rounded, passing into the dorsal margin almost without an angle 9

– Anterior margin of isolated valves less broadly rounded, more pointed, and with a conspicuous angle between anterior and dorsal margin 10

9. Carapace in dorsal view with greatest W situated almost at mid-length
R. kenyensis (Lindroth 1953)

– Carapace in dorsal view with greatest W situated at about 1/3 from the front
R. purcelli (Sars 1924)

10. Carapace in dorsal view with posterior margin convexly rounded *R. montana* (Lindroth 1953)

– Carapace in dorsal view with posterior margin concavely pointed *R. producta* (Sars 1924)

Ecology and distribution (Fig. 131)
Species live in permanent and temporary surface water bodies. The genus is endemic to Africa.

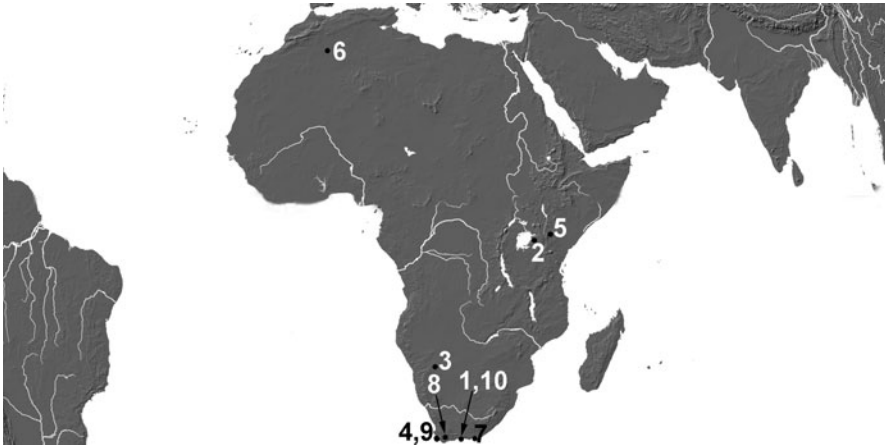


Fig. 131 Distribution of *Ramotha* Martens 1992: Numbers correspond to the species list

4.6 Subfamily Cypridopsinae Kaufmann 1900a

Diagnosis (after Meisch 2000): Carapace small, from 0.3 to 0.9 mm (Figs. 132a, b, e, 133f, 134a, 135c,e, 136a–d, and 137d). LV overlapping RV ventrally and anteriorly (Figs. 132c and 135a,b) or RV overlapping LV (Figs. 132d and

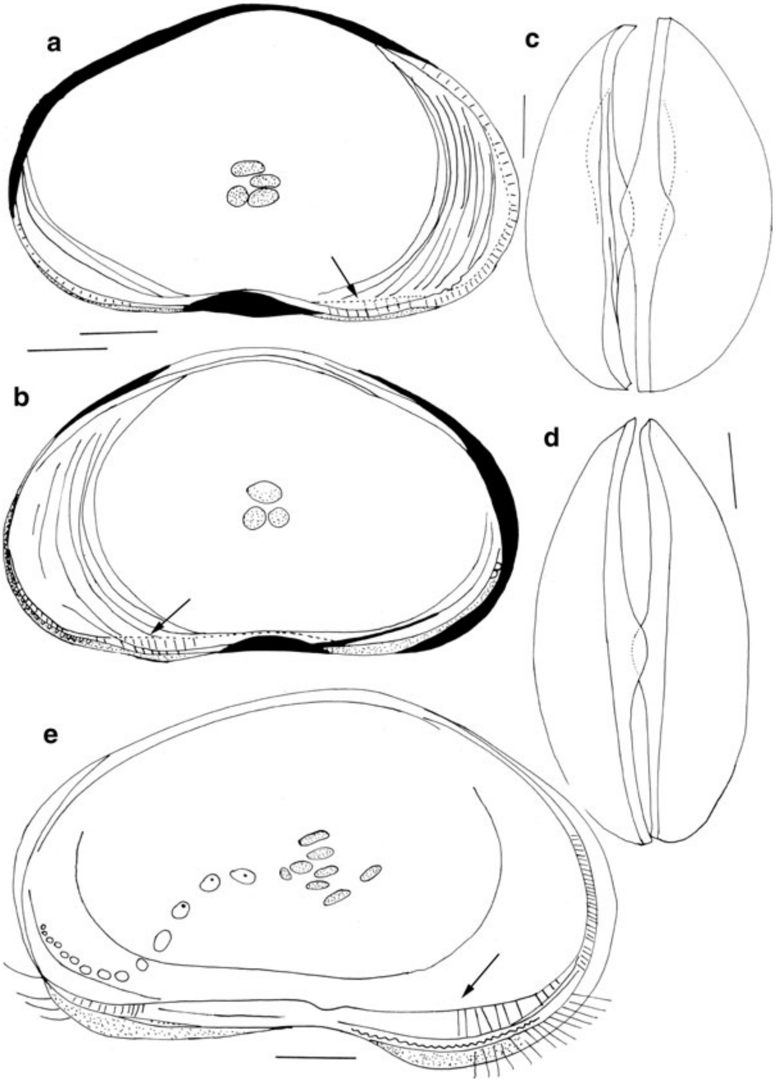


Fig. 132 Line drawings: (**a**–**c**) *Cypridopsis vidua* (OF Müller 1776); (**d**) *Sarscypridopsis ochracea* (Sars 1924); (**e**) *Plesiocypridopsis newtoni* Brady and Robertson 1870: (**a**, **e**) LV, inside view; (**b**) RV, inside view; (**c**, **d**) carapace, ventral view. *Arrows* pointing enlarged fused zone. Scales = 0.1 mm

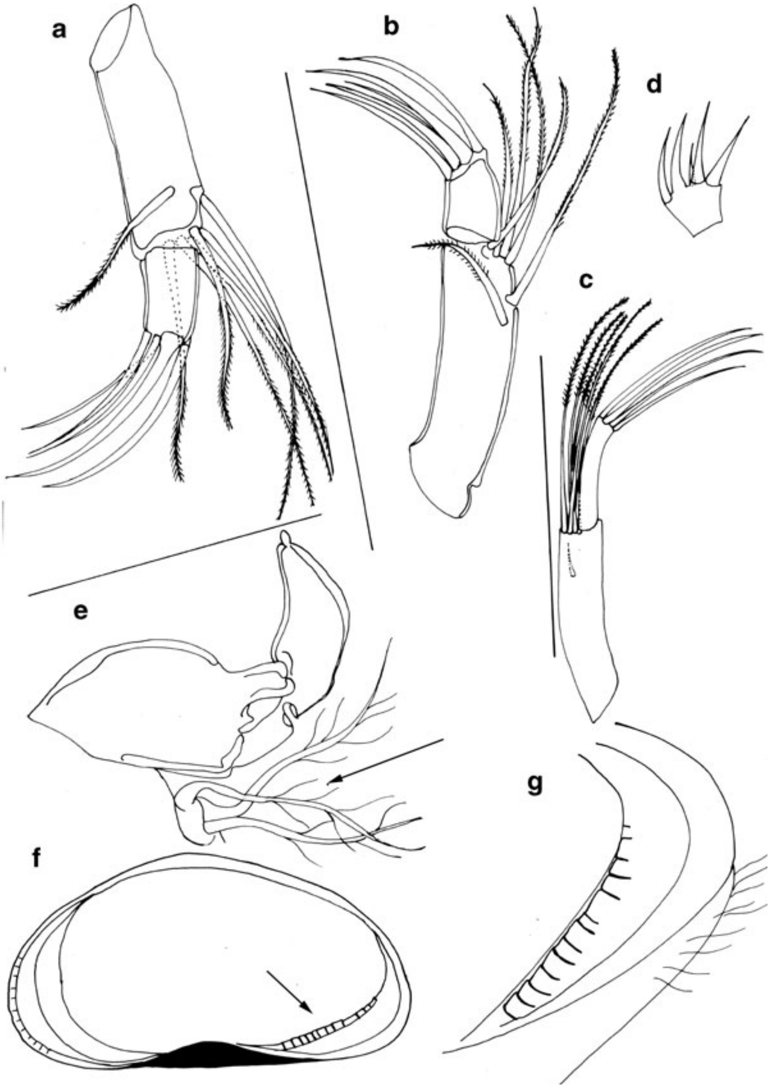


Fig. 133 Line drawings: (**a**) *Cypridopsis vidua* (OF Müller 1776); (**b**) *Sarscypridopsis ochracea* (Sars 1924); (**c**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**d**) *Potamocypris arcuata* (Sars 1903b); (**e**) *Zonocypris glabra* Klie 1944; (**f**, **g**) *Klieopsis horai* (Klie 1927a): (**a**–**c**) Mxl palp; (**d**) second segment of the Mxl palp; (**e**) prehensile palp; (**f**) RV, inside view, arrow pointing septae; (**g**) RV, posterior margin, detail. (**f**, **g**) modified after Martens et al. (1991). Scales = 0.1 mm. (**f**, **g**) not to scale

135d). Line of concrescence on both valves antero-ventrally curved inward in the mouth area (Fig. 132a, b, e), the fused marginal zone therefore distinctly broadened in that part. A1 7-segmented (Fig. 138a). Swimming setae on A2

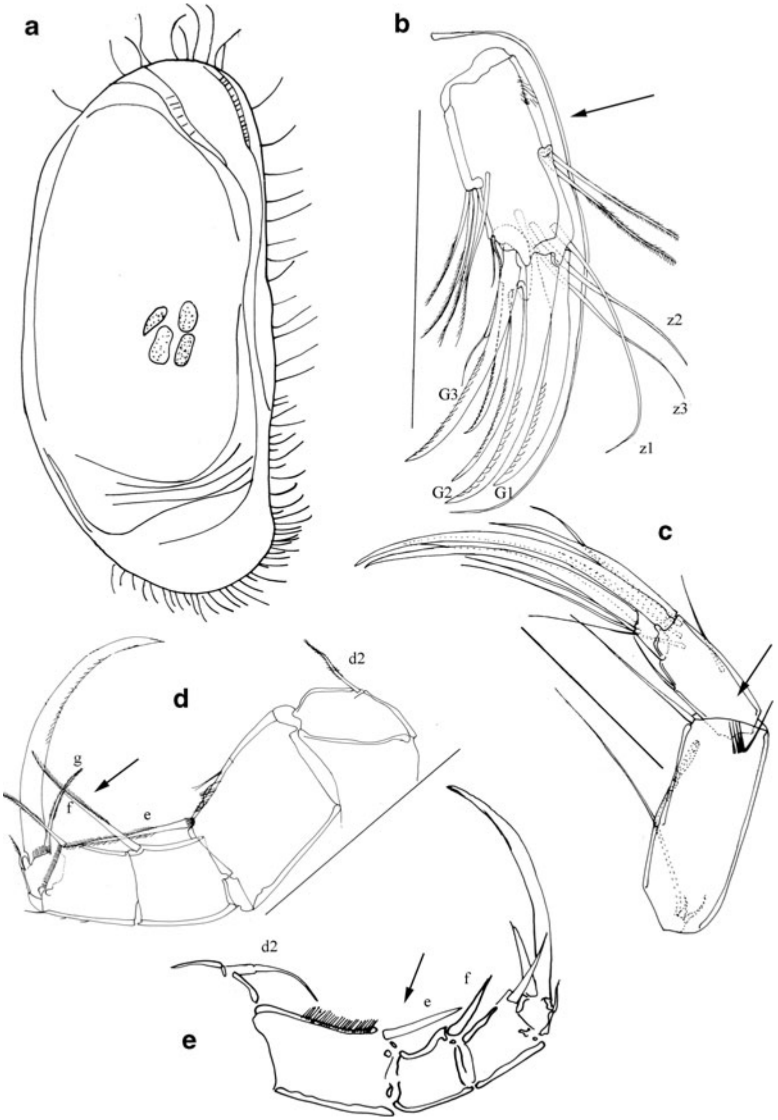


Fig. 134 (**a**) *Tanganyikacypridopsis depressa* (Kiss 1959a, b); (**b**, **d**) *Sarscypridopsis ochracea* (Sars 1924); (**c**) *Pseudocypridopsis clathrata* (Klie 1937a); (**e**) *Kapcypridopsis barnardi* McKenzie 1977: (**a**) RV, inside view; (**b**) part of A2, showing the long swimming setae; (**c**) A2, showing the short swimming setae; (**d**, **e**) L6, showing the setae on the endopod. (**a**) modified after Martens (1985a, b); (**e**) modified after McKenzie (1977). Scales = 0.1 mm. (**a**, **e**) not to scale

long (Fig. 134b) or reduced (Fig. 134c), but never missing. Md palp normally developed (Fig. 138b). Terminal segment of Mxl palp cylindrical or spatula like (Fig. 133a–d). Vibratory plate on L5 sometimes with reduced number of

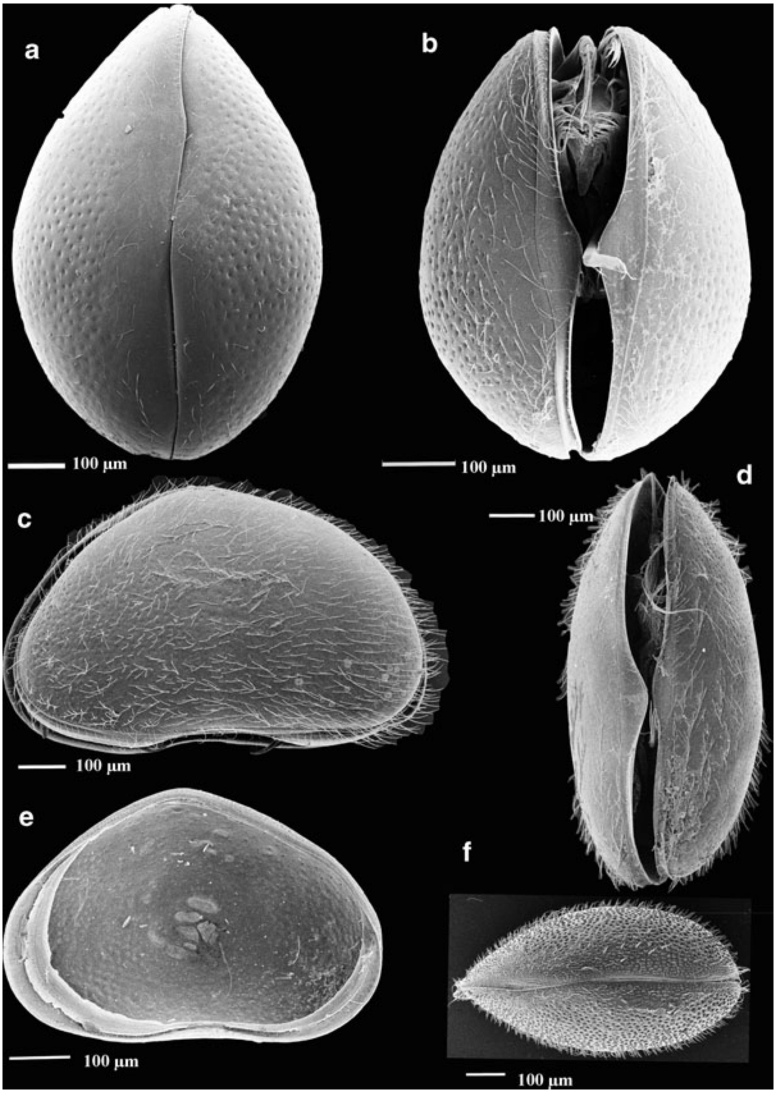


Fig. 135 SEM: (**a**, **b**) *Cypridopsis vidua* (OF Müller 1776); (**c**, **d**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**e**, **f**) *Sarscypridopsis aculeata* (Costa 1847): (**a**, **f**) dorsal view; (**b**, **d**) ventral view; (**c**) lateral view for the left side; (**e**) RV, inside view. Photos: D. Keyser

rays (Fig. 133e). Prehensile palps asymmetrical (Figs. 139a–h and 136g, h). L6 5-segmented (Fig. D, E). Terminal segment of L7 pincer shaped (Figs. 138c and 137b). UR strongly reduced, flagellum like in females (Fig. 140) and missing in males (in some genera even in females). Hemipenis with two lobes: outer and inner (Figs. 139i and 137a).

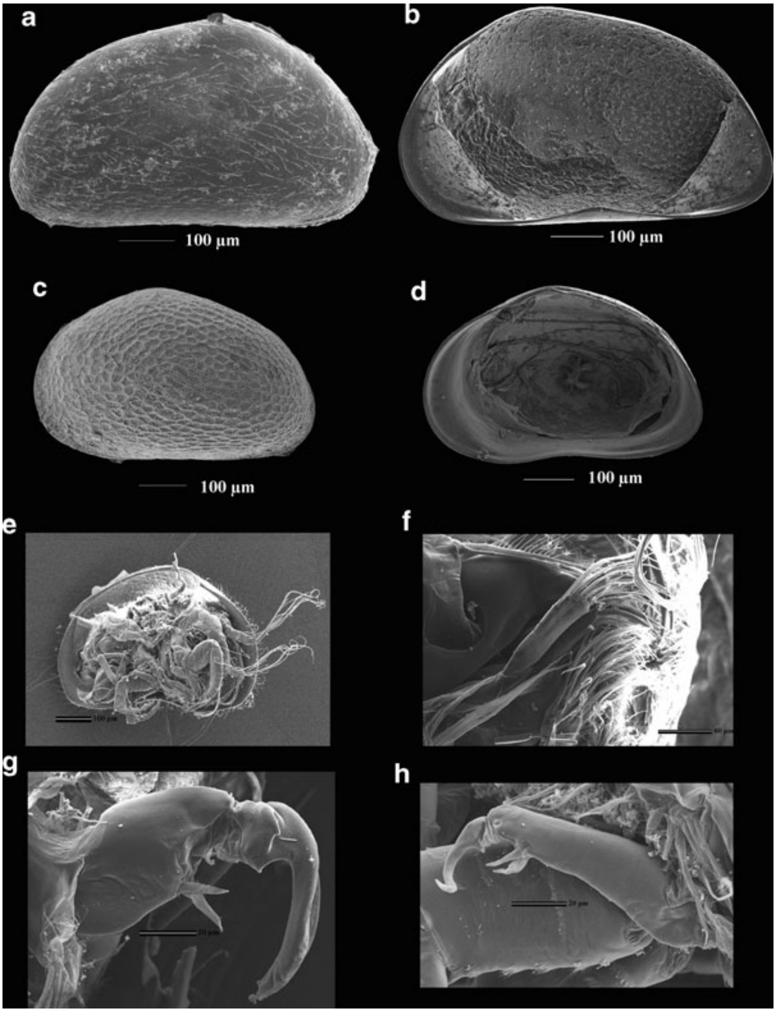


Fig. 136 SEM: (**a**, **b**) *Potamocypris fulva* (Brady 1868); (**c**, **d**) *Pseudocypridopsis clathrata* (Klie 1937a); (**e**, **g**, **h**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**f**) *Cypridopsis vidua* (Müller OF 1776): (**a**) RV, outside view; (**b**) RV, inside view; (**c**) LV, outside view; (**d**) RV, inside view; (**e**) inside view of the soft parts; (**f**) Mxl palp; (**g**, **h**) prehensile palps

Type genus: *Cypridopsis* Brady 1867

Other (recent) genera: *Austrocypridopsis* McKenzie 1982b; *Bryocypris* Roen 1956; *Cavernocypris* Hartmann 1964; *Plesiocypridopsis* Rome 1965b*; Kapcypridopsis* McKenzie 1977; *Klieopsis* Martens et al. 1991; *Martenscypridopsis* Karanovic and Pesce 2000a; *Sarscypridopsis* McKenzie 1977; *Potamocypris* Brady 1870a; *Pseudocypridopsis* Karanovic 1999a; *Tanganyikacypridopsis* Martens 1985b;

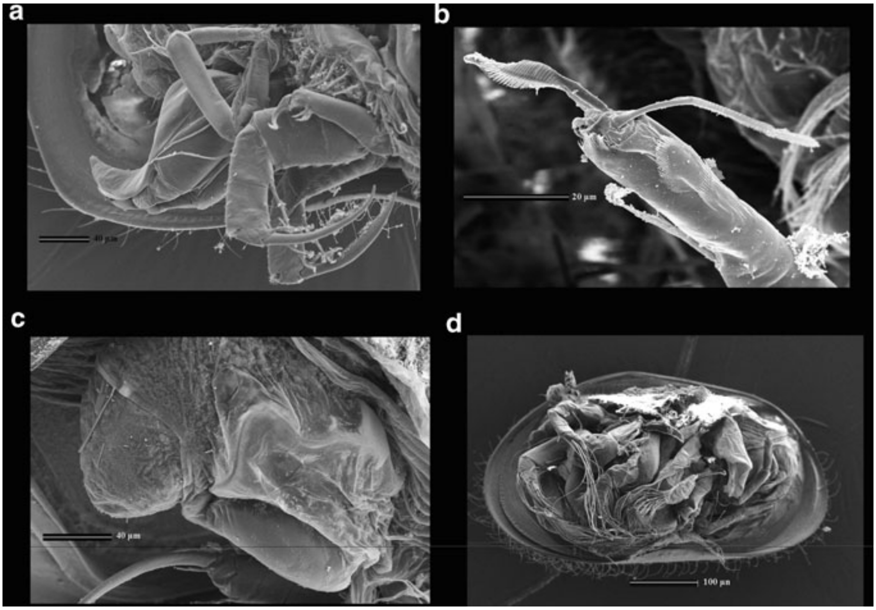


Fig. 137 SEM: (**a**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**b**) *Potamocypris fulva* (Brady 1868); (**c**) *Pseudocypridopsis clathrata* (Klie 1937a); (**d**) *Sarscypridopsis aculeata* (Costa 1847). (**a**) hemipenis; (**b**) distal part of L7; (**c**) genital field; (**d**) inside view of the soft parts

Thermopsis Külköylüoğlu et al. 2003; *Tungucypridopsis* Victor 1983; and *Zonocypris* Müller 1898.

Key to the genera

1. Terminal segment of Mxl palp cylindrical (Figs. 133a–c and 136f) 2
– Terminal segment of Mxl palp spatula like (Fig. 133d) . . *Potamocypris* Brady 1870a
2. UR completely absent in both males and females (Figs. 140f and 137c) . . . 3
– UR absent in males, but present in females 4
3. RV overlapping LV ventrally *Martenscypridopsis* Karanovic and Pesce 2000a
– LV overlapping RV ventrally . . . . *Pseudocypridopsis* Karanovic 1999a
4. Vibratory plate of L5 completely missing *Austrocypridopsis* McKenzie 1982b
– Vibratory plate of L5 present (Fig. 133e) 5
5. Carapace ornamented with prominent circular ridges *Zonocypris* Müller 1898
– Ornamentation of carapace if present much finer (Fig. 135) 6
6. RV overlapping LV ventrally (Fig. 132d) 7
– LV overlapping RV ventrally (Fig. 132c) 13
7. UR cylindrical (Fig. 140c, d) 8

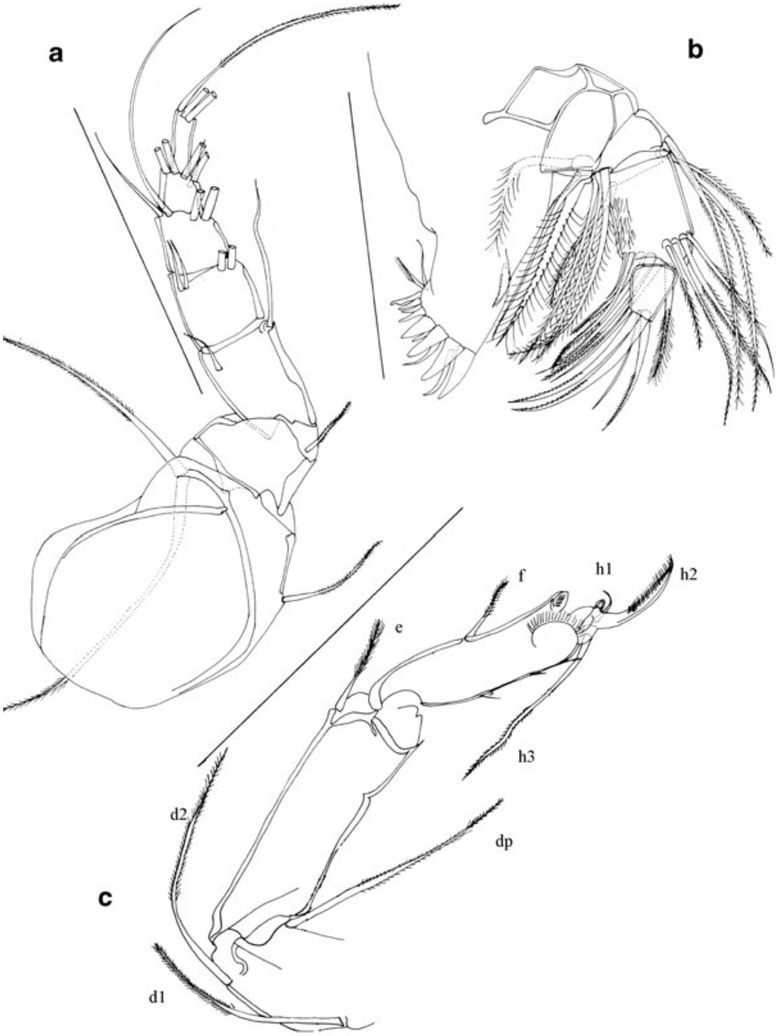


Fig. 138 Line drawings: *Sarscypridopsis ochracea* (Sars 1924): (**a**) A1; (**b**) Md palp and part of the coxa; (**c**) L7. Scales = 0.1 mm

– UR triangular (Fig. 140a, b, e) 9

8. Septae present on the posterior CIL of RV (Fig. 133f, g) . . . . *Klieopsis* Martens et al. 1991

– No septae present on the CIL of RV . . . . *Plesiocypridopsis* Rome 1965b

9. Valves elongated (Fig. 134a) . . . . *Tanganyikacypridopsis* Martens 1985b

– Valves more globular (Figs. 135e and 136a–d) 10

10. Swimming setae on A2 long (Fig. 134b) . . *Sarscypridopsis* McKenzie 1977

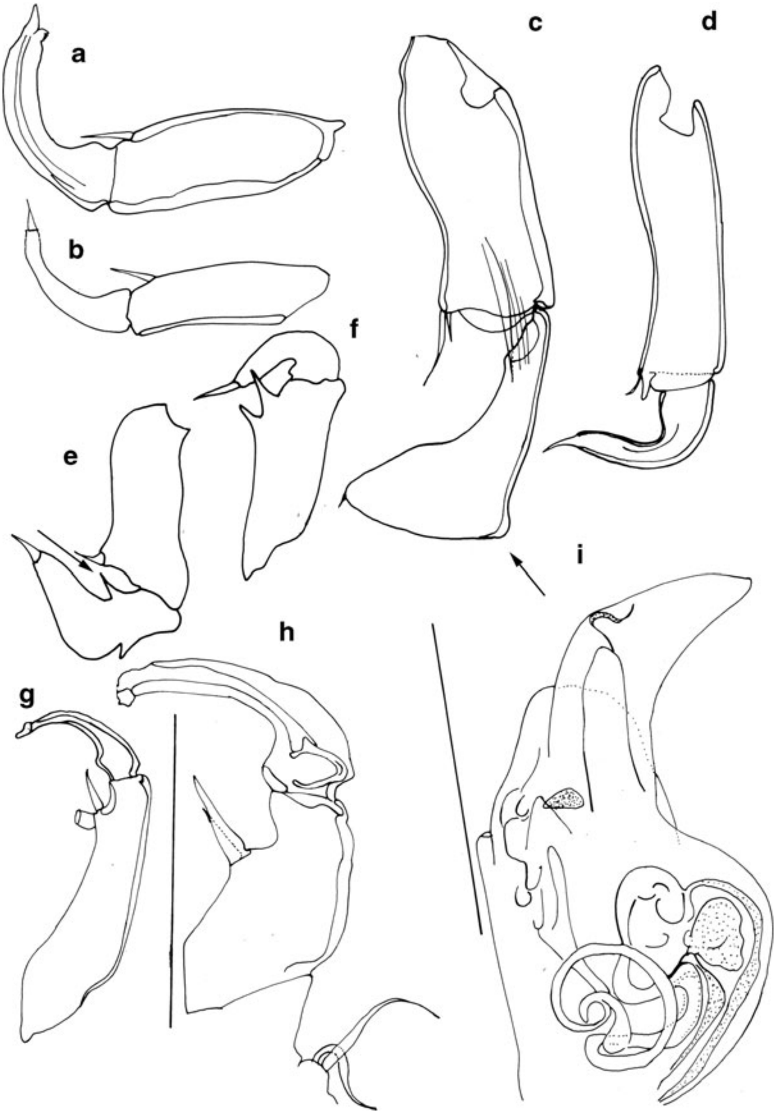


Fig. 139 Line drawings. (**a**, **b**) *Thermopsis thermophila* Külklöylüoğlu et al. 2003; (**c**, **d**) *Bryocypris grandipes* Roen 1956; (**e**, **f**) *Tungucypridopsis lairdi* (Victor and Fernando 1978b); (**g**–**i**) *Plesiocypridopsis newtoni* Brady and Robertson 1870: (**a**–**h**) prehensile palp, arrow showing the swelling of the finger on the right palp; (**i**) hemipenis. (**a**, **b**) modified after Külklöylüoğlu et al. (2003); (**c**, **d**) modified after Martens (1989b); (**e**, **f**) modified after Victor (1983). Scales = 0.1 mm. (**a**–**f**) not to scale

Fig. 140 (**a**) *Cypridopsis vidua* (OF Müller 1776); (**b**) *Sarscypridopsis ochracea* (Sars 1924); (**c**) *Klieopsis horai* (Klie 1927a); (**d**) *Plesiocypridopsis newtoni* Brady and Robertson 1870; (**e**) *Potamocypris arcuata* (Sars 1903b); (**f**) *Martenscypridopsis materia* Karanovic and Pesce 2000a: (**a**–**e**) ♀ UR; (**f**) posterior end of the body with caudal seta and no UR. Scales = 0.1 mm

– Swimming setae on A2 short 11

11. All setae on L6 very thick, claw like (Fig. 134e) . . . . *Kapcypridopsis* McKenzie 1977

– Setae on L6 normally developed 12

12. Both fingers on prehensile palps elongated (Fig. 139a, b) . . . . . *Thermopsis* Külköylüoğlu et al. 2003

– Right prehensile palp with inflamed finger (Fig. 139c, d) . . *Bryocypris* Roen 1956

13. Carapace elongated in lateral and dorsal views *Cavernocypris* Hartmann 1964
– Carapace more globular in lateral and dorsal views 14
14. Left prehensile palp with wing-like expansions on the finger part (Fig. 139e, f) *Tungucypridopsis* Victor 1983
– No wing-like expansions on the finger part . . . . *Cypridopsis* Brady 1867

Austrocypridopsis **McKenzie 1982b**

Diagnosis (after McKenzie 1982b): Carapace subrectangular. Mxl palp elongated, A2 with reduced swimming setae, vibratory plate on L5 missing. UR flagellum like in female, with strong ramus.

Type (and only) species: *A. terrilli* McKenzie 1982b

Species list with type locality and type material
A. terrilli McKenzie 1982b. Stream, Saddle between Mt. Azimuth and Mt. Fizean, Campbell Island, New Zealand, 52°32′S 169°08′E: Holotype (♂), AMS – P.31528.

Ecology and distribution
The species has been found only once at its type locality.

Bryocypris **Roen 1956**

Diagnosis (after Martens 1989b): Carapace elongated, RV overlapping LV anteriorly, posteriorly, and ventrally. RV with well-developed anterior and posterior lists. LV with posterior, submarginal selvage and weak frontal inner list. Terminal segment of Mxl palp elongated. Females with flagellum like UR, absent in males. Genital field in females with chitinized, hook-like processes.

Type (and only) species: *B. grandipes* Roen 1956

Species list with type locality and type material
B. grandipes Roen 1956: Mosses in caves just above the waterfall of Mpoumé, N bank of River Nyong, Cameroon, 03°30′N 11°05′E: Holotype (♀), ZMC – KM.512.

Ecology and distribution
The species is known only from the type locality.

Cavernocypris **Hartmann 1964**

Diagnosis (after Marmonier et al. 1989): LV overlapping RV on all free margins. Selvage peripheral on both valves. CIL broad to very broad anteriorly and posteriorly. Inner list present on the ventral and ventro-posterior end. Ventral marginal zone on both valves with distinct outer list. Swimming setae on A2 very short. Terminal segment of Mx palp cylindrical. UR flagellum like in females, absent in males.

Type species: *C. subterranea* (Wolf 1920)

Species list with synonyms, type locality, and type material

1. *C. coreana* (McKenzie 1972). Daeya-gul Cave, at Jinbyeol-ri, Hadong-myeon, Yeongweol-gun, Kangweon-do, South Korea, 37°16′N 128°24′E: Holotype (♂), NSMT – 787.
2. *C. subterranea* (Wolf 1920). Well, Engler-Groß-Gut, Basel, Switzerland, 47°33′N 07°34′W: Syntypes, ZMK – UR-146-68.

   Syn.: *Cypridopsis shadini* Akatova 1950; *Cavernocypris lindbergi* Hartmann 1964

3. *C. wardi* Marmonier et al. 1989. South Fork of the South Platte River, 46 km SSW of Denver, Colorado, USA, 39°05′N 105°10′W: Holotype (♀), SM – 193911.

Key to the species

1. A1 with fused third and fourth segments ...... *C. coreana* (McKenzie 1972)

– All segments free on A1 2

2. First segment of Mxl palp with 5 (long) +1 (short) setae ..... *C. subterranea* (Wolf 1920)

– First segment of Mxl palp with 4 (long) +1 (short) setae .... *C. wardi* Marmonier et al. 1989

Ecology and distribution (Fig. 141)

The species can be found in springs, streams, rivers, caves, hyporheic zone of rivers, and littoral zones of mountain lakes. The genus is distributed in the Northern Hemisphere.

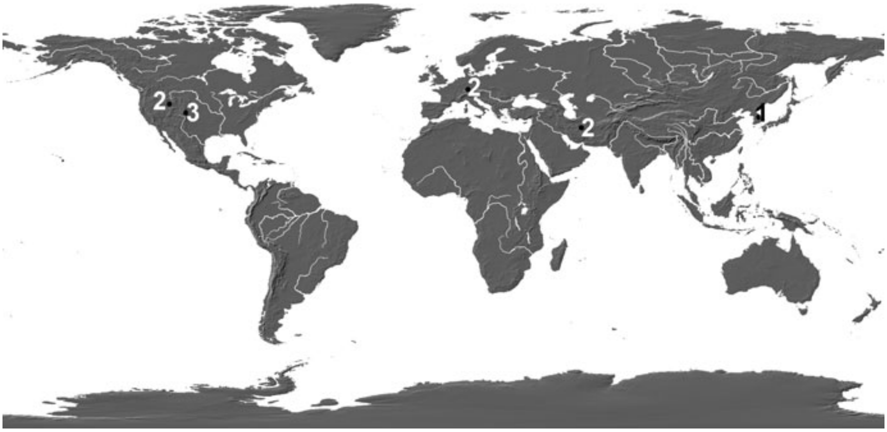


Fig. 141 Distribution of *Cavernocypris* Hartmann 1964: Numbers correspond to the species list

Cypridopsis Brady 1867 [Syn.: _Pionocypris_ Brady and Norman 1896]

Diagnosis (after Meisch 2000): Carapace ovate in lateral and dorsal view (Figs. 135a, b). H and W approximately equal ½ L. LV overlapping RV ventrally (Fig. 132c). Posterior CIL of LV with a well-developed oblique inner list. This list close to the selvage in RV. Terminal segment of the Mxl palp cylindrical (Fig. 133a). Ramus of the UR in females triangular (Fig. 140a), UR absent in males. Genital field with well-developed genital hooks.

Type species: *C. vidua* (OF Müller 1776)

Species list with synonyms, type locality, and type material

1. *C. acanthodes* Rome 1962. Edith Bay, Kigoma, Tanzania, 06°30′S 29°55′E: Holotype (♂), RBINS – O.C. 623.
2. *C. adusta* Sars 1903a. Sumatra. Exact type locality unknown, the species was raised from dried mud. Sars (1903a) mentioned two provinces in Sumatra: Deli and Langkat. Lectotype, NHMO – F12286a/b.
3. *C. aequalis* Rome 1962. Beach and creek, small bay S of Cap Tembwe, Lake Tanganyika, DR Congo, 06°31′S 29°29′E: Holotype (♂), RBINS – O.C. 0593.
4. *C. arcuata* Rome 1962. At sea, ca. 500 m from the shore, near Lagosa, Kungwe Bay, Tanzania, 05°56′S 29°53′E: Holotype (♂), RBINS – O.C. 622.
5. *C. arhiga* Cole 1965. Centerville spring, Hickman County, Tennessee, USA, 35°48′N 87°29′W: Holotype (♀), SM – 120578.
6. *C. australis* Henry 1923. Raised from dried mud, Maryula station, Cobar, NSW, Australia, 31°30′S 145°49′E: Holotype, AMS – P.6123.
7. *C. bidentata* Sars 1910. Niamkolo, Lake Tanganyika, Zaire, 06°00′S 29°30′E: Repository of type material unknown.
8. *C. bisexualis* Cole 1966. Savage Branch, Davidson County, Tennessee, USA, 36°03′N 86°34′W: Holotype (♀), SM – 120568.
9. *C. brevisetosa* Klie 1943a. Ras el Ma, near Azrou, Morocco, 33°25′N 05°12′W: Syntypes, ZMH – K-1137-8, 1448.
10. *C. canadensis* Ferguson 1959b. Pool near Coop Petroleum Products, Southey, Saskatchewan, Canada, 50°56′N 104°30′W: Holotype (♀), SM – 102576.
11. *C. circinata* Brady 1910a. Yola, Nigeria, 09°12′N 12°29′E: Repository of the type material unknown.
12. *C. compressa* Cole 1965. Stream Savage Branch, 66 km from Brooklyn, Davidson County, Tennessee, USA, 36°28′N 86°46′W: Holotype (♀), SM – collection number unknown.
13. *C. congenera* Sars 1910. Sumbu, Lake Tanganyika, Zaire, 08°31′S 30°30′E: Repository of the type material unknown.
14. *C. cunningtoni* Sars 1910. Monkey Bay, Cape McClear, Lake Nyasa, Malawi, 14°04′S 34°55′E: Repository of the type material unknown.
15. *C. cypera* Tressler 1937. Cyperus, Hawaii, USA, 19°35′N 155°26′W: Type (♀), SM – 71518.

16. C. *diaphana* Barbeito-Gonzales 1971. Paros-Naxos, Greece, 37°00′N 25°24′E: Holotype (♀), ZMH – K-29092.
17. C. *dubia* Sars 1903a. Sumatra. Exact type locality unknown, the species was raised from dried mud. Sars (1903a) mentioned two provinces in Sumatra: Deli and Langkat. Type, NHMO – F12262 .
18. C. *ellipsoidalis* Rome 1962. Beach and creek, small bay S of Cap Tembwe, Lake Tanganyika, DR Congo, 06°31′S 29°29′E: Holotype (♂), RBINS – O.C. 605.
19. C. *elongata* (Kaufmann 1900a). Ditch, Mühlendorf, Germany, 51°53′N 14°09′E: Repository of the type material unknown.

Syn.: *Cypridopsella nicki* Lindner 1920a; *Pionocypris almi* Sars 1925

20. C. *exigua* Sars 1903a. Sumatra. Exact type locality unknown, the species was raised from dried mud. Sars (1903a) mentioned two provinces in Sumatra: Deli and Langkat. Repository of the type material unknown.
21. C. *flavescens* Sars 1901. Raised from dried mud, Itatiba, Brazil, 23°00′S 46°50′W: Repository of the type material unknown.
22. C. *fuhrmanni* Méhes 1914. Laguna de Ubaque, Columbia, 04°29′N 73°56′W: Repository of the type material unknown.
23. C. *funebris* Brady 1886b. Condong, Tweed River, NSW, Australia, 28°18′S 153°26′E: Repository of the type material unknown.
24. C. *gibba* Sars 1910. Bukoba, Lake Victoria, Tanzania, 01°19′S 31°48′E: Repository of the type material unknown.
25. C. *granulata* (Sars 1903b). Salt lake Astshi-sor, Astana (formerly Akmolinsk), Kazakhstan, 51°10′N 71°26′E: Types, ZISP – collection numbers unknown.
26. C. *hartwigi* Müller 1900a. Königswusterhusen, near Berlin, Germany, 52°31′N 13°24′E: Repository of the type material unknown.

Syn.: *Pionocypris elongata* Sars 1925; *Cypridopsis norvegica* Sywula 1972

27. C. *herpestica* Cole 1965. Centerville spring, Hickman County, Tennessee, USA, 35°48′N 87°29′W: Holotype (♀), SM – 120582.
28. C. *howei* Ferguson 1964c. US Hwy 80, E boundary, Minden, Webster Parish, Louisiana, USA, 32°36′N 93°17′W: Holotype (♀), SM – 110193.
29. C. *japonica* Okubo 1990a. Raised from dried mud, Okayama, Japan, 34°35′N 133°46′E: SJU (?) – FO339.
30. C. *jollaea* Chapman 1963. Brackish ponds, Allans Beach, Dunedin, New Zealand, 45°52′S 170°30′E: Types, OMD – collection numbers unknown.
31. C. *kurilensis* Schornikov 1974. Iturup Island, Chirip Peninsula, Kuril Islands, Russia, 45°00′N 148°00′E: Holotype (♀), IMB-RAS – 414–415.
32. C. *lacustris* Rome 1962. Kalemie (Kalumbe, in front of camp Jaques), DR Congo, 05°56′S 29°11′E: Holotype (♂), RBINS – O.C. 616.
33. C. *longa* Rome 1962. Sumbu Bay, Lake Tanganyika, Zambia, 08°29′S 30°28′E: Holotype (♂), RBINS – O.C. 598.
34. C. *lusatica* Schäfer 1943. Environs of Görlitz, Oberlausitz, Saxony, Germany, 51°10′N 15°00′E: Repository of the type material unknown.

Syn.: *C. lauta* Margalef 1948; *C. brincki* Petkovski 1963; *C. bamberi* Henderson 1986

35. *C. madurainensis* Victor and Michael 1975. Temporary pond, near Madurai University Campus, Nagamalai area, Madurai, India, 09°56′N 78°07′E: Holotype (♀), DBSMU – slide no. 5.
36. *C. malcolmi* Löffler 1968. Poishman-Tarn, Mt. Kenya, Kenya, 00°10′S 37°20′E: Holotype (♀), LIM – collection number unknown.
37. *C. marmorata* Brady 1902. Bahia, type locality plurivalent. Syntype, HM – NEWHM:1.31.33.
38. *C. mawenzii* Löffler 1968. Puddle between Kibo and Mawenzi, Kilimanjaro, Kenya, 02°12′S 37°43′E: Holotype (♀), LIM – collection number unknown.
39. *C. meruensis* Lindroth 1953. Temporary waters, Mt. Meru, Tanzania, 03°14′S 36°45′E: Repository of the type material unknown.
40. *C. minima* Klie 1935a. Moss, Ko River, Man, Ivory Coast, 07°24′N 7°32′W: Syntypes, ZMK – UR-1139.
41. *C. minuta* Löffler 1963a. Rio Napo, Ecuador, 01°04′S 77°48′W: Types, LIM – collection numbers unknown.
42. *C. monodonta* Sars 1910. Sumbu, Lake Tanganyika, Zambia, 08°45′S 30°25′E: Repository of the type material unknown.
43. *C. musquizensis* Tressler 1954. Davis Mountains, Muquiz Creek, Texas, USA, 30°42′N 103°54′W: Holotype (♀), SM – 96055.
44. *C. niagranensis* Furtos 1936b. Niagra Cenote, Merida, Yucatán, Mexico, 20°58′N 89°37′W: Holotype (♀), SM – 67958.
45. *C. nigrovittata* Okubo 1990a. Okayama, Japan, 34°35′N 133°46′E: SUJ (?) – FO232.
46. *C. obliquata* Sars 1910. Sumbu Bay, Lake Tanganyika, Zambia, 08°29′S 30°28′E: Repository of the type material unknown.
47. *C. obscura* Sars 1901. Raised from dried mud, Argentina. Repository of the type material unknown.
48. *C. ovalis* Rome 1962. Small bay S of Cap Beach and creek, Lake Tanganyika, DR Congo, 06°31′S 29°29′E: Holotype (♂), RBINS – O.C. 597.
49. *C. palustris* Gauthier 1951. Duck pool, near Tiélao, Senegal, 16°34′N 14°33′W: Repository of the type material unknown.
50. *C. phantomensis* Tressler 1954. Phantom Lake, Texas, USA, 30°56′N 103°48′W: Holotype (♂), SM – 96054.
51. *C. pinguis* Sars 1901. Raised from dried mud, Argentina. Repository of the type material unknown.
52. *C. potamis* Tressler 1954. River Bottom, San Jacinto, Harris City, Texas, USA, 29°46′N 95°14′W: Holotype (♀), SM – 96058.
53. *C. pseudoparva* Löffler 1963a. Near Quito, Ecuador, 00°13′S 78°31′W: Type (♂), LIM – collection number unknown.
54. *C. punctillata* Brady 1907b. Pietermaritzburg, KwaZulu-Natal, South Africa, 29°37′S 30°23′E: Repository of the type material unknown.

55. *C. pusilla* Sars, 1910. Sumbu Bay, Lake Tanganyika, Zambia, 08°29′S 30°28′E: Repository of the type material unknown.
56. *C. pustulosa* Furtos 1933. Springsville, Ohio, USA, 40°15′N 83°00′W: Syntypes, SM – 67886.
57. *C. raripila* Rome 1962. Beach, bay of Tembwe, Lake Tanganyika, DR Congo, 06°31′S 29°29′E: Holotype (♂), RBINS – O.C. 0595.
58. *C. reptans* Cole 1965. Dover Spring, Stewart County, Tennessee, USA, 36°29′N 87°50′W: Holotype (♀), SM – 120573.
59. *C. rhomboidea* Furtos 1936b. Pond, Piste, Yucatán, Mexico, 20°42′N 88°35′W: Holotype (♀), SM – 67959.
60. *C. saetosa* Hartmann 1964. Marsh near Rasht, coast of the Caspian Sea, Iran, 37°16′N 49°34′E: Repository of the type material unknown.
61. *C. sanctipetri* Anichini-Pini 1968a. Isola di San Pietro, Sardinia, Italy, 39°08′N 08°16′E: Holotype (♀), ZIUC – collection number unknown.
62. *C. sarasini* Méhes 1939. Ouvéa, Iles Loyalty, New Caledonia, 20°35′S 166°35′E: Repository of the type material unknown.
63. *C. sbruchniensis* Kovalenko 1976. Zbruch, River Dniester, Ukraine, 48°32′N 26°26′E: Holotype (♀), DPS-ASM – collection number unknown.
64. *C. serrata* Sars 1910. Kala, Lake Tanganyika, Tanzania, 08°07′ 30°58′E: Repository of the type material unknown.
65. *C. shadini* Akatova 1950. Tajikistan. Repository of the type material unknown.
66. *C. sinuata* Sars 1910. Sumbu, Zambia, Lake Tanganyika, 08°45′S 30°25′E: Repository of the type material unknown.
67. *C. toyensis* Tressler 1954. Toya Lake, Pecos County, Texas, USA, 30°45′N 102°45′W: Holotype (♀), SM – 96057.
68. *C. uenoi* Brehm 1933. Tamagawa, Suwagun, Shinano Province, Japan, 35°45′N 139°18′E: Repository of the type material unknown.
69. *C. vidua* (OF Müller 1776). Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.

    Syn.: *Cypridopsella tumida* Kaufmann 1900b; *Cypris pincta* Straus 1821; *Cypridopsis chavesi* Moniez 1888; *C. helvetica* Kaufmann 1900b; *C. mariae* Rome 1943; *C. obesa* Brady and Robertson 1869; *C. okeechobei* Furtos 1936a; *C. parva* Müller 1900a; *C. parvoides* JM Martens 1977; *C. viduella* Sars 1895; *Pionocypris assimilis* Sars 1895; *P. intermedia* Sars 1924; *Proteocypris globuloides* Brady 1907b

70. *C. werneri* Brehm 1928b. Pool near the beach of Milos Island, Greece, 36°40′N 24°26′E: Repository of the type material unknown.
71. *C. yallahensis* (Baird 1862). Yallah Hill, Jamaica, 18°15′N 77°30′W: Repository of the type material unknown.

Key to the species

1. Swimming setae on A2 not exceeding distal end of penultimate segment . 2
– Swimming setae on A2 exceeding distal end of penultimate segment 9

2. Carapace covered with well-developed tubercles that give a “spiky” appearance . . . . *C. acanthodes* Rome 1962

– No such tubercles developed 3

3. Dorsal margin flat, swimming setae completely absent *C. minima* Klie 1935a

– Dorsal margin arched or rounded, swimming setae present 4

4. In lateral view, dorsal margin highly arched in the middle . . . . . . *C. shadini* Akatova 1950

– In lateral view, dorsal margin more evenly rounded 5

5. Posterior margin evenly rounded 6

– Posterior margin inclined, or almost straight 8

6. Surface of the carapace covered with prominent shallow pits . . . . *C. herpestica* Cole 1965

– Surface of the carapace not covered with prominent shallow pits 7

7. UR broad proximally, narrow distally (funnel shaped) . . . . *C. malcolmi* Löffler 1968

– UR with almost parallel margins, almost equally wide proximally and distally . . . . *C. mawenzii* Löffler 1968

8. Vibratory plate on L5 with only one filament . . . *C. brevisetosa* Klie 1943a

– Vibratory plate on L5 with three filaments . . . . *C. arhiga* Cole 1965

9. In lateral view, valves with marginal spines 10

– No spines present 15

10. Spines present on both antero-ventral and postero-ventral margins 11

– Spines present only on the postero-ventral margin 12

11. Claws on the third masticatory process of Mxl serrated *C. serrata* Sars 1910

– Claws on the third masticatory process of Mxl smooth *C. lacustris* Rome 1962

12. Only one spine present on the postero-ventral margin *C. monodonta* Sars 1910

– More than one spine present 13

13. Only two spines present on LV, RV without any spines *C. bidentata* Sars 1910

– Two or more spines present on LV, one or more spines present on RV . . 14

14. RV with only one spine on the antero-ventral margin, LV with two *C.tumidula* Sars 1910

– RV with more than one spine on the antero-ventral margin 16

15. Carapace more elongated, H/L ratio around 50% . . . . *C. arcuata* Rome 1962

– Carapace more tumid, H/L ratio more than 60% . . . *C. colorata* Rome 1962

16. UR separated in two parts with one septa . . . . . . *C. saetosa* Hartmann 1964

– UR not separated 17

17. Valves very asymmetrical LV overlapping RV dorsally with a pronounced flange . . . . *C. obliquata* Sars 1910

– Valves more or less symmetrical, no prominent flange present 18

18. Inner marginal zone of RV with a row of rounded tubercles . . . . *C. hartwigi* Müller 1900a

– No tubercles on the inner marginal zone of RV 19

19. Swimming setae on A2 only reaching middle of terminal claws . . . . *C. lusatica* Schäfer 1943

– Swimming setae on A2 reaching and exceeding tips of terminal claws . . 20

20. Anterior external margin of RV with a raw of tubercles . . . . *C. vidua* (OF Müller 1776)

– No tubercles on the anterior external margin of RV 21

21. Posterior margin rounded 22

– Posterior margin almost straight . . . . *C. compressa* Cole 1965

22. Dorsal margin sinusoid . . . . *C. sarasini* Méhes 1939

– Dorsal margin not sinusoid . . . . *C. hartwigi* Müller 1900a

Species not included in the key

Unfortunately, quite a number of species assigned presently to the genus *Cypridopsis* could not be included in the key provided. The first reason is variability of the type species of the genus, *C. vidua* (OF Müller 1776) which reproduces parthenogenetically. This species varies in the shape, ornamentation, and coloration of its carapace; number of rays on the vibratory plate of L6; serration of the claws on the third masticatory process of the Mxl; etc. The second reason is poor and very basic description of a number of species. The genus *Cypridopsis* is in need of revision, and type materials need to be checked for most of the species so that their clear mutual differences can be established. The following species not included in the list have only the carapace characteristics described: *C. adusta* Sars 1903a; *C. circinata* Brady 1910a; *C. diaphana* Barbeito-Gonzales 1971; *C. dubia* Sars 1903a; *C. exigua* Sars 1903a; *C. flavescens* Sars 1901; *C. funebris* Brady 1886b; *C. granulata* Sars 1903b; *C. marmorata* Brady 1902; *C. nigrovittata* Okubo 1990a; *C. obscura* Sars 1901; *C. pinguis* Sars 1901; and *C. yallahensis* (Baird 1862). *Cypridopsis australis* Henry 1923 looks like a juvenile of *C. vidua* (with subtriangular valves and the greatest H situated in front, and all the setae on the appendages being quite "plump"). *Cypridopsis japonica* Okubo 1990a is the same as *C. nigrovittata* Okubo 1990a and they are both similar to *C. vidua*. All of the following species are not sufficiently described and some of them might also be junior synonyms of *C. vidua: C. bisexualis* Cole 1966; *C. canadensis* Ferguson 1959b; *C. cypera* Tressler 1937; *Cypridopsis fuhrmanni* Méhes 1914; *C. howei* Ferguson 1964c; *C. madurainensis* Victor and Michael 1975; *C. minuta* Löffler 1968; *C. musquizensis* Tressler 1954; *C. niagranensis* Furtos 1936b; *C. palustris*

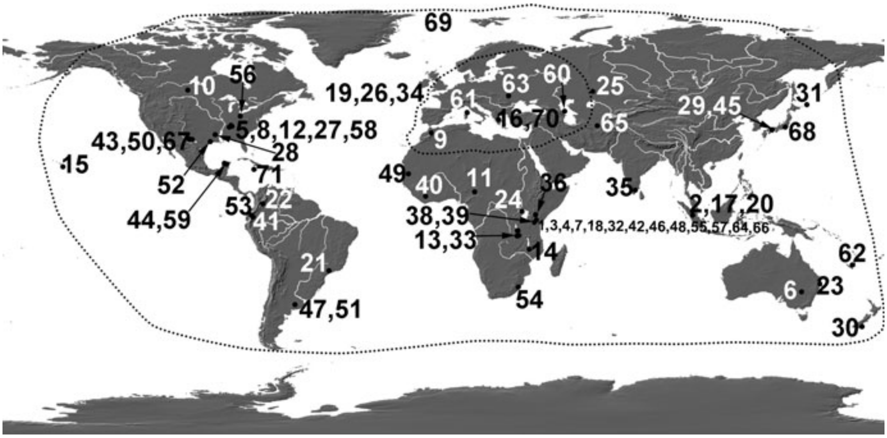


Fig. 142 Distribution of *Cypridopsis* Brady 1867: Numbers correspond to the species list

Gauthier 1951; *C. phantomensis* Tressler 1954; *C. potamis* Tressler 1954; *C. pseudoparva* Löffler 1963a; *C. punctillata* Brady 1907b; *C. pustulosa* Furtos 1933; *C. rhomboidea* Furtos 1936b; *C. sanctipetri* Anichini-Pini 1968a; *C. sbruchniensis* Kovalenko 1976; *C. toyensis* Tressler 1954; *C. uenoi* Brehm 1933; and *C. werneri* Brehm 1928b. In *Cypridopsis meruensis* Lindroth 1953, RV overlaps LV anteriorly, which is very unusual for the genus *Cypridopsis*, and this needs to be checked. Species *C. aequalis* Rome 1962; *C. congenera* Sars 1910; *C. cunningtoni* Sars 1910; *C. ellipsoidalis* Rome 1962; *C. gibba* Sars 1910; *C. longa* Rome 1962; *C. ovalis* Rome 1962; *C. pusilla* Sars 1910; *C. raripila* Rome 1962; and *C. sinuata* Sars 1910 are all described from the Lake Tanganyika, and although they differ considerably from *C. vidua*, differences between them are not clear and they have not been included in the key. *Cypridopsis reptans* Cole 1965 is, on the contrary, very similar to *C. arhiga* Cole 1965.

Ecology and distribution (Fig. 142)
The species can be found in all kinds of continental waters, including interstitial and brackish water habitats. The genus has a cosmopolitan distribution.

***Kapcypridopsis* McKenzie 1977**
Diagnosis (modified after McKenzie 1977): Carapace small, subreniform. CIL broad both anteriorly and posteriorly. A2 with reduced swimming setae. Terminal segment of Mxl palp elongated. UR flagellum like in females, absent in males.

Type species: *K. barnardi* McKenzie 1977

Species list with type locality and type material
1. *K. asymmetra* De Deckker 1981c. Natural granite rock pool near Frenchman's bay road, Albany, WA, Australia, 35°01′S 117°53′E: Holotype (♂), NMV – collection number unknown.

2. *K. barnardi* McKenzie 1977. Small pool, Table Mountain, Cape Town, Western Cape, South Africa, 33°55′S 18°25′E: Syntypes, SAFM – A15451.

Key to the species

1. LV with a postero-dorsal extension . . . . *K. asymmetra* De Deckker 1981c
– LV without a postero-dorsal extension . . . . *K. barnardi* McKenzie 1977

Ecology and distribution
The species is known only from the type locality.

***Klieopsis* Martens et al. 1991**

Diagnosis (after Martens et al. 1991): Carapace elongated or rounded. RV overlapping LV anteriorly, ventrally, and posteriorly. RV with an oblique, erected, and narrow inner list, the later especially on the posterior side connected with the CIL by numerous short septae (Fig. 133f, g). A2 with only three terminal claws in the females (G2 and Gm reduced into seta). Terminal segment of the Mxl palp cylindrical. UR with cylindrical ramus, distally abruptly narrowing.

Type (and only) species: *K. horai* (Klie 1927a)

Species list with synonyms, type locality, and type material
K. horai (Klie 1927a). Moss, Kangra Valley, Tilok, Punjab, India, 31°42′N 76°31′E: Syntypes, ZMK – UR-1095-6.

Syn.: *Cypridopsis caerulescens* Klie 1939a

Fig. 143 Distribution of *Martenscypridopsis* Karanovic and Pesce 2000a: Numbers correspond to the species list

Ecology and distribution
The species can most commonly be found in mosses in the splash zone of waterfalls. It is recorded in India, Israel, and East Africa.

Martenscypridopsis Karanovic and Pesce 2000a

Diagnosis (after Karanovic and Pesce 2000a): Small animals with slightly ovoid valve form. RV overlapping LV frontally and ventrally, LV overlapping RV caudally. Carapace smooth. Selvage peripheral. A2 with long swimming setae. Terminal segment of Mxl palp cylindrical, two times longer than wide; third endite of this appendage with two smooth claws. Hemipenis with obtuse inner and elongated outer lobe; outer lobe medially with clear hollow. Furca absent in both sexes. Genital lobe with copulatory hooks (Fig. 140f).

Type species: *M. materia* Karanovic and Pesce 2000a

Species list with type locality and type material

1. *M. materia* Karanovic and Pesce 2000a. Freshwater well, village Tindouf, Algeria, 27°40′N 08°09′W: Holotype (♂), ZMH – K-42337.
2. *M. pygmea* (Sars 1924). Cape Flats, South Africa, 33°56′S 21°51′E: Types, SAFM – A11202.

Key to the species

1. Tubercles present along the valve margins .... *M. pygmaea* (Sars 1924)
– Tubercles absent along the valve margins .... *M. materia* Karanovic and Pesce 2000a

Ecology and distribution (Fig. 143)
The genus seems to be endemic to Africa. Material of *Martenscypridopsis material* was collected only from wells, while the second species was raised from dried mud, and Klie (1944) reported the species from several lakes in DR Congo and Uganda.

Plesiocypridopsis Rome 1965b

Diagnosis (after Meisch 2000): Carapace small, less than 1 mm (Figs. 135c and 136e). RV overlaps LV ventrally (Figs. 132d and 135d). Swimming setae on A2 well developed. G1 claw of A2 conspicuously more developed than the neighboring claws. Second segment of Mxl palp cylindrical (Figs. 133c and 136f). Ramus of the UR cylindrical in females (Fig. 140d) and absent in males. Female genital field with copulatory hooks.

Type species: *P. newtoni* Brady and Robertson 1870

Species list with synonyms, type locality, and type material

1. *P. albida* (Vávra 1897). NE from Tabora, Tanzania, 09°02′S 32°57′E: Repository of the type material unknown.

2. *P. alluaudi* (Klie 1935a). Spring near Danané, Ivory Coast, 07°15′N 08°09′W: Syntypes, ZMK – UR-1127-9.
3. *P. arsenia* (Tressler 1937). Buki River, Mindoro Island, Philippines, 13°12′N 120°53′E: Types, SM – 71519.
4. *P. caerulescens* (Klie 1939a). In algae of a waterfall near Lokitang, Kenya, 04°16′N 35°44′E: Syntypes, ZMK – UR-1130.
5. *P. chrissiensis* (Methuen 1910). Lake Chrissie, Mpumalanga, South Africa, 26°20′S 30°13′E: Repository of the type material unknown.
6. *P. fuellebourni* (Daday 1910a). Lake Nyasa, Malawi, 12°00′S 34°30′E: Types, HNHM – IV/P-331-332.
7. *P. huaronensis* (Delachaux 1928). Lake Huaron, Peru, 11°01′S 76°25′W: Repository of the type material unknown.
8. *P. humilior* (Gauthier 1934a). Pools at Isampeza, Toliara, Madagascar, 25°08′S 45°43′E: Repository of the type material unknown.
9. *P. inaequivalva* (Klie 1933a). Banagher Pan, Lake Chrissie, Mpumalanga, South Africa, 26°20′S 30°13′E: Syntypes, ZMK – UR-1098–1102.
10. *P. insidiosa* (Rome 1965b). Kaokoveld, Kaoko Otavi, Namibia, 18°18′S 13°42′E: Repository of the type material unknown.
11. *P. laevigata* (Klie 1935a). Waterfall of Comoe, near Banfora, Burkina Faso, 10°38′N 04°46′W: Syntypes, ZMK – UR-1214.
12. *P. newtoni* Brady and Robertson 1870. River Nene and Cam, England, UK, 52°48′N 00°13′E: Repository of the type material unknown.

    Syn.: *Cypridopsis aldabrae* Müller 1898; *C. pilosa* Anichini 1967; *Potamocypris intermedia* Daday 1900

13. *P. silvestrii* (Daday 1902). St. Cruz, Patagonia, Chile, 41°48′S 68°54′W: Types, HMNH – IV/P-348.
14. *P. thermarum* (Tagliasacchi-Masala 1968a). Santa Maria de is Aquas, Sardara, Sardegna, Italy, 39°36′N 08°49′E: Holotype (♀), ZIUC – collection number unknown.

Key to the species

1\. Dorsal margin in lateral view almost flat ..... *P. fuellebourni* (Daday 1910a)

– Dorsal margin in lateral view rounded 2

2\. Greatest H lying behind the middle .... *P. alluaudi* (Klie 1935a)

– Greatest H lying in the middle or frontally 3

3\. Swimming setae on A2 not reaching tip of terminal claws (reaching at the most middle of the following segment) 4

– Swimming setae on A2 reaching and over passing tips of terminal claws .. 5

4\. Surface of the carapace pitted .... *P. caerulescens* (Klie 1939a)

– Surface of the carapace smooth *P. thermarum* (Tagliasacchi-Masala 1968a, b)

5. Greatest H lying in the middle 6
– Greatest H lying frontally 9
6. Dorsal margin evenly rounded 7
– Dorsal margin slightly elevated in middle 8
7. Small tubercles present along valve margins . . . *P. humilior* (Gauthier 1934a)
– No tubercles along valve margins . . . . *P. chrissiensis* (Methuen 1910)
8. Swimming setae on A2 only reaching tip of distal claws . . . . *P. laevigata* (Klie 1935a)
– Swimming setae on A2 by far reaching beyond tips of terminal claws . . . . *P. huaronensis* (Delachaux 1928)
9. Posterior margin almost straight . . . . *P. insidiosa* (Rome 1965b)
– Posterior margin rounded . . . . *P. newtoni* Brady and Robertson 1870

Species not included in the key

The following species are not included in the key: *P. albida* (Vávra 1897); *P. arsenia* (Tressler 1937); *P. inaequivalva* (Klie 1933a); *P. silvestrii* (Daday 1902). Partly because of their brief description and partly because of a great variability of *P. newtoni* Brady and Robertson 1870 (Meisch 2000), it is not possible to distinguish these species from the latter one based on the characteristics described by the authors.

Ecology and distribution (Fig. 144)

Species can be found in all types of freshwater, even slightly saline water bodies. Most of the species prefer small ditches and puddles. The genus has a world-wide distribution.

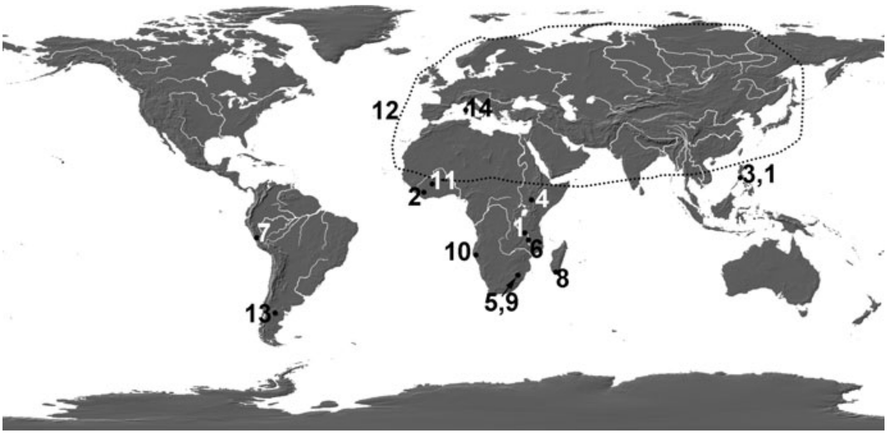


Fig. 144 Distribution of *Plesiocypridopsis* Rome 1965b: Numbers correspond to the species list

Potamocypris Brady 1870a [Syn.: *Cyprilla* Sars 1924; *Cypridopsella* Kaufmann 1900b; *Paracypridopsis* Kaufmann 1900b]

Diagnosis (after Meisch 2000): Carapace small, 0.5 mm – 1.0 mm (Fig. 136a, b). Laterally compressed and distinctly asymmetric. RV overlapping LV ventrally. Selvage peripheral on RV, anteriorly and posteriorly usually displaced inwardly on LV. Valve surface smooth or pitted. Terminal segment of the Mxl palp spatula shaped (Fig. 133d). Ramus of the UR in females distally tapering (not cylindrical) (Fig. 140e), absent in males. Female genital field with well-developed copulatory hooks.

Type species: *P. fulva* Brady 1870a

Species list with synonyms, type locality, and type material

1. *P. alveolata* Daday 1910b. Zoological Garden, Giza, Egypt, 30°00′N 31°12′E: Repository of the type material unknown.
2. *P. arcuata* (Sars 1903b). Territory of Atbassar, Kazakhstan, 51°48′N 68°21′E: Lectotype, ZISP – collection number unknown.

   Syn.: *Cypridopsis verrucosa* Daday 1894; *Cypris orientalis* Baird 1859a; *Potamocypris almasyi* Daday 1904; *P. longisetosa* Bronstein 1928; *P. maculata* Alm 1914a; *P. rullieri* Anichini-Pini 1968a

3. *P. angularis* Victor and Michael 1975. Well in Meenakshipuram, India, 09°59′N 77°22′E: Syntypes, DBSMU – slide no. 6, 6a.
4. *P. bituminicola* Klie 1940b. Itaparica, Pernambuco State, Brazil, 12°54′S 38°39′W: Syntypes, ZMK – UR-1188.
5. *P. bowmani* Ferguson 1967d. Small spring, Rock Creek Park, Washington DC, USA, 38°58′N 77°02′W: Holotype (♀), SM – 119638.
6. *P. brachychaeta* Goins 1972. Pit, Interstate 69, Delaware County, Indiana, USA, 40°11′N 85°23′W: Repository of the type material unknown.
7. *P. chelazzii* Martens 1982. Spring, Missarole, Somalia, 03°26′N 45°01′E: Holotype (♀), NHMF – collection number unknown.
8. *P. dadayi* (Méhes 1914). Pond, Bogota, Columbia, 04°36′N 74°04′W: Repository of the type material unknown.
9. *P. deflexa* (Sars 1924). Neighborhood of Port Elizabeth, South Africa, 33°58′S 25°35′E: Types, SAFM – A11314.
10. *P. dorsomardinata* Rome 1965a. Ganza, DR Congo, 07°05′S 29°25′E: Holotype (♀), RBINS – O.C. 724.
11. *P. elegantula* Furtos 1933. Hollyhock Pond, North Bass Island, Ohio, USA, 40°11′N 82°40′W: Syntypes (♀), SM – 67887.
12. *P. fallax* Fox 1967. Malham Tarn, Yorkshire, England, UK, 54°05′N 02°09′W: Lectotype, BM – 1967.4.3.8.

    Syn.: *Potamocypris wolfi* Bronstein 1928

13. *P. fulva* Brady 1870a. Side of Loch Ascog, Scotland, UK, 55°53′N 05°16′W: Lectotype (only carapace), BM – slide 1.18.05.
14. *P. gibbula* (Sars 1924). Cape of Good Hope, South Africa, 34°21′S 18°28′E: Syntypes, NHMO – F4335a/b.
15. *P. helicina* (Fischer 1848). St. Petersburg, Russia, 59°53′N 30°15′E: Repository of the type material unknown.
16. *P. humilis* (Sars 1924). Surroundings of Faure, Cape Flats, South Africa, 33°59′S 18°34′E: Syntypes, NHMO – F10922.
17. *P. hummelincki* Klie 1933b. Pools, Onima, Bonaire, Netherlands Antilles, 12°15′N 68°19′W: Syntypes, ZMK – UR-1172.
18. *P. hyboforma* Dobbin 1941. Alkali Lake, Chelan County, Washington, USA, 47°14′N 117°58′W: Lectotype (♀), SM – 113513.
19. *P. illinoisensis* Hoff 1943a. Spring, South Park, Quincy, Illinois, USA, 39°56′N 91°24′W: Holotype (♀), SM – 80035.
20. *P. islagrandensis* Hoff 1943b. Isla, Louisiana, USA, 29°14′N 89°59′W: Holotype (♀), SM – 78888.
21. *P. lobata* Daday 1910b. Zoological Garden, Giza, Egypt, 30°00′N 31°12′E: Repository of the type material unknown.
22. *P. mastigophora* (Methuen 1910). Lake Chrissie, Mpumalanga, South Africa, 26°20′S 30°13′E: Repository of the type material unknown.

    Syn.: *Cyprilla reniformis* Brady 1907b; *C. producta* Sars 1924

23. *P. narayanani* George and Martens 2002. Chalakkudy River, Vettukadavu, Meloor, Kerala, India, 10°00′N 76°30′E: Holotype (♀), RBINS – O.C. 2442.
24. *P. ombrophila* Margalef 1961. Puddle, Porlamar, Punta de Piedras, Venezuela, 10°57′N 63°51′W: Repository of the type material unknown.
25. *P. pallida* Alm 1914a. Härjedalen, Ransjö, Sweden, 62°02′N 14°21′E: Repository of the type material unknown.

    Syn.: *P. thienemanni* Klie 1925

26. *P. paludum* Gauthier 1939. Neighborhood of Bergvliet, South Africa, 25°04′S 30°53′E: Types, SAFM – A11158.
27. *P. philotherma* Rome 1970. Sodere, Ethiopia, 08°24′N 39°23′E: Repository of the type material unknown.
28. *P. problematica* Löffler 1963a. Lake San Pablo, Ecuador, 00°13′N 78°12′W: Types, NHMV – collection numbers unknown.
29. *P. reticulata* Huang 1979. Chinghai Lake, Thailand, 14°15′N 100°26′E: Repository of the type material unknown.
30. *P. saskatchewanensis* Ferguson 1959a. Pool Along Hwy 54, Regina Beach, Saskatchewan, Canada, 50°47′N 105°00′W: Holotype (♀), SM – 102574.
31. *P. schubarti* Klie 1940b. Several localities in N Brazil: Syntypes, ZMK – UR-1192-3, 1197–1200, 1446, 548.

32. *P. similis* Müller 1912. Lake Lucerne, Switzerland, 47°00′N 08°28′E: Lectotype, NHMG – collection number unknown.
33. *P. smaragdina* (Vávra 1891). Surroundings of "Oberbaumgarten," Sady, near Bolkow, Poland, 52°27′N 16°44′E: Repository of the type material not known.

    Syn.: *P. dianae* Fox 1965

34. *P. steueri* Klie 1935b. Lake Maryut, Egypt, 31°09′N 29°53′E: Lectotype (♀), ZMK – UR-1175.
35. *P. stewarti* Daday 1908. Gyantze, China, 28°57′N 89°38′E: Repository of the type material unknown.
36. *P. tetrataeniata* Anichini 1967. Brackish water, Basso Flumendosa, Sardinia, Italy, 40°00′N 09°00′E: Holotype (♀), ZIUC – collection number unknown.
37. *P. sudzukii* Okubo 1992 (in Okubo and Terauchi 1992). Yaeyama, Okinawa, Japan, 24°20′N 124°02′E: Holotype (♀), SJU – FO 799.
38. *P. unicaudata* Schäfer 1943. Lake Barsbek, Schleswig-Holstein, Germany, 54°24′N 10°19′W: Lectotype (♀), ZMK – UR-1183.

    Syn.: *P. vanoyei* De Vos 1946

39. *P. variegata* (Brady and Norman 1889). Side of Lough Naegh, Northern Ireland, UK, 54°37′N 06°25′W: Lectotype (♀), BM – 1900.2.29.135.
40. *P. villosa* (Jurine 1820). Surroundings of Geneva, Switzerland, 46°12′N 06°08′E: Repository of the type material unknown.
41. *P. worthintoni* (Lowndes 1936). Lake Rudolf, Aman, Kenya, 03°30′N 36°00′E: Types, BM – 1939.4.18.185–204.
42. *P. zschokkei* (Kaufmann 1900a). Environs of Buchs in the Rhine Valley, St. Gallen, Switzerland, 46°31′N 08°37′E: Lectotype (♀), NHMG – collection number unknown.

    Syn.: *P. compacta* Klie 1925; *P. foxi* Sywula 1972; *P. hambergi* Alm 1914a; *P. pyrenaica* Margalef 1947; *P. tarnogradskyi* Bronstein 1928; *P. wolfi* Brehm 1920

Key to the species

1. Swimming setae on A2 short (not exceeding distal end of the penultimate segment) 2

– Swimming setae on A2 long (reaching and often exceeding tips of distal claws) 11

2. In lateral view, LV with almost straight posterior margin and with posteroventral margin rounded and extended 3

– In lateral view, LV with more inclined or rounded posterior margin, posteroventral margin not extended 4

3. RV overlapping LV dorsally with a flange, swimming setae almost reaching distal margin of penultimate segment . . . . *P. paludum* Gauthier 1939

– RV not overlapping LV with a flange, swimming setae much shorter ...... *P. illinoisensis* Hoff 1943a

4. Valves clearly and rather heavily ornamented 5

– Valves sometimes with faint ornamentation consisting of shallow pits 6

5. Mxl palp with four distal claw-like setae .... *P. similis* Müller 1912

– Mxl palp with five distal claw-like setae ... *P. zschokkei* (Kaufmann 1900a)

6. Ramus of the UR very long, as long as the terminal seta ... *P. brachychaeta* Goins 1972

– Ramus of the UR very short, not even third of terminal seta 7

7. Mxl palp with five distal claw-like setae 8

– Mxl palp with less than five distal claw-like setae 10

8. Vibratory plate of L5 with only one filament 9

– Vibratory plate of L5 with two filaments .... *P. fallax* Fox 1967

9. The longest of the swimming setae only reaching half L of penultimate segment .... *P. fulva* Brady 1870a

– The longest of the swimming setae reaching distal end of penultimate segment *P. pallida* Alm 1914a

10. Lateral seta on UR absent .... *P. bowmani* Ferguson 1967d

– Lateral seta on the UR present .... *P. dorsomardinata* Rome 1965a

11. In dorsal view, LV with prominent posterior extension overlapping RV, this visible even in lateral view 12

– No prominent posterior extension on LV 21

12. Carapace strongly ornamented 13

– Valves sometimes with faint ornamentation consisting of shallow pits ... 14

13. Dorsal flange on RV very prominent, triangular .... *P. narayanani* George and Martens 2002

– Dorsal flange much less developed .... *P. gibbula* (Sars 1924)

14. Mxl palp with four distal appendages (both claw-like and normal setae) . 15

– Mxl palp with more than four distal claw-like setae (both claw-like and normal setae) 17

15. LV elongated, with long dorsal margin (very gently sloping toward posterior end) .... *P. philotherma* Rome 1970

– LV more rounded, with dorsal margin more steeply sloping toward posterior end 16

16. In dorsal view, LV overlapping RV anteriorly . *P. smaragdina* (Vávra 1891)

– In dorsal view, RV overlapping LV anteriorly . . *P. unicaudata* Schäfer 1943

17. Mxl palp with seven distal appendages (both claw-like and normal setae) ... *P. lobata* Daday 1910b

– Mxl palp with five distal appendages (both claw-like and normal setae) . 18

18. Posterior margin of LV sinusoid 19

– Posterior margin of LV rounded . . . . *P. worthintoni* (Lowndes 1936)

19. All five appendages on the terminal segment of Mxl palp stout . . . . *P. chelazzii* Martens 1982

– At least one of the appendages on the terminal segment of Mxl palp is a fine seta 20

20. Terminal segment of Mxl palp with only one fine seta and four claw-like setae. . . . . *P. mastigophora* (Methuen 1910)

– Terminal segment of Mxl palp with two fine setae and three claw-like setae *P. schubarti* Klie 1940b

21. Posterior margin straight, carapace in lateral view square 22

– Posterior margin inclined or rounded, carapace in lateral view more subtriangular 23

22. LV with lip-like projection well developed, hanging over ventral margin *P. deflexa* (Sars 1924)

– LV with a small anterior process . . . . *P. humilis* (Sars 1924)

23. Carapace surface covered with prominent pits 24

– Carapace sometimes with very faint pits 26

24. Terminal segment of Mxl palp with four claw-like setae and no additional setae . . . . *P. variegata* (Brady and Norman 1889)

– Terminal segment of Mxl palp with four spin-like setae and one or two additional fine setae 25

25. Terminal segment of Mxl palp with two additional fine setae and carapace covered with short, stiff setae . . . . *P. alveolata* Daday 1910b

– Terminal segment of Mxl palp with one additional fine seta and carapace covered with long setae ("hairy appearance") . . . . . *P. arcuata* (Sars 1903b)

26. Terminal segment of Mxl palp with only three claw-like setae *P. tetrataeniata* Anichini 1967

– Terminal segment of Mxl palp with four or five claw-like setae 27

27. Terminal segment of Mxl palp with four claw-like setae 28

– Terminal segment of Mxl palp with five claw-like setae 31

28. In lateral view, a lip-like extension (selvage?) well developed frontally to the middle . . . . *P. islagrandensis* Hoff 1943b

– No such extension present 29

29. In dorsal view, anterior end broadly rounded . . . . *P. steueri* Klie 1935b

– In dorsal vie, anterior end narrow, cuneiform 30

30. Anteriorly RV overlapping LV . . . . *P. dadayi* (Méhes 1914)

– Anteriorly LV overlapping RV . . . . *P. hummelincki* Klie 1933b
31. Anteriorly LV overlapping RV . . . . *P. bituminicola* Klie 1940b
– Anteriorly RV overlapping LV . . . . *P. villosa* (Jurine 1820)

Species not included in the key
The following species have not been included in the key: *P. angularis* Victor and Michael 1975; *P. elegantula* Furtos 1933; *P. helicina* (Fischer 1848); *P. hyboforma* Dobbin 1941; *P. islagrandensis* Hoff 1943b; *P. ombrophila* Margalef 1961; *P. problematica* Löffler 1963a; *P. reticulata* Huang 1979; *P. saskatchewanensis* Ferguson 1959a; *P. stewarti* Daday 1908; and *P. sudzukii* Okubo 1992 (in Okubo and Terauchi 1992). *Potamocypris elegantula* and *P. hyboforma* Dobbin 1941 are very similar to *P. variegata* (Brady and Norman 1889). *Potamocypris helicina* is very basically described. Terminal segment of the Mxl palp has not been described for *P. angularis*, *P. ombrophila*, *P. problematica, P. stewarti,* and *P. sudzukii*. The last species has a very conspicuous appearance of the carapace and UR (more cylindrical), looking more like a *Plesiocypridopsis* Rome 1965b. *Potamocypris stewarti* has a very globular carapace in dorsal view, resembling more *Cypridopsis* Brady 1867. Description of *P. reticulata* is in Chinese, while *P. saskatchewanensis* was described only after carapace.

Ecology and distribution
The species can be found in many types of freshwater bodies, those with short swimming setae preferring springs and spring-associated habitats. The genus has a wide distribution (Fig. 145)

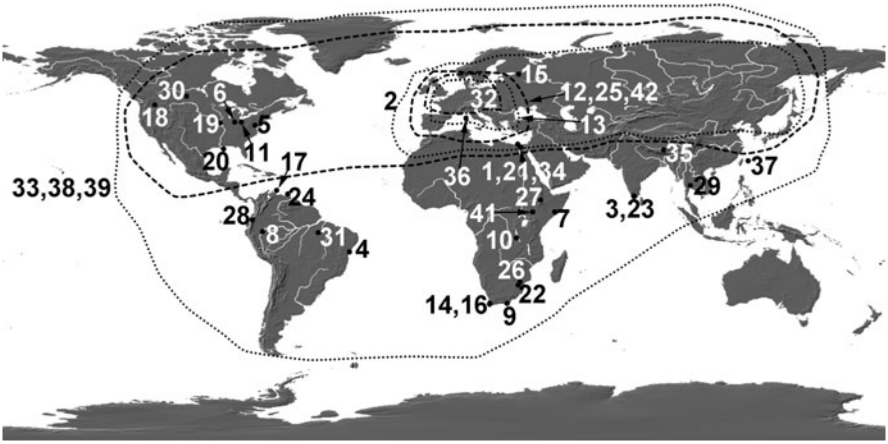


Fig. 145 Distribution of *Potamocypris* Brady 1870a: Numbers correspond to the species list

Pseudocypridopsis **Karanovic 1999a**

Diagnosis (after Karanovic 1999a): Small ostracods with ovoid valve form. LV overlapping RV anteriorly, posteriorly, and ventrally. Carapace ornamented (Fig. 136c). Valves without double-folded inner list. Selvage peripheral. Terminal segment of Mxl palp cylindrical. Hemipenis with obtuse inner lobe and elongated outer lobe. UR in both sexes. Genital lobe with copulatory hooks.

Type species: *P. clathrata* (Klie 1937a)

Species list with type locality and type material

1. *P. clathrata* (Klie 1937a). Well, Ribnica, Skadar Valley, Podgorica, Montenegro, 42°26′N 19°16′E: Syntypes, ZMK – UR-1131.
2. *P. petkovskii* Karanovic 2000. Cave Sulimska Jama, Beri, Podgorica, Montenegro, 42°25′50″N 19°10′40″E: Holotype (♂), ZMH – 39696.

Key to the species

1. Swimming setae on A2 long (exceeding distal claws) . . . . *P. petkovskii* Karanovic 2000
– Swimming setae on A2 short (reaching middle of the penultimate segment) . . . . *P. clathrata* (Klie 1937a)

Ecology and distribution

Both species have only been found in the subterranean waters of the Balkan Peninsula.

Sarscypridopsis **McKenzie 1977**

Diagnosis (modified after McKenzie 1977 and Meisch 2000): Carapace, small to medium sized, subtriangular. Surface often covered with pits. CIL relatively broad anteriorly and narrow posteriorly. RV overlapping LV ventrally. Terminal segment of the Mxl palp cylindrical (Fig. 133b). Ramus of the UR in females triangular (Fig. 140b).

Type species: *S. gregaria* (Sars 1895)

Species list with type locality and type material

1. *S. aculeata* (Costa 1847). Puddle around Naples, Italy, 40°50′N 14°15′E: Repository of the type material unknown.

   Syn.: *Cypridopsis obstinata* Barclay 1968; *C. spinifera* Sars 1924

2. *S. brevis* (Sars 1924). Pond on Bergvliet Flats, South Africa, 33°59′S 18°26′E: Repository of the type material unknown.
3. *S. clavata* (Sars 1924). Dam at Touws River Station, Worcester Division, South Africa, 33°20′S 20°02E: Types, SAFM – A11230.
4. *S. echinata* (Müller 1908). Fishhoek, South Africa, 34°08′S 18°26′E: Types, ZMB – 1345.

5. *S. elizabethae* (Sars 1924). Neighborhood of Port Elizabeth, South Africa, 33°55′S 25°34′E: Types, SAFM – A11320.
6. *S. glabrata* (Sars 1924). Small pools near whaling station at Saldanha Bay, South Africa, 33°53′S 25°33′E: Types, NHMO – F11079.
7. *S. gregaria* (Sars 1895). Neighborhood of Bergvliet, near whaling station at Saldanha Bay, South Africa, 33°53′S 25°33′E: Types NHMO – F10975, 10976, 10978.
8. *S. hirsuta* (Sars 1924). Ashton, South Africa, 33°49′S 20°03′E: Types, NHMO – F11024, 11025.
9. *S. katesae* (Hartmann 1957). Remaining pool of a creek near Gibeon, Hardap, Great Namaqualand, Namibia, 25°08′S 17°46′E: Syntypes, ZMH – K-27656–657.
10. *S. lanzarotensis* (Mallwitz 1984). Temporary wells S of Haria, NE Lanzarote, Canary Islands, Spain, 29°08′N 13°29′W: Holotype (♀), ZMH – K-32508.
11. *S. ochracea* (Sars 1924). Cape Flats, near Cape Town, South Africa, 33°56′S 21°39′. Types, SAFM – A11727.
12. *S. punctata* (Sars 1924). Otjituo, Otjozondjupa, Damaraland, Namibia, 19°50′S 18°00′E: Types, NHMO - F11075.
13. *S. pyramidata* (Sars 1924). Pond at Ashton, South Africa, 33°49′S 20°03′E: Repository of the type material unknown.
14. *S. reniformis* (Sars 1924). Pond at Fishhoek, South Africa, 34°08′S 18°26′E: Types, NHMO – F11031.
15. *S. sarsi* (Klie 1935a). Neighborhood of Port Elizabeth, South Africa, 33°55′S 25°34′E: Types (as *C. tumidula* Sars 1924), NHMO – F11074.
16. *S. striolata* (Sars 1924). Bergvliet, South Africa, 33°53′S 25°33′E: Types, NHMO – F11070-1.
17. *S. tonsa* (Sars 1924). Pond on Green Point Common, Cape Town, Western Cape, South Africa, 33°54′S 18°24′E: Types, NHMO – F11061.
18. *S. trigonella* (Sars 1924). Neighborhood of Bergvliet, South Africa, 33°53′S 25°33′E: Types, NHMO – F11050-11053.

Key to the species

1. Carapace ornamented with longitudinal stripes . . . . . . *S. striolata* (Sars 1924)
– Carapace ornamented with pits or smooth 2
2. Carapace covered with spine-like setae (in addition to the normal setae) . . . 3
– No spine-like setae present 4
3. Greatest H situated more toward middle . . . . *S. aculeata* (Costa 1847)
– Greatest H situated more toward anterior 1/3 of the carapace *S. echinata* (Müller 1908)
4. Carapace smooth 5
– Carapace covered with pits 6
5. Inner lists present . . . . *S. lanzarotensis* (Mallwitz 1984)

– Inner lists absent . . . . *S. glabrata* (Sars 1924)

6. Greatest H situated in the middle, from which point dorsal margin sloping evenly toward both anterior and posterior ends . . . . *S. gregaria* (Sars 1895)

– Greatest H situated more on the first 1/3 of L from which point dorsal margin more rounded toward posterior and sloping toward anterior end . *S. trigonella* (Sars 1924)

Species not included in the key
The following species are not included in the key, as they have been very briefly described (mostly only carapace shape) and it is not even certain if they belong to the genus *Sarscypridopsis* McKenzie 1977: *S. brevis* (Sars 1924); *S. clavata* (Sars 1924); *S. elizabethae* (Sars 1924); *S. hirsuta* (Sars 1924); *S. katesae* (Hartmann 1957); *S. ochracea* (Sars 1924); *S. punctata* (Sars 1924); *S. pyramidata* (Sars 1924); *S. reniformis* (Sars 1924); *S. sarsi* (Klie 1935a); and *S. tonsa* (Sars 1924).

Ecology and distribution (Fig. 146)
The species prefer open water bodies and the genus is mostly distributed in the Southern Hemisphere.

***Tanganyikacypridopsis* Martens 1985b**

Diagnosis (after Martens 1985b): Small ostracods with elongated shells, RV overlapping LV anteriorly and ventrally, LV overlapping RV caudally. RV with a large inner list on the posterior and the anterior CIL and on the ventral side. LV with posterior selvage displaced substantially to the front, anterior selvage situated on the valve margin. Fused zone narrow in both valves. Terminal segment of the Mxl palp cylindrical. UR flagellum like in females, absent in males. Hemipenis with short, broad inner lobe and elongated outer lobe.

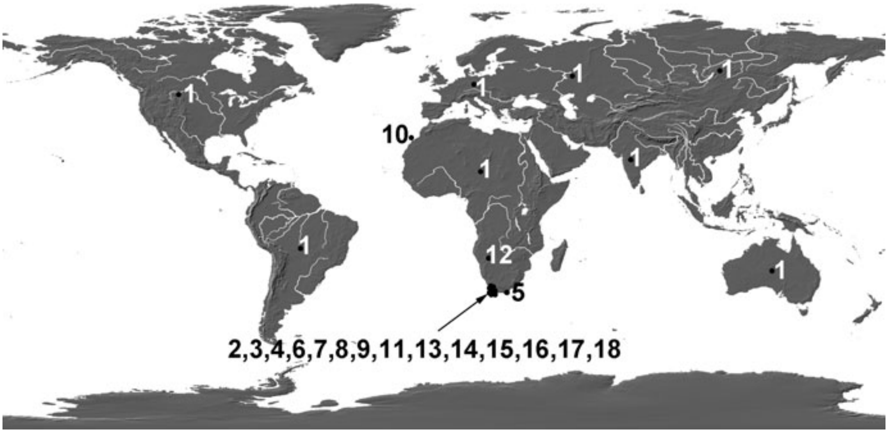


Fig. 146 Distribution of *Sarscypridopsis* McKenzie 1977: Numbers correspond to the species list

Type species: *T. depressa* (Kiss 1959a)

Species list with type locality and type material

1. *T. anomala* (Rome 1962). At sea, ca. 500 m from the shore, near Lagosa, Kungwe Bay, Tanzania, 05°56′S 29°53′E: Lectotype (♂), RBINS – O.C. 825.
2. *T. calcarata* (Rome 1962). At sea, ca. 500 m from the shore, near Lagosa, Kungwe Bay, Tanzania, 05°56′S 29°53′E: Lectotype (♂), RBINS – 13040.
3. *T. depressa* (Kiss 1959a). Uvira, Lake Tanganyika, 03°24′S 29°08′E: Lectotype (♂), RMCA – 56.257.

Key to the species

1. Distal shield of hemipenis broadly dilated distally . . . *T. anomala* (Rome 1962)
– Distal shield of hemipenis not broadly dilated, with almost parallel sides . . 2
2. In dorsal view, carapace with a beak-like anterior part *T. calcarata* (Rome 1962)
– In dorsal view, carapace with rounded anterior part . *T. depressa* (Kiss 1959a)

Ecology and distribution
The genus is endemic to the Lake Tanganyika.

***Thermopsis* Külklöylüoğlu et al. 2003**

Diagnosis (after Külklöylüoğlu et al. 2003): RV overlapping LV ventrally. CIL of RV broad, without any inner lists. Calcified posterior zone of RV postero-ventrally with a double-folded list that progressively disappears toward the posterior end. CIL of LV with postero-ventral double-folded list and posterior calcified lamella distinctly narrower than in RV. Terminal segment of Md palp with strongly developed distal claw, fused with the segment. Terminal segment of Mxl palp cylindrical to distally slightly enlarged. UR flagellum like, missing in males.

Type (and only) species: *T. thermophila* Külklöylüoğlu et al. 2003

Species list with type locality and type material
T. thermophila Külklöylüoğlu et al. 2003. Hot spring at Soldier Maedow, Humboldt County, Nevada, USA, 41°25′30″N 119°09′40″W: Holotype (♀), SM – 1007408.

Ecology and distribution
The species has only been found so far in hot springs in USA.

***Tungucypridopsis* Victor 1983**

Diagnosis (after Victor 1983): Carapace moderately inflated. LV overlapping RV anteriorly, posteriorly, and ventrally. CIL wide anteriorly, narrow posteriorly. Selvage peripheral. Mxl palp cylindrical. Left prehensile palp with wing-like expansions on the finger part (Fig. 139e, f). UR flagellum like in females, absent in males.

Type (and only) species: *T. lairdi* (Victor and Fernando 1978b)

Species list with type locality and type material
T. lairdi (Victor and Fernando 1978b). Tree hole in Motusanga, Nukunono, Tokelau Islands, 09°00′S 171°45′W: Holotype (♀), BM – 1977.130.

Ecology and distribution
The species is so far known only from the type locality.

Zonocypris Müller 1898

Diagnosis: Carapace globular, often ornamented with ridges distributed in concentric circles. LV overlapping RV ventrally. Terminal segment of the Mxl palp cylindrical. UR flagelliform in females, absent in males.

Type species: *Z. costata* (Vávra 1897)

Species list with type locality and type material

1. *Z. alveolata* Klie 1936a. Crater Lake Mfou, Bafoussam, Cameroon, 05°32′N 10°42′E: Syntypes, ZMK – UR-1204.
2. *Z. calcarata* Klie 1936a. Crater Lake Mfou, Bafoussam, Cameroon, 05°32′N 10°42′E: Syntypes, ZMK – UR-1209.
3. *Z. cordata* Sars 1924. Cape of Good Hope, South Africa, 34°21′S 18°28′E: Types, NHMO – F11334, 11335.
4. *Z. corrugata* Rome 1965a. Lake Nyanza: Holotype (♂), RBINS – O.C. 728.
5. *Z. costata* (Vávra 1897). Ugogo, Tanzania, 05°04′S 34°04′E: Repository of the type material unknown.

   Syn.: *Z. madagascarensis* Müller 1898

6. *Z. elegans* Müller 1898. Mahajanga, Madagascar, 15°43′S 46°19′E: Syntypes, ZMG – 24717.
7. *Z. glabra* Klie 1944. Kishushu Island, Lake Kivu, DR Congo, 01°54′S 29°11′E: Syntypes, ZMK – UR-1210.
8. *Z. hispida* (Sars 1901). Itatiba, Brazil, 23°00′S 46°50′W: Repository of the type material unknown.
9. *Z. inconspicua* Schäfer 1952. Puddle, central Anatolia, Turkey: Repository of the type material unknown.
10. *Z. inornata* Klie 1936a. Crater Lake Mfou, near Bafoussam, Cameroon, 05°32′N 10°42′E: Syntypes, ZMK – UR-1215.
11. *Z. laevis* Sars 1910. Bukoba, W shore of Lake Victoria, Kagera, Tanzania, 01°19′S 31°48′E: Repository of the type material unknown.
12. *Z. lata* Rome 1962. Swampy lake at Kioko-Niumba (Ludjingi), DR Congo, 05°50′S 28°24′E: Holotype (♀), RBINS – O.C. 637.
13. *Z. peralta* Rome 1969. Archeï, Chad, 16°57′N 21°46′E: Repository of the type material unknown.
14. *Z. pilosa* Rome 1962. Border of Lake Bangwe, between Kigoma and Ujiji, Tanzania, 04°53′S 29°39′E: Holotype (♀), RBINS – O.C. 644.

15. *Z. tuberosa* Müller 1908. Plumstead, Zeekoevlei near Simon's Town, South Africa, 34°11′S 18°26′E: Syntypes, ZMG – 24729.
16. *Z. uniformis* Rome 1962. At sea, ca. 200 m from the shore, opposite of Formulac Hospital in Katana, Lake Kivu, DR Congo, 02°13′S 28°49′E: Holotype (♀), RBINS – O.C. 641.

Key to the species

1\. Carapace ornamented with longitudinal ridges 2

– No longitudinal ridges present (distributed in concentrated circles), carapace differently ornamented or smooth 6

2\. Two posterior marginal spines present on each valve *Z. calcarata* Klie 1936a

– No marginal spines 3

3\. In dorsal view, carapace triangular with posterior margins on both valves flat and inclined . . . . *Z. elegans* Müller 1898

– In dorsal view, carapace globular, with both posterior margins rounded . . . 4

4\. Carapace with longitudinal striae on entire surface . . *Z. costata* (Vávra 1897)

– Central part of the carapace smooth 5

5\. Basal segment of L6 without any seta . . . . *Z. lata* Rome 1962

– Basal segment of L6 with one seta . . . . *Z. corrugata* Rome 1965a

6\. Surface of the carapace covered with prominent warts, from which exit surface setae (strong wart-like appearance) 7

– Warts not prominent 8

7\. Selvage very strongly developed forming a clear lip-like extension frontal to the middle . . . . *Z. alveolata* Klie 1936a

– Selvage not so strongly developed . . . . *Z. tuberosa* Müller 1908

8\. Carapace ornamented with deep, regular pits 9

– Carapace smooth 10

9\. Greatest W 80% of L, distal seta on the UR almost as long as ramus itself . *Z. cordata* Sars 1924

– Greatest W around 60%, seta on the UR much longer than ramus itself . . . . *Z. inconspicua* Schäfer 1952

10\. RV overlaps LV frontally 11

– LV overlaps RV frontally 12

11\. Carapace densely covered with surface setae . . . . *Z. inornata* Klie 1936a and *Z. pilosa* Rome 1962

– Surface setae sparse . . . . *Z. peralta* Rome 1969

12\. Dorsal margin arched . . . . *Z. laevis* Sars 1910

– Dorsal margin rounded . . . *Z. glabra* Klie 1944 and *Z. uniformis* Rome 1962

Remarks

Zonocypris lilljeborgi (Müller 1900a) is not included here, as this species has completely developed UR and does not belong to the subfamily Cypridopsinae at all. It was originally described in the genus *Cypris* and transferred to the genus *Zonocypris* by Mandelstam (1962). *Zonocypris dadayi* Lowndes 1932a is the replacement name for *Oncocypris costata* Daday 1910a, but this species is at the moment placed in the genus *Neocypridopsis* Klie 1940b, of the family Notodromadidae.

Species not included in the key
The only species not included in the key is *Z. hispida* (Sars 1901), described from South America. The original description contains only the appearance of the carapace, with a brief mention that UR is rudimentary. The species was originally described in the genus *Cypridopsella* Kaufmann 1900a, and transferred by Klie (1940b) into the genus *Zonocypris*. Klie (1940b) provided a short description and a couple of drawings of *Zonocypris hispida*, but the appearance of carapace of the species Klie illustrated is completely different from the one Sars provided. Namely, Klie's species is much higher in lateral view, greatest H being more than 80% of the L, while Sars' species is much more elongated, greatest H being slightly more than 50%. Original material of both authors needs to be checked in order to be sure if they were dealing with the same species. *Zonocypris inornata* Klie 1936a and *Z. pilosa* Rome 1962 as well as *Z. glabra* Klie 1944 and *Z. uniformis* Rome 1962 are placed together in the key, indicating that both Rome's species are very similar to Klie's species and that they might be junior synonyms.

Ecology and distribution (Fig. 147)
The species live mostly in permanent open freshwater bodies, such as lakes, but can also be found in small puddles. The genus is mostly distributed in Africa.

4.7 *Subfamily Cyprinotinae Bronstein 1947*

Diagnosis (modified after Meisch 2000): Carapace usually very stout, 1–2 mm L (Figs. 148a, b, 149a, b, and 150). Dorsal margin usually arched, and valves usually asymmetric. RV or LV with or without marginal tubercles (Fig. 151). A1

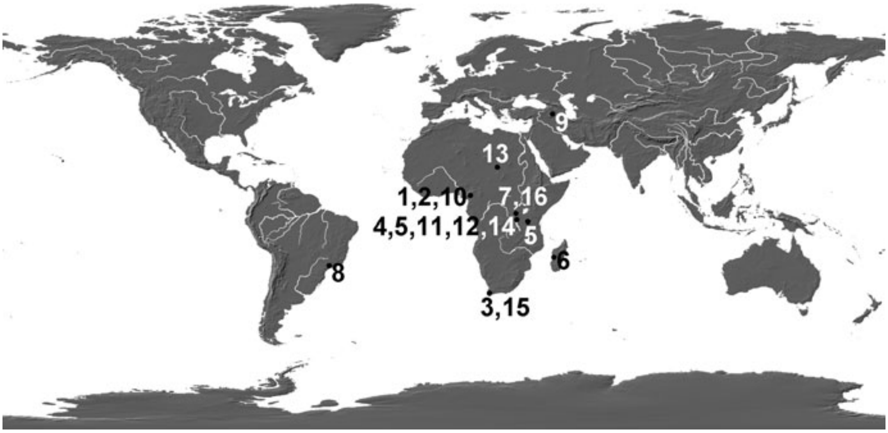


Fig. 147 Distribution of *Zonocypris* Müller 1898: Numbers correspond to the species list

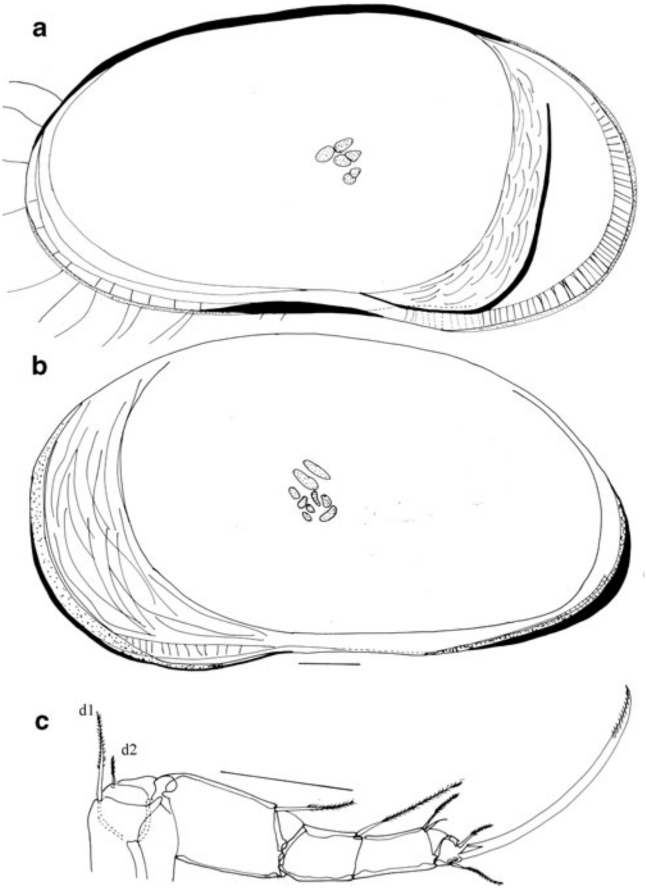


Fig. 148 Line drawings: *Riocypris hinzeae* Karanovic 2008a: (**a**) LV, inside view; (**b**) RV, inside view; (**c**) L6. Scales = 0.1 mm

7-segmented. A2 usually with well-developed swimming setae. Prehensile palp asymmetrical (Fig. 152a, c). Vibratory plate on L5 well developed and usually with six rays (Figs. 152a and 153c). L6 5-segmented (Figs. 148c and 154b). Terminal segment of L7 transformed into pincer organ (Fig. 153a, b). UR well developed with both claws and both setae present (Fig. 149d). Attachment simple (Fig. 149c).

Type genus: *Cyprinotus* Brady 1886a

Other genera: *Hemicypris* Sars 1903a; *Heterocypris* Claus 1892; *Homocypris* Sars 1924; *Riocypris* Klie 1935c.

Key to the genera

1. Tubercles absent along the valve margins (Fig. 148a, b) 2
– Tubercles present at least on one margin 3

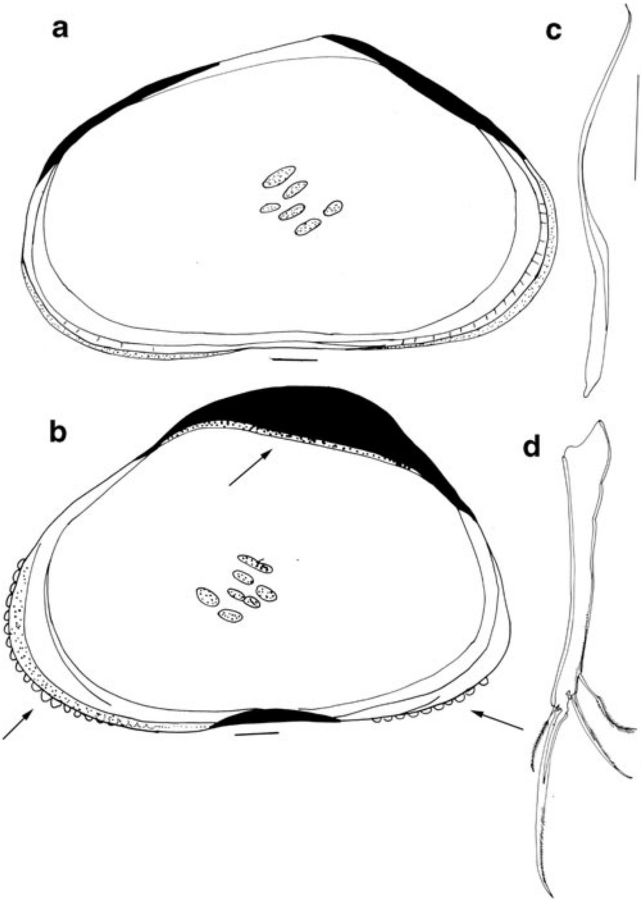


Fig. 149 Line drawings: *Cyprinotus cingalenis* Brady 1886a: (**a**) LV, inside view; (**b**) RV, inside view, *arrows* pointing the tubercles along the margins and the flange; (**c**) UR attachment; (**d**) UR. Scales = 0.1 mm

2. Both “d1” and “d2” setae present on L6 (Fig. 148c) . . . *Riocypris* Klie 1935c
– Only seta “d1” present . . . . *Homocypris* Sars 1924
3. Tubercles present on LV (Fig. 151b), RV overlapping LV frontally *Hemicypris* Sars 1903a
– Tuberlces present on RV (Figs. 149b and 151a), LV overlapping RV frontally 4
4. Dorsal hump present on RV (Fig. 149b) . . . . *Cyprinotus* Brady 1886a
– Dorsal hump on RV absent . . . . *Heterocypris* Claus 1892

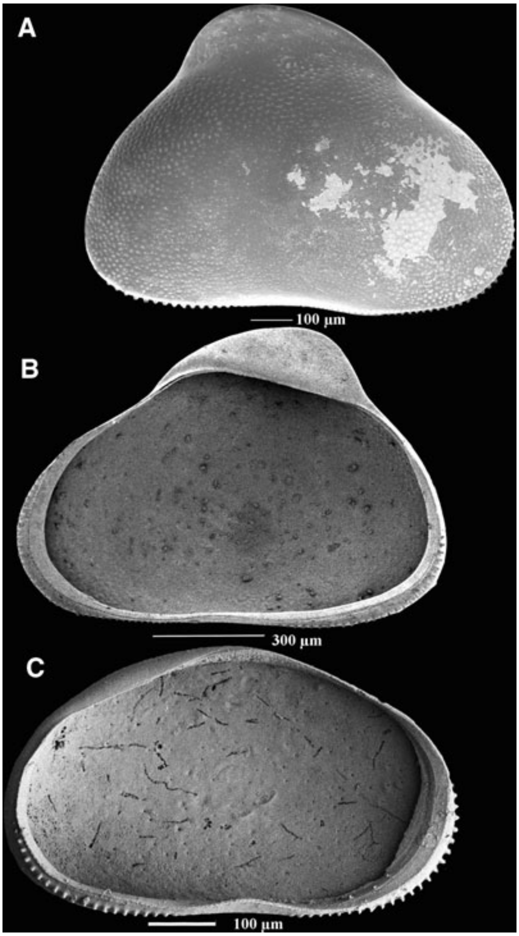


Fig. 150 SEM: (**a**, **b**) *Cyprinotus cingalenis* Brady 1886a; (**c**) *Hemicypris ovata* Sars 1903a: (**a**) RV, outside view; (**b**) RV, inside view; (**c**) LV, inside view

Remarks

There is some confusion in the literature regarding the differences between genera *Cyprinotus* Brady 1886a and *Heterocypris* Claus 1892. Some species of the genus *Heterocypris* have a dorsal hump on RV, but there are also some species in the other genus without the hump. Both genera need to be revised and their current diagnosis amended with possibly new characters. Also, there seems to be variability in the presence of the marginal tubercles. At the moment this is one of the key characters in the generic diagnosis of all the genera of Cyprinotinae, and therefore, most of the species that are aberrant in that regard were not put in the keys.

Cyprinotus Brady 1886a

Diagnosis: Valves asymmetrical, RV sometimes overlapping LV on all free margins, dorsally often with a well-developed flange (Fig. 149b). RV with marginal

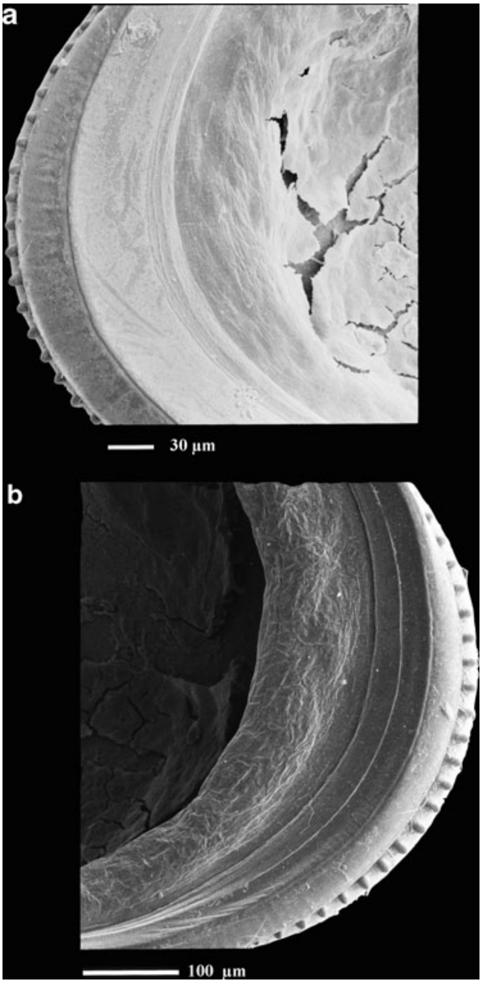


Fig. 151 SEM: (**a**) *Heterocypris barbara* (Gauthier and Brehm 1928); (**b**) *Hemicypris ovata* Sars 1903a: (**a**) RV, anterior margin; (**b**) LV, anterior margin. Photos: D. Keyser

tubercles (Fig. 150a, b). Terminal segment of the Mxl palp cylindrical (Fig. 152b). Prehensile palps asymmetrical. Both "a" setae on L5 present. Vibratory plate of the same appendage with six filaments (Fig. 152a). Setae "b" and "d" also present. Basal segment of L6 with only "d1" seta (Fig. 154b). L6 5-segmented. UR slender with long and thin posterior seta. Both claws present (Fig. 149d). Outer lobe of hemipenis distally foot like (Fig. 154a), inner lobe rounded.

Type species: *C. cingalensis* Brady 1886a

Species list with type locality and type material

1. *C. americanus* Cushman 1905. Grove Lane ditch, Nantucket, Massachusetts, USA, 41°17′N 70°05′W: Repository of the type material unknown.

Fig. 152 Line drawings: *Cyprinotus cingalenis* Brady 1886a: (**a**) L5; (**b**) Mxl palp; (**c**) prehensile palp. Scale = 0.1 mm

2. *C. cingalensis* Brady 1886a. Colombo, Sri Lanka, 06°55′N 79°50′E: Syntype, HM – NEWHM:1.56.25.
3. *C. crenatus* (Turner 1893). The name of this species appears as *C. crena* Turner; *C. crenata* Turner. The name used here is from Kempf (1980a). Ponds, Cincinnati, Ohio, USA, 39°09′N 84°27′W: Repository of the type material unknown.
4. *C. dentata* (Sharpe 1910). Stanford, Nebraska, USA, 41°14′N 95°55′W: Types, SM – 39513.
5. *C. flavescens* Brady 1898. Surroundings of Dunedin, New Zealand, 45°52′S 170°30′E: Repository of the type material unknown.
6. *C. inconstans* Furtos 1936b. Pisté, Yucatán, Mexico, 20°42′N 88°35′W: Holotype (♀), SM – 67963.

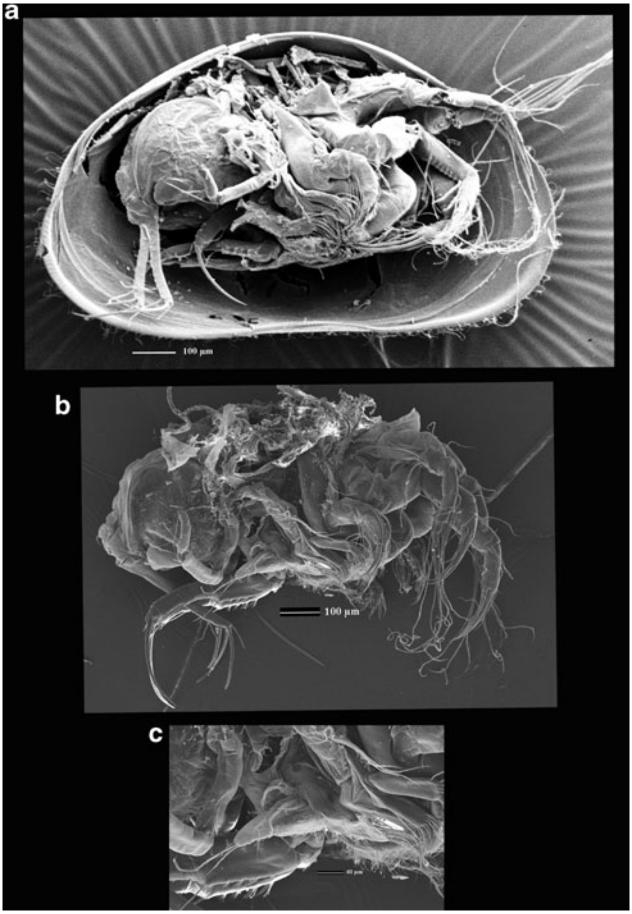


Fig. 153 SEM: (**a**) *Heterocypris salina* (Brady 1868); (**b**, **c**) *Heterocypris reptans* (Kaufmann 1900a): (**a**) inside view of the soft parts; (**b**) soft body; (**c**) L5. Scale = 0.1 mm. (**a**) Photo: D. Keyser

7. *C. newmexicoensis* Ferguson 1967c. Temporary pond, New Mexico, USA, 34°30′N 106°00′W: Holotype (♀), SM – 113381.
8. *C. ohanopecoshensis* Ferguson 1966. Spring 2, Ohanopecosh Hot Springs, Longmire Mt. Rainier National Park, Washington, USA, 46°44′N 121°48′W: Holotype (♀), SM – 113013.
9. *C. pellucida* Sharpe 1897. Roadside pool near Havana, Illinois, USA, 40°18′N 90°03′W: Repository of the type material unknown.
10. *C. persica* Ghetti 1972. Rice Fields, Rasht, Iran, 37°16′N 49°35′E: Holotype (♀), IZUP – collection number unknown.

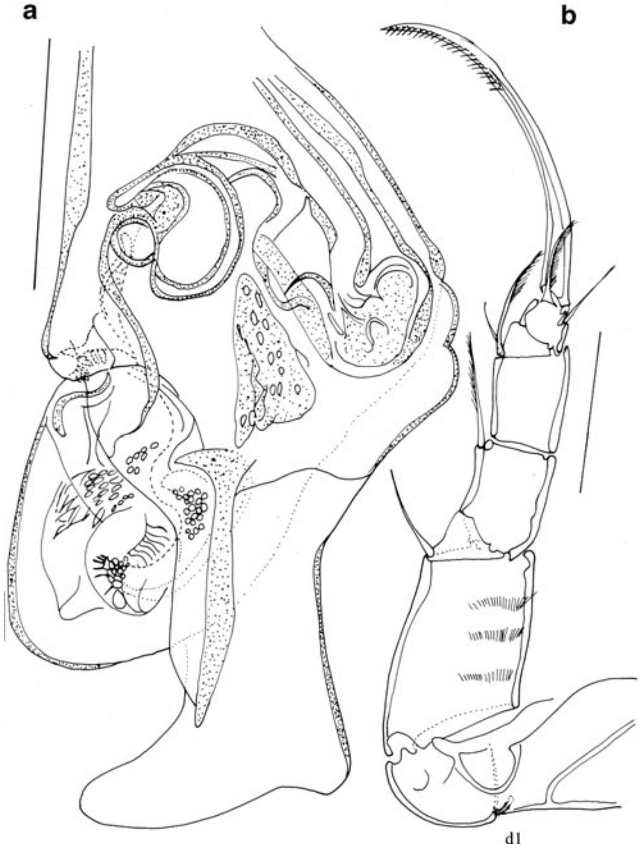


Fig. 154 Line drawings: *Cyprinotus cingalenis* Brady 1886a: (a) hemipenis; (**b**) L6. Scales = 0.1 mm

11. *C. scytoda* (Dobbin 1941). Pond, Portola Valley, California, USA, 37°23′N 122°14′W: Lectotype (♀), SM – 1134441.
12. *C. sulphureus* Blake 1931. Sulphur Spring, Utah, USA, 39°41′N 111°09′W: Repository of the type material unknown.
13. *C. tenuis* Henry 1923. Kensington, NSW, Australia, 33°55′S 151°13′E: Types, AMS – collection numbers unknown.
14. *C. unispinifera* Furtos 1936b. Yalic Aguada, Champotón, Campesche, Mexico, 19°21′N 90°43′W: Holotype (♀), SM – 67968.

Key to the species

1. RV overlapping LV dorsally with well-developed flange . . . . . *C. cingalensis* Brady 1886a

– No such flange developed 2

2. Valves in lateral view elliptical . . . . *C. inconstans* Furtos 1936b
– Valves in lateral view reniform or elongated 3
3. Antero-ventral and postero-ventral margins in lateral view angular . . . . *C. tenuis* Henry 1923
– Antero-ventral and postero-ventral margins in lateral view rounded 4
4. Anterior seta on the UR reaching and slightly exceeding middle L of anterior claw 5
– Anterior seta on the UR not reaching middle (only 1/3) L of anterior claw . 6
5. Swimming setae on A2 not reaching tips of terminal claws . . . . *C. sulphureus* Blake 1931
– Swimming setae on A2 exceeding tips of terminal claws *C. ohanopecoshensis* Ferguson 1966
6. In lateral view, valves with protruding and narrow posterior margin *C. dentata* Sharpe 1910
– In lateral view, posterior margin broadly rounded 7
7. Ramus of UR very short, almost as long as anterior claw . . . . *C. scytoda* (Dobbin 1941)
– Ramus of UR much longer than anterior claw (almost twice as long) 8
8. Surface of the valves reticulated . . . . *C. newmexicoensis* Ferguson 1967c
– Surface of the valves smooth . . . . *C. pellucida* (Sharpe 1897)

Species not included in the key
The following species currently belonging to the genus *Cyprinotus* have not been included in the key: *C. americanus* Cushman 1905; *C. crenatus* (Turner 1893); *C. flavescens* Brady 1898; *C. persica* Ghetti 1972; and *C. unispinifera* Furtos 1936b. Descriptions of these five species do not mention the presence of the marginal tubercles on either of the valves, so it is uncertain if they belong to this genus. The last species has a very prominent spine-like extension on the posterior margin of LV and the UR very similar with the representatives of the subfamily Cypricercinae (with very long and thin ramus and a very short posterior seta), so this species doubtfully belongs into the genus *Cyprinotus*. The other species Furtos (1936b) described from the Yucatan Peninsula, *C. inconstans* Furtos 1936b might also belong to the subfamily Cypricercinae rather than Cyprinotinae.

Ecology and distribution (Fig. 155)
Species live usually in ponds, often temporary ones. The genus is mostly distributed in North America and South East Asia.

***Hemicypris* Sars 1903a**

Diagnosis: RV overlapping LV on all free margins. LV with marginal tubercles (Fig. 150c). Terminal segment of the Mxl palp slightly trapezoidal. Prehensile palps asymmetrical. Both “a” setae on L5 present. Vibratory plate of the same appendage

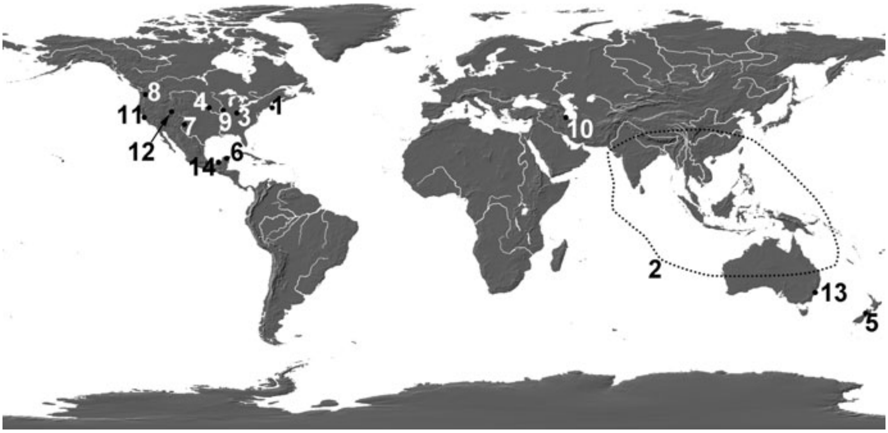


Fig. 155 Distribution of *Cyprinotus* Brady 1886a: Numbers correspond to the species list

with six filaments. Setae "b" and "d" also present. Basal segment of L6 with only "d1" seta. L6 5-segmented. UR slender with long and thin posterior seta. Both claws present.

Type species: *H. pyxidata* (Moniez 1892)

Species list with synonyms, type locality, and type material

1. *H. anomala* (Klie 1938d). Rice Fields, Uzanto, Taiwan, 23°47′N 120°10′E: Syntypes, ZMK – UR-653.
2. *H. arorai* (Battish 1981b). Muddy pond, road Jullundur-Ludhiana, Punjab, Pakistan, 31°25′N 75°37′E: Holotype (♀), PAU – O-80 F2.
3. *H. aurita* (Klie 1939a). Stream, Lokitang, Rudolf Lake, Kenya, 03°30′S 36°00′E: Syntypes ZMK – UR-726.
4. *H. bairdi* Martens and Wouters 1985. Pools at Nagpur, Mahārāshtra, India, 21°10′N 79°12′E: Holotype (♀), BM – 1985.1.
5. *H. barbadensis* Broodbakker 1983b. WH 867, Cole's Pasture Pond and Mill, St. Philip, Barbados, 13°09′00″N 59°25′33″W: Holotype (♀), ZMA – Ost. 150.762A.
6. *H. bhatiai* Battish 1981b. Temporary pond, village Dhaba, Lohara, Ludhiana District, Punjab, India, 32°22′N 75°02′E: Holotype (♀), PAU – O-20 F1.
7. *H. communis* (Klie 1940c). Açuden, Brazil, 06°23′S 38°58′W: Syntypes, ZMK – UR-716, 720, 724, 728, 738.
8. *H. congenera* (Vávra 1897). Ugogo, Tanzania, 05°04′S 34°04′E: Repository of the type material unknown.
9. *H. decorata* (Daday 1910b). Zoological Garden, Giza, Egypt, 30°00′N 31°12′E: Repository of the type material unknown.
10. *H. dentatomarginata* (Baird 1859b). Pools, Nagpur, Mahārāshtra, India, 21°10′N 79°12′E: Lectotype, BM – 1945.9.26.126.

Syn.: *Cyprinotus marginatodentatus* Baird 1859b

11. *H. derweshensis* Battish 1981b. Pond, village Derwesh, road Phagwara-Nurmahal, Punjab, India, 31°13′N 75°46′E: Holotype (♀), PAU – O-83 F1.
12. *H. dissona* Victor and Fernando 1976. Temporary pool in a rock quarry opposite the Department of English building, Madurai University, Madurai area, Tamil Nadu, India, 09°56′N 78°07′E: NMNSO – 21582.
13. *H. exigua* Broodbakker 1983b. WH 390, Pool at the Museum Garden, Mundo Nobo, Curaçao, Netherlands Antilles, 12°06′05″N 68°56′35″W: Holotype (♀), ZMA – Ost. 150.757.
14. *H. falcata* Victor and Fernando 1976. Salem, Tamil Nadu, India, 11°39′N 78°10′E: Holotype (♀), NMNSO – 21580.
15. *H. fossulata* (Vávra 1897). Mud, Usaramo, Zimbabwe, 17°19′S 31°29′E: Repository of the type material unknown.
16. *H. fuelleborni* (Daday 1910a). Rikwa Lake, Nigeria, 10°59′N 07°09′E: Types, HMNH – IV/P-160.
17. *H. futunaensis* Victor and Fernando 1978b. Hole in a lump of coral, Mission Bay, Futuna, Solomon Islands, 08°18′S 160°46′E: Holotype (♀), BM – 1977.124.
18. *H. gillensis* (Battish 1981b). Pond, Gill, Ludhina–Malerkotla road, Punjab, India, 30°54′N 75°51′E: Holotype (♀), PAU – O-82 F1.
19. *H. humbertii* (Gauthier 1933b). Temporary pools, Ambovombe, Toliara Province (formerly Province of Fort Dauphin), Madagascar, 25°10′S 46°05′E: Repository of the type material unknown.
20. *H. intermedia* (Lindroth 1953). Swamp, N of Ngong Hills, Kenya, 01°24′S 36°38′E: Repository of the type material unknown.
21. *H. inversa* (Daday 1913). Ku-Gudie, between Phitshane and Kooa, Kalahari, 25°45′S 25°06′ E: Types, HMNH – IV/543.
22. *H. kaufmanni* (Vávra 1906). Stoup, Osawa Temple (Bronze Horse Temple), Nagasaki, Japan, 32°45′N 129°52′E: Repository of the type material unknown.
23. *H. kawagaensis* Okubo 2004. Mino town (today part of Mitoyo city), Kagawa, Japan, 34°10′18″N 133°43′00″E: Repository of the type material unknown.
24. *H. kibiensis* Okubo 1990b. Paddy fields, Ashimori, Okayama, Japan, 34°39′N 133°55′E: Holotype (♀), SJU (?) – FO-172.
25. *H. kissi* Martens 1984b. Niagara Swamp, Kavimvira, DR Congo, 03°20′S 29°10′E: Repository of the type material unknown.
26. *H. kliei* (Lindroth 1953). Ferguson Bay, Lake Rudolf, Kenya, 03°30′S 36°00′E: Repository of the type material unknown.

Syn.: *H. posterotruncata* Bate 1970

27. *H. largereticulata* (Rome 1969). Fada, Chad, 17°11′N 21°35′E: Repository of the type material unknown.
28. *H. levis* (Hartmann 1964). Lagoon, near Dezful, Iran, 32°20′N 48°20′E: Syntypes, ZMK – UR-27 510, 27 528–9.
29. *H. malerkotlaensis* Battish 1981b. Main Toba, Malerkotla, Punjab, India, 30°31′N 75°58′E: Holotype (♀), PAU – O-19 F2.

30. *H. megalops* Sars 1903a. Sumatra. Exact type locality unknown, the species was raised from dried mud. Sars (1903a) mentioned two provinces in Sumatra: Deli and Langkat. Lectotype, NHMO – F12292a/b.
31. *H. mizunoi* Okubo 1990b. Paddy fields, Ashimori, Okayama, Japan, 34°39′N 133°55′E: Holotype (♀), SJU (?) – FO-183.
32. *H. nipponica* Okubo 1990b. Paddy fields, Ashimori, Okayama, Japan, 34°39′N 133°55′E: Holotype (♀), SJU (?) – FO-153.
33. *H. nonstriata* (Lindroth 1953). Swamp, N of Ngong Hills, Kenya, 01°24′S 36°38′E: Repository of the type material unknown.
34. *H. okayamenesis* Okubo 2004. Kuratomi, Okayama, Japan, 34°38′30″N 133°58′22″E: Repository of the type material unknown.
35. *H. ovata* Sars 1903a. Sumatra. Exact type locality unknown, the species was raised from dried mud. Sars (1903a) mentioned two provinces in Sumatra: Deli and Langkat. Lectotype (♀), NHMO – F12293a.
36. *H. pailensis* Battish 1981b. Pond, Nawan Pind, Pail, District Ludhiana, India, 32°27′N 74°17′E: Holotype (♀), PAU – O-88 F2.
37. *H. paucipustulosa* Victor and Fernando 1981f.Fish pond, Calamba, Luzon, Philippines, 14°12′N 121°09′E: Holotype (♀), NMNSO – 21629.
38. *H. pyxidata* (Moniez 1892). Luwu, South Sulawesi, Indonesia, 01°50′S 120°31′E: Repository of the type material unknown.
39. *H. rara* (Klie 1940c). Artificial lake, Pernambuco State, Brazil, 08°00′S 37°00′W: Syntypes, ZMK – UR-734.
40. *H. reticulata* (Klie 1930a). Puddle, Nanahua, Paraguay, 59°30′W 23°30′S: Lectotype, ZMK – UR-642a.
41. *H. salaria* (Hartmann 1962). Brackish water, Lenga Estuary, Concepción, Chile, 36°49′S 73°02′W: Syntypes, ZMH – K-27 512.
42. *H. stenoglypha* (Rome 1969). Fada, Chad, 17°11′N 21°35′E: Repository of the type material unknown.
43. *H. vulgaris* Okubo 1990b. Paddy fields, Ashimori, Okayama, Japan, 34°39′N 133°55′E: Holotype (♀), SJU (?) – FO-163.

Key to the species

1. Posterior claw on the UR equaling only 1/3 of anterior claw . . . *H. decorata* (Daday 1910b)

– Posterior claw longer 2

2. Posterior seta on the UR as long or longer than anterior claw 3

– Posterior seta on the UR clearly shorter than anterior claw 4

3. In lateral view, dorsal margin of RV arched, ventral margin concave around mouth region . . . . *H. kissi* Martens 1984b

– In lateral view, dorsal margin of RV rounded, ventral margin convex . . . *H. pyxidata* (Moniez 1892)

4. Posterior claw on the UR less than 70% of the anterior one 5

– Posterior claw on the UR more than 70% of the anterior one 19

5\. Posterior seta on the UR shorter than posterior claw 6

– Posterior seta on the UR as long as or longer than posterior claw 11

6\. Surface of the carapace smooth 7

– Surface of the carapace punctate 9

7\. Both lateral setae on the protopod of L5 in females shorter than ½ of the medial seta 8

– At least one of the lateral setae longer than ½ of the medial seta . . . *H. ovata* Sars 1903a

8\. Greatest H more than 60% of L . . . . . . *H. dissona* Victor and Fernando 1976

– Greatest H les than 60% on L . . . . . . *H. falcatus* Victor and Fernando 1976

9\. In lateral view, dorsal margins of both valves highly arched and greatest H more than 60% of L . . . . *H. malerkotlaensis* Battish 1981b

– In lateral view, dorsal margins more evenly rounded and the greatest H less than 60% of L 10

10\. Lateral lobe of the hemipenis distally rounded (globular) . . . . . *H. pailensis* Battish 1981b

– Lateral lobe of the hemipenis distally foot shaped . *H. inversa* (Daday 1913)

11\. Surface of the carapace smooth 12

– Surface of the carapace reticulated 13

12\. Genital field with a finger-like process . . . . *H. communis* (Klie 1940c)

– No finger like process . . . . *H. rara* (Klie 1940c)

13\. Posterior margin evenly rounded 14

– Posterior margin slightly angular 15

14\. Claws on the third masticatory process of the Mxl strongly serrated . . . . *H. stenoglypha* (Rome 1969)

– Only one claw slightly serrated 16

15\. In dorsal view, anterior overlap not prominent . . . . *H. paucipustulosa* Victor and Fernando 1981f

– In dorsal view, anterior overlap prominent . . *H. humbertii* (Gauthier 1933b)

16\. Posterior seta on the UR longer than posterior claw . . . . . . *H. largereticulata* (Rome 1969)

– Posterior seta not longer 17

17\. In dorsal view, both anterior and posterior ends rounded . . . . . . *H. reticulata* (Klie 1930a)

– In dorsal view, anterior end much narrower 18

18\. In lateral view, antero-dorsal margin evenly sloping toward anterior . . . . *H. derweshensis* Battish 1981b

– In lateral view, antero-dorsal margin more steeply sloping toward anterior *H. congenera* (Vávra 1898)

19. Posterior seta on the UR as long or longer than posterior claw 20
– Posterior seta of the UR shorter than posterior claw 25

20. Both valves with marginal tubercles .... *H. mizunoi* Okubo 1990b
– Only LV with marginal tubercles 21

21. Antero-dorsal margin sinusoid .... *H. aurita* (Klie 1939a)
– Antero-dorsal margin rounded 22

22. Dorsal margin flat .... *H. bairdi* Martens and Wouters 1985
– Dorsal margin rounded or arched 23

23. Posterior margin narrower than anterior, surface of the carapace smooth ..... *H. megalops* Sars 1903a
– Posterior margin equally wide as anterior one, surface of the carapace punctated 24

24. In dorsal view, anterior end cuneiform .... *H. fossulata* (Vávra 1897)
– In dorsal view, anterior end rounded ... *H. barbadensis* Broodbakker 1983b

25. Dorsal margin evenly rounded 26
– Dorsal margin arched 27

26. Postero-dorsal margin broadly rounded .... *H. kaufmanni* (Vávra 1906)
– Postero-dorsal margin more inclined toward posterior end .... *H. salaria* (Hartmann 1962)

27. Outer lobe of hemipenis distally rounded .... *H. anomala* (Klie 1938d)
– Outer lobe of hemipenis distally dillated .... *H. levis* (Hartmann 1964)

Species not included in the key

The following species currently belonging to this genus are not included in the key: *H. arorai* (Battish 1981b); *H. bhatiai* (Battish 1981b); *H. exigua* Broodbakker 1983b; *H. fuelleborni* (Daday 1910a); *H. futunaensis* Victor and Fernando 1978b; *H. gillensis* (Battish 1981b); *H. intermedia* (Lindroth 1953); *H. kawagaensis* Okubo 2004; *H. kibiensis* Okubo 1990b; *H. kliei* (Lindroth 1953); *H. nipponica* Okubo 1990b; *H. nonstriata* (Lindroth 1953); *H. okayamenensis* Okubo 2004; *H. vulgaris* Okubo 1990b. *Hemicypris arorai* (Battish 1981b), *H. bhatiai* (Battish 1981b), and *H. gillensis* (Battish 1981b) were originally described in the genus *Heterocypris* Claus 1892, but transferred into the genus *Hemicypris* by Savatanalinton and Martens (2008). These three species stand apart from the rest of their congeneres by the LV overlap over RV and by the presence of the tubercles on the RV. Species *H. futunaensis* is extremely similar to *H. levis* (Hartmann 1964) and might be its junior synonym. *Hemicypris exigua* Broodbakker 1983b is very similar to *H. anomala* (Klie 1938d), with a slight difference in the appearance of the carapace. Unfortunately, Broodbakker species was described only after females, while Klie (1938d) had both sexes. *Hemicypris intermedia* (Lindroth 1953) and *H. kliei*

(Lindroth 1953) are also described only after females, and they belong to a group where posterior claw on the UR is less than 70% of the L of the anterior claw, but they do not have any outstanding features to be distinguished at the moment from the rest of the species belonging to this group. It is a similar case with *H. nonstriata* (Lindroth 1953), although it belongs to the second group, where the posterior claw is longer. Okubo (1990b, 2004) described his species briefly giving details only of the carapace and/or UR.

Ecology and distribution (Fig. 156)
Species mostly live in small, temporary freshwater bodies, tolerating also high degree of salinity. The genus is distributed mostly in the southern hemisphere.

***Heterocypris* Claus 1892 [Syn.: *Cyprinotoides* Masi 1925]**
Diagnosis (after Meisch 2000): Carapace relatively stout in lateral view, dorsal margin usually distinctly arched. RV anteriorly and posteriorly usually crenulated (with small tubercles). LV larger than RV and overlapping the latter ventrally. RV without dorsal flange. UR well developed, anterior claw longer than half L of the ramus.

Type species: *H. incongruens* (Ramdohr 1808)

Species list with synonyms, type locality, and type material

1. *H. affinis* Klie 1930a. Cistern pool, surroundings of Nanahua mission, in valleys suddenly flooded after rainfalls (riachos), Rio Monte Lindo, Paraguay, 23°30′S 59°30′W: Syntype, ZMK – UR-641.
2. *H. anitae* Battish 1981b. Pond at Nawan Pind near Pail, District Ludhiana, Punjab, India, 30°43′N 76°03′E: Holotype (♀), PAU – O-79 F_1.

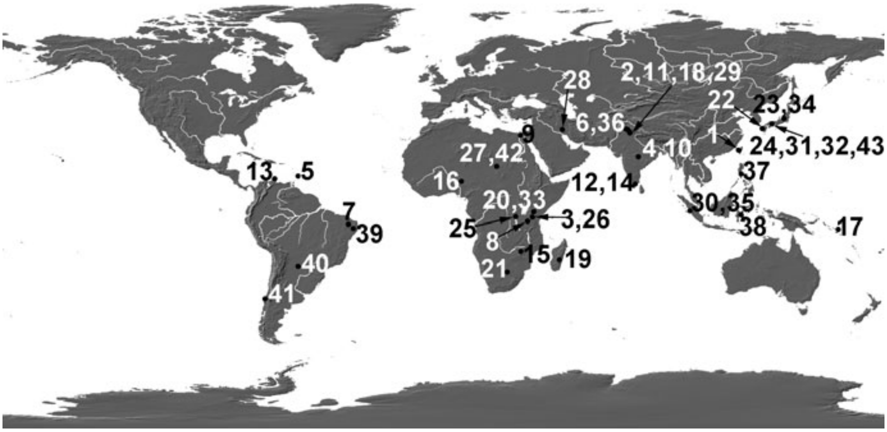


Fig. 156 Distribution of *Hemicypris* Sars 1903a: Numbers correspond to the species list

3. *H. antillensis* Broodbakker 1982. Semi-permanent, open well, Pos Soedesthoed, S Bonaire, Netherlands Antilles, 12°02′N 68°15′W: Holotype (♀), ZMA – 150.731.
4. *H. aurea* (Sars 1895). Dried mud, swamp at Knysna, Western Cape, South Africa, 34°02′S 23°02′E: Type, NHMO – F 4336.
5. *H. balnearia* (Moniez 1893). Edge of water, thermal bath Hammam Meskhoutine (Hammam Chelalla/Dbegh), close to Guelma, Annaba, Algeria, 36°27′N 07°25′E: Repository of the type material unknown.
6. *H. barbara* (Gauthier and Brehm 1928). Large natural "R'dir" (temporary pool without outlet) on 199 km E of the road Algier–Djelfa/Laghouat, Algeria, 35°35′N 02°53′E: Repository of the type material unknown.

   Syn.: *H. turcica* Schäfer 1952; *H. nurrensis* Tagliasacchi-Masala 1968b; *H. bulgarica* Sywula 1968; *H. levis* Hartmann 1964; *H. erikae* Petkovski and Keyser 1995; *H. vitrea* Sywula 1968; *H. rostrata* Beldescu 1961

7. *H. bogotensis* Roessler 1982. Park "El Largo," Bogota, Savannah of Bogota, Colombia, 04°44′N 74°05′W: Holotype (♀), ICN-MHN – UR-1-79.
8. *H. bosniaca* Petkovski, et al. 2000. Well at the house of Cika Nadje, Buseni village near Prijedor, Republika Srpska, Bosnia and Herzegovina, 44°58′N 16°42′E:Holotype (♀), NHMS – Ostr. 98/1.
9. *H. calva* (Rome 1965b). Toeslaan, ca. 48 km N of Kakamas, Northern Cape, South Africa, 28°18′S 20°37′E: LZM – collection number unknown.
10. *H. capensis* (Müller 1908). Plumstead, Zeekoevlei, near Simon's Town, Western Cape, South Africa, 34°01′S 18°28′E: Syntypes, ZMB – ZMBln 13146.
11. *H. carolinensis* (Ferguson 1958). Weedy, shallow ditch alongside US Hwy 33, ca. 8 km E of Orangeburg, South Carolina, USA, 33°28′N 80°54′W: Holotype (♀), SM – 97708.
12. *H. chandrai* (Arora 1931). Lahore, Punjab, Pakistan, 31°29′N 74°23′E: Repository of the type material unknown.
13. *H. ciliata* (Thomson 1879). Stagnant freshwater near Dunedin, Otago, New Zealand, 45°52′S 170°30′E: Repository of the type material unknown.
14. *H. congenera* (Vávra 1897). Ugogo, Tanzania, 06°07′S 35°30′E: ZMB – collection number unknown.
15. *H. dubia* Sars 1910. Bukoba, W shore of Lake Victoria, Tanzania, 01°19′S 31°48′E: Repository of the type material unknown.
16. *H. euplocama* (Lowndes 1931a). Lake Elgol (propably at Mount Elgon), Uganda, 01°8′N 34°31′E: BM – collection number unknown.
17. *H. exigua* (Gauthier and Brehm 1928). Temporary natural pool beside the hill, halfway on the road "du Bou Liff" from El Kala to the village's standpost, Algeria, 36°54′N 08°24′E: Repository of the type material unknown.
18. *H. favosa* Victor and Fernando 1980. Ditch on roadside, Camaguin Island, Philippines,19°19′N 121°27′E: Holotype (♀), SM – 71507.
19. *H. fluviatilis* (Furtos 1933). Tontogany Creek and Maumee River, near Toledo, Ohio, USA, 41°25′N 83°44′W: Types, UAPC – 1029–1031.

20. *H. gevgelica* Petkovski, Scharf and Keyser 2000. Ground water pond with additional supply of precipitation, fields at E outskirts of Gevgelija town, S Macedonia, 41°08′N 22°31′E: Holotoype (♀), NHMS – PMMS-Ostr100/1.
21. *H. giesbrechtii* (Müller 1898). Waterhole, E Aldabra, Seychelles, 09°26′S 46°13′E: Repository of the type material unknown.

    Syn.: *Cyprinotus imus* Gauthier 1934b; *C. hesperidum* Masi 1925; *C. rotondus* Rome 1969; *C. incongruens* Masi 1905a; *Cypris gunningi* Methuen 1910

22. *H. glauca* (Furtos 1933). Stony bars, weedy inlets and rock-pools of Lake Erie, Ohio, USA, 41°23′N 82°11′W: Types (♂, ♀), USNM – 311084–85.
23. *H. gregaria* (Skogsberg 1917). Mangona well, St. Georges Ranges, Kimberley District, WA, NW Australia, 18°40′S 125°00′E: Types, SMNH – 1617.

    Syn.: *Cyprinotus dentatomarginatus* Sars 1889

24. *H. humilis* (Lindroth 1953). Small temporary waters immediately N of Ngong Hills, W of Nairobi, Rift Valley, Kenya, 01°24′S 36°38′E: Syntypes, ZMU –229a-f.
25. *H. hyalina* Klie 1930a. Flooded swamp mud, Makthlawaiya mission, Paraguay, 23°˜25′S 58°˜19′W: Syntypes, ZMK – UR-644.
26. *H. imus* (Gauthier 1934b). Temporary pool near Ambondro, W of Ambovombe, Toliara Region (formerly Province of Fort Dauphin), Madagascar, 23°13′S 45°49′E: Repository of the type material unknown.
27. *H. incongruens* (Ramdohr 1808). Stagnant water close to the entrance of the Botanical Garden, Neumarkt, Halle, Germany, 51°29′N 11°57′E: Type (♀), PAU – O-93 F$_1$, F$_a$.

    Syn.: *Cypris conchacea* (Linné 1758); *C. fusca* Straus 1821; *Cyprinotus hertwigi* Lindner 1920b; *Heterocypris obliqua* Lowndes 1936; *Monoculus ruber* Jurine 1820; *M. aurantius* Jurine 1820

28. *H. indica* (Battish 1981b). Moti Bagh Lake, Patiala, India, 30°15′N 76°30′E: Holotype (♀), PAU – O-94F$_1$.
29. *H. kervillei* (Daday 1911b). Artificial pond, countryside of Damascus, Syria, 33°30′N 36°17′E: Types, HMNH – IV-255.
30. *H. leana* (Sars 1896a). Pond, near Hay, NSW, Australia, 34°30′S 144°51′E: Repository of the type material unknown.
31. *H. luzonensis* Neale 1981. Flooded soil in rice fields, International Rice Research Institute Farm, Los Baños area, Laguna, Luzon Isand, Philippines, 14°10′N 121°15′E: Holotype (♀), UH – HU.308.R.1a.
32. *H. makua* (Tressler 1937). Makua, Oahu Island, Hawaii, USA, 21°31′N 158°12′W: Holotype (♀), SM – 71506.
33. *H. malini* Deb 1983. Rainwater pond, Duttuwadi, ca. 7 km from Pune on the way to Sinhagad, Maharashtra State, India, 18°27′N 73°48′E: Holotype (♀), ZSI – C 1164/2.

34. *H. margaritae* Margalef 1961. Pond next to southern side of the road Punta de Piedras - Porlamar, very close to first populated place, Isla de Margarita, Venezuela. 10°56′N 64°03′W: Type (♂), FIB – collection number unknown.
35. *H. nicaraguensis* Hartmann 1959. Beach, S of Granada, Nicaragua Sea, Nicaragua, 11°54′N 85°56′W: Syntypes, ZMH – K-27 511.
36. *H. nuda* (Victor and Michael 1975). Temporary freshwater pool, within Tallakulam Tank, Madurai, South India, 09°56′N 78°08′E: Holotype (♀), BSMU – Slide No. 1.
37. *H. nusbaumi* (Grochmalicki 1911). Sulfur Spring "Siwa Woda"/"Siwej Wody," Wyżyska near Szkło/Shklo, Galicia/Halychyna, Ukraine, 49°57′N 23°32′E: Repository of the type material unknown.
38. *H. oblonga* (Sars 1924). Otjituo, formerly Damaraland, WNW Namibia, 19°47′S 16°09′E: Types (♀), SAM – collection number unknown.
39. *H. ovularis* (Sars 1924). Ukualuthi and Ongka, formerly Ovamboland, N Namibia, 18°00′S 16°30′E: Types (♀, ♂), SAM – collection numbers unknown.
40. *H. panningi* Brehm 1934. Viña del Mar, Valparaíso, Chile, 33°01′S 71°33′W: Syntypes, ZMH – K-26 270, 25 783.
41. *H. persica* (Klie 1937b). Very small, shallow pool, upper Abbasabad Valley, Alborz Mountains, N Iran, 36°13′N 51°06′E: Syntypes, ZMK – UR-836.
42. *H. punctata* Keyser 1975. Marco Island, Florida, USA, 25°57′45″N 81°43′45″W: Holotype, ZMH – K-30332.
43. *H. putei* (Furtos 1936b). Pool D, Progreso, Yucatán, Mexico, 21°17′N 89°40′W: Holotype (♀), SM – 67965.
44. *H. reptans* (Kaufmann 1900b). Selhofen near Bern, Switzerland, 46°54′N 07°28′E: Types, RBINS – 00.1770-1773.

    Syn.: *Heterocypris brteki* Petkovski 1966

45. *H. rotundata* (Bronstein 1928). Turtle Lake (Ozero Kustba or Ozero Cherepash'ye), Tbilisi, Georgia, 41°42′N 44°45′E: Types, RIS – SMF Xe 20084–85.

    Syn.: *Cyprinotus dextrodepressus* Moroni 1961; *C. euplocamus* Lowndes 1931a

46. *H. sabirae* Guelen 1985. Hot-water pools, Kaynarca, Palanga, Bergama-İzmir, Turkey, 39°07′N 27°10′E: Holotype, ZMSIU D-1092.
47. *H. salaria* Hartmann 1962. Brackish water, Estero Lenga near Concepción, Central Chile, 36°49′S 73°02′W: Syntypes, ZMH – K-27 512.
48. *H. salina* (Brady 1868). Cooling-pond at Monkwearmouth Colliery, or a pond of somewhat brackish water, above high water mark, in a salt marsh N of River Coquet, below Warkworth, England, UK, 54°54′N 01°22′W: Types in the Brady Collection, HM – collection numbers unknown.

    Syn.: *Cyprinotus fretensis* Brady and Robertson 1870; *C. sobrinus* Masi 1932b; *C. maurus* Masi 1932a; *C. inaequivalvis* Bronstein 1928; *C. ichnusae* Anichini

1967; *Cypris lamperti* Lindner 1920a; *C. fragilis* Brady 1902; *C. prasina* Fischer 1855; *Eucypris palermitana* Fischer 1855

49. *H. sanukiensis* Okubo 2004. Ricefields, Mino town (today Mitoyo city), Kagawa, Shikoku, Japan, 34°10′18″N 133°43′00″E: Repository of the type material unknown.
50. *H. sarsi* (Brady 1906). Bottom of Lake Taupo, New Zealand, 38°48′S 175°54′E: Repository of the type material unknown.
51. *H. setoensis* (Okubo 1990b). Paddy fields (before rice was planted) near coast of Kurosaki, Kurashiki City, Okayama Prefecture, Honshu, Japan, 34°31′N 133°38′E: Holotype (♀), SUJ (?) – FO-387.
52. *H. similis* (Wierzejski 1893). Type locality unknown. Types (♀ and ♂), FCEN –LM 2902.
53. *H. somalica* (Masi 1925). Cut Geledi, Somalia, 03°40′N 45°44′E: Repository of the type material unknown.
54. *H. sydneia* (King 1855). Swamp near Wooloomooloo Bay, Sydney, NSW, Australia, 33°51′S 151°13′E: Types, NMV – J 9, 10.
55. *H. symmetrica* (Müller 1898). Aldabra, Seychelles, 09°25′S 46°22′E: Syntypes, ZMG – 24602.
56. *H. syriacus* (Daday 1911b). Koutaïfé, NE of Damascus, Syria, 33°31′N 36°17′E: Types, HNMH – IV-543.
57. *H. takedai* Okubo 1973. Rice field, Hachioji, Tokyo, Japan, 35°39′N 139°19′E: Holotype (♀), NSMT – collection number unknown.
58. *H. tatei* (Brady 1886b). Brackish pools, Dry Creek, N Adelaide, Australia, 34°49′S 138°36′E: Holotype (♂?), BM – collection number unknown.
59. *H. vandouwei* (Brehm 1923b). Peking, China, 39°54′N 116°23′E: Repository of the type material unknown.
60. *H. vatia* De Deckker 1981c. Hexham Swamp, behind University campus, Newcastle, NSW, Australia, 32°51′S 151°40′E: Holotype (♂), NMV – J1163.
61. *H. wolffhuegeli* (Méhes 1914). Stagnant water, Tupungato Mountain, Cordillera de Mendoza, Argentina, 32°54′S 69°49′W: Repository of the type material unknown.
62. *H. zugmayeri* (Brehm 1914). Balochistan, Pakistan, 28°16′N 64°11′E: Repository of the type material unknown.

Key to the species

1. In lateral view, valves very low, and elliptical 2
– In lateral view, valves rounded 4
2. In dorsal view, carapace laterally compressed . . . . . . *H. hyalina* Klie 1930a
– In dorsal view, carapace rounded 3
3. Posterior seta on the UR shorter than ½ L of the posterior claw, lateral lobe of the hemipenis elongated and narrow . . . . *H. anitae* Battish 1981b
– Posterior seta on the UR as long as the posterior claw, lateral lobe of hemipenis not so elongated and more square in its distal part . . . . *H. affinis* Klie 1930a

4. Posterior margin of LV with a clear extension (sinusoid) 5
– Posterior margin on LV without such extension, evenly rounded, or straight 7
5. Dorsal margin almost flat . . . . *H. aurea* (Sars 1895)
– Dorsal margin arched 6
6. In dorsal view, anterior overlap prominent . . . . *H. barbara* (Gauthier and Brehm 1928)
– In dorsal view, LV and RV almost equal . . . . *H. salina* (Brady 1868)
7. Antero-ventral margin of RV angular . . . . *H. oblonga* (Sars 1924)
– Antero-ventral margin of RV rounded 8
8. Greatest H situated well behind the middle, from which point dorsal margin inclined toward anterior end . . . . *H. vandouwei* (Brehm 1923b)
– Greatest H situated around the middle or on the fist third of L 9
9. Greatest H situated anteriorly and ventral margin with enlargement in front of the mouth region . . . . *H. persica* (Klie 1937b)
– Greater H around the middle, and no enlargement present in front of the mouth region 10
10. Dorsal margin almost flat 11
– Dorsal margin more or less arched 13
11. Posterior margin inclined . . . . *H. calva* (Rome 1965b)
– Posterior margin rounded 12
12. Posterior seta on the UR as long as posterior claw *H. congenera* (Vávra 1897)
– Posterior seta on the UR very short . . . . *H. dubia* Sars 1910
13. Posterior seta on the UR almost as long as posterior claw 14
– Posterior seta on the UR shorter (at the most slightly exceeding ½ L of posterior claw) 26
14. Swimming setae on A2 reduced . . . . *H. reptans* (Kaufmann 1900b)
– Swimming setae on A2 reaching minimum tips of terminal claws 15
15. Both anterior and posterior claws on the UR distinctively curved 16
– Claws more or less straight 17
16. Postero-dorsal margin slightly angular . . . . *H. imus* (Gauthier 1934b)
– Postero-dorsal margin rounded . . . . *H. takedai* Okubo 1973
17. Anterior claw on the UR considerably stronger (broader in the base) than the posterior one . . . . *H. kervillei* (Daday 1911b)
– Both claws more or less same in the base 18
18. Posterior claw on the UR almost the same L as anterior one . *H. incongruens* (Ramdohr 1808) and *H. rotundata* (Bronstein 1928)
– Posterior claw on the UR clearly shorter than anterior one 19

19. Posterior margin of RV clearly narrower than the anterior one . . . . *H. nusbaumi* (Grochmalicki 1911)
– Posterior and anterior margin equally wide 20
20. Surface of the carapace strongly punctuate . . . . . . *H. punctata* Keyser 1975
– Surface usually smooth or very lightly punctuate or reticulated 21
21. In lateral view, valves strongly arched 22
– In lateral view, valves rounded 23
22. Surface of the valves reticulated . . . . . *H. favosa* Victor and Fernando 1980
– Surface of the valves smooth . . . . *H. panningi* Brehm 1934
23. Greatest H on RV moved slightly behind the middle . . . . *H. euplocama* (Lowndes 1931a)
– Greatest H in the middle 24
24. Posterior claw on the UR only ½ as long as the anterior one . . . . . *H. makua* (Tressler 1937)
– Posterior claw longer 25
25. Seta "f" on L6 reaching distal end of penultimate segment
H. bogotensis Roessler 1982
– Seta "f" on L6 exceeding distal end of terminal segment . . . . *H. wolffhuegeli* (Méhes 1914)
26. In lateral view, dorsal margin angular, especially at the posterior end . . . 27
– Dorsal margin rounded 29
27. Anterior inner margin on both valves aberrant in the antero-dorsal part (with a small intrusion) . . . . *H. giesbrechtii* (Müller 1898)
– Inner margin evenly rounded 28
28. Terminal segment of the Mxl palp elongated *H. antillensis* Broodbakker 1982
– Terminal segment of the Mxl palp square shaped . . . . *H. gevgelica* Petkovski et al. 2000
29. Posterior margin on RV considerably narrower than LV . . . . . . *H. capensis* (Müller 1908)
– Posterior margin on RV almost equally wide as the anterior one 30
30. Finger on the right prehensile palp extremely swollen, its greatest W more than two times the W of the body . . . . *H. humilis* (Lindroth 1953)
– Finger on the right prehensile palp not so swollen 31
31. Outer lobe on the hemipenis almost equally wide and evenly curved
H. ovularis (Sars 1924)
– Outer lobe with a distinct proximal and distal part, the later in the shape of a foot 32
32. Distal margin of the "foot" part of the outer lobe of hemipenis concave . 33

– This margin more or less straight or slightly convex 36

33. Carapace strongly punctuate .... *H. putei* (Furtos 1936b)

– Carapace smooth or very slightly punctuate 34

34. Dorsal margin in males highly arched 35

– Dorsal margin in males rounded .... *H. fluviatilis* (Furtos 1933)

35. Greatest H situated in front of the middle, outer margin of the outer lobe of hemipenis wide and evenly rounded .... *H. glauca* (Furtos 1933)

– Greatest H situated around the middle and outer margin of the outer lobe of hemipenis narrow .... *H. sarsi* (Brady 1906)

36. Outer lobe of the hemipenis elongated ...... *H. symmetrica* (Müller 1898)

– Outer lobe on the hemipenis more square shaped *H. vatia* De Deckker 1981c

Species not included in the key
The presence of the "d1" and "d2" setae on the basal segments of L6 seems to be a very important characteristic for distinguishing genera of Cyprididae. The type species of the genus *Heterocypris* has only one seta, namely "d1," present, as well as many other species assigned to the genus. On the contrary, the following two species have both setae present, and they are not included in the key, as they probably do not belong to the genus *Heterocypris*: *H. carolinensis* (Ferguson 1958) and *H. margaritae* Margalef 1961 (this species was redescribed by Broodbakker 1982 and both "d" setae on the basal segment of L6 were drawn). Insufficiently described species are: *H. chandrai* (Arora 1931); *H. ciliata* (Thomson 1879); *H. gregaria* (Skogsberg 1917); *H. similis* (Wierzejski 1893); *H. sydneia* (King 1855); *H. tatei* (Brady 1886b); *H. sanukiensis* Okubo 2004 (description is in Japanese, drawings only of the valves are provided); and *H. setoensis* (Okubo 1990b) (this species is described only after carapace, and it has a hump on RV). *Heterocypris balnearia* (Moniez 1893) has very long setae on the posterior margin of the carapace (like *Isocypris*) and the terminal segment of L7 is very strange, either the specimen was juvenile, or the species does not belong to Cyprididae. *Heterocypris syriacus* (Daday 1911b) has a spatula-like terminal segment of the Mxl palp and a very strong posterior seta on the UR, looking more like it belongs to Herpetocypridinae. *Heterocypris exigua* (Gauthier and Brehm 1928) and *H. malini* Deb 1983 also have a spatula-like terminal segment of the Mxl palp. *Heterocypris indica* (Battish 1981b) has a clear dorsal hump on RV and should belong to the genus *Cyprinotus*. *Heterocypris luzonensis* Neale 1981 has tubercles on both valves, and although Neale (1981) states that it does not have tubercles on LV, they are clearly visible on the SEMs provided in the paper. *Heterocypris sabirae* Guelen 1985 is described almost only on the soft parts, and except for the note on the appearance of the valve margins, no other description of the carapace or its drawings are provided in that paper. *Heterocypris bosniaca* Petkovski et al. 2000 lacks tubercles on both valves; this is also the case with *H. reptans* (Kaufmann 1900a), but Martens (2000) indicated that the tubercles are visible on RV under the

SEM, so the latter species is included in the key. *Heterocypris leana* (Sars 1896a) has only carapace and UR briefly described. In *Heterocypris nicaraguensis* Hartmann 1959, RV overlaps LV anteriorly. Carapace is not illustrated for *H. zugmayeri* (Brehm 1914), and it is generally insufficiently described. The species has a very long "e" seta on L6. *Heterocypris salaria* Hartmann 1962 has tubercles on LV. *Heterocypris nuda* (Victor and Michael 1975) has, according to the authors, "beak-like claws" on L6, which is not clearly drawn. This species has a conspicuously thick anterior claw on the UR, but this may be misleading because of the very poor drawings. *Heterocypris somalica* (Masi 1925) is closely related to the group of species with a short posterior seta on the UR and a rounded dorsal margin, but because the males are not known, it is hard to separate it from this group.

Ecology and distribution (Fig. 157)
The species of this genus can be found in all kinds of freshwater bodies, including ones with higher salinity. Most of the widely distributed species have a wide range of ecological tolerance. The genus is cosmopolitan.

Homocypris Sars 1924

Diagnosis (modified after Sars 1924): Carapace moderately tumid, smooth, and elongate. Valves equal in size and no tubercles present on either of the valves. CIL anteriorly very broad. Terminal segment of the Mxl palp elongated and cylindrical. Prehensile palps asymmetrical. Only one seta ("d1") present on the basal segment of L6. UR well developed, but anterior claw not longer than half the ramus.

Type (and only) species: *H. conoidea* Sars 1924

Species list with type locality and type material
H. conoidea Sars 1924. Raised from mud from grassy park, Bergvliet Flats, Cape Town, South Africa, 30°00′S 26°00′E: Type (♀), SAFM – A 3796.

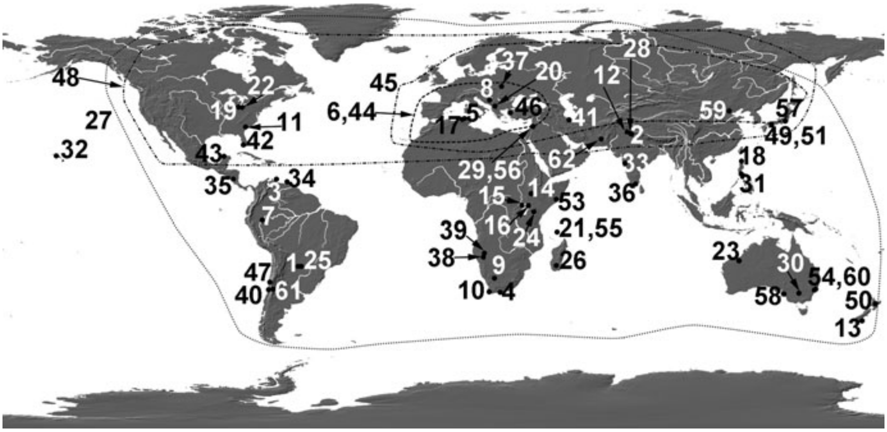


Fig. 157 Distribution of *Heterocypris* Claus 1892: Numbers correspond to the species list

Syn.: *Homocypris longirostrata* Rome 1965b

***Riocypris* Klie 1935c**

Diagnosis (after Karanovic 2008a): RV with inwardly displaced selvage at least anteriorly. Selvage on LV, if present, usually peripheral. Inner list prominent, especially on LV. Terminal segment of the Mxl palp cylindrical. Prehensile palps asymmetrical. Seta "d1" on L6 considerably longer than "d2" (usually three times), penultimate segment on the same leg clearly divided (Fig. 148c). Penultimate segment on L7 with only one seta. Caudal ramus thin and elongated, both claws and setae present, posterior seta not transformed into claw. Attachment simple.

Type species: *R. uruguayensis* Klie 1935c

Species list with type locality and type material

1. *R. fitzroyi* (McKenzie 1966a). Near junction of Broome-Derby-Fitzroy crossing roads, WA, Australia, 18°11′S 125°35′E: Holotype (♀), NMV – J23 24.
2. *R. hinzeaze* Karanovic 2008a. Friday Well, Depot Springs, Murchison Region, WA, Australia, 28°04′S 120°04′E: Holotype (♂), WAM – C35693.
3. *R. uruguayensis* Klie 1935c. Side river from Rio de la Plata, Santa Lucia, Uruguay, 34°52′S 56°42′W: Syntypes, ZMK – UR-998.

Key to the species

1. Dorsal margin highly arched, almost triangular . . *R. uruguayensis* Klie 1935c
– Dorsal margin evenly rounded 2
2. Anterior seta on the UR very short, reaching only ¼ of the anterior claw . . *R. hinzeaze* Karanovic 2008a
– Anterior seta on the UR much longer, more than ½ of the anterior claw *R. fitzroyi* (McKenzie 1966a)

Ecology and distribution (Fig. 158)
The species are found in the fresh open water bodies, as well in wells in the arid Australia. The genus is distributed in Australia and South America.

4.8 Subfamily Diacypridinae McKenzie 1978a

Diagnosis (modified after McKenzie 1978a): Small to medium sized ostracods, subtriangular or subrectangular (Figs. 159a, b and 160a), globular in dorsal and ventral views (Fig. 159d) often ornamented with reticulation or pits (Fig. 159c). Segments on A1 very small (Figs. 161a and 160b). Mxl palp rectangular (Figs. 161c and 160c). Vibratory plate on L5 reduced (Fig. 161d). Prehensile palps asymmetrical (Figs. 161b, d and 160d). Penultimate segment of L6 undivided (Fig. 162c). Terminal segment of L7 transformed into the pincer organ (Figs. 162a and 160e).

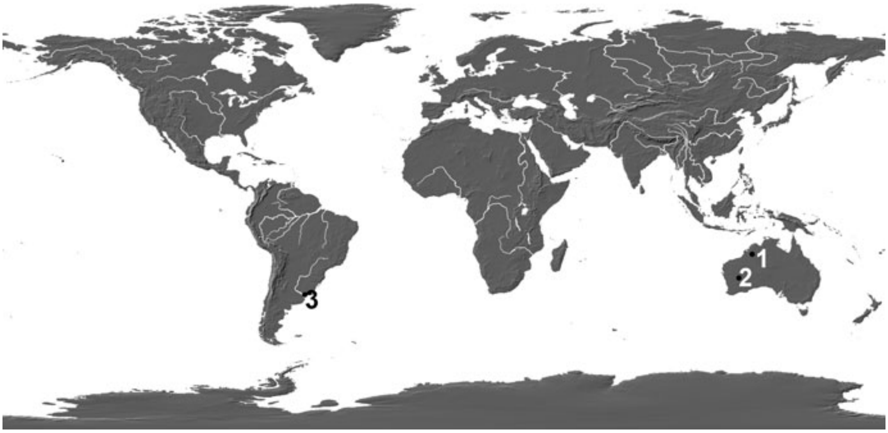


Fig. 158 Distribution of *Riocypris* Klie 1935c: Numbers correspond to the species list

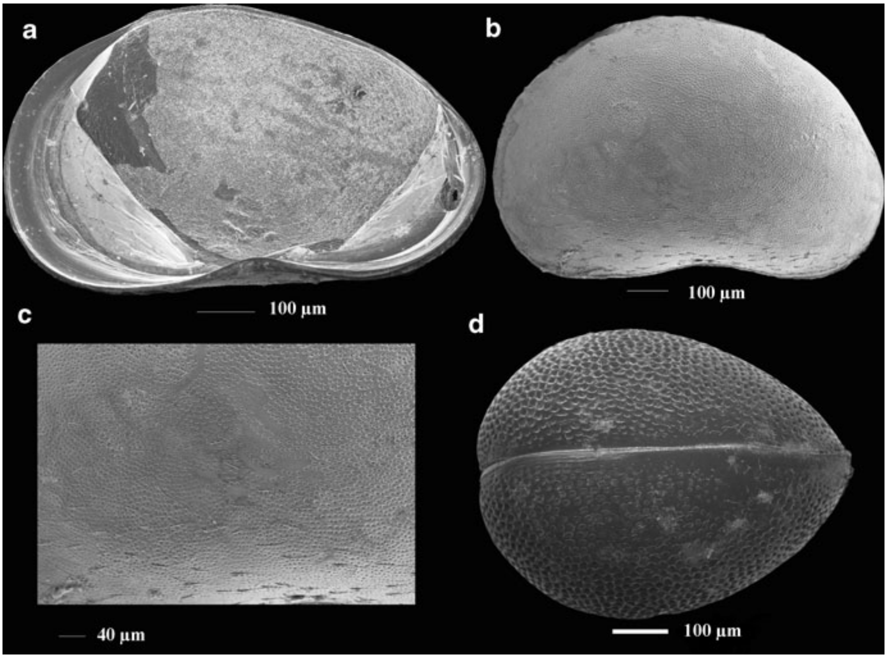


Fig. 159 SEM: *Diacypris whitei* (Herbst 1958): (**a**) RV, inside view; (**b**) LV, outside view; (**c**) CMS; (**d**) ventral view

UR well developed with all claws and setae, posterior seta positioned very close to the base of the ramus, and is short (Fig. 162b). Hemipenis with all three lobes present (Figs. 162d and 160f).

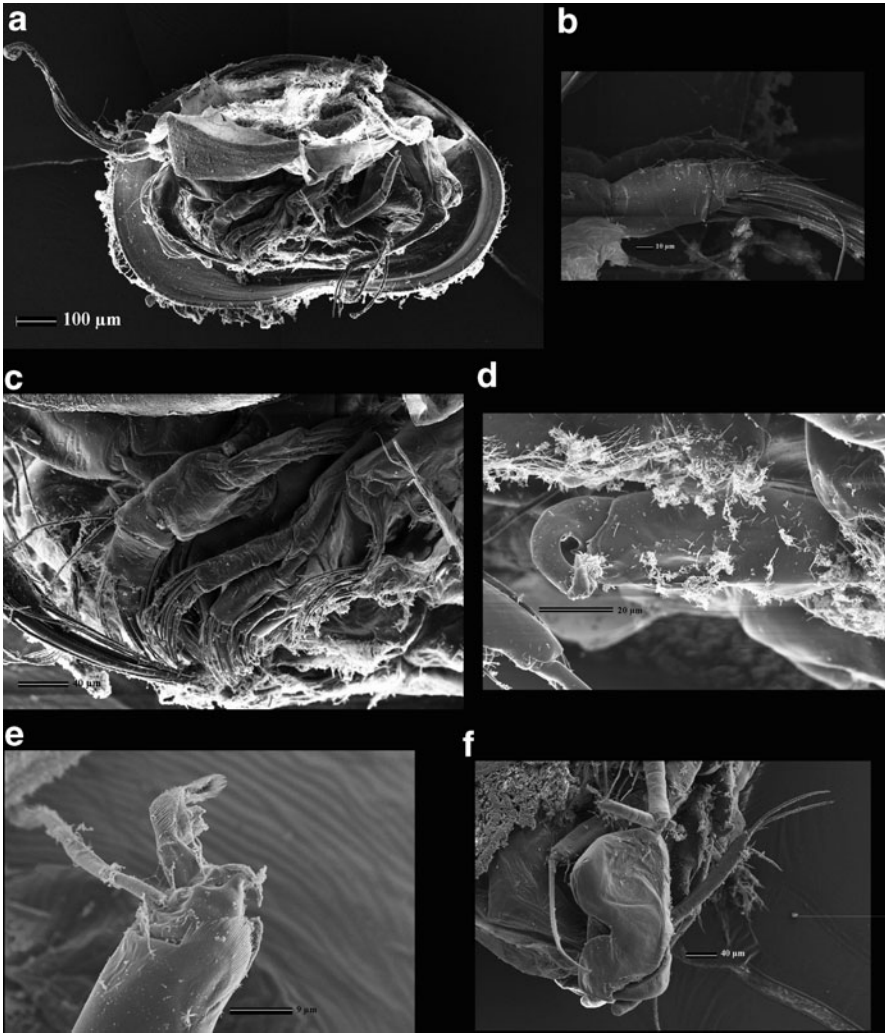


Fig. 160 SEM: *Diacypris whitei* (Herbst 1958): (**a**) inside view of the soft body; (**b**) A1; (**c**) Md and Mxl; (**d**) prehensile palp; (**e**) distal part of L7; (**f**) UR and hemipenis

Type genus: *Diacypris* Herbst 1961

Other genera: *Reticypris* McKenzie 1978a

Key to the genera

1. Surface of the carapace reticulated . . . . *Reticypris* McKenzie 1978a
– Surface of the carapace not reticulated . . . . *Diacypris* Herbst 1961

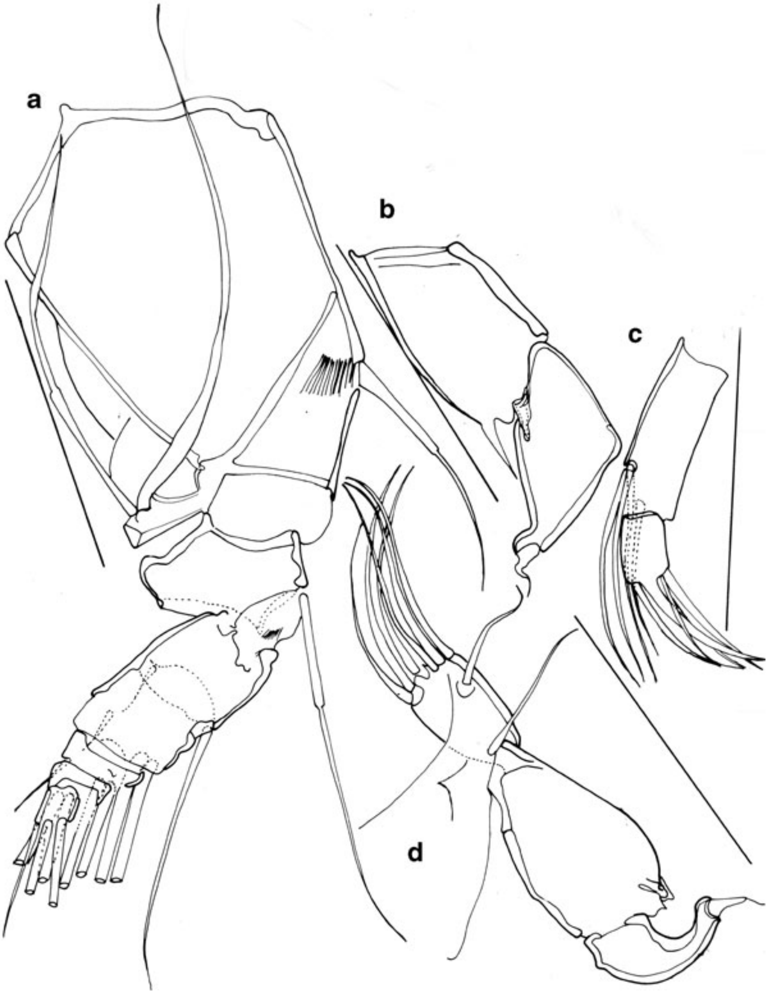


Fig. 161 Line drawings: *Diacypris whitei* (Herbst 1958): (**a**) A1; (**b**) prehensile palp; (**c**) Mxl palp; (**d**) L5. Scales = 0.1 mm

Diacypris Herbst 1961

Diagnosis: Small to medium sized ostracods, subtriangular or subrectangular. Surface of the carapace nor reticulated. Segments on A1 very small. Vibratory plate on L5 reduced. Prehensile palps asymmetrical. Penultimate segment of L6 undivided. Terminal segment of L7 transformed into the pincer organ. UR well developed with all claws and setae, posterior seta positioned very close to the base of the ramus, and being short. Inner lobe of the hemipenis not so prominent.

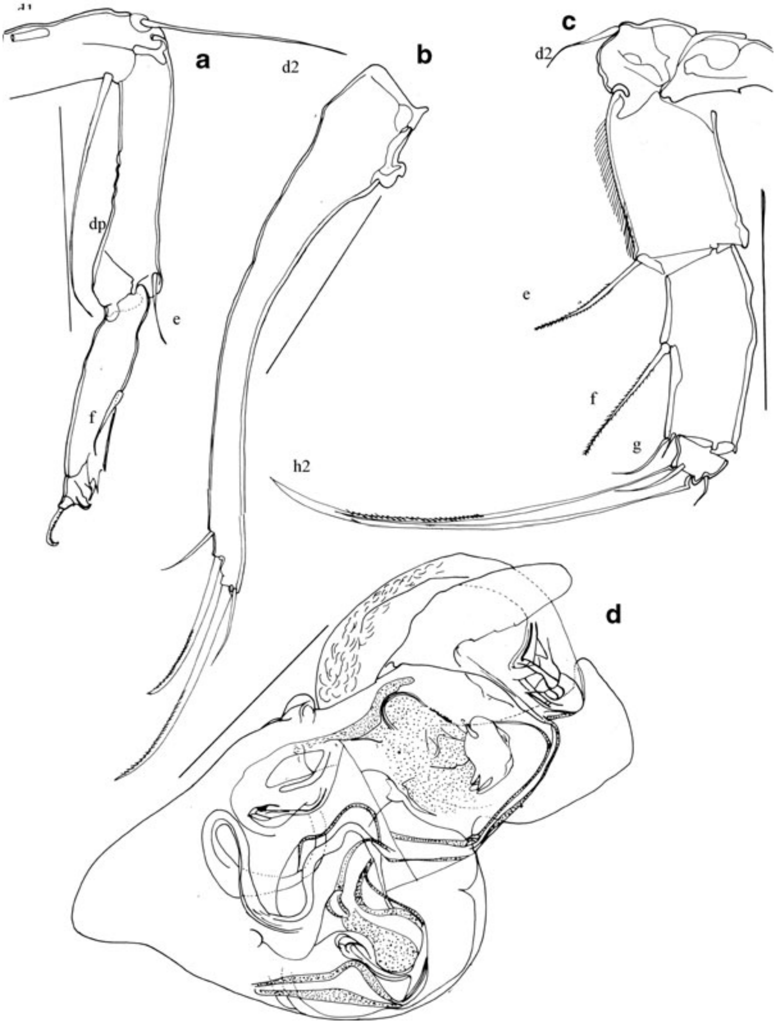


Fig. 162 Line drawings: *Diacypris whitei* (Herbst 1958): (**a**) L7; (**b**) UR; (**c**) L6; (**d**) hemipenis. Scales = 0.1 mm

Type species: *D. dietzi* (Herbst 1958)

Species list with type locality and type material

1. *D. compacta* (Herbst 1958). Lake Albert, SA, Australia, 35°38′S 139°17′E: Repository of the type material unknown.
2. *D. dictyote* De Deckker 1981a. Salt lake, near Cantarra Homestead, S of Coorong Lagoon, SA, Australia, 36°19′52″S 139°˜44′48″E: Holotype (♂), AMS – P.28639.

3. *D. dietzi* (Herbst 1958). Lake Albert, SA, Australia, 35°38′S 139°17′E: Repository of the type material unknown.
4. *D. fodiens* (Herbst 1958). Lake Hamilton, SA, Australia, 34°00′S 135°18′E: Repository of the type material unknown.
5. *D. occidentalis* McKenzie 1978a. Lake Dumbleyung, WA, Australia, 33°21′S 117°39′E: Holotype (♂), AMS – P.26673.
6. *D. paracompacta* McKenzie 1978a. Very large shallow lake 15 km N of Kingston, SA, Australia, 34°14′S 140°21′E: Holotype (♂), AMS – P.26669.
7. *D. parva* Hartmann 1978. Riftterrace beside Tantadiddy Creek, W Exmouth, NW WA; Australia, 21°56′S 11°08′E: Holotype (♂), ZMH – K-30570a.
8. *D. phoxe* De Deckker 1981a. Small lake N of the salt works, N of Lake Alexandrina, SA, Australia, 35°15′13″S 139°10′57″E: Holotype (♂), AMS – collection numbers unknown.
9. *D. spinosa* De Deckker 1981a. Small temporary pool, S of Coorong Lagoon. SA, Australia, 139°47′27″E 36°26′45″S: Holotype (♂), AMS – P.28641.
10. *D. whitei* (Herbst 1958). Lake Alexandrina, SA, Australia, 35°26′S 139°10′E: Repository of the type material unknown.

Key to the species

1. Carapace covered with spines, and with one long spine on the postero-ventral margin on the each valve .... *D. spinosa* De Deckker 1981a

– No spines on the carapace 2

2. Posterior margin very narrow comparing to the anterior one, greatest H lying at the front from which point dorsal margin sloping steeply toward posterior end 3

– Posterior margin not so narrow and dorsal margin more rounded 6

3. LV and RV asymmetrical: LV with a large flange dorsally overlapping RV *D. dictyote* De Deckker 1981a

– Valves only slightly asymmetrical, no large flange present 4

4. Anterior seta on the UR only ¼ L of the posterior claw ...... *D. occidentalis* McKenzie 1978a

– Anterior seta on the UR at least ½ L of the posterior claw 5

5. Outer lobe on the hemipenis triangular .... *D. parva* Hartmann 1978

– Outer lobe on the hemipenis square .... *D. dietzi* (Herbst 1958)

6. Middle part of the hemipenis large and in the shape of a fist, being higher than outer lobe .... *D. fodiens* (Herbst 1958)

– Middle part of the hemipenis much smaller and less developed 7

7. Outer lobe of the hemipenis oval .... *D. phoxe* De Deckker 1981a

– Outer lobe of the hemipenis square 8

8. Distal margin of the outer lobe of the hemipenis flat and lateral sides of the outer lobe parallel .... *D. whitei* (Herbst 1958)

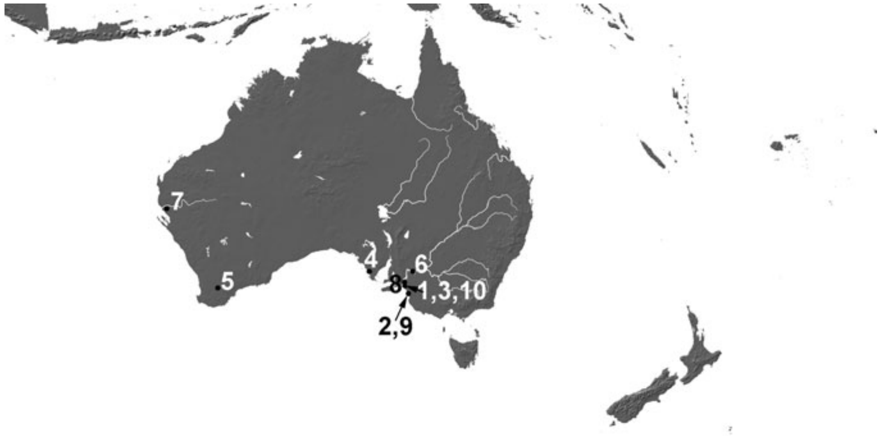


Fig. 163 Distribution of *Diacypris* Herbst 1961: Numbers correspond to the species list

– Distal margin of the hemipenis concave and lateral sides of the outer lobe not parallel . . . . *D. compacta* (Herbst 1958)

Species not included in the key
The only species not included in the key is *D. paracompacta* McKenzie 1978a which resembles *D. compacta* (Herbst 1958) a lot, both in the carapace shape and the morphology of the hemipenis and might be its junior synonym.

Ecology and distribution (Fig. 163)
Species live in salt lakes and the genus is endemic to Australia.

Reticypris **McKenzie 1978a**

Diagnosis: Small to medium sized ostracods, subtriangular or subrectangular. Surface of the carapace reticulated. Segments on A1 very small. Vibratory plate on L5 reduced. Prehensile palps asymmetrical. Penultimate segment of L6 undivided. Terminal segment of L7 transformed into the pincer organ. UR well developed with all claws and setae, posterior seta positioned very close to the base of the ramus, and being short. Inner lobe of the hemipenis flap like and flap turned downward.

Type species: *R. herbsti* McKenzie 1978a

Species list with type locality and type material

1. *R. clava* De Deckker 1981b. Ephemeral salt lake, S of Coorong Lagoon, SA, Australia, 36°13′36″S, 139°41′29″E: Holotype (♂), SAM – collection number unknown.

2. *R. dedeckkeri* McKenzie 1978a. Small pond S of Yorketown, SA, Australia, 35°02′S 137°36′E: Holotype (♂), AMS – P.26680.
3. *R. herbsti* McKenzie 1978a. Very large shallow lake 15 km N of Kingston, SA, Australia, 34°14′S 140°21′E: Holotype (♂), AMS – P.26676.
4. *R. kurdimurka* De Deckker 1981b: Madigan Gulf, Lake Eyre, SA, Australia, 28°30′S 137°20′E: Holotype (♂), SAM – collection number unknown.
5. *R. pinguis* De Deckker 1981e. Lake George, NSW, Australia, 35°05′S 149°25′E: Holotype (♂), AMS – P.32004.
6. *R. walbu* De Deckker 1979b: Pool in Margaret River, SA, Australia, 29°22′38″S 136°46′52″E: Holotype (♂), AMS – P.28688.

Key to the species

1. Posterior margin of the carapace denticulate 2

– Posterior margin smooth 4

2. Posterior claw on the UR only ½ as long and the anterior one . . . . . *R. walbu* De Deckker 1979b

– Anterior and posterior claws subequally long 3

3. Inner lobe of the hemipenis thin and only slightly curved . . . . *R. pinguis* De Deckker 1981e

– Inner lobe very large and thick, and covering the entire hemipenis . . *R. clava* De Deckker 1981b

4. Anterior and posterior claws subequally long *R. kurdimurka* De Deckker 1981b

– Posterior claw considerably shorter than anterior one 5

5. Posterior margin of the carapace narrower than the anterior one . . . *R. herbsti* McKenzie 1978a

– Margins subequally wide . . . . *R. dedeckkeri* McKenzie 1978a

Ecology and distribution (Fig. 164)
Species live in salt lakes and the genus is endemic to Australia.

4.9 Subfamily Dolerocypridinae Triebel 1961

Diagnosis (after Meisch 2000): Carapace long 1–7 mm, and elongated ($H < 1/2$ L), laterally compressed (Fig. 165). LV overlaps RV ventrally, but RV>LV. CIL wide on both ends. Selvage peripheral on RV, inwardly displaced on LV. Rarely the opposite. Mxl with terminal segment elongated. Basal segment of L6 with both "d1" and "d2" setae present. Posterior margin and terminal claws of the UR with setulae, strong striae, or denticles. Posterior seta set closely to the distal margin of the ramus.

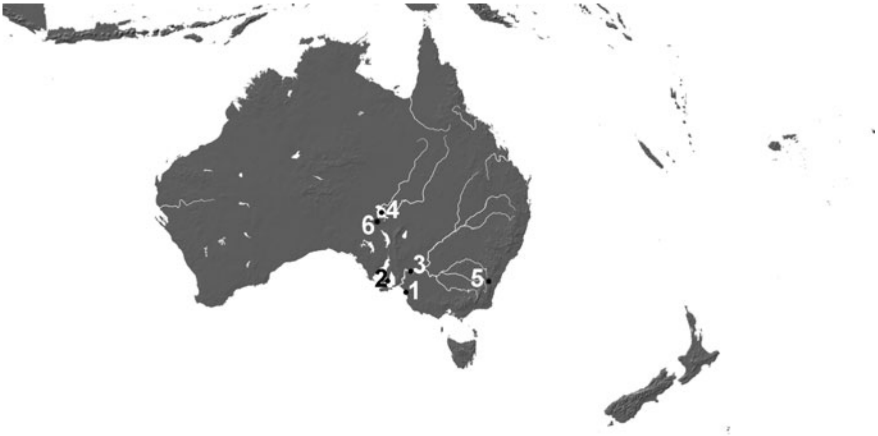


Fig. 164 Distribution of *Reticypris* McKenzie 1978a: Numbers correspond to the species list

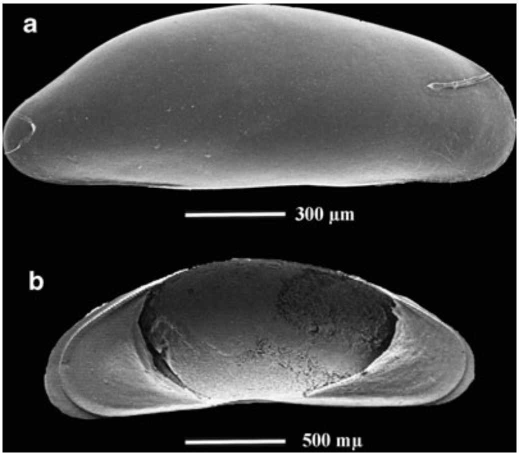


Fig. 165 SEM: (**a**) *Dolerocypris fasciata* (OF Müller 1776); (**b**) *Dolerocypris sinensis* Sars 1903a; (**a**) RV, outside view; (**b**) RV, inside view. Photos: D. Keyser

Type (and only) genus: *Dolerocypris* Kaufmann 1900a

***Dolerocypris* Kaufmann 1900a**
Diagnosis: Same as for the subfamily.

Type species: *D. fasciata* (OF Müller 1776)

Species list with synonyms, type locality, and type material

1. *D. fasciata* (OF Müller 1776). Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.

   Syn.: *Cypris angustata* Sars 1863; *Cypris ephippiata* Koch 1837c

2. *D. ikeyai* Smith and Kamiya 2006. Spring at top of beach, coastal area at Yudomari, S Yakushima Island, Kagoshima, Japan, 30°13′48.7″N 130°28′50.5″E: Holotype (♂), NSMT – RA28863.
3. *D. opesta* Brehm, 1932b. Lago Petén Itzá (Laguna de Petén), Guatemala, 16°59′N 89°50′W: Repository of the type material unknown.

   Syn.: *D. maya* Brehm 1939c

4. *D. sinensis* Sars 1903a. Raised in aquaria with mud from swamps and rice fields, Pucheng, China – type locality plurivalent. Holotype, NHMO – F12247.
5. *D. tenuis* (Daday 1905). Side arm of the Paraguay River, Asuncion, Gran Chaco, Paraguay, 25°18′S 57°38′W: Types, HMNH – IV-287.

Key to the species

1. Swimming setae reduced, not reaching middle L of penultimate segment . *D. ikeyai* Smith and Kamiya 2006
– Swimming setae reaching (and sometimes exceeding tip of the claws) 2
2. Posterior claw on the UR "S" shaped, anterior seta exceeding ½ L of anterior claw . . . . *D. tenuis* (Daday 1905)
– Posterior claw on the UR straight, anterior seta only reaching ½ L of anterior claw 3
3. Carapace shorter than 1.7 mm, laterally moderately compressed . . *D. fasciata* (OF Müller 1776)
– - Carapace longer than 1.7 mm, laterally conspicuously compressed *D. sinensis* Sars 1903a

Species not included in the key
Only *D. opesta* Brehm 1932b is not included in the key because of an insufficient description.

Ecology and distribution (Fig. 166)
The species can be found in all types of the surface water bodies. Although, the genus has only a couple of species it has almost a world-wide distribution.

4.10 Subfamily Eucypridinae Bronstein 1947

Diagnosis (after Meisch 2000): Size from 1 to 2.5 mm. Carapace elliptical to elongated, more rarely stout in lateral view (Figs. 167a–d, 168a, f, 169a, b, c, e, and 170a, b). LV overlapping RV ventrally. Seta "c" on the protopod of L5 present (Fig. 171a), vibratory plate with six rays (Fig. 170d). L6 5-segmented (Fig. 171b, e). L7 with the pincer organ (Fig. 170c). UR well developed (Fig. 167). Attachment of the UR simple, proximally branched, without Triebel loop. Posterior end of the body with a spine.

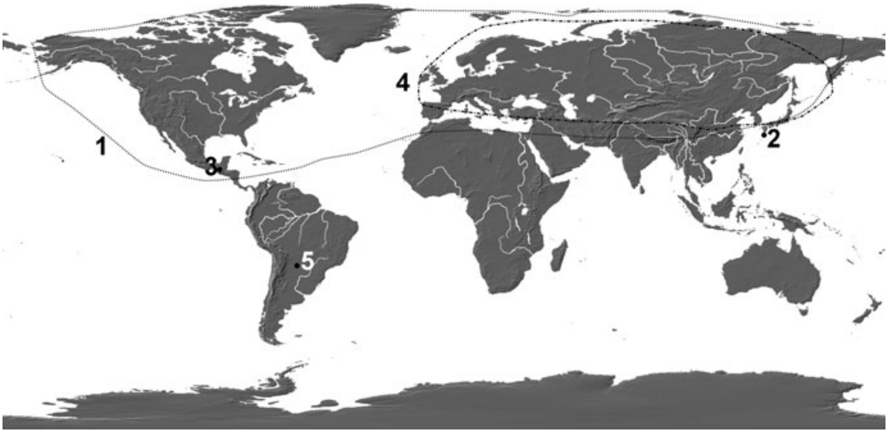


Fig. 166 Distribution of *Dolerocypris* Kaufmann 1900a: Numbers correspond to the species list

Type genus: *Eucypris* Vávra 1891

Other genera: *Amphicypris* Sars 1901; *Candelacypris* Baltanás 2001; *Cypriconcha* Sars 1926; *Eucyprinotus* Sywula 1972; *Koencypris* Meisch 2000; *Prionocypris* Brady and Norman 1896; *Tonnacypris* Diebel and Pietrzeniuk 1975; *Trajancypris* Martens 1989c.

Key to the genera

1. Basal segment of L6 with both setae present 2
– At least one of the setae missing 7
2. Terminal segment of the Mxl palp cylindrical (Fig. 171c) 3
– Terminal segment of the Mxl palp distally dilated (Fig. 171d) 5
3. Selvage inwardly displaced on RV . . . . *Koencypris* Meisch 2000
– Selvage, if present, peripheral (Fig. 167a, b) 4
4. Seta "d1" on L6 four to five times longer than "d2" *Eucyprinotus* Sywula 1972
– Seta "d1" on L6 three times longer than "d2" (Fig. 171b) *Eucypris* Vávra 1891
5. Seta "d1" on L6 shorter than "d2" . *Tonnacypris* Diebel and Pietrzeniuk 1975
– Seta "d1" and "d2" subequally long (Fig. 167e) 6
6. CIL broad (Fig. 167c) . . . . *Trajancypris* Martens 1989c
– CIL narrow (Fig. 167d) . . . . *Prionocypris* Brady and Norman 1896
7. Basal segment of L6 without any seta . . . . *Candelacypris* Baltanás 2001
– Basal segment of L6 with only one seta . . . . *Amphicypris* Sars 1901 and *Cypriconcha* Sars 1926

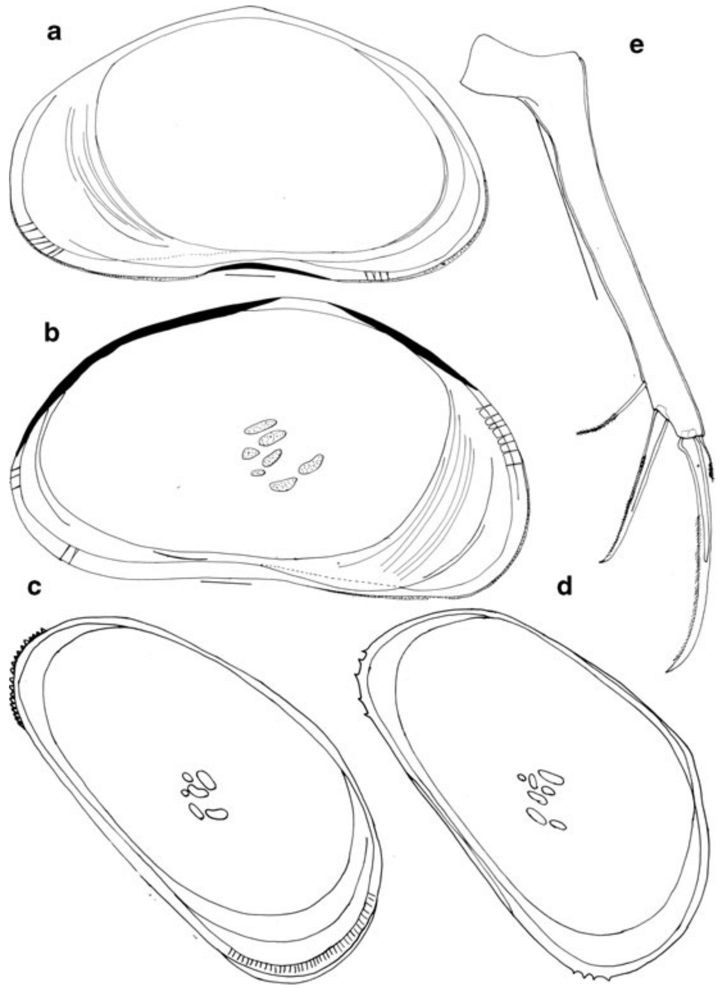


Fig. 167 Line drawings: (**a**, **b**, **e**) *Eucypris pigra* (Fischer 1851); (**c**) *Trajancypris serrata* (Müller 1900a); (**d**) *Prionocypris zenkeri* (Chyzer and Toth 1858): (**a**) RV, inside view; (**b**–**d**) LV, inside view; (**e**) UR. (**c**, **d**) modified after Meisch (2000). Scales = 0.1 mm. (**c**, **d**) not to scale

Remarks

Genera *Amphicypris* Sars 1901 and *Cypriconcha* Sars 1926 key together, as their differences are not clear. These two genera have also the same appearance of the hemipenis and prehensile palps.

Amphicypris Sars 1901

Diagnosis: Subovoidal to subtrapezoidal in lateral view. Terminal segment of the Mxl palp short but not distally dilated. Prehensile palps large, strongly

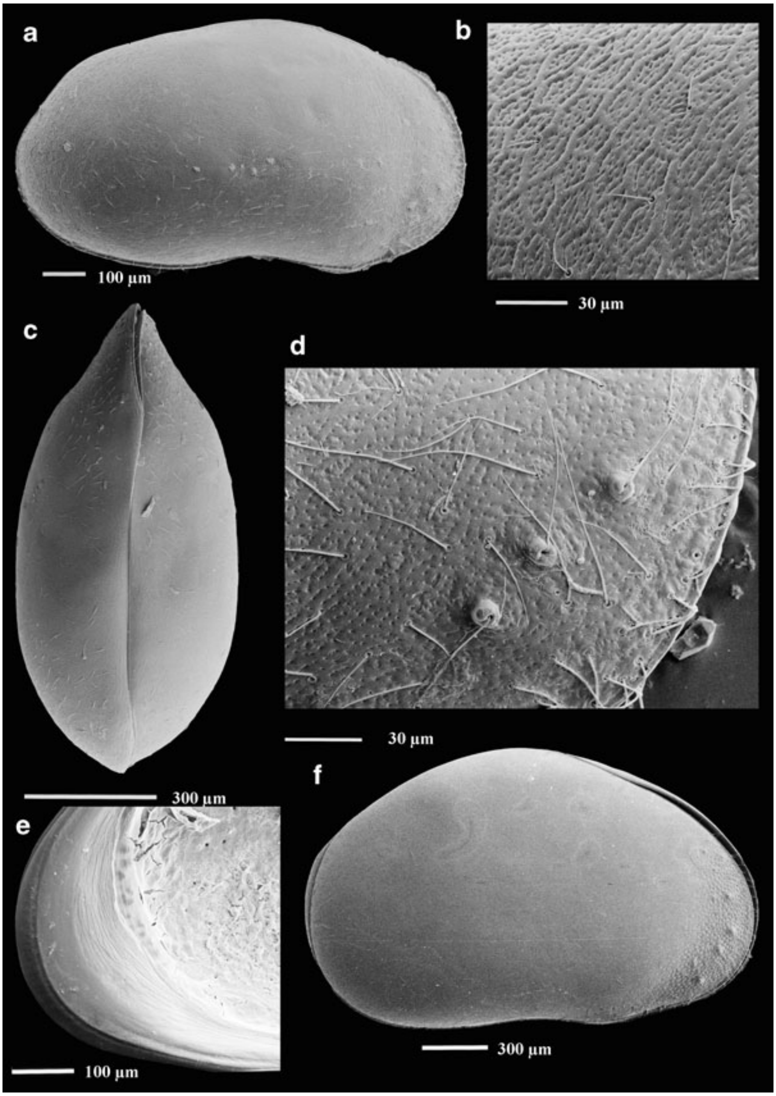


Fig. 168 SEM: (**a**, **b**) *Eucyprinotus rostratus* (Sywula 1966); (**c**) *Eucypris bronsteini* Petkovski 1959b; (**d**) *Eucypris kurtdiebeli* Petkovski and Keyser 1997; (**e**) *Eucypris elongata* Stephanides 1937; (**f**) *Eucypris virens* (Jurine 1820): (**a**, **f**) carapace, lateral view from the right side; (**b**, **d**) detail of the surface; (**c**) carapace, dorsal view; (**e**) RV, anterior margin. Photos: D. Keyser

asymmetrical; left palp more stout. Basal segment of L6 only with one, “d1” seta. UR long and stout, posterior margin armed with spines, posterior seta positioned very low on the ramus.

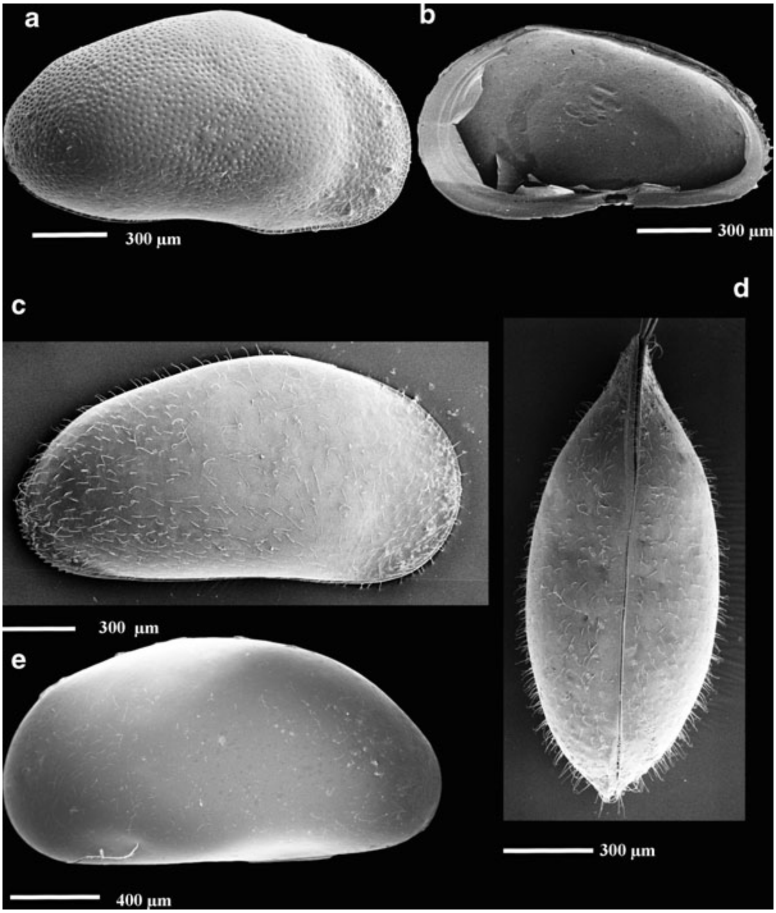


Fig. 169 SEM: (**a**) *Eucypris elongata* Stephanides 1937; (**b**) *Prionocypris zenkeri* (Chyzer and Toth 1858); (**c,d**) *Trajancypris serrata* (Müller 1900a); (**e**) *Tonnacypris lutaria* (Koch 1838): (**a**, **c**) carapace, lateral view from the right side; (**b**) RV, inside view; (**d**) carapace, dorsal view; (**e**) LV, outside view. Photos: D. Keyser

Type species: *A. nobilis* Sars 1901

Species list with type locality and type material

1. *A. argentinensis* Fontana and Ballent 2004. Laguna Caliba, Buenos Aires Province, Argentina, 39°02′S 61°13′W: Holotype (♂), NHMLP – Mi1309.
2. *A. nobilis* Sars 1901. Raised from dried mud from Argentina, 34°00′S 64°00′W: Syntypes, BM – 1901.12.12.326-336.
3. *A. pestai* (Graf 1931). Open well on the way to Grytviken and Maiviken, Nunavut, Canada, 75°16′N 104°43′W: Repository of the type material unknown.

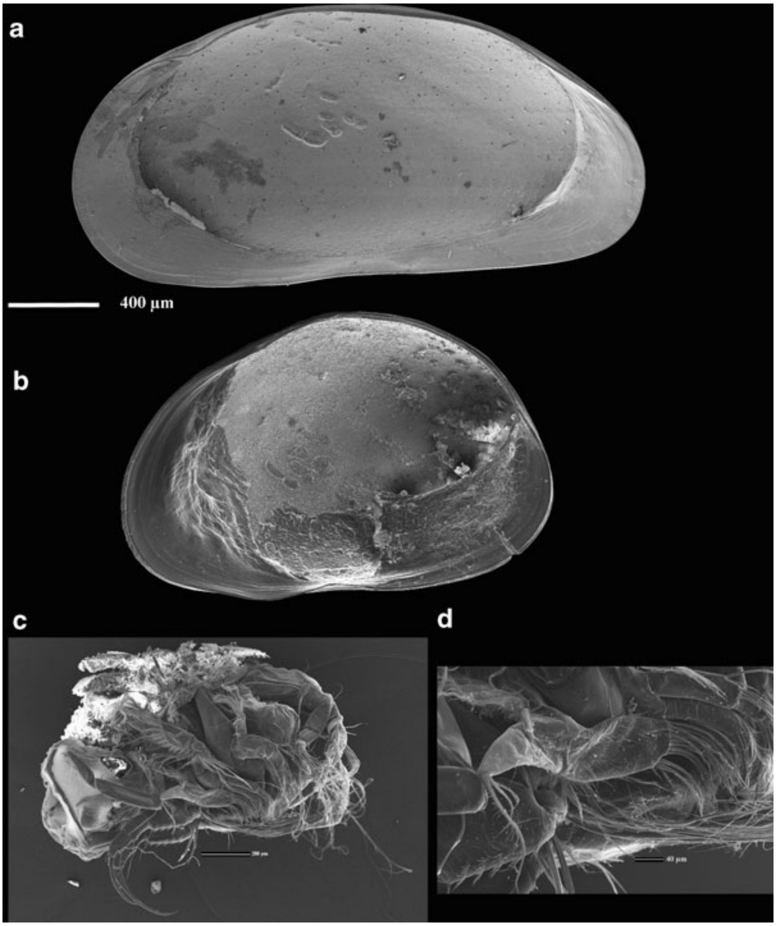


Fig. 170 SEM: (**a**) *Tonnacypris lutaria* (Koch 1838); (**b–d**) *Eucypris* cf. *virens* (Jurine 1820): (**a**, **b**) RV, inside view; (**c**) soft body; (**d**) L5. (**a**) Photo: D. Keyser

Key to the species

1. Carapace suboval, greatest H situated on the last ½ of the L . . . . *A. argentinensis* Fontana and Ballent 2004
– Carapace oval, greatest H situated on the last 1/3 of L . . . . . . *A. nobilis* Sars 1901 and *A. pestai* (Graf 1931)

Species not included in the key
Species *Amphicypris nobilis* Sars 1901 and *A. pestai* (Graf 1931) key out together, because of the same carapace shape and morphology of the soft parts. The latter species is described only after female, and maybe the discovery of males will clear out the possible differences between the two species.

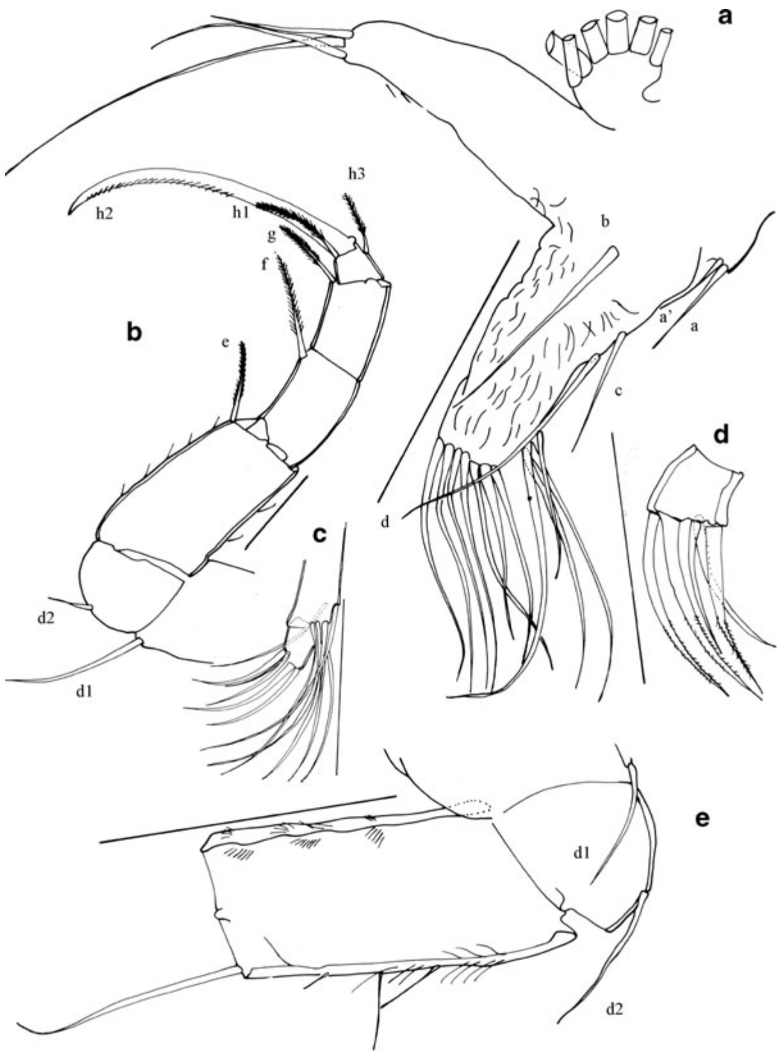


Fig. 171 Line drawings: (**a**, **c**) *Eucypris pigra* (Fischer 1851); (**b**) *Eucypris* cf. *virens* (Jurine 1820); (**d**, **e**) *Prionocypris zenkeri* (Chyzer and Toth 1858): (**a**) L5; (**b**) L6; (**c**) Mxl palp; (**d**) second segment of Mxl palp; (**e**) part of L6. Scales = 0.1 mm

Ecology and distribution (Fig. 172)
The species inhabit temporary freshwater bodies.

Candelacypris Baltanás 2001

Diagnosis (after Baltanás 2001): Valves medium size (around 1.5 mm), elongated and subrectangular, weakly calcified with a narrow fused zone. No inner lists or selvages present. Terminal segment of the Mxl palp trapezoidal. Lateral seta on the

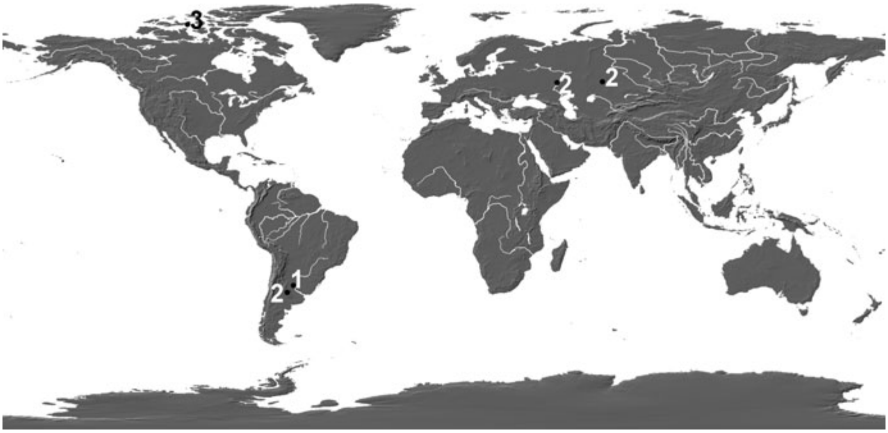


Fig. 172 Distribution of *Amphycypris* Sars 1901: Numbers correspond to the species list

first segment of the same appendage short. Distal anterior seta on the terminal segment of L6 transformed into a strong claw. Both basal setae on L6 missing.

Type (and only) species: *C. aragonica* (Brehm and Margalef 1949). Pinol Lagoon, de las Salada des Sastago Monegros, Saragossa, Spain, 41°39′N 00°52′W: Types, NHMM – collection numbers unknown.

Ecology and distribution
The species seems to be endemic to Spain and lives in saline lakes.

Cypriconcha Sars 1926

Diagnosis (after Diáz and Lopretto 2009): Shell subcompressed, reniform; valves subequal, thin, and densely hairy. Both the anterior and posterior margins are broadly rounded and slightly pointed postero-ventrally in females. The surface of the valves smooth. The prehensile palps are slightly unequal and with a conspicuous thumb-like process. Only seta "d1" present on the basal segment of L6. Posterior margins of both UR finely spinulose. Hemipenis of a moderate size and slightly unequal. Left palp elongate and subtriangular, right palp short and subquadrate. Zenker organ large, with 31–35 whorls of radiating spines.

Type species: *C. barbata* (Forbes 1893)

Species list with synonyms, type locality, and type material

1. *C. alba* Dobbin 1941. Dry alkaline lake, Grand Coulee, Washington, USA, 47°56′N 119°00′W: Syntypes, SM – 180422.
2. *C. barbata* (Forbes 1893). Yellowstone River, Yellowstone National Park, Wyoming, USA, 44°59′N 110°28′W: Repository of the type material unknown.
3. *C. gigantea* Dobbin 1941. St. Michaels, Alaska, USA, 64°32′N 165°09′W: Syntypes, SM – 180423.

4. *C. gnathostoma* Ferguson 1967e. East Playa Lake, Roosevelt County, New Mexico, USA, 33°58′N 103°27′W: Holotype (♀), SM – 119246.
5. *C. grandis* (Chambres 1877). Ponds along the Arkansas River in Mt. Harvard Region, Colorado, USA, 38°56′N 106°11′W: Repository of the type material unknown.

   Syn.: *Amphicypris macra* Blake 1931

6. *C. hypsophila* Diáz and Lopretto 2009. Vega Los Aparejos, Tinogasta County, Catamarca Province, Argentina, 27°40′56.8″S 68°26′40.6″W: Holotype (♂), NHMLP – 26137
7. *C. ingens* Delorme 1967. Waldsea Lake, ca. 6 km N of Humboldt, Saskatchewan, Canada, 52°17′N 105°12′W: Holotype, GMUS – Ao-125.
8. *C. pseudoingens* (Delorme 1969). Lake with a soft bottom and no aquatic vegetation at a depth of 3.5 ft. Location: Lsd. 16, Sec. 25, Tp. 14,Rg. 19, W. 3. Saskatchewan, Canada, 54°00′N 106°00′W: Holotype (♂), GSC – 24186.
9. *C. steveni* McKenzie 1982a: Vernal pools, San Diego County, California, USA, 32°42′N 117°09′W: Holotype (♂), SM – 184854.

Key to the species (after Diáz and Lopretto 2009)

1. Masticatory surface of mandible with molar-shaped processes 2

– Masticatory surface of mandible without molar-shaped processes .... *C. alba* Dobbin 1941

2. L at the most 3.4 mm 3

– L between 3.4 and 4.2 mm 5

3. Carapace sub-quadrate in shape, dorsal margin straight; CIL, line of concescence well defined; radial pore canals abundant 4

– Carapace elongate, bean shaped in lateral view; dorsal margin concave; without radial pore canals .... *C. hypsophila* Diáz and Lopretto 2009

4. Anterior end of carapace rounded, posterior end slightly rounded to truncated *C. pseudoingens* (Delorme 1969)

– Both anterior and posterior ends rounded, not truncated *C. ingens* Delorme 1967

5. Carapace regularly rectangular in shape and strongly arched postero-dorsally *C. steveni* McKenzie 1982a

– Carapace subrectangular in side view, anterior and posterior acutely pointed . 6

6. Swimming setae of A2 non-plumose and not reaching the apical claws ...... *C. gnathostoma* Ferguson 1967e

– Swimming setae of A2 reaching at least the apical claws 7

7. L of anterior seta on the UR less than ½ L of posterior claw ..... *C. barbata* (Forbes 1893)

– L of anterior seta on the UR at least ½ L of posterior claw ...... *C. grandis* (Chambres 1877)

Species not included in the key
The only species not included in the key is *C. gigantea* Dobbin 1941.

Ecology and distribution (Fig. 173)
The genus is distributed in America, it is often associated with high salinity ecosystems.

***Eucyprinotus* Sywula 1972**
Diagnosis (after Martens et al. 1992): Middle-sized ostracods, with a beak-like front in dorsal view and a sinuous ventral margin (Fig. 168a); surface pitted (Fig. 168b) and with a large number of warts on anterior and posterior ends. RV with selvage submarginal, but obvious, anteriorly with an inner list about halfway the wide inner lamella. LV without selvage, but with an anterior inner list. Both valves with posterior inner lists on or near the inner margin, in LV at least supported by small septae. A2 with swimming setae reaching well beyond tips of claws. Mxl with terminal segment cylindrical; third endite with two smooth claws. L6 with seta "d1" 4–5 times as long as the minute seta "d2".

Type (and only) species: *E. rostratus* (Sywula 1966)

Species list with type locality and type material
E. rostratus (Sywula 1966). Salt water pond, Inowroclaw, Poland, 52°48′N 18°16′E: Holotype (♀), ZIPAS – collection number unknown.

***Eucypris* Vávra 1891**
Diagnosis (after Meisch 2000): Carapace approximately elliptical in lateral view. Surface of the valves anteriorly usually with warts (Fig. 168d, f). Ventral margin usually concave around the mouth region. CIL on both valves broad (Fig. 167a, b).

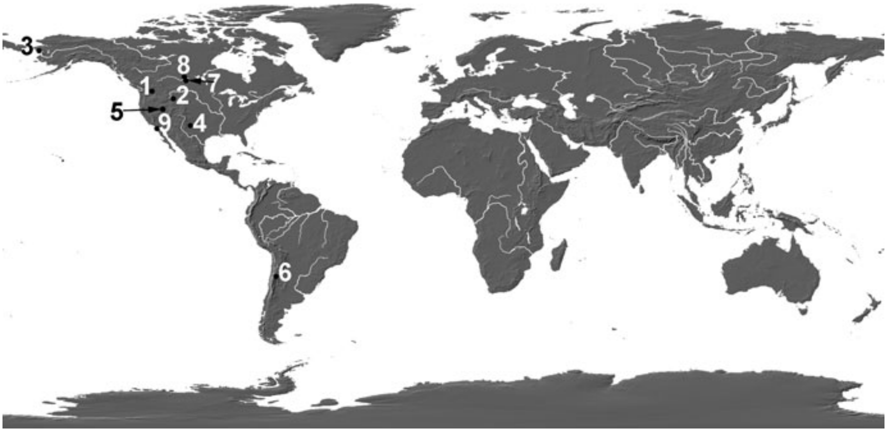


Fig. 173 Distribution of *Cypriconcha* Sars 1926: Numbers correspond to the species list

Selvage if present peripheral (Fig. 168e). LV overlap RV ventrally. Terminal segment of the Mxl palp distally cylindrical and curved. Seta “d1” on the basal segment of L6 three times as long as seta “d2”.

Type species: *E. virens* (Jurine 1820)

Species list with synonyms, type locality, and type material

1. *E. afghanistanensis* Hartmann 1964. Shore of Band-e Amir Lake, Afghanistan 34°50′23″N 67°13′51″E: Syntypes, ZMH – K-27 57–45; 27 571–583; 27 716.
2. *E. ambigua* Ghetti 1972. Rasht, Iran, 37°16′N 49°34′E: Holotype (♀), IZUP – collection number unknown.
3. *E. anglica* Fox 1967. Temporary pool on a meadow, parish of Hambleden, Bucks, England, UK, 51°34′N 00°52′W: Types, BM – 1967 4.3.3.
4. *E. angulata* Hartmann 1964. Sarbordj River, 10 km from Moghan, Iran, 36°47′N 59°02′E: Syntypes, ZMH – K-27 573.
5. *E. arcadiae* Furtos 1936a. Ca. 5 km W of Arcadia, Florida, USA, 27°12′N 81°51′W: Holotype (♀), SM – 71383.
6. *E. areguensis* Daday 1905. Stagnant pond, Yuguari River, Areguá, Paraguay, 25°18′S 57°25′W: Types, HMNH – IV-216.
7. *E. bayensis* Tressler 1937. Laguna de Bay, Luzon, Philippines, 14°22′N 121°14′E: Holotype (♂), SM – 71508.
8. *E. biharensis* Deb 1984. Pond W of Ranchi University campus, Ranchi, Jharkhand (fomerly southern Bihar), India, 23°23′N 85°19′E: Holotype (♀), ZSI – C1349/2.
9. *E. bispinosa* (Victor and Michael 1975). Temporary pond, in front of DBSMU, India, 09°56′N 78°07′E: Holotype (♀), DBSMU – collection number unknown.
10. *E. bronsteini* Petkovski 1959b. Kadina River, S of Skopje, Macedonia, 41°50′N 21°38′E: NHMS – collection numbers unknown.
11. *E. cameronensis* Roen 1956. Groove near River Nyong, Cameroon (on the territory of the formerly French Cameroons), 03°16′N 09°56′E: Repository of the type material unknown.
12. *E. cisternina* Furtos 1936b. Champotón, Campeche, Yucatán, Mexico, 19°21′N 90°43′W: Holotype (♀), SM – 67971.
13. *E.compressa* Deb 1983. Pond at Pānchgani, Mahārāshtra, India, 17°55′N 73°49′E: Holotype (♀), ZSI – C 1112/2.
14. *E. crassa* (OF Müller 1785). Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.
15. *E. crinita* (Henry 1923). Holbrook, NSW, Australia, 33°52′S 151°12′E: Holotype (♀), AMS – P.6122.
16. *E. domestica* Löffler 1968. Mawenzi, Tanzania, 03°05′S 37°27′E: Repository of the type material unknown.
17. *E. elliptica* (Baird 1846). Pond at Highgate, England, UK, 51°30′N 00°11′W: Repository of the type material unknown.
18. *E. ellipticalis* Deb 1983. Rewa, paddy field near Chaclai, India, 24°32′N 81°18′E: Holotype (♀), ZSI – C 1097/2.

19. *E. elongata* Stephanides 1937. Stagnant pool, Korfu, Greece, 39°37′N 19°55′E: Repository of the type material unknown.
20. *E. fabaeformis* Daday 1900. Lemien, Papua New Guinea, 09°30′S 147°07′E: Types, HMNH – IV-239.
21. *E. fontana* (Graf 1931). Bottom of a well, Grytviken, South Georgia, and the South Sandwich Islands, 54°16′S 36°30′W: Types, BM – 1981.302-308.
22. *E. foveata* Delorme 1968. Porcupine River near village of Old Crow, Yukon, Canada, 67°34′N 139°50′W: Holotype, GSC – 23634.
23. *E. gomti* Deb 1983. Pond near inspection bungalow, Sātāra, India, 17°41′N 73°59′E: Holotype (♀, ZSI – C 1095/2.
24. *E. halyi* (Brady 1886a). Sri Lanka. No other details on the type locality. Repository of the type material unknown.
25. *E. hamadensis* Hartmann 1964. Lake near Abassabad, Hamadan State, Iran, 38°55′N 46°50′E: Syntypes, ZMH – K-27 584.
26. *E. himani* Deb 1983. Duttuwadi, 7 km from Pune on the way to Sinhgarh, Mahārāshtra, India, 18°31′N 73°51′E: Holotype (♀), ZSI – C 1161/2.
27. *E. illyrica* Klie 1937a. Puddle on building site, Skopje, Macedonia, 42°00′N 21°25′E: Syntypes, ZMK – UR-840.
28. *E. inaequalis* Deb 1983. Old unused well at Pānchgani, 1 km of Government House, Mahārāshtra, India, 17°55′N 73°49′E: Holotype (♀) ZSI – C 1106/2.
29. *E. indica* Deb, 1983. Pond at Pānchgani, Mahārāshtra, India, 17°55′N 73°49′E: Holotype (♀), ZSI – C 1110/2.
30. *E. kerkyrensis* Stephanides 1937. Stagnant pool, Korfu, Greece, 39°37′N 19°55′E: Repository of the type material unknown.
31. *E. kurtdiebeli* Petkovski and Keyser 1997. Temporary spring, village Rotino, near Bitola, Macedonia, 41°03′N 21°12′E: Holotype (♀), NHMS – Ostr. 83/1.
32. *E. lateraria* (King 1855). Pond in a brickfield near Sydney, NSW, Australia, 33°52′S 151°12′E: Repository of the type material unknown.
33. *E. lilljeborgi* (Müller 1900a). Ditch near forest edge, Germany (no other details on the type locality). Repository of the type material unknown.
34. *E. lineata* Akatova 1950. Lake Saloi, Pakistan, 32°44′N 73°05′E: Repository of the type material unknown.
35. *E. mareotica* (Fischer 1855). Mareotis Lake, near Alexandria, Egypt, 31°09′N 29°53′E: Repository of the type material unknown.

    Syn.: *Eucypris inflata* Sars 1903b

36. *E. minuta* Daday 1908: Kang-ma, Tibet, 26°08′N 93°38′E: Types, HMNH – IV/P-231.
37. *E. mongolica* (Daday 1909). Lake Issyk-Kul, Kyrgyzstan, 42°25′N 77°15′E: Types, HMNH – IV/P-245-246.
38. *E. montelgoni* Kiss 1959b. Mount Elgon, Uganda, 01°14′N 34°35′E: RMCA – 47 350.
39. *E. moravica* Jancarik 1947. Stagnant pond, 30 km from Brno, Moravia, Czech Republic, 49°11′N 16°36′E: Repository of the type material unknown.

40. *E. munia* Deb 1983. Pond near inspection bungalow, Sātāra, India, 17°41′N 73°59′E: Holotype (♀), ZSI – C-1103/2.
41. *E. noodti* Hartmann 1965. Brackish water puddle, El Tabo, Chile, 33°27′S 71°41′W: Syntypes, ZMH – K 28288.
42. *E. opulenta* Margalef 1961. Pond near the Hwy, Juan Griego, Venezuela, 11°05′N 63°57′W: Repository of the type material unknown.
43. *E. orca* Tressler 1937. Camiguin Island, Misamis Oriental, Philippines, 09°10′N 124°42′E: Holotype (♀), SM – 71509.
44. *E. pagasti* Schäfer 1952. Mud sample from Turkey. No more details on the locality. Repository of the type material unknown.
45. *E. petkovskii* Danielopol 1965. Braila close to Varsatura, Romania, 45°16′N 27°59′E: Repository of the type material unknown.
46. *E. pigra* (Fischer 1851). Surroundings of Castle Fall near Tallinn, Estonia, 59°26′N 24°45′E: Repository of the type material unknown.
47. *E. pratensis* Eagar 1970. Makara Stream, New Zealand, 41°15′S 174°43′E: Holotype (♀), DMW – UR 1836.
48. *E. rava* Furtos 1933. Cold Spring Run near Newark, Ohio, USA, 40°03′N 82°25′W: Syntypes, SM – 67891.
49. *E. salina* Hartmann 1964. Small pond near Borazdjan, Iran, 29°15′N 51°12′E: Holotype (♀), ZMH – K-27 594.
50. *E. sonia* Deb 1983. Pond near Inspection Bungalow, Sātāra, India. 17°41′N 73°59′E: Holotype (♀), ZSI – C-1100/2.
51. *E. stephanidesi* Petkovski 1959b. Spring, Aracinovo, Macedonia, 42°03′N 21°35′E: Types, NHMS – collection numbers unknown.
52. *E. tarentina* Anichini 1963. Small calcareous pool, Taranto, Italy, 40°28′N 17°13′E: Repository of the type material unknown.
53. *E. thomsoni* Chapman 1963. Ponds, often those with much filamentous algae, Dunedin, New Zealand, 45°52′S 170°30′E: Types, OMD – collection numbers unknown.
54. *E. tibetana* Daday 1908. Rham-Tso, Tibet, 26°08′N 93°38′E: Types, HMNH – IV/P-241.
55. *E. trajani* Sywula 1968. Helocrene, Devnya, Bulgari, 43°11′N 27°39′E: Holotype (♀), ZIPAS – collection number unknown.
56. *E. trapezoides* Hartmann 1962. Beach Estuary, Los Vilos, Chile, 31°54′S 71°30′W: Syntypes, ZMH – K-27 595.
57. *E. ungulata* (Moniez 1891). Sebkha d'Oran, Algeria, 35°31′N 00°49′W: Repository of the type material unknown.
58. *E. virens* (Jurine 1820). Pond of Malagnou, Geneva, Switzerland, 46°11′N 06°10′E: Types, NHMG – collection numbers unknown.

Syn.: *E. longisetosa* Anichini-Pini 1968a; *E. molybdena* Anichini-Pini 1968a; *E. sulcitana* Anichini-Pini 1968a, *E. accipitrina* Anichini-Pini 1968a, *E. hieracina* Anichini-Pini 1968a

Key to the species

1. Two lateral spinous projections present on the valves . . . . *E. bispinosa* (Victor and Michael 1975)

– No lateral spinous projections present 2

2. RV overlaps LV frontally 3

– LV overlaps RV frontally of both valves equal 6

3. Posterior seta on the UR very short, being less than 1/3 of the posterior claw *E. compressa* Deb 1983

– Posterior seta on the UR by far exceeding ½ L of posterior claw 4

4. In dorsal view, valve margins almost parallel . . . . *E. munia* Deb 1983

– In dorsal view, valve margins not parallel, ovoid appearance 5

5. RV considerably over passing LV frontally . . . . *E. gomti* Deb 1983

– RV only slightly over passing LV frontally . . . . *E. sonia* Deb 1983

6. In lateral view, greatest H lying in the middle, dorsal margin sloping evenly toward both margins 7

– In lateral view, greats H lying in the middle or frontally, but from that point dorsal margin inclined toward posterior margin, and rounded toward anterior one 28

7. Posterior claw on the UR shorter than ½ L of anterior claw 8

– Posterior claw on the UR longer than ½ L of anterior claw 9

8. Dorsal margin almost straight . . . . *E. minuta* Daday 1908

– Dorsal margin evenly rounded to slightly arched . . . *E. urinita* (Henry 1923)

9. Anterior seta on the UR almost as long as anterior claw 10

– Anterior seta on the UR at the most ½ as long as the anterior claw 11

10. Dorsal margin almost straight . . . . *E. ellipticalis* Deb 1983

– Dorsal margin evenly rounded to slightly arched . . . . . . *E. himani* Deb 1983

11. Posterior seta on the UR being longer than ½ L of posterior claw 12

– Posterior seta on the UR not being longer than ½ L of posterior claw . . . 15

12. In lateral view, posterior end wider than anterior end *E. tibetana* Daday 1908

– In lateral view, posterior end narrower or equally wide as anterior end . . 13

13. Dorsal margin evenly rounded to slightly arched . *E. cisternina* Furtos 1936b

– Dorsal margin almost straight 14

14. In lateral view, posterior end narrower than anterior end . . . . *E. bayensis* Tressler 1937

– In lateral view, posterior and anterior ends equally wide *E. orca* Tressler 1937

15. Swimming setae on A2 reaching only ½ L of penultimate segment . *E. pigra* (Fischer 1851)

– Swimming setae longer 16

16. In dorsal view, anterior end broadly rounded 17

– In dorsal view, anterior end narrower, sometimes even beak shaped 19

17. Valves in lateral view slightly angular . . . . . . *E. hamadensis* Hartmann 1964

– Valves in lateral view triangular 18

18. Anterior marginal area with wart-like elevations . . . *E. trajani* Sywula 1968

– Anterior marginal area without wart-like elevations . . . . *E. angulata* Hartmann 1964

19. Surface covered with stiff setae . . . . *E. indica* Deb 1983

– Setae on the surface not stiff 20

20. Ventral margin straight 21

– Ventral margin concave and often with expansion around the mouth region 22

21. Greatest W lying in front of the middle (kite-like shape) . . . . . . *E. tarentina* Anichini 1963

– Greatest W lying in the middle . . . . *E. inaequalis* Deb 1983

22. Posterior margin of the carapace angular 23

– Posterior margin of the carapace rounded 24

23. Dorsal margin rounded . . . . *E. kerkyrensis* Stephanides 1937

– Dorsal margin highly arched . . . . *E. salina* Hartmann 1964

24. In lateral view, valves triangular . . . . *E. lilljeborgi* (Müller 1900a)

– In lateral view, valves more rounded 25

25. In dorsal view, beak not so well pronounced 26

– In dorsal view, anterior end conspicuously beak like 27

26. Posterior claw on the UR only slightly exceeding ½ L of the anterior claw *E. virens* (Jurine 1820)

– Posterior claw on the UR longer . . . . *E. pagasti* Schäfer 1952

27. In lateral view, carapace more globular . . . . *E. moravica* Jancarik 1947

– In lateral view, carapace elongated . . . . *E. elongata* Stephanides 1937

28. Greatest H around the middle 29

– Greatest H distinctly frontally 31

29. Posterior margin angular 30

– Posterior margin rounded . . . . *E. petkovskii* Danielopol 1965

30. Anterior end in dorsal view cuneiform . . . . *E. anglica* Fox 1967

– Anterior end in dorsal view rounded . . . . *E. noodti* Hartmann 1965

31. Greatest W more than 50% of L 32

– Greatest W less than 50% of L 36

32. Anterior end in dorsal view beak like 33

– Anterior end in dorsal view rounded 34

33\. Posterior claw on the UR only ½ as long as the anterior one . . . . *E. elliptica* (Baird 1846)

– Posterior claw on the UR longer than ½ L of the anterior one . . . . *E. Cassa* (OF Müller 1785)

34\. Posterior seta on the UR very short (very slightly exceeding distal end of the ramus) 35

– Posterior seta on the UR longer (1/2 as long as posterior claw) . . . . . *E. rava* Furtos 1933

35\. Ventral margin of the valves with a distinct enlargement around the mouth region . . . . *E. ambigua* Ghetti 1972

– Ventral margin in that area almost straight . . . . *E. lineate* Akatova 1950

36\. Dorsal margin of the valves very steeply sloping toward posterior end . . . *E. thomsoni* Chapman 1963

– Dorsal margin more gently sloping toward posterior end 37

37\. In dorsal view, carapace kite like (greatest W situated frontally) 38

– Greatest W situated around the middle 39

38\. Anterior and posterior claws on the UR almost equally long . . *E. montelgoni* Kiss 1959b

– Posterior claw on the UR only slightly longer than ½ of the anterior claw *E. arcadiae* Furtos 1936a

39\. One of the caudal rami missing anterior seta . . . . *E. fontana* (Graf 1931)

– Both caudal rami with anterior seta present 40

40\. Greatest W less than 40% of L . . . . *E. illyrica* Klie 1937a

– Greatest W more than 40% of L 41

41\. Swimming setae on A2 over passing tips of terminal claws . . *E. stephanidesi* Petkovski 1959b

– Swimming setae on A2 shorter 42

42\. Swimming setae reaching ½ L of the terminal claws *E. pratensis* Eagar 1970

– Swimming setae on A2 shorter 43

43\. Swimming setae on A2 slightly exceeding distal end of penultimate segment *E. kurtdiebeli* Petkovski and Keyser 1997

– Swimming setae on A2 at the most reaching to the last third of the penultimate segment 44

44\. Anterior and posterior claws on the UR almost equally long, posterior seta longer than ½ L of the posterior claw . . . . *E. domestica* Löffler 1968

– Anterior claw and posterior seta on the UR much shorter . . . . *E. bronsteini* Petkovski 1959b

Species not included in the key
The following species have not been included in the key because of the insufficient description: *E. biharensis* Deb 1984; *E. cameronensis* Roen 1956; *E. hayli* (Brady 1886a); *E. lateraria* (King 1855); *E. mareotica* (Fischer 1855); *E. mongolica* (Daday 1909); and *E. pulenta* Margalef 1961. A couple of species have a short, claw-like posterior seta on the UR, which is, in addition, positioned very close to the posterior claw, and should not belong to the genus *Eucypris*, but rather to some of the genera within the subfamily Herpetocypridinae. These species were not included in the above key, and they are *E. afganistanensis* Hartmann 1964; *E. areguensis* Daday 1905; *E. fabaeformis* Daday 1900; and *E. trapezoides* Hartmann 1962.

Ecology and distribution (Fig. 174)
The species can be found in all types of open water bodies, including the ones with higher salinity. The genus had a world-wide distribution.

Koencypris Meisch 2000

Diagnosis: Carapace subclavate in lateral view, subovate in dorsal view. LV overlapping RV ventrally. Valves without warts along the anterior valve margin. Ventral margin slightly concave around the mouth region. Selvage peripheral both anteriorly and posteriorly on LV. On RV anteriorly selvage displaced inwardly (and overlapped by a well-developed flange); peripheral posteriorly. Terminal segment of the Mxl palp almost cylindrical. Seta "d1" on L6 much longer than seta "d2". UR relatively short, but distal claws very long.

Type (and only) species: *K. ornata* (OF Müller 1776)

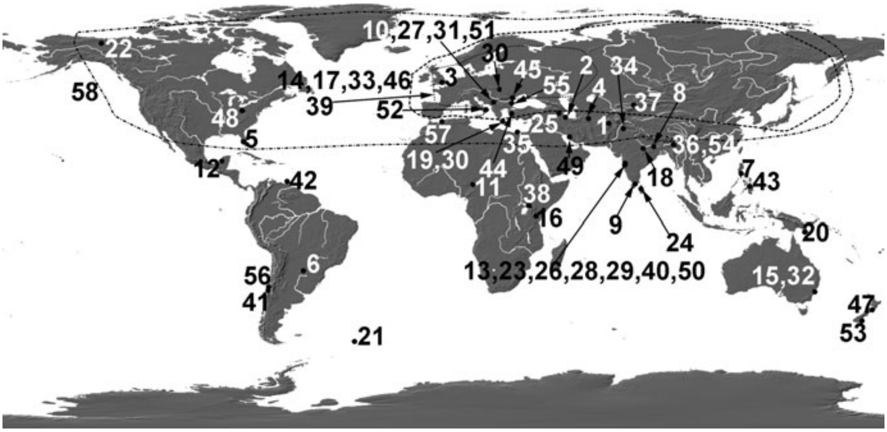


Fig. 174 Distribution of *Eucypris* Vávra 1891: Numbers correspond to the species list

Species list with type locality and type material
K. ornata (OF Müller 1776). Surroundings of Copenhagen, Denmark, 55°40′N 12°33′E: Repository of the type material unknown.

Ecology and distribution
The species prefers small grassy pools and ditches situated in the open field. It is distributed all over Europe.

Prionocypris **Brady and Norman 1896**

Diagnosis (after Meisch 2000): Carapace about 1.5 mm long, subclavate in lateral view (Figs. 167d and 169b). Greatest H situated in front of the middle, LV overlapping RV ventrally. CIL narrow on both valves, without inner lists. Valves lacking frontal warts. Selvage peripheral on both valves and both anteriorly and posteriorly. Terminal segment of the Mxl palp distally dilated, spatula like (Fig. 171d). Both basal setae on L6 present and subequally long (Fig. 171e). UR well developed.

Type species: *P. zenkeri* (Chyzer and Toth 1858)

Species list with synonyms, type locality, and type material

1. *P. longiforma* Dobbin 1941. Stream, near Bald Hill Lake, Thurston County, Washington, USA, 46°49′N 122°26′W: Syntype, SM – 180420.
2. *P. marplesi* Chapman 1963. Flag Swamp near Palmerston, Otago, New Zealand, 45°32′S 170°40′E: Type, OMD – collection number unknown.
3. *P. zenkeri* (Chyzer and Toth 1858). Slowly flowing brook in the municipal wood of Pest (today part of Budapest on the E side of River Danube) eastern, Hungary, 47°29′N 19°02′E:

   Syn.: *P. serrata* Norman 1862

Key to the species

1. Both valves with serrated anterior and posterior margins *P. zenkeri* (Chyzer and Toth 1858)
– Valves not serrated along the margins 2
2. Valves elongated, and dorsal margin arched . . . . *P. longiforma* Dobbin 1941
– Valves reniform and dorsal margin evenly rounded *P. marplesi* Chapman 1963

Ecology and distributions (Fig. 175)
The species of this genus prefer habitats connected to the springs, also found in stream with rich aquatic vegetation. The species have been recorded in North America, Euro-Asia, and New Zealand.

Tonnacypris **Diebel and Pietrzeniuk 1975**

Diagnosis (after Meisch 2000): Carapace about 2 mm long, two times longer than high (Figs. 169e and 170a). CIL broad or narrow. Valves without inner lists.

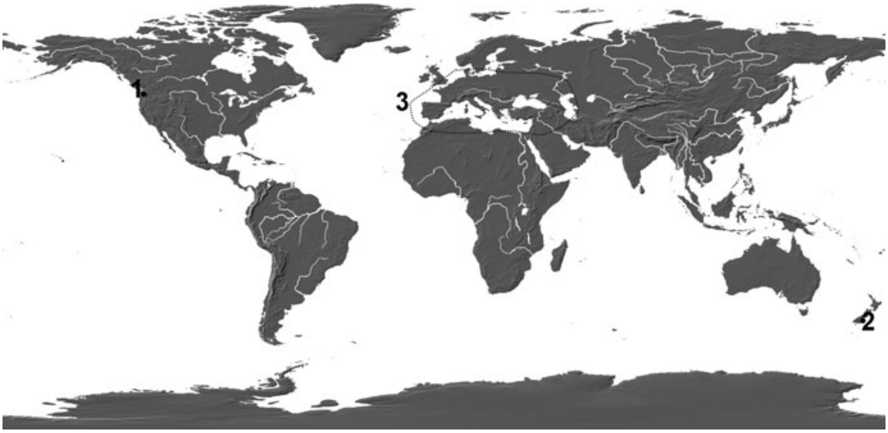


Fig. 175 Distribution of *Prionocypris* Brady and Norman 1896: Numbers correspond to the species list

Selvage peripheral on both valves and along entire free margins. CIL on LV with a small antero-ventral blunt tooth. Terminal segment of the Mxl palp slightly or distinctly spatula like. Seta “d1” on the basal segment of L6 shorter than seta “d2”.

Type species: *T. loessica* Diebel and Pietrzeniuk 1975 (fossil species)

Species list with synonyms, type locality, and type material

1. *T. crassoides* (Alm 1914b). Yenissey, Russia, 55°02′N 91°21′E: Types, SMNH – 1392.
2. *T. edlundi* Van Der Meeren et al. 2009. Grassy outflow stream from Bakhlagiin spring, ca. 30 km SW of Achid Nuur Lake, Nogoonnuur sum, Bayan-Ölgii province, W Mongolia, 49°10′46″N 90°17′03″E: Holotype (♂), RBINS – OC.2988.
3. *T. estonicus* (Jaervekuelg 1960). Cold reocrene spring from Mõdriku, Lääne-Virumaa, N Estonia, 59°18′N 26°27′E: Repository of the type material unknown.
4. *T. glacialis* (Sars 1890). Svalbarð, NE Iceland, 66°12′N 15°43′W : Repository of the type material unknown.
5. *T. lutaria* (Koch 1838). Ditch in the surrounding of Regensburg, Bavaria, Germany, 49°00′N 12°05′E: Repository of the type material unknown.
6. *T. mazepovae* Van Der Meeren et al. 2009. Sandy sediment, shallow embayment, SE shore of Lake Hövsgöl, ca. 2.5 km S of the inflow of Hilent stream, Chandmani-Öndör sum, Khövsgöl, Mongolia, 50°37′28″N 100°30′50″E: Holotype (♂), RBINS – OC.3017.
7. *T. tonnensis* (Diebel and Pietrzeniuk 1975). Weichsel-Frühglazial, Burgtonna, Erfurt area, Thuringia, Germany, 51°04′N 10°44′E: Repository of the type material unknown.

Key to the species

1. Swimming setae on A2 long, i.e. almost reaching tips of the terminal claws 2
– Swimming setae on A2 short; i.e. not reaching distal end of penultimate segment 3
2. Inner lobe of the hemipenis rounded and outer lobe distally elongated *T. edlundi* Van Der Meeren et al. 2009
– Inner lobe of the hemipenis with a convex margin, outer lobe rounded *T. crassoides* (Alm 1914b)
3. Claw G2 on the female A2 exceeding ⅔ L of the claw G1 . . . . . *T. estonicus* (Jaervekuelg 1960)
– Claw G2 on the female A2 shorter than ½ L of the claw G1 4
4. Gamma seta on the Md palp stout *T. tonnensis* (Diebel and Pietrzeniuk 1975)
– Gammy seta on the Md palp long 5
5. Posterior margin of the carapace broad and rounded . . . . *T. mazepovae* Van Der Meeren et al. 2009
– Posterior margin of the carapace considerably narrower than anterior one . . 6
6. Second segment of the left prehensile palp with rectangular dorsal margin *T. lutaria* (Koch 1838)
– Second segment of the left palp with rounded dorsal margin . . . . . *T. glacialis* (Sars 1890)

Ecology and distribution (Fig. 176)
Species live in both temporary and permanent water bodies, and often in springs and spring-connected habitats. The genus is distributed in Holarctic.

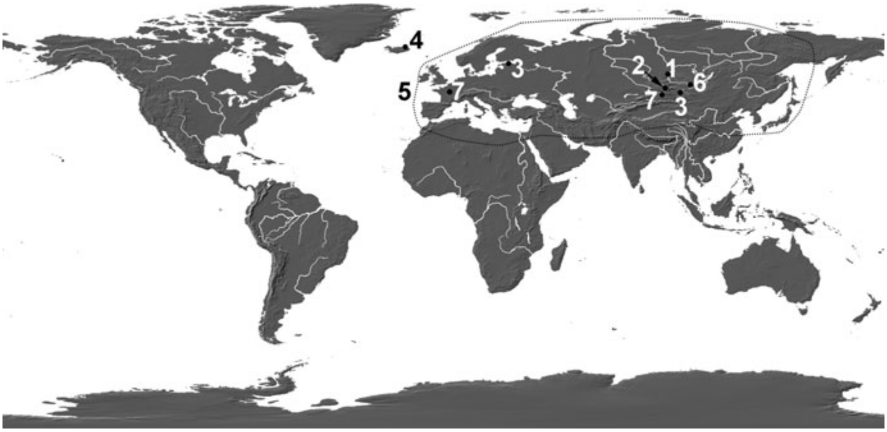


Fig. 176 Distribution of *Tonnacypris* Diebel and Pietrzeniuk 1975: Numbers correspond to the species list

Trajancypris Martens 1989c

Diagnosis (after Meisch 2000): Carapace approximately 2 mm long, clavate to simply elongated in lateral view (Figs. 167c and 169c). CIL broad in both valves. Anterior selvage on RV inwardly displaced, never marginal. LV without selvage, anteriorly with well-developed inner list situated in the proximal half of the CIL. LV overlapping RV ventrally. Terminal segment of the Mxl palp spatula like. Basal setae on L6 subequally long.

Type species: *T. laevis* (Müller 1900a)

Species list with synonyms, type locality, and type material

1. *T. clavata* (Baird 1838). Pond near Copenhagen Fields, Islington, London, England, UK, 51°32′N 00°07′W: Types, BM – collection numbers unknown.

   Syn.: *Cypris celtica* Baird 1859a; *Candonocypris ferdinandi* Lindner 1920b

2. *T. domingensis* (Daday 1910d). Santo Domingo, Dominican Republic, 18°30′N 69°59′W: Types, HMNH – IV/P-220.
3. *T. laevis* (Müller 1900a). Muddy ditches, vicinity of Greifswald, Mecklenburg-Vorpommern, Germany, 54°06′N 13°23′E: Repository of the type material unknown.
4. *T. serrata* (Müller 1900a). Rapid-flowing creeks near Arnstadt, Thuringa, Germany, 50°50′N 10°57′E: Repository of the type material unknown.

Key to the species

1. Each valve postero-ventrally with a row of small pointed denticles 2

– No denticles present 3

2. Posterior margin broadly rounded . . . . *T. serrata* (Müller 1900a)

– Posterior end narrow . . . . *T. domingensis* (Daday 1910d)

3. No list present on the CIL of RV . . . . *T. clavata* (Baird 1838)

– Distinct list present on the CIL of RV . . . . *T. laevis* (Müller 1900a)

Ecology and distribution (Fig. 177)
The species prefer temporary small freshwater bodies. The genus is distributed in the Holarctic.

4.11 Subfamily Herpetocyprellinae Bronstein 1947

Diagnosis (after Bronstein 1947): Valves with rather large tubercular projections. RV overlapping LV dorsally, anteriorly, and posteriorly. A2 completely lacking swimming setae. Terminal segment of the Mxl palp cylindrical. Prehensile palps asymmetrical, vibratory plate on L5 well developed. L6 with subdivided penultimate segment. L7 with terminal segment transformed into pincer organ. UR well developed, asymmetrical.

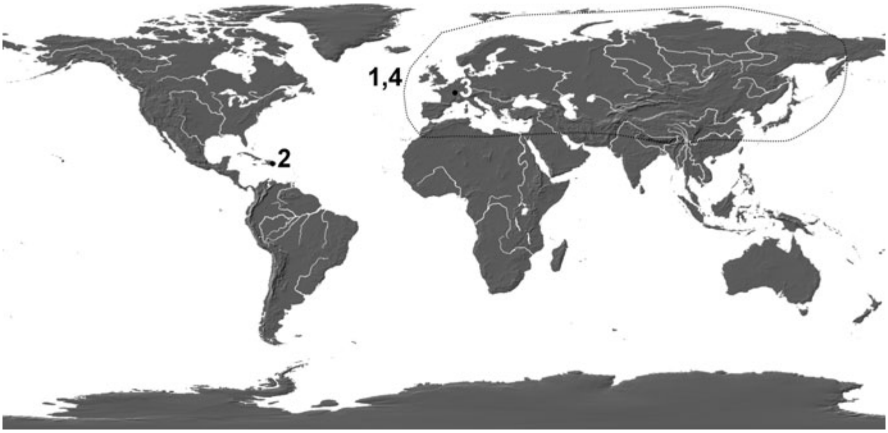


Fig. 177 Distribution of *Trajancypris* Martens 1989c: Numbers correspond to the species list

Type (and only) genus: *Herpetocyprella* Daday 1909.

Type (and only) species: *H. mongolica* Daday 1909. Lake Issyk-Kul, Kyrgyzstan, 42°25′N 77°15′E: Types, HMNH – IV/P-245-246.

4.12 Subfamily Herpetocypridinae Kaufmann 1900

Diagnosis (after Meisch 2000): Carapace medium size, 1–3 mm long, mostly elongated, subrectangular, and laterally compressed (Figs. 178a, b, 179a–g, 180a–d, h–j). Surface smooth or rough. Valves with conical inclusions, showing up in the transmitted light as small dark dots among the larger seta-bearing pore canals. Marginal valve structures mostly well developed (Fig. 179h, i); branched pore canals and marginal septae (Fig. 178b) present in some genera. A1 7-segmented (Fig. 181b). Swimming setae on A2 either well developed or reduced (Fig. 181c). Longer claw on the terminal segment of the male A2 modified into comb-like structure with a row of strong teeth. Terminal segment of the Mxl palp different in shape (Figs. 178c, d and 181e). L5 without "c" seta (Fig. 182f). Prehensile palps asymmetrical (Fig. 183b, c). L6 with both basal setae usually present (Figs. 182e and 184d, e). Terminal segment of L7 pincer like (Figs. 182a, b, and 181h). UR well developed, symmetrical or asymmetrical (Figs. 182c, d, 184a, and 181f, g). Hemipenis with large and sclerotized bladder-like part. Posterior part of the body lacking a seta or spine.

Remarks
The subfamily is divided into three tribes, but the composition of these tribes is such that it is impossible to give a key to them. Therefore, only the key to the individual genera is provided here.

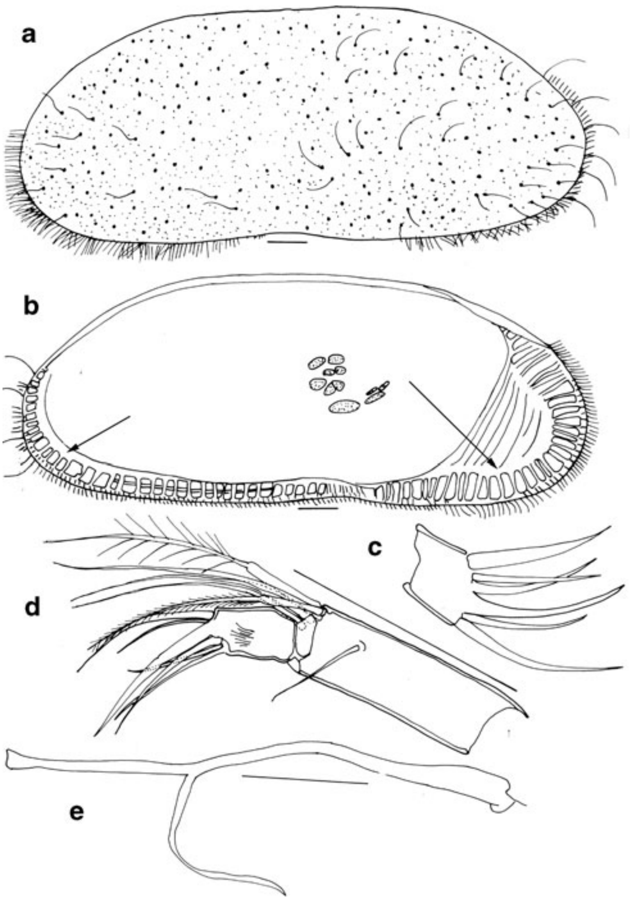


Fig. 178 Line drawings: (**a**, **b**, **d**, **e**) *Stenocypris bolieki* Ferguson 1962; (**c**) *Candonocypris novaezelandiae* (Baird 1843b): (**a**) LV, outer view; (**b**) LV, inside view; (**c**) second segment of the Mxl palp; (**d**) Mxl palp; (**e**) UR attachment. Scales = 0.1 mm

Key to the genera (after Higuti et al. 2009a)

1. Terminal segment of the Mxl- palp spatula like (Fig. 178c) 2

– Terminal segment of Mxl-palp rectangular (Figs. 178d and 181e) 5

2. Penultimate segment of L7 at around mid-length with two (long) setae (Fig. 182a) . . . . *Candonocypris* Sars 1894

– Penultimate segment of L7 at around mid-length with one (long) seta (Fig. 182b) 3

3. Posterior seta on the UR untransformed (a true seta) (Fig. 182d). L 1.5–2.5 mm . . . . *Herpetocypris* Brady and Norman 1889

– Posterior seta on the UR transformed, claw like (Fig. 182c). L 0.7–1.5 mm . . . 4

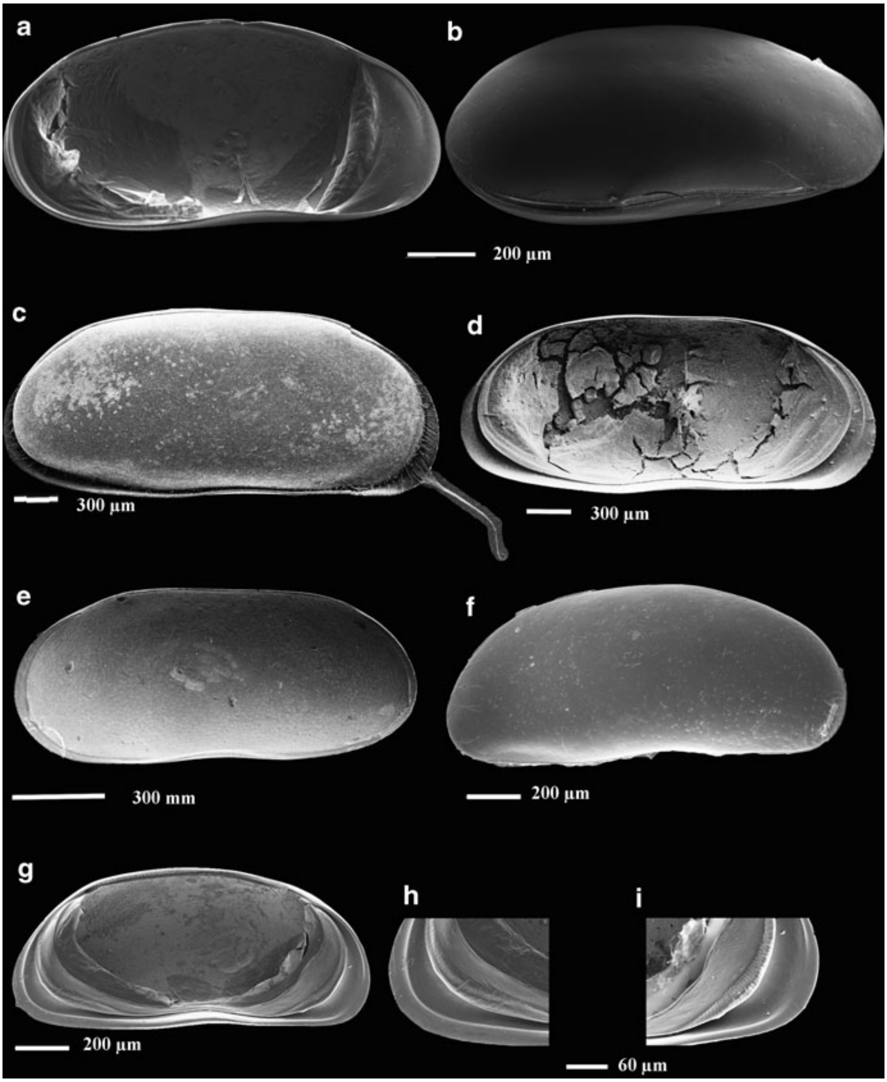


Fig. 179 SEM: (**a**, **b**) *Candonocypris novaezelandiae* (Baird 1843b); (**c**–**e**); *Herpetocypris chevreuxi* (Sars 1896b); (**f**–**i**) *Herpetocypris brevicaudata* Kaufmann 1900b: (**a**, **d**, **g**) LV, inside view; (**b**, **c**, **f**) lateral view from the right side; (**e**) RV, inside view; (**h**) LV, posterior end; (**i**) LV, anterior end. (**c**–**e**) Photos: D. Keyser

4. Setae "d1" and "d2" on L6 subequal in length (Fig. 182e) L >1.0 mm . . *Ilyodromus* Sars 1894

– Seta "d1" long, "d2" absent. Length, 1 mm . . . . *Paranacypris* Higuti et al. 2009b

5. Caudal rami conspicuously asymmetrical (Fig. 184a) 6

– Caudal rami symmetrical or slightly asymmetrical (Fig. 181a, f, g) 7

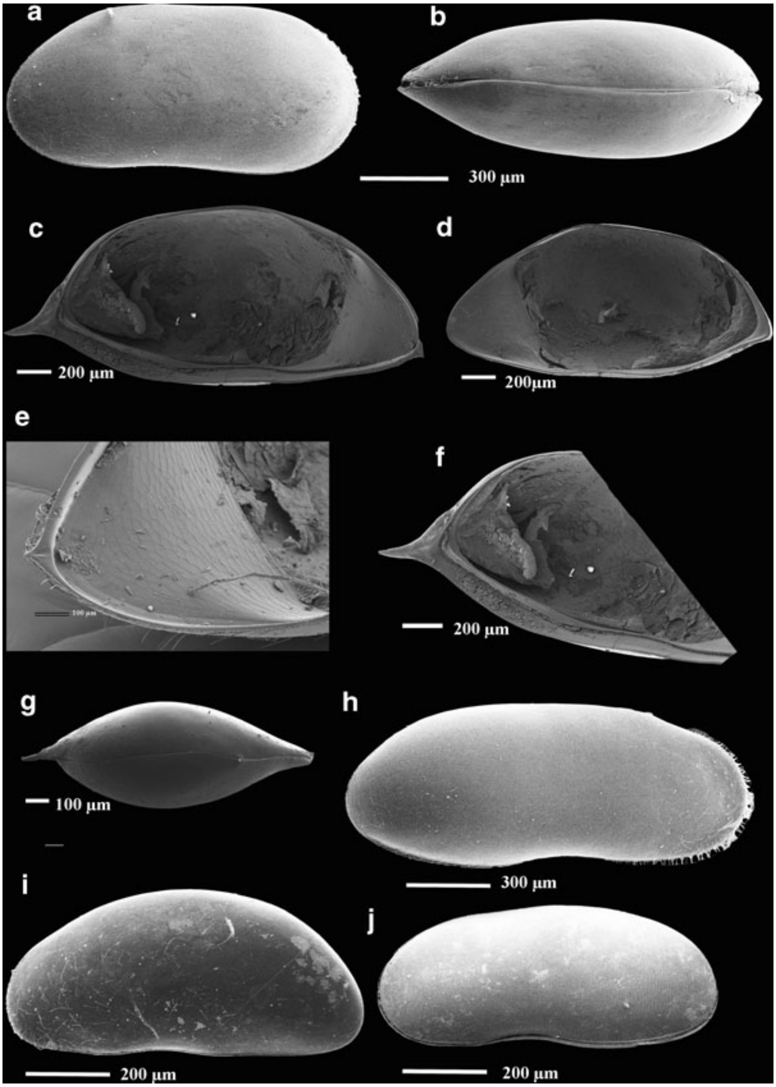


Fig. 180 SEM: (**a**, **b**) *Ilyodromus viridulus* (Brady 1886b); (**c**–**g**) *Acocypris capillata* (Vávra 1895); (**h**) *Stenocypris major* (Baird 1859b); (**i**) *Humphcypris subterranea* (Hartmann 1964); (**j**) *Chrissia sp.*: (**a**, **i**, **j**) lateral view from the left side; (**b**, **g**) dorsal view; (**c**) LV, inside view; (**d**) RV, inside view; (**e**) LV, anterior end; (**f**) LV, posterior end; (**h**) lateral view from the right side. Photos: D. Keyser

6. Marginal valve zones with conspicuous septa (Fig. 178b) . . . . . *Stenocypris* Sars 1889

– These septa always missing . . . . *Chrissia* Hartmann 1957

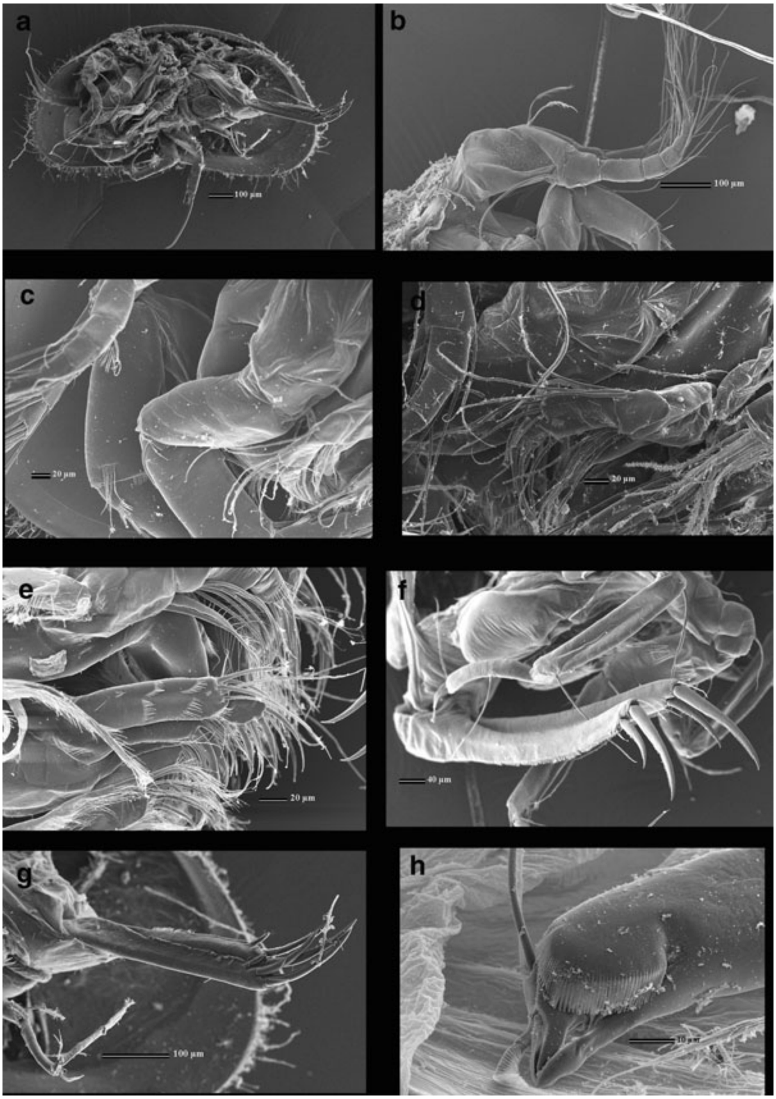


Fig. 181 SEM: (**a**, **g**) *Psychrodromus olivaceus* (Brady and Norman 1889); (**b**–**f**, **h**) *Psychrodromus fontinalis* (Wolf 1920): (**a**) inside view of the soft body; (**b**) A1; (**c**) swimming setae on A2; (**d**) Md palp; (**e**) Mxl palp; (**f**, **g**) UR; (**h**) distal end of L7

7. Posterior seta on the UR long 8

– Posterior seta on the UR short and claw like or absent (Fig. 184b, c, f) . . . 9

8. Posterior inner valve margin conspicuously curved . . . . *Stenocypria* Müller 1901

Fig. 182 Line drawings: (**a**) *Candonocypris novaezelandiae* (Baird 1843b); (**b**, **c**, **e**, **f**) *Ilyodromus sp*.; (**d**) *Herpetocypris chevreuxi* (Sars 1896b): (**a**, **b**) distal part of L7, *arrows* showing the number of setae; (**c**, **d**) UR, *arrows* showing the morphology of the posterior seta; (**e**) basal segment of L6; (**f**) L5. Scales = 0.1 mm

– Posterior inner valve margin regularly rounded . . . . *Ampullacypris* De Deckker 1981c

9. Posterior seta on the UR a conspicuous claw or claw-like seta (Fig. 181g) *Psychrodromus* Danielopol and McKenzie 1977

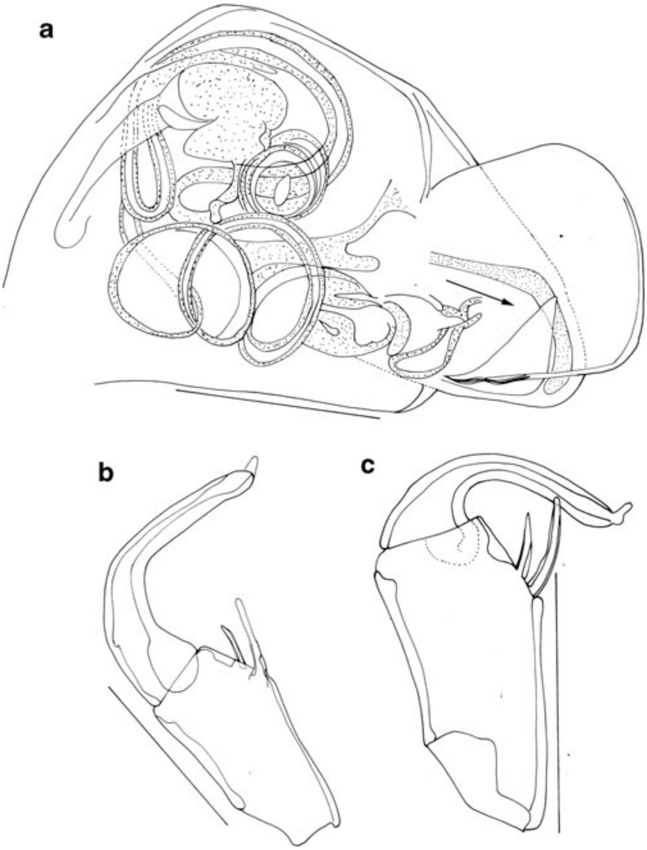


Fig. 183 Line drawings: *Humphcypris chappuisi* (Klie 1935a): (**a**) hemipenis; (**b**, **c**) prehensile palps. Scales = 0.1 mm

– Posterior seta on the UR either an inconspicuous spinule or absent (Fig. 184c, f) 10

10. Setae "d1" and "d2" subequally long (Fig. 184d) *Acocypris* Vávra 1895a, b

– Seta "d1" 2–4 times longer than "d2"(Fig. 184e) 11

11. Posterior seta on the UR an inconspicuous spinule or absent. Carapace 1.0–2.0 mm long. Males present or missing. Hemipenis with conspicuous, sclerotized hook-like apical structure on middle lobe (Fig. 183a); post-labyrinthal spermiduct with two to four additional circular whorls . . . . *Humphcypris* Martens 1997a

– Posterior seta on the UR absent. Carapace approximately 1.0 mm long. Males always present. Hemipenis without hook-like apical structure on medial shield; post-labyrinthal spermiduct with up to six additional circular whorls . . . . *Somalicypris* Martens 1997a

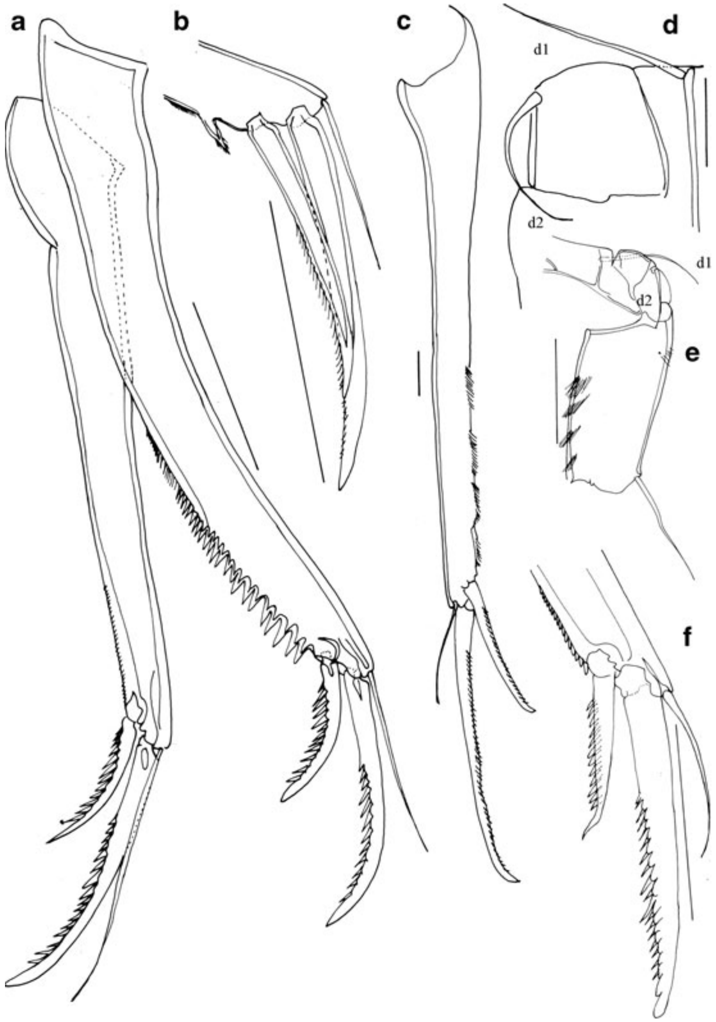


Fig. 184 Line drawings: (**a**) *Stenocypris bolieki* Ferguson 1962; (**b**) *Psychrodromus fontinalis* (Wolf 1920); (**c**, **d**) *Acocypris stenocyproides* Klie 1938; (**e**, **f**) *Humphcypris chappuisi* (Klie 1935a): (**a**, **b**, **c**, **f**) UR; (**d**, **e**) part of L6. Scales = 0.1 mm

4.12.1 Tribe Herpetocypridini Kaufmann 1900

Diagnosis (after Martens 2001): Mostly elongated and laterally flattened species; one valve (LV or RV) with inwardly displaced selvage, either anterior or posterior, or both; marginal zones without septa. Rome organ on Al medium sized to large (in some cases, longer than the segment itself and consisting of up to three parts);

Fig. 185 Distribution of *Amphibolocypris* Rome 1965b: Numbers correspond to the species list

second segment of Mxl palp spatula like, L equal to or smaller than distal W; setae “d1” and “d2” on L6 subequal, or “d2” longer than “d1”; UR symmetrical, proximal seta always present.

Type genus: *Herpetocypris* Brady and Norman 1889

Other genera: *Candonocypris* Sars 1894; *Ilyodromus* Sars 1894

***Candonocypris* Sars 1894**

Diagnosis (after Martens 2001): Valves elongated and laterally compressed (Fig. 179a, b), $L = 1.4–2.0$ mm; RV with inwardly displaced selvage and wide fused zone, marginal septa absent. LV overlapping RV on ventral side. Al with small Rome organ. Natatory setae on A2 short to long (beyond tips of claws), but always present. Mxl palp spatulate, with length about equal to distal width. Setae “d1” and “d2” on L6 subequal. L6 with two lateral setae on penultimate segment (unique feature for this genus) (Fig. 182a). UR symmetrical, proximal seta long. Internal hemipenis morphology unknown, no hook-like process on medial shield.

Type species: *C. candonioides* (King 1855)

Species list with type locality and type material

1. *C. assimilis* Sars 1894. Lagoons, neighborhood of Dunedin, New Zealand, 45°52′S 170°30′E: Repository of the type material unknown.
2. *C. caledonica* (Méhes 1939). Pond on the way to La Foa, New Caledonia, 21°30′S 165°30′E: Types, NHMB – collection numbers unknown.
3. *C. assimilis* Sars, 1894. Varroville, NSW, Australia, 34°04′S 150°49′E: Repository of the type material unknown.

4. *C. deeveyi* Tressler 1954. Lake no.3, Kleiberg County, Texas, USA, 36°03′N 102°30′W: Holotype (♀), SM – 96052.
5. *C. fitzroyi* McKenzie 1966a. Near junction of Broome-Derby-Fitzroy Crossing roads, WA, Australia, 17°38′S 123°44′E: Holotype (♀), NMV – J23, J24.
6. *C. incosta* De Deckker 1981c. Spring at base of limework quarry, Pulbeena Swamp, NW Tasmania, Australia, 40°53′S 145°09′E: Holotype (♂), NMV – J1134-J1162.
7. *C. macra* (Blake 1931). The specimens bore an ancient and illegible label, possibly collected in Colorado, USA, 39°45′N 98°30′W: MCZ – collection numbers unknown.
8. *C. novaezelandiae* (Baird 1843b). New Zealand. No more details on the locality. Types possibly deposited in BM.
9. *C. pascheri* (Brehm 1929a). Tube sent from Mr EW Bennett with lost label, New Zealand, 42°00′S 174°00′E: Repository of the type material unknown.
10. *C. pugionis* Furtos 1936a. Hwy pool, ca. 6.5 km from Miakka, toward Fruitville, Florida, USA, 27°19′N 82°16′W: Holotype (♀), SM – 71382.
11. *C. sarsi* Danforth 1948. Shallow, weedy pond in Dewey's Pasture, Clay County, Iowa, USA, 43°05′N 95°08′W: Types, SM – collection numbers unknown.

Key to the species

1. Posterior claw on the UR only ½ as long as anterior one . . *C. novaezelandiae* (Baird 1843b)

– Posterior claw on the UR exceeding ½ L of anterior claw 2

2. Posterior seta on the UR longer than ½ L of posterior claw . . . . *C. caledonica* (Méhes 1939)

– Posterior seta on the UR equaling only ⅓ of posterior claw 3

3. Posterior seta on the UR transformed into a short, strong claw . . . . *C. incosta* De Deckker 1981c

– Posterior seta on the UR seta like 4

4. Carapace elliptical with evenly rounded dorsal margin, and greatest H situated in the middle . . . . *C. assimilis* Sars 1894

– Carapace sub-elliptical, greatest H lying distinctly behind the middle . . . . *C. assimilis* Sars 1894

Species not included in the key
The following species doubtfully belong to the genus because the penultimate segment of L7 has only one seta: *C. deeveyi* Tressler 1954; *C. macra* (Blake 1931); *C. pascheri* (Brehm 1929); *C. pugionis* Furtos 1936a; and *C. sarsi* Danforth 1948. McKenzie (1966a) did not describe the appearance of L7, but, nevertheless, *C. fitzroyi* McKenzie 1966a can hardly belong to the genus *Candonocypris* because the terminal segment of the Mxl is not spatula like.

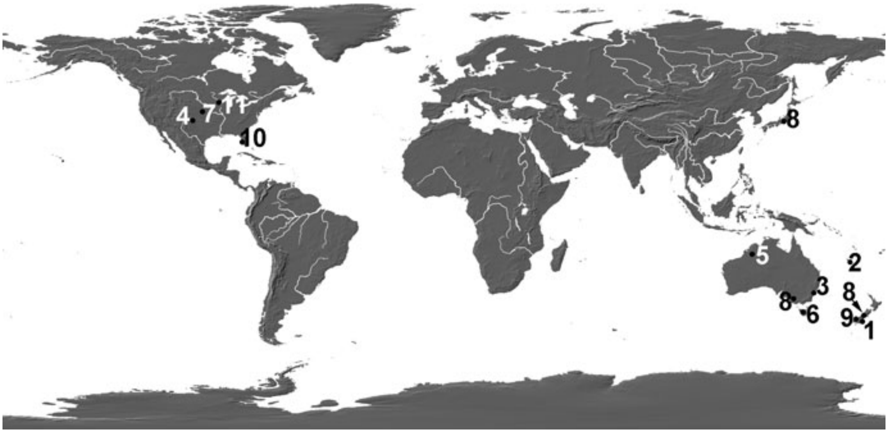


Fig. 186 Distribution of *Candonocypris* Sars 1894: Numbers correspond to the species list

Ecology and distribution (Fig. 186)
Species live in open freshwater bodies, such as ponds and lakes. With the exception of the couple of species described from America, with clearly doubtful position in the genus, *Candonocypris* has been found in Australia, New Zealand, New Caledonia, and Japan.

Herpetocypris Brady and Norman 1889

Diagnosis (after Martens 2001): Valves elongated and laterally compressed, $L = 1.5–2.5$ mm (Fig. 179c–g); LV with largely inwardly displaced selvage and wide fused zone, false pore canals present (Fig. 179h, i); marginal septae absent. LV overlapping RV on all sides. RV with well-developed CIL along anterior, ventral, and posterior margins. A1 with small Rome organ. Swimming setae on A2 very short to long (beyond tips of claws), but always present. Mxl palp spatula like, with L about equal to distal W. Seta "d2" on L6 about 1.5–2 L of seta "dl." UR symmetrical, proximal seta present, not claw like (Fig. 182d), spines on ramus short and grouped. Attachment with typical basal triangle, and an additional, but weakly built small branch toward the distal part of the main branch. Hemipenis without hook-like process on middle lobe; no additional internal coils of spermiduct.

Species list with type locality and type material

1. *H. bicolor* (Müller 1880). Creek Burgbach at Mühlberg near Erfurt, Thuringia, Germany, 50°52′N 10°49′E: Repository of the type material unknown.
2. *H. brevicaudata* Kaufmann 1900b. Shallow trench near Bülach, Zürich, Switzerland, 47°31′N 08°32′E: Repository of the type material unknown.

   Syn.: *H. ghigii* Masi 1932a; *H. lenta* Rome 1947a; *H. flumendosae* Anichini 1967

3. *H. chevreuxi* (Sars 1896b). Swamp of Bon Kamera, neighborhood of Annaba, Algeria, 36°54′N 07°44′E: Repository of the type material unknown.

   Syn.: *Cypris hessei* Keilhack 1911; *H. agilis* Rome 1954; *H. scoininosa* Anichini-Pini 1968a; *H. tarnogradskyi* Bronstein 1925

4. *H. fontinalis* Bronstein 1928. Rheocrene springs and brooks, foot of Fethus Mt., alongside the "Grusinische Heerstrasse," Redanttal, near Wladikawkas, N Caucasus, 42°53′N 44°38′E: Repository of the type material unknown.
5. *H. helenae* Müller 1908. Spring next to Napoleon's tomb, St. Helena, UK, 15°57′S 05°42′W: Syntypes, ZMB – ZMBln 13155.

   Syn.: *Cypris intermedia* Masi 1905a (unused senior synonym); *H. palpiger* Lowndes 1932c; *H. caerulea* Rome 1954; *H. puteolina* Anichini-Pini 1968a

6. *H. intermedia* Kaufmann 1900b. Slowly flowing brook, near Colico, close to the shore of Lake Como, Lombardy, Italy, 46°07′N 09°22′E: Repository of the type material unknown.

   Syn.: *H. andegavensis* Anichini-Pini 1968a, b

7. *H. laevissima* Henry 1923. Parramatta, NSW, Australia, 33°44′S 151°00′E: Type (♀), AMS – P.6118.
8. *H. ludhianaensis* Battish 1982b. Small muddy ditch at Jodhan Road, Lalton, near Ludhiana, Punjab, India, 30°˜50′N 75°˜47′E: Holotype (♀), repository of the type material unknown.
9. *H. mateusorum* Paulo 1969. Castelo do Queijo, Porto, Portugal, 41°10′N 08°41′W: Holotype (♀), ZIANP – 9.
10. *H. minnesotensis* (Herrick 1887). Type locality not explicitly given, possibly Mobile Bay area, Alabama, USA, 30°26′N 88°00′W: Repository of the type material unknown.
11. *H. pattersoni* Tressler 1954. Upper pool in Fern Canyon, Davis Mountains, Texas, USA, 29°10′N 103°30′W: Holotype (♀), SM – 96052.
12. *H. pectinata* Brehm 1934. Osorno, S Chile, 40°34′S 73°09′W: Syntype (♀), ZMH – K-21420.
13. *H. peregrina* Croneberg 1894. Ditch at the Botanical Gardens, Moscow, Russia, 55°50′N 37°36′E: Repository of the type material unknown.
14. *H. reptans* (Baird 1835). Yetholm Loch, Scotland, UK, 55°32′N 02°18 W: Repository of the type material unknown.
15. Syn.: *Candonopsis complanata* Brady 1902; *Candona similis* Baird 1846; *Candona virescens* Brady 1864
16. *H. smaragdea* Daday 1908. Surface of Lake Rham-Tso, Tibet, 28°27′N 89°36′E: Repository of the type material unknown.
17. *H. stewarti* Daday 1908. Surface of Lake Mang-Tsa (Mangcuo), Tibet, 29°32′N 98°50′E: Types, HMNH – IV/P-247.
18. *H. syriaca* Daday 1911b. Artificial pond near Aaddoûs, close to Baalbek, Lebanon, 34°01′N 36°08′E: Repository of the type material unknown.

19. *H. testudinaria* Cushman 1908. Fresh water or very slightly brackish pond, Funk Island, ca. 48 km off the N coast of Labrador, Canada, 49°44′N 53°10′W: Type, SM – 38339.

Key to the species

1. Swimming setae on A2 strongly reduced (the longest reaching at the most end of penultimate segment) 2
– Swimming setae well developed, reaching at least middle of terminal claws 12
2. Posterior seta on the UR as long or longer than ½ L of posterior claw 3
– This seta very short 7
3. Posterior margin of the carapace wider than anterior one . . . . . *H. laevissima* Henry 1923
– Posterior margin of the carapace as wide as or narrower than anterior margin 4
4. Swimming setae on A2 reaching distal end of penultimate segment . . . . . *H. ludhianaensis* Battish 1982b
– Swimming setae reaching only middle of penultimate segment 5
5. Anterior seta on the UR almost reaching middle of the anterior claw 6
– This seta very short . . . . *H. peregrina* Croneberg 1894
6. Posterior claw on the UR only ½ as long as anterior one . *H. stewarti* Daday 1908
– Posterior claw almost as long as anterior one . . . *H. smaragdea* Daday 1908
7. Swimming setae on A2 only ½ L of penultimate segment 8
– At least one of the swimming setae on A2 reaching beyond middle of penultimate segment 10
8. Posterior seta on the UR seta like . . . . *H. reptans* (Baird 1835)
– This seta claw like 9
9. Anterior and posterior margins broadly rounded and equally wide *H. syriaca* Daday 1911b
– Posterior margin very narrow, valves almost subtriangular . . . . *H. fontinalis* Bronstein 1928
10. Dorsal margin of the valves flat . . . . *H. brevicaudata* Kaufmann 1900b
– Dorsal margin of the valves rounded 11
11. Greatest H around middle . . . . *H. mateusorum* Paulo 1969
– Greatest H on the last 1/3 of the carapace . . . *H. testudinaria* Cushman 1908
12. Swimming setae on A2 reaching and slightly exceeding tips of terminal claws . . . . . *H. chevreuxi* (Sars 1896b) and *H. intermedia* Kaufmann 1900b
– Swimming setae on A2 not reaching tips of terminal claws . . . . . *H. helenae* Müller 1908 and *H. pattersoni* Tressler 1954

Species not included in the key
The following species have not been included in the key because of insufficient descriptions: *H. bicolor* (Müller 1880); *H. minnesotensis* (Herrick 1887); and *H. pectinata* Brehm 1934.

Ecology and distribution (Fig. 187)
The species can be found in all types of open freshwater bodies, ones with shorter swimming setae prefering springs and spring-connected habitats. The genus has a world-wide distribution.

Ilyodromus **Sars 1894**

Diagnosis (after Martens 2001): Valves elongated and laterally compressed (Fig. 180a, b), $L = 1.0$–1.5 mm; RV and LV with weakly inwardly displaced posterior selvage and wide, fused zone, no marginal septa. LV overlapping RV on all sides. A1 with large Rome organ, longer than the segment on which it is situated, and consisting of three parts. Aesthetasc “Y” on A2 short to medium length (halfway end claws), but always present. Mxl palp spatula like, with L smaller than distal width. Setae “d1” and “d2” on L6 subequal, both long (Fig. 182e). UR symmetrical, posterior seta long and stout, claw like (Fig. 182c).

Type species: *I. stanleyana* (King 1855)

Species list with synonyms, type locality, and type material

1. *I. anisitsi* (Daday 1905). Swamp, Alto Parana, Encarnacion, Paraguay, 27°20′S 55°51′W: Type, HMNH – IV/P-211-212.

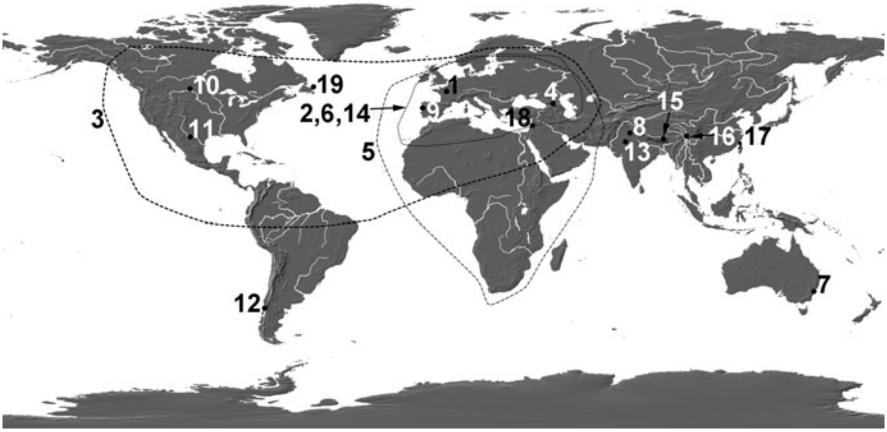


Fig. 187 Distribution of *Herpetocypris* Brady and Norman 1889: Numbers correspond to the species list

2. *I. candonites* De Deckker 1981c. Small granite rock pool, summit of Mt. Chudalup, near Northcliffe, WA, Australia, 34°45′S 116°05′E: Holotype (♂), NMV – J1134-J1162.
3. *I. intermedia* Okubo 2004. Lake Biwa vicinity, Shiga Prefecture, Kinki Region, Honshu, Japan, 35°00′38″N 135°57′38″E: Repository of the type material unknown.
4. *I. kerguelensis* Müller 1906b. Freshwater, Kerguelen Islands, French Southern Territories, 49°20′S 69°21′E: Repository of the type material unknown.
5. *I. lanaoensis* Victor and Fernando 1981d. Pond at entrance to Bacolod Chico, Marawi City, Lanao del Sur, Lake Lanao, Mindanao Island, Philippines, 07°59′N 124°16′E: Holotype (♀), NMNSO – 21608.
6. *I. obtusus* Sars 1894. Lagoons, neighborhood of Dunedin, New Zealand, 45°52′S 170°30′E: Repository of the type material unknown.
7. *I. pectinatus* Sharpe 1908. Stomach of *Spatula clypeata,* South Carolina, USA, 34°00′N 81°00′W: Type (♂), SM – 38346.
8. *I. smaragdinus* Sars 1894. Lagoons near Dunedin, New Zealand, 45°52′S 170°30′E: Repository of the type material unknown.
9. *I. stanleyana* (King 1855). Ponds, top of sandstone rocks overlooking the sea near Coogee, NSW, Australia, 33°55′S 151°15′E: Repository of the type material unknown.
10. *I. substriatus* Sars 1894. Lagoons near Dunedin, New Zealand, 45°52′S 170°30′E: Repository of the type material unknown.
11. *I. varrovillius* (King 1855). Varroville, Sydney, NSW, Australia, 34°00′S 150°49′E: Repository of the type material unknown.
12. *I. verreauxii* (Baird 1862). Chile, no more details on the locality: Repository of the type material unknown.
13. *I. viridulus* (Brady 1886b). Tweed River, Condong, N of Sydney, NSW, Australia, 28°19′S 153°26′E: Types, BM – collection numbers unknown.

Key to the species

1. Swimming setae on A2 over passing middle of the terminal claws 2
– Swimming setae on A2 at the most reaching distal end of penultimate segment 7
2. Dorsal margin of the carapace rounded 3
– Dorsal margin of the carapace straight 4
3. Surface of the carapace striated and posterior seta on the UR almost ½ as long as posterior claw .... *I. lanaoensis* Victor and Fernando 1981d
– Surface of the carapace smooth, posterior seta on the UR much shorter *I. anisitsi* (Daday 1905)
4. Surface of the carapace smooth .... *I. smaragdinus* Sars 1894
– Surface of the carapace striated 5
5. Posterior margin clearly narrower than anterior one *I. varrovillius* (King 1855)

– Anterior and posterior margin equally wide 6

6. In dorsal view, sides almost parallel, posterior end as narrow as anterior one . . . . *I. obtusus* Sars 1894

– In dorsal view, shape more ovoid, and posterior end wider than anterior one . . . . *I. stanleyana* (King 1855) and *I. substriatus* Sars 1894

7. Swimming setae on A2 reaching distal end of penultimate segment *I. kerguelensis* Müller 1906b

– Swimming setae on A2 very short and only slightly exceeding distal end of the first endopodal segment . . . . *I. candonites* De Deckker 1981c

Species not included in the key

The following species have not been included in the key because of the very short and insufficient descriptions: *I. intermedia* Okubo 2004; *I. pectinatus* Sharpe 1908; *I. verreauxii* (Baird 1862); and *I. viridulus* (Brady 1886b). Species described by Okubo (2004) very closely resembles *I. smaragdinus* Sars 1894. *Ilyodromus pectinatus* doubtfully belongs to this genus, while Baird's and Brady's species have been described only based on valve shape, and *I. viridulus* resembles very much the type species of the genus.

Ecology and distribution (Fig. 188)

The species can be found in lakes, but are very often associated with streams and springs. The genus is distributed mainly in the southern hemisphere, with a couple of exceptions.

4.12.2 Tribe Stenocypridini Ferguson 1964b

Diagnosis (after Martens 2001): Mostly elongated and laterally flattened species, with no inwardly displaced selvage, valves with or without marginal septa. Rome

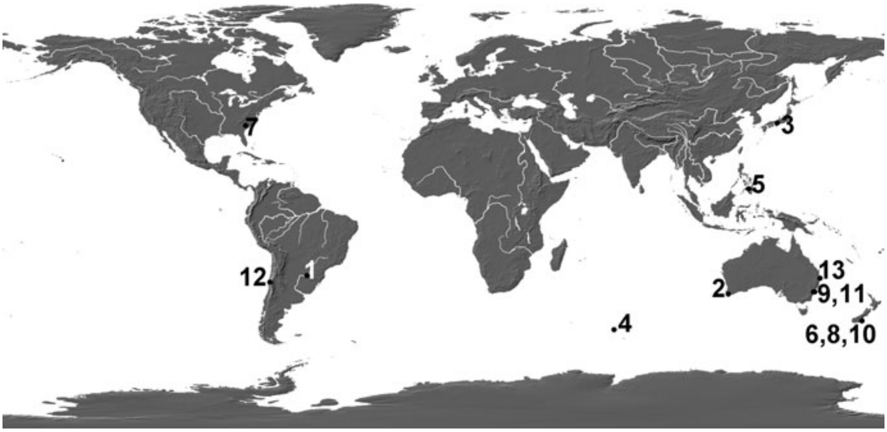


Fig. 188 Distribution of *Ilyodromus* Sars 1894: Numbers correspond to the species list

organ on Al small or medium sized (never longer than segment), consisting of one part only; second segment of Mxl palp rectangular, with length 1.5–3 times the distal width; setae “d1” and “d2” on L6 subequal; UR symmetrical or asymmetrical, sometimes strongly so, and with or without proximal seta.

Type genus: *Stenocypris* Sars 1889

Other genera: *Acocypris* Vávra 1895; *Ampullacypris* De Deckker 1981c; *Chrissia* Hartmann 1957; *Stenocypria* Müller 1901

***Acocypris* Vávra 1895**

Diagnosis (after Martens 2001): Valves with pore canals branched; marginal septa absent; both valves hairy, posterior part of valves set with several long setae; anterior part of carapace in dorsal view beak like (Fig. 180c–g). A2 with swimming setae long, reaching tips of claws; terminal segment of Mxl palp semi-rectangular, with length 1–1.5 times the distal W; setae “d1” and “d2” on L6 subequally long; UR symmetrical, proximal seta absent.

Type species: *A. capillata* (Vávra 1895)

Species list with synonyms, type locality, and type material

1. *A. acuminata* Rome 1962. Bangwe Bay, Lake Tanganyika, Tanzania, 02°23′S 32°08′E: Holotype (♀), RBINS – O.C. 586.
2. *A. angulosa* (Daday 1910a). Bog, Kilimanjaro, 03°04′S 37°21′E: Repository of the type material unknown.
3. *A. capillata* (Vávra 1895). Bog behind the German Club, Zanzibar, Tanzania, 06°09′S 39°11′E: Syntypes, ZMH – K-19 118–119.

   Syn.: *Parastenocypris unispinosa* Onyedineke 2000

4. *A. hirsuta* Rome 1965a. Lake Victoria, Burundi, 01°00′S 33°00′E: Holotype (♀), RBINS – O.C. 716.
5. *A. hyalina* Lowndes 1931a. Lake Elgol, Uganda: Repository of the type material unknown.
6. *A. longiuscula* Rome 1965a. Mabwe, DR Congo, 08°39′S 26°31′E: Holotype (♀), RBINS – O.C. 719.
7. *A. platybasis* (Lowndes 1932a). Water hole N of Makki River, Mt. Chillalu, Kenya, 01°00′N 38°00′E: Repository of the type material unknown.
8. *A. stenocyproides* Klie 1938c. Busingizi, Congo: Syntypes ZMK – UR-901.

Key to the species

1. Postero-ventral margin on both valves rounded 2
– Postero-ventral margin on LV pointed and sometimes extended into a spine 3
2. Posterior margin of valves sinusoid with last 1/3 slightly protruding . . . . . . *A. stenocyproides* Klie 1938c
– Posterior margin inclined, and no protruding part . *A. hyalina* Lowndes 1931a

3. Anterior seta on the UR very short, not reaching ⅓ of anteiror claw *A. angulosa* (Daday 1910a)
– Anterior seta on the UR at least ½ as long as anterior claw 4
4. Postero-ventral margin of LV conical but not extended into a long thin spine 5
– Postero-ventral margin of LV extended into a long and thin spine 6
5. Greatest H lying around the middle . . . . *A. platybasis* (Lowndes 1932a)
– Greatest H lying frontally . . . . *A. acuminata* Rome 1962
6. Antero-ventral margin on LV pointed . . . . *A. hirsuta* Rome 1965a
– Antero-ventral margin on LV rounded 7
7. Anterior seta on the UR reaching only ½ L of anterior claw . . *A. longiuscula* Rome 1965a
– Anterior seta on the UR reaching ⅔ L of anterior claw . . . . *A. capillata* (Vávra 1895a, b)

Ecology and distribution (Fig. 189)
Species are found in stagnant water bodies, most usually lakes. The genus is endemic to Africa.

Ampullacypris De Deckker 1981c

Diagnosis (after Martens 2001): Valves elongated and laterally compressed, $L = 1.5$–2.0 mm; RV and LV without selvages or inner lists; fused zone wide; marginal septa absent; anterior CIL well developed. Al with Rome organ small, but 2-segmented. Swimming setae on A2 long, reaching beyond tips of end claws, Mxl palp rectangular, with length about twice that of distal W. Seta “d1” on L6 long, “d2” missing. UR symmetrical, proximal seta long and strong. Hemipenis without hook-like process on middle lobe.

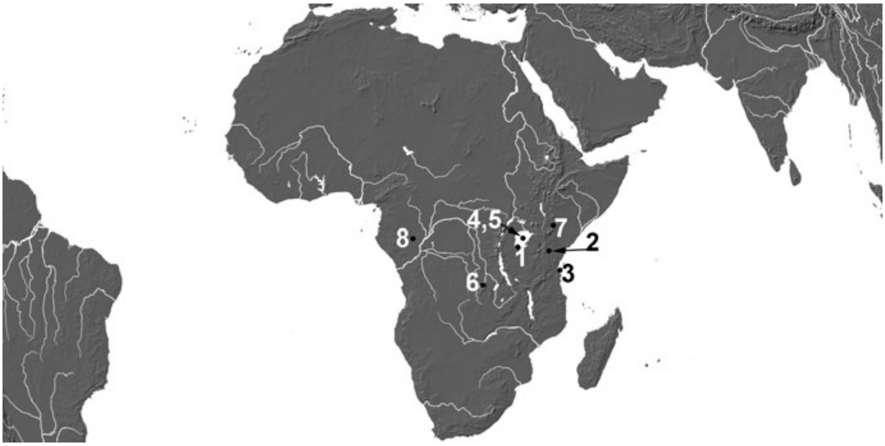


Fig. 189 Distribution of *Acocypris* Vávra 1895: Numbers correspond to the species list

Type (and only) species: *A. oblongata* (Sars 1896c)

Species list with type locality and type material
A. oblongata (Sars 1896c). Raised from dried material, from shallow depressions in the reddish sand from desert, about 65 km E of Roebuck Bay, WA, Australia, 18°04′S 122°17′E: Syntypes, NHMO – F11189.

Chrissia **Hartmann 1957 [Syn.:** ***Gesa*** **Hartmann 1957;** ***Parastenocypris*** **Hartmann 1964]**

Diagnosis (after Martens 2001): Valves elongated (Fig. 180j) and laterally compressed, $L = 1.5–3.5$ mm; RV and LV without selvages or inner lists; fused zone wide, pore canals straight along anterior and posterior margins, branched along ventral margin, false pore canals present, especially ventrally; marginal septa absent; anterior CIL well developed. A1 with Rome organ small. Swimming setae on A2 of medium length, reaching about halfway the end claws; Mxl palp rectangular and elongate, with L 2–3 times that of distal W. Setae “dl” and “d2” on L6 subequal, both short. UR asymmetrical, proximal seta absent, spines on ramus of right UR larger than on left UR, sometimes very long and stout. Hemipenis without hook-like process on middle lobe; up to two additional internal coils of the spermiduct.

Type species: *C. levetzovi* Hartmann 1957

Species list with synonyms, type locality, and type material

1. *C. achandii* (George and Martens 1993b). Inundated brickyards and paddy fields, both sides of National Hwy 47, at Puthukad, Trichur district, Kerala State, India, 10°29′32″N 76°16′22″E: Holotype (♀), RBINS – O.C.1652.
2. *C. aldabrae* (Müller 1898). Near Morondava, Madagaskar, 20°17′S 44°17′E: Syntypes, ZMG – 24708.
3. *C. ametra* (Müller 1908). Sandvley near Lakeside, near Simon’s Town, Western Cape, South Africa, 34°11′S 18°25′E: Syntypes, ZMB – 13153–4.

   Syn.: *Stenocypris olivacea* Sars 1924

4. *C. bispinosa* (Müller 1914). Chapman’s Bay, Western Cape, South Africa, 34°06′S 18°20′E: Repository of the type material unknown.

   Syn.: *Stenocypris pardalis* Sars 1924

5. *C. biswasi* (Deb 1972). Balatalao, Julgati, Jaipur District, Rajasthan, India, 26°55′N 75°49′E: Type (♀), ZSI – C-1005/2.
6. *C. canaliculata* (Hartmann 1964). Pond, near Nagpur in Jodpur, Madhya Pradesh, India, 21°09′N 79°06′E: Syntypes, ZMH – K-27 495.
7. *C. ceylonica* (Daday 1898). Bog in the area of Kala Wewa, Sri Lanka, 08°01′N 80°33′E: Types, HMNH – IV/P-357.
8. *C. cultrata* (Müller 1900b). Masai, Kenya, 02°30′S 37°00′E: Syntypes, ZMB – 10 267.

9. *C. declivis* (Sars 1924). Green Point Common, N Cape Town, Western Cape, South Africa, 33°55′S 18°28′E: SAFM – AII939.
10. *C. dayalpurensis* Battish 1998. Pond at village Dayalpur, on Samrāla–Chandigarh road, 5 km from Samrāla, Punjab, India, 30°49′N 76°13′E: Repository of the type material unknown.
11. *C. fasciculata* (Daday 1910a). Flood pools of Mbasi River, Zambia, 10°48′S 33°29′E: HMNH – IV/551.
12. *C. fascigera* (Sars 1924). Eunda, Omusati, Namibia, 17°31′S 14°38′E: Type (♀), SAFM – AII864.
13. *C. fernandoi* (Neale 1976c). Pond, Yala-Palatupana, Sri Lanka, 06°22′N 81°31′E: Holotype (♀), UH – HU.239. R.5.
14. *C. formosa* (Klie 1938d). Rice field by Uzanto, Taiwan, 23°47′N 120°10′E: Syntypes, ZMK – UR-962.
15. *C. fuelleborni* (Daday 1910a). Nyassa Lake, Mozambique, 12°00′S 34°30′E: HMNH-P-362.
16. *C. goddeerisi* (George et al. 1993). Small temporary pool adjacent to paddy field, near Chalakudy Railway Station, Trichur District, Kerala, India, 10°18′21″N 76°22′22″E: Holotype (♀), RBINS – O.C. 1643.
17. *C. halyi* (Ferguson 1969). Pools in Sri Lanka. No further details on the type locality: Holotype (♀), HM – collection number unknown.
18. *C. hislopi* (Ferguson 1969). Nagpur, Mahārāshtra, India, 21°09′N 79°06′E: Holotype (♀), BM – 1966.10.17.1.
19. *C. hodgsoni* (Sars 1924). Raised from dried mud, from a valley near Port Elizabeth, Eastern Cape, South Africa, 33°58′S 25°35′E: Types, SAFM – AII126.
20. *C. humilis* (Klie 1932). Backwater pools N of Pangururan, Samosir Island, Lake Toba, North Sumatra, Indonesia, 02°35′N 98°50′E: Syntypes, ZMK – UR-964.
21. *C. icosacantha* (Lowndes 1931a). Lake Elgol, Uganda: Cotypes, BM – 1931.12.30.1-4.
22. *C. junodi* (Delachaux 1919). Village Rikatla, N of Maputo (formerly Lourenço Marques), Mozambique, Africa, 25°44′S 32°34′E: Repository of the type material unknown.

    Syn.: *Stenocypris urodonta* Rome 1965a

23. *C. khopoliensis* (Deb 1983). Khopoli rainwater pond at Karla, 13 km S of Lonavala on Bombay–Poona Road, India, 18°45′N 73°29′E: Holotype (♀), ZSI – C 10862.
24. *C. krishnakantai* (Deb 1972). Pond inside Ajintara fort, Sātāra, Mahārāshtra, India, 17°41′N 73°59′E: Holotype (♀), National Collection, ZSI – C1006/2.
25. *C. levetzovi* Hartmann 1957. Lake Chrissie, Mpumalanga, South Africa, 26°20′S 30°13′E: Syntypes, ZMH – K-27 668.

    Syn.: *Gesa dubia* Hartmann 1957

26. *C. monodi* (Gauthier 1930). Bourem, Niger, 13°37′N 12°19′E: Repository of the type material unknown.
27. *C. ousmana* Ghetti 1972. Taşköprü, Turkey, type locality plurivalent. Holotype (♀), IZUP – collection number unknown.
28. *C. pectinata* (Sars 1924). Pond, Cape Flats, South Africa, 33°58′S 25°35′E: Types, NHMO – F 11313–4.
29. *C. perarmata* (Brady 1904). Pools in Greytown, KwaZulu-Natal, South Africa, 29°04′S 30°35′E: Types, SAFM – AII153.
30. *C. sinuata* (Müller 1898). Mahajanga, Madagascar, 15°43′S 46°19′E: Syntypes, ZMG −24709.
31. *C. smaragdina* (Sars 1924). Raised from dried mud, from a grassy dried-up valley on the Cape Flats, Western Cape, South Africa, 33°58′S 25°35′E: Types, NHMO – F4350.

    Syn.: *Stenocypris anisoacantha* Rome 1965b

32. *C. spinosa* (Tressler 1937). Pool on Camiguin Island, Philippines, 09°10′N 124°42′E: Holotype (♀), SM – 74516.
33. *C. vittata* Okubo 1974. Rice fields of Higashikaimon, Kagoshima, Japan, 31°33′N 130°33′E: Holotype (♀), UMT – UR 4143.
34. *C. werneri* (Daday 1910b). Pond in the Zoological Garden of Giza (Gizeh), Cairo, Al Jīzah, Egypt, 30°05′N 31°13′E: Repository of the type material unknown.

Key to the species

1. Postero-ventral margin very pointed, terminating with a conical extension 2
– Postero-ventral margin rounded without pointed extension 8
2. Anterior margin also with a pointed part 3
– Anterior margin rounded 5
3. Pointed end situated close to the ventral margin . . . . *C. goddeerisi* (George et al. 1993)
– Pointed end situated medially on the margin 4
4. Fingers on both prehensile palps much longer than the body *C. ametra* (Müller 1908)
– Fingers on both palps shorter or equally long as the body . . . . . *C. bispinosa* (Müller 1914)
5. Anterior inner margin not evenly rounded, but with sinusoid dorsal part . . . . *C. cultrata* (Müller 1900b)
– Anterior inner margin evenly rounded 6
6. Penultimate segment of L6 undivided . . . . *C. fernandoi* (Neale 1976c)
– Penultimate segment of L6 subdivided 7
7. Posterior margin of RV with marginal tubercles . . . . . . *C. achandii* (George and Martens 1993b)

– No tubercles present on RV . . . . *C. biswasi* (Deb 1972)

8. Postero-ventral margin on the valves rounded, but narrow and protruding from the rest of the margin 9

– Postero-ventral margin sometimes narrow but not protruding 12

9. Protruding part of the posterior margin wider than half of the entire margin 10

– Protruding part narrow 11

10. Anterior seta on the UR reaching only ½ L of the anterior claw . . . . *C. ceylonica* (Daday 1898)

– Anterior seta on the UR by far exceeding ½ L of the anterior claw . . . . *C. perarmata* (Brady 1904)

11. MPC very short and not branched . . . . *C. fascigera* (Sars 1924)

– MPC short but branched . . . . *C. junodi* (Delachaux 1919)

12. Posterior margin of valves inclined and sometimes even straight 13

– Posterior margin of valves widely rounded 19

13. Spines on the right UR posterior margin so strong, being ½ as long as posterior claw 14

– Spines on the right UR posterior margin much shorter 16

14. Anterior inner margin evenly rounded . . . . *C. hodgsoni* (Sars 1924)

– Anterior inner margin dorsally with a sinusoid curve 15

15. Antero-dorsal margin inclined . . . . *C. declivis* (Sars 1924)

– Antero-dorsal margin almost flat . . . . *C. monodi* (Gauthier 1930)

16. Dorsal margin straight, and inclined toward anterior margin . . . *C. pectinata* (Sars 1924)

– Dorsal margin more rounded and not inclined (but evenly rounded) toward anterior margin 17

17. Greatest H situated in the middle L . . . . . . *C. icosacantha* (Lowndes 1931a)

– Greatest H situated anterior to the middle . . . . . . *C. aldabrae* (Müller 1898)

18. Dorsal margin almost flat both anterior and posterior margins more or less equally wide 19

– Dorsal margin more rounded, one of the margins wider than the other (usually anterior being wider) 23

19. Anterior seta on the UR not reaching ½ L of the anterior claw 20

– Anterior seta on the UR exceeding ½ L of the anterior claw 21

20. Posterior margin of the valves with spines . . . . . . *C. spinosa* (Tressler 1937)

– Posterior margin without spines . . . . *C. halyi* (Ferguson 1969)

21. Posterior margin with a couple of clearly longer setae . . . . *C. ousmana* Ghetti 1972

– Posterior margin without a couple of clearly longer setae 22

22\. MPC very short, barely visible . . . . *C. khopoliensis* (Deb 1983)

– MPC clear and branched . . . . *C. canaliculata* (Hartmann 1964)

23\. Posterior margin wider than anterior . . . . *C. humilis* (Klie 1932)

– Posterior margin narrower than anterior one 24

24\. CIL very narrow both anteriorly and posteriorly . . . . *C. levetzovi* Hartmann 1957

– CIL wide 25

25\. Posterior claw on the UR at the most ½ as long as anterior one . . *C. formosa* (Klie 1938d) and *C. vittata* Okubo 1974

– Posterior claw on the UR more than ½ as long as anterior one 26

26\. Surface of the carapace very densely covered with stiff setae 27

– Surface of the carapace covered with sparse not stiff setae 28

27\. Dorsal margin evenly sloping toward both anterior and posterior margins from the middle . . . . *C. fuelleborni* (Daday 1910a)

– Dorsal margin rounder toward posterior and inclined toward anterior margin *C. fasciculata* (Daday 1910a)

28\. Anterior seta on the UR reaching only ½ L of anterior claw . . *C. smaragdina* (Sars 1924)

– Anterior seta on the UR exceeding ½ L of anterior claw . . . . *C. sinuata* (Müller 1898)

Species not included in the key

The following species have not been included in the key: *C. dyalpurensis* Battish 1998, *C. krishnakantai* (Deb 1972), and *C. werneri* (Daday 1910b), mostly because of the insufficient description. *Chrissia hislopi* (Ferguson 1969) is not included in the key, because it has septae along the anterior margin, and therefore its position within the genus is doubtful. Species *C. formosa* (Klie 1938d) and *C. vittata* Okubo 1974 key together, and the latter is most probably a junior synonym.

Ecology and distribution (Fig. 190)

The species can most often be found in the temporary freshwater bodies. The genus is distributed in Africa, Middle East, and South-East Asia.

***Stenocypria* Müller 1901**

Diagnosis (after Martens 2001): Valves elongated and laterally compressed, $L = 1.9–2.1$ mm; both valves without selvages and inner lists; fused zone wide, marginal septa absent; anterior CIL wide; posterior inner margin conspicuously curved; LV overlapping RV on all sides. Morphology of Rome organ on A1 unknown. Swimming setae on A2 long (reaching beyond tips of claws). Mxl palp rectangular, with L about 1.5 times distal W. L of setae “dl” and “d2” on L6 unknown. UR symmetrical and proximal seta long and stout.

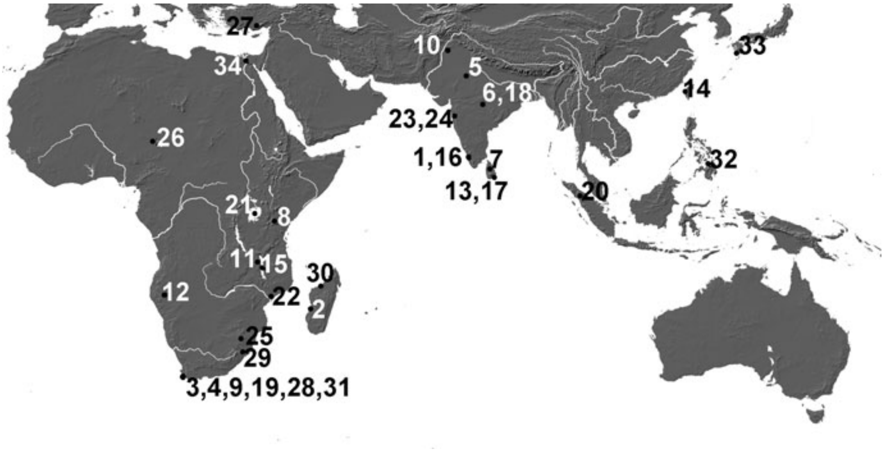


Fig. 190 Distribution of *Chrissia* Hartmann 1957: Numbers correspond to the species list

Type (and only) species: *S. fischeri* (Lilljeborg 1883)

Species list with type locality and type material
S. fischeri (Lilljeborg 1883). Surroundings of Sergiefskoje near Peterhof Palace, Russia, 59°53′N 29°54′E: Repository of the type material unknown.

Ecology and distribution
The species can be found in small freshwater bodies, both permanent and temporary. It has a Palearctic distribution.

Stenocypris **Sars 1889**

Diagnosis (after Martens 2001): Valves elongated (Figs. 178a, b and 180 h) and laterally compressed, $L = 1.0–2.0$ mm; both valves without selvages and inner lists; fused zone wide, marginal septa present, at least along anterior and posterior margins. A1 with Rome organ relatively large, but 1-segmented. Swimming setae on A2 mostly long (reaching beyond tips of claws). Mxl palp rectangular, with L up to 1.5 times distal W. Setae “dl” and “d2” on L6 subequal. UR asymmetrical, proximal seta absent (Fig. 184a).

Type species: *S. cylindrica* Baird 1859b

Species list with synonyms, type locality, and type material

1. *S. acocyproides* Klie 1933c. Lake Naivasha, Great Rift Valley, NW Kenya, 00°46′S 36°21′E: Syntypes, BM – 1933.9.25.37.
2. *S. acuta* (Vávra 1895). Pool beside way to Masingini, Zanzibar, Tanzania, 05°56′S 39°17′E: ZMH – K 19019.

3. *S. akatovae* Semenova 1996. Reservoir cooler of Chernobyl Nuclear Power Source, Chernobyl, Kiev Province, Ukraine, 51°16′N 30°14′E: Holotype (♀), IBIW-RAS – 954.
4. *S. archoplites* Ferguson 1964b. Stomach of Sacramento perch (*Archoplites interruptus*), Lake Anza impoundment, Berkeley, California, USA, 37°53′N 122°15′W: Holotype (♀), SM –109322.
5. *S. bolieki* Ferguson 1962. Lake Munson, ca. 6.5 km W of Tallahasee, Leon County, Florida, USA, 30°22′N 84°18′W: Holotype (♀), SM – 104468.
6. *S. bimucronata* Vávra 1906. Pond in front of Wat Sabatome (Sabatome Temple), Bangkok, Thailand, 13°45′N 100°31′E: Repository of the type material unknown.
7. *S. caesia* Klie 1935a. Swamp formed by Bandama Lake, near Toumodi, Ivory Coast, 07°26′N 05°37′W: Holotype (♀), ZMK – UR-1494.
8. *S. curvirami* Lowndes 1932a. Lake Ziway, Ethiopia, 08°00′N 38°50′E: Types, BM – 1934.6.19.46.
9. *S. damasi* Kiss 1959b. Lake Muhazi, Mulambi, Karambi, Eastern Province, Rwanda, 01°50′S 30°24′E: Type, RMCA – 46.809.
10. *S. decorata* Daday 1910c. Pond in the Zoological Garden of Giza (Gizeh), Cairo, Al Jīzah, Egypt, 30°05′N 31°13′E: Repository of the type material unknown.
11. *S. derupta* Vávra 1906. Between water plants, shore of Lake Bagendit, near Garut, West-Java, Indonesia, 07°09′S 107°56′E: Repository of the type material unknown.
12. *S. distincta* Victor and Fernando 1978a. Rice fields, Nidubrolu, Andhra Pradesh, India, 16°04′N 80°34′E: Holotype (♀), NMNSO – 21573.
13. *S. dybowskii* Grochmalicki 1913. Temporary pools, Usangu Steppe, Tanzania, 08°30′S 34°15′E: Repository of the type material unknown.
14. *S. elongata* Daday 1910a. Swamp, Kilimanjaro, Kenya, 03°04′N 37°21′E: Type, HMNH – IV-550.
15. *S. exsiccata* (Vávra 1897). Algae mud, dried creek bed, Bibisande (Gunda mkali), Uyamwezi-Ugogo, Tanzania, 04°09′S 32°43′E: Repository of the type material unknown.
16. *S. fontinalis* (Vávra 1895a, b). Between algae, in a water pipe, N of Zanzibar City, Zanzibar, Tanzania, 06°09′S 39°12′E: Syntype, ZMH – K-18 928.
17. *S. hirutai* Smith and Kamiya 2006. Small trickle flowing in crack of rock, area near Yudomari, S Yakushima Island, Kagoshima Prefecture, Japan, 30°13′48.0′N 139°45′51.9′E: Holotype (♀), UMT – 28870.
18. *S. ilyophila* Klie 1932. Moss at waterfall, Lake Bedali, Mount Lamongan area, East Java, Indonesia, 07°57′S 113°16′E: Syntype, ZMK – UR-941-5.
19. *S. intermedia* Klie 1932. Seepage spring, Balige, S shore of Lake Toba, North Sumatra, Indonesia, 02°19′S 99°03′E: Syntypes, ZMK – UR-986.

   Syn.: *S. macedonica* Petkovski and Meisch 1996

20. *S. jabalpurensis* Harshey and Patil 1988. Ranital tank at Jabalpur, Madhya Pradesh, India, 23°10′N 79°57′E: Holotype (♀), National Collection, ZSI – collection numbers unknown.

21. *S. major* (Baird 1859b). Freshwater pools at Nagpur, Mahārāshtra, India, 21°10′N 79°12′E: Types, BM – collection numbers unknown.

    Syn.: *S. cylindrica* Baird 1859b; *Cypris chittyensis* Baird 1862; *Stenocypris malcolmsoni* Brady 1886a

22. *S. malayica* Victor and Fernando 1981g. Pond, Agricultural University, Serdang, Selangor, near Kuala Lumpur, Malaysia, 02°59′N 101°41′E: Holotype (♀), ZMH – K-31913.
23. *S. marginata* Daday 1910a. Pond near Tukuyu, Tanzania, 09°15′S 33°38′E: Syntype, ZMH – K 18 939.
24. *S. maxillaris* Kiss 1960. Semi-permanent swamp, side of the road to Cyanugu, N of Bujumbura, Rusizi plain, Burundi, 03°20′S 29°19′E: Holotype, RMCA – 50884.
25. *S. orientalis* Victor and Fernando 1981g. Pond near chemical plant, Bulacan, Central Luzon, Philippines, 14°47′N 120°52′E: Holotype (♀), ZMH – K-31915.
26. *S. pancratovae* Akatova 1950. Lake Saloi, Middle Asia, no more details on the locality: Repository of the type material unknown.
27. *S. parva* Lowndes 1932a. Wouramboulchi, Serpent Lake, Ethiopia, 08°58′N 39°36′E: Type, BM – 1934.6.19.62-65.
28. *S. pseudoelongata* Martens 1984b. Semi-permanent swamp, 3.5 km from the crossing of Bujumbura with the road to Cyanugu, Rusizi plain, Burundi, 03°20′S 29°19′E: Type, RMCA – 50882.
29. *S. quadridentata* Rome 1962. Kalugwe, DR Congo, 02°37′S 28°15′E: Types, RBINS – C.O.581.
30. *S. simulans* Rome 1965a. Pond, down of saline, Ganza, Parc National de l'Upemba, Katanga, DR Congo, 09°01′S 26°36′E: Holotype (♀), RBINS – O.C. 714.
31. *S. sohni* Deb 1983. Rain water pond, Kholapur, India, 16°42′N 74°13′E: Holotype (♀), ZSI – C 1083/2.
32. *S. stagnalis* Daday 1910a. Pond near Tukuyu, Tanzania, 09°15′S 33°38′E: Syntype, ZMH – K-18977.
33. *S. trapezoides* Klie 1932. Small pond, Cibodas Botanical Garten, West Java, Indonesia, 06°44′S 107°00′E: Holotype (♀), ZMK – UR-1495.
34. *S. tsukagoshii* Smith and Kamiya 2006. Spring at top of beach, coastal area at Yudomari, S Yakushima Island, Kagoshima Prefecture, Japan, 30°˜13′48.7′N 130°˜28′50.5′E: Holotype (♀), UMT – 28874.
35. *S. ussangiana* Grochmalicki 1913. Temporary pools, Usangu Steppe, Tanzania, 08°30′S 34°15′E: Repository of the type material unknown.
36. *S. viridis* Okubo 1990a. Paddy fields, Okayama Prefecture, Honshu, Japan, 34°54′N 133°48′E: Holotype (♀), SJU (?) – FO-477.

Key to the species

1. In lateral view postero-ventral margin sharply pointed, the entire margin inclined . . . . *S. acuta* (Vávra 1895)

– Posterior margin sometimes much narrower than anterior one, but not so much pointed 2

2. Postero-ventral margin serrated, or terminating with one or two spines . . . 3

– Postero-ventral margin not serrated and no terminal spines present 6

3. Postero-ventral margin serrated 4

– Only one or two spines present on the postero-ventral margin 5

4. Posterior margin strongly inclined . . . . *S. maxillaris* Kiss 1960

– Posterior margin rounded . . . . *S. quadridentata* Rome 1962

5. On spine present on the postero-ventral margin of RV *S. simulans* Rome 1965a

– Two spines present . . . . *S. bimucronata* Vávra 1906

6. Valves trapezoidal in lateral view . . . . *S. trapezoides* Klie 1932

– Valves not trapezoidal 7

7. Postero-ventral margin very narrow, almost angular 8

– Postero-ventral margin may be narrower, but not angular 9

8. Posterior claw on the UR less than ½ L than anterior one . . . *S. pancratovae* Akatova 1950

– Posterior claw on the UR ½ as long as anterior one . . . . *S. dybowskii* Grochmalicki 1913

9. Posterior margin strongly inclined and posterior end looking considerably narrower than anterior one 10

– Posterior margin only slightly inclined, but most usually evenly rounded, so that posterior end has the same W as the anterior one 20

10. Dorsal margin rounded 11

– Dorsal margin straight 13

11. Anterior end of the carapace in lateral view elongated, due to the antero-dorsal margin being inclined and very long . . . . *S. caesia* Klie 1935a

– Anterior end not extended in lateral view, antero-dorsal margin short and rounded 12

12. Posterior seta on the UR less than ½ as long as the anterior claw . . . . *S. pseudoelongata* Martens 1984b

– Posterior seta on the UR reaching 2/3 of the anterior claw . . . . . *S. exsiccata* (Vávra 1897)

13. Posterior seta on the UR only reaching ½ L of the posterior claw 14

– Posterior seta on the UR reaching minimum 2/3 of the posterior claw . . . 16

14. Postero-dorsal corner of the valves in lateral view angular 15

– Postero-dorsal corner of the valves in lateral view gently rounded . . . . *S. akatovae* Semenova 1996

15. Serration on the posterior margins of both UR not so drastically different, i.e. spines not so strong on the left UR . . . . *S. elongata* Daday 1910a

– Serration on one of the UR considerably stronger than on the other *S. derupta* Vávra 1906

16. Ventral margin of the carapace with a prominent concave region around the middle 17

– Ventral margin almost straight 18

17. In dorsal view, lateral margins angular in the first and last third of L, from which point margins abruptly inclined toward anterior and posterior ends . *S. marginata* Daday 1910a

– In dorsal view, lateral margins evenly curved without abrupt transition toward anterior and posterior ends . . . . *S. stagnalis* Daday 1910a

18. Septae along the valve margins extremely long, starting at the mid way between the inner margin and the outer margin . . . . *S. sohni* Deb 1983

– Septae much shorter 19

19. Posterior end of carapace a little bit extended and the postero-dorsal margin little bit sinusoid . . . . *S. fontinalis* (Vávra 1895)

– Posterior end of carapace not with an extending appearance, postero-dorsal margin gently curved . . . . *S. malayica* Victor and Fernando 1981g

20. Swimming setae on A2 strongly reduced (not exceeding distal end of the penultimate segment 21

– Swimming setae on A2 longer 23

21. Swimming setae reaching only 1/3 of the penultimate segment L 22

– Swimming setae longer (maximum distal end of penultimate segment) . . . . . *S. ilyophila* Klie 1932 and *S. intermedia* (Klie 1932)

22. Dorsal margin in lateral view almost straight . . . . . *S. tsukagoshii* Smith and Kamiya 2006

– Dorsal margin in lateral view gently curved, so that the transition toward the anterior and posterior ends is very clear . . . . *S. hirutai* Smith and Kamiya 2006

23. Posterior seta on the UR longer than 2/3 of the posterior claw 24

– Posterior seta on the UR shorter than 2/3 of the posterior claw 27

24. Anterior end in lateral view extended and septae very short *S. acocyproides* Klie 1933c

– Anterior end in lateral view not extended, septae very long 25

25. Septae much longer around the eye region (antero-dorsally) 26

– Septae not longer around the eye region, but rather all septae subequally wide . . . . *S. major* (Baird 1859a)

26. Surface ornamented with punctae and reticulation . . . . . . *S. orientalis* Victor and Fernando 1981g
– Surface not ornamented . . . . *S. bolieki* Ferguson 1962
27. Dorsal margin straight, and postero-dorsal corner slightly angular 28
– Dorsal margin gently rounded and postero-dorsal corner not angular but gently rounded 29
28. Septae along the margins very long and much longer around the eye region *S. distincta* Victor and Fernando 1978a
– Septae very short and not enlarged around the eye region . . . . *S. ussangiana* Grochmalicki 1913
29. UR thin and strongly curved . . . . *S. curvirami* Lowndes 1932a
– UR not so thin and not strongly curved . . . . *S. parva* Lowndes 1932a

Species not included in the key
Stenocypris archoplites Ferguson 1964b was described from California, but has very strange features like the presence of the posterior seta on the UR, 5-segmented A2, where swimming setae start from the middle of the penultimate segment and the absence of the second segment on the Mxl palp. All these features are quite remarkable not only for the genus *Stenocypris*, but also for the entire family Cyprididae. *Stenocypris damasi* Kiss 1959b is a species with a rounded dorsal margin in the lateral view, and it stands apart from the rest of the *Stenocypris* species by the absence of septae along the margins and by the absence of the posterior seta on one of the UR. Daday (1910b) did not provide any drawings for *S. decorata* Daday 1910b and therefore it is hard to place this species in the key. *Stenocypris viridis* Okubo 1990a, a Japanese species, is very closely related to *S. bolieki* Ferguson 1962, and it is actually very hard to distinguish the two species apart.

Ecology and distribution (Fig. 191)
The species of this genus prefer temporary, stagnant freshwater bodies. The genus has a world-wide distribution with the center of biodiversity in Asia. Species in Europe live in rice fields and they have been introduced there by human activity.

4.12.3 Tribe Psychrodromini Martens 2001

Diagnosis (after Higuti et al. 2009b): Mostly compact carapaces, with inwardly displaced selvage present or absent, fused zones without septa. Rome organ on A1 small or medium sized, consisting of one or two parts; second segment of Mxl palp rectangular (with length 1.5–2.5 times the distal width) or spatulate; setae “d1” on L6 two to four times longer than “d2” or “d2” absent; UR symmetrical or slightly

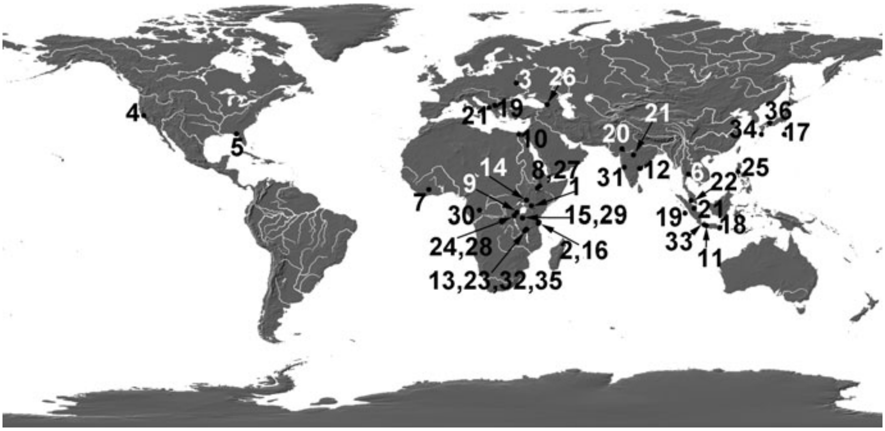


Fig. 191 Distribution of *Stenocypris* Sars 1889: Numbers correspond to the species list

asymmetrical, with proximal seta absent or a spine; hemipenis with one to six internal coils of the spermiduct, sometimes with a hook-like structure on the medial shield.

Type genus: *Psychrodromus* Danielopol and McKenzie 1977

Other genera: *Humphcypris* Martens 1997a; *Paranacypris* Higuti et al. 2009b; *Somalicypris* Martens 1997a.

Humphcypris Martens 1997a

Diagnosis (after Martens 2001): Laterally flattened carapaces with $L = 1.0–2.0$ mm; fused zone relatively wide in the anterior part of ventral margin; marginal septae absent; weakly built marginal selvages possible; LV overlapping RV. Eye small or absent. Al with Rome organ small. Swimming setae on A2 very short, not reaching halfway the penultimate segment; fused base of aesthetasc “y3” and accompanying seta on terminal segment very short. Second segment of Mxl palp sub-rectangular, with L up to 1.5 times that of distal W. L6 with seta “dl” 3–4 times longer than “d2”. UR weakly asymmetrical to nearly symmetrical, proximal seta spine like or absent. Hemipenis with conspicuous, sclerotized hook-like apical structure on middle lobe (Fig. 183a); post-labyrinthal spermiduct with 2–4 additional circular whorls.

Type species: *H. subterranea* (Hartmann 1964)

Species list with synonyms, type locality, and type material

1. *H. anomala* (Lindroth, 1953). Suam River, just before its outflow from Mt. Elgon crater, close to “Maji ya moto,” at 3,580 m, Kenya, 01°08′N 34°34′E: Repository of the type material unknown.

Syn.: *Stenocypris decipiens* Löffler 1968

2. *H. brevisetosa* (Lowndes 1932a). Wouramboulchi, Serpent Lake, Ethiopia, 08°58′N 39°36′E: Repository of the type material unknown.

   Syn.: *Stenocypris parva* Lowndes 1932a

3. *H. chappuisi* (Klie 1935a). Enclosed but not covered drinking water spring, near Man, Ivory Coast, 07°52′N 06°33′W: Syntypes, ZMK – UR-960.
4. *H. condarensis* (Akatova 1950). Mine, Kondara, Tajikistan, 38°48′N 68°49′E: Repository of the type material unknown.
5. *H. decipiens* (Klie 1939a). Moss in waterfall, spring of Moiben, Rift Valley, Kenya, 00°54′N 35°30′E: Syntypes, ZMK – UR-940.
6. *H. exigua* (Rome 1953). Very small subterranean water course, Grotto Tsebahu, on Mt. Hoyo, Irumu, DR Congo, 01°12′N 29°49′E: Lectotype (♀), RMCA – 40.730-40.731.
7. *H. greenwoodi* Martens 1997a. Small lake fed by submerged dolomitic springs, Molopo Oog, North West Province (formerly western Transvaal), South Africa, 26°01′30″S 25°53′30″E: Holotype (♂), AM – TDW90A.
8. *H. leleupi* (Harding 1955). Underground lake, Cave of Kakontwe, DR Congo, 10°59′S 26°40′E: Holotype (♀), RMCA –40.178.
9. *H. sewelli* (Klie 1927a). Moss on stones of waterfall in small river, Shimla, State of Himāchal Pradesh, India, 31°06′N 77°10′E: Lectotype (♀), ZMH – 11498.
10. *H. subterranea* (Hartmann 1964). Rheocrene spring, Zīıārat-e Khwājah Şafā shrine, Kabul, Afghanistan, 34°30′N 69°10′E: Lectotype (♀), ZMH – 27482a.
11. *H. thysvillensis* (Harding 1955). Grotto of Mbanza-Ngungu (formerly Thysville), DR Congo, 05°15′S 14°52′E: Types (♀ and ♂), RMCA – 46.975 and 46.974.
12. *H. tumens* (Rome 1977). Rather troubled water of low depth, Shaneshi, estuary of Shaneshi River, Basin of Kalehe, South Kivu, DR Congo, 02°06′S 28°55′E: Type (♀), RBINS – OC.738-OC.739.

Key to the species (modified after Martens 1997a)

1.	Length of females more than 1.75 mm	*H. brevisetosa* (Lowndes 1932a)
–	Length of females less than 1.6 mm	2
2.	H of LV and RV unequal	3
–	H of both valves similar	4
3.	RV higher than LV	*H. tumens* (Rome 1977)
–	LV higher than RV	*H. thysvillensis* (Harding 1955)
4.	Shape of valves sub-triangular	5
–	Both valves elongated	7
5.	Valves highly arched in lateral view	6
–	Valves moderately arched	*H. subterranea* (Hartmann 1964)

6. Swimming setae on A2 moderately short, L of setae 1–4 approx. 1/4 of penultimate segment, in dorsal view .... *H. decipiens* (Klie 1939a)
– Swimming setae on A2 very short, setae 1–4 barely reaching beyond edge of penultimate segment .... *H. chappuisi* (Klie 1935a)
7. Dorsal margin rounded in both valves 8
– Dorsal margin in RV straight over a short distance *H. anomala* (Lindroth 1953)
8. Posterior CIL very broad, as broad as anterior one .... *H. condarensis* (Akatova 1950)
– Posterior CIL much narrower than anterior one 9
9. Anterior seta on the UR as long as anterior claw ... *H. sewelli* (Klie 1927a)
– Anterior seta on the UR shorter than anterior claw 10
10. Swimming setae on A2 very short, setae 1–4 barely reaching beyond edge of penultimate segment 11
– Swimming setae 1–4 on A2 approx. 1/4 of L of penultimate segment ...... *H. exigua* (Rome 1953)
11. Valves rather compact .... *H. greenwoodi* Martens 1997a
– Valves very elongate .... *H. leleupi* (Harding 1955)

Ecology and distribution (Fig. 192)
Species live in lakes, and very often also in springs and habitats closely connected to the subterranean waters such as wells, and water bodies in the caves. The genus is known from Africa and Asia.

***Paranacypris* Higuti et al. 2009b**
Diagnosis (after Higuti et al. 2009b): Elongated carapace, narrow in dorsal view, with large anterior LV. RV overlap, external valve surface set with large pores.

Fig. 192 Distribution of *Humphcypris* Martens 1997a: Numbers correspond to the species list

Rome organ on A1 of medium size. Second segment of the Mx1-palp spatula like;. L5 with special “e”-seta (distal to “d”-seta). L6 with seta “d1” very long, “d2” absent. UR with posterior seta a stout spine.

Type (and only) species: *P. samambaiensis* Higuti et al. 2009b

Species list with type locality and type material
P. samambaiensis Higuti et al. 2009b. Lake Samambaia 2, a closed lake in the

Taquaruçu system, between Ivinhema River and Paraná River, Mato Grosso do Sul, Brazil, 22°35′48″S 53°22′18 W: Holotype (♀), MZUSP – 19289.

Psychrodromus Danielopol and McKenzie 1977
Diagnosis (modified after Martens 2001): Smaller species (L = 1.0-1.8 mm); fused zone narrow, especially in anterior part of ventral margin, radial pore canals straight; anterior CIL larger than posterior one, both valves with marginal selvages; RV posteriorly sometimes with a short inner list. Eye small or absent. A1 with Rome organ small. Swimming setae on A2 very short, not reaching halfway the penultimate segment. Second segment of Mxl palp subrectangular, with L up to 1.5 times that of distal width. L6 with seta “d1” longer than “d2,” in some species about twice as long. UR weakly asymmetrical to nearly symmetrical, proximal seta shaped as a spine (Fig. 184b). Hemipenis with minute hook-like apical structure on middle lobe; post-labyrinthal spermiduct with only one additional circular whorl.

Type species: *P. olivaceus* (Brady and Norman 1889)

Species list with type locality and type material

1. *P. betharrami* Danielopol and Baltanás 1993. Subterranean stream, Cave of Bétharram, Lestelle-Bétharram, Nay Est, Pau, Pyrénées-Atlantiques, Aquitaine, France, 43°07′N 00°12′W: Holotype (♀), NHMP – collection number unknown.
2. *P. fontinalis* (Wolf 1920). Cold water springs, area around Basel, Switzerland, 47°32′N 07°35′E: Repository of the type material unknown.
3. *P. olivaceus* (Brady and Norman 1889). River Lathkill, Derbyshire, England, UK, 53°11′N 01°41′W: Repository of the type material unknown.
4. *P. peristericus* (Petkovski 1959a). Detritus and moss, mountain springs and their pools, Pelister/Baba-Mountains, Macedonia, 40°55′N 21°10′E: Types, MNHS – collection numbers unknown.
5. *P. robertsoni* (Brady and Norman 1889). Hayston Dam, Peebles, Scotland, UK, 55°38′N 03°11′W: Repository of the type material unknown.
6. *P. turcicus* (Hartmann 1964). River pond, Yarni Pounar, Gaziantep Province, mountains of SE Turkey, 37°03′N 37°28′E: Syntypes, ZMH – K-27 484.

Key to the species

1. L of carapace at the most 1.4 mm 2
– L of carapace more than 1.6 mm 5
2. Posterior seta/claw on the UR with a filamentous tip *P. fontinalis* (Wolf 1920)
– Posterior seta/claw on the UR normally terminating 3
3. Posterior claw of the UR at the most ½ as long as anterior one; antero-dorsal margin of the valves slightly sinusoid . . . . *P. turcicus* (Hartmann 1964)
– Posterior claw of the UR longer than ½ L of the anterior one; dorsal margin of the valaves evenly rounded 4
4. Posterior margin of the carapace broadly rounded, posterior seta/claw on the UR very broad and very slightly narrowing from the basis to the tip . . . . . *P. olivaceus* (Brady and Norman 1889)
– Posterior margin of the carapace slightly inclined, posterior seta/claw on the UR very narrow distally . . . . *P. betharrami* Danielopol and Baltanás 1993
5. Dorsal margin very highly arched, greatest H in the middle from which point margin slopes equally toward anterior and posterior ends . . . . *P. peristericus* (Petkovski 1959a)
– Dorsal margin less arched, greatest H situated around the middle from which point margin inclined toward anterior end and more rounded toward posterior end . . . . *P. robertsoni* (Brady and Norman 1889)

Ecology and distribution (Fig. 193)
Most often the species can be found in springs and water bodies closely connected to springs. The genus is distributed in Europe and Asia Minor.

Somalicypris Martens 1997a

Diagnosis (after Martens 2001): Laterally flattened carapaces; L around 1.0 mm; CIL large anteriorly, nearly missing posteriorly; fused zone narrow, marginal pore canals branching; marginal septae absent; weak marginal posterior selvages on RV and LV; LV with strong anterior and posterior inner lists. Eye small or absent. Morphology of Rome organ on A1 unknown. Swimming setae on A2 very short, not reaching halfway the penultimate segment; second segment of Mxl palp subrectangular, with length 1.5–2 times that of distal width. L6 with seta "dl" 3 times longer than "d2." UR weakly asymmetrical to nearly symmetrical, proximal seta spine like or absent. Hemipenis without hook-like apical structure on middle lobe; post-labyrinthal spermiduct with up to six additional circular whorls.

Type (and only) species: *S. uegitia* (Masi 1925)

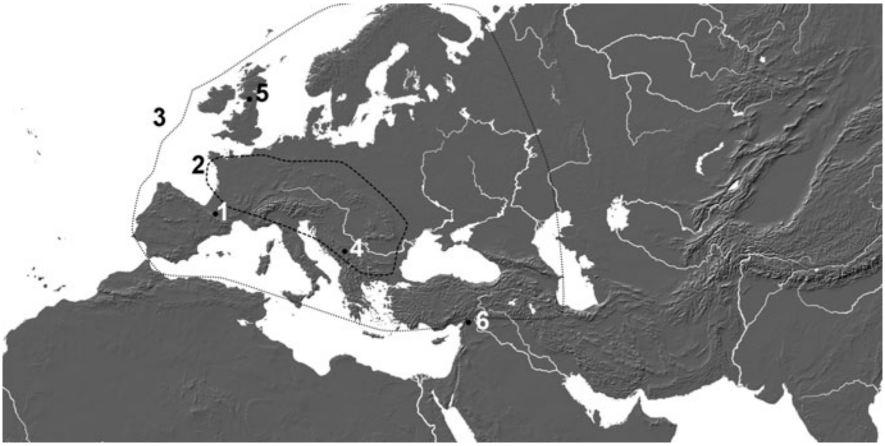


Fig. 193 Distribution of *Psychrodromus* Danielopol and McKenzie 1977: Numbers correspond to the species list

Species list with type locality and type material
S. uegitia (Masi 1925). Stomach of phreatic fish (*Uegitglanis zammaranoi*), well at Waajid (Uegit), Somalia, 03°48′N 43°14′E: Types, NHMG – collection numbers unknown.

4.13 Subfamily Hungarocypridinae Bronstein 1947

Diagnosis (after Meisch 2000): Carapace exceeding 3 mm in L, laterally compressed, both ends beak like. Terminal segment of the Mxl palp spatula like (Fig. 194b). Terminal segment of L7 pincer like (Fig. 194d). UR posteriorly with two long setae (Fig. 194c).

Type (and only) genus: *Hungarocypris* Vávra 1906

***Hungarocypris* Vávra 1906**
Diagnosis: Same as for the subfamily.

Type species: *H. madaraszi* (Örley 1886)

Species list with synonyms, type locality, and type material
1. *H. asymmetrica* Victor and Fernando 1981e. Water of fallow rice field, near Lake Tempe, Sulawesi, Indonesia, 04°07′S 119°57′E: Holotype (♀), NMNSO – Collection number unknown.
2. *H. gawemuelleri* Vávra 1906. Pond in front of Wat Sabatome, Bangkok, Thailand, 13°45 N 100°31′E: Repository of the type material unknown.

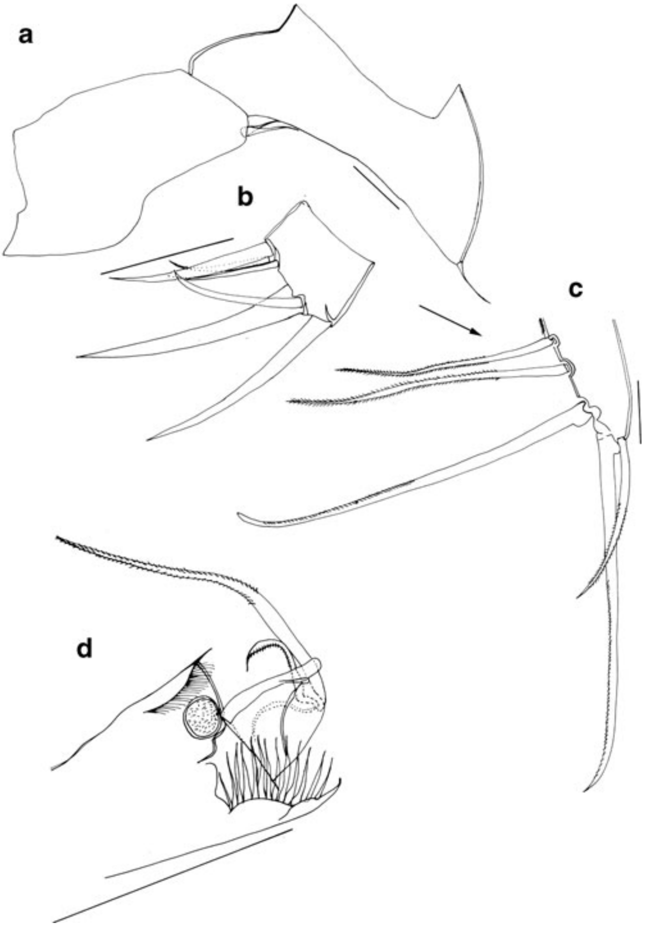


Fig. 194 Line drawings: *Hungarocypris madaraszi* (Örley 1886): (**a**) prehensile palp; (**b**) second segment of Mxl; (**c**) distal part of UR, *arrow* showing the presence of two posterior setae; (**d**) terminal segment of L7. Scales = 0.1 mm

3. *H. levigata* Chen 1991. Yinjiang, Guizhou Province, China, 28°02′N 108°24′E: Types, IHB-CAS – collection numbers unknown.
4. *H. madaraszi* (Örley 1886). Outflow ditch of the pond in the municipal wood of Budapest, Hungary, 47°29′N 19°02′E: Types, HMNH – collection numbers unknown.

   Syn.: *Cyprois dispar* Chyzer 1858 (non Fischer 1851)

5. *H. serrata* Chen 1983. Guangzhou, Guangdong Province, China, 23°07′N 113°15′E: Holotype (♀), IHB-CAS – Collection number unknown.

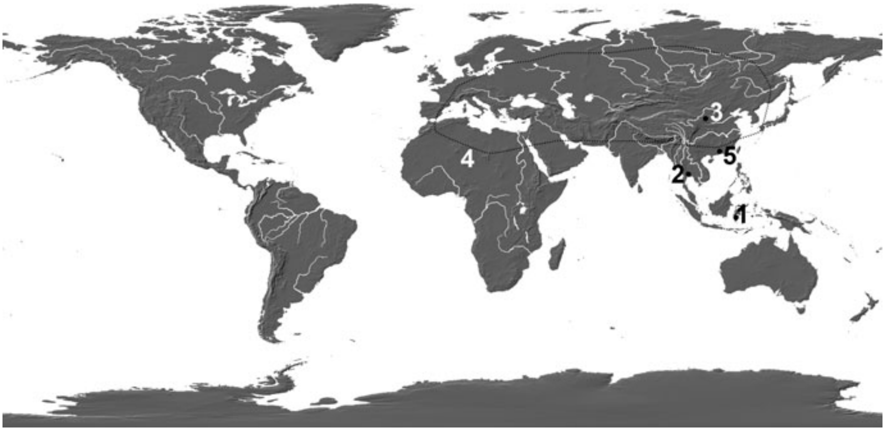


Fig. 195 Distribution of *Hungarocypris* (Örley 1886): Numbers correspond to the species list

Key to the species

1. In lateral view, dorsal margin of RV very long and steeply sloping toward posterior end, which is very narrow 2
– In lateral view, dorsal margin of RV more gently sloping toward posterior end, which is broad 3
2. Both lobes on the hemipenis equally wide, and equally high; RV serrated posteriorly . . . . *H. serrata* Chen 1983
– Outer lobe much wider and higher than inner one: posterior margin of RV smooth . . . . *H. asymmetrica* Victor and Fernando 1981e
3. In dorsal view, both anterior and posterior ends cuneiform . . . . *H. madaraszi* (Örley 1886)
– In dorsal view, anterior end only pointed, posterior more rounded, but never cuneiform . . . . *H. gawemuelleri* Vávra 1906

Ecology and distribution (Fig. 195)
The genus is distributed in the Palearctic and South-East Asia. The species live in stagnant freshwater bodies, such as ponds, lakes, and dead river arms.

4.14 Subfamily Isocypridinae Rome 1965b

Diagnosis (after Jocque et al. 2010): Medium-sized ostracods, with laterally flattened and elongated valves (Fig. 196a), posterior CIL either narrow or completely absent (Figs. 197b and 196b). A1 7-segmented. A2 usually with long swimming setae (Fig. 198b). L6 large, sometimes with long seta z3 (Fig. 197a, c), and elongated segments; this limb mostly sticking out of the carapace.

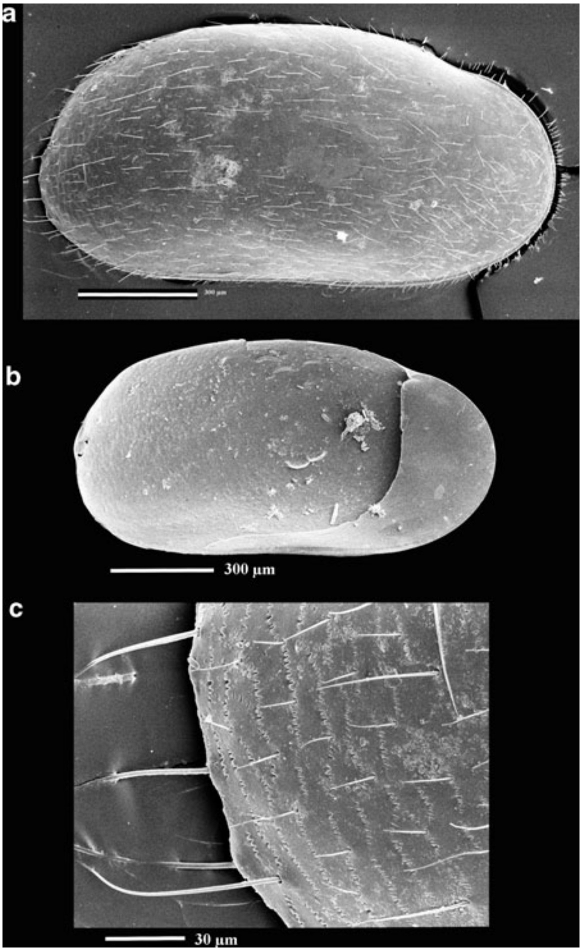


Fig. 196 SEM: *Platicypris baueri* Herbst 1957: (**a**) RV, outside view; (**b**) LV, inside view; (**c**) RV, posterior margin. Photos: D. Keyser

Type genus: *Isocypris* Müller 1908

Other genera: *Amphibolocypris* Rome 1965b; *Platycypris* Herbst 1957.

Key to the genera (after Jocque et al. 2010**)**

1. Terminal segment of L6 with a short, subapical "h3" seta (Fig. 197c) *Isocypris* Müller 1908

– Terminal segment of L6 with claw-like subapical seta, reaching beyond the middle of the end claw (Fig. 197a) 2

2. UR with a posterior seta (Fig. 199c) . . . . *Platycypris* Herbst 1957

– UR without posterior seta . . . . *Amphibolocypris* Rome 1965b

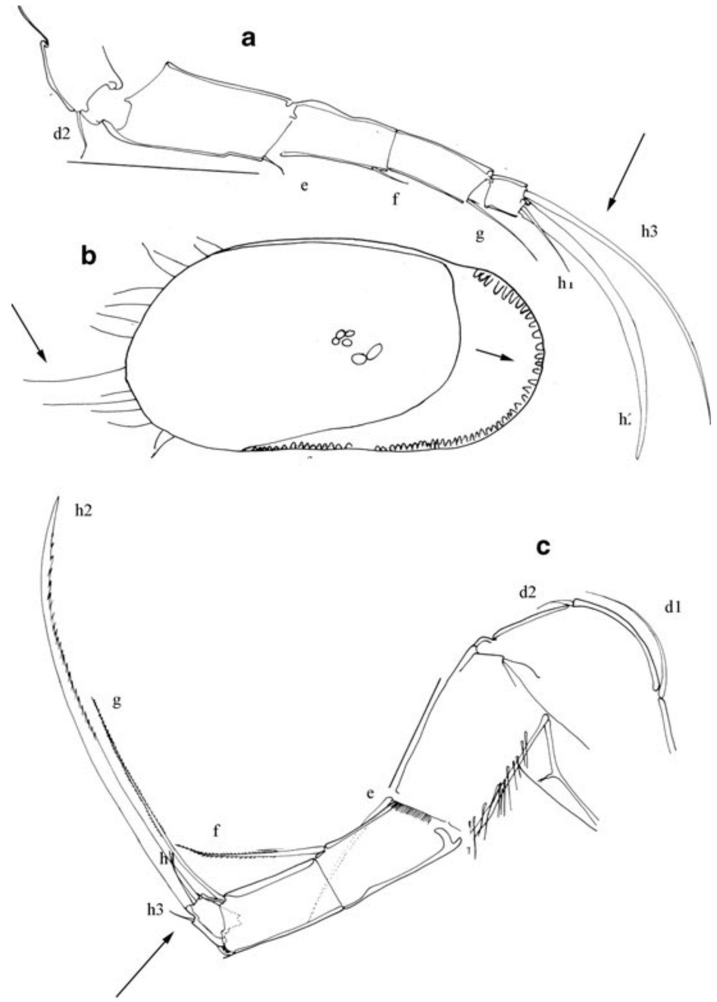


Fig. 197 Line drawings: (**a**) *Platicypris baueri* Herbst 1957; (**b**,**c**) *Isocypris beauchampi* (Paris 1920b): (**a**, **c**) L6, *arrows* showing the L of the seta h3; (**b**) LV, inside view, arrow showing L setae on the posterior margin. Scales = 0.1 mm

Amphibolocypris Rome 1965b

Diagnosis (after Jocque et al. 2010): Carapace elongated, narrow in dorsal view. Third endite of Mxl with two large, smooth claws. L6 with “h3” on the 4th segment long and claw like. UR without posterior seta.

Type species: *A. exigua* Rome 1965b

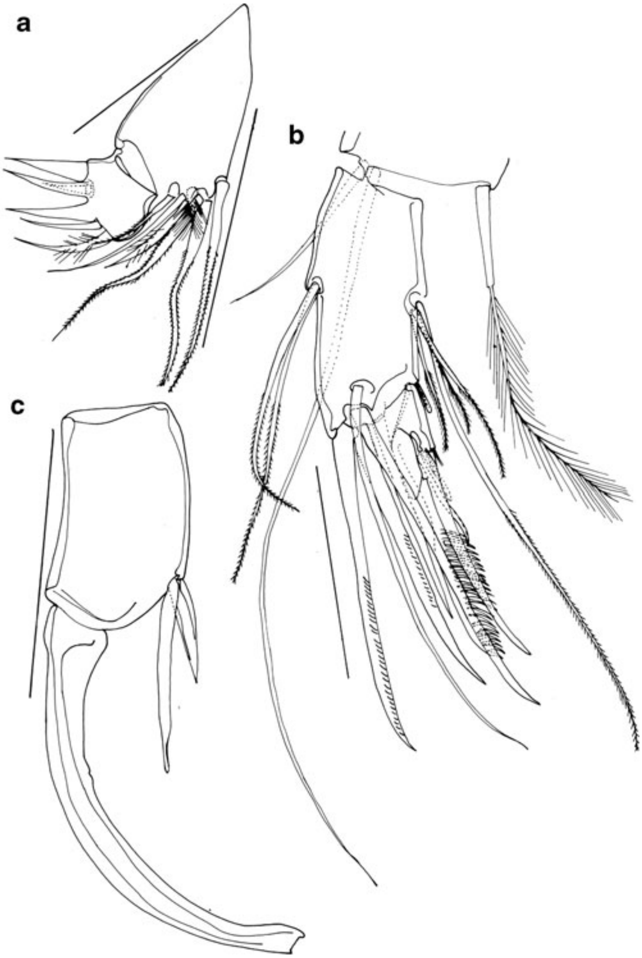


Fig. 198 Line drawings: *Platicypris baueri* Herbst 1957: (**a**) Mxl palp; (**b**) part of A2; (**c**) prehensile palp. Scales = 0.1 mm

Species list with type locality and type material

1. *A. arida* Jocque and Martens 2010 (in Jocque et al. 2010). Small, shallow temporary freshwater pools on granite rock outcrops near Thamaga, SE Botswana, 24°40′30″S 25°31′00″E: Holotype (♂), RBINS – O.C. 3167.
2. *A. exigua* Rome 1965b. Soft bottomed, temporary freshwater pan, Leeupan, Station 287, Kruger National Park, ca. 24 km NE of Skukuza, Mpumalanga, South Africa, 24°51′S 31°46′E: Repository of the type material unknown.

Key to the species

1. Carapace more elongated, posteriorly more pointed, hemipenis with one large rounded lobe and one narrower lobe ..... *A. arida* Jocque and Martens 2010 (in Jocque et al. 2010)

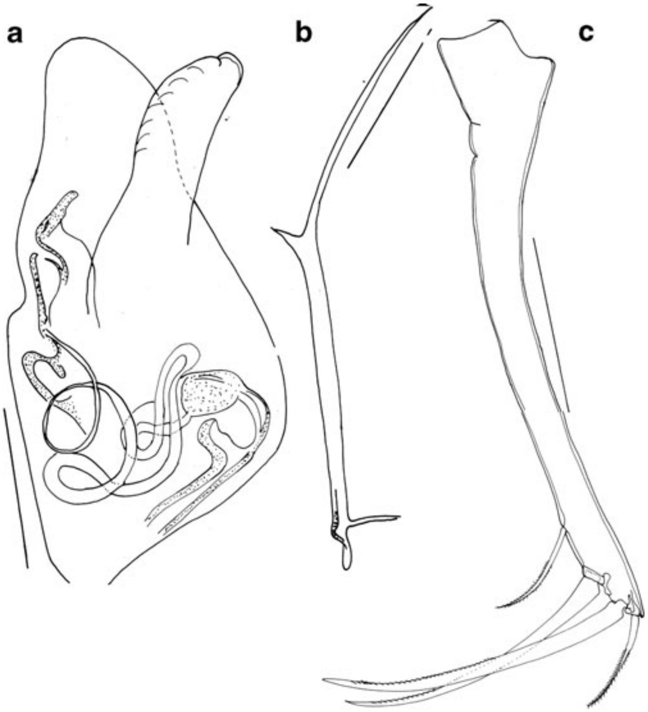


Fig. 199 Line drawings: *Platicypris baueri* Herbst 1957: (**a**) hemipenis; (**b**) attachment of UR; (**c**) UR. Scales = 0.1 mm

2. Carapace less elongated, posteriorly less pointed, hemipenis with one subquadrate lobe and three more elongated lobes . . *A. exigua* (Rome 1965b)

Ecology and distribution (Fig. 185)
The species can often be found in temporary freshwater bodies. The genus is distributed in Africa.

***Isocypris* Müller 1908 [Syn.: *Hyalocypris* Brady 1913]**
Diagnosis (after Meisch 2000): Medium sized, laterally compressed. Valves translucent, thin, and fragile. Posterior margin of each valve below mid H with (rarely without) two conspicuously long setae (Figs. 197b and 196c). Anterior and anteroventral marginal zone with septae formed by excrescences of the fused zone. Terminal segment of the Mxl palp spatula like. Terminal claw of L6 very long (Fig. 197c). UR strongly developed, curved, and with two almost equally long terminal claws.

Type species: *I. priomena* (Müller 1908)

Species list with synonyms, type locality, and type material

1. *I. africana* (Brady 1913). At 1,524 m at Witsieshoek, neighborhood of Mont-aux-Sources, Drakensberg Mountains, Free State, South Africa, 28°36′S 28°48′E: Type, HM – Collection number unknown.

2. *I. amplicolis* (De Deckker 1981c). Granite rock pool, top of Boyagin Rock, between Brookton and Pingelly, WA, Australia, 32°28′S 116°53′E: Holotype (♀), NMV – 11134–11162.
3. *I. beauchampi* (Paris 1920b). Type locality not explicitly given, but first finds in the Panthier reservoir, Cote d'Or, Bourgogne, France, 47°30′N 04°50′E: Repository of the type material unknown.

   Syn.: *I. arnoldi* (Dubowsky 1927); *I. quadrisetosa* (Rome 1947a); *I. nocentiniae* (Fox 1963); *Stenocypris longicomosa* (Furtos 1933)

4. *I. dikrus* (De Deckker 1981c). Dam at Wasley Well, near Nallan, 21 km NNE of Cue, WA, Australia, 27°16′54″S 118°09′06″E: Holotype (♂), NMV – 11134–11162.
5. *I. laskaridisi* Herbst 1951. Flat pond on a plain ca. 500 m from the coast, near Provàti, S coast of Milos Island, Greece, 36°40′N 24°26′E: Repository of the type material unknown.
6. *I. nivea* Sars 1924. Pond on Green Point Common, near Cape Town, Western Cape, South Africa, 33°54′S 18°24″E: Type, SAFM – Collection number unknown.
7. *I. perangusta* Müller 1908. Plumstead, Zeecoevlei, near Simon's Town, Western Cape, South Africa, 34°01′S 18°28′E: Syntype, ZMB – ZMBln 13150.
8. *I. priomena* Müller 1908. Plumstead, Zeecoevlei, near Simon's Town, Western Cape, South Africa, 34°01′S 18°28′E: Syntype, ZMB – ZMBln 13151.
9. *I. williamsi* McKenzie 1966a. About 1.6 km W of Inverway, NT, Australia, 17°50′S 129°38′E: Holotype (♀), NMV – J17 and J18.

Key to the species

1. Swimming setae on A2 nor exceeding distal end of penultimate segment . . 2

– Swimming setae on A2 reaching and usually over passing tips of the terminal claws 3

2. Postero-dorsal margin angular . . . . *I. nivea* Sars 1924

– Postero-dorsal margin rounded . . . . *I. amplicolis* (De Deckker 1981c)

3. Antero-ventral margin inclined . . . . *I. dikrus* (De Deckker 1981c)

– Antero-ventral margin rounded 4

4. All the surface setae subequally long (no conspicuously long setae on the posterior margin) 5

– Posterior margin of the valves with two conspicuously long setae 6

5. Ventral margin straight . . . . *I. africana* (Brady 1913)

– Ventral margin distinctly concave around the mouth region . . . . . *I. williamsi* McKenzie 1966a

6. Posterior seta on the UR at the most ½ as long as the posterior claw . . . . . . *I. perangusta* Müller 1908

– Posterior seta on the UR much longer than ½ L of the posterior claw 7

7. UR asymmetrical: one with both setae and claws normally developed, other with reduced anterior claw and absent posterior one . . . . *I. priomena* Müller 1908

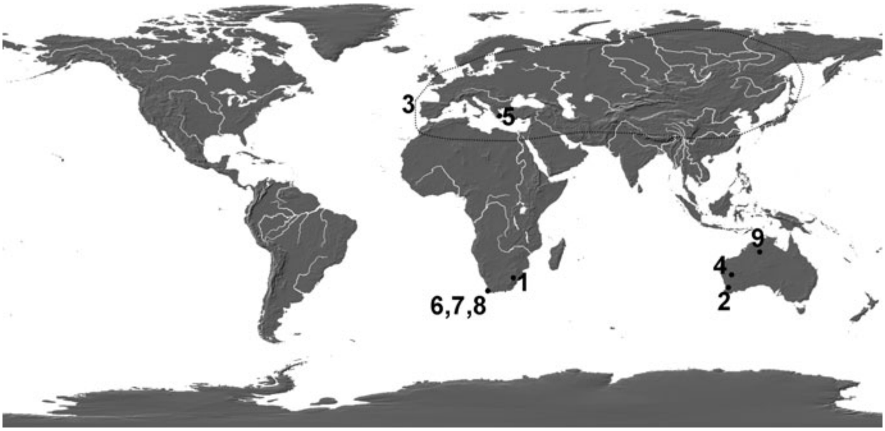


Fig. 200 Distribution of *Isocypris* Müller 1908: Numbers correspond to the species list

– UR symmetrical 8

8. Anterior and antero-ventral marginal zone with septae . . . . . . *I. beauchampi* (Paris 1920b)

– No septae on the anterior and antero-ventral zones . *I. laskaridisi* Herbst 1951

Ecology and distribution (Fig. 200)
Species prefer temporary water bodies. The genus is distributed in Europe, Africa, and Australia.

***Platycypris* Herbst 1957**
Diagnosis: Valves elongated. Terminal segment of the Mxl palp spatula like (Fig. 198a). Prehensile palps with very long fingers (Fig. 198c). Terminal segment of L6 with claw-like "h3" subapical seta, reaching beyond the middle of the end claw (Fig. 197a). Hemipenis with two lobes (Fig. 199a). UR with a posterior seta (Fig. 199c). Attachment simple (Fig. 199b)

Type (and only) species: *P. baueri* Herbst 1957

Species list with synonyms, type locality, and type material
P. baueri Herbst 1957. Lake Alexandrina, SA, Australia, 35°26′S 139°10′E: Repository of the type material unknown.

4.15 Subfamily Limanocypridinae Hartmann and Puri 1974

Diagnosis (after Hartmann and Puri 1974): Valves elongated, weakly calcified. Surface smooth. CIL broad anteriorly. Fused zone narrow, with many short and simple marginal pore canals. Terminal segment on the Mxl palp short and spatula like. Seta "h3" on the terminal segment of L6 transformed into a strong claw. Terminal segment of L7 pincer like. Both claws and setae on the UR present.

Type (and only) genus: *Limanocypris* Schornikov 1961

***Limanocypris* Schornikov 1961**
Diagnosis: Same as for the subfamily.

Type (and only) species: *L. lurida* Schornikov 1961. Suhom, Delta of Kuban River, Krasnodarskiy, Russia, 45°41′N 37°47′E: Repository of the type material unknown.

4.16 Subfamily Liocypridinae Martens 2003b

Diagnosis (after Martens 2003b): Giant Cyprididae ($L \geq 5$ mm), with arched, laterally compressed carapaces and wide anterior CIL. A1 without flagellated claws. A2 in males with both claws G3 and G1 short and claw like. Mxl with smooth claws on third endite, terminal segment rectangular. Md with alpha-seta with broad base and flagellum-like tip, beta-seta stout and hirsute, gamma-seta stout and hirsute in the terminal half. L5 in females long and stout, three terminal setae relatively short; "c" seta absent; male prehensile palps asymmetrical, right palp larger than left palp. L6 with penultimate segment divided. L7 with a pincer. UR symmetrical, slender, attachment without Triebel loop. Adult females with a series of additional paired appendages associated with the genital operculum. Hemipenis large, lateral shield consisting of 3 lobes; internal anatomy simple.

Type genus: *Liocypris* Sars 1924

Other genera: *Afrocypris* Sars 1924.

Key to the genera

1. Selvage inwardly displaced and swimming seta on A2 long ..... *Afrocypris* Sars 1924
– Selvage, if present, peripheral swimming setae very short *Liocypris* Sars 1924

***Afrocypris* Sars 1924**
Diagnosis (after Matzke-Karasz and Martens 2007): Giant species with elongated valves; RV with selvage anteriorly widely inwardly displaced, posteriorly submarginal. LV without selvage but with inner list, ventral margin slightly sinuous. A1 with third segment unusually elongated, around three times as long as wide. Mxl with second palp segment subquadrate, third endite with two smooth claws and some further claw-like setae, vibratory plate with five reflexed setae. L5 in female

with unusually long endopodite, distally with three short setae and in some cases with an additional, lateral seta. Prehensile palps asymmetrical, both segments of right prehensile palp larger than in left palp, this right palp also with two small setae at joint between segments. L6 elongated, penultimate segment divided, seta “d1” longer than “d2.” L7 with a distal pincer. Attachment of UR with additional, lateral branch, the latter connecting to the female copulatory organ. Female copulatory organs associated with a number of additional appendages. Hemipenis stout, with large lobe of the peniferum and with well-developed sclerified inner structures; at fusion of both hemipenis, an additional, basal structure carrying an asymmetrical, pointed finger is present.

Type (and only) species: *A. barnardi* Sars 1924

Species list with type locality and type material
A. barnardi Sars 1924. Ukualuthi (Kwaluudhi) and Tamansu, formerly Ovamboland, N Namibia, 17°52″S 16°26′E: Type, SAFM – AI 1289–92.

***Liocypris* Sars 1924**
Diagnosis (modified after Martens 2003b): Valves large, laterally flattened, in lateral view highly arched in the posterior half of the valves; external valve surface smooth, CIL anteriorly wide, posteriorly narrow. All appendages elongated. A1 with long, A2 with short swimming setae. Mxl palp segment rectangular, around 1.5 times as long as the basal W. L5 in females with unusually elongated palp. L6 with seta “d1” around three times as long as “d2”. UR elongate, with both claws and setae, all apically or subapically inserted; attachment slender and with additional dorsal branch. Hemipenis large, outer lobe with three large sub lobes, middle lobe rounded. Females with five additional pairs of appendages associated with the genital organs, i.e.: an anterior plate-like expansion, followed by a worm-like structure, medially with a palp- and respiratory plate like structure, caudally with a distally pointed, pseudo-segmented rod and a large, hook-like structure.

Type (and only) species: *L. grandis* Sars 1924. Stompneus, Western Cape, South Africa, 31°22′S 17°54′E: SAFM – 6281.

4.17 Subfamily Megalocypridinae Rome 1965b

Diagnosis (modified after Martens 1986). Large (2–8 mm) ostracods (Fig. 201), mostly elongated and laterally flattened. Selvage inwardly displaced on both valves, ranging from strong to nearly absent, always slightly asymmetrical with left selvage embracing the right selvage when the valves are closed. LV with at least one inner list, sometimes a second one developed close to selvage. A1 with flagellated claws (Fig. 202b). L5 without “c” seta (Fig. 203c). L6 with penultimate segment divided

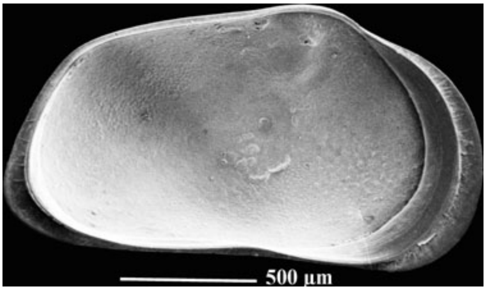


Fig. 201 SEM: *Sclerocypris sp.* : LV, inside view. Photo: D: Keyser

(Fig. 203b). L7 with terminal segment pincer like (Fig. 203d). UR well developed (Fig. 204b).

Type genus: *Megalocypris* Sars 1898

Key to the tribes

1. Terminal segment of the Mxl palp spatula like (Fig. 202a) . . Megalocypridini
– Terminal segment of the Mxl palp not spatula like . . . . Tanganyikacypridini

4.17.1 Tribe Megalocypridini Rome 1965b

Diagnosis: Large (2–8 mm) ostracods, mostly elongated and laterally flattened. Selvage inwardly displaced on both valves, ranging from strong to nearly absent, always slightly asymmetrical with left selvage embracing the right selvage when the valves are closed. LV with at least one inner list, sometimes a second one developed close to selvage. Terminal segment of the Mxl palp spatula like.

Type genus: *Megalocypris* Sars 1898

Other genera: *Apatelecypris* Rome 1965b; *Eundacypris* Martens 1986; *Hypselecypris* Rome 1965a; *Madagascarcypris* Martens 1986; *Sclerocypris* Sars 1924.

Key to the genera

1. Selvage peripheral (Fig. 202c) . . . . *Eundacypris* Martens 1986
– Selvage inwardly displaced 2
2. Anterior selvage on both valves inwardly displaced over ¾ of the distance between valve margin and inner margin (Fig. 202d) 3
– Anterior selvage inwardly displaced over shorter distance (Fig. 202e) 4
3. Ovaries turned dorsally toward the posterior end . . . . . *Sclerocypris* Sars 1924
– Ovaries turned ventrally toward the posterior end (Fig. 202d) . . *Hypselecypris* Rome 1965a
4. Valves around 3 mm long . . . . *Apatelecypris* Rome 1965b
– Valves between 5 and 8 mm long 5

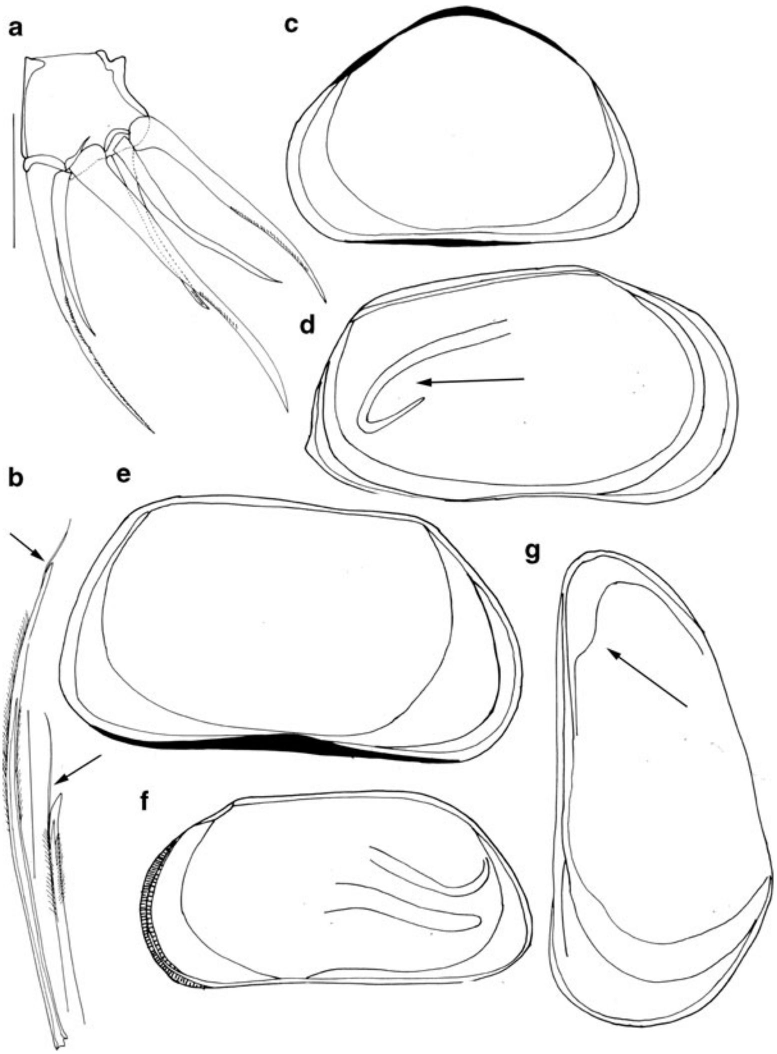


Fig. 202 Line drawings: (**a**) *Sclerocypris jenkinae* Klie 1933c; (**b**) *Sclerocypris sarsi* Martens 1986; (**c**) *Eundacypris superba* (Sars 1924); (**d**) *Hypselecypris wittei* Rome 1965a; (**e**) *Apatelecypris schultzei* (Daday 1913); (**f**) *Megalocypris durbani* (Baird 1862); (**g**) *Madagascarcypris voeltzkowi* (Müller 1898): (**a**) second segment of Mxl palp; (**b**) setae on A1, *arrows* pointing flagellated claws; (**c**, **f**) RV, inside view; (**d**, **e**, **g**) LV, inside view, *arrows* pointing the position of ovaries and the undulated inner margin. (**c**, **e**, **f**, **g**) modified after Martens (1986); (**d**) modified after Rome (1965a). Scales = 0.1 mm. (**c**–**g**) not to scale

5. Caudal inner margin on both valves evenly curved (Fig. 202f) . *Megalocypris* Sars 1898
– Caudal inner margin on both valves sinuated (Fig. 202g) . *Madagascarcypris* Martens 1986

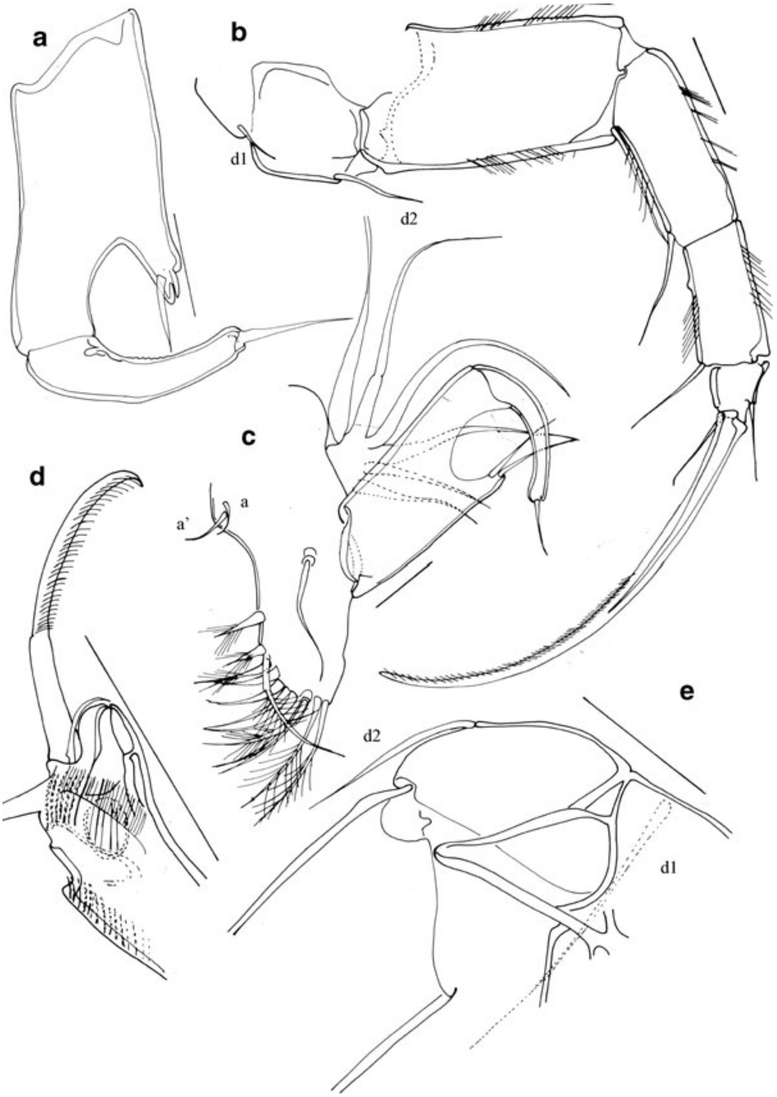


Fig. 203 Line drawings: (**a**–**d**) *Sclerocypris jenkinae* Klie 1933c; (**e**) *Megalocypris durbani* (Baird 1862): (**a**) prehensile palp; (**b**) L6; (**c**) L5; (**d**) terminal segment of L7; (**e**) basal segment of L6. Scales = 0.1 mm

Apatelecypris Rome 1965b

Diagnosis (after Martens 1986): L of valves around 3 mm. Selvage on both valves inwardly displaced, but over a very short distance only. CIL on both valves with prominent inner list. Marginal pore-canals numerous and branched. Ventro-caudal margin on both valves with a row of small teeth. Hemipenis with two dorsal extensions on the outer lobe. Attachment of the UR with additional branches.

Fig. 204 Line drawings: *Sclerocypris jenkinae* Klie 1933c: (**a**) hemipenis; (**b**) UR. Scales = 0.1 mm

Type (and only) species: *A. schultzei* (Daday 1913)

Species list with synonyms, type locality, and type material
A. schultzei (Daday 1913). Besondermaid, watering place between Berseba and Bethanie, Karas, Namibia, 26°16′S 17°33E: Syntypes, ZMB – 17450.

Syn.: *Megalocypris brevis* (Sars 1924)

Eundacypris Martens 1986

Diagnosis (after Martens 1986): L of valves approximately 4 mm. Selvage not inwardly displaced. Fused zone narrow, pore canals simple. Ovaries turned dorsally on their caudal side. Central muscle scar somewhat aberrant. Prehensile palps asymmetrical, right palp larger. Hemipenis relatively small, with internal labyrinth narrow and elongated.

Type (and only) species: *E. superba* (Sars 1924)

Species list with type locality and type material
E. superba (Sars 1924). Eunda, Onesi, Omusati, Namibia, 17°31′S 14°38′E: Lectotype (♂), SAFM – KM-65.

Hypselecypris **Rome 1965a**
Diagnosis (after Martens 1986): L of valves approximately 3 mm. Anterior selvage on both valves inwardly displaced over ¾ of the distance between valve margin and inner margin. Fused zone wide with marginal pore canals branched. Ovaries turned ventrally on their posterior side. L5 with short and stout "d" seta and prehensile palps almost symmetrical. Seta "d1" on L6 shorter than "d2." Hemipenis with only one dorsal extension on the outer lobe. Labyrinth short and broad. No supplementary branches on the UR attachment.

Type (and only) species: *H. wittei* Rome 1965a

Species list with type locality and type material
H. wittei Rome 1965a. Sanga River, close to the road, Parc National de l'Upemba, DR Congo, 09°00′S 26°45′E: Repository of the type material unknown.

Madagascarcypris **Martens 1986**
Diagnosis (after Martens 1986): Valves very large (5–7 mm). Anterior selvage on both valves inwardly displaced over 1/3 of the distance between valve margin and inner margin in RV, over 1/6 of this distance on LV. With valves closed, left selvage overlapping right at anterior and posterior ends, right selvage overlapping LV ventrally, caudal inner margin on both valves sinuated. Marginal pore canals numerous but short and branched only near the basis.

Type (and only) species: *M. voeltzkowi* (Müller 1898)

Species list with type locality and type material
M. voeltzkowi (Müller 1898). Mahajanga, Madagascar, 15°43′S 46°19′E: Repository of the type material unknown.

Megalocypris **Sars 1898**
Diagnosis (after Martens 1986): Valves large (5–8 mm). Anterior selvage on RV inwardly displaced over less than ½ the distance between the valve margin and the inner margin. Fused zone narrow, marginal pore canals short and anteriorly branched near basis only, posteriorly not branched. Ovaries dorsally curved on the posterior side. Caudal inner margin on both valves evenly curved. Swimming setae on A2 not reaching tip of the penultimate segment. Prehensile palps slightly asymmetrical. Seta "d1" on L6 twice as long as "d2" (Fig. 203e). Hemipenis with outer lobe large and dilated.

Type species: *M. princeps* Sars 1898

Species list with type locality and type material

1. *M. durbani* (Baird 1862). Bed of a dried up valley (large freshwater pond), near Port Elizabeth, Cape Colony, South Africa, 29°44′S 22°44′E: Types, BM – 1945.9.26.116-120.
2. *M. hispida* (Sars 1924). Pond on the Cape Flats, Western Cape, South Africa, 34°02′S 18°38′E: Syntype, NHMO – F11157.
3. *M. princeps* (Sars 1898). Pond on Green Point Common, Cape Town, South Africa, 33°55′S 18°24′E: Syntypes, BM – 1901.12.12.121.

Key to the species

1. Inner side of the distal lobe of hemipenis rounded . . . . *M. hispida* (Sars 1924)

– Inner side of the distal lobe of hemipenis angular 2

2. Finger of the prehensile palp angular at the basis (palps also quite asymmetrical, right one with longer and thinner finger than the left one) . . . . . . *M. princeps* (Sars 1898)

– Finger of the prehensile palp rounded at the basis (palps quite symmetrical) *M. durbani* (Baird 1862)

Ecology and distribution

Species are known only from South Africa. Species most often live in temporary ponds.

Sclerocypris **Sars 1924 [*Bharaticypris* Battish 1978]**

Diagnosis (after Martens 1986): Valves between 2 and 5 mm long. Frontal selvage on both valves strongly inwardly displaced, over ¾ of the distance between outer and inner margins; ventral selvage on RV running close to or nearly on the valve margin. Surface pitted. Ovaries turned dorsally toward the posterior end. L5 with "d" seta short and with a broad basis. Prehensile palps symmetrical or asymmetrical (Fig. 203a, c). Seta "d1" on L6 shorter than seta "d2" (Fig. 203b). Attachement on the UR simple. Labyrinth of the hemipenis short and heavily sclerotized (Fig. 204a).

Type species: *S. clavularis* Sars 1924

Species list with synonyms, type locality, and type material

1. *S. bicornis* Müller 1900b. Massai Nycke, Tanzania: Lectotype (♂), ZMB – 1314.

   Syn.: *Eucypris elongata* (Spandl 1924) (sensu Martens and Coomans 1990)

2. *S. clavularis* Sars 1924. Mud, valley at Klipdam, near Kimberley, South Africa, 28°20′S 24°39′E: Types, SAFM – A11118, 11739.

Syn.: *Eucypris capensis* Daday 1910d

3. *S. coomansi* Martens 1986. Sossusvlei, Hardap, Namib Desert, Namibia, 24°47′S 15°24′E: Holotype (♂), SMW – 50806.
4. *S. dayae* Martens 1988. Hoanib River, about 6.5 km inland, Skeleton Coast Park, Namibia, 19°33′S 12°56′E: Holotype (♂), SMW – 51228.
5. *S. dedeckkeri* Martens 1988. Pool between Tumasberg and Anichab, central Namib Desert, Namibia, 23°10′S 15°30′E: Holotype (♂), SMW – 51238.
6. *S. demoori* Martens 1991c. Shallow, temporary valley on the road to Bedford, 80 km from Grahamstown, Eastern Cape, South Africa, 32°49′30″S·26-°06′20″E: Holotype (♂), AM – LEN.58A.
7. *S. devexa* (Daday 1910a). Pool on Kilimanjaro, Tanzania, 03°03′S 37°21′E: Lectotype (♂), HMNH – IV/P-219.
8. *S. dumonti* Martens 1988. Ukualonkathi, formerly Ovamboland, Namibia, 18°00′S 16°00′E: Holotype (♂), SAFM – SAM A39527.
9. *S. exserta* Sars 1924. Onambeke, Oshikoto, Namibia, 18°02′S 16°12′E: Lectotype (♂), SAFM – SAM Al1237.
10. *S. flabella* (Vávra 1897). Busisi, Mwanza Gulf, Lake Victoria, Tanzania, 02°43′S 32°52′E: Repository of the type material unknown.
11. *S. jenkinae* Klie 1933c. E shore of Lake Naivasha, near Crescent Island, NW of Nairobi, Kenya, 00°46′S 36°24′E: Paratype (♀), ZMK – UR-993.
12. *S. longisetosa* Martens 1988. Orambo pool, Nanga swamp, marsh near Kisumu, Kenya, 00°09′S 34°44′E: Holotype (♂), BM – 1987.174.
13. *S. major* Sars 1924. Onolongo, formerly Ovamboland, Namibia, 18°00′S 16°00′E: Lectotype, SAFM – A11234.
14. *S. multiformis* (Kiss 1960). Semi-permanent marsh in floodplains of Rusizi River, wayside of the road to Cyangugu, near Bujumbura, Burundi, 03°19′S 29°19′E: Syntypes, RMCA – 5088–5095.

Syn.: *Eucypris serratamarginata* Kiss 1960

15. *S. pardii* Martens 1987b. Gal Leef, well-spring 3 km N of Bud Bud, Somalia, 04°12′07″N 46°28′10″E: Holotype (♀), NHMF – MF-1253.
16. *S. rajasthanensis* (Deb, 1973). Bisprasar Tank, Jaisalmer District, Rajasthan, India, 26°54′N 70°54′E: Types ZSI – collection numbers unknown.

Syn.: *Bharatcypris indica* Deb 1973; *Bharatcypris mackenziei* Battish 1978; *Bharatcypris dentata* Victor and Michael 1975

17. *S. rothschildi* (Daday 1910c). Ouardy, S Ethiopia, 06°13′N 38°51E: Lectotype (♂), HMNH – collection number unknown.
18. *S. sarsi* Martens 1986. Kimberley, South Africa, 28°44′S 24°45′E: Lectotype (♂), SAFM – collection number unknown.
19. *S. tuberculata* (Methuen 1910). Muddy bottoms of shallow littoral water of Lake Chrissie, E of Pretoria, Mpumalanga, ca. 60 km from the border to Swaziland, South Africa, 26°19′S 30°13′E: Repository of type material unknown.

Syn.: *Afrocypris biconica* Klie 1933a

20. *S. venusta* (Vávra 1897). Mud from Ugogo, Tanzania, 06°07′S 35°30′E: Lectotype, ZMB – 10014.
21. *S. virungensis* Martens 1988. Pools in the savannah at Kisisie, E of Rwindi camp, ca. 20 km S of Vitshumbi, S end of Lake Edward, Virunga National Park, DR Congo, 00°51′S 29°23′E: Holotype (♂), RBINS – O.C. 1223.
22. *S. woutersi* Martens 1988. Littoral zone of Lake Albert, Ngeze mukubwa, ca. 20 km SSE of Kasenji, DR Congo, 01°15′N 30°28′E: Holotype (♂), RBINS – O.C. 1209.
23. *S. zelaznyi* Martens 1988. Pan, 3 km E of Makuvi on the road to Baraka, Bushmanland, Namibia, 18°50′S 16°20′E: Holotype (♂), SMW – 51221.

Key to the species

1. Lateral (horn-like) projections present on one or both valve 2
– No such projection present, sometimes only rounded tubercles present . . . 4
2. Projections formed by both external and internal lamellae (hollow and opening into the carapace cavity) 3
– Projections formed only by outer lamella (no open cavity) . . . . . *S. jenkinae* Klie 1933c
3. MPC branched, dorsal margin gently sloping toward posterior end . . . . *S. multiformis* (Kiss 1960)
– MPC straight, dorsal margin straight . . . . *S. bicornis* Müller 1900b
4. Margins of the valves lined with spines . . . . *S. venusta* (Vávra 1897)
– No spines present along the margins 5
5. L6 with three subapical setae on the third segment all being very long . . . . . *S. longisetosa* Martens 1988
– L6 normally developed 6
6. Antero-ventral margin in front of the mouth region acutely pointed 7
– Antero-ventral margin in front of the mouth region rounded 8
7. Prehensile palps symmetrical . . . . *S. woutersi* Martens 1988
– Prehensile palps asymmetrical . . . . *S. rothschildi* (Daday 1910c)
8. Tubercles present on the carapace surface 9
– Surface of the carapace sometimes ornamented, but no tubercles present . 10
9. Caudal valve margin on LV forming distinct lobe . . . . *S. tuberculata* (Methuen 1910)
– No lobe present . . . . *S. virungensis* Martens 1988
10. Dorsal margin of the valves straight (at least on LV) 11
– Dorsal margin inclined 15

11. Prehensile palps asymmetrical: finger on the right one conspicuously thicker than on the left one . . . . *S. pardii* Martens 1987b

– Prehensile palps symmetrical 12

12. Outer lobe on the hemipenis (the largest one) conical in shape and very large *S. dayae* Martens 1988

– Outer lobe, more of less square 13

13. Ventral process on both prehensile palps situated more or less on the same distance from the finger 14

– Ventral process on the left prehensile palp distinctively situated more closely to the finger . . . . *S. zelaznyi* Martens 1988

14. Ventral process on the left prehensile palp bilobate *S. dedeckkeri* Martens 1988

– Ventral process on the left prehensile palp not bilobate *S. sarsi* Martens 1986

15. In lateral view, posterior margin evenly rounded and wide, without any postero-ventral extensions 16

– In lateral view, posterior margin considerably narrowing on the postero-ventral part, often with extensions on that margin 17

16. MPC long and branched . . . . *S. flabella* (Vávra 1897)

– MPC short and straight . . . . *S. devexa* (Daday 1910a)

17. Postero-ventral margin on LV actually pointed 18

– Postero-ventral margin on LV not so acutely pointed 19

18. Lateral shield of hemipenis (the largest one) with parallel sides and with obliquely rounded distal margin . . . . *S. rajasthanensis* (Deb 1973)

– Lateral shield of hemipenis (the largest one) with inclined sides and with almost flat distal margin . . . . *S. major* Sars 1924

19. Prehensile palps strongly asymmetrical (ventral extensions on different distance from the finger) 20

– Prehensile palps more symmetrical (ventral extensions on more or less same distance from the finger) 21

20. Setae on L6 long, especially the “g” seta, which is more then two times longer than terminal segment . . . . *S. exserta* Sars 1924

– Setae on L6 much shorter . . . . *S. coomansi* Martens 1986

21. Lateral shield on the hemipenis distally rounded 22

– Lateral shield on the hemipenis distally almost flat . . *S. clavularis* Sars 1924

22. Distal margin of the outer lobe of hemipenis obliquely rounded . . . . *S. demoori* Martens 1991c

– Distal margin of the outer lobe of hemipenis evenly rounded . . . . *S. dumonti* Martens 1988

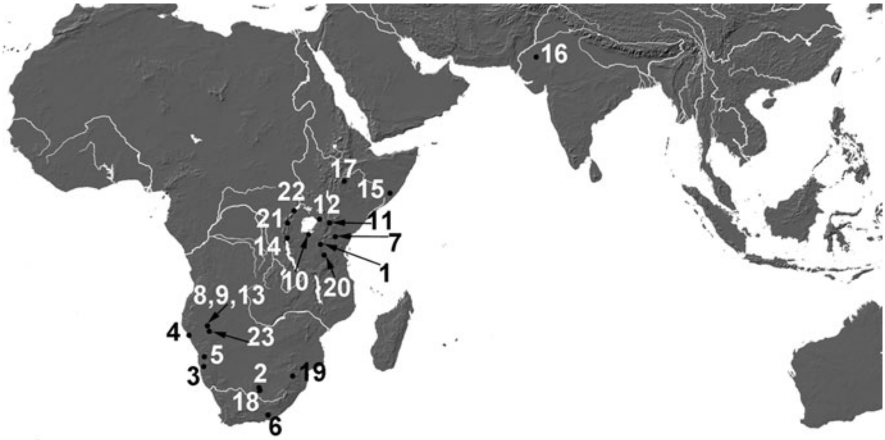


Fig. 205 Distribution of *Sclerocypris* Sars 1924: Numbers correspond to the species list

Ecology and distribution (Fig. 205)
The species live in all types surface freshwater bodies, most often in temporary ones. The genus is recorded only in Africa and India.

4.17.2 Tribe Tanganyikacypridini De Deckker and Wouters 1983

Diagnosis (modified after Wouters et al. 1989): Relatively small Megalocypridinae, with thick and strongly calcified valves, frontal selvage on both valves inwardly displaced over ⅓–½ of the distance between valve margin and inner margin and with the fused zone situated proximally to the selvage, with two types of marginal pore canals: some opening on the external side of the selvage, others running up to the valve margin. Terminal segment of the Mxl palp curved, distally not dilated.

Type (and only) genus: *Tanganyikacypris* Kiss 1961b

Type species: *T. matthesi* (Kiss 1961b)

Species list with synonyms, type locality, and type material
1. *T. matthesi* (Kiss 1961b). In the stomach of the fishes *Lamprologus cunningtoni* and *Xelotilapia sima*, littoral zone of Lake Tanganyika, Central Africa, 06°00′S 29°30′E: Holotype (♀), RMCA – 50.879.
2. *T. stappersi* (Wouters et al. 1989). SW part of Lake Tanganyika, Moliro, DR Congo, 08°13′S 30°34′E: Holotype (♂), RBINS – O.C. 1262.

Key to the species
1. Lateral shield of the hemipenis with a flat distal margin *T. matthesi* (Kiss 1961b)

– Lateral shield of the hemipenis with a rounded distal margin . . . *T. stappersi* (Wouters et al. 1989)

Ecology and distribution
The genus is endemic to the Lake Tanganyika and the area surrounding it.

4.18 Subfamily Mytilocypridinae De Deckker 1974

Diagnosis (after Halse and McRae 2004): Large carapace (more than 3 mm), subrectangular to subtriangular in lateral view (Figs. 206 and 207); marginal pore canals numerous and simple or branched; selvages weak to strongly raised and sometimes asymmetrical, with a list in one valve. A1 slender. Mxl palp cyllindical (Fig. 208a). Prehensile palps symmetrical. UR well developed. L6 5-segmented (Fig. 208c). L7 with terminal segment pincer like (Fig. 208d). Spinules present in variable patterns on the posterior margin of UR (Fig. 208e); attachment simple (Fig. 208f). Zenker organ with >60 rosettes.

Type genus: *Mytilocypris* McKenzie 1966b

Other genera: *Australocypris* De Deckker 1974; *Caboncypris* De Deckker 1982a; *Lacrimicypris* Halse and McRae 2004; *Repandocypris* Halse and McRae 2004; *Trigonocypris* De Deckker 1976.

Key to the genera (after Halse and McRae 2004)

1. Carapace elongate ellipsoid in dorsal view (W less or equal to 0.4 of L) (Figs. 206i, j and 207e) 2
– Carapace rounded in dorsal view (W more or equal to 0.5 of L) (Fig. 207f) 4
2. Selvage present posteriorly in at least one valve (Fig. 206e, f) 3
– Selvage best developed in antero-dorsal portion of valves (often indistinct) and absent posteriorly (Fig. 207a, b) . . . . . *Repandocypris* Halse and McRae 2004
3. Selvage in RV only (list in left), proud of anterior margin (Fig. 206e, f) *Lacrimicypris* Halse and McRae 2004
– Selvage present in both valves, contained below margin (Fig. 206g, h) *Mytilocypris* McKenzie 1966b
4. Carapace H reduced by slight dorsal concavity in anterior third; pronounced selvage in both valves anteriorly (Fig. 206c, d); posterior claw of UR ⅔–¾ L of anterior one . . . . *Caboncypris* De Deckker 1982a
– Even dorsal arch in anterior half of carapace, selvage present or absent anteriorly; claws on the UR subequal 5
5. Carapace subrectangular or bean shaped in lateral view, selvage usually absent anteriorly but always present posteriorly (sometimes weakly) (Fig. 206a, b); no setules on proximal part of UR . . . . *Australocypris* De Deckker 1974

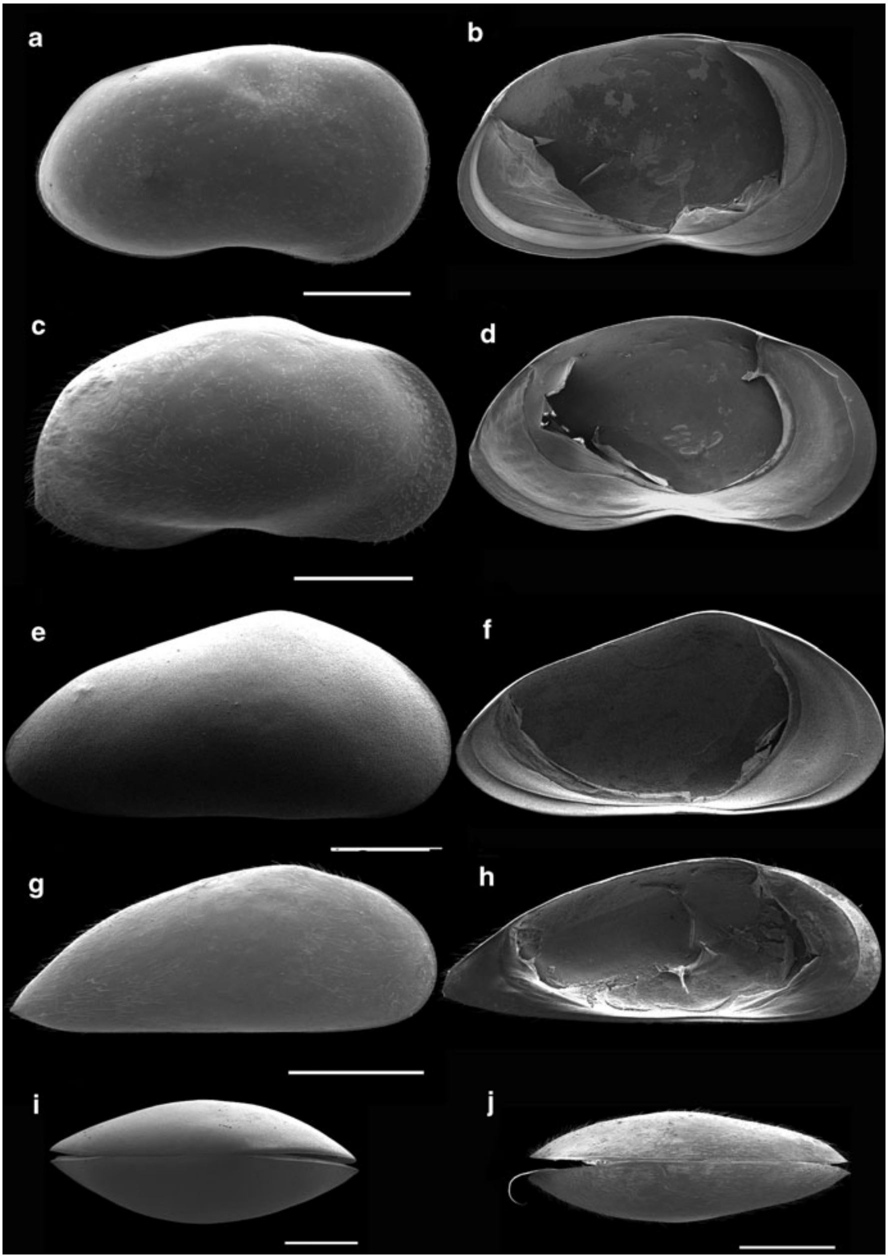


Fig. 206 SEM: (**a**, **b**) *Australocypris benetti* Halse and McRae 2004; (**c**, **d**) *Caboncypris kondininensis* Halse and McRae 2004; (**e**, **f**, **i**) *Lacrimicypris kumbar* Halse and McRae 2004; (**g**, **h**, **j**) *Mytilocypris coolcalalaya* Halse and McRae 2004: (**a**, **c**, **e**, **g**) RV, outside view; (**b**, **d**, **f**, **h**) LV, inside view; (**i**, **j**) dorsal view. Photos: S. Halse

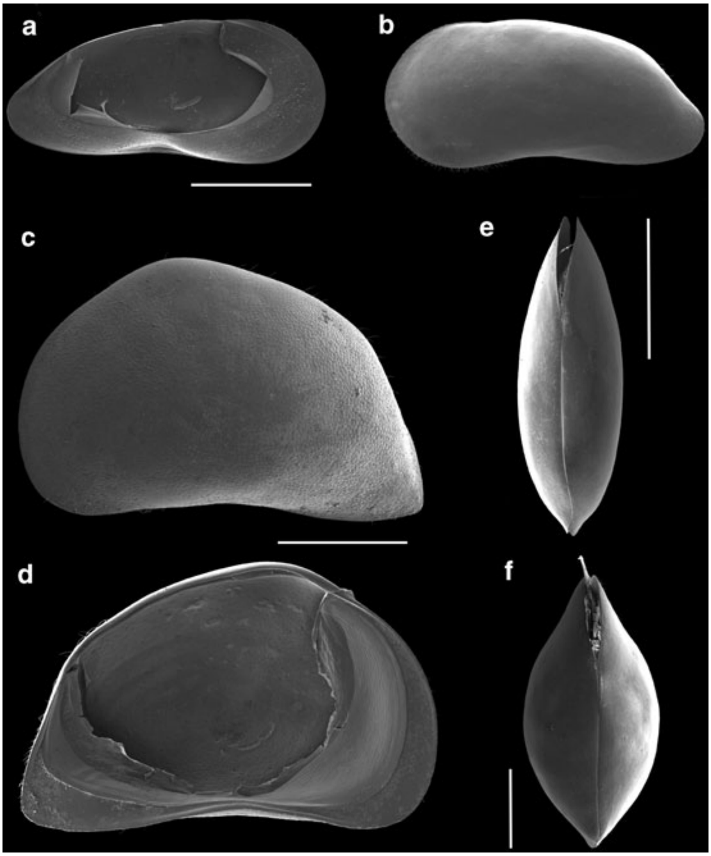


Fig. 207 SEM: (**a**, **b**, **e**) *Repandocypris austinensis* Halse and McRae 2004; (**c**, **d**) *Trigonocypris globulosa* De Deckker 1978; (**f**) *Australocypris benetti* Halse and McRae 2004: (**a**, **d**) LV, inside view; (**b**, **c**) LV, outside view; (**e**, **f**) dorsal view. Photos: S. Halse

– Carapace strongly arched dorsally (Fig. 207c, d); selvage present anteriorly and posteriorly; small cluster of ventral setules at proximal end of UR *Trigonocypris* De Deckker 1976

***Australocypris* De Deckker 1974**

Diagnosis: Carapace large (>3 mm), subrectangular to subtriangular, with smooth valves. Ventral margin almost straight, except in mouth region where slightly to strongly concave. Anterior broadly rounded compared with posterior. LV slightly longer than RV posteriorly. Selvage narrow and marginal on both valves; CIL relatively narrow both anteriorly and posteriorly and broadest in postero-ventral area. MPC numerous, short, and almost all straight; most abundant antero-ventrally. Longer claws on the terminal segment of A2 not sexually dimorphic. Terminal

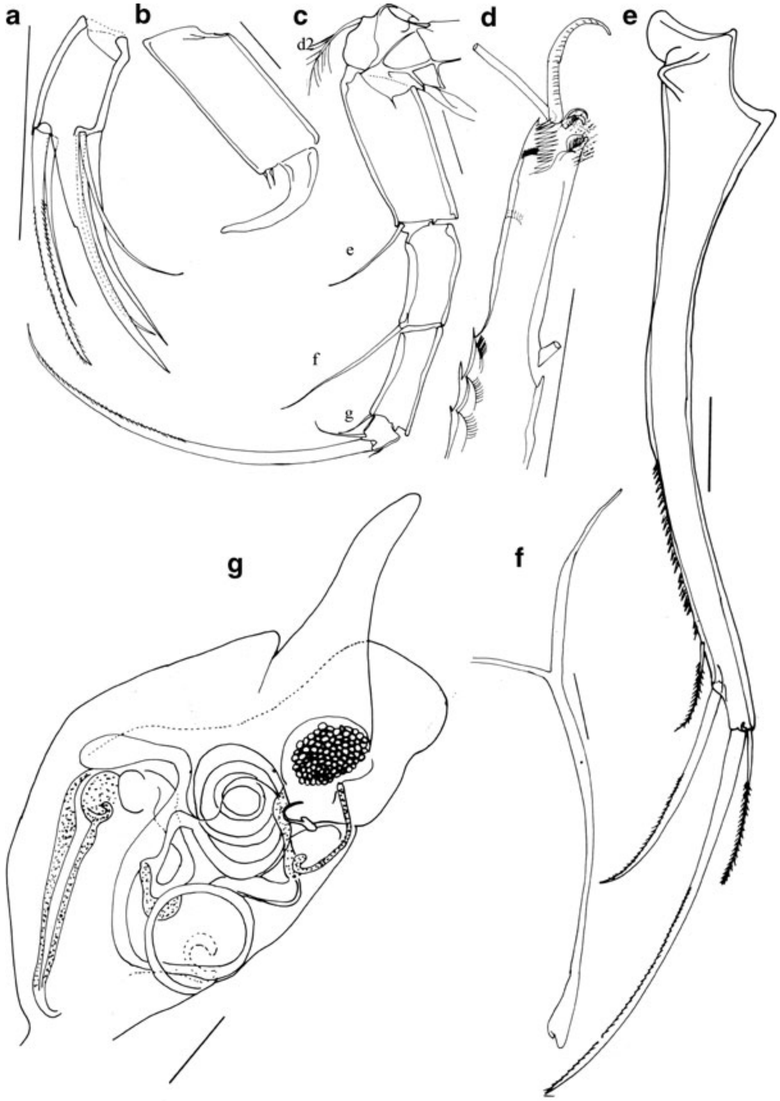


Fig. 208 Line drawings: *Mytilocypris mytiloides* (Brady 1886b): (**a**) second segment of the Mxl palp; (**b**) prehensile palp; (**c**) L6; (**d**) distal end of L7; (**e**) UR; (**f**) attachment of UR; (**g**) hemipenis. Scales = 0.1 mm

segment of the Mxl palp cylindrical. Seta "d2" on L6 (almost always) absent. UR with double row of four groups of fine spinules on posterior side; terminal claws equal or almost equal in size. Zenker organ with about 75 rosettes.

Type species: *A. robusta* De Deckker 1974

Species list with synonyms, type locality, and type material

1. *A. beaumonti* Halse and McRae 2004. Small, un-named seasonal salt lake, Beaumont Nature Reserve, WA, Australia, 33°27′59″S 122°36′45″E: Holotype (♂), WAM – C 33717.
2. *A. benetti* Halse and McRae 2004. Naturally saline, seasonal playa, W side of the Lake Grace chain of wetlands, Isthmus Lake, WA, Australia, 33°19′30″S 118°27′05″E: Holotype (♂), WAM – C 33711.
3. *A. dispar* De Deckker 1981b. Ephemeral salt lake, S of Coorong Lagoon, SA, Australia, 36°26′45″S 139°47′32″E: Holotype (♂), SAM – collection number unknown.
4. *A. insularis* (Chapman 1966). Large flat area with shallow water from recent rains, centre of West Wallabi Island, Houtman Abrolho Archipelago, WA, Australia, 28°27′S 113°41′E: Holotype, AMS – P.19550.

   Syn.: *A. hypersalina* De Deckker 1974

5. *A. mongerensis* Halse and McRae 2004. Small episodically filled claypan, adjacent to Lake Monger (very large naturally saline playa), N edge of the Western Australian Wheatbelt, WA, Australia, 29°32′43″S 116°41′58″E: Holotype (♂), WAM – C 33722.
6. *A. rectangularis* De Deckker 1978. Surrounded by salt crystals, very small dried out pool, Centre Lake, Victoria, Australia, 37°01′S 141°44′E: Holotype (♀), AMS – P.27680.
7. *A. robusta* De Deckker 1974. Lake Keilambete, W of Colac, W Victoria, Australia, 38°12′S 142°52′E: Holotype (♀), AMS – P.19547.

Key to the species (after Halse and McRae 2004)

1. The largest lobe on the hemipenis broad and wider at tip than base . . . . *A. mongerensis* Halse and McRae 2004
– The largest lobe on the hemipenis more or less digitate, of varying width but tip never wider than base 2
2. The largest lobe on the hemipenis without pronounced taper on lateral side, ratio of width at base to narrowest point below tip <2 3
– The largest lobe on the hemipenis with obvious taper on lateral side, ratio of width at base to narrowest point below tip >2 4
3. Inner lobe on the hemipenis not produced distally, left prehensile palp long and thin . . . . *A. beaumonti* Halse and McRae 2004
– Inner lobe on the hemipenis produced distally (extending ca. ¼ of L of outer lobe), prehensile palp robust . . . . *A. robusta* De Deckker 1978
4. Inner lobe on the hemipenis tapered on lateral side with pronounced lateral inflexion near tip, outer lobe not produced distally, prehensile palp thin and hook shaped with angle > or = 90° . . . . *A. rectangularis* De Deckker 1978.

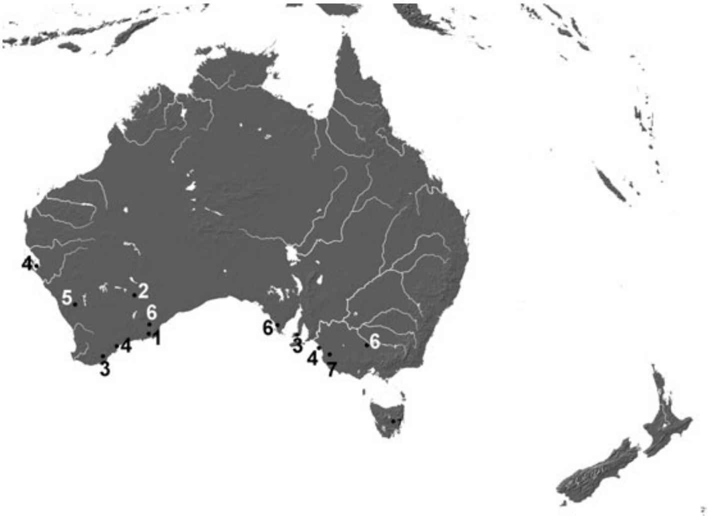


Fig. 209 Distribution of *Australocypris* De Deckker 1974: Numbers correspond to the species list

– The largest lobe on the hemipenis tapered on lateral side but without a pronounced inflexion near tip, inner lobe shield produced distally 5

5. The largest lobe on the hemipenis with medial side of tip curved and lateral side forming a more acute angle, prehensile palp robust *A. insularis* (Chapman 1966)

– The largest lobe on the hemipenis strongly tapered, narrow at tip, which is more or less rounded 6

6. Large inner lobe extending distally around ½ L of outer lobe, prehensile palp shorter than width of endopod . . . . *A. dispar* De Deckker 1981b

– Inner lobe extending <⅓ of L of outer lobe, prehensile palp variable *A. bennetti* Halse and McRae 2004

Ecology and distribution (Fig. 209)
The genus is endemic to Australia where it can be found in wide range of salinities, mostly in temporary waters.

***Caboncypris* De Deckker 1982a**
Diagnosis: Shell ellipsoidal in lateral view. LV overlapping RV dorsally with a small keel. Selvage inwardly displaced on both valves. MPC branched. Longer claws on the terminal segment of A2 sexually dimorphic. Terminal segment of the Mxl palp cylindrical. Both “d1” and “d2” setae on L6 long.

Type species: *C. nunkeri* De Deckker 1982a

Species list with type locality, and type material
1. *C. kondininensis* Halse and McRae 2004. Flooded samphire flat (ca. 40 ha in extent), unnamed playa in Kondinin Salt Marsh within Avon River

paleodrainage channel, WA, Australia, 32°35′25″S 118°24′42″E: Holotype (♂), WAM – C 33739.

2. *C. nunkeri* De Deckker 1982a. Roadside swamp, edge of Armidale golf course along Forrest Road, E of Forrestdale Lake, near Perth, WA, Australia, 32°09′S 115°57′E: Holotype (♂), AMS – P.32563.

Key to the species (after Halse and McRae 2004)

1. Body of the prehensile palps with both setae, L of palp approx. 1.5 W of endopod *C. nunkeri* De Deckker 1982a

– Body of the prehensile palps with tufts instead of setae, L of palp subequal to W of endopod .... *C. kondininensis* Halse and McRae 2004

Ecology and distribution (Fig. 210)
The genus is endemic to Australia where it can be found in wide range of salinities, mostly in temporary waters.

***Lacrimicypris* Halse and McRae 2004**
Diagnosis (after Halse and McRae 2004): Strongly raised selvage close to outer margin in RV is especially prominent ventrally; small list in LV recessed well below margin. MPC short and simple, both anteriorly and posteriorly. Selvage with remnant MPC and associated setae. Shorter claw on the terminal segment of A2 well developed on female, but a serrate seta on the male antenna, “y3” aesthetasc <½ of L of the longer claw on the terminal segment of A2. Rome organ small.

Fig. 210 Distribution of *Caboncypris* De Deckker 1982a: Numbers correspond to the species list

Palp of Mxl with quadrate 2nd segment. Prehensile palps scythe like. Third segment of L6 leg divided; "d1" and "d2" setae on basal segment long, "d1" around 1.5 times longer than "d2". UR with unequal claws. Attachment simple and bifurcate. Zenker organ with large number of rosettes.

Type (and only) species: *L. kumbar* Halse and McRae 2004

Species list with type locality and type material
L. kumbar Halse and McRae 2004. Seasonal freshwater swamp, Qualeup Lake, WA, Australia, 33°50′19″S 116°45′52″E: Holotype (♂), WAM – C 33691.

Mytilocypris McKenzie 1966b
Diagnosis: Carapace elongate, ellipsoidal in dorsal view, selvage present posteriorly on both valves.

Type species: *M. mytiloides* (Brady 1886b)

Species list with synonyms, type locality, and type material
1. *M. ambiguosa* De Deckker 1978. Barkers Swamp, Rottnest Island, WA, Australia, 32°00′S 115°30′E: Holotype (♀), AMS – P.27611.
2. *M. coolcalalaya* Halse and McRae 2004. Unnamed claypan, Murchison River, E of Kalbarri National Park, WA, Australia, 27°31′29″S 115°05′14″E: Holotype (♂), WAM – C 33706.
3. *M. henricae* (Chapman 1966). Lake Linlithgow, E of Hamilton, Victoria, Australia, 37°46′S 142°13′E: Syntypes, AMS – P.19365/69/99.
4. *M. mytiloides* (Brady 1886b). Freshwater, Kangaroo Island, SA, Australia, 35°48′S 137°12′E: Types, HM – collection numbers unknown.

   Syn.: *M. minuta* De Deckker 1978; *M. tasmanica* McKenzie 1966b; *M. praenuncia* Chapman 1936

5. *M. splendida* (Chapman 1966). Stomach of rainbow trout (*Oncorhynchus mykiss*), Lake Learmouth, near Ballarat, Victoria, Australia, 37°33′S 143°49″E: Holotype, AMS – P.19356.

Key to the species (after Halse and McRae 2004)
1. Hemipenis with broad largest lobe on the hemipenis, smaller lobe with rounded lateral edge 2
– Hemipenis with narrowly digitate the largest lobe, smaller lobe with straight lateral edge 3
2. Carapace H:L ratio ≤ 0.4, postero-dorsal angle absent . . . . . *M. coolcalalaya* Halse and McRae 2004
– Carapace H:L ≥ 0.5, postero-dorsal angle pronounced . . . . *M. splendida* (Chapman 1966)

3. Body of the prehensile palps with setae covered in long hairs, bursa copulatrix with narrow base and thin curved process projecting distally ..... *M. ambiguosa* De Deckker 1978
– Body of the prehensile palps with setae without hairs 4
4. Bursa copulatrix round or oval basally with narrow distal process overall L of bursa .... *M. mytiloides* (Brady 1886b)
– Bursa copulatrix triangular with elongate distal process .... *M. henricae* (Chapman 1966)

Ecology and distribution (Fig. 211)
The genus is endemic to Australia where it can be found in wide range of salinities, mostly in temporary waters.

Repandocypris Halse and McRae 2004
Diagnosis (after Halse and McRae 2004): Selvage visible only in anterior of valves (most obvious dorsally), anterior MPC intermediate L, simple and narrowly spaced (occasional, small branches antero-ventrally), posterior pore canals simple and widely spaced. RV overlapping LV ventrally. No sexual dimorphism in the appearance of the smaller claw on the terminal segment of A2; "y3" aesthetasc long in both sexes. Male prehensile palps with scythe-like distal segment. L6 without "d2" seta; "d1" seta either absent or relatively short, posterior seta on 4th segment chelate. Hemipenis with large rectangular medial shield. Claws on UR equal. Attachment bifurcate; dorsal and ventral branches with small distal bifurcations. Zenker organ with >60 rosettes.

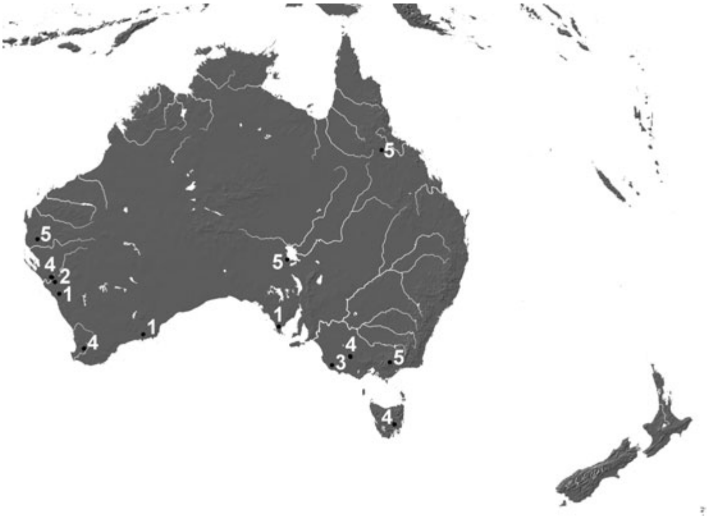


Fig. 211 Distribution of *Mytilocypris* McKenzie 1966b: Numbers correspond to the species list

Type species: *R. austinensis* Halse and McRae 2004

Species list with type locality and type material

1. *R. austinensis* Halse and McRae 2004. Lake Austin, S of Cue, WA, Australia, 27°27′S 117°42′E: Holotype (♂), WAM – C 33697.
2. *R. gleneagles* Halse and McRae 2004. Lake Eyre South, SA, Australia, 29°20′S 137°20′E: Holotype (♂), WAM – C 33702.

Key to the species

1. Outer lobe of hemipenis more or less rounded, no obvious projection .... *R. austinensis* Halse and McRae 2004
– Outer lobe of hemipenis extending almost as far as beyond peniferum as medial shield, short fingerlike projection ..... *R. gleneagles* Halse and McRae 2004

Ecology and distribution (Fig. 212)

The genus is endemic to Australia where it can be found in wide range of salinities, mostly in temporary waters.

***Trigonocypris* De Deckker 1976**

Diagnosis: Carapace strongly arched dorsally; selvage present anteriorly and posteriorly. MPC strongly branched. Both “d1” and “d2” setae on L6 long.

Fig. 212 Distribution of *Repandocypris* Halse and McRae 2004: Numbers correspond to the species list

Fig. 213 Distribution of *Trigonocypris* De Deckker 1976: Numbers correspond to the species list

Type species: *T. timmsi* De Deckker 1976

Species list with type locality and type material

1. *T. globulosa* De Deckker 1978. Lake Buchanan, Qld, Australia, 21°28′S 145°52′E: Holotype (♀), AMS – P.27669.
2. *T. timmsi* De Deckker 1976. Pine Tree Lagoon, via Hughenden, Qld, Australia, 20°50′S 144°11′E: Holotype (♀), CPC – 15795.

Key to the species

1. Finger of the prehensile palps long and thin (approximately 2 times W of endopod . . . . *T. timmsi* De Deckker 1976
– Finger robust (L approximately 1.2 times W of endopod . . . . *T. globulosa* De Deckker 1978

Ecology and distribution (Fig. 213)
The genus is endemic to Australia where it can be found in a wide range of salinities, mostly in temporary waters.

4.19 Subfamily Ngarawinae De Deckker 1979b

Diagnosis: LV with dorsal hump and slightly larger than RV; edge of RV with faint tuberculation posteriorly; broad selvage near edge of LV. CIL broad anteriorly;

CMS consisting of six scars at the maximum arranged in circle. MPC numerous, straight, and arranged in groups of two and sometimes bifid; four rows of seminal vesicles forming V-shape in postero-ventral area and forming two loops, one clockwise in dorsal area around central muscle field, the other anticlockwise in postero-dorsal area. A1 with one thick and straight seta at the end of last segment; A2 with short, unequal swimming setae. Terminal segment of Mxl palp spatula like. Prehensile palps almost identical with two long and narrow setae. Zenker organ with both ends rounded and bearing 25 rosettes. UR with both claws almost equal in L and two setae; attachment with one ventral extension near the basis, two small dorsal branches and a bifid ventral one; no spine on posterior of body.

Type (and only) genus: *Ngarawa* De Deckker 1979b

***Ngarawa* De Deckker 1979b**
Diagnosis: Same as that for the subfamily.

Type (and only) species: *N. dirga* De Deckker 1979b. Blanche Cup Spring, Strangways-Curdimurka area, SW of Lake Eyre South, SA, Australia, 29°27′08″S 136°51′04″E: Holotype (♂), AMS – P.28680.

4.20 Subfamily Pelocypridinae Triebel 1962

Diagnosis (after Hartmann and Puri 1974): Valves similar in outline and sculptured. Vertical folds on the surface of the valves do not reach down to the CMS. Surface covered with spines, tubercles, or long processes on which normal pores may open. CIL broad, penetrated by many marginal pore canals simple or situated in groups. Terminal segment of the Mxl palp spatula like (Fig. 214c). Prehensile palps slightly asymmetrical (Fig. 214a, b). L6 5-segmented and without basal setae (Fig. 215b). Terminal segment of L7 pincer like (Fig. 214d). Anterior margin of both valves without inner lists. Hemipenis with two lobes (Fig. 215a). Posterior seta of UR long (Fig. 215b).

Type (and only) genus: *Pelocypris* Klie 1939c [Syn.: *Pseudoilyocypris* Ferguson 1967e]

Species list with type locality and type material
1. *P. lenzi* Klie 1939c. Mud of lake front, Açude Piaba, Paraíba, Brazil, 07°15′S 36°30′W: Repository of the type material unknown.
2. *P. tuberculata* (Ferguson 1967e). W Playa Lake, Roosevelt County, New Mexico, USA, 33°58′N 103°27′W: Holotype (♀), USNM – 119249.

Key to the species
1. Processes on the valves very long, extending far, like projections . . . . *P. lenzi* Klie 1939c

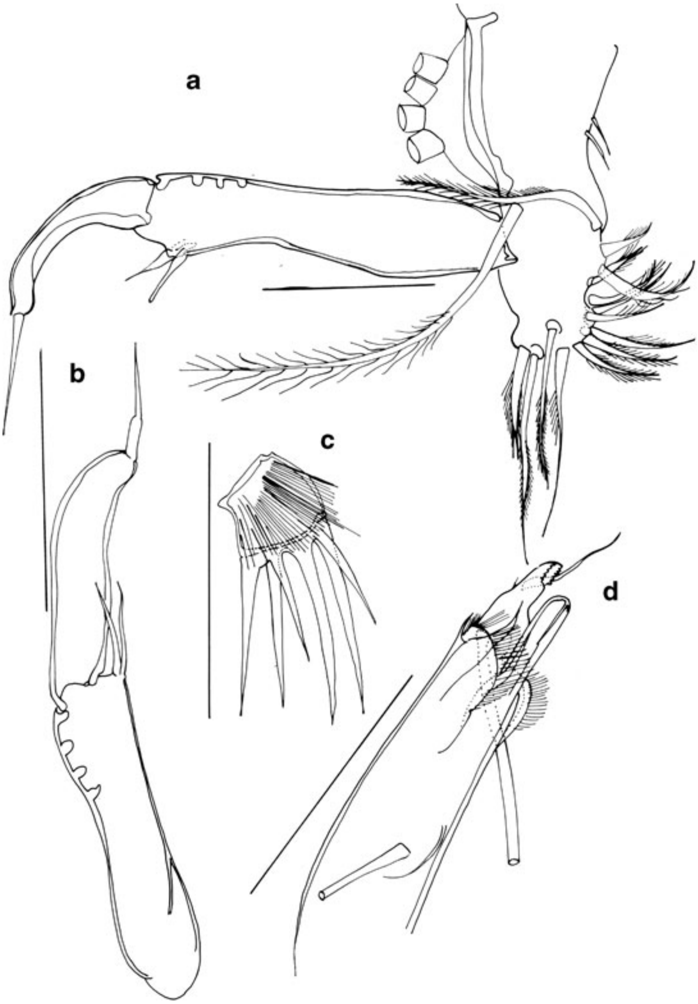


Fig. 214 Line drawings: *Pelocypris lenzi* Klie 1939c: (**a**) L5; (**b**) prehensile palp; (**c**) second segment of Mxl palp; (**d**) distal part of L7. Scales = 0.1 mm

– Processes much shorter . . . . *P. tuberculata* (Ferguson 1967e)

Ecology and distribution (Fig. 216)
The genus is endemic to America.

4.21 Subfamily Rudjakoviellinae Triebel 1973

Diagnosis (after Hartmann and Puri 1974): Shell slender and spindle like (Fig. 217a). LV larger than RV, rising above it at both ends with long pointed

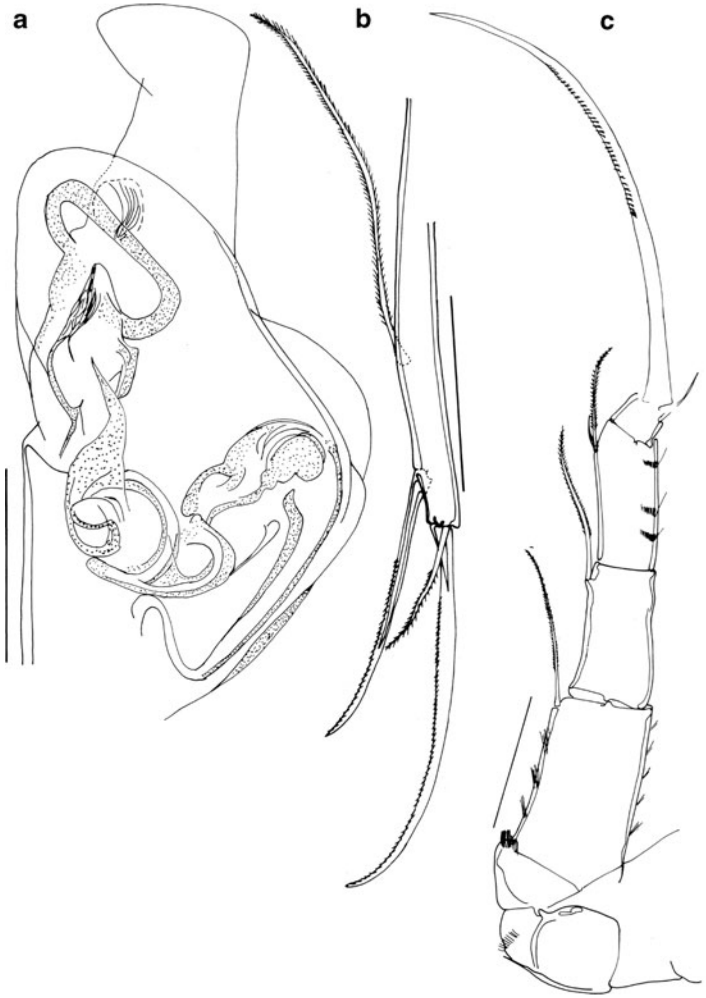


Fig. 215 Line drawings: *Pelocypris lenzi* Klie 1939c: (**a**) hemipenis; (**b**) UR; (**c**) L6. Scales = 0.1 mm

processes. Selvage on RV displaced inward and a narrow secondary zone of concrescence developed there. LV anteriorly missing fused zone, along other parts of margin is narrow with many simple MPC. CMS with only four scars. UR very slender and with only one terminal claw, other reduced into a seta (Fig. 217b). Posterior seta short.

Type (and only) genus: *Rudjakoviella* Triebel 1973

***Rudjakoviella* Triebel 1973**
Diagnosis: Same as that for the subfamily.

Fig. 216 Distribution of *Pelocypris* Klie 1939c: Numbers correspond to the species list

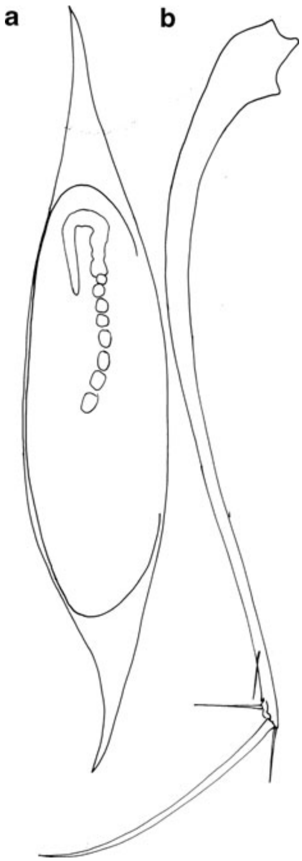
Type (and only) species: *R. prolongata* (Triebel 1973). Puddle S of Los Robles, Margarita Island, Venezuela, 10°59′N 63°50′W. Holotype (♂), RIS – Xe4134.

Syn.: *Xenocypris procera* (Triebel 1962).

4.22 Subfamily Scottiinae Bronstein 1947

Diagnosis (after Martens et al. 2004a): Shell small to medium sized ($L = 0.5$–0.9 mm), oviform, dorsally arched and ventrally flattened, smooth, and often hirsute, especially in the ventral area (Fig. 218). CMS a vertical row of three rectangular scars and a smaller one below plus two other scars posterior to that row. CIL wide.

Fig. 217 Line drawings: *Rudjakovskiella prolongata* (Triebel 1973): (**a**) RV, inside view; (**b**) UR. Modified after Triebel (1962). Not to scale



Claws on all appendages short and strongly chitinized. Swimming setae on A2 strongly reduced. UR symmetrical or asymmetrical, with shaft and claws short and stout (Fig. 219a), attachment simple.

Type genus: *Scottia* Brady and Norman 1889

Other genera: *Austromesocypris* Martens et al. 2004; *Mesocypris* Daday 1910a.

Key to the genera

1. Penultimate segment on L6 separated (Fig. 219b) . . . . *Scottia* Brady and Norman 1889

– Penultimate segment on L6 fused or incompletely separated (Fig. 219d) . . . 2

2. Segments four and five on A1 fused (Fig. 219c) . . . . *Austromesocypris* Martens et al. 2004

– Segments for and five on A1 separated . . . . *Mesocypris* Daday 1910a

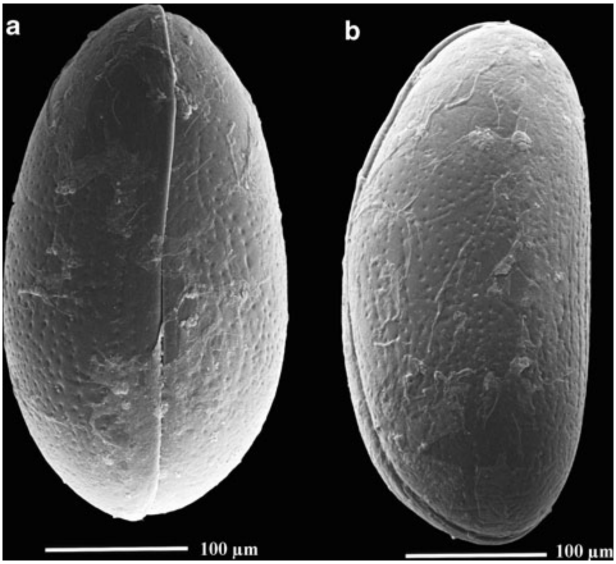


Fig. 218 SEM: *Mesocypris sp.*: (**a**) dorsal view; (**b**) lateral view from the right side. Photos: D. Keyser

Austromesocypris Martens et al. 2004

Diagnosis (after Martens et al. 2004a): Carapace smooth or pseudo-punctate, often strongly pilose, mostly elongated and with Width less than half the Length. LV/RV overlap at anterior, ventral, and posterior sides, sometimes also along dorsal side. Both LV and RV with inner lists on well-developed CIL; selvages absent. A1 with segments four and five always fused, segments six and seven either fused or separated. A2 with two short swimming setae. L6 with segments two and three (completely or incompletely) fused; fourth segment with subapical seta short, mostly 1/3 or 1/4 of L of end claw; setae "e" and "f "short. UR asymmetrical, right ramus with anterior seta and thick claw and with shaft strongly denticulate, left ramus with anterior seta and more slender claw and with shaft finely pectinate.

Type species: *A. berentsae* Martens et al. 2004

Species list with type locality and type material

1. *A. australiensis* (De Deckker 1983). On moss, Beauchamp Falls, Otway Ranges, Victoria, Australia, 38°39′S 143°36′E: Holotype (♂), SAM – C3922.
2. *A. berentsae* Martens et al. 2004. Leaf litter, Barrington Tops, Chichester, Jerusalem Creek, NSW, Australia, 32°14′5″S 151°43′38″E: Holotype (♀), AMS – P.68089(GR.497).
3. *A. tasmaniensis* (De Deckker 1983). Wet sclerophyll litter, lower Gordon River area, SW Tasmania, Australia, 42°51′S 145°50′E: Holotype (♂), TMAG – G2237.

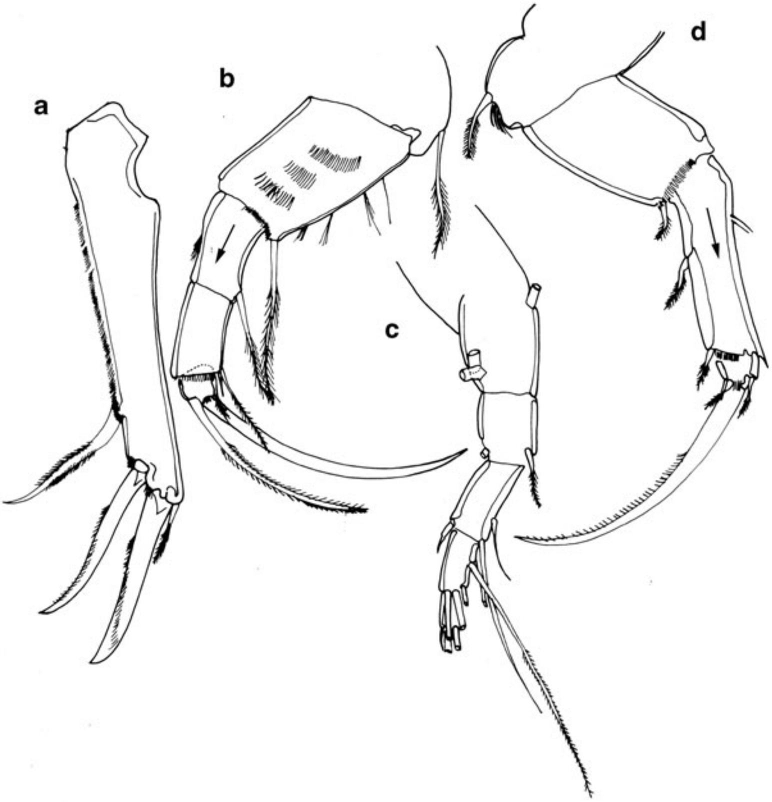


Fig. 219 Line drawings: (**a**, **b**) *Scottia birigida* Smith et al. 2002; (**c**, **d**) *Austromesocypris berentsae* Martens et al. 2004: (**a**) UR; (**b**, **d**) L6, arrows pointing the division of the penultimate segment; (**c**) A1. (**a**, **b**) modified after Smith et al. (2002); (**c**, **d**) modified after Martens et al. (2004a). Not to scale

Key to the species

1. Posterior seta on the left UR spine like . . *A. australiensis* (De Deckker 1983)
– Posterior seta on the UR long and seta like 2
2. Segments five and six on A1 fused . . . . *A. berentsae* Martens et al. 2004
– These segments separate . . . . *A. tasmaniensis* (De Deckker 1983)

Ecology and distribution (Fig. 220)
The genus is endemic to Australia. Species inhabit semi-terrestrial ecosystems, like, for example, leaf litter.

Mesocypris Daday 1910a

Diagnosis: Carapace smooth or pseudo-punctate, often strongly pilose, mostly elongated and with Width less than half the Length. LV/RV overlap at anterior, ventral, and posterior sides, sometimes also along dorsal side. Both LV and RV

Fig. 220 Distribution of *Austromesocypris* Martens et al. 2004: Numbers correspond to the species list

with inner lists on well-developed CIL; selvages absent. A1 with segments four and five separated, segments six and seven separated. A2 with four to six swimming setae. L6 with segments two and three (completely or incompletely) fused; fourth segment with subapical seta short, mostly ⅓ or ¼ of L of end claw; setae "e" and "f" short. UR asymmetrical, right ramus with anterior seta a thick claw and with shaft strongly denticulate, left ramus with anterior seta a more slender claw and with shaft finely pectinate.

Type species: *M. pubescens* Daday 1910a

Species list with type locality and type material

1. *M. madagascariensis* Danielopol and Betsch 1980. Litter, dense humid forest of mid-altitude, 950 m, Ranomafana, E-central Madagascar, 21°21′S 47°24′E: Holotype (♀), NHMP – 929.
2. *M. pauliani* Danielopol and Betsch 1980. Litter, dense humid forest of mid-altitude, 950 m, Ranomafana, E-central Madagascar, 21°21′S 47°24′E: Holotype (♀), NHMP – 929.
3. *M. pubescens* Daday 1910a. Kilimanjaro, Tanzania, 03°04′S 37°21′E: Types, HMNH – IV/P-290-291.

4. *M. terrestris* Harding 1953. Soil at 183 m, Knysna forest, South Africa, 34°01′S 23°03′E: Holotype (♀), BM – 1953.1.2.1-7.

Key to the species

1. Posterior seta on the UR spine like 2
– Posterior seta on the UR short, seta like . . . . *M. madagascariensis* Danielopol and Betsch 1980
2. Setae "e" and "f" on L6 long . . . . *M. terrestris* Harding 1953
– Setae "e" and "f" on L6 short 3
3. A2 with five swimming setae . . . . *M. pubescens* Daday 1910a
– A2 with four swimming setae . . . . . *M. pauliani* Danielopol and Betsch 1980

Fig. 221 Distribution of *Mesocypris* Daday 1910a: Numbers correspond to the species list

Ecology and distribution (Fig. 221)
Like the rest of the subfamily, species of the genus *Mesocypris* live in the semi-terrestrial environment, such as leaf litter. The genus is distributed in Africa and Madagascar.

***Scottia* Brady and Norman 1889**
Diagnosis: Carapace smooth or pseudo-punctate, often strongly pilose. LV/RV overlap at anterior, ventral, and posterior sides, sometimes also along dorsal side. A1 with all segments free. A2 with six swimming setae. L6 with segments two and three separated; fourth segment with subapical seta long; setae “e” and “f “long. UR symmetrical.

Type species: *S. pseudobrowniana* Kempf 1971

Species list with type locality and type material

1. *S. audax* Chapman 1961. Leith Saddle, Dunedin, New Zealand, 45°46′S 170°32′E: Holotype (♀), OMD – collection number unknown.
2. *S. birigida* Smith, Matzke-Karasz et al. 2002. Area directly adjacent to artificial Shinkai Pond, Kanazawa University, Kakuma, Kanazawa, Ishikawa Prefecture, Japan, 36°32′31.6″N 136°42′12.4″E: Holotype (♂), UMT – UMUT RA 28198.
3. *S. insularis* Chapman 1963. Peat ponds by Rakeahua River, Stewart Island, New Zealand, 46°59′S 167°52′E: Repository of the type material unknown.
4. *S. pseudobrowniana* Kempf 1971. Meadow pond at a spring near E shore of Loch Fad, W of Rothesay, Isle of Bute, Scotland, UK, 55°48′N 05°03′W: Holotype (♀), BM – 1900-3-6-35 A.

Key to the species

1. Two “g” setae present on L6 2
– Only one “g” seta present on L6 . . . . *S. insularis* Chapman 1963
2. Four “t” setae present on A2 . . . . *S. audax* Chapman 1961
– Two “t” setae present on A2 3
3. Alpha seta on the Md palp narrow . . . . *S. pseudobrowniana* Kempf 1971
– Alpha seta on the Md palp swollen *S. birigida* Smith, Matzke-Karasz, Kamiya, and Ikeda 2002

Ecology and distribution (Fig. 222)
The genus has been reported from Europe, Japan, Australia, and New Zealand. Species of this genus live in the semi-terrestrial environment, such as leaf litter.

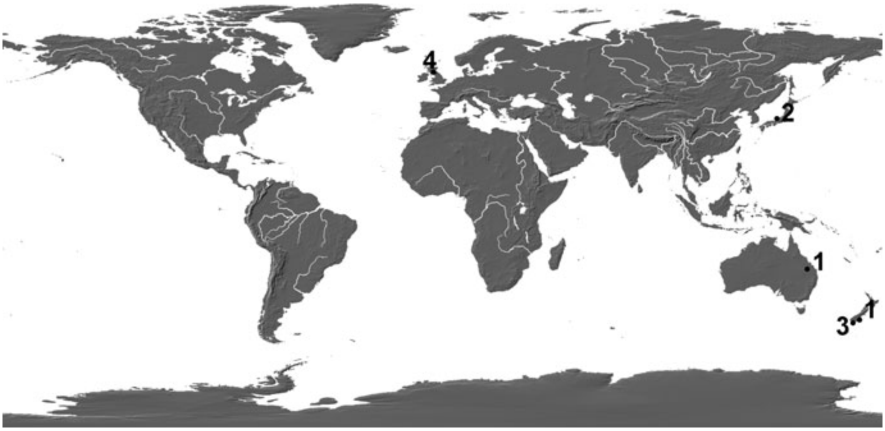


Fig. 222 Distribution of *Scottia* Brady and Norman 1889: Numbers correspond to the species list

4.23 Genera without Clear Systematic Position

Bennelongia De Deckker and McKenzie 1981 (Fig. 223c–g)

Type species: *B. australis* (Brady 1886a)

Species list with type locality and type material

1. *B. australis* (Brady 1886a). Penola, SA, Australia, 37°23′S 140°49′E: Types, BM – collection numbers unknown.
2. *B. barangaroo* De Deckker 1981b. Temporary pools, Lake Buchanan, Qld, Australia, 21°35′S 145°52′E: Holotype (♂), SAM – collection number unknown.
3. *B. harpago* De Deckker and McKenzie 1981. Dam near Mt. Teddy, beside McKinnons Creek, Lyndhurst Station, Kennedy Highway near Einasleigh, Qld, Australia, 19°00′S 144°37′E: Holotype (♀), AMS – P.31612.
4. *B. nimala* De Deckker 1981b. Lagoons, Georgetown Lagoon, Jabiru, NT, Australia 21°35′S 145°52′E: Holotype (♂), SAM – collection number unknown.
5. *B. pinpi* De Deckker 1981b. Freshwater, Pine Tree Creek Lagoon, N of Hughenden, exactly 16 km S of Louisa Lake on the road to Hughenden, Qld, Australia, 20°00′30″ S 144°16′44″E: Holotype (♂), SAM – collection number unknown.
6. *B. tunta* De Deckker 1982c. Swamp, Billabong, Australia, 20°12′23″S 145°58′41″ E: Holotype (♂), AMS – P.32574.

Key to the species

1. LV with a large dorsal keel overlapping RV . . . . *B. tunta* De Deckker 1982c
– LV without a large keel 2

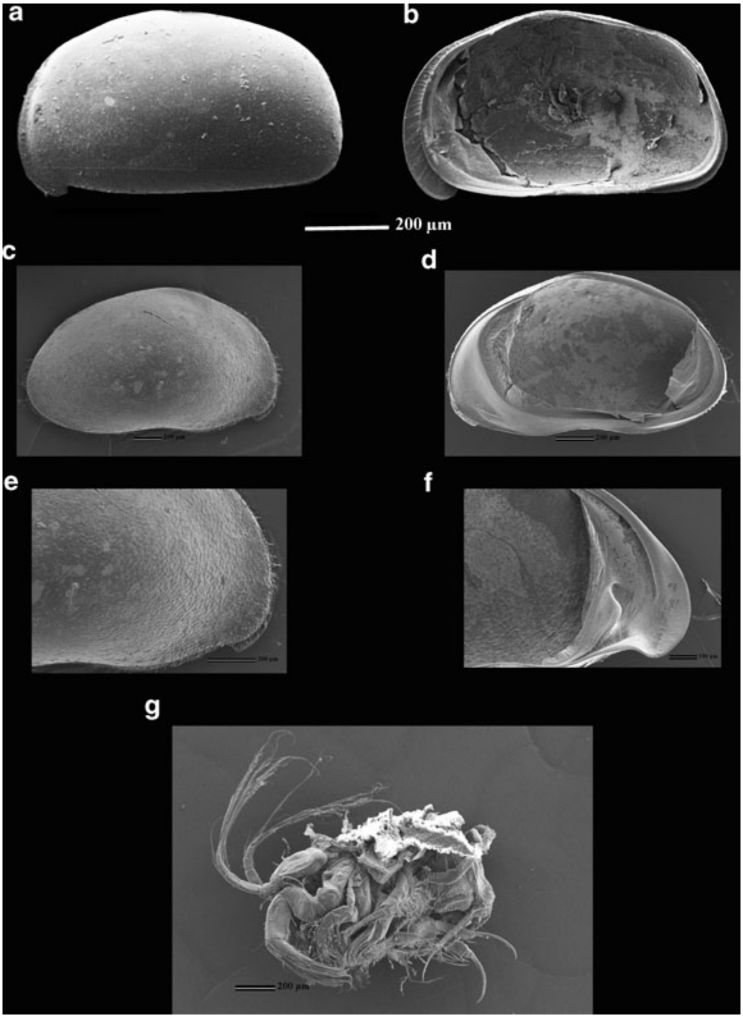


Fig. 223 SEM; (**a**, **b**) *Chlamydotheca sp*.; (**c**–**g**) *Bennelongia sp*.: (**a**) LV, outside view; (**b**, **d**) RV, inside view; (**c**) RV, outside view: (**e**) RV, anterior part; (**f**) LV, anterior part; (**g**) soft parts. (**a**, **b**) Photos = D. Keyser

2. Surface of carapace almost smooth, without surface setae, except in the mouth region . . . . *B. pinpi* De Deckker 1981b

– Surface of the carapace much "hairier" 3

3. Posterior seta on the UR longer than ½ L of posterior claw 4

– Posterior seta on the UR shorter than ½ L of posterior claw 5

4. In dorsal view, anterior part clearly separated from the rest of the carapace (beak like) . . . . *B. nimala* De Deckker 1981b

Fig. 224 Distribution of *Bennelongia* De Deckker and McKenzie 1981: Numbers correspond to the species list

- In dorsal view, anterior part gently narrowing ...... *B. harpago* De Deckker and McKenzie 1981

5. Greatest H in the middle .... *B. australis* (Brady 1886a)

- Greatest H in front of the middle .... *B. barangaroo* De Deckker 1981b

Ecology and distribution (Fig. 224)
Temporary and permanent water bodies, very rarely with higher salinity. The genus was recorded from Australia and New Zealand.

Chlamydotheca Saussure 1858 [Syn.: *Pachycypris* Claus 1892] (Fig. 223a, b)

Species list with synonyms, type locality, and type material

1. *C. angulata* Klie 1939d. Açude Borborema, Rio Grande do Norte, Brazil, 05°35′S 36°55′W: Syntypes, ZMK – UR-1031–1032.
2. *C. arcuata* (Sars 1901). Raised from dry mud, Itatiba, Brazil, 23°00′S 46°50′W: Repository of the type material unknown.

   Syn.: *Eucypris* (*Chlamydotheca*) *bennelong* King 1855

3. *C. azteca* Saussure 1858. Coastal water, Vera Cruz Sea, Mexico, 27°33′N 99°43′W: Repository type material unknown.
4. *C. barbadensis* Sharpe 1910. Pond, Government Hill, Barbados, 13°10′N 59°32′W: Type, SM – 40524.

   Syn.: *Chlamydotheca hummelincki* Triebel 1961

5. *C. bicolor* Roessler 1986c. Temporary pools, Colombia, Sabana de Bogota, Columbia, 04°36′N 74°04′W: Holotype (♀), ICN-MHN – UR-101-80.

6. *C. brasiliensis* (Lubbock 1855). Lake or river, Maldonado, Brazil, 34°54′S 54°57′W: Repository of the type material unknown.
7. *C. calcarata* Klie 1930a. Pond, Makthlawaiya, Rio Verde, Paraguay, 25°05′N 57°30′W: Syntypes, ZMK – UR-1014.

   Syn.: *Chlamydotheca kleerekoperi* Tressler 1950

8. *C. colombiensis* Roessler 1985. Temporary and permanent ponds, Valle de Rio Cauca, Columbia, 02°59′N 76°40′W: Holotype (♀), ICN-MHN – collection number unknown.
9. *C. deformis* (Farkas 1858a). Açude Quixaba, Ouricuri, Pernambuco, Brazil, 07°58′S 39°46′W: Repository of the type material unknown.
10. *C. elegans* Roessler 1986d. Pools, Lorica, Columbia, 09°10′N 75°50′W: Holotype (♀), ICN-MNH – UR-41-79.
11. *C. flexilis* (Brady 1902). St. Croix, US Virgin Islands, USA, 17°44 N 64°46′W: ZMC – collection numbers unknown.
12. *C. herricki* (Turner 1892). Shallow weedy tongue of a canal basin, Cincinnati, Ohio, USA, 39°45′N 98°30′W: Repository of the type material unknown.
13. *C. iheringi* (Sars 1901). Raised from dry mud, Itatiba, Brazil, 23°00′S 46°50′W: Repository of the type material unknown.
14. *C. incisa* (Claus 1892). Caracas, Venezuela, 10°30′N 66°55′W: Some material deposited at ZMC.

   Syn.: *Chlamydotheca alegrensis* Tressler 1950; *Chlamydotheca incisa clara* Roessler 1986d; *Chlamydotheca incisa obscura* Roessler 1986d; *Cypris limbata* Wierzejski 1893; *Cypris labiata* Sars 1901

15. *C. leuckarti* (Claus 1892). Caracas, Venezuela, 10°30′N 66°55′W: Some material deposited at ZMC.
16. *C. magdalenensis* Roessler 1986d. Lagoons and temporary pools, valley del Rio Magdalena, Aipe, Columbia, 03°15′N 75°20′W: Holotype (♀), ICN-MNH – UR-61-80.
17. *C. manguerensis* Kotzian 1974. Superficial waters, border of S tip of Mangueira Lagoon, close to village Curral Grande, State of Rio Grande do Sul, Brazil, 03°48′S 42°20′W: Holotype (♀), UFRGS – MP-0-381.
18. *C. mayor* Roessler 1986d. Temporary pools and lagoons, Valle del Rio Cauca, Columbia, 02°59′N 76°40′W: Holotype (♀), ICN-MNH – UR-51-81.
19. *C. mckenziei* Kotzian 1974. Large pool, 119 km on road Porto Alegre-Tramandai, Loc. Tl, Rio Grande do Sul, Brazil, 29°52′S 50°36′W: Holotype (♀), UFRGS – MP-0-369.
20. *C. mexicana* Sharpe 1903. Durango, Mexico, 24°02′N 104°40′W: Types, SM – 32559 N.
21. *C. obliqua* (Daday 1902). Amenkelt, Santa Cruz, Argentina, 50°03′S 69°01′W: HMNH – IV/361.
22. *C. pseudobrasiliensis* Martens and Behen 1994. Lake near Lavras, Ceará, Brazil, 06°43′S 38°58′W: Holotype (♀), SM – 83012.

23. *C. riograndensis* Kotzian 1974. Pool at 128 km on road Porto Alegre-Tramandai, Loc. T6, Rio Grande do Sul, Brazil, 30°01″S 51°18′W: Holotype (♀), UFRGS – MP-0-357.
24. *C. rudolphi* Triebel 1939. Russinho near Souza, Paraíba State, Brazil, 06°46′S 38°12′W: Holotype (♀), NMS – Xe27a.
25. *C. speciosa* (Dana 1849). Rio de Janeiro, Brazil, 22°54′S 43°12′W: Repository of the type material unknown.
26. *C. spectabilis* (Sars 1901). Raised from dry mud, Itatiba, Brazil, 23°00′S 46°50′W: Repository of the type material unknown.
27. *C. symmetrica* Vávra 1898. Freshwater ponds, Port Stanley, Falkland Islands, Argentina, 51°42′S 57°51′W: Repository of the type material unknown.
28. *C. texasiensis* (Baird 1862). Texas, USA, 31°15′N 99°15 W: Repository of the type material unknown.
29. *C. tolimensis* Roessler 1986d. Pools and lagoons, Valley del Rio Magdalena, Natagaima, Colombia, 03°37′N 75°05′W: Holotype (♀), ICN-MNH – UR-121-84.
30. *C. unispinosa* (Baird 1862). Hawaiian Islands ("Sandwich Islands"), 23°13′S 164°10′W: Repository of the type material unknown.

    Syn.: *Candonocypris serratomarginata* Furtos 1935

31. *C. vanhoeffeni* (Daday 1911a). Ceará, Brazil, 05°00′S 40°00′W: HNHM – 1916–34, IV/156.
32. *C. wrighti* Tressler 1950. Sao Pedro, Brazil, 22°33′S 47°54′W: Types, SM – 83010.

Key to the species

1\. RV with a well-developed spine-like process postero-ventrally 2

– RV with such process not developed 9

2\. Lip-like projection of the antero-ventral valve margin very poorly (ventral margin almost flat) developed 3

– Lip-like projection well developed . . . . *C. rudolphi* Triebel 1939

3\. RV overlapping LV with a big flange 4

– Flange not so well developed 5

4\. Posterior margin of RV almost straight . . . . *C. calcarata* Klie 1930a

– Posterior margin on RV rounded and inclined . *C. tolimensis* Roessler 1986d

5\. Greatest H of RV more than 50% of L, valves more tumid in lateral view . 6

– Greatest H of RV less than 50% of L (valves elongated in lateral view) . . 8

6\. Genital field with a bulging rounded process which is clearly defined from the rest of the genital field 7

– Genital field evenly rounded . . . . *C. mayor* Roessler 1986d

7\. Greatest H of RV more than 60% of L . . *C. magdalenensis* Roessler 1986d

– Greatest H of RV less than 60% of L . . . . *C. mckenziei* Kotzian 1974

8. Posterior margin of RV serrated above the spine-like process .... *C. spectabilis* (Sars 1901)
– Posterior margin of RV not serrated .... *C. unispinosa* (Baird 1862)
9. Lip-like projection not well-pronounces 10
– Lip-like projection well-pronounced 16
10. Dorsal margin highly arched 11
– Dorsal margin flat or slightly rounded 12
11. Posterior CIL not clearly defined .... *C. pseudobraziliensis* Martens and Behen 1994
– Posterior CIL well defined .... *C. wrighti* Tressler 1950 and *C. riograndensis* Kotzian 1974
12. Dorsal margin gently rounded .... *C. arcuata* (Sars 1901)
– Dorsal margin flat or inclined toward posterior end 13
13. Dorsal margin inclined toward posterior end ..... *C. leuckarti* (Claus 1892)
– Dorsal margin straight 14
14. Swimming setae reaching only distal end of penultimate segment *C. obliqua* (Daday 1902)
– Swimming setae reaching middle of distal claws 15
15. Posterior seta on the UR as long as posterior claw *C. symmetrica* Vávra 1898
– Posterior seta on the UR shorter than posterior claw *C. flexilis* (Brady 1902)
16. In dorsal view, RV by far over passing LV anteriorly 17
– In dorsal view, valves subequal 18
17. There is a small constriction on the side of RV in dorsal view, just before the anterior tip .... *C. deformis* (Farkas 1858a)
– RV in that part evenly rounded .... *C. colombiensis* Roessler 1985
18. In lateral view, posterior margin very sharply cut-off in the first ⅔ of its L *C. azteca* Saussure 1858
– In lateral view, posterior margin evenly rounded 19
19. On both valves lip-like projection separated from the ventral margin with a deep incisures 20
– Lip-like projection not separated with an incisures .. *C. vanhoeffeni* (Daday 1911)
20. Incisures equally deep on both valves .... *C. incisa* (Claus 1892)
– Incisures less developed on LV 21
21. Posterior claw on the UR reaching only 1/3 of the anterior one .. C. *herricki* (Turner 1892)
– Posterior claw on the UR reaching and over passing ½ L of the anterior one 22
22. Anterior and posterior margins almost equally wide (posterior one being broad) 23

– Posterior margin being much narrower than anterior one 24

23. In dorsal view, valves asymmetrical: “shoulder” of RV is lower than the one of LV . . . . *C. mexicana* Sharpe 1903

– In dorsal view, valves symmetrical . . . . *C. bicolor* Roessler 1986c

24. Dorsal margin in lateral view angular . . . . *C. angulata* Klie 1939d

– Dorsal margin in lateral view nor angular . . . . . *C. barbadensis* Sharpe 1910

Species not included in the key
Chlamydotheca iheringi (Sars 1901) has a spine on the postero-ventral margin of RV, does not have a lip-like process, and it is very similar to the following group of species: *C. mckenzie* Kotzian 1974, *C. elegans* Roessler 1986d, *C. magdalensis* Roessler 1986d, and *C. major* Roessler 1986d, but it is very briefly described and

Fig. 225 Distribution of *Chlamydotheca* Saussure 1858: Numbers correspond to the species list

the morphology of the other soft parts are unknown. Roessler (1986d) described a couple of species of the genus *Chlamydotheca* with differences only in valve dimensions. *Chlamydotheca brasiliensis* (Lubbock 1855) lacks the posterior spine on RV and has a flat dorsal margin, very similar to *C. symmetrica* Vávra 1898 and *C. flexilis* (Brady 1902), but it is insufficiently described (only carapace outline) to be clearly distinguished from the similar species. *Chlamydotheca texasiensis* (Baird 1862) belongs to the group of species without posterior spine on the carapace, and with well-defined lip-like extensions, but it also has only carapace described. The last species not included in the above key is *C. speciosa* (Dana 1849) described very briefly and without providing any accompanying drawings.

Ecology and distribution (Fig. 225)
The species can be found in stagnant water bodies, often temporary ones as well. The genus is distributed in North and South America.

References

Abe K, Vannier J (1995) Functional morphology and significance of the circulatory system of Ostracoda, exemplified by *Vargula hilgendorfii* (Myodocopida). Mar Biol 124:51–58

Absolon A (1973) Ostracoden aus einigen Profilen Spät- und Postglazialer Karbonat-Ablagerungen in Mitteleuropa. Mitt Bayer Staatssamml Paläontol Hist Geol 13:47–94

Akatova NA (1950) K faune Ostracoda Sredney Azii. Tr Zool Inst Akad Nauk SSSR 9:90–115

Allison EC, Holden JC (1971) Recent ostracodes from Clipperton Island, Eastern Tropical Pacific. Trans San Diego Soc Nat Hist 16:165–214

Alm GC (1914a) Beschreibung einiger neuen Ostracoden aus Schweden. Zool Anz 43:468–475

Alm GC (1914b) Beiträge zur Kenntnis der nördlichen und arktischen Ostracodenfauna. Ark Zool 9:1–20

Alm GC (1914c) Ostracoden aus den nordschwedischen Hochgebirgen. Naturwiss Unters d Sarekgebirges in Schwed-Lappland 4:639–664

Anichini G (1963) *Eucypris tarentina*, una nuova specie di ostracode trovata nei dintorni di Taranto. Rend Semin Fac Sci Univ Cagliari 33:391–397

Anichini G (1967) Gli Ostracodi della Sardenia. Rend Semin Fac Sci Univ Cagliari 32:1–42

Anichini-Pini G (1968a) Ostracodi delle piccole isole sarde meridionali. Rend Semin Fac Sci Univ Cagliari 38:53–93

Anichini-Pini G (1968b) *Herpetocypris andegavensis* n. sp. – *Potamocypris rullieri* n. sp., due nuove specie di ostracodi reperite ad Angers (Francis). Rend Semin Fac Sci Univ Cagliari 37:587–594

Arora GL (1931) Fauna of Lahore: 2. Entomostraca (water-fleas) of Lahore. Bull Dep Zool Punjab Univ 1:62–100

Artheau M (2007) Geographical review of the ostracod genus *Vestalenula* (Darwinulidae) and a new subterranean species from southern France. Invertebr Syst 21:471–486

Athersuch J, Horne DJ, Whittaker JE (1989) Marine and brackish water ostracods. In: Kermack DM, Barnes RSK (eds) Synopsis of the British Fauna 43. EJ Brill, Leiden, p 343

Baird W (1835) List of Entomostraca found in Berwickshire. Trans Berwicks Nat Club 1:95–100

Baird W (1838) The natural history of the British Entomostraca: Part IV. Mag Zool Bot 2:132–144

Baird W (1843a) Notes on british entomostraca. Zoologist – Pop Misc Nat Hist 1:193–197

Baird W (1843b) *Cypris novaezelandiae*. In: Dieffenbach E (ed) Travels in New Zealand; with contributions to the geography, geology, botany, and natural history of that country, vol 2. BiblioBazaar, London, p 268

Baird W (1845) Arrangement of the British Entomostraca, with a list of species, particularly noticing those which have as yet been discovered within the bounds of the club. Trans Berwicks Nat Club 2:145–158

Baird W (1846) Description of some new genera and species of British Entomostraca. Ann Mag Nat Hist, ser 1 17:410–416

I. Karanovic, *Recent Freshwater Ostracods of the World*,
DOI 10.1007/978-3-642-21810-1,

Baird W (1850) Description of several new species of Entomostraca. Ann Nat Hist, ser 2 10:56–59

Baird W (1859a) Description of several species of entomostracous Crustacea from Jerusalem. Ann Mag Nat Hist, ser 3 4:280–283

Baird W (1859b) Description of some new recent Entomostraca from Nagpur, collected by the Rev S Hislop. Proc Zool Soc Lond 27:231–234

Baird W (1862) Description of some new species of entomostracous Crustacea. Ann Mag Nat Hist, ser 3 10:1–6

Baltanás A (2001) *Candelacypris* gen.n. (Crustacea, Ostracoda), a new genus from Iberian saline lakes, with a redescription of *Eucypris aragonica*. Bull Soc Nat Luxemburg 101:183–192

Baltanás A, Otero M, Arqueros L, Rossetti G, Rossi V (2000) Ontogenetic changes in the carapace shape of the non-marine ostracod *Eucypris virens* (Jurine). Hydrobiologia 419:65–72

Barbeito-Gonzales PJ (1971) Die Ostracoden des Küstenbereiches von Naxos (Griechenland) und ihre Lebensbereiche. Mitt Hambg Zool Mus Inst 67:255–326

Barclay MH (1968) Additions to the freshwater ostracod fauna of New Zealand. NZ J Mar Freshw Res 2:67–80

Bate RH (1970) A new species of *Hemicypris* (Ostracoda) from ancient beach sediments of Lake Rudolf, Kenya. Palaeontology 13:289–296

Battish SK (1977) Record of genus *Pseudocypris* Daday, 1908 (Crustacea: Ostracoda) with the description of a new species from India. Zool J Linn Soc 60:363–366

Battish SK (1978) A new genus and species of cypridid ostracod from India with notes on its biology. Zool J Linn Soc Lond 64:283–292

Battish SK (1981a) Two new species of *Centrocypris* Vávra, 1895 (Crustacea: Ostracoda) from Punjab, India. J Nat Hist 15:135–143

Battish SK (1981b) Freshwater Ostracoda of the subfamily Cyprinotinae from Punjab, India, with the description of eight new species. J Nat Hist 15:645–669

Battish SK (1982a) Freshwater Ostracods of the family Cypridopsidae from Punjab, India, with the description of two new species. J Nat Hist 16:83–93

Battish SK (1982b) On two species of *Herpetocypris* Brady, Norman (Ostracoda) from Punjab with the description of a new species. Crustaceana 42:142–149

Battish SK (1985) A new species of *Cypria* (Ostracoda: Crustacea) from India. Res Bull (Sci) Panjab Univ, New Ser 36:155–156

Battish SK (1987) A new recent genus and species of notodromadinid ostracod from India. Res Crustac, Carcinol Soc Jpn 16:127–135

Battish SK (1998) A new species of cypridid ostracod from India. Proc Zool Soc 52:33–37

Beldescu S (1961) *Heterocypris rostrata* n. sp. din apele periodice din jurul Brailei. Comun Acad Repub Pop Romîne 11:939–943

Benson RH, Macdonald HC (1963) Postglacial (holocene) ostracodes from Lake Erie. Palaeontol Contrib Univ Kans 33:1–26

Bhatia SB, Mannikeri MS (1974) Recent fresh-water ostracodes from Rajasthan. Proc Colloq Indian Micropalaeontol Stratigr 4:81–86

Blake CH (1931) Two freshwater ostracods from North America. Bull Mus Comp Zool Harv Coll 72:279–292

Boero F (2010) The study of species in the era of biodiversity: a tale of stupidity. Diversity 2:115–126

Bonaduce GM, Danielopol DL (1988) To see and not to be seen: the evolutionary problems of the Ostracoda Xestoleberididae. In: Hanai T, Ikeya N, Ishizaki K (eds) Evolutionary biology of Ostracoda, its fundamentals and applications – Proceedings of the 9th International Symposium on Ostracoda Developments in palaeontology and stratigraphy 11. Kodansha and Elsevier, Tokyo and Amsterdam, pp 375–398

Boomer I, Horne DJ, Slipper IJ (2003) The use of ostracods in palaeoenvironmental studies, or what can you do with an ostracod shell? In: Park LE, Smith AJ (eds) Bridging the gap: Trends in the ostracode biological and geological sciences. Paleontol Soc Pap 9:153–179

Bosquet J (1852) Description des entomostraces fossiles des terrains Tertiaires de la France et de la Belgique. Mém Couronnes Mém Savant Etrangers Publ Acad R Sci Belg 24:37–41

Bou C, Rouch R (1967) Un nouveau champ de recherches sur la faune aquatique souterraine. CR Acad Sci Paris 265:369–370

Boxshall GA, Jaume D (2009) Exopodites, epipodites and gills in crustaceans. Arthropod Syst Phylogen 67:229–254

Boxshall GA, Danielopol DL, Horne DJ, Smith RJ, Tabacaru I (2010) A critique of biramous interpretations of the crustacean antennule. Crustaceana 83:153–167

Brady GS (1864) On species of Ostracoda new to Britain. Ann Mag Nat Hist, ser 3 13:59–64

Brady GS (1867) A synopsis of the recent British Ostracoda. Intell Observ 12:110–130

Brady GS (1868) A monograph of the recent British Ostracoda. Trans Linn Soc Lond 26:353–495

Brady GS (1869) Contributions to the study of the Entomostraca. IV: Ostracoda from the River Scheldt and the Grecian Archipelago. Ann Mag Nat Hist, ser 4 3:30–5

Brady GS (1870a) Notes on Entomostraca taken chiefly in the Northumberland and Durham District (1869). Nat Hist Trans Northumberl Durh 3:361–373

Brady GS (1870b) On the crustacean fauna of the salt-marshes of Northumberland and Durham. Nat Hist Trans Northumberl Durh 3:120–136

Brady GS (1886a) Notes on Entomostraca collected by Mr A Haly in Ceylon. J Linn Soc Lond Zool 19:293–317

Brady GS (1886b) Notes on freshwater Entomostraca from South Australia. Proc Zool Soc Lond 1886:82–93

Brady GS (1898) On new or imperfectly known species of Ostracoda, chiefly from New Zealand. Trans Zool Soc Lond 14:429–452

Brady GS (1902) On new or imperfectly-known Ostracoda, chiefly from a collection in the Zoological Museum Copenhagen. Trans Zool Soc Lond 16:179–210

Brady GS (1904) On Entomostraca collected in Natal by Mr James Gibson. Proc Zool Soc Lond 1904:121–128

Brady GS (1906) On the entomostracan fauna of the New Zealand lakes. Proc Zool Soc Lond 1906:692–702

Brady GS (1907a) On the crustacean fauna of a salt-water pond at Amble. Trans Nat Hist Soc Northumberl Durh Newctle-Upon-Tyne, New Ser 1:330–336

Brady GS (1907b) On Entomostraca collected in Natal by Mr James Gibson (Part II). Ann Natal Mus 1:173–186

Brady GS (1910a) On some species of *Cyclops* and other Entomostraca collected by Dr JM Dalziel in northern Nigeria. Ann Trop Med Parasitol 4:239–251

Brady GS (1910b) A revision of the British species of ostracod Crustacea belonging to the subfamilies Candoninae and Herpetocypridinae. Proc Zool Soc Lond 1910:194–220

Brady GS (1913) On freshwater Entomostraca from various parts of South Africa. Ann Natal Mus 2:459–474

Brady GS, Norman AM (1889) A monograph of the marine and freshwater Ostracoda of the North Atlantic and of northwestern Europe. Section I: Podocopa. Sci Trans R Dublin Soc, ser 2 4:63–270

Brady GS, Norman AM (1896) A monograph of the marine and freshwater Ostracoda of the North Atlantic and of northwestern Europe. Section II–V: Myodocopa, Cladocopa, Platycopa. Sci Trans R Dublin Soc, ser 2 5:621–784

Brady GS, Robertson D (1869) Notes on a week's dredging in the west of Ireland. Ann Mag Nat Hist, ser 4 3:353–374

Brady GS, Robertson D (1870) The Ostracoda and Foraminifera of tidal rivers. Part I. Ann Mag Nat Hist, ser 4 6:1–33

Brady GS, Robertson D (1885) Genus *Darwinula*. In: Jones TR (ed) On the ostracoda of the Purbeck formation with notes on the Wealden species. J Geol Soc London 41:311–353

Brehm V (1911) Die Entomostraken der Danmark-Expedition. Medd Grønland 45:303–317

Brehm V (1914) Cladoceren und Ostracoden aus Balutschistan. Zool Anz 43:511–515

Brehm V (1920) Die Entomostraken der Quellen Holsteins. Festschr Zschokke, Art 18:1–19

Brehm V (1923a) Zur Mikrofauna javanischer Binnengewässer: *Cypris magnifica* spec. nov. Treubia 3:222–224

Brehm V (1923b) Bericht über die von Dr H Weigold in China gesammelten Kopepoden und Ostrakoden. Int Rev Ges Hydrobiol Hydrogr 11:329–345

Brehm V (1924) Entomostraken aus der Laguna de Junin, gesammelt von Graf Sten V Rosen (Expedition O Nordenskjoeld). Göteborgs K Vetensk Vitterh Samh Handl, ser 4 27:1–23

Brehm V (1928a) Mitteilungen über die Süßwasserfauna Neu-Seelands: 2. Teil Zool Anz 78:315–323

Brehm V (1928b) Die Entomostraken. Beiträge zur Kenntnis der Fauna Griechenlands, namentlich der Aegaeischen Inseln. Sitzungsber Akad Wiss Wien. Math-Naturwiss Klasse, Abt 1 137:283–289

Brehm V (1929) Fresh-water fauna of New Zealand. Trans Proc N Z Inst 59:793–806

Brehm V (1932a) Vorläufige Mitteilungen über die Süßwasserfauna Neuseelands: 5. Teil Zool Anz 99:79–81

Brehm V (1932b) Notizen zur Süßwasserfauna Guatemalas und Mexikos. Zool Anz 99:63–66

Brehm V (1933) Einige japanische Ostracoden. Trans Nat Hist Soc Formosa 23:297–298

Brehm V (1934) Über südamerikanische Ostracoden des Zoologischen Staatsinstitutes und Museums in Hamburg. Zool Anz 108:74–85

Brehm V (1935) Mitteilungen von den Forschungsreisen Prof Rahms. I. Zwei neue Entomostraken aus der Wüste Atacama. Zool Anz 111:279–284

Brehm V (1939a) Eine neue, subfossile *Limnocythere* von Neuseeland. Zool Anz 127:191–193

Brehm V (1939b) Zur systematischen und tiergeographischen Stellung der als *Limnocythere promblematica* beschriebenen *Gomphocythere*. Zool Anz 125:190–195

Brehm V (1939c) La fauna microscópica del Lago Petén, Guatemala. An Esc Nac Cienc Biol 1:173–203

Brehm V (1949) Datos para la fauna de agua dulce de Cuba. Publ Inst Biol Apl 5:95–112

Brehm V (1950) Zur Süßwasser-Mikrofauna Tasmaniens. Anz Österr Akad Wiss, Math-Naturwiss Kl 87:332–333

Brehm V (1953a) *Candona dichtliae* nov. sp., eine neue Ostracodenspezies. Anz Österr Akad Wiss. Math-Naturwiss Kl 90:21–22

Brehm V (1953b) Bemerkenswere Entomostraken aus der Salzburger Brunnenfauna. Österr Zool Z 4:9–18

Brehm V, Margalef R (1949) *Eucypris aragonica* nov. sp., nuevo ostrácodo de una laguna salada de los Monegros. Publ Inst Biol Apl 5:5–9

Bronstein ZS (1925) Beiträge zur Kenntnis der Ostracodenfauna USSR und Persiens. Arch Naturgesch, Abt A 91:1–30

Bronstein ZS (1928) K poznaniyu Ostracoda Kavkaza i Persii. Rab Severo-Kavkazkoy Gidrobiol Stantsii 2:67–119

Bronstein ZS (1929) Ostracoda ozera Issyk-Kul. Tr Sredne-Aziat Gos Univ, ser 8a 7:1–20

Bronstein ZS (1930) K poznaniyu fauny Ostracoda ozera Baykala. Tr Kom Izucheniyu Ozera Baykala 3:117–157

Bronstein ZS (1947) Fauna SSSR. Rakoobraznye, Tom 2, Vypusk 1: Ostracoda presnykh vod. Zool Inst Akad Nauk SSSR, Nov Ser 31:1–339

Broodbakker NW (1982) The genus *Heterocypris* (Crustacea, Ostracoda) in the West Indies, Part 1: Taxonomic characters. Bijdr Dierkd 52:207–227

Broodbakker NW (1983a) The genus *Strandesia* and other Cypricercini (Crustacea, Ostracoda) in the West Indies, Part 1: Taxonomy. Bijdr Dierkd 53:327–368

Broodbakker NW (1983b) The genus *Hemicypris* (Crustacea, Ostracoda) in the West Indies. Bijdr Dierkd 53:135–157

Broodbakker NW (1983c) The subfamily Candoninae (Crustacea, Ostracoda) in the West Indies. Bijdr Dierkd 53:287–326

Broodbakker NW, Danielopol DL (1982) The chaetotaxy of Cypridycea (Crustacea, Ostracoda) limbs: proposal for a descriptive model. Bijdr Dierkd 52:103–120

Brusca RC, Brusca GJ (1990) Invertebrates. Sinauer Associates, Sunderland, p 922

Butlin R, Schön I, Griffiths HI (1998) Asexual reproduction in nonmarine ostracods. Heredity 81:473–480

Caraion FE (1976) *Candona absoloni*, a new species of fresh-water ostracode (Candoninae) captured from Romania (Danube delta). Rev Roum Biol, Ser Biol Anim 21:77–83

Carbonnel G (1965) Sur un nouveau genre (*Paralimnocythere*) et une nouvelle espèce (*P. bouleigensis*) d'ostracodes du Tortonien. Arch Sci 18:146–150

Carbonnel G (1969) Les ostracodes du Miocène Rhodanien: Systématique, biostratigraphie écologique, paléobiologie. Doc Lab Geol Fac Sci Lyon 32:1–469

Chambres VT (1877) New Entomostraca from Colorado. Bull US Geol Surv 3:151–155

Chapman F (1914) Notes on Testacea from the Pleistocene marl at Mowbray Swamp, north-west Tasmania. Mem Natl Mus Melb 5:55–62

Chapman F (1934) Report on samples of surface tertiary rocks and a bore sample containing Ostracoda from Queensland. Proc R Soc Qld 46:66–71

Chapman F (1936) Cypridiferous limestone from the Mallee. Rec Geol Surv Vic 5:296–298

Chapman MA (1961) The terrestrial ostracod of New Zealand. *Mesocypris audax* sp. nov. Crustaceana 2:255–261

Chapman MA (1963) A review of the freshwater ostracods of New Zealand. Hydrobiologica 22:1–40

Chapman MA (1966) On *Eucypris mytiloides* (Brady) and three new species of *Eucypris* Vávra (Cypridae, Ostracoda) from Australia. Hydrobiologica 27:368–378

Chappuis PA (1942) Eine neue Methode zur Untersuchung der Grundwasserfauna. Acta Sci Math Nat Univ Francisco-Josephina Kolozsvar 6:1–7

Chen S-Z (1983) Description of a new species of the genus *Hungarocypris* Vávra 1906 (Crustacea: Ostracoda). Acta Zootaxon Sinica 8:370–373

Chen S-Z (1991) A new species of the genus *Hungarocypris* from China (Ostracoda, Cyprididae). Acta Zootaxon Sinica 16:283–285

Chyzer C (1858) Über die Crustaceen-Fauna Ungarns. Verh Zool-Bot Ver Wien 8:505–515

Chyzer C, Toth A (1858) Über die Crustaceen-Fauna Ungarns. In: Chyzer C (ed), Verh Zool-Bot Ver Wien 8:505–515

Claus C (1892) Beiträge zur Kenntnis der Süßwasser-Ostracoden: 1. Über den Körper- und Gliedmaßenbau der Cypriden nebst Bemerkungen über einzelne innere Organe derselben. Arb Zool Inst Univ Wien Zool Stn Triest 10:147–216

Cohen AC, Morin JG (1990) Patterns of reproduction in ostracodes: a review. J Crustac Biol 10:184–211

Cohen A, Morin JG (1997) External anatomy of the female genital (eighth) limbs and the setose openings in Myodocopid ostracodes (Cypridinidae). Acta Zool 78:85–96

Cohen AC, Martin JW, Kornicker LS (1998) Homology of holocene ostracode biramous appendages with those of other crustaceans: the protopod, epipod, exopod and endopod. Lethaia 31:251–265

Cole GA (1949) A new cytherid from minnesota. Trans Am Microsc Soc 68:350–354

Cole ME (1965) Seven new species of ostracods from Tennessee (Cypridae: Candocyprinae and Cypridopsinae). J Tenn Acad Sci 40:132–142

Cole ME (1966) Revised name for a new species of ostracod from Tennessee. J Tenn Acad Sci 41:91

Colin JP, Danielopol DL (1980) Sur la morphologie, la systématique, la biogeography et l'évolution des ostracodes Timiriaseviinae (Limnocytheridae). Paléobiol Cont 11:1–52

Costa O-G (1847) Entomostraci, Ostracodi. Fauna Regno Napoli, Enumerazione Tutti Anim Abitano Divers Reg Questo Reg Acque Bagn: Anim Articol, Crostac 1:7–12

Croneberg A (1894) Beitrag zur Ostracodenfauna der Umgegend von Moskau. Bull Soc Imp Nat Mosc Nouv Sér 8:284–306

Cushman JA (1905) A new ostracod from Nantucket. Am Nat 39:791–793

Cushman JA (1908) Fresh-water Crustacea from Labrador and Newfoundland. Proc US Natl Mus 33:705–713

Cvetkov L (1968) Un filet phreatobiologique. Bull Inst Zool Mus Acad Bulg Sci 27:215–219

Daday E (1893) Adatok az alfoeldi szekes vizek mikrofaunajanak ismeretehez. Math Termtud Ertesitoe 12:10–43

Daday E (1894) Ujabb adatok a Balaton mikrofaunäjänak ismeretehez: Nematotada, Rotatoria, Entomostraca. Math Termtud Ertesitö 12:122–145

Daday E (1897) Crustaceen. Res Wiss Erforsch Balatonsee 2:163–193

Daday E (1898) Mikroskopische Süßwasserthiere aus Ceylon. Termrajzi Füz 21:1–123

Daday E (1900) Ostracoda Hungariae. A Magyarországi Kagylósrákok Magánrajza. Kiadja a Magyar Tudományos Akadémia, Budapest, pp 320

Daday E (1901a) Mikroskopische Süßwasserthiere. Dritte Asiat Forschungsreise d Grafen Eugen Zichy (Zool Ergeb) 2:375–470

Daday E (1901b) Mikroskopische Süßwasserthiere aus Deutsch-Neu-Guinea. Termrajzi Füz 24:1–56

Daday E (1902) Mikroskopische Süßwasserthiere aus patagonien, gesammelt von Dr Silvestri. Termrajzi Füz 25:201–310

Daday E (1903) Mikroskopische Süßwasserthiere aus Kleinasien. Sitzungsber Kais Akad Wiss. Math-Naturwiss Cl, Abt 1 112:139–167

Daday E (1904) Mikroskopische Süßwasserthiere aus Turkestan. Zool Jahrb, Abt Syst Geogr Biol Tiere 19:469–553

Daday E (1905) Untersuchungen über die Süßwasser-Mikrofauna Paraguays. Zoologica 18:1–374

Daday E (1906) Edesvizi mikroskopi allatok Mongoliabol. Math Termtud Ertesitö 24:34–77

Daday E (1908) Entomostraca et Hydrachnidae e Tibet. Rec Indian Mus 2:323–341

Daday E (1909) Beiträge zur Kenntnis der Fauna Turkestans: 5. Ostracoden und Plankton der Seen Issyk-Kul und Tschatyr-Kul. Trav Soc Nat St Petersbg, ser 2 39:1–32

Daday E (1910a) Unterschungen über die Süßwasser-Mikrofauna Deutsch-Ost-Africas. Zoologica 23:1–314

Daday E (1910b) Ergebnisse der mit Subvention aus der Erbschaft Treitl unternommenen zoologischen Forschungreise Dr Franz Werner's nach dem ägyptischen Sudan und Nord-Uganda. Sitzungsber Kais Akad Wiss, Math-Naturwiss Cl, Abt A 119:537–589

Daday E (1910c) Collections recueillies par M le Baron M de Rothschild dans l'Afrique orientale (Abyssinie et Ethiopie): Entomostraces d'eau douce. Bull Mus Hist Nat Paris 1910:253–265

Daday E (1910d) Species aliquot novae entomostracorum. Arch Zool 1:187–195

Daday E (1911a) Eine neue *Cypris*-Art aus Brasilien. Zool Anz 38:337–339

Daday E (1911b) Description de quatre espèces nouvelles de crustacés ostracodes recoltées par M Henri Gadeau de Kerville pendant son voyage en Syrie. Bull Soc Amis Sci Nat Rouen 47:93–107

Daday E (1913) Cladoceren und Ostracoden aus Süd- und Südwestafrika. Denkschr Med-Naturwiss Ges Jena 17:89–102

Dahl F (1888) Die Cytheriden der westlichen Ostsee. Zool Jahrb, Abt Syst Geogr Biol Tiere 3:597–638

Dana JD (1849) Conspectus crustaceorum quae in orbis terrarum circumnavigatione, Carolo Wilkes e classe Reipublicae Foederatae Duce, lexit et descripsit Jacobus D Dana. Pars 2. Proc Am Acad Arts Sci 2:9–61

Dana (1852) Crustacea: Cyproidea. United States Exploring Expedition during the years 1838-1842 under the command of Charles Wilkens 13(2):1277–1304

Danforth WA (1948) A list of Iowa ostracods with descriptions of three new species. Proc Iowa Acad Sci 55:351–359

Danielopol DL (1965) Nouvelles donnés sur les ostracodes d'eau douce de Roumanie: *Cordocythere phreaticola* n. gen., n. sp., *Eucypris petkovskii* n. sp., Limnocytherini et

Metacyprini nouvelles tribus de la sous-famille Limnocytherinae Sars, 1925. Ann Limnol 1:443–468

Danielopol DL (1968) *Microdarwinula* n. gen. et quelques remarques sur la répartition de la famille Darwinulidae Brady et Norman (Crustacea, Ostracoda). Ann Limnol 4:153–174

Danielopol DL (1969a) Un nouvel ostracode des eaux souterraines de l'Ile de Hvar. Ann Speleol 24:125–128

Danielopol DL (1969b) Notes sur la morphologie et la systématique de la sous-famille Limnocytherinae Sars (Crustacea, Ostracoda). Ann Speleol 24:129–142

Danielopol DL (1970) Sur la morphologie, l'origine et la répartition du genre *Cordocythere* Dan. (Ostracoda – Cytheridae). In: Orgihidan T, Dumitresco M (eds) Livre du centenaire Emile G Rakovitza. Edition Acad RSR, Bucharest, pp 287–299

Danielopol DL (1971) Sur la structure des aesthetascs de l'antenne de quelques Cyprididae (Crustacea, Ostracoda, Podocopida). CR Acad Sci Paris 272:596–599

Danielopol DL (1973) Sur la morphologie des aesthetascs chez quelques ostracodes hypogés de la sous-famille des Candoninae (Cyprididae, Podocopida). Ann Speleol 28:233–245

Danielopol DL (1976) On the origin and diversity of European freshwater interstitial ostracods. In: Löffler H, Danielopol DL (eds) Aspects of ecology and zoogeography of recent and fossil Ostracodai Proceedings of the Sixth International Symposium on Ostracods, Saalfelden, Salzburg. W Junk, The Hague, pp 295–305

Danielopol DL (1978a) Ostracodes hypogés du sud de la France – 2. *Pseudocandona simililampadis* n. sp. Int J Speleol 10:57–71

Danielopol DL (1978b) Ostracodes hypogés du sud de la France – 1. *Mixtacandona juberthieae* n. sp. Int J Speleol 9:235–249

Danielopol DL (1978c) Über die Herkunft und Morphologie der Süßwasser-hypogaeischen Candoninae (Crustacea, Ostracoda). Sitzungsber Österr Akad Wiss. Math-Naturwiss Kl, Abt 1 187:1–162

Danielopol DL (1979) On the origine and the antiquity of the *Pseudolimnocythere* species (Ostracoda, Loxoconchidae). Biol Gallo-Helenica 8:99–107

Danielopol DL (1980a) On the carapace shape of some European freshwater interstitial Candoninae (Ostracoda). Proc Biol Soc Wash 93:743–756

Danielopol DL (1980b) An essay to assess the age of the freshwater interstitial ostracods of Europe. Bijdr Dierkd 50:243–291

Danielopol DL (1982a) Nouvelles données sur les Candoninae (Ostracoda) hypogés de Roumanie et Yougoslavie. Bull Mus Natl Hist Nat Paris, ser 4 4:369–396

Danielopol DL (1982b) *Mixtacandona cottarellii* n. sp., un ostracode interstitiel de Sardaigne. Boll Mus Civ Storia Nat Verona 8:419–425

Danielopol DL, Baltanás A (1993) In: Baltanás A, Danielopol DL, Roca JR, Marmonier P Psychrodromus betharrami n. sp. (Crustacea, Ostracoda): Morphologie, ecology and biogeography. Zool Anz 231:39–57

Danielopol DL, Betsch JM (1980) Ostracodes terrestres de Madagascar: Systématique, origine, adaptations. Rev Ecol Biol Sol 17:87–123

Danielopol DL, Cvetkov L (1979) Trois nouvelles espèces du genre *Mixtacandona* (Ostracoda, Cyprididae, Candoninae). Hydrobiologia 67:249–266

Danielopol DL, Hartmann G (1986) Ostracoda. In: Botosaneaun L (ed) Stygofauna mundi. Brill Acad Pub, Leiden, pp 265–294

Danielopol DL, McKenzie KG (1977) *Psychrodromus* gen. n. (Crustacea, Ostracoda), with redescription of the Cypridid genera *Prionocypris* and *Ilyodromus*. Zoologica Scripta 6:301–322

Danielopol DL, Rouch R (2004) Invasion, active versus passive. In: Culver D, White W (eds) Encyclopedia of caves. Elsevier, Amsterdam, pp 305–310

Danielopol DL, Tetart J (1990) Morphology of *Cytherissa* nd *Cyprideis*: supplementary data on the appendages and the carytype. In: Danielopol DL, Carbonel P, Colin JP (eds) *Cytherissa* the drosophila of paleolimnology. Bull Inst Geol Basin Aquataine 47/48:55–67

Danielopol DL, Vespremeanu EE (1964) The presence of ostracods on floating fen soil in Romania. Fragm Balc 5:29–36

Danielopol DL, Carbonel P, Colin JP (1990) *Cytherissa* (Ostracoda) – the *Drosophila* of paleolimnology. Bull Inst Geol Bassin Aquitaine 47:310

Danielopol DL, Martens K, Casale LM (1989) Revision of the genus *Leucocythere* Kaufmann, 1892 (Crustacea, Ostracoda, Limnocytheridae), with the description of a new species and two new tribes. Bull Inst R Sci Nat Belg, Biol 59:63–94

Danielopol DL, Marmonier P, Boulton AJ, Bonaduce G (1994) World subterranean ostracod biogeography: dispersal or vicariance. In: Culver DC, Holsinger JR Biogeography of Subterranean Crustaceans: the effects of different scales. Hydrobiologia 287:119–129

Danielopol DL, Ito E, Wansard G, Kamiya T, Cronin TC, Baltanás A (2002) Techniques for collection and study of Ostracoda. In: Holmes JA, Chivas AR (eds) The ostracoda: application in quaternary research. Geophys Monogr 131:65–96

Danielopol DL, Baltanás A, Namiotko T, Geiger W, Pichler M, Reina M, Roidmayr G (2008) Developmental trajectories in geographically separated populations of non-marine ostracods: morphometric applications for palaeoecological studies. Senckenb Lethaea 88:1–10

Deb M (1972) Two new species of *Stenocypris* Sars, 1889 (Crustacea, Ostracoda, Cypridae) from India. J Zool Soc India 24:91–95

Deb M (1973) First record of the genus *Sclerocypris* Sars, 1924 (Crustacea: Ostracoda), from India, with description of two new species. J Zool Soc India 25:47–52

Deb M (1983) Brief descriptions of new species of Ostracoda: Crustacea from Maharashtra State (India). Rec Zool Surv India 81:135–166

Deb M (1984) On a small collection of freshwater ostracods (Crustacea) from Bihar, India. J Zool Soc India 36:35–43

Deb M, Nasar SAK (1977) *Cypricercus munshii* sp nov (Crustacea: Ostracoda: Cyprididae) from India. Zool Beitr NF 23:455–457

De Deckker P (1974) *Australocypris*, a new ostracod genus from Australia. Aust J Zool 22:91–104

De Deckker P (1976) *Trigonocypris* a new ostracod genus from Queensland. Aust J Zool 24:145–157

De Deckker P (1978) Comparative morphology and review of mytilocyprinid ostracods (family Cyprididae). Aust J Zool, Suppl Ser 58:1–62

De Deckker P (1979a) Comparative morphology and review of Australian Notodromadinae Kaufmann, 1900. Senckenb Biol 59:417–463

De Deckker P (1979b) Ostracods from the mound springs area between strangways and Curdimurka, South Australia. Trans Roy Soc S Aust 103:155–168

De Deckker P (1981a) Taxonomic notes on some Australian ostracods with description of new species. Zool Scr 10:37–55

De Deckker P (1981b) Taxonomy and ecological notes on some ostracods from Australian inland waters. Trans Roy Soc S Aust 105:91–138

De Deckker P (1981c) Ostracoda from Australian inland waters – notes on taxonomy and ecology. Proc Roy Soc Vic 93:43–85

De Deckker P (1981d) On *Notiocypridopsis frigogena* (Graf). Stereo-Atlas Ostracod Shells 8:101–106

De Deckker P (1981e) On *Reticypris pinguis* De Decker sp. nov. Stereo-Atlas Ostracod Shells 8:93–100

De Deckker P (1982a) On *Caboncypris nunkeri* De Decker gen. et sp. nov. Stereo-Atlas Ostracod Shells 9:125–132

De Deckker P (1982b) On *Cypretta yapinga* De Deckker sp. nov. Stereo-Atlas Ostracod Shells 9:133–140

De Deckker P (1982c) On *Bennelongia tunta* De Decker sp. nov. Stereo-Atlas Ostracod Shells 9:117–124

De Deckker P (1983) Terrestrial ostracods in Australia. In: Lowry JK (ed) Papers from the conference on the biology and evolution of Crustacea. Aust Mus Mem 18:87–100

De Deckker P, McKenzie KG (1981) *Bennelongia*, a new cyprididid ostracod genus from Australasia. Trans Roy Soc S Aust 105:53–58

De Deckker P, Wouters K (1983) On *Tanganyikacypris matthesi* Kiss. Stereo-Atlas Ostracod Shells 10:139–148

de Hornibrook NB (1955) Ostracoda in the deposits of Pyramid Valley swamp. Rec Canterb Mus 6:267–277

de Saussure H (1858) Mémoire sur divers Crustacés nouveaux des Antilles et du Mexique. Mém Soc Phys Hist Nat Genèv 14:417–496

de Sowerby J (1840) Organic remains collected by Mr Malcolmson. In: Macolmson JG (ed) On the Fossils of the eastern portion of the Great Basaltic District, vol 5. Trans Geol Soc Lond, India, pp 537–575

de Vos APC (1946) A new ostracod from the Netherlands: *Potamocypris vanoyei* n. sp. Biol Jaarb 13:168–170

Delachaux T (1919) Description d'un ostracode nouveau de l'Afrique Portugaise (*Stenocypris junodi* nov. Spec.). Bull Soc Port Sci Nat 8:145–147

Delachaux T (1928) Faune invertébrée d'eau douce des hauts plateaux du Pérou. Extrait du Bull Soc Neuchâteloise Sci Nat, Nouv Sér 1:45–77

Delorme LD (1967) New freshwater Ostracoda from Saskatchewan, Canada. Can J Zool 45:357–363

Delorme LD (1968) Pleistocene freshwater Ostracoda from Yukon, Canada. Can J Zool 46:859–876

Delorme LD (1969) On the identity of the ostracode genera *Cypriconcha* and *Megalocypris*. Can J Zool 47:271–281

Delorme LD (1970a) Freshwater ostracodes of Canada. Part 4. Families Ilyocyprididae, Notodromadidae, Darwinulidae, Cytherideidae, and Enthocytheridae. Can J Zool 48:1251–1259

Delorme LD (1970b) Freshwater ostracodes of Canada. Part 1: Subfamily Cypridinae. Can J Zool 48:153–168

Delorme LD (1970c) Freshwater ostracodes of Canada. Part 3: Family Candonidae. Can J Zool 48:1099–1127

Delorme DL (1971) Freshwater ostracods of Canada. Part 5. Families Limnocytheridae, Loxoconchidae. Can J Zool 49:43–64

Diáz AR, Lopretto EC (2009) A new species of *Cypriconcha* Sars (Crustacea: Ostracoda) from high mountain wetlands of Argentina. Zootaxa 2291:51–64

Diebel K, Pietrzeniuk E (1969) Ostracoden aus dem Mittelpleistozän von Süßenborn bei Weimar. Paläontol Abh, Abt A 3:463–488

Diebel K, Pietrzeniuk E (1975) Neue Ostracoden aus dem Pleistozän von Burgtonna (Bezirk Erfurt). Z Geol Wiss 3:87–97

Diebel K, Wolfschläger H (1975) Ostracoden aus dem jungpleistozänen Travertin von Ehringsdorf bei Weimar. Abh Zent Geol Inst, Paläontol Abh 23:91–136

Dobbin CN (1941) Fresh-water Ostracoda from Washington and other western localities. Univ Wash Publ Biol 4:175–245

Dubowsky NW (1927) Über zwei neue Ostracoden im Bassin des Sewerny-(Nord)-Donetz (Nebenfluss des Don). Zool Anz 73:81–88

Dubowsky NW (1929) Materialy k poznaniyu fauny i biologii Ostracoda basseyna reki Severnyy Donets. Tr Kharkiv Tov Dosl Prir 52:100–165

Ducasse O, Carbonel P (1993) *Tanganyikacythere* nov. gen. (Cytherideinae, Ostracoda) du lac Tanganyika: Systématique des valves, données écologiques. Geobios 26:427–447

Ducasse O, Carbonel P (1994) Cytherideinae (Crustacea, Ostracoda) récents du Lac Tanganyika. *Archeocyprideis tuberculata* n. gen., n.sp.: systématique, distribution, écologie. Rev Micropaléontol 37:97–112

Eagar SH (1970) A new species of *Eucypris* (Ostracoda) from Wellington. New Zealand J Mar Freshw Res 4:195–202

Ekman S (1908) Ostracoden aus den nordschwedischen Hochgebirgen. Naturwiss Unters d Sarekgebirges in Schwed-Lappland 4(Zool):169–198

Ekman S (1914) Beiträge zur Kenntnis der schwedischen Süßwasser-Ostracoden. Zool Bidr Upps 3:1–36

Elofson O (1938) Neue und wenig bekannte Cytheridenvon der schwedischen Westküste. Ark Zool. 30: 21 pp.

Elofsson R (2006) The frontal eyes of crustaceans. Arthopod Struct Dev 35:275–291

Farkas HK (1957) Über einige neue *Cypricercus*-Arten (Ostracoda). Ann Hist-Nat Mus Natl Hung 49:247–253

Farkas HK (1958a) Über einige Süßwasser-Ostracoden von Südamerika. Ann Hist-Nat Mus Natl Hung 50:307–312

Farkas HK (1958b) *Candona szoecsi* n. sp., eine neue Ostracoden-Art der Rostrata-Gruppe aus der ungarischen Brunnen-Fauna. Zool Anz 160:110–112

Farkas HK (1959) Die Beschreibung von *Cypretta schubarti* n. sp. (Ostracoda) aus Südamerika. Ann Hist-Nat Mus Natl Hung 51:277–280

Ferguson E Jr (1953) A new cyprid Ostracod from Maryland. J Wash Acad Sci 43:194–197

Ferguson E Jr (1957) Ostracoda (Crustacea) from the northern lower peninsula of Michigan. Trans Am Microsc Soc 76:212–218

Ferguson E Jr (1958) Freshwater ostracods from South Carolina. Am Midl Nat 59:111–119

Ferguson E Jr (1959a) The ostracod genus *Potamocypris* with the description of a new species. Proc Biol Soc Wash 72:133–137

Ferguson E Jr (1959b) A synopsis of the ostracod (Crustacea) genus *Cypridopsis* with the description of a new species. Proc Biol Soc Wash 72:59–67

Ferguson E Jr (1962) *Stenocypris bolieki*, a new freshwater ostracod from Florida and a new record of distribution for the genus. Am Midl Nat 67:65–67

Ferguson E Jr (1964a) Freshwater ostracods from Florida with description of *Cypris floridensis* n. sp. Am Midl Nat 72:129–132

Ferguson E Jr (1964b) Stenocyprinae, a new subfamily of freshwater cyprid ostraocods (Crustacea) with description of a new species from California. Proc Biol Soc Wash 77:17–23

Ferguson E Jr (1964c) The ostracod (Crustacea) genus *Cypridopsis* in North America and a description of *Cypridopsis howei*, sp. nov. Trans Am Microsc Soc 83:380–384

Ferguson E Jr (1966) Some freshwater ostracods from the western United States. Trans Am Microsc Soc 85:313–318

Ferguson E Jr (1967a) Three new species of freshwater ostracods (Crustacea) from Argentina. Not Nat 405:1–7

Ferguson E (1967b) A new species of freshwater ostracod from Puerto Rico. Proc Biol Soc Wash 80:9–11

Ferguson E Jr (1967c) *Cyprinotus newmexicoensis*, a new cyprid ostracod. Am Midl Nat 78:248–251

Ferguson E Jr (1967d) *Potamocypris bowmani*, a new freshwater ostracod from Washington, DC. Proc Biol Soc Wash 80:113–116

Ferguson E Jr (1967e) New ostracods from the playa lakes of eastern New Mexico and western Texas. Trans Am Microsc Soc 86:244–250

Ferguson E Jr (1969) The type species of the genus *Stenocypris* Sars 1889 with description of two new species. In: Neale JW (ed) The taxonomy, morphology and ecology of recent Ostracoda. Oliver and Boyd, Edinburgh, pp 67–75

Fischer S (1848) Über die in der Umgebung von St Petersburg vorkommenden Crustaceen aus der Ordnung der Branchiopoden und Entomostraceen. Mém Prés Acad Imp Sci St Petersbg 6:159–198

Fischer S (1851) Abhandlung über das Genus *Cypris* und dessen in der Umgebung von St Petersburg und von Fall bei Reval vorkommenden Arten. Mém Prés Acad Imp Sci St Petersbg 7:127–167

Fischer S (1855) Beitrag zur Kenntnis der Ostracoden. Abh Math-Phys Cl Kgl- Bayer Akad Wiss 7:635–666

Flössner D (1965) *Limnocythere psammophila* n. sp., ein neuer Muschelkrebs (Crustacea, Ostracoda) der deutschen Fauna. Zool Anz 175:466–470

Fontana SL, Ballent S (2004) A new giant cypridid ostracod (Crustacea) from southern Buenos Aires Province, Argentina. Hydrobiologia 533:187–197

Forbes SA (1893) A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyoming, and of the Flathead region of Montana. Bull US Fish Comm 11:207–258

Forest J (1994) Les Crustacés: définition, formes primitives et classification. In: Forest J (ed) Traité de Zoologie 7. Crustacés 1. Morphologie, physiologie, reproduction, embryologie. Masson, Paris, pp 1–8

Forró L, Meisch C, Petersen H, Martens K (1987) Ostracoda taxa described by E Daday, together with a catalogue of pertinent material in the Hungarian Natural History Museum. Misc Zool Hung 4:33–63

Fox HM (1963) A new species of *Isocypris* (Crustacae, Ostracoda) from the Lago Maggiore and a new subspecies from ricefields in Piedmont. Mem Inst Ital Idrobiol, Pallanza 16:127–136

Fox HM (1965) New and interesting cyprids (Crustacea, Ostracoda) in Britain. Ann Mag Nat Hist, ser 13 7:623–633

Fox HM (1967) More new and interesting cyprids (Crustacea, Ostracoda) in Britain. J Nat Hist 1:549–559

Frenzel P, Boomer I (2005) The use of ostracods from marginal marine, brackish waters as bioindicators of modern and Quaternary environmental change. Palaeogeogr Palaeoclim Palaeoecol 225:68–92

Fuhrmann R, Pietrzeniuk E (1990) Die Ostracodenfauna des Interglazials von Gröbern (Kreis Gräfenhainichen). In: Eissmann L (ed) Die Eemwarmzeit und die frühe Weichseleiszeit im Saale-Elbe-Gebiet: Geologie, Paläontologie, Palökologie. Altenburger Naturwiss Forsch 5:168–193

Furtos NC (1933) The Ostracoda of Ohio. Bull Ohio Biol Surv 5:411–524

Furtos NC (1934) Two new species of *Cypretta* (Ostracoda) from, the Marquesas Islands and Florida with notes on the distrbution of the genus. Bull Bernice P Bishop Mus 114:279–286

Furtos NC (1935) Fresh-water Ostracoda from Massachusetts. J Wash Acad Sci 25:530–544

Furtos NC (1936a) Fresh-water Ostracoda from Florida and North Carolina. Am Midl Nat 17:491–522

Furtos NC (1936b) On the Ostracoda from the Cenotes of Yucatán and vicinity. Publ Carnegie Inst Wash Publ 457:89–115

Furtos NC (1938) A new species of *Cypridopsis* from Yucatán. Publ Carnegie Inst Wash 491:155–157

Gauthier H (1928) Recherches sur la faune des eaux continentales de l’Algérie et de la Tunisie. Thèses Prés Fac Sci Univ Paris, Ser A 1160:1–423

Gauthier H (1929) Cladocères et ostracodes du Sahara central. Bull Soc Hist Nat Afr N 20:143–162

Gauthier H (1930) Mission saharienne Augieras-Draper 1927–1928: Cladocères, ostracodes, phyllopodes anostraces et conchostraces. Bull Mus Natl Hist Nat, ser 2 2:92–116

Gauthier H (1933a) Entomostraces de Madagascar. 1. note: description d’une nouvelle *Cypris* (Ostracodes). Bull Soc Zool Fr 58:209–216

Gauthier H (1933b) Entomostraces de Madagascar. 2. note: description d’un nouveau *Cyprinotus* (Ostracodes). Bull Soc Zool Fr 58:305–316

Gauthier H (1934a) Entomostraces de Madagascar. 3. note: description d’une nouvelle *Cypridopsis* (Ostracodes). Bull Soc Zool Fr 59:73–85

Gauthier H (1934b) Entomostraces de Madagascar. 3. note: description d’un second *Cyprinotus* (Ostracodes). Bull Soc Zool Fr 59:382–387

Gauthier H (1938) Ostracodes continentaux récoltés par M Monod au Sahara occidental et en Mauritanie. Bull Soc Sci Nat Maroc 18:39–61

Gauthier H (1939) Contribution à l'étude de la faune dulçaquicole de la région du Tchad et particulièrement des branchiopodes et des ostracodes. Bull Inst Fr Afr Noire 1:110–244

Gauthier H (1951) Contribution à l'étude de la faune des eaux douces au Sénégal (Entomostraces). Imprimerie Minerva, Alger, pp 1–171

Gauthier H, Brehm V (1928) Ostracodes et cladocères de l'Algérie et de la Tunisie. 3. note. Bull Soc Hist Nat Afr N 19:114–121

Geiger W, Otero M, Rossi V (1998) Clonal ecological diversity. In: Martens K (ed) Sex and parthenogenesis: evolutionary ecology of reproductive modes in non-marine ostracods. Backhuys, Leiden, pp 243–256

George S, Martens K (1993a) Two new species of freshwater Ostracoda of the genus *Strandesia* Stuhlmann, 1888 from Kerala, India. J Nat Hist 27:255–265

George S, Martens K (1993b) In: George S, Martens K, Nayar CKG (eds) Two new species of freshwater Ostracoda of the genus *Parastenocypris* Hartmann, 1964 from Kerala, India. Hydrobiologia 254:183–193

George S, Martens K (2002) On a new species of *Potamocypris* (Crustacea, Ostracoda) from Chalakkudy, Kerala (India), with a checklist of the *Potamocypris*-species of the world. Zootaxa 66:1–15

George S, Martens K (2004a) On a new species of the genus *Newnhamia* King, 1855 (Crustacea, Ostracoda) raised from Chalakkudy River sand, (Kerala, India), with notes on the taxonomy and distribution of the Notodromadidae. Hydrobiologia 497:25–37

George S, Martens K (2004b) On the taxonomic position of Indiacypridinae (Crustacea, Ostracoda), with the description of a new species of *Indiacypris* Hartmann, 1964 from Chalakkudy River (Kerala, India). J Nat Hist 38:537–548

George S, Martens K, Nayar CKG (1993) Two new species of freshwater Ostracoda of the genus *Parastenocypris* Hartmann, 1964 from Kerala, India. Hydrobiologia 254:183–193

Ghetti PF (1972) L'ostracodofauna di alcune risaie turche e persiane. Ateneo Parm 8:117–147

Gidó Z, Artheau M, Colin J-P, Danielopol DL, Marmonier P (2007) Description of the stygobiotic crustacean *Dolekiella europea* gen. nov., sp. nov. (Ostracoda, Limnocytheridae) from southern France. Vie Milieu 57:109–116

Goins DR (1972) A check-list of freshwater ostracods of Indiana, including sixteen new recordings and a description of two new species. Proc Indiana Acad Sci 81:355–358

Graf H (1931) Süßwasser-Ostracoden aus Südgeorgien. Zool Anz 93:185–191

Green J (1962) Zooplankton of the River Sokoto. The Crustacea. Proc Zool Soc Lond 138:415–453

Green J (1973) A new species of *Oncocypris* (Ostracoda) from a crater lake in west Cameroon. J Zool 171:251–256

Griffiths HI, Evans JG (1992) A simple notation to describe time-averaged ostracod assemblages (Crustacea, Ostracoda) by their taxonomic composition. J Micropalaeontol 11:31–35

Griffits HI, Evans JG (1994) Infestation of the freshwater ostracod *Cypria ophtalmica* (Jurine) by the peritrich *Nüchterleinella corneliae* Matthes. Arch Protistenkd 144:315–317

Grochmalicki J (1911) *Cypris nusbaumi* nov. sp., nowy gatunek malzoraczka z rodziny grzepikow (Cypridae). Księga pamiątkowa ku uczczeniu trzydziestoletniej działalności naukowej i piśmienniczej Prof dra Józefa Nusbauma-Hilarowicza wydana staraniem uczniów, 49–56

Grochmalicki J (1912) *Cypris nusbaumi* nov. sp., eine neue Ostracodenart aus einer Schwefelquelle. Zool Anz 39:585–589

Grochmalicki J (1913) Beiträge zur Kenntnis der Süßwasserfauna Ost-Afrikas: Copepoda und Ostracoda. Bull Int Acad Sci Crac, Cl Sci Math Nat, Ser B: Sci Nat 7:517–537

Grochmalicki J (1915) Beiträge zur Kenntnis der Süßwasserfauna Javas: Phylopoda, Copepoda und Ostracoda. Bull Int Acad Sci Crac, Cl Sci Math Nat, Ser B: Sci Nat 1915:217–242

Guelen D (1985) The species and distribution of the group Podocopa (Ostracoda: Crustacea) in the fresh waters of western Anatolia. İstanb Üeniv Fak Mecm, Ser B (Sci Nat) 50:65–80

Gupta LP (1984) *Indocandona krishnakanti* gen. et sp. nov. (Crustacea: Ostracoda: Candonidae) from subterranean water of Bihar, India. Rec Zool Surv India 81:291–298

Gupta LP (1988) *Candonopsis urmilae*, a new species of subterranean Crustacea (Ostracoda: Candonidae) from India. Rec Zool Surv India 85:419–427

Gupta LP (1991) Studies on Crustacea (Ostracoda) of Bihar, India. II. Centrocypris indicus sp. nov. Rec Zool Surv India 89:147–153

Gurney R (1916) On some fresh-water Entomostraca from Ceylon. Proc Zool Soc Lond 1916:333–343

Gurney R (1921) Fresh-water Crustacea collected by Dr PA Buxton in Mesopotamia and Persia. J Bombay Nat Hist Soc 27:835–843

Gutentag ED, Benson RH (1962) Neogene (plio-pleistocene) fresh-water ostracodes from the central High Plains. Bull State Geol Surv Kans 157:1–60

Hahn HJ (1990) *Candona scharfi* n. sp., ein neuer Muschelkrebs aus dem Vogelsberg. Beitr Naturkd Osthess 26:127–133

Halse SA, McRae JM (2004) New genera and species of giant ostracods (Crustacea: Cyprididae) from Australia. Hydrobiologia 524:1–52

Hanai T (1957) Studies on the Ostracoda from Japan. I. Subfamily Leptocytherinae, new subfamily. J Fac Sci, Univ Tokyo 10:431–468

Harding JP (1953) The first known example of a terrestrial ostracod, Mesocypris terrestris sp. nov. Ann Natal Mus 12:359–365

Harding JP (1955) Two new species of ostracod from caves in the Belgian Congo. Rev Zool Bot Afr 52:169–174

Harding JP (1962) *Mungava munda* and four other new species of ostracod crustaceans from fish stomachs. In: Wolff T (ed) The natural history of Rennell Island. Br Solomon Islands 4:51–62

Harshey DK, Patil SG (1988) A new species of the genus *Stenocypris* Sars, 1889 (Crustacea: Ostracoda) from India. J Curr Biosci 5:6–10

Hart CW Jr (1962) A revision of the Ostracods of the family Entocytheridae. Proc Acad Nat Sci Phila 114:121–147

Hart CW Jr, Hart DG (1967) The entocytherid ostracods of Australia. Proc Acad Nat Sci Phila 119:1–51

Hart DG, Hart CW Jr (1974) The ostracod family Entocytheridae. Acad Nat Sci Phila, Monogr 18:1–239

Hart CW Jr, NB Nair, DG Hart (1967) A new ostracod (Ostracoda: Entocytheridae) commensal on a woodboring isopod from India. Not Nat Acad Nat Sci Phila: 409

Hartmann G (1957) Ostrakoden aus dem Namaland und Transvaal. Veröff Naturwiss Ver Osnabr 28:50–60

Hartmann G (1959) Beitrag zur Kenntnis des Nicaragua-Sees unter besonderer Berücksichtigung seiner Ostracoden (mit Beschreibung von 5 neuen Arten). Zool Anz 162:269–294

Hartmann G (1962) Ostracoden des Eulitorals. In: Hartmann-Schröder G, Hartmann G (eds) Zur Kenntnis des Eulitorals der chilenischen Pazifikküste und der argentinischen Küste Südpatagoniens unter besonderer Berücksichtigung der Polychaeten und Ostracoden. Mitt Hambg Zool Mus Inst 60:169–270

Hartmann G (1964) Asiatische Ostracoden, systematische und zoogeographische Untersuchungen. Int Rev Ges Hydrobiol, Syst Beih 3:1–155

Hartmann G (1965) Ostracoden des Sublitorals. In: Hartmann-Schröder G, Hartmann G (eds) Zur Kenntnis des Sublitorals der chilenischen Küste unter besonderer Berücksichtigung der Polychaeten und Ostracoden. Mitt Hambg Zool Mus Inst 62:307–384

Hartmann G (1966) Dr HG Bronn's Klassen und Ordnungen des Tierreichs. In: Gruner HE (ed) 5. Bd: Arthropoda, 1. Abt: Crustacea, 2. Buch, IV. Teil: Ostracoda, 1. Lief. Geest and Portig, Leipzig, pp 1–216

Hartmann G (1967) Dr HG Bronn's Klassen und Ordnungen des Tierreichs. In: Gruner HE (ed) 5. Bd: Arthropoda, 1. Abt: Crustacea, 2. Buch, IV. Teil: Ostracoda, 2. Lief. Geest and Portig, Leipzig, pp 217–408

Hartmann G (1968) Dr HG Bronn's Klassen und Ordnungen des Tierreichs. In: Gruner HE (ed) 5. Bd: Arthropoda, 1. Abt: Crustacea, 2. Buch, IV. Teil: Ostracoda, 3. Lief. Geest and Portig, Leipzig, pp 409–568

Hartmann G (1975) Dr HG Bronn's Klassen und Ordnungen des Tierreichs. In: Gruner HE (ed) 5. Bd: Arthropoda, 1. Abt: Crustacea, 2. Buch, IV. Teil: Ostracoda, 4. Lief. Gustav Fisher, Jena, pp 569–786

Hartmann G (1978) Die Ostracoden der Ordnung Podocopida GW Müller, 1894, der tropisch-subtropischen Westküste Australiens (zwischen Derby im Norden und Perth im Süden). Mitt Hambg Zool Mus Inst 75:64–219

Hartmann G (1989) Dr HG Bronn's Klassen und Ordnungen des Tierreichs. In: Gruner HE (ed) 5. Bd: Arthropoda, 1. Abt: Crustacea, 2. Buch, IV. Teil: Ostracoda, 5. Lief. Gustav Fisher, Jena, pp 787–1067

Hartmann G, Petersen HEE (1985) Homonyms of recent and fossil Ostracoda (Crustacea) and the Introduction of three new names. Mitt Hambg Zool Mus Inst 82:263–267

Hartmann G, Puri HS (1974) Summary of neontological and paleontological classification of Ostracoda. Mitt Hambg Zool Mus Inst 70:7–73

Hartwig W (1898a) In *Candona fabaeformis* Vávra stecken drei verschiedene Arten. Zool Anz 21:566–567

Hartwig W (1898b) Zwei neue Candonen aus der Provinz Brandenburg. Zool Anz 21:474–477

Hartwig W (1899a) *Candona euplectella* (Robertson 1880) bildet eine selbstständige Gattung. Zool Anz 22:309–311

Hartwig W (1899b) Eine neue *Candona* aus der Provinz Brandenburg: *Candona muelleri* nov. spec. Zool Anz 22:149–151

Hartwig W (1899c) Eine neue *Candona* aus der Provinz Brandenburg: *Candona weltneri* nov. spec. Sitz-Ber Ges Naturforsch Freunde Berl 1899:50–55

Hartwig W (1899d) Eine neue *Candona* aus der Provinz Brandenburg: *Candona marchica*, und über die wahre *Candona pubescens* (Koch). Sitz-Ber Ges Naturforsch Freunde Berl 1899:183–189

Hartwig W (1900a) Eine neue *Candona* aus der Provinz Brandenburg: *Candona reniformis* nov. spec. Sitz-Ber Ges Naturforsch Freunde Berl 1900:139–141

Hartwig W (1900b) Eine neue *Candona* aus der Provinz Brandenburg: *Candona holzkampfi* nov. spec. Sitz-Ber Ges Naturforsch Freunde Berl 1900:149–152

Hartwig W (1900c) Abermals eine neue *Candona* aus der Provinz Brandenburg: *Candona lobipes* n. sp. Zool Anz 23:51–53

Hartwig W (1901a) Die Arten der Ostracoden-Unterfamilie Candoninae der Provinz Brandenburg. Sitz-Ber Ges Naturforsch Freunde Berl 1901:87–129

Hartwig W (1901b) Eine neue *Candona* aus der Provinz Brandenburg: *Candona sucki* nov. spec. Sitz-Ber Ges Naturforsch Freunde Berl 1901:8–11

Henderson PA (1986) *Cypridopsis bamberi* sp. nov., a new species of ostracod (Crustacea: Podocopida) from England. J Nat Hist 20:1–5

Henderson PA (1990) Freshwater Ostracods: keys and notes for the identification of the species. In: Kermack DM, Barnes RSK (eds) Synopsis of the British Fauna 42. Universal Book Series and Backhuys Publishers, Oegstgeest, pp 1–228

Henningsmoen, G. 1953. Classification of Paleozoic straight-hinged ostra-cods. Norsk Geologisk Tidsskrift 31:185–288.

Henry M (1923) A monograph of the freshwater entomostraca of New South Wales. Proc Linn Soc NSW 48:267–285

Herbst HV (1951) *Isocypris quadrisetosa* Rome (Crustacea, Ostracoda) aus der Eider. Anhang: Isocypris laskaridisi n. sp. Von der Insel Milos. Abh Naturwiss Ver Brem 32:403–414

Herbst HV (1957) Neue Cypridae (Crustacea, Ostracoda) aus Australien: 1. Zool Anz 158:217–225

Herbst HV (1958) Neue Cypridae (Crustacea, Ostracoda) aus Australien: 1. Zool Anz 160:177–192

Herbst HV (1961) Nomenklatorische Bemerkungen über Cypridae (Crustacea, Ostracoda). Zool Anz 167:142–145

Herrick CL (1887) Contribution to the fauna of the Gulf of Mexico and the south. List of the fresh-water and marine Crustacea of Alabama, with descriptions of the new species and synoptical keys for identification. Mem Denison Sci Assoc 1:1–56

Higuti J, Velho LFM, Lansac-Tôha FA, Martens K (2007) Pleuston communities are buffered from regional flood pulses: the example of ostracods in the Paraná River floodplain, Brazil. Freshw Biol 52:1930–1943

Higuti J, Lansac-Tôha FA, Velho LFM, Pinto RL, Vieira LCG, Martens K (2009a) Composition and distribution of Darwinulidae (Crustacea, Ostracoda) in the alluvial valley of the Paraná River, Brazil. Braz J Biol 69:253–262

Higuti J, Meisch C, Martens K (2009b) On *Paranacypris samambaiensis* gen. nov., sp. nov. (Crustacea, Ostracoda), the first South American psychrodromid from the alluvial valley of the upper Paraná River, Brazil. J Nat Hist 43:769–783

Hirschmann N (1909) Beitrag zur Kenntnis der Ostracodenfauna des Finnischen Meerbusens: 1. Med Soc Fauna Flora Fenn 35:282–296

Hirschmann N (1912) Beitrag zur Kenntnis der Ostracodenfauna des Finnischen Meerbusens: 2. Acta Soc Fauna Flora Fenn 36:1–68

Hoff CC (1942) The ostracods of Illinois: their biology and taxonomy. Ill Biol Monogr 19:1–196

Hoff CC (1943a) A new ostracod belonging to the cyprid genus *Potamocypris*. Trans Am Microsc Soc 62:200–206

Hoff CC (1943b) The description of a new ostracod of the genus *Potamocypris* from Grand Isle, Louisiana, and records of ostracods from Mississippi and Louisiana. Occas Pap Mar Lab, La State Univ 3:1–11

Holmes PF (1937a) Ostracoda of Lake Ohrid. Arch Hydrobiol 31:484–500

Holmes PF (1937b) *Pseudocandona elongata*, a new species of ostracod. Ann Mag Nat Hist, ser 10 19:422–430

Horne DJ (1983) Life-cycles of podocopid Ostracoda – a review with particular reference to marine and brackish-water species. In: Maddocks RF (ed) Applications of Ostracoda. Proceedings of the 8th International Symposium on Ostracoda. University of Houston Geoscience, Houston, pp 581–590

Horne FR (1993) Survival strategy to escape desiccation in a freshwater ostracod. Crustaceana 65:53–61

Horne DJ (2003) Key events in the ecological radiation of the Ostracoda. In: Park LE, Smith AJ (eds) Bridging the gap: trends in the ostracode biological and geological sciences. Paleontol Soc Pap 9:181–201

Horne DJ (2005) Homology and homeomorphy in ostracod limbs. Hydrobiologia 58:55–80

Horne DJ, Martens K (1994) The evolutionary ecology of reproductive modes in non-marine Ostracoda. Greenwich University Press, London, pp 1–73

Horne DJ, Martens K (1999) Geographical parthenogenesis in European non-marine ostracods: post-glacial invasion or Holocene stability? Hydrobiologia 391:1–7

Horne DJ, Whittaker JE (1985) A revision of the genus *Paradoxostoma* Fischer (Crustacea: Ostracoda) in British waters. Zool J Linn Soc 85:131–203

Horne DJ, Martens K, Mösslacher F (1998) A short note: is there brood selection in *Darwinula stevensoni*? In: Crasquin-Soleau S, Braccini E, Lethiers F (eds) What about Ostracoda! Actes du 3e Congrès Européen des Ostracodologistes, Paris-Bierville, France 8–12 julliet 1996. Bull Cent Rech Explor-Prod Elf-Aquitaine 20:33–35

Horne DJ, Cohen A, Martens K (2002) Taxonomy, morphology and biology of quaternary and living Ostracoda. In: Holmes JA, Chivas AR (eds) The Ostracoda, applications in quaternary research. Geophys Monogr 131:5–36

Horne DJ, Smith RJ, Whittaker JE, Murray JW (2004) The first British record and a new species of the superfamily Terrestricytheroidea (Crustacea, Ostracoda): morphology, ontogeny, lifestyle and phylogeny. Zool J Linn Soc 142:253–288

Horne DJ, Schön I, Smith RJ, Martens K (2005) What are Ostracoda? A cladistic analysis of the extant superfamilies of the subclasses Myodocopa and Podocopa (Crustacea: Ostracoda). In: Koenemann S, Jenner RA (eds) Crustacea and arthropod relationships. Cruscaean issues, vol 16. Taylor and Francis, London, pp 249–273

Hou X, Siveter DJ, Williams M, Walossek D, Bergström J (1996) Appendages of the arthropod *Kunmingella* from the early Cambrian of China: Its bearing on the systematic position of the Bradoriida and the fossil record of the Ostracoda. Phil Trans R Soc Lond Ser B 351:1131–1145

Howe HV (1961) Family Schizocytheridae Howe, n. fam, p. Q 331. In R. C. Moore (ed.), Treatise on invertebrate paleontology, Part Q, Arthropoda 3, Crustacea, Ostracoda. Geological Society of America, New York.

Huang B-R (1979) Report of combined investigation into Chinghai Lake. Beijing Science Press, Beijing, pp 1–270

Hussainy SU (1969) A new species of *Gomphocythere* (Limnocytheridae, Ostracoda) from Australia. Proc R Soc Vic, New Ser 82:299–303

Lepure S, Namiotko T, Danielopol DL (2007) Evolutionary and taxonomic aspects within the species group *Pseudocandona eremita* (Vejdovsky) (Ostracoda, Candonidae). Hydrobiologia 585:159–180

International Commission on Zoological Nomenclature (1999) International Code of Zoological Nomenclature, 4th edn. The International Trust for Zoological Nomenclature, London

Jaervekuelg A (1960) *Ilyodromus estonicus* n. sp. – novyy presnovodnyy rakushkovyy rachok iz Estonii. Izv Akad Eston SSR. Ser Biol 9:27–34

Jain SP (1979) Some recent freshwater ostracods from parts of Kutch, Gujarat. Bull Indian Geol Assoc 12:191–202

Jancarik A (1947) *Eucypris moravica* n. sp. (Ostracoda). Vestn Ceskoslov Zool Spol 11:196–205

Jancarik A (1949) Prispevek k poznani rodu *Cyclocypris* (Ostracoda) s popisem noveho druhu. Přírodověd Sb Ostrav Kraje 10:1–26

Jocque M, Martens K, Riddoch B, Brendonck L (2006) Faunistics of ephemeral rock pools in southeastern Botswana. Arch Hydrobiol 165:415–431

Jocque M, Brendonck L, Riddoch BJ, Martens K (2010) On *Amphibolocypris arida* sp. nov. (Crustacea, Ostracoda), from rock pools in Botswana (southern Africa). Zootaxa 2408:47–58

Jones TR (1849) A monograph of the Entomostraca of the Cretaceous formation of England. Palaeontograph Soc London 3:1–140

Jones TR (1850) Description of the Entomostraca of the Pleistocene beds of Newbury, Copford, Clacton, and Grays. Ann Mag Nat Hist, ser 2 6:25–28

Jones TR (1857) A monograph of the Tertiary Entomostraca of England. Monogr Palaeontol Soc 9:1–68

Jones TR (1901) In: Chapman F (ed) On some fossils of Wenlock age from Mulde, near Klinteberg, Gotland. Ann Mag Nat Hist 7:141–160

Jurine L (1820) Histoire des Monocles, qui se trouvent aux environs de Genève. I–XVI:1–260

Kajiyama E (1913) The Ostracoda from Misaki. Zool Mag Tokyo 25:1–16.

Karaman S (1935) Die Fauna der unterirdischen Gewässer Jugoslaviens. Verh Int Ver Theor Angew Limnol 7:46–73

Karanovic I (1999a) On Pseudocypridopsis n. gen., with a redescription of Pseudocypridopsis clathrata (Klie,1936) and a first description of the male (Ostracoda, Cypridopsinae). Bull Zool Mus Univ Amst 17:1–6

Karanovic I (1999b) A new genus and two new species of Candoninae (Crustacea, Ostracoda) from Montenegro (SE Europe). Mem Biospeol 26:47–57

Karanovic I (1999c) Two interesting Candoninae (Crustacea, Ostracoda) from Montenegro (SE Europe). Bull Inst R Sci Nat Belg, Biol 69:47–56

Karanovic I (2000) *Pseudocypridopsis petkovskii* sp. nov., a stygobiont freshwater ostracod (Crustacea, Ostracoda, Cypridopsinae) from Montenegro (SE Europe). Mitt Hambg Zool Mus Inst 97:59–66

Karanovic I (2001) *Meischcandona* gen. nov. from Africa, with a key to genera of the subfamily Candoninae (Crustacea, Ostracoda). Bull Inst R Sci Nat Belg Biol 71:93–99

Karanovic I (2003a) The genus *Kovalenskiella* (sic) Klein, 1963 from the ground waters of Greece, with description of *Kovalenskiella dani*, spec. nov., and a key to the world recent species. Spixiana 26:227–242

Karanovic I (2003b) A new Candoninae genus (Crustacea, Ostracoda, Candonidae) from the subterranean waters of southwestern Western Australia. Rec W Aust Mus 21:315–332

Karanovic I (2003c) Towards a revision of Candoninae (Crustacea, Ostracoda): description of two new genera from Australian groundwater. Species Divers 8:353–383

Karanovic I (2004) Towards a revision of Candoninae (Crustacea, Ostracoda): on the genus *Candonopsis* Vávra, with descriptions of new taxa. Subterr Biol 2:91–108

Karanovic I (2005a) On the genus *Strandesia* Stuhlmann, 1888 (Crustacea, Ostracoda, Cyprididae) with description of a new species and a key to world species. Contrib Zool 74:77–95

Karanovic I (2005b) Towards a revision of Candoninae (Crustacea, Ostracoda): Australian representatives of the subfamily, with descriptions of three new genera and seven new species. NZ J Mar Freshw Res 39:29–75

Karanovic I (2005c) A new Candoninae genus (Crustacea: Ostracoda) from subterranean waters of Queensland with a cladistic analysis of the tribe Candonopsini. Mem Qld Mus 50:303–319

Karanovic I (2005d) On the genus *Typhlocypris* Vejdovský, 1882, with description of two new species. Syst Biodivers 3:1–32

Karanovic I (2005e) Comparative morphology of the Candoninae antennula, with remarks on the ancestral state in ostracods and a proposed new terminology. Spixiana 28:141–160

Karanovic I (2006a) On the genus *Gomphodella* (Crsuatcea: Ostracoda: Limnocytheridae) with descriptions of three new species from Australia and redescription of the type species. Species Divers 11:99–135

Karanovic I (2006b) Recent Candoninae (Crustacea, Ostracoda, Candonidae) of North America. Rec W Aust Mus, Suppl 71:1–75

Karanovic I (2007) Candoninae ostracodes from the Pilbara region in Western Australia. Crustac Monogr 7:432

Karanovic I (2008a) Three interesting Cyprididae (Ostracoda) from Western Australia. Rec W Aust Mus 24:267–287

Karanovic I (2008b) A new species of the genus *Candonopsis* Vávra, 1891 (Crustacea, Ostracoda) from Western Australia. Rec W Aust Mus 24:411–419

Karanovic I (2009) Four new species of *Gomphodella* De Deckker, with a phylogenetic analysis and key to the living representatives of the subfamily Timiriaseviinae (Ostracoda). Crustaceana 82:1133–1176

Karanovic I (2011) On the recent Cyclocypridinae (Podocopida, Candonidae with description of two new genera and one new species. Zootaxa, Monograph 2820:1–61.

Karanovic I, Datry T (2009) Overview of Candoninae (Crustacea, Ostracoda) of South America and the West Indies, with the description of two new species and one new genus. Zootaxa 2267:1–25

Karanovic I, Marmonier P (2002) Genus *Candonopsis* (Crustacea, Ostracoda, Candoninae) in Australia, with a key to world recent species. Ann Limnol 38:199–240

Karanovic I, Marmonier P (2003) Three new genera and nine new species of the subfamily Candoninae (Crustacea, Ostracoda, Podocopida) from Pilbara region (Western Australia). Beaufortia 53:1–51

Karanovic I, McKay K (2010) Two new species of Leicacandona Karanovic (Ostracoda, Candoninae) from the Great Sandy Desert, Australia. J Nat Hist 44: 2715–2736

Karanovic I, Pesce GL (2000a) *Martenscypridopsis* a new ostracod genus (Crustacea: Ostracoda) from African inland waters. Ann Limnol 36:149–155

Karanovic I, Pesce GL (2000b) *Trapezicandona italica* n. sp. (Crustacea, Ostracoda) from the freshwater of southern Italy. Fragm Entomol 32:213–224

Karanovic I, Petkovski TK (1999a) Two interesting ostracod species from Montenegro (SE Europe). Ann Limnol 35:123–132

Karanovic I, Petkovski TK (1999b) Two new species of the subfamily Candoninae (Ostracoda) from Montenegro (SE Europe). Crustaceana 72:603–610

Karanovic I, Ranga Reddy Y (2008) The second representative of the genus *Indocandona* Gupta (Crustacea, Ostracoda) from a well in southeastern India. Crustaceana 81:861–871

Kashevarova NP, Neustrueva IY (1982) Sostoyanie izuchennosti i printsipy klassifikatsii ostrakod nadsemeystva Darwinulacea Brady et Norman, 1889. Vopr Mikropaleontol 25:141–154

Kaufmann A (1892) Über die Gattung *Acanthopus* Vernet und eine neue Süßwassercytheridae. Zool Anz 15:393–395

Kaufmann A (1893) Die Ostracoden der Umgebung Berns. Mitt Naturforsch Ges Bern 49:70–76

Kaufmann A (1900a) Cypriden und Darwinuliden der Schweiz. Rev Suisse Zool 8:209–423

Kaufmann A (1900b) Neue Ostracoden aus der Schweiz. Zool Anz 23:131–133

Kaufmann A (1900c) Über zwei neue *Candona*-Arten aus der Schweiz. Zool Anz 23:108–110

Keilhack L (1911) *Cypris hessei* n. sp. aus den Dauphine-Alpen. Arch Hydrobiol Planktonkd 6:201–205

Kempf EK (1971) Ökologie, Taxonomie und Verbreitung der nichtmarinen Ostrakoden-Gattung *Scottia* im Quartär von Europa. Eiszeitalt Ggw 22:43–63

Kempf EK (1980a) Index and bibliography of nonmarine Ostracoda. Part 1, Index A. Geol Inst Univ Köln, Sonderveröffentlich 35:1–188

Kempf EK (1980b) Index and bibliography of nonmarine Ostracoda. Part 2, Index B. Geol Inst Univ Köln, Sonderveröffentlich 36:1–180

Kempf EK (1980c) Index and bibliography of nonmarine Ostracoda. Part 3, Index C. Geol Inst Univ Köln, Sonderveröffentlich 37:1–204

Kempf EK (1980d) Index and bibliography of nonmarine Ostracoda Part 4, Bibliography A. Geol Inst Univ Köln, Sonderveröffentlich 38:1–186

Kempf EK (1991) Index and bibliography of nonmarine Ostracoda. Part 5, Bibliography B. Geol Inst Univ Köln, Sonderveröffentlich 77:1–232

Kempf EK (1997a) Index and bibliography of nonmarine Ostracoda. Part 6, Index A (Suppl 1). Geol Inst Univ Köln, Sonderveröffentlich 109:1–142

Kempf EK (1997b) Index and bibliography of nonmarine Ostracoda. Part 7, Index B (Suppl 1). Geol Inst Univ Köln, Sonderveröffentlich 110:1–134

Kempf EK (1997c) Index and bibliography of nonmarine Ostracoda Part 8, Index C (Suppl 1). Geol Inst Univ Köln, Sonderveröffentlich 111:1–152

Kempf EK (1997d) Index and bibliography of nonmarine Ostracoda. Part 9, Bibliography C. Geol Inst Univ Köln, Sonderveröffentlich 112:1–144

Keyser D (1975) Ostracoden aus den Mangrovegebieten von Südwest-Florida (Crustacea: Ostracoda: Podocopa). Abh Verh Naturwiss Ver Hambg 18:255–290

Keyser D (1990) Morphological changes and function of the inner lamella layer of podocopid Ostracoda. In: Whatley R, Maybury C (eds) Ostracoda and global events. Chapman and Hall, London, pp 401–410

Keyser D (2005) Histological peculiarities of the nodding process in *Cyprideis torosa* (Jones) (Crustacea, Ostracoda). Hydrobiologie 538:95–106

Keyser D, Walter R (2004) Calcification in ostracods. Rev Esp Micropaleontol 36:1–11

King RL (1855) On Australian entomostracans. Proc R Soc Tasman 3:56–75

Kingma JT (1948) Contributions to the knowledge of the Young-Cenozic Ostracoda from the Malayan region. Thesis, Univ. Utrecht, pp 1–119

Kiss A (2004) Field and laboratory observations on the microhabitat and food selection as well as predator avoidance of *Notodromas monacha* (Crustacea: Ostracoda). Rev Esp Micropaleontol 36:147–156

Kiss R (1959a) Quelques ostracodes nouveaux et intéressants de la région de l'extrémité nord du Lac Tanganyika. Rev Zool Bot Afr 59:81–105

Kiss R (1959b) Ostracodes de l'Afrique tropicale. Rev Zool Bot Afr 60:1–16

Kiss R (1961a) Entomostraces de la plaine de la Ruzizi (Congo et Ruanda-Urundi). Première notice: Entomostraces de la région d'Usumbura (Urundi). Mém Acad R Sci O-M, Cl Sci Nat Med, Nouv Sér 11:1–49

Kiss R (1961b) Un nouvel ostracode du Lac Tanganyika: *Tanganyikacypris matthesi*. Bull Inst Fr Afr Noire, Ser A (Sci Nat) 23:18–24

Klein LN (1963) Novye Ostrakody iz verkhnepliotsenovykh i antropogenovykh otlozheniy Azerbaydzhana. Sb Nauchno-Tekh Informat, Vopr Geol, Aznii DN 2:91–97

Klie W (1923) Beitrag zur Kenntnis der Süßwasserostracoden Russlands. Rab Volzh Biol Stantsii 7:58–67

Klie W (1925) Entomostraken aus Quellen. Arch Hydrobiol 16:243–301

Klie W (1926a) Zweiter Beitrag zur Kenntnis der Süßwasser-Ostracoden Russlands. Rab Volzh Biol Statsii 9:35–53

Klie W (1926b) Über eine neue Art der Ostracodengattung *Candona*. Zool Anz 66:302–306

Klie W (1927a) Zur Kenntnis der Mikrofauna von Britisch Indien. I: Ostracoda. Rec Indian Mus 29:157–165

Klie W (1927b) In: Kiefer F, Klie W (eds) Zur Kenntnis der Entomostraken von Brunnengewässern. Zool Anz 71:5–14

Klie W (1930a) Ostracoden aus dem paraguayischen Teile des Gran-Chaco. Arch Hydrobiol 22:221–258

Klie W (1930b) Eine neue unterirdisch lebende Art der Ostracodengattung *Candona*. Allattani Koezlemenyek 27:163–167

Klie W (1931a) Campagne spéologique de C Bolivar et R Jeannel dans l'Amérique du Nord (1928): 3. Crustacés, ostracodes. Arch Zool Exp Gén 71:333–344

Klie W (1931b) Zwei neue Arten der Ostracoden-Gattung *Candona* aus unterirdischen Gewässern im südöstlichen Europa. Zool Anz 96:161–168

Klie W (1932) Die Ostracoden der Deutschen Limnologischen Sunda-Expedition. Arch Hydrobiol 11:447–502

Klie W (1933a) Drei neue Süßwasser-Ostracoden aus Südafrika. ZoolAnz 102:65–74

Klie W (1933b) Süß- und Brackwasser-Ostracoden von Bonaire, Curaçao und Aruba. Zool Jahrb, Abt Syst, Ökol Geogr Tiere 64:369–390

Klie W (1933c) Die Ostracoden der Rift-Tal-Seen in Kenia. Int Rev Ges Hydrobiol Hydrogr 29:1–14

Klie W (1934a) Zur Kenntnis der Ostracoden-Gattung *Limnocythere*. Arch Naturgesch, Z Wiss Zool, Abt B 3:534–544

Klie W (1934b) Zwei neue subterrane Ostracoden der Gattung *Candona*. Zool Anz 106:193–199

Klie W (1935a) Voyage de Ch Alluaud et PA Chappuis en Afrique occidentale française (Dec 1930-Avril 1931): VIII. Ostracoda aus dem tropischen Westafrika. Arch Hydrobiol 28:35–68

Klie W (1935b) Die Fischereigründe vor Alexandrien. 5: Ostracoda. Fish Res Dir Notes Mem 12:1–9

Klie W (1935c) Süßwasser-Ostracoden aus Uruguay. Arch Hydrobiol 29:282–295

Klie W (1935d) Drei neue Höhlenostracoden aus der Umgebung von Laibach. Zool Anz 111:189–198

Klie W (1936a) Ostracoden aus Kamerun. Rev Zool Bot Afr 28:287–309

Klie W (1936b) Neue Candoninae (Ostracoda) aus dem Grundwasser von Belgien. Bull Mus R Hist Nat Belg 12:1–13

Klie W (1936c) Zwie neue Süßwasser-Ostracoden der Unterfamilie Candocyprinae von der Insel Korfu. Zool Anz 113:325–331

Klie W (1937a) Neue Ostracoden aus Jugoslavien. Glas Skopskog Nauchno Drush 17:143–150

Klie W (1937b) Süßwasserorganismen aus dem Elbursgebirge (Persien). 2. Teil: Ostracoda. Zool Anz 119:207–211

Klie W (1937c) Weitere Ostracoden aus dem Grundwasser von Belgien. Bull Mus R Hist Nat Belg 13:1–6

Klie W (1938a) Ostracoda, Muschelkrebse Die Tierwelt Deutschands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise 34 Teil: Krebstiere oder Crustacea. Gustav Fischer, Jena, pp 1–230

Klie W (1938b) Ostracoden aus unterirdischen Gewässern in Süditalien. Zool Anz 123:147–155

Klie W (1938c) Ostracoden aus dem belgischen Kongogebiet. Rev Zool Bot Afr 30:364–388

Klie W (1938d) Ostracoden aus Formosa. Bull Biogeogr Soc Jpn 8:21–33

Klie W (1938e) *Candona bilobata*, ein neuer Muschelkrebs aus dem Grundwasser des unteren Maintales. Zool Anz 124:216–220

Klie W (1938f) Ostracoden aus dem Grundwasser der oberrheinischen Tiefebene. Z Wiss Zool, Abt B 7:1–28

Klie W (1939a) Ostracoden aus dem Kenia-Gebiet, vornehmlich von dessen Hochgebirgen. Int Rev Ges Hydrobiol Hydrogr 39:99–161

Klie W (1939b) Studien über Ostracoden aus dem Ohridsee: II. Limnocytherinae and Cytherinae. Arch Hydrobiol 25:631–646

Klie W (1939c) Süßwasserostracoden aus Nordostbrasilien. 1. *Pelocypris*, eine neue Gattung der Unterfamilie Cyprinae. Zool Anz 128:84–91

Klie W (1939d) Süßwasserostracoden aus Nordostbrasilien. 2. Die Gattung *Chlamydotheca*. Zool Anz 128:152–159

Klie W (1939e) Studien über Ostracoden aus dem Ohridsee: 1. Candocyprinae. Arch Hydrobiol 35:28–45

Klie W (1939f) Süßwasserostracoden aus Nordostbrasilien. 3. Die Gattungen *Stenocypris* und *Dolerocypris*. Zool Anz 128:316–320

Klie W (1939g) Ostracoden aus den marinen Salinen von Bonaire, Curaçao und Aruba. Capita Zool 8:1–19

Klie W (1940a) Süsswasserostracoden aus Nordostbrasilien. 5: Die Gattung *Strandesia*. Zool Anz 129:201–206

Klie W (1940b) Süßwasserostracoden aus Nordbrasilien. 6. Cyprinae mit geißelförmiger Furka. Zool Anz 130:59–73

Klie W (1940c) Süßwasserostracoden aus Nordbrasilien. 4. *Eucypris* oder *Heterocypris*? Zool Anz 129:113–120

Klie W (1940d) *Candona latens*, ein neuer Muschelkrebs aus dem Grundwasser von Mittelfranken. Zool Anz 131:101–104

Klie W (1940e) Süßwasserostracoden aus Nordbrasilien. 7. Ilyocyprinae und Candocyprinae. Zool Anz 130:219–229

Klie W (1941a) Süßwasserostracoden. Beitr Fauna Perus 2:77–88

Klie W (1941b) Süßwasserostracoden aus Südosteuropa. Zool Anz 133:233–244

Klie W (1942) Studien über Ostracoden aus dem Ohridsee: 3. Erster Nachtrag. Arch Hydrobiol 38:254–259

Klie W (1943a) Ostracoden aus Marokko und Mauretanien. Zool Anz 143:49–62

Klie W (1943b) Ostracoden aus dem Grundwasser der Umgebung von Kolozsvár. Fragm Faun Hung 6:35–41

Klie W (1944) Ostracoda. Explor Parc Natl Albert, Mission H Damas 12:1–62

Klugh AB (1923) A new *Cyclocypris* from eastern Canada. Trans R Can Inst 14:337–342

Koch CL (1837a) Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur Deutschen Fauna. Heft 10, Regensburg, F. Pustet

Koch CL (1837b) Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur Deutschen Fauna. Heft 11. Regensburg

Koch CL (1837c) Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur Deutschen Fauna. Heft 12. Regensburg

Koch CL (1838) Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur Deutschen Fauna. Heft 21. Regensburg

Kornicker LS, Sohn IG (1971) Viability of ostracod eggs egested by fish and effect of digestive fluids on ostracod shells – ecologic and paleontologic implications. In: Oertli HJ (ed) Paléoécologie des ostracodes. Bull Cent Rech Pau-SNPA 5(Suppl), pp 125–135

Kotzian SCB (1974) New fresh-water ostracods of the genus *Chlamydotheca* from Brazil. Ecology, geographic distribution and stratigraphical position. An Acad Bras Cienc 46:423–467

Kovalenko AL (1970) Novyy vid Rakushkovykh Dnestra: *Ilyocypris carinata*. In: Fauna Kaynozoya Moldavii, pp 112–116

Kovalenko AL (1972) Novye dlya SSSR vidy roda *Ilyocypris* (Crustacea, Ostracoda). Izv Akad Nauk Mold SSR, Ser Biol Khim Nauk 4:65–71

Kovalenko AL (1976) Sovremennye ostrakody basseyna Dnestra. Kishinev, p 180

Kovalenko AL (1982) Novye vidy roda *Cypria* (Crustacea, Ostracoda). Izv Akad Nauk Mold SSR, Ser Biol Khim Nauk 1982:38–42

Kovalenko AL (1987) Bentocypria – novyy rod nadsemeystva Cypridacea (Crustacea, Ostracoda). In: Nevesskaya (ed) Stratigrafiya verkhnego Fanerozoya Moldavii (Sbornik Nauchnykh Trudov). Shtiintsa, Kishinev, pp 99–105

Kozloff EN, Whitman DC (1954) *Enthocythere occidentalis* sp. nov., a Cytherid ostracod commensial on western species of Pacifastacus. American Midland Naturalist 52:159–163.

Krstić N (1972) Rod *Candona* (Ostracoda) iz kongerijskikh slojeva juzhnog dela Panonskog Basena. Poseb Izd, Srp Akad Nauka Umet, Odelene Prir-Math Nauka 39:1–145

Krstić (1987) Three new ostracode genera from lacustrine Miocene. Bull Acad Serbe Sci Arts, Cl Sci Nat Math 92 (Sci Nat 27):129–130

Krstić N (1995) Ostracodes of lower and middle paludinian beds of Fruska Gora s. l. Chronostratigr Neostratotypen. Neogen Zent Paratethys 9:387–425

Külköylüoğlu O (2008) *Cyclocypris vinyardi* sp. n. (Ostracoda) described from a rheocrene spring in Nevada (USA). Crustaceana 81:385–402

Külklöylüoğlu O, Meisch C, Rust RW (2003) *Thermopsis thermophila* n. gen. n. sp. from hot springs in Nevada, USA (Crustacea, Ostracoda). Hydrobiologia 499:113–123

Lawrence JR, Scharf B, Packroff G, Neu TR (2002) Microscale evaluation of the effects of grazing by invertebrates with contrasting feeding modes on river biofilm architecture and composition. Microb Ecol 44:199–207

Latifa GA (1987) Effects of temperature on the development of embryonic and postembryonic stages of *Heterocypris incongruens* (Ramdohr, 1808) (Ostracoda). Crustaceana 52:95–100

Lerner-Seggev R (1968) The fauna of Ostracoda in Lake Tiberias. Isr J Zool 17:117–143

Lerner-Seggev R (1973) *Limnocythere titicaca* new species (Ostracoda, Cytheridae) from Lake Titicaca, Bolivia. Crustaceana 25:88–94

Liebau A (1991) Skulptur-Evolution bei Ostrakoden am Beispiel der europäischen “Quadracytheren”. Geol Palaontol Westfal 13:1–395

Liebau A (2005) A revised classification of the higher taxa of the Ostracoda (Crustacea). Hydrobiologia 538:115–137

Lilljeborg W (1853) De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrentibus. I–XVI. Lund, pp 1–222

Lilljeborg W (1863) Beskrifning öfver tva arter crustaceer af ordingarna Ostracoda och Copepoda. Öfvers Kungliga Vetensk-Akad Förh 19:391–398

Lilljeborg W (1883) Collection of chiefly fresh-water Crustacea from Sweden. In: Great International fisheries exhibition, London 1883, Special Catalogue: Sweden. Devision 50, 265:140–150

Lilljeborg W (1890) In: Sars, GO Oversigt af Norges crustaceer med forelobige bemærkninger over de nye eller mindre bekjendte arter: 3 (Brachiopoda, Ostracoda, Cirripedia). Forh Christiania Vidensk-Selsk 1890:1–80

Lindner E (1920a) Ein Beitrag zur Kenntnis der Ostracodenfauna Polens mit zwei Neubeschreibungen. Abh Senckenb Naturforsch Ges 37:23–29

Lindner E (1920b) Neue mazedonische Ostracoden. Zool Anz 52:37–41

Lindner E (1923) Muschelkrebse (Ostracoda). Beitr Naturdenkmalpfl 8:332–343

Lindroth S (1953) Taxonomic and zoogeographical studies of the ostracod fauna in the inland waters of east Africa. Zool Bidr Upps 30:43–156

Linnaeus C (1758) Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio Decima 1, Holmiae, pp 634–635

Lo C-T (1967) The inhibiting actions of ostracods on snail cultures. Trans Am Microsc Soc 85:402–405

Löffler H (1960) Die Entomostrakenfauna der Ziehbrunnen und einiger Quellen des nördlichen Burgenlandes. Wiss Arb Burgenland 24:1–32

Löffler H (1961a) Zur Systematik und Ökologie der chilenischen Süßwasserentomostraken. Beitr Neotrop Fauna 2:143–222

Löffler H (1961b) Grundwasser- und Brunnenostracoden aus Südwestdeutschland und den Vogesen. Beitr Naturkdl Forsch SW-Dtschl 20:31–42

Löffler H (1961c) Beiträge zur Kenntnis der iranischen Binnengewässer 2: regional-limnologische Studie mit besonderer Berücksichtigung der Crustaceenfauna. Int Rev Ges Hydrobiol Hydrogr 46:309–406

Löffler H (1961d) Beitrag zur Copepoden-und Ostracodenfauna Chiles. Anz Österr Akad Wiss, Math-Naturwiss Kl 98:111–117

Löffler H (1963a) Zur Ostrakoden-und Copepodenfauna Ekuadors (mit Beschreibung 6 neuer Arten und 3 neuer Unterarten). Arch Hydrobiol 59:196–234

Löffler H (1963b) Beiträge zur Fauna Austriaca: 1. Die Ostrakodenfauna Österreichs. Sitzungsber Österr Akad Wiss, Math-Naturwiss Kl, Abt A 172:193–211

Löffler H (1964) Dritter Beitrag zur Kenntnis der Entomostrakenfauna burgenländischer Brunnen und Quellen (südliches Burgenland). Wiss Arb Burgenland 31:156–169

Löffler H (1968) Die Crustaceenfauna der Binnengewässer ostafrikanischer Hochgebirge. Hochgebirgsforschung 1:107–169

Lowndes AG (1931a) A small collection of Entomostraca from Uganda, collected by Mr GL Hancock. Proc Zool Soc Lond 1931:1291–1299

Lowndes AG (1931b) Some fresh-water Entomostraca of the Birmingham district. Ann Mag Nat Hist, ser 10 8:561–577

Lowndes AG (1932a) Report on the Ostracoda. Mr Omer-Cooper's investigation of the Abyssinian fresh waters (Dr Hugh Scott's Expedition). Proc Zool Soc Lond 3:677–708

Lowndes AG (1932b) *Candona wedgwoodii*, a new species of ostracod. Ann Mag Nat Hist, ser 10 10(10):278–280

Lowndes AG (1932c) *Herpetocypris palpiger*, a new species of freshwater ostracod. Ann Mag Nat Hist, Ser 10 9:155–157

Lowndes AG (1936) Scientific results of the Cambridge Expedition to the east african lakes, 1930/1931: No. 16. The smaller Crustacea. J Linn Soc Lond Zool 40:1–31

Lubbock J (1855) On the freshwater Entomostraca of South America. Trans Entomol Soc Lond, New Ser 3:232–240

Lucas H (1849) Histoire naturelle des animaux articulés. Exploration scientifique de l'Algérie pendant les années, 1840, 1841, 1842. Sci Phys Zool 1:1–403

Maddock RF (1969) Revision of Recent Bairdiidae (Ostracoda). United States National Museum Bulletin 275, 126 pp

Maddocks RF (1979) Two new examples of symbiosis or parasitism in Cypridacea Ostracoda. Crustaceana 37:1–12

Maddocks R (1982) Ostracoda. In: Bliss DE (ed) The biology of Crustacea, vol 1, Systematics, the fossil record and biogeography. Academic, New York, pp 221–239

Maddocks R (2000) The antennule in podocopid Ostracoda: chaetotaxy, ontogeny and morphometrics. Micropaleontology Press, New York, pp 1–72, Am Mus Nat Hist

Mallwitz J (1984) *Cypridopsis lanzarotensis* n sp ein neuer Ostracode von Lanzarote (Kanarische Inseln) (Crustacea: Ostracoda: Podocopida). Mitt Hambg Zool Mus Inst 81:171–176

Mandelstam MI (1947) Ostracoda iz otlozheniy sredney Yury poluostrova Mangyshlaka. Microfauna Neftyanykh Mestorožhd Kavk, Emby Sredn Azii, pp 239–259

Mandelstam MI (1959) Ostracoda from Paleogene formations of central Asia. Mikrofauna SSSR [in Russian]. Vses. Neft. Nauchno-Issledovatelsk. Geologorazvedoch. Inst. (VNIGRI), Trud. 136:442–525

Mandelstam MI (1960) In: Luebimova PS, Mandelstam MI, Schneider GF, Osnovy Paleontologii 8:347–365

Mandelstam MI (1962) In: Mandelstam MI, Markova LP, Rosyjeva TR, Stepanaitys NE (eds) Ostracody pliotsenovykh i postpliotsenovykh otlozheniy Turkmenistana. Ashkhabad, p 288

Mandelstam MI, Markova LP, Rosyjeva TR, Stepanaitys NE (1962) Ostracody pliotsenovykh i postpliotsenovykh otlozheniy Turkmenistana. Ashkhabad, p 288

Mannikeri MS, Vaidya AS (1990) New freshwater ostracodes from Dharwad, Karnataka. J Palaeontol Soc India 35:17–24

Margalef R (1947) Datos zoogeográficos sobre ostráodos de agua dulce de Cataluña y descripción de la nueva especie *Potamocypris pyrenaica*. P Inst Biol Apl 3:163–171

Margalef R (1948) Flora, fauna y comunidades bióticas de las aguas dulces del Pirineo de la Cerdaña. Monogr Inst Estud Piren 11:1–226

Margalef R (1952) La vida en las aguas dulces de Andorra. Actas 1. Congr Int Inst Estud Piren:1–107

Margalef R (1953) Los crustáceos de las aguas continentales ibéricas: Ostrácodos (Ostracoda). Biol Aguas Cont 10:137–167

Margalef R (1958) Algunos crustáceos de las aguas continentales de España y norte de Africa. Misc Zool, Ed Mus Zool 1:51–60

Margalef R (1961) La vida en los charcos de agua de Nueva Esparta (Venezuela). Mem Soc Cienc Nat la Salle 21:75–110

Marmonier P, Danilopol DL (1988) Découverte de *Nannocandona faba* Eckman (Ostracoda, Candoninae) en basse Autriche. Son origine et son adaptation au milieu interstitiel. Vie Milieu 38:35–48

Marmonier P, Ward JV (1990) Superficial and interstitial Ostracoda of the South Platte River (Colorado, USA) – Systematics and biogeography. Stygologia 5:225–239

Marmonier P, Meisch C, Danielopol DL (1989) A review of the genus *Cavernocypris* Hartmann (Ostracoda, Cypridopsinae): Systematics, ecology and biogeography. Bull Soc Nat Luxemb 89:221–278

Marmonier P, Boulal M, Idbennacer B (2005) *Marococandona*, a new genus of Candonidae (Crustacea, Ostracoda) from southern Morocco: morphological characteristics and ecological requirements. Ann Limnol 41:57–71

Marshall WS (1903) Entocythere cambaria (nov.gen. et nov.spec.) a parasitic ostracod. Trans Wisconsin Acad Sci Arts Lett 14:117–145

Martens JM (1977) *Cypridopsis parvoides* n. sp., ein neuer Ostracode aus Norddeutschland (Crustacea: Ostracoda: Podocopida). Abh Verh Naturwiss Ver Hambg, NF 20:87–97

Martens K (1982) On a small collection of freshwater ostracods (Crustacea, Ostracoda) from Somalia, with description of two new species. Monit Zool Ital, Nov Ser 17:149–170

Martens K (1984a) On the freshwater ostracods (Crustacea, Ostracoda) of the Sudan, with special reference to the Red Hills, including a description of a new species. Hydrobiologia 110:137–161

Martens K (1984b) Annotated checklist of non-marine ostracods (Crustacea, Ostracoda) from African inland waters. Doc Zool, Mus R Afr Cent, Tervuren 20:1–51

Martens K (1985a) Effects of temperature and salinity on postembryonic growth in *Mytilocypris henricae* (Chapman) (Crustacea, Ostracoda). J Crustac Biol 5:256–272

Martens K (1985b) *Tanganyikacypridopsis* gen. n. (Crustacea, Ostracoda) from Lake Tanganyika. Zool Scr 14:221–230

Martens K (1986) Taxonomic revison of the subfamily Megalocypridinae Rome, 1965 (Crustacea, Ostracoda). Verh K Acad Wet, Lett Schon Kunsten Belg, Kl Wet 48:1–146

Martens K (1987a) Homology and functional morphology of the sexual dimorphism in the antenna of *Sclerocypris* Sars, 1924 (Crustacea, Ostracoda, Megalocypridinae). Bijdr Dierkd 57:183–190

Martens K (1987b) On *Sclerocypris pardii* n. sp. (Crustacea, Ostracoda) from Somalia. Monit Zool Ital 22:59–72

Martens K (1988) Seven new species and two new subspecies of *Sclerocypris* Sars, 1924, from Africa, with new records of some other Megalocypridinids (Crustacea, Ostracoda). Hydrobiologia 162:243–273

Martens K (1989a) *Ovambocythere milani* gen. n., spec. n. (Crustacea, Ostracoda), an African limnocytherid reared from dried mud. J Afr Zool 103:379–388

Martens K (1989b) On *Bryocypris grandipes* Roen. Stereo-Atlas Ostracod Shells 16:140–147

Martens K (1989c) On the systematic position of the *Eucypris clavata*-group, with a description of *Trajancypris* gen nov (Crustacea, Ostracoda). Arch Hydrobiol 83(Suppl):227–251

Martens K (1990) Taxonomic revision of African Cypridini. Part I: The genera *Cypris* OF. Müller, *Pseudocypris* Daday and *Globocypris* Klie (Crustacea, Ostracoda). Bull Inst R Sci Nat Belg Biol 60:127–172

Martens K (1991a) A new and enigmatic representative of *Leucocythere* Kaufmann, 1892 from the Eastern Cape Province (South Africa) (Crustacea, Ostracoda). J Nat Hist 25:583–596

Martens K (1991b) On a small collection of non-marine ostracods from Mongolia, with the description of a new species (Crustacea, Ostracoda). Misc Zool Hung 6:53–60

Martens K (1991c) On *Sclerocypris demoori* spec. n. (Crustacea, Ostracoda, Megalocypridinae) from the Eastern Cape Province (R South Africa). J Afr Zool 105:63–67

Martens K (1992a) A reassessment of *Paralimnocythere* Carbonnel, 1965 (Crustacea, Ostracoda, Limnocytherinae), with a description of a new genus and two new species. Bull Inst R Sci Nat Belg, Biol 62:125–158

Martens K (1992b) Taxonomic revision of African Cypridini. Part II. Description of *Ramotha* gen. nov. (Crustacea, Ostracoda). Ann S Afr Mus 102:91–130

Martens K (1992c) On *Namibcypris costata* n. gen., n. sp. (Crustacea, Ostracoda, Candoninae) from a spring in northern Namibia, with the description of a new tribe and a discussion on the classification of the Podocopina. Stygologia 7:27–42

Martens K (1993) On the taxonomy and zoogeography of the genus *Gomphocythere* Sars, 1924 (Crustacea, Ostracoda), with the description of a new species from the Nahal Dan (Israel). Belg J Zool 123:39–54

Martens K (1994a) Ostracod speciation in ancient lakes. In: Martens K, Goddeeris B, Coulter G (eds) Speciation in ancient lakes. Arch Hydrobiol, Beih Ergeb Limnol 44:203–222

Martens K (1994b) Towards a revision of the Cypricercinae (Crustacea, Ostracoda): on the validity of the genera *Neocypris* Sars 1901 and *Bradleycypris* Mckenzie, 1982. Bull Inst R Sci Nat Belg Biol 64:231–233

Martens K (1995) On the validity and the taxonomic position of the Cytheridellini (Crustacea, Ostracoda, Limnocytheridae). Mitt Hambg Zool Mus Inst 92:273–280

Martens K (1996) On *Korannocythere* gen. nov. (Crustacea, Ostracoda), a new genus of temporary pool limnocytherids from southern Africa, with the description of three new species and a generic reassessment of the Limnocytherinae. R Sci Nat Belg Biol 66:51–72

Martens K (1997a) Two new crenobiont ostracod genera (Crustacea, Ostracoda, Herpetocypridinae) from Africa and Asia Minor, with the description of a new species from dolomitic springs in South Africa. S Afr J Sci 93:542–554

Martens K (1997b) Speciation in ancient lakes. Tree 12:177–182

Martens K (1998a) Diversity and endemicity of recent non-marine ostracods (Crustacea, Ostracoda) from Africa and South America: a faunal comparison. Verh Int Ver Limnol 26:2093–2097

Martens K (1998b) Sex and parthenoghenesis. Evolutionary ecology of reproductive modes in non-marine ostracods. Backhuys, Leiden, pp 1–335

Martens K (2000) Factors affecting the divergence of mate recognition system in the Limnocytherinae (Crustacea, Ostracoda). Hydrobiologie 419:83–101

Martens K (2001) Taxonomy of the Herpetocypridinae (Ostracoda, Cyprididae). Crustaceana 74:295–308

Martens K (2003a) On the evolution of *Gomphocythere* (Crustacea, Ostracoda) in Lake Nyassa/ Malawi (East Africa), with the description of 5 new species. Hydrobiologia 497:121–144

Martens K (2003b) On a remarkable South African giant ostracod (Crustacea, Ostracoda, Cyprididae) from temporary pools, with additional appendages. Hydrobiologia 500:115–130

Martens K (2007) On a new species and genus in the Cypridini (Crustacea, Ostracoda, Cyprididae) from South Africa, with a phylogenetic analysis of the tribe and a discussion on the genus concept in this group. J Nat Hist 41:381–399

Martens K, Behen F (1994) A checklist of the recent non-marine ostracods (Crustacea, Ostracoda) from the inland waters of South America and adjacent islands. Trav Sci Mus Natl Hist Nat Luxemb 22:1–81

Martens K, Coomans A (1990) Phylogeny and historical biogeography of the Megalocypridinae Rome, 1965; with an updated checklist of the subfamily. In: Whatley RC, Maybury C (eds) Ostracoda and global events. Chapman and Hall, London, pp 545–556

Martens K, Horne DJ (2000) Preface: Ostracoda and the four pillars of evolutionary wisdom. In: Horne DJ, Martend K (eds) Evolutionary biology and ecology of Ostracoda. Hydrobiologia 419:7–11

Martens K, Mazepova G (1992) On *Limnocythere baikalensis* n. sp., from Lake Baikal (Siberia, USSR), with notes on the position of the *L. goerbachensis*- group (Crustacea, Ostracoda, Limnocytheridae). Arch Hydrobiol 1:115–131

Martens K, Rossetti G (1997) On two new species of *Darwinula* Brady, Robertson, 1885 (Crustacea, Ostracoda) from South African dolomitic springs. Bull Inst R Sci Nat Belg Biol 67:57–66

Martens K, Rossetti GP (2002) On the Darwinulidae (Crustacea: Ostracoda) from Oceania. Invertebr Syst 16:195–208

Martens K, Meisch C, Marmonier P (1991) On Klieopsis n. gen., with a redescription of Cypridopsis horai Klie, 1927 (Crustacea, Ostracoda). Bull Inst R Sci Nat Belg Biol 61:55–64

Martens K, Ortal R, Meisch C (1992) The ostracod fauna of Mamilla Pool (Jerusalem, Israel) (Crustacea, Ostracoda). Zool Middle East 7:95–114

Martens K, Rossetti GP, Fuhrmann R (1997) Pleistocene and recent species of the family Darwinulidae Brady and Norman, 1889 (Crustacea, Ostracoda) in Europe. Hydrobiologia 357:99–116

Martens K, Horne DJ, Griffiths HI (1998) Age and diversity of non-marine ostracods. In: Martens K (ed) Sex and parthenogenesis: evolutionary ecology of reproductive modes in non-marine ostracods. Backhuys, Leiden, pp 37–55

Martens K, Rossetti G, Horne DJ (2003) How ancient are ancient asexuals? Proc R Soc Lond 270:723–729

Martens K, De Deckker P, Rossetti G (2004) On a new terrestrial genus and species of Scottiinae (Crustacea, Ostracoda) from Australia, with a discussion on the phylogeny and the zoogeography of the subfamily. Zool Anz 243:21–36

Martens K, Rossetti G, Butlin RK, Schön I (2005) Molecular and morphological phylogeny of the ancient asexual Darwinulidae (Crustacea, Ostracoda). Hydrobiologia 538:153–165

Martens K, Schön I, Meisch C, Horne DJ (2007) Global diversity of ostracods (Ostracoda, Crustacea) in freshwater. Hydrobiologia 595:185–193

Martens K, Svatenalinton S (2011) A subjective checklist of the Recent, free-living, non-marine Ostracoda (Crustacea). Zootaxa, Monograph 2855:1–79

Martin JW, Davis GE (2001) An updated classification of the recent Crustacea. Nat Hist Mus Los Angel Cty Sci Ser 39: 132

Mandelstam MI (1960) In: Luebimova PS, Mandelstam MI, Schneider GF, Osnovy Paleontologii 8, 347-365.

Masi L (1905a) Nota sugli ostracodi viventi nei dintorni di Roma ed osservazioni sulla classificazione della Cypridae. Boll Soc Zool Ital, Ser 2 2(6):115–128

Masi L (1905b) Nota sopra una nuova species di *Cypris sessuata* e sulla *Cypris bispinosa*. Monit Zool Ital 16:240–244

Masi L (1906) Contributo alla sistematica delle Iliocyprinae. Boll Soc Zool Ital, Ser 2 7:133–146

Masi L (1925) Descrizione di tre nuovi ostracodi africani. Ann Mus Civ Stor Nat "Giacomo Doria" 52:50–63

Masi L (1932a) Escursione zoologica all'oasi di Marrakesch nell'aprile 1930: Ostracodi. Boll Zool 3:213–223

Masi L (1932b) Spedizione scientifica all'oasi di Curfa (Marzo-Luglio 1931): Ostracodi. Ann Mus Civ Stor Nat "Giacomo Doria" 55:310–328

Matthens D (1990) *Nüchterleinella corneliae* n. g., n. sp. – ein Peritrich auf *Cypria ophthalmica* (Ostracoda). Arch Protistenkd 138:139–141

Matzke-Karasz R, Martens K (2005) The female reproductive organ in podocopid ostracods is homologous to five appendages: histological evidence from *Liocypris grandis* (Crustacea, Ostracoda). Hydrobiologia 542:249–259

Matzke-Karasz R, Martens K (2007) On *Afrocypris barnardi* GO Sars, 1924 (Ostracoda), a second giant ostracode with additional appendages. Crustaceana 80:603–623

Matzke-Karasz R, Martens K, Schudack M (2007) Ostracodology in time and space: looking back on fifteen international symposia on Ostracoda, and the themes in between. Hydrobiology 585:1–11

Mazepova GF (1970) Novyy vid Ostracoda is Baykala I ego rodstvennye svyazi s zakavkazskoy peshchernoy faunoy. Zool Z 49:1632–1637

Mazepova GF (1976) Novyy rod Ostracoda v faune Ozera Baykal i ego otnoshenie k peshchernoy *Candona taurica* Schornikov iz Kryma. Tr Limnol Inst Sib Otd Akad Nauk SSSR 18:54–79

Mazepova GF (1982) Novye vidy endemichnykh ostracod (Ostracoda, Candonini) iz Bykala. In: Galazii GI (ed) Novoe o faune Baykala, ABB. Nauka, Novosibirsk, pp 99–140

Mazepova GF (1984) Novye endemichnye rakushkovye rachki (Ostracoda). In: Sistematika i evolyutsiya bespozvonochnykh Baykala. Akadeima Nauk SSSR, Nauka, Novosibirsk, pp 15–75

Mazepova GF (1985) Novye materialy po faune rakushkovykh rachkov. In: Bespozvonochnye i ryby fauna Baykala 1. Akadeima Nauk SSSR, Nauka, Novosibirsk, pp 62–83

Mazepova GF (1990) Rakuschkovie rachki (Ostracoda) Baykala. Akadeima Nauk SSSR, Novosibirsk (Nauka), pp 1–471

McGregor DL (1967) Rhythmic pulsation of the hepatopancreas in freshwater ostracods. Trans Am Microsc Soc 86:166–169

McGregor DL, Kesling RV (1969) Copulatory adaptations in ostracods. Part II: Adaptations in living ostracods. Contrib Mus Paleontol Univ Mich 22:221–239

McKenzie KG (1966a) Freshwater Ostracoda from North-Western Australia. Aust J Mar Freshw Res 17:259–279

McKenzie KG (1966b) *Mytilocypris*, a new ostracode genus from Tasmania. Pap Proc R Soc Tasman 100:27–30

McKenzie KG (1971a) Paleozoogeography of freshwater Ostracoda. In: Oertly HJ (ed) Pléoécologie d'ostracodes. Bull Centre Recherches PAU-SNPA 5, pp 207–237

McKenzie KG (1971b) Species list of South African freshwater Ostracoda with an appendix listing museum collections and some further determinations. Ann S Afr Mus 57:157–213

McKenzie KG (1971c) Ostracoda from Lake Peunde, near Mt Wilhelm, New Guinea. Zool Anz 186:391–403

McKenzie KG (1972) Results of the speleological survey in South Korea 1966: 22. Subterranean Ostracoda from South Korea. Bull Natl Sci Mus Tokyo 15:155–166

McKenzie KG (1977) Illustrated generic key to South African continental Ostracoda. Ann S Afr Mus 74:45–103

McKenzie KG (1978a) Ostracoda (Crustacea: Podocopida) from southern Australian salt lakes, with the description of *Reticypris* new genus. Trans R Soc S Austr 102:175–190

McKenzie KG (1978b) Ostracoda. Ann Mus R Afr Cent, Ser In 8 (Sci Zool) 220:444–451

McKenzie KG (1982a) Homoeomorphy: persistant joker in the taxonomic pack, with the escription of *Bradleycypris* gen. nov. In: Bate RH, Robinson E, Sheppard LM (eds) Fossil and recent ostracods. Ellis Horwood Ltd., Chichester, pp 407–438

McKenzie KG (1982b) Description of a new Cypridopsine genus (Crustacea: Ostracoda) from Campbell Island, with a key to Cypridopsinae. Proc Biol Soc Wash 95:766–771

McKenzie KG, Hussainy SU (1968) Relevance of a freshwater Cytherid (Crustacea, Ostracoda) to the continental drift hypothesis. Nature 5169:806–808

McKenzie K, Swanson K (1981) On *Paralimnocythere vulgaris* McKenzie and Swanson sp. nov. Stereo-Atlas Ostracod Shells 8:45–50

McKenzie KG, Müller KJ, Gramm MN (1983) Phylogeny of Ostracoda. In: Schram FR (ed) Crustacean issues 1. Crustacean phylogeny. AA Balkema, Rotterdam, pp 29–46

Méhes G (1907) Beiträge zur Kenntnis der pleistozänen Ostrakoden Ungarns – 1: Die Cypridaeen der unterpannonischen Stufe. Földt Közlöny 37(Suppl):495–536

Méhes G (1914) Süßwasser-Ostracoden aus Columbien und Argentinien. Mém Soc Sci Nat Neuchâtel 5:639–663

Méhes G (1939) Ostracodes de la Nouvelle-Calédonie. Rev Suis Zool 46:549–565

Meisch C (1979) *Cypricercus alacer* n. sp. (Crustacea, Ostracoda) en provenance du Grand-Duche de Luxembourg. Arch Inst Grand-Ducal Luxemb, Sect Sci Nat Phys Math, Nouv Sér 38:191–196

Meisch C (1987) Ostracodes d'eau douce récoltés dans le sud-ouest de la France (Crustacea, Ostracoda). Bull Soc Nat Luxemb 87:89–118

Meisch C (1996) Contribution to the taxonomy of *Pseudocandona* and four related genera, with the description of *Schellencandona* nov. gen., a list of the Candoninae genera, and key to the European genera of the subfamily (Crustacea, Ostracoda). Bull Soc Nat Luxemb 97:211–237

Meisch C (2000) Freshwater Ostracoda of western and central Europe. Süsswasserfauna von Mitteleuropa 8/3. Spektrum Akad Vlg, Gustav Fischer, Heidelberg, Berlin, pp 1–522

Meisch C (2007) On the origin of the putative furca of the Ostracoda (Crustacea). Hydrobiologia 585:181–200

Menzel R (1916) Moosbewohnende Harpacticiden und Ostracoden aus Ost-Afrika. Arch Hydrobiol Planktonkd 11:478–489

Menzel R (1923) Beiträge zur Kenntnis der Mikrofauna von Niederländisch-Ostindien. 5: Moosbewohnende Ostracoden aus dem Urwald von Tjibodas. Treubia 3:193–196

Methuen PA (1910) On a collection of freshwater Crustacea from the Transvaal. Proc Zool Soc Lond 1910:148–166

Mezquita F, Roca JR, Wansard G (1999a) Moulting, survival and calcification: the effects of temperature and water chemistry on an ostracod crustacean (*Herpetocypris intermedia*) under experimental conditions. Arch Hydrobiol 146:219–238

Mezquita F, Hernandéz R, Rueda J (1999b) Ecology and distribution of ostracods in a polluted Mediterranean river. Palaeogeogr Palaeoclim Palaeoecol 148:87–103

Mezquita F, Griffiths HI, Domínguez MI, Lozano-Quilis A (2001) Ostracoda (Crustacea) as ecological indicators: a case study from Iberian Mediterranean brooks. Arch Hydrobiol 150:545–560

Mikulic F (1961) Nove *Candona* vrste iz Ohridskog Jezera. Glas Prir Muz, Ser B 17:87–107

Mills DH, Wyatt JT (1974) Ostracod reactions to non-toxic and toxic algae. Oecologia 17:171–177

Moniez R (1888) Ostracodes. In: Barrois TC (ed) Matériaux pour servir à l'étude de la faune des eaux douces des Acores: 4. Crustacés. Lille, pp 7–11

Moniez R (1889) Sur quelques cladocères et sur un ostracode nouveau du Lac Titicaca. Rév Biol N Fr 1:419–429

Moniez R (1891) Faune des lacs salés d'Algérie: Ostracodes. Mém Soc Zool Fr 4:246–257

Moniez R (1892) Entomostraces d'eau douce de Sumatra et de Célèbes. 2. Ostracodes. Zool Ergeb Reise Niederl Ostindien 2:129–135

Moniez R (1893) Description d'une nouvelle espèce de *Cypris* vivant dans les eaux thermales du Hammam-Meskhoutine. Bull Soc Zool Fr 18:140–142

Moroni A (1961) L'ecosistema di Risaia. Ann Fac Agrar Univ Cattol Sacro Cuore, Nuov Ser 1:490–624

Müller GW (1880) Beitrag zur Kenntnis der Fortpflanzung und der Geschlechtsverhältnisse der Ostracoden nebst Beschreibung einer neuen Species der Gattung *Cypris*. Z Ges Naturwiss 53:221–246

Müller GW (1894) Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Fauna Flora Golf Neapel 21:1–404

Müller GW (1898) Ergebnisse einer zoologischen Forschungsreise in Madagaskar und Ost-Afrika 1889–1895 von Dr A Voeltzkow: Die Ostracoden. Abh Senckenb Naturforsch Ges 21:255–296

Müller GW (1900a) Deutschlands Süßwasser-Ostracoden. Zool, Orig-Abh Gesamtgeb Zool 12:1–112

Müller GW (1900b) Afrikanische Ostracoden, gesammelt von O Neumann im Jahre 1893. Zool Jahrb, Abt Syst Geogr Biol Tiere 13:259–268

Müller GW (1901) *Stenocypria* nov. gen. Zool Anz 24:571–572

Müller GW (1903) Hamburgische Elb-Untersuchung – 3: Ostracoden. Mitt Naturhist Mus Hambg 19:163–167

Müller GW (1906a) Ostracoden aus Java, gesammelt von Prof K Kräpelin. Mitt Naturhist Mus Hambg 23:139–142

Müller GW (1906b) Die Ostracoden. Wiss Ergeb Dtsch Tiefsee-Exped Dampfer 'Valdivia' 1898–1899 8:27–154

Müller GW (1908) Die Ostracoden der Deutschen Südpolar-Expedition 1901–1903. Dtsch Südpolar-Exped 10:51–182

Müller GW (1912) Crustacea: Ostracoda. Das Tierreich 31:1–434

Müller GW (1914) Süßwasserostracoden der Deutschen Südpolar-Expedition 1901–03, Nachtrag. In: Drygalski E von (ed) Deutsche Südpolar-Expedition 8:67–78

Müller OF (1776) Zoologie danicae prodromus, seu animalium Danie et Norvegie indigenarum characters, nomina, et synonymy imprimis popularium. I-XXXII:198–199

Müller OF (1785) Entomostraca seu Insecta testacea, quae in aquis daniae et norvegiae reperit, descripsit et iconibus illustravit:48–67

Namiotko T, Danielopol DL (2004) Review of the *eremita* species-group of the *Pseudocandona* Kaufmann (Ostracoda, Crustacea), with the description of a new species. Rev Esp Micropaleontol 36:109–125

Namiotko T, Danielopol DL, Rađa T (2004) *Pseudocandona sywulai* sp. nov., a new stygobitic ostracode (Ostracoda, Candonidae) from Croatia. Crustaceana 77:311–331

Neale JW (1973) Cluthia (Crustacea, Ostracoda), a new Pleistocene and recent Leptocytherid genus. J Paleontol 47:683–688

Neale JW (1976a) On *Ilyocypris taprobanensis* Neale sp. nov. Stereo-Atlas Ostracod Shells 3:37–40

Neale JW (1976b) On *Centrocypris viridis* Neale sp. nov. Stereo-Atlas Ostracod Shells 3:13–20

Neale JW (1976c) On *Stenocypris fernandoi* Neale sp. nov. Stereo-Atlas Ostracod Shells 3: 29–36

Neale JW (1981) On *Heterocypris luzonensis* Neale sp. nov. Stereo-Atlas Ostracod Shells 8:79–86

Neale JW, Victor R (1978) The Lund University Expedition freshwater Ostracoda from Sri Lanka (Ceylon). Can J Zool 56:1081–1087

Neale JW, Zhao Y-H (1991) A new species of the fresh-water genus *Notodromas* (Ostracoda) from Heilongjiang, northeast China. Acta Micropaleontol Sin 8:153–170

Negadaev-Nikonov KN (1967) Morfologiya, paleobiologicheskoe i biostratificheskoe znachenie antropogenoykh limnotsiter (Ostracoda, Arthropoda). Izv Akad Nauk Mold SSR 1967:34–44

Newman WA (2005) Origin of the Ostracoda and their maxillopodan and hexapodan affinities. Hydrobiologia 538:1–21

Norman AM (1862) Contributions to British carcinology – 2: on species of Ostracoda new to Great Britain. Ann Mag Nat Hist, Ser 3 9:43–52

Nüchterlein H (1969) Süßwasserostacoden aus Franken. Ein Beitrag zu Systematik und Ökologie der Ostracoden. Int Rev Ges Hydrobiol 54:223–287

Oakley TH, Cunningham CW (2002) Molecular phylogenetic evidence for the independent evolutionary origin of an arthropod compound eye. Proc Nat Acad Sci USA 99:1426–1439

Örley L (1886) Über die Entomostraken-Fauna von Budapest. Termr Füz 10:7–14

Okada R, Tsukagoshi A, Smith RJ, Horne DJ (2008) The ontogeny of the platycopid *Keijcyiodea infralittoralis* (Ostracoda: Podocopa). Zool J Linn Soc 153:213–237

Okubo I (1973) Freshwater Ostracoda from Japan – 5: *Heterocypris takedai* sp. nov. (Ostracoda, Cyprididae) from Japan. Annot Zool Jpn 46:85–89

Okubo I (1974) Freshwater Ostracoda from Japan – 10: *Chrissia vittata* sp. Nov. from japan (Ostracoda, Cyprididae). Proc Jpn Soc Syst Zool 10:1–9

Okubo I (1990a) Sixteen species of freshwater Ostracoda from Japan (Freshwater Ostracoda from Japan XV). Bull Biogeogr Soc Jpn 45:39–50

Okubo I (1990b) Seven new species of freshwater Ostracoda from Japan (Freshwater Ostracoda from Japan XIV). Res Crustac (Carcinol Soc Jpn) 19:1–12

Okubo I (2004) Nihon tansui san kaimijinko rui ni tsuite. Kabushikigaisha Sanmon Insatsusho, Okayama, Japan, 72 pp [In Japanese, privately published]

Okubo I, Terauchi M (1992) Freshwater ostracods from the southwestern islands of Japan. Proc Jpn Soc Syst Zool 46:101–108

Onyedineke NE (2000) A new species of the genus *Paractenocypris* (Ostracoda) from Nigeria. Crustaceana 73:385–391

Ostermeyer E (1937) Über zwei neue *Candona*-Arten aus dem Saalekreis. Zool Anz 119:155–159

Otero M, Rossi V, Baltanás A, Menozzi P (1998) Effect of genotype and photoperiod on diapause strategies in *Eucypris virens* (Jurine, 1820) (Crustacea: Ostracoda). Arch Hydrobiol 52: 229–236

Palacios-Fest M (1997) Paleoenvironmental reconstruction of human activity in Central Arizona using shell chemistry of Hohokam canal ostracodes. Geoarcheol 12:211–226

Palacios-Fest M, Carreño AL, Ortega-Ramírez JR, Alvarado-Valdéz G (2002) A paleoenvironmental reconstrucion of Laguna Babícora, Chihuahua, Mexico based on ostracode paleoecology and trace element shell chemistry. J Paleolimnol 27:185–206

Paris P (1920a) Biospeologica 41: Ostracodes (Prem Ser). Arch Zool Exp Gén 58:475–487

Paris P (1920b) Notes sur les cladocères et les ostracodes du département de la Côte-d'Or. Bull Soc Zool Fr 44:251–266

Park LE, Martens K (2001) Four new species of *Gomphocythere* (Crustacea, Ostracoda) from Lake Tanganyika, east Africa. Hydrobiologia 450:129–147

Paulo LF (1969) Contribution à l'étude des ostracodes du Portugal: Note sur une nouvelle espèce du genre *Herpetocypris*. Publ Inst Zool 'Dr Augusto Nobre'. Fac Cienc Porto 108:7–39

Petkovski TK (1958) Zwei neue Ostracoden aus dem Dojransee. Biol Glas 11:27–34

Petkovski TK (1959a) Beitrag zur Kenntnis der Ostracoden-Fauna Jugoslawiens (5). Hidrobiol, Publ Hydrobiol Res Inst, Fac Sci, Univ Istanb, Ser B 4:158–165

Petkovski TK (1959b) Süßwasserostracoden aus Jugaslavien (6). Acta Mus Maced Sci Nat 6:53–75

Petkovski TK (1960a) Zwei neue Ostracoden aus dem Ohrid- und Prespasee. Izd Inst Piscic RP Maced 3:57–66

Petkovski TK (1960b)) Süßwasserostracoden aus Jugaslavien (7). Fragm Balc Mus Maced Sci Nat 3:99–106

Petkovski TK (1960c) Zur Kenntnis der Crustaceen des Prespasees. Fragm Balc Mus Maced Sci Nat 3:117–131

Petkovski TK (1961) Zur Kenntnis der Crustaceen des Skadar- (Scutari-) Sees. Acta Mus Maced Sci Nat 8:29–52

Petkovski TK (1962) Beitrag zur Kenntnis der Ostracodenfauna Mitteldeutschlands (Thüringen-Sachsen). Acta Mus Maced Sci Nat 8:115–133

Petkovski TK (1963) Über Süßwasser-Ostracoden der Azoren. Bol Mus Munic Funchal 17:49–65

Petkovski TK (1966) Ostracoden aus einigen Quellen der Slowakei. Acta Mus Maced Sci Nat 10:91–107

Petkovski TK (1969a) Zwei neue *Limnocythere*-Arten aus Mazedonien (Crustacea-Ostracoda). Acta Mus Maced Sci Nat 12:1–17

Petkovski TK (1969b) Einige neue und bemerkenswerte Candoninae aus dem Ohridsee und einigen anderen Fundorten in Europa (Crustacea, Ostracoda). Acta Mus Maced Sci Nat 11:81–111

Petkovski TK (1976) Zwei neue und eine seltene Ostracoden-Art der Gattung *Cypria* Zenker aus Jugoslawien (nebst einer Bestimmungstabelle der europäischen Arten). Acta Mus Maced Sci Nat 14:173–192

Petkovski TK, Karanovic I (2004) *Eucandona svetozari* n. sp., a freshwater ostracode (Crustacea, Ostracoda, Candoninae) from Macedonia (SE Europe). Senckenb Biol 83:103–111

Petkovski TK, Keyser D (1992) *Leptocythere ostrovskensis* sp. n. (Crustacea, Ostracoda, Cytheracea) aus dem See Vegoritis (Ostrovsko Ezero) in NW Griechenland. Mitt Hambg Zool Mus Inst 89:227–237

Petkovski TK, Keyser D (1995) Neue und seltene limnische Ostracoden aus Mazedonien (Crustacea: Ostracoda, Pododopida). Mitt Hambg Zool Mus Inst 92(Suppl):295–313

Petkovski TK, Keyser D (1997) *Eucypris kurtdiebeli*: Ersatzname für *Eucypris diebeli* Petkovski and Keyser, 1995 (Crustacea: Ostracoda). Mitt Hambg Zool Mus Inst 94:187

Petkovski TK, Meisch C (1994) *Cypria bicolor* n. sp., a new crenobiont freshwater ostracod (Crustacea, Ostracoda) from Slovenia. Bull Soc Nat Luxemb 95:229–236

Petkovski TK, Meisch C (1996) Species of the genus *Stenocypris* Sars, 1889 from the rice-fields of Macedonia (Crustacea, Ostracoda). Trav Sci Mus Natl Hist Nat Luxemb 23:57–85

Petkovski TK, Scharf B, Keyser D (2000) New and little known ostracods of the genus Heterocypris (Crustacea, Ostracoda) from the Balkan Peninsula. Limnologica 30: 47–57

Petkovski TK, Scharf B, Keyser D (2002) New and little known species of the genus *Candona* (Crustacea, Ostracoda) from Macedonia and other Balkan areas. Limnologica 32:114–130

Pinto ID, Kotzian SCB (1961) Novos ostracodes da familia Darwinulidae e a variação das impressôes musculares. Bol, Inst Cienc Nat, Univ Rio Gd Sul 11:5–64

Pinto ID, Purper I (1965) A new fresh-water ostracode *Cyprinotus trispinosus* Pinto et Purper, sp. nov., from southern Brazil, its ontogenetic carapace variation and seasonal distribution. Publ Espec, Esc Geol, Univ Rio Gd Sul 7:1–53

Pinto RL, Rocha CEF, Martens K (2003) On two species of the genus *Vestalenula* Rossetti and Martens, 1998 (Crustacea, Ostracoda, Darwinulidae) from semiterrestrial habitats in São Paulo State (Brazil). Zool J Linn Soc 139:305–313

Pinto RL, Rocha CEF, Martens K (2004) On the genus *Penthesilenula* Rossetti and Martens, 1998 (Crustacea, Ostracoda, Darwinulidae) from (semi-) terrestrial habitats in São Paulo State (Brazil), with description of a new species. J Nat Hist 38:2567–2589

Pinto RL, Rocha CEF, Martens K (2005a) On the evolution of the genus *Microdarwinula* Danielopol, 1968 (Ostracoda, Darwinulidae) with the description of a new species from semi-terrestrial habitatas in São Paulo State (Brazil). Crustaceana 78:975–986

Pinto RL, Rocha CEF, Martens K (2005b) On new terrestrial ostracods (Crustacea, Ostracoda) from Brazil, primarily from São Paulo State. Zool J Linn Soc 145:145–173

Pinto RL, Rocha CEF, Martens K (2007) Early release of eggs and embrios in a brooding ancient asexual ostracod: brood selection or gabling strategy to increase fecundity? Hydrobiologia 585:249–253

Pinto RL, Rocha CEF, Martens K (2008) On the first terrestrial ostracod of the superfamily Cytheroidea (Crustacea, Ostracoda): Description of *Intrepidocythere ibipora* n. gen. n. sp. from forest leaf litter in São Paulo State, Brazil. Zootaxa 1828:29–42

Proctor VW (1964) Viability of crustacean eggs recovered from ducks. Ecology 45:656–658

Puri HS (1953) The ostracode genus *Hemicythere* and its allies. J. Wash. Acad. Sci. 43:169–179

Puri HS (1954) Contribution to the study of the Miocene of the Florida Panhandle, Part 3, Ostracoda: Florida Geol Surv Bull. 36:216–345

Puri HS (1957) Notes on the ostracode subfamily Cytherideidinae Puri, 1952. J. Wash. Acad. Sci. 47:305–308.

Puri HS (1966) Ecologic distribution of recent Ostracoda. In: Proc Symp Crustac, Ernakulam, Part I:457–495

Puri HS (1974) Normal pores and the phylogeny of Ostracoda. Geoscience and Man 6:137–151

Ramdohr AF (1808) Über die Gattung *Cypris* Müller und drei zu derselben gehörige neue Arten. Mag Ges Naturforsch Freunde Berl Neusten Entdeck Ges Naturkd 2:85–93

Redeke HC (1936) Ostracoda. In: Redeke HC (ed) Flora en fauna der Zuiderzee Monografie van een brakwatergebied, Suppl. De Boer, Den Helder, pp 97–112

Regier JC, Shultz JW, Kambic RE (2005) Pancrustacean phylogeny: Hexapods and terrestrial crustaceans and maxillopods are not monophyletic. Proc R Soc, Ser B 272:395–401

Robertson D (1889) In: Brady GS, Norman AM (eds) A monograph of the marine and freshwater Ostracoda of the North Atlantic and of northwestern Europe. Sci Trans R Dublin Soc, Ser 2, 5:621–784

Roca JR, Danileopol DL (1991) Exploration of interstitial habitats by the phytophilous Ostracod *Cypridopsis vidua* (OF Müller): Experimental evidence. Ann Limnol 27:243–252

Roca JR, Wansard G (1997) Temperature influence on development and calcification of *Herpetocypris brevicaudata* Kaufmann, 1900 (Crustacea: Ostracoda) under experimental conditions. Hydrobiologia 347:91–95

Roca JR, Baltanás A, Uiblein F (1993) Adaptive responses in *Cypridopsis vidua* (Crustacea, Ostracoda) to food and shelter offered by a macrophyte (*Chara fragilis*). Hydrobiologia 262:127–131

Roen U (1956) Results from the Danish expedition to the French Cameroons 1845–1950. 11. Entomostraca. Bull Inst Fr Afr Noire, Ser A 18:913–925

Roessler EW (1982) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia – 1: Estudio morfológico de una nueva especie colombiana del género *Heterocypris* Claus 1892 (Ostracoda, Podocopa, Cyprididae). Caldasia 13:429–452

Roessler EW (1985) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia – 5: Estudio taxonómico del género *Chlamydotheca* Saussure 1858 (Ostracoda, Podpcopida, Cyprididae), Parte 1: Aspectos morfológicos de una nueva especie colombiana del género *Chlamydotheca*. Cladasia 14:329–354

Roessler EW (1986a) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia – 6: Estudio taxonómico del género *Strandesia* Stuhlmann 1888 (Ostracoda, Podocopida, Cyprididae), Parte 2: El grupo *Strandesia variabilis* Roessler 1986. Caldasia 15:599–615

Roessler EW (1986b) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia – 6: Estudio taxonómico del género *Strandesia* Stuhlmann, 1888 (Ostracoda, Podocopida, Cyprididae) – Parte 1: Aspectos morfológicos de una nueva especies colombiana del género *Strandesia*. Caldasia 15:577–598

Roessler EW (1986c) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia – 5: Estudio taxonómico del género *Chlamydotheca* Saussure 1858 (Ostracoda, Podpcopida, Cyprididae), Parte 2: El grupo *Chlamydotheca colombiensis* Roessler, 1985. Cladasia 14:585–616

Roessler EW (1986d) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia – 5: Estudio taxonómico del género *Chlamydotheca* Saussure 1858 (Ostracoda, Podpcopida, Cyprididae), Parte 3: El grupo *Chlamydotheca iheringi* (Sars, 1901). Cladasia 14:617–650

Roessler EW (1990a) Estudios sobre los ostracodos de agua dulce en Colombia – 6, Parte 4: Estudio taxonómico del grupo '*Strandesia psittacea psittacea* (Sars, 1901)'. Caldasia 16:215–230

Roessler EW (1990b) Estudios taxonómicos, ontogenéticos, ecológicos y etológicos sobre los ostracodos de agua dulce en Colombia (Ostracoda, Podocopida, Cyprididae) – 6: Estudio taxonómico del género *Strandesia* Stuhlmann, 1888 – Parte 3: El grupo '*Strandesia elliptica* (Sars, 1901)'. Rev Acad Colomb Cienc Exact, Fis Nat 17:795–804

Rogulj B, Danielopol DL (1993) Three new *Mixtacandona* (Ostracoda) species from Croatia, Austria and France. Vie Milieu 43:145–154

Rogulj B, Marmonier P, Lattinger R, Danielopol DL (1994) Fine-scale distribution of hypogean Ostracoda in the interstitial habitats of the rivers Sava and Rhône. In: Culver DC, Holsinger JR (eds) Biogeography of subterranean crustaceans: The effects of different scales. Hydrobiologia 287:19–28

Rome DM (1943) *Physocypria perlata*, *Cythere rivulorum*, *Cypridopsis mariae*, trois espèces nouvelles d'ostracodes d'eau douce. Bull Mus R Hist Nat Belg 19:1–9

Rome DM (1947a) Contribution à l'étude des ostracodes de Belgique: 1. Les ostracodes du Parc St-Donat à Louvain. Bull Mus R Hist Nat Belg 23:1–24

Rome DR (1947b) *Herpetocypris reptans* (Ostracode). Etude morphologique et histologique. I. Morphologie externe et système nerveux. Cellule 51:1–152

Rome DM (1953) Ostracodes cavernicoles de la grotte Tsebahu, Mont Hoyo (Irumu, Congo Belge). Rev Zool Bot Afr 47:34–42

Rome DM (1954) Contribution à l'étude des ostracodes de Belgique: 2. Espèces rares et espèces nouvelles. Bull Inst R Sci Nat Belg 30:1–32

Rome DR (1962) Exploration hydrobiologique du Lac Tanganyika (1946–1947) 3. Ostracodes. Inst R Sci Nat Belg, Bruss: p 309

Rome DR (1965a) Ostracodes. Parc Natl Upemba. Mission GF Witte 69:3–71

Rome DR (1965b) Crustacea: Ostracoda. In: Hanstroem B, Brinck P, Rudebeck G (eds) South African animal life results of the Lund University expedition in 1950–1951, 11. Swedish Natural Science Research Council, Stockholm, pp 9–58

Rome DR (1969) Contribution à l'étude des eaux douces de l'Ennedi: 5. Crustacés, Ostracodes. Bull Inst Fondam Afr Noire, Ser A 31:1074–1104

Rome DR (1970) Quelques ostracodes d'Ethiopie. Bull Inst Fondam Afr Noire 32:83–99

Rome DR, De Decker P (1977) Otracodes du Lac Kivu. Mém Inst Géol Univ Louvain 29:241–287

Rossetti G, Martens K (1996) Redescription and morphological variability of *Darwinula stevensoni* (Brady and Norman, 1870) (Crustacea, Ostracoda). Bull Inst Sci Nat Belg Biol 66:73–92

Rossetti G, Martens K (1998) Taxonomic revision of the recent and holocene representatives of the family Darwinulidae (Crustacea, Ostracoda), with a description of three new genera. Bull Inst R Sci Nat Belg, Biol 68:55–110

Rossetti G, Martens K (1999) Contribution to taxonomy and distribution of the genus *Vestalenula* Rossetti and Martens, 1998 (Crustacea, Ostracoda, Darwinulidae), with the description of two new species. Bull Inst R Sci Nat Belg, Biol 69:57–66

Rossetti G, Martens K, Mourguiart P (1996) On *Darwinula incae* Delachaux. Stereo-Atlas Ostracod Shells 23:35–40

Rossetti G, Eagar SH, Martens K (1998) On two new species of the genus *Darwinula* (Crustacea, Ostracoda) from New Zealand. Ital J Zool 65:325–332

Rudjakov YA (1963) O faune peshchernykh Ostracoda zapadnogo Zakavkazya. Zool Zh 42:32–40

Ruggieri G (1953) Età e faune di un terrazzo marino sulla costa ionica della Calabria. Ann Mus Geol Bologna, Ser 2 2(23):19–168

Rybecky M (1988) Zwei neue Arten der Ostracodengattung *Strandesia* Vávra, 1895 aus Thermalgewässern der Slowakei. Annot Zool Bot 187:1–8

Sars GO (1863) Beretning om en i sommeren 1862 foretagen zoologisk reise I Christianias og Trondhjems stifter. Nyt Mag Naturvidensk 12:193–252

Sars GO (1866) Oversigt af Norges marine ostracoder. Forh Vidensk-Selsk Christiania 1865:1–130

Sars GO (1886) Crustacea, 2. Den Nor Nordhavs-Exped 1876–1878 6:74–76

Sars GO (1887) Nye bidrag til kundskaben om Middelhavets invertebratfauna: 4. Ostracoda mediterranea (sydeuropaeiske ostracoder). Arch Math Naturvidensk 12:173–324

Sars GO (1889) On some freshwater Ostracoda and Copepoda, raised from dried Australian mud. Forh Christiania Vidensk-Selsk 8:1–78

Sars GO (1890) Oversigt af Norges crustaceer med forelobige bemärkinger over de nye eller mindre bejkendte arter: 2 (Branchiopoda, Ostracoda, Cirripedia). Forh Christiania Vidensk-Selsk 1890:1–80

Sars GO (1894) Contributions to the knowledge of the fresh-water Entomostraca of New Zealand as shown by artificial hatching from dried mud. Skr Vidensk-Selsk, I, Math-Naturvidensk Kl 1894:1–62

Sars GO (1895) On some South-African Entomostraca raised from dried mud. Skr Vidensk-Selsk, I Math-Naturvidensk Kl 8:1–56

Sars GO (1896a) Freshwater Entomostraca from the neighbourhood of Sydney, partly raised from dried mud. Arch Math Naturvidensk 18:1–81

Sars GO (1896b) On a new fresh-water ostracod, *Stenocypris chevreuxi*, with notes on some other Entomostraca raised from dried mud from Algeria. Arch Math Naturvidensk 18:1–27

Sars GO (1896c) On some West-Australian Entomostraca raised from dried sand. Arch Math Naturvidensk 19:1–35

Sars GO (1898) On *Megalocypris princeps*, a giant fresh-water ostracod from South-Africa. Arch Math Naturvidensk 20:1–18

Sars GO (1899) The Cladocera, Copepoda and Ostracoda of the Jana Expedition. Annu Mus Zool Acad Imp Sci St Petersbg 3:324–359

Sars GO (1901) Contribution to the knowledge of the freshwater Entomostraca of South America as shown by artificial hatching from dried material. Arch Math Naturvidensk 24:3–52

Sars GO (1903a) Freshwater Entomostraca from China and Sumatra. Arch Math Naturvidensk 15:1–44

Sars GO (1903b) On the crustacean fauna of central Asia. Part 3: Copeopda and Ostracoda. Annu Mus Zool Acad Imp Sci St Petersbg 8:195–264

Sars GO (1910) Zoological results of the third Tanganyika Expedition, conducted by Dr WA Cunnington, 1904–1905. Report on the Ostracoda. Proc Zool Soc Lond 54:732–760

Sars GO (1923) An account of the Crustacea of Norway with short descriptions and figures of all the species. 9 Ostracoda, Parts 3/4. Bergen Museum, Bergen, pp 33–72

Sars GO (1924) The freshwater Entomostraca of the Cape Province (Union of South Africa) Ostracoda. Ann S Afr Mus 20:105–193

Sars GO (1925) An account of the Crustacea of Norway with short descriptions and figures of all the species, vol 9: Ostracoda. The Bergen Museum, Bergen, pp 73–208

Sars GO (1926) Freshwater Ostracoda from Canada and Alaska. Rep Can Arct Exped 1913–18, vol 7 (Crustacea), Part 1 (Ostracoda), pp 1–23

Sars GO (1928) An account of Crustacea of Norway. Vol 9: Ostracoda. The Bergen Museum, Bergen

Savatanalinton S, Martens K (2008) Redescription of *Hemicypris mizunoi* Okubo, 1990 (Crustacea, Ostracoda) from Thailand, with a reassessment of the validitiy of the genera *Hemicypris* and *Heterocypris*. Bull Inst R Sci Nat Belg Biol 78:17–27

Savatenalinton S, Martens K (2009a) On a freshwater species of the genus *Sanyuania* Zhao & Han, 1980 (Crustacea, Ostracoda, Loxoconchidae) from Thailand, with a discussion on morphological evolution of the freshwater Loxoconchidae. J Nat Hist 43:259–285

Savatenalinton S, Martens K (2009b) Generic revision of Cypricercinae McKenzie, 1971 (Crustacea, Ostracoda), with the description of three new genera and one new species and a phylogenetic analysis of the subfamily. Hydrobiologia 638:1–48

Savatenalinton S, Martens K (2009c) Redescription of the type species of *Strandesia* Stuhlmann, 1888 and *Cypricercus* Sars, 1895 (Crustacea, Ostracoda, Cypricercinae), with a description of a new species of *Cypricercus* from South Africa. Zootaxa 2007:1–42

Savatenalinton S, Martens K (2010) On the subfamily Cypricercinae McKenzie, 1971 (Crustacea, Ostracoda) from Thailand, with description of six new species. Zootaxa 2379:1–77

Savatelaninton S, Borgonie G, Martens K (2008) On *Thaicythere srisumonae* n. gen., n. sp. (Ostracoda) from Thailand, with notes on the phylogeny of the subfamily Timiriaseviinae Mandelstam, 1960. Crustaceana 81:411–432

Schäfer HW (1934) Beiträge zur Ostrakodenkunde. Bul Soc Stiinte Cluj (Rom) 7:559–565

Schäfer HW (1943) Über zwei neue deutsche Arten der Süßwasser-Ostracoden. Zool Anz 143:210–216

Schäfer HW (1945) Grundwasser-Ostracoden aus Griechenland. Arch Hydrobiol 40:847–866

Schäfer HW (1952) Über Süßwasser-Ostracoden aus der Türkei. Hidrobiol, İstanb Üniv Fak Hydrobiol Araşt Enst Yayın, Ser B 1:7–32

Scharf BW (1983) Bemerkenswerte Muschelkrebse (Crustacea, Ostracoda) aus den Eifelmaaren. Mitt Pollichia 69:262–272

Schmit O, Rossetti G, Vandekerkhove J, Mezquita F (2007) Food selection in *Eucypris virens* (Crustacea: Ostracoda) under experimental conditions. Hydrobiologia 585:135–140

Schön I, Martens K (1998) Sex determination in non-marine ostracods. In: Martens K (ed) Sex and parthenogenesis: evolutionary ecology of reproductive modes in non-marine ostracods. Backhuys, Leiden, pp 25–36

Schön I, Martens K (2003) Phylogenetic reconstructions of ostracodes – a molecular approach. Paleontol Soc Pap 9:71–88

Schön I, Martens K (2004) Adaptive, pre-adaptive and non-adaptive components of radiations in ancient lakes: a review. Org Divers Evol 4:137–156

Schön I, Verheyen E, Martens K (2000) Speciation in ancient lake ostracods: comparative analysis of Baikalian *Cytherissa* and Tanganyikan *Cyprideis*. Verh Int Ver Theor Angew Limnol 27:2674–2677

Schornikov EI (1961) K izucheniyu ostracod iz vodoemov delty kubani. Tr Azovsk Nauchno-Issled Inst Rybn Khoz (Azniirkh) 4:131–141

Schornikov EI (1964) Opyt vydeleniya kaspiyskikh elementov fauny ostrakod v Azovo-Chernomorskom Basseyne. Zool Zh 43:1276–1293

Schornikov EI (1966) O nakhozhdenii v Kaspyskom More v retsentnom sostoyanii predstavitelya roda *Candona* (Crustacea, Ostracoda), prinadlezhashchego k gruppe iskopaemykh vidov *Candona lobata* (Zalanyi, 1929). Zool Zh 45:1094–1096

Schornikov EI (1969) Novyy vid ostracod roda *Candona* iz podzemnykh vod Kryma. Zool Zh 48:927–929

Schornikov EI (1973) Dva novykh vida i novyy podrod ostrakod roda *Limnocythere* (Cytheridae). Zool Zh 52:1246–1250

Schornikov EI (1974) K izucheniyu ostrakod (Crustacea, Ostracoda) litorali Kurilskikh Ostrovov. Sb Rab, Inst Biol Morya, Dalnev Nauchn Tsentr, Akad Nauk SSSR 1:137–214

Schornikov EI (1975) Ostracoda fauna of the intertidal zone in the vicinity of the Seto Marine Biological Laboratory. Publ Seto Mar Biol Lab 22:1–30

Schornikov EI (1980) Ostrakody v nadzemnykh biotopakh. Zool Zh 59:1306–1319

Schornikov ES (1986) Novye taksony ostrakod Limnocytheridae iz vodoemov dalnego vostoka i sredney Azii. In: Donnye organizmy presnykh vod dalnego vostoka, pp 19–29

Schram FR (1986) Crustacea. Oxford University Press, New York, pp 1–606

Schulz K (1976) Das Chitinskelett der Podocopida und die Frange der Metamerie dieser Gruppe. Unpublished doctoral dissertation, University of Hamburg, p 167

Scott HW (1961) Shell morphology of Ostracoda. In: Moore RC (ed) Treatise on invertebrate paleontology, Part Q, Arthropoda 3, Crustacea, Ostracoda. Geological Society of America and University of Kansas Press, Colorado

Semenova LM (1996) In: Semenova LM, Gusakov VA Pervoe nakhozhdenie vidov roda *Stenocypris* (Ostracoda, Crustacea) v vodomakh rossii i ukrainy. Zool Zh 75:315–319 → s. nächsten Eintrag (in Kempf nur "Semenova LM (1996) In: Semenova, Gusakov")

Semenova LM, Gusakov VA (1996) Pervoe nakhozhdenie vidov roda *Stenocypris* (Ostracoda, Crustacea) v vodomakh rossii i ukrainy. Zool Zh 75:315–319

Sharpe RW (1897) Contribution to a knowledge of the North American fresh-water Ostracoda included in the families Cytheridae and Cyprididae. Bull Ill State Lab Nat Hist 4:414–484

Sharpe RW (1903) Report on the freshwater Ostracoda of the United States National Museum, including a revision of the subfamilies and genera of the family Cyprididae. Proc US Natl Mus 26:969–1001

Sharpe RW (1908) A further report on the Ostracoda of the United States National Museum. Proc US Natl Mus 35:399–430

Sharpe RW (1910) On some Ostracoda, mostly new, in the collection of the United States National Museum. Proc US Natl Mus 38:335–341

Sharpe RW (1918) The Ostracoda. In: Ward HB, Whipple GC (eds) Fresh-water biology. Wiley, New York, pp 790–828

Shu D, Vannier J, Lou H, Chen L, Zhang X, Hu S (1999) Anatomy and lifestyle of *Kunmingella* (Arthropoda, Bradoriida) from the Chenjiang fossil Lagerstätte (lower Cambrian, south-west China). Lethaia 32:279–298

Siveter DJ, Sutton MD, Briggs DEG, Siveter DJ (2003) An ostracode crustacean with soft parts from the Lower Silurian. Science 302:1749–1751

Siveter DJ, Briggs DEG, Siveter DJ, Sutton MD (2010) An exceptionally preserved myodocopid ostracod from the Silurian of Herefordshire, UK. Proc R Soc, Ser B 277:1539–1544

Skogsberg T (1917) A new fresh-water ostracod. K Sven Vetensk-Akad Handl, NF 52:9–22

Smith AJ, Horne DJ (2002) Ecology of marine, marginal marine and nonmarine ostracodes. In: Holmes JA, Chivas AR (eds) The Ostracoda, applications in quaternary research, Geophysical Monographs, 131. American Geophysical Union, Washington, DC, pp 37–64

Smith RJ, Hiruta S (2004) A new species of *Metacypris* (Limnocytherinae, Cytheroidea, Ostracoda, Crustacea) from Hokkaido, Japan. Species Divers 9:37–46

Smith RJ, Janz H (2008) Recent species of the family Candonidae (Ostracoda, Crustacea) from the ancient Lake Biwa, central Japan. J Nat Hist 42:2865–2922

Smith RJ, Janz H (2009) Recent ostracods of the superfamiles Cytheroidea and Darwinuloidae (Crustacea) from Lake Biwa, a Japanese ancient lake. Species Divers 14:217–241

Smith RJ, Kamiya T (2002) The ontogeny of *Neondesidea oligodentata* (Bairdioidea, Ostracoda, Crustacea). Hydrobiologia 489:55–80

Smith RJ, Kamiya T (2003) The ontogeny of *Loxoconcha japonica* Ishizaki, 1968 (Cytheroidea, Ostracoda, Crustacea). Hydrobiologia 490:31–52

Smith RJ, Kamiya T (2005) The ontogeny of the enthocytheris ostracod *Urinocythere occidentalis* (Kozloff and Whitman, 1954) Hart, 1962 (Crustacea). Hydrobiologia 538:217–229

Smith RJ, Kamiya T (2006) Six new species of fresh and brackish water ostracods (Crustacea) from Yakushima, southern Japan. Hydrobiologia 559:331–355

Smith RJ, Kamiya T (2007) Copulatory behaviour and sexual morphology of three Fabaeformiscandona Krstić, 1972 (Candoninae, Ostracoda, Crustacea) species from Japan, including descriptions of two new species. Hydrobiologia 585:225–248

Smith RJ, Kamiya T (2008) The ontogeny of two species of Darwinuloidea (Ostracoda, Crustacea). Zool Anz 247:275–302

Smith RJ, Martens K (2000) The ontogeny of the cypridid ostracod *Eucypris virens* (Jurine, 1820) (Crustacea, Ostracoda). Hydrobiologia 419:31–63

Smith RJ, Matzke-Karasz R (2008) The organ on the first segment of the cypridoidean antennule: Morphology and phylogenetical significance. Senckenb Lethaea 88:127–140

Smith RJ, Matzke-Karasz R, Kamiya T, Ikeda Y (2002) *Scottia birigida* sp. nov. (Cypridoidea: Ostracoda) from western Honshu, Japan and a key to the subfamily Scottiinae Bronstein, 1947. Zootaxa 126:1–20

Smith RJ, Kamiya T, Horne DJ, Tsukagoshi A (2005) Evaluation of a new character for the phylogentic analysis of Ostracoda (Crustacea): the podocopan maxillular branchial plate. Zool Anz 243:139–153

Smith RJ, Kamiya T, Horne DJ (2006) Living males of the "ancient asexual" Darwinulidae (Ostracoda: Crustacea). Proc R Soc, Ser B 273:1569–1578

Sohn IG (1987) The ubiquitous ostracode *Darwinula stevensoni* (Brady and Roberston, 1870), redescription of the species and lectotype designation. Micropaleontology 33:150–163

Sohn IG, Kornicker LS (1972) *Cypretta kawatai*, a new species of freshwater Ostracoda (Crustacea). Proc Biol Soc Wash 85:313–316

Sohn IG, Kornicker LS (1973) Morphology of *Cypretta kawatai* Sohn and Kornicker, 1872 (Crustacea, Ostracoda), with a discussion of the genus. Smithson Contrib Zool 141:1–28

Sokac A (1972) Pannonian and pontian ostracode fauna of Mt Medvednica. Palaeontol Jugosl 11:1–140

Spandl H (1924) Wissenschaftliche Ergebnisse der zoologischen Expedition nach dem anglo-ä gyptischen Sudan (Kordofan) 1914. 17. Die Süßwasser-Mikrofauna. Denkschr Akad Wiss. Math-Naturwiss Kl 99:259–262

Spears T, Abele LG (1997) Crustacean phylogeny inferred from 18S rDNA. In: Fortey RA, Thomas RH (eds) Arthropod relationships. Systematics Association Spec Vol Ser 55 Chapman and Hall, London, pp 169–187

Staplin FL (1963a) Pleistocene Ostracoda of Illinois. Part 2: Subfamilies Cyclocypridinae, Cypridopinae, Ilyocyprinae; families Darwinulidae and Cytheridae. J Paleontol 37:1164–1203

Staplin FL (1963b) Pleistocene Ostracoda of Illinois. Part 1: Subfamilies Candoninae, Cyprinae, general ecology, morphology. J Palaeontol 37:758–797

Stephanides T (1937) Zwei neue *Eucypris*-Arten (Ostracoda) von der Insel Korfu. Zool Anz 119:269–272

Straub EW (1952) Mikropaläontologische Untersuchungen im Tertiär zwischen Ehingen und Ulm an der Donau. Geol Jahrb 66:433–524

Straus HE (1821) Mémoire sur les *Cypris*, de la classe des crustacés. Mém Mus Hist Nat 7:33–61

Stuhlmann F (1888) Vorläufiger Bericht über eine mit Unterstützung der königlichen Akademie der Wissenschaften unternommene Reise nach Ost-Afrika zur Untersuchung der Süßwasserfauna. Sitzungsber Kgl-Preuss Akad Wiss 49:1255–1269

Swain FM (1963) Pleistocene Ostracoda from the Gubik formation, arctic coastal plain, Alaska. J Palaeontol 37:798–834

Sylvester-Bradley PC (1948) The ostracod genus *Cythereis*, J. Paleontol 22:791–797

Sylvester-Bradley PC, Benson RH (1971) Terminology for surface features in ornate ostracods. Lethaia 4:249–286

Sywula T (1966) Notes on Ostracoda 1: on some Polish species. Bull Acad Pol Sci, Cl 2, Ser Sci Biol 13:647–652

Sywula T (1968) Notes on Ostracoda 2: on some Bulgarian species. Bull Soc Amis Sci Lett Pozn, Ser D 8:11–42

Sywula T (1970a) Notes on Ostracoda 4: some limnetic Cytheridae from Europe. Bull Acad Pol Sci, Cl 2, Ser Sci Biol 17:11–12

Sywula T (1970b) Notes on Ostracoda 5: Taxonomy of the genus *Candona* Baird. 6: Species from Dar Fur (western Sudan). Bull Acad Pol Sci, Cl 2, Ser Sci Biol 18:79–85

Sywula T (1971a) Notes on Ostracoda 11: New taxa of the nominate subgenus of genus *Candona* Baird from Poland. Bull Acad Pol Sci, Cl 2, Ser Sci Biol 19:587–591

Sywula T (1971b) Notes on Ostracda 12: New and interesting species from Poland. Bull Acad Pol Sci, Cl 2, Ser Sci Biol 19:665–670

Sywula T (1972) Notes on Pstracoda 7–11. Bull Soc Amis Sci Lett Pozn, Ser D 12(13):225–250

Sywula T (1974a) Notes on Ostracoda 14: interesting species from the basin of the River Raba (south Poland). Ann Zool, Pol Akad Nauk, Inst Zool 32:59–73

Sywula T (1974b) Malzoraczki (Ostracoda). Fauna Slodkowodna Pol 24:1–315

Sywula T (1976) Notes on Ostracoda 16; New species of Ostracoda (Crustacea) from subterranean waters of Poland. Bull Acad Pol Sci, Cl 2, Ser Sci Biol 24:271–278

Sywula T (1981) New taxa of Ostracoda (Crustacea) from Pomerania (north Poland). Bull Acad Pol Sci, Cl 2, Ser Sci Biol 28:625–636

Sywula T (1989) Gene conversion as a possible factor influencing genetic polymorphism. Hereditas 111:171–174

Sywula T (1990) The dispersal ability of *Cytherissa lacustris*. Bull Inst Geol Bassin Aquitaine 47:135–138

Sywula T (1992) The population genetics of the Ostracode *Cyprinotus incongruens* on the basis of esterase markers. Biochem Syst Ecol 20:735–746

Sywula T, Lorenc R (1982) Esterase polymorphism as a marker of inter-population differentiation in *Cyprinotus incongruens* (Ramd) (Ostracoda, Crustacea). Bull Acad Pol Sci, Cl 2, Ser Sci Biol 29:317–322

Sywula T, Sell J, Wozniak G, Sobolewska A (1991) Non-specific esterase polymorphism in marginal populations of *Cyprinotus (Heterocypris) barbarus* (Gauthier et Brehm) (Crustacea, Ostracoda). Bull Acad Pol Sci, Cl 2, Ser Sci Biol 39:353–362

Sywula T, Glazewska I, Whatley RC, Moguilevsky A (1995) Genetic differentiation in the brackish-water ostracod *Cyprideis tirisa*. Mar Biol 121:647–653

Tagliasacchi-Masala ML (1968a) Gli ostracodi sorgenti termali di Sardara (Sardegna meridionale). Rend Semin Fac Sci Univ Cagliari 37:613–630

Tagliasacchi-Masala ML (1968b) Una nuova specie di ostracode del bacino del Lago Baratz (Sardegna nord-occidentale): *Cyprinotus nurrensis*. Boll Soc Sarda Sci Nat 5:63–70

Tanaka G (2006) Functional morphology and light-gathering ability of podocopid ostarcod eyes and the paleontological implications. Zool J Linn Soc 147:97–108

Thiebaud M (1908) Les entomostraces du Canton de Neuchâtel. Ann Biol Lacustre 3:184–247

Thomson GM (1879) On the New Zealand eEntomostraca. Trans Proc New Zealand Inst 11: 251–263

Tressler WL (1937) Ostracoda. (Mitteilung 18 von der Wallacea-Expedition Woltereck 1931–32.). Int Rev Ges Hydrobiol Hydrogr 34:188–207

Tressler WL (1939) *Onychocythere*, a new genus of marine ostracod from Florida, with a description of one species. J Wash Acad Sci 29:336–339

Tressler WL (1941) Ostracoda from Puerto Rican bromeliads. J Wash Acad Sci 31:263–269

Tressler WL (1950) Fresh-water Ostracoda from Brazil. Proc US Natl Mus 100:61–83

Tressler W (1954) Fresh-water Ostracoda from Texas and Mexico. J Wash Acad Sci 44:138–149

Tressler W (1956) Ostracoda from bromeliads in Jamaica and Florida. J Wash Acad Sci 46: 333–336

Tressler WL (1957) The Ostracoda of Great Slave Lake. J Wash Acad Sci 47:415–423

Tressler WL (1959) Ostracoda. In: Ward HB, Whipple GC, Edmondson WT (eds) Fresh-water biology, 2nd edn. Wiley, New York, London, pp 657–734

Triebel E (1939) Zur Ostracoden-Fauna von Brasilien. Senckenbergiana 21:363–374

Triebel E (1959) Zur Kenntnis der Ostracoden-Gattungen *Isocypris* und *Dolerocypris*. Senckenb Biol 40:155–170

Triebel E (1961) Süßwasser-Ostracoden von den Karibischen Inseln: 1. Cypridini. Senckenb Biol 42:51–74

Triebel E (1962) Süßwasser-Ostracoden von den Karibischen Inseln: 2. Xenocypris n. gen. Senckenb Biol 43:47–63

Triebel E (1963) Ostracoden aus dem Sannois und jüngeren Schichten des Mainzer Beckens: 1. Cyprididae. Senckenb Lethaea 44:157–207

Triebel E (1973) In: Malz H *Rudjakoviella* Triebel, nom. Nov., replaces *Xenocypris* Triebel, 1962 (Ostracoda). Senckenb Lethaea 53:543

Tsukagoshi A, Parker AR (2000) Trunk segmentation of some podocopine lineages in Ostracoda. Hydrobiologia 419:15–30

Tsukagoshi A, Okada R, Horne DJ (2006) Appendage homologies and the first record of eyes in platycopid ostracods, with the description of a new species of Keijcyoidea (Crustacea: Ostracoda) from Japan. Hydrobiologia 559:255–274

Turner CH (1892) Notes upon the Cladocera, Copepoda, Ostracoda and Rotifera of Cincinnati, with descriptions of new species. Bull Sci Lab Denison Univ 6:57–74

Turner CH (1893) Additional notes on the Cladocera and Ostracoda of Cincinnati, Ohio. Bull Sci Lab Denison Univ 8:3–18

Turner CH (1894) Notes on American Ostracoda, with descriptions of new species. Bull Sci Lab Denison Univ 8:13–26

Turner CH (1895) Fresh-water Ostracoda of the US. Geol Nat Hist Surv Minn Zool Ser 2:277–337

Van Der Meeren T, Khand Y, Martens K (2009) On recent species of *Tonnacypris* Diebel and Pietrzeniuk, 1975 (Crustacea, Ostracoda), with new species descriptions from Mongolia. Zootaxa 2015:1–41

Van Doninck K, Schön I, Martens K, Goddeeris B (2003a) The life-cycle of the asexual ostracod *Darwinula stevensoni* (Brady, Robertson, 1870) (Crustacea, Ostracoda) in a temporate pond. Hydrobiologia 500:331–340

Van Doninck K, Schön I, Maes F, De Bruyn L, Martens K (2003b) Ecological strategies in the ancient asexual animal group Darwinulidae (Crustacea, Ostracoda). Freshw Biol 48: 1285–1295

Van Doninck K, Schön I, Martens K, Backeljau T (2004) Clonal diversity in the ancient asexual ostracod *Darwinula stevensoni* assessed by RAPD-PCR. Heredity 93:154–160

Van Harten D (1975) Size and environmental salinity in the euryhaline ostracod *Cyprideis torosa* (Jones, 1850), a biometrical study. Palaeogeogr Palaeoclimatol Palaeoecol 17:35–48

Vannier J, Katsumi A (1993) Functional morphology and behaviour of *Vargula hilgendorfii* (Ostracoda: Myodocopida) from Japan, and discussion of its crustacean ectoparasites: preliminary results from video recordings. J Crustac Biol 13:51–76

Vannier J, Abe K, Ikuta K (1996) Gills of cylindroleberidid ostracodes exemplified by *Leuroleberis surugaensis* from Japan. J Crustac Biol 16:453–468

Vannier J, Abe K, Ikuta K (1998) Feeding in myodocopid ostracods: functional morphology and laboratory observations from videos. Mar Biol 132:391–408

Vávra W (1891) Monographie der Ostracoden Böhmens. Arch Naturwiss Landesdurchforsch Böhmen 8:1–116

Vávra V (1895) Süsswasser-Ostracoden Zanzibar's. Jahrb Hambg Wiss Anst 12:1–23

Vávra V (1897) Die Süßwasser-Ostracoden Deutsch-Ost-Afrikas. Deutsch-Ost-Afrika 4:1–28

Vávra V (1898) Süßwasser-Ostracoden. Ergeb Hambg Magalhäns Sammelreise (NatHist Mus Hambg) 2:1–26

Vávra V (1901) Die Ostracoden vom Bismarck-Archipel. Arch Naturgesch 67:179–186

Vávra V (1906) Ostracoden von Sumatra, Java, Siam, den Sandwich-Inseln und Japan. Zool Jahrb 23:413–436

Vejdovsky F (1882) Thierische Organismen der Brunnengewässer von Prag, pp 64–65

Vernet H (1878) *Acanthopus*, un nouveau genre d'ostracodes. Bull Soc Vaud Sci Nat, 2 15:506–526

Victor R (1983) A new freshwater ostracod genus (Crustacea, Ostracoda) from Tokelau Islets, South Pacific Islands. J Nat Hist 17:615–618

Victor R (1987) A new species of the genus Cytheridella (Crustacea, Ostracoda) from Nigeria, West Africa. J Nat Hist 21:893–902

Victor R, Fernando CH (1976) Two new species of the genus *Hemicypris* Sars, 1903 (Ostracoda: Crustacea) from India. Can J Zool 54:1806–1810

Victor R, Fernando CH (1978a) Two new species of freshwater ostracods from southern India. Zool J Linn Soc 64:79–85

Victor R, Fernando CH (1978b) Systematics and ecological notes on Ostracoda from container habitats of some South Pacific Islands. Can J Zool 56:414–422

Victor R, Fernando CH (1979) The freshwater ostracods (Crustacea: Ostracoda) of India. Rec Zool Surv India 74:147–242

Victor R, Fernando CH (1980) On *Heterocypris makua* (Tressler, 1937), a freshwater ostracod (Crustacea: Ostracoda) from the Hawaiian Islands, with notes on the other species of the genus. Can J Zool 58:1288–1297

Victor R, Fernando CH (1981a) A new freshwater ostracod (Crustacea, Ostracoda) from Batu Caves, West Malaysia, with the description of Batucyprettinae new subfamily. Can J Zool 59:405–415

Victor R, Fernando CH (1981b) Freshwater ostracods (Crustacea: Ostracoda) of the genus *Cypretta* Vávra, 1895 from Malaysia, Indonesia and the Philippines. Int Rev Ges Hydrobiol 66:415–433

Victor R, Fernando CH (1981c) Freshwater ostracods (Crustacea: Ostracoda) of the genus *Strandesia* Vávra, 1895 from Malaysia, Indonesia and Philippines. Arch Hydrobiol 58 (Suppl):469–522

Victor R, Fernando CH (1981d) A new species of *Ilyodromus* Sars (Crustacea, Ostracoda) from the Philippines. Zool Scr 10:255–257

Victor R, Fernando CH (1981e) Description of a new species of the genus *Hungarocypris* Vávra, 1906 (Crustacea: Ostracoda) from Sulawesi, Indonesia, with a discussion on the distribution of the genus. Hydrobiologia 77:145–154

Victor R, Fernando CH (1981f) Freshwater ostracods (Cruistacea: Ostracoda) of the subfamily Cyprinotinae Bronstein, 1947 from Malaysia, Indonesia and the Philippines. Hydrobiologia 83:11–27

Victor R, Fernando CH (1981g) Freshwater Ostracoda of the genera *Chrissia* Hartmann, 1957 and *Stenocypris* Sars, 1889 from Malaysia, Indonesia and the Philippines. Mitt Hambg Zool Mus Inst 78:151–168

Victor R, Michael RG (1975) Nine new species of freshwater Ostracoda from Madurai area in southern India. J Nat Hist 9:361–376

Victor R, Paul MA, Fernando CH (1980) Two new species of the genus *Strandesia*

Vávra, 1895 (Ostracoda-Crustacea) from Kerala, southern India. Can J Zool 58:727–734

Vinyard G (1979) An ostracod (*Cypridopsis vidua*) can reduce predation from fish by resisting digestion. Am Midl Nat 102:108–190

Wagenleitner H (1990) Morphology and evolution of *Cypria cavernae* n. sp. (Ostracoda, Crustacea). Bull Soc Nat Luxemb 90:199–226

Wakayama N (2007) Embryonic development clarifies polyphyly in ostracod crustaceans. J Zool 273:406–413

Walossek D, Müller KJ (1998) Early arthropod phylogeny in the light of the Cambrian "Orsten" fossils. In: Edgecombe GD (ed) Arthropod fossils and phylogeny. Columbia University Press, New York, pp 185–231

Wansard G, Mezquita F (2001) The response of ostracod shell chemistry to seasonal change in a Mediterranean freshwater spring environment. J Paleolimnol 25:9–16

Wansard G, De Deckker P, Julía R (1997) Variability in ostracod partition coefficients *D* (Sr) and *D* (Mg) implication for lacustrine palaeoenvironmental reconstructions. Chem Geol 146:39–54

Whatley R (1990) The relationship between extrinsic and intrinsic events in the evolution of Mesozoic non-marine Ostracoda. Extinct Events Earth Hist Lect Notes Earth Sci 30:253–263

Wierzejski A (1893) Skorupiaki i wrotki (Rotatoria) slodkowodne zebrane w Argentynie. Rozpr Akad Umiejeţ. Wydz Mat-Przyr 24:229–246

Wingstrand KG (1988) Comparative spermatology of the Custacea Entomostraca. 2. Subclass Ostracoda. Biol Skr 32:1–149

Wolf JP (1920) Die Ostracoden der Umgebung von Basel. Arch Naturgesch, Abt A 85:1–100

Wouters K (1979) *Kavalacythereis braconensis* gen. n., sp. n., a remarkable new cytheracean ostracod genus and species from Lake Tanganyika (Zaire). Ann Soc R Zool Belg 108:179–187

Wouters K (1988) On *Romecytheridea ampla* Wouters sp. nov. Stereo-Atlas Ostracod Shells 15:101–106

Wouters K, Martens K (1992) Contribution to the knowledge of Tanganyikan cytheraceans. Bull Inst R Sci Nat Belg, Biol 62:159–166

Wouters K, Martens K (1994) Contribution to the knowledge of the *Cyprideis* species flock (Crustacea, Ostracoda) of Lake Tanganyika, with the description of three new species. Bull Inst R Sci Nat Belg Biol 64:111–128

Wouters K, Martens K (1999) Four new species of the *Cyprideis* species flock (Crustacea: Ostracoda) of Lake Tanganyika. Bull Inst R Sci Nat Belg Biol 69:67–82

Wouters K, Martens K (2000) On the taxonomic position of the genera *Archeocyprideis* and *Kavalacythereis* of the *Cyprideis* species flock (Crustacea, Ostracoda) in Lake Tanganyika (east Africa), with the first description of the appendages. Bull Inst R Sci Nat Belg, Biol 70:207–216

Wouters K, Martens K (2001) On the *Cyprideis* species flock (Crustacea, Ostracoda) in Lake Tanganyika, with description of four new species. Hydrobiologia 450:111–127

Wouters K, Martens K (2007) Three new species of the *Cyprideis* species flock (Crustacea, Ostracoda) of Lake Tanganyika (east Africa). Bull Inst R Sci Nat Belg Biol 77:147–160

Wouters K, Martens K, De Deckker P (1989) On the systematic position of *Tanganyikacypris* Kiss, 1961, with a description of *T stappersi* sp. n. (Crustacea, Ostracoda). Cour Forsch-Inst Senckenb 113:177–186

Würdig NL, Pinto ID (1990) *Diaphanocypris*, a new ostracod genus occuring in South and Central America. Pesqui, Inst Geocienc, Univ Fed Rio Gd Sol 17:31–38

Würdig NL, Pinto ID (1993a) A new-fresh water Ostracoda from southern Brazil. An Acad Bras Cienc 65:89–99

Würdig NL, Pinto ID (1993b) New species of Cyclocyprididae (Ostracoda) from the north coast of the state of Rio Grande do Sul, Brazil. An Acad Bras Cienc 65:285–294

Würdig NL, Pinto ID (1999) *Pseudocandona pumilis* sp. novo (Ostracoda). Ecological data and distribution in the Tramadai Lagunar System, RS, southern Brasil. Nauplius 7:39–42

Yamada S (2007) Ultrastructure of the carapace margin in the Ostracoda (Arthropoda: Crustacea). Hydrobiologia 587:201–211

Yamada S, Keyser D (2010) Calcification of the marginal infold in podocopid ostracods. Hydrobiologia 638:213–222

Yamada S, Tsukagoshi A, Ikeya N (2004) Ultrastructure of the carapace in some *Semicytherura* species (Ostracoda: Crustacea). Micropaleontology 50:381–289

Yamaguchi S, Endo K (2003) Molecular phylogeny of Ostracoda (Crustacea) inferred from 18S ribosomal DNA: implications for its origin and diversification. Mar Biol 143:23–38

Yang, L-F (1985) In: Huang B-R, Yang L-F, Fan Y-Q Ostracods from surface deposits of recent lakes in Xizang. Acta Micropalaeontol Sin 2:369–376

Yin Y, Martens K (1997) On a new species of *Fabaeformiscandona* Krstic, 1972 (Crustacea, Ostracoda) from China, with a preliminary checklist of recent Chinese non-marine ostracods. Hydrobiologia 357:117–128

Zaddach EG (1844) Synopseos crustaceorum prussicorum prodromus. Diss Zool Regiomonti: pp 1–39

Zenker GFW (1854) Monographie der Ostracoden. Arch Naturgesch 20:1–87

Zhao B-Q, Liao Y, Zhang J-J (1982) Ostracoda. Mem Ser, China Minist Geol Miner Resour 2:347–404

Zhao G, Han D (1980) Late Quaternary brackish-water ostracod fauna from the area to the west of Wishanhn Lake, Jiangsu and their significance. In: Wang P (ed) Papers on marine micropaleontology. Ocean Press, Beijing, pp 120–129

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